AUGUST 1924

RADIO AGE

The Magazine of the Hour

WITH WHICH IS COMBINED

Radio Topics

In This Issue

Price 25 cents

Let Our Hook-ups Be Your Guide

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How I Average $12 a Day in RADIO WORK

By Howard Houston

"YES, Mr. Crosby, I'll have the set installed tonight . . . yes, all ready to 'listen-in' . . . sure you'll be able to get Washington by 9 o'clock."

Another hour and a half job! And another ten dollar bill in my pocket! It all seems like a dream. But let me tell you the whole story from the very start.

A few months ago, I was driving a bread wagon, selling bread to retail stores. I had a good route though, and if I do say so myself, I had built up a pretty good business. But try as I could, thirty-five dollars a week was all I could make that job pay.

I'd be working there now if it hadn't been for Mary. We'd been "keeping company" for about two years, and everything was all set for our getting married as soon as I would be earning more money. But the old job didn't hold out much promise—and I didn't see how I was qualified for any other work that would pay more.

It was Mary who gave me the tip. "You can't earn big money," she said, "unless you're some kind of a specialist. Learn some line of work—become an expert in it." But what business, profession or trade was there that wasn't overcrowded? Where could an ambitious fellow stand a good chance to earn big money and get ahead? Stenographers, accountants, clerks—all down the line—every well established line of work was overcrowded, and the pay was small.

Then Mary said, "Why not find a new field?" That was a good thought. The men who went into the railroad business early "cleaned up." The same was true of the movie game, the automobile business—but what was the coming field? What new development was there that looked like a new promising industry?

We both jumped to our feet.

"RADIO."

Why hadn't we thought of it before? All around us was the evidence of the tremendous development of Radio. The broadcasting stations sprouting up all around—the rapid increase in Radio Stores—new radio manufacturing plants — everybody talking about the latest radio program. Radio had captured America almost overnight—and thousands of men who were on their toes were due to make fortunes out of it.

Thousands of Men Needed

The very next day after I had finished my route, I went to several radio business firms. "Sure, there was an opening. Oh, they'd pay big money—but did you know Radio?"

That was my cue. Learn Radio. Become a Radio Expert—and I did!

Well, that really is my whole story. I've only started. I've followed the path of least resistance. Sort of built up a business of my own installing, building, and repairing radio sets. Any small job pays me at least $5—and usually $10. I can easily make from $50 to $100 a week—and more as I get my work systematized.

What Mary and I have got to decide after our honeymoon—oh, yes, we are soon having a very quiet wedding—what we must decide after that—is which end of Radio will be best. You see, there are dozens of different kinds of work in this field, it's so big. I've already had several offers—one to take charge of a radio department, another with a broadcasting station, another to give radio entertainments, and a good offer as superintendent of construction in a radio plant. What we want to decide on is which will not only pay the most money now but will lead to the most rapid advancement in the future.

Easy to Learn Radio at Home in Spare Time

Just a word about this Radio business. Some fellows think you've got to have some training before you start to learn Radio. That's bunk. I didn't know the difference between an amplifier and a doorknob before I started. But let me give you a tip. Don't experiment with your radio course. Get the best. The National Radio Institute has been teaching Radio ever since 1914. The government recognizes its course by allowing credits to its graduates when they are trying for a license, so you see you can be confident you're getting the best training possible—and that means a lot.

Send for Free Book "RICH REWARDS IN RADIO"

Incidentally, the National Radio Institute publish a mighty interesting book on Radio. They send it out without cost to anyone who wants to learn about Radio. It is filled with facts, photos, and figures on the Radio Industry, and tells all about its course which quickly prepares you right at home in spare time for one of the big pay positions in Radio.

Take my advice and Mary's—and send for that, no matter how little you know of Radio, or what your plans are. Just mail the coupon for it now. Address the National Radio Institute, Dept. 53HA, Washington, D. C.

NATIONAL RADIO INSTITUTES,
Dept. 53HA, Washington, D. C.

Please send me without cost or obligation your Free Book "Rich Rewards in Radio," which tells all about the opportunities in Radio, and how spare time study at home will qualify me for a big paying radio position. Also full details on your Free Employment Service.

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RADIO AGE

The Magazine of the Hour
Established March, 1922
WITH WHICH IS COMBINED
Radio Topics

Volume 3 *AUGUST, 1924* *Number 8*

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A Chat With the Editor

THE most modest-appearing departments of a magazine like RADIO AGE usually are the most valued in the minds of the readers. This was especially evident recently, when M. C. Williams, of Rantoul, Ill., wrote us he received 1,180 letters within ten days after the June RADIO AGE appeared on the news-stands, because of the publication of one of his hookups in the "Pickups" section.

Just 1,180 readers thought enough of Mr. Williams' short article to write him immediately and ask for more information. We have yet to learn the total number of readers who have communicated with Mr. Williams since the June issue.

To augment RADIO AGE'S powerful influence over followers of the latest and best in radio development, we are continuing our policy of keeping the "fans" informed on the most recent discoveries and theories in the scientific field. In this issue, which has not been decreased one iota in interest because of the presence of Summertime, especial attention is paid to plans now under way for circumnavigating the globe with radio.

Last month we started a series on this subject by delving into the mysteries of short wave transmission and reception. This same subject is taken up again in the following pages to show how world-wide co-operation of radio stations will enable the fan in Cleveland to tune in on a broadcast from Berlin whenever his fancy desires.

The foregoing is just a sample of what is offered to RADIO AGE readers every month in our technical columns alone. This careful selection of editorial content has made RADIO AGE a by-word for reliability, and old and new readers are assured this steady improvement will be carried on more intensively than ever in the September number—which, by the way, has a "surprise" feature that will revolutionize the radio magazine field. On the stands about Aug. 26.

Frederick Smith

—Editor, RADIO AGE

America's Best Known Amateur

Fotograms.

Harry H. Carman, of Freeport, L. I., or, technically speaking "2EL," is called the country's best known amateur radio broadcaster. He has been heard in England, France, San Francisco, and other distant points. He has received cards from all over the country acknowledging reception of his station. He is shown above in his broadcasting room seated at his apparatus.

RADIO AGE
The Magazine of the Hour
M. B. Smith
Business Manager
A Monthly Publication
Devoted to Practical
Radio
Frederick A. Smith
Editor

The Invisible Circuit

By FRANK D. PEARNE

A Novel Explanation of Jinx That Often Causes Two Sets of Same Circuit to Function Differently

IN THE construction of radio sets it very often happens that the same kind of a circuit assembled by two different individuals will not give the same quality of reception. They look alike, contain the same apparatus and to all appearances they are the same, but one works better than the other.

Where is the jinx that selects some poor hard working fan as the object of his attention? Why is it that one set will work better than another, when they are apparently just the same? The answer is that there is so much going on inside of a receiving set that the eye does not see and, in fact, the circuit itself is such a very small part of the set, that the builder does not realize what is going on in the invisible circuit. The "invisible circuits" in a receiving set are those formed by magnetic and electro-static fields which are set up by the rapidly oscillating currents flowing through the different parts used in it; and in most cases little or no attention is paid to them. More trouble and dissatisfaction are caused by these magnetic and electro-static couplings than from any other source, although many radio enthusiasts do not even know that they exist.

FIRST of all, let us consider the magnetic field which is produced in and around the coils used. Figure 1 shows the lines set up in one turn of wire through which a current is flowing. This pictures the lines in a small way and represents the two sides of the loop through which the current travels. The rapidly oscillating current makes these lines whirl about the conductor, first in one direction and then the other, their direction changing with each alternation of the current. If another coil which is in no way connected to the first one is placed close to it, these invisible lines of force cut through it, and in doing so will produce a current in this second coil which will have the same characteristics as the current in the first coil.

Any inductively coupled circuit operates upon this principle. The most unfortunate part of it is that these lines do not confine themselves to just cutting through the turns of the second coil, but if the coil happens to be of the type shown in Figure 2, consisting of many turns wound side by side on an insulating tube, the lines arrange themselves somewhat as shown. It will be seen that some of the lines never even get far enough out to reach the second coil, while some of them travel out for some considerable distance from their source, often going far enough to cut through other coils used in other parts of the set, which they are not intended to cut through. When this occurs, then, currents are set up which cause iinterference; and these currents are due to undesired magnetic coupling. In this type of coil there are many lines produced by the coil which are not utilized, and many of them will cause interference.

Now, by referring to Figure 3, we find another type of coil. This is of the honeycomb or spider web variety and it is not hard to see that in such an arrangement the magnetic circuit is concentrated in a very small space. In this case, nearly all of the lines get out far enough to do useful work, but do not travel far enough to cause interference with other coils. Consequently there is much less loss from stray fields than will be found in coils shaped like that in Figure 1.

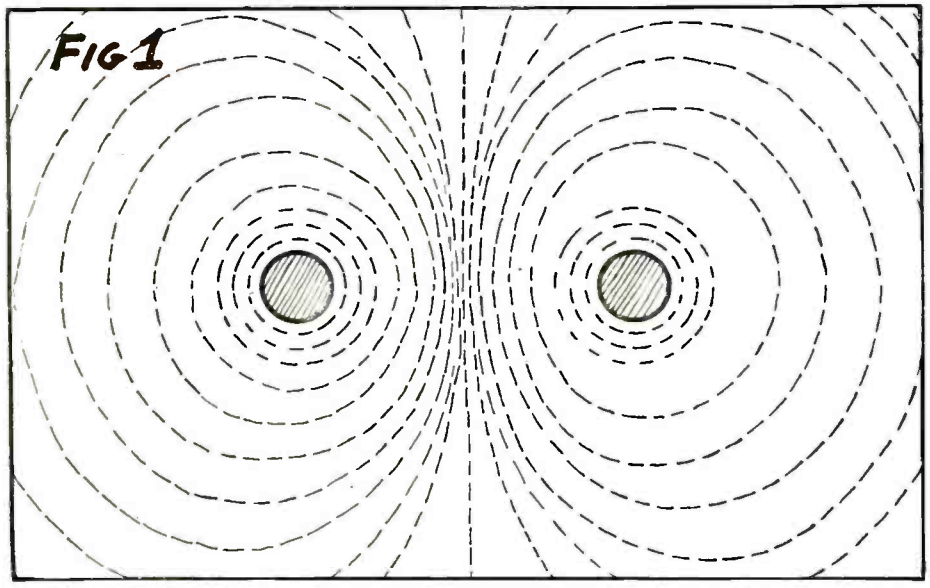
Let us suppose, for example, that we have two radio receiving sets which are apparently just alike, but some of the parts are not located in exactly the same position. In one case an offending stray magnetic force may reach just far enough to cause interference in another part of the set, while in the other case the parts are so located that they cannot quite reach the danger line. How are we to know how far apart these parts may be located with safety? This is a question, indeed, and one which only may be answered by experience and past performances of a similar nature. One is very much surprised to find how far these magnetic fields will sometimes stray.

IT IS possible to find stray lines of force from the field of a direct current generator as far as ten feet from the field. At a distance of six feet, a small piece of very thin iron pointed toward it at just the right angle may be made to support small nails and tacks, by the stray lines which are collected and concentrated in this way. Naturally the magnetic field set up in the neighborhood of such coils as are used in radio receiving sets never reaches anywhere near the strength of the field of a generator, but it must also be remembered that a radio receiver is about the most sensitive piece of apparatus known and extremely weak magnetic fields will have a very noticeable effect upon them.

It is not very difficult to realize how very little we know about the invisible magnetic field which is ever surrounding the different parts of the set. Our troubles do not stop here, either, for there is another invisible force at work which destroys much of the energy which really ought to be harnessed and made to do useful work. This is the electro-static field to which many losses in the receiving set may be directly traced. Electro-static losses are always present where currents of high frequencies are employed and the places where they may occur are many indeed.

How many of us have tried the old experiment of rubbing the glass, or hard rubber rod with a silk handkerchief and seeing it attract small tissue paper pieces just as a magnet attracts a piece of iron? Did you ever at the time stop to consider how much energy was used up in rubbing the dielectric, compared to the small amount of work which was required to lift the small pieces of paper? Well, at any rate, it is not the most efficient means of transferring energy from one form to another. Insulation such as hard rubber is absolutely necessary in the construction of a radio set and it makes wonderful insulators, but it also saps the energy away from the places where it is needed most. We do not, however, rub the insulators or insulating materials with silk in the radio set, but the high frequency currents which are used do practically the same thing.

IN ORDER that we may understand just what a dielectric material is, let us refer to the variable condenser. Here we have two sets of metal plates which



Magnetic field between conductors.

are separated by air. Air is, of course, an insulator and in this case is the dielectric between the plates. Now let us set the movable plates in a certain position and notice the capacity. If thin sheets of mica are placed between the plates, it will be found that, although the plates are still in the same position and the same distance apart, the capacity of the condenser has been considerably increased. The reason for this is the fact that the dielectric constant of mica is much higher than that of air. But what does this all mean? The ordinary definition of the word dielectric would be "a non-conductor of electricity." Some of these non-conductors are better insulators than others. In all cases they have the property of absorbing electrical energy under certain conditions and they also have what is known as specific inductive capacity, which means "ability to convey the influence of an electrified body."

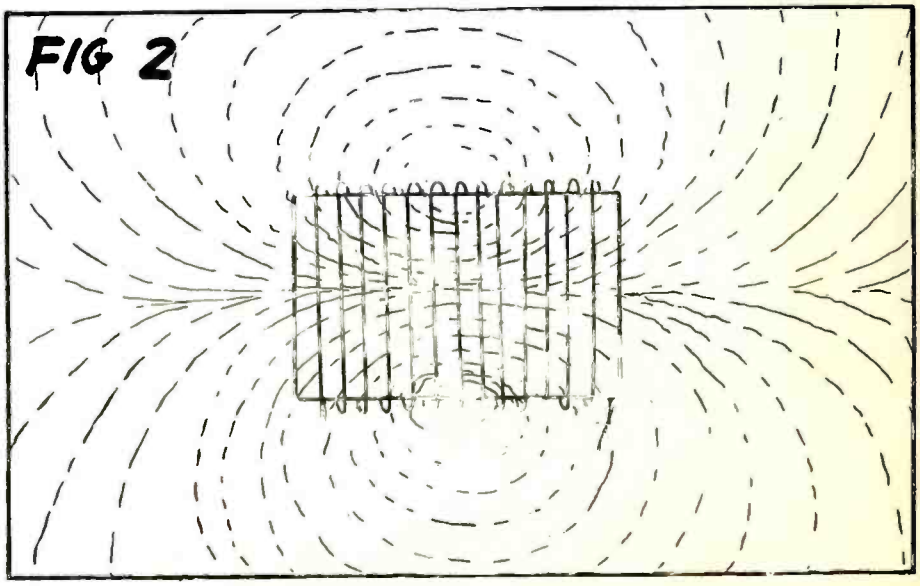
The dielectric constant of air is taken as unity and the dielectric capacity value of other substances are reckoned from this value. When a rapidly oscillating current is passed through a condenser, the plates are first charged in one direction and then the other as the current oscillates. This produces a strain on the dielectric material between the plates and these lines of strain may be made visible by sprinkling finely powdered mica around and about the plates and the insulating material between them. Figure 4 shows how a map of the electro-static field between two oppositely charged conductors would look. It will be noticed that these lines of strain are at right angles to the magnetic lines of force and Figure 5 shows the combination of both the magnetic and electro-static fields around two wires of a circuit.

When an insulating material is under the influence of a rapidly oscillating current, it absorbs energy which seems to be caused by the molecules of the material moving back and forth with each reversal of the current. When the current passes through in one direction, the molecules all are forced around so that they point in the same direction. When the current is reversed, then they are all swung around so that they point in the other direction. As the direction of the position of these molecules is changed with each reversal of current, it may be easily understood that the more rapid the oscillations, the faster these molecules will move back and forth and also that considerable energy is required to move them at this high rate of speed. When the rapidly oscillating current is passed into a condenser, the plates receive a charge, first in one direction and then in the other.

EACH charge so received on the plates, however, is retained for a fraction of a second and at the next reversal of the impressed current this charge travels with it with its energy added to it, so that the energy used in charging the plates is not all wasted, but in many other cases where insulating materials are used, this energy which is absorbed is absolutely lost so far as radio reception is concerned. The energy consumed in moving these molecules back and forth must come from somewhere, and the only energy coming into the receiving set is from the transmitting station, so it is not very hard to see that when the high frequency currents act upon insulating bodies in a receiving set, much of the energy which should be giving up useful work is entirely wasted and lost so far as reception is concerned. Therefore the reception is materially weakened.

Just where do these losses occur? In the first place, most of the coils used in radio work today are wound upon insulating tubes and as these tubes come under the influence of the electro-static field set up in the coils by the rapidly oscillating currents, all the energy used in swinging the molecules back and forth is wasted energy which is supplied by the very feeble current received upon the aerial. It may be readily understood that there is not very much energy to do the required work, to say nothing of throwing most of it away in useless work. How, then, may this loss be eliminated? Some kind of a foundation or support must be used to hold the turns of wire in place. If these coils could be made self-supporting, our troubles from this source would be over, but this seems an impossibility. The efficiency of a coil having only an air core would certainly be a valuable asset to the radio receiver. The nearest thing to perfection is the honeycomb and the spider web coil. This type of coil is wound in a zig-zag manner in such a way that it is self-supporting and at the same time the turns are widely separated, which is another great advantage.

Let us analyze this coil before going any farther and see just what can be gained by using it instead of the long type with many turns spread out over the surface of an insulating tube. Referring again to Figure 3, we find that the windings are concentrated within a very small space. This, as previously explained, keeps the magnetic field within bounds so that it is not scattered all through the other apparatus and at the same time the coil is small and takes up less space than the one which is wound on a tube.



Magnetic lines produced by current passing through a coil wound on a tube.

IT IS self-supporting, as it has no tube in the center to hold the turns together. Another thing in its favor is the fact that the turns are so arranged that there is considerable space between them. Here we have another advantage not yet mentioned. In any coil where the turns are close together there exists what is known as distributed capacity. That is, one turn acts like a plate of a condenser with reference to the turns close to it and the more turns the coil contains, the higher will be the distributed capacity. The effect of this capacity when added up means that here again much energy is lost, as it is the same as though a high resistance is connected across the terminals of the coil, through which much of the energy supposed to be passed to other parts of the circuit leaks away.

Many radio engineers recommend a method of reducing this distributed capacity in long coils consisting of a single layer. This is accomplished by winding a piece of cord beside the wire and after the coil is completed, the twine is removed, leaving a coil in which the turns are separated far enough to reduce the capacity to quite an extent. But in the honeycomb and spider web windings we find that the particular form of winding gives to the turns even a greater separation than the twine method, and we also have the benefit of the advantages before mentioned.

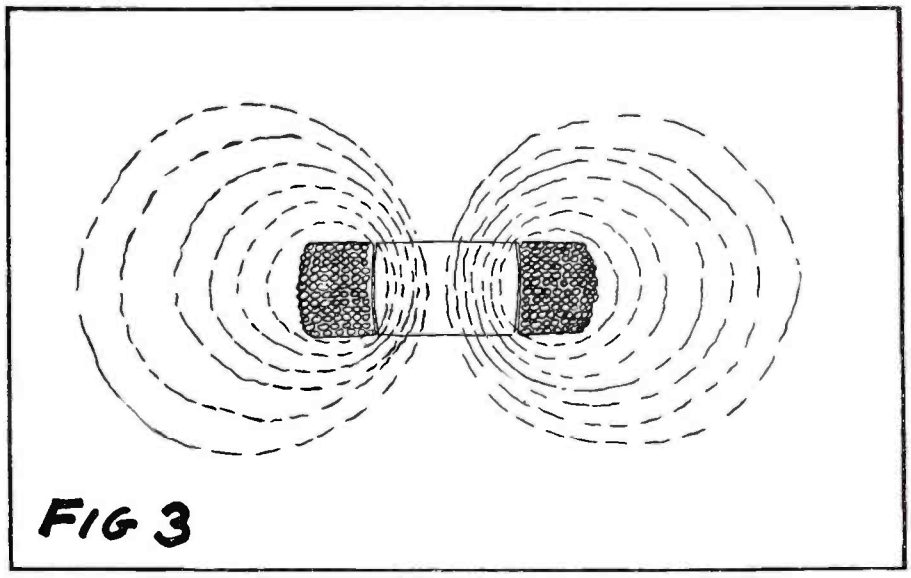
There is one very important point to remember in the construction of such coils, and that is not to make them too small in diameter, as this will have a tendency to crowd too many lines through the center and over-saturate the air space within the coil. Naturally, the smaller the coil, the smaller will be the opening in the middle, and if the lines become too crowded in this space, then the nice circles shown in Figure 3 are very much distorted and are forced out farther than they would be if the air core were not saturated.

Thus it would seem that the use of this type of coil would eliminate many of the troubles so common to the radio receiver and also serve to unravel the mystery of why one set should work better than another.

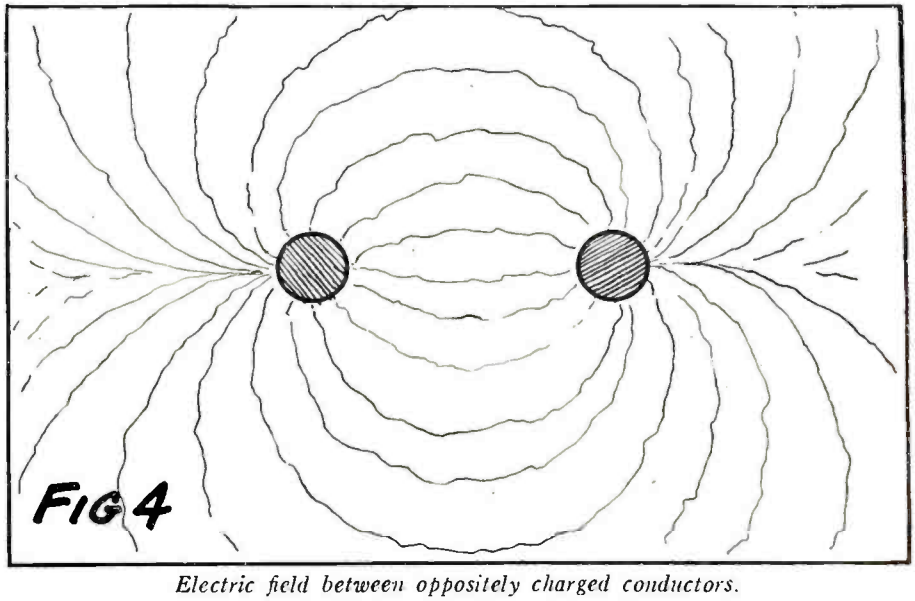
Dry Cell Standards Under Way

Representatives of nine dry battery manufacturers, four electric companies, two telephone companies, a railroad, the American Railway Association, and nine Government departments met at the Bureau of Standards recently at a preliminary conference on dry cell standardization. Standard performance tests for radio filament and plate batteries were adopted at the conference, and the standardization of B battery sizes, or at least a standardization of the unit cells, was proposed. A special sub-committee will shortly be appointed by Dr. G. W. Vinal of the Bureau of Standards to make recommendations as to the B battery specifications.

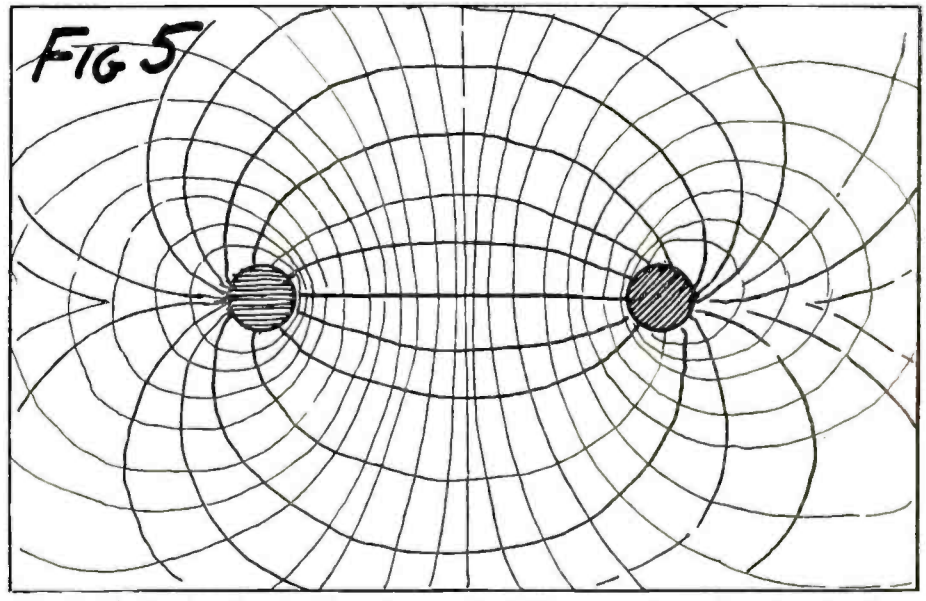
The committee decided not to require a "noise" test of batteries since they were not believed responsible for sufficient noises to make such tests worth while.



Magnetic lines produced by honeycomb or spiderweb coil.



Electric field between oppositely charged conductors.



A sketch showing the electric and magnetic fields around two wires of a circuit.

Short Wave Transmission and Its Recent Phenomena

THE development of short wave radio transmission, which has resulted in the rebroadcasting of American signals by eight English stations, has produced some interesting phenomena. As high as ten kilowatts have been impressed on one antenna in starting the 107 meter pulsations on their long journey and, because of this great power, special precautions must be taken by those who handle it.

For months experiments have been carried on by a group of General Electric radio engineers in a small isolated building, a mile from the transmitter of WGY. In this building has been assembled, in the apparent disorder of most laboratories, the equipment necessary for a high-powered radio transmitter. The station, because of the power and variety of wave lengths used, operates on the experimental license of the General Electric Company, 2XI.

Because of the intense field about the transmitter it is possible to light an ordinary sixty-watt lamp to full brilliancy by holding the lamp in the hand. Two men, standing on insulated stools, and each holding a metal rod in his hand, can draw a six-inch arc between the rods. No shock is felt because current of this nature travels through the skin rather than through the body. However, if bare hands were used instead of the metal rods, a severe burn would be the result. The building is heated by a small coal stove and the engineers have learned that care must be taken in transferring coal from the coal bucket to the stove. If the body comes in contact with any metallic object. arcs will jump from stove to shovel.

Precautions Necessary

Metal pencils, watches or similar articles containing metal cannot be carried on the person on account of the small sparks which will jump to them. Shoes with nails cannot be worn because of the sting experienced when the wearer steps on nails in the floor.

By the use of its short wave transmitter, WGY has reached distant places with a fair degree of reliability which were only occasionally reached on long wave lengths. The signals are also transmitted so clearly and with such volume that it is possible to rebroadcast them 3,000 miles away. On several occasions all eight stations of the British Broadcasting Company relayed WGY's broadcast programs. The most successful experiment was that of April 5 when an entire program of organ, tenor and trumpet solos and an address, was carried by wire from the Wanamaker auditorium in New York to the transmitter of WGY in Schenectady.

This entire program was sent out on 107 meters and also on 380 meters, and the signals on the former wave length were picked up and relayed by the British stations. According to a radiogram received from London during the progress of the program the transmission was: "All as clear as if played in London." The short wave signals have also been heard consistently in Los Angeles with loud speaker strength on only two tubes, and this at times when daylight covered the Western half of the country. Tests have shown that the signals are remarkably free from fading, which is experienced on the longer wave lengths.

Novel Sets Used

While the design of a short wave transmitter is similar to that of any broadcasting set, the enormously high frequency involved—2,803 kilocycles—requires the use of some unusual and novel apparatus. The antenna is of the fan type, but it differs in some respects from the conventional antenna. In order to decrease resistance losses its conductors are made of three-eighth inch hemp, over which is braided many fine strands of bare copper wire. The two wooden poles supporting the antenna are much larger than necessary to support a structure of this size but they are essential to prevent the antenna from swinging.

The building sheltering the transmitter is located a short distance to one side, allowing the counterpoise to come directly underneath the center of the antenna, and greatly increase the radiating efficiency of the system. The antenna is eighty feet high and sixty feet in width at the top part of the fan. It has a fundamental of 160 meters.

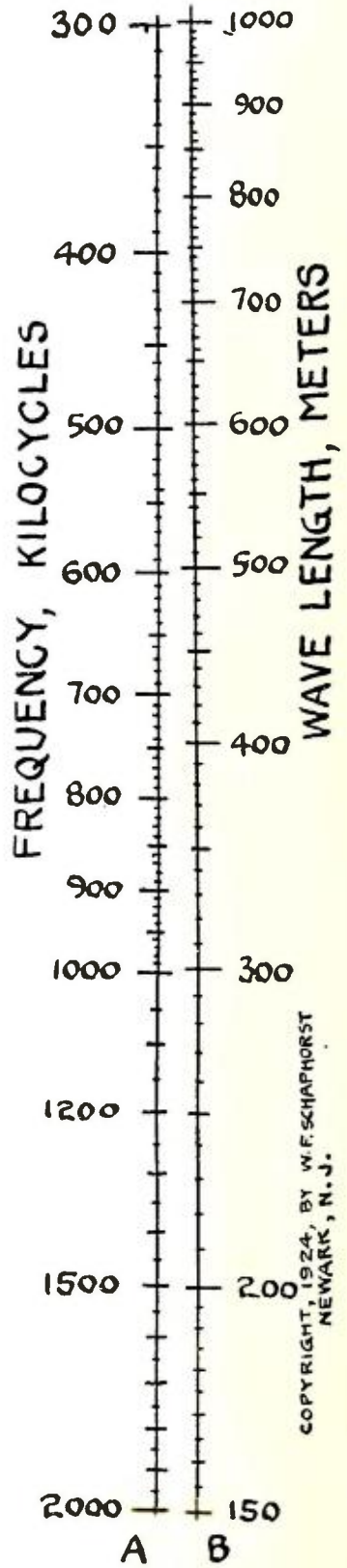
The oscillating system is of the conventional coupled-type in which the frequency is controlled by a tuned circuit rather than the antenna circuit. This eliminates the possibility of frequency change due to the swinging of the antenna in the wind. The primary coil consists of one and one-half turns of copper ribbon two inches wide tuned by an air condenser made of aluminum plates three feet square. In solving the problem of a spacer for these plates that would not break down, the use of very thin hard rubber strips was decided upon. Power tubes are of the water-cooled type and are connected through a pump to a large radiator which insures an uninterrupted water supply.

Modulator Tube Cooled

The modulator tube is water-cooled and it is connected to the same cooling system as the oscillator. The speech power amplifier is a 250-watt radiotron, and, because of the intense field from the oscillator and its associated apparatus, it is shielded by a copper box to prevent regeneration and the resulting loss in quality. All wires connected to the amplifier are shielded and the lines to the studio and control room are covered with lead and are buried to prevent the radio signal from getting back into the input circuit.

The plate power supply to the water-cooled tubes is a three phase, full wave rectifier capable of supplying thirty kilowatts at fifteen thousand volts. Filaments are lighted by special direct current machines to eliminate the ripple which results from the use of alternating current on tubes employing a high filament current.

A Handy Wireless Chart



Here is a chart that will be found useful for quickly converting kilocycles into wave lengths or vice versa.

If the frequency is known, find it in Column A and look across to Column B, where it is instantly converted into wave lengths.

For example, if the frequency is 1,500 kilocycles, what is the wave length? Find the 1,500 in Column A. Directly opposite it in Column B is 200 meters—the wave length.

Again, if the wave length in meters is 300, what is the frequency? Find the 300 in Column B and directly across in Column A the answer is found to be 1,000 kilocycles.

How Soon Will We Have Radio Movies?

By S. R. WINTERS

Experiments by Noted Inventor Show Radio Entering Magic Realm of Visual Broadcasting

"FROM our easy chairs by the fireside we stay-at-homes will soon be able to view the bleak ice fields as the broadcasting lens is carried over the North Pole in that great ship, the Shenandoah."

Thus spoke C. Francis Jenkins of Washington, D. C., as he contemplated the possibilities of the transmission and reception of motion pictures by radio. He had just completed the apparatus for accomplishing this epochal achievement, and the photograph illustrating this article is the first one showing this mechanism.

The inventor claims that only refinements in this apparatus are necessary before a football game played in Philadelphia may be witnessed in San Francisco.

Already moving objects—the movements of a hand, for instance, have been sent from one point to another in the laboratories of Mr. Jenkins. The extension and application of this demonstrated experiment, in accordance with theory, would seem to bring within the realm of accomplishment the flashing on the screen of an event transpiring at some distant place. For instance, the President of the United States in exchanging greetings with the Premier of France could look upon the countenance of the latter, or vice versa. Similarly, the chiefs of staff of our Navy and Army could view at headquarters all that the lens records as it is carried aloft in scouting aircraft.

Not So Complicated

THE mechanical units for the sending and receiving of motion pictures by radio, as apparent in the accompanying photograph, are not as complicated as one would think. The essential parts consist of a glass prism and another glass disc which contains a plurality of lens elements. Immediately in front of these prismatic rings is an electric lamp, similar to the light bulbs in homes, and an electric motor for rotating the prismatic rings. Light from this high-frequency lamp shines through the large number of lens prisms or holes in one of the discs as it revolves, fluctuating in value in order to make the moving pictures on the screen. The entire apparatus may be enclosed in a small box.

The transmission and reception of photographs by radio is already an accomplished fact—this feat being daily demonstrated over a distance of seven miles, and in one instance, pictures have been sent and received between Washington and Philadelphia, a distance of 135 miles. The principle applied in the transmission of "still" pictures and motion pictures differs only with respect to speed. Demonstrations in sending photographs have required three minutes for completing the process, whereas, the sending of moving objects involves a speed of sixteen pictures a second.

The prismatic lenses or revolving prisms serve the purpose of cutting up the light rays as they emanate from the high-frequency lamp stationed immediately in front of them. In the path between the conventional radio-transmitting apparatus and the revolving prisms is a light sensitive cell, for instance, a Case Thalafide cell, through which the fluctuating electric currents are given passage before being put on the air by the transmitter. The principle involved, in general, is that electro-magnetic waves are susceptible to the impression of picture characteristics just as electrical waves may be translated into speed if voice characteristics are impressed thereon.

How Rays of Light Work

THE new optical shape in glass makes possible the transmission of photographs and ultimately motion pictures by radio. The warped contour of this ring of transparent substance, when rotated across a beam of light from this high-frequency lamp, produces an effect on the latter comparable to that of a glass prism which changes the angle between its faces. Or, putting it differently, there is a constant change in its retracting angle.

The effect on a ray of light passing through this glass ring, having a fixed axis on one side of the latter, is to give to the ray of light on the other side of the glass prism an oscillation or hinged action in the plane of its diameter. Consequently, a ray of light passing through this prism and spending its force on a picture surface at the top will travel across the picture surface to the bottom as the prismatic ring rotates. By the same token, the identical ray of light passing through a second prismatic ring, with its diameter set at right angles to the first, will embrace the picture surface from left to right. If, then, one of the prismatic rings is rotated one hundred times faster than the other, it is seen that the picture surface would be covered horizontally in one hundred parallel stripes by the pointed beam of light.

"But have you never put a nickel under a piece of paper and by drawing straight lines across it with a very dull pencil made a picture of the Indian appear?" inquired Mr. Jenkins in reducing the process to a simple analogy.

"Well, now, that isn't so very different from the way we do it. In place of the crayon pencil we draw lines across the white surface with a pencil of light, the image of light being the source of high intensity and high frequency.

"When the machine (referring to the glass discs) is turned over slowly, this little light looks for all the world like a tiny twinkling star as it travels across the white surface in adjacent parallel lines, changing in light values to correspond in position and intensity to the light values of the scenes before the lens at the broadcasting station.

A Magic Picture

"BUT when the machine is speeded up until the succession of lines recur with a frequency that deceives the eye, because of persistence of vision into the belief that it sees all these lines all the time, then a picture suddenly flashes out on the white screen in all the glory of the pantomime mystery."

The equipment for the reception of photographs and motion pictures by radio duplicates the units used in their trans-

C. Francis Jenkins, of Washington, D. C., is shown below with his invention for broadcasting motion pictures by radio. The essential parts are very simple, consisting of a glass prism and a glass disc containing a plurality of lens elements. The accompanying article tells how it's done.

mission. The modulated electro-magnetic waves, arriving at the receiving station, are translated from electrical characteristics to picture characteristics by means of another pair of prismatic rings and a light valve or lamp. The latter unit, which is now subject to refinements in order to transmit motion pictures over distances, may be filled with carbon bisulphide and the tube is wound with wire somewhat similar to the winding formation of the tuning coil used in radio telephony and telegraphy. The electric waves as they come into the receiving station light and extinguish this small lamp thousands of times a second—with such rapidity, in fact, that the human eye is deceived in believing that the light is burning constantly without fluctuations. Once the light rays pass through the prism lenses at the receiving station, the picture sent out by the broadcasting station is automatically reproduced on a screen.

"The whole apparatus," to quote the inventor, "is comparable to a camera with a lens in Washington and its photographic plate in San Francisco; with this difference, that the one lens, in Washington, may put its picture on ten, one hundred or one thousand photographic plates in as many different cities at the same time, and at distances limited only by the radio power of the broadcasting station.

"With this new apparatus wireless distribution of news pictures for daily paper illustration insures the distribution of picture news as promptly as telegraphic news; which means that pictures of news events get into the daily papers as early as telegraphic text. It means just exactly that, and it takes no particular imagination to visualize the value of such service to the newspapers.

"IT IS even more than this, for these radio news pictures projected from magic lantern slides on to the screens of the best picture theaters in the cities, enable the theater to put news events before the public sooner than the newspapers can print and distribute telegraphic news; that is, the daily paper is now threatened with second place as a means of news distribution, for no newspaper can possibly put a distant news event before the public as quickly as the theater can with radio pictures."

Photography is the most rapid means of copying and radio is the swiftest means of intelligence. C. Francis Jenkins, inventor of the motion picture projecting machine universally used in theaters, claims to have wedded the two.

"Radio vision" is the term he employs, and it differs from the telescope in that the latter covers great distances only by following straight lines which lead off into space. Radio vision, on the other hand, is enabled to see along curved lines, and, therefore, mountains and other common obstructions do not mar the view. In fact, Mr. Jenkins contemplates the time when the President of the United States may look upon the face of the King of England as he talks with him; and radio vision around the globe is not, according to this distinguished inventor, beyond the realm of future possibility.

Fifteen Million Homes to Have Radios

Atlantic City, N. J.—"The many technical improvements in the art of broadcasting and in the manufacture of receiving apparatus during the past year have given such impetus to the development of the radio industry in the United States that radio now occupies a leading place in American life," David Sarnoff, vice-president and general manager of the Radio Corporation of America, declared recently in an address before the annual convention of the National Electric Light Association.

"Present indications point to two methods of operating radio receivers in the future," he said. "These might be classed as follows.

Kadel & Herbert

HERE'S A NEW ONE.

When you tire of that old phonograph record, don't throw it away or let it collect dust on the shelf. Follow Rudolph Arnold's novel scheme of using an ordinary 12-inch phonograph record as a panel for a one-tube receiving set. He reports more than satisfactory results.

The Future of Radio

"Type 1—The home receiver that will draw its vacuum tube energy through such a current supply device operated from the lighting circuit now supplied by the Central Station.

"Type 2—The rural home receiver, or the portable receiver that obtains operating power from storage or dry batteries."

Discussing the many contacts which radio has made with other industries, Mr. Sarnoff pointed out that radio already has affected the electric light and power situation in the United States.

"More people," he said, "now stay at home to enjoy radio, which means more use of lights and greater current consumption. Radio enthusiasts who stay up until the small hours of the early morning to get distance still further increase the drain on your lighting supply mains.

A 75 Million Increase

"At the present rate of progress in the radio industry, it will not be long before radio will add $75,000,000 yearly to the aggregate income of the Central Station industry, while daily it becomes more convenient and economical for the public.

"It is more than a mere prediction to say that 10,000,000 radio receivers will be in operation within the next five years. My understanding is that the lighting industry serves approximately 10,000,000 wired homes, with an expected annual increase of 1,000,000 homes per year.

"At the end of five years you would supply electricity to at least 15,000,000 homes and we might safely predict that at least one-half of these wired homes will be equipped with radio."

Amateurs Help Station

Dartmouth, Nova Scotia.—Frustrated in his attempt to get a "repeat" on an important European news article by a sudden break in the trans-Atlantic cables, the operator of the local radio receiving station, maintained by several American newspapers, called on amateur radio men to help him resume his schedule with the British transmitting station. As the station is equipped for receiving purposes only, the operators are seriously handicapped whenever the reception is broken and a "repeat" is desired.

In such cases they make a practice of calling upon the cable companies to forward requests that the transmitting station resume schedule at the place where the break occurred. On this occasion, it was impossible to get even this help. The operator of the British transmitting station, unaware of the difficulty, continued to send. In about an hour and a half the schedule would be over and it would be impossible to get the particular portion of the item that had been lost.

The local receiving operator communicated with Major William C. Borrett, operator of Canadian amateur station, 1DD, and manager of the Maritime division of the American Radio Relay League. Major Borrett asked several Halifax and Dartmouth amateurs to listen on short waves and, if a European amateur was heard, request him to have the British operator repeat.

Half an hour was consumed in listening but, as no European amateurs were heard, the operators of 1BQ and 1DD decided to send out a "general call" in the hope that some listener in England would pick it up. The call was kept up for fifteen minutes; then another fifteen were spent in listening.

Finally they received a telephone message that they had been successful. The superintendent of the transatlantic receiving station was heard saying "Thanks, you have put it over all right. We are getting our repeat." A British amateur had heard the message and informed the operator of the transmitting station.

Breaking Into Radio Without a Diagram

A Simple Receiver Which Will Work Without Outside Wires

By BRAINARD FOOTE

ARE YOU afraid of "diagrams," of "hook-ups?" Do you hesitate to join the radio game because you have heard that you can't work a radio set costing less than $150 on anything but an outside aerial? Did you realize that you can assemble your own receiving set from a mere photograph without previous radio experience of any kind and at a cost of about $25 all told? You can.

Even if your landlord won't let you hang wires on his roof, you are already provided with an aerial in the form of your electric lighting wires, your telephone line and your door-bell wiring. Of course, I don't mean to imply that such a method of receiving will bring in stations from across the continent, but it will work well up to 25 or 30 miles, and if you have a broadcasting station in your own town, you are well equipped. No doubt the simple set illustrated is not the handsomest model in the world, but its chief merits lie in its simple construction and equally simple operation. And you don't have to buy instruments which look exactly like those shown to secure successful results either, but, nevertheless, the pictures will tell you how to make the connections.

What You'll Need

Identification marks after the parts listed below appear in *Fig. 1.*

Four spring clips or binding posts (A, G, T).
Two .002 mfds. fixed condenser (1) (9).
Two single honeycomb coil mountings (2, 2).
One 17-plate variable condenser (4).
One fixed or variable grid condenser (5).
One 2-megohm grid leak and mounting (6).
One porcelain tube socket (7).
One 6-ohm filament rheostat (8).
One 1½-volt dry cell (12).
One variometer (10).
One 22½-volt "B" battery (11).
One board about 8 by 18 inches.

Other parts not in *Fig. 1* are:

One WD12 detector tube.
One 25-turn honeycomb or Coto-Coil.
One 75-turn honeycomb or Coto-Coil.
One telephone head set.
½ lb. of bell wire for connections.
One separable plug for connection to lighting socket.
Two small spring clips for making contact to radiator, etc.
Dials for condenser and variometer if not furnished with them.

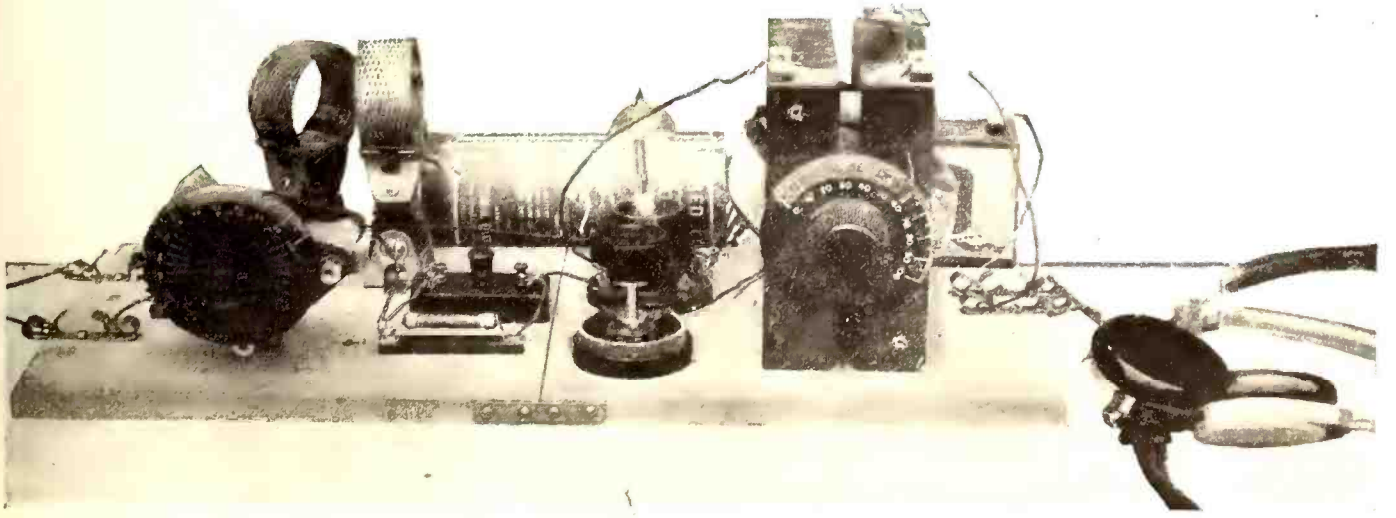
Even though the grid condenser you purchase doesn't look just like the one illustrated, it will have two binding posts which are connected in circuit as in *Fig. 1.* This, in fact, is true of the variometer and the variable condenser. Don't get the very cheapest in each line and you'll be rewarded with better results and more durability.

The first part of your program is to mount the instruments on the board after the fashion of *Fig. 1.* They will all be easy to screw in place except the variometer and the condenser. These may be fastened down with small brass brackets such as hardware stores carry, removing one of the mounting screws of the instrument and using it as a holding post for the bracket. The batteries may merely be stood in position. The socket is mounted with the slot toward the left.

The Wiring

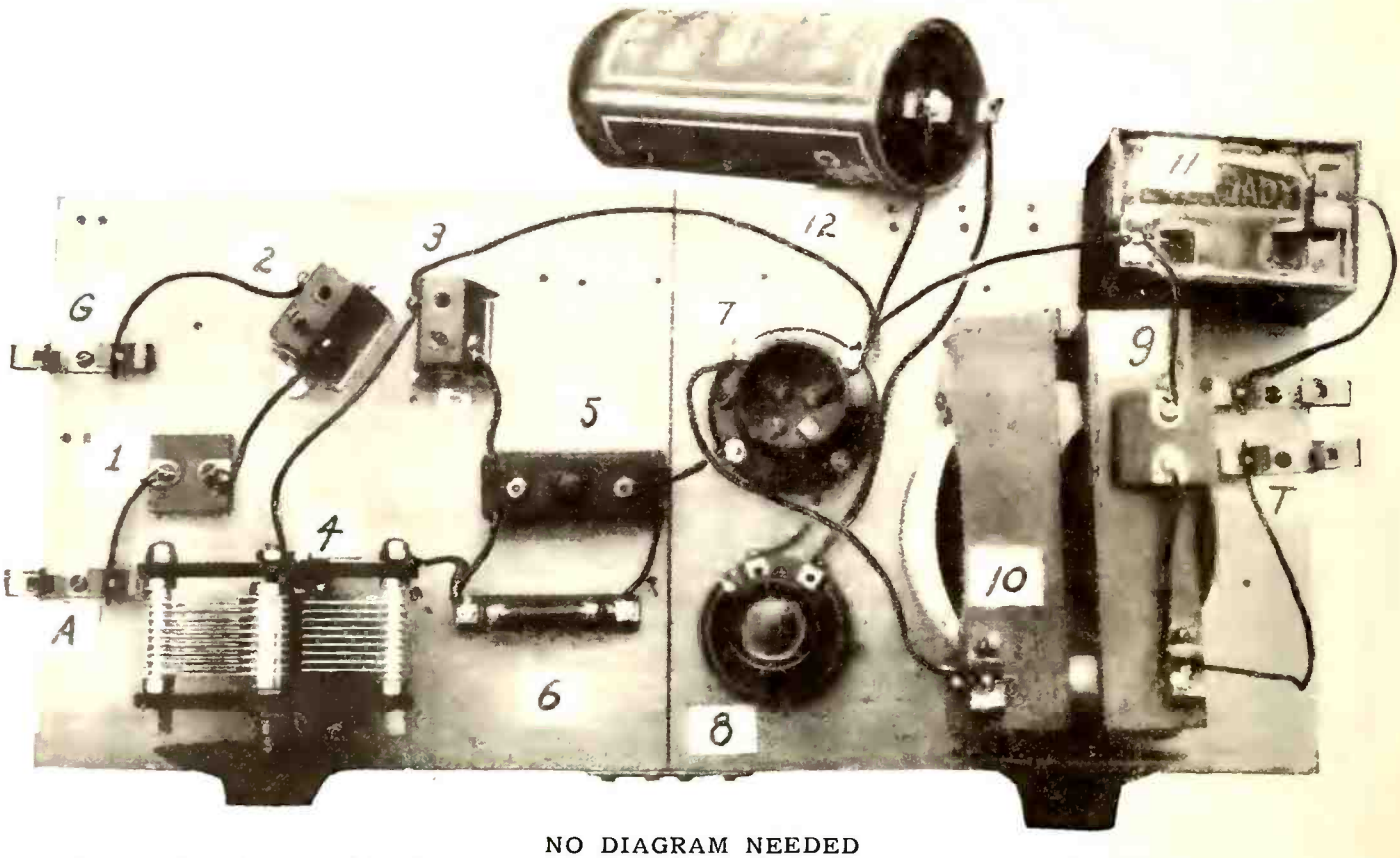
Lengths of the bell wire are cut off to make the connections. The pieces should be slightly longer than necessary to allow enough for bending the end around the binding posts. "Skin" the insulation off the ends with a knife and use pliers or a wrench to tighten the binding posts securely. The wiring list is as follows, and you should check it against the photograph as you make each joint:

Post "A" to left side condenser "1."
Right side of condenser "1" to right side mounting "2."
Left side mounting "2" to post "G."
(These connections finish the "primary" circuit.)
Rotary plates of variable condenser "4" to left side mounting "3."
Left side mounting "3" to socket "7" post marked "F+."
Right side mounting "3" to left side grid condenser "5."
Fixed plates variable condenser "4" to left side grid leak "6."
Left side grid leak "6" to left side grid condenser "5."
Right side grid condenser "5" to socket "7" post marked "G."
Right side grid leak "6" to right side grid condenser "5."
(These connections form the "secondary" circuit.)
Socket "7" post marked "F—" to left side rheostat "8."
Right side rheostat "8" to outer post of dry cell "12."
Socket "7" post marked "F+" to center post of dry cell "12."
(These connections form the "filament" circuit.)
Socket "7" post marked "P" to left post of variometer "10."
Right side of variometer "10" to front post "T."
Rear post "T" to right side (plus) post of "B" battery "11."
Left post (negative) of "B" battery "11" to socket "7" marked "F+."



THE SET ASSEMBLED

Figure 2. The completed model with tubes and honeycomb coils in place. The left-hand dial tunes in the stations while the right-hand controls the loudness.



NO DIAGRAM NEEDED

Figure 1. This is your wiring diagram, and it should be checked with the list of connections given in the text. Technically, this is a "Tuned Plate Regenerator."

Right side variometer "10" to front side fixed condenser "9."

Rear side fixed condenser "9" to left side (negative) of "B" battery "11."

(These connections complete the "plate" circuit.)

After the connecting wires have been put in and carefully checked up, you are ready to learn something about the principles upon which the set operates. Connect the phone cord terminals to posts "T," insert honeycomb coil of 25 turns into mounting "2" and the 75-turn coil into mounting "3." Then set the rheostat to the "Off" position, where the contacting blade does not touch the wires of the little coil but rests upon the fiber. Next insert the tube into the socket, handling it carefully, as it is valuable and delicate. Turn on the rheostat slowly until you can see a faint cherry red glow in the center of the tube, showing that current from the battery is passing through the "filament" circuit and illuminating the tube.

At this juncture, you should hear a bell-like ringing note when you touch the tube or the table, and if you do not, it is a sign that something is wrong with the plate circuit or with the telephones. These can be tested quickly by touching their terminals to the posts of the dry cell, where a loud click should be heard if they are O. K. Verify the plus and negative connectins to the "B" battery.

Getting Oscillation

Now set the condenser "4" at about half scale, or with the rotary plates half way in between the fixed plates. Then turn the variometer slowly. At a certain point you will hear a click, and then you will find that if you place your finger on the left post of the variometer a click is heard. As you take your finger off, another click is heard. When your set is so adjusted that you hear a click when you place your finger on that binding post and hear another one as you take it off, the tube is actually a low power transmitting or sending outfit. Were the aerial and ground wires connected, the set would send out disturbing noises and might interfere with reception by some neighbor within a few blocks. Hence you should be careful not to allow your set to transmit any more than you can help. Your tube is said to be "oscillating" when it is in the sending condition. However, the most sensitive point is found just below the actual oscillation, so when turning the variometer, get as close as you can to that point without actually allowing the tube to send. The sensitive condition is indicated by a sort of breathing sound.

Now you will find that if you increase the "capacity" of the variable condenser by turning the movable plates further in between the fixed plates you will have to move the variometer to again locate the "clicking" point. You will find that you can follow the condenser up and down the scale by readjusting the variometer.

Next turn off the rheostat. If you have a telephone in your house, this makes the best receiving aerial. Locate the receiving set near the phone and at the same time near a cold water pipe or the radiator. Cut two lengths of the bell wire about the correct size and fasten one of the extra spring clip connectors to an end of each. One wire should run from the "G" post of the set to the radiator or pipe. If the radiator is employed, just clip on to the nickel plated outlet valve or to the screw of the control handle. Be very careful when you connect to the phone, for the wire must not touch anything but the "A" post of the set. Condenser "1" prevents any interference with the phone conversations, but permits radio currents to pass through the coil of the primary circuit. Attach the clip to the nickel plated screw which fastens the microphone to the stand.

Other Aerials

You should try your set in connection with some other antenna system, too. Of course, if you have the space for an outdoor wire, erect one by all means—a well-insulated antenna of about 100 feet direct length will do very well. The wires of the doorbell system always operate with considerable success as an aerial, and connection to them may be made by attaching the clip connecting to the "A" post to either binding post of the doorbell. Where the electric light wires are elevated on poles in the street, or in a building containing a large amount of wiring, the lighting wires sometimes form a better aerial than the phone line. Remove the spring clip from the "A" wire and attach, instead, one post of the separable socket plug. Insert the plug in a suitable lamp socket, turning the switch "on" and trying a reversal of the plug to make contact to the side of the line which works the better. As in the case of the phone, the condenser "1" insulates the set from the

(Continued on page 61)

Broadcasting by Repeating Will Enable Radio to Encircle Globe

H. P. DAVIS, vice-president of the Westinghouse Electric and Manufacturing Company, universally known as the "Father of Broadcasting," has made public a plan for world-wide programs combining all the modern engineering achievements of radio transmitting and forecasting the marvelous development radio will make in the next few years.

The plan Mr. Davis proposes makes use of radio repeating, eliminates interference possibilities and shows how, in the near future, the radio listener will be enabled to hear programs from London, Paris, Tokio, in fact any part of the globe, with the same ease as programs from local stations are now heard.

The plan shows a marvelous vision for the future of radio and indicates how radio will eliminate time and distance.

In detail it follows:

"In the past few months the public has heard much regarding radio repeating without realizing, perhaps, just what this extraordinary achievement of radio engineering means to the future of radio. If the public knew that when the first radio repeating was successfully accomplished, the entire course of future radio development has been changed and the practically unlimited possibilities of radio broadcasting had at last been opened, it would have given the idea even more attention than was granted when it was announced.

Opens Way to World Wireless

"Radio repeating is the 'open sesame' to world-wide wireless and will make possible the receiving of programs from any part of the globe, with the same ease with which we now hear programs from stations located only a few miles from the radio receiver.

"Naturally, before world-wide wireless is a reality, there will have to be installed special stations in various parts of the globe and these stations must be located advantageously.

"Radio repeating when it was first successfully accomplished was the outcome of the development of short wave transmitting. Short wave transmitting means the sending of radio signals on a wave length of 100 meters or lower. Because this wave length is so low it is not heard on the ordinary receiver, and we therefore call it the inaudible wave. The ordinary broadcasting wave length band for 250 meters to 600 meters is heard, of course, on the ordinary receiver and is termed the audible wave. Inaudible wave transmitting forecasts the following radio development:

"Certain well designed central stations will be located at the world centers. These stations will be equipped to transmit on the audible or the inaudible wave length or both as desired. The audible wave transmitter need not have excessive power, so that its operation will not interfere with distant tuning by adjacent receivers if

Davis Predicts Advent of Super-Station Chain

desired. These transmitters will not need any more power than have the leading stations of the United States today. The inaudible transmitters, however, may be highly powered to give them the ability when necessary to maintain a constant range. As their signals will be transmitted on the inaudible wave length, the power used will not cause interference with receivers.

New Stations Needed

"There will be located, at advantageous points, inaudible wave length repeating stations whose sole duty it will be to receive these inaudible waves from the central stations and pass them along. These repeating stations will act as 'booster' stations to amplify over and over again the inaudible signals.

"Certain other stations, and there may be as many of these as desired, will be equipped with short wave receivers with which it is possible to pick up the short wave signals and repeat them on a low power audible wave. These stations, which are to serve local districts only, will merely repeat the signals caught on the low wave length and rebroadcast them for the benefit of the listeners in their immediate vicinity. These local broadcasters, therefore, need only a small amount of power. This interconnected international system will have a despatching organization to direct how and when the various programs of the central stations will be sent and what stations should stand by to handle the program circuits.

"Such a system will also need a world-wide and very efficient program-collecting organization. This program organization will be operated somewhat in the manner of the great news agencies of today, and will continually be on the search for interesting programs from every point in the world.

"A famous statesman—a world-wide figure of interest—is speaking in Paris. He faces the microphone which leads to the station located at one of the central broadcasters. This central station sends out his speech on the audible wave which can be heard on the ordinary receiver operated in the district surrounding Paris. Then, if desired, the inaudible wave transmitter also sends out the speech for world-wide transmitting.

"The despatchers have selected the route for transmitting the 'booster' stations who by prearrangement pick up the inaudible wave coming from Paris. These stations will then 'boost' the inaudible Paris wave so that anywhere in the world, as has previously been determined, it may be received on the short wave receivers of the local broadcasting stations.

"In Pittsburgh, KDKA, being equipped with a short wave receiver, could pick up these repeated short wave Paris signals and repeat them through its own transmitter with the result that everyone within the range of KDKA's signals could hear the Paris speech with receiving apparatus no more sensitive than is required to pick up the broadcasts originating in KDKA's studio.

(Continued on next page)

Kadel & Herbert

SPEAKING OF POLITICAL EXPERTS

Graham McNamee, the "sport reporter" of Station WEAF, ought to be one by this time. For he reported the daily doings of the hectic Democratic nomination convention at New York last month. His voice was heard by inestimable millions of radio fans throughout the country when several stations co-operated in simultaneous broadcasting of the historic event. McNamee is a St. Paul native and was a concert singer before taking up the microphonic profession.

"Perhaps an event of world-wide importance takes place in Pittsburgh. KDKA could duplicate the inaudible and audible wave length transmitting and the despatcher would instruct the 'booster' station to send along only KDKA's inaudible wave length signals.

"Thus this station's program would be the one that would be repeated by repeating stations located at any prearranged points on the globe and the signals could be received in Shanghai, San Francisco, London and Sidney, Australia, with the same intensity as signals are now received when transmitted by stations located at those points.

"This system means world-wide radio and it also means less interference to the radio listener, for, with a selective receiver, he could still hear long distance stations, even though the local station should be repeating a London program picked up from the inaudible wave source."

Radio Association Official Raps Plan for Super-Stations

The recent announcement of the Radio Corporation of America that the big electrical and radio companies of the country had decided to establish ten super-broadcasting stations in zones throughout the country is of considerable interest to radio manufacturers, broadcasters, dealers and the public at large, according to Alfred M. Caddell, secretary of the American Radio Association, New York City.

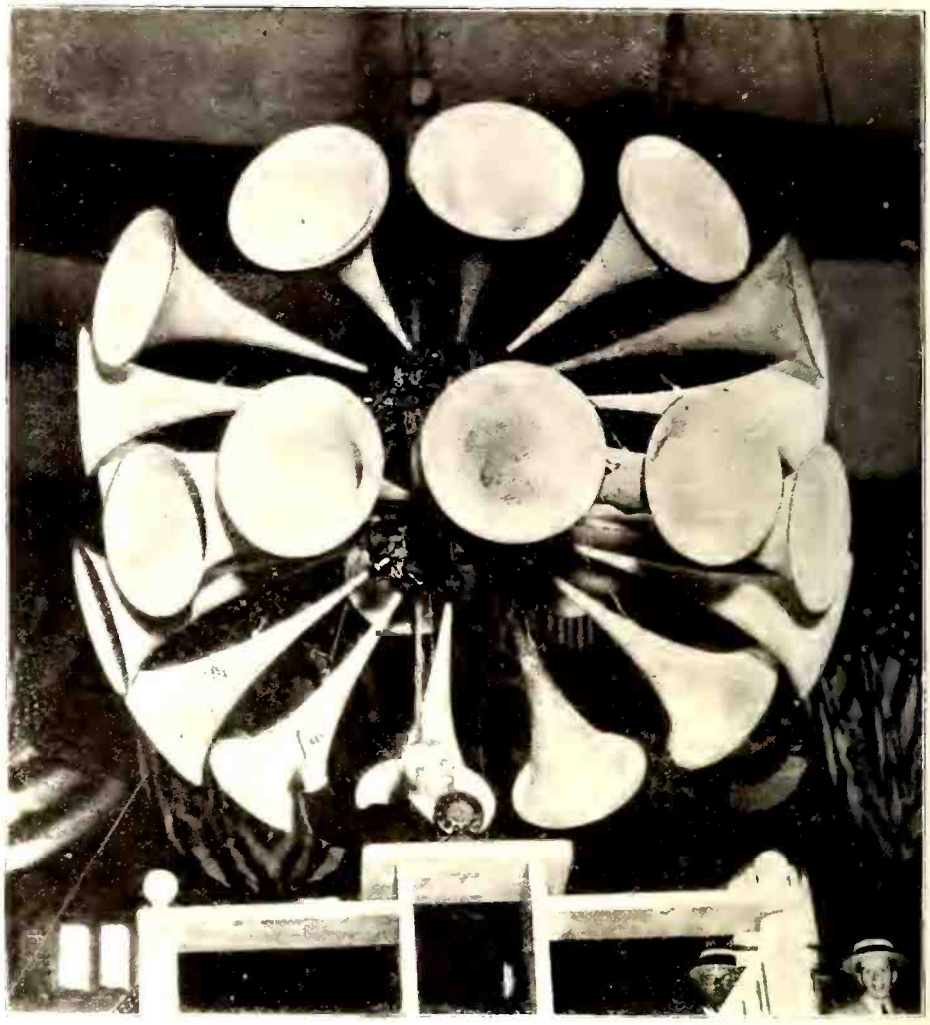
"The proposed blanketing of the country by super-broadcasting stations certainly blankets a lot of opinions that might want to be expressed before such a policy would be put into effect," said Mr. Caddell.

"While it is stated that such a broadcasting system would not interfere with local stations which take care of local needs, experience has shown that unless exceptionally selective receivers are used, it is impossible to tune out stations using a carrier wave of high power. This was demonstrated recently when the Republican National Convention was broadcast over the entire country—very few other stations could be picked up by average radio receivers in any section of the country.

"The radio business has been built largely on the thrill of getting distance, and if this thrill (and therefore other stations) becomes destroyed by blanketing the country steadily with high power, it might lead to serious consequences in the radio world.

"Everyone knows that radio broadcasting needs a complete overhauling and that the present lack of economic stability surrounding broadcasting cannot endure, but the public and the independent broadcasters naturally want to be heard when it comes to the overhauling.

"To this end the American Radio Association is conducting a contest in which a $500 prize is offered for the most practical solution of the problem, and it may reasonably be expected that a constructive solution will be found."



Kadel & Herbert

AMPLIFYING SPEECH ONE BILLION TIMES

That's what this bunch of lily-like amplifiers does when someone talks into the microphone connected to it. Twenty-four amplifying horns are shown in the photograph, which was taken recently in Madison Square Garden, New York. This huge radio attachment will be used in future meetings, including the Radio World's Fair next month, to speed the proceedings to a listening world.

Common Law Could Handle Radio, Claim

Legal questions arising out of interference between users of radio could probably be settled by common law, in the opinion of Hon. Stephen B. Davis, solicitor for the Department of Commerce. In speaking on this subject before a recent meeting of the Federal Club at the Bureau of Standards in Washington he called attention to the fact that, while common law is based almost wholly on precedent, it is often modified by court decision to meet new conditions, such as have been created by radio and aircraft.

Under the constitution, Judge Davis stated, the control of radio apparatus with regard to structural and safety features properly belongs to the individual states, but the Federal Government would control the interstate commerce features, and could regulate any broadcasting station whose signals could be picked up outside the boundaries of the state in which it is located.

There has been some fear of a radio monopoly, the judge said, but if this monopoly came about through the suppression of competition and unfair trade practices, the present anti-trust laws could handle it. A monopoly arising from patent ownership, however, could not be broken, for reasons that are inherent in the patent law.

The most difficult communication problem in the army, according to Maj. J. O. Mauborgne, the next speaker, has heretofore been that of keeping in contact with advanced troops in battle. All forms of communication in use in the past war proved inadequate, he stated. He then told of a portable radio set developed toward the end of the war which is expected to solve this problem.

There are a great many radio sets on the battle front, he said, and the problem of assigning wave lengths to them all is a very complicated one. The wave lengths and call letters must be changed every day or so, in order to avoid giving the enemy a clue to the nature of the sending station. Radio sets are carried by tanks, airplanes, and advanced infantry units, and form part of the equipment of all grades of headquarters and of artillery brigades

Vacuum Tube Circuits Without "B" Batteries

By JOHN B. RATHBUN

English 4-Element Tube Based on 'Unidyne' Idea; Has Faults, But Tests Indicate Possibilities

A CONSIDERABLE amount of interest has been awakened in this country as well as in Europe by the appearance of an English four-element tube which does away with the necessity of the usual plate or "B" batteries. This tube, the joint invention of K. D. Rogers and G. V. Downing, is based on what they term the "Unidyne Principle" and is applicable to regenerative circuits where the three-element tube is commonly used. While the idea is not basically new, and experiments in this country have shown that the principle has several inherent disadvantages, yet the four-element tube shows promise and we will undoubtedly hear more of it in the future.

In Fig. 1 we show a sketch of a four-element tube in which the terminal (A) is the connection of the second grid to the positive side of the "A" battery. The remaining connections to the plate, the first grid and the filament, are made through the four prongs in the base as with the conventional three-element tube. For convenience, the terminal (A) can be connected to the metal sleeve of the tube mounting, and can thus be used without much complication in metal sockets. It should be understood at this point that the second grid, or the fourth element of the tube, is maintained at a positive potential and in close proximity to the filament so that the electrons are set free by the attraction between the minute negative electrons and the positive grid. In other words, the second grid (A) performs a part of the functions of the plate used in the triode tube—that of increasing the electron emission of the filament. The plate now is simply the output terminal with the first grid functioning in the usual way.

Fig. 2 is a schematic diagram or symbol of this tube where the elements bear the same letters as Fig. 1.

To understand the operation and construction of the four-element tube we must first take up the construction of the simpler tubes, such as the two-element and three-element types so common on the market at the present time, for it is only by this comparison that we can see how the four-element tube functions.

The Two-Element Tube

In Fig. 3 we show an ordinary incandescent lamp bulb containing the usual hairpin filament (F). The filament is heated to incandescence by the battery (A) and the temperature is controlled by the filament rheostat (R). At high temperatures, electrons are emitted from the surface of the filament as indicated by the short arrows (e), and as there is no control over these small negative charges, they fly off the filament in every direction.

Now consider the case where the plate (P) is placed in the vacuous space with the filament (F) as in Fig. 4. The plate (P) is given a slight positive charge by induction, and as the negative particles or electrons are attracted by the opposite positive plate, they stream across between (F) and (P) and form a continuous bridging current. This effect was discovered by Edison many years ago. As long as the electrons are emitted by the filament, a current will be established through the inductance coil (L), the phones (H) and the gap between the filament (F) and the plate (P). This is the simple two-element tube commonly known as the "Fleming Valve" and is now represented commercially by the Electrad Diode and the Dietzen tubes.

THE aerial (An) and the variable condenser (C) are connected to the upper end of the inductance (L), while at the lower end is the usual ground connection at (g). Impulses entering the aerial cause variations in the electron stream between (P) and (F) and these variations in current flow cause sounds in the phones (H). The plate (P) is not strongly charged to a positive sign, and the electron emission is comparatively weak, so that the signals at the phones are not much stronger than with the ordinary crystal detector. By connecting the positive pole of a high voltage battery to (P) the stream or emission is greatly increased and the signals are correspondingly increased in volume.

In Fig. 5 we have the two-element tube to which the high voltage plate battery "B" is added with the positive pole connected to the plate. The battery "A" is simply used for heating the filament as before. As the plate (P) is now given a strong positive charge there is a powerful attraction for the negative electrons and the velocity and rate of emission is very much greater than in the case where the positive plate charge was maintained simply by induction. A comparatively heavy current now flows in the plate and "B" battery circuit, and also through the vacuous space between the filament (F) and the plate (P). This system, however, will not give a signal in the phones since the current is continuous and unvarying. To produce a sound in the phones there must be a variation in current strength in the phone circuit.

The Three-Element Tube

The three-element tube of Fig. 6 is basically the same as that of Fig. 5 so far as the output circuit is concerned and includes the "B" battery for maintaining the positive plate charge. Interposed between the filament (F) and the plate (P) is the "Grid" marked (G) which is used for the control of the electron stream passing between the filament and plate. The grid in practice is a cage surrounding the filament (F) composed of a spirally wound wire coil, and in order to reach the plate the electrons must pass through

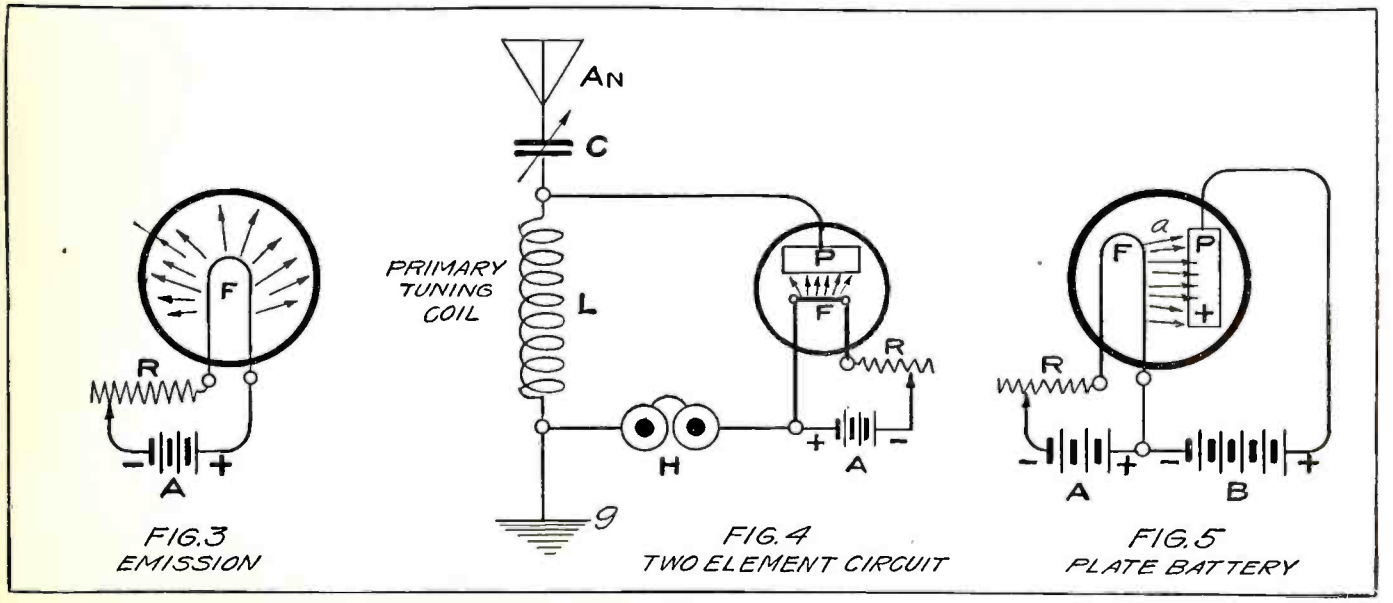
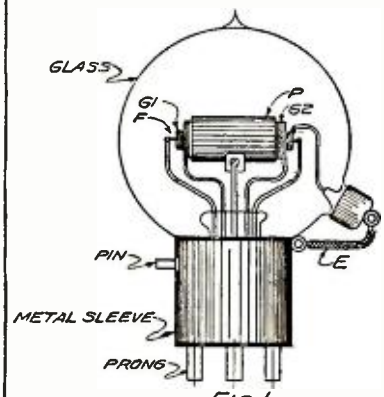


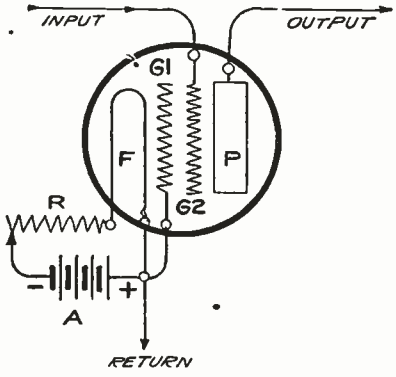
FIG. 3 EMISSION

FIG. 4 TWO ELEMENT CIRCUIT

FIG. 5 PLATE BATTERY



F16.1
TUBE ASSEMBLY



F16.2
SYMBOLS AND CONNECTIONS

the meshes of the grid.

By means of the tuning inductance (L) and the variable condenser (C), the circuit is tuned to the frequency of the incoming radio waves, and when tuned in, the impulses from the aerial are communicated directly to the grid (G) through the grid condenser (K). As these radio currents are alternating currents, the grid is given alternate positive and negative charges which vary in amplitude with the sound or modulation impressed upon the carrier waves at the transmitting station. The charge on the grid now corresponds to the charge on the aerial circuit, and the grid in turn varies the flow of electrons between (F) and (P) to correspond exactly to the variations taking place in the aerial.

As a result, the current flowing through the phones (H) pulses in step with the modulation (sound) waves and the transmitted speech or music is heard at (H). The grid can be really considered as a valve which controls the relay battery current in the plate circuit, the valve being opened or closed to check or accelerate the electron flow by the very feeble impulses acting on the grid.

WHEN a negative charge enters the grid (G) the grid is charged negatively. and the circuit is interrupted for the reason that the negative electrons are repelled by the grid and returned to the filament, therefore never reaching the plate (P). This interruption gives a click or sound in the phones (P). A succeeding wave of positive polarity charges the grid with a positive charge and this attracts the electrons and accelerates the flow between (F) and (P) at a speed above normal. This increased plate current gives a second sound in the phones. A very feeble charge in the aerial and grid is therefore capable of controlling a considerable flow of battery current, and the initial wave is therefore "Amplified" or multiplied many times. The positively charge plate (P) tends to maintain a steady flow of battery current through the tube, while the grid charge varies the amplitude or magnitude of the phone current in direct proportion to the amplitude of the incoming radio waves.

A positive charge on the grid (G) increases the rate of electron flow or emission while a negative charge tends to impede to flow. The exact degree of acceleration or impedance depends upon the magnitude of the voltage applied to the grid. For each volt impressed on the grid there is a definite flow of current in milliamperes through the phones with a constant "B" battery voltage. A milliammeter placed in series with the phones and "B" battery as at (MA) will plainly indicate the fluctuations of current taking place when the circuit is receiving signals. The needle of the meter will swing back and forth in almost direct relation to the intensity of the sounds heard at (H).

The strength of the received signals is roughly proportional to the plate voltage impressed by the "B" battery when a hard amplifying tube is used. Thus, with 16 volts on the piate, the voice and music may be quite faint on local stations, but when the "B" battery voltage is built up to 67.5 or 90 volts the signals are very much stronger because of the increased emission and velocity imparted to the electrons. This, however, is not so marked on distanct stations for the reason that the grid potentials are now too feeble to entirely control the tremendous emission and hence the electron stream is not so completely modulated by the grid as when the grid potentials were stronger.

Three Elements Without "B" Battery

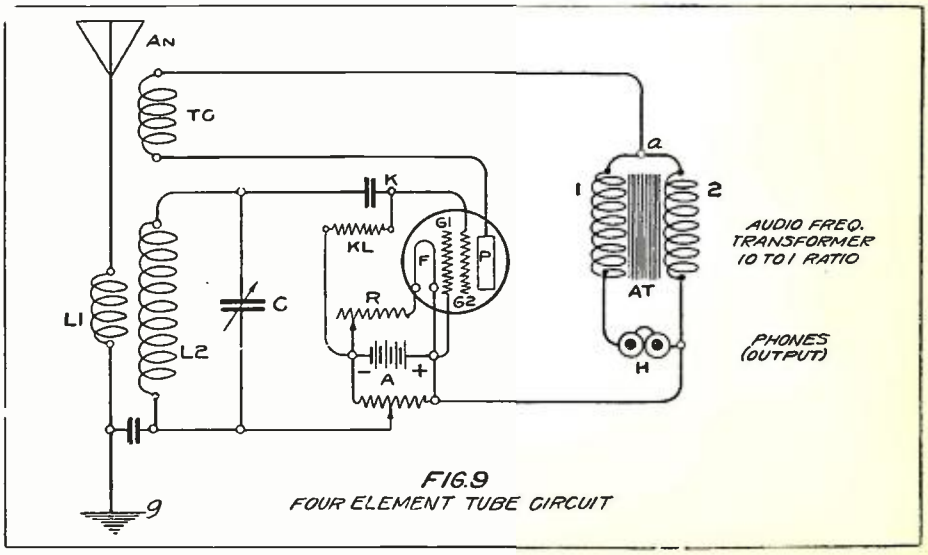
Now let us consider that we have disconnected the "B" battery in Fig. 6 and have then connected the phones in the plate circuit directly from (2), or in other words, have short circuited the posts where the "B" battery was formerly connected. The positive pole of the "A" battery will now maintain a low voltage positive charge on the plae (P) and the signals will continue to be heard, but with greatly reduced strength owing to the lower voltage of the "B" battery. This circuit is shown by Fig. 7 with the "B" battery removed and where the "A" battery alone maintains the plate at a positive potential. This arrangement works fairly well on strong local signals with six-volt tubes, and would no doubt work very much better with tubes having the filaments designed for a 22.5 to 45-volt "A" battery, as then we would have a much more effective voltage on the plate.

Signal strength and distance are both very much increased by the adoption of the "Regeneration" or "Feed-back" principle by which a part of the plate circuit is fed back into the aerial circuit for reamplification in the tube. Thus, in Fig. 8 we have a typical regenerative circuit for a three-element tube where the aerial impulses pass through the primary coil (L1) and induce charges in the secondary coil (L2) which is connected to the grid (G) of the tube. The plate output at (P) is very much stronger than the aerial currents, as before explained, due to the relaying with local battery current. Hence, if we feed back this amplified current into the secondary coil (L2) by means of the "Tickler coil" (TC), we will gain an additional amplification since the impulses will be fed through the tube a second time and will receive a second amplification. Instead of the feeble aerial impulses acting on the grid (G) alone, we will also have the stronger plate impulses acting inductively on the grid, which very greatly increases the effective grid potential.

The Four-Element Tube

WE now arrive at the four-element tube, which in many respects resembles the three-element tube. We have the same filament and plate and also the same control grid as before, but in addition to these elements is a second grid which maintains a positive potential independently of the plate. The plate in this case is simply an output electrode.

In Fig. 2 we show the four-element tube



F16.9
FOUR ELEMENT TUBE CIRCUIT

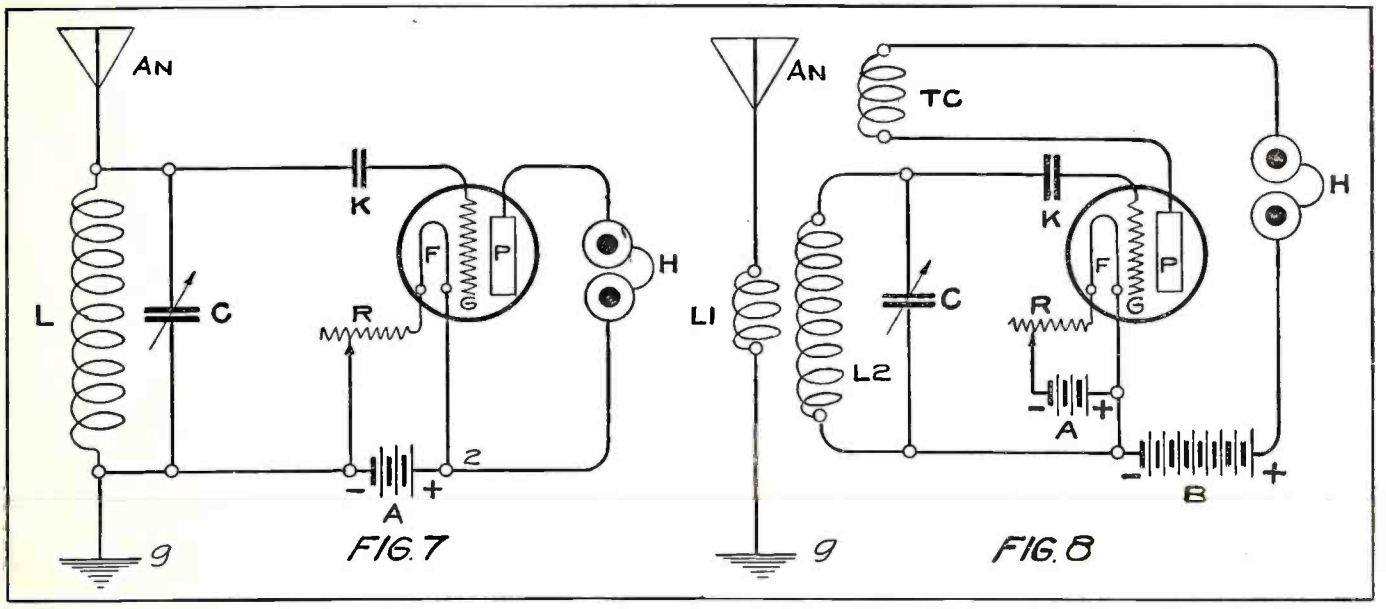


FIG. 7 FIG. 8

in diagrammatic form so that its relation to the three-element tube can be more easily followed. Here we have the filament (F), the plate (P), and the aerial grid (G2) as before. Placed close to the filament is the second grid (G1) which connects to the positive side of the (A) battery and which is therefore constantly maintained at a low positive potential. No "B" battery is necessary for the reason that the positively charged grid (G1) pulls the negative electrons from the filament and increases the emission in the same way as the older charged plate did the job but at a lower potential. In fact, the whole scheme is reminiscent of Fig. 7, except that the extra grid is located more advantageously than the plate of the ordinary tube.

The tube shown in Fig. 1 is a development of Fig. 7 made some time ago by the writer in which a commercial tube was remodeled on the score of economy. Owing to more recent schemes the idea was finally discarded in favor of more promising fields.

The Four-Element Circuit

Fig. 9 is a general schematic circuit of the regenerative type in which the four-element tube is used. This is only one of a great many such circuits possible, and it is likely that expediments in four-element hookups will develop more highly efficient schemes. The plate (P) output is fed back inductively into the secondary coil (L2) of the coupler in the usual way by (TC), the secondary being tuned by the variable condenser (C). The grid (G2) is connected into the secondary circuit through the grid condenser (K) and grid leak (KL).

At (G1) is the second grid, which is connected to the positive side of the "A" battery. The phones (H) can be placed in series with the plate and tickler (TC), or else the special audio transformer (AT) can be connected as shown to increase the volume of the signals. Here, the phones (H) are in series with the secondary (1). The primary and secondary have a common connection at (a) and both coils are in series with the plate circuit.

This is a rather novel connection and it would seem at first glance to partake somewhat of the reflex principle. This, in general, is the "Unidyne" circuit, which, however, is subject to as many modifications as the circuits of a three-element tube.

Original "Unidyne" Developed by U. S. Manufacturer?

There has recently been released in various radio publications information concerning a circuit brought out by two radio men of London, which does away with the separate "B" battery.

This circuit employs a four-element tube which contains two grids as indicated in the diagram above. The extra grid is inserted between the usual grid and filament. It is made positive by being connected to the positive of the "A" battery and it is placed so close to the filament that the electrons are pulled away from the filament and hurried to the plate. Added velocity is given them by the extra grid.

This circuit has been named by its English inventors, the Unidyne. However, the original "Unidyne" circuit was developed by the engineers of the United Manufacturing & Distributing Company of Chicago, and they have the name "UNIDYNE" registered in the U. S. Patent Office, according to a bulletin released by the United Manufacturing Company last week.

The United "Unidyne" Receiver is the result of over a year of experimenting and development work by renowned engineers.

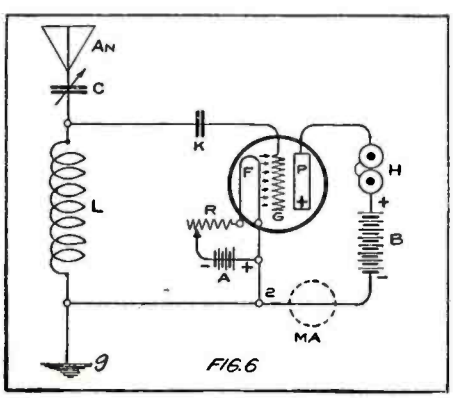


FIG. 6

Tubes Replace Spark Signals on Lighthouses

Marked improvement in the sending of wireless fog signals from lightships and lighthouses has been achieved through the development by radio engineers of the General Electric Company of a vacuum tube radio transmitter expressly designed for this sort of work.

In tests which have just been completed on Staten Island, the new tube set showed superior efficiency as compared with the typical spark set of the type used for a number of years by the United States Bureau of Lighthouses.

During the tests both of the fog signal radio transmitters were adjusted to about ten amperes in the antenna. It was found that the total power consumed by the spark set averaged around 2,300 watts, nearly 50 per cent greater than the power consumption of the tube set, the latter being about 1,650 watts.

This will have a direct bearing on the question of fuel supply to lightships and lighthouses, since the power for these sets is supplied by gas-engine driven generators, in which kerosene is usually burned.

If the lightship or the lighthouse is located in an inaccessible position, as is often the case, a considerable saving in fuel and other expenses can be effected if fuel ships are not required to make the trip as frequently as at present.

The tube set was shown to be safer to operate and much more simple than the spark sets heretofore used, and the signals were clearer and better toned, making them easier to read.

The spark sets heretofore used have caused many complaints to be sent in by listeners to broadcasting stations because of their tendency to originate interference. This condition will be remedied by the use of the tube sets, which possess a non-interference characteristic.

The outcome of the tests with the new set was a recommendation by J. T. Yates, superintendent of lighthouses of the third district, to the Bureau of Lighthouses in Washington, asking that these tube sets be adopted generally for the bureau's radio beacon stations.

The Heart of the Radio

By ERNEST WALKER SAWYER
CHIEF ENGINEER, ELECTRAD, Inc.

PART 2.

IN A previous article I showed you the importance of the proper size grid leak. I hope you had the opportunity of testing my advice by trying a different size leak in your set.

Now I want to explain to you why it is so important for you to have grid leaks which are manufactured by responsible people who will certify they are correctly made and guaranteed.

Here is the Heart of the Radio. The source of success or failure of the set and yet a careless pencil mark has, until recently, been permitted even in expensive sets of well known manufacturers.

In the grid leak, you are dealing with minute electrons of electricity passing over a path of extreme high resistance 500,000 to 30,000,000 ohms. Here is the essence for a great deal of research work. The problem of handling such minute portions of electricity at such extraordinarily high resistances resembles somewhat the problems of dealing with lightning. Two storm clouds are filled with energy. The electricity generated is enormous; the path between the clouds or from the cloud to the earth is possibly a mile of thin air. Its resistance is beyond comprehension. Finally the pressure becomes so great the electricity jumps.

If there was a copper wire or other easy conducting path, there would be no zigzag and no thunder. It is exactly the same in the receiving set. The accumulated charges jump along the grid leak. If the path is a perfect conductor, there is no noise. If the grid leak element is uneven or only partially a conductor, then the grid leak actually creates noises in your set. You will realize from this the importance of a proper element in the grid leak.

Just as a copper conductor carries low frequency currents in a smooth, proper manner, because each molecule of copper has its functions to perform harmoniously with its neighbor; so likewise or even more so should the substance of your grid leak element be so composed that the molecular displacement of the carbonaceous conducting material should be equal throughout the entire cross sectional area. In plain English, the grid leak element should be made of a material which is exactly the same in the interior as on the surface or you will get the zigzag jumps together with the noises as in lightning.

The elements of many grid leaks are made of a paper in which carbon in the form of lamp black has been defloculated through the pulp during the process of the paper manufacturing. This is one method of obtaining the desired result.

After the paper is cut to the desired size for the grid leak required, copper or brass clamps are fastened to each end or some special method is used to make contact between the element and the ferrules or ends of the grid leak. These contacts likewise are extremely important, as a loose contact means a noisy grid leak or one of very high resistance.

An electric current is now passed through the element to season it. An analogy to this might be shown as the passing of a current through a piece of iron to form a permanent magnet. The atoms of lamp black align themselves in perfect regular order, end for end, so as to offer the smoothest possible path to the passage of the small current for which it is intended.

Next the elements are treated with waterproofing compounds, usually of secret formulae, as the waterproofing matter must not affect the element adversely.

The leaks are now seasoned a few days just as you bake steel.

Next, the element is carefully inserted in the glass tube or other insulating case, and the ferrules are soldered on each end to further protect the element from contact with fingers and atmosphere. Glass cases are most common, but there are other insulating materials now in use, where the dielectric losses and insulating qualities are considered better.

The finished grid leak is again tested and labeled or stamped and certified correct. It is now ready for use.

There has in the past been considerable propaganda on grid leaks to the effect that if your grid leak is the incorrect resistance, you can compensate by adjustment of your variable condenser. This is an absolutely incorrect method of procedure. As you can readily see, one cannot adjust resistance by altering capacity. If your grid leak is the wrong size, you must get another. If they are certified correct, then you know what you are getting and can try out several sizes until you find the one best suited for your particular requirement.

Photo from Kadel & Herbert

A ONE TUBE TRANSMITTING SET

The photo shows the interior of a transmitting set built by George B. Myers of Athenia, N. J. It operates on a U. V. 201 tube, 23 plate condenser and an inductance. Also a Ford spark coil is used and a glass plate condenser for supplying the high plate voltage.

Canadian Tries to Reach MacMillan

Toronto, Canada.—William Choat, local radio amateur and radio operator for the Canadian government steamer "Arctic," which left Quebec the first of July on her annual trip to Baffin Bay, may be the first amateur operator to relay back to Canada and the United States the complete details of the Winter experiences and home-coming arrangements of Captain Donald B. MacMillan, Arctic explorer.

The departure of the "Arctic," under the Northwest Territories Branch of the Canadian Department of the Interior, comes at a time when the arrival of daylight in the Far North is beginning to shut off the radio contact between MacMillan and radio amateurs of the United States and Canada.

The radio messages that have come from Donald Mix, the explorer's radio operator, last Fall and Winter have become gradually less frequent as darkness began to leave the polar regions. Of late there have been only a few weak messages that have sufficed to show the "Bowdoin's" crew have come through without hardship. The last one told of the explorer's plan to start for home soon.

On its annual trip, the "Arctic," which this time is in charge of J. D. Craig, M. E. I. C., and Captain Bernier, famed Canadian explorer, sails as far north as Etah, Greenland. Last Fall, on their arrival in that harbor, the "Arctic's" crew found the "Bowdoin" there and one of them took a snapshot of MacMillan's little schooner as she lay at anchor near the shore.

This year the "Arctic" will carry a short wave I. C. W. outfit which will enable its operator to transmit on the amateur wave lengths between 100 and 150 meters. This equipment is in addition to her two regular sets, consisting of a standard 600-meter, 2 k. w. spark transmitter and a continuous wave transmitter working on a 2,100-meter wave length.

Radio Drawn Into Field of Magic by Queer Tales of Ether Bogies

Scientists Are Baffled by Accounts Verging on Supernatural

By CARL H. BUTMAN

WASHINGTON.—Radio supervisors and inspectors hear many queer tales of strange messages, sounds and calls emanating from somewhere within the boundless realms of radio land. Some complaints are weird, a few pathetic and still others almost convince one that there are Ethereal Bogies.

Radio is of itself more or less of a marvel and a mystery, with the rapid advancement of its range, manipulation and scope, and it is small wonder that certain susceptible fans and even operators long in the game hear or imagine they hear curious and unaccountable messages verging on the supernatural.

There is the story of one old-timer who declared that he no longer needed head phones, his ears having become so tuned to the notes of code stations that he could pick up messages from almost anywhere.

Some of these complainants perhaps improperly classified as bugs of the ether, insist that they are haunted by "Hertzian spooks," which in certain cases seem to approach from the spiritual angle and assume radio control of their victims. They not only exercise an undue influence but create actual fear in the hearts and minds of those persecuted. Certain students of the problem refuse to believe that it is all imagination, attributing the influence to something supernatural or at least a power not yet understood.

Does Radio "Control" Exist?

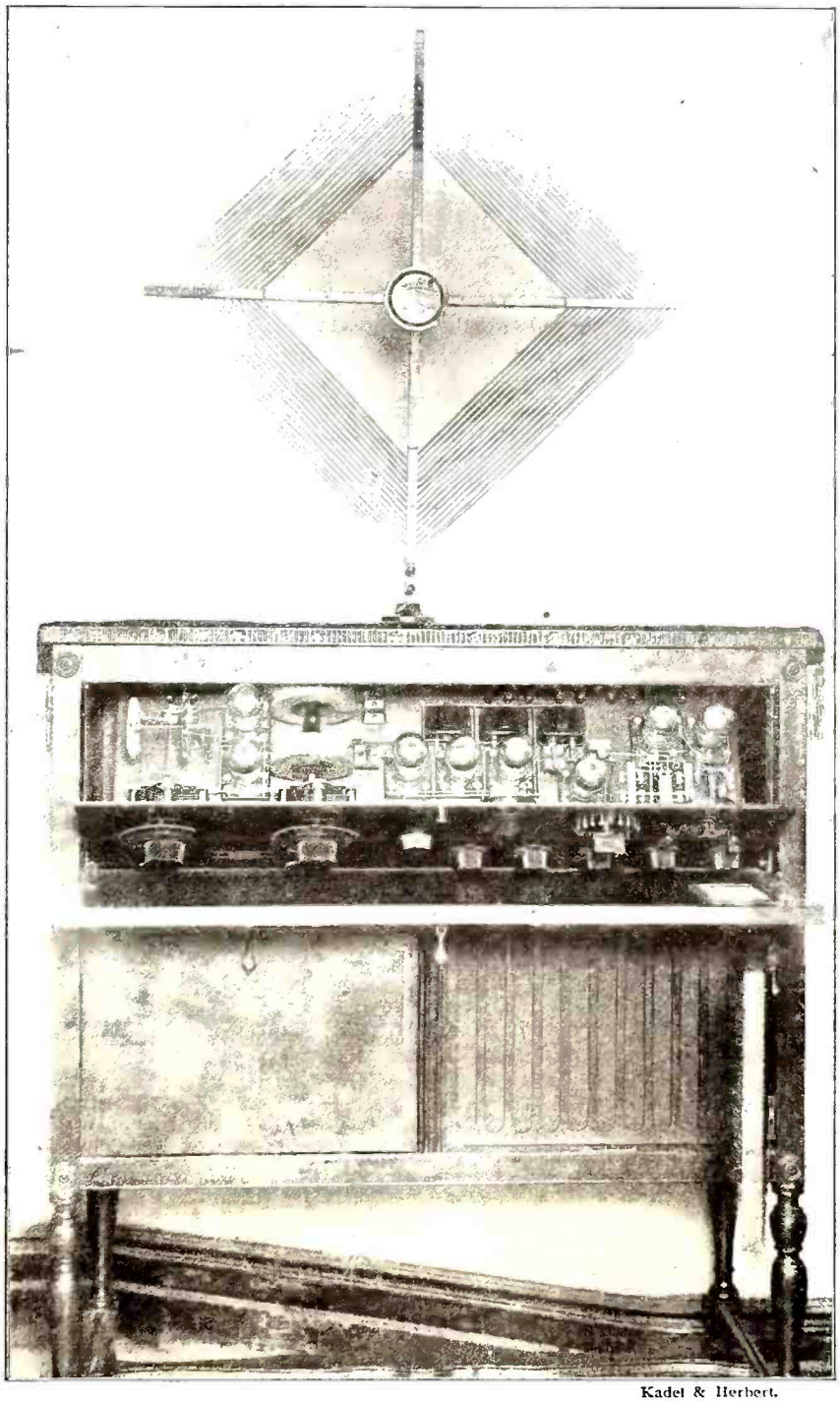
Of many cases reported to the Department of Commerce, there is none so striking as the "Strange Case of Operator Blank," on which there is a thick file of papers:

Nearly four years ago a sea-going radio operator of twenty years' experience reported to the supervisor of a coastal district that he was the object of radio persecutions in the form of radio telephonic messages which were transmitted to him continually by virtue of wired-wireless when he was ashore.

Three unprincipled young operators, he asserted, kept a surveillance over his every move, reading his thoughts, and at times "neutralizing" his brain action. These three persecutors relieved each other, but kept up their vocal messages day and night, no matter where he was. Their sinister influence, he felt sure, was affecting his young daughter when she was near him, and practically broke up his home. He appealed to scientists, doctors, radio experts, the government and police without benefit, as the source of the radio emanations could not be traced. They seemed to come from a coastal point. Even while on an automobile trip across the continent and into Canada, the "phantom" radiophone or photophone messages pursued him. The messages were transmitted on various frequencies and were impossible to ignore.

Operator Blank believed the young men had invented an ultra-modern transmitting set of which no one knew the circuit. He said the boys told him it was a wired wireless psychometer affecting the transmission of speech by a therapeutic oscillator, and received by triplex phantomining attunement. He couldn't get away from the messages, and he was certain that the boys kept a log of his thoughts.

(Continued on next page)



Kadel & Herbert.

CABINET AUTOMATICALLY CONTROLS TUBES

This unique set, constructed by Harold Herbert, radio engineer of New York, and valued at more than $500, operates when the cabinet is opened and automaticaly turns off the tubes when the front is closed. It is an eight-tube Super-Heterodyne with two tuning controls entirely self-contained.

And Still They Pursue

Later on, when he was again at sea, the messages pursued him, evidently through the medium of radio. In the Atlantic or Pacific the effect was the same, and the operator came to believe that the primary phonetic effect kept his head aching continually; sometimes he was driven from his radio shack. He was certain his death could be caused by these boys if they desired. He again took up the matter of locating the station with authorities in New York, San Francisco and Washington, but no one was able to aid him nor locate the unknown station. Unofficial and unsigned messages continued to follow him, causing interference with his regular traffic, his sleep and his mental stability. Investigations showed him to be in good physical and mental state, but although pronounced sound in his mind and body and only about 42 years old, he was literally driven from the sea and his profession.

Following up some of his suggestions, radio officials report that spiritualists have been affected in a similar way, and from New York came information that complaints of this character were increasing—in fact, becoming quite common. Department of Commerce radio officials say that during the full of the moon complaints of weird and unnatural radio messages in the ether come in with a strange regularity. Even to date the department and its field staff have not been able to solve the mystery of Operator Blank's persecution nor the source of the phone messages he reported.

Other curious cases reported to the department include the Western farmer who, whenever he was plowing in a field near an insane asylum, declared that he was influenced and persecuted by voices which seemed to come from a queer box on the sill of a window in the institution. He came to Washington in an effort to rid himself of this "radio control." When he returned the box was no longer visible, and it is understood he was bothered no further, though it was never wholly explained.

From Philadelphia came a story of a woman who was constantly hearing radio voices, especially when riding on a train, although it was long before trains were equipped with receiving sets. Another woman out West recently wrote that waves from a certain radio station pass through her house and her person, causing a most unpleasant effect; she said she could never sleep until the station closed for the night.

Now Come Radio Sleuths

During the World War, complaints of this type and others attributed to German spies, codes, etc., came to the department's supervisors in great numbers, some of them obviously from people with unsound minds, who sought to become radio sleuths and desired special transmitting licenses and stations. Such desires, however, were almost always in the interest of defending the government, and differed from the case of Radio Operator Blank, and a few others whose radio troubles have never been solved.

Getting a Stranglehold on Static

Explaining that static is usually due to distant electrical disturbances in the upper atmosphere, and the trouble is generally less the higher the frequency to which the receiving set is tuned, the radio laboratory of the Bureau of Standards, of which J. M. Dellinger is chief, offers the following suggestions for meeting the difficulty:

"There are no known methods of completely eliminating interference caused by atmospherics in receiving sets tuned to the commonly used radio frequencies," he says.

"Methods are available which partly overcome the trouble. One is the use of a small receiving antenna. This may be a relatively low and short outdoor wire, or may be an indoor antenna. Such an antenna receives less powerful signals, but this may be compensated by using a more sensitive receiving set, employing regeneration or radio-frequency amplification. A small coil antenna or loop antenna, consisting of a few turns of wire on a frame a few feet square may be used, provided the receiving set is so designed as to permit operating with such an antenna. The coil antenna has the added advantage that it can eliminate, by virtue of its directional characteristics, the atmospherics that come from a specific direction.

"Another means of reducing the interference from atmospheric disturbances is to use a very selective receiving set. Two-circuit receiving sets, using loose coupling, are preferable to single-circuit sets for this reason. Radio-frequency amplification, with sharply-tuned transformers, is helpful. Well designed regenerative sets are also very selective.

"A specialized method is the use of a 'wave antenna,' which is a very low antenna, one wave length or more long. Another way of decreasing interference from atmospheric disturbances makes use of a combination of several antennas in such a way as to partly balance out the atmospherics. Also, a long antenna may be buried a short distance underground. This type of antenna reduces both the signal strength and the strength of atmospherics. Some evidence has been obtained to show that certain types of local atmospherics are reduced in a greater ratio than the signal strength.

"Still another method which has been reported to be of some use in reducing interference makes use of the limiting action of an electron tube used in conjunction with tuned audio-frequency amplification. It is stated that this method is based on the theory that an electron tube, when worked at a certain point on its characteristic curve, possesses a limiting action restricting the strength of the signal heard in the telephone receivers to a definite maximum. Thus atmospherics, although stronger than the signal being received, are equal in intensity to it, as heard in the telephone receivers. This equality in signal strength having been obtained, the advantage of audio-frequency tuning may be utilized. The result is a partial elimination of interference from atmospherics. This method is not adapted to broadcast reception."

To Eliminate Radiation

"How can I prevent other radio sets from interfering with my reception?" ask many readers and radio fans continually.

A special organization has recently been formed among radio engineers to formulate some method by which radiation or "canary bird" interference can be eliminated.

Users of Antenella aerial plugs report that this ingenious light socket aerial has solved this problem for them and many have taken down their aerials because they can get just as good results with the Antenella.

The construction of the Antenella is such that it makes the house wiring system act as an antenna, and because these lines are self-shielding due to conduit wiring, they do not pick up outside aerial radiation and are accordingly ideal to eliminate such interference, as well as static.

Filtered Heterodyne Audio Stages

By MARVIN HUGHES

REFERENCE has frequently been made in these columns to the fact that some sort of filter must be used in the audio stages of a Super-Heterodyne receiver to eliminate the noises and distortion which frequently are unpleasantly apparent in this circuit. This filter system must not be confused with the so-called "filter" or transfer coupler working at radio frequency which is installed at the beginning of the radio frequency stages, or rather between the first detector and the first radio amplifier tube. The audio frequency filter referred to here damps down the "Bumps" and harmonies developed in the first radio stages and is effective in clarifying speech and music when the loud speaker is used. It is almost a necessity with the two stages of audio amplification.

In general, the audio frequency filter system can be divided into two principal divisions: (1) That part which comes between the second detector tube and the first audio stage which damps down undesirable oscillations emanating from the detector, and (2) That part which prevents direct "B" battery current from entering the loud speaker and introducing distortions due to the constant deflection of the diaphragm under the stress of the "B" battery current. The first element precedes the audio amplifier, while the second comes between the amplifying stages and the speaker. In addition to these devices the conventional grid biasing "C" battery is installed, which is a further aid to clarity and which materially increases the volume.

Two Inductances Needed

FIG. 1 is a diagram of the complete two stage filtered amplifier which is connected to the second detector tube at the "INPUT" end or at the left of the diagram by the connecting posts (x) and (y). The connection (x) is made to the plate of the detector tube (P') as usual. The circuit can be installed in the same cabinet with the main heterodyne circuit or in a second cabinet. The former, of course, is preferable, but one should note that at least two inches more will be required on the length of the panel than with the more straight audio stages, owing to the introduction of additional apparatus.

Two large inductances of the iron core type are used. This rather complicates matters, since we must arrange these parts so that there will be no inductive interference or transfer of energy through the wild flux issuing from the coils, and this is not always a simple matter in the limited space that we have at our disposal.

Preceding the first audio frequency transformer (AFT1) is the preliminary filter circuit consisting of the two 12,000 ohm non-inductive resistance (R1) and (R2). Connected to the mid point of these resistances is the 100 millihenry iron cored choke or inductance (L1) in series with the 0.01 Microfarad fixed condenser (K2). Across this assembly is the 0.005 mf. fixed condenser (K1) which functions in the ordinary capacity of a phone condenser. The reactance of (L1) and (K2), together with the damping effect of the resistances (R1-R2) eliminates the high frequency disturbances which may originate in the radio frequency stages and detectors, and "irons out" the bumps before passing to the primary coil of the first audio frequency transformer (AFT1). Also see Fig. 2 for assembly.

Watch Detector Tubes

Connections at (B1) and (+22) depend largely upon the nature of detector tube used and on the "B" battery arrangement. If a soft detector of the UV200 or the C300 type is used, then a tap is made at the 22-volt terminal of the "B" battery. If a hard tube such as the UV201A or C301A is used which, by the way, is better practice, then (y) can be connected to the 45-volt tap. For the best results it is very desirable that the first radio stages, the detectors and the oscillator be carried on one "B" battery with the audio stages on an independent "B" battery as at (B2). However, this is very expensive and greatly increases the complexity of the circuit so that a single "B" is imperative. With a single "B" connections can be made as per dotted lines.

IT WILL be noted that the first single circuit jack (JD) for the detector circuit is connected directly across the primary posts (P) and (+B) of the first audio frequency transformer (AFT1). This arrangement does away with the contact troubles often encountered with a conventional two circuit jack and insures that the primary coil is always connected permanently in circuit without danger of noise due to poor contacts. The first audio stage jack (J1) is connected across the primary of the second audio transformer (AFT2) in the same way, so that in all we have three single circuit jacks in parallel on a continuous circuit which are not interrupted by the insertion or removal of the plugs nor by vibration. This is of the utmost importance in a circuit of this sort where the great amplification and the heavy "B" battery current makes jack contacts a serious problem.

The secondary coil of the first audio transformer (AFT1) connects to the grid of the first audio tube (T1) in the usual manner. Both tubes are given a negative bias by the "C" battery shown which has its negative pole connected to both the (—A) posts of the two transformers by a common connector. The positive pole of the "C" battery goes to the (—A) lines. For a 90-volt potential on the plates, the "C" battery biasing voltage should be about 4.5 volts, and from 6 to 9 volts for plate voltages much above this. So much has been said upon the subject of the "C" battery in its relation to volume and grid stability that it seems almost unnecessary to enter into a discussion of its functions at this point, but it should be understood that it is one of the most important adjuncts to the system and should not be omitted under any conditions. Condensers (K4) shown dotted are optional and may or may not give improved results. (.0005 mf.).

To minimize the number of controls on the panel, both tubes (T1) and (T2) are controlled by the single rheostat (M) inserted in the negative lead of the tubes. Separate rheostats can be used of course, but it is not advisable to enter into more complication than absolutely necessary, even at the expense of an extra tube burning when only the first audio stage is being used. Under most conditions, the set will be operated on both audio stages with the speaker plugged in on the output jack (J2).

The Output Circuit

Now we come to the final or output circuit of the second tube (T2). Ordinarily the connections from the plate and (+B) are connected directly to the output, but this introduces certain difficul-

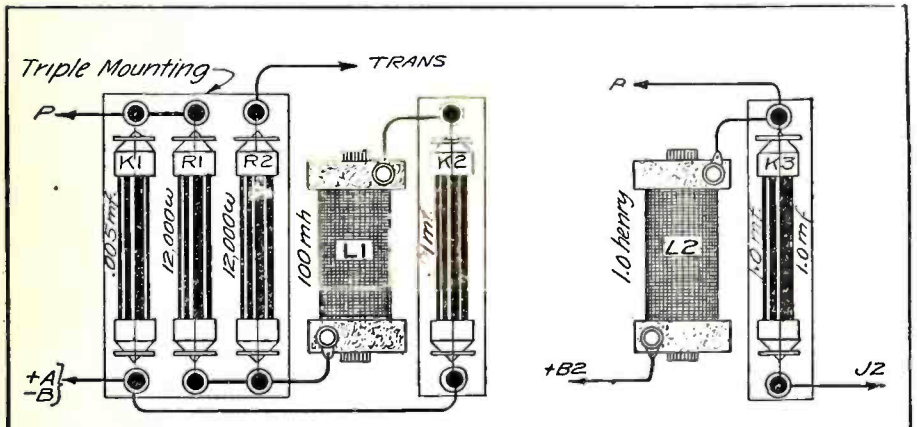


FIG. 2. Input Filter Circuit SHOWING GROUP OF UNITS AND THEIR MOUNTINGS AND CONNECTIONS

FIG. 3. Output Stage

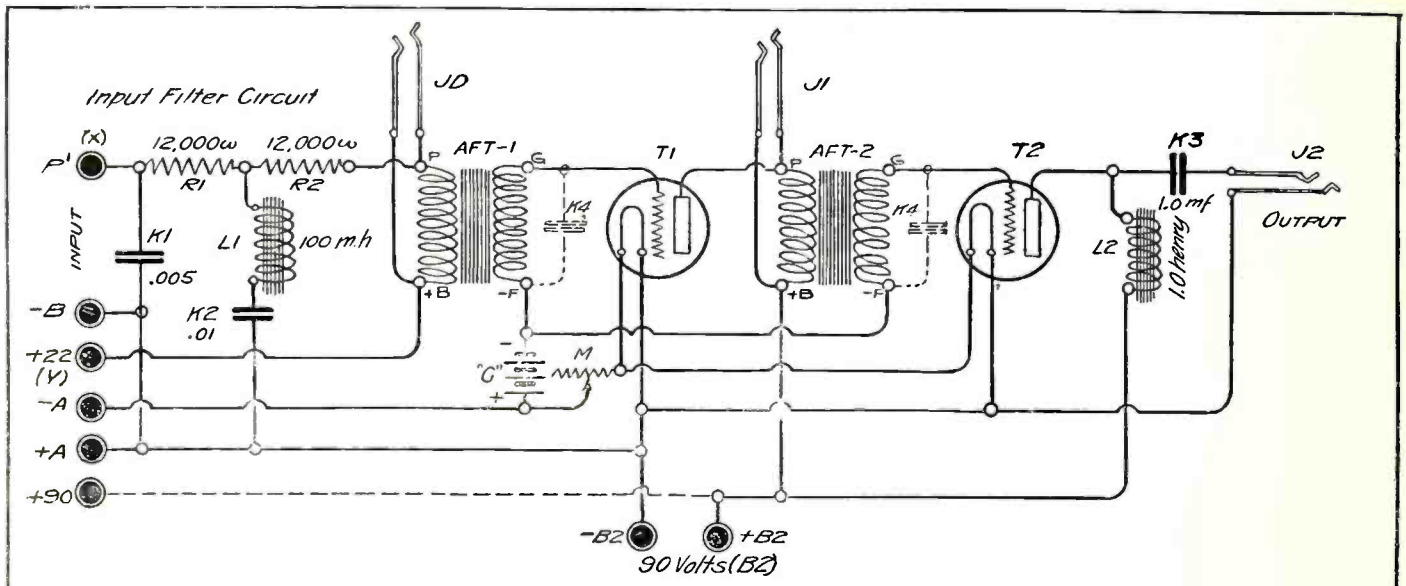


Fig. 1. Filtered Two Stages of Audio for Heterodyne

ties in the loud speaker and distortion in the final stages. To remedy this defect, the fixed stopping condenser (K3) of 1.0 mf. capacity is inserted in the plate circuit to interrupt the flow of continuous "B" battery current that ordinarily takes place through the coils of the loud speaker. This relieves the speaker diaphragm of the magnetic stress imposed upon it by the battery current and makes it more responsive as only the alternating audio currents can pass to the coils of the speaker.

As equal deflection is now imparted to both negative and positive waves there is no distortion due to diaphragm reaction. Current from the (+B) leads to the plate of tube (T2) and passes through the iron core choke (L2), which permits free flow to the plate, but which chokes down and prevents the audio frequency currents from short circuiting back through the battery. Some amplification is also due to the "kick" from (L2), and in general this combination not only improves the quality of the reception, but also adds considerably to its volume. Inductance value about 1.00. See Fig. 3 also.

IT IS imperative that both (L1) and (L2) be iron core inductances of the value given, owing to the low frequencies of the currents dealt with in this part of the circuit. The impedance of air core inductances while effective with the high frequency radio currents, offers very little opposition to the flow of audio frequency currents which are in the nature of 5,000 cycles per second. The inductance (L1) can be obtained from the better class of radio supply houses or from the various telephone manufacturing firms. Inductance (L2) can be a 1.0 henry iron cored inductance, or if desired, the secondary coil of an audio frequency transformer can be connected into circuit for this purpose. The latter, however, is rather bulky and takes up valuable room, but on the other hand, it is comparatively well shielded and causes practically no interference.

In locating (L1) and (L2) we must take every precaution against magnetic coupling and interference. The coils should be kept as far apart as practicable and well away from tuning inductances and the transformers. In all cases they should be laid out with the cores at right angles to one another and at right angles to the coils of the transformers so that the flux will not induce wild currents in the circuits. Enclosing the coils in grounded metal boxes is a great help, for the boxes shield the adjacent apparatus from the intense magnetic fields of the coils.

Our 12,000 ohm non-inductive resistances are of the type commonly used by telephone companies and are now to be obtained from the larger and better radio supply houses. As in Fig. 2, their general appearance is similar to that of a grid leak and they can be held in the same sort of clips and stands. Their value is not critical, but in general they should be as nearly 12,000 ohms as possible and of exactly equal resistance. Further, they must be truly non-inductive so that there is no phase displacement. No opposition to the radio frequency component which passes from the plate of the detector tube.

The Tubes

Regarding the tubes to be used for the amplifying stages (T1) and (T2), it may be said that the UV201A or the C301A are the best all around tubes to use. Of the dry cell tubes the UV199 or C299 are by far the best but, of course, do not deliver the volume attained with the power tubes before mentioned. Still further amplification can be had by the use of the Western Electric 216A tubes or the five watt transmitting tubes such as the UV202 or C302, but these latter tubes take a great deal of filament current and with the heterodyne any additional filament current is to be looked upon with disproval.

Both the 216A tube and the five watt tube permit of very high plate voltages and for this reason are essential where the maximum volume is to be obtained when the set is to be used in large halls or for outdoor service. Up to 350 volts may be used on the plates of these tubes and the amplification is in proportion, but it must be borne in mind that such voltages call for heavy plate currents and put a heavy demand on the "B" battery. The use of storage type "B" batteries is almost necessary if plate voltages of over 100 volts are to be used.

Figs. 2-3 show the general arrangement of the units used for the filters and stops, and their mountings. Fig. 2 is the input filter with the condensers and resistances placed in the usual spring clip mountings connected up for use. This arrangement probably gives the shortest leads. Fig. 3 shows the condenser and choke for the output "stop." It is likely that the least room is taken up when these parts are mounted on a small vertical panel placed near the rear edge of the baseboard, and as no adjustment is required there is no reason why this will not prove satisfactory.

100-Meter Transmitter Tested on the Shenandoah

That radio messages can come from a point high up in the air as well as "through it" was demonstrated recently when the radio operator on the Navy's big airship "Shenandoah" gossiped for a while with radio amateurs below.

"To the Rochester amateurs," read the message in code. "You are the first bunch that have woke up today. Best regards."

This was not a casual greeting, attempted as a pastime for the "Shenandoah's" crew, but part of a systematic program for testing out the possibilities of short wave amateur communication. Some time ago the American Radio Relay League learned from the Navy Department that a short wave transmitter was being installed on the airship for the express purpose of enabling its operator to communicate with amateurs should it be needed in emergency during flights.

Radio is no Longer "Seasonable"

By ROBERT J. CASEY

The Vest Pocket Anthologist

WHY should radio be a seasonable affair—like the flu and the winter coal bill?

It seems to be the accepted psychology in the radio business to shut up shop and go fishing at the first breath of Spring. But why? That, Oswald, is one of the real mysteries of radio. It ranks in interest with static, body capacity, and the proposed tax on broadcasting and it outclasses them in importance. But it is undeniably a mystery.

According to the popular conception of the thing, the entire world goes deaf in the Summer time. All the stations quit broadcasting simultaneously — or simultaneously quit broadcasting, depending on your particular situation. All the batteries die. And all the "gyp distributors" have their annual fires.

The Cause of It All

A survey recently completed by the Electrical Research Laboratories of Chicago may furnish a clew to the causes of this phenomenon. Two years ago a hard Summer followed a particularly soft Winter. Many a manufacturer sighs at the memory of that glorious period when a brace of static-sifters euphemistically called head-phones brought an unquestioning $15 and a wooden variometer was considered cheap at $7. Every second-hand clothes dealer who could make a Chinese copy of a piece of wireless apparatus went into the radio manufacturing business and took out more fire insurance.

Along about Spring the great mass of radio pioneers had become convinced that radio was a myth. But why go on? The story of that fearful Summer is written in records of the bankruptcy courts of every county in the United States. The public had suddenly become convinced that short-circuited coils and contact-less rheostats are an expensive attic decoration. That radio ever recovered from this period of disillusionment is proof enough of its permanence, and of American adjustability.

A manufacturer of loud speakers referred to those days last week as he paid off the last of the loan that had saved him from wreckage.

Radio revived because it changed. The Gyps are always with us. But their numbers are decreasing and it has become possible for a fan to buy standard parts with fair assurance that they will work. The elementary telephone circuits are fairly well understood by a majority of amateurs. And the sounds that come over the radio are quite similar to those sent out by the broadcasting station. Prospects for continuous popularity should be good. But in the background is the memory of that terrible Summer.

Because of one "silent Summer" it seems likely that all Summers are doomed to the gag rule. A matter of psychology, Oswald, that only the nimble of wit can explain.

Taking Off the "Curse"

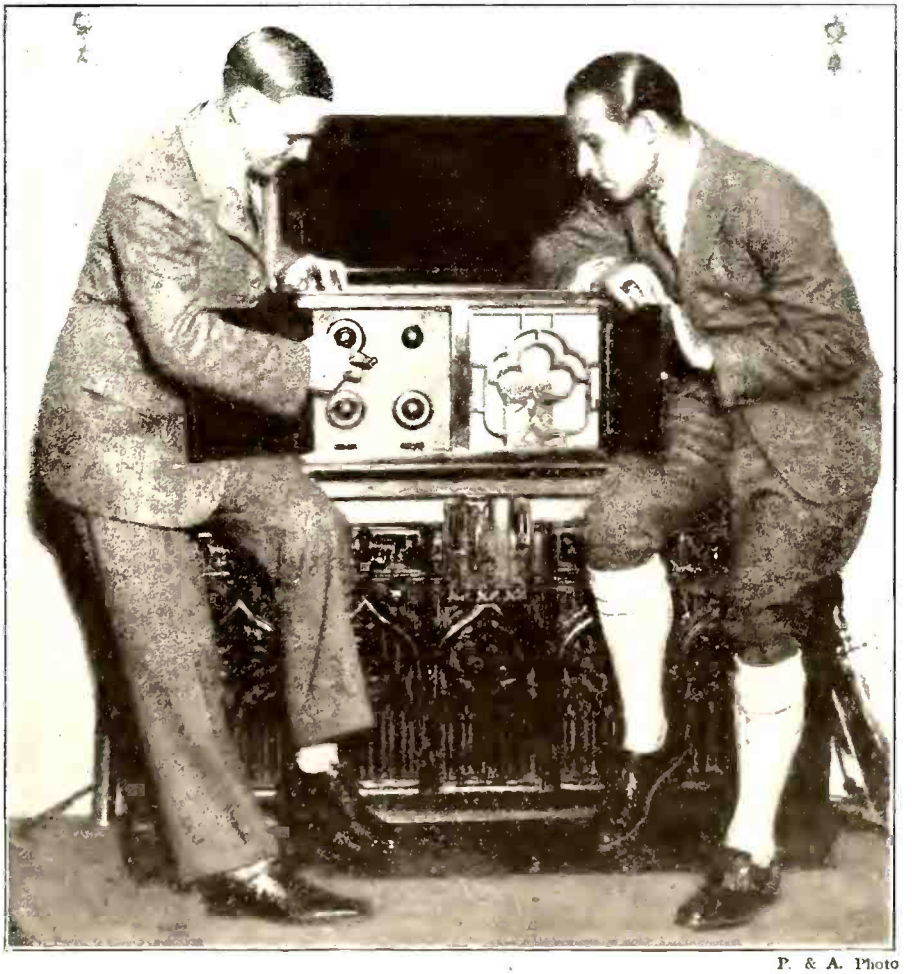
Application of the reflex principle to radio sets with dry battery tubes has made possible the construction of efficient receivers, all contained in cabinets a foot long or less, that will operate a loud speaker on a loop. A Summer evening on the front porch or the lawn certainly is no less enjoyable for a radio concert, and a radio set more than once has been known to take the curse off a Summer resort vacation.

As for static, most of it disappeared with the wooden variometer and its rough looking cousins. Inbuilt crackles in radio sets went out of style with switch arms and taps and Mexico City sounds just as bad in Summer as it does in Winter.

The Erla canvass shows that distributors and set builders throughout the country see no good reason for a warm-weather depression and look upon the annual vacation from broadcast as a tribute to the memory of the inefficient sets of two years ago. The material works of the hay-wire mechanics' guild have vanished. But only a patient and honest campaign of education extending over a period the length of which no one can forecast will destroy the psychological bugaboos that Gyp built.

Radio Technical Talks Over WTAY

RADIO AGE broadcasts technical talks every Wednesday evening from Oak Leaves station WTAY on 283 meters at 9:00 o'clock. Tune in your receivers to this wave some Wednesday evening and listen to the various members of the staff of RADIO AGE tell you the most recent developments in the radio field.



P. & A. Photo

EVEN "THE SHEIK" IS A RADIO FAN

Rudolph Valentino, a favorite with thousands of movie fans he never sees, is himself one of the great invisible audience which listens nightly to radio programs. He started by making a crystal set and has worked his way up to the most complicated hookups. Here he is shown with Alfred Grebe, the radio engineer, testing a new 5-tube set designed by the inventor for Valentino.

"This is WMC, 'Way Down in Dixie!"

How Local Talent Made WMC Popular

"STATION WMC, the Commercial-Appeal, Memphis, Down in Dixie," has been heard from London to Hawaii by countless thousands of loyal radio fans. From latitude 20 degrees South and longitude 97 West—a spot in the Parific Ocean—to MacMillan's expedition at 97 North, within 11 degrees of the North Pole, the ethereal concerts of this popular station have traveled.

WMC is owned and operated by the Commercial-Appeal at Memphis, Tenn. It was first opened in Januady, 1923, and soon became one of the best known stations in the United States

Here are the three hard workers who keep things humming from WMC, above is Percy G. Root, chief operator; at the left is Joseph E. Kabakoff, assistant operator; and right, Gerald L. Dearing, chief announcer.

because of the high quality of its programs and the bubbling exuberance radiated by the men and women who operated its studio.

Depending on local orchestras, with some aid from outside entertainers, WMC built up a reputation that meant "Varied programs with good music and excellent vocalists." Especially were its "genuinely Southern" jazz orchestras popular with the Northern and Eastern fans who received WMC's broadcasts.

Then came George D. Hay, better known as the "Solemn Old Judge," who is now with WLS at Chicago. With his Good Ship Huspuckiny and its famous whistle, he inaugurated a bit of foolish and good-natured byplay that took well with the listeners-in and established WMC as a real "human station" with human folks behind it.

The station, its mythical ship and the announcer soon became nationally known and recognized.

Dearing Now Announces

The newest announcer, Gerald L. Dearing, has picked up where the "Solemn Old Judge" left off and is working to make still better the reputation and popularity of WMC. Dearing is known in the air as "Jerry," while the operating staff, Percy Root and Joseph Kabakoff, are known to ether fans as "The Gold Dust Twins."

Incidentally, WMC has the smallest studio personnel of any 500-watt station in existence. Four persons outline and arrange the programs, announce, and operate the station. Two work in the studio itself and two in the operating room, the two rooms adjoining.

The transmitter at WMC is the 1A type—a 500-watt Western Electric. The power supply consists of a three-unit Robbins-Myer motor generator set, employing one low-voltage generator for filament supply and one high-voltage generator for plate circuit supply.

The regulation speech input equipment is used for both studio and remote control programs, while the usual two-button microphone is used at all times.

The antenna is of the four-wire inverted

Meet the "Gold Dust Twins" of Radio Land

L type supported by two 70-foot steel towers, 150 feet apart and located on the four-story Commercial-Appeal Building in Memphis. The ground connection for the transmitter is made to the iron frame of the building.

Receivers at All Points

The monitoring of the transmission speech and music is acomplished by means of receivers located both at the station and at remote points.

WMC has operated on wave lengths from 345 to 500 meters, but has accepted 500 as producing the best all-around results. It has been at this wave length that the longest distance records have been made.

WMC's daily correspondence from fans all over the country is amazing, Mr. Dearing reports.

'Tis a Pleasure

"Entertainers like to broadcast from WMC because they always receive such good response from the eager fans who listen to them," he explained. "And the cheery spirit we try to maintain at all times makes it a real pleasure to listen in with us for an evening."

Try it some time. You'll know WMC by that "Down in Dixie" flavor of its programs.

WMC is virtually the leader of all Southern stations, having to compete only with those in Birmingham, Dallas and Fort Worth for first honors.

Hardly a visitor can stay in Memphis for more than a day without being asked the familiar question: "Have you seen our WMC yet?

(Another interesting broadcast feature in the September RADIO AGE.)

How to Tune WLW's 423-Meter Wave Length

When the Crosley Radio Corporation's WLW broadcasting station began using their new 423-meter wave length it was discovered that several owners of receiving sets did not know how to adjust their receivers to tune in on the high wave length. E. J. Bussard, of the engineering department, prepared the following information for those who desire to make the necessary changes in their radio sets:

There are quite a number of receiving sets on the market, sets manufactured one to three years ago, which will receive wave lengths no higher than 400 meters. It can be readily seen that a receiver of this nature is of no value for receiving wave lengths between 400 and 600 meters.

In the majority of cases these receivers are of the single circuit type. It is relatively easy to correct this type of receiver to receive higher wave lengths. The most common method is to insert a small loading coil in the antenna circuit. In quite a few cases it is only necessary to increase the length of the receiving antenna. Another common method is to remove the condenser from the series connection with antenna circuit and place it in parallel with the antenna inductance coil of the receiver.

By a loading coil is meant an inductance coil; usually only a few turns of wire are necessary, placed in the antenna lead, one side of the coil being connected to the antenna lead-in and the other to the antenna binding post.

Should the circuit be tuned by a condenser used in series with tuning coil or tuned inductance, the wave length range may be sufficiently increased by shunting this condenser or connecting it in parallel with the tuned inductance or untuned inductance, as the case may be. This can usually be done by connecting the antenna binding post to the ground binding post with a piece of copper wire and then connecting the antenna lead-in to the wire connecting the antenna condenser to the inductance coil, should the condenser be in the antenna side of the circuit.

A few complaints have been received from people using three-circuit tuners. The difficulty here lies in the type of variometers used and it will be necessary to substitute variometers having the proper characteristics for tuning between 200 and 600 meters. In a few cases it may be possible to wind a few turns of wire on the variometer and correct this defect to some extent, but the novice will find no little difficulty in doing this.

"Quiet Hours" Changed

Hartford, Conn.—The changes in radio transmitting schedules caused by the observance of daylight saving time in some sections and standard time in others have prompted the American Radio Relay League, at the suggestion of the Department of Commerce, to agree to the temporary expansion of amateur "quiet hours" from 7:00 to 10:30 p. m., standard time, 8 to 11:30 p. m. daylight saving time. Amateurs are being advised of the expansion by the Department and are asked to attach the notice to their station licenses.

How Radio Waves Travel

The fact that radio waves can be made to go "there and back in nothing flat" was demonstrated at WTAM, radio station of the Willard Storage Battery Company, broadcasting from the Cleveland *Plain Dealer* studio.

A late dance concert of request numbers was being put on the air when a fan called the studio by long distance telephone from St. Thomas, Ontario, placed his loud speaker to the telephone and sent back over the wire the same music that was being sent out by wireless fifteen feet away.

The speed of the round trip of the signals was so great that the music came back from Canada at the same instant that it was going into the microphone in the next room.

To complete the circuit of sound, telephone wires carried the signals from the studio to the transmitting set, seven miles away. From there the ether carried them to St. Thomas, about 100 miles away, straight across Lake Erie. From St. Thomas they were put on the wire again, going about 400 miles around the lake to get back to the studio. And the return was instantaneous with the start!

ESSAY WINS RADIO SET

Grace Ann Yaeger, an opera star, of 23 W. 64th St., New York City, was awarded a $250 radio set recently by the Associated Exhibitors for her prize winning criticism of "The Chechahcos," a motion picture. More than 700 criticisms were submitted in the contest.

WJAX Studies Remote Control

WJAX, the Union Trust broadcasting station, Cleveland, has been a pioneer in Cleveland, as far as remote control broadcasting is concerned; that is, broadcasting from points distant from the actual radio studio.

Besides Symphony Orchestra Concerts, which were given at Masonic Hall, there have also been broadcast the organ of the Cleveland Public Auditorium, where the big Republican Convention took place; the orchestras of the Cleveland Hotel and the Winton Hotel; the Boys' Choir of Trinity Cathedral; and a number of Cleveland's best known dance orchestras.

A great many people have been under the impression that when a concert is broadcast from some point away from the studio, it is necessary to install complete broadcasting equipment at the place where the concert is being given. Of course that is not the case.

No matter from what point WJAX broadcasts concerts, the transmitters, generators, and all other standard station equipment, are undisturbed and are operated within the studio.

The concert is carried to the station by telephone wires. This involves the use of a private line direct from the place of the concert to the radio station, together with three pairs of conductors—one pair for regular telephone equipment, in order that the operator at the station and the operator at the remote control panel may have physical means of communication, the remaining two pairs of conductors being installed so that in case one pair should develop trouble, broadcasting could be continued over the other pair. These conductors are given a special test and all line noises and cross talk eliminated.

After the lines have been made ready, special input equipment including an amplifier and microphone are installed at the place where the concert is to be given and are connected to one pair of conductors. The lines are then connected to the speech amplifier equipment at the station and tests are conducted for both audibility and quality. The volume is adjusted to a certain level in order to insure perfect broadcasting.

Portugal Adopts Radio

Authority to install and operate radio telephone apparatus in Portugal is granted in a recent decree of the Portuguese Government, says Vice-Consul Moers of Lisbon. Prior to this action no legal right existed whereby amateurs could install receiving sets, although no objection had been interposed by the government. Stores and novelty shops are now beginning to put in stocks of radio apparatus.

But in Roumania

Roumania has not given as yet official sanction for the use of private receiving sets, nor is there any broadcasting service, a statement from Bucharest announces. A government commission, however, is now studying the question and legislation permitting the use of radio by the public under governmental regulation will soon be requested.

Here Is Your Chance

to Pick

YOUR FAVORITE RADIO STAR!

RADIO AGE is conducting a **RADIO FAVORITE POPULARITY CONTEST** to determine which radio announcer, entertainer, musician or other personage is the most popular in the minds of the thousands of fans who listen in on their concerts nightly.

Beginning with the next issue, the first tabulation of results will begin. Fans are responding with a will, and several broadcasting stations already have enlisted their co-operation in this contest.

RADIO AGE wants to give its readers more news stories and pictures of the men and women who supply their radio entertainment. And in order to do so, we want to find out just WHO are the most popular and who shall be given first consideration in our columns. It is up to you to select your choice.

Read the rules below, get your friends together and send in your vote by clipping the coupon on this page. All together for the big competition among the studio stars!

Rules of the Contest

1. Readers of RADIO AGE are entitled to as many votes as they wish. Each coupon counts for one vote, and only those written on blanks clipped from RADIO AGE will be honored.

2. The candidate must be a person identified with the Radio World and may be an announcer, entertainer, orchestra, manufacturer or, in fact, any person in any manner connected with the great radio industry.

3. State clearly the name of your favorite, his classification (announcer, entertainer, etc.), the station from which last heard and approximate date when you were entertained.

4. Send in the coupons at once. First tabulations of results will appear in the September RADIO AGE and monthly thereafter until a grand winner is decided upon.

5. Radio entertainers are usually announced through the microphone, but it is suggested that in the event voters do not know the name of the announcer, they should give only the station from which he announces.

POPULARITY CONTEST COUPON

Harry A'dyne,
Contest Editor,
RADIO AGE,
500 N. Dearborn St., Chicago.

I wish to cast my vote for:

Name of favorite.....

Classification .....

Station.....**Approx. date heard**.....

My name [optional].....

My address [optional].....

Radio—the "Great Discoverer"

How *One Ambitious* but *Unknown Youth Won Fame* and *Fortune Overnight*

Being the Almost Incredible Story of the Jump to Prominence of "Sen" Kaney, Chicago's Veteran Radio Announcer

RADIO has made scores of interesting personalities, all of whom have profited greatly because they had the good fortune to become associated with a new and mysterious pastime. But the real personalities are the young men—and some women—who had the foresight to jump into the doubtful radio fray before it became the rage it is today.

Two years ago A. W. ("Sen") Kaney was a wandering youngster of about 25 years of age, flitting from place to place without a definite destination—just as thousands of other pleasing but unknown young men were doing.

Kaney had done some local theatricals and was popular among both sexes at any social event. But that popularity could not be translated into dollars and cents, and his personality was too young and not widely enough advertised to deserve a prominent place on a vaudeville bill.

Trusting to Luck

So Kaney went along unappreciated, trusting to luck something would happen.

It did. When the Westinghouse Electric and Manufacturing Company opened its station, KYW, in Chicago—and, by the way, it was one of the first to be started in that city—a call was sent out for announcers and entertainers.

Very few responded. The art of radio broadcasting was new and untried. The money end of it was uncertain, and altogether the new profession seemed more of a temporary occupation than a permanent calling.

But young Kaney had been keeping his eyes open. He grasped at this straw of hope and got a job as part-time announcer and fill-in entertainer. He could sing a little, talk a lot and keep up a running fire of conversation that was pleasing to the ear.

KYW grew. Other promising but unknown young men came over to the ranks, and by the time the station was well under way, Kaney was the acknowledged "guiding genius."

Kaney Guides It All

Elaborate programs were arranged. Famous stage and movie stars contributed their talents to the ethereal concerts—and all with the dominant personality of "Sen" Kaney hovering about. Before a few months had passed Kaney was flooded with offers from every section of the country, to go on the stage—take charge of other stations—and what not. Prospective offers ran into several figures, and Kaney found himself blinking in a new calcium of public favor—a new experience for him.

Finally he realized he was a star in every sense of the word—and after a few "rounds" of vaudeville and "personal appearances" in Chicago, he signed up with a local newspaper as Chief Announcer of WGN, Chicago, a new station. He was to receive a fat sum to transfer the "fans" from KYW to WGN and retain their favor with the same humanness that made his voice a byword in thousands of households.

No sooner had Kaney become established at WGN than that station was again sold and moved to another location and given a new wave length. This time—and at latest writing, Kaney is Co-Announcer with Jack Nelson at WGN, formerly WDAP, on the Drake Hotel, Chicago.

Owners of the station declare Kaney has accomplished a radio miracle of which he can be proud; namely, he has created a following of radio listeners who have shown by their correspondence with KYW, WGN and the old WDAP that they care more for Kaney's announcing and chatty talk than they did the programs he announced. Such an accomplishment is indeed a compliment.

One of Kaney's greatest successes in the broadcasting line was his broadcast of the automobile races from Indianapolis on Memorial Day, through WGN. This feat—accomplished in the pit alongside the track at Indianapolis Speedway, precipitated an avalanche of praise for Kaney

that has been unrivaled in the history of broadcasting.

Kaney has made broadcasting his *forte*. He has found his bent and he plans to "stick" until his voice gives out.

A Human Calling

"I believe announcing is the greatest human job there is," this young philosopher says. "You get to more people, and gain more friends, than in any other way. I never realized how many people 'knew' me until I began to meet a lot of them in person, in theaters and elsewhere.

"It isn't the glow of satisfaction alone that makes my work worth while; it's the thought that I'm bringing cheer and friendliness to someone alone by a fireside, or helping to inject pep into a party or meeting of some kind. Announcing is a public service and an art that's going to be as necessary as life in a very short time. I started with radio and I hope to finish with it."

Therein lies "Sen's" reason for his success.

Perhaps it was luck that Kaney was without prospects of a promising nature when radio made its debut. For it brought him fame and fortune and made him the reputed leader of his profession—or at least one of the leaders—and one of the profoundest students of the radio industry as a science and as a cog in human life.

After all, Kaney has been successful because he's the kind of a soul who makes friends easily. And that's what makes a successful broadcasting station.

WLW Heard in England

There have been many attempts made by stations in this part of the United States to reach England with their broadcasting, but it remained for WLW at Cincinnati to reach the goal. Henry Field, who operates Radio Station 6ZX in Baggrave Hall, Leicestershire, England, heard the station clearly as it broadcast the Chubb-Steinberg orchestra's regular midnight concert.

This is a remarkable achievement which marks a new era in broadcasting. The recent success of sending photographs by wire will no doubt soon be possible with radio and then the dreams of scientists will come true.

Another interesting reception of the broadcast concerts from WLW was aboard the U. S. S. Orion, when Stanley E. Wolf heard the music while his ship was 750 miles off the Florida coast.

In contrast to the reception of WLW on the water, A. K. Almon, operator on the train between Vancouver and Montreal, heard the broadcast concert very clearly. This radio set was installed aboard the Canadian Railways train and is a regular feature of the service for the convenience and entertainment of the passengers.

A Foreign Radio Record

An amateur in the Pyrenees district of France claims a record for the reception of American broadcasting. With only two tubes he receives nightly the American stations WGY, on 105 meters, and KDKA —both on the loud speaker. He has also to his credit over 500 American amateur stations.

AND ANOTHER REDSKIN BIT THE DUST!

It takes considerable imagination to convey realism by radio waves. Here is a "terrible" fight scene from "Pierre of the Plains" as produced from WGY. "Jap" Durkin has fired from ambush at Pierre, who feigns death and falls in the "dead leaves" which carpet the forest floor. When Durkin approaches, Pierre grapples with him and "slays him with his bare hands." Pierre then escapes on his trusty steed. Edward St. Louis, the player at the left, fires the shot; Edward Smith as Pierre is stifling the cries of Frank Oliver, alias Durkin, who is knee deep in onion-skin paper. A microphone on the floor picks up the sound of the struggle and the young woman at the piano depicts the clattering of the horse's hoofs. Quite exciting, eh?

How an Announcer Feels

By KOLIN HAGER
Chief Announcer of WGY, Schenectady, N. Y.

FEW people realize how earnestly we who are connected with the WGY studio hope they will listen to our nightly request for their comments and suggestions. We know that, if we are to succeed at all, it will be by carefully watching the attitude and following the wishes of the public.

Those who have followed the programs of WGY perhaps have noticed that the average week's broadcasting is carefully proportioned. On Monday evening a brass quartet might be scheduled with half popular and half classical music. Tuesday evening we would endeavor to offer either a drama, a comedy, or a program of music in contrast to the previous evening.

Radio Turns to New Field

The travelogue programs, embracing stories of trips through different countries of the world; the series of addresses by college instructors; and the many talks on various phases of manufacturing by numerous experts and scientists; all these help to give greater variety to our broadcasting. The predominance of music, which a year or more ago was very evident, is changing now to a greater emphasis on educational material in the form of school or college instruction, and talks by men who are specialists in their particular field. Indeed, if radio is to keep up its popularity, it must offer a greater proportion of programs which will make people think rather than cause them to sit back and merely be amused or entertained.

There isn't any reason why broadcasting can not be made the school and the college for all kinds of listeners. Its faculty members can be drawn from instructors throughout the country, and its classroom may extend even to the humble farmhouse and far into remote places. This should make for a magnificent organization, but to create and carry on such an undertaking the government will be obliged to take an active interest and be a part in the creation and continuance of this work.

My faith in the future of this development is in part due to the sensible letters we receive. The type of our audience is, I believe, superior to that of the average theater. The better things are preferred, and even strongly urged.

It may surprise many to know that we have five times as many requests for classical music—the compositions of the masters and oldtime American songs—as we have for popular, present-day music. The general opinion seems to be that popular dance music is the all desirable thing, but according to the requests we receive, it is the reverse. I believe, too, that this is a representative judgment. WGY's mail will shortly approach a quarter of a million communications of one kind or other, cablegrams, telegrams, letters and post cards. Doesn't it seem logical that if the people want the better music, they also want other features of a high quality?

The WGY announcers have all caught this spirit and have confidence in this broadening.

Two Stations Help

Not so long ago WGY and WJZ joined forces, with the result that many good events from New York have already been broadcast, notable among these, the luncheon of the Associated Press, when President Calvin Coolidge was the principal speaker. Incidentally, the President's father in Vermont heard the broadcasting of the address.

Several weeks ago WGY took part in a coast-to-coast program, when we relayed the alumni dinner of the Massachusetts Institute of Technology. Six other stations carried this program on; so that it is estimated fifty million people heard it and England and Cuba received clearly the music and part of the speeches. This is opening up a new phase of broadcasting, which by the several relays from one station to another, can give the listeners a program from the far West, the far North, or perhaps from Cuba. We may some day relay the English programs to America with the same ease that our own programs are transmitted today.

The studio broadcasting at the present time at the major stations is being better and more carefully prepared. The announcing which plays an important part in every program is more dignified and has not the former careless tone which some may remember. As much personality as possible should be in the voice of the announcer, and whatever he says ought to add to the program, and help in its success. There must be an optimism and brightness in all he says, if he is to hold the interest and have the favor of his audience.

A CO-ED RADIO STAR

Rey Marchant, between musical activities at the Mills College, manages to maintain her popularity as a violinist at Station KGO, Oakland, Calif. She is a member of the Mills College Trio and can manipulate popular and classical airs with equal dexterity. Whenever Rey's picture is published, her mail at KGO is doubled. Do you wonder?

Broadcast With Storage Batteries

"The Storage-Battery Station of the East" is the new designation of Broadcasting Station WDAR, Lit Brothers, Philadelphia, which recently changed its source of transmission power from motor generators to storage batteries.

The results obtained, in increased strength and clearness of signals, are reported as astonishing. Letters and telegrams commenting on the vast improvement were received by the station from listeners all over the country.

WDAR is the first big broadcasting station in the East to equip for operation with storage batteries. Heretofore the universal practice has been to use motor generators for supplying the large filament current and high plate voltage required by the main oscillator and modulator tubes of the transmitting set.

Lit Brothers, who have led the way in making other recent innovations in broadcasting, decided that the time had come for improving the quality of broadcasting by eliminating the commutator hum and other objectionable features of motor generated power. Philco Diamond-Grid Batteries were used.

Seek a Better Word Than "Jazz" By Radio

According to Meyer Davis, head of one of the largest orchestral organizations in the country and whose music is familiar to millions of radio fans, the word "Jazz" does not represent a true description of modern music for dance or song.

Mr. Davis further states that the dance music demanded today is far removed from the style of a few years ago, when the wheeze and shrill of the clarinet, the blare of the trumpet and the banging of the drums pleased the majority of people who became dance enthusiasts for the first time. This taste has changed for the better to a remarkable degree, and dance music has improved accordingly. But we still call it "Jazz."

Mr. Davis, in his desire to obtain a more truly descriptive word for dance music of today, has offered a prize of $100 cash for a name to displace the word "Jazz." This prize will be given to the person—man, woman or child—who sends in the name which will be acceptable to himself and to the executives of his organization.

There are no restrictions in this contest, except that the number of names submitted by any one person must be limited to five and must be mailed to Meyer Davis' Music at the New Willard Hotel, Washington, D. C., or the local or nearby radio broadcasting station on or before August 15, 1924. The award will be made September 1, 1924, by the broadcasting station which receives the winning word.

An Audio Amplifier Without an "A" Battery

How to Extract Filament Current from the A. C. Lamp Socket

By BRAINARD FOOTE

MANY a man is the owner of a one tube dry cell tube receiving set. Perhaps he's had it quite a while and feels that the next step for him is to get an amplifier into operation so that the whole family can enjoy the broadcasting. He can still use his headphones when he's after DX, but for fairly short range reception, a loud speaker will suit him much better; for after all the headphones are a rather selfish proposition unless you have four or five sets of them.

Yet, there are numerous listeners who don't want the trouble of caring for a storage battery and perhaps don't wish to spend $15 extra for a battery charger to avoid the inconvenience of carting the battery around to the service station every now and then. But, unless dry cell tubes are used, such an amplifier requires a storage battery, and at best, the dry cell tubes can scarcely compare with larger tubes for volume output.

Alternating Filament Current

However, it is now possible to secure equally good results without employing a storage battery, providing you have alternating current supplied for lighting and electric power in your home. Through the use of a simple transformer which may be had anywhere, the necessary filament current may be drawn from the lamp socket at scarcely any cost.

THE photograph shows a power supply unit comprising this transformer, a 30 ohm rheostat and a potentiometer, from 200 to 400 ohms resistance. The parts are mounted on a regular radio panel, with three outlet binding posts. Two of them are for connection to the filament circuit, while the third is connected to the movable contact of the potentiometer.

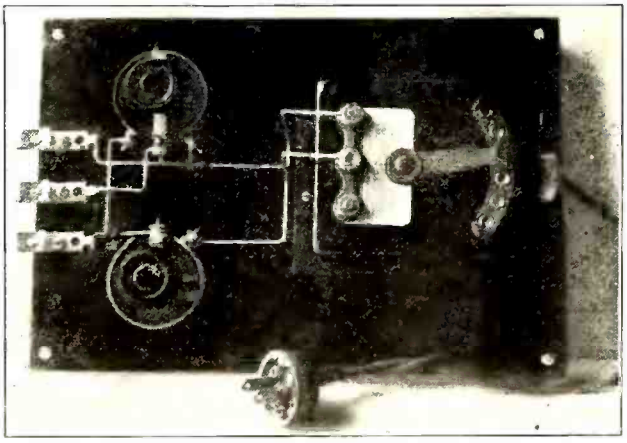
Any department store with a good sized toy department, or any large electrical supply house has the toy transformer in stock. The cost will be between $3 and $4.50, depending upon the make. There should be adjustable means for securing various voltages for lighting the filaments, and if the output voltage is between 6 and 12 volts, the proper amount of current can easily be applied to the two amplifier tubes through the 30 ohm rheostat. UV201-A or C301-A tubes are used.

In case you may wish to try smaller tubes than these, the transformer chosen should supply lower voltage, perhaps 2½ as a minimum. To use the A. C. filament supply with an amplifier already completed, mount the parts as in the photograph and wire them together in accordance with the section of the circuit diagram to the right of the dotted line. This includes the rheostat, the potentiometer and the toy transformer.

Changing the Amplifier

Certain alternations must be made in the amplifier, although these are very simple. The rheostats should be turned to the "full on" position and the entire filament adjustment of the audio amplifier tubes done by the rheostat on the supply unit. Then, the two grid return leads from the "F" posts of the two audio transformers are connected to the negative terminal of a 4½-volt "C" battery, the positive side of which is connected to the minus "B" battery post and to the arm of the potentiometer. The negative "B" post is disconnected, of course, from its usual position on the plus side of the "A" battery wiring.

It is assumed that a separate battery is used for lighting the detector tube, since alternating current cannot be employed



A unit arranged to secure filament for an audio amplifier from the alternating current lighting socket. The panel measures 7x10 inches, and the instrument by which the correct voltage is obtained is a toy transformer.

the wiring for an audio amplifier which may be mounted with the rheostat and potentiometer, but for which the toy transformer is laid on the floor or shelf under induction between the grid leads and the filament wires or the transformer itself. The transformer should not be mounted in the amplifier cabinet.

THE audio amplifier wiring is quite standard, although no jack is shown for the second stage, it being assumed that if phones are used, the amplifier will be turned off altogether, but that if the loud speaker is employed, both tubes will be necessary for sufficient volume. Special precautions should be taken with the grid leads and the grid return wires. These must all be short and carried above or away from the filament wires. A separation of four or five inches is desirable.

There is a very slight hum caused in the speaker, but this is much weaker than the actual carrier wave noise of the broadcasting station itself, and the faintest sounds of speech and music drown it out immediately, even with one's ear close to the for the purpose. The circuit gives also horn. But this slight hum is caused by the reversal of current in the filaments, since for a small fraction of a second the filament current falls to zero and then comes back the other way, as the 60-cycle A. C. reverses itself 120 times every second. This varies the plate current slightly, but the effect is not trouble- at all.

Avoid Grid Induction

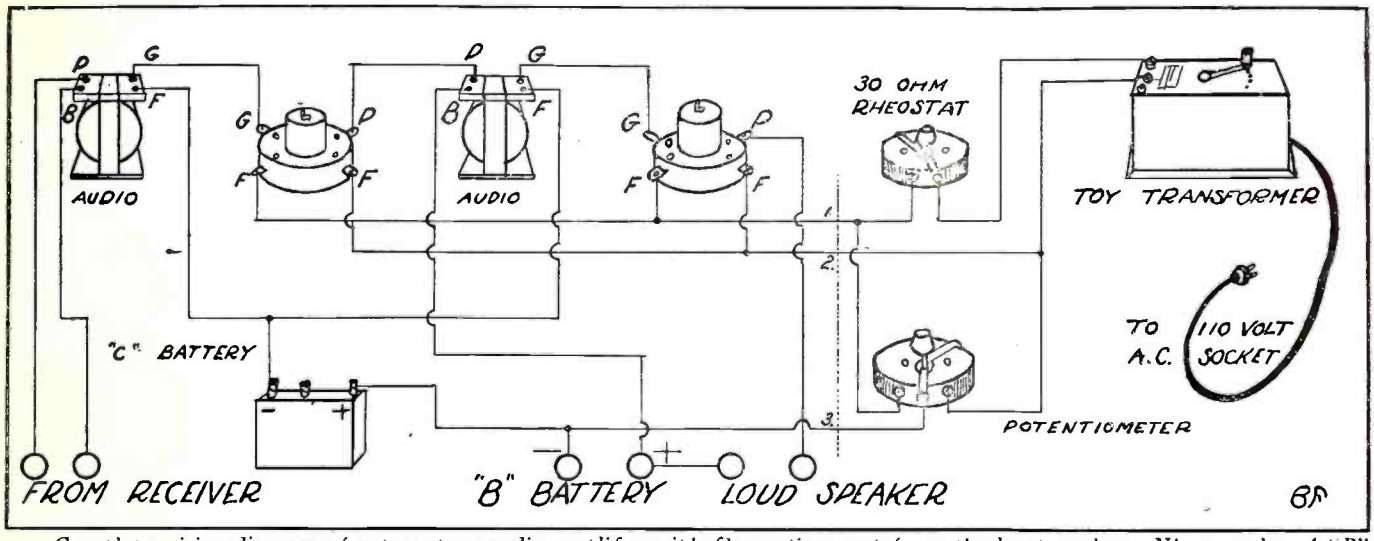
Therefore, any noticeable hum is caused by induction between the filament wiring, which carries alternating current, and the grid or grid return leads. This means that special precautions must be taken to keep them four or five inches away from other wires in the set, and to make them as short as possible besides. If any A. C. induction affects the grid, the amplification constant of the tube (about 7 or 8) will make the noise a whole lot louder.

Ordinarily, the grid return leads are run to the negative side of the filament to secure the necessary negative grid bias for clear amplification. Here, however, the filament's poliarity changes continually, so a "C" battery is used to get the negative bias. If the positive of the "C" battery were now connected to either end of the filament wiring, there would be a very strong hu min the speaker. This is due to the fact that every time the grid is charged positively by the voltage at the end of the filament, some electrons are drawn to the grid and it thereby reduces the plate current a great deal. In order to avoid this alternating charge on the grid, it would be necessary to connect the grid return lead to the center point of the filament, inside the tube.

THE situation is similar to that of a man walking up and down a large see-saw. When he stands at either end, he is bumped up and down a great deal; the nearer he gets to the middle, the less he's jolted, and finally right at the center of the board, he doesn't go up and down at all. But since it's physically impossible to make that center connection, we shunt a potentiometer across the filament and run the grid return lead to its movable arm. This is then placed at the electrical center of the winding, or at the center of filament resistance and the A. C. hum is nicely balanced out.

Preventing Tube Danger

It is usually necessary to connect the ground to the negative "B" battery binding post of the amplifier, in order to ground the central balance point of the potentiometer. Care must be exercised in



Complete wiring diagram of a two stage audio amplifier with filament current from the lamp socket. Ninety volts of "B" battery are used, with a potentiometer and 4½ volt "C" battery to eliminate the A. C. "hum."

first lighting the tubes to use a combination of binding posts and switch lever adjustments on the toy transformer to give a voltage of about 6 or 7, to prevent danger to the tubes. The rheostat should not be turned on farther than is necessary for good volume and clear results on the loud speaker.

The A. C. system is bound to come into wide use shortly, because it can be applied to radio frequency tubes also, by a similar treatment of the grid return leads. Moreover, it is now coming into use for delivering plate voltage, too, when used with a proper rectifier and filter system. Hence the man who starts in to become familiar through practice with the use of A. C. is the one who will first succeed in cutting his battery upkeep expense to about one-tenth or less of its present cost. The A. C. is always on tap, never runs down, and is used for filament lighting at a cost of less than $2 a year, even if the set is used three hours a day every day in the year

The Importance of the Loud Speaker

By WILLIAM CULLENS

Not long ago, when broadcasting was more or less of a novelty, it was common with many enthusiastic experimenters to entertain their friends with a radio concert. After the loud speaker had been induced to operate, the congratulations of the guests were made with effort, the more candid of the critics declaring that if the barnyard chorus coming from the horn was radio, they would be content with a phonograph.

There were many fans, it is true, who overlooked the obvious imperfections in the reproduction of the human voice. The marvelousness and mystery of radio itself was quite sufficient to outweigh any shortcomings of the loud speaker. Recently the demands have become more critical, and the radio public have been insistent that the loud speaker should not be the cause of imperfect reproduction.

In its present usage, the term loud speaker is applied generally to electrophonic devices employing some means of distributing sound over an area. It is possible to divide loud speakers into three separate and distinct classes, however:

1. Those which make use of existing telephone receivers by means of rubber connectors or clamps to attach a pair of phones to a horn.
2. The type of speaker that uses a single telephone receiver equipped with a cap to permit its being fastened to the small opening of a horn. In this class can be included the numerous loud speakers that incorporate a telephone of some sort in the base of the horn.
3. The loud speakers constructed on the solenoid principle, in which the currents act on a coil placed in the field of a strongly energized magnet.

The first and second types of loud speakers are excellent in their own limited way; however, there are a few serious faults that entirely prevent them from being considered as first class loud speakers. One is that they cannot be used on very strong signals without causing the diaphragm to strike the pole pieces of the small fixed magnet and produce a rattle in the loud speaker.

Another serious limitation to this class of loud speakers is that when high B battery voltages, such as are common in most audio frequency amplifiers, are used, a DC current flows through the windings of the phone and exerts a strong downward pull on the diaphragm. This causes the metal diaphragm to be drawn out of shape and will cause the loud speaker to have a hollow or tinny sound.

Impedance Shouldn't Vary

The vibration of the metal diaphragm toward and away from the poles of the magnet in the unit will cause the air gap to vary. This, in turn, will cause the impedence (alternating current resistance) of the loud speaker to vary and has a great deal to do with the proper operation of the receiving set itself on weak or distant signals. The impedance of the loud speaker has its function in the tuning and balancing of the receiver, and if it is fluctuating, will have its effect in upsetting the accurate tuning of a receiver.

The third type of loud speaker this factor need not be considered as the air gap is constant and fluctuations of current through the windings of the loud speaker does not change the impedance of the circuit. The DC current from the B battery does not act on the diaphragm of loud speakers such as the Thorophone and less distortion may be expected.

At the same time the third type of reproducer will not rattle or "freeze" on extremely loud signals, yet will give a greater amount of sound on extremely weak or faint signals. A mica diaphragm one of the most perfect substances known for sound reproduction, is used, whereas in most of the other classes of speakers a metal diaphragm must be used, resulting in a greatly inferior tone quality.

The particular shape of the horn has a great deal to do with the performance of any loud speaker. From a theoretical point of view, a straight horn is better than a curved one, and the amount of increase in the size of the horn in proportion to its length must be very carefully calculated for best results. When this is once obtained the horn can be curved into most any shape without destroying its amplifying value or tonal qualities.

The material of which the horn is composed of is very important in regards to the quality of music that will be received, and with the faithfulness with which the sounds are reproduced. A horn made of wood or paper mache gives a purer tone than a metal one, which is liable to produce brassy overtones or vibrations. Horns made of some inert material and which will not vibrate or absorb the sound waves, have been found to be the most satisfactory for loud speaker use.

Radio In Other Lands

New French Theory Opens Way to Solution of Static

PARIS:—General Ferrié and Monsieur R. Bureau have just completed a most interesting study of the occurrence of static disturbances—the so-called "atmospherics"—and of their possible causes. The result is a novel theory of the air currents in the atmosphere; a suggestion that is perhaps the most important contribution made so far to the explanation of static.

The new theory is already the focus of active discussions among French scientists and radio amateurs. It seems certain that it will play an important role in the study of static everywhere; a study now actively under way all over the world.

The outstanding conclusion from the observations collected and analyzed by General Ferrié and Mr. Bureau is the close relation between the occurrence of static and the presence of currents of cold air above the great mountain region of the Alps.

During the Winter the correspondence in time between these Alpine air disturbances and the onset of static is practically perfect. In the Summer the results are more complicated. The static seems to come then from every direction at once.

Cold Air Not So Disturbing

This is explained, the French investigators believe, by the fact that currents of cold air do not cause so much disturbance in the atmosphere during the Winter as they do in the Summer. The difference between them and the main mass of the atmosphere (all of which is then cold) is not so great.

ACCORDINGLY, during the Winter it is only in the much confused atmosphere over the Alpine regions that the air disturbances are great enough to produce important amounts of static. In other seasons the atmosphere as a whole is warmer. Cold air currents disturb it everywhere. Much static is produced, therefore, in all districts.

The observations also bring out the fact that in the latitude of France the occurrence of static is favored by the prevalence of cool winds coming from the polar regions. On the other hand, the warmer air currents that come from equatorial regions not only yield less static but seem actually to suppress a period of static arising from the previous prevalence of the cooler polar winds.

The electromagnetic disturbances—that is, the static—are parallel in every way with the more familiar meteorological disturbances such as hot waves, thunderstorms, and the like. The cool polar winds bring on these disturbances; the warmer winds from the equator are calming and quiet.

Technical Expert Will Send Radio Data From France

C. R. Bluzat, formerly technical editor of RADIO TOPICS and at present a special technical writer for RADIO AGE, is in France visiting relatives and studying the latest developments that country has made in the field of radio.

M. Bluzat is a native Frenchman and is thoroughly familiar with both American and French radio circuits. In the September RADIO AGE his first article on the latest steps in French radio science will be published, approaching the subject from an authoritative technical angle.

M. Bluzat's article, along with those to be published next month by Frederick A. Smith, editor of RADIO AGE, who has been in Europe making a radio survey for the past two months, will give "The Magazine of the Hour" a truly distinctive foreign radio department second to none.

The Source of Trouble

The chief place of disturbance is the plane of contact—what is called in French the "front"—between a mass of cold Northern air and one of warm Southern air. Such a "front" is the seat of exchange of a large amount of energy; both gravitation and electrical. The gravitational energy is expressed in upward or downward currents of great masses of air.

Such "fronts" between hot and cold masses of air may exist high in the atmosphere without being perceptible in any way on the ground. Gradually they equalize themselves either by the mixture of the two currents of air or by the transfer of heat energy from the warmer air to the cooler. This explains the effect of a warm, equitorial current in causing a decrease in static. The warm air arrives, usually, at a high level in the atmosphere. It mixes slowly with the underlying cooler air. As it does so the disturbance in the atmosphere is decreased; the "front" between the two air currents becomes less marked and the static disturbances die away.

The reverse case can also occur. Whenever a mass of cold air sweeps down over France from the Northwest toward the Southeast (which is the usual direction of such currents in France) great atmospheric disturbances are produced, with accompanying interference with radio. These disturbances become more pronounced as the cold air approaches the Alps and is forced to rise to higher altitude.

In this way General Ferrié and M. Bureau have been able to trace the static produced by individual "fronts" of cold air in their progress across France from the northwest coast clear to, and even across, the Alps.

EVERY radio fan knows that static is extremely prevalent in mountainous regions. The new investigations give the first real evidence as to why this is so. They provide, in addition, the first consistent theory of the hitherto mysterious relations between radio disturbances and the weather. Hot weather means much static because it is usually a time of intense atmospheric movement and mixture, at least in a part of the country.

"Fronts" Help Static

Again, the supposed relation between static and the occurrence of areas of high barometric pressure may be due not to any effect of the air pressure itself, but to the fact that high-pressure areas are frequently surrounded by one of General Ferrié's "fronts," that is, by a region of contact between a central mass of warm air and surrounding masses of cooler air.

Wherever warm air and cold air meet and mix there is in active exchange of

thermal energy. A part of this energy seems to be translated into electrical energy; to be expressed either in thunderstorms or in static disturbances or in both. The ultimate origin of static, like the ultimate origin of our weather, seems to be the fact that the poles of the earth are cold, whereas the tropics are hot.

World's First Tri-Lingual Station

Fans who receive broadcasts from Canada's premier radio station are familiar with the fact that all announcements are made in French and English.

Soon a third language will be added: "La Internaciona Linguo"—Ilo, the perfect radio auxiliary international language—simple, neutral, harmonious, flexible, expressive, logical.

Jacques N. Cartier, director, and his staff of announcers and story tellers are studying Ilo and find it extremely easy to learn.

By the time the new big plant of CKAC has been installed, everybody connected with the studio expects to be able to talk Ilo, and then this musical "tongue" will be on the air regularly.

Heretofore CKAC has found bi-lingualism adequate for its needs, but now that constantly increasing numbers of radio enthusiasts are clamoring for Ilo—"Well, not to advance is to recede," according to J. N. C., "and in Ilo all fans have a new standard! There is no way possible for us to satisfy everybody. All non-English and French fans, within our range, advocate Ilo, because it is the only known auxiliary language possessing complete radio, scientific and business vocabularies."

Mr. Cartier points out that CKAC serves a big Italian colony, a Greek village, a miniature Vaterland, a tiny Chinese town, a large Jewish settlement and several other small colonies, whose inhabitants speak Polish, Roumanian, Russian, Galician, Ukranian, Dutch, Swedish, Norse and twenty other languages, besides the two big majority French and English-speaking nationalities.

Because they do not know French or English, foreigners are sore and irritated in spirit and constantly chafing under the restraint of language barriers.

Eiffel Tower on Short Wave

The Eiffel Tower is now calling America on the short-wave telegraph set which they have recently installed at this big station. The Tower commander furnishes a monthly schedule of transmissions.

Transmissions take place every Monday, Tuesday, Friday and Saturday. Transmission will be on 25 meters.

The transmissions will take place at intervals as follows, according to the following table:

5:00-5:10	A. M.—	f	f	f	f
5:15-5:25	A. M.—	h	h	h	h
5:30-5:40	A. M.—	f	f	f	f
5:45-6:00	A. M.—	h	h	h	h
3:00-3:15	P. M.—	f	f	f	f
3:20-3:35	P. M.—	h	h	h	h
9:00-9:15	P. M.—	f	f	f	f
9:30-9:35	P. M.—	h	h	h	h

These times are Greenwich mean time, which is five hours earlier than Eastern standard time in the United States. Local times, daylight saving time, etc., may be computed from the relation of these times to Eastern standard time.

The text which is being sent by the Tower is simply: "v. v. v. de FL—FL—115 metres—emission f f f (or h h h)." This text, of course, in code is being transmitted very slowly, just as above; not, it must be remembered, in English.

The commandant of the Tower, Captain Bergeron, has asked all American amateurs who pick him up to please notify him of the relative intensity of the "fff" and "hhh" signals, as well as of the atmospheric conditions under which the signals were heard.

To simplify the notices which are coming in in many different languages, Captain Bergeron has devised the following code to be used by hearers reporting to him:

R1—Signals unreadable.
R2—Readable with great difficulty.
R3—Weak but readable.
R4—Readable.
R5—Comfortably readable.
R6—Readable quite strong.
R7—Signals strong.
R8—Signals too strong.
R9—Loud speaker.

British Plan Radiophone Plant

Following a demonstration by the officials of the American Telephone and Telegraph Company and the Radio Corporation of America, by which radio telephone speech was transmitted for two hours from New York to London, the British post-office appointed a committee to investigate trans-Atlantic telephony. This committee has recently recommended that the British post-office establish a 200 k. w. radio telephone plant at their new radio station at Rugby, England.

The committee recommends that this plant be of a type similar to that which has been used by the American Telephone and Telegraph Company and the Radio Corporation of America in the experiments which they have been carrying on for the last eighteen months in transmitting speech across the Atlantic.

If this work is carried out, it is expected that under favorable atmospheric conditions during the winter months, it will be possible to connect telephone subscribers in the United States to telephone subscribers in London, and in this way permit them to talk to each other as they do over ordinary telephone circuits. In doing this the subscribers at each end would be connected to their respective radio stations by the wire telephone lines. Atmospheric conditions, however, vary tremendously from winter to summer and during the different hours

(Continued on next page)

THE CANADIAN CASTLE OF JAZZ

American Radio fans who tune in on CKCH at Ottawa, Canada, and roll up the rugs for the peppy dance programs this station broadcasts, will be interested to know where the alluring music originates. Above is shown the "Chateau Lanier" Hotel, near Ottawa, which is connected with CKCH's studio. Popular programs pleasing to Americans and Canadians alike are broadcast from the Chateau Wednesday and Saturday nights on a 435-meter wave length.

of each day.

To determine the effect of such atmospheric changes, the engineers of the American Telephone and Telegraph Company have been transmitting speech weekly from America to England, measuring static interference and the strength of signals received from a number of British telegraph stations. The British postoffice has been carrying out careful measurements of the energy which they receive under various conditions from the telephone transmitting station in America, and also from certain telegraph stations.

The tests which will be possible when the British transmitting station is completed will form another important step in the work which has been carried on for many years in the development of radio telephony across the Atlantic Ocean. The first successful telephone transmission across the Atlantic was in 1915, when engineers succeeded in talking by radio telephone from the United States Naval Station at Arlington, Virginia, across the Atlantic to Paris, while the same messages were heard 5,000 miles to the westward at Honolulu.

Amateur Arrested for "Talking" to U. S.; Vindicated

The decision that it is not a serious offense against law and order for an experimental radio amateur of Holland to communicate with amateurs in this country has done much to vindicate the standing of amateurs in the Netherlands, according to a report received by the American experimenters.

Soon after a prominent French telegraph amateur was decorated with a gold medal for the skill with which he communciated across the Atlantic Ocean on short wave lengths, amateurs in Holland were regarded as something equivalent to the boll weevil. The authorities were inclined to classify them as a menace to their community.

The science of private radio communication among the youths of the country had kept abreast of progress much better than the laws, with the inevitable result that H. J. Jesse, Jr., prominent radio experimenter at Leiden, was made the defendant that the courts might decide whether it was lawful for a citizen to transmit.

It was charged that Jesse's telegraph and telephone station was not intended for public communication and that messages had been exchanged "without authority having been obtained from the minister of Waterstaat." He had in fact taken part in transatlantic radio tests and communicated with amateurs in the United States as far west as Nebraska.

The attorney for the defense pointed out that regular telegraphic communication in competition with commercial traffic was not intended and that the case was in the class with work concerning laboratories. The clerk of the open ministry congratulated the defendant for having communicated with a station in America. It was shown the defendant had not transgressed and the case was dismissed.

HE WINS THE BROWN DERBY Photo from Intl.

And he isn't ashamed of it, either. F. H. Schnell, traffic manager for the American Radio Relay League, is shown wearing the brown derby awarded by Kenneth B. Warner to the first American amateur to establish two-way communication with a European operator. Mr. Schnell swept aside all derby opposition when he conversed with French 8AB.

Broadcasting in South Africa Soon

Although not actually granted, the Government has finally definitely promised a broadcasting license to the Associated Scientific and Technical Societies, Johannesburg, for a broadcasting station to be installed in that city, Consul G. K. Donald reports. The reason for the delay has been an objection lodged by the Johannesburg municipality on the ground that the city was the proper authority to exercise broadcasting rights. The objection has now been overruled. When the license is issued, it will be only a matter of a few days before broadcasting is commenced.

It is announced that the new station will be installed on the top of the Stuttaford Building, with a broadcasting studio located on the third floor in the same premises. The wave length has not yet been definitely settled upon, but it will be between 350 and 450 meters. A 500-W. transmitting set will be used.

The Associated Societies' license gives them an area for the collection of fees from listeners extending 100 miles in all directions from Johannesburg and it is expected that the station will be supported by the fees paid in by persons owning receiving sets.

The program for broadcasting includes, in addition to musical entertainments, talks of interest to women, market reports, local news and a children's hour.

Application has been made to the Paraguay Chamber of Deputies by Messrs. Eduardo Rojas & Compania of Asuncion for a concession giving this company exclusive rights to sell radio telephone equipment in Paraguay for five years. It is said, Consul D. A. Wilson reports, that Mr. Rojas has already obtained the necessary equipment for broadcasting and will place it in operation within six months if the concession should be granted.

"Big Things Are Coming for Radio on the Farm"

By GEN. JAMES G. HARBORD

RADIO'S greatest opportunity lies in its usefulness to the farm. I believe that radio broadcasting is destined to become a greater boon to the farm than to the city home. It can be made a thing of greater benefit and more practical use to the thirty-nine millions of you who live on farms than to the rest of us who live in cities. And this very soon.

Those of us who are trying to direct this gigantic new industry that has sprung up overnight have been thinking about the farmer's problems and his needs—about how radio can be made to serve him. We have just completed some nation-wide inquiries on the subject of how radio can help the farmers. We have asked questions of thousands of farmers, school-teachers, agricultural professors, farm paper editors, farm agents, Grange officials, country editors and bankers.

ORDINARY common sense tells me what a blessing radio can be to the farm; but the unanimity of the evidence which our national inquiry brought us was amazing.

Consider for a moment the amazing growth of the radio broadcasting industry as a whole.

We point to the automobile industry as having experienced an amazingly rapid growth. In about twenty-five years the motor has come into such general use that there are now 14,000,000 automobiles in the country, or two for every three homes in the country. But radio broadcasting is only two years old and already there is one radio set to every seven homes!

We have been riding in auomobiles for so long that we have forgotten, almost, the day of the horse-drawn carriage, while it was only day before yesterday, one might say, that we learned we could have an inexpensive radio telephone in our homes. Yet as against 4,000,000 cars made last year for us, we bought and constructed 2,000,000 radio sets.

The phonograph had a startlingly abrupt leap into popularity. The Department of Commerce estimates that we have spent a little less than $150,000,000 in a year for phonographs and records. We estimate that "radio fans" spent $150,000,000 last year for sets and parts.

Of the 3,000,000 radio sets now being used in the United States we estimate that only about 150,000 are on the farm. Although farmers constitute a third of the population, they are as yet using only one twentieth of all the radio sets in existence in America. There is only about one set to each forty farm homes.

YOU will soon sit in that familiar living-room in the old farmhouse and hear the President and others speak, enjoy Grand Opera as thoroughly as the thirty-two hundred who actually have found seats in the Metropolitan Opera House in New York. Paul Whiteman and Paul Specht, the jazz kings, have come to you already as stars of the phonograph record; but you may pluck their syncopations from the air tonight, and on many another night if you wish.

The nearest agricultural college, the one that knows most about your own peculiar local problems, will be brought into your little sitting-room of an evening to help guide you in tomorrow's farm work. The general educational and entertainment lectures of the Chautauqua type need no longer wait upon Summertime and the big tent.

If you live in Nebraska and have a load of hogs to ship to market, you can know the quotations up to the last minute on the Chicago market—by radio. The newspaper will not get these quotations to you until many hours later. This of course is a fact of the present, and no forecast of radio future.

Photo from Fotogram

YOUNGEST BROADCASTER

That's the distinction enjoyed by little Harriett Carman, daughter of Harry H. Carman, at 2 E L. She is only 4 years old, but she's on the air frequently and is rapidly becoming known to radio fans all over the country. The picture shows her at her father's broadcasting apparatus at Freeport, L. I.

Soon we shall be able to render great service to agriculture by broadcasting weather warnings that have a bearing on the care and shipment of crops and farm stock. In periods of epidemics, such as hoof-and-mouth disease, radio will deliver instant advice on prevention and treatment even to the most remote localities. Radio will tell you how to fight insect pests that are devastating your crops.

The radio telephone also will be able to broadcast calls for farm help for districts in which labor shortage exists. If, because of a sudden change in weather, crops are spoiling in Kansas while men seek jobs in Nebraska, a veritable labor army could be started for the Sunflower State overnight.

WE WILL try to make radio give you just the kind of service you need—at the time when you need it most.

Wireless can help link up government services direct with the farm. It will become the servant of the various farmer co-operative movements. In one state where there are two hundred Grange halls arrangements are being made to place receiving sets in each hall. Someone has pointed out to us that by use of radio broadcasting Farm Bureaus could get their information and proposed policies into the hands of individual farmers *"with the speed of light."* Grain elevators and live-stock shipping associations can get market information instantaneously by wireless. That is almost a literal use of the word instantaneous.

The spread of advanced farming methods through the teaching of agricultural colleges has added hundreds of millions to farm productivity, and yet only about 150,000 students are enrolled at these colleges at any given time. Faculties of agricultural colleges are aroused to the tremendous magnification of teaching opportunity which broadcasting gives. One has suggested that the farmer be given a wave length all his own. This sort of a teaching program is being worked out: Illustrations and charts and textbooks to be sent by mail, instruction and guidance regarding the studies to be by radio lectures—a great radio extension university, in which hundreds of thousands will be enrolled and work at home, to travel to their alma mater only on completion of the courses, when they go to receive a diploma.

Personally I believe that radio development is going to continue at such a rapid pace that in a period of three to five years it will be possible for one man to speak to 50,000,000 persons in the United States, and to many millions in Canada, South America, and Europe, if stations there relay his voice.

We believe that there will come to be perhaps three of four great super-broadcasting stations. These then can broadcast identical programs by retransmission from one station to another. With such technical resources at their command, consider what wonderful programs such a national entertainment institution could provide.

I like to visualize what radio means by thinking of the boys around the grub wagon at round-up time on some far

(Continued on page 48)

Only a Short Time Left to Get the Best Hookup Book Ever Printed!

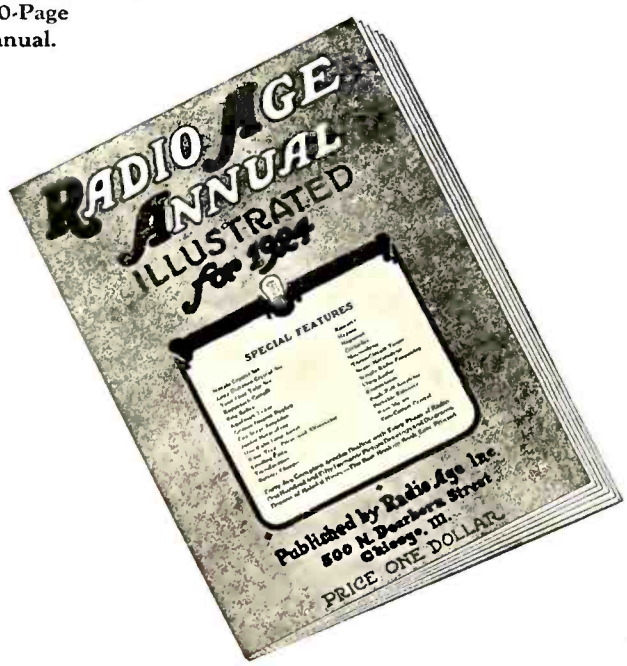
The profound technical problems to be encountered in the study of Radio are all very interesting to the expert, but the great majority of "fans" are vitally concerned in the building of simple sets that really will work and produce effective results.

To supply this demand for practical, simple and efficient sets, RADIO AGE compiled THE RADIO AGE ANNUAL for 1924 in the belief that it contains more real help and meaty material than any other book on this subject ever published.

THOUSANDS have been sold at $1 each since they were first offered to fans early this year. The supply is rapidly becoming exhausted, so we are making this last appeal to the fans to order their ANNUAL now if they have not already done so.

This Book Is Endorsed by Expert and Novice Alike

Cover View of 120-Page Annual.



Full of Hookups That Are Guaranteed to Work!

The RADIO AGE ANNUAL for 1924 is chock full of real radio ideas. From the humble $6 crystal receiver to the great engineering problems involved in the Grimes Inverse, Neutrodyne and Super-Heterodyne sets, the fan is taken by easy and successive stages through the various steps in radio construction.

The principal articles are illustrated with the well-known RADIO AGE isometric drawings, reputed by countless experts as the clearest construction diagrams ever put on the market.

The construction of every standard set and essential accessories is described in detail in the ANNUAL. Each tuner and each accessory was built in the RADIO AGE laboratories and tested and proved before it was awarded space in the ANNUAL.

You cannot afford to be without this wonderful radio "guide book." Send your dollar today for this gold-mine of radio ideas.

here!

This Coupon, Pinned to a Dollar Bill, Will Bring the ANNUAL to You by Return Mail!

(If by Check, Add 5c for Exchange.)

RADIO AGE, Inc., 500 N. Dearborn St., Chicago, Ill.

Gentlemen: Attached find One Dollar ($1) for which kindly forward me by return mail one copy of RADIO AGE ANNUAL FOR 1924. If not satisfied with it I will return it to you within three days and you will refund my money.

Name.....

Address.....

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

RADIOTORIALS

AROUND the world by radio!

It sounds impossible, and yet scientists are talking about it without cracking a smile. In fact, they are devoting the best part of their lives to determining just how and when radio will be sufficiently harnessed and organized to allow Mother Earth to be the universal playground of the ether waves.

Heretofore radio transmission of 4,000 miles was considered miraculous and the height of radio development. Devotees of the science settled back with the air of a person who has seen all there is to see and expects to view no more. But no sooner was this "last step" announced than the next step was under way.

Readers of RADIO AGE who have been keeping themselves informed on latest developments will need no explaining as to the real situation. They know efforts are being made to get every big country in the world to become a part of a great chain of short wave radio stations whose sole duty will be to relay programs around the world on special, pre-arranged wave lengths.

The United States already has the beginning of such a "radio chain." Powerful stations are well sprinkled throughout the country so that with a few weeks' preparation, America's part in the world-wide transmitting program could easily be taken care of. A few other nations, including Great Britain, France, Germany, South America and Canada, have one or two giant stations, but they are not yet fully developed.

All that remains is the final word which would set all radio forces in action to complete this international program of radio broadcasting.

The answer lies in an international radio conference. Radio as an industry and as a science has far outgrown the limitations originally placed upon it. It is too big to be controlled as each nation sees fit. There must be international radio co-operation or radio will stand still just when it should forge ahead into a new realm of magic accomplishments.

The United States has taken the lead in peace and armament conferences. Why not in radio? This country has developed radio more than any other, and has shown the most liberal attitude concerning the use of receiving sets by the general public.

Then why should not America assume radio leadership by calling this radio conference? Secretary of Commerce Hoover has shown the right spirit by calling a conference of those interested in radio *in this country*; but he should look farther and invite foreign nations to share in the long strides America is taking in the once "infant industry."

If it can obtain a willing and influential listener among the government officials interested in radio, or among prominent radio manufacturers, RADIO AGE will be so bold as to offer a tentative constructive program for such an international radio conference. This proposal should be especially welcome at this time, because of its proximity to the Radio World's Fairs in New York and Chicago. Correspondence from readers is urgently invited.

Every broadcasting station should be interested, especially in view of the fact that the government has begun to weed out "dead wood" among the broadcasters. Eighty-two stations were shut down last month alone. Is this not proof enough that only those who produce the best service to the fans will survive in the future?

IS THE American Society of Composers, Authors and Publishers weakening? We have heard several broadcasts of popular copyrighted music recently from stations who do not pay levies to the Society. These stations are proceeding on the theory that one court decision against the Society is enough to throw out its contention that it is a crime to broadcast copyrighted selections over the ether without a permit. As many fans will remember, an Ohio Supreme Court judge ruled broadcasting is not a public performance for profit and therefore does not come under the jurisdiction of the copyright laws. We are elated to hear that the Society is at last realizing the futility of its fight against the broadcasters and the listening public. Our only hope is that the broadcasters will not decide they can get along without the Society's compositions and refuse to render them altogether; for then the Society will have lost the greatest agency it ever had for the free popularization of timely tunes. If nothing else, the war between the broadcasters and the music publishers has resulted in the birth of a new coterie of music writers whose work is becoming more popular than the so-called popular copyrighted brand.

ONE BIG broadcasting station reports that there has been a decided trend toward increasing classical music in recent programs. Asked why, he reports that the demand came from the public itself, who, contrary to common belief, was fed up on jazz and wanted something soft and soothing. Perhaps we can take this as an indication that radio is becoming a barometer of the national mind. If so, are we becoming more serious and even-minded, and getting over the flapper-and-sheik age that preceded radio's entry into the scheme of human events? Maybe so. Watch radio programs and judge for yourself.

GENE McDONALD, president of the Zenith Radio Corporation of Chicago, has a fine idea. He sold station WJAZ because he believed it interfered too much with local broadcasting, located as it was in the heart of a big Chicago residential section. Mr. McDonald now proposes to find a location a hundred miles or so from the city, where he can build an isolated broadcasting station which would not interfere with reception of other stations any more than reasonably possible. The studio would be located in the city, connected with the station by telephone. If this country had more liberal-minded men like Mr. McDonald, the ether wouldn't be so clogged with unnecessary wave lengths and those stations which had to exist wouldn't do so at the expense of exasperated neighbors. Mr. McDonald's experiment, if successful, ought to open a new era in broadcasting.

RADIO MOVIES! Will wonders never cease? In this issue you will read how radio motion pictures have become an accepted fact in experiments in Washington, D. C., and it is now only a matter of time before the fan may equip himself with the proper apparatus. Telephone pictures first, then radio pictures; now radio movies. We refuse to predict the climax of it all.

Pick-ups and Hook-ups by our Readers

The material appearing under the title "Pickups and Hookups by Our Readers" in RADIO AGE, is contributed by our readers. It is a department wherein our readers exchange views on various circuits and the construction and operation thereof. Many times our readers disagree on technical points, and it should be understood that RADIO AGE is not responsible for the views presented herein by contributors, but publishes the letters and drawings merely as a means of permitting the fans to know what the other fellow is doing and thinking.

WE ARE quite sure that many of our new readers, in scanning over the July issue of RADIO AGE, will wonder just what the Pickups by Readers section of this magazine is, how to contribute and what our purpose is. At the time we learned that RADIO TOPICS was to be absorbed by RADIO AGE, our July copy had all gone forward to the printer, and we therefore lost our chance to welcome that group of readers who formerly used to refer to RADIO TOPICS for all their radio news and information. At any rate, though we are a little late, we want to extend to these new friends our heartiest welcome and assurance that their contributions are as welcome as any others. We know that they will have a different perspective of this department, and may have some constructive criticisms, too, to offer.

Briefly, the Pickups Pages are a group of pages devoted to the contributions of all our readers in general. In this department, fans avail themselves of the chance to compare results, circuits and information, and contribute anything of interest to the radio world as a whole. Under the direction of the Pickups Editor, letters, lists, circuits, challenges and other interesting matter is published. You can feel the wave of good fellowship that this cold type and paper radiates as you read over the varied items of interest.

Contributions to the department are always welcome. Any items of interest with regard to lists of stations, results, information and other items are solicited. Information with regard to experiences with different types of receivers is especially desirable because it shows the other fellow just what you have done in cases which are much like the ones he may be experiencing.

Contributions should be neatly executed and, if possible, written on a typewriter; or if not, should be neatly done in pen and ink. Pencil contributions may look all right when you've just finished writing them, but you should try to read them after they have been handled a few times.

However, all we expect is that you make them as neat as possible, because a neat letter always has twice as much chance of publication as one that is difficult to read and poorly executed.

Lists of stations heard containing trans-Pacific or trans-Atlantic receptions should preferably be confirmed. Your contribution always is twice as convincing if you can say, "the reception was confirmed." Incidentally, if you are contributing a circuit or other matter of technical nature it is a wise plan to omit no details; too many of our contributors have been swamped with questions. Witness the letter of M. C. Williams, a contributor to the June issue, in the department this month. *He says he got 1,180 letters since that time.* Make your descriptions as complete as possible.

The purpose of the Pickups Pages I am sure can be gleaned from the contributions that follow. All in all, we have built up a hearty, good-natured following of readers, and we have all kinds of fun in this department.

We're glad to meet you. We hope you'll like our department, and we hope to include some of your contributions in the next month's department.

THE PICKUPS EDITOR.

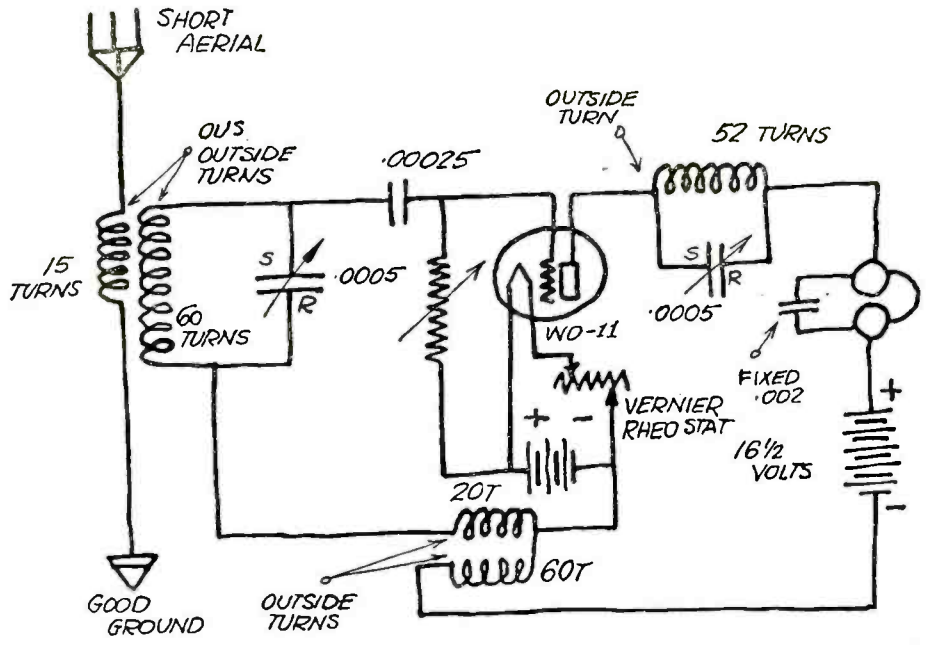


Figure 1. The diagram of the Baby Heterodyne receiver constructed with spiderweb coils as it was submitted to us by Mr Lueven of Los Angeles, California.

The first of our contributions this month is a gathering of additional material on the Superdyne by M. C. Williams, who asks help because he seems to be overwhelmed by mail. We're always willing to help our contributors out, so here goes:

RADIO AGE,

Gentlemen:

Due to numerous letters I am receiving in the daily mails asking for technical data relative to the *Superdyne* receiver, as published in the RADIO AGE for June, I suggest you print the following additional compiled technical data which is requested by the majority:

(A) It has been found that a five-tube Superdyne using one stage radio frequency, detector, one stage audio transformer coupled frequency and the push and pull (two-tube) stage, gives all around better results as to clarity, about the same range, and affords a saving in both "A" and "B" batteries. Also not much difference in volume.

(B) The Superdyne ranks next to the Superheterodyne. Ultradyne and other multi-tube circuits, in the order

other multi-tube circuits, in the order named, possibly next to the Super-Het, according to number of tubes, to volume and clarity of tone.

(C) The small fixed condensers as shown in the June RADIO AGE may be done away with, connected as they are across the primaries of the audio transformers, for they are seldom needed.

(D) An 11-plate condenser connected in series with antennae lead seems to meet all wave length problems.

(E) A good grade variable grid leak should be used and is very essential to tone.

(F) The following arrangement of parts in a 7x26-inch cabinet has proven to be the most efficient layout so far:

(1) A .00055 (De Forest) condenser connected at extreme left end of panel.

(2) Beneath this condenser the variable grid leak is mounted on panel.

(3) Directly behind this condenser place the radio frequency and detector sockets on back edge of baseboard.

(4) To the right of the condenser with proper clearance mount the special Superdyne coupler to both baseboard and panel.

(5) To the right of this special coupler mount the other .00055 condenser on panel.

(6) Mount the plate reactance coil directly back of the second condenser. De Forest condensers have binding posts at rear which are long enough to mount this coil snugly. After this coil is mounted, it will be found that it all will barely fit in cabinet.

(7) To the right of the plate reactance coil place all the audio sockets in line to nearly end of baseboard.

(8) Install audio transformers between the line of audio transformers and panel. Be sure to slightly turn one transformer or mount at right angles if enough room is available.

(9) At the extreme end (right) of baseboard install the push and pull transformers running line from panel to back edge of baseboard.

(10) Install jacks, rheostats and filament switch to the right of the three large dials on panel. Voltmeter is desirable.

(11) A small Bakelite sub-panel is connected by right angle brackets to top front edge of panel, far enough down, however, to allow binding posts to pass into cabinet. The following binding posts are mounted on this panel in the order named: Aerial, Ground, B—, B+ Det., B+, A—, A+, C—, C+. However, better results are obtained by having a separate B battery for the push and pull stage, so separate binding posts will have to be added to the sub-panel in case this is desired.

(12) A 1-henry choke coil and a 1-MFD. fixed condenser shunted across the aerial and ground leads will tone down static considerably and will nearly cut out AC hum and other foreign battery interference. This may be added and wired so that it may be cut out with a neat filament switch installed on the panel.

(13) A variable grid-condenser (grid-denser) is also very essential and is certainly worth installing in place of the .00025 fixed grid condenser.

(14) Vernier or micrometer adjusted condensers are not needed but a micrometer adjustment on the special coupler is a great help. Any of the micrometer adjusted dials on the market will serve the purpose.

(15) It takes patience and time to learn the technique in tuning the Superdyne, but the results obtained are surely worth the time spent.

I will be glad to answer any of the DT's who desire any additional information and who are actually contemplating on building the set.

Superdyne Supplement Experimental

The following information furnished for the convenience of DT's who are experimenting on my hookup of the *Superdyne* shown in June RADIO AGE and who have swamped me wtih mail, having *received eleven hundred and eighty* letters so far.

1. The by-pass condensers may be .001 or .002 as the case may require. May be done away with on transformers.

2. Audio transformers need not be as high a ratio as shown; in fact, a 6 to 1 in first stage and a 4 to 1 in second will be better.

3. A fixed condenser suitable to your present antenna placed in series in aerial lead is better than a variable. This must be arrived at by trial.

4. It is not necessary to have rheostats for each tube, but they help to get the best there is in each tube, for the characteristics of tubes vary. One good rheostat for detector and one for radio frequency are essential and one for the two audio tubes and one for P. & P. will work wonders and save money for the builder.

5. For selectivity cut down your aerial to about sixty feet with single wire, well insulated.

6. When you heard a noise like rushing wind, your set is in oscillation and then is the time to adjust the feed-back (rotor) and bring in quiet the music or speech.

7. A 1-henry choke coil (iron coil) and a 1-MFD. fixed, cut directly across the ground and aerial binding posts works wonders in cutting out power hum and foreign battery noises.

8. It is not necessary to use the P. & P. at all if not desired; it only helps to cut down distortion and produce volume.

9. Amplex Instrument Laboratories, 57 Dey Street, New York City, put out a kit complete with all parts with tested instruments which are wonderful and cost only $30.75, which includes a drilled panel with baseboard.

STATIC PUNCTURING CONTEST

CAN old man static stop you or can you stop old man static? We offer the following prizes to DTs for the five best records submitted during the month of August. The contest is open to any reader of RADIO AGE, and any type of set. The Pickups Editor reserves the right to pick the winners.

We will be especially interested in lists submitted by persons making their receptions on portable receivers.

The baseball season is open—who will be the ones to sock old static for a home run? Wot sa, DTs?

PRIZES for August

A year's subscription to RADIO AGE for the first best list submitted showing receptions made during the month of August.

A year's subscription to RADIO AGE for the second best list submitted showing receptions made during the month of August.

For the third, fourth and fifth best lists, we will award a copy of the RADIO AGE ANNUAL to the contributor of the winning list.

If any transcontinental or transatlantic reception is accomplished, confirmation of such reception is necessary.

10. Do not use taps unless absolutely necessary, as these ends afford a great loss in sensitiveness.

11. In case two wires are used in aerial, transposition should be used; i. e., in the center of the wires disconnect and insert strain insulators and change left wire to right and right to left and you will be surprised how this will help where you are located near power lines.

12. Any of the Superdyne coils advertised in RADIO AGE are tested and O. K.

MARVIN C. WILLIAMS.
Department of Communications,
Air Service Technical School,
Box 353, Rantoul, Ill.

Our hat is off to Mr. Williams. If I could, I would like to shake hands with him. If every radio man in the game were as generous with information, and information on a circuit that he has become acquainted with as he is, what a wonderful radio world this would be! Now, if some fellow would only give a similar report of experiments and experiences with a super-het, we would consider him a regular radio fan at heart. Remember, all the information you may glean from your experiments is of little use if you hoard it. This game progresses only when we let others know of what progress we have made. Radio free-givers like Mr. Williams, Mr. Gannon, Mr. Baumgardner, Mr. Glass and others who have given us their experience with circuits are the real fellows who further the progress of the art. The world loves a cheerful giver, and although you may not be an engineer, when you contribute a gathering of information as did Mr. Williams and the others whose work has been offered in the Pick-ups Pages, you spell GENEROSITY with capital letters.

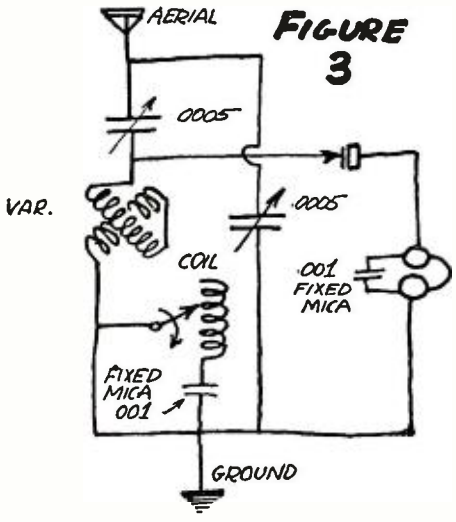


FIGURE 3

A diagram showing the connections of the crystal receiver which has done exceptionally good work for one of our Dial Twisters. The coil is a 40 turn inductance wound on a 3½ inch tube tapped every fifth turn. It is wound with No. 20 DSC wire.

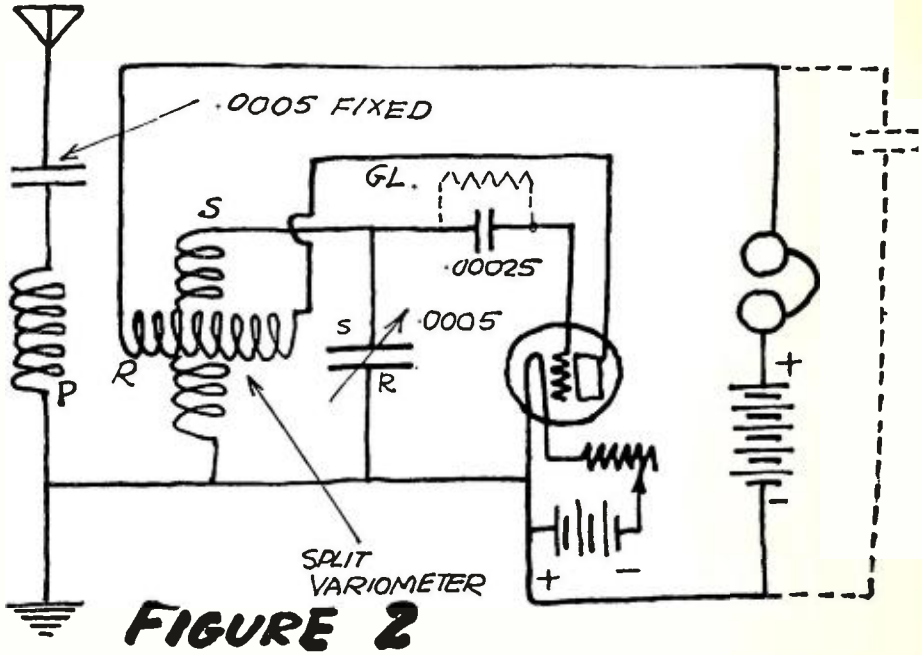


FIGURE 2

An improvised low loss tuner suggested by one of our readers.

RADIO AGE,
Gentlemen:

I notice that M. R. C. of Los Angeles has built one of your Baby Heterodyne receivers without success, in scanning over the Trouble-shooter section of RADIO AGE. In answering this letter of M. R. C.'s you first state that WD11 or WD12 tubes will not work efficiently. Now, if you will be so kind as to inform M. R. C. that I, too, have built your Baby Heterodyne around a WD12 tube with great results and that I live in Los Angeles, at 1536 East 40th Street, I will show him how he can get more volume from this hookup than 50 per cent of the neutrodyne owners of Southern California.

I have done quite a bit of experimenting on this set and I have it so that I now can take in Oakland every night they are on the air. I have heard KGW at Portland, Ore.; I get KPO repeatedly and I can tune out local with a variation of two degrees on my tuning condenser. I hear Oakland as loud as local. This is done in Southern California, Los Angeles, the worst place in the United States for getting distance on any set. And during Summer, too.

Let me say that the Baby Heterodyne hookup is the best little single tube hookup going.

For those who want to get results from this hookup, using WD12 or WD11 tubes, I am writing these few hints.

The antenna should be only one wire, not over 50 feet long. And the antenna coils should only be 15 turns; no more, no less. The tuning coil should be 60 turns, which if used with a *good* 23-plate condenser will tune very sharply. Both these coils, which are primary and secondary, are wound on spider web forms of 15 slots each. The antenna connection is made on the outside turn of the spider web primary. The turn nearest to the outside of the coil on the secondary is connected to the grid. Coils M and N are wound also on spider web forms of 15 slots. Coil M has 20 turns, and M, 60 turns. The inside turns of both coils are connected together, and then to the negative side of the A battery. The outside turn of coil N runs to the negative B battery, putting the phones nearer to the plate of the tube. The diagram shown in Figure 1 illustrates what I mean.

Now as to mounting these coils, it is important that it be done correctly or the selectivity of the set will be lost. Drill holes in the center of each form. Place a 1½-inch brass screw through the form P and a nut is run on it. Coil S is then mounted on the other end of the screw, taking care that both coils are placed with the winding running in the same direction—preferably to the right. The two coils constitute the tuner, and are mounted on the end of the board, in a horizontal position. It is advisable to use a Bakelite mounting board to fasten the apparatus.

Coils M and N are mounted in the same manner, but when placed on the board I set them to turn in the opposite direction (say to the left), and are mounted on the extreme end from the coupler. Inductance L is 52 turns, which I found tunes well with the WD12 tube and 23-plate condenser.

Incidentally, the outside turns of all the honeycomb or spider web coils should be connected to the radio frequency paths; in other words, the plate and grid circuits, while the inside terminals should go to the low

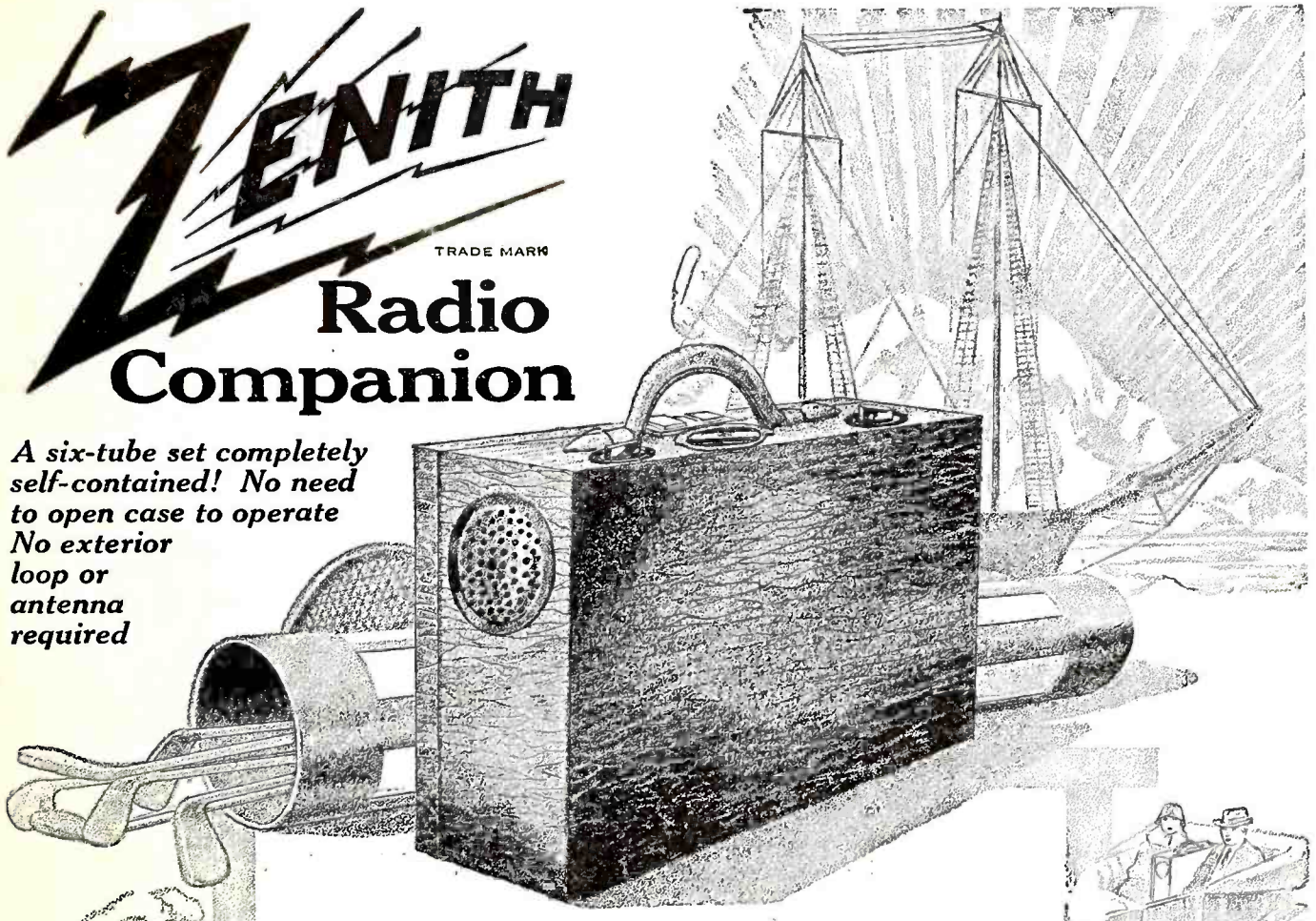
(Continued on page 42)

ZENITH

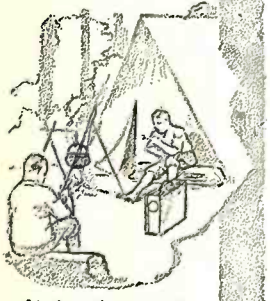
TRADE MARK

Radio Companion

A six-tube set completely self-contained! No need to open case to operate No exterior loop or antenna required



Listening, with the keenest pleasure, to music and voices in the cities they have left behind!



Lively orchestras entertain these boys, miles and miles from civilization.

Receiving the latest market reports, the latest news developments, with the aid of the Zenith Radio Companion.

Zenith — MacMillan's Choice

Encased in a Light Traveling Bag!

Here's a six-tube radio set that's entirely self-contained—tubes, "A" batteries, "B" batteries, loud speaker and loop antenna complete, and it's a ***Zenith!***

Packed into a small, beautifully finished traveling case—much smaller than the average suitcase—this new Zenith is the most compact set ever made giving clarity, quality, volume and distance.

Do you see those two little buttons close to the handle? Those are the controls. In order to operate the new Zenith Radio Companion you simply turn the controls to bring in the station you want—then for maximum volume you swing the case so that the loop is facing that particular station. You will be astonished at the clearness with which the music and the voices come through—and in what volume!

Think what it would mean to you to be able to take one of these new Zeniths with you on your travels and outings. A real radio set—the exclusive choice of Donald B. MacMillan for his Arctic expedition—yet so compact that it takes up no more space than a light traveling bag!

Think of the fun you could have with this set—the dance music you could listen to on moonlit nights—the orchestras that would play for you as you and your pals gathered round the camp fire—the companionship it could give you on your motor parties—at the bathing beach. Picture the enjoyment it could bring your guests at the house-party or the week-end gathering.

Again, think how such a set would while away a lonesome evening in that dreary out-of-town hotel—what a god-send it would be to that invalid mother—to that dear relative or friend who must spend weeks and months in the hospital!

But if you have already been initiated into the wonders of the Zenith, you don't need be told the extraordinary use you could get from this new model or the fun it could give you.

Just the knowledge that you could pick up this beautifully finished case—even as you would pick up your hand bag—and take it with you across city, country, lakes, mountains, and *still* turn those two controls and be able to listen at a moment's notice to the world you have left behind—that thought alone should be enough to suggest the infinite delights provided by this new Zenith Radio Companion

You will want to know more of this remarkable set—so light and compact, so easy to operate, so wonderfully convenient. You will want to see it for yourself, at the very earliest moment. No earphones, you understand. No outside antenna. Yet clarity, volume, quality, distance! A real Zenith, packed into a traveling case!

Your name and address on the coupon, and the coupon placed in the mail, will bring you full particulars.

The height of luxury—motoring to music!

When three is company at the bathing beach.

A constant source of entertainment and delight to the invalid.

Zenith Radio Corporation

McCormick Building
Chicago, Illinois

ZENITH RADIO CORPORATION,
Dept.4-F 328 S. Michigan Ave., Chicago, Ill.

Gentlemen:

Please send me illustrated literature on Zenith Radio, including full particulars of the new Zenith Radio Companion.

Name.....

Address.....

.....

Pickups
By Our Readers

(Continued from page 40)

voltage or battery connections common to the ground.

I use a Bradleyleak, connecting it to the grid of the tube and the positive filament as shown. The Bradleystat is connected in the negative lead of the filament instead of the positive as was originally specified. Dials of the friction or gear type were used and not separate plate type condensers. This is very necessary for sharp tuning. A .002 fixed mica condenser across the phones helps to clear up noises, and makes the regenerative action more stable.

A mounting board of Bakelite is used, raised sufficiently on the back of the main panel to permit the coils to be placed underneath and the tube sockets and controls to be placed on top. On my set I put the condensers on each end, and the grid leak between them.

I soldered all connections, using bus bar wire, lugs and spaghetti. I wiped every joint of soldering paste and used the paste only very sparingly.

Before placing the set in the cabinet, be sure that all soldered joints are clean of foreign matter. Dust off everything carefully, and clean the plates of the condensers with a bent pipe cleaner or a vacuum cleaner.

I find that a tapped 22½-volt B battery is a necessity to get a clear, audible signal. I found that around 16½ volts the WD12 tube responded best. Also set the grid leak by turning the knob all out and turning it in until good clear signal is heard. The higher you make the grid leak resistance without making it scratchy, the louder the signal will be.

I hope that this will be of interest to some of your Baby Heterodyne fans. Very truly yours,

A. F. VAN LEUVEN.

1536 East Fortieth Street,
Los Angeles, Cal.

Mr. Van Leuven wants to know if he can't make his Baby Het into a Super by adding another detector tube and an oscillator. We'll almost bet you could do it and still make it work, but the only trouble is that when you do that, you've got to have an intermediate amplifier, and then your set runs into tubes—and $$$$$. However, information of that nature is in the RADIO AGE ANNUAL, under the heading of the "Junior Heterodyne." You might look it up.

Now here's something that looks interesting:

RADIO AGE,
Gentlemen:

In your excellent magazine for May there appeared an article on "Aperiodic Antenna Coupling." I have been using an aperiodic coupler with which I have had good success, so am passing it on for the boys to fool with. As seen in the drawing, it is an exact duplicate of the Low Loss Tuner which has appeared of late. It is very selective and has the advantage of only two controls.

The primary consists of fifteen turns of No. 18 D. C. C. wound on wooden pegs directly on the side of the variometer, which should be of the wooden variety, having fifty turns on both stator and rotor. For the secondary I used the stator and the rotor is used for the tickler. A .0005 fixed condenser in the antenna lead makes the tuner more selective.

The drawing (Figure 2), I think, is self-explanatory. For those who want a set that will "do its stuff" and is portable, lash this up.

Yours truly,

E. M. ABBOTT.

R. No. 1, Box 152,
Petaluma, Calif.

Now look what we dug out of the mail bag for the crystal fans:

RADIO AGE,
Gentlemen:

Enclosed you will find a list of stations received during the month of June. This is a crystal set of my own make, and with which I have had exceptional results with in freak receptions.

If I had a camera, I'd like to drop you a few photos of the set, of which I am quite proud. The diagram of the circuit is enclosed. I hope that it will be of some use to those bugs who can't afford a tube receiver. (Diagram is shown in Figure 3.)

I have a card and letter of confirmation from most of these stations while others just sent a pamphlet and a card confirming the receptions.

This ought to win a prize on the DT list. Very truly yours,

JAMES A. BENNETT.

Chester, Pa.

**Calls Heard by James A. Bennett,
2733 W. Third Street, Chester, Pa.**

WGY, WEAF, WBAP, WBZ, WMAQ, WHAV, WHAZ, WWJ, KDKA, PWX, 9XAE, 2X1, 2XAP, 2CDC, WOO, WIP, WFI, WDAR, WWAD, WCAU, WIAD.

This seems to be another little "Long Distance Crystal set." Mr. Bennett has the dope, all right—you've got to know HOW to make 'em to do a thousand miles or more. Good stuff!

RADIO AGE.
Gentlemen:

In your issue for June, 1924, I see a radio fan from Halifax, N. S., sent in his list of stations heard. I refer to H. K. Hatheway, as I reside just across the harbor from him, and am naturally interested in any news from Halifax pertaining to radio.

(Continued on page 52)

Have You Placed Your Entry in the Popularity Contest?

As announced in a page advertisement in this and in the July issue, RADIO AGE is conducting a RADIO FAVORITE POPULARITY CONTEST to determine the most popular personage in the radio world.

This contest is open to all readers of RADIO AGE, and each coupon clipped from this magazine is good for one vote. First tabulation of results will appear in the September issue.

If you have not already voted for your favorite announcer, entertainer, or other radio figure, clip the coupon in this issue and get your friends to do the same.

Get a Job Like These

Earn $3500 to $10,000 a Year

in the Big Pay Field of ELECTRICITY

20 Years Old—Makes Almost $500 a Month

Harold Hastings of Somers, Mass., says: "The profit on my electrical business amounts to $475.00 a month. My success is due entirely to your instruction. You make your men just what you say—Electrical Experts. No man will ever make a mistake enrolling for your course."

Dickerson Gets $7500 a Year

"I earned $30 a week when I started with you—$50 a week when half through your course. Now I clean up at the rate of $7500 a year. Thank you a thousand times for what you did for me. Electricity pays big on the farm." Herbert M. Dickerson, Warrentown, Va.

$20.00 a Day for Schreck

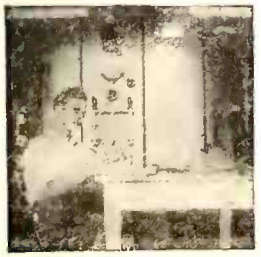
"Use my name as a reference and depend on me as a booster. The biggest thing I ever did was answer your advertisement. I am averaging better than $500 a month from my own business now. I used to make $18.00 a week." A. Schreck, Phoenix, Ariz.

Pence Earns $9000 a Year

W. E. Pence, Chehalis, Wash., says: "Your course put me where I am today, Mr. Cooke—making $750 a month doing automobile electrical work—think of it—$9000 a year. Besides that I am my own boss. My wife joins me in thanking you for what you did for us."

$30 to $50 a Day for J. R. Morgan

"When I started on your course I was a carpenter's helper, earning around $5.00 a day. Now I make from $30 to $50 a day and am busy all the time. Use this letter if you want to—I stand behind it." J. R. Morgan, Delaware, Ohio.



Spare Time Work Pays Stewart $100 a Month

"Your course has already obtained a substantial increase in pay for me and made it possible for me to make at least $100 a month in spare time work. You can shout this at the weak fellows who haven't made up their minds to do something yet." Earl Stewart, Corona, Calif.

It's your own fault if you don't earn more. Blame yourself if you stick to your small pay job when I have made it so easy for you to earn $3500 to $10,000 a year as an electrical expert. **Electrical Experts** are badly needed. Thousands of men must be trained at once. One billion dollars a year is being spent for electrical expansion and everything is ready but the men. Will you answer the call of this big pay field? Will you get ready now for the big job I will help you get? The biggest money of your life is waiting for you.

I Will Train You at Home

I will train you just like I trained the six men whose pictures you see here. Just like I have trained thousands of other men—ordinary, everyday sort of fellows—pulling them out of the depths of starvation wages into jobs that pay $12.00 to $30.00 a day. Electricity offers you more opportunities—bigger opportunities—than any other line and with my easily learned, spare time course, I can fit you for one of the biggest jobs in a few short months' time.

Quick and Easy to Learn

Don't let any doubt about your being able to do what these other men have done rob you of your just success. Pence and Morgan and these other fellows didn't have a thing on you when they started. You can easily duplicate their success. Age, lack of experience or lack of education makes no difference. Start just as you are and I will guarantee the result with a **signed money back guarantee bond.** If you are not 100% satisfied with my course it won't cost you a cent.

Free—Electrical Working Outfit and Tools

In addition to giving my students free employment service and free consultation service, I give them also a complete working outfit. This includes tools, measuring instruments, material and a real electric motor—the finest beginners' outfit ever gotten together. You do practical work right from the start. After the first few lessons it enables you to make extra money every week doing odd electrical jobs in your spare time. Some students make as high as $25 to $35 a week in spare time work while learning. This outfit is all FREE.

Mail Coupon for FREE BOOK—
The Vital Facts of the Electrical Industry

The coupon below will bring you my big free electrical book—over 100 interesting pictures. The real dope about your opportunities in electricity—positive proof that you, too, can earn $3500 to $10,000 a year. Send for it now. Along with the book I will send you a sample lesson, a credit check allowing you a $45.50 reduction, my guarantee bond and particulars of the most wonderful pay-raising course in the world. Send the coupon now—this very second may be the turning point in your life. Send it while the desire for a better job and more money is upon you, to

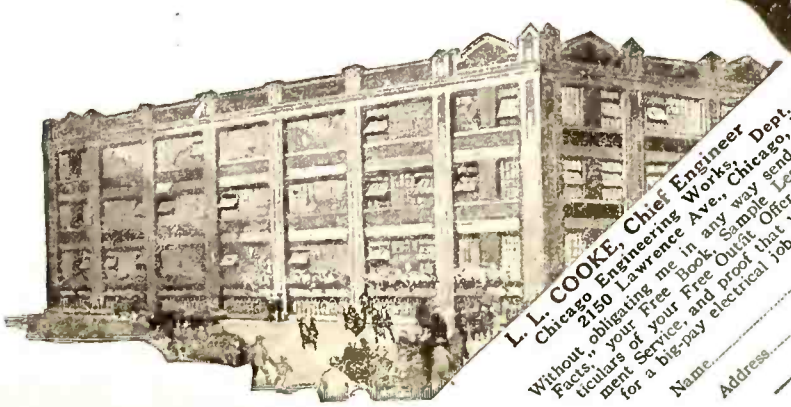
L. L. COOKE, *Chief Engineer*

Chicago Engineering Works

DEPT. 82-B

2150 Lawrence Ave., Chicago

The Cooke Trained Man is the Big Pay Man



L. L. COOKE, Chief Engineer, Dept. 82-B
Chicago Engineering Works, 2150 Lawrence Ave., Chicago, Ill.
Without obligating me in any way send me the "Vital Facts," your Free Book, Sample Lessons and particulars of your Free Outfit Offer, Free Employment Service, and proof that you can fit me for a big-pay electrical job.

Name.....

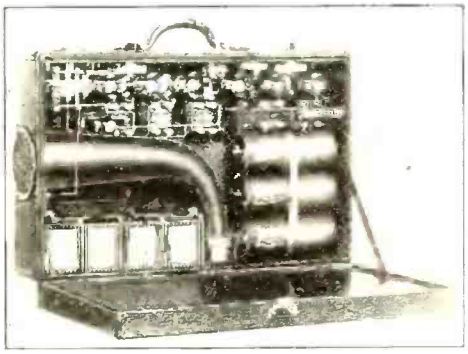
Address.....

WITH THE MANUFACTURERS

The New Zenith Super-Portable

The new Zenith Super-Portable is a six-tube radio set complete with tubes, "A" batteries, "B" batteries, loud speaker and loop antenna, entirely self-contained. It is fitted into a small traveling case—giving clarity, quality, volume and distance.

In the case are included all the essentials of an efficient six-tube receiver employing three stages of transformer-coupled radio frequency, a detector, and two stages of audio frequency. The set is dry-cell operated. A loop antenna is permanently mounted inside the case, and the three controls—(1) A rheostat for regulating the battery current; (2) Tuning control for selecting stations; (3) Volume control—are mounted close to the handle in three recessed dials.



The Zenith Super-Portable weighs only twenty-four pounds and may be carried about like an ordinary small suitcase. No external aerial is required for operating the Zenith Super-Portable, nor is it necessary to open the case. The set is operated by means of two controls, both on top of the case. Having tuned in the station you want, volume can be further regulated by swinging the case so that the loop is pointed in the direction of the station broadcasting. A station may be tuned and the Super-Portable placed in full operation while it is being carried down the street, in an automobile or otherwise transported.

An extremely sensitive and distortionless loud speaker is mounted inside the cabinet with a shielded orifice through which the spoken word or music is clearly heard. Neither head phone nor external loud speaker is therefore necessary. The same principles that have made the Zenith models 3R and 4R so highly selective—permitting the tuning out of powerful local broadcasting stations close to the receiver and at the same time tuning in distant stations—have been utilized in the new Super-Portable. Special attention has been given to low-loss design and distortionless amplification. Reception of distant stations may be accomplished in full phonographic volume with the Super-Portable without any external equipment.

In creating the new Zenith Super-Portable its designers had high standards to live up to. For it was a Zenith set which Donald B. MacMillan, world-famous Arctic explorer, chose exclusively for his expedition to the North Pole; it was a Zenith with which Miss Florence MacDonald, a passenger on the trans-Atlantic liner Berengaria, established a new long-distance record over land and water, tuning in station WDAP, Drake Hotel, on the fifth day out—a distance of 3,463 miles. With these records in mind, the designers of the new Zenith Super-Portable undertook to create a set which would live up to the Zenith name in every particular, and yet would be contained in a small traveling case.

New Trirdyn 3 R 3 Receiver

The rapidly increasing popularity of tuned radio frequency in receiving sets is clearly indicative of its extreme efficiency. The Crosley Radio Corporation has used tuned radio frequency for the past two years, notwithstanding the great amount of publicity already given to tuned radio frequency of the transformer type. It is gratifying to know that so many large and influential manufacturers are turning to tuned radio frequency amplification in the design of the new receivers.

The newest addition to the Crosley line is the Trirdyn 3 R 3, announced on the third anniversary of the corporation. The Trirdyn, having passed through a thorough test from every angle and after practical use by people in various parts of the United States, was deemed ready to be distributed to the public. Laboratory tests are not always as practical as those given a receiver under the different circumstances encountered in actual operation and the reports received bore out the excellent tests of the designers. A year has been given to perfecting this receiver.

Four important principles are accomplished in receiver design in the Trirdyn: Tuned radio frequency amplification with the first tube; Armstrong regenerative detector action with the second tube; reflex amplification by employing the first, or radio frequency tube as an audio amplifier and one-stage of audio frequency with the third tube. These factors combined in the particular arrangement of this receiver, give high signal strength.

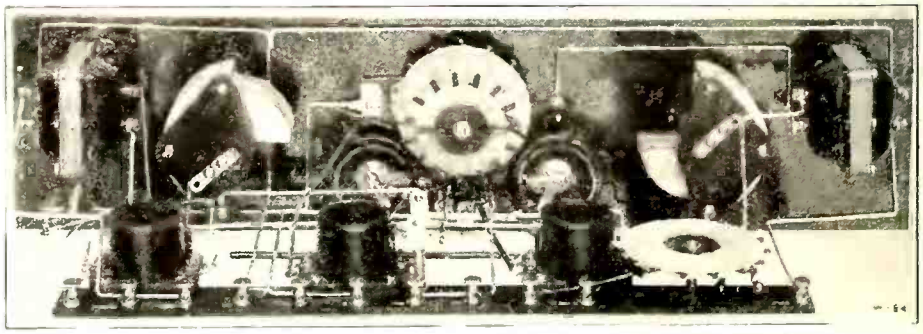
The Trirdyn will not radiate when receiving broadcasting stations' signals, due to the fact that the antenna is very loosely coupled to the secondary circuit and a non-oscillating radio-frequency amplifier is employed before the regenerative detector, as a barrier to prevent oscillations generated by the detector upon reaching the antenna.

The primary or antenna circuit of this set is aperiodic or untuned, making it possible to calibrate the secondary circuit and the tuned radio frequency amplifier in terms of wave length, thereby enabling the receiver to be accurately adjusted to the signals of any broadcasting station from a calibration table or curve sheet.

The set is selective because it employs tuned radio frequency, loose-coupled antenna and a tuned secondary. The operation of the Trirdyn is very simple and will give excellent results with any good antenna. It also operates well with a small indoor antenna.

It requires a detector and two amplifier tubes of standard type. Good results are obtained when UV 199 tubes are employed, but the volume will be greater with 6-volt tubes. The amplifier circuit employs 90 volts of "B" battery. A "C" battery may be employed if desired. The Trirdyn is enclosed in a beautiful solid mahogany cabinet.

(Continued on page 64)



The back panel view of the new Crosley Trirdyn 3R3 receiver. Note the symmetrical arrangement of the apparatus, designed to make possible short leads and yet preserve the front panel appearance of the set. The open work style of mounting, and the method used to keep the tubes away from the controls on the panel insure extreme stability.

RADIO FANS—YOU NEED THIS!

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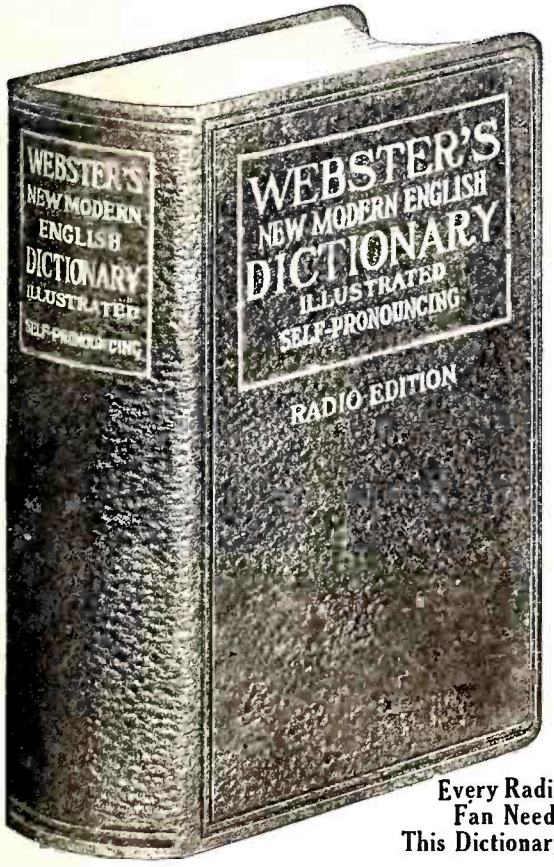

Every Radio Fan Needs This Dictionary

Every teacher, student, reader, writer and author will find this splendid word-book exceedingly helpful in the preparation of their work. It is a recognized, authoritative guide containing practically every word in the English language in daily use and in addition hundreds of new words brought into use by the recent World War, political upheavals, recent investigations in arts, science, and modern industrial activities never before found in any dictionary. Bold black face type, easily readable and words clearly and concisely defined.

New 1924 *Special Radio Edition*

A special supplementary vocabulary consisting of over one thousand (1,000) radio and wireless terms are herein concisely and authentically defined. This popular edition is invaluable to "Radio Fans."

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USE THIS COUPON

RADIO AGE,

510 N. Dearborn St., Chicago, Ill.

Gentlemen:—Enclosed find $3.75 in cash or equivalent, for which send me one copy of your Webster's New Modern English Dictionary, Radio edition, postpaid, and Radio Age for one year.

Name.....

Address.....

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

New and Novel Radio Patents

Selective Tuning Possible by New Vario-Coupler

NEARLY perfect zero coupling in radio-frequency amplification is claimed for a vario-coupler designed by Alfred Crossley of the Bureau of Engineering, United States Navy Department, for which invention a patent has just been issued.

Selective tuning is the practical accomplishment of this new coupling device. Novices and amateurs are earnestly seeking in these days to attain this end, especially since local broadcasting stations are creating interference with respect to long-distance reception.

The newly designed vario-coupler, according to claims, provides large electro-magnetic coupling with a minimum electrostatic coupling. That is to say, in many of the radio-frequency amplifying receiving sets in use today, the passage of electrostatic energy from one circuit to another has a tendency of annulling the tuning effects and thereby making difficult fine adjustments of the circuits.

This vario-coupler serves the highly desirable purpose of bucking out the electrostatic energy and employing the electro-magnetic energy, which alone is useful in the reception of radio communication.

Structurally, this tuning device includes a rotor and stator forming the primary and secondary windings, which connect to the coupled electric circuits. The stator takes the form of a tube or cylinder and its windings are in the interest of the least dielectric loss. The rotor, on the other hand, is in the shape of a disc mechanically mounted in a plane passing through the diameter of the stator and at right angles to the axis thereof. The rotor, like the wheel of a wagon, contains a hub with spokes.

The windings of wires on this rotor, or revolving portion of the vario-coupler, resemble a spider web, the turns of wire being threaded upon the spokes and spirally built up to occupy the length of the latter.

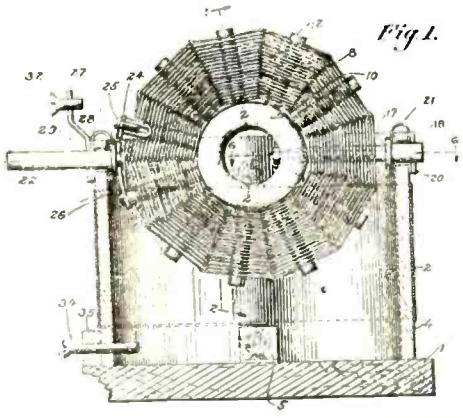


Fig 1.

Photo from Fotograms

GIRLS BECOMING RADIO EXPERTS

Gone are the days when one had to be a man to understand the intricacies of radio apparatus. Now girls are employed extensively in the big radio manufacturing plants to make and assemble radio sets. Two interested girl workers are shown above assembling vernier wheels on clarifier panels in the Grebe Mfg. Plant, Richmond Hill, L. I. Their positions were won only after long study of the principles and practice of Radio.

In practice, when this vario-coupler is used in the tuning circuit before a radio-frequency vacuum-tube amplifier, the stator or primary winding is connected in the antenna ground system while the rotor or secondary winding is identified with the input circuit of the first stage of the radio-frequency vacuum-tube amplification. The greatest degree of electro-magnetic coupling is accomplished when the flat area of the rotor is in a position parallel with the direction of the turn of the windings of wire upon the stator; whereas, zero coupling takes place when the flat area of the rotor is approximately at right angles with the direction of the turns of wire upon the stator.

The Crossley vario-coupler should be useful in exact tuning of radio-receiving sets when operating over a band of wave lengths of narrow margins. And with approximately 500 broadcasting stations in operation, this condition exists at all times. This is accomplished, in part, by the elimination of electrostatic energy and the maximum building up of the electro-magnetic field.

The papers granted by the Patent Office accede to these claims: A vario-coupler having a large electro-magnetic coupling with minimum electrostatic coupling; an instrument attaining a more perfect zero coupling than found in any vario-coupler yet introduced; and a device which may be connected in a circuit and arranged to secure extremely selective tuning of the circuits.

"Great Things Are Coming for Radio On the Farm"

(Continued from page 35)

Western ranch. In the old days they could cuss the cook and play cards. Now they can carry a radio outfit on the wagon, and pluck out of the night voices of many distant cities, while in a mean room in some city slum the owner of a fifteen-dollar set may hear John McCormack, Mary Garden, Chaliapin. Neither the cowboys on the plains nor the victim of city poverty need any longer be isolated.

It seems probable, judging by experiments already made, that, in the course of four or five years of research, engineers will have perfected methods of rapid, accurate, and detailed transmission of photographs by wireless. They will then work on the more difficult problems of reproducing at a distance moving pictures of moving bodies.

You will sit before your radio set out there on the farm and hear the Presidential address while you watch his gestures and the crowds about him. Opera and drama in a distant city you will both see and hear. You may have almost ringside seats at the world championship match, and thrill to the swat of the "Babe" Ruth of that day—all in your own sitting-room. This will never be a complete substitute for seeing and hearing the opera and the play or the great political or sporting event—but then indeed will the farm cease to be "isolated."

*Courtesy *Farm and Fireside.*

A New Service to Aid the Radio Public In Buying Efficient Sets and Parts

By EDMUND H. EITEL

Vice-President, Pfanstiehl Radio Co.

SERVICE? What is it? Perhaps we had better ask, "What *isn't* it?" If the vacuum tube is the "heart of the receiving set," service is the heart of the radio industry. A receiver is not a few pounds of wood, metal, and rubber, which are worth intrinsically very little, but it is the most marvelous service that science has yet contributed to civilization, a service which annihilates space and time and the ordinary considerations of economics.

And so, from the manufacturer to the public, we deal not so much in radio materials as in radio service. It is just as important for the public to recognize this, as for the man who wholesales or retails radio, in order that the merchandising of radio may be placed on a more dependable basis and those merchants eliminated who sell apparatus which will not work properly.

Let us illustrate with what service *is not*. A certain manufacturer, who is noted for doing his utmost to make products of the best design and workmanship, recently discussed his line with a small New York dealer who said, "I believe your goods are the best and I know how well they are made. That's just why I don't carry them. You see, when I sell the junk I now carry, the customer usually brings his set in and gives me a chance to make a profit repairing it."

That dealer will not be permanently in the radio industry. Fortunately, there are few merchants who talk in this way and who know and care so little about service. To eliminate such menaces to the health of radio, we need more intelligent buying on the part of the public, and this leads us to the question of where service begins.

There is apt to be a vicious circle started when dealers sell without conscience, and the public will buy anything. Weak manufacturers will be tempted to furnish junk and the newspapers to print hookups to serve. The public, *while* uneducated, is duped.

We have had some experiences of this kind in the first few years of radio and we see now that to begin with the public must be well trained in the fundamental principles of radio by the radio journals. The manufacturer must build with foresight for the future; must not "fall" for the temptation to sell even fads. The wholesalers must think first of all not what will sell today, but what reputation is he building? And the dealer the same. The dealer, like the journal, can render an invaluable service by helping educate the public in the fundamental principles of good buying; and grateful customers will pay him in the long run.

No other industry has ever before placed such a difficult technical problem in the hands of the public. RADIO AGE offers a solution of this problem in a series of Service articles on buying and selling radio. These discussions will not deal with the theoretical requirements of voltage, capacity, etc., which are covered in the usual diagrams and articles, but with a side of the subject which has been neglected; namely, the practical points one needs in selecting apparatus. What you want to know chiefly is how to buy apparatus which *will work* and work most efficiently.

Too Many Radio Fans Are Duped By Failing to Do Buying Wisely; Radio Age to Tell How

The group with whom I am identified received some curious advice when it proposed to make sets. We were warned by a manufacturer of parts to leave sets alone. The trouble with making sets, he said, lay in there being so much junk in radio apparatus that you had the greatest difficulty in building a set which would work. If you sold parts, he said, you were relieved of the responsibility of making the set perform.

In the course of many experiences we have often laughed over this advice. After the manufacturer designs his apparatus, he reviews the materials and parts available, tests them, and makes his selections. Next he buys a very great number of the units selected and learns how many hundred different ways they can fail to work. Occasionally, despite all the manufacturers' foresight and final testing, the customer gets into difficulties. And so, the manufacturers' knowledge is widened into a new field of troubles, due for the most part to the customer's unfamiliarity with the technical side of the apparatus. This results ultimately in simplification of design.

RADIO AGE has asked me to set down points of practical, as contrasted with theoretical, experience on data sheets in the form of buyer's guide or service. During the coming radio season, we shall hear less of so-called "new" hookups and more about improving the efficiency of those circuits which have demonstrated their superiority. For this development of interest such data will be timely.

Since the data on these sheets will aid those who buy as well as to those readers who sell radio, they will be called a "Buyers' and Sellers' Service." They will supplement and be convenient to bind with Mr. Rathbun's technical data sheets.

The First of the Buyers' and Sellers' Service Sheets Will Be Found on Page 50.

HOW DID THEY GET THAT WAY?

What did the radio announcers and entertainers do before they were brought into the limelight by the sudden advent of radio popularity?

Some were unknown completely. Others were struggling along at some kindred occupation, such as theatricals or public speaking. Overnight they became familiar—by voice and name, though not by sight—to millions of radio listeners.

The story of how many studio favorites rose to fame and how they did it ought to prove of interest to every RADIO AGE reader. The first of an interesting series on this subject begins in this issue and will be continued in the September RADIO AGE. Order your copy from your news-dealer in advance to insure getting this All-Star number.

Sonora Phonograph Co. Produces Radio Speaker

The Sonora Phonograph Company has recently produced a Radio Speaker which is a radical departure from the established type of upright horn loud speaker, and which bears evidence of becoming exceedingly popular with radio enthusiasts.

The Sonora Radio Speaker differs from those now on the market in two major characteristics; its horn is concealed in a mahogany cabinet, following present day practice, and it embodies the most advanced theories of tone production as developed by this successful phonograph company's engineers.

Incorporated in this Radio Speaker is the famous Sonora tone passage, consisting of a highly developed, correctly proportioned all-brass tone arm and the Sonora all-wood, laminated horn. It is the product of years of thought and experiment pursued in the interest of high quality sound reproduction. When it is realized that the principle of sound reproduction applied to the phonograph holds true in radio, then the significance of this latest addition to radio reproduction will be appreciated.

One of its chief bids for popularity is its small size. It measures only 16½ inches long, 9½ inches high and 9½ inches deep. Combined in this small space is the large, full tone passage, representing skillful engineering design. It is equipped with a generous length of cord and connections for use with any good receiving set.

BUYERS' AND SELLERS' SERVICE SHEETS

ON BUYING IN GENERAL (No. 1-A-24)

The first principle of good buying, of course, is to know exactly what you want and why you want it. Then in looking over the sources of supply you can select more surely from the mass of stuff offered you the thing in the market which most nearly meets your demands. You should know more about the subject if possible than the salesman who waits on you, for he is very apt to know only one line well or be stimulated by his employer to sell a special line.

Assuming that you correctly know what you need from the theoretical point of view—say a 30-ohm rheostat or a .00025 mfd. condenser—first of all, how are you going to get exactly what you ask for?

Unless you have expensive testing instruments, you are going to have to depend on somebody's **word**. Whose word shall it be?

Somebody, of course, whose word is good. That is, someone who is honest and also knows what he is talking about. Isn't this someone who recognizes that he is selling service? Such a man, if he failed to deliver you an article which **worked** properly, would replace it.

1. Buy, therefore, of a reliable merchant.

Radio is so new an industry that there are many concerns which have made a fine reputation in the mechanical field, and yet have not made good in radio. You cannot judge the merchant by size alone, for very often the new and smaller firms are the best and know most about radio. The test to make is, will the concern replace the article if it proves inferior?

The next point is, buy goods with a reputation. If I say, "with good will," you will agree at once, but if I say "well advertised" you may not. Some people distrust advertising because they do not understand exactly what considerations make a firm advertise. .

If it were not for "quality" goods, as contrasted with "goods at a price," there would be little advertising. There would be little use to advertise. If a head-set were only a "head-set," for example, and all head-sets were considered of equal value, just as so many grains of wheat, price would determine sales. Manufacturers would sell to the trade on a price basis and you would buy the **cheapest** head-set, and that is all there would be to it.

The moment the radio manufacturer introduces some improvement in an article, he must find a way to let you know that you can get superior service with that article. Design and excellence necessitate his advertising. This is because well-designed, well-made goods cost more to make than poor goods. The buyer must be educated by advertisements so that he will know how much better service he can get from quality goods; in other words that they are worth the extra money he must pay. And the law of service in business is inexorable. As Lincoln said, "You can fool some of the people all of the time and all of the people some of the time, but you can't fool all of the people all of the time." The manufacturer whose goods fail to live up to his advertisements is soon found out and deserted. And the sooner the public knows the fundamental principles well, the quicker will such manufacturers be found out.

Furthermore, advertising to a certain extent gives the buyer this protection: To misrepresent in a publication which goes through the mails is to commit the very serious offense of "using the mails to defraud." Every advertiser has to make good advertised claims. You can hold him to it.

2. Therefore, buy goods with a reputation.

When you find well-tried and established reputation you may bank on it.

3. Don't try to get something for nothing. You won't. Don't be penny-wise, pound foolish. For suppose you save a dollar on a condenser and get an inferior instrument which destroys the value of a set on which you have spent twenty dollars! The chain is no stronger than its weakest link.

Next, assuming you know the technical requirements of the apparatus you are buying, you should know the practical points. The manufacturer soon learns that these, after all, constitute the most vital requirements.

For example, a certain factory laid down a splendid set of technical specifications for jacks and instituted a careful inspection of goods received. Despite all this, one practical consideration was neglected which might have brought "tragic" consequences to some young radio fan had he been the victim. A set passed the factory tester, who "plugged in" successfully. But when the customer "plugged in" he burned out all his tubes!

The jack arm was slightly misshaped. The factory plug was standard, but the customer's plug was undersized. The latter, being loose, came into contact with the arm, sending the B-battery current into the filaments.

That is an example of how important the practical considerations of buying may be.

The next four service sheets will have to do with vacuum tubes, sockets, jacks and plugs.

COMPILED BY EDMUND H. EITEL

No. 1-A-24

BUYERS' AND SELLERS' SERVICE SHEETS

TUBES (No. 2-A-24)

More than of any other radio item, from a commercial point of view, the most interesting things might be said about tubes. And yet fewer practical points of advice can be given here than anywhere else. Tubes are the best example of the above general principles of radio buying outlined in the first Buyers' and Sellers' Service Sheets.

If you are a fan, you can, of course, insist on one thing when making a purchase. You can see the filament tested; or if buying by mail, have a certified report upon this test. And you should immediately check it.

If the tube is transparent, you also can observe whether the grid, plate, and filament are separated and are in alignment. If a radio set happened to be in operation in the store and you have a lot of nerve or know the dealer well, you may have the tube tested under receiving conditions. Or if you are a manufacturer or engineer, you may test your tubes with proper instruments for filament emission, etc. But what is the fan to do under the usual conditions of purchase to make certain that he is securing a good tube?

Right here is where difficulties arising "on both sides of the counter," so to speak, make it well to examine points of view of tube manufacturer, jobber, dealer and public. The facts are they each want to be protected from the other.

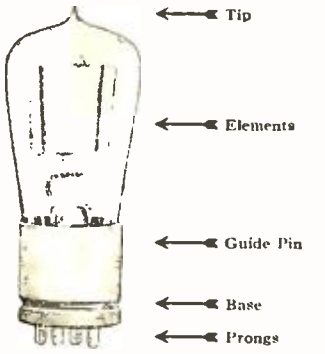
If a tube receives an overvoltage, it will have the electrons boiled off the filament and become low in electronic emission. Since the ultimate purchaser, or user, may cause this damage, the manufacturer will not officially "make good" such tubes, although occasionally he may be persuaded to replace them. If a fan damages a tube in this manner, he should light the filament at rated voltage for ten to twenty minutes (sometimes longer) with plate voltage off and thus drive the thorium from the inside of the filament to the surface, thus restoring the high rate of electronic emission. This applies to the tubes using thoriated filaments or to most of the new and better tubes; and the buyer can at least ascertain whether the tube he is purchasing can be restored in such a manner if accidentally given an overvoltage.

The fan has only one source of protection, however, against spending his money for a poor tube; he must buy a tube made by one of the reputable tube manufacturers, and buy it through reliable merchants, whose connections with the tube manufacturer are through a reliable wholesaler. Under these conditions, and also provided he will test his tube at once and report if it proves inferior, he has an excellent chance of securing a replacement. The reputable tube manufacturers guarantee their tubes against faulty manufacture, although not specifically against low electron emission.

Various tube patents are now expiring and several other large and reliable radio manufacturers will begin the making of tubes. It would seem the part of wisdom for the present tube manufacturers to establish a reputation for liberal replacement. There is every indication of a tube shortage for the coming season. Those who can afford to do so will do well to buy their tubes early.

VACUUM TUBES

1. Buy only reliable and reputable brands.
2. Buy only through reliable dealer whose connections are through reliable wholesaler.
3. See that tube filament is tested in your presence, or certified, if you buy by mail.
4. Examine elements, if tube is transparent, to make sure they are not touching, loose, or out of line.
5. See that tube base or insulating plate is clean and free from dealer's pencil marks; also see that prongs are clean.
6. Examine the tip where tube is sealed off. If this is broken, air may enter the tube and the vacuum be lost, or impaired, even though the filament may burn.
7. Microphonic tubes: About 2 per cent of most tubes and all U. V. 199 or C. 299 tubes and W. D., or C, 11 and 12, will sing if the set is jarred. This cannot be helped in the case of the tubes named above, but in the large sizes of tubes it is a defect due to poorly attached connections. The large manufacturers will not officially replace such tubes, but the best dealers and wholesalers usually can secure a replacement.



8. Tube noises: Determine if your tube is noisy by comparative tests. High vacuum means uniform characteristics and quiet operation.
9. Remade tubes: The end of the useful life of a vacuum tube is indicated by a decrease in electron emission and increase in filament voltage required for satisfactory operation. Repaired tubes, if the filament is old, are likely to be short-lived.

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COMPILED BY EDMUND H. EITEL

No. 2-A-24

American Boy Important Factor in Summertime Radio

The American boy, with his wonderful adaptation to electrical and mechanical development, continues to be a factor both in the progress of the radio art and in the Summertime demand for radio apparatus, according to reports received by the Radio Section of the Associated Manufacturers of Electrical Supplies.

He is supplementing his Winter book-studies with practical work at home, in camp or at the seashore. Pierre Boucheron, chairman of a committee now compiling statistics on the subject, declares the outstanding fact already developed is that no other scientific achievement in recent history has so captured the imagination of millions of American boys as radio has done.

"In this case, at least," Mr. Boucheron adds, "it stands thoroughly proved that the American boy is father to the radio man."

Radio has created a new type of electrical experimenter with the result, as Mr. Boucheron points out, that many of the noteworthy developments in the art have been brought about by comparatively young men.

"Boys of today are astonishing their elders with glib references to such recondite subjects as electrons, ether waves and radio frequency amplification," Mr. Boucheron continues. "These boys understand the fundamentals of electrical theory and practice and the complex changes undergone by electrical impulses in a radio circuit.

"Radio this Summer has taken the American boy off the street corner and placed him in his home-made laboratory. Instead of lurid novels, he now reads the authoritative radio magazines.

"Radio is teaching the boy a greater appreciation of music than he could possibly have attained from painful 'music lessons' or lectures on the subject. It has given him a more graphic knowledge of current events. Radio Sunday sermons bring the teachings of religion home to him.

"But the gain is not all one-sided. The youth of the nation perhaps have done as much for radio as the art has done for them. For the fact remains that it was the boy who first 'sold' the idea of radio to the entire family. It is the boy who keeps the older folks informed of developments in the radio art; it is the boy who determines very largely the type and character of radio equipment which the family shall buy; and it is the boy who this Summer is making radio a year-round necessity rather than a seasonal luxury."

"THE TROUBLESHOOTER"

Due to unexpected changes in makeup of this issue of RADIO AGE, the "Troubleshooter Section" for fans is omitted. Watch September RADIO AGE for an extraordinarily big section answering all the latest technical queries.

The Second of RADIO AGE'S Articles on Tube Efficiency Will Appear Next Month

Pickups
By Our Readers

(*Continued from page 42*)

Instead of the honeycomb set used by him, I am using the old-fashioned, much-abused single circuit, and although I must have caused interference at first, now I can consistently tune in stations by setting the dials. The tickler coil is set at zero first, then the condenser is set for the proper wave length, then I reset the tickler dial, and no squeals are heard either in my phones or in the neighbor's. It is just as easy to do it right as wrong if one keeps a log.

Below are the stations I have consistently heard up until the end of April, when I ceased listening in. All these on two small peanut tubes:

WCAR (once an entire program), KFKX, WRAN, WCAL, WSB, WDAP, WLW, WNAP, WWI, WCAD, WRC, WSAX, KDKA, WGR, WMAK, WCAP, WHAM, WFI, WIP, WOO, WDAR, WOAX, WOR, WGY, WBZ, WEAF, WHN, WJZ, WMAF, WHAZ, WJAR, WNAC, WGI, CHCX, CHYC, CHXC.

I want to thank both yourself and Mr. Kennedy for the suggestion of grid leaks across the secondary of the transformers, as I am sometimes bothered with shrillness of tone.

Thanking you again for many valuable hints I have received in your wonderful magazine, I am,

Yours very truly.
J. T. CREELMAN.
198 Windmill Road,
Dartmouth, N. S., Canada.

RADIO AGE,
Gentlemen:

I am fifteen years old and I believe that I ought to be admitted to your Loyal Order of Dial Twisters. I am a regular reader of your magazine and I like your technical articles. As to my opinion of your little magazine I think it the best of its kind. I am enclosing my list of stations heard since about January.

KFI, KHJ, KGO, KPO, KLZ, KFAF, KYW, KFLZ, KFNF, KFKB, KOP, KFOY, KSD, KFIX, KFKX, KGW, KFGL, KDKA, KQV, KFFZ KFOP, KFIZ, CYB, CYL, CHYB, CKCH, CFCA, CFCN, CKCK, CKAC, WMAV, WSY, WEAP, WKAN, WABE, WCAP, WEAS, WMU, WRC, WSB, WEBH, WGN, WAAF, WDAP, WMAQ, WPAD, WTAS, WTAN, WRM, WCBD, WLS, WWAE, WOAG, WQJ, WJAK, WSAL, WOI, WIAS, WDAX, WOC, WHAA, WHAC, WHO, WOAK, WHAS, WAAB, WKC, WSAR, WBZ, WGI, WDAS, WCX, WWJ, WOAP, WWAO, WCAL, WFAX, WRAH, WLAG, WBAH, WAAH, WOS, WDAF, WHB, WCK, WMAJ, WEB, WOO, WOAW, WIAW, WAAW, WOR, WHAR, WGR, WCAD, WMAK, WEAF, WJX, WJS, WJZ, WHN WSAP, WGY, WHAZ, WHAM, WAAD, WLW, WSAI, WPAL, WBAV, WOAC, WABT, WGAF, WLAL, WNAD, WOAV, WCAU, WOAR, WFI, WIP, WOO, WJAS, WJAI, WPAB, WCAM, WIAD, WJAR, WSAD, WMC, WNAV, WFAA, WBAP, WIAC, WEAY, WFAH, WCAR, WOAI, WJAD, NAA, WPAH, WCAY, WIAO, WAAK, WHAD, WOAY, WHA, WRAL, WLAY, WKAQ, PWX, 6KW.

These stations were all heard more than once and can all be verified.

I use a three-tube single circuit set. Most of the above stations come in on the loud speaker. It is not at all uncommon to hear KGO on the loud speaker.

Hoping to find my name with the Dial Twisters,

I am,
RALPH RIPSOM.
544 20th Street,
Milwaukee, Wis.

RADIO AGE,
Gentlemen:

After reading some of the records hung up by "Dial Twisters," I decided to construct a reflex set, which proved inefficient. Then I monkeyed on a one-tube hookup of my own, which has proved a "wow." Below are a list of stations bagged by my set.

KDKA, WTAM, WWAE, WBZ, CJCG, WCAP, WCAM, WGY, WCAE, WSB, WIP, WDAR, WEAF, WAID, WJZ, WJY, WMAJ, WGR, CKY, CFCF, WNAC, WJAR, WRL, KYW, WDAF, WOAW, KGO, KFI, WMAQ, WDAP, WBAV, WSAI, WPAB, WJAN, WRC, WMU, WDM, WHAZ, WIH, WIAY, WCBD, WHN, WHAR, WHB, WOR, WLW, WFI, KSD, NAA, KQV, PWX, WGI, WHAM, WLAS, KFGZ, WBAP, KFKX, 6KW, WOO, CFAC, WWJ, WCAL, WGL, CFCA, WRAM, KFKB, WIAG, WFAA, WCAJ, WHAA, KFAF, WABQ, WBBG, WGR, WGN, WTAR, WOC, WOS, WAAM, WCX, WBT, WRAZ, WMAK, WGAN.

On the first night I tuned in forty-one stations. Altogether I have tuned in eighty-four stations, the farthest being KGO, California, about 2,500 miles from here. Will be pleased to give information regarding my set.

Yours very truly,
JOHN F. MULLIKIN.
128 Bates Street, N. W.,
Washington, D. C.

P. S.—Do not think hearing the coast was a freak, for the following day I picked up KFI and held it for half an hour.

RADIO AGE,
Gentlemen:

About two weeks ago I got the bug. A friend of mine let me have some magazines. Among these I found the RADIO AGE for January. I followed the instructions and built the Rosenbloom circuit. Last Monday I was ready to try the set, and the first station I heard was KFI of Los Angeles, Calif.!

In six days I have heard sixty-seven stations, many of them being over 1,000 miles away. Saturday night from 7:30 to 1:00 o'clock the following stations were heard:

Calls Heard by Jewell A. Goddard, Farmland, Ind.

WBS, WMAQ, KYW, WRC, KSD, WGY, KPO, KGW, KDKA, WLS, WGN, WFAA, WOC, PWX, WDAF, KFI, CKAC, WEAF and WOAW.

They were all heard very clearly. If I had a transmitting set, I'd give three cheers for the RADIO AGE and add, long may it live.

Yours very truly,
JEWELL A. GODDARD.

(Continued on page 55)

BATTERIES (DD-1-5)
PRIMARY BATTERIES

GENERAL PRINCIPLES. When two different metals are placed in contact with one another, or when these metals are placed mutually in contact with certain solutions, an electromotive force (voltage) is generated. The value of this voltage depends upon the kind of metals used, the nature of the solution, character of the contact surfaces, etc. The dry contact voltage between two metals in air is quite low, but when the metals are immersed in a suitable fluid which is capable of attacking and dissolving at least one of the metals, the voltage may range from 0.5 to 3.0 volts per pair. The two metals are known as the "ELECTRODES" or plates while the solution is called the "ELECTROLYTE."

Each pair of metal electrodes with its electrolyte and container is called a "CELL," while a group of such cells electrically connected together is a "BATTERY." Any number of unit cells can be connected together to obtain greater voltages or greater currents in amperes than the voltages or currents of a single cell.

Electrical energy is produced within the cell by the chemical reduction of one of the electrodes and the electrolyte, the reducable elements being the fuel from which the electrical energy is obtained. The electrolyte, which is alkaline or acidnous by nature, combines with the electrode to form metallic salts while the electrolyte in turn is neutralized by the metal. This is very similar to the chemical process of combustion in which heat energy is liberated by the combination of the oxygen of the air with the carbon of coal, the final product being carbon dioxide. When the electrode is completely consumed and the electrolyte is neutralized, the chemical action ceases and the production of current also ceases. A cell of this sort is called a "PRIMARY CELL" and is one in which the elements must be replaced physically and in which the elements cannot practically be renewed by the electrical process known as "Charging."

Both electrodes form the "poles" of the battery, one electrode being the positive pole while the other is the negative. When the ends projecting above the electrolyte are connected together, an electric current will flow from the positive pole to the negative pole at the outer ends and will return through the electrolyte from the negative to positive electrode. Thus, the electrode really has two polarities, one external and one internal, but for convenience it is the practice to consider only the outer poles above the level of the electrolyte where the current flows from the positive to negative. With proper materials, the chemical action continues as long as the external circuit is closed and will cease when the circuit is opened. With impure materials there will always be some wastage due to small currents set up within the electrodes which will continue regardless of whether the external circuit is open or closed. These wasteful currents are known as "local currents."

It should be noted that the electrolyte solution forms a part of the electrical return circuit and that the current flows through the electrolyte in the reverse direction to that in the external circuit. This "internal circuit" results in the production of hydrogen gas bubbles at the positive pole and oxygen bubbles at the negative pole, or just the reverse of the case in the electrolytic cell. The bubbles of gas are due to the decomposition of the water in the electrolyte, and are produced in the proportion of two parts of hydrogen to one part of oxygen. The escape of these gases from the cell means that the electrolyte will gradually lose weight during the discharge as well as suffering decomposition in regard to the acid or alkaline elements.

COMPILED BY
J. B. RATHBUN

BATTERIES (DD-80-5)
PLATE OR "B" BATTERIES

THE "B" BATTERY. The "Plate Battery," also commonly known as the "B" battery, is used in the receiving circuit for the purpose of maintaining a positive potential on the plate of the tube. For the ordinary regenerative circuit it is common practice to apply from 16 to 22.5 volts on the detector tube, but in radio or audio amplifying circuits or in super-regenerative circuits from 45 to 100 volts may be applied to the plate or even greater voltages in certain limited cases. While the voltage of the "B" battery is comparatively high, the current demand on the battery is very low, being only in the nature of a few thousandths of an ampere for a single tube. The demand is increased in proportion to the number of tubes used, since the plates are all connected in parallel across the "B" battery, so that a six or eight-tube set consitutes quite a pull on the battery and rapidly exhausts it.

Plate batteries are supplied both in dry cell and in storage cell types, the former having the advantage of low first cost and simplicity while the latter costs more in the beginning but effects a saving in the long run particularly if more than three tubes are used. When a dry cell."B" battery is exhausted it must be thrown away, but the storage cell type can be recharged indefinitely be means of simple charging apparatus, and in addition maintains a more nearly constant voltage throughout its charge. However, the dry cell battery is the most convenient for the average amateur and for small and medium size sets is used more extensively than the storage type.

Both types of battery are built up into blocks having a number of small cells connected in series. The unit block of dry cells develops a total of 22.5 volts with 15 cells in series. The unit block of the storage type develops 24 volts with 12 cells in series. The "plain" block has only two connection posts giving the total voltage, but for use with gas filled detector tubes which are quite critical to the plate voltage, we should use the "tapped" type in which intermediate connections between cells give intermediate voltages of 16.5, 18, 19.5, 21 and 22.5 volts. (Dry cell type.) The tapped battery costs a little more than the plain but is better.

For higher voltages two or more blocks can be connected in series. Thus, with dry cell batteries we can obtain 45 volts, 67.5 volts, 90 volts and 112.5 volts by connecting two, three, four or five blocks in series. For convenience in making connections to sets having amplifying stages, the dry cell "B's" can also be obtained in single blocks giving a total of 45 volts. Such blocks cost less than two 22.5 blocks connected in series and are much simpler to connect. While 90-volt blocks can be obtained they are not so often stocked by the dealer. Storage batteries can be obtained in units of 24 or 48 volts and contain respectively 12 and 24 cells each.

The life of a "B" battery depends upon several factors. It is shorter when a number of tubes are used than with only a single detector. For a given number of tubes, the life is longer when the audio stage tubes are "biased" with a negative charge to the grid since under these conditions less current is drawn from the battery. Again, the life of the battery in hours depends upon the plate voltage used, less current being drawn with low voltages than at voltages of from 67 to 90 volts. While high plate voltages are necessary for maximum amplification, yet there is much waste and expense incurred if the plate voltage is unnecessarily high. When voltages higher than 45 volts are used, the grids of the tubes should be biased by a "C" battery.

COMPILED BY
J. B. RATHBUN

Pickups
By Our Readers

(*Continued from page* 53)

Farmland, Ind.

P. S.—Your Rosenbloom is a wonder. From now on, I am going to be counting the days until the RADIO AGE is on sale at the news stands again.

Looks like the Rosenbloom is stepping out to the front. That certainly is some record, if you ask us.

RADIO AGE,
Gentlemen:

For some time I have read the Pickups Pages of your magazine. It is but recently that I think that I have a good enough list to become a member of the Dial Twisters.

I am 14 years old, and have had my set about four months. The most distant station I have heard is WKAQ at San Juan, which is about 3,300 miles from Los Angeles by air line. The following stations have confirmed my reception of their programs:

KDKA, KFI, KHJ, KSD, KGO, WFI, WGY, PWX, WKAQ, KLZ, KOB, KGW, WHO, WCBD, CKY, WMC, WHYC, KPO, KFNF, WTAM, KLX, WLAG, WHAS, KFKX, KFOA, CKAC, WJZ, WJY, CAL, WDAH, WHB, WRC.

The following have been received, but have not been confirmed.

KGU, WLW, WSAI, KYW, WJAZ, WDAP, CFCN, CFAC, CHYB, KFNC, WBAV, WEAO, KFAF, KFSG, KNX, KFON, WCX, WFAA, KOP, WOC, WBAP, KFKA, KDAS, CFCH, WDAF, KJS, CYB, WBAH, CYL, WKAN, WOR, WEAF, KLS, WAAW, KGG, KFEC, KGN, KFAD, KFAE, KQU, WCAE, KUO, KDYM, KDYL, KZN, KFBK, KWG, KHQ, KFHJ, KFAW, KDPT, WBZ, KFFR, WSY, CFCA, CFCQ and WCAP.

I hope that list lets me in.
Sincerely yours,
HAMPTON MACOMBER.
843 Third Avenue,
Los Angeles, Calif.

RADIO AGE,
Gentlemen:

The other day I bought my first copy of your magazine and I thought "what a little magazine for two bits!" When I looked over its contents, I changed my mind. It certainly is full of good stuff from cover to cover.

I have been doing a little experimenting in building, and I have contrived to devise a little hookup of my own which is a real DX-getter. Here is my log for Saturday, May 24:

KGO, PWX, KPO, KHJ, WOR, WDAR, WSB, WFAA, WBBR, KLS (or X; I wasn't sure on account of heavy static), KDKA, WLS, WMC, WOC, WCAE, KFNF, WGN, WDAJ, and about five others whose calls were weak due to the terrific

(*Concluded on page* 57)

BATTERIES (DD-1-9)
PRIMARY BATTERIES

VOLTAGE AND CURRENT. The voltage of a primary cell is determined by the nature of the electrodes and electrolyte, and is independent of the size of the battery. Thus, with any given combination of electrodes and electrolyte, the voltage remains constant regardless of the size. When a higher voltage is required than is produced by a single cell, a number of cells can be connected up in "series" to form a high voltage battery. This will be explained later.

Current flow in amperes depends upon both the voltage of the cell and upon the resistance of the internal circuit. If the internal resistance of the electrolyte is high, then it is evident that the flow of current will be small. This is determined by Ohm's law. Since the internal resistance is largely determined by the area of the plates, the current capacity of a cell in amperes is roughly in proportion to the size of the plates or the size of the battery, all other conditions remaining constant. For this reason, the area of the plates is made as great as possible so that the maximum current flow can be obtained.

Some electrolytes have a higher specific resistance than others, hence with equal plate areas one type of cell with a given electrolyte will produce less current with a given plate area than another. Dilute sulphuric acid and caustic soda solutions have a very low resistance, hence the current flow in such cells will be greater than where the high resistance copper sulphate solutions are used. A second consideration is the spacing of the electrodes. The farther they are spaced apart, the higher will be the resistance.

The current flow can be determined as follows by Ohm's law when the internal resistance (r) in ohms is known. Let (E) be the voltage of the battery, and (I) be the current in amperes, then:

$$I = \frac{E}{r}$$

This assumes that the resistance of the external circuit is zero. For example, let the internal resistance of a cell be 0.05 ohm. Then the current flow with a potential of 1.0 volt will be:

$$I = \frac{E}{r} = \frac{1.00}{0.05} = 20 \text{ amperes}$$

If a greater current than 20 amperes is desired, then we must connect two or more of the cells in "parallel" or "multiple" to form a battery. After the cell has been in operation for some time, and polarization has set in, then the hydrogen film will increase the resistance and the current will fall off gradually.

Under practical working conditions the total opposition offered to the flow of current, or the total resistance, is equal to the sum of the resistance of the external circuit and the internal resistance of the battery cell. Thus, if (R) is the resistance of the external circuit, then the total resistance will be: (R+r), and the current flow under these conditions will be:

$$I = \frac{E}{(R+r)}$$

The resistance of a cell can only be determined accurately by test on each individual cell, and it is impossible to make estimates that will hold true under all conditions.

Owing to the internal resistance, there is a drop of voltage across the battery terminals when the flow of current is increased. The greater the amperage, the lower will be the terminal voltage. If (e) is the drop in voltage due to a flow of (I) amperes, then

$$e = I \times r$$

COMPILED BY I. B. RATHBUN

INDUCTANCES (F-18-20)
SPIDERWEB COIL CALCULATIONS

PFANSTIEHL COILS. The Pfanstiehl spiderweb coils, known to the trade as "Pure Inductances," are spiderweb coils of the self-supporting type without supporting forms or spiders. The elimination of fiber or wood supports eliminates the dielectric losses common to coils built up on such form, and in addition the Pfanstiehl coils give a more concentrated magnetic field with reduced possibility of trouble causing stray fields within the set. In many circuits, a widely dispersed magnetic field introduces interferences that lead to noise and reduced power of reception and in this respect the self-supporting type coils are far superior to the homemade variety wound on wood spiders or fiber discs.

They are wound on a 2.25 mandrel which leaves an opening of the same diameter in the center of the coil. The wire is double silk insulated and the whole structure is then stiffened by the use of a special non-capacity cement. It is said that distributed capacity of the winding is so small that it cannot be measured by ordinary laboratory methods, hence the expression "Pure Inductance." The absence of distributed capacity is productive of sharp tuning and avoids the losses that take place in coils less carefully constructed.

The following table gives the wave lengths in meters of the straight untapped inductances, and is based on the use of a variable condenser shunted across the coil which has a maximum capacity of 0.0005 m. f., or equivalent to the common 23 plate type. For minimum readings, the condenser is set at its lowest possible capacity, probably in the neighborhood of 0.00003 to 0.00004 m. f. The maximum wave length is attained with the condenser "full in" with the maximum capacity of 0.0005 m. f.

PFANSTIEHL UNTAPPED PURE INDUCTANCE COILS

TYPE NO.	No. OF TURNS	WAVE LENGTHS IN METERS MAXIMUM	MINIMUM
P-201	25	340	Less than 100
P-202	35	470	125
P-203	50	650	170
P-204	75	960	220
P-205	100	1300	300
P-206	150	1980	470

Such inductances can be used wherever inductances are necessary in a circuit, for tuning, chokes, R. F. transformers and couplers, plate and grid inductances, etc.

For the conventional primary inductance used in tuning, a special type known as P-225 is made. This is a tapped coil having a total of 86 turns, and will cover a band of wave lengths ranging from 150 meters to 700 meters when used IN SERIES with a 0.0004 m. f. variable condenser. The coil has four taps taken off at the proper points in the winding to cover the various wave lengths with plenty of overlap between points so that a continuous field can be covered within the range of the coil.

COMPILED BY J. B. RATHBUN

Pickups
By Our Readers

(Continued from page 55)

static abated, and I got KGO like a local station.

I am willing to pass this circuit on to any brother radio fan who desires it if he will only write for it.

There is another set here in town I made and the owner thinks it great. I had a crowd May 30 and 31 up at my house just to look over this little wonder.

Those Dial Twister buttons are the thing—I'm sure I would be proud to wear one.

Yours for better radio,
WILLIAM WEIGHTMAN.
P. O. Box 288,
Middletown, Ind.

RADIO AGE.
Gentlemen:

I built one of your Low Loss Tuners, and I must report the wonderful results I have had with it. I have built several hookups since I first built my Low Loss set, to compare it with for results, and I pick it as "the berries" of the lot. I have one step of audio frequency and work all the strong stations within 500 miles on the loud speaker. The night before last I had station WBAP of Fort Worth, Texas, at 10:15 P. M. louder than in the Winter time. Fine for this time of the year.

All the big sets about here can bag no distance at all.

I have tried out a great many grid leaks, but have tried nothing higher than 3 megohms. I wonder what the results would be in trying something higher?

I certainly want to recommend your RADIO AGE, and want to thank you for printing the description of the Low Loss Tuner. I have convinced several fellows around here to the extent of building one for themselves.

Yours very truly,
NORMAN E. RINGLER.
134 King Street,
Guelph, Ont., Can.

Low Loss Tuners—that's the little set in the March, 1924, issue. What this fellow says for it is enough to make anyone throw their super-iodine receiver out the window.

The letter you last read was the concluding contribution to the July Pickups Pages of RADIO AGE. In signing off we wish to say that the supply of buttons for the contributions has been entirely exhausted and as soon as a new supply can be made we will again be shooting them out to those fellows whose letters could not be printed, due to lack of space. In the meantime let's all get ready for a big rush of things in the September issue and here's hoping to see some keen records hung up.

This is the Pickups Pages of RADIO AGE magazine signing off until the September, 1924, issue. (Now—watch this—we're going to sign off like WQJ, Chicago.)

Don't go away,
This much we have to say:
We'll be back, just twice as strong,
Some fine September day—
Letters, Circuits, Everything.
With diagrams complex,
We're going to help most everyone
To get the best DX.
It only costs you two bits
To tune in on our wave;
You can be in Troy or Fargo
And a connection can be made.
We'll have stuff from California,
We'll have stuff from New York, too;
From Portland down to Cuba
You'll hear us calling you;
We'll have the finest line of radio
In our next month's Pickups Page;
You can tune in strong.
You can't go wrong
With a copy of RADIO AGE.

Corrected List of U. S., Cuban and Canadian Broadcasting Stations

Complete Each Issue

THE list of broadcasting stations on these pages is brought up to date each month by additions of new stations and deletion of those which have suspended operation. The list is the product of a vast volume of correspondence and its completeness is due in large measure to the assistance of our special news service in Washington, D. C. Suggestions, corrections and additional data will be welcomed from readers and broadcasters.

KDKA	Westinghouse Electric & Mfg. Co.	East Pittsburgh	326
KDPM	Westinghouse Electric & Mfg. Co.	Cleveland, Ohio	270
KDPT	Southern Electrical Co.	San Diego, Calif.	244
KDYL	Telegram Publishing Co.	Salt Lake City, Utah	360
KDYM	Savoy Theatre	San Diego, Calif.	244
KDYQ	Oregon Institute of Technology	Portland, Oreg.	360
KDZB	Frank E. Siefert	Bakersfield, Calif.	240
KDZE	Rhodes Department Store	Seattle, Wash.	270
KDZI	Electric Supply Co.	Wenatchee, Wash.	360
KDZR	Bellingham Publishing Co.	Bellingham, Wash.	261
KFAD	McArthur Bros. Mercantile Co.	Phoenix, Ariz.	360
KFAE	State College of Washington	Pullman, Wash.	330
KFAR	Studio Lighting Service Co. (O. K. Olsen)	Hollywood, Calif.	280
KFAW	The Radio Den (W. B. Ashford)	Santa Ana, Calif.	280
KFAY	W. J. Virgin	Medford, Oreg.	283
KFBB	F. A. Buttrey & Co.	Havre, Mont.	360
KFBC	W. K. Azbill	San Diego, Calif.	278
KFBE	Reuben H. Horn	San Luis Obispo, Calif.	242
KFBG	First Presbyterian Church	Tacoma, Wash.	360
KFBK	Kimball-Upson Co.	Sacramento, Calif.	283
KFBL	Leese Bros.	Everett, Wash.	224
KFBS	Trinidad Gas & Electric Supply Co. and the Chronicle News	Trinidad, Colo.	360
KFBU	The Cathedral (Bishop N. S. Thomas)	Laramie, Wyo.	283
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238
KFCF	Frank A. Moore	Walla Walla, Wash.	360
KFCH	Electric Service Station (Inc.)	Billings, Mont.	360
KFCP	Ralph W. Flygare	Ogden, Utah	360
KFCV	Fred Mahaffey, Jr.	Houston, Texas	360
KFCZ	Omaha Central High School	Omaha, Nebr.	258
KFDD	St. Michaels Cathedral	Boise, Idaho	252
KFDH	University of Arizona	Tuscon, Ariz.	368
KFDJ	Oregon Agricultural College	Corvallis, Oreg.	360
KFDR	Bullocks' Hardware & Sporting Goods (Rob. G. Bullock)	York, Nebr.	360
KFDX	First Baptist Church	Shreveport, La.	360
KFDY	South Dakota State College of Agriculture and Mechanics Arts	Brookings, S. Dak.	360
KFDZ	Harry O. Iverson	Minneapolis Minn.	231
KFEC	Meier & Frank Co.	Portland, Oreg.	360
KFEL	Winner Radio Corp.	Denver, Colo.	254
KFEQ	J. L. Scroggin	Oak, Nebr.	360
KFER	Auto Electric Service Co.	Fort Dodge, Iowa	231
KFEV	Radio Electric Shop	Douglas, Wyo.	261
KFEX	Augsburg Seminary	Minneapolis, Minn.	261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.	Kellogg, Idaho	360
KFEZ	Asso. Engr. Societies of St. Louis	St. Louis, Mo.	248
KFFB	Jenkins Furniture Co.	Boise, Idaho	240
KFFE	Eastern Oregon Radio Co.	Pendleton, Oreg.	360
KFFP	First Baptist Church	Moberly, Mo.	266
KFFR	Nevada State Journal (Jim Kirk)	Sparks, Nev.	226
KFFX	McGraw Co.	Omaha, Nebr.	278
KFFY	Pincus & Murphy	Alexandria, La.	275
KFGC	Louisiana State University	Baton Rouge, La.	254
KFGD	Chickasha Radio & Electric Co.	Chickasha, Okla.	248
KFGH	Leland Stanford University	Stanford University, Calif.	273
KFGL	Arlington Garage	Arlington, Oreg.	234
KFGQ	Crary Hardware Co.	Boone, Iowa	226
KFGX	First Presbyterian Church	Orange, Tex.	250
KFGZ	Emmanuel Missionary College	Berrien Springs, Mich.	268
KFHA	Western State College of Colorado	Gunnison, Colo.	252
KFHD	Utz Electric Shop Co.	St. Joseph, Mo.	226
KFHH	Ambrose A. McCue	Neah Bay, Wash.	283
KFHJ	Fallon & Co.	Santa Barbara, Calif.	360
KFHR	Star Electric & Radio Co.	Seattle, Wash.	270
KFI	Earle C. Anthony (Inc.)	Los Angeles, Calif.	469
KFID	Ross Arhuckle's Garage	Iola, Kans.	246
KFIF	Benson Polytechnic Institute	Portland, Oregon	360
KFIL	Windisch Electric Farm Equipment Co.	Louisburg, Kans.	234
KFIO	North Central High School	Spokane, Wash.	252
KFIQ	Yakima Valley Radio Broadcasting Association	Yakima, Wash.	224
KFIU	Alaska Electric Light & Power Co.	Juneau, Alaska	226
KFIV	V. H. Broyles	Pittsburg, Kans.	240
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints	Independence, Mo.	240
KFIZ	Daily Commonwealth and Oscar A. Huelsman	Fon Du Lac, Wis.	273
KFJB	Marshall Electrical Co.	Marshalltown, Iowa	248
KFJC	Seattle Post Intelligencer	Seattle, Wash.	233
KFJF	National Radio Manufacturing Co.	Oklahoma City, Okla.	252
KFJI	Liberty Theatre (E. E. Marsh)	Astoria, Oreg.	252
KFJK	Delano Radio and Electric Co.	Bristow, Okla.	233
KFJL	Hardsacg Manufacturing Co.	Ottumwa, Iowa	242
KFJM	University of North Dakota	Grand Forks, N. Dak.	229
KFJQ	Valley Radio, Div. of Elec. Constr. Co.	Grand Forks, N. D.	280
KFJR	Ashley C. Dixon & Son	Stevensville, Mont. (near)	258
KFJX	Iowa State Teachers' College	Cedar Falls, Iowa	229
KFJY	Tunwall Radio Co.	Fort Dodge, Iowa	248
KFJZ	Texas National Guard, One hundred and twelfth Cavalry	Fort Worth, Texas	254
KFKA	Colorado State Teachers College	Greeley, Colo.	248
KFKB	Brinkley-Jones Hospital Association	Milford, Kans.	286
KFKQ	Conway Radio Laboratories (Ben H. Woodruff)	Conway, Ark.	224
KFKV	F. F. Gray	Butte, Mont.	283
KFKX	Westinghouse Electric & Manufacturing Co.	Hastings, Nebr.	286
KFKZ	Nassour Bros. Radio Co.	Colorado Springs, Colo.	234
KFLA	Abner R. Willson	Butte, Mont.	283
KFLB	Signal Electric Manufacturing Co.	Menominee, Mich.	248
KFLD	Paul E. Greenlaw	Franklinton, La.	234
KFLE	National Educational Service	Denver, Colo.	268
KFLO	Bizzell Radio Shop	Little Rock, Ark.	261
KFLU	Rio Grande Radio Supply House	San Benito, Texas	236
KFLV	Rev. A. T. Frykman	Rockford, Ill.	229
KFLX	George Roy Clough	Galveston, Tex.	240
KFLY	Fargo Radio Supply Co.	Fargo, N. Dak.	231
KFLZ	Atlantic Automobile Co.	Atlantic, Ia.	273
KFMQ	University of Arkansas	Fayetteville, Ark.	263
KFMR	Morningside College	Sioux City, Iowa	261
KFMT	Dr. George W. Young	Minneapolis, Minn.	231
KFMW	M. G. Sateren	Houghton, Mich.	266
KFMX	Carleton College	Northfield, Minn.	283
KFNF	Henry Field Seed Co.	Shenandoah, Iowa	266
KFNG	Wooten's Radio Shop	Coldwater, Miss.	254
KFNJ	Warrensburg Electric Shop	Warrensburg, Mo.	234
KFNL	Radio Broadcast Ass'n.	Paso Robles, Calif.	240
KFNV	L. A. Drake Battery and Radio Supply Shop	Santa Rosa, Calif.	234
KFNX	Peabody Radio Service	Peabody, Kansas	240
KFNY	Montana Phonograph Co.	Helena, Montana	261
KFNZ	Royal Radio Company	Burlingame, Calif.	231
KFOC	First Christian Church	Whittier, Calif.	236
KFOD	Vern Peters	Wallace, Idaho	224
KFOJ	Moberly High School Radio Club	Moberly, Missouri	246
KFOL	Leslie M. Schafbush	Marengo, Iowa	234
KFON	Echophone Radio Shop	Long Beach, Calif.	234
KFOQ	Latter Day Saints University	Salt Lake City, Utah	261
KFOQ	Ora William Chancellor	Galveston, Texas	240
KFOR	David City Tire & Electric Co.	David City, Nebraska	226
KFOT	College Hill Radio Club	Wichita, Kansas	231
KFOU	Hommel Mfg. Co.	Richmond, Calif.	254
KFOX	Board of Education, Technical High School	Omaha, Nebraska	248
KFOY	Beacon Radio Service	St. Paul, Minn.	226
KFOZ	Leon Hudson Real Estate Co.	Fort Smith, Ark.	233
KFPB	Edwin J. Brown	Seattle, Wash.	224
KFPG	Garretson and Dennis	Los Angeles, Calif.	238
KFPH	Harold Chas. Mallander	Salt Lake City, Utah	242
KFPL	C. C. Baxter	Dublin, Texas	242
KFPM	The New Furniture Co.	Greenville Texas	242
KFPN	Missouri National Guard	Jefferson City, Mo.	242
KFPP	G. & G. Radio & Electric Shop	Olympia, Washington	236
KFPQ	Clifford M. Esler	Denison, Texas	231
KFPR	Los Angeles Co. Forestry Dept.	Los Angeles, Calif.	231
KFPS	Carter A. Ross Motor Service Co.	Casper, Wyo.	242
KFPV	Heintz & Kohlmoos, Inc.	San Francisco, Calif.	236
KFPW	St. Johns M. E. Church, S.	Carterville, Mo.	268
KFPY	Symons Investment Co.	Spokane, Wash.	283
KFPX	First Presbyterian Church	Pine Bluff, Ark.	242
KFQA	The Principia	St. Louis, Mo.	261
KFQB	The Searchlight Publishing Co	Fort Worth, Tex.	254
KFQC	Kidd Brothers Radio Shop	Taft, Calif.	227
KFQD	Chovin Supply Co.	Anchorage, Alaska	280
KFQE	Dickenson-Henry Radio Laboratories	Colorado Springs, Colo.	224
KFQG	Southern Calif. Radio Ass'n	Los Angeles, Calif.	226
KFQH	Albert Sherman	Hillsbourgh, Cal.	231
KFQR	Walter LaFayette Ellis	Oklahoma City, Okla.	250
KFQI	The Thos. H. Ince Corp.	Culver City, Calif.	234
KFSG	Angelus Temple	Los Angeles, Calif.	278
KGB	Tacoma Daily Ledger	Tacoma, Wash.	252
KGG	Hallock & Watson Radio Service	Portland, Oreg.	360
KGO	General Electric Co.	Oakland, Calif.	312
KGU	Marion A. Mulrony	Honolulu, Hawaii, Waikiki Beach	360
KGW	Portland Morning Oregonian	Portland, Oreg.	492
KGY	St. Martins College (Reb. Sebastian Ruth)	Lacy, Wash.	258
KHJ	Times-Mirror Co.	Los Angeles, Calif.	395
KHQ	Louis Wasmer	Seattle, Wash.	360
KJQ	C. O. Gould	Stockton, Calif.	360
KJR	Northwest Radio Service Co.	Seattle, Wash.	270
KJS	Bible Institute of Los Angeles	Los Angeles, Calif.	360
KLS	Warner Brothers Radio Supplies Co.	Oakland, Calif.	360
KLX	Tribune Publishing Co.	Oakland, Calif.	509
KLZ	Reynolds Radio Co.	Denver, Colo.	283
KMJ	San Joaquin Light & Power Corp.	Fresno, Calif.	273
KMO	Love Electric Co.	Tacoma, Wash.	360
KNT	Grays Harbor Radio Co. (Walter Hemrich)	Aberdeen, Wash.	263
KNX	Electric Lighting Supply Co.	Los Angeles, Calif.	360
KOB	New Mexico College of Agriculture & Mechanic Arts	State College, N. Mex.	360
KOP	Detroit Police Department	Detroit, Mich.	286
KPO	Hale Bros.	San Francisco, Calif.	423
KQP	Apple City Radio Club	Hood River, Oreg.	360
KQV	Doubleday-Hill Electric Co.	Pittsburgh, Pa.	360
KQW	Charles D. Herrold	San Jose, Calif.	360
KRE	V C Battery & Electric Co.	Berkeley, Calif.	278
KSD	Post Dispatch (Pulitzer Pub. Co.)	St. Louis, Mo.	546
KTW	First Presbyterian Church	Seattle, Wash.	360
KUO	Examiner Printing Co.	San Francisco, Calif.	360
KUY	Coast Radio Co.	El Monte, Calif.	256
KWG	Portable Wireless Telephone Co.	Stockton, Calif.	360
KYQ	Electric Shop	Honolulu, Hawaii	270
KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.	536
KZM	Preston D. Allen	Oakland, Calif.	360
KZN	Cope and Johnson Co.	Salt Lake City, Utah	268
WAAB	Valdemar Jensen	New Orleans, La.	268
WAAC	Tulane University	New Orleans, La.	360
WAAD	Ohio Mechanics Institute	Cincinnati, Ohio	360
WAAF	Chicago Daily Drovers Journal	Chicago, Ill.	286
WAAK	Gimbel Brothers	Milwaukee, Wis.	280
WAAM	I. R. Nelson Co.	Newark, N. J.	263
WAAN	University of Missouri	Columbia, Mo.	254
WAAW	Omaha Grain Exchange	Omaha, Nebr.	360
WABB	Harrisburg Sporting Goods Co.	Harrisburg, Pa.	266
WABD	Parker High School	Dayton, Ohio	283
WABE	Young Men's Christian Association	Washington, D. C.	283
WABG	Arnold Edwards Piano Co.	Jacksonville, Fla.	248
WABH	Lake Shore Tire Co.	Sandusky, Ohio	240
WABI	Bangor Railway & Electric Co.	Bangor, Me.	240
WABL	Connecticut Agricuttural College	Storrs, Conn.	283
WABM	F. E. Doherty Automotive and Radio Equipment Co.	Saginaw, Mich.	254
WABO	Lake Avenue Baptist Church	Rochester, N. Y.	252
WABP	Robert F. Weinig	Dover, Ohio	266
WABQ	Haverford College, Radio Club	Haverford, Pa.	261
WABR	Scott High School, N. W. B. Foley	Toledo, Ohio	270
WABT	Holiday-Hall, Radio Engineers	Washington, Pa.	252
WABU	Victor Talking Machine Co.	Camden, N. J.	226
WABW	College of Wooster	Wooster, Ohio	234
WABX	Henry B. Joy	Mt. Clemens, Mich.	270
WABY	John Magaldi, Jr.	Philadelphia, Pa.	242
WARZ	Coliseum Place Baptist Church	New Orleans, La.	263
WBAA	Purdue University	West Lafayette, Ind.	360
WBAH	The Dayton Co.	Minneapolis, Minn.	417
WBAN	Wireless Phone Corp.	Paterson, N. J.	244
WBAO	James Millikin University	Decatur, Ill.	360
WBAP	Wortham-Carter Publishing Co. (Star Telegram)	Fort Worth, Tex.	476
WBAV	Erner & Hopkins Co.	Columbus, Ohio	390
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.	360
WBAY	Western Electric Co.	New York, N. Y.	492
WBBA	Newark Radio Laboratories	Newark, Ohio	240
WBBD	Barbey Battery Service	Reading, Pa.	234
WBBE	Alfred R. Marcy	Syracuse, N. Y.	246
WBBG	Irving Vermilya	Mattapoisett, Mass.	240
WBBH	J. Irving Bell	Port Huron, Mich.	246
WBBJ	Neal Electric Co., P. E. Neal	West Palm Beach, Fla.	258
WBBL	Grace Covenant Presbyterian Church	Richmond, Va.	283
WBBM	Frank Atlass Produce Co.	Lincoln, Ill.	225
WBBN	Blake, A. B.	Wilmington, N. C.	275
WBBR	Peoples Pulpit Asso.	Rossville, N. Y.	744

CLASSIFIED ADVERTISEMENTS

Ten cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 10th of month for succeeding month's issue.

RADIO CIRCUITS

SPECIAL FOR AUGUST

The Reinartz Radio Booklet, by Frank D. Pearne, fully illustrated, and RADIO AGE, for $2.50. Price of booklet alone is 50c. Send check, currency or money order to RADIO AGE, 500 N. Dearborn Street, Chicago.

RADIO EQUIPMENT.

WHOLESALE PRICES ON STANDARD RECEIVERS, 25% discount; list for stamp. LIVE PROPOSITION to DEALERS. Thomas Radio Co., 111a Dix St., Muncie, Ind.

RADIO BATTERIES

Super Radio A and B Circuit Batteries, which bring in long distance reception. Sold for cash or on payment plan. Write for prices and details. Radio Battery Corporation, 501-B Industrial Bank Bldg., Flint, Mich.

MISCELLANEOUS

158 GENUINE Foreign Stamps. Mexico War Issues. Venezuela, Salvador and India Service. Guatemala, China, etc., only 5c. Finest approval sheets 50 to 60%. Agents Wanted. Big 72-p. Lists Free. We Buy Stamps. Established 20 Years. Hussman Stamp Co., Dept. 152, St. Louis, Mo.

QUALITY PRINTING—200 bond letter heads, $1.50; 250 envelopes, $1.50; 250 cards, $1.25. Samples. Midland Press, 543 West Hickory, Kankakee, Ill.

Radio Geniuses to Be at 'World's Fair'

The first Radio World's Fair, to be held in Madison Square Garden and the 69th Regiment Armory, New York City, Sept. 22nd to 28th, is attracting the serious attention of the radio geniuses of the world and scores of them are preparing to introduce their latest inventions at the coming exposition.

Managers U. J. Herrmann and James F. Kerr have been compelled to enlarge the "New Inventions Section" to a size which will allow the exposition of one hundred devices. Among the noteworthy American discoveries to be shown will be at least three different instruments designed for the purpose of radiocasting "photographs in motion." Europe will also be well represented in this department. Several Continental inventors will display new inventions of a most unusual character.

Half a dozen recognized wireless engineers are now busily engaged trying to perfect systems for broadcasting pictures and it is hoped the world's first program of "Radio Motion Pictures" will be broadcast on the opening night of the exposition.

Sixty nationally known manufacturers of the United States will have de luxe exhibits at the big fair and England, France, Belgium, Italy, Switzerland and Austria will have proper representation in the "Foreign Section." Exhibition booths of elaborate construction will fill both big buildings to which there will be but one admission charge.

The most attractive feature programs imaginable will be staged every afternoon and evening, which will include a series of almost unbelievable overseas tests in which Miss Edith Bennett, the famous young American concert star, will participate. Miss Bennett is well known to the radio enthusiasts of every land because of her now historical trans-Atlantic recital last year, which was heard by millions of people in a hundred or more countries.

The International Amateur Builders' Contest is assuming such huge proportions that the show management expects this feature alone to fill the entire basement of Madison Square Garden.

WorkRite Opens Los Angeles Branch

To take care of the tremendous demand for WorkRite radio sets on the Pacific Coast, the WorkRite Manufacturing Company of Cleveland have recently opened a branch in Los Angeles, where they will manufacture WorkRite five-tube super-neutrodyne sets.

This Pacific Coast factory is under the direction of Emmet R. Patterson, who is well known to the Western trade.

With the establishment of this Pacific Coast factory branch, the WorkRite company have also opened a Western sales office in Los Angeles, at 230 Los Angeles street. This branch of the business is managed by J. A. Hymer, sales manager.

Mr. Hyman has just completed a trip over the entire Western territory and writes that the Los Angeles factory will be hard pressed to meet the demand for Work-Rite sets during the coming season.

YOUR SUBSCRIPTION

—should be renewed as soon as it expires, so you won't miss a single issue of RADIO AGE. Order your September copy in advance if you buy from a news-stand, or you may miss the all-star September issue with the new Radio Technical Feature originated by RADIO AGE.

Corrected List of U. S., Cuban and Canadian Broadcasting Stations

WBBT	Lloyd Brothers	Philadelphia, Pa.	234
WBBU	Jenks Motor Sales Co.	Monmouth, Ill.	224
WBBV	Johnstown Radio Co.	Johnstown, Pa.	248
WBBW	Ruffner Junior High School	Norfolk, Va.	222
WBBY	Washington Light Infantry, Co. "B" 118th Inf.	Charleston, S. C.	268
WBBZ	Noble B. Watson	Indianapolis, Ind.	227
WBL	T & H Radio Co.	Anthony, Kans.	254
WBR	Pennsylvania State Police	Butler, Pa.	286
WBS	D. W. May, Inc.	Newark, N. J.	360
WBT	Southern Radio Corp.	Charlotte, N. C.	360
WBZ	Westinghouse Elec. & Mfg. Co.	Springfield, Mass.	337
WCAD	St. Lawrence University	Canton, N. Y.	280
WCAE	Kaufmann & Baer Co.	Pittsburgh, Pa.	462
WCAG	Clyde R. Randall	New Orleans, La.	268
WCAH	Entrekin Electric Co.	Columbus, Ohio	286
WCAJ	Nebraska Wesleyan University	University Place, Nebr.	360
WCAK	Alfred P. Daniel	Houston, Texas	263
WCAL	St. Olaf College	Northfield, Minn.	360
WCAO	Sanders & Stayman Co.	Baltimore, Md.	360
WCAP	Chesapeake & Potomac Telephone Co.	Washington, D. C.	469
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.	360
WCAT	South Dakota State School of Mines	Rapid City, S. Dak.	240
WCAU	Durham & Co.	Philadelphia, Pa.	286
WCAV	J. C. Dice Electric Co.	Little Rock, Ark.	360
WCAX	University of Vermont	Burlington, Vt.	360
WCAZ	Carthage College	Carthage, Ill.	246
WCBA	Charles W. Heimbach	Allentown, Pa.	280
WCBC	University of Michigan	Ann Arbor, Mich.	280
WCBD	Wilbur G. Voliva	Zion, Ill.	345
WCBE	Uhalt Radio Co.	New Orleans, La.	263
WCBF	Paul J. Miller	Pittsburgh, Pa.	236
WCBG	Howard S. Williams (Portable)	Pascagoula, Miss.	236
WCBI	Nicoll, Duncan & Rush	Bemis, Tennessee	360
WCBJ	J. C. Mans	Jennings, Louisiana	244
WCBK	E. Richard Hall	St. Petersburg, Fla.	266
WCBL	Northern Radio Mfg. Co.	Houlton, Me.	280
WCBM	Charles Swarz	Baltimore Md.	229
WCBN	James P. Boland	Ft. Benj. Harrison, Ind.	266
WCBO	The Radio Shop, Inc.	Memphis, Tenn.	250
WCBQ	First Baptist Church	Nashville, Tenn.	236
WCBR	University of Mississinpi	near Oxford, Miss.	242
WCBR	Charles H. Meester (Portable Station)	Providence, R. I.	246
WCBT	Clark University, Collegiate Dept.	Worcester, Mass.	238
WCBU	Arnold Wireless Supply Co.	Arnold, Pa.	254
WCBV	Tullahoma Radio Club	Tullahoma, Tenn.	252
WCRW	George P. Rankin, Jr., and Maitland Soloman	Macon, Ga.	226
WCBX	Radio Shop of Newark (Herman Lubinsky)	Newark, N. J.	233
WCBY	The Forks Electrical Shop	Buck Hill Falls, Pa.	268
WCBZ	Coppotelli Bros. Music House	Chicago Heights, Ill.	248
WCK	Stix, Baer & Fuller Dry Goods Co.	St. Louis, Mo.	360
WCX	Detroit Free Press	Detroit, Mich.	517
WDAE	Tampa Daily Times	Tampa, Fla.	360
WDAF	Kansas City Star	Kansas City, Mo.	411
WDAG	J. Laurence Martin	Amarillo, Tex.	263
WDAH	Trinity Methodist Church (South)	El Paso, Tex.	268
WDAK	The Courant	Hartford, Conn.	261
WDAR	Lit Brothers	Philadelphia, Pa.	395
WDAS	Samuel A. Waite	Worcester, Mass.	360
WDAU	Slocum Kilburn	New Bedford, Mass.	360
WDAY	Radio Equipment Corp.	Fargo, N. Dak.	244
WDBA	Fred Ray	Columbus, Ga.	236
WDBB	A. H. White & Co., Inc.	Taunton, Mass.	229
WDBC	Kirk, Johnson & Co.	Lancaster, Pa.	258
WDBD	Herman Edwin Burns	Martinsburg, W. Va.	268
WDBE	Gilham-Schoen Electric Co.	Atlanta, Ga.	252
WDBF	Robert G. Phillips	Youngstown, Ohio	246
WDBH	C. T. Scherer Co.	Worcester, Mass.	268
WDBI	Radio Specialty Co.	St. Petersburg, Fla.	226
WDBJ	Richardson Wayland Electric Corp.	Roanoke, Va.	229
WDBK	M. Boz Radio Co.	Cleveland, Ohio	248
WDBL	Wisc. Dept. of Markets	Stevens Point, Wisc.	278
WDBN	Electric Light & Power Co.	Bangor, Me.	252
WDBO	Rollins College, Inc.	Winter Park, Fla.	240
WDBP	Superior State Normal School	Superior, Wis.	261
WDBQ	Morton Radio Sunply Co.	Salem, N. J.	234
WDBR	Tremont Temple Baptist Church	Boston, Mass.	256
WDBS	S. M. K. Radio Corp.	Dayton, Ohio	283
WDBT	Taylor's Book Store	Hattlesburg, Miss.	236
WDBU	Somerset Radio Co.	Skowhegan, Maine	258
WDBV	The Quimby Enterprises, The Strand Theatre	Fort Wayne, Ind.	258
WDM	Church of the Covenant	Washington, D. C.	234
WDZ	James L. Bush	Tuscola, Ill. Star Store Bldg.	278
WEAA	E. D. Fallain	Flint, Mich.	280
WEAF	American Telephone & Telegraph Co.	New York, N. Y.	492
WEAH	Wichita Board of Trade	Wichita, Kans.	244
WEAI	Cornell University	Ithaca, N. Y.	286
WEAJ	University of South Dakota	Vermillon, S. Dak.	283
WEAM	Borough of North Plainfield (W. Gibson Buttfield)	North Plainfield, N. J.	252
WEAN	Shepard Co.	Providence, R. I.	273
WEAO	Ohio State University	Columbus, Ohio	360
WEAP	Mobile Radio Co.	Mobile, Ala.	360
WEAR	The Evening News Publishing Co.	Baltimore, Md.	261
WEAU	Davidson Bros. Co.	Sioux City, Iowa	360
WEAY	Iris Theatre (Will Horowitz, Jr.)	Houston, Texas	360
WEB	Benwood Co.	St. Louis, Mo.	273
WEBC	Walter Cecil Bridges	Superior, Wis.	242
WEBD	Electrical Equipment and Service Co.	Anderson, Ind.	246
WEBH	Zenith-Edgewater Beach Broadcasting Station	Chicago, Ill.	370
WEV	Hurlburt-Still Electrical Co.	Houston, Texas	360
WEW	St. Louis University	St. Louis, Mo.	261
WFAA	Dallas News & Dallas Journal	Dallas, Texas	476
WFAB	Carl F. Woese	Syracuse, N. Y.	234
WFAH	Electric Supply Co.	Port Arthur, Texas	236
WFAM	Times Publishing Co.	St. Cloud, Minn.	360
WFAN	Hutchinson Electric Service Co.	Hutchinson, Minn.	360
WFAV	University of Nebraska, Department of Electrical Engineering	Lincoln, Nebr.	275
WFBW	Ainsworth-Gates Radio Co.	Cincinnati, Ohio	309
WFI	Strawbridge & Clothier	Philadelphia, Pa.	395
WGAL	Lancaster Electric Supply & Construction Co.	Lancaster, Pa.	248
WGAN	Cecil E. Lloyd	Pensacola, Fla.	360
WGAO	Glenwood Radio Corp. (W. G. Patterson)	Shreveport, La.	252
WGAW	Ernest C. Albright	Altoona, Pa.	261
WGAZ	South Bend Tribune	South Bend, Ind.	360
WGI	American Radio & Research Corp.	Medford Hillside, Mass.	360
WGL	Thomas F. I. Howlett	Philadelphia, Pa.	360
WGN	Chicago Tribune Broadcasting Station	Chicago, Ill.	360
WGR	Federal Telephone & Telegraph Co.	Buffalo, N. Y.	319
WGY	General Electric Co.	Schenectady, N. Y.	380
WHA	University of Wisconsin	Madison, Wis.	360
WHAA	State University of Iowa	Iowa City, Iowa	484
WHAD	Marquette University	Milwaukee, Wis.	280
WHAG	University of Cincinnati	Cincinnati, Ohio	222
WHAH	Hafer Supply Co.	Joplin, Mo.	283
WHAK	Roberts Hardware Co.	Clarksburg, W. Va.	258
WHAM	University of Rochester (Eastman School of Music)	Rochester, N. Y.	283
WHAP	Otta & Kuhns	Decatur, Ill.	360
WHAR	Paramount Radio & Electric Co. (W. H. A. Pulus)	Atlantic City, N. J.	231
WHAS	Courier-Journal & Louisville Times	Louisville, Ky.	400
WHAV	Wilmington Electrical Specialty Co.	Wilmington, Del.	360
WHAZ	Rensselaer Polyteehnic Institute	Troy, N. Y.	380
WHB	Sweeney School Co.	Kansas City, Mo.	411
WHK	Radiovox Co. (Warren R. Cox)	Cleveland, Ohio	360
WHN	George Schuhel	New York, N. Y.	360
WHO	Bankers Life Company	Des Moines, Iowa	526
WIAB	Joslyn Automobile Co.	Rockford, Ill.	252
WIAC	Galveston Tribune	Galveston, Texas	360
WIAD	Howard R. Miller	Philadelphia, Pa.	254
WIAH	Continental Radio & Mfg. Co.	Newton, Iowa	258
WIAK	Journal-Stockman Co.	Omaha, Nebr.	278
WIAO	School of Engineering of Milwaukee	Milwaukee, Wis.	246
WIAQ	Chronicle Publishing Co.	Marion, Ind.	226
WIAS	Home Electric Co.	Burlington, Iowa	283
WIAT	Leon T. Noel	Tarkio, Mo.	360
WIAU	American Trust & Savings Bank	Le Mars, Iowa	360
WIAY	Woodward & Lothrop	Washington, D. C.	273
WIK	K. & L. Electric Co. (Herbert F. Kelso and Hunter J. Lohman)	McKeesport, Pa.	234
WIL	Continental Electric Supply Co.	Washington, D. C.	360
WIP	Gimbel Brothers	Philadelphia, Pa.	509
WJAB	American Electric Co.	Lincoln, Nebr.	229
WJAD	Jackson's Radio Engineering Laboratories	Waco, Texas	360
WJAG	Norfolk Daily News	Norfolk, Nebr.	283
WJAK	Clifford L. White	Greentown, Ind.	254
WJAM	D. M. Perham	Cedar Rapids, Iowa	268
WJAN	Peoria Star	Peoria, Ill.	280
WJAQ	Capper Publications	Topeka, Kans.	360
WJAR	The Outlet Co. (J. Samuels & Bro.)	Providence, R. I.	360
WJAS	Pittsburgh Radio Supply House	Pittsburgh, Pa.	250
WJAX	Union Trust Co.	Cleveland, Ohio	390
WJAZ	Chicago Radio Laboratory	Chicago, Ill.	448
WJD	Richard H. Howe	Granville, Ohio	229
WJY	R. C. A.	New York, N. Y.	405
WJZ	R. C. A.	New York, N. Y.	455
WKAA	H. F. Paar	Cedar Rapids, Iowa	268
WKAD	Chas. Looff (Crescent Park)	East Providence, R. I.	240
WKAF	W. S. Radio Supply Co.	Wichita Falls, Texas	360
WKAN	United Battery Service Co.	Montgomery, Ala.	226
WKAP	Dutee W. Flint	Cranston, R. I.	360
WKAQ	Radio Corp. of Porto Rico	San Juan, P. R.	360
WKAR	Michigan Agriculture College	East Lansing, Mich.	280
WKAS	L. E. Lines Music Co.	Springfield, Mo.	360
WKAV	Laconia Radio Club	Laconia, N. H.	254
WKY	WKY Radio Shop	Oklahoma, Okla.	360
WLAG	Cutting & Washington Radio Corp.	Minneapolis, Minn.	417
WLAH	Samuel Woodworth	Syracuse, N. Y.	234
WLAL	Naylor Electrical Co.	Tulsa, Okla.	360
WLAP	W. V. Jordon	Louisville, Ky.	360
WLAQ	Arthur E. Shilling	Kalamazoo, Mich.	283
WLAV	Electric Shop	Pensacola, Fla.	254
WLAW	Police Dept., City of New York	New York, N. Y.	360
WLAX	Putnam Electric Co. (Greencastle Community Broadcasting Station)	Greencastle, Ind.	231
WLB	University of Minnesota	Minneapolis, Minn.	360
WLS	Sears, Roebuck and Co.	Chicago, Ill.	345
WLW	Crosley Manufacturing Co.	Cincinnati, Ohio	309
WMAC	J. Edw. Page (Olive B. Meredith)	Cazenovia, N. Y.	261
WMAF	Round Hills Radio Corp.	Dartmouth, Mass.	360
WMAH	General Supply Co.	Lincoln, Nebr.	254
WMAK	Norton Laboratories	Lockport, N. Y.	273
WMAL	Trenton Hardware Co.	Trenton, N. J.	256
WMAN	First Baptist Church	Columbus, Ohio	286
WMAP	Utility Battery Service	Easton, Pa.	246
WMAQ	Chicago Daily News	Chicago, Ill.	448
WMAV	Alabama Polytechnic Institute	Auburn, Ala.	250
WMAY	Kingshighway Presbyterian Church	St. Louis, Mo.	280
WMAZ	Mercer University	Macon, Ga.	261
WMC	"Commercial Appeal" (Commercial Publishing Co.)	Memphis, Tenn.	500
WMH	Precision Equipment Co.	Cincinnati, Ohio	248
WMU	Doubleday-Hill Electric Co.	Washington, D. C.	261
WNAC	Shepard Stores	Boston, Mass.	278
WNAD	University of Oklahoma	Norman, Okla.	360
WNAL	J. J. Rockwell	Omaha, Nebr.	242
WNAM	Ideal Apparatus Co.	Evansville, Ind.	360
WNAP	Wittenberg College	Springfield, Ohio	231
WNAR	C. C. Rhodes	Butler, Mo.	231
WNAT	Lennig Brothers Co. (Frederick Lennig)	Philadelphia, Pa.	360
WNAW	Peninsular Radio Club (Henry Kunzmann)	Fort Monroe, Va.	360
WNAX	Dakota Radio Apparatus Co.	Yankton, S. Dak.	244
WOAA	Dr. Walter Hardy	Ardmore, Okla.	360
WOAC	Maus Radio Co.	Lima, Ohio	266
WOAD	Friday Battery & Electric Corp.	Sigourney, Iowa	360
WOAE	Midland College	Fremont, Nebr.	280
WOAF	Tyler Commercial College	Tyler, Texas	360
WOAG	Apollo Theater (Belvedere Amusement Co.)	Belvedere, Ill.	224
WOAH	Palmetto Radio Corp.	Charleston, S. C.	360
WOAI	Southern Equipment Co.	San Antonio, Texas	385
WOAN	Vaughn Conservatory of Music (James D. Vaughn)	Lawrenceburg, Tenn.	360
WOAO	Lyradion Mfg. Co.	Mishawaka, Ind.	360
WOAQ	Portsmouth Kiwanis Club	Portsmouth, Va.	360
WOAT	Boyd M. Hamp	Wilmington, Del.	360
WOAV	Pennsylvania National Guard, 2d Battalion, 112th Infantry.	Erie, Pa.	242
WOAW	Woodmen of the World	Omaha, Nebr.	526
WOAX	Franklyn J. Wolff	Trenton, N. J.	240
WOC	Palmer School of Chiropractic	Davenport, Iowa	484
WOI	Iowa State College	Ames, Iowa	360
WOO	John Wanamaker	Philadelphia, Pa.	509
WOQ	Western Radio Co.	Kansas City, Mo.	360
WOR	L. Bamberger & Co.	Newark, N. J.	405
WOS	Missouri State Marketing Bureau	Jefferson City, Mo.	441
WPAB	Pennsylvania State College	State College, Pa.	283
WPAC	Donaldson Radio Co.	Okmulgee, Okla.	360
WPAJ	Doolittle Radio Corp.	New Haven, Conn.	268
WPAK	North Dakota Agricultural College	Agricultural College, N. Dak.	283
WPAL	Superior Radio & Telephone Equipment Co.	Columbus, Ohio	286
WPAM	Auerbach & Guettel	Topeka, Kans.	360
WPAP	Theodore D. Phillips	Winchester, Ky.	360
WPAR	Ward Battery and Radio Co.	Beloit, Kans.	236
WPAU	Concordia College	Moorhead, Minn.	286
WPAZ	John R. Koch (Dr.)	Charleston, W. Va.	273
WQAA	Horace A. Beale, Jr.	Parkersburg, Pa.	360
WQAC	E. B. Gish	Amarillo, Texas	234
WQAE	Moore Radio News Station (Edmund B. Moore)	Springfield, Vt.	275
WQAF	Sandusky Register	Sandusky, Ohio	240
WQAL	Coles County Telephone & Telegraph Co.	Mattoon, Ill.	258
WQAN	Scranton Times	Scranton, Pa.	280
WQAO	Calvary Baptist Church	New York, N. Y.	360
WQAQ	Abilene Daily Reporter (West Texas Radio Co.)	Abilene, Texas	360
WQAS	Prince-Walter Co.	Lowell, Mass.	266
WQAX	Radio Equipment Co.	Peoria, Ill.	360
WQJ	Calumet Baking Powder—Rainbow Gardens Station.	Chicago, Ill.	448
WRAF	The Radio Club (Inc.).	Laporte, Ind.	224
WRAL	Northern States Power Co.	St. Croix Falls, Wis.	248
WRAM	Lombard College	Galesburg, Ill.	244
WRAO	Black Hawk Electrical Co.	Waterloo, Iowa	236
WRAQ	Radio Service Co.	St. Louis Mo.	360
WRAV	Antioch College	Yellow Springs, Ohio	242
WRAW	Avenue Radio Shop (Horace D. Good)	Reading, Pa.	238
WRAX	Flaxon's Garage	Gloucester City, N. J.	268
WRBC	Imanuel Lutheran Church	Valparaiso, Ind.	278
WRC	Radio Corporation of America	Washington, D. C.	469
WRH	Chicago Herald & Examiner	Chicago, Ill.	536
WRK	Doron Bros. Electric Co.	Hamilton, Ohio	360
WRL	Union College	Schenectady, N. Y.	360
WRM	University of Illinois	Urbana, Ill.	360
WRR	City of Dallas (police and fire signal department)	Dallas, Texas	360
WRW	Tarrytown Radio Research Laboratory (Koenig Bros.)	Tarrytown, N. Y.	273
WSAB	Southeast Missouri State Teachers College	Cape Girardeau, Mo.	360
WSAC	Clemson Agricultural College	Clemson College, S. C.	360
WSAD	J. A. Foster Co.	Providence, R. I.	261
WSAI	United States Playing Cards Co.	Cincinnati, Ohio	309
WSAJ	Grove City College	Grove City, Pa.	259
WSAN	Allentown Radio Club	Allentown, Pa.	229
WSAP	Seventh Day Adventist Church	New York, N. Y.	263
WSAR	Doughty & Welch Electrical Co.	Fall River, Mass.	254

Breaking Into Radio Without a Diagram

(Continued from page 12)

electric light current, but permits radio currents to pass unimpeded.

With your "aerial" connected, turn on the rheostat again and proceed to "tune in." Vary the condenser over its range as before and follow up with variometer, trying to avoid actual oscillation. You should look up the broadcasting hours of the nearby stations beforehand to be sure there is something "on the air." A whistle is a sign that your tube is oscillating, and the variometer setting should be changed until it stops. By this time you will have tuned in a station or two and will have a better understanding of the relationship between condenser and variometer. Always think of the condenser as the "tuner," or the device which selects the station you wish to hear. The variometer is the "volume" control, for it determines the sensitiveness of your set. A loud howl may result if the variometer if turned too far.

The "Circuits"

During the wiring, you noticed that several "circuits" were referred to. The current set up in the phone or lighting wires by the wave from the broadcasting station passes through the condenser "1" and thence through the primary coil "2," to the earth at "G." As these radio currents fluctuate in coil "2" in accordance with the voice or music from the station, there is a magnetic field spreading out and then collapsing back again in the space around that coil just as there is a magnetic field (though steady) surrounding the ordinary horse-shoe magnet. As a matter of fact, current set up by a great many broadcasting stations is passing through coil "2" at the same time. It is the function of the secondary circuit with coil "3" and variable condenser "4" to pick out which station is desired. If the station is sending on 300 meters, not very much of the capacity of condenser "4" will be required, but if the wave length is longer, say 500 meters, more of the capacity is necessary and the plates must be moved further in, perhaps as shown in *Fig. 2*. The magnetic field from coil "2" sets up current in coil "3" once the latter has been "tuned" to the right wave length by the condenser. Then through the tube and the variometer, the energy is very greatly amplified. It is really not the actual energy which comes in on the aerial which actuates the magnets in your telephone receivers, but the current from the "B" battery. The tube is a valve through which a slight impulse from the broadcasting station causes a great variation of the "B" battery current in the telephones.

It is a good plan to fasten a stiff wire as a pointer for the dial of the condenser. It may be attached to one of the mounting screws and allowed to project past the rim at some convenient point. Then the dial should be set to read "100" when the movable plates are all the way enmeshed between the fixed plates, and there the capacity is a maximum.

As your radio knowledge grows there are other combinations you will like to try, but for a simple and easily comprehended "starter" in radio reception, the board layout is unbeatable. *Fig. 2* gives the final appearance, and the set is a simple and sure receiver that will in most locations not only respond to local stations, but will at times bring in plenty of distance for you. With the phone line or with an outside aerial, "DX" stations are easily heard with this regenerative arrangement, and for sharp tuning and for volume, even though your aerial is small, or if you use the lighting circuit or bell wiring, you'll be pleased with your first plunge into the most fascinating game of them all.

No Radio Conference This Summer

[By Washington Radio News Service]

Just before Secretary Hoover left the city last week for a two-month vacation it became known that he would not call the third radio conference before September.

KEEPING UP-TO-DATE

For the latest radio inventions RADIO AGE readers should keep a close watch on the "New and Novel Radio Patents" department beginning in this issue. Up-to-date every month.

Corrected List of U. S., Cuban and Canadian Broadcasting Stations

WSAU	Camp Marienfeld	Chesham, N. H.	229
WSAX	Chicago Radio Laboratory	Chicago, Ill.	268
WSAY	Irving Austin (Port Chester Chamber of Commerce)	Port Chester, N. Y.	233
WSAZ	Chas. Electric Shop	Pomeroy, Ohio	258
WSB	Atlanta Journal	Atlanta, Ga.	429
WSL	J. & M. Electric Co.	Utica, N. Y.	273
WSY	Alabama Power Co.	Birmingham, Ala.	360
WTAB	Fall River Daily Herald Publishing Co.	Fall River, Mass.	248
WTAC	Penn Traffic Co.	Johnstown, Pa.	360
WTAF	Louis J. Gallo	New Orleans, La.	242
WTAG	Kern Music Co.	Providence, R. I.	258
WTAH	Carmen Ferro	Belvedere, Ill.	236
WTAJ	The Radio Shop	Portland, Me.	230
WTAL	Toledo Radio & Electric Co.	Toledo, Ohio	252
WTAM	Willard Storage Battery Co.	Cleveland, Ohio	390
WTAP	Cambridge Radio & Electric Co.	Cambridge, Ill.	242
WTAQ	S. H. Van Gordon & Son	Osseo, Wis.	220
WTAR	Reliance Electric Co.	Norfolk, Va.	280
WTAS	Charles E. Erbstein	Elgin, Ill.	275
WTAT	Edison Electric Illuminating Co.	Boston, Mass. (portable)	244
WTAU	Ruegg Battery & Electric Co.	Tecumseh, Nebr.	360
WTAU	Ruegg Battery & Electric Co.	Tecumseh, Nebr.	242
WTAW	Agricultural & Mechanical College of Texas	College Station, Tex.	280
WTAX	Williams Hardware Co.	Streator, Ill.	231
WTAY	Oak Leaves Broadcasting Station	Oak Park, Ill.	283
WTAZ	Thomas J. McGuire	Lambertville, N. J.	283
WTG	Kansas State Agricultural College	Manhattan, Kans.	273
WWAB	Hocnig, Swern & Co. (John Rasmussen)	Trenton, N. J.	220
WWAD	Wright & Wright (Inc.)	Philadelphia, Pa.	360
WWAE	Alamo Dance Hall, L. J. Crowley	Joliet, Ill.	227
WWAO	Michigan College of Mines	Houghton, Mich.	244
WWI	Ford Motor Co.	Dearborn, Mich.	273
WWJ	Detroit News (Evening News Assn.)	Detroit, Mich.	517
WWL	Loyola University	New Orleans, La.	260
WYAM	Electrical Equipment Co.	Miami, Fla.	283
WYAW	Catholic University	Washington, D. C.	236

Canadian Stations

CFAC	Calgary Herald	Calgary, Alberta	430
CFCA	Star Pub. & Prtg. Co.	Toronto, Ontario	400
CFCF	Marconi Wireless Teleg. Co. of Canada	Montreal, Quebec	440
CFCH	Abitibi Power & Paper Co.	Iroquois Falls, Ont.	400
CFCJ	La Cie de L'Evenement	Quebec, Quebec	410
CFCK	Radio Supply Co.	Edmonton, Alberta	410
CFCL	Centennial Methodist Church	Victoria, British Col.	400
CFCN	W. W. Grant Radio (Ltd.)	Calgary, Alberta	440
CFCQ	Radio Specialties (Ltd.)	Vancouver, B. C.	450
CFCR	Laurentide Air Service	Sudbury, Ont.	410
CFCW	The Radio Shop	London, Ont	420
CFDC	Sparks Co.	Nanaimo, B. C.	430
CFQC	The Electric Shop (Ltd.)	Saskatoon, Saskatchewan	400
CFRC	Queens University	Kingston, Ontario	450
CFUC	University of Montreal	Montreal, Quebec	400
CHAC	Radio Engineers	Halifax, Nova Scotia	400
CHBC	Albertan Publishing Co.	Calgary, Alberta	410
CHCB	Marconi Company	Toronto, Ont.	410
CHCD	Canadian Wireless & Elec. Co.	Quebec, Quebec	410
CHCE	Western Canada Radio Sup. (Ltd.)	Victoria, B. C.	400
CHCL	Vancouver Merchants Exchange	Vancouver, B. C.	440
CHCM	Riley & McCormack	Calgary, Alberta	415
CHCS	The Hamilton Spectator	Hamilton, Ont.	420
CHYC	Northern Electric Co.	Montreal, Quebec	410
CJCA	Edmonton Journal	Edmonton, Alberta	450
CJGC	London Free Press Prtg. Co.	London, Ont.	430
CJCD	T. Eaton Co.	Toronto, Ont.	410
CJCE	Sprott-Shaw Radio Co.	Vancouver, B. C.	420
CJCI	Maritime Radio Corp.	St. John, New Brunswick	400
CJCM	J. L. Phillipe	Mont Joli, Quebec	430
CJCN	Simons Agnew & Co.	Toronto, Ont.	410
CJSC	Evening Telegram	Toronto, Ont.	430
CKAC	La Presse Pub. Co.	Montreal, Quebec	430
CKCD	Vancouver Daily Province	Vancouver, B. C.	410
CKCE	Canadian Independ. Telephone Co.	Toronto, Ont.	450
CKCH	Canadian National Railways	Ottawa, Ont.	435
CKCK	Leader Pub. Co.	Regina, Saskatchewan	420
CKCO	Ottawa Radio Association	Ottawa, Ont.	440
CKCX	P. Burns & Co.	Calgary, Alberta	445
CKLC	Wilkinson Electric Company	Calgary, Alberta	400
CKOC	Wentworth Radio Supply Co.	Hamilton, Ont.	410
CKY	Manitoba Telephone System	Winnipeg, Manitoba	450

Cuban Stations

PWX	Cuban Telephone Co.	Habana	400
2DW	Pedro Zayas	Habana	300
2AB	Alberto S. de Bustamante	Habana	240
20K	Mario Garcia Velez	Habana	360
2BY	Frederick W. Borton	Habana	260
2CX	Frederick W. Borton	Habana	320
2EV	Westinghouse Elec. Co.	Habana	220
2TW	Roberto E. Ramires	Habana	230
2HC	Heraldo de Cuba	Habana	275
2LC	Luis Casas	Habana	250
2KD	E. Sanchez de Fuentes	Habana	350
2MN	Fausto Simon	Habana	270
2MG	Manuel G. Salas	Habana	280
2JD	Raul Perez Falcon	Habana	150
2KP	Alvara Daza	Habana	200
2HS	Julio Power	Habana	180
2OL	Oscar Collado	Habana	290
2WW	Amadeo Saenz	Habana	210
5EV	Leopoldo V. Figueroa	Colon	360
6KW	Frank H. Jones	Tuinucu	340
6KJ	Frank H. Jones	Tuinucu	275
6CX	Antonio T. Figueroa	Cienfiegos	170
6DW	Eduardo Terry	Cienfiegos	225
6BY	Jose Ganduxe	Cienfuegos	300
6AZ	Valentin Ullivarri	Cienfuegos	200
6EV	Joseia Alverax	Caibarien	225
8AZ	Alfreda Brocks	Stgo de Cuba	240
8BY	Alberto Ravelo	Stgo. de Cuba	250
8FU	Andres Vinnet	Stgo. de Cuba	225
8DW	Pedro C. Anduz	Stego. de Cuba	275
8EV	Eduardo Mateos	Stego. de Cuba	180

Status of Broadcasting Stations Falling Off

A survey and house cleaning of broadcasting stations, completed by the Department of Commerce on July 1, eliminated a lot of "dead wood" stations, reducing the total number of broadcasters to 534, thirty-nine less than on July 1, last year, and fifty-five less than on June 1 this year.

Fans should not be alarmed, however, for fear that this popular practice is about to die out. Many of the stations eliminated simply failed to renew their licenses, and some will again apply for permission to broadcast it is believed. Of the stations which dropped out, 53 were in Class A, and 29 in Class C. No Class B stations quit the air, and there are today 54 such, an increase of 12 over the number on June 1. There are also 377 Class A stations; 101, C, and 2 in the experimental Class D, still operating. Nevertheless, the peak of broadcasting, on May 1, 1923, totaled 592 stations and may never again be attained, although the total was only 3 below par, so to speak, on June 1, 1924, when 589 were on the air.

The eighty-two stations which were dropped from the Department of Commerce active list for various reasons are as follows:

CALL	STATION
KDYX	Star Bulletin Pub. Co., Honolulu, T. H.
KDZQ	Nichols Academy of Dancing, Denver, Col.
KFAF	Western Radio Corp., Denver, Col.
KFAJ	University of Colorado, Boulder, Col.
KFCY	Western Union College, LeMars, Iowa.
KFDA	Adler's Music Store, Baker, Oregon.
KFFQ	Marksheffel Motor Co., Col. Springs, Col.
KFFV	Graceland College, Lamoni, Iowa.
KFGV	Heidbreder Radio Supply Co., Utica, Neb.
KFHX	Nelson, Robert W., Hutchinson, Kansas.
KFJV	Warren, Thomas H., Dexter, Iowa.
KFLH	Erickson Radio Co., Inc., Salt Lake City, Utah.
KFLP	Everette M. Foster, Cedar Rapids, Iowa.
KFMS	Freimuth Dept. Store, Duluth, Minn.
KFMY	Boy Scouts of America, Long Beach, Cal.
KFNH	State Teachers College, Springfield, Mo.
KFOV	Davis Electrical Corp., Sioux City, Iowa.
WABA	Lake Forest University, Lake Forest, Ill.
WABN	Ott Radio Inc., La Crosse, Wis.
WBBF	Georgia School of Technology, Atlanta, Ga.
WBBO	Mich. Limestone & Chemical Co., Rogers, Mich.
WCAS	Dunwoody Industrial Institute, Minneapolis, Minn.
WFAJ	Hi Grade Wireless Inst. Co., Asheville, N. C.
WFAQ	Missouri Wesleyan College and Cameron Radio Co., Cameron, Mo.
WFAT	Columbus College, Sioux Falls, S. Dak.
WIAI	Heers Stores Co., Springfield, Mo.
WIAJ	Fox River Valley Radio Supply Co., Neenah, Wis.
WJAT	Kelley-Vawter Jewelry Co., Marshall, Mo.
WKAY	Brenau College, Gainesville, Ga.
WLAK	Vermont Farm Machine Corp., Bellows Falls, Vt.
WMAJ	Drovers Telegram Co., Kansas City, Mo.
WNAQ	Charleston Radio Elect. Co., Charleston, S. C.
WOAR	Lundskow, Henry P., Kenosha, Wis.
WQAW	Catholic University of America, Washington, D. C.
WSAG	Davis, Loren V., St. Petersburgh, Fla.
WSAW	John L. Long, Jr., Canandaigua, N. Y.
WWAF	Galvin Radio Supply Co., Camden, N. J.
KFAN	Electric Shop, Moscow, Idaho.
KFAU	Independent School Dist. of Boise City, Boise, Idaho.
KFDO	Cutting, H. E., Bozeman, Mont.
KFDV	Gilbrech and Stinson, Fayetteville, Ark.
KFHB	A. S. Kolstad, The Rialto Theatre, Hood River, Ore.
KFHF	Central Christian Church, Shreveport, La.
KFFO	Smith, Dr. E. H., Hillsboro, Ore.
KFFZ	Al. G. Barnes Amusement Co., Dallas, Texas.
KFLR	University of New Mexico, Albuquerque, N. M.
KFLW	Missoula Electric Supply Co., Missoula, Mont.
KFMU	Stevens Brothers, San Marcos, Texas.
KFMZ	Roswell Broadcasting Club, Roswell, N. M.
KFNC	Alonzo Monk, Jr., Corsicana, Texas.
KFOF	Rohrer Electric Co., Marshfield, Oregon.
KFOH	The Radio Bungalow, Portland, Oregon.
KFOP	Willson Construction Co., Dallas, Texas.
KGN	Northwestern Radio Mfg. Co., Portland, Ore.
KZV	Wenatchee Battery and Motor Co., Wenatchee, Wash.
WABS	Essex Mfg. Co., Newark, N. J.
WABV	DeWitt, John H., Jr., Nashville, Tenn.
WBBQ	Frank Crook, Pawtucket, R. I.
WBBS	First Baptist Church, New Orleans, La.
WCAM	Villanova College, Villanova, Pa.
WCM	University of Texas, Austin, Texas.
WDAO	Automotive Electric Co., Dallas, Texas.
WFAF	Spratley, Henry C., Poughkeepsie, N. Y.
WGV	Interstate Electric Co., New Orleans, La.
WHAB	Thompson, Clark W., Galveston, Texas.
WIAF	De Cortin, Gustav A., New Orleans, La.
WJX	De Forest Radio Telephone & Telegraph Co., New York City.
WLAJ	Waco Electrical Supply Co., Waco, Tex.
WMAB	Radio Supply Co., Oklahoma City, Okla.
WNAN	Syracuse Radio Telephone Co., Syracuse, N. Y.
WNAS	Texas Radio Corporation, Austin, Texas.
WNAV	Peoples Tel. & Tel. Co., Knoxville, Tenn.
WNJ	Shotton Radio Mfg. Co., Inc., The, Albany, N. Y.
WOAP	Kalamazoo College, Kalamazoo, Mich.
WOK	Pine Bluff Company, The, Pine Bluff, Ark.
WPAT	Saint Patricks Cathedral, El Paso, Texas.
WQAD	Whitall Electric Co., Waterbury, Conn.
WRAA	Rice Institute, Houston, Texas.
WRAH	Read, Stanley N., Providence, R. I.
WRAY	Radio Sales Corp., Scranton, Pa.
WSAT	Donohoo Ware Co., Plainview, Texas.
WWAC	Sanger Bros., Waco, Texas.

Department of RADIO ENGINEERING

Radio Age Institute

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The above approval seal will be furnished free of charge by RADIO AGE, and any article bearing this seal has been approved by the Institute Laboratory.

We will be pleased to receive and test any materials that are offered on the market and give them our endorsement where they meet all Institute tests. Send materials to RADIO AGE INSTITUTE, 500 N. Dearborn St., Chicago.

Radio sets and equipment sent to the RADIO AGE INSTITUTE since its inception last month are now being tested in our laboratories. This apparatus includes sets from amateur radio builders as well as the perfected inventions of well known manufacturers.

All will be tested, and, if meeting RADIO AGE INSTITUTE requirements, will be given the official approval seal reproduced above and sent back to the maker.

This service is absolutely free, and RADIO AGE wishes it understood a test by its INSTITUTE does not incur any obligations on the part of the maker, whether he be amateur or manufacturer.

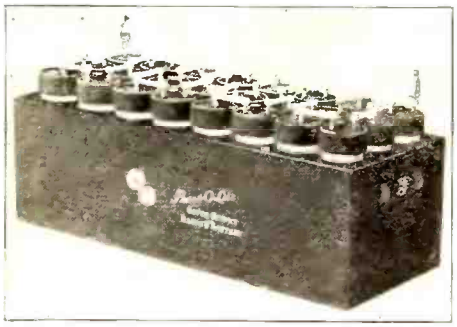
Results of the first tests will be announced in the September RADIO AGE, with illustrations.

With the Radio Manufacturers

(*Continued from page 44*)

Prest-O-Lite Announces New Radio "B" Battery

A radio "B" battery with many new features has just been announced by the Prest-O-Lite Co., Inc., from their factory at Speedway, Indianapolis, Ind. It will



be known as the Prest-O-Lite Super-Service Radio "B" Battery and will be supplied in 24 and 48-volt sizes in 4,500 and 2,500 M. A. H. capacities for each. It is designed not only to produce dependable continuous service but to harmonize in appearance with the finest furniture and radio sets.

It is generously proportioned and ruggedly built to insure trouble-free operation and uniform voltage without the disturbances-causing reception faults frequently attributed to other sources.

The cells are kept correctly spaced and are protected from breakage by spacing panels at both top and bottom. The semi-hard rubber cell covers lock securely around the jars and plate lugs, preventing seepage. The inside of the case is coated with an acid-proof preparation and as a further precaution the cell jars rest on a thick shock-absorbing pad containing an acid absorbing and neutralizing compound. It is claimed that the entire contents of a cell could be suddenly spilled into the case, yet all the acid solution would be absorbed and neutralized without the slightest danger of its soaking through and damaging the furniture.

Another feature of the design to which particular attention has been given is the cell connectors. Great precautions have been made against short circuiting.

This raised position of the cell connectors makes it easy to keep the top of the cells dusted and looking spick and span. It is to be noticed that the positive and negative terminals are large enough to allow easy ample gripping of connection clips.

"Kodel" Portable Like a Camera

In the early day of the automobile, the car owner used to place his machine in the garage long before the first snow fall, there to let it remain until the coming of Spring. It was thought that an automobile was of no use, and impracticable to operate, during the Winter months.

For some time the radio operator has held to an equally foolish view of Summer receiving conditions. The use of radio during the Summer months was thought to be impracticable and impossible.

Winter driving was not exactly a pleasure before the windproof top and the closed body became standard equipment. Neither has the use of a radio set with its cumbersome storage battery, bulky size, and the need for a suspended aerial, been much of a success as a portable proposition for Summer use.

All of these disadvantages have been overcome in the design of a new and novel receiving set that fits a neat leather covered carrying case of practically the same size and general appearance of a camera. You can now take your radio set with you wherever you go without the incoveniences formerly attached to portable radio sets.

The "Kodel," as this new receiving set is called, is entirely self contained. "A" and "B" batteries, head phones, vacuum tube, and a fifteen-foot aerial and ground wire are accommodated within the small case which measures only 5¾x4½x8 inches over all, and weighs but 4¾ pounds complete with all accessories.

The "Kodel" requires no loop or aerial for its successful operation. A single connection to water pipe or other ground is all that is required. Where a ground is not available, stations from 50 to 100 miles away can be heard with surprising clearness by merely throwing the fifteen-foot ground and aerial wires on the floor.

So sensitive is this set that, under favorable conditions, Havana, Cuba, New York City and Jefferson City, Mo., have been clearly heard in Cincinnati by using ground connections only. Pittsburgh, Schenectady and other high power stations are picked up regularly in the same manner. With outside aerial, the set is claimed to have, under favorable conditions, truthfully a range of from coast to coast.

Big Production Increase Planned by Pacent

The Pacent Electric Company, Inc., of 22 Park Place, New York, manufacturer of the well known Pacent Radio Essentials, announces the opening of its enlarged factory, laboratories and engineering department at 91 Seventh Avenue, New York City.

The Popularity of Pacent Radio Essentials reached a point last season where the old Pacent factory on 38th Street was unable to cope with the increase in production that was necessary. The new factory is believed to provide for future service that is more consistent with the quality of their products.

The Pacent Company lay great stress upon the careful inspection and testing of their apparatus before it leaves the factory. In their new factory the testing department has been considerably enlarged and improved in every way. For the use of this department a number of unique testing instruments have been constructed.

In one corner of the factory there is a model room. In this room may be found practically every kind of radio apparatus ever designed. It is used by Mr. Pacent and his engineers for their experimental work, and in this room are being developened many new Pacent Essentials that will make their appearance during the coming season.

A completely equipped laboratory is maintained for the purpose of making special tools, jigs, etc., necessary to the manufacture of Pacent Essentials. This laboratory functions in close co-operation with the drafting department.

A Manufacturers' Exposition

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New Crosley Radio Receivers

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The new Crosley line illustrated here is still better as shown by laboratory tests and by reports from users of performances under all weather conditions.

Listen in on a Crosley—compare it with other receivers—then you will choose a Crosley!

CROSLEY 50, a new one tube Armstrong Regenerative Receiver. We believe this to be the most efficient one tube receiver ever put on the market.....***Price, $14.50***
Crosley 50-A, two tube amplifier may be added at..... ***18.00***

CROSLEY 51, two tube regenerative receiver, the biggest selling radio receiver in the world. Gives loud speaker volume on local and distant stations under average conditions.....***Price, $18.50***
Crosley 51-A, one tube amplifier may be added at..... ***14.00***

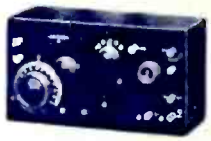
CROSLEY 52, a new three tube Armstrong Regenerative Receiver. Provides loud speaker volume on distant stations under practically all conditions.....***Price, $30.00***

CROSLEY 51-P, this is our new portable set. It is the Crosley Model 51, two tube receiver mounted in a leatherette covered carrying case, battery space and all self-contained.....***Price, $25.00***

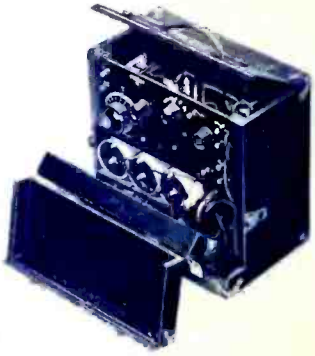
CROSLEY TRIRDYN 3R3, this three tube receiver gives the efficiency and volume of five tubes. We believe it is the most efficient receiver on the market at any price for bringing in long distance stations.....***Price, $65.00***

CROSLEY TRIRDYN 3R3 SPECIAL, the same as the Trirdyn 3R3, except cabinet is larger to contain "A" and "B" dry cell batteries and accessories. A beautiful set to match the highest grade of furniture..... ***Price, $75.00***

Crosley 50 $14.50



Crosley 51 $18.50



Crosley 51-P $25.00

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The Crosley Radio Corporation owns and operates broadcasting station WLW