

# Radio Topics

July, 1923



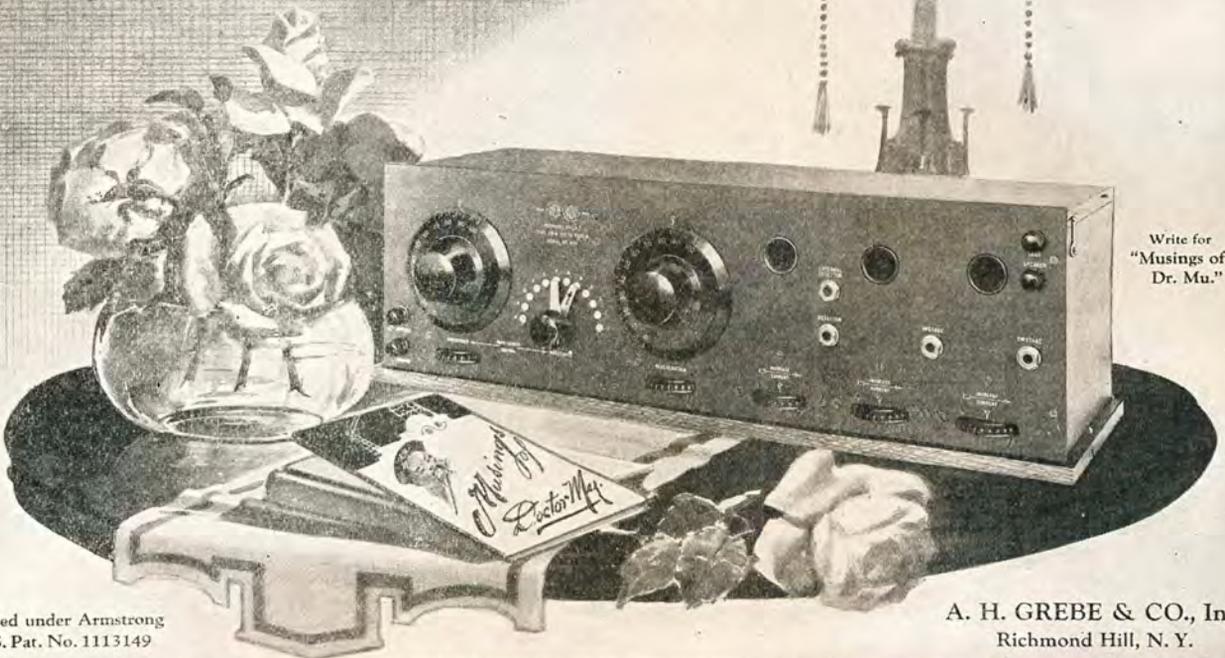
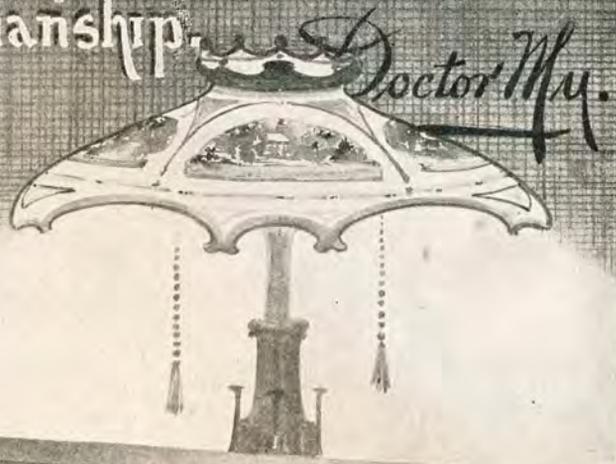
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the eye to see  
what it likes.”

Kuan-Yi-Wu.

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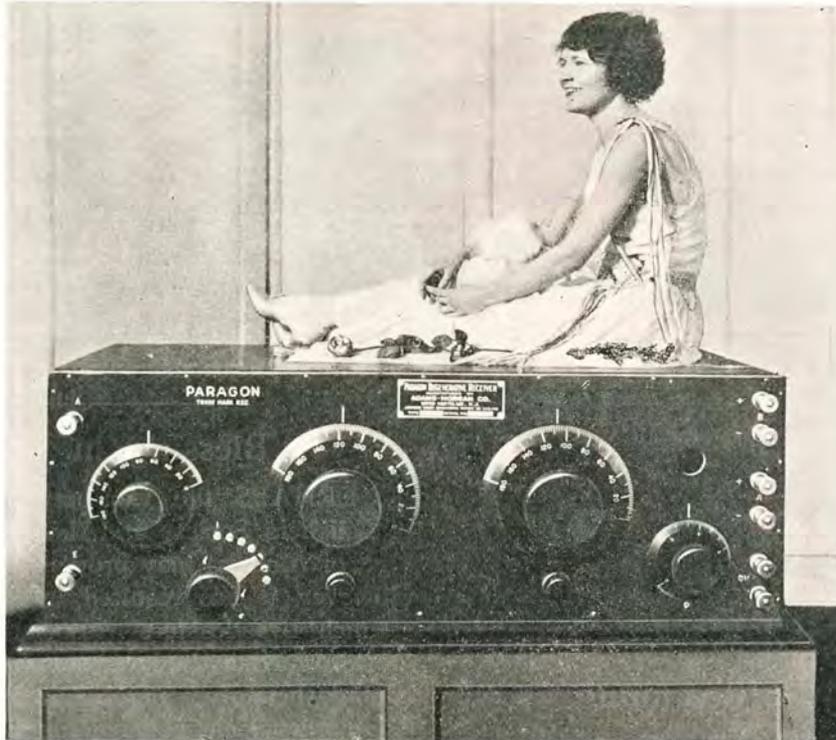
# Radio Topics

An Illustrated Monthly Devoted to Radio

Volume III

JULY, 1923

Number 6



## ONE OF THE BEAUTIES OF RADIO

The Adams-Morgan Company of Upper Montclair, N. J., built this radio set and posed the girl. It is a regular Paragon regenerative receiver. (Photo by Underwood & Underwood.)

## CONTENTS

	Page
The Girl on the Cover—Blanche Sweet, Goldwyn star.	
Best of Music for Radio Fans.....	7
The First Radio Club.....	8
What Will Be the Future of Radio, by Robt. J. Stanton.....	9
Home Economics by Radio, by J. Farrell.....	11
The Real Development of Radio, by James M. Sawyer.....	13
Reduction of Static Interference, by C. E. Butler.....	15
A Good Condenser, by Paul McGinnis.....	16
World-Wide Communication, by Frank R. Carney.....	17
Department of Radio Engineering—	
Adapting Your Set to Wavelength, by C. E. Butler.....	19
Practical Hints on Designing Regenerative Receivers, by Paul A. Perry .....	23
Distortion in Radio Telephony, by Benj. F. Messner.....	25
Importance of Good Transformer.....	27
New and Novel Patents.....	31

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# RADIO TOPICS

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Vol. III

July, 1923

No. 6

## Radio Just Beginning

**I**N the opinion of W. R. G. Baker, one of the radio engineers of the General Electric Company, radio regulation of everyday affairs is not far off. He predicts a marked improvement in the perfecting of home receivers and gives his ideas of its possibilities in an interesting article published in the New York Evening Mail Radio Review.

"Imagine," said Mr. Baker, "every home equipped with a small cabinet, resembling the usual type of phonograph. Instead of the familiar mechanical contrivance, however, we find in the machine one or more small transformers, some coils, a few wires and several bulbs.

"On the front of the machine is a small dial, which can be placed on four points, all numbered. If the dial is set at position 1, we are provided with instrumental music; by changing to position 2, we have grand opera, with such perfect reproduction that we could easily imagine ourselves seated in the Metropolitan Opera House; the third position of the dial gives various types of popular music, and the fourth position supplies important news events, with political and sporting information.

"In broadcasting radio programmes, the entire United States might eventually be divided into sections, each with a central radio transmitting station.

The various news items would be supplied by stations through a method similar to the present Associated Press service. Any special concert or lecture occurring in a particular area could be handled in that section.

"Broadcasting would also be of considerable service at the time of a national emergency, a country-wide strike or great accident. I feel confident that some day a company will provide this service, perhaps on the same basis as the present-day telephone. When this time arrives, we will have a system of news distribution available at the same time to both city dwellers and the farmer."

In the opinion of radio engineers of the General Electric Company, almost unlimited commercial, naval and military possibilities for radio will gradually be unfolded or will unfold themselves. These will include radio lighthouses, radio block signal systems, radio guidance of airship lines and a hitherto undreamed-of warfare science originating entirely in radio applications.

## Blessing in Disguise

**P**ERHAPS the war between the Music Publishers Society and the broadcasting stations of America may prove a blessing in disguise. However, it has resulted in the formation of a staunch Broadcasters' Association, which will do more to further the interests of good music and encourage heretofore unrecognized talent than all the Composers Societies have done in a lifetime.

## Radio Aids Deaf

**O**NE of the greatest helps to deaf people, it is declared by eminent physicians in convention in Chicago, is the radio. It seems the vibrations from an amplifier act as a massage to the muscles of the deaf and gradually their hearing is restored. Here, indeed, is a great victory for the new science.

A lot of people say they can't understand radio. Suppose it is because it is over their heads.

Don't let old Summer Static interfere with your enjoying your radio on your vacation trip.

They're teaching science in the Cincinnati High Schools by means of radio. Now nobody "cuts" his classes.

Down on Long Island, N. Y., they nightly broadcast a motion picture magazine. Charles Reed Jones, former editor of a film magazine, in charge of WHN's programs, is responsible for it.

# The First Radio Club

President George E. Burghard of the Radio Club of America Reads Interesting Paper at Columbia University, New York

**H**OW the first radio club was formed and who figured in the development of the art formed the basis of an intensely interesting paper read recently before the Radio Club of America at the Columbia University, New York City, by George E. Burghard, president of the pioneer organization.

The world-famous club was the first amateur radio organization to be formed anywhere, and it dates back to 1909. A brief history related by the president told of the details of the first known radiophone broadcasting ever constructed. This was put up in 1912 in the home of Frank King, in One Hundred and Seventh street, and consisted of an arc transmitter. Two pioneer members of the club, Frank King and George Eltz, designed the set and operated it for the benefit of the United States fleet, which was anchored in the Hudson River.

\* \* \*

A regular program of music was sent out until the alcohol in the arc chamber exploded and put an end to the program without the possibility of an apogetic "One moment, please!" from the energetic and enthusiastic operators.

Mr. Burghard stated that the year 1912 was a banner one for the club, because it was then that Dr. Hudson announced his invention of the coated filament in a paper read before the club, and E. H. Armstrong, another pioneer member, disclosed his epoch-making invention of regeneration.

In 1914 Louis Pacent and Harry Sadenwater strung an aerial from the Palisades on the Hudson River and demonstrated that amateurs could readily receive messages from Europe. Sadenwater was later to become famous as radio officer aboard the seaplane NC-1 in the first flight across the Atlantic Ocean.

\* \* \*

In the year 1915 the club installed a transmitting station on the Ansonia Hotel which was used by Admiral Fletcher to communicate with the fleet during its stay in the harbor. For this work President Wilson congratulated the club and

the Navy League presented it with a banner.

This station 2PM, was destined to make history a year later by being the first amateur station to transmit a message across the continent. On this occasion it was operated by John Grinan, one of the best known amateurs in the country. He also had the honor of transmitting the first message across the Atlantic Ocean with amateur transmitting apparatus in 1921 from the station built at Greenwich, Conn., by the Radio Club. This station was designed by George Burghard, E. H. Armstrong, Minton Cronkhite, E. V. Amy and John Grinan. The reception was made in Scotland by Paul Godley, who went over with a super-sensitive receiver built by club members.

\* \* \*

The splendid record of the members of the club during the war, and particularly the services of Major Armstrong, who invented the super-heterodyne system at the front, was brought out by the president. This system was of untold value in intercepting the low-powered transmissions by the Germans. The announcement of his invention of the super-regenerative system was made in a paper read before the club last year.

One of the greatest achievements of the club was in designing and constructing the official receiving apparatus for the radio exposition in the Grand Central Palace, New York, last December. This building is the worst in New York for reception, owing to the tremendous amount of electrical apparatus in its vicinity.

The problem was solved by means of special trap circuits. In this case the receiver consisted of three stages of radio frequency amplification, a super-heterodyne receiver, with an initial stage of radio-frequency amplification, one

stage of audio and then by six stages of push-pull audio-frequency amplification. Some twenty-nine tubes were used in this receiver. The problem of controlling such a set was solved by a special committee appointed for the purpose. It did the job after many professionals had refused to tackle it.

"This organization belongs to no one branch of the art," said Mr. Burghard. "Through the medium of its papers and discussions it must endeavor to terminate the disastrous conflict which has sprung up between the original radio amateur or traffic amateur and the broadcast listener. Both classes must be educated so that they will co-operate and become mutually beneficial to each other."

## German Radio Club Formed

A radio club has been founded in Berlin by a number of experts and amateurs with the purpose of furthering the interests of amateur operators and of bringing general radio matters to the attention of the authorities.

In other countries the general and technical radio development has lately progressed far more than in Germany where today only a single private radio company exists. This, as noted in a report from Berlin entitled "Broadcasting Commercial News in Germany," dated January 27, 1923, has acquired broadcasting rights from the postal administration and enjoys the advantages of the wireless station at Koenigswusterhausen which it has leased from the government.

The offices of the Radio Club are at Stechbalm 1, Berlin C. 2.

## Helpful Handbook

One of the most helpful little handbooks of reference concerning radio and the fundamental principles of electricity underlying this interesting pastime, has just been published by the International Textbook Company, Scranton, Pa. It covers fully every phase of radio construction and is a valuable book to have around when testing or rebuilding a receiving set.

# Best of Music for Radio Fans

New National Association of Broadcasters Recently Formed Is Prepared to Furnish High-Class Entertainment

**W**HILE the organized music publishers handed the radio public an awful jolt when it demanded fees from the various broadcasting stations for using their copyrighted music, like the Salvation Army refugee, it may be "down but not out."

As evidence of this comes the announcement of Paul B. Klugh, executive chairman of the new National Association of Broadcasters, which held a meeting recently in Chicago. Mr. Klugh says:

"Two weeks ago the National Association of Broadcasters opened offices at 1265 Broadway, New York City, and since that time we have received more than 300 pieces of popular music. Under the direction of Raymond Walker, about 100 selections have been chosen and we expect to give the public about a dozen real hits—the kind of songs everyone will be singing after they hear them."

## Conducts Experiments

The National Association of Broadcasters, to answer the contention of the American Society of Composers, Authors and Publishers that the radio hurts the sale of sheet music, phonograph records, piano rolls, etc., conducted an experiment in an obscure town, where it was found the music store had five phonograph records of a song which had been published two years previous. Not a copy of the record had been sold in a year.

Through an arrangement with a large broadcasting station this particular song was sung by a talented singer and it is on record that the following day the music dealer disposed of all five of the old records, with a demand for many more.

At the various large broadcasting stations throughout the country the announcement goes forth nightly of the plans and purposes of the American Society of Publishers, its methods of operation, how it collects revenue from motion picture theaters and hotel orchestras, as well as other public

places. This society is controlled by about thirty publishers.

## New Talent Sought

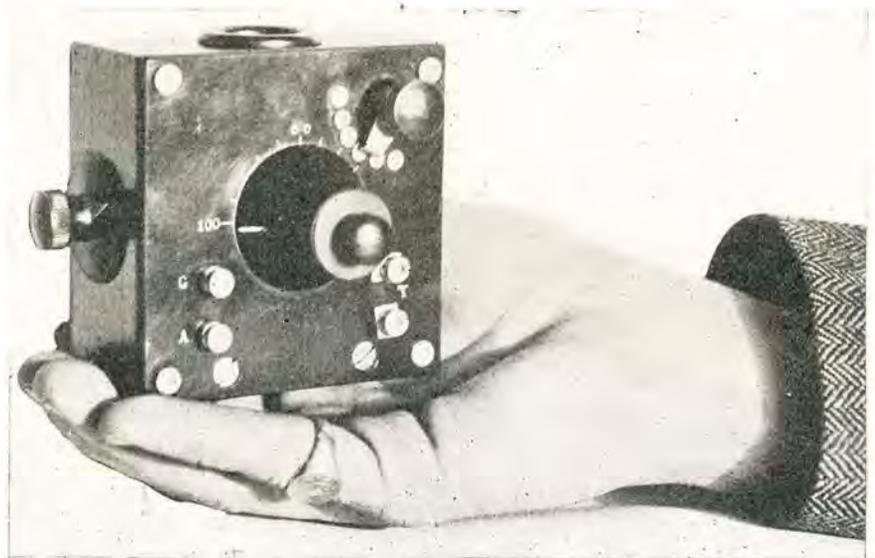
The music publishers maintained that the broadcasting stations were operated for profit and now the Broadcasters Association is prepared to furnish music written by well known composers who realize the power of radio in popularizing their numbers.

It is planned to get the West Coast stations in the new association. Several of these closed due to threats of the music publishers society.

## Cincinnati Musicians

Station WLW, Cincinnati, O., is successfully combating the demands of the copyright music publishers by encouraging local musicians. Cincinnati is famous for being a musical center, and the Crosley studio has become interested in the compositions of two Cincinnati composers, Aichele and Schmidt, who have already published a number of popular selections. Elmr Aichele has played a successful concert from station WLW in which he featured these original selections. The Crosley Publishing Company has published one of these compositions entitled "Somebody Else," which is ready for distribution among broadcasting stations throuth the country.

The Detroit Welfare League, under the direction of Miss Grace D. Davis, is arranging to place a receiving set in the hands of every blind person in Detroit. The radio is a vast comfort, it is said, to blind people, and the work of the Welfare League is meeting with hearty response.



ANOTHER "SMALLEST" RECEIVING SET

This regenerative outfit, said to be the smallest of its kind in the world, measuring  $3\frac{1}{2}$  inches by  $3\frac{1}{4}$  inches, is the work of a Niagara Falls, N. Y., radio fan—Roslyn Russell, a member of the American Radio League. With it Mr. Russell has picked up stations more than 800 miles distant, he says. The set is equipped with a peanut tube. The rheostat knob at the left is  $\frac{3}{8}$  inch in diameter and is homemade. Spider web coil, made of No. 32 enamel wire with the tickler wound inside of the main inductance, with a dubilier vernier type variable condenser cut down to fit the box, with shaft and plate on back of box, are features. Binding posts, switch and corner screws are all homemade. The panel is of  $\frac{1}{8}$  inch bakelite and the sub panel  $\frac{1}{4}$  inch thick. The range of this set is between 200 and 600 meters. (Photo by International Newsreel.)

# What Will be *the* Future of Radio

By ROBERT J. STANTON

*Assistant to the Director, Westinghouse Station KYW.*

**R**ESIDENTS of Chicago, when enumerating a specific description of the factors constituting their civic pride, now point with boastful demeanor to the fact that Chicago is the home of nine large radiophone broadcasting stations.

From these powerful units of radiation there is transmitted each evening musical programs arranged to entertain an audience of over a million people of the United States, Canada and neighboring territory. One of these—KYW—maintained and operated by the Westinghouse Electric & Mfg. Co., not only transmits a musical concert each evening but also maintains a twelve hour daily broadcasting schedule, comprising the latest commercial and financial reports, news bulletins, weather forecasts and general comment on the world markets.

Embraced in this radio schedule is a highly developed romance. From an antenna, not exceeding 100 feet in length, is transmitted information that not only reaches the financiers of the East but also farmers and ranchers and cotton planters scattered widely throughout the country.

During the Grand Opera season in Chicago KWKY broadcast twice each week complete operatic productions from the stage of the Auditorium Theater. Imagine then the broadening influence of this music, which was not only heard by wealthy patrons of the muses in the large cities of the United States, but also by men engaged in industries far removed from the centers of art, literature, and science. Prior to the broadcasting of brilliant classical music, these men scoffed at opera, for the simple reason that their opportunity of hearing famous works of the world's best composers had been confined to the bits of music played on a tin-pan electric piano in some country town movie theater. However, since this music has been brought to them through the medium of radio, in which it was sung by internationally famous opera stars, their viewpoint has undergone a complete transformation. As a short synopsis of each act of the opera broadcast was read by the announcer preceding its transmission, these persons are not only familiar with the music but also the theme of the brilliant works of the masters. This then, answers to some extent the subject question. Radio will tend to

bring together the classes of American society, which heretofore has been so distinctly defined, that it approaches the ancient caste system of India.

## Radio Educational Value

Then there is also the educational value of radio. Take for example, the regular Thursday evening feature "Twenty Minutes of Good Reading," broadcast from Station KYW, by the Rev. C. J. Pernin, dean of the Department of English at Loyola University. The Rev. Father Pernin is considered to be one of America's leading authorities on the short story and in his readings from classical works of prose and poetry from KYW, he gives the vast radio audience a short subject matter of the best literature, both contemporary and of the past.

Suggest to the average person that the writings of Rudyard Kipling, Joseph Conrad, and Bernard Shaw are not only of interest but also of philosophical and sociological interest. Will they read them? The greater majority will not. Then read to them a few of the highly interesting passages from the books. As curiosity is predominate in human character nine times out of ten the book will be read and studied from cover to cover.

During the past year such celebrities as Georges Clemenceau and Lord Robert Cecil have visited America carrying important messages from here their country to our. What were these messages? Was it possible for the metropolitan newspapers to publish their speeches word for word? No. In how many cities did they



**THIS IS SOME ANTENNA**

High on top of the Commonwealth Edison Building, at Adams and Clark streets, Chicago, stands the specially constructed steel antenna towers of KYW, 125 feet above the roof.

appear publicly to give their talks? New York, Washington and Chicago. However, the speeches delivered by both of these notables were broadcast by KYW direct from the platform and were heard throughout the entire United States. Farmers, cowboys, lumber-jacks and other residents of partially isolated communities, through the medium of radio, were able to hear these talks and to become informed on the viewpoint of the people of foreign countries on important international questions. Judge for yourself the national value of this work.

## Market Reports Come Direct

Countless other examples could be enumerated. Another of the most important which I shall set down, however, is the value of radio broadcasts to the business man. During the day, complete and latest quotations on the commercial and financial mar-

kets are broadcast direct from their source, the trading floor. There are also broadcast as regular features of KYW's schedule, complete reports compiled by the United States Department of Commerce. A few simple adjustments on an inexpensive receiving set are all that are necessary to bring these reports to the attention of the business man interested in any one of the many items listed among the quotations broadcast.

This great public service has been developed in slightly less than a year and a half. Since it first began to be of general importance in modern affairs radio broadcasting has developed in rapid strides. However, as radio is as yet in its earliest infancy, its value to the public, commercially as a public service, and a

source of entertainment, is limitless. As new improvements are made the present maze of difficulties gradually unravel, and the future broadcasting schedules become more systematized, radiophone broadcasting will take its place among the foremost factors in the daily activities of the public.

Inter-continent radio communication is now an established fact, as radio central, operated by the Radio Corporation of America, is at the present time, exchanging daily communication with England, France, and other continental nations, with radio still in its infancy. Ten years from now, will the radiophone supplant the wire-phone? Time, and additional technical improvements may prove the solution.

## Milwaukee Radio Club Doings

**T**HE American Radio Relay League's Rochester Plan, which calls for no amateur transmission between the hours of 7:30 p. m. and 10:30 p. m., has been officially adopted in Milwaukee and approved by the membership of the Milwaukee Radio Amateurs' Club, Inc. The society, with the aid of A. R. R. L., City Manager I. H. Strassman, 9AHO, and his staff is attempting to secure the utmost co-operation from the few local radio amateurs who are neither its own members or those of the league.

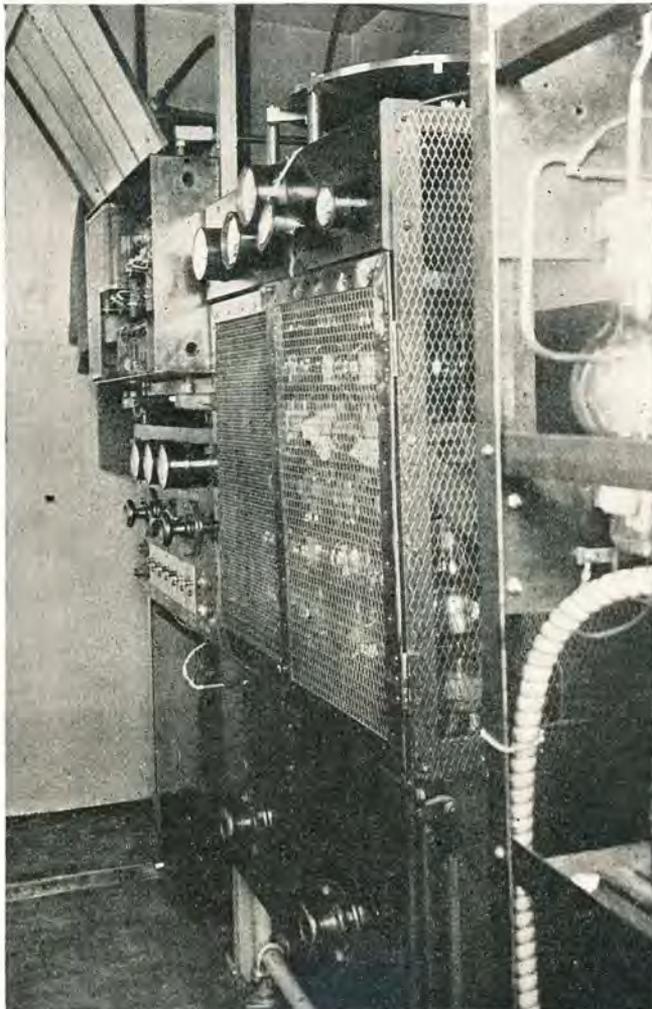
By such action the local amateur fraternity is sacrificing the use of the best hours of the evening in order that the broadcast listeners may be assured of no local amateur interference whatsoever. Directly bearing upon this subject was a paper prepared by the A. R. R. L. entitled "The Status of the Amateur," which was read before the society recently by Business Manager L. S. Hillegas-Baird.

A full house turnout marked the visit of R. H. G. Matthews, 9ZN, Central Division Manager for the A. R. R. L., and Fred J. Marco, 9CD, "FJ" at 9ZN, and Secretary of the Chicago Radio Traffic Organization. Mr. Matthews spoke under the title of "Construction and Operation of Radio Receptors" and Mr. Marco "Some Recent Experiments With I. C. W."

Following their talks at the club they were taken to station 9AAP, where among other things Mr. Matthews listened with some surprise to his Chicago Radio Laboratory station WJAZ.

E. T. Howell, Sc. M., Technical Committee Chairman, has been very regular with his recent weekly reports, the subjects discussed being the new improved Reinartz receptor, syntonized grounds, aeriels, and University of Illinois stations 9XJ and WRM. Station 9AAP, owned by Marian Szukalski Jr., one of the society's directors, was the only local station to be entered in the trans-Pacific tests.

The Club's code class for fans and others is being conducted by H. F. Wareing, pre-war 9AEX and a former Marconi operator.



**THIS IS KYW'S TRANSMITTING PANEL**

The popular Chicago station, atop the Commonwealth Edison Building, is operated by the Westinghouse Company.

Blanche Sweet, the Goldwyn Pictures Star, "Listens-in"



"Static! Oh, Mommer"



"That's Better"



"Oh Boy, Jazz"

# Home Economics by Radio

By J. FARRELL

"THE best type of cream for whipping purposes . . . ." The voice trailed off to an indistinct murmur. Mrs. Mallory quickly readjusted a dial on her household radio set, and tuned back the message. It was part of the new service put on by the Department of Agriculture of teaching home economics by radio. At the end of the paragraph the message was repeated.

"Experiments to determine the best type of cream for whipping purposes have been completed by the United States Department of Agriculture. Raw cream is the best. It should be rich and from 24 to 48 hours old. It should be kept very cold. The most important things influencing the quality of whipping cream are the kind, its age, content of butterfat and temperature."

The "Agriogram" service, the Department calls this new system of bringing radio into the home. More than fifty radio-telephone stations now broadcast the messages, and thousands of women everywhere have enrolled themselves in the course. Tuition is free to all who have radio sets.

For more than two years the Department of Agriculture has been broadcasting by radio market reports on supplies and prices of fruits and vegetables in the leading consuming markets. The service was intended primarily for

farmers to bring them quickly the market information needed in the proper distribution of farm products. It has served an additional purpose as well. The Department learned that many housewives eagerly listen to the market news for information regarding local produce supplies and prices. Information regarding supplies enables housewives to plan their canning operations, and knowledge of wholesale prices is valuable as a check against retail prices.

## How to Buy Food

This situation offered great possibilities for carrying the service a step further, and the Department decided not only to tell housewives of the general market conditions but to advise them how and what to buy, and methods of preparing the food for consumption. One of the first messages sent out read:

"The United States Department of Agriculture has been investigating the uses of the many cuts of pork, lamb and mutton. This shows that the cheaper cuts may be made as tasty as the higher priced cuts. Many recipes have been worked out and are now available to the public upon application."

The service met with instantaneous success. Numerous communications were received from

broadcast operators and housewives commending the plan, and requesting recipes. Off to such an auspicious start the service has grown rapidly and radio broadcast stations everywhere have incorporated the messages in their regular programs.

The word "agriogram" was coined by Secretary of Agriculture Wallace. The agriograms are prepared by a radio editor, especially detailed to make public the results secured by the home economics force of the Department of Agriculture, and are mailed to 500 broadcasting stations for simultaneous release on designated dates. Relayed by radio the items are also published widely in newspapers and magazines so that housewives may have written copies of the recipes and other material. The public is also invited to correspond with the Department direct to obtain additional information and bulletins.

## A Woman's Department

In conjunction with the new service the Department has announced that it plans to strengthen its scientific work in home economics. This calls for the establishment of a Bureau of Home Economics that will rank with the other important bureaus

in the Department, and the Bureau is to be headed by a woman specially trained for the work, and who has a sympathetic understanding of the needs of both farm and city women.

The experimental kitchen of the Department is a revelation in culinary art. Here the nature and uses of agricultural products used in the home for food are studied, the making of jellies, economy in gas consumption, the economical use of different cooking fats, and methods of utilizing meat in the home. Experiments are made to determine the digestibility of foods such as animal and vegetable fats, cereal grains, flour, raw starch, meats and meat products. Menus intended to secure the maximum food values in mixed diets are prepared. The uses of agricultural products for clothing, and the kinds of clothing most conducive to health and economy are studied. Studies calculated to remove the drudgery from housework through the efficient planning of kitchens and the proper selection and care of household equipment are also constantly under way.

The results of this work are made public in illustrated pamphlets distributed by the Department all over the country, in household pages of the daily newspapers, in magazines, through contact with public and private schools teaching domestic science, and through personal correspondence with housewives direct. A large audience is reached in these ways, but the audience has been greatly augmented through broadcasting the information by radio.

#### Million Sets in Use

More than a million radio receiving sets are now in use in both urban and rural homes all over the country. In less than two years radio has progressed from an experiment to an instrument of practical value. First its novelty, then its value as a medium of disseminating education and entertainment, quickly captured the public imagination. The fear of movie and theatrical managers that box office receipts may suffer as a result is real.

People everywhere nowadays are keeping close to the fireside, families grouped around the home radio set that brings to them from great distances the

work of music masters, news of world happenings, and much other information of practical value. Radio seems to be of especial value to folks in rural communities, by breaking down the isolation surrounding them because of their distance from centers of activity. Leaders in rural development express the belief that the time is not far off when every farm home will have a radio set, thus giving the rural dweller all the advantages enjoyed at first hand by people in cities. Rural life will take on a new attraction.

The "agriograms" also include considerable data of an educational character designed to tell city people something about the sources of the clothes they wear and the food they eat. People are giving more thought to problems of food and clothing supply, and the Department has seized upon radio as a means of telling them something of the farmer's work. It has rolled up the curtain and is giving consumers a peek backstage, presenting a picture of sources of supply.

#### Farmer is Coached

Radio "listeners" are being told something about the aeroplane campaign against the spread of wheat rust which destroys millions of bushels of grain each year; the history and scope of the great wheat, corn and cotton crops; the reduction of the meat supply through the ravages of wild animals, and the methods used to combat the depredations; the scientific discoveries such as the manufacture of alcohol from sawdust; the work of the Weather Bureau in warning fruit growers of impending storms; the scouring of the world for new plants to introduce and raise in the United States; the inspection of foods so that labels on fruit and vegetable shipments contain no misstatements regarding quality or quantity, and so on ad infinitum.

Consumers are beginning to realize that they must look behind the corner grocery store for their food supply. That the number of sheep grazing on the slopes of the Rockies, and the ravages of the boll weevil have a great deal to do with the supply and price of their clothing. One of the objects in broadcasting this news is to bring about a more sympathetic

understanding of the problems that confront the American farmers. Farming is an uncertain business. The farmer never knows when he plants a crop whether he will get one bushel or a hundred bushels from a given area of land. Innumerable things can happen to the crop. There may be too much rain or too little rain; a frost may kill an entire crop over night; there is the constant battle against plant diseases, insect and animal pests. And when the crops are harvested there are the problems of distribution and marketing.

#### High vs. Low Prices

During the past two years farmers frequently have been unable to secure for their products the cost of production. Yet consumers have often paid relatively high prices for their fresh fruits, vegetables and meats. This situation is charged to an "inefficient system." After months of investigation a Congressional Agricultural Committee found that the marketing of farm products frequently costs more than production. The cure is seen to be a closer study of the economic phases of production and marketing, and the wide dissemination of such knowledge.

The Department of Agriculture is devoting much time to these economic studies, and is broadcasting the results to the whole people with the use of every available means of communication. It is endeavoring to engender the spirit of co-operation among all concerned, to bring together the farmer and the consumer, telling each about the problems of the other. By radio, hundreds of thousands of people are being reached with these agricultural messages.

#### Elgin, Ill., Station Enlarged

Station WTAS, owned and operated by Charles E. Erbstein, a criminal lawyer of Elgin, Ill., is to be enlarged and improved, it is announced, and when completed will be one of the largest privately owned stations in the world.

WTAS is located on a hill and because of this vantage point, can be heard in almost every station of the union it is said. Many amateurs in Canada have also listened to concerts broadcast by Mr. Erbstein's specially selected artists, and he hopes to reach London, Paris and Berlin before he is through.

# The Real Development of Radio

By JAMES M. SAWYER

"THOSE who go down to the sea in ships!"

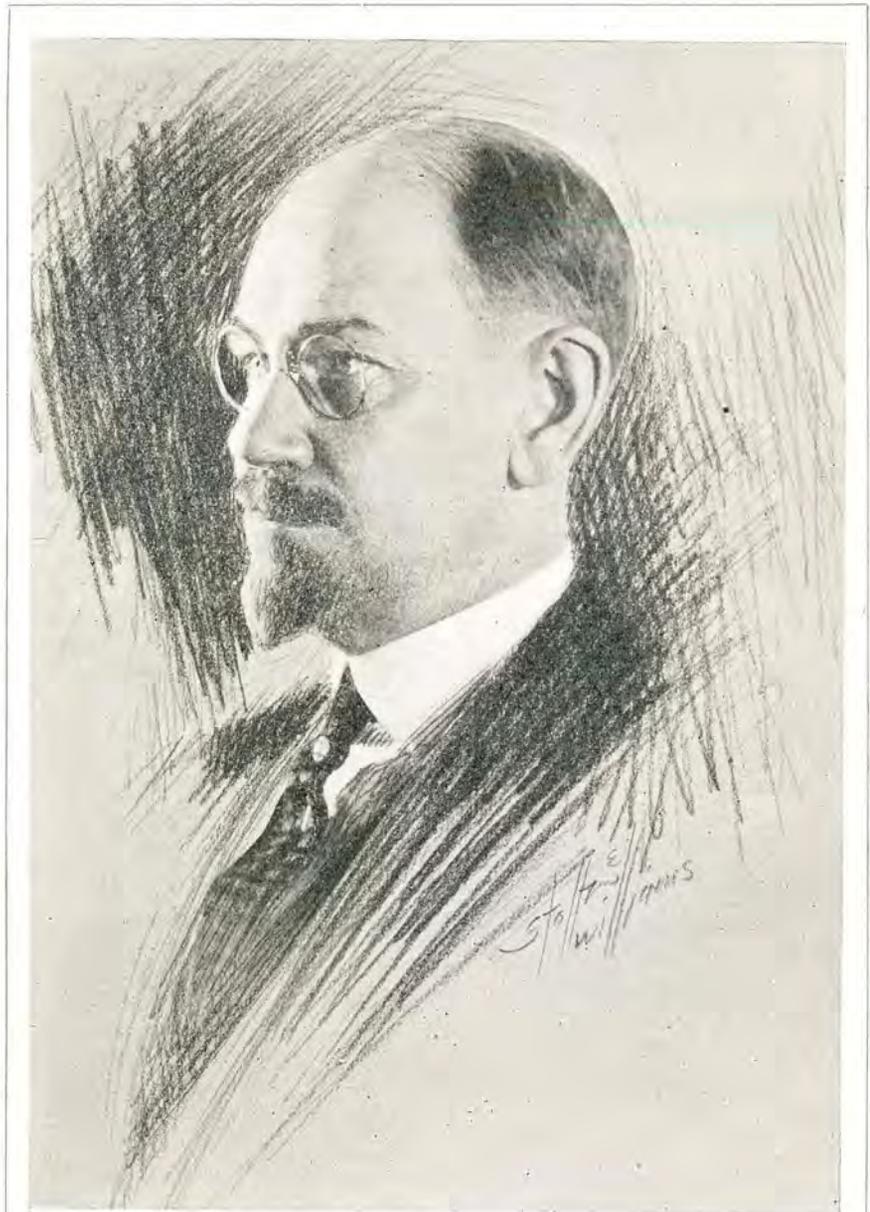
I have often wondered whether the reading or hearing of this phrase arouses in the minds of others the thrill it brings to me. It is, and always has been, to me the source of many mental images—pictures of those who first sailed into the west seeking the edge of the world; those who looked for new lands beyond the horizon, with the sun, moon and stars as their only guides; those who, in skirting our western coast, missed the Golden Gate and discovered the Half-Moon Bay; hardy fishermen going forth from Gloucester; generation after generation of New England mariners bringing back cargoes of rum and molasses from the West Indies, or silks and spices from the Far East; graceful clipper ships; clumsy side-wheel steamers, and so on, a continuous stream of pictures finally ending with the gigantic steamships of today and mile after mile of docks to which these modern monsters of the deep are secured.

Then in my imagination I can see those sailors of the past and those early passengers who ventured forth from harbor and home with very little assurance of reaching their destination and with no means of advising their relatives and friends of their safe arrival until many anxious months had passed.

With the passing of the years, ships were greatly enlarged and many conveniences added, with the result that more passengers ventured forth. The increase in traveling and the size of the cargoes carried have brought repeated demands on ship owners for greater and better accommodations, until the government's attention was drawn to the necessity of safeguarding life and property, and passed requisite laws to this end.

## Introduction of Wireless

Volumes would be required to recount the improvements produced by these regulations. I shall therefore pass them by and take up that which interests me most, namely, that period when radio, or



JAMES M. SAWYER

Assistant Sales Manager, Radio Corporation of America

wireless, as it was then called, for the first time made communication between ships at sea a possibility. Although that was but a few years ago, less than twenty-five, yet ship owners received it very coldly and refused to consider it part of their regular equipment until the government in 1912 made radio compulsory on certain classes of steamships.

When I look back over my twenty years or more of personal contact with marine radio work there is one outstanding feature which impresses me more and more strongly as time goes by, and that is the unswerving pursuit of an ideal by all who served to make radio communication successful. The entire energy of these men was devoted to giving to those using

radio reliable communication that would not fail in the time of need. The record of lives saved in times of disaster, the suffering relieved and property losses avoided proves that they did not fail.

For many years marine and transoceanic communication were considered the chief uses to which radio would be applied, but as some success in radio telephony had been achieved, it was hoped that it could be developed to such an extent that it would be commercially practical.

#### Radio's Advance During War

Then the World War came upon us, during which rapid progress was made, and when peace returned radio telephonic communication over long distances was a reality.

After much development work component parts were produced which enabled the amateur to construct a radio set with which he could actually talk "through the air."

This phase was shortly followed by the first broadcasting of music and news, and almost over night the world (at least the United States part of it) was in a turmoil. It was revolutionary; today it has spread over the civilized world, and no man can say what the end will be. There can be no doubt about its influence constantly increasing and bettering the condition and lives of the inhabitants of the earth.

I have spoken several times of an "ideal." That ideal has been "Service"—service to mankind and service to the world at large. In performing this service, rank and file have worked shoulder to shoulder to produce results.

#### Realization of an Ideal

If you will scan the names of those now foremost in this latest—this revolutionary—development, you will find they are among those who five, ten and twenty years ago were carrying out their ideal of giving the best service to "Those who go down to the sea in ships."

These men have brought to their new task that same high ideal, that same sense of responsibility to the world, to the end that every home and every family may have an instrument through which will come music direct from the greatest artists, words of wisdom from the greatest minds, entertainment, edu-

cation and a constant daily knowledge of the social, political and business world. They will bring this to pass, for their ideal is implanted in the hearts of their fellow workers, and the world will see as wonderful results in this, their latest endeavor, as has been recorded in that service which they have given in the past to "Those who went down to the sea in ships."

#### Station WDT Re-opens

Miss Vaughn DeLeath, studio manager, announces the opening of a new broadcasting station, or rather a re-opening of WDT, at its new home, 510 West 23rd street, New York. This station is operated jointly by the Ship Owners Radio Service, Inc., and the Premier Grand Piano Corp.

#### Storage Battery in Summer

Now that summer is approaching, there may be some who will not use the regular six-volt storage battery but use the dry cell ones instead. If you are contemplating doing this, take the advice of the battery expert in the Crosley Manufacturing Company's laboratory and do the following things:

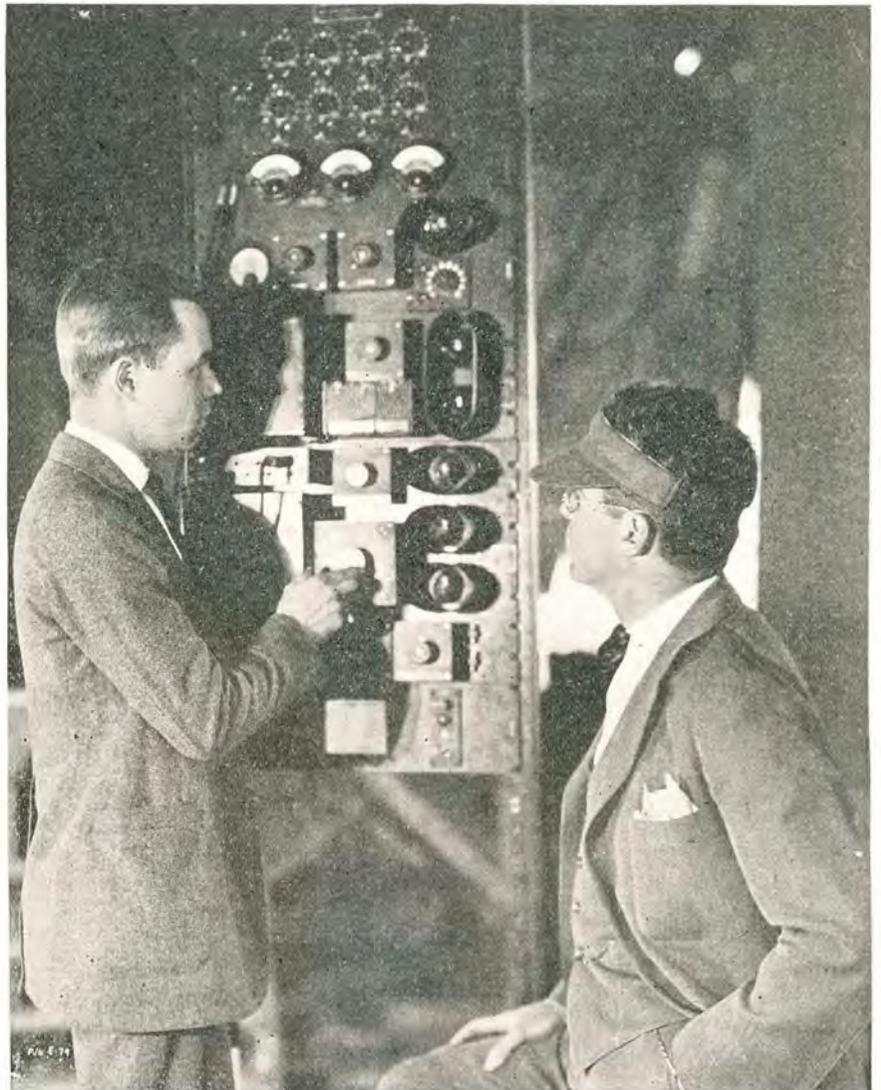
Charge the 6-volt battery to its usual full capacity.

Drain the cells of their liquid.

Place the liquid in an air tight receptacle.

Be careful not to spill the liquor, as it will destroy clothing, rugs, etc.

When ready to use again, divide the liquid into three parts and pour into the battery cells proportionately and fill up the cells until the plates are covered with distilled water and then recharge.



#### RADIO IN THE STUDIO

The Goldwyn studio, Culver City, Calif., recently installed this very complete radio outfit. Mr. Santee of the Western Electric Company is demonstrating to Marshall Neilan, the Goldwyn director, the new device, which is to be used to facilitate the work of the director in handling large mob scenes.

*Here's a Practical Article and a Timely One*

# Reduction of Static Interference

By C. E. BUTLER

*Manager Radio Service Division, Westinghouse Electric & Mfg. Co., Chicago, Illinois.*

**S**TATIC, the seemingly unavoidable demon who is with us always, is especially active in warm weather. Frequent storms during the summer months cause a great deal of atmospheric interference that makes receiving conditions in the Great Lakes and the Corn Belt region of the United States as bad as the tropics at times.

Last summer exceptional weather prevailed permitting reception of many long distant stations by the fans in spite of the low power of many of the stations. This summer the country is dotted with powerful broadcasting stations that should be able to push through interference in great style.

The thing bothering most of us is how to enjoy our favorite programs without the continuous roar of static, which, especially on a loud speaker, is very annoying. Three means of reducing static interference by increasing the ratio of signal strength as compared to static strength are recommended:

1. The use of a low, short aerial, or an indoor aerial.
2. The use of a loop aerial.
3. The use of a ground antenna.

Number one can consist of thirty to fifty feet of wire around the picture moulding in a room, a single wire run through the house or down the hall, or suspended on the rafters in the attic. Any size wire may be used but number eighteen enameled wire is often used on account of its inconspicuousness. An aerial tacked along the board fence in the back yard works splendidly for the writer. An outside aerial should not consist of more than a single wire, and that not too high. More than one wire in the aerial tends to reduce rather than aid reception and is a most efficient static collector. Be sure that all joints are soldered, or if possible erect your antenna of a single wire.

It is our opinion that a good many antennas have been erected with an amateur transmitting aerial as a model, overlooking the fact that the amateur probably does his receiving on a low single wire.

## Loop Has Advantages

Loop reception eliminates a great percent of static and has the added advantage of being directional. Radio frequency amplification is usually employed with a loop but an ordinary regenerative set and even a crystal set can employ a loop to advantage. Tuning is much sharper and for that reason it is well to use a three plate venier condenser in place of the

usual fixed grid condenser, and to use a potentiometer for a great deal of the tuning in and clarifying signals. Connect the loop, one side to the aerial binding post and the other to the ground binding post. A good detector tube will be of considerable value when using the loop.

The ground antenna may be constructed by digging a shallow trench and burying a heavily insulated copper wire about four inches below the surface. This antenna will be directional in effect, especially in wet weather, but will pick up little static even during severe electrical storms.

Vacationists report excellent results using an insulated wire immersed in a lake or river. Using such an aerial the writer was able to copy arc signals at a time when reception was impossible on a large 12 wire aerial 400 feet high.



## U. S. NAVY DEPARTMENT'S RADIO SERVICE

The United States Navy Department is farther advanced in the science of radio than any other group. The Navy Department maintains a special research bureau and is always improving all branches of the service. The radio central control room in the Navy Department Building, Washington, D. C., is the largest receiving control room in the government service, having ten channel lines on the board receiving from such distant points as France and California. The photo shows Chief Gunner J. J. Delany in charge of the radio room, plugging in one of the ten trunk lines. The board works like a telephone switchboard, and operators in the receiving room transcribe the messages as they come in on typewriters. Both sending and receiving is done in this room.

# A Good Condenser

How to Choose the Proper Materials and Make Them Fit Your Need

By PAUL MCGINNIS

**A**LTHOUGH condensers are nothing more than metal plates insulated from one another, they operate in a most delicate manner and in making such instruments it is necessary to choose the proper materials and to use them in the proper way.

The maker of a condenser will be rewarded by attention to small details, for his set is affected by such a small amount of capacity as that which would exist between a metal sphere an inch in diameter and the walls of an ordinary room.

A condenser is usually described as a storehouse of electricity, with the electric charge resting on the plates. The capacity, or the ability of a condenser to store electricity, is determined partly by the size of its plates, but to a far greater extent by what lies between the plates and it is here that the builder of a condenser must take his greatest pains.

What would be an insulator in other parts of electrical equipment takes on different properties when placed between the plates of a condenser and is known as "dielectric." While air is a fairly good insulator for the simpler forms of electric current, it does only about one-eighth the work of glass or mica when used in a condenser.

The accompanying table gives the values of a number of ordinary insulators as compared to air when used in condensers. The figures represent what is called the "dielectric constants" of the various materials.

There is yet another factor influencing the capacity of a condenser, and that is the distance between the plates. The closer together the plates can be brought, the greater will be the capacity, and so three things must be taken into consideration: (1) the size of the plates, (2) the character of the dielectric and (3) the thickness of the dielectric.

In addition to these three main factors must be considered the

extent to which the dielectric absorbs moisture, the rate at which it "absorbs" electricity, its durability and other characteristics, but if the common materials are used, these minor factors will have little bearing on the efficiency of the condenser.

It is obvious, from a glance at the table, that the use of air will mean the making of a large condenser with much plate surface. Air as a dielectric is practical only in variable condensers where solid material would not stand the wear of rotating plates. The accepted standard for the fixed condenser is mica because of its high dielectric constant and its perfect operation when cut as thin as a few thousandths of an inch.

The next best dielectric for the experimenter is paraffined paper. An efficient condenser can be made with paraffined paper and tinfoil. A condenser of such material suitable for connection across the terminals of the phones, one having approximately .0015 microfarads capacity, can be made by using about 24 square inches of heavy tinfoil well separated by the paper.

The tinfoil is cut into six strips 1 inch wide and 4 inches long. A good grade of bond paper which has been thoroughly saturated with paraffin is then cut into seven strips 1¼ inches wide and 3 inches long and used for the dielectric between the tinfoil strips.

The tinfoil pieces are laid in the center of the paper strips so as to leave a margin of ⅛ inch on both sides and one end; the foil projects over the other end for connecting purposes. The condenser is put together so that three alternate pieces of foil project from one end to form one plate, the other three projecting from the opposite end to form the second plate.

Cardboard or dry wood is used, at least on one side of the strips to make them rigid and all are bound together with bare copper wire, the ends of foil folded under the wire to make connection.

Several condensers may be connected together to form different capacities. For instance, to make the .006 condensers used in the Flewelling hook-up, four such condensers as the one just described can be connected in parallel, for in such connection their values are added. If they were connected in series, however, their capacity would be only .000375 mfd., as calculated by the formula,

$$\frac{1}{X} = \frac{1}{C} + \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \text{ etc.,}$$

where X represents the unknown capacity and the C's the various condensers to be connected.

Condensers of various sizes can be planned by using the formula,

$$C = 0.0885 \frac{KS}{t}$$

where "C" is the desired capacity, "K" is the dielectric constant indicated in the table, "S" is the surface area of one side of one plate in square centimeters and "t" is the thickness of the dielectric in centimeters.

## TABLE DIELECTRIC CONSTANTS

Prepared by U. S. Army, Signal Corps

Air .....	1.0
Glass .....	4 to 10
Mica .....	4 to 8
Hard Rubber .....	2 to 4
Paraffin .....	2 to 3
Paper, dry .....	1.5 to 3
Paper (treated as used in cables) .....	2.5 to 4
Porcelain, unglazed .....	5 to 7
Sulphur .....	3 to 4.2
Marble .....	9 to 12
Shellac .....	3 to 3.7
Beeswax .....	3.2
Silk .....	4.6
Celluloid .....	7 to 10
Wood, maple, dry .....	3 to 4.5
Wood, oak, dry .....	3 to 6
Molded insulating material .....	4 to 7.5
Vulcanized fibre .....	5 to 8
Castor oil .....	4.7
Transformer oil .....	2.5
Water, distilled .....	.81
Cottonseed oil .....	3.1

# World-Wide Communication

The Triumph of Radio Over the Cable by One Who Studied Wireless for Thirty Years

By FRANK C. CARNEY

*THIS is the first of a series of interesting and instructive articles prepared especially for RADIO TOPICS by Frank R. Carney, division manager of the transoceanic department of the Radio Corporation of America. Others will follow in subsequent issues.*

**F**RANK EDWARD HINKLE says he knows a man who writes books, and in them he puts wonderful things.

He can write about a star gleam coming down from heaven and fill your heart with a sense of constancy and eternal hope.

He can write about an old, weather-beaten oak on the wind-swept summit of a far away hill and make you see in it God's own emblem of all that is steadfast and true.

He can write about a placid stream flowing silently on its way to the sea, and bring to you a touch of that wonderful peace which, "Like a river, shall forever flow."

And he can write a volume about the out-of-doors that will keep you reading through the night and send you out to greet the dawn with a love for trees and mountains, and sunshine and sky, that you have never felt in your soul before.

Who is this man to whom Mr. Hinkle refers? Surely not I.

\* \* \*

It is not my intention to write about trees and flowers and rivers. What I am going to endeavor to do is to write something about world-wide wireless and foreign communication, telegraphically speaking, because in my thirty years of experience I have been in close personal touch with thousands of firms and individuals who have had occasion to communicate with one country or the other throughout the world, many of whom, lacking knowledge of certain information essential to the proper preparation and routing of cablegrams or radio-grams, severely criticize the Amer-

ican transoceanic carriers for matters and faults entirely beyond their control.

Let us start at the beginning. Let us go back to the days when the only method of international communication was via sailing schooners.

As late as 1774, Edmund Burke, one of the greatest minds in English history, in a speech to the House of Lords against the coercion of the American colonies, declared that three thousand miles of rolling ocean separated England from her American colonies, that months must necessarily elapse between the order and the execution, and that no human ingenuity could ever overcome this handicap.

Twenty-one years later, Sir Charles Bright informs us, a Spaniard named Salva suggested submarine telegraphy, and in 1811 Sommering and Schilling conducted a series of experiments. A

material, said to be india rubber, was first used to insulate the wires.

From this time England must be credited with the great progress made in the development of submarine telegraphy. Short cables were laid and operated successfully throughout Europe long before the coming of the great feat of laying the first transoceanic cable.

After many attempts, the successful laying of the first Atlantic cable was accomplished, and on August 5, 1858, England and America exchanged electrical greetings. This cable never worked successfully, as a maximum speed of only six words per minute could be developed. A message of 150 words from the President of the United States to the English Queen occupied thirty hours in transmission.

Hope, however, was never abandoned. No other enterprise in the world required more faith, more enthusiasm, more earnestness or indomitable will on the part of the promoters and those who ultimately succeeded in accomplishing a purpose as did the laying of the first North Atlantic cables. Volumes have been written describing the most excruciating trials, physical mental and financial, that few men are ever called upon to undergo, and the names of Cyrus W. Field and John Watkins Brett will live forever as being prominently identified with the successful launching of this enterprise.

Naturally, progress has been made during all these years. Today millions of dollars are invested in submarine cables. They circle South America, they radiate from the United States on the Atlantic and on the Pacific. All civilized countries in the world and prominent islands of the seas are in electrical touch with the outside world.

Will the energies of Field, Brett and Bright, and the millions of dollars invested in cables be spent in vain? Will the electrical wire highways of the world be "junked" with the birth of the new and more modern method of world-wide communication, "Radio?"



## POLICE USE RADIO

New York police department now uses radio. One of the machines of the motor cycle squad equipped with receiver. (Photo by News Events.)

# Regulating Radio in China

IT is apparent that increasing interest is being taken by foreigners in the Tientsin Consular District in the use of radio telephony for both amateur and commercial purposes. The Chinese Government Telephone Administration last year contracted with an American company to install at one of the local telephone exchanges a powerful, up-to-date plant for transmitting and receiving wireless telephone messages.

This station was designed to supplement the land lines in between Tientsin and Peking, a similar plant being in process in Peking to work in conjunction with it. Experiments are now going on with a view to perfecting the operation of these stations. The design is such that an ordinary telephone subscriber who wishes a long-distance connection with Peking may be connected either by the land lines or by means of radio. These installations have not yet been taken over by the Chinese Government Telephone Administration, but it is understood that this may be done in the future.

A number of general import firms have become interested in developing the market for radio telephone apparatus and have inquired regarding the importation of both receiving and sending sets, together with the Chinese regulations governing their use.

The regulations of the Chinese Government now in effect do not permit individuals or companies, either in the interior or at the treaty ports, to install and operate radio telegraph or telephone stations, either for amateur or commercial purposes. These regulations, however, govern the use of wireless apparatus and do not apply to the importation or sale of such articles. There is no ruling of the Chinese Government which would prevent importation without permit of wireless telephone sets not intended for military uses.

Under regulations wireless telephone sets for amateur uses were imported into China last fall. In another instance the superintendent of customs permitted the entry of two wireless telephone transmitting sets that were not intended for sale, but merely as samples.

## Radio Restricted in Czechoslovakia

THE manufacture, sale, storage, and importation of radio telephone and telegraph equipment in Czechoslovakia is only permitted under license from the state, says Trade Commissioner H. L. Groves in a report to the Department of Commerce. The Ministry of Commerce, in cooperation with the Ministry of Posts and Telegraphs, are authorized to grant licenses for this purpose. The Ministry of Posts and Telegraphs also supervises and controls the manufacture, sale and storage of radio equipment and co-operates with the Ministry of Commerce in the granting of licenses.

Up to the present time only one company—"Radioslavia"—has obtained a license for the manufacture of radio equipment in Czechoslovakia. It has not yet started production. This company is understood to be affiliated or closely connected with the French Company "Societe Francaise Radio-electrique." A German company, "Gesellschaft fur Drahtlose Telegraphie, System Telefunken," is said to be promoting a company with Czechoslovakian capital for the purpose of exploiting German wireless patents, but it has not yet been granted the necessary license.

The attitude of the Ministry of Posts and Telegraphs toward the granting of licenses to transmit as well as to receive radio messages is said to be favorable in the following instances:

(1) Technical high schools, for scientific purposes.

(2) Industrial establishments which have obtained special licenses from the Ministry of Commerce to manufacture radio equipment.

(3) Ships and aircraft.

(4) Electric Power stations, waterworks, and other establishments of public utility, under special conditions.

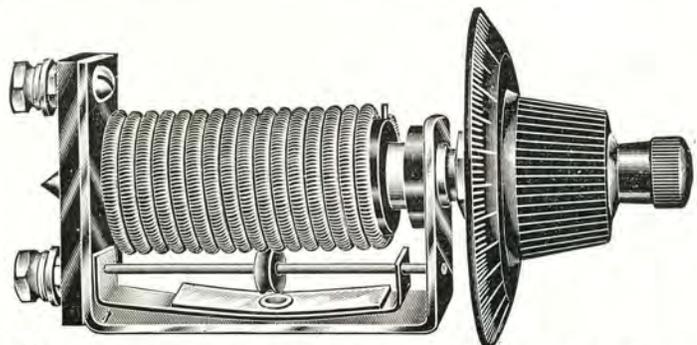
(5) Companies which have been authorized by the state to broadcast matter of general interest, such as news-statements, exchange reports, agriculture reports, concerts, lectures, etc.

Licenses for operation of receiving sets only will be granted to institutions, companies, and those regularly taking the reports transmitted either by the State Telegraph Office or by companies authorized by the state to transmit such messages.

## A 33 Ohm Rheostat

The Marquette Radio Corporation, Chicago, has placed a new rheostat on the market. It is declared to be a perfect arrangement for the new vacuum tube filament circuits giving the proper temperature control at all times and allowing smooth tuning. It comes in 25 and 33 ohms.

The 33 ohms rheostat is especially adapted to the new UV-199 tubes and the 201-A and 301-A. It has an off and on switch which serves as a locking device as well as other unique features. The Marquette company is using this rheostat exclusively in their regenerative receiver, the latter being made up in two units with an attachable top and base so that either the detector unit or the two stage amplifier may be purchased separately.



New Marquette rheostat which works with UV-199 tube at 33 ohms.

# Department of RADIO ENGINEERING

## Radio Topics Institute

Nanko C. Bos, Chairman Advisory Board



### Look for the Approval Seal

Such as the one just above which are furnished manufacturers whose radio merchandise has been tested and approved by the Institute Laboratory. We urge you to purchase only such apparatus, for it carries the guarantee of our organization.

Send all inquiries and material for test, calibration, or reconstruction to RADIO TOPICS INSTITUTE, Oak Park, Ill.

## Adapting Your Set to Wavelengths

By C. E. BUTLER

A GOOD many radio fans have complained to the editor of Radio Topics that they have had considerable difficulty in receiving, or have been unable to hear at all, some of their familiar broadcasting stations since the change in wavelengths, recently made by the government, went into effect.

This is due in a large measure to the fact that the normal range of their receiving sets is not of sufficient range to reach the stations that are now on 447 meters and higher.

To change the ordinary regenerative set to reach the higher wavelengths is accomplished in several ways. One is to shunt a small fixed condenser of .00025-MF capacity between the aerial and ground connections inside your set.

An 11 or 23 plate variable condenser may be used in the same manner. On Westinghouse radio receiving sets which have a series antenna condenser with two binding posts, one for long, and one

for short waves, simply shunting the post not in use to the ground binding post will often raise the wavelength sufficiently high to reach the stations on higher wavelengths.

Another method, although less efficient, is to insert a 50-turn honeycomb coil in series with the antenna. A thirty-five turn coil will suffice in some sets which have more inductance in the primary circuit. Circuits employing radio frequency amplification using transformers will require new transformers having a higher wavelength range.

A transmitting station requires considerable readjusting and rebuilding when drastic changes in wavelength are made in order to again regain the efficiency and strength they formerly had on their old wave. These changes take time and sometimes much experimenting and listeners should bear this in mind before condemning their receiving sets or their favorite broadcasting stations.

### Variocoupler Adapted to Short Wave Work

One of the old time devices used for tuning radio signals is the tuning coil having one, two, or three sliders. Many of these tuners are in use today, probably because they can be easily constructed, but their efficiency is not to be compared with variocouplers, variometers, and loose couplers. The latter are but the outgrowth of the tuning coil and with their use much finer tuning and more selective tuning is possible.

A tuning coil can be made by simply winding a coil of wire any size from number 18 to 24 on a cardboard tube or wooden form of any dimension, placing a slider on a square brass rod and arranging it so as to make contact with any one of the turns of wire. This permits very close tuning with a minimum of interference.

Loose couplers secondaries, and variocoupler primaries are always tapped, that is, pigtailed are taken off every angle turn for the first ten turns and then every tenth turn

thereafter. By this means stations are brought in by adjusting the turn switch with fine tuning and interference eliminated upon varying the single turn lever. The tapped method of coil connection is in some ways preferable. Very rarely do sliders make the perfect electrical contact that the sliding arm and switch points permit. Then, too, continual use of the slider will wear into and in time make rewinding of the coil necessary.

The variocoupler is an evolution of the loose coupler created to perform the same service, but taking up about one-half the space necessary to panel mount the variocoupler. They are peculiarly adapted to short wave work. The distinctive feature of the variocoupler is the ball shaped, untapped secondary which rotates through ninety degrees inside of the primary. This is done to the inductive relation between the two.—Radio Globe.

## Hiram Jones Ruminates

By C. M. BUCHANAN

WHEN I tune in "Sche-nec-tady," I thrill with honest pride; and when old Denver talks to me I'm more than satisfied; it gives me joy to listen in to San Francisco cheer; Atlanta with her sunny voice I very plainly hear; I pick 'em up from East and West, from North and South they sing, I'll tell the world this radio can beat most anything. Just think what my old dad would say if he were here today, he wonders that are all around—he'd hardly know his way. I get a notion now and then that since the radio, has cut out distance—banished space—perhaps some day we'll know, the language of the stars that shine each night up in the sky, and soon old "Mars" will broadcast "Earth," and to us she will try and teach her lingo through our sets—mayhap those buzzing sounds we hear on certain stormy nights are signals from her bounds. What is there that's impossible?—we ask you one and all, since radio has set the pace, we may yet get a call right from the gates of heaven for an hour of diversion with some old friend who passed away and took the long excursion. What is there that's impossible—I surely'd like to know, since we can banish time and space with modern radio?

HIRAM JONES.

## TAKE ALONG YOUR RADIO

RECENTLY I met a drummer in St. Louis who was sitting in his room in the Statler Hotel enjoying an evening concert being broadcast by the St. Louis Post-Dispatch. This is but one of the uses of a receiving set.

If you have a small radio receiving set which can be conveniently placed in the automobile, boat, or taken along with you in your trunk, do not fail to make room for it. You will be more than repaid for the effort. The summer season is here and with it comes the mistaken idea that radio is but a winter indoor amusement and source of information. That is not so. Nearly every first class broadcasting station in the country is prepared to keep up a fine schedule of programs for the summer, with especially attractive novelties to be given the radio fans. This is especially true of WLW of the Crosley Manufacturing Company, Cincinnati, where unusual programs have been arranged.

In order that you may fully appreciate the advantages in radio in the summer months and do not care to purchase one of the regulation portable model radio receiving sets, take your small set and arrange to place a strap or handle for it so that it may be conveniently carried about on the auto, trolley car or boat.

If you have been using a regular six-volt type of storage battery and contemplate taking your set on an auto trip, you need not worry about taking along the heavy radio battery. Just attach your battery clips to the battery in your automobile, but first ascertain if it is of the six volt type. If not, find out from your dealer or garage man just where to make the connections on your automobile battery so as to get the required six volts without burning out the tubes. It is also possible, where the battery is of the six-volt type, to take out the little lamp in the dash board and place in the socket a connector

which can then be wired to the radio receiving set. This will give the desired current and by reversing the wires, the positive and negative may be ascertained. It is not advisable to use the frame of the automobile as a ground.

Of course, should your receiving set be fitted with the 1½-volt tube, the batteries are so small as to be easily carried without taking up much space.

There are several types of aerial which may be used, including the loop, single wire thrown over a tree but insulated from grounding, and hung from a mast on the boat.

## Frost Opens New Branch

Herbert H. Frost, Inc., 154 West Lake Street, Chicago, has opened a New York City office at 30 Church Street, under the direction of M. Frank Burns as district sales manager. Mr. Burns was formerly with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

The opening of Herbert H. Frost's New York office is one of the moves toward general expansion of its organization, it is announced through district sales offices, and will be followed by the opening of similar offices in San Francisco and other cities.

## United Plant Expanding

The United Manufacturing & Distributing Company has purchased a new manufacturing plant at 9705 Cottage Grove avenue, Chicago. The entire property covers over eight acres of which 60,000 square feet is occupied by a very modern factory.

The plant is fully equipped with the most modern equipment available and will make possible a very much larger production of radio equipment. The United people make the well known United line of condensers, vernier dial assemblies, and transformers popular with the radio fans all over the country.

A. E. Dreier, sales manager of the Radio Department, announces that his company is doing a great deal of experimental research work and will add two or three more parts to their line which will be ready for the fall buying season.

## CORRESPONDENCE WITH THE INSTITUTE

Conducted by Carlton E. Butler, Mgr. Radio Division, Service Department, Westinghouse Electric & Manufacturing Co., Chicago, Ill.

Mr. Butler will answer any questions puzzling Radio Fans. Make your letters as short as possible, write on one side of the paper only, and give your name and address plainly. In conjunction with questions and answers in this Department, an article will appear elsewhere in this magazine each month dealing with particular phases of trouble experienced in assembling and operating radio receiving sets by a great number of our readers. Save these articles, as they may answer many of your questions and prevent you from making costly mistakes in the future. This is your Department. Use it.

*I am a constant reader of RADIO TOPICS magazine and I was very much interested in the article on Ultra Audion system in May issue, since I have had very good luck with this circuit. Is it not possible, however, in Fig. 5 on page 18 that the sketch or description is wrong, since it states "inductance 1, 3, and 4 are 35 turn coils and No. 2 a fifty-turn honey comb coil." When used as sketched, the inductance 2 does not seem to function. An explanation will be appreciated.—B. E. B., KANSAS CITY, MO.*

ANSWER: You are correct in assuming that the description of Ultra Audion hook-up on page 18 is incorrect. It should state "inductance 1 and 3 are 35 turns and No. 2 is the 50-turn honey comb coil."

*In your issue of May you show several hook-ups on the Ultra Audion. Will you please give me some specific specifications on diagram No. 3? (1) What kind of a tube is used? (2) Is there a grid leak in this circuit and where is it located? (3) What is the capacity of the condenser between the variometer and bulb? (4) How many volts in battery? (5) Will a 23-plate variable condenser be sufficient?—F. V. M., Chicago.*

ANSWER: In hook-up No. 3 of the Casey Audion circuit in May RADIO TOPICS (1) is a UV-199 tube. (2) The grid leak is in the grid circuit and is indicated by staggered line; this is a variable leak. (3) Use a 23-plate condenser (.0005 capacity). (4) Use a 22½ volt "B" battery and three dry cells as "A" battery. (5) A 23-plate variable condenser will answer all purposes and give you fine tuning.

*Will you kindly explain in RADIO TOPICS the difference between radio frequency and audio frequency amplification? I am an amateur operating a single circuit receiver.—A. J. L., Scranton, Pa.*

ANSWER: The incoming signal is of radio frequency but when it is rectified or changed by a detector, it becomes audio frequency. In radio frequency amplification the incoming signals are amplified before they reach the detector tube and signals that are not under ordinary circumstances strong enough to be rectified by the detector are built up to a higher potential.

Answer to W. P. S., Emington, Ill.—Regarding difficulty you are having with the Erla Duc-Reflex circuit, it is our

opinion that the failure of your hook-up to work is due to a poor crystal, to improper location of the various pieces of apparatus in regard to each other, involving long parallel leads, to condensers of improper value, or a combination of the three.

When properly constructed you will find a certain value of your variable condenser at which your set will oscillate and howl when the catwhisker is off the crystal, which will disappear when a proper contact is made. Your set should act this way in order to be functioning properly.

Perhaps your condensers are not of the proper capacity to fully by-pass the radio frequency currents. It should be noted that the values of the condensers in your circuit will need to be varied somewhat to agree with the characteristics of the tubes used, and the proper condensers for a WD-11 tube probably would not work as satisfactorily with a 201-A tube, or another WD-11 tube. The condensers you are using might be defective, too. We suggest that you try different condensers.

It is further suggested that all leads be made as short as possible and run at right angles or in a non-inductive relation to each other as much as possible. The transformers should also be placed in non-inductive relation to each other.

## Radio and Daylight Saving

IT isn't only the commuter who leaves the city at 5 o'clock (daylight saving time) and arrives home at twenty minutes to 5 (standard time) that this thing of changing the hands on the clock is confusing. It has become quite a complicated problem to users of the radio, especially the DX boys.

With various large cities working under the daylight saving time, and consequently broadcasting concerts according to their watches, the country towns who do not have this war-time measure still in effect, are thrown completely out of gear. It takes quite a mathematician to figure out whether the program of KSD, St.

Louis (which is central standard time) broadcast at 8:30 is going to be heard at 9:30 or 7:30 or exactly what time for the listener East or West of that point. Pittsburgh on the other hand has daylight saving, so has New York and Chicago, which means Chicago is broadcasting at exactly the same hour that those eastern cities that do not have daylight saving are. One ought to carry three watches or even four to keep track of the various schedules.

## European Stations Now Broadcasting

In case you pick up any of the following foreign stations, perhaps the following list will guide you as to the present activities of radio stations across the water. There are regular evening programs from the following English stations:

London.....	2LO	.....369 meters
Birmingham.....	5IT	.....420 meters
Manchester.....	2ZY	.....385 meters
Newcastle.....	5NO	.....400 meters
Cardiff.....	5WA	.....353 meters
Glasgow.....	5SC	.....415 meters

### Dutch Stations

PCGG—The Hague, 1,050 meters, Sunday 3 to 5:40 p. m., concert; Monday and Thursday, 8:40 to 9:40 p. m., concert. Monday concerts are sometimes given on 1,300 meters, notice of this being given on the previous Sunday.

### French Stations

Eiffel Tower—2,600 meters. 11:15 a. m., weather reports (duration of 10 minutes); 6:20 p. m., weather reports and concert (duration about 30 minutes); 10:10 p. m., weather reports (duration 10 minutes).

Radiola Concerts—1,565 meters. 5:05 p. m., news; 5:15 p. m., concert till 6 p. m.; 8:45 p. m., news; 9 p. m., concert till 10 p. m.

L'Ecole Supérieure des Postes, Telegraphes et Telephones de Paris—450 meters. Tuesdays and Thursdays, 7:45 p. m. to 10 p. m. Saturdays, 4:30 p. m. to 7:30 p. m. Greenwich mean time.

Down in South America they're attaching meters on receiving sets to see how much persons use the radio. Wait till they get the drop a nickel in the slot boxes, and the slug manufacturers will be working overtime.

# Rapid Change in Radio

The Number of Stations Must Be Limited—New Apparatus Coming Into Use, Says Radio Expert

**W**ITH cities such as New York, Chicago, San Francisco, Philadelphia, Pittsburgh, etc., which may be classed as musical centers where talent is available almost momentarily, and with the air having definite limitations for broadcasting," says W. C. Horn, veteran broadcast engineer in the Chicago Daily Journal, "Certain restrictions must be enforced by the authorities in order that the public interests may be protected.

"Therefore, the stations having considerable power and situated in these centers are better able to supply the public need of entertainment than a station radiating a very poor wave and situated in some rural place or second-rate city, and which depends for its music on the volunteer fire department band.

"As evidence, I would like to have the reader compare the programs being radiated from New York and Chicago, where one occasionally hears opera or prominent artists as well as the speakers and entertainers at banquets of national organizations, with the talent that is broadcast from stations situated in small cities or towns.

## Limited Number of Cities

"As there are only a limited number of large cities in this country, surely not exceeding twenty-five, special attention should be given stations located in these cities in order that they may make use of available talent.

"The apparatus in use to broadcast music or speech is rapidly undergoing changes and it is safe to state that any apparatus in use at the present day and considered very modern will be almost obsolete in six months. I will describe briefly some of the energy transformations which take place from the time sound energy is first picked up until it is reproduced at the receiving station, in the head phones or loud speaker. The sound energy, as we all know, consists of vibrations in the air or a series of compressions and rarefactions.

"These waves strike the diaphragm in the microphone, causing it to vibrate, which, in turn, varies the resistance of the phone and thus changes the flow of current according to the sound waves. This is like our ordinary telephone. However, this energy is greatly amplified by means of vacuum tube amplifiers and then fed into the modulators or high powered vacuum tubes which are so designed that they will change their resistance according to the electric current which comes from the microphone.

## Changes Carrier Wave

"These modulators are connected to the oscillators or the tubes which generate the high frequency carrier energy which makes possible radio telephony. The modulators are so connected to these oscillators that any changes which occur in the modulator will produce a corresponding change in the oscillator and also in the carrier wave.

"The carrier wave is then said to be modulated and this wave radiated in all directions from the transmitting antennae and is picked up by the antenna attached to the receiver. A current is thus caused to flow in the receiving antenna, particularly when it is in resonance, or, as we say, has the same electrical length, or is tuned to the transmitted wave. This energy is detected, in the more modern tests, by vacuum tubes and then usually amplified in order to operate a loud speaker.

"Through each stage that this energy has been taken, it is constantly undergoing some change or other. At one instant the energy is all electric and at another it is all magnetic. It is stepped up and stepped down and transformed in order to overcome some local difficulty. The general result is as we hear it, and it must be admitted that it is pretty good, for we have been taught that nothing is perfect and there is a little loss whenever energy is transformed from one kind to another.

## Distinct Characteristics

"Each individual piece of apparatus that is used in radio has distinct characteristics. Take for instance a microphone used to pick up sound energy. There are microphones on the market which will pick up certain notes better than others, and I might state that the microphone is one of the most inefficient pieces of apparatus used in the entire broadcasting station. Likewise, loud-speaking telephones are by no means perfect.

"On both of these pieces of apparatus much development work is required and is being undertaken. Gradually defect after defect is being removed from each individual piece, and in the end all of these will be standardized very much in the same manner that the automobile or other mechanical or electrical equipment has become standardized.

"I have mentioned before that we are at the present time in a very unhappy state in radio broadcasting, due to overcrowding and the desire of so many stations to use the air for publicity or some other selfish purpose. If the White bill which passed the house and which was anchored in the senate should ever become a law the department of commerce would have authority to more closely regulate this activity, and some relief can be hoped for. However, unless very unwisely administered and a very fixed and definite plan is adopted, this added authority will help very little. My suggestion for a plan of action follows:

"Determine by means of an engineering commission the number of stations that can operate simultaneously on different wavelengths without undue interference. Then very carefully allocate these stations throughout the country, paying particular attention to the large cities. The cities that are most favored with facilities for obtaining talent, such as New York and Chicago, should be permitted to have at least four stations, each operating on a separate wave length."

*Every Radio Fan Should Read This*

# Practical Hints on Designing of Regenerative Receivers

By PAUL A. PERRY

## PART 2—THE SINGLE CIRCUIT REGENERATIVE

**N**EXT to the Ultra-Audion circuit for simplicity of control and distant reception comes the single regenerative circuit. To many this circuit is known as the tickler-feed-back circuit. This circuit, or a modification, is almost universally used in all regenerative receivers having a wide wave length range. Its universality, like that of the Ultra-Audion, has been none too good for it. To the writer's knowledge there are only two correctly designed and built single circuit instruments to be obtained on the market. It seems unbelievable, but it is true.

This circuit, one may say, is the Ultra-Audion with a variable means of regulating the feeding back of the radio-frequency current, generated in the plate circuit, into the antenna or grid circuit. This is accomplished by placing a coil carrying the plate oscillations in variable, usually by rotation, inductive relation with the antenna or grid inductance.

As the position of the plate coil is varied in relation to the antenna inductance, the amount of radio-frequency current induced into the grid circuit is controlled at will. When the windings of both are in the same direction, the maximum current is induced, but when they are in opposition the minimum current is present.

However, this rule cannot be applied in the reception of all stations. Each station has a different wave-length and an accordingly different operating frequency. The radio-frequency generated by the tube may be considered as constant. Therefore, the plate coil carrying the constant radio-frequency current must be placed at different inductive relations with the antenna inductance in order to be in resonance with the incoming frequen-

cies of the signals. The maximum signal strength is obtained when this point of resonance is reached.

This adjustment of the plate coil, as one can readily understand, must of a necessity be very accurate, sharp, and so constructed that the maximum radio-frequency current will be induced into the antenna inductance for each signal received.

In order to secure the maximum current by induction the

coils should always be as close as practicable and in the same plane. If this rule is not followed the amount of current induced into the antenna inductance, as well as the all-around efficiency of the instrument, will be greatly reduced. As the adjustment of the plate coil usually is by rotary motion, it is of a spherical shape in order to be as close as possible to the cylindrical antenna inductance, inside of which it revolves,

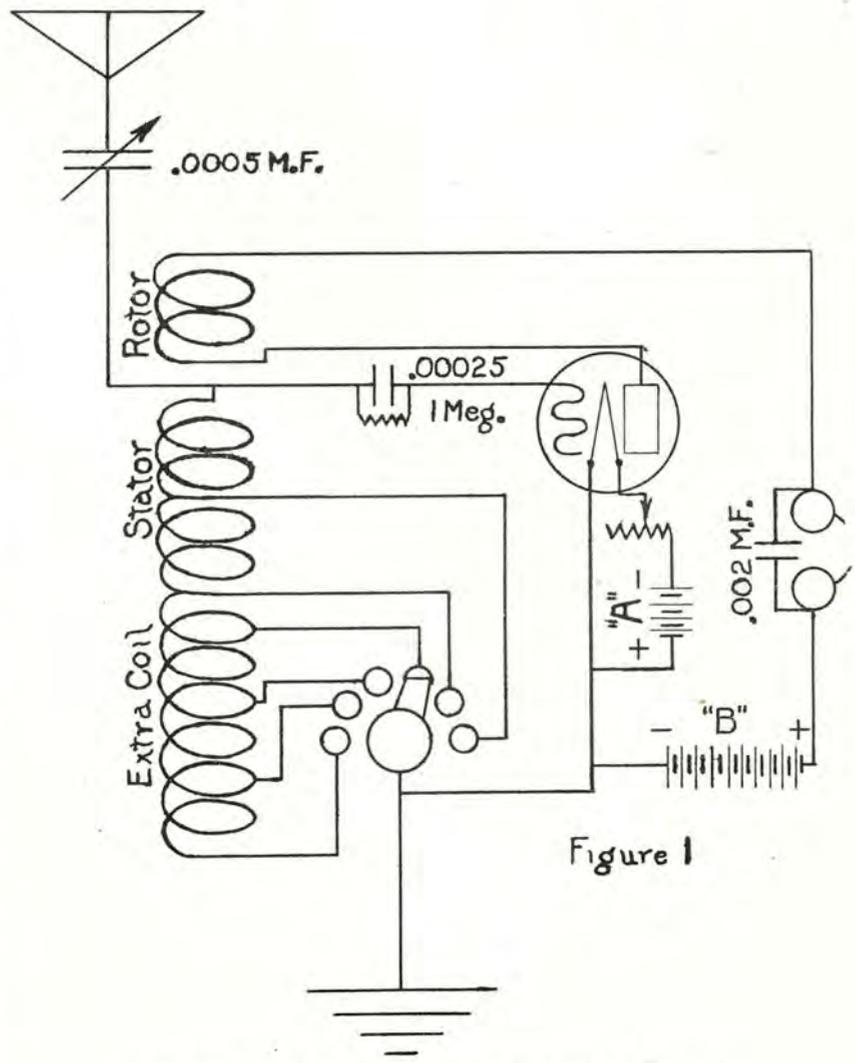


Figure 1

Hook-up of a highly efficient tickler type of receiver.

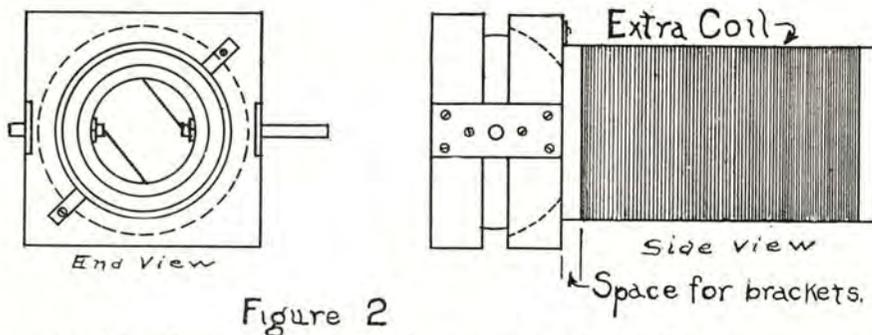


Figure 2

Working drawing of stator and extra coil as described in accompanying article.

when at the minimum and maximum positions.

The plate coil being spherical and the antenna inductance cylindrical means there are several positions when the plate coil moves out of the plane of the antenna inductance. When these positions are present the induced current is cut to a minimum.

This is also the reason why, in receivers using a spherical plate coil in conjunction with a cylindrical antenna inductance, that as the plate coil approaches an angle of 45 degrees with the antenna inductance its adjustment becomes very critical. In instruments using both cylindrical antenna and plate coils, the adjustment of the plate coil at these points becomes still more critical.

To make the adjustment of regeneration regularly increase from minimum to maximum, as it should, by using the rotary movement, it is necessary that the antenna coil, or at least the part in which the plate coil rotates, be spherical in shape in order that its windings always be in the same plane as those of the plate coil.

#### Winding of Plate Coil

Another serious point often overlooked is the construction of the plate coil. The requirement that it be spherical in shape is not the only one. The windings are more important than the shape. A fairly heavy wire, numbers 18-20 single or double cotton covered, should be used in the winding in order to cut down the radio-frequency resistance of the plate circuit and also to broaden the effective field of the plate coil—about forty turns are required. All wires, excepting the extremely heavy ones, give a high resistance to radio-frequency currents. Cutting down this resistance in the

plate circuit increases the plate current in the receivers and also increases the induced current in the antenna coil.

The use of small sized wires in winding the plate coil really converts it into a radio-frequency choke coil that accordingly cuts down the plate current in the receivers and the induced current in the antenna coil. Also the use of small sized wires concentrates the magnetic field of the plate coil into a very narrow band, thereby reducing its effectiveness in the grid circuit.

The easiest and best method of fulfilling all these requirements is to obtain a variometer that was intended to be used in the plate circuit of a double circuit regenerative set. Be sure to obtain one that is wound with no finer wire than number 22 and has no more than 40 turns on the rotor.

The best for this use are wound with number 18 or 20 wire. This variometer is then remodeled so that the rotor is not connected with the stator.

The two rotor leads are connected in the plate circuit as shown in figure 1 and the stator acts as part of the antenna or grid coil. However, the inductance value of the stator is very low and must be built up by an additional coil placed in inductive relation with the stator as shown in figure 2.

The diameter of this coil should be the average between the inside and outside diameters of the stator coil it is placed next to. The winding of this extra inductance MUST BE IN THE SAME DIRECTION AS THAT OF THE STATOR COILS. In other words, this extra inductance together with the stator windings acts as one coil.

The variometer is only to give

the spherical shape to the antenna coil necessary for best efficiency when a spherical plate coil is used. For best efficiency, this coil is wound with number 20 double cotton covered wire, the amount of winding depending upon the wave length required, the size of the antenna variable condenser, and the size of the antenna. Room enough should be left at the beginning of the coil for fastening the brackets that hold it to the variometer. Taps, to vary the antenna inductance, are taken off the coil every tenth turn.

When finally arranged to be connected, the taps should be in the following order: First, one-half the stator winding; second, the whole stator winding; third, the first ten turns of the extra inductance, and so on until the whole inductance is used up.

The table given below is an approximate winding data based upon an average antenna with a .0005 mfd. variable condenser, usually used, in series in the antenna lead. The number of turns given includes those of the stator winding:

Wavelength Range in Meters	No. Turns No. 20 D.C.C.	Coil Length	Tap No.
180-260	20	½ Stator	1
180-370	40	Whole Stator	2
180-500	60	3"	3
180-800	150	5½"	4
180-1000	250	5½"*	5
180-1500	350	5½"†	6

\*When 250 turns are used, it will be necessary to make a double bank winding to get them into the allotted space.

†When 350 turns are used, it will be necessary to make a triple bank winding to get them into the allotted space.

The bank windings are used to keep the inductance of the extra coil as close as possible to the inductance of the stator windings of the variometer. Also to cut down the space required for the whole unit in the case.

When carefully constructed, this instrument will reward the builder by being one of the best obtainable. Only the fundamentals that must be abided by for efficient operation have been given. Each experimenter has his own ideas as to the design and layout of the case and panel and some having limited materials would of a necessity change the minor details if they were given. However, in either case the fundamentals given should be adhered to as closely as possible.

# Distortion *in* Radio Telephony

By BENJAMIN F. MIESSNER

FUNDAMENTALLY, radio telephony as we know it today is an art developed for the purpose of reproducing sound at a distance. In broadcasting the art of reproducing sounds at any number of distant points simultaneously it has found its greatest application, for here it does what no other known agency can do.

Telephony by wire can reach a limited number of distant points. Broadcasting by loud speaking telephones can reach a few listeners within a very limited distance, but radio broadcasting has absolutely no limits. From the engineering standpoint, it is perfectly feasible for one person, we will say President Harding, to address from the White House in Washington every person in these United States.

But a step further is broadcasting to the entire world.

Truly, the possibilities of this art for reproducing sound at many distant points simultaneously are amazing.

We need not discuss here or speculate on the practical applications of broadcasting. They are quite evident to any one with a sense of imagination. A little over a year ago, the man in the street hardly knew what radio meant. Much less did he realize what it would or could do for him personally. Today it is spreading like wild-fire to every nook and cranny of the country, and it bids fair to become one of the greatest forces ever developed by man. I say this advisedly and with due consideration for the fad theory held by a few who do not understand it fully.

Probably the most potent single force acting on the peoples of the world in enlightening and civilizing them, in hurrying their progress, in drawing them nearer one another and linking them together in hundred varying ways, is communication. Since time immemorial the communication of intelligence has been the basis of

all the co-ordinated efforts of men and of groups of men, whether at arms distance or across seas and continents. It has developed from grunts and signs to spoken words, runners, smoke clouds, semaphores, heliographs, telegraphs, telephones, cables. All of these have played and still play their parts in providing one of the most fundamental necessities of mankind. The newspaper is surely a vital and powerful influence in our daily lives as a highly developed form of broadcasting. But how puny and limited in comparison with radio!

## Eliminating Distortion

The success or failure of radio broadcasting is determined very largely by the degree of faithfulness attained in the reproduction of sound. In the early days when both transmitting and receiving equipment were imperfect in design and the reproduction was faulty, this art was but little more than a fad in danger of back sliding into oblivion at any moment. But progress is being made in reducing distortion. When it is completely eliminated, absolutely perfect reproduction will be attained and the greatest obstacle to complete success removed.

The degree of faithfulness attained in the reproduced sound is determined wholly by the distortive influences of the chain of devices through which the sound waves in one form or another must pass in the radiophone system. In this system the original sound waves must undergo many transformations. Consider for a moment only the transmitting microphone. From the atmospheric pressure variations constituting the original sound waves they are transformed into mechanical or physical to and fro movements of a telephone transmitter diaphragm. These movements are transformed into physical pressure variations on carbon granules. These pressure variations are transformed into resistance variations and these again into electric current variations which finally constitute the function of the transmitter. We see

then that in order to transform sound waves into a form suitable for use in electrical apparatus by this universally used instrument, four separate and distinct transformations must occur to the original sound. If the electrical waves finally produced in the telephone transmitter circuit are to constitute an exact replica of the original sound waves, that is, to be without distortion, each of these transformations must be accomplished with perfect precision.

## Sound Waves Complicated

Sound waves constituting speech or music are extremely complicated. They are in addition very difficult to study. They are transient, elusive and intangible—here one instant, gone the next.

As with the slow movies for analyzing physical movements special and highly complicated oscillographic apparatus must be used in obtaining a record suitable for study. Once such a record is obtained, it is absolutely meaningless to the layman and only partly understandable to the expert who must apply laborious analytical methods of interpretation to learn anything from it. When such a complicated wave motion must pass through several transformations only the greatest care and ingenuity in designing the transforming devices will preserve its identity.

Imagine a piece of fine literature with fine shades of meaning and of intricate grammatical form translated from English into Chinese, from Chinese to Arabian, from Arabian to German, from German to Spanish and so through perhaps a dozen or more translations. If the mere crude outline of the idea described were obtained in the final translation it would be surprising, and so it is in a radiophone system.

In radio, the study of distortion is of paramount importance. Every transformation or translating step must be studied in the most painstaking detail.

While such studies are extremely difficult, methods are being worked out and progress is

greatly improving. The fundamental idea which should always be held up as the guiding light here is that the wave form of the vibration must be preserved without change. If a transforming device like a diaphragm vibrates more energetically for a particular pitch of sound than for another or if it neglects certain regions of pitch and exaggerates others, or if it completely fails in transforming some sounds and introduces other vibrations entirely absent from the actuating sound waves it cannot translate the atmospheric pressure waves into diaphragm movements of exactly similar wave form. All of these effect and many more can and do occur as serious distortions in telephone transmitter diaphragms. In addition, weak sounds are not heard by it and very strong ones are suppressed so that the ticking of a clock might be entirely omitted and a cannon's roar might become the crack of a child's cap pistol. When one considers that the diaphragm is only one of the four translating agencies in the microphone and that the microphone is only one of a dozen or more devices or elements in a broadcasting and receiving system, the extent and complexity of the distortion problem becomes more evident.



#### TAKING BROADWAY WITH HIM

Another attractive window display used by Lyon & Healy, Chicago, during the Outdoor and Sportsman's Show. Effective bit of woodland and a twelve-foot waterfall added realism to the whole.

#### An Unique Display

"Taking Broadway with him" was well illustrated by a recent exhibit which Lyon & Healy, Chicago, had at the Outdoor and Sportsman Show at the Coliseum in Chicago recently.

The Chicago music house used an elaborate setting, a reproduction of a bit of woodland scenery. The effect was very artistically worked out, an interesting feature of the display being a 12-foot waterfall. This fed a miniature stream, besides which the camper

sat, listening to music from afar over the radio.

The dummy of the sportsman attracted favorable comment from men who know the joys of fishing.

The exhibit was given over to radio. Lyon & Healy displayed their new portable outfit and got over very effectively their sales messages in this way.

#### Deaf Made to Hear by Radio

The deaf are learning to hear by means of radio, according to Dr. Harold Hays, president of the American Federation of Organizations for the Hard of Hearing, Inc., which recently held its annual conference at the Congress Hotel, Chicago.

The "muscles" of hearing are massaged and exercised by the vibrations from the radio amplifier, and gradual improvement results, much as massage and exercise assist a man to regain the use of his legs, according to Dr. Hays.

"There are thousands of nearly deaf persons who are regaining their hearing by their nightly 'listening in' over the radio," he said. "They thus re-educate their ears. The muscles of the ear must be trained to catch the sound waves, just as muscles must be trained for physical activity, and this nightly listening to radio concerts trains the ear to hear."



#### THIS WINDOW SELLS RADIO SUPPLIES

An especially attractive radio window used to stimulate summer business. This display of radio supplies is in the window of A. E. Schilling, electrical contractors, Kalamazoo, Mich.

# Importance of Good Transformer

**T**HE Federal Research Division has during the last year made several interesting discoveries in its work on the theory of and means for the faithful reproduction of music.

While the work of the research division has for its aim the discovery of new principles upon which to base the design of new apparatus for radio transmission, the solutions to the problems involved in the faithful transmission of music are of such a fundamental nature and such broad significance that they explain much of the past failure of radio and sound recording transmitting and reproducing apparatus to meet the high standards of the music lovers, and they point the way past the many well nigh insurmountable difficulties that have confronted the designer of the equipment for these uses.

The most significant of discoveries lies in its analysis of what constitutes satisfactory music. This has required not only an investigation of what constitutes faithful music reproduction and how it may be secured, but a very careful investigation of the psychological effects of various types of music, the psychological effects of various types of musical instruments and a careful trial of the conclusions arrived at.

Trials were first made to determine what part of the music of a good orchestra could be omitted without serious loss of the pleasure of listening by the average observer. This was done through the manipulation of the broadcasting equipment of WGR. At certain performances the apparatus of the broadcasting station was deliberately manipulated that certain bands of tones were much reduced or increased while the remaining tones were kept at normal intensity. Then criticism of the transmission was asked and when given, carefully noted.

## Lower Orchestra Tones Lost

The results of successive trials have proven beyond a shadow of doubt that what the ear of the observer needs for complete satisfaction in the music is the presence of the lower tones of the or-

chestra. Its lack leaves a distinct feeling of dissatisfaction and insufficiency in the music, while its presence gives a completeness and satisfaction that constitutes the difference between good music and what the radio listener has been forced in the past to accept.

The actual production of the means for securing the majesty and dignity of good music through the presence of the lower tones opens up a new and more serious problem than even the determination of what makes music reproduction satisfactory. There



An amplifying transformer that gives excellent satisfaction.

seems almost to be a conspiracy on the part of nature to make this difficult, if not impossible.

In transmission of music by radio this is easily evident. The more usual forms of voice converting equipment such as the ordinary microphone invariably neglect the lower tones, and while the very high tones may not be emphasized, they are invariably reproduced with greater intensity than are the very low tones, and the beauty of the music lost in the very first link between the sound and the ear of the observer. The same loss of the lower tones follows in each

step of amplification between the microphone and the transmitting antenna, with the exception perhaps, that in the transfer of the music carrying radio into the transmitting antenna no loss of the low tones may occur.

## Amplifiers Neglect Low Tones

In the reception of the music-laden radio wave the same loss of the lower tones and the over emphasis of the higher tones occurs again. Here again the amplifiers neglect the bass and emphasize the upper register and here, perhaps, lies the greatest cause for dissatisfaction with the radio music.

While the problem of the loss of the lower tones is as serious in the transmitting equipment as in the receiving equipment, the fact that one transmitter serves many thousands of listeners has justified the great investment necessary for the construction of special faithfully reproducing microphone and voice amplifying equipment. But the problem of designing equally good equipment for the radio listener has been attended by the same difficulties and with the added limitation that comes with the fact that the selling price of such equipment must be such that it is well within the reach of the radio listener.

In addition to the need for the more faithful reproduction of the low tones, careful measurement has shown that the ordinary amplifying equipment fails in that it adds tones that are not present in the music and amplifies these self-made tones.

Fortunately for the radio listener these added tones are usually of such a nature that they are not unharmonious but they do, of course, materially change the nature of the music. These are, in the main, harmonies of the note being amplified and are, therefore, notes of frequencies which are multiples of the frequency of the original note. Unless, of course, harmonic notes higher than the 7th harmonic are produced, the combination of the note plus its harmonic will not be unpleasant, but the combination will again be preponderantly higher in tone

than was the original note and will, therefore, add further to the predominance of the high notes.

#### Good Transformer Needed

The methods for the elimination of these many difficulties lie through the careful design of the amplifying transformer. The matter is one that requires the greatest possible care in choice of proportions, natures of the materials involved, and their more careful fabrication and assembly.

The No. 65 Federal transformer has been designed to eliminate the objections that have so limited the beauty and faithfulness of reproduction in the past. Its design and construction is said to be such a nature that the notes of the bass viol, the kettle drum, the piano bass are carried through the system with a completeness and soundness that is amazing.

It is of such construction that each note that enters it is passed on to the vacuum tubes with exactly the same fidelity and without a suggestion of any added tones, whether dissonant or not. And, when used with UV-201, WD-12 and the new UV-199 or any of the other commonly available tubes the degree by which this exceptionally satisfactory amplification exceeds that which has yet been available with any A. F. transformer is almost unbelievable.

### Don't Like Silent Period

ACCORDING to advices from the Department of Commerce at Washington, D. C., the A. R. R. L. do not like the silent period for amateurs from 7:30 to 10:30 p. m. These protesting amateurs claim it would prevent them giving valuable assistance in cases of storms, floods and wrecks. While it does undoubtedly discourage a few amateurs from continuing their experiments, this is offset in a large measure by the large number of enthusiastic radio fans who nightly listen in and spread the gospel of radio to others. Having had experience with these pests who used to clog up the ether with their amateurish efforts, it is quite a relief to have the evening programs come in uninterrupted.

# New Grebe Uses Any Tube

RADIO fans will find the solution to many of their broadcasting problems in the new Grebe receiver—the CR-12—wherein is employed radio frequency and regeneration, the two factors most important in long distance reception.

One of the distinctive features of this Grebe product is the novel manner in which that company has equipped it for use with any tubes now on the market. A 201-A may be used in the radio frequency circuit, a WD-11 as a detector, a UV-199 in the first stage of audio frequency amplification, and a UV-200 in the second stage audio frequency amplification. Such combinations may be used with either dry cells or a 6-volt storage battery, such as is employed when using UV-200 or UV-201 tubes, and with no combination of tubes is more than one A battery necessary.

Although the CR-12 is a four tube set, the simplicity with which it may be tuned, can only be compared with single circuit receivers. Its selectivity is far greater than that previously obtained with the best types of coupled circuit regenerative receivers.

#### Has Two Controls

This receiver has but two tuning controls, one of which is calibrated to wavelengths, thus reducing to a minimum, the elements of chance in tuning for a given station. With a wavelength of 200 to 600 meters, the set will receive all wavelengths which have come into effect since May 15.

No out-door antenna is used, in fact the antenna is supplied with the set, and consists of a silk covered wire 20 feet in length. This wire although not unsightly may be hidden in back of a picture moulding, or run along the baseboard.

An "operating switch," located at the lower right corner of the main panel, controls the use of one or two stages of amplification at will.

Telephone jack and plug has been provided for those who wish

to receive with the telephone headset, and the insertion of the plug in the jack automatically disconnects the loud speaker and transfers the signals to the telephones.

#### A Complete Set

Distinguishing it from the usual Grebe cabinet design, the Grebe CR-12 cabinet is provided with compartments for the filament and plate batteries, and although it is not the intention of the Grebe company to build a portable receiver, this new type is readily transportable, inasmuch as it is with the exception of the loud speaker self-contained.

The cabinet measures 17 inches wide by 13 inches deep, constructed of walnut, and finished attractively to harmonize either with mahogany or walnut furniture.

This set will find its way into many homes where the unsightly storage battery, outdoor antenna, and other crude characteristics have been objectionable.

### Industry Adjusts Itself

(From New York Radio Globe)

Instead of creating a state of wild confusion and setting a blight on the industry, the ban on the broadcasting of copyright music seems to be working no hardship on the radio listeners. On those laboring mortals who make up the programme the same statement probably does not apply.

If all broadcasting stations had refused to meet the demand for royalty from the official society of the song writers and publishers it is possible that the air would have been denuded of modern musical selections, but now with some stations having acquiesced and others stubbornly refusing to give in, the radio listeners have separated their programs naturally into those stations which feature dance music and those making a feature of classical selections and general lectures.

After all has been said this condition is one that has been forecast as the ultimate arrangement of broadcast features. It is possible that many of the stations which refused to pay the royalty asked will continue to broadcast their present style of programs and work up an enthusiastic and loyal army of listeners through it.

# Bureau of Standards Makes Tests

Interesting Experiments Made With Specially Designed Apparatus to Radiate Wave in Only One Direction

ONE of the most interesting experiments with very short wave transmission reflected in a single direction has just been completed, according to the New York Tribune, by the Bureau of Standards.

The experiments were based upon those initiated by Senator William Marconi, and involved the use of parabolic reflector consisting of wires tuned to the wavelength used.

In the tests both wireless telegraphy and telephony were used in order to obtain specific information upon the elimination of interference of every kind, including static. The results have been prepared in a scientific paper written by Francis W. Dunmore and Francis H. Engel and issued by the bureau.

## Fifty-Watt Tube Used

During the period of the experiments a 50-watt vacuum tube was used to generate the high frequency current involved in the use of a wavelength of ten meters, and the authors state that at least 75 per cent of the radiated power was confined to an angle of 40 degrees.

Owing to the fact that at ten meters the frequency of the radio current is 30,000,000 cycles per second, extreme care had to be exercised in view of the importance of capacity effect at this frequency. The difficulty was overcome by using the internal capacity of the elements of the vacuum tube as part of the oscillating circuit.

The transmitting circuit consisted of three coils loosely coupled, one each in the aerial, grid and plate circuits. Each of these coils consisted of a single turn of wire 17 centimeters in diameter. The aerial proper consisted of two cages each containing six wires spaced 3 centimeters apart, and each 1.8 meters in length. These were placed in series with the aerial coil so that one acted as the aerial and the other as the counterpoise.

## Parabolic Frame

The reflector was arranged on a parabolic frame, and consisted of forty wires suspended in a vertical position. Each of them was placed one foot apart, and their length was 8 feet 2.4 inches—equivalent to the wavelength of ten meters.

Great care was exercised in the construction of the receiving apparatus. The aerial consisted of a single turn of wire 31 inches in diameter. This was loosely coupled to another single turn coil 12 inches in diameter, which constituted the secondary or grid circuit of the receiver. This was tuned by means of a two-plate condenser. Two stages of audio-frequency amplification were used in conjunction with the detector tube.

During the experiments the reflecting parabola was changed in many ways. Wires were removed from it and untuned wires were substituted for the tuned ones in certain parts of the reflector. The results were plotted out in a number of radiation curves, all of which showed marked unidirectional effect.

The authors state that very strong reception was obtained at a distance of two miles using the single wire loop aerial, and then add: "Reception could have been accomplished at a much greater distance, but lack of time prevented an investigation being made of the maximum range of transmission. The use of reflectors at the receiving station was not attempted. Throughout the time when this antenna was used for reception no strays (static) were heard. This was probably due to the small dimensions of the antenna employed and the short wavelength to which the receiving circuit was tuned."

## Buildings Absorb Waves

One of the interesting phases of the experiments was made in connection with the absorption of the waves by different types of structures in the focal plane of the reflected beam. In this connection the report says:

"It was noted that wavelengths

of the order of magnitude used in these tests are absorbed to a very considerable extent by buildings and other metallic structures. An interesting experiment was made. The reflected wave was directed toward a building 150 feet away. A three-quarter scale deflection on the galvanometer was obtained immediately outside the entrance to the building. When the receiver was taken just inside the door the deflection dropped to zero, the door being open.

"Measurements were also taken in back of the building, the building being between the reflector and the receiving loop. The energy received from the reflector was materially decreased whenever any part of the building lay in the path of the wave.

"In conclusion it may be said that directive radio communication on short wavelengths, employing the type of apparatus described, has been found to be practicable and to merit much more comprehensive investigation and use."

## Mexico City Has Station

TWO radio telephone broadcasting stations were recently opened in Mexico City, a report from Consul Thomas D. Bowman, Mexico City, states. Various efforts have been made in recent months to obtain concessions for the establishment of such stations, but it is only recently that the government granted this permission.

There appears to be great enthusiasm over local broadcasting, and it is believed that the market for radio sets in Mexico is favorable to considerable development by American manufacturers.

Radio sets are now sold by electrical dealers, for the most part, although some American concerns have sent direct agents to promote sales. One dealer has estimated that approximately 150 high power sets have already been sold in Mexico City.

It is reported that other broadcasting stations are to be erected in Mexico.

# A Unique All-glass Cabinet

**A** RADIO set of glass. The very latest conception in the radio field—later than the WD12 tube, and the "A" battery.

The French Battery and Carbon Company, Madison, Wis., has the distinction of having in its employ Chief Designer John Graves, who has conceived and built a radio receiving set of glass with two steps of audio frequency. The set operates with three WD-11 tubes on a number 1261B Ray-O-Vac "A" Battery and three No. 2151 Ray-O-Vac "B" Batteries on the plate circuit.

This unusual set of glass is the eighth radio set Mr. Graves has built. Several years ago when radio was first coming into general use, he designed and built a set with the navy type loose coupler and a Remler Detector Panel. With this set only a very few stations were heard, chief among them being the University of Wisconsin broadcasting station at Madison.

## Two Steps A. F.

Following sets were furnished with the other "hook-up," all of them being of two steps of audio

frequency. Fellow workers at the French Battery and Carbon Company were fortunate in having Mr. Graves build sets for their use, all of them operating perfectly today.

The idea for the building of his glass set springs from Mr. Graves' association several years ago with a business in Milwaukee which made glass window display fixtures.

"It was while attempting to cut down the expense of drilling holes through the plate glass used in making these fixtures," states Mr. Graves, "that I discovered a solution, through the use of which, I could drill these holes myself without danger of breaking the plates and at one-tenth the previous cost. With my solution, plate glass can be put into a lathe, if necessary and turned without danger of breakage. It holds the edge of the tool to the glass and makes a clean cut job."

## Drills Holes in Glass

There are 54 holes drilled through the glass used in the set varying in diameter from 3/16 to

3/8 of an inch. Each hole required from 10 to 12 minutes for drilling. Ordinary twist drills were used. The set is 26 inches long, 9 inches high and 6 inches deep.

With the set Mr. Graves reports having tuned into more than one hundred and fifty stations among them being the largest stations in the United States, Canada, Cuba and Porto Rico.

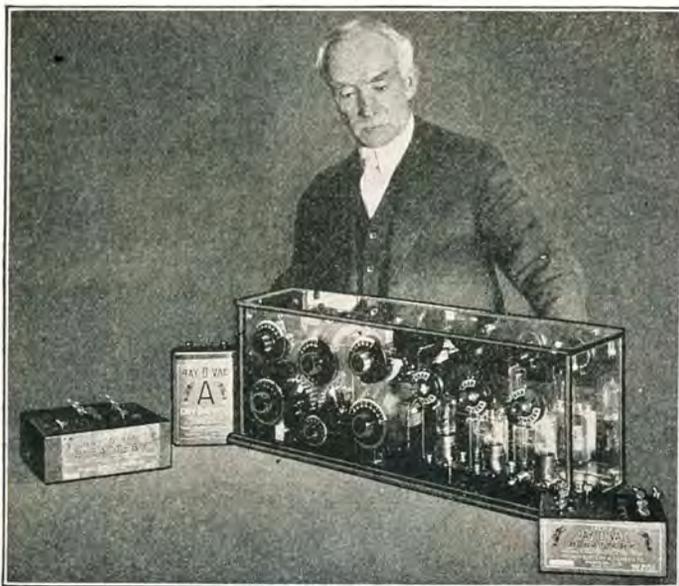
## An All-Wood Speaker

**T**HE Granolite is a new Universal radio horn said to be superior to all others because of certain features embodied in their construction which insures perfect acoustic qualities.

The horn has a universal base permitting the installation of any of the standard and well known loud-speaking units.

The wood is hydraulically treated and after being treated will not warp, crack, chip or peel. The bell is shaped to give clear and distinct sounds, eliminating the rasping and objectionable sounds of the fibre or metal horns.

"Granolite" horns come in three sizes, a small one 15 inches high, with 8 inch bell for crystal receivers; No. 2 a medium size, 19 inches high, with 9½ inch bell for home use and No. 3 with 25 inch high horn, with 14 inch bell, for concert work, motion picture theaters, etc.



## HERE'S A NOVEL RECEIVER

John Graves of Madison, Wis., and a photo of his eighth all-glass radio receiving set.



View of "Granolite" universal loud speaker radio horn.



# New and Novel Radio Patents



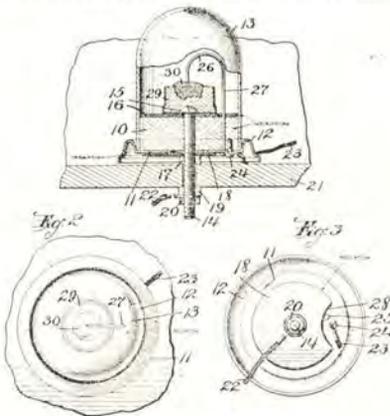
## NEW CRYSTAL DETECTOR

(Patent No. 1,454,997, issued to Goetano Greco and Karl G. Wolfe, under date of May 15, 1923.)

This invention relates to an improved crystal detector for wireless receiving sets, and is adapted to be placed in position in a set and is easily accessible for adjustment, if the small wire engaging the piece of crystal becomes dislodged from a detecting point, by the removal of the dust-proof cover, which cover fits over a block on which the crystal is mounted and through which the detecting wire passes, the cover fitting within an annular flange of a bottom plate to which the block is secured.

The detector comprises a block 10 made of insulating material, which is mounted on a base plate 11, the base plate 11 having an annular flange or bulged part 12 thereon spaced from the block 10 so that a dome-shaped cover 13 can be slid down to be grasped and held against dislodgment, since the block 10 is spaced from the flange 12 sufficiently to permit a tight fit between the bottom of the cover 13 and these elements, the cover 13 being preferably made of glass.

The device is held down by means of a bolt 14, the head 15 of which engages a sheet 16 of insulation, and a nut 17 is arranged on the screw-threaded end of the bolt 14 to clamp



New Crystal Detector

a washer of insulation 18 against the bottom of the base plate 11.

The washer 18 of insulation is usually expansive enough to protect the base plate 11 from contact with the bolt 14, and is preferably cut away, as at 28, to give room for convenience of attachment of the wire 23 and for soldering the end 25 of the wire 27. Secured to the head 15 of the bolt 14 is a block of metal 29 into which the piece 30 of crystal is embedded.

Under normal use there will seldom be any necessity for readjustment of the end 26 of the wire 27, so that the wire is substantially in fixed position as supplied by the dealer to the purchaser, the end of the wire having been previously set on a good detecting point.

## NEW ELECTRIC BATTERY

(Patent No. 1,454,943, issued to David Pepper, of Philadelphia, Pa., under date of May 15, 1923.)

This invention relates to electric batteries and has for its object to provide a battery of high voltage and simple and effective construction, especially, though not exclusively, adapted for use as a flashlight battery.

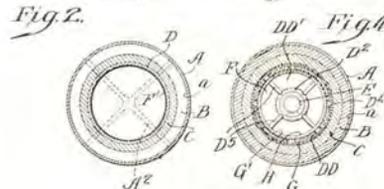
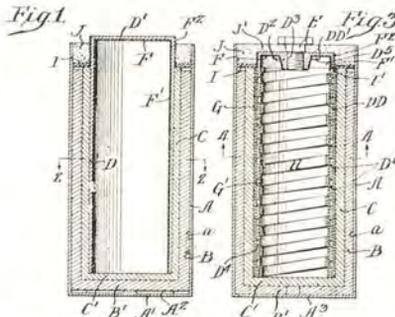
Figure 1 is a sectional elevation of battery. Figure 2 is a cross-section on the line 2—2 of Fig. 1.

Figure 3 is a sectional elevation of a modified and preferred construction of battery and Figure 4 is a cross-section on the line 4—4 of Fig. 3 looking upward.

A is a thin walled cup of lead or lead-antimony alloy which may have its bottom A' strengthened by ribs as shown at A<sup>2</sup> or may have a plain flat bottom, as shown at A<sup>3</sup> in Fig. 3. By preference, the walls of the

cup A have a thin layer of electrodeposited lead peroxide deposited on them before the layer of lead peroxide and a suitable binder, indicated at B, is applied to them. This peroxide layer B, or its equivalent similarly applied, constitutes the cathode of my battery.

D, Figs. 1 and 2, is a zinc cup having a closed end D' which is set in the centre of the battery with the closed end uppermost and which constitutes the anode of my battery.



Pepper's Electric Battery

The closed top zinc cup is greatly strengthened by its closed top and constitutes an important feature of my invention.

At F<sup>2</sup>, at the top of the cup, is shown a layer of asphalt which protects this nonactive portion from amalgamation and serves to make a better joint with the asphalt plug J which closes the top of the battery and holds the zinc cup in position. I is a washer on top of which the plug J is formed. In the construction of Figs. 1 and 2 the electrolyte is charged into the battery before the plug J is formed and of course impregnates the layer C.

In the modified battery of Figs. 3 and 4 the zinc cup DD is formed with strengthening ribs D<sup>2</sup> extending across its top end with a perforated boss D<sup>2</sup> through which the electrolyte is introduced and which is closed by a plug E forming one of the connections. The cup DD is formed with perforations as indicated at D<sup>4</sup>.

In the construction of Figs. 3 and 4, I apply to the inner and outer walls of the cup DD a layer of paper as indicated at G and G' on which has been applied a thin layer of zinc amalgam. At H is shown a spring of stiff paper the function of which is to hold the paper layer G in contact with the inner wall of the zinc cup.

In Fig. 3 is shown the asphalt plug J as extending over the top of the cup DD as shown at J'.

## DETECTING ELECTRIC CURRENTS

(Patent No. 1,455,458, issued to John Seay Edward Townsend, of Oxford, England, under date of May 15, 1923.)

The object of this invention is primarily to provide a simplified instrument whereby the wave length of electrical oscillations can be readily measured. The instrument may, however, be used merely for detecting the presence of small oscillating currents.

It has been before proposed to employ an incandescent electric lamp bulb for detecting electric currents, but hitherto it has been possible to use such a detector only when the current is fairly large; that is, large enough to heat the filament from its normal condition to the temperature at which it becomes incandescent.

According to this invention an evacuated bulb is employed having its filament connected

in series with a choke coil and a battery of sufficient strength to heat the filament to a temperature slightly above or below the point of incandescence, so that the lamp is in a sensitive condition to show visually any small change of temperature due to the passage through the filament of a small current, and I superimpose the current to be detected upon the current flowing from the battery through the filament, so that the addition of this small current to the normal current may cause a change in the condition of the filament, which change is easily distinguished by the eye. Such a detector is especially suitable for showing alternating currents or currents of high frequency, and may be used either to detect the currents or to indicate when they attain a maximum value.

Figure 1 is a diagram of the connections in one form of my invention and Figures 2 and 3 are diagrams of modifications.

In Figure 1, G is a low resistance lamp having its filament connected in an oscillatory circuit comprising a condenser C and in inductance L. In series with the filament are also connected a cell B and a choke coil K. The battery is of such a strength as to maintain the filament of the lamp at a temperature just below that of incandescence, while the choking coil prevents the passage of oscillations through the battery. It is desirable to have the choke coil K of low resistance and low capacity, and provided with a large number of turns so that its impedance for high frequency currents is large as compared with the resistance of the lamp filament. When therefore an oscillatory current flows through the circuit CGL the temperature of the filament is raised and the filament glows.

Thus the figure shows the circuits arranged near an aerial A, in which oscillations are supposed to be occurring. When the aerial is in tune with circuit GGL the filament will be at its brightest.

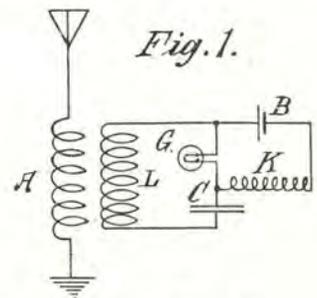


Fig. 1.

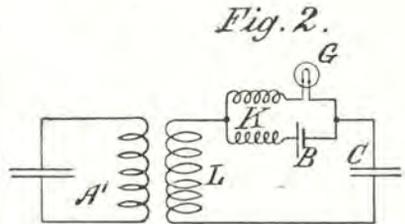


Fig. 2.

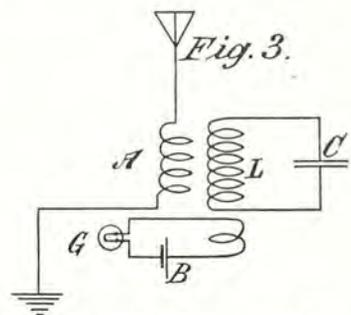


Fig. 3.

To Detect Small Electric Currents

The oscillatory circuit may be tuned by making either the condenser of the inductance adjustable; when this circuit is in tune with the oscillations to be detected the brightness of the filament is at a maximum, and therefore the arrangement may be used as a wave meter, and the wave length of the oscillations can be determined.

If the circuits are placed in proximity to a closed oscillatory circuit A' in which oscillations are flowing, the lamp G will be at its brightest when the circuits are in tune.

**WIRELESS RECEIVING SYSTEM**

(Patent No. 1,455,768, issued to Joseph Slepian, of Swissvale, Pa., under date of May 15, 1923.)

This invention relates to methods and means for amplifying currents and particularly to wireless receiving systems.

In its broad aspect, the object is to provide an improved wireless receiving system which has highly desirable operating characteristics and which is responsive to signal impulses radiated from either damped or undamped wireless transmission systems without the customary heterodyning step.

More specifically, one object of this invention is to provide a receiving system which admits of an extremely high amplification of received signal impulses.

It is well known that, in a regenerative feedback system employing a grid condenser having insufficient grid leak, the system oscillates intermittently, as indicated by a howling in the telephone receivers. That is to say, upon some slight unbalancing of the system, the tube is set to oscillating, the oscillations increasing in amplitude. When the amplitude of the oscillations stops increasing, the oscillations become unstable, since any slight decrease in their amplitude fails to produce a corresponding decrease in the charge in the grid condenser; hence the oscillations continue to decrease in amplitude and finally stop. When the charge on the grid condenser has decreased to a sufficiently low value, as deter-

effect is shown as comprising a three-electrode tube 1 of well known design and input and output circuits therefor.

The three-electrode tube 1 comprises an anode 2, a controlling grid member 3 and a hot cathode 4, the latter being energized from a source of direct-current energy 5 through a resistor 6. The input circuit includes a coupling coil 7 and a shunt-connected grid condenser 8 and adjustable grid leak 9. The grid leak is so adjusted as to cause said feedback system to oscillate intermittently at a predetermined frequency upon the receipt of an initial impulse, as by a received signal impulse.

The output or plate-filament circuit includes a translating device shown as a telephone receiver 11, a source of direct-current energy 12 and a tuned circuit 13. The tuned circuit 13 comprises a condenser 14 and a coupling coil 15 connected in shunt relation, the latter being inductively coupled to the coupling coil 7 which is included in the grid filament circuit. The feedback coupling between the coils 15 and 7 is so adjusted as to provide a regenerative system having an extremely large negative-resistance effect.

An auxiliary grid-biasing means is provided for increasing the negative charges on the grid condenser 8 to values greater than the peak-value of the alternating-grid potential in accordance with the varying intensity of the disturbing impulses tending to unbalance the feedback system, and comprises a coupling coil 16 inductively coupled to the tuned circuit 13 and deriving alternating voltage therefrom and translating means 17 for rectifying said voltage, all of which are serially included in a circuit connected in shunt relation to the grid condenser 8. The translating device 17 is shown in the form of a two-electrode tube 18 comprising an anode 19 and a hot cathode 21, the latter being energized from the source of energy 5 through a resistor 22.

An antenna circuit for impressing the received signal impulses upon the feedback system comprises an antenna 23, a tuning inductance coil 24, a coupling coil 25 and a ground conductor 26, the coupling coil 25 being operatively connected to coupling coils 15, 16 and 7.

**A NEW WIRELESS AMPLIFIER**

(Patent No. 1,450,275, issued to Chester T. Allcutt, of Pittsburgh, Pa., under date of April 3, 1923.)

This invention relates to vacuum apparatus of the type commonly employed for the amplification of impulses in the transmission of intelligence, having particular reference to that type of apparatus wherein the flow of charged bodies from a hot electrode to a cold electrode is under the control of a grid electrode charged in accordance with the incoming impulses, the charged bodies being permitted to traverse said grid electrode to a greater or less degree, dependent upon the potential thereof.

Fig. 1 of the accompanying drawing is a partially sectional perspective view of a vacuum tube, together with its associated cir-

cuits and apparatus illustrating a preferred form of my invention; and Fig. 2 is a partially sectional side view of the apparatus shown in Fig. 1.

Amplifiers are well known wherein a continuous electron stream is emitted from a hot cathode within an evacuated space, and the number of electrons permitted to impinge upon the anode or cold electrode is determined by an intervening grid member connected to the antenna of the line wire so as to be energized in accordance with the incoming impulses. With apparatus of this type, as usually constructed in the past, the electrons left the hot cathode and traveled at high velocity through the grid to the cold plate. Because of this high velocity, it has been necessary for the grid to acquire a pronounced change in potential and electrostatic influence before being enabled to appreciably change the number of electrons reaching the cold plate.

Referring to the drawing, an evacuated container at 1 in which are mounted two plate electrodes 2 and 3, a hot-wire cathode 4, and a grid electrode 5 are shown. The hot cathode 4 preferably lies substantially in the plane of the electrode 3, as shown, and the electrode 2 is parallel to the common plane of the electrodes 3 and 4 and spaced some distance therefrom. The grid 5 is mounted between the plate electrodes 2 and 3.

A magnet 6 is disposed outside the container in such manner as to produce a magnetic field, the lines of which are substantially parallel to the plate electrodes 2 and 3 or transverse to an electron path between these electrodes.

The electrodes 2 and 4 are connected, respectively, to the positive and negative terminals of a battery 7 so as to maintain a fixed unidirectional difference of potential therebetween, and the electrode 4 is further connected across a small current source in order to maintain this electrode at incandescence. A receiving device 8, such, for example, as a telephone receiver only, is connected between the electrodes 3 and 4 but any other well-known form of receiver or receiver circuit can be employed. The receiving circuit from an antenna 9 is connected between the electrodes 3 and 5.

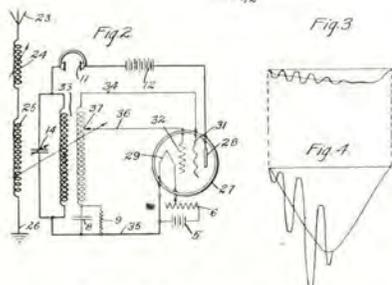
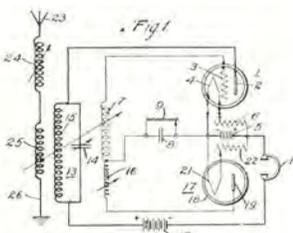
**New Code Increases Speed**

A new telegraph alphabet for use in radio, telegraph and cable, in all languages, has just been given to the world by Major Gen. George O. Squirer, Chief Signal Officer of the Army and one of America's most prolific electrical communication inventors.

With his new code system a speed 2.65 times the present transmitting rate can be achieved, and it is easier to "tune to."

The first presentation of this new "universal" code was made recently by the General in a speech before the National Academy of Science in Washington. It now appears that the code used for almost eighty years will be superseded throughout the world, with a gain of over 150 per cent, in speed.

The system has been studied by radio experts of the Army and Navy, who, it is reported, find no "bugs" in it; on the contrary, they see added efficiency, and decreased interference. It is the plan of the inventor to submit the system to the next International Technical Conference on Telegraphy with a suggestion for unification of all codes, radio, wire and cable, using the same system of modulation for the signals.



Wireless Receiving System

mined by the constants of the system, the oscillations again build up, as before, and the blocking action is repeated. It will be noted that the oscillations must build up to approximately the maximum limits of the tube before the blocking action becomes effective.

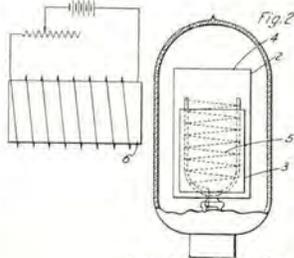
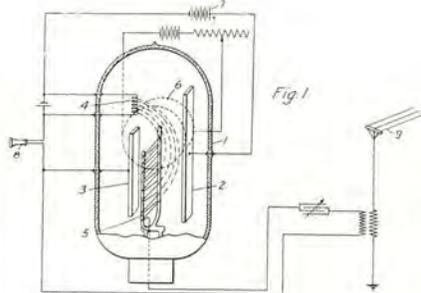
It is found that, by increasing the charge on the grid to values higher than the peak value of the alternating grid potential, in accordance with the varying intensity of a signal impulse to be detected, the blocking action may be manifested before the oscillations reach their maximum value, as determined by the constants of the tube, and that the maximum amplitude of the intermittent oscillations obtaining in the system is directly dependent upon the varying intensity of said signal impulse, all as will be explained more fully hereinafter.

Figure 1 is a diagrammatic view of circuits and apparatus.

Fig. 2 is a similar view showing a modification;

Fig. 3 and 4 are curve diagrams illustrating the potential variations of the grid during the intermittent oscillation of the tube for relatively weak and strong disturbing effects, respectively.

In Fig. 1, a regenerative feed-back system having an extremely large negative damping



Wireless Amplifier

### Eliminate Static With the Cloydstat

NOT so many years ago, it was an undisputed and accepted practice for those fortunate enough to own an automobile, to place it in winter storage during the cold winter months. It was regarded as purely a seasonable product and was regarded only from a standpoint of pleasure. Such is not the case today, however.

It has not been so very long since the public at large in purchasing their new phonographs have been demanding and are not satisfied without perfect reproduction, and as one manufacturer of phonographs terms it, "recreation." In other words, phonographs that still retain the old tinny sound are not selling. This is more than true of radio today.

Up to the present time radio was considered a seasonable product and it had been generally regarded by the public and the so-called radio engineers as being practically useless during the hot summer months. There are a number of reasons for this and the most favorite alibi seems to have been "summer static."

Have you ever passed a radio store and heard the loud speaker roaring out on the sidewalk in a so-called demonstration, producing a combination of noises that are rather hard to classify? Some say it sounds like a lawn mower running over a steel grating. Other say, a load of hard coal going down a tin funnel. Others are not very complimentary to the animal kingdom by classing it as a cat fight. Regardless of how it impresses you, the fact remains that it is.

Facing these conditions, not as we would like to have them, but as they are, a device known as the Cloydstat has been put on the market. This device, it is said, produces practically perfect tone reproduction. It will eliminate virtually all of the frying and hissing and other stray noises present to a greater or less degree in any receiving set. Under normal static conditions, it will eliminate practically all of it. Yet, at other times when static is unusually bad, it will reduce it to a surprising degree. On numerous occasions it has been possible on various sets to tune in out-of-town stations successfully that couldn't be tuned without the attachment for the reason that the static and other noises were so loud that they practically drowned the faint distant signals.

This device can be attached to any audio amplifying circuit or any loud speaking power amplifying circuit in a few moments time without altering the circuit in any way. However, this is not a seasonable device for in the winter months when we are not bothered with our friend "static," the tone reproduction, it is said, is almost unbelievable. It has been thoroughly tried and tested and has already received the whole-hearted endorsement of some of the most prominent men in the radio industry for the simple reason that it does what it is

# The Receiver famous thru Performance Telmaco



### Type B-R Receiver

fully meets the requirements of the discriminating purchaser because of the following features:

**EFFICIENCY OF OPERATION:** Securing volume, distance (1500 miles with single tube is not unusual), selectivity; broadcasting stations one-half mile distant are tuned out by a slight turn of condenser dial.

**EASE OF OPERATION** enabling the novice to secure satisfactory results.

**HIGHEST QUALITY OF WORKMANSHIP AND MATERIALS.**

\$25<sup>00</sup>

PRICE within the reach of everybody.

Manufactured exclusively for us by

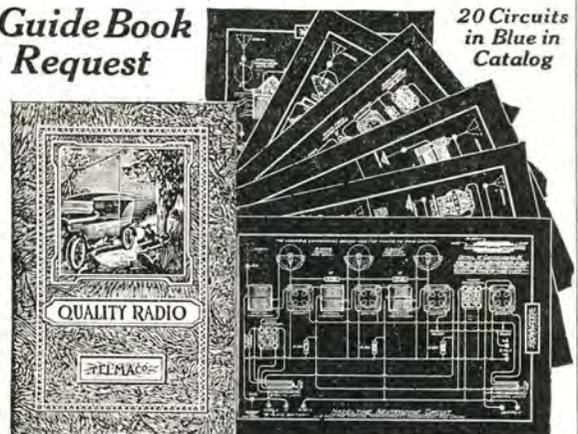
Tri-City Radio Electric Supply Co., licensed under Armstrong U. S. Patent No. 1113149, Oct. 6, 1914.

### Telmaco BA 2-Stage Amplifier for the Above \$20.00

### Our New Radio Guide Book Sent at Your Request

Our new 64-page Catalog No. TCR contains twenty of the most popular radio circuits printed in blue. These include the Hazeltine Neutrodyne, Grimes Inverted, Colpitts, Flewelling, Reinartz, Diode Electrad, Heterodyne, Super-Regenerative and many others. Each article used in circuit is attractively pictured instead of appearing in straight schematic form. Besides containing blue prints, the best in radio is also illustrated and described. Catalog sent postpaid for ten cents. Each circuit worth double.

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**TELMACO**  
Quality Radio Exclusively

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**TELEPHONE MAINTENANCE CO.**

20 So. Wells St., Dept. C, Chicago, Ill.

built to do. This device is manufactured and distributed exclusively by C. W. Howe & Company, 21 East Van Buren street, Chicago.

### Station Closes

The Pennsylvania State College station WPAB, Bellefonte, Pa., closed down for the summer season on June 8 and will remain silent until September. When the station opens again it will broadcast the games between Penn State and the Navy and Georgia Tech.

### Safe and Sane War

THEY are piloting airplanes with radio and stopping automobiles in Germany, so it is said, and experts declare the next war will be fought with radio. Oh well, we'll gladly contribute our old crystal set if it will help win a war, and most people will be willing to give variometers, tubes and condensers 'till it hurts, if they're not called upon to go into the trenches and fight.

## President Speaks Over Radio

ON the first leg of his trip to Alaska President Harding spoke over the radio at St. Louis at the international convention of Rotary Clubs. It was broadcast by station KSD on 546 meters of 550 kilocycles. All stations in the United States were asked to stand-by by F. W. A. Vesper, president of the St. Louis Chamber of Commerce, while the president was speaking.

President Harding will be almost entirely dependent on radio during his trip to keep him in touch with affairs at Washington.

The president, heretofore just a radio fan like most of his fellow citizens, will have an opportunity to see its great practical use demonstrated.

By radio the president will learn of political development following the series of speeches he will make through the West on his way to Alaska. On account of the prominence of several issues he will develop, it will be most important that he keep constantly in touch with the reaction to the international court of justice speeches, as well as those on the railroad consolidation plan and his shipping program.

After the president and his party get to Alaska, there will be only a thin thread of copper cable between him and the United States, as far as wire communication is concerned. It stretches 1,000 miles from Cordova to Sitka, and thence to Seattle. During cable breaks, which sometimes last for several weeks, this system is useless.

But cable breaks are not so disastrous as formerly, for radio can take up their burden, as it frequently has in the last few years.

When the president gets to Alaska he will also find that the land wire systems are very inadequate, on account of the contour of the country. On the other hand, conditions are exceptionally favorable to radio transmission. In the summer "static season," atmospheric or other disturbances are much less severe in Alaska than in the United States. During other seasons of the year static is rarely experienced. Radio waves do not lose their effectiveness in Alaska and its coasts are well

supplied with radio stations, so that the president will always be in touch with the United States, as well as with parts of Alaska, with which he wishes to communicate. There are also nine radio stations maintained by the navy along the coasts of the Gulf of Alaska and in the Bering Sea. They are in touch with radio stations along the Pacific coast in Washington, Oregon and California, and thus with the entire United States.

## Motion Pictures by Radio

IT begins to look as though we would soon have motion pictures right in our homes. At least pictures by radio are not far off, a demonstration marking the latest experiments of C. Francis Jenkins of Washington, D. C., having proved successful.

In the presence of officials of the Bureau of Standards, the Navy department, and the Post Office officials, still pictures were transmitted through the air and the movements of a hand held in front of the "radio eye" in Mr. Jenkins' laboratory, were distinctly visible some distance away.

The pictures were reproduced on a small screen in another room by means of a separate apparatus and while the movements of the hand were not distinct, it is said, yet they were unmistakable. Further improvements are to be made to overcome this.

As stated in Radio Topics Mr. Jenkins made tests between Washington and Philadelphia several months ago, and it is believed that radio motion pictures are now "but a matter of time."

Mr. Jenkins said that the "very near future" will see radio motion pictures in the home become one of the most popular pastimes of the world, in addition to taking their places as indispensable factors in commercial life and in time of war. He stated that his newest invention is even simpler in construction and operation than his apparatus for sending still pictures by wireless. The distance to which motion pictures may be sent is limited only by the sending capacity of the radio equipment proper, he explained, trans-oceanic and trans-continental projection being possible if

radio stations used for the picture transmission work have sending sets of sufficient power.

The demonstration was watched by Henry D. Hubbard, assistant director of the bureau of standards; Prof. C. C. Diller and George H. Vaneman, also of the bureau; Paul Henderson Jr. of Chicago, second assistant postmaster general, and A. Crossley, radio expert of the navy department.

## Milwaukee Amateur Club Gets Busy

Much interest in the Zenith receptor has been aroused among members of the Milwaukee Radio Amateurs' Club, Inc.; several have built models according to the specifications given before a recent club meeting by R. H. G. Mathews, 9ZN, engineer of the Chicago Radio Laboratory, and have reported favorably on the receiver's merits. Among these were E. T. Howell, Sc. M., vice president, and the club's recently appointed assistant treasurer, F. W. Catel, 9DTK, sometime an operator for the now defunct United Wireless Telegraph Co.

A good share of one of the season's last meetings was taken up with a discussion of the superheterodyne receptor with E. T. Howell, 9CVI, and H. F. Wareing, pre-war 9AEX and president, leading. At the final meeting for the season of 1922-23 Business Manager L. S. Hillegas-Baird read Dr. D. B. MacMillan's partitions, taking an A. R. R. L. members. This statement was prepared by Dr. MacMillan shortly before he left for the Arctic regions, taking an A. R. R. L. member and radio operator with him.

Regular weekly meetings on Thursday evenings will be resumed by the society about the middle of September. The club's directors and officers will hold several mid-summer meetings at which plans will be formed for the fall membership campaign. A society consisting of a 100 per cent of the local radio amateurs and members of the American Radio Relay League, Inc., is the goal to be set in the membership drive. The club's office to which all general correspondence should be addressed is 601 Enterprise Bldg., Milwaukee, Wis.



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Don't miss the Frank R. Carney articles appearing each month.

Say you saw it in Radio Topics when writing to advertisers.

**F. Clifford Estey Makes Change**

F. Clifford Estey, president of the New England Executive Radio Council, has severed his connection with the Clapp, Eastham Co. to become president of a new company that will supply the trade with a complete assortment of moulded parts and a full line of licensed regenerative receiving sets.

Mr. Estey is well known in the radio field, being one of the oldest amateurs in the country, having built and operated Station IAFV at Salem, Mass., which was one of the first successful stations in trans-Atlantic work.

During the past three years Mr. Estey has traveled practically every state in the Union in the interest of citizen radio and has been instrumental in organizing a great many radio clubs.

His sixteen years' experience as a radio amateur, coupled with his professional experience as sales manager for Amrad and the Clapp, Eastham Co. places him in an enviable position to bring out

**Both Selling Fast Because the Price is Right!**

Variocoupler \$3.00  
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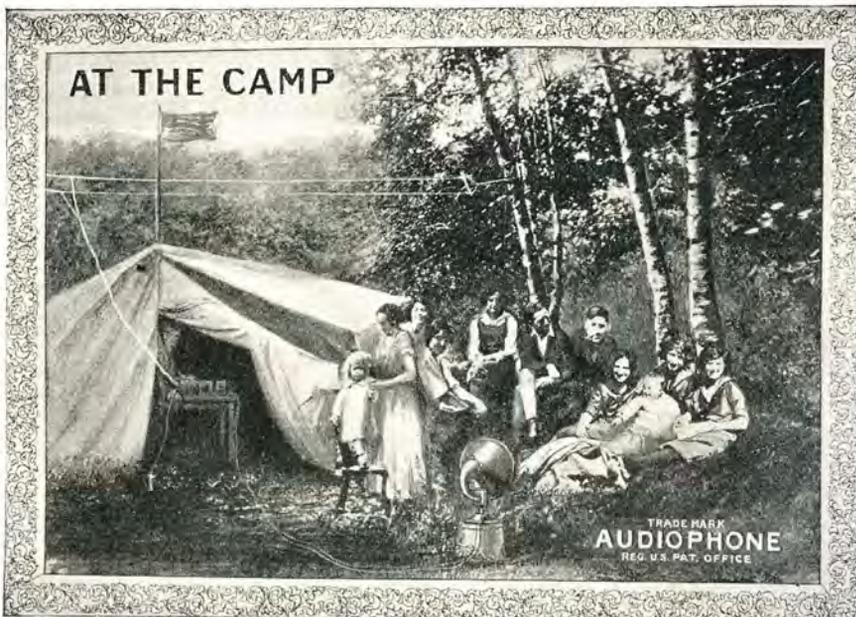
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2 Variometers \$8.00  
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~~\$11.00~~  
**Special \$10.00**

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equipment of a type that will merit national attention.

Mr. Estey is a member of the Radio Club of America, the Institute of Radio Engineers and a director of the Radio Trade Association.



Nobody wants to wear head phones during hot, stuffy weather. A small, efficient Loud Speaker ruggedly built will be welcome in any camp outfit. The AUDIOPHONE, JR. is just the thing.

Light in weight and easily assembled or dismantled without tools. Doesn't require any battery. The tone quality is exceptional and enough volume to entertain the whole camp party.

See it at your dealers or write direct.



Bristol AUDIOPHONE made in two sizes

AUDIOPHONE SR. — Diameter of horn, 15 inches; weight, 10 pounds. Price, \$32.50.

AUDIOPHONE JR. — Diameter of horn, 11 inches; weight, 7 pounds. Price, \$22.50.

Bulletin 3006-P describes them.

**The Bristol Company**

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Boston, New York, Philadelphia, Pittsburgh, Detroit, Chicago, St. Louis, San Francisco.

# The New BURGESS Radio Atlas of the World

**T**HROUGH the air comes a signal! Who's calling? Where is he located? Can you mentally put your finger on the spot?

The new Burgess Radio Atlas lists every broadcasting station in the world and contains three big double page maps, 13 x 16 inches in size, showing—(1) The United States; (2) Canada; (3) The World.

## 10c Brings It

Send us ten cents *and your dealer's name* and we will send you this big 16-page atlas containing the three big maps showing by red dots the location of all towns with broadcasting stations. Contains two lists of all stations, alphabetically and by towns, together with wave lengths and names of owners. Maps show time divisions and radio districts. All new countries correctly shown and named. Single page map shows U. S. Army and Navy Stations. Many other descriptive facts and data too numerous to mention.

Every radio operator *needs* one of these Burgess complete Atlases. \* First edition is limited. Send your order *today* and *don't fail to mention your dealer's name.*

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"ASK ANY RADIO ENGINEER"



## American Radio Popular

**A**CCORDING to advices from Santiago, Valparaiso and other Chilian cities, interest in radio is growing apace and it is expected that a large broadcasting station within that country will soon be established. There are several large stations now operating on the east coast of South America, says Assistant Trade Commissioner W. E. Embury, in his report to the department of commerce.

### Satisfactory Results

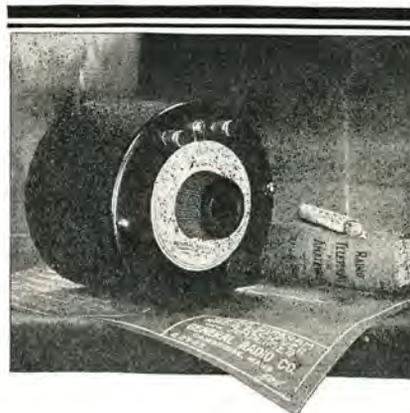
It is reported that the broadcasting stations recently erected in Buenos Ayres, Montevideo and Rio de Janeiro have given very satisfactory results, and large numbers of amateur receiving sets have been sold in these countries.

This is especially true of Argentina, where conditions for broadcasting programs are almost ideal, as the land generally is flat and radio-transmission carries all over the River Plate district, Uruguay, and into Southern Brazil on the north, and as far as the Andes on the east. For this reason the sale of radio equipment has met with the greatest success in that country and it is now estimated that there are approximately 25,000 sets in the Argentine Republic, in comparison with approximately 100 less than one year ago.

### Like American Apparatus

American radio equipment, up to the present time, has been given preference. This is especially true of Chilian orders, as practically all equipment now in use in Chile is of American origin. Four or five concerns in Santiago deal in this class of goods and a similar number handle radio apparatus in Valparaiso. Estimates of the number of sets throughout Chile vary between 100 and 500.

The Chile Radio Corporation, a local Chilian concern with offices on the top floor of the highest office building in Santiago, has a very good amateur broadcasting station with one kilowatt power, and programs, consisting mainly of music, are being offered from time to time. Outlying cities within a radius of 300 miles report that the concerts are heard very distinctly under normal weather conditions.



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Type 247-G Variable Air Condenser	Type 231-A Transformer	Type 214 Rheostat
A quality condenser at a reasonable price. Low dielectric loss. Rigid mechanical assembly. Fitted as shown, with reduction gearing for fine capacity adjustment.	Gives the maximum amplification possible without distortion. Like all apparatus manufactured by The General Radio Company, the Type 231-A is guaranteed.	A quality rheostat for the new UV201-A and 199 Tubes. A convenient, practical instrument. You'll never cause unpleasant noises in the phones when you rotate the contact arm of a Type 214 Rheostat.
PRICE—Type 247-G Mounted as shown. With gear (calibrated in MMF). \$7.25	PRICE . \$5.00	For UV201-A and UV199 Tubes, 20 Ohms. For Tubes such as UV201, 7 Ohms.
Other capacities, with or without gear, from \$3.25 to \$6.00.		PRICE . \$2.25

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Bring in programs clear and sweet, free from distortion. Highest quality—biggest value. 2000 ohms, \$5; 3000 ohms, \$6.

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# The Cat's Whiskers

By  
AUNT ENNA

RADIO jokes have reached the screen. In every movie theater now you can read tid-bits about this modern invention. It provides an easy way to be amused—says "Topics of the Day" Films—just tune in and listen. It reminds one of a man arguing with his wife. All he can do is listen while the wife broadcasts. The radio fan has it on the poor husband; he can turn it off. Of course the nearly Happyweds have a radio; hubby can turn on the machine when wife becomes temperamental and let her hear a temperamental opera star vocalize. This should prove a distraction which will erase all thoughts of argument from the wedded pair, and the evening should continue happily ever after—as long as the radio is in tune. But here's the "Topics of the Day" jokes broadcasted this month:

Jay—How is your new radio set?  
Ray—Great, but my wife is kinda jealous of it.  
Jay—Howzzat?  
Ray—I have a loud speaker.—"Topics of the Day."

"If I buy a radio apparatus, is there any danger of getting a shock?"  
"Only when the dealer tells you the price."—Madison's Comedy Service.

"What did Noah do for laughs on his voyage in the ark with no radio to amuse him?"  
"Well, the hyenas were the laughing stock of the ark."

Lawyer—"Now, if you will let me have some of his love letters."  
Breach - of - Promise Gertie—"I haven't any. We both had radio sets."  
—New York Globe.

Spinkus—"Old Henpeck doesn't look as downhearted as he used to."  
Spukus—"No, he doesn't have to listen to his wife talk any more. He has a radio set and wears receivers around the house all the time."  
—New York Globe.

"The radiophone has wonderful possibilities."  
"Yeah?"

"When they get it perfected we can visit with relatives without having to feed 'em."—Judge.

Jimmy—"You take this wireless receiver I just finished makin' and go downstairs to the cellar, hold it close to your ear and listen."

Freddy (after waiting in suspense for several moments in cellar)—"Aw, it's a fake; I didn't hear a thing."

Jimmy—"Good! That shows it's workin' all right. I didn't say anything yet."—New York Mail.

*a Chi-Rad Special!*   
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Standard, threaded rubber, Willard's specially adapted for use with W. D. 11 tubes. Supply current at 2 volts to one W. D. 11 tube for 210 hours on a single charge. Rechargeable. Brand new, size 4x5½x7 inches—Chi-Rad guaranteed.

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The Perasco Kewpie



Ideal for vacation or home use. Its special circuit makes possible the reception of stations without an aerial of any description. Any tube may be used with equal efficiency. Range 1,000 miles.

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Number  
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*Facts from the Factory*

Just so sure as this magic called Radio is here to stay, just so sure will SIGNAL folks be making Radio apparatus. For in manufacturing Radio equipment, just as in every other phase of human life, the law of the survival of the fittest holds good.

The big thing in SIGNAL survival and success is that SIGNAL Radio sets, and parts, are designed for service. They're made right. They look right. They work right. Expert engineering, fine materials, workmanship of utmost precision, all guarantee this.

(See next column)

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(Continued from first column)

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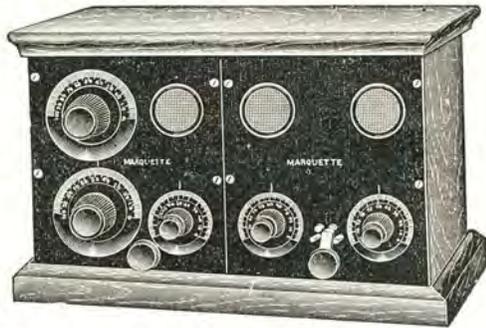
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The MARQUETTE Receiver is equipped with three 33 ohm MARQUETTE Rheostats which are adjustable from 0 to 33 ohms, thus making it possible to use any style of tube. The MARQUETTE Rheostat is recognized by radio engineers as a perfect control of vacuum tube filament temperature, which is at all times necessary for smooth tuning.

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This set may be used with headphones or loudspeaker and has switch control for one or two stages of amplification.

The detector unit in this set is manufactured by the Klitzen Mfg. Co., exclusively for the Marquette Radio Corporation, and Licensed under Armstrong Patent No. 1,113,149.

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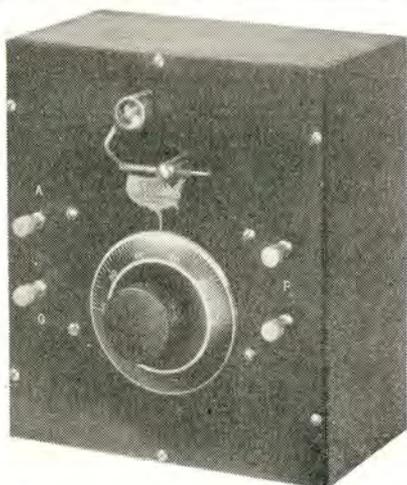
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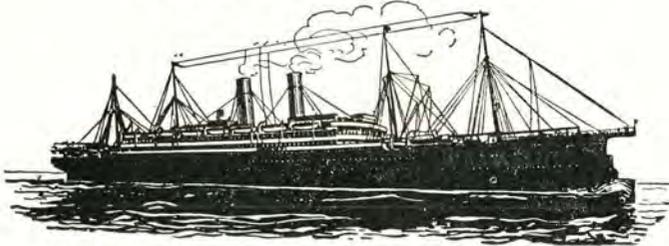
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☐ Gone are the scratching and noises as you vary the current to your tubes.

☐ Can you imagine anything more perfect and smooth in operation than a resistance wire passing through a well of mercury?

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☐ There is also a Gollos Potentiometer on the same principle.

☐ They come ready for panel mounting and template furnished. A Gollos Mercury Rheostat sent postpaid for only.....\$2.00

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## *The Gollos Mercury Rheostat*

# May We Give You Any of These?—

It won't cost you a cent to get any of these things. Just secure a few subscriptions to Radio Topics and they are yours

*You, as a reader of RADIO TOPICS, know that you, as well as your friends, should be regular subscribers. Sign them up and get whatever you wish.*

*A well built variocoupler, complete with dial, which sells for \$6.50, will be mailed to you postpaid for 3 one-year subscriptions.*



*Manhattan 2,000 ohm phones sell for \$6.00. You may have a pair postpaid for 3 one-year subscriptions at \$2.00; total \$6.00.*

*All of the items listed on this page are fully guaranteed.*

*If there is something you want not listed, we'll arrange to get it.*

*A WorkRite splendid loudspeaker made of a composition and having a receiver in the base with extension cord. It costs \$12.00, and is yours for 6 one-year subscriptions.*

*A variometer, complete with dial, is also yours for 3 one-year subscriptions to RADIO TOPICS.*

You may also have a full set, consisting of a variocoupler and two variometers, with dials, whose value is about \$18.00, for only 8 one-year subscriptions.

Just send us subscriptions, either renewals, new ones or your own, whose total at our rate of \$2.00 per year equals the price of the item you want, and we'll send it immediately prepaid.

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of ILLINOIS  
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May 26, 1923.

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Gentlemen:

Analyzing the quality of inquiries received ever since we have advertised in RADIO TOPICS, it has been proved conclusively that fifty-five per cent of the inquiries are from fruitful sources.

You will continue having our advertising, knowing well the value of a good "National Radio Monthly" and without fear of any "summer slump", with everybody striving to make this a RADIO SUMMER.

Sincerely yours,

DX RADIO COMPANY OF ILLINOIS

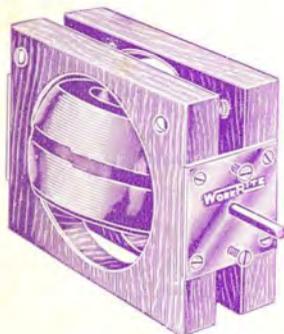
*Edward F. Spadoni*

EFS:FA

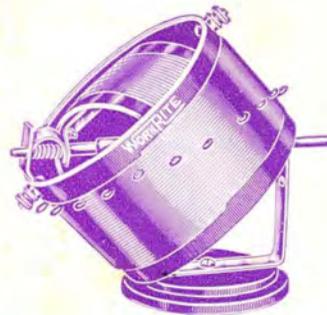
DEPENDABLE QUALITY

# "WORKRITE"

## TUNER TEAM



Here it is—The WorkRite Tuner Team—the most selective circuit possible. Two WorkRite Super Variometers made from polished mahogany and a WorkRite 180° Super Variocoupler made from molded Bakelite make up this wonderful team. Let the WorkRite Tuner Team get your station for you. Just look at these extremely low prices.



WorkRite Super Variometer..... Each \$3.50  
WorkRite 180° Super Variocoupler

## NEW WORKRITE SUPER VERNIER RHEOSTAT \$1.00

This instrument is the last word in Rheostats. 50,000 possible adjustments for \$1. The drum is molded and cannot shrink. No danger of the wires loosening.

Easy to mount on panel. Pushing the knob way in turns off filament. Turning the knob gives the very finest adjustment. Often a turn of 1/32 inch will clear up a station or separate two stations.

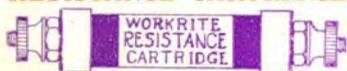


The WorkRite Super Vernier Rheostat is made with three different resistances so that there is a WorkRite Rheostat that will work with any Tube now on the market.

WorkRite Vernier Rheostat  
6 ohms .....\$1.00  
WorkRite Vernier Rheostat  
15 ohms .....\$1.10  
WorkRite Vernier Rheostat  
30 ohms .....\$1.25

## WORKRITE UV 199 TUBE ACCESSORIES ARE BEST

### WORKRITE RESISTANCE CARTRIDGE



No need to buy a new Rheostat to get the 30 ohms resistance required for the UV 199 Tubes, or the 15 ohms for the 201A and 301A Tubes. Just put a WorkRite Resistance Cartridge on the circuit with your old 5 or 6 ohm Rheostat. Price 15 or 25 ohm .....40c

### WORKRITE NON-MICROPHONIC SOCKET



Here is the right socket for your new UV 199 Tube. It is molded with a sponge rubber base in one piece, which is even better than the soft rubber recommended for use with this tube. Price.....60c

### WORKRITE Hydrometer



Double the life of your battery by giving it proper care. Fill and test it regularly with a WorkRite Hydrometer. Never let it get below 1150. Full instructions for testing and care of battery with each "WorkRite." Get one now. Price.....75c

## OTHER WORKRITE RADIO PRODUCTS

WorkRite E-Z-Tune Dial. Has a knurled flange on outer edge, giving firm grasp for fine tuning. Price .....75c  
WorkRite Concertolas. Loud Speakers of Quality. Carefully made.  
WorkRite Concertola, Jr. ....\$12.00  
WorkRite Concertola, Sr. ....\$18.00

WorkRite Switch Set. Complete switch set in one unit. Parts made to work together. Use block for template in drilling panel. Price.....50c  
WorkRite Head Set. Extremely sensitive and free from distortion. Compare it with any one the market. Price .....\$6.00

**"WORKRITE RADIO PARTS WORKRITE"**

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