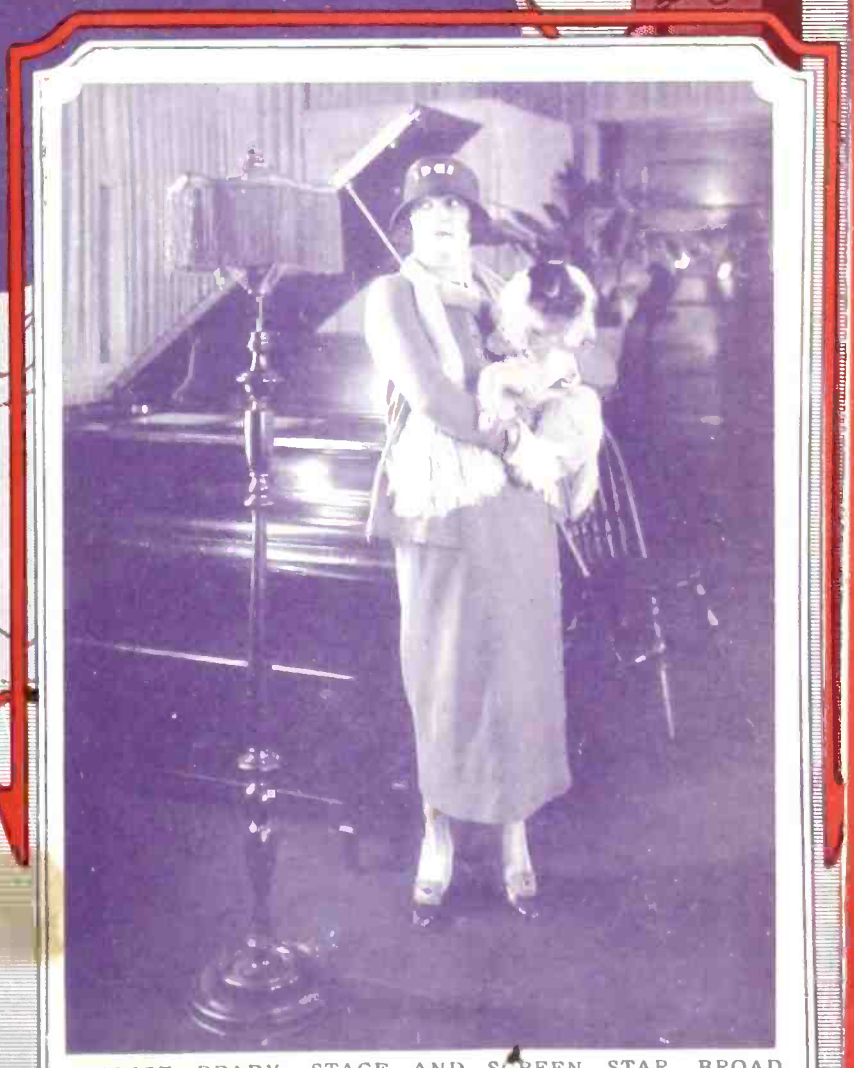
JUNE, 1924

Radio Topics



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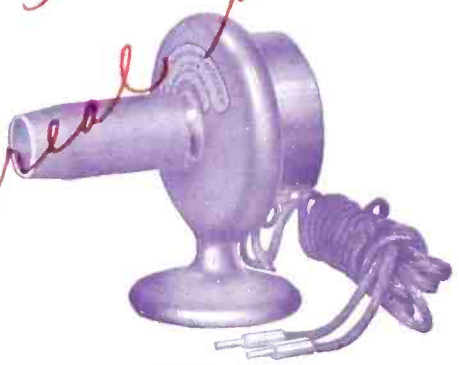

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The greatest electro-chemical laboratory known created these famous dry cell batteries on which radio largely depends. The experience of thirty years in battery making stands back of them.

Eveready Radio "A" and "B" Batteries—lively, peppy, long-lived producers of power.

For your light-weight sets to take camping or on hikes, Eveready has suitable small batteries.

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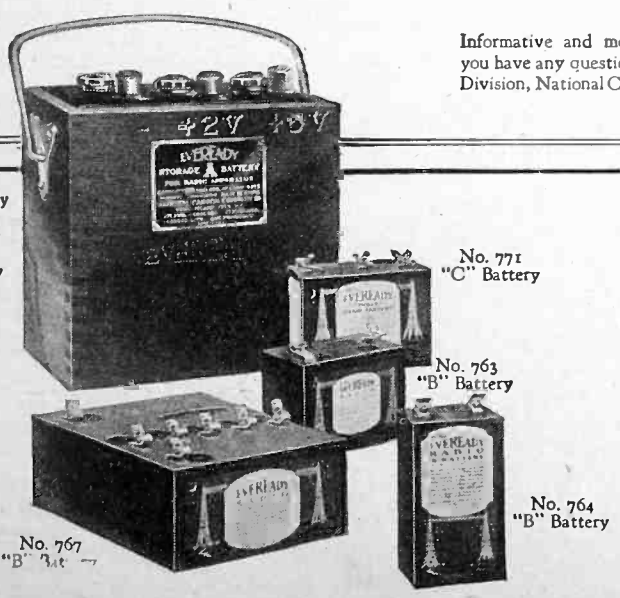

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Radio Batteries
—they last longer

GREBE

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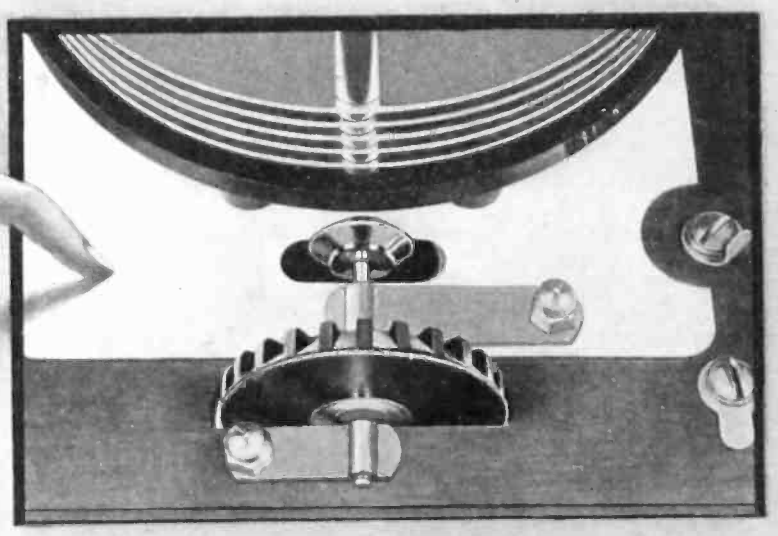

"The Sage attends to the inner and not to the outer."
— Lao Tzu

The wise buyer of a radio receiver is not misled, he looks inside the cabinet.

Doctor Thy

CLOSE inspection of many receivers reveals but one large shield to prevent body-capacity effects. As a result of research, each tuning control on a GREBE Receiver has its own aluminum shield of special size and shape.

This is just one of many details of craftsmanship which make for the high efficiency of GREBE Receivers.

Ask your Dealer or write us.

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Radio Topics

An Illustrated Monthly Devoted to Radio

Volume IV JUNE. 1924 Number 5

A CHEAP AERIAL—BUT EFFECTIVE.

Here's Estelle Taylor, the movie star, using the radiator of her Packard 8 as an antenna for her radio while out on the beach near her California bungalow.

CONTENTS

PUBLISHED MONTHLY BY RADIO TOPICS
Entered as second-class matter at the Postoffice at Oak Park, Ill., February 25, 1922, under the Act of Congress of March 3, 1879.
Business and Editorial Office at 1112 North Blvd., Oak Park, Ill.
Chicago Phone: Austin 9300
New York Office, 240 Broadway

Radio Topics

FOUNDED 1921

PUBLISHED EVERY MONTH BY

RADIO TOPICS, PUBLISHERS

1112 North Blvd.

OAK PARK, ILLINOIS, U. S. A.

J. RAY MURRAY, EDITOR

WILL M. HIGHT, General Manager

PUBLISHING AND EDITORIAL OFFICES

Chicago Phone: Austin 9300 Oak Park Phone: Oak Park 3200

Twenty Cents the Copy From All Newsdealers. By Subscription: To the United States and Possessions, Cuba and Mexico, $2.00 the Year. Remit by U. S. Money Order, Express Money Order, Check or by Draft, payable in U. S. Funds.

To Canada—By Subscription, $3.00 the Year. Single Copies 25 Cents — Canadian or U. S. Funds.

RADIO TOPICS is on sale the 10th of preceding month. Text and advertising forms close the 22nd of second month preceding issue.

Vol. IV. June, 1924 No. 5

Radio Tax Bill Defeated

THE United States Senate's vote of 40 to 13 which struck out the proposed finance committe's recommendation of adding ten per cent to the cost of all equipment and radio apparatus, meets with the hearty approval of every radio enthusiast. The objectionable features of this measure were many, not the least being its imposition upon people of meager means who get unlimited enjoyment and profit out of their radio sets. A $3 charge added to a $30 set meant considerable to a poor boy or girl, and we're glad the senators saw the bad features of the clause. A flood of telegrams and letters soon convinced them that thousands were vitally interested in radio and wanted the un-American tax defeated.

A Radio Romance

WENDELL HALL, well-known from coast to coast for his ballads over the radio, has won for himself a charming life partner, according to reports. He is to marry Miss Marion Martin of Chicago on June 4 in the presence of the microphone and a host of friends at station WEAF, it is said.

Bureau of Radio Created

THE White bill, with special provisions applying to anti-trust laws and any attempt to monopolize the air or apparatus used, has been reported out of the House merchant marine committee, and Chairman White is preparing his report for early presentation.

Under the revised measure there is provision for a court review of the secretary of commerce's rulings and also a clause prohibiting radio interests from owning or controlling a cable or vice versa.

The bill creates a bureau of radio in the department of commerce which provides for federal regulation of radio communication, with special provisions as above stated.

Radio Audiences Big Hearted

AT a recent benefit staged by the Westinghouse station KYW in conjunction with the Chicago Evening American at McVicker's Theater recently, contributions were asked from radio fans far and near who listened to the soloists and symphony orchestra giving a benefit performance for widows of Chicago firemen who lost their lives in a recent disastrous fire. The admission to the theater was $1.10, and that night and the following day KYW was flooded with telegrams and letters stating various amounts were being sent to the fund. A tidy sum was realized from the performance, but four times as much was received from those who listened in.

Hurrah for Crosley!

POWEL CROSLEY, JR., owner of station WLW, although he has a court decision in his favor, has refused to broadcast copyrighted music controlled by the American Society of Composers, Authors and Publishers. As long as we have music like "Dream Daddy," "Marcheta," "Somebody Stole My Gal," "The One I Love Belongs to Somebody Else" and others equally as popular, he sees no need for playing the copyrighted stuff.

Don't forget your portable receiver this summer. If you haven't one, get busy and construct one. There's one described in this issue of Radio Topics, and the Reflex makes a good portable outfit.

U. S. Owns Super-Heterodyne Patents

DECISION DEALS SEVERE BLOW TO RADIO CORPORATION OF AMERICA AND MAJOR ARMSTRONG

ALTHOUGH the Radio Corporation of America has looked upon the super-heterodyne as its particular foster child for some time and jealously guarded it against anything that might smack of infringement of the patents purchased from Maj. E. H. Armstrong, the government has decided that it will lay claim to all patents taken out by Major Armstrong on the super-heterodyne method of reception because the major was in the army at the time the patents were granted.

Of course the matter will have to be fought out in court and in case the U. S. Government is upheld it is believed that a liberal attitude will be taken toward the development of this particular type of radio receiver.

The district court of appeals of District of Columbia also declared Lee De Forest to be entitled to priority as the inventor of the audion, or regenerative circuit, as a means of producing sustained electrical oscillations in transmission and reception by radio or otherwise. The opinion reversed the finding of the commissioner of patents, who had awarded priority to Edwin H. Armstrong. Claims also had been made by Alexander Meissner and Irving Langmuir.

Priority of De Forest

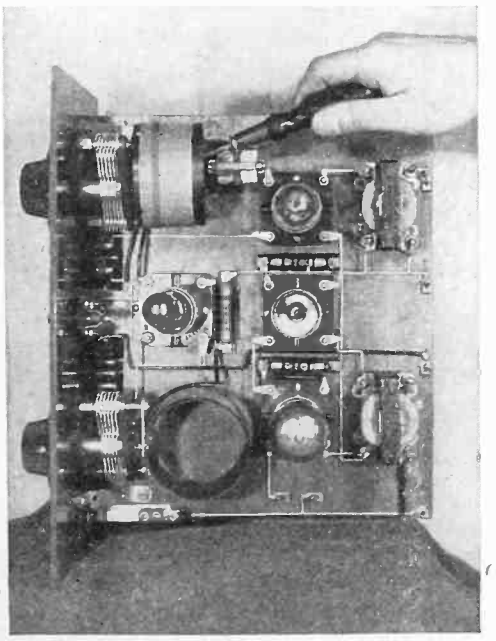
Justice Van Orsdel held that the testimony of Armstrong and his witnesses placed his conception of the regenerative circuit in October, 1912, and that De Forest reduced his invention to practice in August, 1912. The evidence, the opinion held, failed to disclose that De Forest had abandoned it.

"The whole case," said the decision, "turns upon the question of priority to be determined solely as a question of fact. The commissioner of patents, affirming a decision by the board of examiners-in-chief awarded priority to Armstrong.

"We are especially impressed by Armstrong and his witnesses. We have no doubt he produced the invention at the time alleged, but his earliest claim to a conception of this invention is October, 1912, followed by a witnessed sketch on January 31, 1913. . . .

"It is clearly shown that De Forest was developing the idea involved in this invention in the early part of 1912, and it is claimed that the work culminated in a complete disclosure of the invention in August of that year. . . . .

"It appears from his notebook records that the first discovery of the feed-back circuit occurred in connection with his work on the amplifier. There is some testimony that prior to August, 1912, the oscillating properties of the audion were discovered by De Forest. It is unnecessary, however, to go beyond the written records of August 6, 1912. This record, with the accompanying drawing, clearly shows a feedback circuit.



FOUR DIFFERENT RADIO BULBS USED

This novel outfit uses four different tubes of widely different characteristics, which are run from a six-volt battery. This is possible because of the use of Amerite, the self-adjusting rheostat for each amplifying tube. In this way hand rheostats are eliminated and simplicity of control accomplished. The tuned radio frequency circuit with a potentiometer in aerial circuit is used.—(K. & H. photo.)

Ruling Reversed

"It is generally conceded, indeed it must be, that this drawing and the notes not only disclosed the invention but disclosed it in a clear, workable manner. It matters little whether the case be disposed of upon the theory that what was done in August, 1912, amounted to reduction to practice or merely conception of the invention. In either event De Forest must prevail.

"The decisions of the commissioner are reversed and priority awarded to De Forest."

Tax on Radio Sets Is Killed

THE proposed tax of 10 per cent on radio sets and radio parts was defeated by a vote of 40 to 13 in the U. S. Senate, and the Senate Finance Committee amended the tax bill accordingly. There was a long debate on the question, the Senators pointing out the bad features of such a tax.

Responding to an appeal to wire or write representatives at Washington, broadcast from almost every station, floods of protests arrived in every mail and by wire for several weeks. The Radio Trade Association and National Broadcasters Association are elated over the victory attained and they are being showered with messages of thanks from all sides.

WSB's Announcer Confesses

YOU'VE all heard WSB, Atlanta, Ga., "the voice of the South"; that is, all you DX fans. Well, here are his confessions. The truth about Lambdin Kay, WSB's announcer:

He believes that any orator who clutters up the air with words for more than four minutes should be strangled violently enough so that his listeners could hear his death gurgles.

He also believes:

1. An announcer is meant to be heard.

2. Every solitary soul complimentary enough to tune in deserves to hear every thing that is going on.

3. The radio public owns the air regardless of the government, broadcasters or dots and dashers.

4. A station that cannot or does not regard the rights of a majority of the listeners should be legally dynamited.

5. The audience likes anything from banjo picking to grand opera if it is good.

6. Being welcomed by your home circle is worth tons of mail from South Africa.

7. The human race is a fine institution.

8. A broadcasting station's opportunity and obligation as a public servant are an awesome thing.

LAMBDIN KAY
The peppy announcer for WSB.

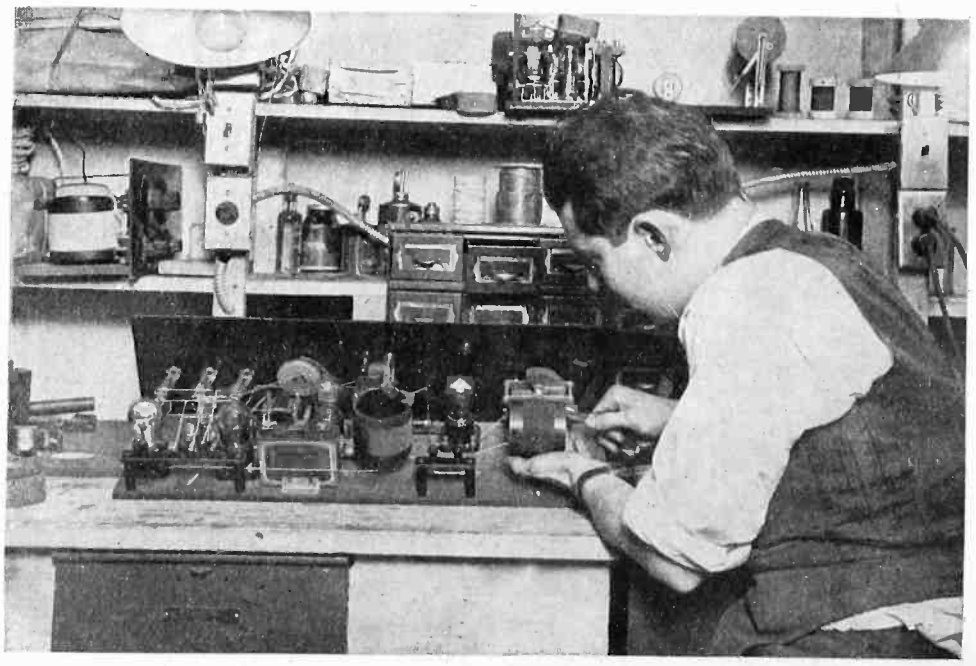
9. Running one is more work and more fun than any other job on earth.

As writing about himself is about the last story any average newspaperman ever expects to cover, this extremely average toiler of the fourth estate wrestles with an uncomfortable assignment in trying to answer the acute, enormous and entirely natural curiosity most fans share concerning who the guys are who earn a living by telling radio audiences what is going to happen next.

Name: Lambdin Kay. Age: Thirty-one—at least. Height: Inconsiderable. Appearance: Deceiving. Hair: Red, and fading (numerically). Condition of servitude: Single. Habits: Irregular. Hobby: Tucking bow necktie inside collar. Weakness: Poetry—trying to write it. Politics: Nil. Religion: trace (Episcopalian). Ambition: Eight hours' sleep. Ideal: Theodore Roosevelt. Aversions: English peas, O. O. McIntyre, cats, fourflushers, bridge-whist, "Love Sends a Little Gift of Roses." Preferences: Beef steak, Charlie Chaplin, large blonds, Sherlock Holmes, golf. Record: (expurgated) grade, school, college, stenog, sales manager, publisher, movie magnate, shoe polish peddler, press agent, cub reporter, "country" editor, laborer at a broadcasting factory. Birthplace: (inhabited chiefly during infancy) Brooklyn, N. Y. Ameliorating circumstances; Mother a Texan, father a Missourian, raised mainly in Georgia.

Since The Journal founded Dixie's first broadcasting station two years ago it has been proven that a radio working day normally runs from midnight to midnight, entailing experiences like meeting some 30,000 new people; delivering after-dinner speeches; christening babies; appearing in vaudeville; lecturing college students; receiving flocks of letters and gifts from ill-informed fans who have guessed that I'm something like William Jennings Bryan, Colonel Henry Waterson and Mark Twain—which I ain't.

Mr. Kay thought up "The Voice of the South" as the world's first radio slogan, likewise three-note chime as first identification signal; likewise WSB 10:45 Radiowls as first aerial fraternity.



THIS SET BRINGS IN PACIFIC COAST

A new radio receiver, entirely self-contained, with exception of loud speaker, that employs one step of tuned radio frequency amplification. Automatic filament jacks eliminate switches and rheostats and only two tuning controls are used. By a special arrangement, oscillations are entirely eliminated, thereby preventing internal "howls" or squealing. This set brings in the Pacific coast stations, it is said, from New York. Harold Herbert, radio engineer, is shown working on the set which he built.—(K. & H. photo.)

Africans Dance to Radio Tunes

WITH the introduction of the loud speaker and the radio receiver in "darkest" Africa, the natives will soon be performing their native dances to the strains of music picked up from the ether and broadcast by loud speakers. The British government is now taking steps to place receivers in the Kenya colony through Trade Commissioner R. A. May at Alexandria, Egypt, and soon radio sets will be installed in every village. Talks will also be given over the radio in the native tongue.

Radio Enters a New Era

By ARMSTRONG PERRY

IN a little more than half a century radio has been developed from an Englishman's theory to an established means of local, long-distance and international communication. What is of greater interest to most persons, radio has reached a stage where it is possible for a whole community to receive at one time, and through one set of apparatus, a grand opera, a church service, a digest of business conditions affecting its local industries, or a spoken message direct from the lips of the President of the United States.

It was in 1867, a year remembered by many besides the oldest inhabitants, that James Clerk-Maxwell, a British scientist, deduced from known phenomena mathematical proof that radio waves must result from certain electrical activity. In 1883 Heinrich Rudolph Hertz, a *privat docent* at the University of Kiel, Germany, began the experiments that in four years added to Clerk-Maxwell's theory the physical proof that radio waves could be produced, controlled, and made to reveal their presence wherever suitable receiving apparatus was operated within their sphere of influence.

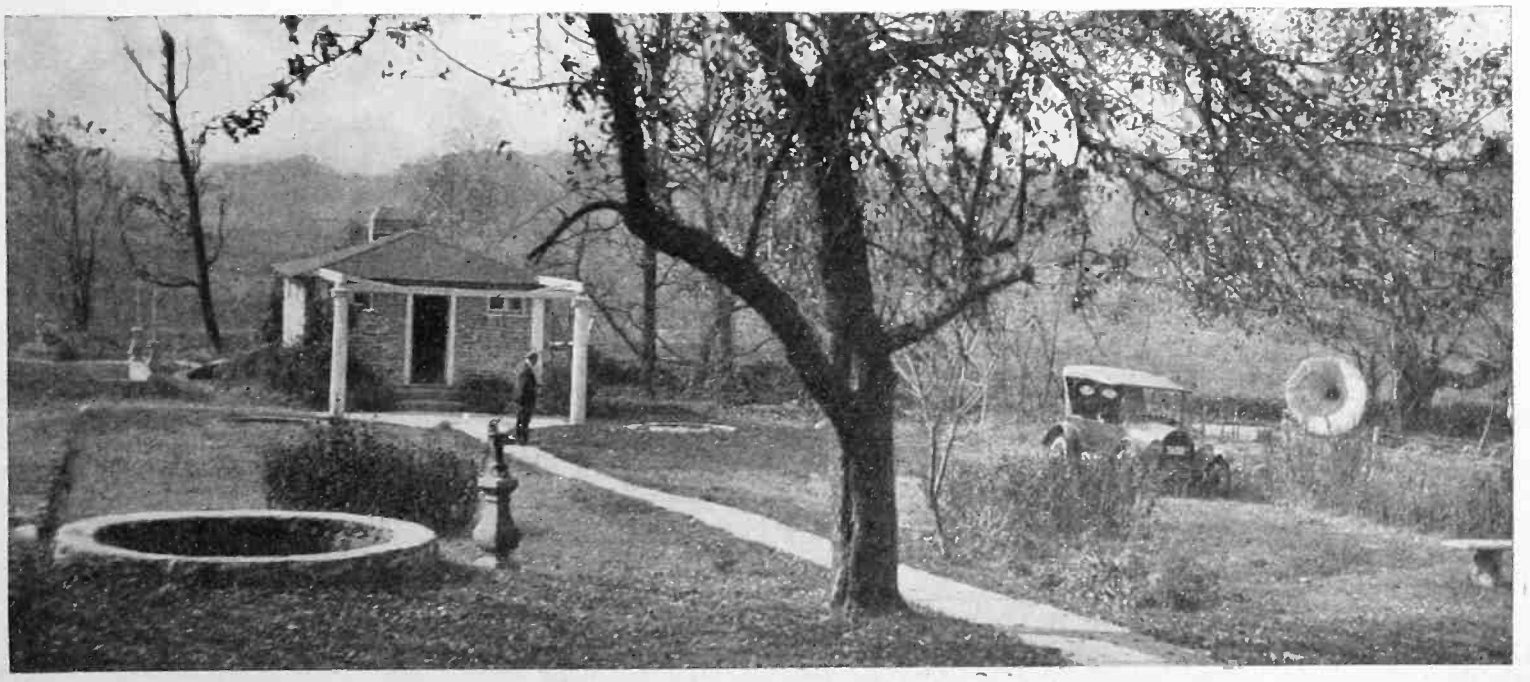
Edouard Branley's "coherer," invented in 1892, used a principle discovered by Hughes in 1879 and made it possible to translate radio waves picked up by a receiver into dots and dashes, the same as those sent from the transmitter.

Sommering in 1811, Oerstedt in 1820, Faraday in 1831, Morse, Cooke and Wheatstone in 1837, Steinheil in 1838, Henry in 1840, Lodge in the '60's, and other scientists and inventors made discoveries concerning electrical conduction and induction that had an influence on radio.

A WHOLE TOWN HEARS THIS LOUD SPEAKER

This loud speaker, mounted on roof of the Keith Theatre, Washington, D. C., was distinctly heard above the roar of traffic, a half a mile away. As the author says, it is to radio what the motor bus is among automobiles.

Marconi was the genius who gathered the facts brought out by all the previous investigators, perfected and invented apparatus, secured patents, promoted radio commercially and brought it to a stage where it could be employed for the same purposes as those served by the land-line telegraph and the submarine cable and also for reaching ships at sea and isolated points ashore.



A LOUD SPEAKER YOU CAN HEAR FOR TWO MILES

No need to get near this loud speaker, the invention of M. C. Hopkins, Waterford, Va. When it opens up you can hear it for two miles. It is made of concrete and wood and is probably the largest single practical speaker in existence.

The coherer gave way to a more sensitive receiving device, the magnetic detector. This was supplanted by the crystal detector, which is still in use though outclassed by the infinitely sensitive electron tubes that not only rectify the current brought in by the antenna, but also amplify it until a sound that in the phone is as faint as a mosquito's hum becomes as piercing as a blast from a factory whistle.

Paralleling the development of communication using dot and dash codes came many experiments in the transmission of the human voice. Bell brought out the telephone in 1876. In the '80's Heaviside in England telephoned from the surface of the earth to mines 350 feet below, but it was by the use of circuits that were in inductive relation and not by means of radio waves. In 1914 the war-time necessity for rapid communication hastened the development of the radio telephone and messages were exchanged between war vessels thirty miles apart. It was employed successfully throughout the war and as soon as military restrictions were removed from American amateur and professional radio experimenters after the armistice, it became a subject for study and experimentation by thousands.

Broadcasts Weather Reports

The "broadcast," as any radio message is called that is addressed not to an individual, but to all listeners, appears to have been less interesting to technically minded operators than individual messages. Although the broadcast was employed by the Navy in sending out time signals, weather forecasts and other matters of general interest almost as soon as radio was used for naval communications, the idea that music, lectures, sermons, addresses, and anything else that could be communicated by the human voice or by sound-producing instruments, might be broadcast was late in making its appearance. When its importance was finally appreciated, broadcasting stations appeared rapidly. Within a year and a half after the appearance of the first that gained any widespread attention, the late President Harding was impelled to ask the Secretary of Commerce to call a conference of representatives of radio interests to suggest how radio could be organized so as to prevent a jumble of broadcasts that would keep a listener from hearing anything intelligibly. At this conference were heard representatives of the various government departments concerned: The Boy Scouts of America, who plan to receive and distribute government broadcasts, each troop in its own neighborhood; and of the commercial radio companies. The results in mutual understanding of the problems involved and in legislation for the regulation of radio were so satisfactory that radio interests petitioned the Department of Commerce for a similar conference on the standardization of radio to be held in January, 1923.

Early Experiments

Up to this point the reception of broadcasts had been a matter for each household to arrange for, except that the Boy Scouts' plan includes the local distribution of broadcast messages by posting them on bulletin boards, publishing them in newspapers, repeating them over telephone lines or rebroadcasting them from transmitting stations having only local range. When some address or concert of unusual importance was to be broadcast, apparatus was often installed temporarily in auditoriums in order to serve larger numbers of listeners. The results were too uncertain, however, to win any great popularity and the quality of the music received via radio appealed less to the listener than the novelty of the method employed in transmitting it.

Late in 1921, when the wave of popular interest in radio was approaching its high water mark, M. C. Hopkins, an expert in acoustics, turned his attention to the development of a "loud speaker" that would take the voice or music brought in by a radio receiver and reproduce it with at least the volume and quality that it had where it was given to the transmitter. He had already produced a phonograph that would carry sounds to a distance of two miles or more. In developing that he discovered that sound waves would travel to distances hitherto unknown, giving their usual results at the human ear, just as long as they retained their form. The types of horns used with many phonographs and radio loud-speakers projected sound waves that were often distorted and that were dissipated before they had traveled very far.

Unique Loud Speaker

At his lodge in the little town of Waterford, Virginia, Mr. Hopkins erected a horn seven feet in diameter, made of stone and concrete and shaped according to the principles that he had evolved. He found that he could not get the desired results with any diaphragm and attachments then in use for changing the radio waves to sounds, so he studied radio and invented the needed device. Still he was not satisfied, for the transmitters did not always function efficiently enough to enable him to give his townsfolk a concert of the quality that he desired, so he went back to the source and designed a "pick-up" that would properly translate voice or music into electrical waves at the transmitting station.

He has demonstrated convincingly that a whole town can be served by a single radio receiving station. Many who listen to the big horn that brings them music, lectures, sermons and addresses from places hundreds of miles away, sit or stroll around his lodge and grounds or float in canoes on a little stream that flows past his estate, but many others merely raise windows at their homes, for the radio entertainment can be heard anywhere in the village and for a mile or more beyond its borders.

The cost of a home radio receiver is considerable and the operation of it, except when nearby stations only are listened to, requires patient study. Not infrequently the member of the household who operates the receiver is the only one who gets great enjoyment from it and the operator's interest often is in seeing how many and how distant stations he can hear momentarily rather than in the programs that are being transmitted. It seems probable therefore that a new radio era is marked by the invention of the apparatus that gives a whole community a radio program of superlative quality at one time without the expense of installing a receiver in every home or even the inconvenience of assembling the listeners in one place.

A Real Super-Heterodyne

(ARTICLE 2)

By W. F. KUSTER

PRESIDENT RADIO INSTRUMENTS CO. OF CHICAGO

IN last month's issue of Radio Topics the wiring diagram, parts required and the pick-up and oscillator coils were briefly discussed. It was noted that the parts were comparatively few and the construction far from complex, making it easily possible for the amateur to successfully build the receiver.

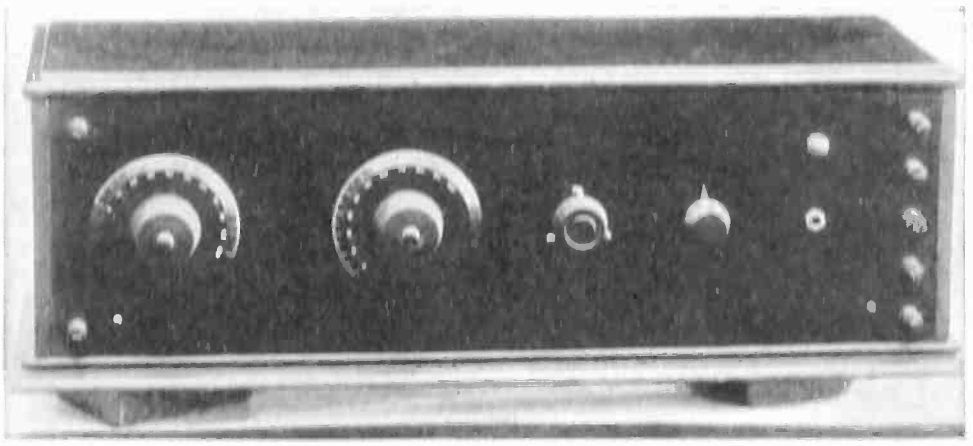
The accompanying photograph shows the relative position of the various parts of the detector stages, showing the modulator, oscillator, three radio frequency and detector tubes, the one stage of audio frequency having been omitted. The space required for accommodating these parts need not exceed 7x24 inches, the one step of audio requiring the addition of six inches in length. Special attention is called to the position occupied by the modulator and oscillator tubes which are spaced well apart and out of line with the balance of tubes.

Wiring the Set

It has been found that stranded copper aerial wire, spaghetti covered, makes the ideal medium for wiring the set. Such wire combines flexibility and low loss and will be found easy to handle and not at all expensive.

The general rule of keeping all leads short and no leads running parallel must be adhered to strictly in building this form of Ultradyne. The leads from the grid half of the oscillator coil to the .001 variable condenser should be the same length if perfect results are desired.

Binding posts for battery connections can be arranged for either front panel mounting or can be placed on a small strip of bakelite or similar material fastened to the rear portion of the baseboard.



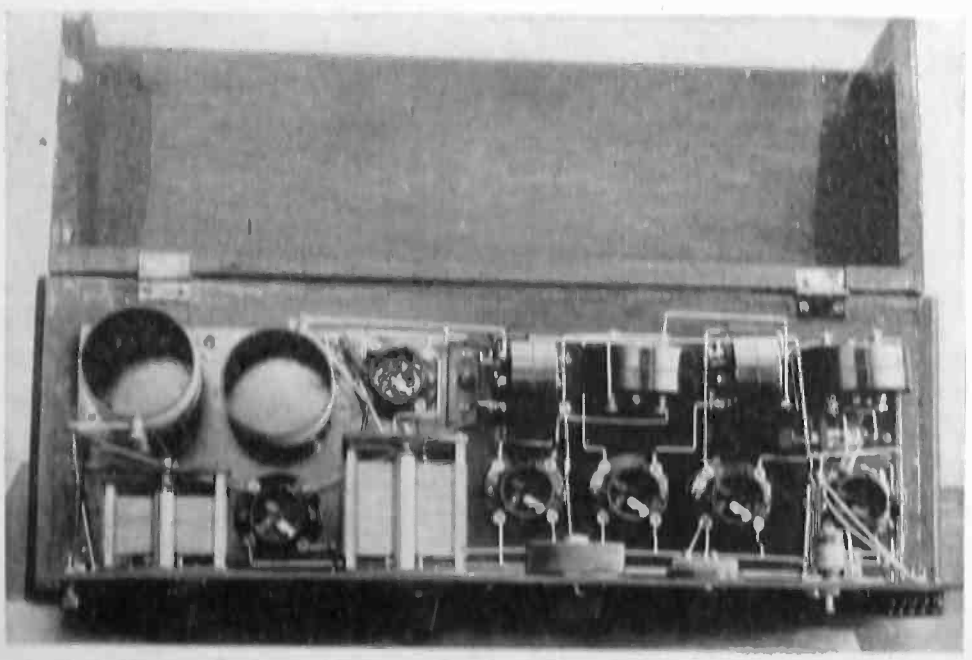
Six-tube Super-heterodyne installed in cabinet.

Tuning

The tuning of this set is comparatively simple. Patience is required as it is necessary to revolve the tuning and oscillating condensers very slowly. The set tunes sharply and a vernier condenser is recommended for the .001 M. F. oscillating condenser.

With a little practice it will be found that stations come in at the same point so long as the same aerial and ground are used. This will enable the operator to calibrate the receiver accurately.

To bring in stations move the tuning condenser a few degrees at a time and then revolve the oscillating condenser very slowly over the whole range, after each setting of the tuning condenser. If whistles are heard, the potentiometer controlling the radio frequency amplifiers should be turned until the whistles stop. It will then be found possible to bring in the station loudly and clearly. The potentiometer is then adjusted to the point where the signals are at a maximum point of amplification. It will also be found that the rheostat acts as a vernier for the potentiometer. It will also be found possible to bring in the same station at two different settings of the oscillator condenser, and this should not be



Front view of panel of real Super-Heterodyne.

mistaken as an indication of any error in construction.

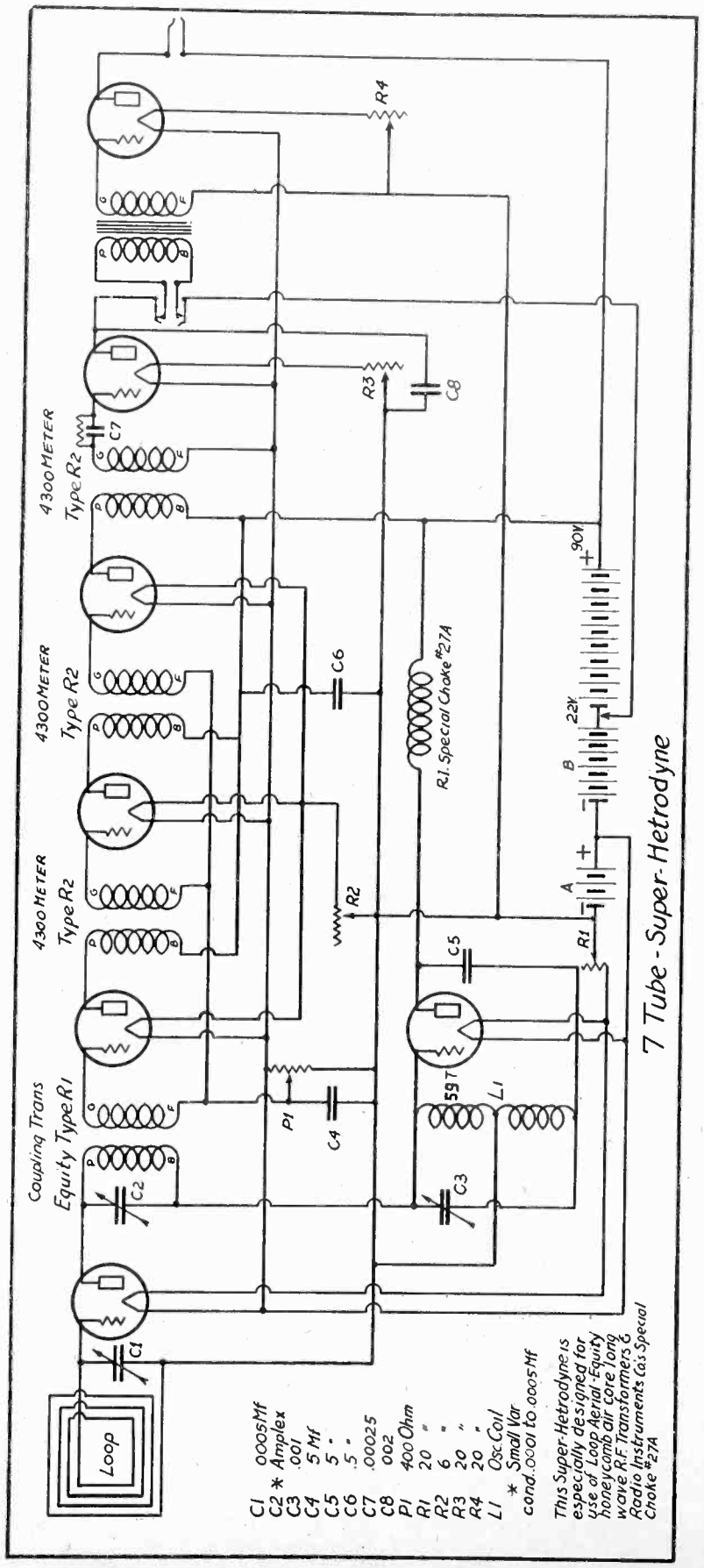
Tubes and Batteries

Hard tubes such as the UV-201A or C-301A, VT-2 or 216A are best suited for the successful operation of this receiver. The UV-199 tubes will also function, but with greatly reduced volume.

Although the use of the choke coil in the "B" battery lead greatly reduces the drain on the "B" batteries, it is advisable to test these frequently, as it is necessary to maintain a constant plate voltage. Sixty-seven and a half to 90 volts are recommended.

Loop Operation

It is possible to operate this receiver from a loop, but careful research has disclosed that far superior results for loop operation are obtained by changing the receiver to conform with hook-up shown herewith.



Here's Another Super-heterodyne Hook-up, Employing Seven Tubes, With the the Modulator Principal and Choke Coil.

Uses Only Modulated Frequencies

THE University of Illinois, which conducts station WRM, claims broadcasting and receiving are on the eve of revolutionary changes.

According to recent experiments conducted by scientists connected with the college, a new device has been found by which only the modulated frequencies of voice or music are broadcast, and these are devoid of the carrier wave tendencies to pick up extraneous frequencies.

Tests have been made, it is said, which have brought responses from all over the United States that signals, broadcast from WRM by the new method came in "loud and clear."

Under the principle of broadcasting now in use, the carrier wave, constantly going out, conveys all manner of sounds, and only the modulation intensity of the sound frequency and the action of the detector tube or crystal in stripping the modulation frequency of its carrier wave to more or less degree, enables the particular voice or music frequency to be heard at the receiving end. More often than not the modulation frequency is not stripped of foreign frequencies borne on the carrier wave, such as static and "strays," and these, too, become audible sounds.

Three distinct advantages are claimed for the new system: Tuning is made more selective at the receiving station because of the sharper decrement; tuning out the station at the receiving is easier for the same reason, and sending efficiency is increased. It is asserted that much greater distance may be covered than possible at present, with reception at 3,000 to 5,000 miles of much higher quality than possible now at 1,000 miles.

Station WRM serves the dual purpose of broadcasting the events of the institution and serving as an experiment station.

The Loop Antenna

By R. H. LANGLEY
Radio Engineer, General Electric Co.

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

Let us examine this special form of inductance, which we call a loop and see why it serves as a pick-up device for radio signals and how it should be made to be effective.

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

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

Voltage is Generated

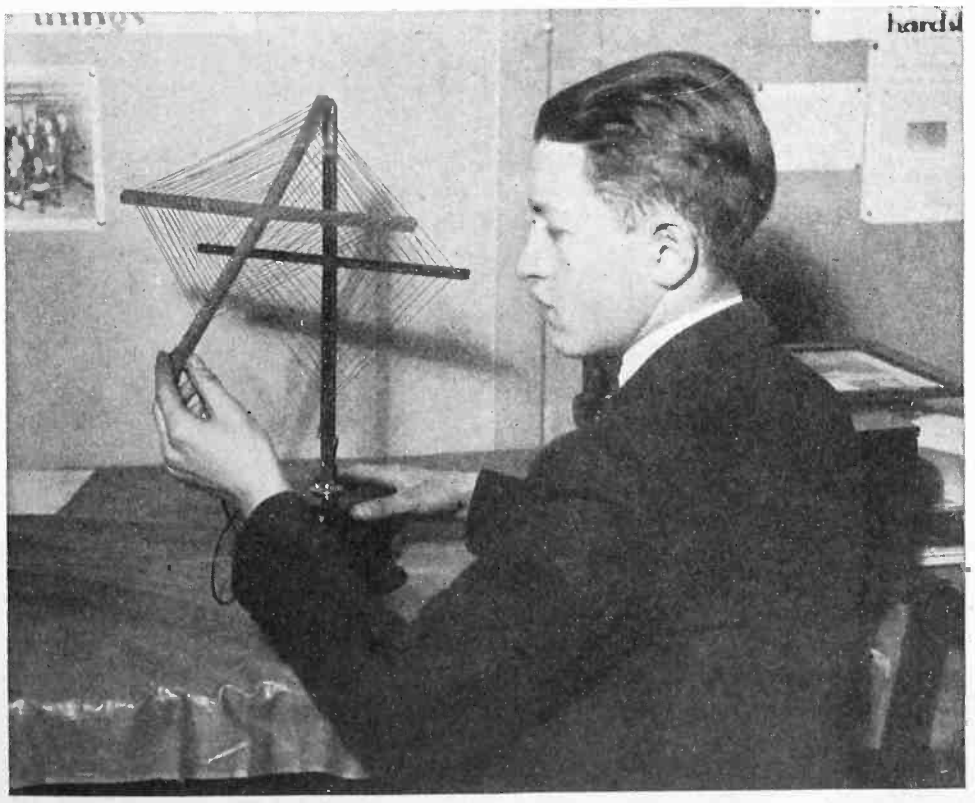
Let us see now what form of loop would have the greatest voltage generated in it by a passing radio wave. Let us think of this radio wave as very much like great smooth waves on the ocean, which of course, also move forward with a very definite velocity. The turns of wire on our loop antenna are necessarily in series with each other, that is to say, they form a continuous winding. If the maximum voltage is to be generated in any one turn of the loop, then the voltage generated in the two sides of this turn should be in opposite direction so that they may add and not oppose each other. If the voltage generated in both sides of the loop were in the upward direction at any one instance, then these two voltages would cancel each other, but if the voltage on one side of the turn was up and on the other side of turn, it was down, then they would add and if the loop were connected to a receiver, a current would flow around the turns of the loop. This, is of course, exactly what we wish to have happen.

Now in order to have the voltage generated on one side of the loop in the opposite direction to that generated on the other side of the loop, the loop would have to be one half a wave length long, that is to say it would have to be long enough in the horizontal direction so that one side was in the crest of the wave when the other side was in the trough of the wave. Since the distance between the crest of the wave is the wavelength itself, then the distance from the crest to the trough is one half the wavelength.

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

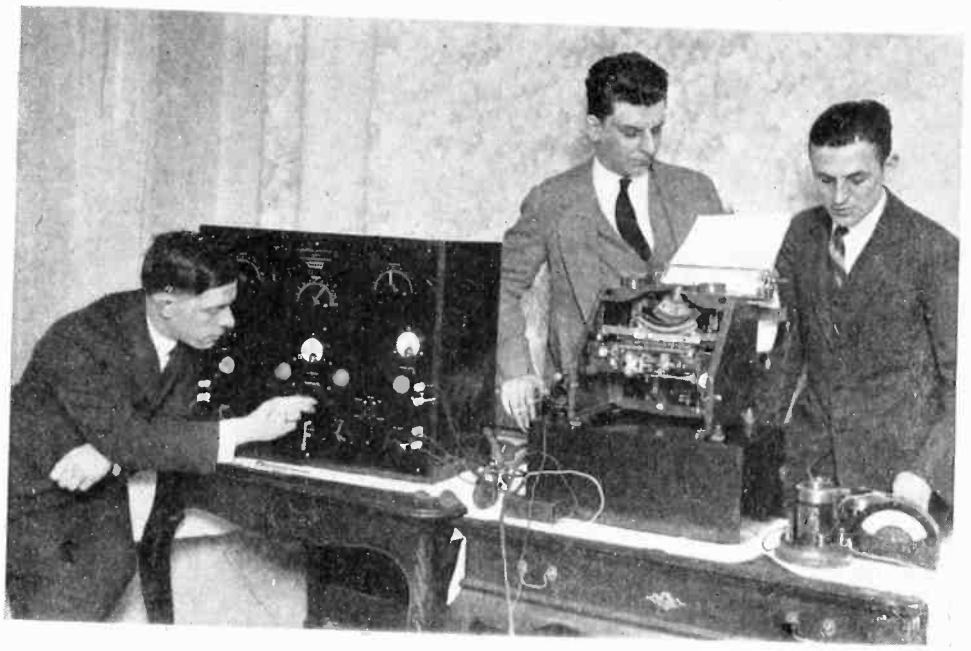
How Loop Functions

But a loop one half a wavelength long is quite out of the question. It would be as long as a steamship and almost as difficult to handle. The loops which we are using every day are of quite reasonable dimensions. They are only a few thousandths of a wavelength long. How do they function? In order to answer this



AMATEUR INVENTS TWIN LOOP

The inventor, Robert F. Good, of New York City, claims that this loop will prevent re-radiation. This twin loop changes a single circuit to a double circuit. It is an aperiodic antenna of ten turns with secondary of twenty turns, thus stepping down re-radiation and stepping up incoming waves, it is claimed.—(Photo by Photo Press.)



RADIO TYPEWRITER REVOLUTIONIZES NEWSPAPER WORK

J. George Uzman, William A. Bruno and W. H. Finch, inventor and electrical and radio engineers, at the American Newspaper Publishers' convention, Waldorf-Astoria Hotel, New York, watching a typewriter being operated by a person who was sitting in the experimental laboratory of the International News Service, two miles away. The copy was clicked off at the rate of sixty-five words a minute. The machine operates on short wave tuner ranging from 60 to 150 meters, with detector and amplifier. At the time the test was made four broadcasting stations were operating within a radius of a few blocks. —(Photo by Kadel & Herbert.)

question let us ask ourselves how we would build a coil of wire in order that absolutely no voltage should be generated in it by the passing wave. The only way in which this could be accomplished would be to so build the coil that the same voltage would be generated in both sides of it and that the voltages generated in the two sides would be opposed to each other. This would give a complete cancellation and no voltage at all at the terminals of the loop or coil. It is obvious that the only way in which this could be done would be by so arranging the loop that it had no length at all. That is to say, arranging it so that the two sides were exactly in the same position in space. This would mean that the horizontal wires across the top and bottom of the loop would cease to exist and the loop would become nothing but a wire laced up and down between pegs on the plain surface of a board.

If there is any distance at all between the two sides of the loop, then there will be some difference not in the amount of voltage generated in the two sides, but in the time at which this voltage is generated and there will consequently be some voltage at the terminals of the loop since complete cancellation of voltages cannot occur.

If the loop is rotated so that its horizontal wires are at right angles to the direction in which the signal is coming, then the loop has no length so far as those signals are concerned. The passing wave strikes both sides of each turn in the loop at exactly the same instance and the voltages generated are, therefore, equal and opposed and there is no terminal voltage. This is of course the fact which gives the loop antenna its very useful directional property. It is to be noted, however, that if the loop is turned ever so slightly from this zero position then the voltages no longer cancel and there is a voltage at the terminal. This means that the zero position of the loop is very sharp, but the maximum position is very broad.

Use of Variable Condenser

In applying the loop antenna to an actual radio receiver, it is necessary that provision be made to tune it to resonance with the desired signal.

This is accomplished by means of a variable air condenser and since this condenser has a very definite maximum capacity, the amount of inductance which the loop can have is also limited. This maximum inductance with the maximum capacity of the variable condenser, must give resonance to the longest wave to be received.

The specification for the best loop antenna, therefore, is that it shall have just as many turns as possible, each turn being just as long as possible and just as high as possible and still have no more than the required maximum inductance. The higher the loop is, the greater will be the voltage generated in each side of each turn and the longer it is, the greater will be the difference in time at which these voltages are generated in the two sides of the loop and consequently the greater will be the voltage at the terminals, but it must not have an inductance value greater than that required for tuning.

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

George Spink Directs New Station

GEORGE SPINK, playwright and theatrical producer, will be entertainment director of the newest broadcasting station, WKAP, in Providence, R. I., which will be opened in the Narragansett boulevard home of Dutee Wilcox Flint. Mr. Spink will arrange all programs sent from the station. Concerts will be broadcast twice a week.

Radio fans are promised that nothing will be put on the air from the new station which has not been tried out before Mr. Spink and approved by Mr. Flint. Amateur entertainers will have an opportunity to try out for places on the entertainment program.

Greatest Radio Summer Here

PLANS and programs just completed by the larger broadcasting stations in the United States, as well as by the leading manufacturers of radio apparatus, will make the summer of 1924 the greatest radio summer since broadcasting was begun.

Extraordinary circumstances have combined to create an exceptionally interesting situation this summer, and a nation-wide survey discloses the fact that at no time has the industry been geared to give a higher standard of service to the radio public.

According to E. B. Mallory, chairman of radio section of the A. M. E. S., the Democratic National Convention in New York in June and the Republican National Convention in Cleveland during the same month, will place the radio "fan" right in the thick of the pre-election campaign. For the first time in the history of the United States, virtually millions of people will "attend" the national conventions. They will be able to follow each issue as it is debated on the convention floor; they will hear the nomination speeches of "favorite sons"; the thunder of applause for popular candidates—the music, the clamor and excitement of the impromptu parades which will spring up from time to time on the convention floors. Elaborate arrangements are now being made so that the greatest possible radio audience may be able to listen in on these conventions.

Immediately after the conventions will come the presidential election campaigns. There again radio will play an epoch-making part, for it is clear that every candidate is preparing to broadcast through the air his appeal to the electorate.

Summer Reception Improved

"The fact that there are more Class B high-powered broadcasting stations in operation this year than last year," said Mr. Mallory, "is assurance to the radio audience that reception during the hottest summer months will be vastly better. The new allocation of wavelengths, particularly among the high-powered stations, it is generally agreed, will eliminate much of the interference that resulted from conflicting wavelengths.

"Then, too, many of the stirring events that will be broadcast by radio this summer are daytime events. This means clarity of reception. Not only the national conventions, but most of the great sporting classics and other outdoor events throughout the country will be held during the day time. So much for this point.

"Another factor that will make for good reception this summer is the striking improvements noted by our technical committee in the new receiving apparatus now on the market. It is impossible, of course, to measure mathematically the advances made by the radio manufacturing industry in the course of one year. But this may be said: One of the results of the many notable improvements made in receiving sets is that day-time reception this summer will be better than night-time reception in previous years. This ensures that the splendid program of sports, music, speeches and entertainment planned for this summer from many broadcasting centers will be received with great satisfaction by the millions of radio listeners in the United States."

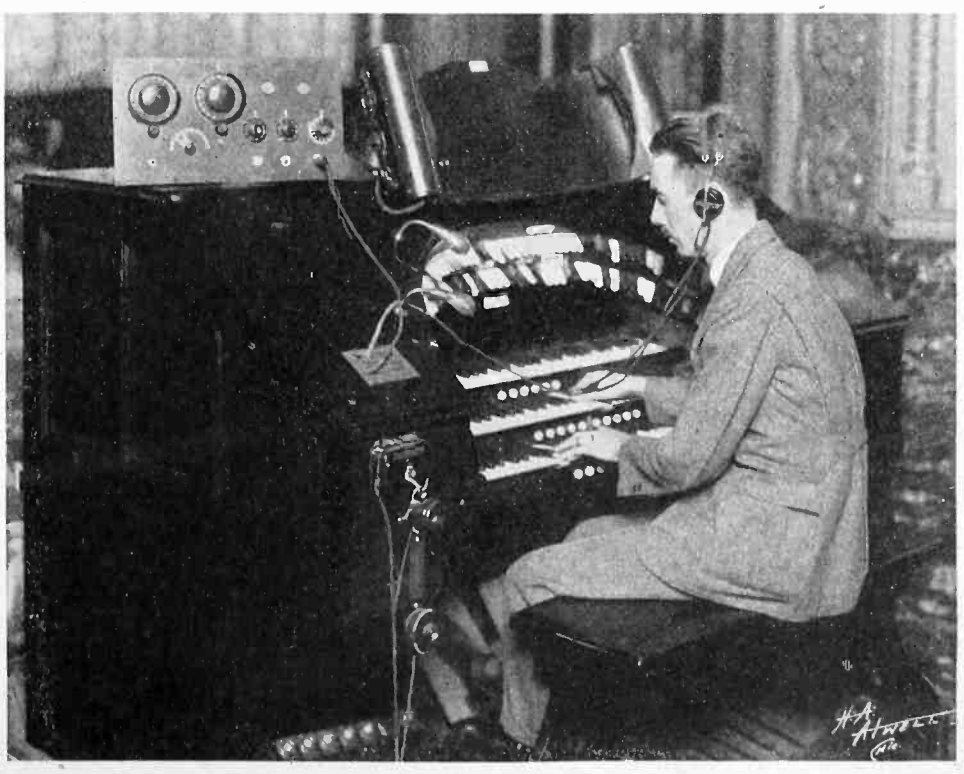
Preliminary reports from radio distributors and dealers indicate the expectation of record-breaking summertime sales of radio apparatus this year.

Hears Coolidge

Listening-in on WGY, the Schenectady station, John G. Coolidge heard his son, President Calvin Coolidge, deliver an address recently at the Associated Press luncheon in New York. Mr. Coolidge hasn't a radio set, but he heard the speech on the set of his neighbor, Richard Brown of Plymouth, Vt. Mr. Brown wired WGY as follows: "President's father heard son's address through WGY. Reception was very good at that time. This was only time during day he could hear because of thunder showers."

Ford Aerial

With a three-tube set installed in a Ford sedan and using an aerial strung from the radiator to the rear tire Harold Finke of Evansville, Ind., recently drove out into the country, stopped his car and succeeded in getting WGY from Schenectady, N. Y., very clearly and with good volume.



ORGANIST HEARS HIS OWN MUSIC

W. Remington Welch, organist at the McVicker's Theatre, Chicago, at the console of the mighty Wurlitzer, hears himself playing his own music as it is broadcast on the midnight concerts from station KYW, the Westinghouse station, Chicago.

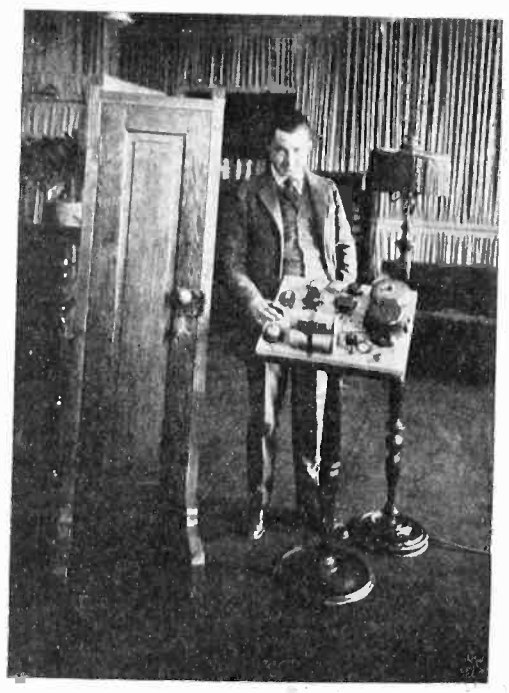
"Props" Used for Radio Drama

DID you know that the realistic rain effects you heard from WGY, the Schenectady broadcasting station, during the production of "The Fortune Hunter" was caused by the rolling of dried peas through a paper tube?

Would it have detracted from your enjoyment of "The Storm" to have known that the forest fire was produced by means of a plumber's gasoline blow torch, the breaking of match sticks and the crushing of paper? The torch produced the effect of rushing wind and flame, and matches and paper, brought close to the microphone, sounded like the crackling of burning tree limbs.

Successful transmission of a dramatic production by radio is dependent upon sound properties. Atmosphere is created and action is simulated by sound, the devices varying with the needs of a particular production.

At WGY, where the radio drama has been a popular weekly feature since August, 1922, special pains are being taken in the preparation of a play for the air to see that maximum sound results are obtained. Considerable experimenting is frequently necessary to produce the sound desired. Two of the most frequently used sound properties of WGY are the door and the bell board. The bell board consists of a convenient arrangement of five bells of different tones and a buzzer. All are connected to dry cells and may be operated by the pressure of a button. There is a door bell, telephone bell, and an alarm bell which may be sounded for fire, ambulance or as a burglar alarm. A clock chime is in the group as is a tap bell.



Edward H. Smith, director of WGY players, with the bell board and door used to produce sound atmosphere in radio drama. The exit and entrance of characters are indicated by the sound of the closing door. There are door bells, telephone, clock chimes, etc., on the board.

Probably no property is more important than the portable door and door frame, for it is only by the closing of the door, in interior scenes, that the entrance or the exit of a character may be conveyed to the radio listener. The door is one of the peculiar conventions of the radio drama. Whereas in the home a softly closing door is considered desirable, it is quite important in the radio drama that the sound of the door and clicking of the lock be loud enough to actuate the microphone. The WGY door is made of thin oak and has a peculiar resonant quality and is easily recognized as a door by its sound.

A. M. JORALEMON

For the past fourteen years with the National Carbon Company in executive capacity, has joined the Crosley Radio Corporation, Cincinnati, as sales manager.

Use Less Wire

EVERYONE who builds a receiving set aims at securing the greatest selectivity. That is why experts are constantly working on new hook-ups.

But in building these circuits to gain selectivity, among many other points of course, there is one point that can be taken up here and that will add materially in increasing the efficient operation of any set.

Eliminate all the wire on the tuning coil that is not in use. Why? Well for this reason, or rather reasons. First, for vacuum tube sets, an oscillating detector will pick up signals within five or ten miles without the use of an aerial. Therefore if there is an excess amount of wire on the coil the unused part will be receiving some other station and the two will be heard in the phones.

Then, for any set, the unused portion of the tuning coil has a certain definite frequency to which it will respond, therefore if the signal received is near this frequency this part of the coil will absorb some of the received energy.

These two reasons should be enough to make any fan tear the wire, that is never used, off the coupler or tuning coil. If this is done there will probably be a noticeable difference on local stations and surely on all distant stations worked.

Rosaline Greene, brown-haired, eighteen-year-old leading lady in WGY radio dramas. She is a former member of the Little Theatre productions in New York University, produced at Washington Square, N. Y.

Untangling the Radiation Tangle

By RALPH R. BATCHER, E. E.,
RESEARCH ENGINEER, A. H. GREBE & CO., INC.

ARTICLE 2

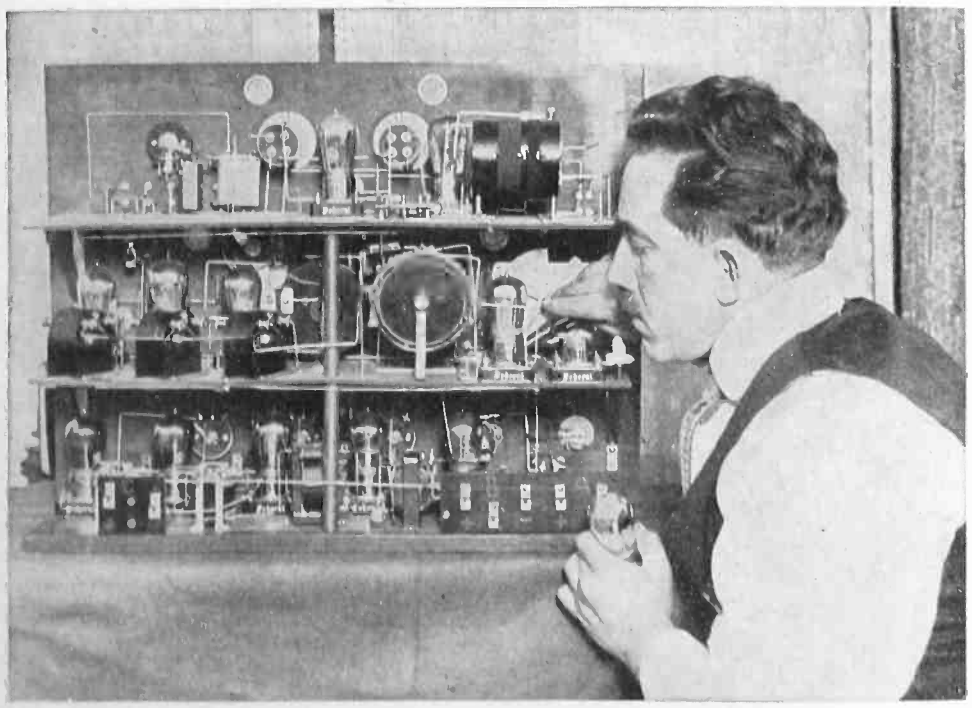
IN THE first installment of this discussion a number of the proposed solutions to radiations disturbances were analyzed.

It was shown that many of these schemes would prove in the majority of instances impractical, or else they were not effective in eliminating the disturbances. It seemed that the only plan that should be considered seriously as a permanent solution is the use of an additional radio frequency stage before the detector circuit. This stage must be so arranged that regeneration is impossible in this tube.

As promised last week, complete details are to follow for the construction of the radio frequency unit known as the "Clarifier" which will completely prevent receiver radiation, no matter how strong the regenerative action in the detector may be. This unit was designed in the laboratories of A. H. Grebe & Co., Inc., and is being placed on the market only after thorough tests on many receivers by a number of individuals, in and about New York City. In each case the eleven requirements were considered which were outlined last week.

It is to be noted that the tube has a balanced output circuit which completely prevents oscillations in this circuit as follows: Whenever the detector tube is oscillating the grid coil acts as a primary of a transformer inducting currents in the winding of the output coil of this stage. Here the current will divide and reach the grid circuit over two paths, but due to the relative directions of the windings of the output coil they are exactly out of phase with each other and so have no effect on the antenna circuit.

Since the panel layout and drilling plans will differ depending upon the type of condenser and rheostat purchased, no definite instructions will be given. The panel and cabinet should be sufficiently large to hold the condenser, tuning coil and one vacuum tube. A photograph (figure 2) shows how the completed instrument looks as constructed by the Grebe Company. This photograph, showing the relative location of each piece of equipment, has various items labeled for simplicity in their description.



TWO SETS IN ONE—A NOVEL SUPER-HETERODYNE

This unique super-heterodyne, built by Henry Brinkman, Pelham, N. Y., is exceptional. Note that the set is built in three separate compartments. The top shelf has two stages of vario transformer tuned radio frequency. On the second shelf is first detector, oscillator and three stages intermediate radio frequency. On the third shelf is second detector and two stages of amplification plus one stage of push-pull amplification. By cutting out the top shelf with its two stages of vario transformer tuned radio frequency, you have a ten-tube super-heterodyne set, which can be used with loop or an aerial and ground. Stations 2LO, London, and CWL, Mexico City, have been heard clearly when weather conditions permit on this remarkable set. Radel & Herbert photo.

The list of apparatus necessary to be purchased by those who prefer to construct their own unit, is as follows:

1. One panel and cabinet.
2. One tube socket, suitable for tube decided upon.
3. One rheostat, suitable for tube decided upon.
4. One glass enclosed cartridge type of grid leak with clips for mounting; one such as sold by the R. C. A. is satisfactory.
5. One honey-comb coil 150 turns, unmounted.
6. One 3-inch length of tubing, 2 inches outside diameter, of paper, fiber, bakelite, etc.
7. One variable condenser of maximum capacity .0004 microfarads. Should have a high maximum to minimum ratio and very low losses.
8. About 60 feet No. 26 wire, with any type of insulation.
9. Miscellaneous material, binding posts, connection wire, spaghetti, etc., the amount of each depending on the type of apparatus purchased.
10. One vacuum tube, UV-201-A and UV-199 are recommended.
11. One ounce of Woods Metal.

The tuning coil consists of 100 turns of wire, tapped at the fifteenth turn from one end. This coil may be conveniently mounted on the condenser by using small brackets of brass. The shape of these brackets will, of course, depend on what make condenser is selected. The coil should preferably be mounted in a position where there will be least magnetic field encountered from the coils in the receiving set. With a well-designed condenser a wavelength range of from about 215 to 590 meters will be obtained. The stabilizing condenser must

next be constructed. This device may easily be made from the grid leak. If the metal ends of the leak are heated slightly they will come off, as they are generally fastened with Woods Metal. The grid leak element is then removed and one cap is replaced on an end.

A small quantity of Woods Metal or other low melting alloy is then melted and poured in the glass tube on one side of the cardboard strip. This will form a semi-circular rod, firmly soldered to the cap on the lower end and extending nearly the full length of the tube. A small brass trough, semi-circular in cross section, is soldered to the other cap. Figure 4 gives the details of this device, how it is assembled, and how it looks when completed.

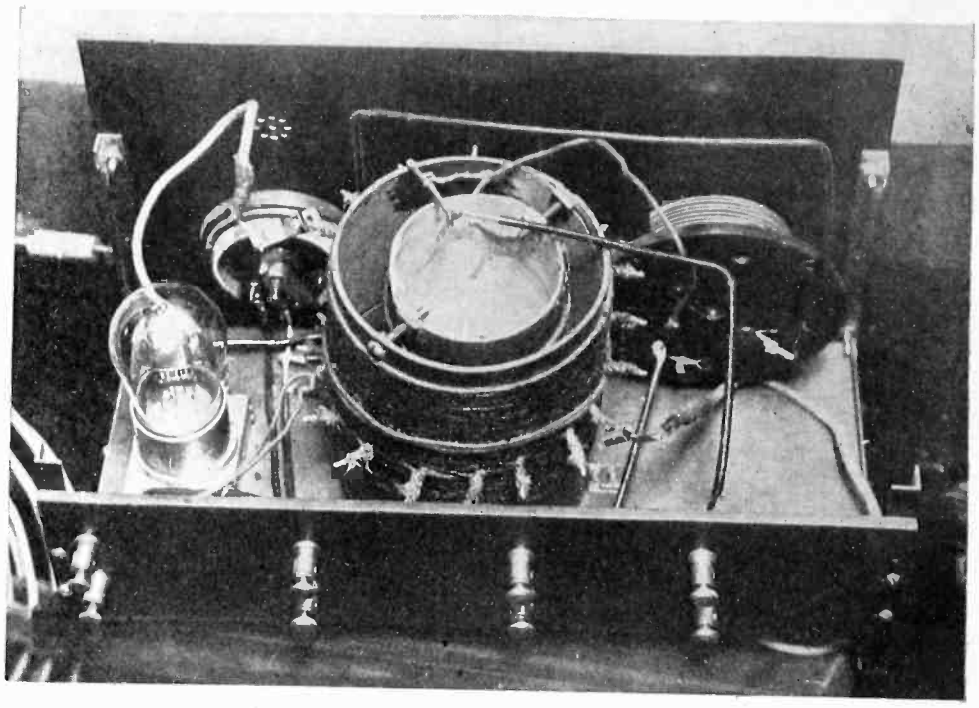
When completed, a small variable condenser with a glass dielectric is obtained which can be readily mounted by means of the grid leak mounting clips. One of the caps should be soldered to a clip. The other cap on the glass tube is then free to rotate, furnishing a means for varying the capacity of this midget condenser. This condenser should be readily accessible from the top of the cabinet, but need not be on the front of the panel because when it is once set, the capacity need not be varied unless the type of tube used is changed.

The honey-comb coil must be tapped as near the center as possible. Careful inspection of the side of the coil should be made and the approximate center turn located. This turn should be pulled out very slightly and a lead soldered on.

The turns on the tuning coil may be wound in either direction and if desired the size and shape of this coil need not be exactly that shown, but the portion connected across the tuning condenser should have an inductance of approximately .250 Millihenry if for any reason the shape must be changed.

An extra binding post is furnished connected directly to the grid, to enable the use of a very short antenna if a long one is not available.

As the photographs indicate, the output coil is completely enclosed in a case to prevent damage to the leads, and to prevent the "B" battery from being short-



One-tube transmitting set built by George S. Myers of Athenia, N. Y. It operates on a UV-201 tube, 23-plate condenser, and an inductance. In addition there is a Ford spark coil, also glass plate condenser for supplying high plate voltage. (Photo by K. & H.)

circuited. Since this coil case is somewhat difficult to construct, the builder of this unit should take particular pains to provide suitable connections to this coil which are protected from breakage. Carefully wrapping the terminals with tape will ordinarily be sufficient. If a spider web coil having about 80 turns of wire with a tap on the middle turn is more convenient it may be used instead of the honey-comb coil. A good coil may be made with two wires wound in parallel on spider web frame, each winding having 40 turns of wire. The outer end of one winding should connect to the inner end of the other and to the center tap. A flexible two conductor cord should be provided to connect the output coil with the rest of the circuit.

The center tap of the output coil is connected with a flexible cord to the plus terminal of the B battery, which should have the voltage recommended for the tube to be provided, for amplifier use. This coil may be laid on top or inside the cabinet of the main receiver whichever is nearest the grid coil of the detector tube.

It is to be noted that no ground connections are necessary on this unit since the regular ground is to be left on the receiver itself. The antenna is disconnected from the receiver and connected to this circuit. The antenna and ground binding posts on the receiver are to be connected together on single circuit receivers such as the Grebe CR-9 or CR-14. On double circuit receivers these posts may be connected together also, if it is found by experiment that there is an improvement by so doing.

It remains to be shown how the balanced output circuit of this tube is adjusted and how the "Clarifier" is to be used in practical cases. After the connections have been made to this device, the tube is turned on to normal brilliancy. The receiving set is adjusted to a low wavelength, such as about 300 meters, and a pair of headphones or loud speaker connected as usual.

Set the receiver dials to receive signals from some broadcasting station. When the tuning condenser is swung around it will at some position be in tune also with the incoming signals. If the "Clarifier" tube is oscillating, the pitch of the notes received will change as its tuning condenser is swung in and out of tune. If this tube is not oscillating the intensity of the signal will change but not the pitch. Since it is desired to stop all oscillations in this tube the small stabilizing condenser is adjusted until the intensity only is changed, when the tuning condenser is varied.

Another method consists of utilizing the feature that all oscillations in a tube are stopped by touching the grid terminal of the circuit with the finger. The stab-

(Continued on page 35)

Department of RADIO ENGINEERING

Radio Topics Institute

Look for the Approval Seal

The above approval seal will be furnished free of charge by RADIO TOPICS, and any article bearing same 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 same meet all Institute tests. Send materials to RADIO TOPICS INSTITUTE, 1112 North Boulevard, Oak Park, Ill.

A Portable Vacation Outfit

FOR the radio fan who is contemplating a vacation trip into the country, away from the high-powered broadcasting stations, and who wants a receiver that is a distance getter, the single circuit here described is "the berries."

It is simple in construction and requires but little patience to tune. It is the type of set used by many DX fans throughout the country and because of the compactness of same and its cheapness, makes a very desirable outfit for the vacationist.

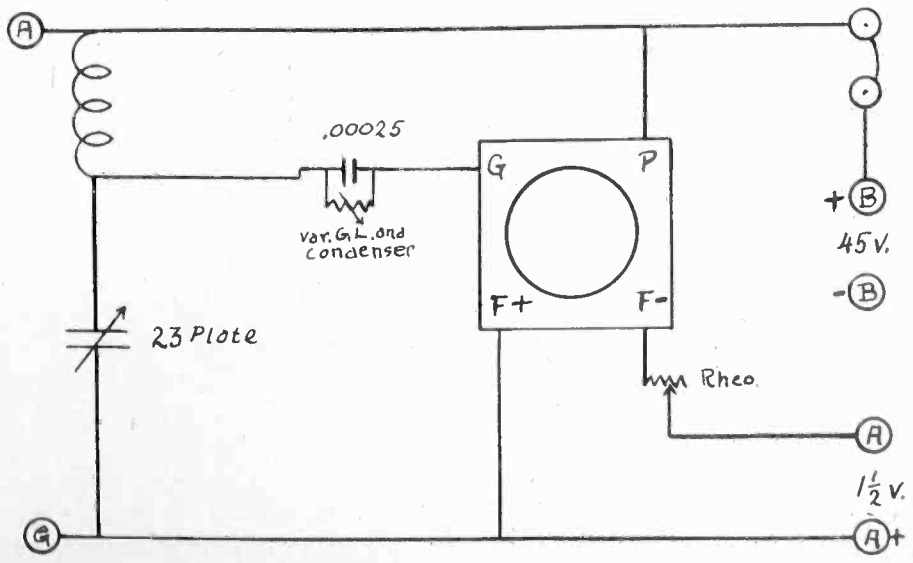
The parts needed are as follows:

100 ft. Aerial wire	$1.00
Ground wire	.60
50 or 100 turn inductance coil	.50
23-plate condenser, .0005 mfd.	1.75
Grid leak (variable) and condenser, .00025 mfd.	1.25
One 30-ohm rheostat	1.00
One UV-199 socket	.50
"C" Battery (for filament)	.60
One 45 volt "B" Battery	2.75
Eight binding posts	.40
One UV-199 tube (or WD-11)	4.00
Panel and cabinet	2.95
Total	$17.30

As will be noted above a "C" or flashlight battery is suggested instead of the regular dry cell. This is because the smaller battery can be tucked away in small space. Small 22½ volt "B" batteries can also be used connected in series for compactness.

The grid condenser should be .00025 mfd. and the grid leak about 2 megohms. If the WD-11 tube is used a 6 ohm rheostat is to be used, and one dry cell "A" battery. In using a flashlight battery with the UV-199 tube tape it at 3 and you will find the filament will light bright enough.

By using double or multiple telephone binding posts several head sets can be used. You can do considerable tuning with a good variable grid leak. By



FOLLOW THIS HOOK-UP CAREFULLY

The plus of your "B" battery goes to the phone. The other side of phone goes to aerial circuit. The honeycomb coil connects to aerial, to the 23-plate condenser and grid circuit. The ground connects to condenser and minus side of "A" battery and plus "B" battery.

changing the honeycomb coil from 50 to the 100 turn coil your wavelength will be increased from 175 to about 500 meters, and navy wavelength stations can easily be picked up.

On account of its re-radiation it is not a set that Radio Topics recommends for city use as it is liable to interfere with your neighbor. But for out in the country, on the lake, or in the mountains, it can't be beat.

Hoover Cup Goes to Minneapolis

The Hoover cup has this year been awarded to Donald C. Wallace of Minneapolis, operator of amateur station 9ZT. The award, known as the "department of commerce cup," is presented annually by Herbert Hoover to the owner of the best all-around amateur station, home designed and constructed.

Announcement of the winner has just been made, following decision of the special committee of judges appointed by Charles Stewart, vice president of the American Radio Relay League and manager of the Atlantic division. The judges were Charles A. Service, assistant secretary of the A. R. R. L.; Howard P. Mason, department editor "QST," and Arthur L. Budlong, editor Current radio department.

Since the passing of amateur station 9ZN Chicago, formerly operated by R. H. G. Mathews, manager of the central division, 9ZT has been recognized by amateurs both east and west of the Mississippi as one of the most reliable relay stations for handling code traffic destined across the continent. The "hub of amateur radio" in this country is centered in Chicago and Minneapolis.

Wallace's station, as the owner puts it, is the "near realization of a lifelong ambition," and, like all stations that have been considered worthy of the requirements of this award, represents to the world at the time what is finest in amateur radio. Station 9ZT is one of those regarded in an idealistic as well as a practical sense, inasmuch as it is kept in readiness for emergency work.

ERNEST TRUEX

Star of the "New Toys" Company now appearing at the Central Theatre, Chicago, who recently broadcast the first act of his new play from WGN, the Chicago Tribune's new station on the Edgewater Beach Hotel.

Circus Broadcasted

FROM calliope to chariot races, from spectacular opening to the ballyhoo of side show "talkers," the circus has gone over the radio.

Westinghouse Station KYW, Chicago, recently broadcast for the first time in radio history the metropolitan opening of a big show—fifth annual premiere of Sells-Floto circus in Chicago's Coliseum.

With a three-way switch, KYW presented the big show performance far beyond both coasts, sending forth side show and menagerie "high lights" to give the typical big top atmosphere to the interesting achievement.

The Sells-Floto performance this season is unusually well adapted to radio, for a sextette of prima donnas, a chorus of several hundred tell the story of the introductory spectacle—"The Bride and the Beasts"—in song. The finale of the number, the unleashing of eighteen lionesses in a steel arena, in which the heroine of the pageant is "thrown to the beasts" gave the fans listening-in a thrill, for the lionesses are thorough in vocal showmanship.

Calliope chants and elephant trumpeting preceded the booming measures of the spectacle, and traditional ringmaster's announcements added color throughout the broadcasting program.

Children on the radio were given a trip around the menagerie oval, for the microphone picked up the roaring salutations of all jungle beasts, the chattering of monkeys, the raucous sigh of the hippo and the laughter of the hyenas.

Long Distance Stuff

ALTHOUGH the Chicago Tribune-Zenith broadcasting station, WGN, located on the Edgewater Beach Hotel, Chicago, is used to distance communications since its establishment of a world's record by confirmed reception in several Australian cities, the studio staff experienced quite a thrill when from one morning's mail delivery letters were extracted bearing postmarks from the West Indies, Bermuda, Cuba, Haiti and Canada.

From John Duperly of 85 King street, Kingston, Jamaica, B. W. I., there came a record of reception on a loud speaker of one of the Macmillan programs put on from WGN each Thursday morning between midnight and 3 o'clock. He reported reception of the April 3 program.

J. B. Kelly, First Sergeant, U. S. M. C., writing from the U. S. Naval Radio Station at Port Au Prince, Republic of Haiti, told of reception of the regular program on the night of April 3.

H. G. Rohne, writing from Felicity Hall, Somerset, Bermuda, told of receiving the April 4 program on a loud speaker. "Your program came in on our loud speaker, filling the room with music," he said, and asked that his thanks be given to several of the artists on the program that evening.

Jose D. Taboada, using one of the applause cards of the Sancti-Spiritus newspaper, "El Fenix," told of reception of the April 5 program "very loud and clear."

Jack Barnsley, writing from Prince Rupert, British Columbia, told of uninterrupted reception of WGN programs for several days, the first time he has been able to make such a report. Barnsley, of course, is the amateur by whom most of the radio code communication with WNP, the Donald B. McMillan station on the schooner Bowdoin, frozen in within eleven degrees of the North Pole, has been carried on.

Farmer's Radio Pays Dividends

MOST radio fans find that their radio sets pay dividends in entertainment and instruction, but the farmer who tunes in WGY and other stations sending out produce market reports is in a preferred position. The farmer, on occasion, may turn radio market information into cash and make such information pay him dividends on his set. One such farmer is reported by F. R. Cozzens of Roxbury, Ohio, in the Southern Ruralist. Mr. Cozzens says:

John Weldon, a farmer of my vicinity, recently got a tip from the air which yielded him $19.60. The "tip" was an unexpected raise in the live stock market, coming at a time when Weldon was preparing to sell a shipment of hogs to a local buyer.

As a result, he got in touch with the city market and $19.60 was his profit over the local buyer's quotations after all shipping expenses were paid.

This was not a streak of luck, however, for Weldon gets such tips frequently, and, they are part of his plan for making his radio pay.

"When I installed my outfit in 1922, I determined to get something from the air besides music," Weldon told me, recently. "I could receive reports from two large city markets, and a number of smaller ones; and to keep tab on these I bought a ledger.

"At the top of each blank page I wrote down the city where the market was located and names of the principal dealers therein, with their addresses. This book is kept on the table where the radio is located, and when I have something to market I get in touch with one of these cities, and write down quotations as I receive them. Then I 'tune in' for another city, and get their prices. Afterwards, I go over these reports and compare them.

"It is a simple matter then, to estimate distance, shipping cost, and so forth, and from this, I can select my market.

"Dealers in these cities are aware of my method, and I have made arrangements with them by letter to accommodate my shipments at any time. This not only applies to live stock, but to poultry, eggs and butter. The latter articles are shipped by parcel post the morning after the quotations are received.

"I have a wide range of markets to select from, where formerly I was compelled to depend upon a local buyer's quotations, or those in the newspaper, which were always two days late.

"And the radio offers another advantage: By getting weather reports and crop conditions from different parts of the country, I can guess pretty accurately the trend of the market."

Special Announcement

Radio Topics has been purchased by Radio Age, Incorporated, beginning with the July number.

Radio Age is edited by Frederick Smith, experienced journalist and successful publisher. Mr. Smith requests that we announce to Radio Topics readers that he is keenly appreciative of the new responsibilities that this increased circulation places upon him and he is hopeful that all the new readers of Radio Age will find a periodical that will please and instruct.

Mr. Smith also announces that important changes in the form of Radio Age may be looked for in the September issue.

The offices of Radio Age are at 510 North Dearborn street, Chicago, and inquiries regarding subscriptions and advertisements may be sent to that address.

There will be no interruption in the services in any way.

Radio Topics takes this opportunity to express its cordial appreciation to subscribers and advertisers for the co-operation so freely and generously extended to this publication and at the same time congratulates its friends upon the fact that hereafter it will have in the combination of two important publications a better and bigger magazine with all the best features of both periodicals combined in the new Radio Age.

How to Connect "C" Batteries

Best results and greatest economy of battery current are obtained from amplifiers when C batteries are used in conjunction with high plate voltages. It is absolutely necessary for clear and faithful reproduction of broadcast reception that the grid be at negative potential with respect to the filament. This negative potential decreases as the plate voltage is raised. When the voltage of the B battery is only about 45 volts or less, putting the rheostat in the negative lead gives the grid the required negative bias, as it is called. Above this voltage, however, a separate C battery should be used. A flashlight battery will do very nicely. It should be connected in the grid return between the transformer and the negative A battery, the negative of the C battery being connected toward the transformer.

The voltage of the C battery should be three or four volts when the plate voltage is about eighty volts and from six to eight volts when the plate voltage is 120 volts, as in 201-A tubes. WD11 or WD12 tubes require only from one to three volts for the C battery.—J. L. Rifkin.

Courtesy of the Air

By ROGER H. BRYANT,
Radio Engineer, Westinghouse Electric & Manufacturing Co.

YOU are all familiar with the expression "the rules of the game." It refers to that great accumulation of unwritten laws governing the conduct of a gentleman in any branch of sport.

A man who lives up to these laws is known as "a good sport" and enjoys the respect of all who know him. Such a man would never take an unfair advantage over his opponent even when to do so might make the difference between winning and losing the game. In other words, it is the practical application of the "golden rule." We see it everywhere. At the theater, the ladies remove their hats so that the people behind them can see more easily. At the concert, only the thoughtless ones talk or whisper during the playing of a number.

Now let us see how the rules of the game apply to radio reception. Every night several hundred broadcasting stations send out the best concert available. The expense involved in operating a broadcasting station is greater than the average man suspects. But just the same, this entertainment is free to all who possess a radio receiving set. That it is free does not alter our obligation to the other members of the audience who have just as much right to an uninterrupted enjoyment of any program they may select as we have.

Unfortunately such is not the case at the present time. There are many people who are just as much annoyance to their radio neighbors as the man who keeps time with his feet is to those around him at the movies. And most of these people do not realize that they are creating a disturbance. At the organ recitals in Carnegie Music Hall, the ushers see that the members of the audience do not create a disturbance, but it is seldom that one of them has to act. It would be impossible to keep as close watch over the vast radio audience but there should be no more need for it than there is in Carnegie Hall. Any of you who listen-in will agree with me that the radio disturbance is many times worse than we would tolerate in a music hall. The question is, what can we do about it?

It seems to me that there are three ways in which the interference can be greatly decreased or practically eliminated.

One way will occur to many people immediately and that is to legislate against the use of any receiving set that is capable of interfering when improperly operated. A second and more desirable way is to educate the operators of receiving sets and to acquaint them with their moral obligations to their neighbors. The third way is to gradually eliminate all receiving sets capable of interfering by a process of development rendering them obsolete.

I am decidedly against the first method mentioned, namely legislation. I believe in laws and every other right minded person does, too. I divide laws into two great classes, the laws of Nature and the laws of man. Most of my time in the last ten years has been spent studying the laws of Nature. I have great respect for them because, to my mind, they are perfection. A certain cause always produces the same effect no matter how hard men may try to make it otherwise. One of the most marvelous things about the laws of Nature is that the number of such laws is so few. Sir Isaac Newton formulated three laws of motion and upon them are based the science of mechanics. If Nature can regulate a universe in the same manner, it would seem that a mere handful of men ought to be able to get along together with but little more. But no. Every time anything displeasing to a few arises there are those who cry "pass a law against it." Of what use is a law unless back of it there is the great force of public opinion which says, "This is for the good of all of us. I am obeying this law. You do likewise."

Just how would you feel if a law were passed forbidding you to use a receiving set which was capable of interfering with your neighbor. My guess is that 95% of you listening tonight would be affected by such a law and that 95% of those affected would feel that their rights were being interfered with.

So I say, let us have no more laws than are absolutely necessary. I want to call your attention though to the fact that the department of commerce has the power to deal severely with the interference problem if it sees fit. There is a paragraph in the laws governing radio communication where a penalty is provided for anyone who wilfully or maliciously interferes with the reception of signals from outside the state. So far this has not been invoked against the owners of oscillating receiving sets and we hope that it will not be necessary.

Our friends in the British Isles began broadcast reception under strict regulations governing the type of apparatus which they might use. It has been interesting to us who are engaged in the radio business to note recently that these regulations have been gradually suspended. While we do not know all of the facts, we can point to one instance where legislation appears to have been satisfactory.

Now let us turn our attention to the second method of handling the problem. This involves the education of the general public and I have been led to believe, from statements by people who know more about it than I do, that this is usually a thankless task. However, I believe that the majority of United States citizens believe in fair play and that when their attention is called to the fact that through improper operation of their receiving sets, they may be a source of much annoyance to their neighbors and they will take enough interest in things to become acquainted with their sets. Such acquaintance should lead to several desirable things. Chief among these is greater satisfaction for all concerned.

Most men who own automobiles can discuss with you the relative merits of nearly every part in their cars but few men who buy radio sets have more than a very hazy idea of what is inside the box.

Until they show the same interest in their radio sets that they do in

(Continued on page 40)

Battery Chargers

By C. R. BLUZAT, Technical Editor

Part II—Mechanical Rectifiers

WE will limit our study to the most common types which are half wave rectifiers in this article. The diagram of a popular model is shown in Fig. 1. The voltage is stepped down to the proper value by transformer T. The value of the current flowing through the A. C. magnet is adjusted by the resistance, r, so that the magnetic field produced by it is opposed and equal to that of the permanent magnet. Then no magnetic force is acting on the spring vibrator which by virtue of its springiness opens contacts a1, a2, and no current flows through the battery.

Upon reversal of the current the magnetic field due to the permanent magnet; the magnetic force overcomes the tension of the spring and contacts a1, a2 are closed and current will flow through the battery. It is thus seen that only one half of the wave is utilized.

Little energy is lost during the half cycle which is not rectified, only enough to account for the losses in the transformer and the vibrator which are kept low by a proper design.

The spring vibrator can be slided along X, thus enabling one to adjust its period of vibration to the frequency of the current wave. The carbon rod or any other contact device may be moved, thus changing the distance between contacts a1 and a2, until sparkless commutation is obtained. Some models are even equipped with a fixed condenser across the contacts so as to prevent sparking.

Adjusting the Resistance

Different taps may be taken from the transformer secondary to give different voltage (see Fig. 2). Adjusting resistances R1 and R2 allows a means of regulating the charging current between wide limits. A .5 amp. outfit was made to yield between .2 amp. and 1 amp. by adjusting the resistance without undue sparking. The ammeter A is to be relied on only as an indicating device of charging or discharging. No attention should be given the scale, if there is one.

The most important points to consider when buying such an outfit are: Rated current, ease of adjustment of the contact distance, sparking at contacts.

The proper current is determined by the number of tubes of the set and the number of hours the set is in operation every day.

The current drawn by each tube being known, the total current to be furnished is easily determined. Suppose we have a five tube set using four UV201-A and one UV-200. The current required will be one ampere for the four UV201-A (each requiring only 25-100 of an amp.) and one ampere for the UV-200 making a total of two amps. Assuming that the set is operated an average of three hours a day, a two-amp. charging outfit would be sufficient. If all the tubes were each drawing one amp. as would be the case of UV201 were used, the total consumption of current would be 5 amps.; to recharge the battery after a day's operation would require over eight hours with the two-amp. outfit; then it will be preferable to buy a five-amp. charger.

See that the contact distance can be varied over a wide range without impairing the functionment of the rectifier (some makes have too critical an adjustment). This gives a means of adjusting the D. C. output current, sparkless commutation being duly considered at the time of adjustment. It is, however, preferable for the regulation of the current, to vary the value of the adjusting resistance. The efficiency varies between 30 to 50 per cent.

Fig. 3 shows the connections of a charging outfit so that the operator may switch conveniently the battery on charge or on discharge through the receiving set. The terminals of the charger are generally marked positive and negative and they should be connected to the same polarity terminals on the battery.

Tube Rectifier

In this type of rectifier the bulb is the rectifying agent. The bulb is of the two electrode type. The

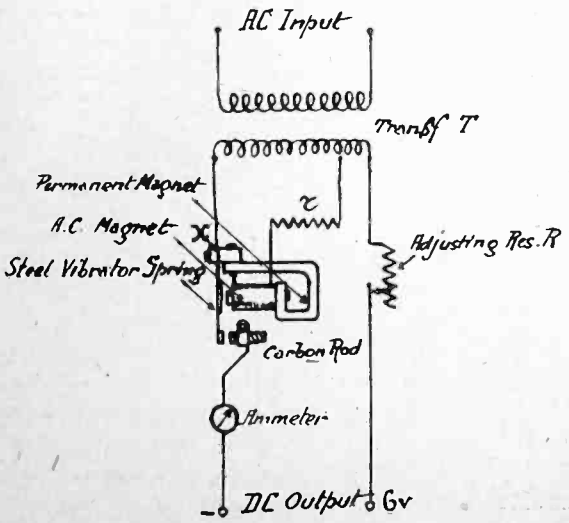


Fig 1

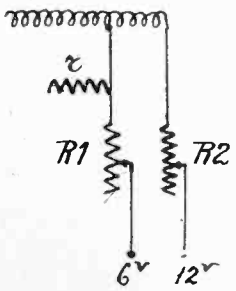


Fig 2

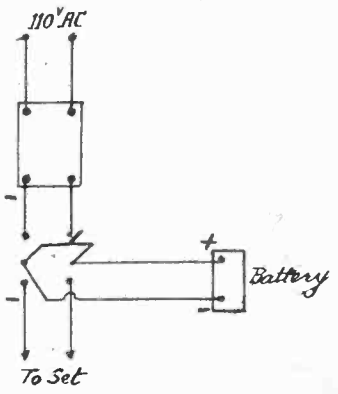
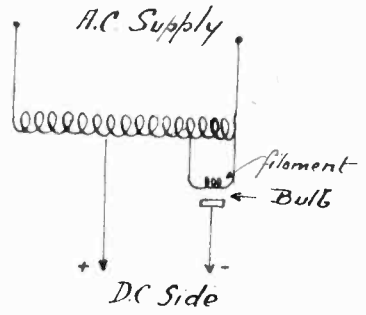
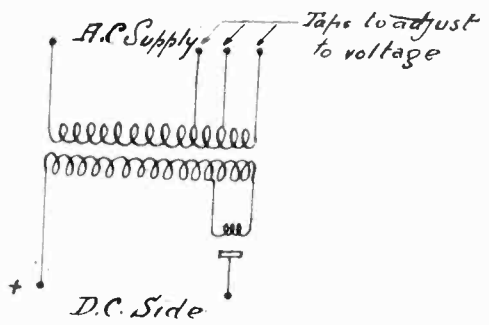


Fig 3



- Fig 4 -



- Fig 5 -

cathode (or negative electrode) consists of a filament of tungsten wire, and the anode (or positive electrode) is a piece of graphite. The tube is filled with an inert gas, at low pressure, usually argon. When the filament is brought to the incandescent point, it emits very small electric particles called electrons, which are of negative polarity. When the filament is negative (for one-half of the wave) the electrons are attracted by the anode which is at a higher voltage; these electrons colliding with the gas molecules ionize them, thus making the space between anode and cathode conductive, resulting in a current flow from anode to cathode.

When the filament is positive (for the other half of the wave) the emitted electrons are driven back to the filament; no ionization of the gas takes place and consequently no current flows through the tube.

Fig. 4 shows connections of a half wave rectifier of the auto transformer type.

Fig. 5 illustrates the connections of the general type. The taps on the primary side are used to adjust the outfit for various line voltages.

For the fans interested in building such an outfit the following specifications are given for a 2 amp. charger (see Fig. 6). The transformer core is 1⅜" by 1" in cross section and has a window 1¼" by 2½". Pieces of transformer iron, of 1⅜" by 3⅞" are to be used, enough being bought so as to make a total stack 5 inches high. The windings should be wound on wooden forms 1½" by 1⅛", these being wrapped with one layer of insulating paper.

Winding Primary

The primary consists of 610 turns of No. 20 S. C. C. wire, the length of the coil to be 2⅜"; each layer is shellaced before the next one is wound. The secondary winding consists of 150 turns of No. 16 D. C. C. between taps 3 and 4.

Between tap 4 and 5 is wound the filament excitation winding consisting of 10 turns of No. 12 D. C. C., wound on top of the secondary winding from which it is insulated with a layer of insulating paper. The approximate length of wire required is 300 feet of No. 20 S. C. C., 75 feet of No. 16, D. C. C., and 6 feet of No. 12 D. C. C. The windings are removed from the forms and carefully taped. The core is then assembled, the laminations being stacked as shown by Fig. 7, first inside the windings then across the two core legs obtained. The windings may also be wound directly on their core legs stacked to the proper thickness in the manner in Fig. 7, carefully insulated with tape and each end fitted snugly in two wooden blocks 1½" deep in the block. When through, the excess tape on both ends is cut off and the magnetic circuit is completed. The core obtained must be clamped tight using angle iron and bolts, the angle iron affording an easy way of fastening the core to a base and of putting a bakelite panel on top for the bulb fuse and switch. The efficiency of the half wave rectifiers varies between 35 and 40%. On the half cycle, when no current flows through the bulb as explained, only enough energy is supplied for the transformer losses and the lighting of the filament. With two bulbs, both halves of the wave can be used, but the complication and expense are not worth while for the ordinary radio battery charging. The commercial models are of 2 amps. and 5 amps. The choice between the two should be made as for the mechanical type; however if the battery is of a lower capacity than 40 ampere-hours, the 2 amps. outfit shall be preferred as 5 amps. would be too high a charging rate for the battery. Special care should be given to the core to see that it is not loose in which case the operation would be noisy.

Motor-Generator Sets

Only a word will be said about these as they have not met with much favor due to the higher ini-

(Continued on page 32)

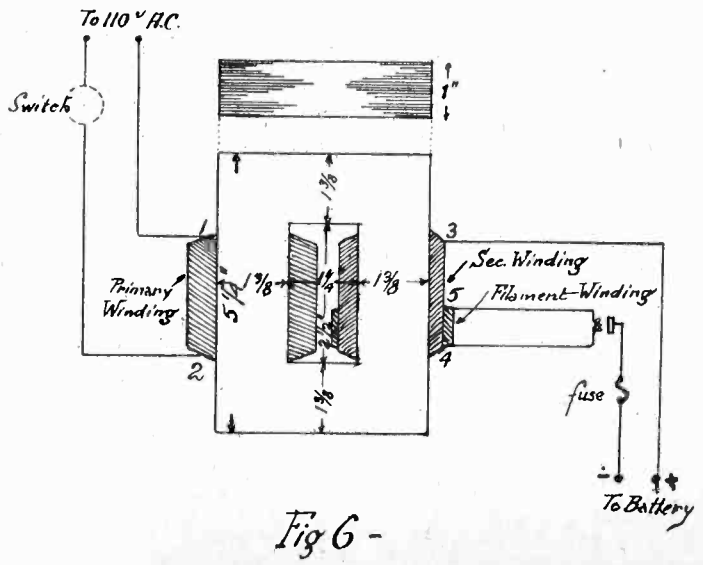


Fig 6 -

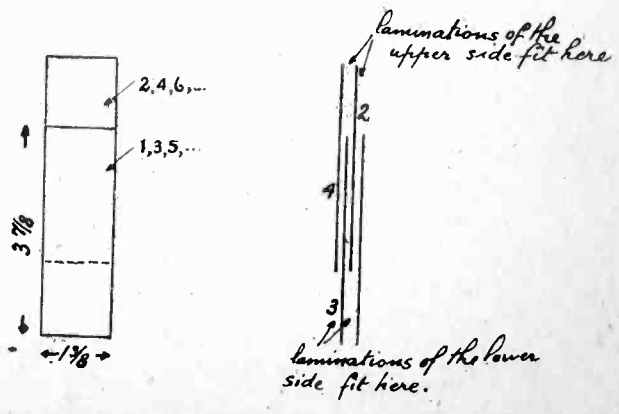


Fig 7

Crosley Company Wins Suit

FEDERAL JUDGE DECLARES MUSIC BROADCAST BY RADIO "NOT A PUBLIC PERFORMANCE FOR PROFIT"

IN A suit before Judge Smith Hickenlooper, U. S. District Court, instituted by Jerome H. Remick and Company, New York music publishers, against the American Automobile Accessories Company, Cincinnati, in which the plaintiff attempted to compel the latter corporation to pay a special tax for permission to play copyrighted music, the judge rules that the present copyright law does not cover broadcasting music via radio.

At the time the suit was filed the Crosley Manufacturing Company, operating Station WLW, was a division of the American Automobile Accessories Company. Since then, however, it has become a part of the Crosley Radio Corporation, of which Powel Crosley, Jr., is president.

The high point in the opinion handed down by Judge Hickenlooper is the holding that the broadcasting of a rendition of a copyrighted musical composition is not a "public performance for profit" within the meaning of the music copyright law, for the reason that to constitute a public performance in the sense Congress intended the words it is essential that there be an assemblage of persons congregated at the place of amusement for the purpose of hearing that which transpires there. He dismissed the Remick petition on the grounds that the facts stated did not establish cause for action.

Crosley's Statement

When Mr. Crosley was notified that the suit had been decided in his favor, he issued the following statement:

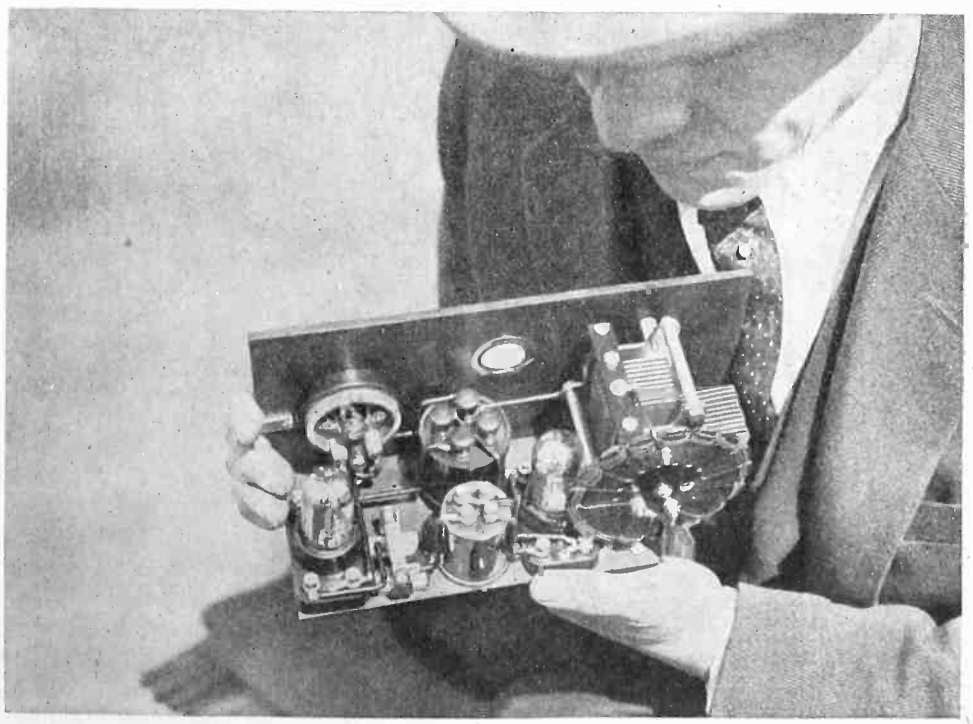
"Although we have won our fight against the publishers of copyrighted music, we do not intend to use such in our broadcasting station. The National Association of Broadcasters is collecting a large amount of excellent music, which is not copyrighted and from which our songs will be selected."

The decision of Judge Hickenlooper was one of the most important ones ever handed down in which the radio industry was affected, and it will have a tremendous bearing upon the development of broadcasting as it literally makes the air free for radio. In other words, it gives to radio broadcasting stations the right to play all music, no matter whether it is copyrighted or not, without their being compelled to pay a special tax to the American Society of Composers, Authors and Publishers, of which the plaintiff, in this case, is a member.

The Crosley Radio Corporation was represented by Allen and Allen, well-known patent attorneys, whose sole contention during the court proceedings was that the broadcasting of a song was not a public performance for profit. They admitted the defendant corporation had played copyrighted music, as charged in the suit, but contended such action was not in violation of any law. They pointed out the fact that the copyright law, so far as music is concerned, permits those holding the copyright to place a special tax on their compositions providing those who play it do so publicly for profit, but that it does not permit the levying of any tax on those who play the music without profit to themselves.

Campaign Two Years Old

The campaign against broadcasting stations was started by certain members of the American Society of Song Writers, Authors and Publishers about two years ago. They began by notifying the studio directors that they could not play certain music unless they announced before each selection that it was being played by permission of the Society. There was no objection to this on the part of the broadcasters, and the wishes of the Society were complied with. Some time later, however, the Society notified all broadcasting stations that they must pay a special tax to the Society before they could play copyrighted music. There were a number of station owners who agreed to the request of the Society and paid this tax, but there were others, including the Cros-



A NOVEL PORTABLE SET—TWO-TUBE REFLEX

Sidney Kasindorf, amateur operator of station 2-ATV," showing the interior of his novel two-tube portable reflex receiver. He uses two UV-199 tubes, a condenser and pancake coil for tuning. It is so compact it can be carried in a small suitcase, which holds all the necessary batteries, phones, etc. Perhaps the most interesting feature of the set is this: Mr. Kasindorf uses a fine wire fishline for aerial and ground, and it is actually possible to fish and receive broadcast music at the same time by placing the hook and sinker on the flexible ground wire and throwing same into the water.—(K. & H. photo.)

ley Radio Corporation, who contended the imposition of this tax was unconstitutional and refused to pay it.

A large amount of music was being published by independent music houses, and distributed among the radio stations by the National Association of Broadcasters, and from this the radio stations selected their songs. The task of eliminating all copyrighted music, however, was a fairly large one, and due to an error a copyrighted selection was played from WLW. This happened to be a song published by the Remick Company, and so that organization filed the suit, which Judge Hickenlooper has just dismissed.

Judge Hickenlooper's Decision

In his decision, Judge Hickenlooper stated:

"We simply feel that the rendition of a copyrighted piece of music in the studio of a broadcasting station, where the public is not admitted and cannot come, but where the sound waves are converted into radio frequency waves and thus transmitted over thousands of miles of space, to be at last reconverted into sound waves in the homes of the owners of receiving sets, is no more a public performance in the studio, within the intent of Congress, than the perforated music roll which enables the reproduction of copyrighted music, by one without musical education, is a copy of such music.

"A private performance for profit is not within the act, or is a public performance not for profit. All contemplate an audience which may hear the rendition itself through the transmission of sound waves, and not merely a reproduction of the sound by means of mechanical device and electromagnetic waves in ether. A parody upon the singing of a copyrighted song has been held not to infringe the copyright (Bloom & Hamlin vs. Nixon, 125 Fed. 977). And by much the same token we think that the rendition of a song in the seclusion of a broadcasting studio and its subsequent reproduction by a radio receiving set, where the auditors are scattered over a vast territory, is not a public performance within the intendment of Congress in enacting the Copyright Law. The auditor listening in at Indianapolis, Cleveland or Chicago would be surprised to learn that he had, that evening, attended a public performance in Cincinnati. This illustrates the incongruity of such a holding."

If the decision of Judge Hickenlooper holds, it will obviate part of the present Dill bill, now in Congress, which would permit public performances of copyrighted music.

CORRESPONDENCE WITH THE INSTITUTE

THIS department is conducted by C. R. Bluzat, Technical Editor, RADIO TOPICS. Any inquiries addressed to him will be answered promptly, provided stamped and self-addressed envelope is enclosed with inquiry.

Please make your questions as concise or brief as possible.

This is your department. Use it freely.

TECHNICAL EDITOR, RADIO TOPICS,
1114 North Boulevard, Oak Park, Ill.

TECHNICAL EDITOR:

Will you please advise me where I can get blue print plans and working instructions for the Superdyne receiver. I want to build one, but cannot get anything about it in my part of the country. There is an article in January RADIO TOPICS, *written by C. D. Tuska, president of the C. D. Tuska Co., on the Superdyne receiver, in which he advises or asks anyone building a Superdyne to advise him of their success. I would write the Tuska Co., but do not know in what city they are located and can find no advertisement of theirs. An early repuly will be appreciated.*—Wesley Hafer, Newport, Ky.

ANSWER: Address the Tuska Co., at Hartford, Conn. I advise that you write them and they will certainly take pleasure in answering you as early as possible.

TECHNICAL EDITOR:

I want to know how to hook up a telegraph set, what I need besides the set? It is a 20 ohm set, and how far could I receive signals with it. Do I need a license? Could I use a radio aerial, ground and phones with this set? Do I need any batteries? Could I receive signals from ships, if not where would I receive from. I will be very pleased if you answer these questions.—Richard Blair, St. Paul, Minn.

ANSWER: Department being limited to queries on receiving sets, I advise you to write to the American Radio Relay League, Hartford, Conn., describing your telegraph set very completely. Your present letter gives such a poor description of the set that no answer would be given by the A. R. R. L. people.

TECHNICAL EDITOR:

It may interest you to know that I made the set described in your issue of December, 1923. This set has performed remarkably well, I think I am in a position to know, as I have been at the set building business off and on for the last three or four years. I have made six or seven different hookups in the last four or five months and I have not come in possession of any yet that shines up with this one. Now it is my object to add two stages of amplification as shown in this same above mentioned issue and I would like to ask a few questions in regard. I intend to use for the first stage as transformer with a ratio of 5 to 1. For the second, a 3 to 1. Do you think this is a good idea?

Also I would like to use one rheostat to control both amplifiers, which will be UV-201-A's at 90 volts "B" battery. Would you give me an idea of what resistance this rheostat must be? Also would appreciate a diagram of same kind showing how the 2 stages would be hooked up so that I can use either detector alone with head phones, or with loud-speaker and both stages. Do not quite understand the jack arrangement or what kind of jack to use. I have a single circuit jack which I think I can use for the loud-speaker. Would the first two connections that start out on the amplifier as shown in the magazine, connect right on to where the head phones do in the set I have now? —Arville A. Sault, Hammond, Ind.

ANSWER: The ratios you propose for the transformers are all right. One 6 ohm rheostat will be enough for both tubes and it should be hooked as I show on your sketch. If you want to listen on the detector circuit alone, you should use a two-circuit jack such as the one shown for the first stage on your sketch. If you do not want to listen on the first stage, disregard the jack and connect as I show. The two outside lugs of the two-circuit jack used on the detector plate circuit must be connected where your phones are now. A single circuit jack is as the one shown on the second stage of your hook-up and should be used as it is for loud speaker.

New and Novel Radio Patents

WIRELESS TELEPHONE INSTRUMENT

(Patent No. 1,486,049, issued to George B. Spring, Milford, N. H., under date of March 4, 1924.)

This invention relates to improvements in wireless telegraph and telephone instruments, and more particularly to a circuit completing device for completing the aerial or ground circuit of receiving instruments.

An important object of the invention is to provide a device for completing an aerial circuit which acts either as the aerial or ground of the circuit and which is applied to the body of the operator.

A further object of the invention is to provide a device of this character which is applied simply by placing the ear pieces of the head set in position upon the head of the operator.

Fig. 1.

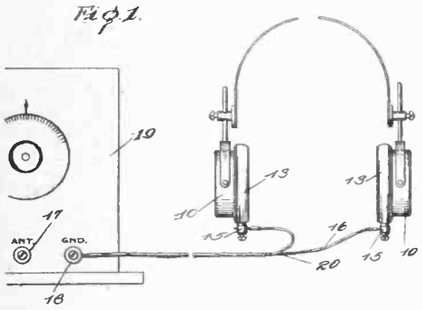
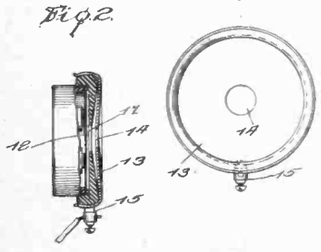


Fig. 3

Fig. 2.



Electrical Condenser

A still further object of the invention is to provide a device of this character which while capable of incorporation in the construction of the head set, may be so formed as to be applicable to the receiver portions of the head sets now in use.

Another object of the invention is to provide metallic contact pieces adapted to cover the cap of the ear piece of the receiver and which by its contact with the body of the operator when the ear pieces are in position may be employed either as an aerial or ground connection for the receiving set by simply electrically connecting the same to the proper terminal of the set.

Figure 1 is a fragmentary side elevation showing apparatus constructed in accordance with my invention applied to a receiving set as a ground therefor;

Figure 2 is a side elevation of a receiver showing the device attached thereto, parts being broken away; and

Figure 3 is a plan view of the connector detached.

The cap 13 is provided with a binding post 15 by means of which a lead wire 16 may be connected to the same, the opposite end of this wire being attached either to the aerial connection 17 or the ground connection 18 of the receiving set 19 as may be desired. Where the head set employed in connection with the receiving set 19 embodies two receivers, a cap 13 is applied to each of the receivers and the wires connected therewith are joined, as at 20, for connection to the terminal 17 or 18 as the case may be.

Fig. 1

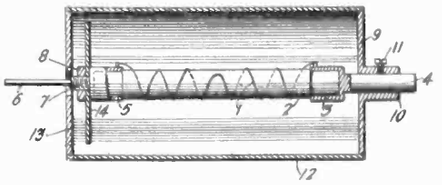
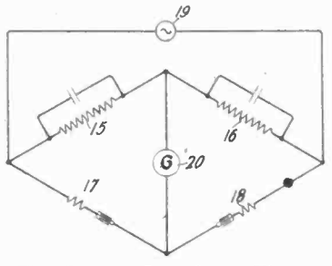


Fig. 2



The Stevens Impedence Element

IMPEDANCE ELEMENT

(Patent No. 1,480,227, issued to George H. Stevenson, Rye, N. Y., under date of January 8, 1924.)

This invention relates in general to electrical impedance elements and more particularly to adjustable impedance elements adapted to be used in systems employing high frequency alternating currents.

It is the object of the invention to provide an impedance element which may be very accurately adjusted and which shall be simple in construction and inexpensive to manufacture.

Devices of this character are particularly useful where an accurate balance between two impedances is required. In the preferred form of this invention a variable condenser is provided which has sufficient range of capacity to obtain an accurate balance of two such elements. A shield is provided to insure that the electrostatic lines of force emanating from the impedance element terminate always on one surrounding surface whose potential relatively to the impedance element is fixed. This gives definiteness and constancy to the effective reactance of the element. The shield so provided forms one plate of the condenser. The other plate of the condenser is a disk within the shield which is adjustable by means of a longitudinally movable shaft supporting the disk as well as the resistance winding.

Fig. 1 is a sectional view of its preferred form; and Fig. 2 is a diagrammatic representation of a circuit in which the invention may be employed to advantage.

A non-reactive winding 1 is wound upon a shaft 2 which is preferably of insulating material. One end of the shaft 2 fits tightly into the cup-shaped end 3 of a shaft 4 which is made of conductive material since it serves as one terminal for the non-inductive winding 1. The other end of shaft 2 fits into the cup-shaped end 5 of a shaft 6. Shaft 6 with its end 5 is of conductive material and serves as the other terminal for the winding 1. Shaft 6 is provided with a threaded portion 7 and a nut 8 fitting thereon.

Figure 2 shows a Wheatstone bridge adapted for measurements with alternating currents of high frequency. It includes a quadrilateral arrangement of ratio arms 15 and 16, and two arms 17 and 18 containing impedance elements to be balanced and measured. High frequency current is impressed on the bridge from the current source 19, and the state of balance is indicated as usual by a current detector 20.

RADIO CALLING SYSTEM

(Patent No. 1,485,773, issued to Lloyd Espenschied of Queens, N. Y., under date of March 4, 1924.)

This invention relates to methods and means for maintaining communication between two radio stations, and in particular to methods and means for calling or signaling the operator at a remote station. Its object is to permit convenient and reliable calling of such stations. A further object is to provide an arrangement for this purpose which will not require the constant personal attention of an operator.

In brief, the invention consists in using what may be termed the "carrier-off" method, that is, the transmitting station transmits a carrier wave continuously on which a message may from time to time be impressed. When it is desired to call a station, the transmission is suppressed and, as a result, certain operations take place at the receiving station giving some audible or visible signal suitable for calling the attention of the attendant.

Figure 1 represents diagrammatically a transmitting station T adapted to co-operate with a receiving station R.

Figs. 2 and 3 are characteristics of the detector at the receiver station R and illustrate more clearly the method of operation of the invention.

Fig. 4 shows a modification of a portion of the receiver station of Fig. 1.

Referring particularly to Fig. 1, the transmitting station T comprises a radiating antenna 5 with which is associated any suitable form of oscillation generator. For the purposes of illustration only, I have shown a vacuum tube generator comprising the well-known three-electrode tube O, this letter suggesting its function as an oscillator. Connected from the filament to the plate of this tube is an inductance 7 and connected from filament to grid is an inductance 8, these two inductances being inductively related to each other, whereby power is transferred from the output circuit to the input circuit. Also, in order to definitely determine the period of oscillations of the generator, there is connected a condenser 9 from the grid to the plate. The antenna is shown as associated with the oscillator by means of the winding 11 adjacent to the winding 7. Power is supplied to the vacuum tube by means of a generator 12. The combination of elements, as thus described, constitutes an efficient generator of oscillations.

In order to transmit messages, it is necessary to modulate the carrier wave generated by the oscillator O with the message to be transmitted. For this purpose there is bridged

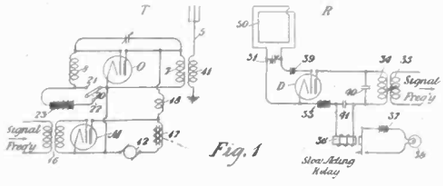


Fig. 1

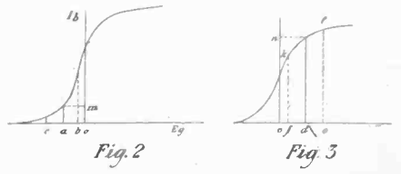


Fig. 2 Fig. 3

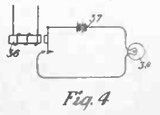


Fig. 4

Radio Calling or Signaling

across the terminals of the power line a vacuum tube M, this letter indicating its function as a modulator. The plate and filament of this tube M are directly connected across the power line, and from the filament to the grid there is connected the secondary of a transformer 16 on the primary of which may be impressed the message to be transmitted and marked as signal frequency. In such a circuit it is desirable to include a choke coil 17 adjacent to the generator 12 and an inductance 18 between the oscillator tube and the modulator tube.

ELECTRICAL PROTECTOR

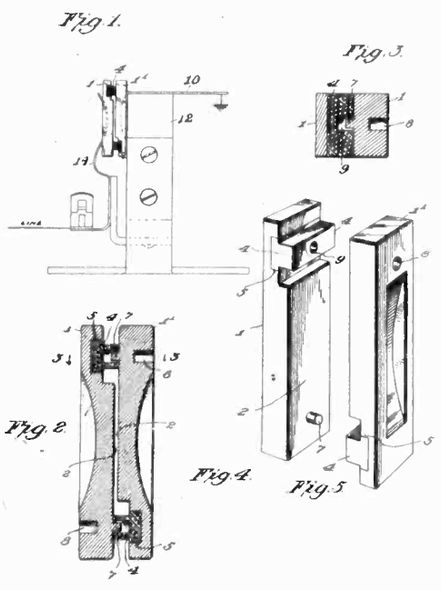
(Patent No. 1,457,249, issued to George W. Janson of Brooklyn, N. Y., under date of May 29, 1924.)

This invention relates to protective devices for electric circuits, commonly referred to as lighting arresters.

The purpose of the present invention is to provide an arrester in which the air-gap is very accurately determined and definitely maintained and wherein no mica or other separators are interposed between the arcing surfaces so that an inspector can readily detect any attempt to alter the thickness of the air gap.

Figure 1 is a side elevation of an electrical protector embodying our invention; Fig. 2 is a central longitudinal sectional view of the same; Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 2; and Figs. 4 and 5 are front and rear perspective views of one of the electrode blocks.

The protector or arrester is composed of a pair of metal block electrodes 1, 1' having arcing surfaces 2, 2, accurately planned or



G. W. Janson Electrical Protector

ground to a true plane which are positioned to oppose each other with a definite air-gap determined by means of insulating posts 4, 4 solidly held in transverse grooves 5, 5, by a force fit or by crimping or pricking in the marginal metal. The parts are positioned and held against lateral shifting by pins 7, 7 which may either be inserts or may be extruded from the body of the blocks by means of a punch pressing the metal from the back and causing it to flow into a recess in a die bearing against the face of the block. The recess 8 indicates the depth of penetration of the punch. The insulating posts or blocks 4 are provided with apertures 9 to receive the pins.

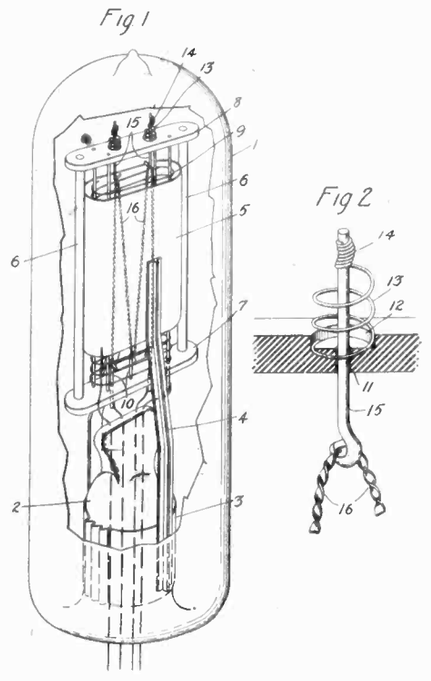
VACUUM TUBE

(Patent No. 140,208, issued to William G. Housekeeper, New York, N. Y., under date of January 8, 1924.)

This invention relates to a suspension device and has particular reference to a device for supporting an electrode of a vacuum tube.

Fig. 1 is a side view partially broken away of a vacuum tube embodying the invention and Fig. 2 is an enlarged detail of the suspension device.

A vacuum tube 1 is provided with a reentrant stem 2 on which is arranged a collar 3 having arms 4 extending therefrom into the interior of the tube. Carried by the inner ends of the arms 4 is a substantially cylin-



New Vacuum Tube

drical anode 5 to which are welded rods 6. Carried by the ends of the rods 6 are the lower and upper lavite blocks 7 and 8 between which is arranged the grid electrode 9. Extending upwardly from the lower block 7 and rigidly mounted therein are the hooks 10. In the upper block 8 are provided apertures 11, the upper part of which are countersunk as at 12. Arranged in each countersunk portion 12 is a resilient support which comprises a loosely wound wire helix 13 of a diameter approximately the same as that of the countersunk socket 12. Integral with the helix 13 is a closely wound wire helix 14 of considerably smaller diameter than the helix 13. The shank of the hook 15 extends through the aperture 11 and the helices 13 and 14, the helix 14 closely embracing the shank. That portion of the shank arranged within the helix 14 and the helix itself are crimped to provide a tight connection between them. The cathode 16 is strung between the hooks 10 and 15 and is maintained under uniform tension by means of the springs 13.

Radio Circular Revised

A second edition of Bureau of Standards Circular 74 on Radio Instruments and Measurements has been issued. This circular presents information regarding the more important instruments and measurements actually used in radio work and is planned to be of use to government officers, radio engineers, etc. It makes no attempt to deal with the operation of apparatus in sending and receiving, but other publications by the Bureau on that and on other subjects are listed in Appendix 2.

The first edition of this circular was issued March 23, 1918. The new edition contains a number of corrections and revisions. Many of the matters dealt with are or have been under investigation in the laboratories of the Bureau of Standards, and are not treated in previously existing publications. The bibliography of radio publications has been considerably extended.

Copies of the new edition of Circular 74 may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., the price 60 cents.

Prizes for WNP Messages

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

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

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

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

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

Amateurs who pick up the messages sent from WNP are re-

(Continued on page 40)

How Vacuum Tubes Are Made

ALTHOUGH hundreds of thousands of dry cell vacuum tubes are now in use by radio enthusiasts, it is safe to say that only a very small percentage of the users know anything at all about their process of manufacture.

These little tubes, because of their convenience and low operating cost, added tremendously to the interest in broadcasting, and gave to the great general public an opportunity to obtain tube receivers. Before the coming of radiotrons WD-11 and UV-199, the greater number of receiving sets used the crystal detector and thus were limited in range.

Great care is necessary in the manufacture of these tubes, which despite the fragile character of the material are sturdy bits of apparatus, well adapted to stand fair handling and give constant service during long periods.

Thirteen Steps Necessary

There are thirteen steps or processes of assembly before the tube, starting as raw material, takes its completed shape. There is also a test made after each assembly and still further tests after the tube is completed. These tests are so severe that once a tube has passed through them, it is rarely returned because of failure in operation.

The raw material from which the tube is assembled consists of the following: A glass blank, a thin glass stem, a short tube of glass; the filament; the plate and grid. The plates are shaped from rectangular bits of metal and the grid wires are wound into the spiral form they take in the completed tube. The illustrations show these various parts clearly.

The first step in the assembly process is spinning a flare on the end of the short glass tube. This tube is then called the flare.

Next is the inserting of the five wires in the flare. Looking at the WD-11 one can see five wires on the inner unit though there are but four leads at the base. The fifth wire is a blind insert to act as a support for the plate. The five wires are inserted in the end of the glass tube opposite the flare and the glass melted to the shape seen in the completed tube, thus holding firmly in place the wires. The glass tube with its five wires inserted is now called the press.

Assembling Parts

The five wires are next cut to their proper lengths so that the plate, grid and filament can be mounted. These units are spot-welded in place by girl operators, each of whom is a highly skilled worker. The filament used in the WD-11 is a metal wire coated with oxides.

Now the glass blank is tubulated, or in other words, the thin glass tube is placed on its end after a small hole has been melted in the glass blank with a gas flame.

Next the press is sealed to the bottom of the blank. In this process the flare is held tightly to the bottom of the blank and a flame melts the glass sufficiently so that they weld together.

As the long glass stem is placed on the blank for the purpose of exhausting the tube, this process is the next in order. The long glass stem is inserted into a piece of rubber tubing which leads directly to the pumps, which are two in number. An oil pump and a mercury vapor pump are used to exhaust the tube down to the required vacuum. Before the pumps are turned on, a covering which serves as an oven is pulled down over them and they are subjected to a high temperature to drive gases from the glass walls and metal parts.

Vacuum Tested

Then the pumps are turned on and the tubes exhausted to a very low pressure which is at a much higher point of exhaustion than that given the electric lamp.

A coil of wire surrounds the tube when placed in the exhausting machine and by means of a high tension spark the vacuum is tested. Next the plate of the tube is heated red hot by a high frequency oscillating current generated from transmitting tubes to remove the gas from the plates and metal supports. The plate oscillations are next turned off and the filament heated to obtain the proper chemical reaction on the filament oxide and thus increase the possible electron emission. The pumps are turned off and a gas flame run around the bottom of the long glass tube until it melts off and forms the tip of the vacuum tube.

The tube is now complete except for the base, which is baked on by a machine and then the tips which contain the leads from the inner unit of the tube are neatly soldered and surfaced.

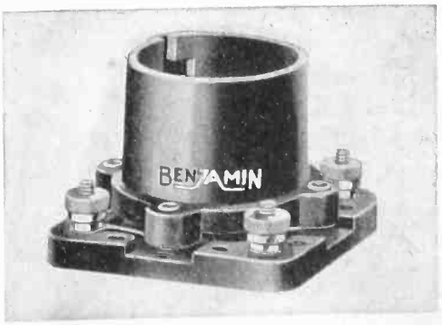
Radio a Boon to the Traveler

RADIO receiving sets seem destined to become part of the regular paraphernalia of travelers both at home and abroad.

WTAM, the broadcasting station of the Willard Storage Battery Co., Cleveland, in the past week has received several letters attesting the popularity of radio among those who leave their firesides to wander into new pastures and scenes.

Two of the letters came from trans-Atlantic voyagers, one from a passenger on a Pacific ocean liner and one from a traveling salesman. Several letters and applause cards have been received from auto tourists in the south.

E. N. Pickerill, chief radio officer of the S.S. Leviathan of the United States Lines, the largest vessel afloat, tells of entertaining



The new Benjamin Electrical Manufacturing Company socket for radio vacuum tubes. It's most unique feature is the fact that the socket cup which holds the tube floats on light springs, thus preventing all vibration interfering with proper operation of amplifying and detector tubes.

his friends with a receiving set while in mid-Atlantic. A midweek concert from WTAM was picked up and held for more than an hour. This was about 2,000 miles east of New York, according to Pickerill's letter.

It was on this trip that the big liner ran aground in New York harbor and was subsequently laid up in dry dock. Pickerill says: "The programs from your station were looked forward to with eagerness by all those on board who had heard them on the way over. The officers and crew of the Leviathan congratulate you on the efficient operation of your station and join with me in wishing you continued success."

P. J. Pritchard, manager of the Nela lamp division of the General Electric Co., and T. L. Cogger, manager of the miniature lamp division, Nela Park, Cleveland, sent word by radio to WTAM that they were getting a recent concert aboard the S.S. Conte Verde.

Mr. Pritchard and Mr. Cogger are visiting Italy and are taking a super heterodyne set with them. They were also in mid-Atlantic when they received the WTAM program.

The name of the Pacific passenger could not be made out but the letter, mailed from Honolulu, stated that a WTAM dance program was heard when the ship was about 1320 miles west of Vancouver.

The traveling salesman did not give WTAM permission to use his name. He said he was representing a New York firm in the southwest and that his radio set was, in many instances, his only diversion in small Texas, Oklahoma and other southwestern towns.

Scores of applause cards and letters have been received from southern auto tourists who have included receiving sets in their outfits. They relate how the whole tourist camp gathers nightly to be entertained.

Radio has not only established itself firmly in American home life but has entered the field of the traveler, bringing pleasure and entertainment to those who have left their hearthstones to wander in far away places.

An Advance in Condensers

THE receiving losses in condensers are formed by the inefficient capacities produced by the insulating material necessary between the rotor and stator plates, called hysteresis.

The Cruver Manufacturing Company, Chicago, has just put out a new condenser, invented and designed by their engineer, G. M. Proudfoot, which cuts down the inefficient capacities by means of mounting the stator plates on two rods instead of the three usually used and thereby have reduced the losses to a negligible quantity. The 23-plate condenser showed the same reading at maximum capacity and 290 meters as the standard used, which is stated to have a loss of only seven one-thousandths of one per cent at a capacity of .001 M. F. This is equivalent to a phase angle of 14.2 seconds. The model was used in the Trans-Atlantic test in the "low-loss" tuner designed and operated by F. J. Marco of experimental station 9XBA, Chicago, who established new long distance records with the unprecedented reception of six foreign amateur stations on 100 meters. Besides the extraordinary efficiency obtained, the condenser has other valuable assets, it is said.

The public is demanding not only fewer adjustments but simpler means by which the distant station desired can be promptly tuned in. This new condenser not only does away with an additional knob, required on the vernier, but has two scales on one dial.

When the knob is turned either to the right or left, the vernier plate lines up with the rotor plates and the vernier index reads zero. When the group plates are set for the coarse adjustment, the reading shows on the large scale. The knob is then turned in the opposite direction and the fine adjustment is read on the inner scale, thus an accurate log can be obtained, which facilitates tuning-in the required station.

New Cruver Condenser.

All fans are familiar with the efficiency of the pigtail connection as long as it remains intact mechanically and also the great annoyance produced by its frequently breaking. The Proudfoot condenser gives a perfect electrical connection between stationary and movable parts and does away with the pigtail.

The end plates are made of metal and the design is such that the annoyance of body capacity is eliminated entirely when the rotor plates are grounded. This is impossible with the ordinary condenser as there is always an inefficient capacity produced irrespective of what side of the circuit is grounded.

Perhaps not the least pleasing feature of this most carefully designed condenser is the fact that it can be mounted by means of one nut in a few seconds after the hole for the shaft has been bored.

DeForest Entitled to Priority

ACCORDING to a decision handed down by the District of Columbia Court of Appeals, May 5, Lee DeForest of New York was entitled to priority as the inventor of the audion as a means of producing sustained electrical oscillations in transmitting radio messages or otherwise.

The opinion reversed the findings of the commissioner of patents, who had awarded priority to Edward H. Armstrong. Claims also had been made by Alexander Meissner and Irving Langmuir some time ago.

Justice Van Orsdel held that the testimony of Armstrong and his witnesses placed his conception of the invention in October, 1912, and that DeForest reduced his invention to practice in August, 1912. The evidence, the opinion held, failed to disclose that DeForest abandoned it.

The decision of a New York court in a suit brought by Armstrong against the DeForest Radio Telephone and Telegraph Company which was decided in favor of Armstrong, had no bearing, the court found, because it involved an infringement and not the question of priority.

WON RADIO DRAMA PRIZE

Miss Agnes Miller, 150 East Seventy-second street, New York, who was awarded the $500 prize for the best radio drama submitted to station WGY, General Electric's radio station, Schenectady, N. Y. Miss Miller's play is called "A Million Casks of Pronto."

Radio Drama Prize Winner

FIRST PRIZE in the Radio Drama Competition conducted by WGY, the schenectady broadcasting station of the General Electric Company, has been awarded to Miss Agnes Miller of 150 East 72nd street, New York, for her comedy drama of business life, entitled "A Million Casks of Pronto."

The object of the competition was to develop a type of play that will tell its story through an appeal to the ear and imagination just as the screen play is directed exclusively to the eye. Miss Miller's play was selected from nearly three hundred manuscripts as the best original drama submitted and she will receive a cash prize of $500.

Miss Miller is a native of New York. She was graduated from Bernard College and later received her master's degree in comparative literature from Columbia University.

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

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

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

THROUGH error in proofreading a paragraph in the last article of "A Real Super-Heterodyne" read as follows: "Mr. LeCault calls the 'Metropolitan System' the modulator tube using no direct 'B' battery voltage on plate." This should read "the Modulation System."

To Make Tubes Oscillate

When using dry cell tubes it is sometimes found that it is hard to get the tube to oscillate at certain wavelengths. Two pieces of lamp cord three inches long connected to the grid and plate terminals of the tube socket and then twisted together will form a small condenser that will make the tube oscillate over the entire wavelength scale of the set. This condenser will also raise the wavelength slightly.

Drains the "B" Batteries

In a radio set that uses five or more tubes, remember that the drain on the "B" battery is very great and that it is necessary to put in new "B" batteries every two months. In this case it is cheaper in the end to buy storage "B" batteries.

The use of a "C" battery will greatly lengthen the life of your "B" batteries.

Battery Chargers

(Continued from page 24)

tial cost. As the name implies they consist of a motor and a generator mounted on the same shaft. The motor is fed with A. C. current and the generator delivers a D. C. voltage slightly above 6 volts. If a rheostat is inserted in the field of the generator, the D. C. voltage can be regulated. The efficiency of these sets is around 50%.

As a brief review of the different types of chargers the following points are given. In all cases the cost of recharging a battery is very low compared to what is asked at a service station so that the device pays for itself in a short time. For that reason, the low efficiency of a type is not very important. The electrolytic type, the cheapest of all, very quiet in operation, will require some water from time to time.

The home-made type is usually of a poor efficiency and subject to heating; so a low charging current should be used. The mechanical type has the disadvantage of being noisy and of requiring the careful adjustment of the vibrator; the adjustment made at the factory is usually very good and will stay so for a long time.

The bulb types cost a little more but require very little attention; the only upkeep cost is the renewal of the bulb; a bulb under ordinary conditions will last over a year. The motor-generator sets require the ordinary attention given to motors, seeing that the bearings are oiled and that the brushes are not sparking too much.

In making his choice, the radio fan should take in consideration his pocketbook, the preceding study, and go to a reliable dealer to get the best make of the chosen type.

Darr Is Elected

WE are advised by K. B. Warner, secretary of the American Radio Relay League, that a corrected ballot was sent out for the election of officers of A. R. R. L. because of an error made in the headquarters office in the omission of certain data respecting one of the candidates, and that on the final counting of these votes Clyde E. Darr, Detroit, Mich., was elected by a substantial majority. The total vote polled in the second ballot was practically the same as on the first, Mr. Warner advises.

Radio Topics was misinformed of the real facts of the ballot, hence the reference to the election in the May issue on page 12. The above clears up all doubt in the matter.

21,967 Stations

ACCORDING to the latest count there are 21,967 radio transmitting stations of all kinds in the United States. Amateur stations, ships, trans-atlantic and broadcasting stations of all kinds are included in the list.

Broadcasting Opens New Field

Since the successful introduction of the McVicker's Theater mid-night organ programs broadcast over KYW, Chicago, W. Remington Welch, organist who is being heard by thousands from coast to coast, declares that this interesting work will eventually create a demand for organists experienced in this field.

It is a fact that the orchestral type of organ which is used at McVicker's is the perfect instrument for radio use, declared the Westinghouse experts, who surveyed McVicker's Theater and took tests of the organ. Throughout the weeks of preparation, the Westinghouse experts and Mr. Welch spent much time in "trying out" various combinations and tone colors which the new Westinghouse microphone receives. It is interesting to note that it requires a new style of "touch" and a vivid imagination in coloring to bring to the KYW "listeners in," the realistic organ they have been receiving from McVicker's.

To carry this to the hundredth degree of perfection, a receiving station was installed on the stage at McVicker's, and the set was placed upon the console for Mr. Welch to criticize his own work. The results astonished him and he too immediately joined the thousands, who from coast to coast are pouring in congratulations to the Chicago American-Westinghouse station for the wonderful organ feature they have secured.

Repair Plant at Chicago

THE Bristol Company, Waterbury, Conn., manufacturers of recording instruments and distributors of radio equipment, has leased 2,740 square feet in the Larkin Building, 3617 South Ashland avenue, Chicago, in order adequately to take care of the Middle West business, which has grown to large volume. Most of this area will be devoted to repairing and recalibrating Bristol instruments sold and used in the Chicago territory, but some will be used for stocking made-up instruments for quick deliveries and various lines of radio merchandise. The present salesroom and offices of the Bristol Company will be maintained in the Monadnock Building.

Broadcasts Heart Throbs

TO demonstrate the extreme sensitivity of the glow-discharge microphone perfected by Dr. Phillips Thomas, station KDKA of the Westinghouse Electric and Manufacturing Company recently broadcasted a program of heart throbs. The test of heart beats was heard from Maine to California and from Canada to Mexico, according to reports that came in.

Because of the fact that heart beats have a much lower period of frequency than the voice or a musical instrument, it is exceedingly difficult to find any pickup that will properly register them. After a long series of tests with the Thomas microphone, it was decided that the instrument had the proper sensitivity to record the heart beats. The apparatus necessary for the experiment, which was installed in Dr. Thomas' laboratory in the Westinghouse research laboratory, consisted of the amplifying apparatus, such as is used with all microphone pickups, the microphone itself, and a telephone line to the broadcasting station in East Pittsburgh. The amplifying apparatus was all arranged by Dr. Thomas and consisted of a number of vacuum tubes balanced with other tubes. In the arrangement the apparatus was so hooked up that high frequencies were eliminated and thus the heart beats could register more clearly.

In the actual broadcasting of the heart beats, the microphone was placed just above the heart of the subject. The heart beats sent out are said to be the faintest sounds ever picked up by a radio microphone but they intensified so clearly that they were audible to all listeners.

To those who heard the heart beats, the sound was most unusual. One radio fan who called up the station said that the beats sounded something like the telephone when the operator is ringing a busy signal.

Broadcast Auto Races

THE twelfth international 500 mile auto races at Indianapolis, Ind., will be broadcast from station WGN, Chicago, on May 30, through an arrangement with the Presto-Lite Company and the Chicago Tribune.

In addition to the announcing microphone at the judges' stand, microphones will be placed in the pits so that, if listeners may not see, they may at least hear the orders and incidents of tire changing, replenishing of gasoline, water, oil, and parts under conditions where seconds may mean the difference between victory and defeat. Other microphones will be placed to pick up the cheering of the thousands in the grand stands, boxes and midfield. Men will be stationed at the turns and along the backstretch to quickly report incidents that may escape the eyes of the man at the microphone.

When the winner of the classic flashes across the line, WGN listeners will know his name and car before he has continued a hundred feet at his 100 mile an hour speed. They will hear the exhaust of his motor through the voice of the announcer and the screams of the thousands as they acclaim him.

Radio Supplants Travel Dope

SPRING fever has taken its toll among the workers of the world but it is not of the travelitis variety as in former years. Scientific experts who have been called into consultation have diagnosed the case as "radio enthusiasm" and the disease is not confined to any age or sex.

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

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

Untangling the Radiation Tangle

(Continued from page 18)

ilizing condenser is adjusted so that no plucking noise or click is heard when grid terminal is touched with the finger. When the stabilizing condenser is once adjusted (and this adjustment is not difficult to obtain, since the setting is not a critical one if the device is properly constructed) it ordinarily need never be touched again.

In order that tuning be made easy the "Clarifier" tuning dial may be calibrated against the receiving set and then later both it and the receiver may be calibrated for various wavelengths by jotting down the positions where each station is found. It may be calibrated against the receiving set by coupling the output coil near the grid tuning condenser in the "Clarifier" one or two clicks will be heard in the receivers when the two circuits are in tune with each other. If the construction has been properly carried out it will be found that the adjustment required for a particular wavelength is constant from day to day.

It will be found that the signal intensity is greatly improved since the device seems to be a particularly efficient radio frequency amplifier.

Although one tuning dial has been added it will be found that tuning is much easier than before. This is due to the fact that the adjustments of a single circuit receiver often change from time to time depending on the position of the tickler coil or plate variometer and changes in antenna constants. In this new plan the resistance in the grid circuit of the detector tube is much lower since the antenna resistance is no longer included, therefore, regeneration is more easily controlled and is not as critical as before. The lower resistance in the grid circuit of the detector tube increases selectivity remarkably. Tests have shown it very much superior to double circuit regenerative receivers in this matter. A wave trap or filter is not needed since this radio frequency unit will do the work instead.

There should be no necessity for receiving any signals on zero beat method so the quality of the received signals is also improved and there need be no squeals in the receivers or loud speaker. All these items are conducive to greater distance reception, so the device seems well worth while, even if the receiver radiation item is not considered.

Easter at Home

Those who were kept from church Easter Sunday by the heavy rain which fell throughout the greater part of eastern United States, appreciated the religious service which the great broadcasting stations gave. WGY, the Schenectady, N. Y., station, for example, broadcast the morning and afternoon services of St. Peter's Episcopal Church, Albany, N. Y., and the evening service of Madison Avenue Reformed Church of the same city. Everyone with a radio set who so desired could pick up and devoutly listen-in to beautiful programs of Easter music, to prayer, sermon and scripture reading.

Trouble Hunting in Your Reflex

IF YOU are having trouble with your reflex circuit perhaps the following hints will prove of value to you. Some of the more frequent sources of trouble are here listed. The sources of distorted signals are said to be three in number, viz:

1. The set is improperly tuned. Correct through closer coupling—i. e., reducing the angle between the rotor and stator of the variocoupler.

2. Crystal rectifier is defective, usually as a result of loose or grainy structure of crystal employed. Replace with Erla crystal rectifier.

3. Transformers do not synchronize received and reflexed currents having the same phase characteristics. Replace with Erla synchronizing radio and audio transformers.

After the receiving apparatus has been assembled and carefully checked for proper wiring and arrangement, it should be hooked to the aerial and ground system in accordance with the "A" and "G" markings on the accompanying diagrams. Next the batteries can be assembled and connected.

First, the "B" battery, consisting of small, high voltage units, is connected together in series so as to obtain the sum of the voltages of its component units. This is accomplished by connecting the highest voltage positive (plus) tap of one battery to the negative (minus) tap of the next, and continuing this process until all the batteries are thus joined together. When finished, a positive tap will be left open at one end of the group and a negative tap at the other. These taps are then connected to the two "B" battery terminals of the set, in accordance with the positive "B" (plus) and negative "B" (minus) markings on the accompanying diagrams.

Next, the "A" or filament lighting battery is made ready. If dry cells are used they should be wired in series by connecting the outer (zinc or negative) terminal of one to the center (carbon or positive) terminal of the next, continuing this process until all the cells have been linked together, leaving a positive terminal at one end of the chain and a negative terminal at the other. If the battery is of storage type the individual cells may be found already strapped together, with the two end terminals marked positive (plus) and negative (minus).

After the "A" battery has been carefully checked to guard against mistakes in wiring or loose connections, the positive and negative terminals should be attached to the corresponding plus and minus terminals on the set, in accordance with the markings on the accompanying diagrams.

Since it is extremely important that the negative and positive connections of both batteries be correct, every precaution in making these connections should be observed.

After the batteries are hooked up insert the tubes in their sockets, with the rheostats turned off, making sure that the socket springs press firmly against the tube contact points.

Now plug in the head phones through the jack provided, and give the rheostat controls slightly more than half a turn. A slight crackling sound (static) in the phones should accompany this movement. Continue to advance the rheostat controls until further movement causes no increase in the crackling sound.

Up to this point instruction for setting up and operating reflex circuits apply equally to all types. When it comes to tuning, however, individual methods must be pursued because of the different characteristics of the various circuits involved. Consequently separate tuning directions are provided for each.

Long Distance Record

According to the Star, a daily newspaper of Johannesburg, Transvaal, Africa, under date of March 14, N. Grant Dalton, a radio amateur of that place, picked up radio broadcasting from Europe and America on the same evening. This linking of three continents was secured when Mr. Dalton, using a three-tube set, picked up 2LO of London and WGY of Schenectady, N. Y. The Schenectady reception was recorded at 4 a. m., so it is evident that Mr. Dalton is a fan of the first water.

WJAX's Remote Control Feature

WJAX, the Union Trust broadcasting station, in 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 coming G. O. P. convention is to be held; 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, including Spitalny's Orchestra of the Hanna Restaurant, Wylie Wahl's Orchestra at the Golden Pheasant, Emerson Gill's Orchestra at the Bamboo Gardens, and Ole Olson's Orchestra at the Carlton Terrace.

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, installed by the Ohio Bell Telephone Company.

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. If the gain is set too low, the broadcast wires will pick up cross-talk from adjacent wires in the same cable and inversely if the gain is too high, telephone subscribers will be greatly annoyed in their conversations from signals collected from the broadcasting wires. A volume indicator is installed on the remote control panel, and after the correct values have been ascertained through tests, the reading of the indicator is noted and from then on the volume is kept as near as possible to this reading during the entire concert.

The matter of controlling whatever is being broadcast is practically the same in the transmitting room, whether it is remote control or local studio broadcasting.

During the past few months, WJAX has accomplished the somewhat remarkable feat of performing remote control broadcasting from two different points upon the same evening, disconnecting the in-put equipment after broadcasting was completed at one point, loading it upon a truck, and carrying it to the location of the next broadcasting, connecting it there to the telephone wires and going on with the program in a space of only 25 minutes.

Ellis Bay Heard From

From Ellis Bay, Anticosti Island, Province of Quebec, comes a letter to WGY complimenting the station on its program, especially those of Friday night. "There are three receiving sets on the island," writes J. A. Renaud. "One is being used at a meeting hall with a loud speaker for the benefit of our population, 600 in all. This island being isolated from the continent for a good five months of the year, except for land telegraph, we seldom get news except by radio."

Easily Satisfied

A. Holt, Michigan man, who explains that he is "just a lonesome young fellow," recently asked WGY to announce his name from the station, "as I wish to hear from young ladies all over the United States and Canada and other places."

Portable Radio Set

"TAKE your entertainment with you" is the new slogan for the radio fan. The new Crosley 51-P portable receiver makes this possible, whether it is for use in an automobile, boat or in camp. This new set weighs only 21 pounds with batteries, phones and aerial.

This set is constructed exactly like the Crosley 51, with detector and one-stage of audio-frequency amplification, using the Armstrong regenerative circuit, licensed under U. S. Patent No. 1,113,149. This is the same type of receiver used by Len H. Weeks of Minot, N. D., who was in direct communication with McMillan's ship near the North Pole. The portable is covered with a beautiful black leatherette, with nickel plated trimmings and hardware.

The case is constructed of strong, light wood and has ample room for a real power plant of "A," "B" and "C" batteries, instead of a limited space for flashlight batteries, as found in some receivers. Three full size No. 6 dry cells furnish the filament current for either 199 or WD-12 tubes, giving economical life and not necessitating frequent renewal of "A" battery. There is also room for 67½ volts of "B" battery for the plate, obtained from the vertical type of battery. Provision is also made for connecting the "C" battery, if desired.

The portable is compact enough to be placed beneath the seat in a railway coach and easily stowed away in auto or camping kits, measuring 12½ inches wide, 7½ inches deep, and 11¾ inches high. The top is hinged in one place and the front in two places. The upper part of the front is opened for operation of the set and the lower half is hinged to permit easy access to the batteries.

Ample volume for using a loud speaker under average conditions up to 1,500 miles is provided, while under bad conditions, it is advisable to use headphones on distant stations. The Crosley 51-P is manufactured by the Crosley Radio Corporation, Cincinnati, and sells for $25 without phones, aerial, batteries or tubes.

Canadian Railway Opens CFCA

THE Canadian National has opened its tenth radio station in its national wide chain—with station CFCA at Toronto.

This development has been brought to a successful conclusion through the co-operation of the "Toronto Star," and advances the plan conceived some time ago by the president of the Canadian National Railways to cover the country with radio stations in such a manner as to ensure the radio penetrating to every corner of the Dominion. Toronto is the center of one of the most densely peopled industrial, agricultural and residential zones upon the Great Lakes, and it was felt that the installation of an adequate radio station at this point would serve to broadcast the opportunities awaiting the settler, investor and agriculturist in, as well as the charms and attractions presented to the holiday-maker, sportsman and lover of nature by, the Dominion, to a very pronounced degree more especially as Toronto is on the fringe of one of the most densely settled and prosperous areas of the United States which will thus be within the radius of station CFCA.

This is the tenth radio station to be operated by the Canadian National Railways to sound far and wide the message of Canada. It will be on 400 meters.

Radio Used to Invite Guests

A "Radio Party" in which even the invitations were sent by radio was recently given to the 23,000 Boy Scouts of New York City. The feature of the affair was the sending of a message from Franklin D. Roosevelt, direct from the lecture platform to Baden-Powell in London, and receiving a reply within the space of twelve minutes.

Chinese Broadcasting

THE Shun Pao of Shanghai, China, has the first broadcasting station to be established by a Chinese newspaper. Programs are being broadcast daily, including lectures and music in Chinese.

ADD COURTESY OF THE AIR

(Continued from page 22)

their motor cars, they need not expect to obtain the same degree of service. I am not going to give you a lesson on the proper way in which to operate your set. The best place to obtain such information is in the instruction book that came with your set. Failing that, the manufacturer can always help you out.

Now for the third method. This is going forward at a fairly rapid rate. Nearly all large radio manufacturing companies are building receiving apparatus which is a great improvement over anything heretofore available. Nearly all of the new designs may be called non-interfering ones in that provision is made to use at least one stage of radio frequency amplification. Use is made of a recent invention which makes it impossible for this radio frequency stage to oscillate and, therefore, the probability of interference is very remote. The tendency in the new designs is toward complication of apparatus but simplification of tuning control. The advantages gained are excellent sensitivity and selectivity, both highly desirable qualities. The only drawback is that such sets can not be built as cheaply as the simpler sets, so that the outlay for equal results is somewhat greater. Until this condition can be remedied or until new developments make the simpler types obsolete, there will be a demand for cheap sets. Out of justice to the general public I think we ought to maintain a line of low priced apparatus and in return, I think that the owners thereof should feel obligated to do their best to avoid interference.

PRIZES FOR WNP MESSAGES

(Continued from page 28)

quested to at once telegraph U. J. Herrmann, National Radio Manufacturers Show Association, 127 North Dearborn street, Chicago, or E. F. McDonald, Zenith Radio Corporation, 332 South Michigan avenue, Chicago.

To the sender of the first telegram containing a message from the McMillan party which it is possible to confirm, will be awarded the $100 in gold. The sender of the second message will be awarded the Zenith receiving set.

Get a Job Like These

Earn $3500 to $10,000 a Year

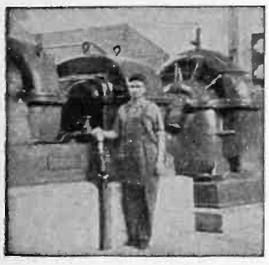
in the Big Pay Field of ELECTRICITY

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. 97-A **2150 Lawrence Ave., Chicago**

The Cooke Trained Man is the Big Pay Man

L. L. COOKE, Chief Engineer, Dept. 97-A
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_____

WorkRite Former

$2.00

This aircore Transformer has been perfected for use in the Neutrodyne method of receiving. It should be used with .0004 mfd. variable condenser for tuning to all broadcasting wavelengths. It can also be used as a transformer for tuned radio frequency reception, or fixed coupler with condenser across secondary. It is made with tubes of moulded Bakelite and wound with green silk wire. Extreme care has been taken to see that the tubes are properly spaced and just the right number of turns of wire are used, insuring maximum efficiency. Like all WorkRite products, it has been thoroughly tested by other laboratories as well as our own before being put on the market. It will measure up to the "WorkRite" standard of quality and efficiency.

Watch for the WorkRite Variable Condenser

WorkRite Super Vernier Rheostat

This improved WorkRite Vernier Rheostat is just the instrument you have been looking for, 50,000 possible adjustments. A turn of 1-32" will separate two stations or clear up one. Made in three different resistances so that there is a WorkRite Vernier Rheostat for every tube now on the market. 6 ohms, $1.00; 15 ohms, $1.15; 30 ohms——$1.25

WorkRite E-Z-Tune Dial

Snappiest Dial on the market. Has a knurled flange on the rim for delicate leverage. Price ——75c

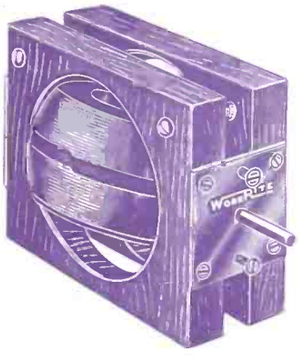
WorkRite Resistance Cartridge

Raises the resistance of your 5 or 6 ohm Rheostat to the 15 or 30 ohms required for UV 199, and similar tubes. Price, either 15 or 25 ohms——40c

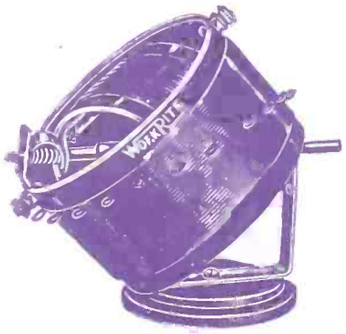
WorkRite Neutralizing Condenser

Neat, compact and very efficient. This instrument has a glass insulation on the outside which greatly expedites neutralizing the set. Price each, 25c.

WorkRite Tuner Team



WorkRite Super Variometer



WorkRite 180° Super Variocoupler

Tunes out local stations and gets the one you want. This famous Tuner Team is made up of two WorkRite Super Variometers and one WorkRite 180° Super Variocoupler. Variometer is made from polished mahogany. Variocoupler made from moulded Bakelite and wound with green silk wire. Range 150 to 705 meters. Shaft 3-16".

WorkRite Super Variometer, each——$3.50

WorkRite 180° Super Variocoupler, each——$3.50

"WORKRITE RADIO PARTS WORKRITE"

WorkRite Nonmicrophonic Socket

Here is the right Socket for use with your UV 199 and C 299 Tubes. It is moulded with a sponge rubber base in one piece which is even better than the soft rubber recommended for use with these tubes. Very neat and attractive. Price ——60c

WorkRite Hydrometer

You need one for your storage "A" battery. Full instructions with each instrument. Price ——75c

WorkRite Head Set

Very Sensitive. Light and sanitary. Try one and see. Price ——$6.00

WorkRite Switch Set

Just what you want. Use the block for drilling panel. Arms and points made to work together. Price ——50c

THE WORKRITE MANUFACTURING CO.

5536 EUCLID AVENUE CLEVELAND, OHIO

(BRANCH OFFICE, 536 LAKE SHORE DRIVE, CHICAGO)

Approved by Over 200 Experts
New Crosley Engineering Achievement

A three-tube set with five-tube efficiency—the greatest selectivity with the minimum effort—positive calibration to any wave length between 200 and 600 meters. These are only a few of the many advantages offered in the remarkable new Crosley Trirdyn Radio Receiver.

It was only after a year of constant experimenting, that our engineering department perfected this exceptional receiver. Thorough tests proved to us that it would outperform any receiver ever before produced. But we were not satisfied with our own opinion. So we shipped out 200 of these sets to experts in every part of the United States. Their criticism are one and the same—"Tried out your new Trirdyn Receiver Saturday night and logged 13 stations, among them Cuba, New York and Omaha, between 9 and 10 o'clock. The set was very selective. During the time this test was on local station KSD was operating and we went through them without any difficulty or interference whatever. The range of the local station was not more than three points variation in the dial setting."

"Tried one of these sets out and obtained wonderful results. Were able to log all stations which we heard very successfully. This set should go over big. The set has wonderful volume and is selective."—etc.

This new Crosley triumph is called the Trirdyn because of its original combination of the three "R's"—Radio frequency amplification, Regeneration and Reflex. The first tube incorporates non-oscillating, non-radiating tuned audio frequency amplification; the second tube, a regenerative detector reflexed back on the first tube for one stage of audio frequency amplification. Then it has a third tube which acts as a straight audio frequency amplifier. It uses the ultra selective aperiodic antenna circuit and external selector coil, which adds to its wonderful selectivity.

The Crosley Trirdyn in range, volume and selectivity is the equal of any five-tube receiver on the market. Greater volume will, of course, be obtained through the use of storage battery tubes, but it will function well in any type and can be used with either indoor or outdoor antenna.

The opinions of many experts have convinced us that the Trirdyn is the best receiver ever offered the public regardless of price.

Practically every radio dealer can furnish you Crosley Radio Sets, including not only the Trirdyn, but the Model 51, a two-tube set for only $18; The Model V. a single tube receiver at $16; The Model VI at $34; The Super VI at $29; the Model X-J at $55, and the Super X-J at $65.

All Crosley regenerative sets are licensed under Armstrong U. S. Patent No. 1,113,149.

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Crosley builds more Radio Receiving Sets than any other manufacturer in the world.

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POWEL CROSLEY, Jr., President

Formerly The Precision Equipment Company and Crosley Manufacturing Company

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