

RADIO AGE

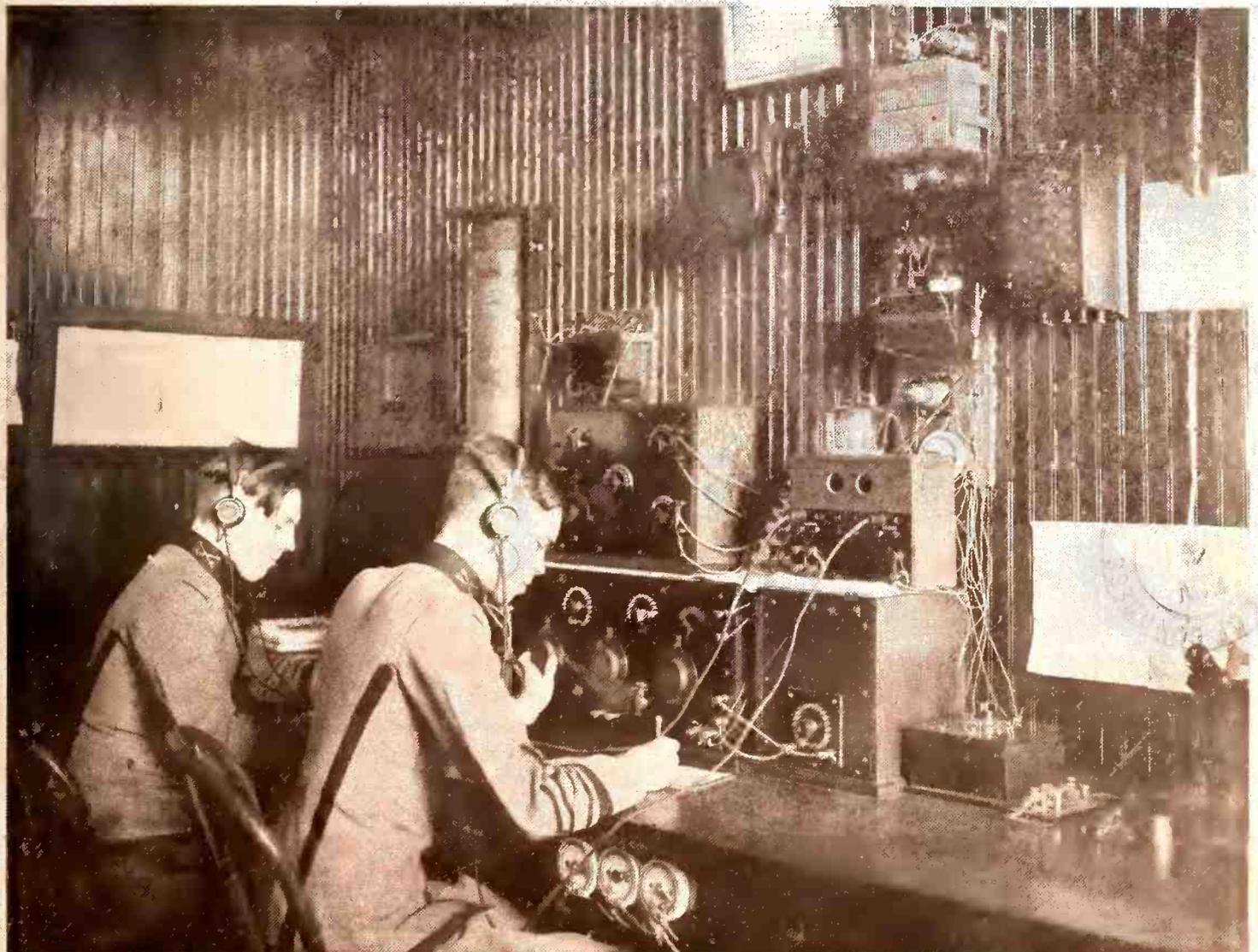
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The Magazine of the Hour

JULY-AUGUST, 1922

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Radio Students at Culver Academy



Introducing Mr. Pearne:

The portrait herewith is that of Frank D. Pearne, chief instructor in electricity at Lane Technical High School, Chicago.

Mr. Pearne is technical editor of Radio Age, and in that capacity he writes our leading technical article each month.

Also he answers all the questions the radio fans can ask, as a feature of the service department of Radio Age.



RADIO AGE

The Magazine of the Hour

Volume 1

Number 3

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If You Like Good News Read This Column

PUBLICATION was retarded this month for the dual purpose of carrying through the absorption of the entire subscription list of the National Radio Magazine, which has suspended publication, and rearranging the publication schedule. Hereafter advertising forms will close on the 19th of the month preceding date of publication.

July and August numbers are combined in this issue but neither subscribers nor advertisers will suffer thereby as contracts have been advanced one month to provide an additional number to subscribers, and a corresponding adjustment for advertisers.

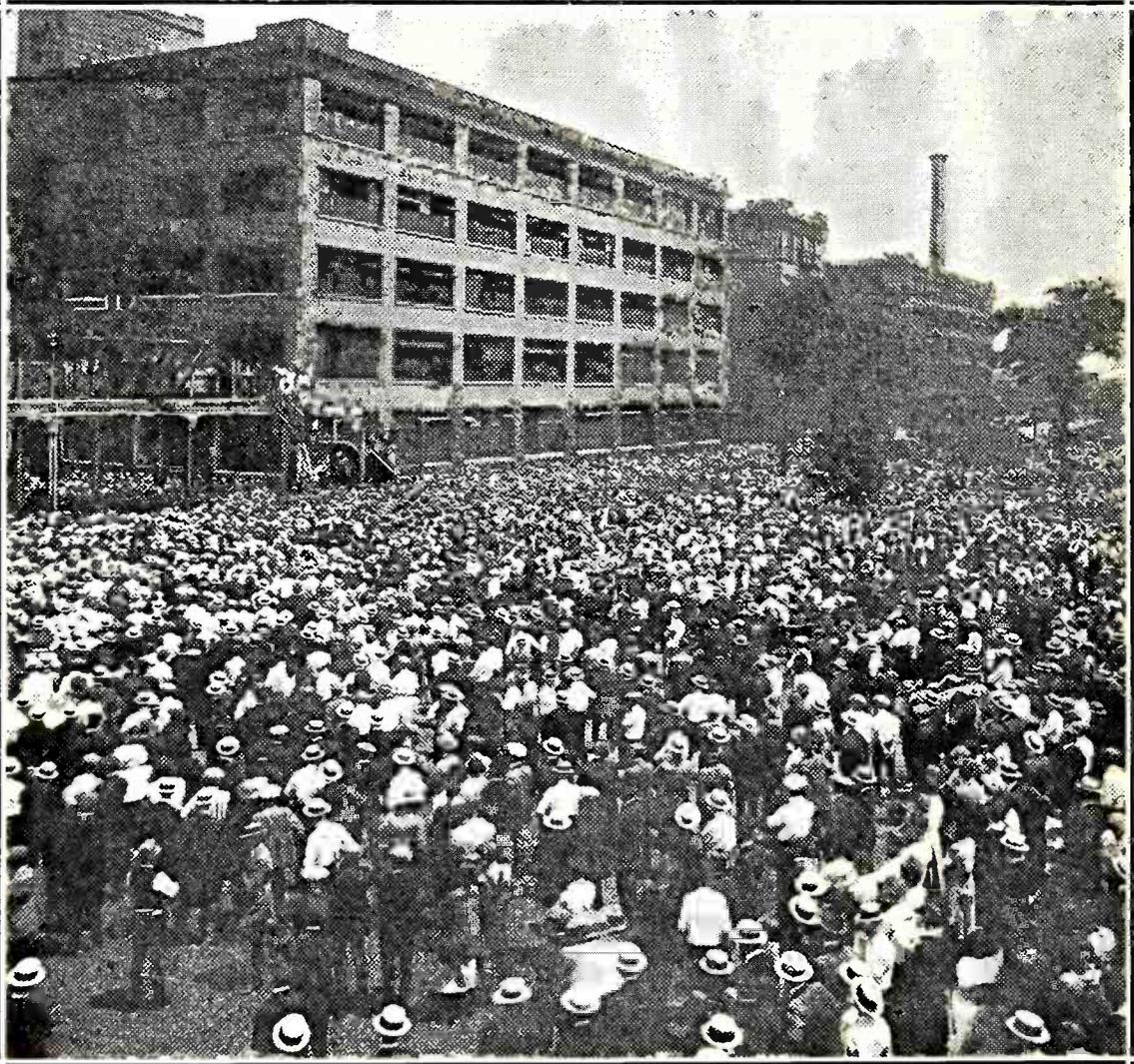
Readers will observe that in this issue we announce the inauguration of RADIO INSTITUTE. Electrical experts will test Radio goods submitted to this institute, thereby supplying a valuable free service bureau to manufacturers and assuring readers that Radio products advertised in this publication are merit products.

If readers are not taking advantage of our free information service they are missing the facilities supplied by an office staff and by thorough radio experts. RADIO AGE welcomes inquiries from manufacturers, dealers and readers on any subject relating to Radio construction, operation or Radio trade.

Lack of space prevents publication of the promised article by the man who made his own receiving set, but the story of his adventures will appear later.

If RADIO AGE covers the news field this month tell your friends, if not, please tell our editor.

Who Said Radio's a Fad?



EVEN the advanced students of radio, the "hard-boiled," who can understand super-regeneration and all that bally high-brow stuff, got a real kick out of the demonstration several weeks ago in the courtyard of the Western Electric Company, at Hawthorne, Chicago. Charles G. Du Bois, president of the company, made an address to 27,000 employes who were assembled in the court yard of the Chicago

plant. Mr. Du Bois was talking in New York, 1,000 miles distant, but his words were heard with perfect distinctness by the entire throng and by others who took up positions hundreds of feet away from the loud-speakers, that were set up especially for the occasion.

It was one of the most impressive demonstrations of radio possibilities. Read the details on another page.

RADIO AGE

"The Magazine of the Hour"

M. B. SMITH
PUBLISHER

PUBLISHED MONTHLY GARRICK BLDG CHGO.

FREDERICK SMITH
EDITOR

How Radio Photograph Crossed the Atlantic in 40 Minutes

Arthur Korn's Achievement Is One of the Recent Amazing Developments of Wireless

By ARTHUR BENINGTON

THE World offers evidence of an extraordinary feat of modern science—the transmission by wireless telegraphy of a photograph from Rome, Italy, to Bar Harbor, Me., and its reproduction in New York.

The process by which this "miracle" was performed is the invention of Dr. Arthur Korn, professor of electro-physics at the Berlin High School of Technology.

When this photograph was "filed" at Rome no one in America had ever seen it. Forty minutes later it had been picked out of the ether on the Maine coast by Chief Radioman Edmund H. Hansen, U. S. N. From Bar Harbor to New York it had to be transmitted by mail, but from Rome to New York less than twenty-four hours elapsed.

The result of the experiment is far from perfect, but it points the way to an achievement that seems now to be in the near future. Over shorter distances and under more favorable conditions pictures have been transmitted and reproduced with surprising clarity of detail. The picture published herewith is evidence that the basic method is sound. The code message for the picture was sent from Rome to Nauven, Germany, and thence to Bar Harbor.

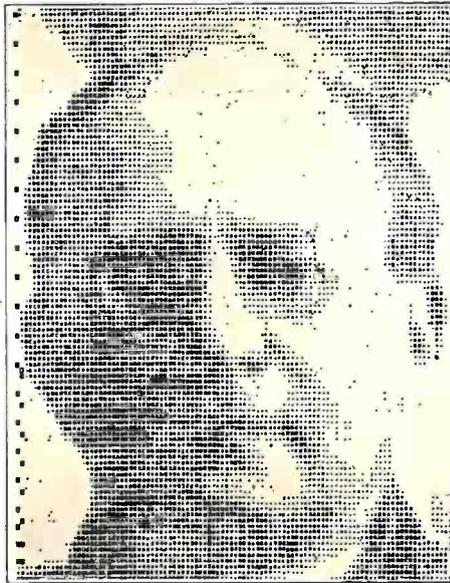
At Work Since 1900

Prof. Korn began working on his process in 1900.

Now Dr. Korn has developed for commercial use three distinct methods for the transmission of photographs. Two of these are for use over ordinary telegraph lines and one for use with Radio.

The first public demonstration of the Korn method of transmitting

The New York World permits Radio Age to republish its description of the method by which a photograph was transmitted from Rome, Italy, to Bar Harbor, Maine. A reproduction of the photograph as received by radio in Bar Harbor is reprinted on this page.



Reproduction of photograph sent from Rome, Italy, to Bar Harbor, Maine, by Radio

photographs through the air took place a few months ago in Rome, where in the presence of the King and Queen of Italy, a photograph was radioed to Berlin, where it was reproduced in a newspaper and actually on sale in the streets just one hour after the picture had been handed to the operator in Rome.

The sending apparatus, as it exists now, is an exceedingly complex and bulky machine, built in Dr. Korn's

laboratory for experimental purposes. The receiving machine is simple and portable, however. Without entering into a minute technical description of the process, the principles of it will easily be understood from the following:

How the Machine Works

If you look through a strong magnifying glass at a halftone picture in a newspaper or magazine you will observe it to be made up of a multiplicity of tiny dots, the very light parts being of small dots widely spaced, the very dark spots of larger dots close together. Prof. Korn, on analyzing photographs and halftones, realized that for practical purposes all the values of light and shade could be reproduced with from 15 to 20 sizes of dots.

Suppose, for example, we take seventeen different sizes of dots and give to each a letter, say A for the Smallest and P for the largest, the intermediate letters being for the intermediate shades. Now, if we can construct an apparatus which will automatically translate these seventeen values into seventeen corresponding letters and print these letters on a tape, we have a code which can be sent by wire or wireless to any place in the world, and if we have a typewriter that prints, instead of the letters indicated on the keys, the large or small dots which correspond to those letters, we can decode or translate that telegraphic or radiographic message into a half-tone picture.

This is just what Prof. Korn did.

As has been said, the machine which does the coding is quite complex. In making a halftone picture direct from a photograph, a wire

screen with larger or smaller mesh, according to the fineness of the half-tone desired, is placed over the face of the picture and a negative photograph is taken through the screen, thus producing the dots.

Light Turns the Trick

The Korn apparatus uses no screen, but a point of brilliant light traveling over the photograph, being cut on and off rhythmically by a commutator in such a way that it strikes the picture at accurately spaced points, working very much like the light of a moving picture machine. An ordinary cabinet size photograph receives the light at about 1,000 points.

The light passing through the negative falls upon a selenium cell, the quantity passing through depending on the darkness or lightness of the spot through which it passes. Selenium is a mineral crystal endowed with the peculiar property of passing an electric current only when exposed to light and of changing its electric resistance according to the degree of light that reaches it.

Prof. Korn makes use of selenium by placing a cell of it in the transparent cylinder on which the negative is coiled, and as the latter slowly revolves the light that passes through the negative falls on the selenium. a current of electricity from a battery passes through the selenium, and its resistance is varied by the values of the light.

Each variation of resistance—of which in this case there would be seventeen—controls a key which drops to print a letter on a tape the instant it is actuated by the electric current. The mechanism by which the present Korn machine does this is too complex to describe here; suffice to say that it prints the letter which corresponds to the particular shade of the photograph.

"Words" Transmit Pictures

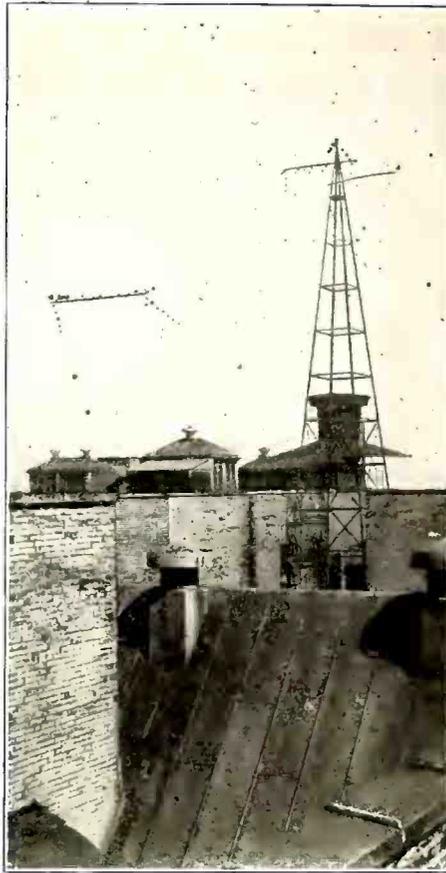
In "coding" a picture we get about 1,000 letters. These are grouped by spacing into about 300 "words" which are sent by Radio (or by telegraph) to any place. They are received by an ordinary telegraph or Radio operator or by an automatic telegraphic receiving apparatus.

To decode or turn this word message back into a picture a Korn decoding instrument is necessary. This is a form of typewriter into which a sheet of paper about twelve by fifteen inches in size is placed. With the printed message before him the operator copies it on the keys; these, however, do not print letters, but dots of the sizes and shapes corresponding to the letters. As the code allows for the blank spaces between the dots the result is a very much enlarged half-tone of the original photograph, and this needs only to be photographed down to the size wanted by the paper; the smaller it is the finer the half-tone. This decoding instrument may be attached to an automatic telegraph receiving machine in such a way that the code letters are entirely cut out and the telegraph machine prints the dots directly.

There are at present only two sets of Dr. Korn's apparatus in existence; one of these is in Germany, the sending machine, and the other is at Dr. Korn's laboratory at Centocelle, near Rome, and the receiving or decoding instrument is in America.

Governments Aided in Test

Through the courtesy of the Italian Ministry of Marine and the American Navy Department The World was able



Station WBU is of a temporary construction, and was constructed for experimental work to determine features and characteristics required for a permanent installation. It is located on the roof of the City Hall, which is 200 feet above street level. The steel tower supporting the antennae is 70 feet high, making a total height of 270 feet above street level. Two six wire antennae are used, respectively 75 feet and 160 feet long, each consisting of six wires composed of phosphor bronze 7-strand No. 18 B. & S. gauge wire. The transmitter is a modified De Forest OT-201 transmitter rated at 1 K.W., having special grid modulation system.

to obtain this unique picture. As related in The World in May, Commendatore Pascale sent a photograph of the king of Italy from Rome as one of the tests made by the navy, but the navy gave no publicity to this, and had it not been for the vigilance of Beatrice Baskerville, The World's staff correspondent at Rome, the American press might never have known of it.

The World thereupon asked the Navy Department to permit the use of the Korn receiving machine at Bar Harbor for the reception of a picture by Radio from Rome. The department replied that as the instrument was the property of the Italian Ministry of Marine, the consent of this latter must first be obtained. After a few days of cabling back and forth, the Naval Attache of the American Embassy in Rome cabled the Navy Department that the Italian Ministry consented.

Pittsburgh's "Radio Day"

By C. E. URBAN

Radio Editor, Pittsburgh Gazette

"RADIO DAY" is the name given by the Radio Engineering Society of Pittsburgh to a day set aside each year for an outing of the radio fans of Pittsburgh and vicinity. The idea originated with the above society when it held the first "Radio Day" in Pittsburgh on August 17th, 1919, attended by a small group of radio enthusiasts. The annual radio outing of the Society has since been a regular event each year and has met with widespread popular approval.

From a small group of "Old Timers" in the amateur radio fraternity of this locality who attended the first modest gathering, the attendance at these annual outings of the Radio Engineering Society each succeeding year has grown to such proportions that it was deemed necessary by the Society to arrange for the exclusive use of a large amusement park this season to accommodate the crowds it is confidently expected will turn out for the occasion.

The committee in charge of the affair is composed of the following officers and members of the Radio Engineering Society: W. K. Thomas, Chairman; C. E. Urban, Secretary; M. Hirsch, Treasurer; Dr. Omar T. Cruikshank, Guy Davis, W. E. Menges, John B. Coleman, C. C. Young, John Schaming and Thomas McLean.

Exhibition by Dealers

Pittsburgh's "Radio Day" will be held August 24th, 1922, at Westview Park, which is ideally situated and adapted for the purpose. A program of events is being planned that is literally "Chock-full" of Novelty, Pep, and Entertainment. Many new and interesting radio contests are being scheduled with prizes for the winners that will cause a scramble of applicants to participate.

The prizes will be donated by the various local radio dealers and manufacturers who will stage an exhibition of the latest developments in radio appliances covering three hundred square feet of space in two large Exhibition Halls on the grounds. Some of the dealers have started a movement to have all radio stores in the Pittsburgh district close on the day of the outing, and will insert placards in their windows bearing the inscription:

"This Store Will Close August 24th,
'RADIO DAY'
Meet us in Westview Park"

Super-Regeneration Secret Revealed

Major Armstrong Explains How Amazing Amplification of 1,000,000 Times Is Achieved

A "Super-regenerative" receiver so sensitive that no aerial nor even a loop is necessary if the set is within twenty miles of a broadcasting station is the amazing achievement of Major Edward H. Armstrong long known to the wireless world as a genius. But the most astounding feature of Major Armstrong's arrangement is that his device will amplify sound one million times or more with the use of only two vacuum tubes.

This revolutionary circuit is a simple line-up of apparatus that accomplishes the same results heretofore achieved only by eight vacuum tubes hooked up in a bewildering

for the construction and operation of the super-regenerative receiver are contained in the following paragraphs.

It was by the extremely clever application of the further effects of regeneration that Major Armstrong was able to obtain amplification of signals from 100,000 to 1,000,000 times in practice, and in theory beyond that. In describing the underlying principle, Major Armstrong recently said:

"I will describe a method of regeneration based fundamentally on regeneration, but which involves the application of a principle and the attainment of a result which is be-

the fundamental theory on which Armstrong worked. This next step he explained as follows:

"The expedient by which oscillations are stopped is known as 'super-regeneration.' The trick is to balance the feedback against the damping of the circuit. When the regeneration overcomes the damping the oscillations stop, but the amplification continues. It is then possible to continue amplifying by the phenomenon of regeneration, and there is no theoretical limit to the amplification obtainable."

Three Methods Possible

In practice there are three ways in which this "balancing" feat may

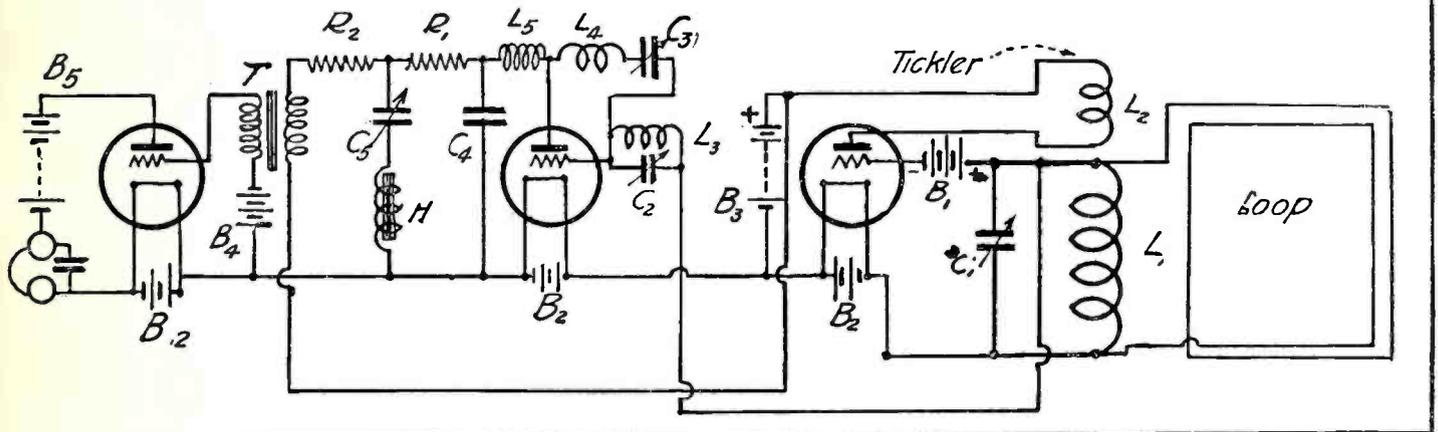


Diagram of the super-regenerative circuit designed by Major Armstrong especially for broadcast reception, showing units and connections: 1. L-1—Primary of 150 to 700 meter vario-coupler; L-2—Tickler coil. Ball of secondary of vario-coupler rewound twice the number of turns; L-3—Duolateral coil 1,250; L-4—5 Millihenry choke; L-5—Duolateral coil 1,500; C-1—.001 variable condenser; C-2—.0025 fixed (or variable) condenser; C-3—.001 variable condenser; C-4—.005 phone condenser; C-5—.005 variable condenser; R-1 and R-2—12,000 ohms Lavite iron core resistances; B-1—Biasing battery 1 to 5 volts; B-2—Filament battery, 6 volts; B-3—Plate battery, 80 to 100 volts; B-4—20 volt block battery; B-5—100 to 200 volts; H—.1 henry choke with iron core; T—Audio frequency amplifying transformer; Loop—12 turns of wire on three-foot frame.

series of inductances, capacities and resistances.

And yet, in spite of this great sensitivity, it is not too critical in adjustment, and the circuit can be understood by the average radio amateur, says Lloyd Jacquet in the New York Evening Mail Radio Review. The apparatus needed can be easily procured and can be connected in the very simple way which Major Armstrong shows in his circuit diagrams.

Armstrong Reveals Secret

The mystery of the whole circuit rests in the correct values for the various pieces of apparatus. It is very necessary that the right size coils, the correct capacities, and the proper kind of batteries be used. All of this information has now been released by Major Armstrong for the first time, and the necessary data

believed to be new. This new result is obtained by the extension of regeneration into a field which lies beyond that hitherto considered. The process of amplification is therefore termed 'super-regeneration.'

To make this clear to the layman:

Every amateur who has a regenerative receiver knows what happens when the knob of the tickler is turned too far. There is a distinct "squeal" or "howl," which can be eliminated after careful tuning. While tuning in a signal it is found that there is a gradual increase in signal strength until a point is reached where the strength becomes very great. This is the point just before the noise begins. If it were possible to remove this noise, there is no reason to believe that amplification could not continue on indefinitely. This in plain language was

be accomplished. First, by varying the feedback with respect to the damping; second, by varying the damping with respect to the feedback, and lastly, by varying both together with respect to each other. The new principle, then, is as follows: A very critical regenerative circuit is so adjusted that it is responsive to infinitely small electrical impulses or changes. It will then be extremely sensitive to changes from a very small negative resistance to a very small positive resistance, and vice versa. This change is controlled by the oscillator tube, at audio, sub-audio or super-audio frequencies. The super-regenerative receiver passes cyclically from one to the other, and while this change takes place the regenerative tube gives out a series of strong oscillations at any desired frequency.

In the first experimental circuits set up by Major Armstrong it was necessary to use one tube as the regenerator, another as an oscillator excited by E. M. F. of suitable frequency. Later experiments permitted the combination of the two actions, with only one tube used to detect, regenerate and produce the necessary oscillations.

This is not the simplest kind of a super-regenerative receiver to begin with, however, for the adjustments and controls are rather delicate and critical. For the radio fan who wants to try out the new type of receiver Major Armstrong has for the first time made public the correct values and data for the installation of a super-regenerative set suitable for broadcast listening in.

It will tune up to 700 meters without any additional loading coils.

The loop used by Major Armstrong in the demonstration was a 3-foot loop, wound with twelve turns of stranded single-wire lampcord, in a flat plane. From seven to twelve turns may be used, and bell wire is suitable for winding. The loop is connected in parallel to the primary of an ordinary vario-coupler. A condenser of .001 microfarad is used to tune up the loop circuit and is absolutely necessary. The tickler is made from the secondary of the loose coupler. The secondary ball is re-wound to twice its capacity; that is, twice as much wire is placed on it.

Parallel Connection Beat

This loop may be connected in series with the primary of the vario-coupler, but it seems to work better when in a parallel connection. The two coils L-3 and L-5 need not be placed in an inductive relation to each other. In fact, they can be placed anywhere without affecting the proper working of the set. The two small resistances which form part of the filter system are of 12,000 ohms resistance each and made of Lavite with iron cores. None of these values are critical. The rest of the filter system comprises the 0.1 henry choke and the variable condenser C-5. This choke may have a value between $\frac{1}{2}$ and $1\frac{1}{2}$ henries, and its effect may be controlled by the variable condenser C-5.

The first tube in the circuit is made to act as the regenerator, with the second tube as the oscillator. The third tube is an audio frequency amplifier and is connected in the regular way. The last tube may be left out if desired, but in that case it will be difficult for experimenters to tune the set, which will be very critical in adjustment. (This course is

not recommended, but if the audio frequency amplifier circuit is omitted the phones should be connected across the .005 fixed condenser at C-4.) In constructing the three-tube set, hard tubes—that is, amplifier tubes—should be used throughout the circuit. In actual demonstrations Western Electric "L" type tubes were used by Major Armstrong. Radiotrons U. V. 201 are very serviceable for the set, as well as any other tube with a high vacuum, which will withstand high voltages without ionizing.

Recommends "A" Battery

One filament battery may be used by merely connecting the filaments and rheostats in parallel, such as in any ordinary amplifier circuit. The use of individual A batteries is recommended, however.

If it is desired to use only one B battery, this may be done by connecting the phone lead from the plate circuit of the last tube to the 100 volts on the first tube. Instead of using the biasing negative C battery in the grid circuit of the first tube, the potential from the B battery in that circuit may be used by tapping it off at the convenient point.

Major Armstrong also gave pointers on the tuning of his super-regenerative receiver. First, of course, the loop should be pointed in the direction from which the signals are emanating. Then the loop and primary circuits should be tuned to the frequency of the incoming wave with condenser C-1. This condenser is generally set for a value of .004 microfarad. This part of the circuit is the ordinary regenerative receiver, and the first tube, therefore, acts as a detector and regenerator. The condenser across the second tube is set to the correct value, and once adjusted need never be changed again. This value depends upon the kind and type of vacuum tube used, so that no actual capacity can be given. This can only be determined by experimenting. The condenser C-5 is next adjusted, and its setting need not be changed either. These are the preliminary adjustments. Once these have been made there remain but two elements to tune, the loop circuit and the feedback.

The loop circuit is tuned by means of the variable condenser C-1, and the variation in feedback is obtained by moving the coil L-2 nearer to or further away from coil L-1. These are practically the only remaining adjustments to make.

Not for Novices

Some difficulty may be experienced at first in getting the set tuned for a particular station. After pa-

tient adjustment of the controls, this will be possible. It must be remembered that this is not a set for absolute novices and that some knowledge of the vacuum tube and its circuits is necessary for obtaining any sort of results.

While the possibilities of the super-regenerative receiver are unlimited, there are certain phases in radio receiving which must be considered. There is no doubt that the new type of receiver has amplifying capabilities far beyond that of any method employing but two or three vacuum tubes. For those who want signal strength in preference to distance, the super-regenerative receiver will serve them best. For those who like to cover as much distance as possible with their equipment, the Armstrong super-heterodyne is still the standard for performance.

Amateurs should bear this in mind before expending much time and energy and money on a wild goose chase.

Visit the Radio Club

The Radio Club of Illinois, of which Radio Age had an interesting description last month, is now located in a new and attractive home at 16 East Ontario street, Chicago. The club is only five minutes' walk from the loop district and keeps its doors open twenty four hours a day. The restaurant is open from 12 o'clock noon, to 2 o'clock a. m.

Initiation fees, including a year's dues, a lapel button and a year's membership are all supplied for \$10 and all the privileges of the club are available to all members.

It is pointed out by Mr. John Tansy, secretary of the club, that the radio rendezvous is a good place for visitors to the coming Pageant of Progress to meet their fellow radio fans. Non-resident members to a limited number can be accommodated with sleeping apartments at \$1.50 a day. The non-resident membership list is limited to 100 and the officers of the club suggest that it would be well for prospective applications for membership to be in as soon as possible.

Peoria Firm Aggressive

The United States Electrical Supply Co. (Incorporated) of Peoria, Ill., has sent out 100,000 radio sheets to individuals and companies in fifteen states. The electrical and telephone supplies, including a large number of radio specialties are illustrated and described on a large folded sheet which is equivalent to a catalogue containing 250 pages.

The City of Chicago in Radio

THE City of Chicago has for its motto "I WILL," and it is this spirit that prevails in the pioneer work that the City of Chicago is doing to apply radio to its various municipal activities. The radio activities are under the jurisdiction of Mr. George E. Carlson, Commissioner of Gas and Electricity, who is an ardent radio "fan." Mr. Carlson believes that one of the great future uses of radio communication will be in coordinating the police work of cities and other municipalities. Incidentally, it can be used to coordinate other governmental functions, broadcast public addresses, governmental information and provide entertainment. Mr. Carlson says "Chicago was a pioneer in electric street lighting and electric fire alarm and police signal systems, and it will try to maintain its past record in being one of the first in radio."

What is believed to be the first municipal radio station in the United States was established on the roof of the City Hall in Chicago as early as June 1921, and operated as an experimental station with the call letters 9 XAM. A second station was installed in the Englewood Fire Alarm Office at 64th street and Wentworth avenue, with the call letters 9 XAN, and about eight miles distant from the City Hall. Radio-telephony communication was carried on between these two stations mainly for the purpose of demonstrating to municipal officials and heads of city departments interested in special applications of radio. Development work was begun to provide transmitting and receiving apparatus for police automobiles, so called "bandit cars," and this effort was carried forward to successful demonstration.

Civic Education

In March of this year, broadcasting in Chicago had reached a climax, and many requests were made by citizens and organizations that the City of Chicago use its radio station to broadcast addresses and talks by municipal officials and leading citizens on subjects of municipal and community interest. Accordingly on Sunday, March 12th, at 6:30 p. m., Commissioner George E. Carlson gave the first address from the City Hall Radio Station (which now had the call letters WBU) on the subject "Municipal Radio." At 7:15 p. m., the same evening, Dr. John H. Williamson, Commissioner of Law

Enforcement of the City of Chicago, on "Crime and the City Council," followed. Since this auspicious opening, many leading public officials and citizens have presented subjects to the people of Chicago and surroundings from station WBU. Representative speakers and subjects have been as follows:

Dr. William J. Hickson, Psychopathic Laboratory of the City of Chicago. "The Cause of Crime."



George E. Carlson, Engineer of Gas and Electricity, Chicago. Ardent Radio Fan

Dr. John Dill Robertson, President Pageant of Progress Exposition. "Invitation to America to attend the Pageant of Progress."

Chief John C. McDonnell, Chicago Fire Department. "Fire Prevention."

Dr. Herman N. Bundeson, Commissioner of Health, City of Chicago. "Community Health a Community Asset."

Mr. Victor H. Tousley, Chief Inspector, Department of Gas and Electricity, City of Chicago. "Electrical Inspection."

Col. Frank L. Smith, Chairman, Illinois Commerce Commission "Good Citizenship."

Postmaster, Arthur C. Lueder. "How You Can Help the Chicago Post Office."

The first woman to give an address from station WBU was Miss Elizabeth Cleveland, R. N., Department of Health, City of Chicago. "Public Health Nursing."

Sports have also formed some of the features and have included:

Mr. Frank McNichols. "Semi-Professional Baseball."

Mr. Dan B. Starkey, Editor of "Outers Recreation." "Why you should make your boy a Fisherman."

Mr. Frank Padeloup, President Chicago Bowling Association. "Something about Bowling."

Mr. J. C. Hail, electrical engineer in the Department of Gas and Electricity, has been placed in charge of radio development and operation, and the broadcasting programs are under his direction. Mr. Edwin K. Oxner is associated in the capacity of Radio Engineer.

Other Practical Uses

Station WBU broadcasts police and health bulletins at 10:15 a.m., 12:45 p.m. and 4:45 p.m., daily except Sundays and holidays. Police bulletins include missing persons, stolen automobile numbers, and other items of police information. The health bulletins include conditions of water supply, milk supply, health conditions throughout the city, and any other reasonable health information or "helps" that may benefit the community. Feature speakers are broadcasted tri-weekly on Monday, Wednesday and Friday of each week, at 3:30 p.m. and also at 7:30 p.m. Wave length is 360 meters.

Station 9XB is the experimental police automobile "bandit car," and on the basis of the results attained to date, Commissioner George E. Carlson has requested an appropriation of \$68,000.00 to provide a continuous operating police dispatching station suitable for 24-hour service, and transmitting and receiving equipment for eight police automobile "bandit cars." The Finance Committee of the City Council of the City of Chicago has the matter scheduled for early consideration.

The Chicago police radio experiments have attracted attention all over the world and many other cities have made plans to use wireless as a police aid if the Chicago test proves it practicable.

Addresses 27,000 Across 1,000 Miles of Ether

President of Western Electric Company Telephones to Chicago Employees

FOR the first time in history the president of a great corporation has been able, talking from his office, to address in person several thousand of his fellow employees, 1,000 miles away, at the same time and in such a fashion that all of them heard distinctly every word he uttered. Charles G. DuBois, President of the Western Electric Company has set the unique example that is attracting widespread attention among other industrial leaders who now see the way cleared for more intimate contact with their fellow employees. The day when they required several weeks to tour the country meeting the scattered personnel of their organizations has passed.

In upsetting tradition Mr. DuBois spoke from his offices at 195 Broadway, New York City to 27,000 workers gathered in the courtyard of the Western Electric plant in Chicago. Transmitted into an ordinary telephone his greetings were carried by long distance telephone over New York, New Jersey, Pennsylvania, Ohio, and Indiana to Chicago and delivered through amplifiers and a loud speaking apparatus erected on a platform in the factory precincts so that every one within a quarter of a mile from the receiving equipment, listened in without the slightest difficulty.

The audience was also addressed by H. B. Thayer, President of the American Telephone and Telegraph Company, and F. B. Jewett, Vice President of the Western Electric Company, talking from New York; and J. C. Nowell, Vice President of the Pacific Telephone and Telegraph Company, speaking directly from San Francisco, more than 2,000 miles away.

Visitors gathered at Chicago for the experiment were amazed by the clearness of tone and the volume of sound obtained in the amplification of the addresses. To impress upon the audience the power of the loud speakers, H. F. Albright, Vice President of the company introduced one of the officials at the factory who talked with and without the aid of the loud speakers.

When he addressed the gathering without the aid of the equipment he



Edwin K. Oxner, Radio Engineer, Chicago Municipal Broadcasting Station

was heard scarcely twenty feet from the stand. Then, as the amplifier was switched on, his voice was carried out over the crowd until it reached the most distant corner of the plant.

A remarkable degree of amplification was possible with the apparatus installed for the demonstration. As a matter of fact the energy delivered to the loud-speaking receivers in the horns was 18,750,000,000 (18¾ billion) times that received over the long-distance wires, but it was necessary to use somewhat less than three-fourths of this capacity.

Officers of the Chicago Telephone Company who were present at the Western Electric demonstration were so impressed by its effect upon the factory employees that they are arranging for a similarly addressed meeting of their own personnel at Chicago. Description of this will be published in a later issue of Radio Age. It seems likely that telephoning in job lots will become a popular business feature.

Mr. Harding's Loud Speaker

ONCE again science has been called upon to help President Harding put over a message to the people. To insure perfect speaking conditions for their favorite son during the many festivities of Marion Homecoming Week, July 4 to 10, when Mr. Harding's neighbors turned out in full force to render him homage, the business leaders of his home town ordered the installation of a public address system. The equipment was capable of throwing the chief executive's voice out over an area of 100,000 square feet, or a space large enough to accommodate about 45,000 listeners.

When the Marion programme was originally planned it was estimated that the President would address about 25,000 people. Led to reconsider their estimates as a result of the enthusiasm manifested by Mr. Harding's friends in all the counties surrounding Marion, the promoters of the homecoming week were forced to augment their original plans. They instructed the engineers of the Western Electric Company who handled the installation of the amplifying apparatus to arrange their equipment in a fashion that would permit the extension of the system, if necessary, to accommodate a crowd of even larger proportions. Bell System engineers demonstrated their ability to throw the voice over great distances recently when a voice, amplified by their methods, was heard without the aid of any receiving apparatus—radio or otherwise—at a spot five miles away.

President Harding, who was the first prominent public official in the world's history to take advantage of the opportunity the loud speaker presents to address vast assemblages, promises to go down into future age as the Stentor of the White House. Where the famous old Greek was said to be possessed of a voice as loud as that of fifty men, Mr. Harding's vocal efforts have been magnified billions and billions of times. In his inaugural address he was aided by the Bell Loud Speaker in reaching the ears of practically everybody in one of the greatest gatherings ever seen in Washington.

Radio Celebrities at Pageant Show

Chicago Convention to Attract Nationally Known Electrical Wizards

THE fastest radio operators in America, if not in the world, together with the world's greatest experts in the radio development and construction field, are to attend the International Radio Congress, August 6, 7 and 8, held in connection with Chicago's second annual international Pageant of Progress Exposition on the Municipal Pier.

Maj. J. O. Mauborgne, signal officer of the Sixth Army Corps Area, located at Chicago, and associated with Maj.-Gen. George O. Squier, chief signal officer of the United States Army, is president of the congress and will preside at the main sessions, of which there will be five. The details of arrangements are in the hands of a committee of Chicago radio men, headed by Commissioner George E. Carlson, of the department of electricity of the city of Chicago, and head of the Chicago Municipal Radio station, as chairman.

Among the noted radio developers expected to take part in the congress are Maj. Gen. Squier, Charles P. Steinmets, Senator Guglielmo Marconi, Edwin H. Armstrong, inventor of the regenerative circuit, Dr. Louis Coen, F. W. Dunmore, and Dr. J. H. Dillinter of the United States Bureau of standards, and others.

Race for Operators

One of the exciting features of the congress will be a radio Marathon for a diamond medal to be held Sunday morning, Aug. 6 and participated in by the fastest receiving operators that can be assembled. The rules of the contest as outlined by the officials of the congress and by Lawrence R. Schmitt, U. S. Radio Inspector for the Ninth Radio District, who will supervise the event, include the following:

The contest is for reception only in the Continental code and the copy received will be straight commercial press which will be transcribed on regulation Western Union typewriters.

The diamond medal, valued at several hundred dollars, is donated by Commissioner Carlson. Applications for entry should be addressed to him at Room 614, City Hall, Chicago. Applicants must give their name, address, business connection, age and

previous records. The contest will be an elimination affair.

Some records are expected to be broken as the set up will be calculated to permit the greatest speed. Some of the best previous records made in the Continental code include:

Fifty-six and one-half words a minute. Made by L. R. McElroy of Boston, at the 71st Regiment Ar-



J. C. Hail, Electrical Engineer in charge of Radio Development and Operation of Chicago Municipal Broadcasting Programs

mory Radio show in New York in May. This is the fastest work recorded.

Forty-nine and one-half words a minute. Made by Jose Seron of New York.

Forty-eight and three-fifths words a minute. Made by B. G. Seutter of New York.

Entry in the contest is open to all expert receivers of the Continental code and every arrangement is being made by Inspector Schmitt for the convenience and comfort of the entrants.

There will be sessions of the International Radio Congress Monday

morning and afternoon, August 7, and also on Tuesday.

Thirty Nations Represented

Thirty nations of the world will take part in the second annual Chicago pageant from July 29 to August 14. There will be three and one-half miles of commercial and industrial exhibits, making what was conceived originally as a distinctly local show an international fair that promises to rival and possibly surpass the great fairs at Prague, Leipsig, and Lyons.

Last year no effort was made to give the exposition more than a middle west interest but exhibitors booked orders from such far points as South Africa and Alaska, China and Norway, and a dozen other countries. This revealed to Mayor William Hale Thompson, originator of the pageant, and Dr. John Dill Robertson, president, its possibilities. This year they expect the foreign trade opened up to merchants and manufacturers of America to run into the millions of dollars.

Exhibitors in the first show subscribed for space in a great measure as a civic duty, many doubting that the financial returns would justify the expenditure of time and money necessary to make the displays their pride demanded but determined to do their utmost to insure success for any enterprise undertaken by Chicago. To the gratification of all they found they had erred. Orders poured in. Factories which were running on part time, plants on the verge of closing down completely signed contracts for their products that assured operation for months at capacity.

This year there was a rush of exhibitors for space. Ninety per cent of those with displays last year renewed their contracts. The remaining ten per cent of space went in a hurry and weeks in advance of the opening date not a foot was left.

Girl Wins Scholarship

Miss Emily Doser, a shop worker at the plant of the Western Electric Company at Chicago has been awarded a scholarship at the newly opened school at Bryn Mawr College. Miss Doser is one of the six Chicago girls selected for the ten weeks course. She has been an employee of the Western Electric Company for about a year and a half.

Woman's Part in Radio

Address by Miss Elizabeth A. Bergner, Lane Technical High School Instructor, Before Exhibitors at Leiter Building Exposition

I THINK you have all heard of the woman in radio who thinks a detector is some kind of a detective, and that an umbrella aerial is the kind they use in countries where it rains a great deal. Usually you think of her as being the woman radio fan or operator, but I think you will find her mostly in the funny column. I think if you have ever talked to a woman operator or any woman who is at all interested in radio, that you have found she is extremely serious about the possibilities of radio. She is just about as serious, at least, as her small brother, and the chances are about ten to one she is a great deal more serious about radio and its possibilities than her grown up brothers or friends. She thinks in radio terms, she believes in radio, she feels the need of radio, and I believe that radio also needs her.

Probably any woman who becomes at all interested in radio follows the path of the small boy in listening to somebody else's sets, perhaps a set one of her friends has. You and I can understand she is very greatly interested, for instance, in the concerts that come over the aerial. The chances are her interest is so great she very speedily acquires a set of her own, probably sooner than the boy who is interested in that. From that point the interest grows so great, her desires to get all she can out of it is so great, that I suppose she goes on by leaps and bounds, if she is to become what we call a radio fan.

Probably the first idea that a woman has of the possibilities of radio, is its use in her home. She is interested in bringing her friends in to hear the concerts. It appeals to her as a source of social communication, if you will. She is interested in it for herself. She likes the programs that come over, she feels she can get a great deal out of them. Broadcasting stations are sending out a great many programs during the day for women, and for women alone.

I think the selfish element, however, of the woman entertaining herself or entertaining her friends, if you call that selfish, is not the one that appeals the most to a woman. And here I think the women can understand best when I ask the question, "How many ever consider the possibility of keeping the boy

Advance Schedule of Radio Shows

Electrical Exhibit at Pageant of Progress, Municipal Pier, Chicago, July 29-Aug. 14.

State Fair, Marshall, Mich., Sept. 1-10.
Toronto Radio Convention—Late in summer.

Cincinnati Radio-Electrical Exposition, Oct. 2-7.

Chicago Radio Show, Coliseum, Oct. 14-22.

Chicago-National Radio Exposition, week of January 15.

home at nights by giving him even the simplest of radio sets to play with and work with?" You have probably tried it. If you haven't tried it, I advise you to do it. If you are up against the problem of keeping boys in at nights, keeping them off the streets, just get a radio set or one for your home; it is inexpensive, and certainly the expense is absolutely negligible if taken into account at all in comparison with the good it does to your boy. They tell me the same thing works with husbands, but I cannot speak from experience there.

Gradually,—well, I should say very suddenly, you get the desire to find out what the dots and dashes are. You know very few people like to listen to the other fellow talking all the time, and that is, of course, what you are doing in radio receiving; you are listening to what the station sends you, and you have to take what they send you.

Of course, you can turn off your tubes, but then you are worse off than you were before. But you want to get to the point where you can talk with the other fellow, where you can create something, and that, after all, is the great pleasure in being able to send, to use a key and talk to the other fellow. Just how much you create is, of course, another matter. But that desire is there. And so a woman is attracted by these dots and dashes and the possibility of being able to talk, and then, of course, from that point on, she will work towards this end. That is, if she makes up her mind that she wants to do this, the probabilities are that she will keep at it until she does learn it.

From this point, of course, she gains more or less rapidly the tech-

nique necessary, and finally she becomes a full-fledged operator, either amateur or commercial.

Now, of course, the two fields are extremely different. In the amateur field there is no compensation other than the pleasure that you derive from it. There is no money compensation. However, in amateur work, as well as in commercial work, woman is taking a leading place, I think. We hear of an Assistant Traffic Manager in the West. I can quote an instance in Washington, Miss Winnie Dow. If you don't know what a traffic manager is, it is simply a question of assisting, in part, the radio inspector, I believe, to keep order in the air and also to help in handling messages from one part of the country to the other. That, of course, is merely amateur work, though it is an executive position and one which it is hard to find a person to fill.

We have Mrs. Candell, Assistant Superintendent of Ohio, who also has such an executive position.

However, in the commercial field the opportunities are even greater, and here, of course, the greatest interest is aroused in a woman. Time after time letters come to me asking me just the possibilities for women in the commercial field. In New York we have a woman who examines the ship stations for sailings. We have an assistant examiner in that capacity in Boston. In Boston we have a society woman who is interested in forming a large radio company for radio supplies.

Radio Needs Trained Men

Radio is sweeping the country like wild fire. Thousands of dollars are being spent for expensive outfits. RADIO EXPERTS are needed everywhere to keep this equipment in order and to sell and install new outfits.

Be a Radio Expert

I will train you quickly and easily in your spare time, to become a RADIO EXPERT so you can install, construct, repair and sell Radio equipment. I am a Graduate Electrical Engineer and from actual experience I will give you exactly what you must know to make the really big money in radio.

FREE My Consultation Service to you is FREE. This outside help which I gladly give you is, in itself, worth more than the small cost of the Complete Course.

START NOW

Don't let others beat you to the big money. Start now and within a few weeks' time I will train you at home, at an amazingly low cost, to become a RADIO EXPERT. Write for "Radio Facts" sent free without obligation.

A. G. MOHAUPT, Electrical Engineer
American Electrical Association
4519 N. Winchester Ave., Chicago

WRITE TODAY

Application of the Vacuum Tube to Radio Circuits and Apparatus

By FRANK D. PEARNE

Chief Instructor in Electricity at Lane Technical High School, Chicago

IT is only within the last few years that the great value of the vacuum tube in the radio field has been known. Dr. J. A. Fleming, of London, was the first to discover the rectifying nature of this form of detector when he made his "glow lamp oscillation detector," which name he adopted because he discovered that this lamp would conduct electric currents in one direction, better than another, through a vacuum.

From that time on inventors in almost every country in the world worked on the development of this greatest of all additions to the art of oscillation detection, until today we have it perfected to such a point that it is used in many different capacities in radio work, among which are detectors, amplifiers, rectifiers, oscillation generators and modulators.

In order that the reader may fully understand these different applications of the vacuum tube, it is necessary that he know something of the electron theory which makes possible the conduction of the electric current from the plate to the filament.

The Electron Theory

The smallest known element of electricity is the electron. An atom of any particular element consists of

many thousands of electrons, which are always of negative polarity. The exact number and arrangement of these electrons are definite for any particular element. Now we must consider any atom as being made up of a definite number of electrons, and if any of these electrons become detached, or attached to an atom (that is giving it more or less than its definite number) the atom then displays the same properties as an electrically charged body. When the electrons become detached, the atom becomes what is known as a "positive ion," and it will then act the same as a positively charged body, but if more electrons become attached to the atoms, it then acts as a negatively charged body, and the atom becomes what is known as a "negative ion."

From this it will be seen that when an atom becomes charged with electricity, it becomes either a positive or negative ion, depending upon whether electrons have become attached or detached from it, and if a stream of these electrons can be carried from one point to another it constitutes an electric current flowing between the two points. It makes no difference whether or not these electrons are carried in the form of actual electrons, positive ions, or negative ions, except as regards the direction of the current.

are negatively charged, and negative electricity only can pass from the filament to the plate, which is the same thing as positive electricity flowing from the plate.

Figure 1 is a diagram of such an arrangement. When the filament is rendered incandescent, current flows from the positive terminal of the battery "B" to the plate "P," through the stream of electrons to the filament and back to the negative terminal of the battery "B." If the current from the battery is reversed in direction, no current will pass between the plate and the filament, for the reason that the plate will then be charged with negative electricity, which will tend to repel the negatively charged electrons instead of attracting them, hence it will be seen that should an alternating current be applied to the plate and filament, current could only pass between them at such a time as the positive impulse was impressed upon the plate, the negative part of the cycle would not pass.

Thus the vacuum tube becomes a rectifier of the alternating current; that is, regardless of the fact that alternating current is being applied to the tube, a direct current consisting of many impulses per second will pass through the circuit.

A diagram of the alternating current wave is shown at "A," Figure 2, while "B" in the same figure shows the rectified half of the wave, and the dotted lines show the half

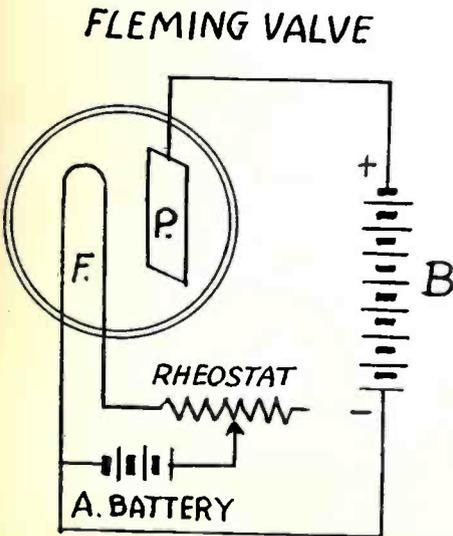


FIGURE 1.

Dr. Fleming's Valves

If a piece of metal is placed in a vacuum and heated to incandescence the electrons of which the particles of metal are formed become loosened and become, to some extent, free to move about. If a metal filament and a metal plate are placed in a vacuum with some source of electricity applied to heat the filament, and an electrical pressure is exerted between the plate and the filament in such a way that the plate is positively charged, quite a number of the electrons which are loosened from the filament will be attracted to the plate. By this action of the electrons, the space between the plate and the filament becomes a conductor, but only in one direction. This is because the electrons which are liberated from the hot filament

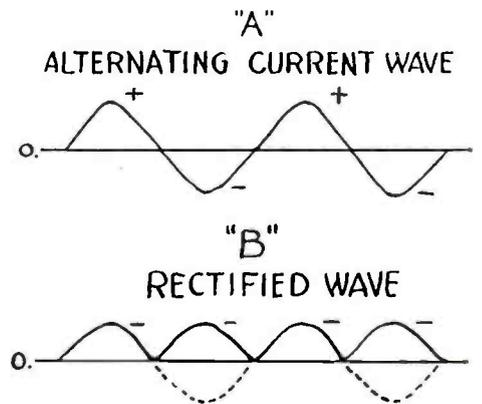


FIGURE 2.

of the wave which does not pass. Arrangements of this kind have been put upon the market for charging storage batteries from alternating current lighting mains, and are called rectifiers.

Now, while it is true that this Fleming valve will only conduct electricity in one direction, it is also a fact that only a limited amount of current can flow through the valve, for the reason that the number of electrons liberated from the filament per second is limited, and consequently no matter how high the applied alternating current voltage may be, only a certain amount of current can flow. As the number of electrons liberated per second will depend upon the size of the filament and the temperature to which it is heated, these valves are constructed in several different sizes, according to the amount of current which they are to pass.

The Amplifying, or Magnifying Valve

One of the main characteristics of the Fleming, or two-element valve, is the fact that it does not obey "Ohm's law," which states that the amount of current flowing in a circuit is directly proportional to the applied pressure and the resistance of the circuit. In the case of the Fleming valve, the plate current is not proportional to the plate voltage except within a very limited range of values of the latter.

This is true also of the "triode," or three-element valve, which is used for many different purposes. This triode valve is the same thing as a two-element tube, with an additional element interposed between the filament and the plate. This new element is called the "grid," which is composed of either a perforated plate, or more often, a simple screen of nickel wire. It is not connected to anything inside the tube, but is connected to a terminal in the base by means of a single wire. This addition of the grid to the Fleming valve was the one thing which revolutionized the art of radio telegraphy and telephony, and practically made a new science. By making the plate more or less positive (within certain limits) the plate current can be increased or decreased, and the same effect can be obtained by keeping the plate voltage constant and merely supplying a more or less positive or negative charge to the grid.

The reason for this is easily understood; the grid is directly in the path of the electrons which are traveling to the plate, on account of its posi-

tive charge; the electrons, or at least a great number of them, pass through the openings in the grid.

Now if the grid was given a slight positive charge, it also would attract electrons from the filament, which would increase the total number of electrons in the stream, which would also increase the amount of current flowing from the plate to the filament, but if on the other hand a slight negative charge was applied to the grid, some of the electrons would be repelled and the total number in the stream would be made less, then the amount of current flowing from the plate would be decreased. A saturation point is reached, just the same as in a two-element tube. The attainment of this value is assisted by the absorption of some of the electrons by the grid itself, when it is positively charged. The more positive the grid is charged the more electrons it will absorb, and consequently the current flowing from the plate will be just that much less, but as the current in the grid circuit due to absorption of electrons is so extremely small, it means very little in the ordinary triode tube, and need be only considered where large-sized tubes are employed.

Grid's Balancing Point

When the tube is to be used for detection and amplification, the circuit is so arranged that the grid charge is produced by the incoming signals, which, when they strike the grid as oscillations, will increase or decrease the flow of electrons to the plate and cause a consequent increase or decrease in the current flowing from the plate.

Now it has been discovered by experiment that each and every tube

has a critical point, at which a very slight change in the charge on the grid will make enormous changes in the flow of electrons, and consequently the current flowing in the plate circuit may be made to vary to a great extent by extremely weak changes in the charge received upon the grid. In order that this effect may be utilized to the fullest extent, the grid is usually charged artificially to just the balancing point, so that any incoming signals of a very weak form will upset this balance and make very large changes in the plate current. Now it is easy to understand how, if a pair of head phones are connected in the plate circuit, very weak incoming signals will be greatly magnified in the receivers, making it possible to receive them quite loud in the receivers when it would be impossible to detect them with a crystal detector.

The variation in the artificial charge placed on the grid to obtain the balance is accomplished by means of a potentiometer connected across another battery, as shown in the circuit Figure 3.

By means of this potentiometer the pressure between the grid and the filament can be varied from a negative value of say 10 volts when the slider is on one end of the potentiometer, to a positive value of 10 volts when the slider is on the other end, thereby allowing the grid potential to be varied to any desired value between these two limits. While this method is very good for adjustments where it is desired to increase the sensitiveness of the set to a very fine point, still many of the more modern sets do not use this extra battery for loading the grid.

Figure 4 is a chart showing the curve of a typical valve of comparatively small dimensions, such as would be used for receiving sets having a battery of 100 volts applied between the plate and the filament. The horizontal line represents the artificial charge on the grid, which is supplied by the potentiometer, and the vertical line shows the change which takes place in the current in the plate circuit by the variation in the charge applied to the grid. For example, it will be seen that with a negative grid charge of between 6 and 8 volts shown at "A," the knee of the curve is found, and any slight change tending to cut down the negative charge will cause a considerable rise in the plate current, and if the incoming signals which strike the grid can be made to reduce the negative charge from "A" to "0" and

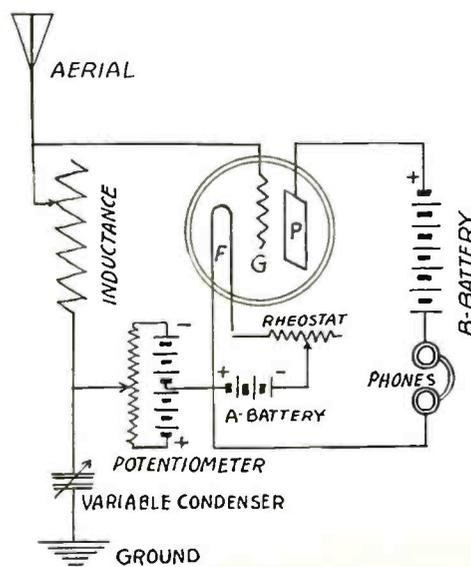


FIGURE 3

(Continued on page 24)

Radio Equipment at KDKA

By D. G. LITTLE

Radio Engineer, Westinghouse Electric & Manufacturing Company

WITH the increasing popularity of radio broadcasting a description of station KDKA at East Pittsburgh, Pa., will be of interest to the general public, a large number of whom are already acquainted with the station through their receiving sets. KDKA opened November 5, 1920, with the broadcasting of the presidential election returns that day.

The power of KDKA was at first relatively small, on the order of 100 watts being delivered to the antenna. In August, 1921, the range of the station was increased by improving the height of the antenna and raising the power output first to 500 watts and subsequently to 1,000 watts.

In keeping with the growth of the station, a special studio was arranged for the artists and announcer, particular attention being given to the acoustic properties, so that echos, reverberation and other disturbances have been largely eliminated. The quality of transmission from this station has been improved at every opportunity by means of the studio, and by improvement in the apparatus. The usual carbon microphone has been replaced by a condenser type transmitter for picking up the sound waves. Resistance coupled amplifiers are employed for increasing the relatively weak output of the pick-up transmitter to a power sufficient to control the radio set.

The natural oscillating frequency of all the units in the pick-up and amplifier system has been placed, so far as possible, outside of the audio

frequency range, so that the radio signal is practically a perfect reproduction of the original sound. Special filter circuits are arranged to eliminate generator hum in the power supply to the radio transmitter. As broadcasting becomes less a novelty and more a practical form of entertainment, the high quality of KDKA's programs is being greatly appreciated. After over a year of operation this audience is very exacting as to the quality of reproduction and arrangement of the programs.

How Current Is Changed

The path of the speaker's voice from the studio to the receiving station is shown in diagrammatical form in Fig. 2. The sound wave picked-up by the transmitter in the studio, theatre or church is amplified before it is transmitted by means of a telephone line to the radio station, where it is further amplified and used to control the output of the radio transmitter. The radio transmitting set is supplied with power directly from the work's power plant through a step down transformer for



Fig. 5—Oscillogram of Rectified Antenna Current for Modulation of Vowel A

the vacuum tube filaments and through special motor generator sets, which change the 220 volts, direct-current to 2,000 volts direct current for the tube plates.

The radio transmitter changes this power from 2,000 volts direct-current to alternating-current power at a frequency of 833,000 cycles per second (360 meters wave length) which is supplied to the radiating system, consisting of an antenna and counterpoise. This high



Fig. 1—Percy Hemus, Baritone, and Gladys Craven, Pianiste

frequency power in the antenna system sets up waves, in the ether, which travel outward in all directions and, intercepting the receiving antenna, set up voltages and currents which operate the receiving sets.

A general view of the radio transmitter now in use at KDKA is shown in Fig. 3. This set furnishes about one kilowatt high frequency power to the antenna. Fig. 4 shows the circuit diagram. For convenience in studying the circuits represented by Fig. 4, which carry a wide variety of frequency, this diagram has been divided into four sections by means of the dotted lines at the right. The lower section, which may be considered as the power supply, carries only direct current at 2,000 volts and low-voltage alternating current at 25 cycles. This 25 cycle current is used only for heating the filaments. To prevent any of the 25 cycle current being superimposed on the grid-filament and plate filament circuit, the return of the grid circuits and the 2,000 volt circuit is connected to the mid point of a resistor r, which is shunted across the filament, each half of the resistor being shunted by a condenser for by-passing the radio and audio frequency circuits.

In the next section of Fig. 3, in

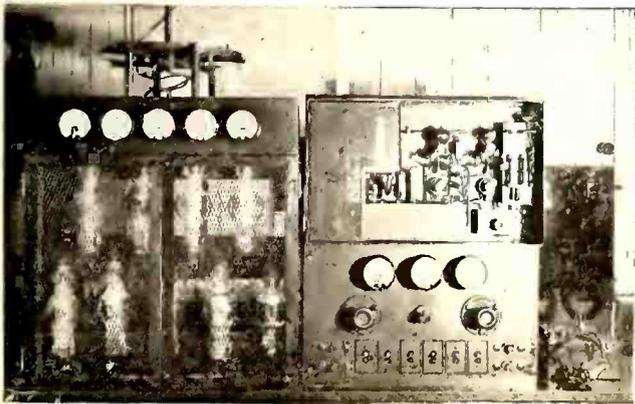


Fig. 3—General View of Equipment in the Operating Room

addition to the power circuits described, audio frequency voltage is impressed upon the grids of the modulator tubes, varying the potential of these grids with respect to their filaments according to the voice waves, through the medium of the pick-up transformer and amplifiers.

The four 250 watt power tubes in the upper part of the set are the oscillators, which, in conjunction with the condensers and oscillation transformer, change the 2,000 volt direct-current powers into alternating-current power at 833,000 cycles, thus generating the carrier wave, which is impressed on the antenna through a remote controlled double throw switch, which allows the same antenna to be used for receiving when the station is not broadcasting. The amplitude of the radio frequency wave thus generated is constant as long as the plate voltage remains constant, and fluctuates with the plate voltage when the latter is varied.

Thus the upper section of Fig. 4 carries only modulated radio frequency waves, while the third section carries both radio frequency and audio frequencies, in addition to the 2,000 volt direct-current and the 25 cycle alternating-current power circuits.

Power Modulation

The function of the five modulator tubes, also rated at 250 watts each, is to vary the voltage on the plates of the oscillator tubes according to the voice frequency impressed upon their grids by the speech amplifiers. This system is known as power modulation, the modulation being accomplished by means of the con-

stant choke oil in series with the positive lead to the modulator and oscillator tube plates. The modulator tube grids are held at a static potential of 80 volts negative with respect to their filaments by means of a battery. (See Figure 6.)

The audio frequency from the speech amplifier then adds to or subtracts from this 80 volt grid potential. At an instant when the modulator tube grids have impressed upon them by the amplifiers a low negative, or zero potential with respect to their filaments, the tube impedances from the plate to the filament are low and a large plate current flows in the 2,000 volt direct-current circuit to the modulator tube plates.

Because of the very large inductance (50 henries) of the audio frequency choke coils in series with the plate supply, the total generator current can change very little in a brief interval of time. Hence, part of the generator voltage occurs across the choke coils, thus lowering the voltage impressed on the oscillator tube plates and hence the radio frequency output of the set. The next instant when the modulator tube grids have a high potential with respect to their filaments, the plate impedances are high and little or no current flows through the modulator tubes.

The choke coils, tending always to keep the total generator current constant, create a voltage which adds to the generator voltage and thus forces most of the current into the oscillator tubes, which increases the radio frequency or antenna output accordingly. In this way the audio frequency choke coils cause the voltage applied to the oscillator tube plates to fluctuate in proportion to the speech voltage impressed on the grids of the modulator tubes by the speech amplifier. As the amplitude of current in the antenna varies directly with the plate voltage on the oscillator tubes and as this voltage varies from nearly zero to 4,000 volts, the an-

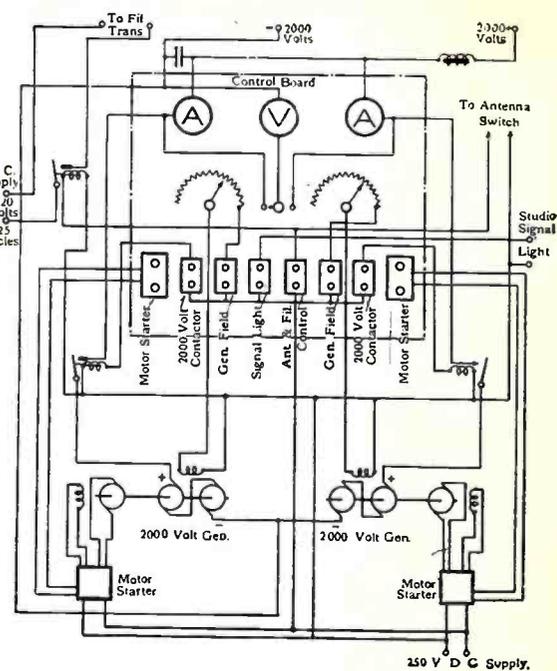


Fig. 7—Circuit Diagram of Power Equipment

tenna current varies accordingly.

Fig. 5 shows an oscillogram of rectified antenna current taken when the announcer is speaking loudly into the pick-up transmitter. It is seen that the antenna current varies from nearly zero to nearly twice its no talk value. This variation in antenna current at voice frequency is known as modulation.

The radio frequency choke coils in series with the oscillator tube plates serve to stop any radio frequency from entering the modulator and power supply circuits. These choke coils are of air core construction and are about five millihenries inductance each. They thus offer a high impedance to the radio frequency, but negligible impedance to the audio frequency.

In order to indicate the amount of modulation, a so-called modulation meter has been developed. This consists of a current transformer, the primary of which is connected in series with the direct-current supply to the oscillator tube plates and the secondary of which is connected to a thermo-ammeter.

Meters in Abundance

The transformer ratio is such that an audio frequency variation in the direct-current from zero to twice its normal value gives full scale deflection. An air-gap is provided in the transformer core to prevent saturation due to the direct-current component of the plate current. The meter has a current scale marked from 0 to 100 percent modulation. When the announcer is speaking into the transmitter, the modulation

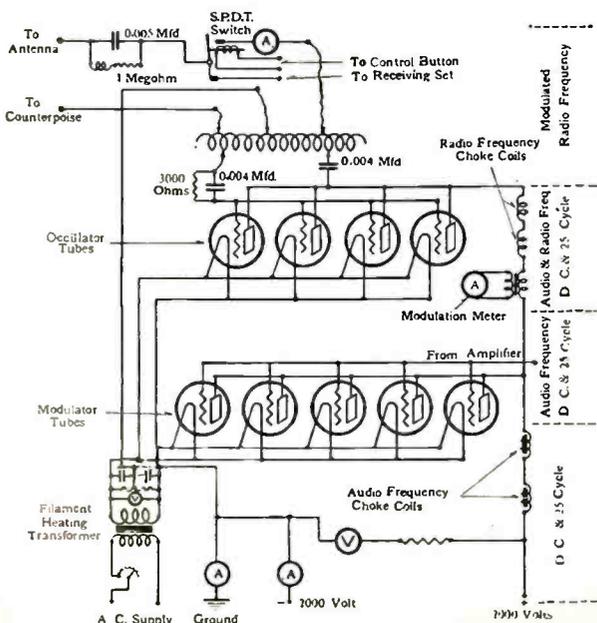


Fig. 1—Hook-Up of Broadcasting Transmitter

meter averages about 40 percent with maximum between 70 and 80 percent. Piano solos average about 30 percent, violin solos 20 to 30 percent and vocal numbers 40 to 50 percent with maximum of 100 percent.

Of course the modulation meter indicates only the average volume of sound. While the meter may read only 30 percent in case of piano music, the individual notes at the instant of striking may reach 80 to 90 percent.

Allowing for the kind of sound being transmitted, that is, piano, speaking voice, solo, etc., the modulation meter provides a convenient means of finding the correct distance to place the artist from the pick-up transmitter and accounts to a large extent for the uniform volume of sound received from KDKA. The instruments at the top of the transmitter panel, Fig. 3 are from left to right, filament volt meter, ground current meter, plate ammeter modulation meter and plate volt meter. The antenna current meter is mounted on the wall with a series condenser and discharge resistance and is not shown in the photograph.

The antenna at KDKA consists of 6 wires, 190 feet in length on 20 feet spreaders. This antenna is supported 210 feet above the ground by a brick smoke stack at one end and by a 100 foot pipe mast on a nine story building at the other end. The operating room and studio are located on the ninth floor of this building. Fig. 6 shows the mast end of the antenna with the operating room directly below. A counterpoise which is a duplicate of the antenna in construction is placed 110 feet beneath the antenna. This brings the counterpoise about 15 feet below the transmitting set.

The down lead from the antenna and the counterpoise lead are made up of eight strands of No. 14 copper wire equally spaced around 1.5 in. diameter wooden spacers. The natural period of this aerial system is approximately 412 meters. A series condenser of 0.0005 mf. capacity is used in series with the antenna and sufficient loading inductance added to obtain the desired wave length of 360 meters. The series condenser is shunted by a radio frequency choke coil of 10 millihenries inductance in series with a one megohm resistance, to drain off any static charge that might accumulate on the antenna when

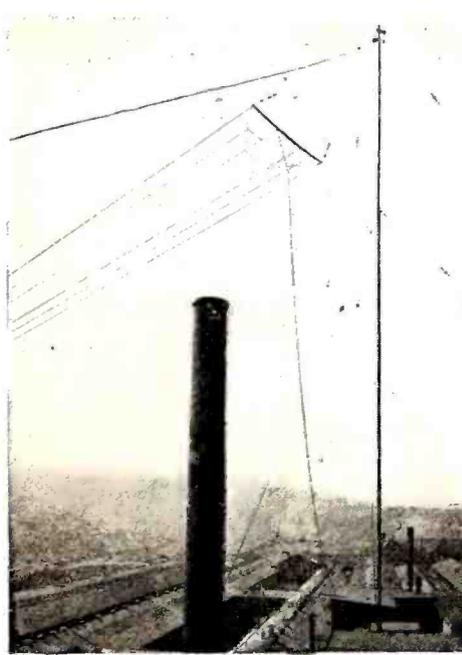


Fig. 6—Antenna at KDKA

insulated from ground by the series condenser. The high frequency resistance of the antenna system at 360 meters wave length is approximately 12 ohms, a large percentage of which is radiation resistance. The antenna current at 500 watts is 6.5 amperes; at one kilowatt it is 9 amperes.

Three Motor Generators

The power equipment consists of two 2 kw. motor generator sets with 250 volt direct-current motors. The current employing two armature windings and two commutators permanently connected in series. Nor-

mally the motor generator sets are used with the generators paralleled.

Either set may be used alone with the radio set at reduced power. There is also a third motor generator set with a 220 volt 25 cycle motor which can be connected to the radio set in case of failure of the direct-current supply. This set is provided with an exciter to supply the field of the high voltage generator. A filter consisting of a 50 henry inductance and 32 microfarad condenser reduces the generator hum to a negligible amount.

The panel beneath the speech amplifier on the right in Fig. 2 controls the power equipment. Here are mounted generator field switches and rheostats, generator paralleling switches, generator voltmeter and ammeters, voltmeter switch, antenna switch control and studio signal light button to show the announcer in the studio when the transmitting set is in operation.

The engineer in charge of the station tests all filament and plate batteries before each program. He next starts the transmitting set and checks the wave length by means of a wave meter. He then lights the signal light in the studio, notifying the announcer that the transmitter is in operation. The announcer turns on the studio amplifier which lights a signal light in the operating room, notifying the engineer that the audio circuits are in operation. The engineer then watches the modulation meter and adjusts the amplification of the speech amplifier to give the desired amount of modulation.

A loud speaking receiver in the operating room serves as a check on the quality of the transmission. When programs from local churches or from the downtown studio are to be transmitted, the telephone line is tested before the program. Orders and any special arrangements are made over a supplementary order wire or phone line between the radio station and place of the performance.

In the concert room the music or speech to be transmitted is recorded on the microphone transmitters by vibration of the diaphragm, one transmitter being used for each instrument, vocalist or speaker.

The recently inaugurated market quotations service is designed for the especial benefit of the farmers, merchants, brokers, co-operative growing and marketing associations, etc.

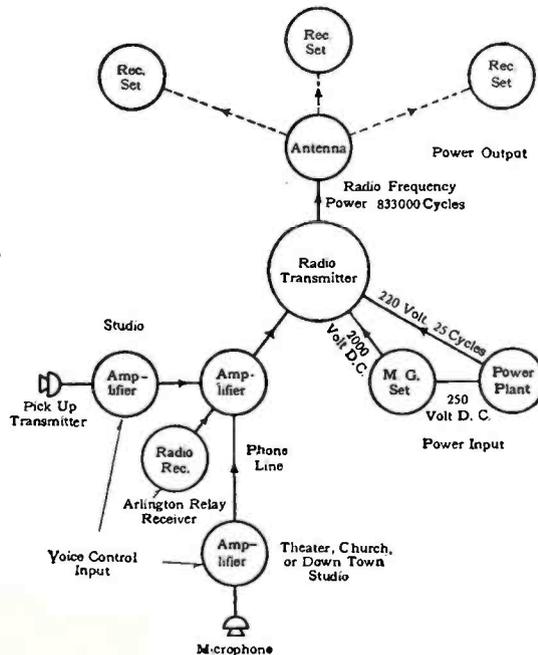


Fig. 2—Schematic Diagram of Radio Broadcast Station

Radio Progress Around the World

IN view of the often repeated and perfectly true assertion that the United States leads the world in radio advancement and number of radio students it is interesting to note what some foreign countries are doing with wireless.

The United States government maintains radio stations at Porto Rico, the Canal Zone, Guantanamo, Cordova, Alaska; St. Paul, Pribilof Islands; Honolulu, Guam, Samoa, Tutila, Cavite, Philippine Islands; Vladivostok and Peking, and through foreign stations of the international chain has communication with every part of the world. A special station of high power is maintained at Coblenz for the use of the American troops there.

Norway

A new radio station is being built in Norway on the summit of Rundemandon, a 2,500-foot mountain near Gergen, with the hope that radio communication between the United States and Norway may be established. The station is designed to have a 3,000 kilometer telegraph radius and an 800 kilometer phone radius. With the phone verbal communication will be held with England. The station will be ready in August, according to expectations.

China

Negotiations between the Chinese government and an American company have been completed whereby China will have within the next two years a complete system of radio communication facilities, which will include one station as large as any at present in existence.

The contract covers the erection of five radio stations, the first to be built at Shanghai. This station will consist of six towers, each 1,006 feet in height. The equipment will include two 1,000 watt arc sets, and will operate on a single-wave system.

In other parts of the world, too, the construction of wireless stations is progressing at a great rate. The zone of radio telegraph stations is constantly being enlarged, each week bringing reports of new and remote lands reached.

South Atlantic

The British island of Tristan da Cunha, in the middle of the South Atlantic, with its 120 odd souls, mostly descendants of Napoleon's St. Helena guards, who hardly hear from civilization more than once in two years, is at last to have a mis-

sonary and radio communication.

Tristan da Cunha is a mountain, 4,000 feet high, rising out of the ocean wastes like an inverted pudding bowl, and, as we saw it, was wreathed in swirling mists. The little colony lives in stone huts on a green strip of pasture land at the foot of the mountain.

Having no commerce and no money, these people certainly cannot worship Mammon, but it is doubtful if they worship God. The two plucky missionaries who have exiled themselves among them for at least two years will try to teach them. They brought large quantities of supplies and civilized comforts and a radio set, so that henceforth Tristan da Cunha will not be cut off entirely from the outside world.

Australia

The preliminary work of establishing the huge Australian radio station for direct communication with Great Britain has been begun at Melbourne.

The sub-stations for overseas traffic will be about three times as powerful as any European station today. It will take two years before the central and feeder stations are completed. As a normal performance the chief station will be able to speak direct over 12,000 miles for the greater part of any working day.

Receiving and sending stations to correspond will be built in Canada during the same period. The plant for the main station will be imported from England, but the plant for the feeder stations will be manufactured in Australia, one for each of the states.

The combined cost of all these stations will be about \$5,000,000. The main station will consist of a transmitter and receiver terminal thirty miles apart, the latter including twenty-four towers each 800 feet high, spread over a square mile. The wireless rates will be one-third less than the present cable rates to Europe.

Canada

The Canadian law, in effect on June 1, reads:

"Every person operating a receiving equipment must have a license; the fee is \$1 per annum and is used to assist in paying the expenses necessary to maintain the inspection staff for the patrolling of the ether so that the reception of broadcasted radio concerts and programs may not be interfered with by irregularly operated transmitting stations.

"Effective June 1, 1922, the naval department announces that all nationality restrictions in connection with radio receiving licenses are canceled and that henceforth any person, irrespective of nationality, may obtain a 'receiving license.' The restriction limiting the issue of transmitting licenses to British subjects remains in force."

Brazil

Brazil is installing the most complete cable and radio system in South America, Charge d'Affaires Crosby at Rio de Janeiro reported to the commerce department.

"It is believed," he said, "that during the present year the development of cable and radio facilities in Brazil by American, British, French, German and Italian companies will give that country the most complete system of international communication in South America."

Belgium

Radio telephony is still an unknown science in Belgium. Only recently King Albert listened to his first aerial conversation—a message from the Eiffel tower in Paris.

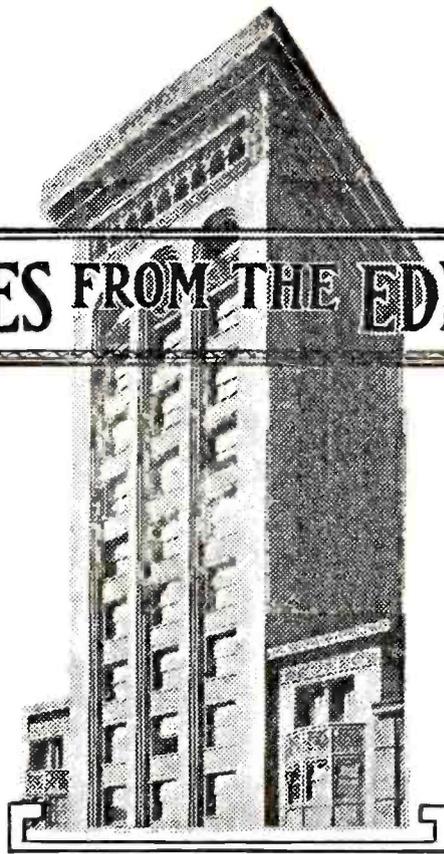
The Belgians have not yet fallen victims to the craze that has spread thru the United States during the last few months. There is not a single radio telephone broadcasting station in Belgium, the few more scientific persons who have built receiving equipment depending entirely upon Paris and Scheveiningen in Holland for their entertainment. Such is the unique picture of aerial communication conditions in the little kingdom as pictured by L. Van Dyck, chief of the production branch of the Bell Telephone Manufacturing company at Antwerp, who has come to the United States to study methods at the company's factory at Chicago.

Expects Much from United States

"Belgium," Mr. Van Dyck declares, "has acquired the habit of looking to the United States for all suggestions in electrical matters. Once the radio telephone has proved its feasibility as a commercial enterprise here, Belgium undoubtedly will take steps to adopt it."

Clapp-Eastham Company, 139 Main Street, Cambridge, Mass., have issued an attractive, informative and comprehensive catalogue of Radio, Electrical and Laboratory Apparatus under the title of Bulletin FZ-1922, Fourth Edition.

THOUGHT WAVES FROM THE EDITORIAL TOWER



WE commend to all readers the article published in this number of Radio Age on "The Development of Radiophone Broadcasting." In our June number we published an article on the Washington conference which decided for certain wave allotments and other limitations respecting broadcasting service. We published this information probably more extensively than any other radio periodical for the reason that we regarded the subject as of paramount importance in all lines of radio. At least it appealed to us more than did some material which came to hand regarding the attachment of a radio receiving set to milady's garter.

The article published in this number was written by Mr. L. R. Krumm, who was a radio man with the Signal Corps for eighteen months in France. Mr. Krumm knows what he is talking about. He is with the Westinghouse Company. It is not surprising that, because of his affiliation with that great corporation, he should have some definite ideas on broadcasting privileges, public and private. He sets forth frankly the attitude of himself and presumably of the Westinghouse organization and that makes interesting reading, whether we all agree with him or not.

If any reader has another side of the question to present we shall be glad to publish it and we have no doubt Mr. Krumm will be among thousands to read it with interest.

Surface thinkers have been saying, these hot days, that radio is done for. No interest in radio, they proclaim. Just a passing fad, as they thought all along. Here is a word to you fellows who let the summer doldrums make you think that the world is all awry. If you will step into the office of Radio Age we will show you files of correspondence that prove there is, at this peak of the torrid season, a very lively and substantial interest in radio all over

our blessed old United States. The croakers who talk about summer static making radio transmission a flivver in the summer and the tragic glooms who spin terrible yarns about the danger of lightning in connection with radiophony have the wrong ticket and they are not even in the right laundry. Hundreds of thousands of men and boys, and an amazing number of women and girls, are building and using their radio outfits. Vacation journeys and motor rides, baseball thrills, fishing expeditions and picnics take Americans away from their homes during the hotter weeks of the year and when the folks are away from their homes they are away from radio, as a rule. However, they are going to troop back to their bakelite panels and their tubes and crystal detectors within a few weeks. Antennae are going to cobweb the city roofs and the country dooryards this fall. Programs broadcast from the rapidly growing number of stations are going to be improved until they will enlist the interest and enthusiasm of a big share of our urban and rural population. Some of the smartest capitalists in the country are throwing millions into radio activities. Radio manufacturers are a tremendous industry, not prospective but actually existing. Meet us at the fall and winter radio shows and give us a chance to say "We told you so."

If you read the official government article in this number which sets forth how radio transmission is being used to disseminate market quotations, weather news and crop reports, you probably will not be surprised that the United State Government is a confirmed radio optimist. The article predicts that the radiophone is to become as common as the telephone. There are many farmer boys on our subscription list and if they do not read that government article they will miss something every country boy should know. And for that matter the facts therein will help the city boys, too. Likewise city grown-ups.

In its issue of May 12 the London Daily Express tells under first page headlines its enterprise and the new era of news dissemination inaugurated by it in broadcasting the Carpentier-Lewis fight.

The Daily Express evidently has not heard of the strides American newspapers have made in the use of radio. Read what the London Journalist wrote on May 12, 1922:

"A wonderful and romantic new era was inaugurated by the Daily Express last night, when, for the first time in the history of the world, a newspaper broadcasted news of universal interest by wireless telephone. The event marks an epoch in the progress of human communications.

"Dempsey, the champion, described the fight between Carpentier and Lewis not only for our readers, but to the multitude of wireless telephone users in Great Britain and the continent.

"His story of the sensational fight was converted by the ordinary telephone from Olympia, where the fight took place, to the Daily Express broadcasting station at Slough, the headquarters of the Radio Communication Company, and thence sent through the ether to an eager, waiting world."

Questions and Answers

This Department Conducted by FRANK D. PEARNE, Technical Editor of RADIO AGE and Chief Instructor in Electricity at Lane Technical High School, Chicago

A. L. W. Jr. St. Louis, Mo.

Question: In your June issue the enclosed circuit was printed and I am of the mind to try it, but am uncertain as to the accuracy of the diagram.

Referring to the first page of amplification you will note that one side of the amplifying transformer goes to terminal "A," other side "B" to a bus terminal leading to a battery and primary of No. 2 transformer; terminal "C" from detector to a bus terminal leading to No. 2 transformer primary and phone terminal, the phone terminal being one side of the battery. Now what I wish to know is, if using only one stage is the battery to flow through the phones without any controlling device and what size is the battery, that is, how many cells? If using 2 stages must the phone terminals which I just spoke of be connected together? If you can make this clear I will be greatly obliged to you. Am having good success with crystal detectors and like the clearness in preference to the screech of most audion sets.

Answer: Not being familiar with this circuit, I have compared it with that shown in the June issue and find that your sketch is correct. In answer to your first question it seems to me that the battery should be used as you suggest, although I must admit that I cannot see just what action takes place unless the second crystal not only acts as a rectifier but also varies the battery current through the phones, in which case it would seem that a carborundum crystal would work best at this point. In case two stages are used the phone terminals would have to be closed in order that the battery current could act. This would give an unbalancing effect when signals are received, in addition to the rectifying of the oscillations, but there is no apparent need for rectifying at this point if two stages are used. The article states that a standard 22½ volt battery is to be used. This battery is known as a standard "B" battery and is composed of 15 small dry cells put up in one package.

M. C. I., Chicago, Ill.

Question: Will you kindly explain in words and diagram how to construct an inside aerial.

Answer: There are many forms of inside aerials and the construction of same will depend upon the available space. A very serviceable aerial can be made simply running one strand of ordinary bell wire around the room, placing it behind the moulding used for hanging pictures. Of course this should only be used where the room is above the first floor, as it will not be very efficient if it is not fairly high from the ground.

M. R. E. Co., Bedford, Ohio.

Question: In your first issue of Radio Age Magazine, on page 9, you say at the end of the article "Further information about Radiola will be furnished upon request." I wrote to you signing under the firm name asking for information about this, as I want to know if there are any patents on using, or making receiving sets in phonograph cabinets, also if you can advise me as to what is the best and loudest receiving hook-up on the market? If you can give me this information, it will be appreciated, as your magazine offers this upon request. I am a subscriber to your magazine under my personal name.

Answer: There are no patents covering the putting of radio apparatus in a phonograph cabinet, although most of the circuits used are patented. The particular circuit used in the Radiola is the regenerative type and uses the new Western Electric loud speaker. The ideal arrangement for an instrument of this kind is to use a circuit having three steps of radio frequency, detector, and two steps of audio amplification, for by using this system a small loop aerial may be placed inside the case, which will bring in stations located a thousand miles away. This circuit however, is also patented and can not be made and sold without first obtaining a license.

H. S. F., Chicago, Ill.

Question: I am constructing a crystal detector amplifier as described in the June number by Edwin Nielson. Could you kindly tell me how to make the amplifying transformer for same?

Answer: It is quite an undertaking to build an amplifying transformer unless full instructions are given. This would require too much

space in this column, but in the near future this magazine will describe an amplifying transformer with all working drawings for same.

W. W. O., Chicago, Ill.

Question: I am a boy 12 years old and would like to know how to connect 3 audion bulbs together with the sockets for my radio apparatus and how to connect a test buzzer to a crystal set. Why can't you use iron contact points for a switch in radio? Can you use the 110 volt alternating current system for an aerial? Is there any way to make a crystal set stronger by adding some current? If so, explain how. I am greatly pleased with your Radio Age magazine, although I am not a subscriber, but expect to be very soon.

Answer: The circuit which you ask for is too large for this column, so I am sending it to you by mail. The test buzzer can be used by simply connecting it up just like an electric bell circuit; that is, so that when you press a button it will buzz, and the only connection necessary to the detector set is a wire connected from the moving armature of the buzzer to the ground wire of the detector set. Iron switch contacts are not practical for the reason that signals coming in to a receiving set are of a very high frequency and any iron material near any of the apparatus is very likely to have a choking effect upon these high frequency oscillations, which would tend to retard them and distort the signals. This is due to the magnetic properties of iron, and all metals used in radio apparatus should be non-magnetic for this reason. The 110 volt electric light system can be used for an aerial, but I do not advise it as it has not yet been passed upon by the Board of Fire Underwriters, and is quite dangerous unless the user is an experienced electrician. A crystal detector set can be amplified by using the standard two step amplifier, but this requires the use of amplifying bulbs, storage, and "B" batteries. An article in the June issue of this magazine gave a description of how a South American boy increased his signals by using additional crystal detectors, transformers and batteries, but as to how it will work out, I do not know, as I have not made a personal test of it.

Questions and Answers

This Department Conducted by FRANK D. PEARNE, Technical Editor of RADIO AGE and Chief Instructor in Electricity at Lane Technical High School, Chicago.

R. H. F., Chicago, Ill.

Question: In regard to the radio set in the Radio Age. I have made a set the same as the one you have in the paper and hooked it up the same as the copy, but I fail to get results. Can you give me any information in regard to the reason it does not work? I have a two-wire aerial nearly forty feet high and I can only get a buzzing sound. I bought a variable condenser, have changed crystals twice, still no results. I will be thankful for any information.

Answer: As a rule these sets give wonderful results, and I am inclined to think that in your case it is a matter of adjustment. Your aerial is high enough to give results, and if it is carefully insulated we can eliminate that. Go over all the connections and see that they are all soldered, making sure that where the loops are soldered to the switch contacts no wires are broken, and especially see that the loops are not broken, as this would leave part of the circuit open. If all the connections prove to be all right, and the set is made exactly as described, then it is nothing more than a poor adjustment of the crystal. If you have had no experience with crystals you will find that it requires a great deal of patience until you get familiar with the sound of a correctly adjusted detector. Look over the ground connection and try hooking your condenser across the aerial and ground. V. C. D., Fort Dodge, Ia.

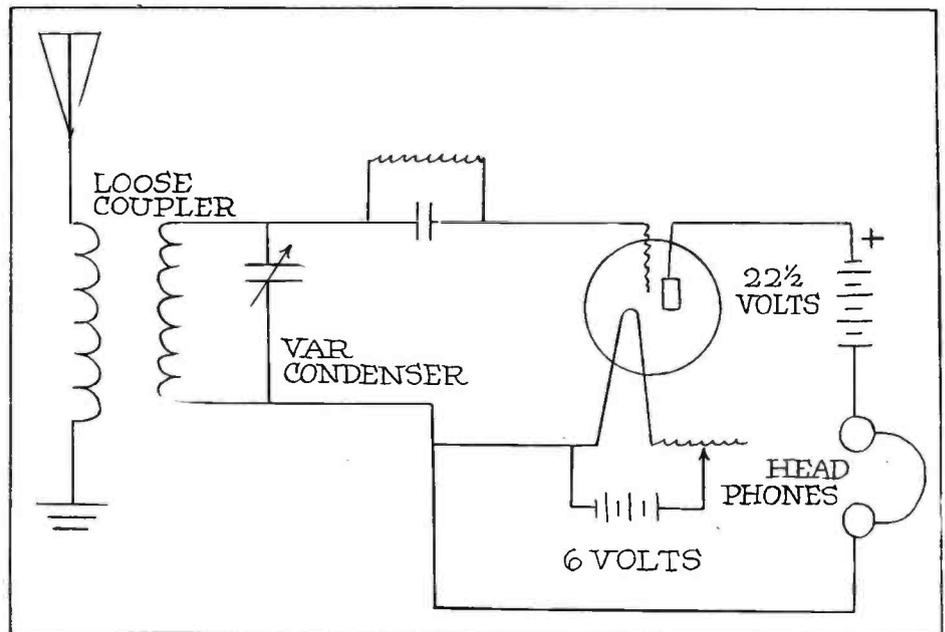
Question: Is there any way that I can use my loose coupler with an audion bulb detector? I am using a crystal detector with it now, and I have a Cunningham bulb and socket, but no variometers, and I want to know if I can use these without buying two variometers. Will I have to have a storage battery, or can I use dry cells on my bulb?

Answer: You can make up a fairly good set with a loose coupler and detector bulb if you will get a variable condenser to go with it. A 23-plate condenser should be large enough if there are not too many turns on the secondary of your coupler. You do not state the range in meters of your coupler. You will also have to have a rheostat for controlling the filament current on your bulb. A storage battery will be

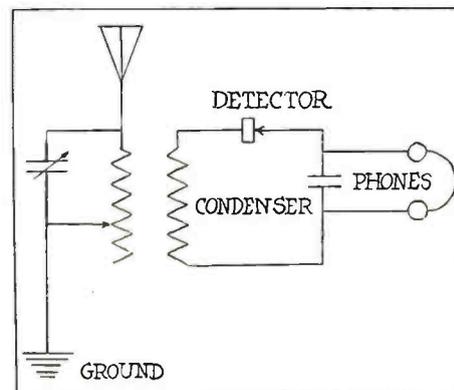
much more economical than the dry cells, as it will last much longer, and when it becomes discharged it can be charged up, while the dry cells will run for a very short time, when they will have to be disconnected and allowed to recuperate, and each time they are used they will run down faster, until they will have to be replaced by new cells. At best, they will give only a few hours' actual

are radio frequency sets, but still he doesn't seem to be able to tell me what it is. Does it use a crystal or an audion detector? Please explain it to me, and any information you will give me will be appreciated very much. I get your paper every month and you can answer with the enclosed envelope, or through your paper.

Answer: Radio frequency is the



service and then you will have to buy four or five new cells. The storage battery will cost more, but the expense of recharging it once in a while is nothing compared to the cost of new dry cells every few days. The above hook-up will answer your purpose.



G. H. B., Kankakee, Ill.

Question: I want to find out what is meant by "radio frequency." I have a friend who says the best sets

term applied to those frequencies which are too high to be detected by the human ear, and those frequencies which are low enough to be heard are called "audio frequency." Usually currents which oscillate at less than 10,000 times per second are called audio frequency, and those which oscillate at a higher rate are called radio frequency. In order that radio frequencies may be heard they must first be changed to audio frequency. This is done by the detector, no matter whether it is a crystal or an audion. Radio signals are transmitted at radio frequency and changed to audio frequency by means of the detector.

R. E. B. Milwaukee, Wis.

Question: Is the enclosed circuit correct? If not will you please set me right and give me a hook-up that will work.

Answer: No. The variable condenser as you show it, is not connected to the right part of the circuit. Correct hook-up at left.

Radio at Culver

Students at Culver Military Academy have an unusual opportunity not only to learn the technical side of wireless, but to engage personally in the work of sending messages and what is more valuable from an educational standpoint, in making apparatus. The following description of the wireless station of Culver was prepared by a cadet operator, Homer M. Barnes, of Chicago, Illinois, a young student, fifteen years of age.

New aerials have been erected during the past year. The old type aerial, an inverted L, was done away with and a six wire fan erected in its place. This fan aerial gave us more radiation and extended our receiving range. The supporting cable of the fan is 95 feet above the ground, and supported by two masts which are made of angle iron. These towers are grounded to the iron frame of the building. The six wires, which constitute the aerial proper, are each 70 feet in length. The fundamental wave length of this aerial is 255 meters.

The receiving equipment consists of two distinct sets. One, a short wave regenerative for 175-600 meters, and the other a long wave set with a range of 325-18,000 meters with a heterodyne oscillatory circuit for receiving undamped traffic. One type S. C. R. 72 two stage amplifier is used alone in connection with a type AC 3 model C magnavox power amplifier and a R 2 18 inch horn. There are several S. C. R. 54 portable field sets, which are used in the field.

Radio concerts are heard here regularly, and with enough volume and clearness to permit the use of twenty pairs of phones. Some of the broadcasting stations heard here are WGY, WJZ, KYW, KDKA, WWJ, WCX, WOH, and others. The radio room is filled with cadets wanting to hear the latest popular pieces played by the famous jazz orchestras.

The main transmitting set is a 2 K. W. 240 cycle Marconi Marine set with a synchronous rotary gap with a fully equipped switchboard as shown in the illustration. The motor generator delivers 500 V. A. C. The maximum transformer input is 2 K. W. which is always varied according to the distance over which we are communicating. The maximum antenna current is $9\frac{1}{2}$ amperes or 375 meters. The high tension condenser bank is made up of 12 Leyden jars connected in series parallel, having a total capacity of .009 mfd, in order not to put too much strain on the jars.

Radio Roster at Chicago Show

The many exhibitors at the National Radio Exposition, held in the Leiter Building, Chicago, from June 26 to July 1st were a live bunch of enthusiastic, hard-working, level-headed radio men. Any doubting Thomas who needed evidence to convince him that radio is here to stay had only to visit this show and absorb some of the forward-moving spirit of it. Herewith we publish a list of firms occupying booths and names of their representatives.

- Jefferson Electric Mfg. Co., 426 So. Green St., Chicago. R. Benson in charge.
 Electric Service Products Co., 10-12 So. Wells St.
 Great Lakes Naval Radio School. F. A. Mueller, chief Electrician's Mate U. S. Navy.
 Indiana Electrical Specialty Co., Martinsville, Ind.
 Aerex Radiophone Corp., 342 Madison Ave., N. Y.
 Taylor Saver Sales, 3500 Greenview Ave., City.
 W. G. Shinn Mfg. Co., L. H. Greenwood, N. W. Caldwell, G. L. McCall.
 Lyon & Healy, Chas P. Hindringer.
 North Shore Radio Co., 810 Davis St., T. B. Wangeman.
 Continental Radiophone Co., 45th and So. Wells St., Otto Henderer, Wm. Sabatay.
 Schreuder-Lockwood Press Syndicate, 64 W. Randolph St., A. N. Schreuder, W. C. Lockwood, F. L. Bollinger, C. W. Hanika, W. J. Carroll.
 The Barkelew Elect. Mfg. Co. C. W. Denny.
 The Heinemann Elect. Co. B. S. Berlin, S. R. Fralick & Co., 15 So. Clinton, Mr. S. R. Fralick, Mr. D. J. Dillon.
 The Davistone Co. Harold I. Orwig, Miles S. Whitney, Mr. McCrillus, Harry B. Davis.
 Post Electric Co. Richard Allen.
 Maring Wire Co., Muskegon, Mich., F. L. Meeske, pres. H. Simpson, Chicago rep., 27 So. Desplaines St.
 The A. & R. Co. Mr. Shirk, Mr. Stoller.
 Ayan Jay Sales Co. N. Afton. C. F. Mayer. H. H. Jones, Miss Thyra Strandberg, J. F. Mayer.
 Cruver Mfg. Co. William Proudfoot.
 L. S. Branch Mfg. Co., Newark.
 American Electric, 6431 State St. P. L. Rose.
 United Mfg. & Distributing Co. A. E. Dreier.
 The Benson Co., 2429 So. Michigan Blvd.
 Commonwealth Edison Co. A. W. Inglis, Dave Miller, R. E. Davis, H. Randol, J. Marshall, Geo. B. Foster.
 Hercules Radio Corp. E. B. Miller, Chas. C. Gordon, H. J. Birmingham, Ben. E. Freund.
 States Radio Corp. Anatol Gallos, Norman Gallos, J. E. Marshall, J. M. Hays, J. W. Juff, S. Owens, F. L. Damarin.
 W. O. Duntley & Co., A. Fasking, S. Fasking, H. J. Theil, W. O. Duntley, C. A. Duntley.
 Dodge's Radio Institute, Valparaiso, Ind.
 Chicago Radio Dealers, Inc.
 Western Electric Instrument Co., Newark, N. J. H. C. Sildorff.
 The Bristol Co., Waterbury, Conn. H. G. Hall, M. J. Maquire, R. C. Wilcox.
 Wireless Corp. of America, E. S. Showers, L. Mandel, H. Mandel.
 M. & M. Mfg. Co., 7447 So. Chicago Ave. A. C. McMillen.
 Hipwell Mfg. Co., Pittsburgh. F. M. Weaver, in charge.
 The Beckley-Ralston Co., 1801 So. Michigan Ave. W. A. Bockius.
 Norbert Radio Co., New York. Wm. G. Moyer.
 Drisco Mfg. Co. Harold M. Schwab, Inc.
 Philadelphia Storage Battery Co. J. N. North, G. M. Netling, E. W. Shepherd, E. H. Stupp, H. W. Stoltz.
 Ray-Di-Co. Organization, Inc., 1547 N. Wells St., 1215 Leland Ave., Chicago. R. O. Ragan in charge.
 Raymond Radio Cor. H. Schwartz in charge.
 Radio Club of Illinois. John Tansey, Secy.
 Westphal Mfg. Laboratory, Railway Exchange Bldg., Chicago.
 Radio Digest, Illustrated. E. C. Rayner.
 Electric Research Laboratories (Erea Products).
 Marshall P. Fox, 2515 Michigan Ave.
 Washburn School. M. Georges.
 Coliseum Battery Co., 1841 So. Wabash Ave. R. E. Harte.
 Raymond Condensers, 914 Wrigley Bldg.
 Herald & Examiner, Victor Crystal Receivers, demonstrated by Prof. Edward L. Taylor and Prof. C. O. Nelson of the Examiner.
 The Nash—Odell Co. I. J. Odell, C. A. Nash, R. J. Weston, K. A. Everett, H. J. Pomy, Mr. Strohart, C. W. Jones, U. S. Radio Inspector, 172 N. Franklin St., Chicago.
 Chicago Radio Co., 123 Madison St. J. F. Palmer, Bert Barsook.
 United Radio Laboratories, Cincinnati, Ohio. Paul P. Ewing, E. W. Wesselman.
 Radio Sales & Service Corp., 1311 First Nat'l Bank Bldg., City. M. Ferry, N. J. Dowdell, Hoppock.
 Darche Mfg. Co., 643 Washington Blvd., City. E. J. Heilman, C. H. Holden.
 Ampli-Radio Co., 1438 Washington Blvd. Earl L. Smith.
 The General Phonograph Mfg. Co., Elyria, O. Homer Stevens, Dan F. Lane, R. G. Sidnell.
 Morscan Radio Co. Eugene Scanlon, P. D. Jackson.
 Crosley Mfg. Co., Cincinnati, O.
 Jewett Mfg. Co., Newark, N. J. C. C. Goheen.
 Widdicomb Furniture Co. (Radio Cabinets) 327 So. La Salle St. W. E. Ernst.
 Atlas Radio Co., 405 Woods Theatre Bldg. M. M. Jess.
 Universal Battery Co. C. R. Story, L. L. Cochran.
 American Enameled Magnet Wire Co., Muskegon, Mich. Thomas F. Kelly.
 American Radio Journal. A. Foster George.
 Electric Machine Corp., Indianapolis, Ind. B. F. Royse.
 Radio Units, Inc., 843 Webster Bldg., City. E. F. Andrews, Frank W. Johnson, R. E. Acre.
 Coyne Trade & Engineering School, 39-51 E. Illinois St., City. E. L. Richards.
 The Ekko Company, 911 Harris Trust Co. H. E. Freund (Phonograph Adapters).

Development of Radiophone Broadcasting

L. R. KRUMM, Superintendent of Radio Operations of the Westinghouse Electric & Manufacturing Company, is one of the best informed men on wireless of the present day. Mr. Krumm served as Lieutenant Colonel, Signal Corps of the A. E. F.; was 18 months in France on the staff of the Chief Signal Officer, Gen. Edgar Russell; and had charge of all radio operations of the A. E. F. For his service during the War he was awarded the Distinguished Service Medal by the United States, and the Legion D'Honneur by France. Mr. Krumm came to the Westinghouse Company from the army. Previous to his army service he was Chief Radio Inspector of the Bureau of Navigation, Department of Commerce.

ON FEBRUARY 27 of this year there was held in Washington an open hearing before a committee of radio engineers, military officers and government representatives, appointed by the Secretary of Commerce to formulate proposed laws and regulations to meet the new radio conditions which have developed since the termination of the war. Nearly two hundred representatives of various commercial, amateur and governmental radio interests attended this conference. The large number of reporters, photographers and moving picture operators in attendance also indicated the great public interest in this meeting.

What caused this sudden interest in new radio legislation? There have been no radical changes in the radio art as applied to international communication between the high powered stations in this country and those in foreign lands. Neither have there been any particular changes in radio communication between ships and between ships and shore stations. There have been some developments in radio telephone communication between ships and airplane and ground stations and in regard to locating ships at sea by means of radio and even some advance in communicating with submarines while submerged, but these were not the answer to our question.

\$75,000,000 Invested in Radio

The main purpose of this conference was to devise means to meet the problems which had arisen

through the establishment of the radio telephone broadcasting stations which are sending out news, live stock and grain reports, weather forecasts, sermons, speeches and entertainment and which have caused the installation during the last year



H. P. Davis

and a half of anywhere from 700,000 to 1,000,000 radio receiving stations, representing a probable expenditure of approximately \$75,000,000.

Previous to the establishment of broadcasting stations working on absolutely dependable schedules, the public's interest in radio had been limited to the technically inclined amateur operators with some knowledge of the electrical principles involved in radio telegraph communication. These men were dyed in the wool faddists on radio. They wanted to know what "made the wheels go round" and how to make them go. They wanted to establish radio telegraph transmitting stations. For this, it was necessary to study the Continental Morse code and secure operators' licenses from the government. All this they did in addition to investing considerable money and time in the purchase and installation of the equipment.

It was estimated before the World War that there were some 6,000 licensed amateur transmitting stations and probably 50,000 receiving stations which required no license. All these were closed during the war. The amateur receiving stations were allowed to reopen April 15, 1919. On October 1, 1919, amateur transmitting stations were allowed to oper-

ate again. The amateur radio activities had languished during the war period and probably there were fewer amateur stations after than before the war.

Mr. Conrad's Great Service

During the war, Mr. Frank Conrad, Assistant Electrical Engineer for the Westinghouse Electric & Manufacturing Company, had become interested in radio work because he had given his best efforts to assist the government in producing the very highest type of radio equipment for the army and navy. Practically the only type of equipment which was produced in quantity and delivered in France in time to be of any service to the American troops and which met the requirements of warfare was an airplane transmitter known as SCR-73 set, developed and produced by this company and its subsidiaries. Mr. Conrad's activities covered, however, more than this equipment, as he was also interested in the development of various types of radio telephone sets. To aid him in his experiments he was given a special license to operate during the war a radio telephone at his home at Pittsburgh, Pa.

After the armistice he retained his interests in his work and, operating under this special license was able to continue development of his radio telephone station to a degree of success exceeding anything heretofore attained. The Westinghouse Company, which, previous to the war, had no radio interests, also decided that a company of its magnitude could no longer exclude radio from its activities and had entered this branch of the electrical business. It was intensely interested in Mr. Conrad's researches and he continued his work with its encouragement and assistance.

In the winter of 1919 Mr. Conrad established at his residence in Pittsburgh, Pa., a radio telephone broadcasting station and began the regular broadcasting of music and entertainment. This station was then known as 8XK, the call letters assigned in the new license he carried from the Department of Commerce. At first his efforts were confined to the broadcasting of phonograph music every Wednesday and Friday night. Soon his supply of records was exhausted and one night, in response to many letters requesting the latest popular music, he an-

nounced that he had exhausted his records and was financially embarrassed trying to keep up with the demand for newer music and suggested that possibly his hearers would like to help him out in this dilemma. He was the recipient of nearly 500 records. The magnitude of the response to this appeal indicated the appreciation of his audience and the demand for its continuance.

Music Transmitted Direct

He broadened his activities by providing a studio in which artists, instrumental and vocal, could render selections for transmission from his radio station, a short distance away.

Mr. H. P. Davis, Vice President of the Westinghouse Electric & Manufacturing Company, who was largely responsible for his company entering the radio field, had been watching not only the technical development of the equipment but also the attitude of the public towards broadcasting, realized the necessity of providing this service in a systematic and properly organized manner as a part of his company's business operations, and, therefore, in the fall of 1920, began the construction of a broadcasting station at the East Pittsburgh plant.

Experiments were carried on for several weeks previous to election night in November, 1920, when it was intended to inaugurate this service by broadcasting the election returns. A special license was obtained from the government radio inspector in Detroit, Mich., and the call letters 8ZZ were assigned to the station in the beginning.

The election results were startlingly satisfactory and the letters of appreciation received by the company dispersed any doubts as to the advisability of continuing broadcasting. Plans for the improvement and enlargement of the station were immediately inaugurated and regular nightly programs were announced with specially selected artists as entertainers. A wave length of 330 meters was originally assigned to this station.

It was immediately evident that suitable programs must be provided for Sundays, as the ordinary entertainment did not seem appropriate. This naturally resulted in the desire to broadcast church services, but this required additional technical development, as it was desired to transmit the complete service from the chimes to the postlude. It was therefore necessary to devise equipment which could be installed in the church, pick up the choir and congregational sing-

ing, the sermon and oral parts of the service and amplify them sufficiently so that they could be transmitted over the telephone line without distortion. Remember, this required transmission over thirteen miles of telephone line and cable. The acoustics of most churches leave much to be desired and this line transmitting was no simple problem.

Radio in the War

Much was printed during the war regarding the radio telephone developments for our fighting forces. While many interesting developments resulted and some fundamental principles founded there was very little practical application of radio telephony during the war, and practically none by the fighting forces. In the development work Mr. Conrad had been an active participant and he began his broadcasting work with this war experience as a basis and used the personnel and manufacturing facilities of the Westinghouse Electric & Manufacturing Company.

When the company took up broadcasting actively they immediately provided the necessary funds to develop it to the utmost. It is not exaggeration to state that their station at East Pittsburgh, now known as KDKA, the matured successor of 8ZZ, has never been more than one week old in the sense that better and improved forms of equipment are continuously being provided. KDKA may, therefore, be called the father of the broadcasting activities in this country today.

It is true that radio telephone broadcasting had been attempted spasmodically even previous to the war. Various experimenters had sent out music from their stations in the course of their efforts to develop radio telephony. These experiments had been with varying results as to quality and were never maintained with any regularity or dependability so that the war found this country without any commercial or reliable radio telephony. Wartime developments indicated the possibilities which the coming of peace made realities. During the war all commercial radio activities were suspended by government decree. The development of KDKA since that time has just been followed.

After KDKA had been operated for nearly a year and its practicability demonstrated the Westinghouse Company proceeded to establish additional stations at their branch factories at Newark, N. J., and East Springfield, Mass. These were opened in the fall of 1921. With

the establishment of the additional stations the Department of Commerce had assigned a wave length of 360 meters to all the Westinghouse Stations.

On November 11, 1921, Armistice Day, an anniversary of the war, which in a way was the father of broadcasting, the Westinghouse Company opened its broadcasting station located on the Commonwealth Edison Building at Chicago, Illinois. This station was opened by arrangement with the Chicago Edison Company, who desired to open it with the broadcasting of complete grand opera from the Auditorium Theatre, Chicago, which started its season the following Monday, November 14, 1921.

This, as far as the writer knows, was the first case in which complete grand opera from the overture at the beginning to the final chorus was sent out by radio telephone.

Each of the Westinghouse stations cover a different section of the country, but each has been successful in arousing great interest and causing the installation of innumerable receiving stations.

Confusion in Broadcasting

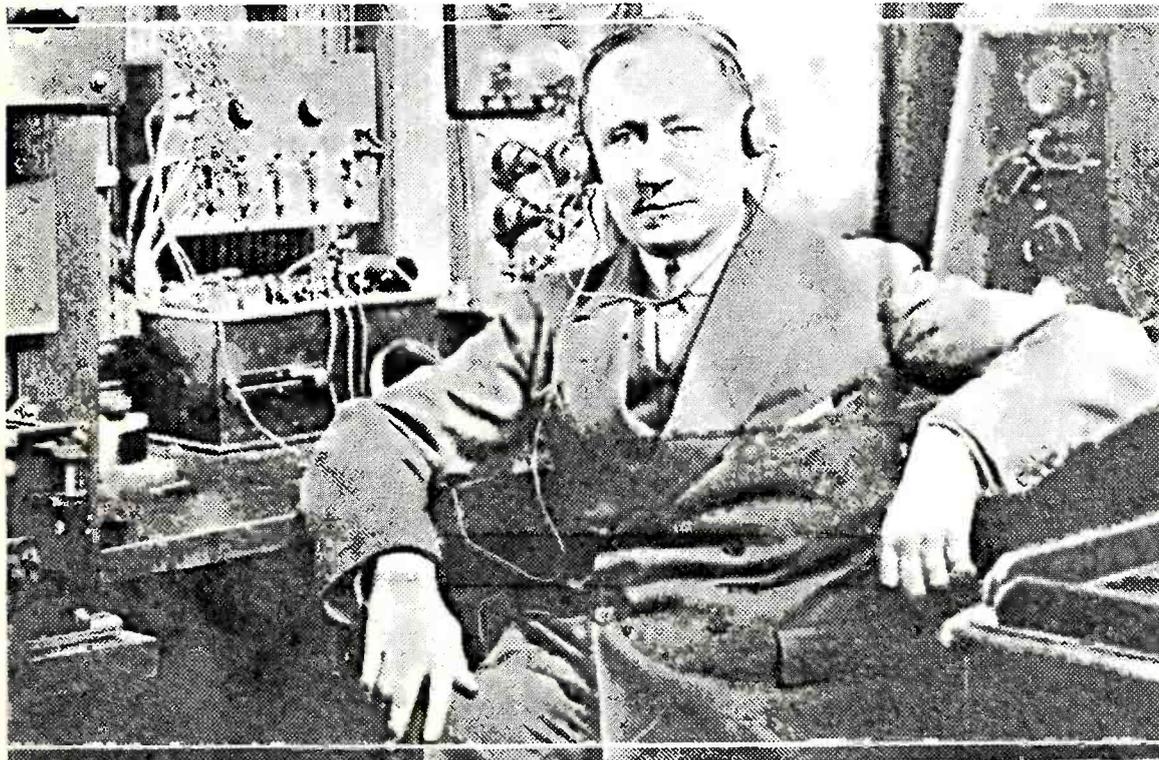
Other business interests established broadcasting stations each of which was assigned to the 360 meter wave length.

The operation of all these stations on the wave length originally assigned the Westinghouse stations had brought up a chaotic condition in the ether which brought about the conference referred to in the beginning of this article.

It was evident that provision must be made to assign different wave lengths to the various stations which must be classified as to range and purpose and that limitations must be imposed as to schedule, power and area of activity. The enormous publicity given the Westinghouse Company because of its pioneer activities attracted the attention of many firms who desired to do likewise, without a realization of the time and money expended or that the greatest expense of the proper operation of such a station is the facilities necessary for the improvement and development of the equipment, such as are usually only available to a company interested in the manufacture of radio equipment. Secretary Hoover of the Department of Commerce recognized that unrestricted establishment of broadcasting stations would result in bedlam and therefore inaugurated the movement which resulted in the commit-

(Continued on page 32)

Marconi Describes Radio Searchlight



Senatore Marconi is in this country for a visit, having sailed from Italy on his yacht "Electra," which is the most elaborately equipped floating radio laboratory in the world. Read what Senatore Marconi has to say about amazing "radio searchlight"

THE radio searchlight, a method by which radio waves transmitted from a broadcasting station can be reflected in any desired direction, just as light rays are directed from a searchlight, was announced by Senatore Guglielmo Marconi in his address before a joint meeting of the Institute of Radio Engineers and the American Institute of Electrical Engineers in New York, Tuesday night, June 20.

At present radio waves, upon leaving the antenna, scatter in all directions. His apparatus, which in no way resembles a searchlight but is a series of wires arranged in a special way on towers or masts, sends the message through the ether in one direction only, Marconi said. He amplified his words by a demonstration in the hall. Messages transmitted were picked up clearly on one side of the room but could scarcely be heard with similar receiving apparatus on the other, and vice versa.

With his system of reflectors, Marconi stated that he had successfully conducted radio telephone conversations between London and Birmingham, a distance of 100 miles. This is a record in long distance radio transmission and reception with very short waves. In all these

experiments the wavelength varied from one to twenty meters.

The reflectors make it possible for the receiving station to reproduce a telephone song or speech about two hundred times louder than is now possible and without distortion. The transmitting aerial can be used both for transmitting and receiving at the same time.

"In these days of broadcasting, it may still prove to be very useful to have a practically new system which would be to a very large degree secret when compared to the usual kind of radio," said Marconi.

The Radio Beacon

Marconi described a revolving transmitter and reflector which acts as a kind of wireless lighthouse or beacon. "By means of the revolving beam," he stated, "it is possible for ships to ascertain in thick weather the bearing and position of the lighthouse."

In wireless, electric energy is flashed into space in waves. The distance from one wave crest to another is called "the wave-length" and is usually expressed in meters. In these days, when radio is the hobby of millions, the wave-length

may be anything from 200 to 20,000 meters. In other words, the ether of space is shaken into terrific billows compared with which the mightiest upheavals of the ocean are mere ripples.

"As far back as 1895 and 1896, I had obtained some promising results with waves not more than a few inches long," said Marconi. He then proceeded to describe how he had returned to his original idea of using short waves.

Marconi stated that when very short waves are used, disturbances caused by static can be said to be almost non-existent and the only interference comes from the ignition apparatus of automobiles and motor-boats. He predicted that, "the day may come when we will have to screen our ignition systems or carry a government license for transmitting."

Radio Around the Earth

"The question as to whether it would be possible to transmit radio signals right around the world is one which has always fascinated me," Marconi assured his hearers. He discovered that "there is something in the idea of the wireless waves traveling around the earth in

various ways and reuniting at the Antipodes." Sometimes these radio waves traveling around the earth in different ways reenforce each other at the receiver and sometimes they interfere with each other. Tuning, however, overcomes the interference. The enormous station built by the Radio Corporation of America at Port Jefferson, Long Island, Marconi found, sent waves which "preferred to travel three-quarters of the way around the earth rather than come the shortest way round."

Static, a subject to which the research engineers of the Radio Corporation of America have devoted much study in this country, was also discussed by Marconi. He told his hearers that there are particularly violent types of static over Africa and South America, but that static did not interfere very seriously in transoceanic communication in temperate zones.

Senatore Marconi is visiting this country for the first time in a decade as guest of the Radio Corporation of America.

For Radio Amateurs

Among the books received for review during the past month is "Radio for the Amateur" published by The Goodheart-Willcox Company, 2009 South Michigan avenue, Chicago. It is a book of 208 pages by A. H. Packer and R. R. Haugh (\$1.50 postpaid).

It's a good book because it is original, and because every word in it can be easily understood. It does not reproduce formerly published material. It is written with clear-sighted originality and with a human appreciation of the fact that there are some things that the amateur does not want to know about, and does not need to be puzzled over, but that there are certain basic principles that he must understand if he is to understand what he is doing when he is playing with "radio."

Russell Productions, Inc., already famous for their "little picture" demonstrating the "how" of making a radio receiving set for 60 cents, will come back with an immense production called "Saved By Radio"—the biggest and most timely feature of the year starring George Larkin in whose support will appear such well known stars as Jacqueline Logan, Harry Northrup and Andrew Arbuckle.

(Continued from Page 12)
reverse the potential to 2 volts positive, then the current in the plate circuit will have changed from 2 micro amperes to 40 micro amperes, which would be the practical limit of change in that particular tube. From this chart it will be seen how, with

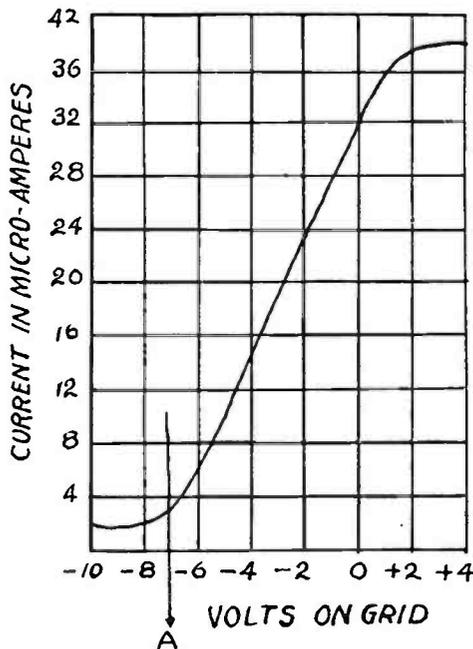


FIGURE 4.

extremely small changes in the grid circuit, very large changes will take place in the plate circuit and the signals are amplified many times in the head phones.

Vacuum Tube as an Oscillator

If a proper coupling is made between the plate and grid circuits, continuous oscillations may be produced with the valve.

Figure 5 shows a circuit of this kind, in which the inductance "L" in the grid circuit and the inductance "L1" of the plate circuit are coupled together in such a way that any change in the current in "L1" will

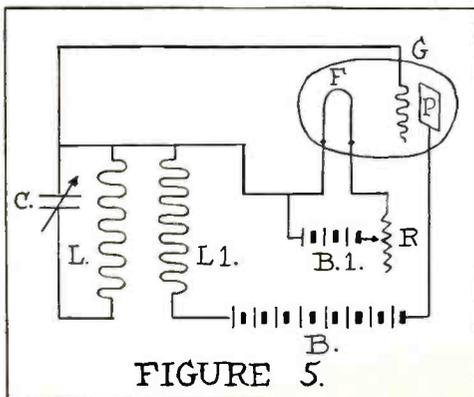


FIGURE 5.

produce a voltage in "L." Now assume that the filament is heated and a steady current of a certain value is flowing in the plate circuit, through the inductance "L1." Now any change in the current flowing through the inductance "L1" will induce a voltage in the coil "L." If the coil "L" is connected so that increasing the current in "L1" induces a voltage in "L" of such a value as to charge the grid positive with respect to the filament, a greater increase will take place in the current in the coil "L1." This will increase the positive charge on the grid still more, by induction and so on. This action continues until it reaches a point where an increase in voltage on the grid ceases to cause an increase in the current in the coil "L1." This point depends upon the characteristic curve of the particular bulb used and the resistance of the circuit. When the current in the coil "L1" ceases to increase the charge on the grid drops to zero and the current in "L1" begins to decrease. Now if an increase in the current in "L1" gives the grid a positive charge by inductive action, then a decrease in it will make it negative in respect to the filament, which will cause the current in "L1" to decrease to a point where a decrease in the grid potential causes no further decrease in the current in the coil "L1," when the conditions will be reversed and the current in "L1" will begin to rise again, repeating the cycle just described. By this means the plate current is made to rise and fall with a definite frequency. This frequency will depend upon the inductance "L" and the condenser "C." It is possible, by properly choosing the inductance and capacity, to produce oscillations in such a circuit ranging from .5 to 100,000,000 cycles per second. This is a description of only one of the many oscillating circuits.

KDKA, the radiophone broadcasting station of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., first station in the world to broadcast concerts on a schedule basis is the first of the American radiophone stations to be heard south of the Equator, having been picked up by a ship operator while in the port of Iquique, Chile.

Solder Your Connections
 For best results. Get the "Wonder" a Self Heating Iron. Use it anywhere without stove. No workshop complete without it. Cheap to operate. Generates own vapor in two minutes. Absolutely safe — a child can operate. Nothing to get out of order. Use it as a blow torch also. Boxed complete with solder, sal-amoniac and full soldering directions. Send No Money — just your name and address on a post card. When the postman delivers, pay him \$2.50. Dealer—a big seller, write for proposition.
North Shore Radio Works, Dept. B-604
 810 Davis Street, Evanston, Ill.

Market and Crop News by Uncle Sam's Radio

Official Information Supplied by the Government Bureau

THE radio market news service of the Federal Bureau of Markets and Crop Estimates is an effort on the part of the Bureau to make its market news more immediately available and more effective than it can be made in any other way. Ever since the inauguration of the first market news service on fruits and vegetables in May, 1915, the specialists of the Bureau have given continuous study to the problem of supplying market news on agricultural commodities to those cooperates with all agencies possible who may have use for such information as quickly as possible after it can be obtained.

The market news service of the Bureau cover live stock and meats; dairy and poultry products; fruits and vegetables; hay, feed and seeds, and some other commodities associated with these four general groups. The information is supplied to and is utilized by producers, shippers, dealers, brokers and commission men, manufacturers, warehousemen, demonstration and extension workers, banks, transportation agencies, chambers of commerce, buying and selling organizations, and other commercial, extension and education agencies.

It is the function of the Bureau to gather or assemble market information from reliable sources and distribute it in such a way as to make it available to the greatest possible number who wish to use it. In performing this function it utilizes and cooperates with all agencies possible. It affiliates with State agencies which may or may not have similar functions with respect to the State as the Federal Bureau of Markets and Crop Estimates has to the Federal Government. It utilizes the railroads for information relative to shipments and movements. In one way or another, it assembles information from every available source where such information can be obtained.

Broadcasting by Radio

In utilizing radio communication as a means of disseminating crop and market information, the Bureau of Markets and Crop Estimates is taking advantage of one of the agencies which has certain possibilities possessed by none that has been used in the past. This new method

COMPLYING with a special request from the Editor of *Radio Age*, Mr. W. R. Wheeler, of the U. S. Bureau of Markets and Crop Estimates, has supplied the following information which will be of universal interest and of particular interest to all lines of business associated with agriculture, grain and produce exchanges, transportation agencies, warehousemen and banks.

makes it possible for all who wish this information to help themselves to it, if they will but equip themselves to receive it in the form in which it is sent. The advantages of broadcasting information by radio are (1) that the information can be intercepted or copied by means of suitable equipment at any point within certain approximate limits whether or not such point is connected by railroad, telegraph or any other of the ordinary means of communication and (2) that the transmission of the news is instantaneous.

These two factors in radio communication make it possible for anyone, whether he is located in a congested city or in the country, one hundred miles from the railroad or telegraph wire to receive information with equal dispatch. Radio transmission can be effected either by the international telegraph code, using dots and dashes, or by radio telephone. The radio telephone has the greatest possible range of usefulness and will probably become almost as widely used as the ordinary telephone or the phonograph.

Reception of Reports

Crop and market reports sent out broadcast by radio can be received by any agency having suitable equipment. With the development of broadcasting by radiophone there has developed a demand for receiving equipment from many sources. Not much greater technical knowledge is required to receive the report by radiophone than to use an ordinary telephone.

The broadcast reports are being utilized by various marketing agencies and agricultural organizations in giving to farmers national crop and market reports which are often combined with local market information. These agencies and associations act as centers for informa-

tion for the country or locality and include farm bureaus, banks, shipping associations, commercial exchanges, chambers of commerce and newspapers. In addition to these agencies the reports are being received direct by farmers, country elevators, dealers, shippers and many others who use the information in the conduct of their business. In some instances it may be to the advantage of the community or to individuals or an organization to enlist the aid of a local radio amateur to get the news and the weather, crop and market reports.

How Service Developed

Since the radio market news service was begun experimentally by the Federal Bureau of Markets, on Dec. 15, 1920 it has developed very rapidly so that, at the present time the national market news is not only being distributed by the Bureau but other agencies are extending the distribution of the national crop and market reports as well as local reports. The reports originally were sent out at 5 p. m. each day from the station of the Bureau of Standards, through the co-operation of the U. S. Department of Commerce.

This was continued for four months to determine the practicability of the method.

When it became apparent that this method would not only be practicable but also more economical and efficient for certain kinds of distribution than any other agencies, the Bureau of Markets accepted the offer of the Post Office Department to utilize the radio stations of the air mail radio service in the dissemination of crop and market reports.

At the present time the air mail radio service is broadcasting the crop and market reports from six of its stations. Of these six stations, two of them, Washington, D. C., and Omaha, Neb., procure their information directly from the Bureau of Markets and Crop Estimates offices. The others, extending at about 350 miles intervals west from Omaha to the Pacific Coast, act as relay stations for the Omaha report.

Many of the universities and agricultural colleges giving instruction in radio communication in connection with their departments of physics or electrical engineering, have set up programs of broadcasting

either alone or in cooperation with the State marketing agencies. This work began with the dissemination of weather reports from the Kansas State Agricultural College in 1916. Crop and market reports are now being broadcast from several universities and colleges. The number of stations broadcasting the weather, crop and market reports is increasing almost daily. The additions to this list can be secured by addressing the Radio News Service of the Bureau of Markets and Crop Estimates, Washington, D. C.

Leased Wires Inadequate

The leased wire service of the Bureau of Markets and Crop Estimates was established in 1916 and during the past six years as many as 17,600 miles of leased wire and 61 branch offices have been in operation. The leased wire has been used to carry reports from the markets, shipment information and reports from shipping points as to supply, demand, and f.o.b. prices. Even in its most extended form, the leased wire with the largest number of branch offices was never able to reach more than a small percentage of the people interested.

The function of the leased wire will not be changed or curtailed by the establishment of the radio method but will be the nucleus of an effective system employing wired telegraph and telephone as well as radio telegraph and telephone, and may be extended.

The Air Mail Radio Service of the Post Office Department was established primarily to give communication between the flying fields, in connection with the transportation of mail by airplanes. These stations have to be available for service a large part of the day but have considerably time which is not necessarily occupied in the business of the air mail service. The market reports are sent out on schedules which are adapted to the unoccupied time at the stations.

Forms of Reports

Certain types of market information can be put into a form for rapid transmission by use of standard forms and code letters. This does not involve the ordinary use of code words and the necessity of coding and decoding the messages received but it does make necessary the sending and receiving of messages on a special form. Inasmuch as the sender and receiver use identical forms it is possible by the use of the code letters preceding each blank space in

which information is to be copied to transmit rapidly a large amount of information prepared in standardized form. By use of such special forms and regular transmitting schedules a very effective service can be developed. This field has only been touched upon and great improvements undoubtedly will be developed in the handling of information in this way by both radio telephone and radio telegraph.

Cooperation with States

In a number of States, the State bureaus of markets and State extension departments, are cooperating with the Federal Bureau of Markets and Crop Estimates in organizing the agricultural communities to receive and utilize radio crop and market reports. In some cases they have established information centers which serve as distribution points for sending out the information through various channels. In some cases progressive agricultural counties have installed receiving equipment in connection with farmers' organizations so that the information will be available to the county agent for further extension either through the daily newspapers, telephone exchanges, or other agencies. It is probable that an important application of the radio service will be through organizations or institutions which will install equipment with competent operators to receive the reports and distribute them or make them available to individuals or groups or organizations of producers. Since the radiophone is coming into more general use, many of those engaged in producing or marketing farm products are installing equipment to receive the reports directly as no special trained operator is necessary to operate the equipment.

The State marketing agencies that have either made installations of equipment or arranged for broadcasting are:

New Jersey Bureau of Markets, Trenton, N. J.

The Alabama Markets Division, Montgomery, Ala.

Iowa Agricultural Extension Service, Iowa State College, Ames, Iowa.

Minnesota Division of Markets, St. Paul, Minn.

Missouri State Marketing Bureau, Jefferson City, Mo.

Nebraska Bureau of Markets & Marketing, Lincoln, Neb.

New York State Division Foods & Markets, Albany, N. Y.

Ohio Division of Markets, Columbus, Ohio.

Pennsylvania Bureau of Markets, Harrisburg, Pa.

Texas Division of Markets and Warehouse Dept., Austin, Tex.

Texas Bureau of Markets, Dept. of Agric., Austin, Texas.

Wisconsin Department of Markets, Madison, Wis.

Massachusetts Division of Markets, Boston, Mass.

Colorado Division of Marketing and College of Agriculture Cooperating, Ft. Collins, Colo.

Arrangements in other States are under consideration.

How to Make a Home Radio Set

To cost from \$6.00 to \$20.00. Contains complete instructions for the construction of a practical home receiving station at small cost.

The Book Every Boy Wants

Price 25c post paid

THE UNIVERSAL PRESS, Mc Clurg Building, Chicago
AGENTS WANTED

GET IN on This Special Short Term Subscription Offer

RADIO AGE

Six Months For A Dollar

Brimful of everything the Radio fan should know. Each issue a liberal education. Surely you will want the coming six numbers of RADIO AGE. It's 25 cents on the newsstands—\$2.50 a year by subscription. Just pin a dollar (currency, check or money order) to this blank—mail today and we'll enter you for a six months' subscription—really TWO NUMBERS FREE.

RADIO AGE, Circulation Department, 64 West Randolph Street, CHICAGO

NAME.....STREET.....

CITY.....STATE.....

Radio News from Coast to Coast

ALABAMA

Farmers of Alabama and adjoining states are getting daily market, crop and weather reports from the broadcasting station of the Alabama Power Co., of Birmingham.

ARKANSAS

Invitations to the Police Chiefs convention in San Francisco were sent broadcast by radio and a keen rivalry resulted in Fort Smith, as elsewhere, among amateurs seeking to first receive and deliver the messages to their local chiefs.

CALIFORNIA

Bus passengers in Oakland are entertained on their way to and from work by radio programs.

Walter Brinkop, Republican candidate for state treasurer, used radio transmission to broadcast his speeches.

COLORADO

A radiophone address was made from an airplane by Secretary of State Carl S. Milliken.

ILLINOIS

Among the many radio tourists who have passed through Chicago is Wallace Blood, of Detroit, bound for San Francisco with full radiophone equipment in his sedan car.

Foreign exchange and Chicago stock market quotations are broadcast daily.

Thieves stole the radio set from the Friendship Center church. It was valued at \$250.

One hundred and fifty men were enlisted in the radio branch of the Illinois National Guard which went into camp at Camp Grant on July 17th. The outfit is known as the 33rd Signal Co.

The Rev. George Craig Stewart, St. Luke's Episcopal Church, Evans-ton, said radio might assist in religious work but it would not interfere with church work nor supplant it.

W. K. McIver, of Elgin, has a receiving set with which he can pick up Schenectady, Indianapolis, Detroit, Chicago, Kansas City and Madison. He has even heard San Francisco. He says he has definitely identified more than sixty broadcasting stations and he attributes his success to his own "Elgin Spider" tuning coil.

Lawrence B. Schmitt, for more than a year and a half inspector of the Ninth radio district, with headquarters in Chicago, has resigned to open a Chicago office for the Ship Owners' Radio Service, Inc., of New York. E. A. Beane, formerly in-

spector with headquarters in New York, succeeded Mr. Schmitt.

Belleville, with upwards of 80 receiving sets, has organized a radio club.

Naval radio compass stations have been opened at Whitefish Point, Detroit Point and Grand Marais, Mich. The U. S. naval communication service will furnish lake vessels with their bearings. The stations were built and are operated under the supervision of Capt. Waldo Evans, Ninth naval district.

IOWA

The Ames Times warns its readers against permitting aerials to come in contact with electric light wires. Do you remember the old story of the old maid who sat by a river and wept distressingly. When they asked her why she wept, she said, "I was thinking what if I should get married and have two children and they should both fall in this river and drown."

INDIANA

An electrical baking apparatus was manipulated by radio at Muncie's annual pure food show. And it was good bread.

The Rochester Radio Co. is receiving and distributing market reports from Chicago, Indianapolis, Peru and Rochester, in co-operation with the Rochester Sun.

KENTUCKY

Walter Shackleton of the Kraus-gill Piano Co., Louisville, attached his aerial lead wire to the bars of the cashier's cage. Result: radio music and everything. Anybody who can get anything out of a cashier's cage these days is going some.

LOUISIANA

The lighting mains of the city of New Orleans have been successfully used as a radio telephone receiving antenna by G. Kerley, chief electrician of the Unedme Service Company on Camp street.

MICHIGAN

The state department of public safety contemplates using radio for automobiles and motorcycles of the state police. If experiments are successful six large stations will be erected.

William J. O'Brien was the first to equip his canoe at Belle Isle with radio.

Joseph Gerou, admiral of the Elks' cruise had the craft equipped with radio by which the cruisers received daily programs from the Detroit News station.

Passengers on a moving street car heard an entertainment broadcast by the Detroit News station.

Modart Corset Co. at Saginaw has installed radio for entertainment of employees during rest hour.

Practically all of Detroit's high schools will have radio courses this fall.

WCX, Detroit reached Saranac Lake, N. Y., with music to cheer victims of tuberculosis in camp there.

Marquette reports that installation of radio on lake boats has proved useful and entertaining.

NEBRASKA

Omaha is testing the use of radio on its police automobiles.

The Omaha World Herald broadcasts programs by arrangement with the Omaha Grain Exchange station.

The Omaha Bee broadcasts programs through the Omaha Grain Exchange station WAAW.

OHIO

Fred King, aviator, flying from Chicago to Cleveland, heard an orchestra concert from KYW, Chicago, while he was speeding along 2,500 feet in the air.

John H. Chase, head of the playground association, says Youngstown's 1,000 radio fans should federate for mutual benefit and assurance that addresses and concerts which they wish to hear will be broadcast. Mr. Chase was disappointed at failure to broadcast a speech by Secretary Herbert Hoover, delivered in Youngstown.

NEW YORK

John H. Morecroft, associate professor of Electrical Engineering at Columbia University predicts 5,000,000 receiving sets will be in operation in the United States within five years.

Dr. R. B. Henline, ship's surgeon on the SS "America" was puzzled by the symptoms of a patient when the vessel was 500 miles out at sea. He communicated by radio with a New York specialist and the patient was restored to health.

The station atop the Walker Lispenard building in New York City is said to be the highest. Towers 100 feet tall support aerials above the roof of the 24-story structure.

NEW JERSEY

Mrs. Avery Lord Elizabeth, reports that she picked up Chicago with a crystal set. Experts say it could only be done with the aid of freak currents.

Radio Aids Davenport

Radio, to catch criminals, is a new law enforcing weapon put into the hands of the Davenport police department today by Dr. B. J. Palmer, who has donated to the city the use of his powerful wireless station at any time the police may call for this help.

An automobile is stolen.

The thief speeds toward Des Moines.

The theft is reported to the police.

The police call the P. S. C. radio station.

Broadcast, to 20,000 stations within a radius of 300 miles of Davenport, goes the notice of the theft, the make, model, description and license number of the stolen machine. Farmers who receive weather and crop reports by radio daily, get the description of the missing car and are put on the lookout for it. Police in the towns around are notified by the amateur wireless operators and inside of a few minutes a network of invisible wireless waves is tangle-foot for the feet of the thief.

This broadcasting of crime notices will be used for all classes of misdeeds in which the police believe the criminal may have left for other cities. No matter what business it is transacting, the Palmer School of Chiropractic radio will stop and broadcast the crime warning whenever the Davenport police chief calls for this service. The chief believes it will be a big help and Dr. Palmer is enthusiastic over its possibilities.—Davenport (Ia.) Democrat and Leader.

The American Art Mache' Company, Chicago, some time ago developed a process of die-casting wood fiber into any desired form. Their earlier products included a wide range of wood castings to replace hand-carved wood, as for instance in interior trim for fine homes for stately, etc.

But their discovery that "Maderaware" had remarkable acoustic properties for horns for radio has led them to abandon practically every other line of manufacture and to concentrate their large producing facilities upon the manufacture of radio horns.

The Radio Corporation of America has issued a new publication "Radio Enters The Home," which comprises descriptive matter on the highest quality radio apparatus available for public use.

Ammeters and Voltmeter

A direct current ammeter connected in circuit with the filament of a tube will show whether or not the filament is receiving the proper circuit for best operation, and whether the current is steady or variable. A variable current means poor contact or that the "A" battery needs charging. For a single tube, an instrument of 1.5 or 2 amperes capacity is sufficient for most of the tubes commonly used. For one or more stages of amplification, an ammeter should be connected in each filament circuit separately.

Some sets are operated satisfactorily using a voltmeter across the filaments of all tubes and adjusting according to voltage.

Both the ammeter and the voltmeter will show loose connections and will provide a visible means of adjusting so that "previous settings" which have proved satisfactory may be duplicated immediately. A direct current voltmeter of a range 0-8 or 0-10 volts should be used to test the "A" battery to ascertain if it is properly charged.

It is always essential to good operation to have plenty of "B" battery voltage. These batteries do not deliver much current and are made up of a number of small cells connected together and sealed up in wax. The voltage of a "B" unit is about 22 volts, so that a voltmeter of 25 volts range would apply for each unit. Since the number of "B" battery units may be varied, a voltmeter for each unit is more satisfactory. In case of trouble, each unit should be tested separately to find out if the voltage is low.

Without instruments, in case of trouble excessive current may be applied to the filament, lessening the life of the tube.

The ammeters and voltmeters manufactured by the Westinghouse Company are similar to the large instruments used by that company at its radio broadcasting stations. Both types of instruments are made with a variety of scale ranges and in several styles, some in portable cases and others for mounting permanently on panels. Type BX ammeter and PX-2 voltmeter are favored by most radio enthusiasts due to their greater accuracy.

Send \$1.00 to Radio Age, 64 Randolph street, Chicago, and receive this middle-west radio periodical for six months. Regular subscription price is \$2.50 a year. Thus you will be getting two months free.

"I have used Combat batteries in my work and at school for the past 10 years and consider them the highest type of battery constructed. I am now using the Combat Radio in my Radio work"—says Frank D. Pearne, noted Radio authority and teacher.

A Battery Built For Radio Only

CHIC c c c a Go—messages like that are the great bane of Radio. They are caused by voltage variation—and the Combat "A" uniform voltage Radio battery corrects voltage variation. The extra-heavy, hand-pasted plates in the Combat Radio deliver a discharge that is slow and uniform, thereby eliminating distorted messages. Made exclusively for Radio work—if you own a vacuum tube set you need it. The Combat Radio is built into a handsome acid-proof steel case which



the one piece hard rubber jar. Special composition between protects against breakage or leakage. Patent plug allows escape of gases but no acids. Well in jar insures against

spilling while filling or charging. Patented non-corroding terminals keep your connections clean at all times—no short circuiting. Fully guaranteed for 18 months by the manufacturers who enjoy reputation of 14 years' high-grade battery making.

SPECIAL OFFER: 5,000 will be sold direct to users at factory prices in order to introduce. This is an opportunity to save money on the best Radio battery ever produced. Some Combs have given as high as 8 years' continuous service. Great length of life more than makes up for any difference in price. Take advantage of this offer NOW. Art Quick to Buy at These Prices.

Full capacity 6 v., 60 amp.....\$15.25
Full capacity 6 v., 80 amp..... 16.85
F. O. B. Chicago

Send only \$1.00 as good faith and we will ship C.O.D. subject to examination.

Territory still open for live dealers.

Commercial Battery Company
759 BOSTON AVE., Dept. A, CHICAGO

For reliable and up-to-date information on radio read

RADIO AGE

For prompt and efficient service place your order with representatives of the Periodical Sales Co., whose authority and responsibility is assured by credentials in their possession bearing the registered trade-mark of the Periodical Sales Co., facsimile of which is reproduced hereon.

PERIODICAL SALES CO., Inc.
538 South Dearborn Street, Chicago, Illinois

Branch Offices

PHILADELPHIA
MINNEAPOLIS
INDIANAPOLIS
DENVER
NEW YORK
BUFFALO
LOS ANGELES



Trade Mark

Branch Offices
MILWAUKEE
DETROIT
CLEVELAND
BOSTON
NEW ORLEANS
TORONTO
CANADA

Let Us Pay You for Your Spare Hours—

There are thousands of subscriptions for Radio publications taken every day.

RADIO AGE

"The Magazine of the Hour," is placing representatives in every community throughout the country. Why not turn your spare hours into dollars. Experience is not necessary. We show you how. Clip this ad and mail it today.

RADIO AGE
64 WEST RANDOLPH STREET, CHICAGO

Featured in the Radio Shops

Experts of the Future

It is predicted by the large manufacturers that the radio business during the coming season will far exceed that which we have just gone through. They tell us that over \$100,000,000 worth of apparatus and outfits will be sold.

And will all this radio equipment install and take care of itself? How many busy men are there who want a receiving set in their homes but do not have the time to install it and maintain it? How many are there who are not sufficiently acquainted with the art to be able to do the work efficiently by themselves?

This creates a demand for a new type of man—the Radio Service Man, the Radio Expert—who is thoroughly acquainted with all the finer points of radio practice. The successful Radio salesman will be the one who understands the subject from A to Z. The manufacturers will need radio-trained men to install newly purchased equipment in the customers' homes. They will also need similar men for "trouble shooting," for the radio public will soon demand service in much the same way that the automobile owners or the telephone subscribers demand that their equipment be maintained in proper operating condition.

It is with these important facts in mind that A. G. Mohaupt, who is at the head of the American Electrical Association at Chicago, has prepared a specialized home study course on the Practice and Theory of Modern Radio. The lessons are for the practical man, full of practical operating information. They are written in clear, concise form, in simple every-day language, so that they can be grasped by anyone who is capable of reading the English language. They cover every important point that the man must know who wishes to construct, install, repair, operate, maintain and sell Radio equipment.

One of the interesting exhibits at the Leiter Building show in Chicago was that of the Jewell Electrical Instrument Co., 1640 Walnut street, Chicago. The Jewell company displayed a complete diagram of a continuous wave set with the various instruments in place in the diagram.

Big Research Studio

The Ra-Di-Co Organization, Inc. has established a new studio with over 3,600 square feet of space devoted to demonstration and experimental research work at 1215 Leland Avenue, Chicago. Every evening in this auditorium as many as 300 people can congregate and be entertained free of charge with the best of concerts, operas, bedtime stories, etc., from the local broadcasting station. In connection with this demonstration room is a special studio, size 15 x 16 ft. with special soundproof walls. This studio is equipped with a pick-up microphone. A particular feature in the Ra-Di-Co demonstration rooms are the special booths built around the room where radio apparatus can be tested out before being purchased by a radio enthusiast.

The directors are: Ralph S. Drummond, member of American Institute of Electrical Engineers, Royal A. Stemm, Phillip Henderson and C. W. Hawthorne.

One of the centers of attraction at the show which just closed in Chicago, was a Knock-Down Set exhibited by the NASH-ODELL Co. of 172 N. Franklin St., Chicago, Ill., who are thereby supplying the demand created by the man who desires to assemble his own equipment without the need of shopping around for parts and experiencing the grief of panel drilling, etc.

This apparatus includes standard tested parts, a $\frac{3}{4}$ " solid hand finished cabinet, a panel 12" x 21", shielded, drilled and engraved, wire, spaghetti, solder, screws, nuts, etc., making an equipment at a price less than one-half of usual figures.

The Rheostat's Big Job

The necessity for a rheostat that would give finer adjustment than any on the market was soon realized after radio got well under way. The advent of Radio Frequency emphasized this still further.

J. E. Jenkins, of Chicago, an inventor and radio engineer, worked out the first Vernier rheostat and the immediate improvement that this invention gave to the selectivity of receiving sets, set up such a demand for this rheostat that Mr. Jenkins placed orders for large quantities and is now selling them under their firm name, J. E. Jenkins (Not Inc.). The principle of the rheostat is a wire wound around a solid horn fibre drum in which a screw thread has been cut. The wire lies in the bottom of the cut. Contact is made by a pointer attached to the shaft of the rheostat; and, by turning to right or left, the resistance can be lessened or increased as desired, with infinitely small resistance variations.

One of the most attractive features of the rheostat is the fact that instant contact can be made by means of a switch connection which is part of the rheostat. By simply pushing the knob the circuit can be broken, and when the filament current is again required, a pull on the knob connects the circuit and the filament is heated at the same resistance as when the circuit was disconnected. This is a big advantage and saves considerable trouble by not having to continually readjust the rheostat every time you get ready to use the set.

Organize for Protection

The National Co-Operative Radio Society, with headquarters at 214 Saratoga street, New Orleans, calls on all owners or prospective owners of radio receiving sets to join that society for the purpose of preventing the larger interests from monopolizing the allotments of wave lengths and periods of sending. The society proposes to collect yearly dues of \$12, one of the results promised being the establishment of a nation-wide chain of broadcasting stations which shall send out what the radio fans want rather than what they are forced to take.

Artistic Variometer Parts



Variocouplers,
Rotors, Winding Forms, Stators,
in Genuine Mahogany.
Quick Delloertes. Write for prices.

Artistic Wood Turning Works
517 No. Halsted Street, Chicago, Illinois

National Radio Club

Pittsburgh, Pa., is the scene of the organization of a club that seems destined to play a big part in the future of radio. The work of enrolling members is already well under way and articles of incorporation have been filed along with application for a charter.

While one of this club's fundamental purpose is to promote and finance the installation of radio equipment in hospitals, it will also use its influence to keep the broadcasting art on its present high plane; enlarge musical and educational radio programs; keep all members informed regarding developments, improvements and news of interest regarding radio; answer, without charge, all technical questions asked by members; receive and file articles written by members for reference, lend the moral support and influence of the club to those agencies endeavoring to eliminate the contusion of signals; promote fraternity and good fellowship among members with the aid of a distinctive official button and card of membership.

The organization committee includes Harold B. Coe of New York City, Charles W. Payne of Philadelphia, F. R. McCray of Los Angeles, Otto J. Palm of Cincinnati, R. Gordon Craig, Ray Mansman, and Francis G. Albertson of Pittsburgh, all radio enthusiasts who are sparing no effort to promote the interest of radio transmission.

A nominal membership fee of two dollars will be paid by applicants who will have issued to them a membership card and club button. Among the possibilities envisioned for the future by the club directors are courses of instruction designed to enable members to pass examinations for operators' license.

Interested persons can get in touch with the club by writing to Francis G. Albertson, Secretary, 419 Fulton Bldg., Pittsburgh, Pa.



PRESCO

Sectional UNIVERSAL
Radio Outfits

Licensed under Armstrong
U. S. Patent No. 1,113,149

The Set Consists of
Three Units:

Turner and Detector Unit... \$ 60.00
Two-Step Amplifier Unit... 35.00
Unit for holding "A" Battery 9.50
Top and Bottom, which when added to the three other units, make a complete section all in one. Each, \$5; both 10.00
Complete Set, Total... \$104.50
Ask your dealer; if he cannot supply you, write us, Dept. 803.



Patent Rights

The Editor of Radio Age is in receipt of the following letter from Independent Radio Manufacturers, Inc., 165 Broadway, N. Y., of date June 30, 1922. As the warnings of patent infringements have attracted some attention we publish the communication as a matter of legitimate discussion of interest to the radio trade generally.

A number of our members have called to the attention of our Board of Directors that certain warning advertisements have been appearing in recent trade publications at the instance of the Wireless Specialty Apparatus Company of Boston and New York.

We commend to your attention the following facts:

1—That the validity and scope of the patents listed in the warning advertisements, some twenty-one in number have not been determined by adjudication in the courts and are, therefore, open to question and, matters of defense, together with the question of infringement in each particular case.

2—That because of this fact, it is improper to create a false impression in the trade to the detriment of crystal manufacturers by representing to the jobbers and dealers, as is done in this form of advertising, that the common type of crystal, crystal detector and crystal radiophone receiving sets are infringements upon incontestable rights of the advertiser founded upon one or more of twenty-one patents listed, whereas in addition to the fact that not one of these patents has been before the courts for adjudication, the majority of the listed patents, if conceded to be valid are not infringed.

3—That in justice to your advertisers of crystal sets, who question the validity of these patents and deny infringement upon the advice of their counsel and therefore do not recognize the validity of the claims made by the Wireless Specialty Apparatus Company, such advertising should not be accepted by you.

4—That certain magazines have already seen fit to refuse this advertising.

5—That it is our duty to our constituency to notify the manufacturers of crystals, detectors and crystal sets that their advertising is of questionable value in those publications which carry the aforementioned warning.

Distribution of foreign trade news and dispatches by radio as a means of informing American business men of developments in the fields of industry and commerce abroad is being given a trial by the commerce department at Washington. On July 11 and 12 the latest cabled news of foreign markets and trade opportunities received from abroad was sent by radiophone to the meetings of the New England shoe and leather association.

Send \$1.00 to Radio Age, 64 Randolph street, Chicago, and receive this middle-west radio periodical for six months. Regular subscription price is \$2.50 a year. Thus you will be getting two months free.

Dr. Jewett's Own Story

HORATIO ALGER and some of the other better known boys' authors have the satisfaction of knowing that they started at least one well known executive along the road to fame. Among a series of human interest stories appearing in the Western Electric News, the employees' magazine of the Western Electric Company, is an amusing anecdote by Dr. F. B. Jewett, vice president of the company and president-elect of the American Institute of Electrical Engineers, entitled "How I Earned My First Dollar."

Dr. Jewett who is recognized internationally as one of the world's best informed communication engineers particularly as a result of his developments in the fields of radio and long distance telephony, attributes his first research work to a desire to be freed from anything that might distract from the usual boyish literary desires. In describing the capture of his initial greenback he says, "My first pay envelope as a boy—was for running an engine and boiler for a fertilizer works. Quite far removed from telephone engineering, was it not? In addition to earning me my first money I think that the job gave me the opportunity of doing my first real research work. We had one of the first oil burners developed for using California crude oil, and I exercised my ingenuity in endeavoring to adjust the burner, the water pump and the engine so that I would have a minimum of interruptions in my reading exciting boys' books, where my real interest lay at the time."

Just how much that first research effort contributed to the awakening of Dr. Jewett's inventive genius is unknown. Suffice to say that it was the first step in a career that among other things found the Bell System executive one of Uncle Sam's most important lieutenants during the war. Dr. Jewett served as a colonel in the Signal Corps and was also an advisory member of the Special Submarine Board of the Navy where he participated in the perfection of super-sensitive devices for detecting hostile submarines.

3000 OHM SETS, \$4.50

2000 OHM SETS, \$4.00 1000 OHM SETS, \$3.50

Plus 20c for Postage and Insurance.

Satisfaction Guaranteed or Money Back



We mail phones the day your order arrives. Every pair tested, matched, and guaranteed as sensitive as \$8 to \$10 phones. We have no agents or dealers. By ordering direct you save dealer's profits—circular free.

TOWER MFG. CO., Brookline, Mass.
22 Station St.

The "Oxaphone"

An Inquiry by Geo. E. Carlson, Commissioner of Gas and Electricity, City of Chicago.

Editorial Note—The Editor does not vouch for the authenticity of this article, but it is published on the assumption that "A little humor now and then is relished by the best of men."

MR. GEO. E. CARLSON, Commissioner of Gas and Electricity of the City of Chicago, has many strenuous duties in his capacity as head of the Department of Gas and Electricity of the City of Chicago. But when time will permit a moment's diversion from the task of running the street lights, electrical inspection, fire alarm and police telegraph systems, and other activities, Mr. Carlson will be found investigating some new "stunt" in the radio field. A device known as the "Oxaphone" was recently called to his attention by some of his friends. Inquiry was immediately made by Mr. Carlson, who assigned the investigation to J. C. Hail, Electrical Engineer in Charge in the department, who among his other duties is in charge of the City Hall Radio Station WBU. The following is the memoranda of orders and reports pertaining to this new device:

May 26, 1922.

Hail:—

A device known as the "Oxaphone" has been called to my attention. What is it?

Carlson
Commissioner.
May 26, 1922.

Mr. Carlson:—

The "Oxaphone" is a device for "cutting out the bull" from telephone conversations. It can be attached to any radio microphone or ordinary telephone.

Hail
May 27, 1922.

Hail:—

We have great need for the "Oxaphone." Please make complete report.

Carlson
Commissioner.
May 31, 1922.

Mr. Carlson:—

With further reference to the "Oxaphone," and the manner in which the device is able to eliminate the "bull" from radio telephone or ordinary telephone conversations, a further examination was made in accordance with your instructions.

The word "bull" is a slang ex-

pression to indicate a particular quality now prevalent in most radio-telephone broadcasting addresses and ordinary telephone conversations. This quality consists of a certain variance from the truth and other slang words to express the same thing are "bunk," "salve," "jolly" and the like.

The mechanical construction of the "Oxaphone" is very well adapted for the purpose intended. The device consists of two parallel plates in which the "bull" is held. The plates further act as barriers over which the "bull" cannot pass. Fastened to the end of each plate is a spiral spring which is so constructed that it will prevent the formation of a lasso with which to "throw the bull." The handle and attachments are so designed that they cannot be gripped by a "cow-puncher" who might "throw the bull."

Time has not permitted any tests to be made to determine the efficiency of the device. Further it was considered inadvisable to attach the device to any of the departmental telephones, because of a possible decrease in the satisfactory operation of the telephone under test from a business standpoint. If you desire tests made, shall we attach the device to the telephone on your desk?

Hail
June 1, 1922.

Hail:—

Not to my telephone. Attach to your telephone, which is more suitable for the purpose.

Carlson.
Commissioner.

Birmingham's WSY

"W S Y" operated by the Alabama Power Co., is of 200 watts capacity, and consists of a 2-foot diameter cage type aerial, mounted on 60-foot towers, with counterpoise; a tuning helix; two 50-watt vacuum tubes acting as oscillators and two as modulators for producing the so-called carrier wave; and other tubes and auxiliary apparatus for varying the amplitude of the carrier wave in accordance with the vibrations produced with music, voice or whatever is broadcast.

This equipment is mounted on a panel board, together with the necessary electrical measuring instruments for observing the operation of the set. The motor generator set is required to produce a high direct voltage in connection with the operation of the tubes, and the storage battery is used to light the filament of the tubes.

Variable Condensers



Variable condensers to be efficient must be well made. Loose joints or faulty construction soon allow the plates to get out of alignment and decrease their efficiency.

A seasoned organization backed by a half million dollar equipment has placed the United Condensers in the front rank with radio engineers, the country over.

PRICES

43 plate \$4.50
23 plate 4.30
11 plate 4.00

without dial or knob.

Liberal discounts to jobbers and dealers.

We invite correspondence with Radio Manufacturers who are interested in using our facilities and services for manufacturing Radio Equipment.

United Mfg. and Distributing Co.

536 Lake Shore Drive
CHICAGO, ILL.

VARIOMETER



\$5.00

Rotor and stator in moulded hard rubber, highly finished, best insulation known. Beautiful design binding posts, eliminating any necessity of soldering. Finished product. Wound with green covered wire; nickel plated hardware. Put up in attractive boxes.

COUPLER



\$4.50

Tube of hard fibre, rotor in moulded hard rubber. Wound with green covered wire. Nickel plated hardware. Special binding posts. No soldering of connections.



The set herewith illustrated is a four tube Radio-frequency set built into a light-weight, portable case with nickel-plated hardware, making a handsome, simple and salable set. Prices on sets range from \$65.00 to \$190.00, including tubes, B Batteries and head phone. These sets can be taken wherever you go, being light and convenient to carry.

VARIABLE CONDENSERS

Aluminum plates, fibre and brass end pieces. Sturdily and well constructed.

11 plates.....	\$3.00
23 plates.....	3.50
43 plates.....	4.50

3" Dials and composition sockets of attractive design at 75c each. Rheostats with pointer, \$1.10; with dial.....\$1.50

POSITIVE IMMEDIATE
DELIVERY FROM STOCK

We have an interesting proposition
for dealers and jobbers

The Reliance Rubber Co.
Dept. D 1806 S. Michigan Ave.
PHONE CALUMET 0947
CHICAGO

(Continued from page 22)

tee meeting referred to in the opening of this article.

Future Uses

No prediction as to the future uses and applications of broadcasting can be too broad. There will be no greater unifying factor in our national life. The immense advantage of a universal national language such as we have is not fully appreciated in this country because it has never occurred to us that any nation would use more than one language in its intercourse. Those of us who have a clear conception of the national conditions in some of the European countries where several languages are spoken realize what a common language means to the nation.

Now that in broadcasting we have a means of transmitting this common language to practically all the nation at one time, the effect in knitting us together as a nation cannot be overestimated. It may play a great part in our national legislative activity and the day may come when the speeches of senators and congressmen may be sent out from a broadcasting station covering the entire nation. The President may issue his national proclamations by radio telephone. National political campaigns will no doubt be waged by means of speeches broadcasted by the candidates. Selective system of broadcasting may develop by which subscribers can obtain the particular character of information or amusement they desire without the possibility of being interfered with by other stations.

Broadcasting has already supplemented the newspapers to a wonderful extent and may greatly increase their activities. Its value to farmers or others living at remote points where newspaper information is not easily accessible is beyond calculation. Already the live stock and grain reports information sent out by the Department of Agriculture regarding farm projects and business has met a response indicating that this is one of the most important fields of service in radio broadcasting. Here is the means that brings the information to the radio listener even quicker than it would an auditor in audiences of ordinary size. In many parts of the middle west the farmer is guided almost entirely by the information he obtains from the Westinghouse station at Chicago, which broadcasts quotations every half hour of the Board of Trade operations. Local brokers handle the farmer's orders which his country line telephone enables him to place

upon the receipt of the guiding radio information.

President Roosevelt during his administration appointed a commission to endeavor to devise means to keep the farmer, in the words of the old song, "down on the farm." Broadcasting will accomplish more in this direction than any means yet devised. Moving pictures and the broadcasting brings cosmopolitan life into the most remote farming regions. Public health instruction is sent out from one government station and the function will no doubt be greatly increased.

Selectivity in Broadcasting

However, in closing this article, the most important impression that we desire to leave is that unlimited broadcasting activities, instead of attaining all the objects outlined heretofore, will, rather, prevent successful attainment. Free speech does not mean that we can all talk at once, and only those with a real message can get attention. Many of us labor under the delusion that we are called and have such a message, but if we speak only in behalf of ourselves or repeat platitudes we add to the din but not to progress.

Unfortunately, the elements controlling radio limit the number of stations that can operate successfully within limited wave bands or geographical areas. The public must decide whether it shall endeavor to pick out the worthwhile message in a bedlam of broadcasting that may come with the establishment of a large number of stations or whether they prefer to limit and classify the broadcasting stations, granting them a license which will carry some of the exclusive features and advantages of a franchise and with its continuity dependent upon the maintenance of a certain standard of excellence and revocable when it is evident that the station no longer fulfills the public demands.

Radio broadcasting stations are now fulfilling a public service without any direct recompense and it is an old adage that things obtained gratis are not always appreciated. It behooves the radio public to consider carefully the effect of unlimited broadcasting and to take an active interest in the radio laws and regulations which may be formulated to control it.

RADIO MANUAL, everything the beginner should know. How to build and operate an inexpensive receiving set. Sixty-four pages, thirty illustrations. Twenty cents. Postpaid. RAYDIO PUBLISHING COMPANY, CAXTON BUILDING, CLEVELAND, OHIO.

FREE—With Head Phones Compact, High-Class Receiving Set

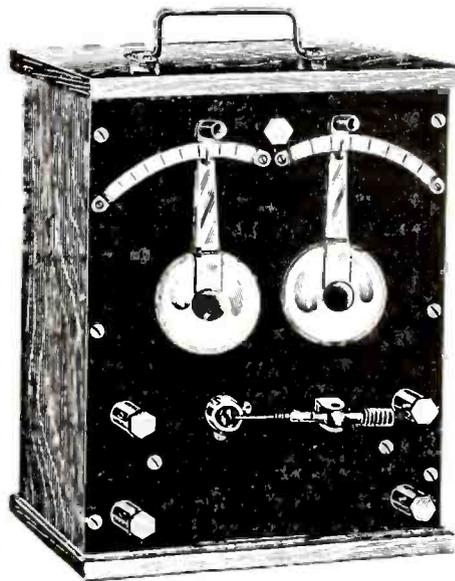
Looks Well and Performs Well

THIS instrument is assembled in a walnut cabinet with a highly polished Bakelite front, all metal parts highly nickeled.

The Crystal Detector is of the very latest pattern, with ball and socket arrangement, so same can be moved up and down, side-wise and forward and back so that the most sensitive point on the Galena can be located.

The Galena retainer is of standard size so that all mounted Galenas will fit it.

The size of the set is as follows: Height, 10 inches; width, 8 inches; depth, 6½ inches.



There are two tuning levers on the front. After locating the most sensitive point of the Galena the two levers are moved back and forth until the best result is obtained.

This receiving set **WILL NOT** receive messages from great distances but it works perfectly under favorable conditions from 15 to 25 miles away from the broadcasting station.

Each receiving set is guaranteed to be in perfect condition, being thoroughly tested before accepted from the factory.

You Can Get This Wonderful Radio Receiving Set

FREE

if you are willing to devote a little effort in telling your friends about RADIO AGE. It's as simple as A. B. C. Just write your name and address on the coupon below and we'll send you full particulars by first mail out.

RADIO AGE, Circulation Department
64 West Randolph Street, Chicago

Date.....

I am interested in securing one of your Radio receiving sets which you offer FREE. Please send me full particulars by return mail.

Name

Street

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

RADIO AGE INSTITUTE

To insure 100% value to readers of advertisements, as well as 100% value to the advertisers themselves, radio equipment is now being tested and indorsed by the

RADIO AGE INSTITUTE
64 WEST RANDOLPH STREET
CHICAGO, ILLINOIS

No charge is made for testing and approval, and all merchandise will be returned as soon as possible, transportation expenses to be paid by the manufacturer. Lists of makers of approved radio goods will be published from time to time.

SERVICE DEPARTMENT FOR READERS

Please remember that Radio Age has one of the best radio instructors in the United States, who is ready to answer any technical question. This costs you nothing.