The WIRELESS AGE

"America's Foremost Radiophone Review"

February
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f American Broadcasters (Complete)

Amateur Trans-Atlantic Results

AMPLIFIES AS IT DETECTS

Cunningham tubes

Give Clearest Reception

Cunningham Tubes used in any standard receiving set will enable you and your friends to listen to news reports at breakfast, stock market quotations at lunch, and in the evening sit in your comfortable living-room by the fireside and enjoy the finest music and entertainment of the day.

Send 5c for new 32-page Cunningham Tube catalog, containing detailed instruction for the operation of Cunningham Tubes as well as numerous circuit diagrams and graphic illustrations of tube action.

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TYPE C-300
Super-Sensitive
DETECTOR
$5.00

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Distortionless
AMPLIFIER
$6.50

The trade mark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

Two Supreme Achievements *in* Radiolas

RADIOLA GRAND and Mahogany Stand with "B" Batteries, tubes and full instructions, $350.00

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TRADE MARK REG. U.S. PAT. OFF.

The finest principles of radio detection, amplification and loud speaking are embodied in the new RADIOLA GRAND.

The RADIOLA GRAND has been especially designed to receive broadcasting stations operating on the standard wave lengths of 360 and 400 meters, but an additional range is available up to 550 meters. By means of a new type of Loud Speaker, the entire family may receive broadcasted music and other entertainment and instruction.

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RADIOLA IV, complete with 4 tubes (1 spare), all batteries, headset with telephone plug and silk covered leads for antenna and ground, $275.00

Radiola IV

TRADE MARK REG. U.S. PAT. OFF.

RADIOLA IV is a self contained console-type broadcast receiver. The cabinet contains a regenerative receiver, a detector, two stages of audio frequency amplification, a new loud speaker of unsurpassed tone quality and all necessary batteries.

RADIOLA IV is not only a highly efficient receiver, embodying the latest developments in design, but is also a thing of beauty that will grace a drawing room or library.

Both of these Radiolas provide exceptional long distance as well as local reception.

Ask your nearest dealer to show you the Radiola line.

"There's a **Radiola** *for every purse"*

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Gen. James G. Harbord, Pres. J. Andrew White, Vice Pres. L. MacConnach, Secy. George S. DeSousa, Treas. J. O. Smith, Business Mgr.

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Every vacuum tube wireless receiving set requires a storage battery for efficient operation. And every storage battery requires frequent recharging. Hence the big market for Rectigons.

Your own radio customers will be interested in Rectigons and the safe, economical and easy means they provide for recharging batteries at home.

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Stock Rectigons now. Our nearest agent-jobber can supply you.

This new Rectigon Folder is specially designed to help you sell to radio enthusiasts. Get a supply from one of our agent-jobbers to keep on your counter.

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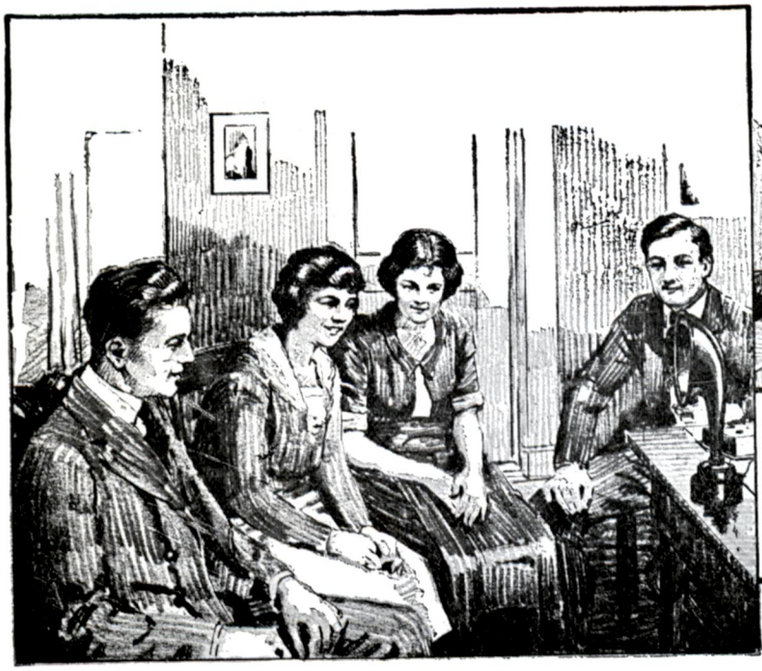


Run-down batteries need not be the reason for missing any broadcast programs

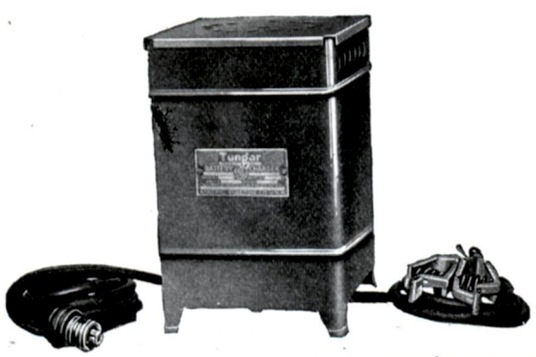
No Concerts Missed Because of Run-Down Batteries

With a Tungar Battery Charger you can easily keep your batteries up to full voltage. It enables you to recharge batteries from any a-c. lighting circuit at your convenience and at a minimum cost. The battery doesn't have to be taken out of the house. "B" storage batteries, also, can be charged by means of a simple, inexpensive attachment.

The Tungar Battery Charger requires no attention while operating and is so designed that there isn't the slightest danger of injuring the battery. And its first cost is very low.

Tungar has kept other people's storage batteries in condition for years—why not yours? Of course, it is equally good for your automobile battery.

Our new booklet on the application of Tungars to radio batteries will interest you. Send to us for booklet B-3640, if your dealer cannot supply you. Address Merchandise Dept., General Electric Company, Bridgeport, Conn.



Tungar Battery Charger—saves disappointments and annoyance

Tungar
BATTERY CHARGER

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

35A-77

Small Current—Big Job!

Care in Selecting Your "B" Battery Cures a Whole Flock of Static Troubles

A LOT of radio bugs are missing a good bet when they fail to give the proper attention to the "B" Battery that supplies current to the plate circuit of the vacuum tube. In a good many cases—and this applies to the seasoned enthusiast as well as the newest novice in the ranks—it is wrongly set down that since this current is so exceedingly small it cannot be very important.

Nothing could more completely misrepresent the facts. True enough, the current supplied by the "B" battery to the plate circuit is small—but it is precisely for that reason that even the slightest variations or disturbances are to be so carefully avoided.

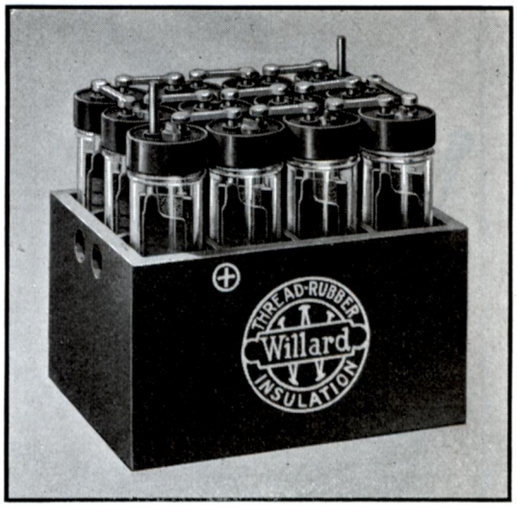
In thinking of "B" batteries keep this in mind: The current from these batteries goes directly into the fine windings of the coils of your phones. Therefore even the slightest disturbance or unbalancing of the battery is translated directly into **noise.**

Obviously the reason for carefully soldered connections, loop aerials, short leads and the elimination of useless wires is to do away with **noise** just as far as possible. The same reason should dictate the careful selection of "B" batteries. It hardly pays to go to a great deal of trouble in taking the usual steps to eliminate static unless you also pick out a battery that is free from the hissing, sputtering and frying noises that are so often confused with static and that in common with static noises are multiplied six or seven times with each stage of amplification.

A "B" battery that is completely in accord with the efforts of manufacturers of sets to do away with static disturbances is known as the Willard "B" battery. This battery consists of a group of twelve glass-jar cells, assembled in oak cases and connected with heavy burned-on connectors. Due to the distance between jars electrical leakage from one jar to the next is practically impossible. As each of the cells has Willard Threaded Rubber Insulation between the plates there is no opportunity for leakage from plate to plate.

It is said by those who have carefully examined the construction of the Willard Radio "B" battery that, in addition to its ability to give results without distracting noises, it will last—if not a lifetime—at least such a long period that it will show a material money saving long before it begins to exhibit even the slightest sign of age.

Willard Storage Battery Co., Cleveland, Ohio



The Willard Radio "B" Battery is a 24-volt rechargeable battery. Glass jars—Threaded Rubber Insulation—screwed-on covers.

The Willard 6-volt, All-Rubber Radio "A" Battery has one-piece rubber case—Threaded Rubber Insulation—special Radio plates.

The new Willard lower priced Radio "A" Battery (Type FW)—Willard-quality plates—selected wood separators—tested rubber jars, specially-designed terminals.

Result of 15 Years Experience

Brandes

Few realize that radio is old enough to have caused the establishment of at least one strong industrial unit 15 years ago.

Brandes *Matched Tone* Headsets were first made in 1908. The fact that they were designed perfect sound-mates, matched in tone so as to catch even the faintest signals, solved the first and foremost problem of radio.

Brandes *Matched Tone* Headsets were indispensable when radio was in its infancy. They have grown more and more essential as time has gone on and the radio industry expanded.

Send ten cents in stamps for the "Beginner's Book of Radio." It explains radio in terms that anyone can understand.

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Matched Tone

TRADEMARK REG. U.S. PAT. OFF.

Radio Headsets

MAGNAVOX Radio

"A Public Institution"

THE real progress of radio is shown by the illustrated magazines and newspaper supplements—nobody follows the popular thought closer than the "art editor."

The preponderance of Magnavox equipment in these illustrations of novel and interesting radio uses, indicates how the Magnavox Radio, like the Morse Telegraph or the Bell Telephone, is becoming a "public institution."

R-2 Magnavox Radio with 18-inch horn

(as illustrated)

This instrument is intended for those who wish the utmost in amplifying power: for clubs, hotels, dance halls, large audiences, etc. It requires only .6 of an ampere for the field.

Price **$85.00**

R-3 Magnavox Radio with 14-inch horn

The ideal instrument for use in homes, offices, amateur stations, etc. Same in principle and construction as Type R-2.

Price **$45.00**

3-stage

Model C Magnavox Power Amplifier

For use with the Magnavox Radio and insures getting the largest possible power input.

2-stage $ 80.00
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Magnavox products can be had of good dealers everywhere. Write our nearest office for copy of new illustrated folder.

No Wireless Receiving set is complete without

MAGNAVOX

To enjoy all that radio offers in the way of daily concert, lecture and news, ask your dealer for a receiving set equipped with Magnavox Radio, the Reproducer Supreme.

The Magnavox can be used with any receiving set of good quality—the better the set, the more Magnavox can do for you.

Magnavox Products can be had from good dealers everywhere. Our interesting new booklet (illustrated in three colors) will be sent on request.

The Magnavox Co., Oakland, California
New York: 370 Seventh Avenue

MAGNAVOX Radio The Reproducer Supreme

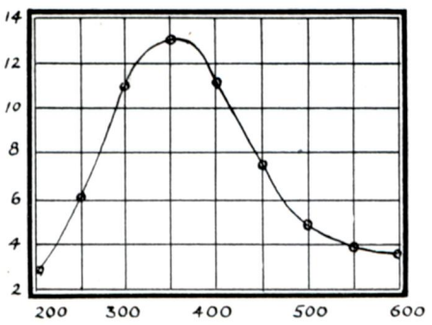


CHART I

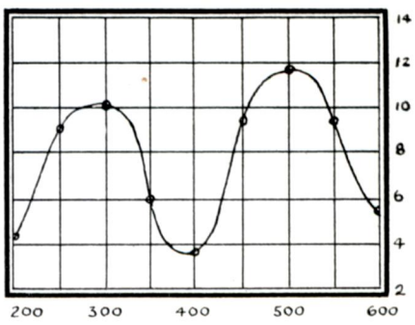


CHART II

Better Radio Results at Lower Cost

THE results obtained from any radio outfit—home made or factory built—depend largely on the units employed. Cheaply constructed electrical apparatus **cannot** give best results.

After twelve successful years building electrical units the Briggs & Stratton Company have acquired an invaluable knowledge of electrical design which now expresses itself in the construction and workmanship of every unit in the Basco Line of radio equipment.

"Better Radio Results at Lower Cost" tells briefly what these many years of experience mean to you. Insure yourself against failures—insure top-notch results by building your outfit on a foundation of real result-getting radio units—the Basco Line.

Insist on Basco parts—ask your dealer for them. If he can't supply you, write us direct and we will see that your order is promptly filled.

Besides articles shown and listed here, we also make switches, contact points, stop posts, binding posts and bezels.

Jobbers and Dealers! Write for free catalog and details of our attractive selling proposition.

BASCO **Radio Frequency Transformer.** Operates with all standard tubes. Efficient over wave band of 200 to 600 meters. Employs non-capacity winding—double silk covered wire—no enamel. Maximum transfer of energy. Windings encased in fibre. Mountings and binding posts silver plated. **List price** **$5.00**

BASCO **Radio Receivers.** Super-sensitive—natural voice pitch—no scratching. Light weight aluminum case—solid horse shoe type magnet—no laminations. Diaphragm set to thousandths-of-an-inch accuracy from magnet poles. Clean-cut, rugged design. Comfortable on ears. **2000 and 3000 ohms, list, $6.00 and $7.50 respectively.**

BASCO **Vernier and Plain Rheostats.** Vernier adjusts to 1-150 of an ohm. None better for detector. Smooth, positive contact always. One hole only for panel installation. Coils rigidly inset in heat-resisting fibre—no shifting possible. Metal parts heavily nickeled. **List price—Vernier Rheostat—$1.25. Plain Rheostat** **85c**

BASCO **Crystal Detector Set.** Complete for instant hook-up to aerial, ground and phones. No batteries. Simple and sturdy. One dial to adjust. Sensitive tested crystal enclosed in glass. Simple cat whisker adjustment. Maximum crystal-set range. Metal parts solid brass. Bakelite composition panel. Mahogany finished cabinet 8" x 6⅛" x 6". **List price**..... **$12.00**

BASCO **11 to 43 Plate Air Condensers.** Sturdy—compact. Heavy plates, accurately spaced—no chance of touching. Two screw holes for easy mounting. Without dial, list prices:

43 plate.....	$4.25	17 plate.....	$3.60
23 plate.....	3.75	11 plate.....	3.45

BASCO **Tube Socket.** Black oxidized tube holder. Bakelite base. Strong—good looking. Sure-contact springs. Nickeled binding posts. An exceptional buy at **50c.**

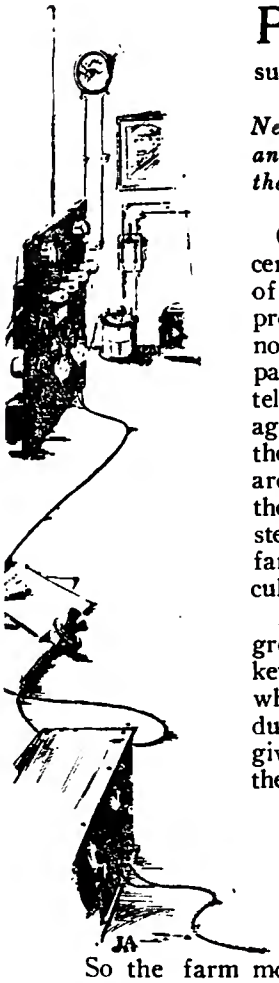
BASCO **Moulded Composition Dial.** Graduated 180° and 100 divisions. 3 inches diameter, 1½ inch knob. High lustre black—white inlaid figures. Accurately trued brass bushing for ¼-inch shaft. **List price**..... **50c**

Briggs & Stratton Co.

A BASCO PRODUCT

Milwaukee Wisconsin

In Our Opinion



Nearer and Nearer the City

PURCHASE of station WDAP by the Chicago Board of Trade, just consummated, gives emphasis to the farm service of the radio telephone. The Board is to use the transmitter for broadcasting grain quotations during trading hours.

Chicago is the great grain marketing center. Prices there govern the prosperity of the thousands of farmers in the grain producing states. These agriculturists now will have a quotation service comparable with that given by the tickers and telegraph lines maintained by the brokerage houses in the large cities, and so will the banks through which grain growers are financed, and the elevators to which they sell. This is the greatest forward step taken in the business of American farming since the introduction of modern cultivating machinery.

Radio welds the highly specialized and greatly ramified grain producing and marketing system into one homogeneous whole, removes the possibility of losses due to ignorance of prevailing prices, and gives the farmer new opportunities for the exercise of business skill in the marketing of his crops.

The radio telephone furnishes not a new solution of an old problem, but the first practical answer to a vital question of many years standing.

So the farm moves still nearer the city, and the city nearer the farm; radio has brought the two together, a contact has been made, and without disturbing either from their appointed places. Only time will tell what changes this and all the other new but vital farm services of broadcasting will make in the relation between city and farm. But the effects will be tremendous and incalculably beneficial to every person in the nation.

* * *

The Amateur Trans-Atlantics

THE one-sided results of the trans-Atlantic amateur tests were not surprising. Close observers of short-wave, low-power communication look upon the outcome of the tests as the logical consequences of the adopted policies of the countries concerned with respect to experimental transmitting radio stations.

Looking at the results from a technical standpoint, it appears that the American amateurs can outtransmit their receivers; and the English, French, Swiss and Hollanders out-receive their transmitters.

There are many reports of the reception of American amateurs on one tube, which is surprising, but understandable—the answer is, efficient radiation of energy at the transmitter, good conditions and absence of interference in Europe on wavelengths used by American stations.

Regretfully it must be recorded in the annals of the event that a large number of American amateur stations transmitted continuously during the westward tests, and so spoiled for many patient and eager listeners the opportunity and satisfaction of listening to signals from European amateur stations. Too, there was a further handicap in the meteorological conditions; these were bad, particularly during the last week.

One thing was definitely established, however, and that is, American amateur station signals can be heard in Europe, and European amateur signals can be heard here; and two-way work between amateurs of the two continents will undoubtedly follow as a matter of course. In the present outlook, though, this 3,000-mile two-way work will be possible only during the best radio months of the year, and even then only when ideal radio conditions prevail.

* * *

Radio the Protector

PHILADELPHIA is doing something new with the radio telephone. Its police department for years has been harassed by the impossibility of patrolling adequately certain sections of its vast area, and though first mounted officers and then motor squads were used, still the ratio of personnel to area remained too low. In essence, the problem is one of communication, and the same factor that prevented complete policing of outlying districts made it impossible to distribute wire-connected boxes thickly in the same areas.

To this situation the radio telephone has brought relief that promises to be nearly perfect. Radio-equipped patrol wagons and the use of transmitters and receivers in important district police stations, as well as at headquarters, bring to the force the means of speedy and reliable communication that has been needed for many years. The great and sometimes fatal gap between the man on an outlying beat and his station is being rapidly closed.

* * *

Radio Did Not Fail

THE storms which swept over the Atlantic Ocean during the last few weeks of the year were declared by seafaring men, who have known the tang of salt spray all their lives, to have been the most severe of their experience. The wind frequently blew with hurricane force, whipping the sea into a boiling frenzy, with crests of giant combers reaching hitherto unheard of heights.

And through it all radio fulfilled its destiny. It was the one means of communication between ships and with the shore; and it did not fail. There was one steamship which on a short voyage was six days late in reaching port; yet at no time was there any anxiety regarding her by those on shore. How different from the agonized straining of eyes out to sea, only a decade or two ago! Today, hearts may beat faster and breathing become easier when the overdue vessel arrives, but all the time, even during a delay of six long days, as the craft battles with mountainous seas and makes little headway, radio keeps telling the story, hour by hour, day by day, "Hard going, but all's well."

—THE EDITOR.

Broadcasting Stars Who Please the Listeners

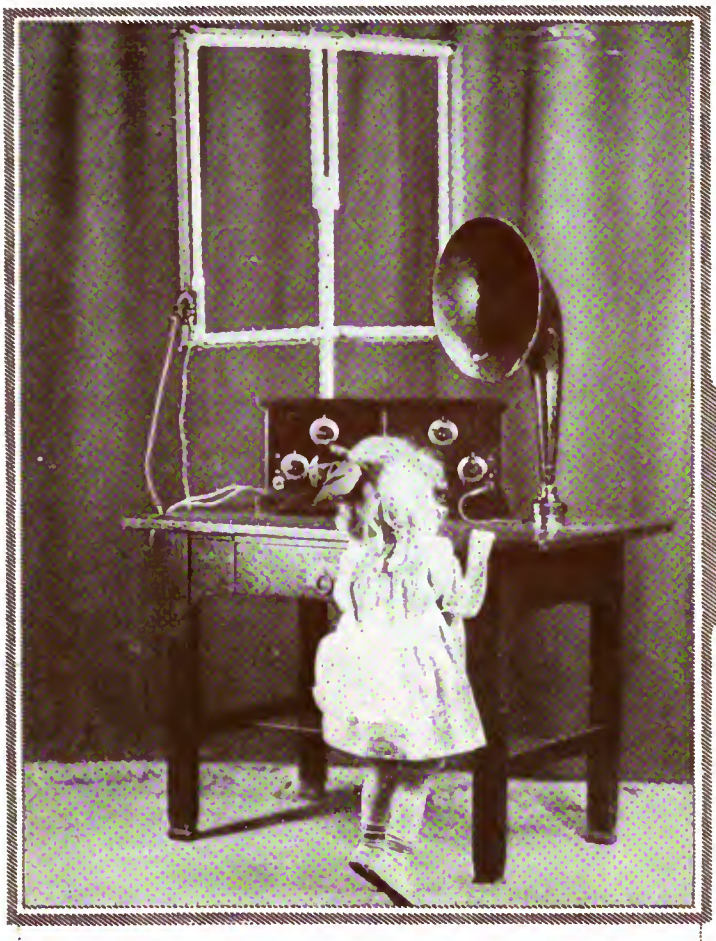
Vaughn De Leath calls herself "The Original Radio Girl," and has added "International" to her title—see article found on page 27

Chief Strong Wolf, the first Indian to broadcast, made a strong plea by radio for justice for his people. It appears on page 28

Pastor of one of the richest churches in America—Dr. Ernest M. Stires. His services are broadcast through WJZ each Sunday with telling effect, as you can read on page 22

LILLIAN and DOROTHY GISH, famous in the screen world for the creation of young girlhood parts, see into the future when they will spread their talents by means of "radio movies." Dorothy tells about it on page 33

Radio's Wonders Interest Children and Grown-Ups



Little Barbara Wagoner is a-tiptoe with wonder before the marvel of the Radiola that brings to her the voice of the Man in the Moon—from up in the sky, she thinks

Two of the reasons why the New York Radio Show was successful—Miss Grace Norwood and the miniature replicas of the giant towers at Radio Central, L. I.

Married by Radio—and it's perfectly legal, too, for although the wedding service was broadcast for all to hear, the minister and witnesses were present in person. Several couples have been thus united during various radio shows. It's the latest thing. Above, Joseph Woorm and his bride, Margaret Girstner, both of Brooklyn, N. Y., going through a rehearsal

MONA MORGAN, well-known Shakespearean actress, has played Ophelia (above) not only on Broadway but in small towns. Now she broadcasts the plays of the poet. Read her article on page 24

"What Hath God Wrought"

Come All Ye Who Listen by Radio and Let Us Worship Together in One Congregation of the Soul of Man

By Maurice Henle

Dr. Ernest M. Stires in his pulpit; the pick-up microphone being seen near his left hand

ON Nov. 5th last—approximately three months ago—Dr. Ernest M. Stires preached his first sermon by radio from the pulpit of St. Thomas's Church, Fifth Avenue, New York City.

For six months previous to that he had been debating with himself the advisability of broadcasting his services. Finally he yielded to his better judgment and allowed the officials of the Radio Corporation, Westinghouse Station, at Newark, N. J., WJZ, to equip the church with pick-up microphones.

Three months have passed. Each Sunday the service has been put on the air, and now radio is regarded by not only Dr. Stires, but his entire congregation as well, as a premanent institution; as "the unifying church force," as he himself describes it.

Broadcasting a church service is by no means new. KDKA, as everyone knows, rightfully claims the distinction of being the first to transmit the message of God by radio, having filled the air with the inspirational service of Calvary Church, in Pittsburgh, soon after KDKA began transmitting. Other churches from coast to coast followed; then St. Thomas's, foremost of them all. Publications have devoted columns of space within the past few weeks to the radio activities of this church. But THE WIRELESS AGE wanted to wait in this particular case, until the word of the rector of this, the wealthiest of American churches, pronounced the experiment a success and made it plain that radio is in the church to stay.

"At first," Dr. Stires told friends, "there was the usual objection. The theory was advanced that if we allowed the services to be broadcast, people would stay at home and would not come to the church. There is no need to dwell on that beyond saying emphatically that just the opposite proved to be the case. I do not mean to imply that radio has driven the people into the churches, but I do mean to say that getting our message into the homes of those who never attended church, or haven't attended it for a long time—getting it into those homes has had the effect of opening the eyes of those people to the beauties and helpfulness of the service. And once their eyes thus were opened, they went to church of their own accord."

He told about two specific instances to illustrate his point. A certain family, consisting of husband and wife, living in a small town in a northern state, were not very consistent churchgoers. In fact the husband had not been to church with his wife for fifteen years. But they had a radio set, and, tuning in one Sunday, heard Dr. Stires. Both became interested in the service, but the husband particularly.

"Perhaps after all," he said, "I have been missing something."

"Perhaps," she replied dryly, and each Sunday now finds them eagerly tuning in for WJZ at the hour the St. Thomas' service starts.

After Nineteen Years

The other case was one of a man who had not been to church for nineteen years. He "could not be bothered." Church services bored him, but radio didn't, and tinkering around one Sunday morning he chanced to hear the colorful notes of the St. Thomas's organ. He listened, enchanted. And when the last note of the choir had died away, when the station signed off, he sat before his set absolutely stunned. He lived in a big city, near New York, and the following Sunday he did not touch his radio set. Instead he polished his shoes and brushed his clothes and took unto himself a church—not the church in which he was reared,—but a church nevertheless, and after all what does it matter what church we are in if our minds and souls are in tune with it?

"And then," went on Dr. Stires, "there are of course, the sick, the shut-in, and the aged. What a blessing has radio been to them! I tell you, radio is the unifying church force!"

St. Thomas's wonderful edifice is on Fifth Avenue—physically. "In reality," Dr. Stires says, "it has ceased to be on Fifth Avenue."

"It is everywhere that radio takes it," he said. "Its walls now enclose the hundreds of square miles over which the ether waves roll. And when I deliver my sermons now, I must take that into account. At least a part of the sermon is intended specifically for the radio audience."

And this part, it may be stated positively, finds its way home. Now, St. Thomas's is a rich church. That is neither a handicap, nor a curse. It just happens to be. There really are no "poor" in the congregation, no one within the flock to care for in any way except spiritually. But Dr. Stires takes up a collection each Sunday, and this money finds its way into hands where it is most needed.

THE INEVITABLE FAITH

"In the Beginning, God."—Genesis 1:1

"THE longer I live the less I am interested in mere Orthodoxy and in the effort to make all people to think alike; but I am the more interested in persuading everybody to believe something worth believing, and to let that belief guide and control the daily life.

"But is it possible for intelligent men; men of scientific training or temperament, to believe in a God who created the universe, who is the moral governor of mankind, who cares for every human being as a loving parent cares for children, who is ever near to help—not to do things for us, but to help us to do them—is such a faith reasonable?"

—From the First Sermon by Dr. Ernest M. Stires, over the Radio Telephone, Nov. 5, 1922.

When the time comes each Sunday to take up the collection, the "radio congregation," one might say, has nothing to do but listen to the offertory music. But it so happens, as letters Dr. Stires has received reveal, that his radio congregation is not content with only partial participation in the services.

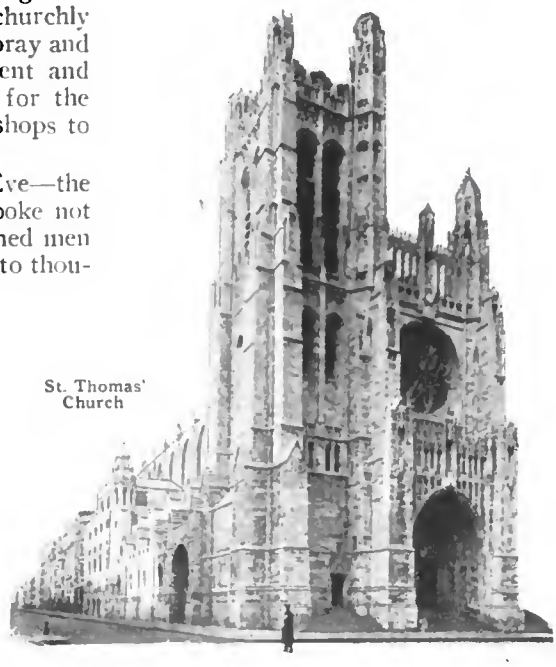
For in many homes, at the precise moment that the bills and coins are being dropped in the collection boxes, a collection is being taken for mailing to the rector. One person recently sent in a $50 Liberty Bond. Others send cash and checks, large and small. Each week the "Radio Collection" grows larger.

Probably there is no more interesting a place on New Year's Eve than St. Thomas's. This is mentioned to give the reader a more intimate picture of what type of man Dr. Stires really is. Not so many years ago the church used to be deserted on New Year's Eve. A few stragglers; that was all. The rector had a heart-to-heart talk with his congregation. He asked them why they didn't come to church on that night. And they said that inasmuch as they attended the theater or some social function on New Year's Eve, and were in evening clothes, they felt that they would be out of place in church.

"I want you to come to church as you are," he told them. "I don't care about your clothes. Clothes do not matter at all. It is YOU that counts—not your clothes."

And now the church is always packed on the last night of the year. As midnight approaches, the congregation takes on a strange, almost unchurchly appearance. Men and women pray and worship in the most resplendent and colorful clothes it is possible for the most exclusive Fifth Avenue shops to produce.

But on last New Year's Eve—the one just passed—Dr. Stires spoke not only to these handsomely gowned men and women. He spoke as well to thousands of those who are perhaps not so fortunate in possession of the goods of this world as they. His voice went into the homes of the rich and poor alike. And when he spoke his words were not confined to his small congregation within the four walls of the church that is an architectural gem. They were heard by that immense radio congregation which he has come to love. the congregation dwelling in God's church, the universe.



St. Thomas' Church

His eyes saw the richly dressed congregation before him. His mind pictured the others as he looked at the little microphone on the pulpit immediately before him.

That, then, is why he KNOWS that radio and the church have a common mission; why he knows that so long as the church exists, radio will go hand in hand with it, steadily forward, toward a common goal. He does not attempt to predict what the future trend of radio will be, but he is assured that it is a powerful instrument for good, that it is in the church—his church—to stay.

Only the other day he had still another conclusive proof of the place that broadcasting has taken. New York City recently spent a week in soliciting and giving contributions to the United Hospital Fund. Part of the campaign called for the cooperation of the ministers. Dr. Stires opened the week with an appeal from his pulpit one Sunday morning. The radio audience heard, and by the following Wednesday it had sent him over a hundred checks, and during the rest of the week numbers came in every mail, bringing the total well up toward two hundred.

Listeners everywhere now lift their voices in praise with this famous boys' choir, one of the best in the country. Until the St. Thomas' services were broadcast it sang with only a few hundreds each Sunday

When Age Turns Back

SIXTY-SIX years after he traveled Indian trails to the frontier of the nation, the Rev. Dr. E. W. Rice, of Philadelphia, sent his voice with the speed of light to the grandchildren of the people he sought to reach in the early days, when he traveled by stage coach, on horseback and afoot.

Dr. Rice, now in his ninety-second year, recently delivered an address, from WGY, at Schenectady, N. Y., and lettters which have reached the station indicate that residents of Iowa, Minnesota and Wisconsin, the field of his missionary travels in 1856, plainly heard Dr. Rice's talk on "The Viewpoint of an Nonagenarian."

With the aid of radfo the former missionary of the gospel was able to reach at one time people within a radius of many hundreds of miles of the point he was speaking from.

Shakespeare for the Village

How Radio Broadcasting Is Restoring the Bard to His Place In Rural America

By Mona Morgan

Mona Morgan as Hamlet

NO doubt there are many Shakespearean actors throughout the country who know what it is to land in a little town after a hard night's travel, to be met with no friendly faces, save those curiosity seekers who have sauntered down to the depot to see the "troupe" come in on the train. After collecting suitcases, the players inquire their way to the "Op'ry House" of some sullen youth with a horse and wagon, who, upon persuasion, allows his dignity to be imposed upon to the extent of driving five or six of the principal actors to the only theatre in the town.

The adolescent coachman of sullen mien usually offers the comment that "this ain't no kind of a show town, no how," thereby killing what little enthusiasm may be left in those who, in a few hours, will present an immortal tragedy to the ungrateful inhabitants.

It often happens that the name of Shakespeare frightens the population away—and the majority of the seats in the theatre are empty, thereby proving the youth's assertion that "it ain't no show town."

"Trouping" Troubles

This was the sort of discouragement that greeted the traveling players of the classics in the nineteenth century. Company after company, including Edwin Booth's, Mary Anderson's, Walker Whiteside's, Robert Mantell's and many others before and since, have toured our great United States, never overlooking even the remotest spot where a theatre was to be secured, toiling and fighting to introduce the best plays, with no guarantee that the people would buy the seats, or if they did so, that they would be pleased.

Then about thirty years elapsed. Most of the great actors and actresses either died or retired, and the ones left who still remained true to the classic drama, only contracted to play in the largest cities. In the meantime all those old country theatres, whose boards had been trodden by masters of the dramatic art, had been converted into moving picture places. Public taste demanded the presence of the light, frivolous and comic spirit on the stage.

But while we were reveling in the silent drama, what was happening to the other and greater adjunct to the drama—the human voice? The splendid actors of the past, who made theatrical history, took great pride in their well-modulated voices; there was Edwin Boothe's "Hamlet," Mary Anderson's "Juliet," Irving's "Shylock," Ada Rehan's "Katherine," Ellen Terry's "Portia." These Shakespearean scholars and players who gave living voices to the glorious lines of the bard, and inspired a love of the poetic and dignified—these beloved old characters have all gone, have passed away as last year's snow, and are remembered only by the few fortunates who heard them so many years ago.

Failure in Movies

Shakespeare's plays have never succeeded greatly as moving pictures. They have been tried again and again, but of no avail. Shakespeare did not write in pictures, but in words. It isn't so much what he said as how he said it, and the opportunity he has given to the human voice to express all its charm and beauty.

There must be a happy medium between these two extremes. Classical plays have not died, they have only gone through a change in the last thirty years. They are no longer entertainments; they have become the property of schools and colleges, they are marked and numbered, dissected and analyzed; they are classified just as prisoners are. They are on a desk or in a library, they have become dusty with neglect, for they are only "dry old text books" now.

Shall the men and women who do not live in large cities be forever without the opportunity of seeing or hearing these lovely plays, just because they do not "screen" well?

The dawn of a tomorrow is at hand, when the finest and best in literature will reach the ears of lovers of beauty, when the poetic words will be heard once more, and the old characters, once so loved, will live again. In a small way this has come to pass and more, much more will follow, *because the radio telephone is in use today.*

The dramatic artist who can read and interpret the lines of the classics will not have the discouragement of bygone years; the empty theatres, rushing for trains, packing huge trunks and all the rest of it. He can "barnstorm by wireless." He won't see his listeners, but he can be sure of reaching the largest audience in the history of the theatre.

Revamping the Village

The small village of the past, with its warped outlook on life, its ignorance of current events, its mean and petty superstitions, is in a line to be completely "revamped," as it were. A great deal of unhappiness and tragedy can be avoided by dispelling discouragement, especially to the mentally and physically ailing. The plays of Shakespeare are a tonic even for the well. These Shakespearean characters, read over the radio telephone with care and dramatic power, will turn the small town into a tiny center of culture.

Sir Forbes-Robertson, about seven years ago, made a year's tour of America, presenting some of the classics in towns that were often thirty or forty miles away from the nearest railway station. Many of the people who attended had never been to the theatre before. The world of the classic drama was for them an unknown quantity, yet some drove hundreds of miles in bad weather to see him repeatedly in the same plays.

The children of those days have grown up, and once more "Hamlet" is for them, not "the sweet prince" of the stage, but the subject for some petty school teacher's rhetoric examination. There are not many fine actors now who will go on prolonged tours, but the day is very nearly at hand when going on the road will be unnecessary, and our rising generation will enjoy the very same plays right in their own homes, and interpreted far better than any touring company has ever done. It means the emancipation of the small town!

Radio Revises Sleepytown Tradition

Wide-Awake Philadelphia Police Through Radio Have Solved the Problem of Patrolling Wide Areas and Quelling Sudden Disturbances

By Ward Seeley

PHILADELPHIA spraddles contentedly and happily over a large area on the eastern edge of Pennsylvania. In its more than 129 square miles are nearly two million people, and it has become practically a tradition that they are slow in changing their ways, steadfast in holding to the old and imbued with a spirit of conservatism that effectively chokes off all young ideas lest they imperil the methods of a bygone day.

That is the tradition, a tradition in which there is a small amount of truth and a great deal of exaggeration. The many who are qualified to judge the character of the city by acquaintance with its business men and with the business men of other communities know that Philadelphia holds hard and fast to the excellent rule that reads like this:

Be not the first by whom the new is tried,
Nor yet the last to cast the old aside.

Under which philosophy Philadelphia has progressed steadily and evenly and happily and prosperously.

These facts may not seem to have anything to do with radio, but they have. Philadelphia, officially, is energetically developing the use of radio to a pitch of which other cities may be envious. In the light of the Philadelphian tradition, this fact assumes considerable importance. For it shows two things.

One, that radio, which is still in its youthful days, nevertheless, has reached such a point that conservative Philadelphia has recognized its great gift to mankind and is eagerly seizing upon its advantages.

Two, that the Quaker City is by no means backward; is in at least this one respect even far ahead of most communities.

Of course, the city has its quota of broadcasting stations. Let it be said that they are excellent ones, and dismiss the matter, for this article does not concern itself with broadcasting to the ordinary radio fan.

Official Philadelphia realizes that the radio telephone has in it far greater possibilities than the dissemination of lectures, concerts, market and weather reports and the thousand and one really vital things that are spread to the winds by the popular broadcasting stations. Official Philadelphia is getting itself set to use the radio telephone for purely municipal purposes.

The first radio telephone patrol in Philadelphia has proved its practicability in severe tests

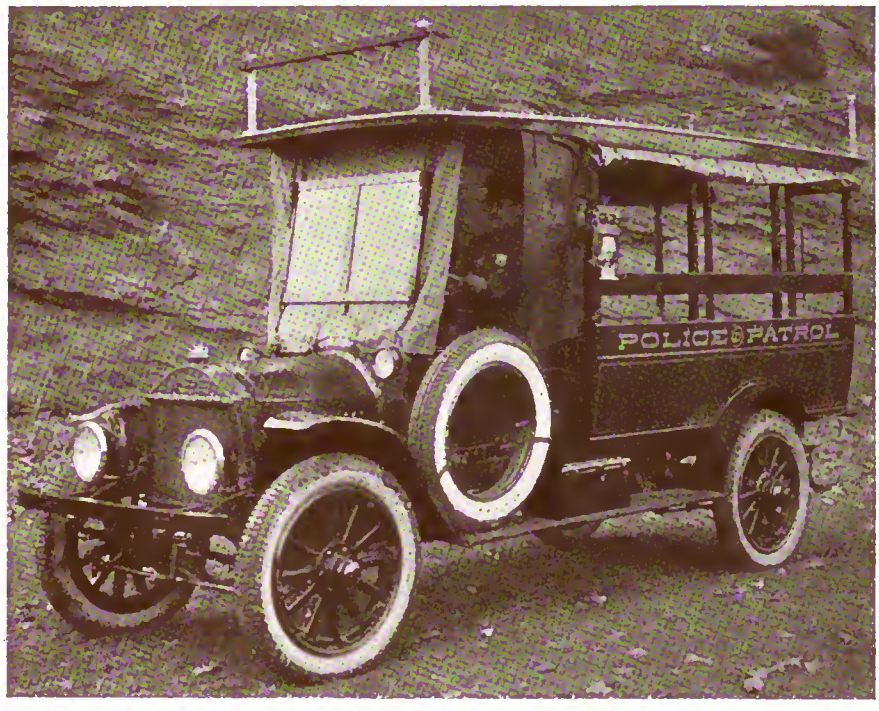
To date the greatest progress in municipal radio in the Quaker City has been made by the police department, which now has the most modern transmitting and receiving apparatus, and is working literally night and day installing it in police headquarters and in the various stations in all parts of the city. In the course of about two or three months the Philadelphia police will be completely equipped with radio telephone apparatus, which will act to supplement the extensive wire telephone system that links all the stations with headquarters.

The Quaker City, despite its ancient reputation for peace and quiet, has a very difficult police problem, due to two conditions.

The city spreads itself over a wide area, presenting patrol problems of unusual severity, so that there are many outlying sections where a single patrolman must cover areas of several square miles.

The other difficulty met by the police lies in the fact that in many of these districts the population is foreign and subject to sudden and often violent disturbances. This is particularly true along the Delaware River water front, where the rough native population is liable to join the aliens in a fracas that needs quick and powerful attention from the police.

There is one police district, the 27th,



They call it the "Hurry-Up Wagon" in Philadelphia—it's that and more, now that it has a radio telephone transmitter and receiver, giving instant and continuous communication with headquarters from any part of the city

that contains thirty-five square miles, stretching up in the northeastern section of the city, along the river, and in this district the patrolling police officer may be, and usually is, four or five miles from his nearest box.

At present, when a riot, fire or other emergency needs attention in this district, there is likely to be considerable delay in getting the alarm to headquarters. The city copes with this situation by using speedy motor patrols which are quickly loaded with policemen and sent to the scene of action. The first step in the utilization of radio by the police has been the equipment of one of these patrols with a radio-telephone transmitter, and it is expected that in the near future enough of these radio-equipped patrol wagons will be available to make it possible to send one of them out on each call from an outlying district that seems to present dangerous possibilities.

Arriving at the scene of action, the patrol will be in instant and continuous touch with the headquarters of the police in the City Hall, at Broad and Market streets, in the center of the city. If reinforcements are necessary, or if the police desire to call on the fire department for aid, the message will be sent by radio. This will obviate the necessity for cutting down the force at the scene of the emergency by sending a man or a wagon a distance of several miles to the nearest box or telephone.

A Great Factor

William B. Mills, Chief of Police, told the writer enthusiastically that he thought that this system of radio patrols would prove to be the greatest factor in the government of the city since the days when the wire telephone was first put in operation. The first radio patrol is now in operation, and has proved its entire practicability in the extensive experimental work conducted in the great electrical experimental laboratories maintained by the Philadelphia Police Department. This patrol has worked with the laboratory and with receiving sets that have been installed in four police stations and at headquarters. Chief Mills has a receiver with a loud speaker in his office, and listens in daily to local broadcasting as well as to the tests with the radio patrol.

"I rather hate to say much about our use of radio at this time," said the Chief, "because we have hardly begun to use it and anything I could say now is mighty poor beside what I will be able to say when we put our plans through. We have all our equipment. Our engineers have told us just what we can do with it, and it is going to be a big thing for Philadelphia when we get it all going in the next month or so. Our problem here is quite different from that of any other city that I know of because we are so big, in square miles I mean, and, of course, our big water-front over thirty miles long is sometimes very difficult to handle.

"Often an ordinary citizen who does not know what policemen can do will send in a riot call for a gang fight that

Mayor Moore of the Quaker City has the subject of radio at heart as he tells his radio audience how greatly he values broadcasting

one or two good policemen could handle. Of course, we cannot take a chance, and so when a telephone message comes in like that the only thing for us to do is to shoot out a patrol. Usually when it gets there, as I say, one or two men can handle the crowd without difficulty, but until an experienced officer gets on the scene we cannot tell just what is needed, and dare not risk the delay of sending a man to a box four or five miles away if reinforcements are needed. That is where the radio patrol fits in, and, although we do not have very many disturbances on the whole, I will be mighty glad when those new wagons of ours get into service.

On All Police Boats

"Of course, we are putting radio equipment on all our police boats. We have four big tugs, five launches that can speed along at sixteen miles an hour if necessary, and three fire boats, and these are patrolling the river continually. The problem of installation there is very simple, of course, and you can see how we will be able to reach any of these boats anywhere by radio-telephone, and direct them from one end of our water front to another if necessary without a moment's delay in getting in touch with them.

"No, so far we haven't done anything in the way of co-operating with the police departments of other cities. We have our own problem here and we are solving it by radio just as fast as we are able, and when we have our own system working then perhaps we may use it occasionally in communicating with other cities; but I rather doubt it, for so far the wire telegraph has proved entirely satisfactory. Of course, we often pick up messages from other police departments and the Detroit police seem to be using a local station out there to broadcast all sorts of warnings; we hear from other cities too. A lot of our amateurs also keep us supplied with information that they think we should have."

Here the Chief picked a bunch of post-cards and letters out of the desk drawer and selected the first one. It was a post-card dated the night before, and read somewhat as follows:

> Just heard the Detroit Police Department broadcasting a warning that Miss Susan Smith is missing, and asking all persons to watch for her.

Then followed a description of the missing person. "We get about one hundred communications like this every week," said the Chief, "and perhaps that is an indication of some big possibility, but, as I say, we are too busy working out our own local problem to give attention to other things."

Although the plans of the police are in the main in their final form, there are other methods of utilizing radio that still are under investigation.

The police department is not the only section of the Quaker City's government that is going into radio extensively, although its plans are further developed than those of any other department. Director of Public Safety Cortelyou told me that he considered the radio-telephone in its present development to be of immense advantage in running the affairs of municipalities, and that he had authorized the Chief of Police to proceed with the adaptation of radio to the needs of that department to the utmost extent to which it can be useful. The Director also has started the Fire Department on the trail of radio's benefits, and it is expected that the fire apparatus in outlying sections soon will be as thoroughly equipped with radio telephone transmitters and receivers as the police, with corresponding benefits.

THREE years ago—"Radio entertainments will no doubt become popular in the near future!"

Said a Listener to

Vaughn De Leath

("The Original Radio Girl")

An Interview by T. J. Dunham

Vaughn De Leath

THUS far no one has come forward to dispute Vaughn De Leath's claim of being "the original radio girl." Probably no one will, for the letters she has from her invisible audience are dated months before radio entertaining became everybody's job.

Her first radio appearance was in the early days of 1920, in the World Tower station, New York City. Even then she sensed radio's impending popularity, and she stoutly defended the latest of arts and sciences against those who contended it would not last.

Among her letters from those early days is one that she prizes highly; it says that the writer is "glad to see that you have introduced the custom of giving entertainments over the radio. It is certainly a fine idea, and *will no doubt become very popular in the near future!*"

That's vision and a tribute, too!

But Vaughn De Leath cannot be classified simply as a singer of popular songs, nor only as "the original radio girl."

In the first place, she composes many of the songs she sings. And in the second place, she has earned high esteem in the theatrical world as a writer of lyrics for musical shows. And in the third place, she has appeared with success as a concert singer. And in the fourth place, she sings for phonograph records.

She has sent her voice over long distances in three distinctly different ways. She sang once from New York to San Francisco over the wire telephone. Her music records have gone farther than that. And now radio!

If there are any more musical worlds to conquer, just tell Miss De Leath about them!

It is extremely difficult to carry to the reader the "personality" of this unusually versatile young woman. Her mind is so alert, so active, so original, that it defies any attempt to pin it down to the finalities of the printed page.

When Miss De Leath is not composing music, she is singing. When she is not singing, she is planning a new play. When she is not planning a new play, or sketch, she is appearing for her radio audience. And when she is not doing that, she is on the concert stage, or, better still, is—smiling.

That smile to us is the best of Vaughn De Leath's bewildering array of riches. Anyone who can fight the battle of "breaking into Broadway" and still smile is on the road to something bigger, something that will compel homage from that strangely cold and fickle creature—the public.

One of her own compositions is "Oliver Twist," whose music carries a naive, entrancing sort of theme, rather melancholy in its tone, but inspiring in its development to triumph. This was the song that she chose to sing at WJZ on the occasion of the special trans-Atlantic test, December 9th last. It was fitting that "the original radio girl" should have been selected to represent American classic music in this test—and her choice of her own song that is a tribute to a character famous in English literature was no less appropriate.

Those who listened to the tests know how the song carried, and heard Miss De Leath wish that now she would be considered as "the international radio girl."

The tests were rather dramatic. Promptly at 12.30 a. m. Sunday—just after midnight of Saturday, December 9th—"The Star-Spangled Banner" burst upon the air like the coming of a cyclone. It simply filled everything, for WJZ was exerting all its energy in the hope of being heard in England.

And then a voice came in:

"WJZ—WJZ—WJZ."

Three times it was repeated, and verily it sounded weird on the air that usually hears that famous call only once before and after each number. The listeners thrilled to the unusual. Some found themselves trying to help push the triple call across the sea.

His Majesty's Consul-General in New York then spoke briefly, expressing the hope that radio will be the means of cementing the English-speaking peoples of the world even more closely.

Then Vaughn De Leath sang; a jazz orchestra called the "Black and White Boys" performed; "God Save the King" was played; someone read the Twenty-third Psalm—and the test was over.

Everyone knows that since that historic test the Europeans have been hearing WJZ regularly, some of them every time they care to tune in on 360 meters, and other American stations also. But WJZ was the first American broadcaster to have the report of its reception abroad fully confirmed, and Miss De Leath says she is proud to have renewed her title of "the original radio girl" by adding the word "international" to it.

Some of the listeners that night may have noted that when the British Consul-General spoke he himself announced the call letters of the station, but in a slightly different manner than that to which the radio audience is accustomed. He said, very slowly and distinctly:

"W—J—*Zed.*"

Many wondered at *Zed.* Obviously it was the letter "Z," but why did he pronounce it *Zed* instead of "Zee," as taught by American schools? Well, according to Miss De Leath, that is just an English peculiarity. That's the way they pronounce the letter over there.

If speakers of other nationalities use their native alphabets at WJZ, the radio audience may hear still stranger ways of pronouncing the historic letters. In French, for instance, it would sound like this:

"Dooble Vay—Zjhee—Zed."

The "dooble vay" means "double v," instead of "double u" as in English. Other calls if spoken in French would sound just as strange. WDY, for instance, would be:

"Dooble Vay—Day—Ee Grec."

"Ee Grec" translated means "Greek I."

How an Indian Feels About Radio

By Chief Strong Wolf

(*The first Indian to broadcast*)

Chief Strong Wolf

I WONDER how many of you realize that the Indians, the original 101 per cent Americans, had a kind of radio and sent messages through the air long before the white man came?

The Indians used smoke fires. With the help of a buffalo robe, they made the smoke white or black, made it go straight up in the air in a long narrow streak, which signified reinforcements; used the buffalo robe to make it go up fanwise, which signified the birth of a child.

The Indian also had a form of sending messages through the air with the hands, the wig-wag, a system which is now used in the navy.

I come to you as a representative of 336,000 Indians. Of these, 17,500 volunteered for the war. My race has never produced a fanatic or an agitator. Think with me, if you will, of the wonderful heritage that my people have left you—300 words in the English vocabulary, including "tomatoes," "potatoes," "corn," "maple sugar," "succotash," "cocaine," "quinine" and "tobacco"; names of rivers and states; "Dakota," which means "Allied People"; the name of that great country across the border line, "Canada," which in the Indian tongue means "Village"; and the very Constitution of the United States, part of which is of Iroquois origin.

To think that this race of men, who had a word of honor and who believed that friendship and word of honor were sacred, and who received, with open arms, the first man who ever landed in this country, trusted him as a brother, received him as a friend, are today under the authority of a stern bureaucracy!

The Chairman of the House Committee on Indian Affairs says that the Government has been trying to correct the deficiencies and the mistakes in the Indian Bureau for a number of years.

But the Indian has not the vote. I think that you will agree with me that it is high time this be given.

The white men are allowed to graze their cattle on Indian lands and pay the Indians 25 cents a head. The white man gets $1.25 a head. There are company stores that the Indian deals with in the off season and when it comes to the end of the season to pay the Indian for allowing him to graze cattle on his lands, he usually has no money coming to him and when he goes down in the town to find out the reason why he has no money coming to him and why he cannot get $1.25 the same as the white man, he finds that the lawyer that he goes to and the banker and the cattlemen are the ones, in a great many cases, who sent the Congressmen to Congress, or helped to send him there in that district. Why can't we give the Indian true freedom—the franchise, so that he can vote for his candidate to send to Congress.

This is only one of the many unjust conditions. The payroll of the Indian Bureau Service is $1,700,000 a year, and, while I do not want to be sarcastic, I cannot help but think that if things keep up there will be more Indian Bureau employees than Indians.

Moving pictures, history that is not always authentic, and circus life has very nearly always pictured the Indian as an accomplice of traitors and renegades. This has done more harm than the bullets of the frontiersman.

I hope that you will give this your most serious consideration, because we are now in the midst of a very hard fight to do away with some unjust laws, but we cannot do anything without your co-operation and without your help because we have already been taught that we must depend upon the white man for our very existence.

I can hardly express my feeling of thanks to be able to use this wonderful means of communication—radio. It would take me a long time to reach all those I am able to speak to at this moment. I cannot see you, but I feel your presence. I seem to hear you say, "Go on—on with your good work."

Let the Great Spirit look down upon you all and bless each and everyone of you and may He give you the eyes of the eagle that you may see clearly and keenly all the unjust things that have been done in the past and are being done today to a race of men who had such a great love for their native land that 17,500 of them went across the water to fight for someone else's liberty when they did not have liberty themselves.

FAR west from Newark—in Boulder, Colorado—Rev. Red Fox, Dark Horse, and other members of the American Indian Association and Ojibway Tribe were listening in for the voice of Chief Strong Wolf to come through the air from out of the East.

They had heard their companion before over the radio, and so when he spoke from WJZ, it was not exactly a novelty. In fact, they had "followed" him on his pilgrimage about the country giving the message of the American Indian, and pleading that the privileges of full citizenship should be granted to the forerunners of the white man on this continent.

Chief Strong Wolf likes to talk over the radio. So far as we know there will be none to dispute his claim of being the first Indian to broadcast a speech. Nor is it likely anyone will arise to dispute his claim of being the first American Indian to fight in the Great War.

When hostilities commenced he took a job of cattle foreman on the S. S. "Rayburn" of the Lamport & Holt Line, which carried horses for the remount corps. One trip of this work was enough, and on his second voyage he became eager, as he tells it, to get into the fighting, and "feeling most afraid it would be over before I got there," he joined the English Army, Second Battalion, in December, 1914. He was one of the now famous "contemptible army" that stopped the Germans in their mad rush for Paris.

Chief Strong Wolf, making his pilgrimage tour about the country, says the Indian regards the radio telephone as the greatest possible medium through which to reach the people. He uses the radio telephone at every opportunity. And so when the officials of WJZ invited him to "appear" on the first anniversary night, he gladly accepted. Herewith are reproduced a few extracts from the address of the first Indian to speak over the radio telephone, not in indorsement of the Indians' plea, but that readers may know his appreciation of radio's opportunity by the importance—to him—of the subject he chose to discuss for his invisible audience.

Radio, Penetrator of Deaf Ears

How One Man, Unable to Hear His Crystal Set, Enjoys It by Proxy—His Wife and Friends Tell Him What Is Being Broadcast—Benefits of Amplification

By George W. Gether

Mr. and Mrs. Welch at their favorite evening amusement—Mrs. Welch listening and her husband, Acousticon on ear, waiting to hear from her lips what is going on in the air

THERE is a man in New York City who has never heard a sound over his radio set, yet he enjoys the broadcast programs.

He is deaf, quite deaf, and although the crystal set in his home speaks pleasantly to those with normal hearing it doesn't produce enough volume of sound to operate the Acousticon, sensitive as the device is through which sound reaches the ears of this particular radio enthusiast.

And thus it is that W. M. Welch hears the radio by proxy, through his wife's voice.

He has the intelligent eye and sensitive hand of one who is accustomed to handling tools and materials, and there is also a shining kindness in his face that is confirmed by the fact that for years he has been in the license department of the American Society for the Prevention of Cruelty to Animals. Included in the household is a parrot who apparently has the freedom of the apartment, and turns upon the visitor first one and then the other beady and benevolent eye.

"I saw these radio sets in windows all over town last Spring," explained he, "and I said to myself, 'why, I can make one of those!'.

"So I got the wire," continued Mr. Welch, "and made myself a set."

He brought it forth from under a side table in the dining room, put it on the table, and connected the aerial and ground wires. It is a loose coupler, and while it shows its home-madeness, it also displays the patient skill of the constructor. It works perfectly.

"Of course I can't hear a thing over this," apologized its maker. "But my wife says it works fine, and visitors who come here who listen to it tell me it is all right.

"It was funny the night of the Britton-Walker bout. I asked my wife to listen for an advertised speech by Governor Miller, so she could tell me about it, but the first thing she said when she put the phones on was 'Fitzsimmons lands a stiff one on the jaw with his left.' I thought she was kidding me. You know Lanky Bob is gone, never to fight again, but she went on talking vividly about a lively ring contest. Now she doesn't know a thing about boxing, and so I knew she wasn't making it up; she couldn't; and pretty soon we found out it was a preliminary bout preceding the Britton-Walker championship match.

"Well, I was kind of disappointed at first; I wanted to know Miller's review of his administration. But say, that fight was good! The only trouble was that it was so fast my wife couldn't keep up with it."

Here Mrs. Welch explained, "I don't know anything about boxing, but he enjoyed it. I couldn't talk to him and listen at the same time so I got a pad of paper and wrote down as fast as I could what happened. The pad got all covered with fine writing before it was over."

It must have been a notable night. Mr. Welch continued with his eager smile, "She told me 'Why they're all yelling down there, and I can hear a bell ring. Do they always yell like that at a fight?'

"I used to go to all the boxing matches I could, here in New York, and in Schenectady and Troy. I saw the Corbett-McCoy match," he announced proudly.

"Are these good phones?" he asked. They were. Very good.

"When I bought them at the store I tried them, the clerk made me put them on, and I heard great, on a set that had three bulbs in it; you know, amplifiers. I could hear everything just as plain."

"We get a great deal of pleasure out of this little radio." There was gratitude in Mrs. Welch's voice, which then lowered to a whisper to say: "I only wish I could give him a real good set for Christmas, one he could hear over himself, loud."

Mr. Welch had been searching in the sideboard, and now drew forth a neat little box of stained oak, with a vertical piece rising from the center, and in that a big opening.

"I thought I had it when I made this," he said regretfully. "You see what it is. I was going to put a phone on this side, in the hole, and right next to it on the other side I put my Mears, something like the Acousticon, but it didn't work, and I couldn't hear a thing. Yes sir, I thought I had it then, but it didn't work, and the Acousticon didn't either.

"I seldom go to concerts or the theater because I don't hear well enough unless I'm right close up to the stage. But I heard the music perfectly over the radio with two stages of amplification that day when I bought those phones.

"You know, they say that one of the best things for the deaf is exercise for the ear. It's like a muscle, if you don't use it, it dries up. The ear I wear my Acousticon on is much better than the other, and maybe if I could hear in both ears by radio they would get better and better."

American Broadcasting Is Permanently Recorded in England

Program of WDAF, Kansas City, Mo., and Signals of Amateur Station 1 CMK, Holyoke, Mass., Received in London with Sufficient Strength to be Successfully Recorded on a Dictograph Cylinder

ONLY one month after the first confirmed reception of American broadcasting in Europe, such great progress had been made that a dictograph record was taken in London of the program from an American broadcasting station, WDAF, of Kansas City. This cylinder has been secured by THE WIRELESS AGE and if it arrives in this country in reproducing condition it will be rebroadcast by WJZ at Newark, N. J., so that American radio fans will be able to hear exactly how American programs are being received in England. This dictograph cylinder marks a tremendous stride by American broadcasting, and already has taken its place as one of the great historical exhibits in the radio industry.

It was made by J. H. D. Ridley, of Burndept, Ltd., of London, on the morning of December 21. On the same cylinder, separate from the broadcasting record, are dots and dashes transmitted by amateur station 1CMK operated by Mr. P. H. Bloom, of Holyoke, Mass., and the wax impression therefore records the double triumph of American broadcasters and amateurs during December. The radiogram from our London correspondent states that Ridley "Gets WJZ regularly on two steps of radio frequency detector and one step of audio frequency." Ridley is a radio expert who is well known in England and he is of course expected to be the leader in the reception of American programs there.

However, he is by no means the only Englishman, nor the only European for that matter, who listens in nightly to the voices from America. So far THE WIRELESS AGE has received reports of over one hundred Britons having heard WJZ, and about a dozen Frenchmen likewise have heard from this powerful one-thousand-watt transmitter in Newark. Listeners in the United States probably have noticed that during the past few weeks the announcer at Newark states, "This is station WJZ, the Radio Corporation-Westinghouse international broadcasting station at Newark, New Jersey, U. S. A.," the addition of "U. S. A." being made in recognition of the now firmly established international character of this famous station.

Listening for voices from across the sea—radio enthusiasts gathered in Selfridge's store in London during the first and unsuccessful attempt to listen to American broadcasting. Since then, experience has brought complete success

In hearing not only WJZ but several other American transmitters, including WGY, WDAM and others, the listeners abroad use receiving apparatus of much the same type as is found in thousands of American homes, no extraordinary installations being necessary. Detailed reports show that while radio frequency amplification is the most uniformly successful across the Atlantic Ocean, the standard two stages of audio frequency amplification are sufficient on many favorable mornings in Europe, while one step at times is effective, and one or two cases have been reported in which a single detector bulb has been sufficient.

The antennas used by the European listeners are just as varied as in the United States and include loops whose directional characteristics recommend themselves to many experimenters with radio frequency. In outside antennas the taste of the European runs from the simple single wire to the more complex arrangement of many wires and counterpoises that is in favor among transmitting amateurs.

HEARD PALLOPHOTOPHONE

One of the Englishmen, who uses a two-foot loop with a Marconi eight-tube set, on Christmas morning picked up the program from WGY at Schenectady, hearing through a loud speaker the speech of Secretary Denby, and the program of Christmas carols. The speech of Secretary Denby, it will be remembered, was recorded about ten days previously in Washington, the General Electric engineers using their new film recording device known as the Pallophotophone. This film, run through the reproducing machine attached to the broadcasting transmitter at Schenectady reproduced the Secretary's voice perfectly, and he was heard over a wide section of the United States and in Europe as well.

In France, where broadcasting has just begun and where comparatively few persons are equipped with apparatus, as the Governmental ban on amateurs only recently has been lifted, not so many report hearing American broadcasting. WJZ, however, is being

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England Impatient for Broadcast Programs

Deliberate Officials Hold Up Transmission While They Study Details—Elaborate System Being Planned—Public Now Limited to Half an Hour Daily From the Eiffel Tower

By Abby Putnam Morrison

IN America there is an impression that English broadcasting is far advanced. Back in July it was thought that their programs had been started and that that branch of radio was progressing rapidly. In fact many people now believe that the English must have caught up and equalled America's efforts in quantity and quality. False rumors of the broadcasting of Princess Mary's wedding service had been spread and eager attempts were made to listen in for a chance organ strain which might possibly be carried across the Atlantic. As a matter of fact, broadcasting cannot be said to have begun in England.

One reason for England's tardiness may be the law which forbids importation of foreign radio goods and eliminates foreign competition for two years. The English companies and government feel, therefore, free to take their time and need not rush uncomfortably in preparing for perfect production. They have only home competition.

In order to prevent unpleasant competition and dissension, the broadcasting from the eight stations to be built probably at such cities as London, Newcastle, Glascow, Cardiff, Plymouth, Birmingham, Manchester and Aberdeen will be financed and operated by an amalgamation of a number of companies into one broadcasting company, entirely separate from each member's business of making and selling receiving and transmitting apparatus. This company will pay for the erection of the eight stations and any small company which wishes may join it. The Post Office takes a tax of 10 shillings sixpence or about $2.50 from each buyer of a receiving set, in return for a license which he is compelled to have. These licenses will be given only for receiving apparatus made by the members of the broadcasting company, and the instruments must conform to certain technical standards.

No inspection of the receiving station will be made as the name of the maker will be registered in the Post Office as already examined and approved. Amateurs who build their own sets or who have already bought foreign sets before the radio laws went into effect will not be interfered with. Few sending sets are licensed as the examination for a license is very strict with the necessity of reception of code at twenty words a minute and a thorough technical knowledge. The revenue required for providing the broadcasting service will be derived partly from the manufacturers forming the broadcasting company and partly by a proportion of the annual license fee of $2.50 paid by each buyer to the Post Office.

The sets authorized by the government are not permitted to receive on higher than 440 meters, the amateur wave. If desiring to receive higher waves one must buy loading coils and attach them to the outside of the set. For the more sentitive multi-tube sets tuned to higer wave lengths one must apply to the government for an experimenter's license, swear that one will not divulge what is heard, and wait patiently to receive permission to receive.

Up to the present time the only really good broadcasting which one can listen to regularly in England and Scotland is that done by the Eiffel Tower in Paris on a 2,600-meter wave. During a half hour every day, at five o'clock in the afternoon, orchestra, instrumental, and vocal music, mostly mechanical, and weather reports in French, is sent to the outlying districts and countries bordering France.

The people in both England and Scotland wonder vaguely what broadcasting is and in some cases are made cautious by the exaggerated accounts of the interference experienced in America. Some who have bought receiving sets are still waiting impatiently to hear something in them. The "Daily Mail" took over the broadcasting station at The Hague in Holland which formerly sent out music Sunday afternoons from three to five o'clock on a wave length of over 1,000 meters. There was expectation of fine things, but all were disappointed. Some discouraged amateurs felt relieved, however, after their first unproductive attempt to receive this broadcasting when they read in the next morning's paper that trouble at the station in Holland had prevented the broadcasting of the program. This continued to be the case, so that the only broadcasting be-

Modernity a la mode—an automobile, exhibited at the first London radio show, fitted with a tea service and a radio receiver, the latter using as an antenna a coil of wire wound around a parasol. No wonder the crowds were thick

sides that of Paris is an occasional test of the Marconi Company from its small experimental station at Chelmsford, 40 miles from London. For any other reception of the human voice, besides an occasional amateur, one can listen all day, tuned to 900 meters, to the instructions of Croydon Aerodrome to their airplanes crossing the Channel to Paris. The reply from the plane is sent on 180 to 200 meters. The fact that there is so much of this sort of government work on land and sea and because England is so small makes it necessary to limit the amateur.

A suggestion that the eight broadcasting stations, to be erected, would work better on 1,500-1,600 meters or possibly 300-450 meters with 1½ kw. power, has not yet been decided and experiments are being carried on to determine the best arrangement. The broadcasting company is organizing a special bureau which will book programs for months ahead. Performances will be given every day from five until eleven P. M. To prevent interfering with each other probably each station will be given one day a week. The London station will be the first to be erected and perhaps Cardiff will come next ending with the Scotch stations.

Regulations for British Broadcast Receiving Sets

The British Broadcasting Company has issued for the information of the English trade, a copy of the regulations decided upon by the British Post Office authorities for the construction of receiving sets. The regulations are as follows:

1. That all types of broadcast receivers may be constructed for the reception of signals of any wave length.
2. That the apparatus shall be so constructed that it is difficult to change the arrangement of the circuits embodied in the design by means of external connections.
3. The following units, each of which must consist of apparatus assembled, connected and mounted in a single container, shall be approved:—
   (a) Combined tuner and rectifier (detector).
   (b) Combined tuner, high-frequency amplifier and rectifier (detector).
   (c) Audio frequency amplifier (of tube or other type).
   Any combination of two or three of the above separate units (a), (b) and (c) will be allowed.
4. No receiving apparatus for general broadcast purposes shall contain a tube or tubes so connected as to be capable of causing the aerial to oscillate.
5. Where reaction is used on to the first receiving circuit it must not be adjustable, but must be fixed and incapable of causing oscillation.
6. Where reaction is used between a second or subsequent tube onto the anode circuit of a valve connected to the aerial, and there is no specifice coupling provided between the first receiving circuit and the first anode circuit the reaction may be adjustable.
7. Tests of sets will be made on two aerials, one 30 feet long and the other 100 feet long.
8. The sets will be tested for the production of oscillations in the aerial and for interference properties with a factor of safety, i. e., increasing the high tension battery by about 30%, changing tubes, etc., but not by altering any soldered connections.
9. The Postmaster-General must be satisfied that sets containing reaction can be reasonably repeated with consistent conditions.
10. After approval the type will be given a Post Office registered number and makers must see that the sets fulfil the non-interfering conditions before they are sold. All sets sold under the broadcast license shall bear the registered trade mark of the broadcasting company and the Post Office registered number.
11. The unit or set approved as the pattern instrument of a type shall be retained without alteration by the maker. The Postmaster-General shall have the right at any time to select any set of an approved type for test to see that the set is reasonably similar to the approved pattern. In the case of sets of an approved type employing reaction being found to oscillate the aerial the Post Office may cancel the authorization of the future sale of that type. No change in the design of any set or unit may be made after approval without the previous sanction of the Postmaster-General.

According to the present plans, only sets filling the above requirements and approved by the Post Office will be salable. By "reaction" the English mean what is generally known as "regeneration" in America.

Radio Aids Astronomers

SHIP and land stations that may have heard special time signals on long waves from NSS, the U. S. Navy transmitter at Annapolis, Md., during the recent solar eclipse in the Indian Ocean, may cease wondering what they were for. The signals were sent especially for the various astronomical expeditions that set up their instruments in Australia and at other points in the path of the eclipse. The expeditions planned to make observations to prove or disprove the much-discussed Einstein theory, and for that purpose it was necessary to have the most accurate time possible to science. In addition to calculating the time from their own observations of the stars, each expedition also desired to check its work by radio time signals from NSS. Special signals there were sent on 17,145 meters for the astronomers.

Madame Tetrazzini, the famous coloratura singer and opera star, was a visitor at the recent London radio show, and purchased a de luxe model Burndept receiver for her personal use

"I THINK the time is coming when we of the movies will be doing our acting in front of something or other and the reflection of it will be sent into the homes by radio"

Dorothy Gish

The Vision of a Film Star

Dorothy Gish

By Paul S. Gautier

IT is difficult to conceive of any connection between the movies and and radio. Off-hand one might say that this is rather discouraging. Not so. Every once in a while a dominant figure of the motion picture world flits across the radio domain, and leaves a vibrant message in the ears of the eagerly listening public.

So it was with the "Orphans of the Storm"—Dorothy and Lillian Gish. (This story concerns Dorothy alone, but to separate their names would be as cruel as to take a knife and cleave a pair of Siamese Twins.)

Both these stellar lights of the silent drama, to which they have contributed their great talents, have mingled a bit with radio. Both have broadcast from stations in various parts of the country. Both have given their messages through the air. Lillian usually is the spokesman for both, but radio doesn't follow precedent, and so Dorothy was interviewed for the purpose of this article.

Dorothy is two years younger than Lillian. Both are blondes, but Dorothy, as you well know, wears a jet black wig for her pictures.

They Are Country Girls

The girls were born and raised in a small town in Ohio. They knew all the simple, healthful joys of country lassies. Hay rides were their particular delight, and friends of the two who grew up with them and went to school with them, told the writer that it is impossible to think of two more happy, contented, natural "kids."

Of course that is why they have been so phenomenally successful in playing such *roles* for the motion pictures. Actors and actresses know that when they are given new parts they must "study" them hard—and not the least of their study is an investigation into how people in real life, of the type they are to portray, walk and talk and look and think. Some of the most successful characterizations on the American stage, or any stage, are directly the result of such research work on the part of the actor, who may have gone into strange places and taken very distasteful jobs in order to be able to understand and thereby make his audiences understand the character he has to portray.

So the Gish sisters in their work have had back of them not this kind of hard-won experience, but what they freely admit was the happiest portion of their lives, and in their acting they frequently find themselves but repeating episodes from their girlhood, when they were still going to school.

During these early years of schooling there often arose occasions when amateur theatricals were given, and always Dorothy and Lillian were drafted first for the most difficult roles.

When they left school they did so to go on the stage, and finally their unusual talents brought them to the attention of D. W. Griffith, and they entered movies.

Dorothy likes to tell about their experiences in London during the war. They were over there with a company to make a picture. With their mother, who has been with them constantly, they lived in the Savoy Hotel. Eight air raids were made by the Germans during their stay in London.

"Early one morning," Dorothy said, "we were told by an employe of the hotel that there was to be anti-aircraft practice that morning and not to be frightened if we heard firing.

"Soon afterward we heard the rap-tap-tap of guns off at a distance, and naturally we thought it was practice firing. But looking out of a window, we saw a flying wedge of planes coming right for the hotel. They were German planes, and as they flew along they dropped bombs.

Waiting for A Bomb

"Now, I can think of many more pleasant things to do than to wait in a hotel for a bomb to drop on it and send you into kingdom come. Yet that is what we did during eight raids, first daylight raids and then those at night. They were the most terrifying experiences I have ever had.

"One bomb dropped within a hundred yards of our hotel. It has completely unnerved our mother, and has left me far from serene. Possibly that explains my absolute fright when attempting anything away from the motion picture world. I confess I was badly scared when I spoke over the radio. It sort of suggested that unseen terror to which we had been subjected over in London, waiting to be blown into bits, in a hotel that was absolutely dark.

Speaking By Radio

"I have been asked to speak over the radio again, but as much as I wanted to, I had to refuse, because I haven't the confidence in myself. I sometimes wonder if it was the war experience, or just my natural self. Radio is all so new. I think the time will come, probably in a hundred years or so when I have grown a bit older, when we of the movies will be doing our acting in front of a something or other and the reflection of it will be sent through the air and into the homes via radio.

"That is a long ways off, but nothing is impossible."

Whenever Dorothy and her mother want to get away from the turmoil of the world they go away and seclude themselves up in a cozy little home in the mountains. There they are rigging up a radio set of sufficient range to bring them in touch with the outside world, if they choose to listen.

The reason we omitted the name of Lillian is because Lillian now is married. The country read about her elopement with James Renny, the actor, at the same time that her chum, Constance Talmadge, also "I do'd" her way out of the simple waters of the single life into the whirlpool of the matrimonial rapids.

Dorothy reports that Lillian is very happy, and this information we pass along to her many friends among the radio public, who were so grateful for her broadcast words of several months ago.

Distant Broadcasting Stations Heard

Broadcasting fans daily surprise themselves and others by reaching out across hundreds of miles by a turn of the wrist. Often the most simple bulb equipment will produce astonishing results, as reported below. What have YOU done?

PERKINS BENNEYAN, Fresno, Cal., has been obtaining wonderful results on one tube, and says he wants to "tell the world" about them in these columns. Here they are:

		Miles
WSB	Atlanta, Ga.	2,025
KYW	Chicago, Ill.	1,775
WCX	Detroit, Mich.	2,000
WLAG	Minneapolis, Minn.	1,500
WDAF	Kansas City, Mo.	1,400
WBAP	Fort Worth, Tex.	1,325
WHB	Kansas City, Mo.	1,400
CFCN	Calgary, Alta., Canada	1,100
PWX	Havana, Cuba	2,500
WGY	Schenectady, N. Y.	2,500
WGM	Atlanta, Ga.	2,025
WDAJ	Atlanta, Ga.	2,025
WOC	Davenport Ia.	1,600
WWJ	Detroit, Mich.	2,000
WOI	Ames, Ia.	1,475
WFAA	Dallas, Tex.	1,350
WFAT	Sioux Falls, S. D.	1,325

EDWARD J. MALONEY, Troy, N. Y., using a UV 201 tube as a detector in a regenerative circuit, has heard the following stations:

		Miles
WOC	Davenport, Ia.	1,000
WDAP	Chicago, Ill.	875
WZAP	Chicago, Ill.	875
WHAS	Louisville, Ky.	850
WLK	Indianapolis, Ind.	650
WLW	Cincinnati, O.	600
WJAX	Cleveland, O.	550

WM. F. ELLIOTT, Red Bank, N. J., thought himself lucky to get Schenectady and Pittsburgh until he made a change in his set, after which the following stations were heard:

		Miles
KYW	Chicago, Ill.	700
WGM	Atlanta, Ga.	725
WHB	Kansas City, Mo.	1,065
WIZ	Cincinnati, O.	525
WOC	Davenport, Ia.	850
WSB	Atlanta, Ga.	725
WDAF	Kansas City, Mo.	1,065
WDAJ	College Park, Ga.	740
WDAO	Dallas, Tex.	1,325
WDAP	Chicago, Ill.	700
WFAJ	Asheville, N. C.	580
WHAS	Louisville, Ky.	600
WIAB	Rockford Ill.	775
WLAG	Minneapolis, Minn.	1,015
WAAS	Decatur, Ga.	690
WLK	Indianapolis, Ind.	600
KSD	St. Louis, Mo.	850
WOI	Ames, Ia.	1,000
WMAQ	Waterloo, Ia.	925
WIAO	Milwaukee, Wis.	715

C. GORDON SPALDING, Windsor, Vt., operating 1ABP, has heard 93 stations in two months. One night he picked up 35 different ones. Some of the distant broadcasters were:

		Miles
KYW	Chicago, Ill.	800
WDAP	Chicago Ill.	800
WBAP	Fort Worth, Texas	1,500
WOC	Davenport, Iowa	950
KOP	Detroit, Mich.	600
WLW	Cincinnati, O.	700
WSB	Atlanta, Ga.	910
WGM	Atlanta, Ga.	910
WJAX	Cleveland, O.	700
WWJ	Detroit, Mich.	600
WHAQ	San Juan, Porto Rico	1,600
WCX	Detroit, Mich.	600
WHB	Kansas City, Mo.	1,250
WLK	Indianapolis, Ind.	750
WIAA	Waupaca, Wis.	800
WHAS	Louisville, Ky.	850
WAAS	Decatur, Ga.	900
WDAJ	College Park, Ga.	900
WDAF	Kansas City, Mo.	1,250
KSD	St. Louis, Mo.	1,000
WOK	Pine Bluff, Ark.	1,100
PWX	Havana, Cuba	1,500

HARRY M. WRIGHT, East Braintree, Mass., uses a UV 201 tube and takes great pleasure in listening while he works at his engraver's desk. He has heard the following:

		Miles
WJAX	Cleveland, Ohio	550
KOP	Detroit, Mich.	600
WWJ	Detroit, Mich.	600
WGU	Chicago, Ill.	850
KYW	Chicago, Ill.	850
WDAP	Chicago, Ill.	850
WSB	Atlanta, Ga.	950
WGM	Atlanta, Ga.	950
WOC	Davenport, Ia.	1,000
KSD	St. Louis, Mo.	1,050
WBAP	Fort Worth, Tex.	1,600
PWX	Havana, Cuba	1,475

CARL J. RAYBURN, Heights, W. Va., uses a single-circuit receiver and one UV 200 bulb, and has heard broadcasting in 22 states, Canada and Cuba. Part of his long list is as follows:

		Miles
PWX	Havana, Cuba	1,350
DN4	Denver, Col.	1,280
KDZU	Denver, Col.	1,240
WOAI	San Antonio, Tex.	1,078
CJCG	Winnipeg, Man., Canada	980
WBHP	Fort Worth, Tex.	980
WEAY	Houston, Tex.	960
WFAA	Dallas, Tex.	920
WNAD	Norman, Okla.	920
WMAB	Oklahoma City, Okla.	920
WBL	Anthony, Kans.	920
WAAP	Wichita, Kans.	855
WKAC	Lincoln, Neb.	820
WAAC	New Orleans, La.	780
WNAL	Omaha, Neb.	770
WLAG	Minneapolis, Minn.	750
WJAP	Duluth, Minn.	750
WEAP	Mobile, Ala.	690
WMAJ	Kansas City, Mo.	690
WDAF	Kansas City, Mo.	690
WHB	Kansas City, Mo.	690
WMAK	Lockport, N. Y.	690
WGF	Des Moines, Ia.	660
WOS	Jefferson City, Mo.	550
WIAS	Burlington, Ia.	540
WHAD	Milwaukee, Wis.	540
WKN	Memphis, Tenn.	520
WGY	Schenectady, N. Y.	503
WGI	Medford Hillside, Mass.	632
WBZ	Springfield, Mass.	575
WDAN	Shreveport, La.	805
WGAJ	Shenandoah, Ia.	750
WEAH	Wichita, Kans.	855
WCN	Worcester, Mass.	575
WDAD	Lindsborg, Kans.	860

ALBERT PATTILLO, Wichita Falls, Texas, uses only one tube to hear the following stations:

		Miles
WLAG	Minneapolis, Minn.	850
WOC	Davenport, Ia.	700
WWJ	Detroit, Mich.	1,100
KSD	St. Louis, Mo.	600
KYW	Chicago, Ill.	800

GROSSMAN TURNER, Carrollton, Mo., has heard 83 stations on his home-made set, some of which are:

		Miles
PWX	Havana, Cuba	1,400
WKAQ	San Juan, P. R.	1,500
KHJ	Los Angeles, Cal.	1,450
WJZ	Newark, N. J.	1,100
WGY	Schenectady, N. Y.	1,100
WEAF	New York, N. Y.	1,100
WGR	Buffalo, N. Y.	800
KFAF	Denver, Col.	650
KLZ	Denver, Col.	650
DN4	Denver, Col.	650
KZN	Salt Lake City, Utah	1,000

C. M. NORTH, Malden, Mass., uses a 35-foot indoor antenna and with two steps of amplification does excellent distance work. Part of his list follows:

		Miles
WSB	Atlanta, Ga.	950
WGM	Atlanta, Ga.	950
WDAJ	College Park, Ga.	975
WKAN	Montgomery, Ala.	1,100
KYW	Chicago, Ill.	850

FRANK D. BAKER, in submitting the attached list, says he had to sit up until 1 o'clock in the morning to hear some of these stations, but "it was worth it!"

		Miles
DN4	Denver, Col.	950
KDYS	Great Falls, Mont.	1,100
KFAF	Denver, Col.	950
KFAY	Medford, Ore.	700
KFC	Seattle, Wash.	1,200
KFFE	Pendleton, Ore.	900
KFZ	Spokane, Wash.	1,200
KLZ	Denver, Col.	950
KZY	Portland, Ore.	975
KSD	St. Louis, Mo.	1,700
KZN	Salt Lake City, Utah	625
WBAP	Fort Worth, Tex.	1,275
WSB	Atlanta, Ga.	2,000
WGM	Atlanta, Ga.	2,000
WFAA	Dallas, Tex.	1,300
WOAA	Ardmore, Okla.	1,275
WOI	Ames, Iowa	1,600
WOAI	San Antonio, Tex.	1,300
WPA	Fort Worth, Tex.	1,275
WWJ	Detroit, Mich.	2,050
WOC	Davenport, Iowa	1,800
KGW	Portland, Ore.	975
WJAD	Waco, Tex.	1,300

RALPH C. GARDNER, Fort Wayne, Ind., heard the following stations in one evening and did not sit up after 1 a. m. either:

		Miles
WKN	Memphis, Tenn.	500
WDAF	Kansas City, Mo.	500
NAA	Arlington, Md.	500
2XI	Schenectady, N. Y.	650
WBL	Anthony, Kansas.	750
WJZ	Newark, N. J.	600
WEAF	New York, N. Y.	625
WBAP	Fort Worth, Texas.	900
WGM	Atlanta, Ga.	500
WNAC	Boston, Mass.	700
WSB	Atlanta, Ga.	500
WDAJ	College Park, Ga.	500
KFAF	Denver, Colo.	1,100
DN4	Denver, Colo.	1,100
CHBL	Calgary, Alberta, Canada.	1,600

FRANTZ LIESE, Santa Monica, Cal., is doing some good distance reception work with a Westinghouse RC set attached to a Dubilier Ducon as an antenna.

		Miles
KDY	Salt Lake City, Utah.	600
KZN	Salt Lake City, Utah.	600
KLZ	Denver, Col.	800
KFAF	Denver, Col.	800
WBAP	Fort Worth, Tex.	1,200
WHB	Kansas City, Mo.	1,400
WFAA	Dallas, Tex.	1,250
KSD	St. Louis, Mo.	1,650
WWJ	Detroit, Mich.	2,000
WGM	Atlanta, Ga.	2,000
WCX	Detroit, Mich.	2,000

CHARLES L. CORDON, Bridgeport, Conn., has heard the following on one tube:

		Miles
KYW	Chicago, Ill.	800
WDAP	Chicago, Ill.	800
WLW	Cincinnati, Ohio.	650
WSB	Atlanta, Ga.	850
WNAC	Boston, Mass.	950
WDAJ	College Park, Ga.	850
WDAF	Kansas City, Mo.	1,150
WOC	Davenport, Iowa.	900
WGF	Des Moines, Iowa.	1,000
WBAP	Fort Worth, Texas.	1,450
PWX	Havana, Cuba	1,400
WHAS	Louisville, Ky.	700
WWJ	Detroit, Mich.	600
WHAL	Lansing, Mich.	625

S. W. TYMESON, South Lancaster, Mass., is having very pleasing results with his receiving set, using a single UV 200 tube, as the following list demonstrates:

		Miles
WHAS	Louisville, Ky.	800
PWX	Havana, Cuba	1,400
WHB	Kansas City, Mo.	1,215
WBAP	Fort Worth, Tex.	1,500
KSD	St. Louis, Mo.	1,000
WSB	Atlanta, Ga.	900
WGM	Atlanta, Ga.	900
WOH	Indianapolis, Ind.	900
WOC	Davenport, Ia.	1,000
KYW	Chicago, Ill.	800
WDAP	Chicago, Ill.	800
WLW	Cincinnati, O.	650
WLK	Indianapolis, Ind.	650
WDAJ	College Park, Ga.	850
WEAO	Columbus, O.	650
WCAF	Rogers, Mich.	625

By S. R. WINTERS

EACH day the announcers in scores of broadcasting stations read market news, such as this:

"The following is the report on hogs in the Chicago market: Receipts, 9,000; holdovers, 11,286. The market closed active, steady with yesterday's close. Bulk 220 to 260-pound butchers, eight dollars to eight oh five. Bulk 140 to 180-pound averages, eight dollars ten cents to twenty cents, top eight dollars twenty.

"Cattle: Receipts, estimated, 1,500. Beef steers unevenly twenty-five cents to seventy-five cents lower, in-between grades reflecting most decline. Best matured steers, thirteen dollars. Lower grades of beef cows and heifers, canners, cutters, bulls and veal calves about steady. . . ."

Radio pours forth the course of meats, live stock, grains, oils, cotton, potatoes, butter and eggs, milk and cream. And then follow weather reports and predictions, sometimes, too, invaluable storm warnings.

What is back of all this? Directly, there is the broadcasting studio, but back of all the United States Department of Agriculture, with its immense organization, spreading over all parts of the country, reporting by telegraph to Washington, and in some cases by radio telegraph. The quotations pour into the Department from all directions, are collated and analyzed quickly, and then distributed. Once they were sent by land wire, but now radio is relied upon as the quickest way of getting immediate country-wide circulation. The first step in broadcasting market news is taken when a messenger walks—or runs—from the offices of the Department of Agriculture in the Bieber Building, carrying the reports to the radio operator in the Navy Radio Office in Potomac Park. Here it is relayed to the great transmitters in Arlington, or Radio, Va., whence a radio-telegraph operator, by pounding a telegraph key for approximately three hours a day, circulates the valuable information in all directions in a radius of hundreds of miles of Washington.

The powerful radio-telegraph station of the Navy Department at Great Lakes, Ill., located as it is in the corn-belt section of the country, is literally a reservoir of helpful information for tapping in behalf of the corn growers and live stock producers of the Middle West. For approximately six hours each working day a radio-telegraph operator at Great Lakes hammers a telegraph key in sending forth data relating to live stock, quotations on cabbage, prices of hay, vegetables, and what not.

From a modest effort covering an area of 75 miles, experimentally begun on December 15, 1920—just over two years ago—the crop and market-reporting service by radio telegraph and telephone has developed into a gigantic project which well-nigh touches every state in the Union. The radio efforts of the Bureau of Agricultural Economics of the United States Department of Agriculture are making available its service to 32,000,000 farming folk. The leased land-line telegraph system, even with its twenty-one branch offices and 3,300 miles of operating telegraph wires, can only hope to reach a small percentage of the interested population, that which is located in congested centers. Radio is a hurry-up messenger of dissemination which radiates in all directions, and the most isolated places of the continent do not escape it. The farmer far removed from the centers of population is reached as easily as the big city.

"We now have a radio-telegraph blanket that can be tapped anywhere east of the Rocky Mountains," is the graphic phrase employed by J. C. Gilbert, market extension specialist of the United States Department of Agriculture. He refers, of course, to the comparatively recent innovation of the United States Navy Department in disseminating crop and market information by radio. The conditions and prices of farm commodities, in terms of dots and dashes, are being circulated through the ether at all times of the day between 8 A. M. and 6 P. M.

However, the information emanates from Arlington and Great Lakes in the form of Continental telegraph code—dots and dashes, if you please. In such guise, the widespread use of marketing data cannot be hoped for. Obviously, one cannot expect the farmer who is wedded to his plow and mule or even to the more modern agricultural machinery, to perform the rôle of radio operator, when dots and dashes must be interpreted into intelligible words. Herein lies the opportunity of the state agricultural college, state marketing bureau, newspaper, bank, business firm, or individual, and scores have seized this

chance to copy the market reports and re-broadcast them by radio-telephone to the surrounding farming community. The farmer easily adjusts a pair of head telephones to his ears, turns a knob or two on his receiving set, and then "listens in."

The example of one broadcasting station that dedicates itself to the dissemination of this market information will illustrate strikingly what the new radio net means to the immense agricultural population.

Recently, an anniversary occurred in the history of the St. Louis University, a Missouri educational institution. It was not the recurrence of the day on which the college was founded, nor was it an occasion for dedicatory ceremonies because of the opening of a new building. Since the affairs of this institution of learning are administered by a Jesuit priest, one might logically conclude that religious rites prompted a celebration of this particular day. These versions, as plausible as they may seem, are in error. The event signalized by the St. Louis University is implied by one word—*Service*. For twelve months, day in and day out, the farmers in Eastern Missouri and Central and Southern Illinois had been served crop and market reports by radio telephone. The end of the first year of this work would not be passed by without fitting recognition.

Somebody has aptly said that culture in the future may be expressed in terms of watts. While Father George E. Rueppel, the Jesuit priest who presides over St. Louis University, doubtless would not subscribe to this extreme viewpoint, he probably favors the revision of college yells so as to emphasize the constant utterance of the letters "WEW." These are call letters of the 100-watt wireless transmitting station, designed and fashioned by engineering skill at the college, from which during every work day in the calendar year farmers contiguous to the campus may "listen in" upon the quotations of cabbage, the fluctuating prices of beef, the demands for hay in the market places, and know the daily valuation of fruits and vegetables. St. Louis University is an outstanding example of a radio-telephone transmitting station whose crop and market-reporting service extends over a considerable period of time and without interruption. Its performances occupy a commanding position.

The example of the St. Louis University, by reasons of its pioneering and consistent activities in the dissemination of crop and market reports, is characterized by aspects which entitle it to marked recognition.

Hearing the city's news, culture and markets — the radio-using farmer

However, from the broad viewpoint of rendering service in distributing news relating to farm commodities, the lettered combination "WEW" is legion—figuratively speaking. The call letters, of course, vary in each instance, but the character of service rendered serves a unity of purpose, namely, the instantaneous and widespread dissemination of crop and market reports. Government bureaus, state agricultural colleges, state marketing agencies, educational institutions, newspapers, large electrical supply establishments, air mail stations of the United States Post Office Department, banks, business firms, and individuals, are co-operating in a master effort to blanket the United States with the crop and market news service. The air mail stations, identified with the distribution of data relating to farm products since the inception of the radio crop and market news service, continue as a useful link in the chain. With the exception of the Washington station, however, radio telegraph is the medium employed. North Platte, Rock Springs, Elko, Reno and Omaha are the air mail stations thus identified with the national crop and market reporting service. Omaha is the western terminus of the leased wire of the Bureau of Agricultural Economics, United States Department of Agriculture. The leased wire service and the air mail station at this point form the connecting links with the East and West. Moreover, the section west of the Rocky Mountains resolves itself into a unit for the development of a market news service. Representatives of the Department of Agriculture are maintained at San Francisco and Los Angeles, who are in touch with the local radio-telephone broadcasting stations. Highly essential crop and market developments in the East are transmitted by commercial land-line telegraph to these cities. The Federal Government does not anticipate that the radio-telephone will displace the leased wire system as a means of disseminating data on agricultural products, but the two will work in double harness, so to speak. The radio telephone, moreover, is characterized as a highly developed means of disseminating information whose life of usefulness is comparatively brief.

England Records American Broadcasting

(*Continued from page* 30)

heard there, and regularly. One radiogram from France reads as follows:

"Telephonie Wagon Jeanne Zoe recus par Perroux et Louis."

which translated means:

"Telephony WJZ received by Perroux and Louis."

Perroux and Louis are well-known radio experimenters, in Paris.

Another radiogram states that the same station was heard by Contant and still another that a group of amateurs at Orléans likewise had listened to the Newark programs. In still another case J. L. Luntley, who lives near Paris, picked up an American station, but was unable to get the call letters.

These are by no means all the cases in which broadcasting has crossed the sea, for American stations have been heard in the other direction, station WSB at Atlanta, Georgia, having been heard distinctly at Wailuku Island, Maui, in the Hawaiian group. WWJ at Detroit likewise has been heard on this same island.

To the south, as is well known, KDKA, the famous pioneer station in Pittsburgh, has been heard in various parts of South America and on ships at sea below the equator. WGY likewise has been heard there, having been reported by R. H. Redlin, wireless operator of the S. S. *Ardmore*, while the ship was in the harbor at Talara, Peru, four degrees and three minutes south of the equator, an airline distance of 3,325 miles. A report that WGY was heard at Hilo in the Hawaiian Islands has been received and is being verified. WGY also has been heard in France, the chief radio operator and other officers of the S. S. *America* having listened in while the ship was in dock at Cherbourg.

Enough was accomplished in December, the second month after American broadcasting began to be heard across the sea, to show that international broadcasting, only a few months previously considered but a dream of the hopeful idealist, is here, that it is in full realization, a practicality of modern science, a nightly accomplishment. The day is here and now when nation speaks to nation freely across the natural barriers that for ages have separated nations from each other and have prevented the easy exchange of their culture.

Radio and Fine Music

"THAT'S classical!" says Mrs. Smith. "That's something we ought to like." The inevitable effect of radio is to raise taste, appreciation, culture, understanding, intelligence everywhere

By Charles D. Isaacson

Percy Grainger broadcasting his remarkable talent to all listeners

OF course one who is lecturing can never tell what the other fellow is thinking. For all one knows, the listener is planning speedy murder, suicide or exit, or is berating himself for his stupidity in coming to hear such rubbish. There is always the possibility, however, that the auditor is enjoying the affair. Which is good.

Now a man who goes into a theatre or concert hall does so with his eyes open, more or less. If he is bored to death, or if he encounters something 'way over his head or beneath his notice, he must admit he knew what he was doing, even if he followed the selfish billboards or the advice of a misinformed friend. But it is quite different with radio. It is somewhat of a blind bargain. If the gentleman from the Society of Mechanical Engineers is billed to talk on metallurgy, and after him Mme. Onkdedonk is to sing grand opera, and she is to be followed by the Wee Willie Winkee Jazz Choral Society, there's no way for the audience to exercise preferences—to any considerable degree. So whatever the family encounters on the air, is no fault of their own, at all. . . . Oh, no, no, I am not criticizing the programs; methinks the public is being treated pretty nicely—pretty? Why, almighty well! But oftentimes some of the crowd don't know a good thing when they meet it. They frequently learn in time to understand, a few never grasp the ridiculously simple solution to the riddle. But most everybody in the long run recognizes the worthy and the important, if it is only by instinct.

Let us, for a brief moment, think of the high class musical offerings which have become so essential a part of the broadcasting programs — the concert groups and their classic numbers, the grand opera presentations, the symphony concerts. Most of the people "out front" — the audience — know when it is very good, even if they don't get as much excited over it as they do at the latest jazz. "That's classical!" says Mrs. Smith. "That's something we ought to like." From the way some talk to me, I'm led to believe there's nothing enjoyed quite so much as a genuine recital program.

I like to think of the various types of humanity at the radio receiving sets.

Here are some dyed-in-the-wool musicians. They are thinking of the purely artistic phase of music—art for art's sake, mechanical and interpretative perfection. They admire the miracle of the radio, but are comparing the rendition with that of the greatest stars. They are uncompromising in their verdicts upon their own colleagues in the opera house—they are ever comparing the newcomers with the old international favorites. Although I am for music, and I devote my life to music, I say that Radio is not for Music—but Music is for Radio, which is for Humanity. I will explain that later before I put down my pencil.

Here are other types. Here are those millions who listen to music without any particular analysis of it, without being able to do anything noteworthy themselves. But they love what they hear. They are the people for whom radio is made. They do things by instinct, they accept opinions and move through existence without questioning the why and the wherefore of every light and shade of day and night.

They may have heard operas and symphonies, pianists and violinists in formal musical performances, they

The children are attracted to radio by its romance and magic. As they play and experiment, the culture of the world comes to their ears and they are educated without knowing it

may not have heard them . . . but here on the radio, what comes over the air seems deliciously refreshing and invigorating. The soft, tender tones of the violinist send peace and comfort to their hearts. The long, hard day's work which has exhausted and depleted their strength puts them in a particularly appropriate state of mind and body. They need and they recognize the tonic effects of this gentle, restful melody.

The husband from his work, the wife from her household duties, the sons and daughters from their long, exciting day—they listen and the violin caresses and solaces. The tense feeling of energy and struggle loosens, the nerves relax, the mind and body sink into a delicious state of content. Nothing else, this is beyond contradiction, nothing else does so much good for business men, the laboring class, everybody, as this fine music.

Here are other types—those who don't want anything but popular music and jazz, which belong in their place, but not to the exclusion of everything else. They are annoyed when a concert program is announced, but they hang on to the receivers—and against their will, through no fault of their own, these folks are led to listen to something of art. Something of art in their ears, and something more, and soon these types will change. The charm of the great song will find the responsive chord somewhere in every listener's breast some time.

This is the special wonder of radio. The broadcasting executives are particular not to send out anything which lowers taste and so the inevitable effect of radio is to raise taste, appreciation culture, understanding, intelligence everywhere.

When the symphony orchestra plays across the atmosphere to audiences who never before listened to the master works of the immortal composers as interpreted by the finest musicians of the day, the seed of better taste and culture is being widely sown, and admirably. They never entered the concert hall, these millions who now hear the sparkling and soul-reaching harmonies so temptingly played. A blind bargain, this radio, but one in which the fan generally wins out.

In typical American homes like this radio realizes at will the dream of father, mother and the children to some day take a trip to the big city and hear soul-reaching harmonies temptingly played in the concert halls

I said a little while ago that Radio is not for Music, but for Humanity. Musicians are too much for music, writers for literature, engineers for sciences, but it is more important that everything beautiful should exist for Humanity. Radio is gleaning from the arts and sciences the things which are going to aid Humanity to a lovelier, fresher, happier, healthier epoch.

The more good music that is sent by wireless, the finer the influence of the radio. Not everybody knows what is good, not everybody knows what is going to do him good. But it is true that the people at large are gaining in the truly important things of life, the more they hear of the best in music and the other arts. Beauty must be spread. Beauty must be made to serve the families of the world. Draw your radio sets close to you, and embrace them for their work done and their future possibilities.

Now here is the point where I may be able to be of some service to readers of THE WIRELESS AGE:

The possibilities of radio are what you make them.

When you hear an opera recital, that isn't the last of it, I hope. No, I know it isn't. I know that you are all keyed up to go to the opera house, to see the costumes, the scenery, follow the action, look upon the great artists in person, to mingle with the excited, enthusiastic music lovers. The radio telephone is the introducing medium. It says: "My dear friend, I want you to meet Grand Opera, and here is another dear friend I would have you know. Here is Symphony Orchestra. You two should know each other."

Radio is the beginning. Are you aware of this? And being aware, are you determined to see it through? Are you going to walk the long road of art and science, upon which radio is taking you such an appreciable distance?

Dear friends of the radio, it has been my joy to speak with you many times without seeing you, but I feel that you and your presence as surely as if you were in the room with me. I imagine that I can sense the thousands and thousands who are thinking "Ah, yes, this is something of fine art. When will I be able to possess it in its entirety?"

And now once again let us all congratulate ourselves that we are living today and that we are not part of that once-envied population of ancient Rome and Greece. We breathe, we laugh, we love—and we possess far greater miracles than all the mystics of Egypt ever dreamed about.

Lydia Lipkowska, world-famous prima donna, sang to multitudes of music lovers in all parts of the world, yet until she performed in the studio of WJZ she had reached only a comparatively few people in an audience "out front"

Sobre las Olas de la Plata

(Over the Waves of the River Plate)

By W. H. Howard

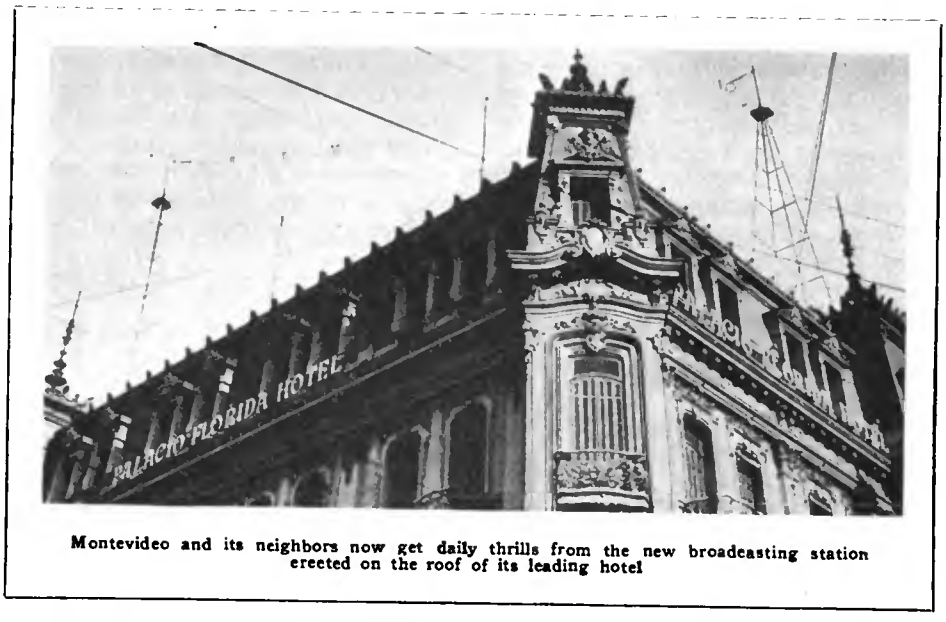
Construction Engineer

IF there is any one section of the world that seems especially suited for service from broadcasting stations it is that part of South America known as the "River Plate District." This, by reason of the nature of the land, and the grouping of its people, offers the possibility of easy covering by one or two stations of average power. It is now so served by radio and I consider it to have been a privilege to have had charge of the engineering, installation and first operation of these stations, located in Buenos Aires and Montevideo.

The River Plate District consists of the countries bordering on the banks of the River de la Plata, namely, the republics of Argentina, Uruguay and Paraguay. This is a distinct territory, separate from Brazil to the north, the west coast on the other side of the Andes, and from the small section "north of the line" or on the other side of the equator. The customs of the people, their industries, their aspirations and in certain cases the language, differ from those of the other section of South America. The land in general is flat, and offers no marked difficulties for radio transmission and reception. To the south the stations erected reach well into Patagonia, and before the radio energy has been weakened in that direction by distances and mountains, the full benefit of radio has been given to that section, as the further south you go the less civilized are the inhabitants.

To the west the broadcasting carries without difficulty as far as the Andes, that great natural barrier forming the boundary line between Chile and the east. To the northward the waves reach well into southern Brazil, finally dying to a whisper in the mountains there. They cover Paraguay, but as the population there is mostly Indian and is backward in progress, this is not so important as is the neighboring state of Uruguay.

The ideal position for a broadcasting station would at first appear to be in the center of this section, the waves thus covering all the territory in very good position. However, other considerations have a prepondering influence on the location. The greater percentage of the population of the River Plate is located near the mouth of the river, the great social centers being the city of Buenos Aires for Argentina and the city of Montevideo for Uruguay. The balance of the people likely to be interested in radio concerts are located along, or close to the banks of the river to the northwest of the river's mouth. And as the propagation of radio waves naturally follow along this broad valley, practically all the radio audience of the River Plate are reached by a station located in the city of Buenos Aires or Montevideo.



Montevideo and its neighbors now get daily thrills from the new broadcasting station erected on the roof of its leading hotel

It was finally decided to locate a broadcasting station in each of these cities as each country was positive in its desire for a station of its own. Thus an Uruguayan did not care to listen for music coming from Argentina any more than an Argentinian desired to manipulate the knobs of his receiver in order to listen to Uruguayan music.

The name "Buenos Aires" means literally "good airs"—and they are only a part of the programs that zip off the broadcasting antenna

In Buenos Aires the site finally decided upon as coming the nearest to meeting all requirements was the building located on the Avenida de Mayo, one of the most important streets in the city.

The first broadcast test of this station, one afternoon, though not prearranged, was heard by an amateur with an ordinary antenna and using a receiver with his detector bulb only, at a distance of 1,400 kilometers (840 miles) from the transmitter. A few weeks later this same amateur telegraphed that he heard the station every day as did many others in the same locality, and it was assumed that this might be definitely taken as daylight range over land for the station. The maximum range at night is not known, though reports have it that the station has been heard on the west coast of Chile and also as far north as Rio de Janeiro, which is about as far as can be expected of any broadcasting transmitter of 500 watts power.

One of the first considerations when erecting a radio station of any sort is to obtain the necessary permission for its erection and operation. This is an ordinary enough procedure in a country where there are rules and regulations covering the requirements of such stations, but in cases such as that of

the stations at Buenos Aires and Montevideo where the governments have not yet formulated regulations, the matter becomes a little more complicated. No one in either government wished to take the responsibility for permitting the construction of the station. It was not a consoling thought that after the station was built and operating, there might be some regulation imposed that would completely change the whole advantage of the construction. The obtaining of concessions of such nature is a matter of much delay, and inquiries in regard to the progress invariably met with the answer, "it is being studied." Finally, however, permission was obtained to start construction in Buenos Aires, on a date which was five days before the greatest sporting event of the year, in South America, the Firpo - Tracey heavyweight championship boxing match.

As demands were being constantly received from out-of-the-way places for the broadcasting of this fight, it was decided to undertake the broadcasting in spite of the short time available, and consequently a temporary antenna was constructed, the transmitter and generator outfit being hurriedly connected together. The broadcasting of this bout was a complete success, as was shown by the multitude of letters and telegrams which immediately began to pour in from all over Argentina and Uruguay.

The installation being of a temporary nature it was taken apart and started over again in permanent form. However, when about half completed the day of the inauguration of the new Argentine president drew near and the balance of the equipment was again put together in temporary form in order to broadcast the President's inaugural address. Again the broadcasting was a complete success, and telegrams and letters came pouring in, filled with felicitations. The whole section was reached and the modulation good, for all reported that they received every word. Here again, the radio was one-half to two hours ahead of the line telegraphs, depending upon the distance from the transmitting station. The newspapers in the distant cities had the material on the press before the confirming line telegrams arrived.

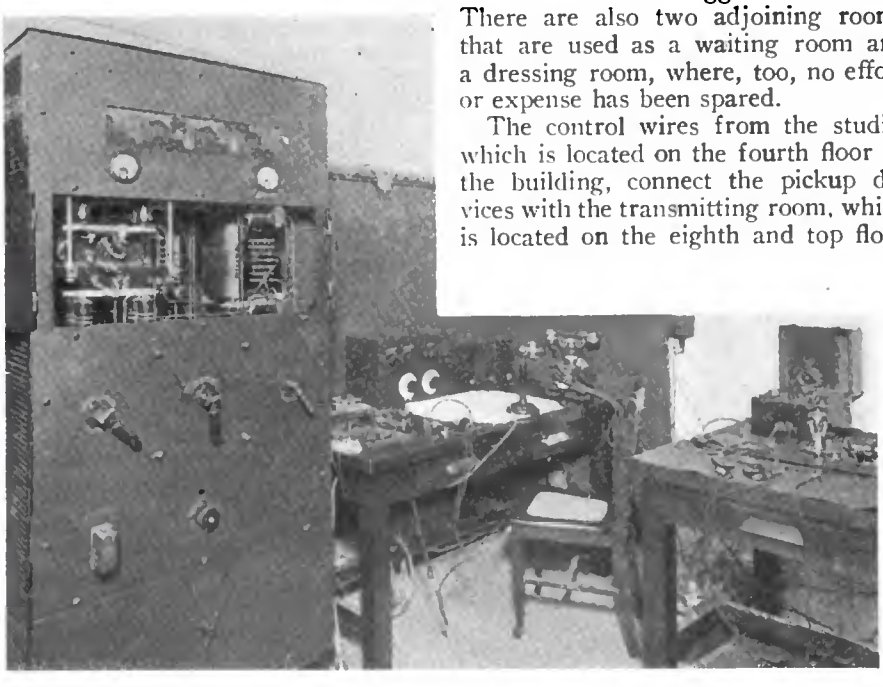
Completing the Installation

After the inaugural address, the permanent installation of the transmitting station was completed. This included the design and decoration of the studio upon which no expense was spared. The studio was so designed that the acoustic qualities are as nearly perfect as is possible in an enclosed room. There is no reflection or echo, nor do outside sounds reach the microphone. Much experimentation, as well as previous experience, finally resulted in the transmission of signals so clear that no unmodulated sound was borne by the carrier wave.

The artistic effect of the studio was beautiful in the extreme. Anyone who is familiar with the ostentation that the wealthy Argentinians effect can readily imagine the luxury of the studio.

The studio itself is large and the deep effects of the drapings make the room seem even bigger than it is. There are also two adjoining rooms that are used as a waiting room and a dressing room, where, too, no effort or expense has been spared.

The control wires from the studio, which is located on the fourth floor of the building, connect the pickup devices with the transmitting room, which is located on the eighth and top floor of the building. Wires also are installed for the warning devices and for an interphone system between the studio and operating room. In addition there are telephones connected to the city exchange and finally a special wire over which the Radio Club of Argentina nightly broadcasts its program.



Only the local telephone instrument on the table reveals that this is not an American station, as the rest of the equipment in the operating room at Buenos Aires is of American design, manufacture, and installation

Owing to the height of the building, which is considerable for Buenos Aires, the public as it passes along the Avenida de Mayo or the Plaza do not obtain a good view of the antenna and counterpoise systems, and visitors to the station, especially those from out of town, frequently express their surprise when taken on the roof. It is not a large antenna and its effective height above the counterpoise is small, but nevertheless it possesses the necessary punch to cover all the radio territory of the River Plate. A party of engineers of the Argentine Public Works Bureau tested the station for a week, every morning, afternoon and evennig, with their representatives "listening in" at various parts of the republic. Not a test failed and not one of the engineers had otherwise than praise for the transmitter. A most satisfying thing occurred during this test. One engineer was very much adverse to any American-built apparatus and was so positive in his views that he declared that he was going to the most distant government station, to listen personally. Not a word was received from him during the whole test until the final day, when a lengthy telegram came from him stating that all tests had been received satisfactorily and ending with his congratulations.

Sharp Waves and Keen Ears

It may be permissible here to tell of one humorous incident during the testing period. The very first test was directed to a station several hundred kilometers away and their answer came back via radio, "We do not hear you." Things looked pretty blue around the transmitting station for a while until another radio station, twice as far away, called us by radio and stated, "We hear you perfectly, your signals are strong." It seems that our wave was so sharp that the first operator passed entirely over it.

The other broadcasting station, that in Montevideo, Uruguay, though it did not broadcast the first transmission over the district of the River Plate, was nevertheless the first to start giving regular programs and concerts on a powerful scale. The antenna of this station is located on the roof of the Palacio Florida Hotel, one of the best in the city.

In this station it was not possible to go far into the detail of internal beauty

for several reasons. First, it was not possible to obtain space in the hotel, for as is evident in a hotel arranged and constructed as this one is, in the Spanish style, the noise due to the machinery and the singing of the artists might cause reason for complaint from some tired traveler who desired to sleep and might not be at that particular moment very enthusiastic over the possibilities of radio. Of the other reasons the most particular was, the urgent demand of powerful political parties for the use of this station for the dissemination of speeches during the campaign then due to start in two weeks.

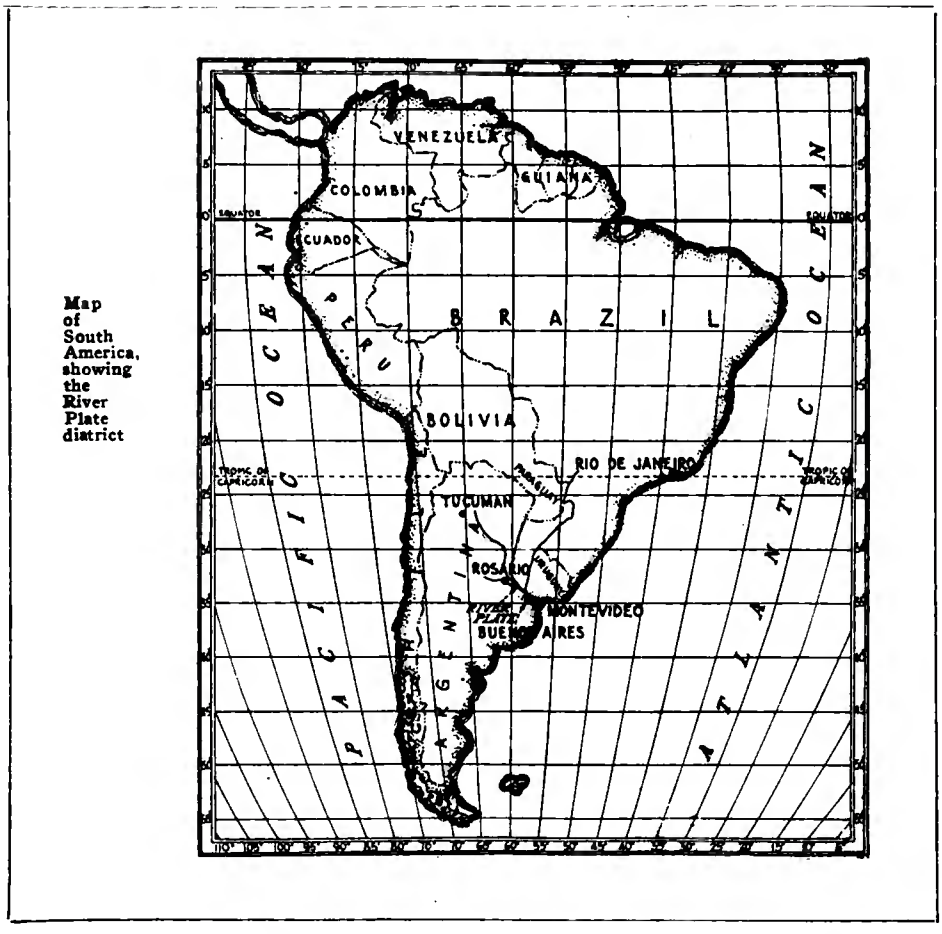
It is needless to state that this station was constructed and the apparatus installed in record time, especially when one considers the delays associated with construction in foreign fields the time from start to completion was remarkable.

In less than two weeks after work was started the station was operated and telegrams indicated a distance of 1,600 kilometers (960 miles), afternoon transmission.

When this station started transmitting on 360 meters, the Chief of the Uruguayan Radio Service complained of interference with a nearby government station and demanded that we use the lowest wave possible, namely, 300 meters. The broadcast wave was reduced to 300 meters in accordance with his wishes and we continued to operate as satisfactorily as before, with the same range.

The station completed and operating satisfactorily, the writer returned to Buenos Aires where work was again undertaken for the final completion of the station there.

Of the two stations the one at Buenos Aires is without doubt the most beautiful in its interior and that of the other at Montevideo, more pleasing on the exterior. Of the distances covered by the two, up to the time of my departure the Montevideo station was leading by a scant 200 kilometers in spite of the difference of the wave lengths, 430 and 320 meters respectively.



Map of South America, showing the River Plate district

Will Broadcast Grain Prices

STATION WDAP, which has been operated for some months by the Drake Hotel, Chicago, has been purchased by the Chicago Board of Trade. It is now operated on 360 meters every 30 minutes during trading hours on the "Pit," transmitting the latest quotations on wheat, corn, oats and similar grains dealt in on the floor of the famous exchange. Chicago is the center of the grain trading business of the United States, if not of the world. Before purchasing WDAP, the Board of Trade had been furnishing its quotations to various stations for transmitting, and these proved to be so valuable to farmers, elevator operators and in fact the whole grain business that it was decided that a station should be operated by the Board itself to give a steady flow of quotations during trading hours. The station is being heard by farmers in all the important grain-growing states.

Argentinians are accustomed to the last word in luxurious appointments in their homes, but this studio, from which they now hear broadcast programs, made them gasp by its quiet dignity, expressed in fine furniture, velour hangings, tasteful lighting and a rare Oriental rug

THE EFFORT TO PROVIDE US WITH
A New and Workable Radio Law

If you are one of the thousands who have written to the Editor asking why something isn't done to stop the interference that gums up broadcast programs you will be interested in this analytical account of what transpired in Washington recently in the effort to bring the Radio Law up to date

What Happened in Washington During the Public Hearings—and Subsequently

Reported by J. Andrew White

DOES radio need new laws? There is one question which it's safe to say hasn't recently been asked without drawing forth an immediate and emphatic affirmative answer.

It seemed that anyone who knew anything at all about radio—whether a novice listener to broadcast programs or a veteran of the days of coherer reception—was agreed that the existing law was hopelessly out of date. Everyone wanted action, too. For months, the need for proper legislative control has been a universal topic of conversation. Better allocation of wave length bands almost invariably cropped up somewhere in lectures, addresses and papers. And as a subject for correspondence! The editors of radio publications have been literally buried under letters, letters, letters, each one insistent upon immediate relief from the congestion of the ether and the interference which gummed up broadcast programs for him, her or them.

Lots of impatience; lots of discussion. One began to believe that every village and hamlet buzzed with agitation on the question.

And now, as this is being written, in Washington early in January, one can look back upon the public hearings on the White Bill as just about the tamest session ever held by the House Committee on Merchant Marine, certainly the mildest ever, on the subject of radio. The hearings lasted but a day and a half; and everything was very smooth and very quiet along the Potomac. What a contrast to other public hearings! It has been hard to realize that the very same room where these proceedings ran amicably along a few days ago, was on other occasions the battleground for an aroused host of amateurs fighting for the right to continue their experimenting; where, too, a notable struggle took place in the defeat of aspirations for Government ownership of the new industry.

There wasn't much of a flurry; little excitement, and less controversy. It could hardly be said, however, that the Bill as drawn met with universal approval. Of amendments suggested and recommended, there must have been at least a hundred. And now that the dust has settled and the Committee's executive session has ended, it appears that the revised Bill has been reported to Congress with something like two score changes incorporated in it.

The proposed amendments that succeeded, and those that failed, and something of the discussion on the most important of these, are set down in this article. It is the belief of the writer that readers of THE WIRELESS AGE have a genuine interest in the subject of radio legislation; certainly that has been indicated in countless letters received; so this account of what transpired in Washington will be comprehensive in its treatment of the main features, without going into detail on the minor points. Law is not an easy subject for the average reader, so all that can be promised here is to be informative, without being unduly dull.

First, the summary:

Have we a new radio law? No; not at this writing. But the White Bill has been revised (it is now known as H. R. 13773, bearing the date of January 11, 1923) and unanimously reported to the House of Representatives by the members of the Merchant Marine Committee.

When will we have a new radio law?

Now there is a question that is not easy to answer. For this article is being written in Washington, on the day when the new Bill reached Congress. All that can be written here, therefore, must be qualified by the familiar phrases, "from reliable sources it is learned," and "the best information in authoritative quarters indicates"—for it is a hazardous proceeding to attempt accurate prediction of the course of legislation in a session such as this, crowded with appropriation bills and unfinished routine. At this writing, however, it is expected that the new Bill will be presented to the House for action just about the time when this issue of the magazine is in the hands of readers. It has an excellent chance of being passed in the lower body of Congress, for the controversial sections have been cleared up. Then, of course, comes consideration by the Senate. Thus far no opposition has definitely expressed itself in the senior body; but the Senate calendar is crowded and the present session ends on March 4th.

And there you are. The indications are hopeful, in so far as lack of opposition is concerned; but the time for consideration is short. If Congress does not pass this law before March 4th, on the other hand, it is doubtful if the matter can be brought up again this year.

That is just about all anybody can say right now on the prospects for a new measure of control for radio.

So it is the writer's task to take you, so to speak, into the Committee room and interpret in type what happened at the public hearings, and subsequently.

First, let it be said that there was no bitter opposition to the Bill; a few endorsed it, without qualification, as drawn; but the majority of interests represented expressed the wish for certain modifications. This spirit of helpful cooperation can perhaps be expressed best by quoting from a communication submitted by the leading commercial company of the nation. It starts off with the statement that this company "is of the opinion that the purposes of the bill are in the interests of the American public to adequately provide for regulations which will foster rather than hinder the scientific

development of the art, and because it provides what radio needs, a flexible, mobile regulating power. The company therefore is not disposed to oppose passage of the bill, provided certain modifications are incorporated therein."

It then points out, how through private enterprise and capital the United States has been placed in the first rank of all nations of the world in the matter of both transoceanic and broadcasting radio communication, and continues: "Second only in importance to the maintaining and operating of American coastal stations on the basis of maximum efficiency for the preservation of life and property at sea, is the matter of maintaining and operating all American radio stations on a basis to assure the retention of such American leadership in radio. This can only be done under an impartial and systematic Government regulation of privately owned radio facilities, designed to minimize existing interference and confusion and to bring about a maximum utilization of available bands of wave lengths as well as the general operation of American radio facilities, so as to produce the greatest good and efficient radio service to the greatest number.

"The White Bill tends toward such results. It should, however, be modified in some respects. For instance, the security of investments necessary for development and extension work should be protected by minor modifications, and a right of appeal to the courts against the arbitrary and unreasonable exercise of the discretionary powers of the Secretary of Commerce would be highly desirable.

"Also the law should scrupulously avoid making unfair discriminations among the several classes or groups of radio concerns through providing specific rights under the regulations in behalf of certain groups or classes, without corresponding provisions for other groups or classes. Thus, a provision of the law assuring regulations to cover the granting of licenses for the erection or operation of stations or the allocation of particular bands of wave lengths in behalf of one class, is unwarranted, unless a similar provision is made in behalf of the other classes. The law should not, except in cases of Government-owned stations when operated exclusively for official communications, provide any such discrimination."

"This company, which probably has more capital invested in radio than any other American concern and is therefore perhaps more vitally interested in the provisions of the proposed law than any other company or organization, said further. "However, if the bill is made to provide that in the exercise of the discretionary powers of the Secretary in the granting, continuing, and revoking of station erection or operation licenses, and in the allocation of wave lengths, due consideration shall be given to existing property rights and investments of the owners; and that the exercise of such discretionary rights shall be made to apply to all classes and groups alike," then the company, subject further to a few minor modifications, saw no objection to passage of the measure.

"We wish to emphasize our contention that the only exception which should be made under the proposed regulations for control of radio by the Secretary of Commerce should be in the case of Government-owned stations, when and as operated exclusively for official Government communications, and possibly in the case of Government radio operators, who are regularly enlisted men in the military or naval establishments of the United States. We submit, however, that a Government station although intended and ordinarily operated for the handling of official Government business exclusively, when and if operated for the handling of any commercial traffic, should be required to conform to the regulations covering commercial service under the control of the Secretary of Commerce, including restrictions requiring the use by such station for any commercial traffic, of a wave length applicable to commercial operations.

"The operation of transmitting stations by the Government for such commercial traffic, whether frequent or infrequent, as well as the operation of stations by amateurs, can cause just as serious interference and disturbance with radio facilities in general as the operation of stations by other interests, and should be subject to the same rigid and impartial regulations.

"The radio art is changing almost from day to day. Restrictions of operations and the allocation of wave lengths suitable under conditions existing at the present time may be wholly inappropriate and impracticable in the near future. Regulations within the control of the Secretary of Commerce are susceptible of speedy and continuing modification to meet new or changing conditions. Statutory law cannot be readily altered to meet such requirements." The communication concludes with the observation that in the interests of affording the necessary flexibility and convenient adaptability of Government supervision of radio calculated to afford the most good and the best radio service to the greatest number, there was no objection to passage of the Bill, subject to the foregoing comments and certain definite modifications submitted to the Committee.

The spirit of this communication

Principal Points of the Discussion

THERE was no bitter opposition. Yet a round hundred amendments were suggested and recommended. Twenty were incorporated in the revised Bill. They are indicated in italics in this article.

There was an extended discussion of the Navy's contention that its operators and stations should not be licensed. Secretary Hoover was emphatically of the opinion that a license should be required where naval stations handled commercial messages, and he didn't want to accept "the principle that the Navy can stand out of cooperation and coordination with the rest of the industries." But the amendment agreed upon by the Committee upholds the naval viewpoint and excepts Government radio stations from the licensing provisions.

The spokesman for the A. R. R. L., Mr. Maxim, wanted only amateurs on the Advisory Committee, asking that the six members other than Government representatives be selected from the ranks of those who had no commercial affiliations. The members of Congress held the directly opposite view; they wanted representation from the great scientific laboratories, and distinguished engineers and technical professors. So the exclusively amateur representation proposal failed; but the revised Bill raises the membership from twelve to fifteen members, and instead of even representation, the Government representatives now have been given a majority with eight members, the remaining seven representing all other radio interests.

supplies a good background for the helpful attitude which was adopted almost universally by those represented at the hearings. There were, as stated early in this article, many amendments and much relevant discussion on various features of the Bill. The speakers of course appeared in rotation, and in most cases dealt with a multiplicity of subjects in discussing the various provisions of the proposed legislation. If the hearings were reported chronologically in this article, therefore, it would be very confusing to the majority of readers.

This report's aim will be for simplicity and clarity by considering the discussions, section by section, in the order in which they appear in the Bill, as drawn, which was printed word for word in the July, 1922, issue of THE WIRELESS AGE and may there be referred to in the exact text if the meaning of what follows is hazy in any particular.

Discussion of the early portions of the first section of the Bill was confined to minor details only. The first paragraph recites merely that it is a substitute for the corresponding section of the existing law dealing with the requirement that transmitting stations on ships and ashore are required to secure a license granted by the Secretary of Commerce.

Rear Admiral Henry J. Ziegemier, Director of Naval Communications, pointed out the fact that considerable work is now being done in radio communication by methods other than "by telegraphy or telephony" and these words should be stricken out so that the legislation might anticipate the new developments. In the same paragraph, it was suggested that the phrase qualifying affected vessels as those "engaged in interstate or foreign commerce" might well be deleted, so that the law would be made sufficiently broad to cover all types of craft. It appeared that yachts, motor-boats, tugs, dredges and vessels of that character were comprehended in the suggested modification.

In the amended Bill, the words "by telegraphy or telephony" have been struck out.

THE second paragraph (B) of this section of the Bill requires that the Secretary of Commerce from time to time, shall classify licensed radio stations and their operators. Hiram Percy Maxim, appearing on behalf of the A. R. R. L., asked for addition of a clause, "including amateur or private stations," for the reason that there would otherwise be no provision in this section for an amateur class, and an unfriendly Secretary of Commerce could take advantage of this and eliminate amateur radio whenever the spirit so moved him.

On the second day of the hearing, the veterans in radio were surprised with a novel viewpoint raised in connection with other provisions of this section. Arthur R. Belmont, committeeman representing the American Railway Association, stated that existing law had placed a burden upon the railroads which had excluded the wireless telephone from certain of its services. "The railroads have from time to time felt the necessity of going into radio communication, most particularly with respect to communication with tugs and lighters connected with their service," he explained, "and the present law, as we understand it, would require that all operators be licensed, which license carries with it a requirement of being able to take a definite number of words in the International Morse Code." This, he pointed out, called for the addition of a skilled radio man to the personnel of a tug crew, whereas if the license were not required, a deck hand could be qualified; and to this end he proposed insertion of a clause authorizing the Secretary of Commerce to: "Grant special licenses to tug dispatching stations under which one or more tugs may operate without further license while it or they are in communicating distance of the dispatching station holding the license."

It was instantly recognized by the Congressmen that this suggestion struck at a fundamental of the radio law, and an interesting discussion developed.

Mr. Belmont stated on behalf of the railroads that they felt that, as the tugs operated within a comparatively small zone, one licensed operator at the dispatching station equipped with apparatus of considerable power would be sufficient, since he as a supervisor could at any time call an unskilled man on any tug and notify him that he was interfering and ask him to immediately cut it out. This was workable, he explained, under their disciplinary system. Obviously, retorted Congressman White, author of the Bill, that would apply to any large concern; and he instanced as a hypothetical case, a commercial radio company with its high-powered stations wanting, for example, to set up throughout the country a number of low-powered, short range stations, as feeders for their central plants, manned by unlicensed men. Although as employees they would be subject to a large degree of control by their company's higher officials, that discipline, to his mind, was no reason for taking these employees out from under the control of the Government; and he added the observation that the railway association's proposed amendment would have an effect just the opposite of the general scheme. In the discussion which followed, it was pointed out that broad powers for granting special licenses were conferred upon the Secretary of Commerce and that his department had great flexibility in the matter of establishing rules and regulations, but it was essential to the law that each transmitting station be licensed and in charge of a licensed man, otherwise responsibility for interference or any other violation could not be fixed. Later, Alfred P. Thom, also of the railway association, advocated in an amendment the authorization of the Secretary of Congress to exclude from the prescribed regulations any radio station or operator, or to modify these regulations, "in his discretion in any case in which he shall find that such action will facilitate commerce and will not be incompatible with the public interests."

The amended Bill, as reported to Congress, does not include the requested provision for the amateur. Practically verbatim, however, Mr. Thom's recommendation is inserted. The exact words of the amendment to this paragraph are: "The Secretary shall have authority to exclude from the requirements of any regulations any radio station and the operators required therein, or to modify the same in his discretion, in any case in which he shall find that such action will facilitate commerce and will not be incompatible with the public interest."

NEXT in order of consideration is paragraph C of the first section. An issue arose here which assumed considerable proportions in the discussion of the Bill. This is the portion which states that the licensing provisions have no application to Government stations "used exclusively for communication of official business." The phrase quoted was not acceptable to the Navy and Admiral Ziegemier suggested that the words be struck out, as they virtually placed the naval stations to a large degree under the Secretary of Commerce. "The President and the Secretary of the Navy should be the only ones to issue radio regulations for the Navy," he insisted. "Under the proposed law it would be perfectly feasible for the Secretary of Commerce to tell the Navy that it could use certain stations only during certain hours, and that naval vessels could not use certain waves when near coasts." He explained the difficulty of entirely separating the official from the commercial part of naval stations, stating: "Although a radio station may be built exclusively for military purposes and Government work, it often happens

that such a station will have to accept a message from a passing vessel, or when all other communications fail, as frequently happens, for example, in Alaska." He instanced, too, how at times the officers or members of the crew of ships wish to send a personal, and sometimes urgent, message ashore; as these messages are paid for they are therefore commercial, and if the Bill were passed as originally drawn it would require the Navy to secure for every radio plant on board ship a license from the Department of Commerce.

This feature came up for extended discussion in the afternoon session of the first day, when Herbert Hoover, Secretary of Commerce, was present. Congressman White stated that it was the intention of the framers of the Bill that when any Government station went outside the official activities and invaded the field occupied by others, "in the interest of coordination and efficiency all along the line, it ought to fit itself into the general scheme of things." It was developed then that one of the fields the Navy had entered was that of broadcasting, Secretary Hoover stating: "They are broadcasting right here in Washington today, and I presume from other stations, to the public, and there is a great deal of complaint that the Navy is interfering with them."

In line with the other non-licensing amendment relative to naval stations, Admiral Ziegemier asked that the provision allowing the President to assign wave lengths to Government stations also not be qualified by the phrase, "used exclusively for the communication of official business," as it permitted the Secretary of Commerce to control wave lengths and make regulations for naval stations if they handle any commercial traffic whatever. Mr. Hoover objected to the suggested change on the ground that it opened the door to private commerce on the part of the Navy—and also the Army, which had endorsed the attitude of the other arm of service—"without," as he said, "any coordination to the general fabric of the country." He added that he knew that this had been one of the desires of the Navy from the beginning, and he thought it sufficient that the Bill purposely excluded the exercise of any control in the transaction of strictly Government business. Mr. Hoover was firm. "I do not see how we can set up any systematic control of radio throughout the country, to prevent interference, if the Navy is to be a complete outlaw in the fabric. So far as its own official business is concerned, yes; but the moment it enters into commerce or, into competitive relationships to commerce, I do think it ought to yield."

To Admiral Ziegemier's direct question as to whether naval stations should be required to have a Department of Commerce license because they accepted commercial business, even though it was not wanted, Mr. Hoover replied that such licenses should be required, otherwise he could conceive such a station "as a complete outlaw running through all of the wave lengths and doing what it pleased," which would entirely disorganize the commercial fabric. The Admiral retorted that the naval stations in question "would not be using all of the wave lengths all of the time," and stressed the point that by the license provision the Department of Commerce would have control over the radio installation on naval ships.

"I have a feeling that the question is more hypothetical than real," was Mr. Hoover's reply, "unless we are going to accept the principle that the Navy can stand out of cooperation and coordination with the rest of the industries. I do not conceive in practice there will be any difficulty in setting up relationships between the two departments that will work." The Admiral agreed that was exactly what the Navy wanted to do. "But," added Secretary Hoover, "I should hate to see the Navy put in a position by law where it was not conforming to the public interest, when the public interest is involved as it is here." He added that it was his feeling that within a short time the Navy would retire entirely from the commercial end of the work, a view which the Admiral endorsed, with the observation that the Navy was trying to do that now, but could not get anybody to take care of the service. The discussion on this particular question ended with Mr. Hoover reiterating that where the Navy is, by necessity, carrying on systematic communication on behalf of private parties, the naval stations could not be omitted and the question be met of a properly coordinated system and proper regulation.

The only other material contribution to this particular feature of the Bill was contained in a communication suggesting that Government stations be subject to the license provision, "wherever located, on land or on board United States vessels, and of whatever class, when and as used for the transmission of commercial radio traffic."

The amendment agreed upon by the Committee on Merchant Marine virtually upholds the contentions of the Navy, for the revised Bill as reported to Congress omits the original paragraph C and includes a new paragraph, which reads:

"Radio stations belonging to and operated by the United States shall not be subject to the provisions of paragraphs A and B of this section. All such Government stations shall use such wave lengths as shall be assigned by the President. All such stations, except stations on board naval and other Government vessels while at sea or beyond the limits of the continental United States, when transmitting any message other than a message relating to Government business, shall conform to such rules and regulations designed to prevent interference with other radio stations and the rights of others as the Secretary of Commerce may prescribe: Provided, That upon proclamation by the President that there exists war or a threat of war or a state of public peril or disaster or other emergency, the President may suspend or amend, for such time as he may see fit, the rules and regulations applicable to any

High Spots in the Progress of the New Radio Law

AS we go to press, the White Bill has been revised and with some twenty amendments and the unanimously favorable report of the House Committee is ready for action by the lower body of Congress.

The revised Bill bears the number H.R. 13773.

The indications are that it will meet with little if any opposition in the House, and may be passed by the time this issue reaches our readers.

What will happen in the Senate cannot be definitely predicted. The problem of the senior body is to find a place on the calendar for its consideration and action before the present session ends on March 4th.

If the Bill is not reached and definite action taken before that date, there is little likelihood of a new law for radio being passed this year.

or all stations within the jurisdiction of the United States. All stations owned and operated by the United States and all other stations on land and sea shall have special call letters designated by the Secretary of Commerce, and such stations and the designated call letters shall be included in the list of radio stations of the United States as published by the Department of Commerce. Radio stations on board vessels of the United States Shipping Board Emergency Fleet Corporation shall not be deemed to belong to or to be operated by the United States or to be Government stations within the meaning and for the purposes of this Act."

A MODIFICATION for clarification of the intent of the second paragraph (B) of Section two was suggested. This particular portion of the Bill contains an Americanism provision, relating that licenses are not to be granted to any corporation in which more than one-fifth of the capital stock is owned or controlled by aliens. The change suggested called for deletion of the ownership phrase and substitution of the proviso that ineligibility rested upon capital stock which "may be voted" by aliens.

The amended Bill does not fully recognize this suggestion, but it now reads, "owned, controlled or voted" by aliens.

THE next paragraph (C) of that Section provides for the Secretary of Commerce to have discretionary power in granting station licenses, but only to a station which is in the interest of the general public service. Omission of the word "service" was recommended by the American Telephone and Telegraph Company, on the ground that "public service" has a rather definite signification and confusion might be avoided by expressing the intent of the paragraph by the phrase "in the interest of the general public."

That the amateur station should not be affected by this provision was the view presented by Mr. Maxim, who asked for insertion of the phrase, "excepting amateur or private stations," for the reason that it might be argued that amateur operation serves no direct and immediate public service. Congressman White was ready with reassurance on this point. "I think it was the theory of the Conference," he explained, "and certainly it was my theory so far as I had a hand in the drafting of the legislation, that the work of the amateur by and large was in the public interest; certainly, it was not intended to exclude him." Congressman Hardy, of Texas, observed that the effect of the proposed amendment would be to require the Secretary of Commerce to issue a license to anybody that applied. In the discussion, the members of the Committee agreed that the language might be improved when they gave final consideration to the Bill, and that there had been no purpose whatever to draw up anything which would interfere with the welfare of amateur operators.

In the amended Bill, as presented to Congress, there is no mention specifically of any exception of amateur stations, but the following words were struck out: "except that he may grant such license only to a station which is in the interest of the general public service."

THIS same sub-section is the one which empowers the Secretary of Commerce to refuse a license where in his judgment the applicant is monopolizing or seeking to monopolize radio communication. As drawn, the Bill leaves this all to "the judgment" of the Secretary. The commercial companies suggested several changes; one requesting that this provision apply only to station licenses and another suggesting that refusal not rest "in the judgment" of the Secretary but "according to an opinion in writing by the Attorney General." Another recommendation called for the insertion of "unlawfully" to qualify the monopoly provision, "in order," as the communication expressed it, "to protect patent rights as established by the United States Government."

Secretary Hoover, when asked for his views on this change, said he could not see any objection to it, that a lawful monopoly could not be dissolved by the Secretary of Commerce, and it seemed to be an unnecessary addition. Congressman White observed that this section involved various things: "First, ascertainment by the Secretary of Commerce of the fact; secondly, a consideration of the patent rights granted by the United States to patentees; and it involves also, a construction of the statutes and interpretation of the decisions of the courts. I personally felt," he added, "that it would be just as well to leave this whole question to the law, but it seemed to be the desire of some that it should be put in, so it is in here. I personally felt this whole subject matter was perfectly well covered by the anti-trust statute, the Clayton Act and the decisions of the courts." To which Secretary Hoover added the comment: "I doubt very much myself whether the Secretary of Commerce would attempt to set up a definition outside of that contained in existing decisions and the existing law. The Secretary of Commerce would not be competent to venture into such a field. The question it seems to me lies largely outside of the field of this particular legislation. I have doubts as to whether we know enough about the development of the art at present, to lay down the form in which regulation will ultimately be required."

The amended Bill makes the refusal provision applicable only to station licenses and a new paragraph has been inserted, reading as follows:

"The Secretary of Commerce in granting any license for a commercial station intended or used for communication between the United States or any territory or possession, continental or insular, subject to the jurisdiction of the United States, the Canal Zone, or the Philippine Islands, and any foreign country, may impose any terms, conditions, or restrictions authorized to be imposed with respect to submarine cable licenses by Section 2 of an Act entitled 'An Act relating to the landing and the operation of submarine cables in the United States,' approved May 27, 1921. Every license for such commercial station shall be approved by the President before the same shall be issued and become effective."

THE final paragraph (F) in Section two also came under discussion. This recites that the Secretary of Commerce shall have the power to revoke any station license for failure to operate service as proposed in the application, for violations of law or regulations, or when he shall deem such revocation in the public interest. It provides that thirty days' notice be given.

Modification of this paragraph was suggested by one of the operating companies, which in a written communication recommended the insertion of: "That in the matter of granting, renewing or revoking of station licenses hereunder, in allocating bands of wave lengths, or in otherwise exercising the regulatory powers conferred by this Act, the Secretary of Commerce shall take into due consideration the existence and location of existing stations, the property interests, investments and any equities involved therein, as well as the special adaptability, if any, of the apparatus therein located for use in specific bands of wave lengths." It was also recommended that the provision of thirty days' notice before the order of revocation could take effect be qualified, in that the notice be given "stating the grounds therefor." This latter proposal was supported with the suggestion for insertion of the phrase, "stating the cause." Secretary Hoover.

when questioned, said he could see no great objection to the change.

In the Bill, as drafted, the Secretary of Commerce is empowered to conduct hearings and their conclusion to affirm, modify, or revoke the order of license revocation. It was suggested that this be modified by: "Provided, however, any licensee whose station license is revoked, or, upon expiration of whose station license, application for a renewal thereof is denied, shall have the right of appeal from such order by the Secretary of Commerce to the Supreme Court of the District of Columbia."

The revised Bill adds another discretionary power in that a license may be revoked whenever "any licensee, who is a common carrier, shall fail, in the judgment of the Secretary of Commerce, to provide reasonable facilities for the transmission of messages, or whenever the Interstate Commerce Commission, in the exercise of the authority conferred upon it by law, shall find that any licensee has made any unjust and unreasonable charge, or has made or prescribed any unjust and unreasonable classification, regulation or practice with respect to the transmission of messages or service." It also includes the recommendation of the commercial companies with insertion of the provision that any notice of revocation must be in written form "stating the cause for the proposed revocation." The requested right of appeal to the courts, however, was not included in the amendments.

SECTION THREE is the one which deals in the first paragraph with the requirement that actual operation of a licensed radio station can be carried on only by a licensed operator. There were several minor modifications suggested, the insertion of "radio transmitting" as designating the affected apparatus and the addition of: "and apparatus used in the reception of transoceanic and ship-to-shore radio telegraphic messages," and further the provision that operation may be carried on "under the supervision of" an operator licensed by the Secretary of Commerce.

Admiral Ziegemier asked for an addition to this paragraph, "that no such license shall be required by operators of the United States Navy," on the ground that the Navy must have absolute control of its enlisted men and for many reasons it was highly undesirable that they should be licensed by another department of the Government. Secretary Hoover commented upon this request to the effect that he did not think there was any great point in licensing the operators and he had no objection to the amendment unless the Navy operators engaged in public service in competition with other public bodies. Another minor change in the fourth paragraph of this section was suggested by the Navy, that the licenses issued specifically state that the applicant has been found proficient in the use of "the class and kind of" radio apparatus "for which he is licensed." It is this paragraph that also prohibits granting licenses to any alien, and a modification of this provision was suggested by the addition: "Provided, however, except during such times as, and in such stations where, the privilege may be suspended by order of the Secretary of Commerce, temporary permits for terms of not to exceed three months may be issued under regulations to be prescribed by the Secretary, to permit operation of radio apparatus under the supervision of a regularly licensed operator, in licensed stations, by aliens or others admitted into such stations by the owners thereof as students, or for instruction or experimental purposes."

These suggestions were not adopted by the Committee, excepting only the designation of the equipment of affected stations as "all transmitting" apparatus. The other changes in the amended Bill are slight; where violation of any provision of any act or treaty is mentioned, it now reads, any treaty "binding on the United States," and that a license may be revoked if the licensee is found ineligible "or unfit."

IT is Section four which contains the provision that a permit is automatically forfeited if the station is not ready for operation within the time specified. Insertion of: "unless prevented by Acts of God, strikes or other causes beyond the control of the applicant," was suggested. This paragraph also makes clear that the granting of a permit does not impose upon the Secretary of Commerce the obligation to later issue the license, a provision which the same two commercial companies thought should be modified by the clause: "unless all the requirements of the Secretary under this Act shall have been complied with."

On the matter of exceptions to the permit feature, naval, commercial and amateur interests all had recommendations. The Navy, consistently following its policy, asked that the words, "to be used exclusively for communication of official business" be deleted, leaving all Government stations exempt from securing permits. The A. R. R. L. wanted exemption for, specifically, "amateur" as well as private stations. One of the proposals suggested the granting of broad discretionary powers by insertion of the provision: "Except in times of war, or other emergency declared by executive order to exist, the Secretary of Commerce may in the public interest or for protection of private property rights prevent the erection and operation of any station hereunder, in a location where the operation thereof would materially interfere with the operation of or property rights in, an existing radio station."

The revised Bill, as reported to Congress, is amended in this section in only three particulars. A clause has been inserted that qualifies forfeiture of the station permit if it is not ready for operation within the time specified, the exception being: "unless prevented by strikes, riots, acts of God, or other causes not under the control of the grantee." The suggestion of the commercial companies has also been adopted, in that the granting of a construction permit shall not "of itself" impose the obligation upon the Secretary to issue a license for operation. The other change is the one advocated by the Navy, exempting Government stations and the provision now reads that permits for construction shall not be required for Government stations—the phrase, "to be used exclusively for communication of official business," having been struck out.

PERHAPS the most astonishing recommendation made during the course of the hearings was the one advanced by Hiram Percy Maxim, on behalf of the A. R. R. L., to modify Section five, which seeks to create an advisory committee to whom the Secretary of Commerce shall refer questions of administration or changes in laws or regulations and the study of scientific problems and progress and use of radio. The original Bill provided for twelve members, six of whom represent the various Government departments, and six others to be designated by the Secretary of Commerce, selected by virtue of recognized attainment in radio communication. In relation to the appointment of these latter, the suggested amendment presented by Mr. Maxim called for men not "affiliated directly or indirectly in the manufacture, sale, transmission or operation of radio telegraphy or telephony for financial profit."

The reason given for the A. R. R. L. suggesting this amendment was expressed by Mr. Maxim as follows:

"If the membership of this advisory committee is made up of lawyers and consulting engineers of companies financially interested in radio, it is un-

avoidable that the recommendations of these members should be colored in the interest of their clients. In our own amateur organization," he continued, "we have laid it down as a basic principle that our policies shall not be decided nor influenced by any commercial affiliations of any kind, and we have found that this principle has been a very wise one indeed. We believe that it will be equally wise in this case."

Representative Chindblom, of Illinois, immediately inquired whether this statement was intended to mean that it was not important to have representation on the advisory committee of men commercially and financially interested in radio. Mr. Maxim replied, "It seems to us to be dangerous." Whereupon Congressman White said he "took the opposite slant," that while there should be one representative of the amateurs in such a body, "my own opinion is that you get your valuable suggestions as to the development of the radio art from the people who have a real and substantial interest in it." Mr. White added that the advisory committee provision was one recommended by the Radio Conference, that the committee was purely advisory, without power to authorize or direct the Secretary of Commerce to do anything, or authorize any action that he cannot now take without any provision of law. He observed that the amendment suggested by Mr. Maxim absolutely excluded from membership on the committee "anybody who is connected with any of the great scientific laboratories of the concerns interested in the manufacture of radio apparatus; anybody who is affiliated with an operating company, anybody who is directly or indirectly affiliated with a company which handles or sells radio apparatus of any sort." The author of the Bill acknowledged the amateurs and the professors of educational institutions, but added that aside from them it was among those whom the A. R. R. L. sought to exclude, "you have to go to find the men who know radio and who are interesting themselves in the advancement of the art."

Representative Chindblom also dissented from the view that these men be excluded, "on account of the danger that they might influence the committee." He objected to giving a majority representation to those not interested financially, and wanted the committee "open to such men, for instance, as distinguished engineers, scientists, experts, and even a humble lawyer who knows something about the laws relating to radio."

When Secretary Hoover's attention was drawn to this suggested change, he observed: "It would exclude technical professors at once, and the engineers, because they all live by private practice."

One of the Congressmen asked Mr. Maxim if the A. R. R. L. would insist upon the suggestion, and the reply was in the negative, that it was something which did not concern the existence of the amateur, "which is really the only thing he is vitally interested in."

The amendment to the Bill in this particular section is a material one. Exclusively amateur representation is not mentioned, but on the other hand the Government representatives are given a majority. In the original draft the committee consisted of twelve members. The revised Bill calls for fifteen, eight of whom are Government representatives, the two additional appointees to be designated by the Secretary of the Treasury and the Chairman of the United States Shipping Board.

THE requirement of Section six, that a licensed operator must listen in for distress signals during the time the transmitter is in operation, was applicable in the draft of the Bill to stations capable of interfering with ship communication. That the word "communication" be replaced by "distress signals," was suggested.

The revised Bill shows no amendment of this section.

THE first three provisions of Section seven of the Bill excited no comment.

There was considerable discussion, however, on the final provision contained in Section seven of the Bill. This called for amendment of the existing regulations on amateur stations, limiting the wave length to 200 meters and substituting the range 150 to 275 meters. In one communication it was suggested that this entire paragraph be omitted, in conformity with the viewpoint that the law should scrupulously avoid class discrimination.

The A. R. R. L. wanted amateur stations classified and assigned wave lengths within this band according to the type of station in each case. The provision recommended: "that the Secretary of Commerce shall classify the transmitting apparatus used by the amateur, private or non-commercial stations, and shall assign within the limits provided in this section such bands of wave lengths to these several types of transmitting apparatus as he may deem proper."

Mr. Maxim, as spokesman for the League, introduced this with the comment: "This is where we seek greater control of amateurs. We believe," he continued, "the Secretary of Commerce should have the power to classify the types of apparatus to be used by amateurs in the band between 200 and 275 meters. We believe it to be to the general interest of all concerned to keep spark transmitters to low wave lengths, indeed if not to discourage their use altogether."

Congressman White observed that under the general powers of regulation given by the first section of the Bill, the Secretary had been given precisely the power designated. He referred to a legal obstacle in giving the Secretary the power to classify transmitting apparatus, as the amendment aimed to do, and observed that Congress had "no business at all to say what kind of an instrument I should buy," but that the regulation of external effects produced by transmitters was a proper authority and that Section one took care of this feature.

The representative of the Wireless Association of Pennsylvania, Mr. McNaughton, expressed doubts as to the wisdom of classifying amateur stations; his organization thought that "a division among amateurs by a special allocation of wave lengths within the confines of 150 to 275 meters would result disastrously to amateur radio in so far as it would incite dissension." His belief was, that the amateurs would develop ability to cut out interference one with the other if they had a broad scope and could select their own wave lengths.

All suggested amendments to this section failed, for in the Bill as reported by the Committee the section remains unchanged.

THERE were two other minor modifications suggested to strengthen and clarify Section seven and Section nine, no comment being made on the intervening section, nor on Section eleven. But on Section ten, a considerable discussion developed. This is the section which seeks to substitute the word "Government" in place of "naval and military" stations in every case where the latter now appears in the existing law.

The Navy was not in favor of the change as the words naval and military were taken from the International Radio Telegraph Convention and the United States is still a party to this convention. This view was supported by calling attention to the fact that the U. S. law is subordinate to that convention. The A. R. R. L. urged elimination of the section as a whole.

The section was not struck out nor was it modified by the Committee: in the revised Bill it stands without amendment.

BROADCASTING STATION DIRECTORY

(Revised to January 20th, 1923)

Class B stations, broadcasting on 400 meters, are designated by ★

KAD	Young Man's Christian Association	Denver, Colo
KDN	Lee U. Meyerberg Co.	San Francisco, Calif.
KFC	Northern Radio & Electric Co.	Seattle, Wash.
KFI	E. C. Anthony	Los Angeles, Calif
KFV	Foster Bradbury Radio Store	Yakima, Wash.
KFZ	Deerr Mitchell Elec. Co.	Spokane, Wash.
KGB	Wm. A. Mullins Electric Co.	Tacoma, Wash.
KGG	Halleck & Watson Radio Service	Portland, Ore.
KGN	Northwestern Radio Mfg. Co.	Portland, Ore.
KGD	Altadena Radio Laboratory	Altadena, Calif.
KGU	M. A. Mulrony	Honolulu, Hawaii
*KGW	Oregonian Publishing Co.	Portland, Ore.
KGY	St. Martin's College	Lacey, Wash.
KHD	Aldrich Marble & Granite Co.,	Colorado Springs, Colo
*KHJ	Times Mirror Co.	Los Angeles, Calif.
KHQ	Louis Wasmer	Seattle, Wash
KJC	Standard Radio Co.	Los Angeles, Calif.
KJJ	The Radio Shop	Sunnyvale, Calif.
KJQ	C. O. Gould	Stockton, Calif.
KJR	Vincent I. Kraft	Seattle, Wash.
KJS	Bibia Institute of Los Angeles, Inc.,	Los Angeles, Calif.
KLB	J. J. Dunn & Co.	Pasadena, Calif.
KLN	Noggle Electric Works	Monterey, Calif.
KLP	Colin B. Kennedy Co.	Los Altos, Calif.
KLS	Warner Brothers	Oakland, Calif.
KLX	Tribune Publishing Co.	Oakland, Calif.
KLZ	Reynolds Radio Co.	Denver, Colo.
KMC	Lindsay-Weatherill & Co.	Beadley, Calif.
KMJ	San Joaquin Light & Power Co.	Fresno, Calif.
KMD	Love Electric Co.	Tacoma, Wash.
KNI	T. W. Smith	Eureka, Calif.
KNJ	Roswell Public Service Co.	Roswell, N. M.
KNN	Bullok's	Los Angeles, Calif.
KNT	North Coast Products Co.	Aberdeen, Wash.
KNV	Radio Supply Co.	Los Angeles, Calif.
KNX	Electric Lighting Supply Co.	Los Angeles, Calif.
KDA	Y. M. C. A.	Denver, Colo.
KOB	New Mexico College of Agriculture and Mechanical Arts, State College, N. Mex.	
KDG	Western Radio Electric Co.	Los Angeles, Calif.
KDN	Holzwasser, Inc.	San Diego, Calif.
KDP	Detroit Police Dept.	Detroit, Mich.
KDQ	Modesto Evening News	Modesto, Calif.
KPD	Hale Brothers	San Francisco, Calif.
KQI	University of California	Berkeley, Calif.
KQP	Blue Diamond Electric Co.	Hood River, Ore.
KQV	Doubleday-Hill Electric Co.	Pittsburgh, Pa.
KQW	Charles D. Herrold	San Jose, Calif.
KQY	Stubbs Electric Co.	Portland, Ore.
KRE	Maxwell Electric Co.	Berkeley, Calif.
*KSD	Post Dispatch	St. Louis, Mo.
KSL	The Emperium	San Francisco, Calif.
KSS	Prest & Dean Radio Rsch. Lab.	Long Beach, Cal.
KTW	First Presbyterian Chnrch.	Seattle, Wash.
KUD	The Examiner Printing Co.	San Francisc, Cal.
KUS	City Dye Works & Laundry Co.	Los Angeles, Cal.
KUY	Coast Radio Co.	Del Monte, Calif.
KVQ	J. C. Hobrecht	Sacramento, Calif.
KWQ	Portable Wireless Telephone Co.	Stockton, Calif.
KWH	Los Angeles Examiner	Los Angeles, Calif.
KXD	Herald Publishing Co.	Modesto, Calif.
KXS	Braun Corporation	Los Angeles, Calif.
KYI	Alfred Harrell	Bakersfield, Calif.
KYJ	Leo J. Meyberg Co.	Los Angeles, Calif.
KYQ	Electric Shop	Honolulu, T. H.
*KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.
KYY	The Radio Telephone Shop.	San Francisco, Calif.
KZC	Public Market & Mkt. Stores Co.	Seattle, Wash.
KZM	Preston, D. Allen	Oakland, Calif.
KZN	The Desert News	Salt Lake City, Utah
KZV	Wenatchee Battery & Motor Co.	Wenatchee, Wash.
KZY	Atlantic Pacific Radio Supplies Cn.	Oakland, Calif.
*KDKA	Westinghouse Electric & Mfg. Co.,	Pittsburgh, Pa.
KDPT	Southern Electric Ce.	San Diego, Calif.
KDYL	Telegram Publishing Co.	Salt Lake City, Utah
KDYM	Savoy Theatre	San Diego, Calif.
KDYD	Carson & Simpson	San Diego, Calif.
KDYQ	Oregon Institute of Technology	Portland, Ore.
KDYS	The Tribune, Inc.	Great Falls, Mont.
KDYV	Cope & Cornwell Co.	Salt Lake City, Utah
KDYW	Smith Hughes & Co.	Phoenix, Ariz.
KDYX	Star Bulletin Publishing Co.	Honolulu, T. H.
KDZA	Arizona Daily Star	Tucson, Ariz.
KDZB	Frank E. Siefert	Bakersfield, Calif.
KDZE	The Rhodes Co.	Seattle, Wash.
KDZF	Automobile Club of So. Calif.,	Los Angeles, Calif.
KDZB	Cyrus Peiree & Co.	San Francisco, Calif.
KDZH	Fresno Evening Herald	Fresno, Calif.
KDZI	Electric Supply Co.	Wenatchee, Wash.
KDZK	Nevada Machinery & Electric Co.	Reno, Nev.
KDZL	Rocky Mountain Radio Corp.	Ogden, Utah
KDZM	E. A. Hollingworth	Centralia, Wash.
KDZP	Newberry Electric Corporation.	Los Angeles, Cal.
KDZQ	William D. Pyle	Denver, Colo.
KDZR	Bellingham Publishing Co.	Bellingham, Wash.
KDZT	Seattle Radio Association	Seattle, Wash.
KDZU	Western Radio Corporation	Danver, Colo.
KDZV	Cope & Cornwell Co.	Salt Lake City, Utah
KDZW	Claudo W. Gerdes	San Francisco, Calif.
KDZX	Glad Tidings Tabernacle	San Francisco, Calif.
KDZZ	Kinney Brothers & Sipprell	Everett, Wash.
KFAC	Glendale Daily Press	Glendale, Calif.
KFAD	McArthur Brothers Mercantile Co.,	Phoenix, Ariz.
KFAE	State College of Washington	Pullman, Wash.
KFAF	Western Radio Corporation	Denver, Cnio.
KFAJ	University of Colorado	Boulder, Colo.
KFAN	Electric Shop	Moscow, Idaho
KFAP	Standard Publishing Co.	Butte, Mont.
KFAQ	City of San Jose	San Jose, Calif.
KFAR	O. K. Olsen	Hallywood, Calif.
KFAS	Reno Motor Supply Co.	Reno, Nev.
KFAT	Dr. S. T. Donohue	Eugene, Ore.
KFAU	Independent School District	Boise City, Idaho
KFAV	Abbott-Kinney Co.	Venice, Calif.
KFAW	The Radio Den, Ashford & White,	Santa Anna, Cal.
KFAY	W. J. Virgin Milling Cn.	Central Point, Ore.
KFAZ	C. H. Weatherill	Reddley, Calif.
KFBB	F. A. Buttrey & Co.	Havre, Mont.
KFBC	W. K. Asbill	San Diego, Calif.
KFBD	Clarence V. Welch	Hanford, Calif.
KFBE	Reuben H. Horn	San Luis Obispo, Calif.
KFBH	Thomas Musical Co.	Marshfield, Idaho
KFBK	Kimball-Upson Co.	Sacramento, Calif.
KFBL	Leese Brothers	Everett, Wash.
KFBM	Cook & Foster	Astoria, Ore.
KFBN	Borch Radio Corporation.	Oakland, Calif.
KFBQ	Savage Electric Co.	Prescott, Aria.
KFBS	Chronicle News and Gas & Elec. Supply Co.,	Trinidad, Colo.
KFBU	Bishop N. S. Thomas	Laramie, Wyo.
KFBV	Clarence O. Ford	Colorado Springs, Colo.
KFCB	Nielsen Radio Supply Co.	Phoenix, Ariz.
KFCC	Auto Supply Co.	Wallace, Idaho
KFCD	Salem Elec. Co.	Salem, Ore.
KFCF	Frank A. Moore	Walla Walla, Wash.
KFCH	Electric Service Station.	Billings, Mont.
KFCK	Colorado Springs Radio Co.,	Colorado Springs, Colo.
KFCL	Los Angeles Union Stock Yds.	Los Angeles, Calif.
KFCM	Richmond Radio Shop	Richmond, Calif.
KFCQ	Motor Service Station.	Casper, Wyo.
KFD4	Adler's Music Store	Baker, Ore.
*KFDB	Mercantile Trust Co.	San Francisco, Calif.
KFDC	Radio Supply Co.	Spokane, Wash.
KFDD	St. Michaels Cathedral	Boise, Idaho
KFDF	Wyoming Radio Corp.	Casper, Wyo.
KFDH	University of Arizona	Tucson, Ariz.
KFDJ	Oregon Agri. College	Corvallis, Ore.
KFDL	Knight-Campbell Music Co.	Denver, Colo.
KFEB	The City of Taft	Taft, Calif.
KFEC	Meier & Frank Co.	Portland, Ore.
KFED	Billings Polytechnic Institute.	Polytechnic, Mont.
KFEJ	Guy Greason	Tacoma, Wash.
KFEP	Radio Equipment Co.	Denver, Colo.
KFFA	Dr. R. C. Shelton	San Diego, Calif.
KFFE	Eastern Oregon Radio Co.	Pendleton, Ore.
KFGG	Astoria Budget	Astoria, Oregon
KFGH	Leland Stanford, Jr., Univ.	Stanford Univ., Calif.
KFHJ	Fallon Co.	Senta Barbara, Calif.
WAH	Midland Refining Co.	El Dorado, Kans.
WBL	T. & H. Radio Co.	Anthony, Kans.
WBS	D. W. May, Inc.	Newerk, N. J.
WBT	Southern Radio Corporation.	Charlotte, N. C.
WBU	City of Chicago	Chicago, Ill.
WBZ	Westinghouse Elec. & Mfg. Co.	Springfield, Mass.
WCE	Findley Electric Co.	Minneapolis, Minn.
WCK	Stix-Baer-Fuller	St. Louis, Mo.
WCM	University of Texas	Austin, Tex.
WCN	Clark University	Worcester, Mass.
*WCX	Detroit Free Press	Detroit, Mich.
WDM	Church of the Covenant.	Washington, D. C.
WDT	Ship Owners Radio Service.	New York, N. Y.
WDV	John O. Yelser, Jr.	Omaha, Nebr.
WDZ	James L. Bush	Tuscola, Ill.
WEB	Benwood Co.	St. Louis, Mo.
WEH	Midland Refining Co.	Tulsa, Okla.
WEV	Hurlburt-Still Electrical Co.	Houston, Tex.
WEW	St. Louis University	St. Louis, Mo.
*WFI	Strawbridge & Clothier	Philadelphia, Pa.
WFD	The Rike Kumler Co.	Dayton, Ohio
WFY	Cosradio Co.	Wichita, Kans.
WGF	The Register & Tribuna	Des Moines, Iowa.
WGI	American Radio and Research Corporation,	Medford Hillside, Mass.
WGL	Thomas F. J. Howlett.	Philadelphia, Pa.
*WGM	Atlanta Constitution	Atlanta, Ga.
WGR	Federal Tel. & Tel. Co.	Buffalo, N Y.
WGV	Interstate Electric Co.	New Orleans, La.
*WGY	General Electric Co.	Schenectady, N. Y.
WHA	University of Wisconsin.	Madison, Wisc.
*WHB	Sweeney School Co.	Kansas City, Mo.
WHD	West Virginia University.	Morgantown, W. Va.
WHK	Warren B. Cox	Cleveland, Ohio
WHN	Ridgewood Times Printing & Pub. Co.,	Ridgewood, N. Y.
WHW	Stewart W. Seeley	East Lansing, Mich.
WHX	Iowa Radio Corporation.	Des Moines, Iowa
WIK	K. & L. Electric Co.	McKeesport, Pa.
WIL	Continental Electric Supply Co.	Washington, D. C.
*WIP	Gimbel Brothers	Philadelphia, Pa.
WIZ	Conn Radio Mfg. Co.	Cincinnati, Ohio
WJD	Richard H. Howe	Granville, Ohio
WJH	White & Boyer	Washington, D. C.
WJK	Service Radio Equipment Co.	Toledo, Ohio
WJX	DeForest Radio Tel. & Tel. Co.	New York, N. Y.
WJZ	Radio Corporation of America—Westinghouse Elec. & Mfg. Co.,	Newark, N. J.
WKA	Landaus Music & Jewelry Co.	Wilkes-Barre, Pa.
WKC	Josepb M. Zawoiski Co.	Baltimore, Md.
WKN	Riechman-Crosby Co.	Memphis, Tenn.
WKY	Oklahome Radio Shop.	Oklahoma City, Okla.
WLB	University of Minnesota.	Minneapolis, Minn.
WLK	Hamilton Mfg. Co.	Indianapolis, Ind.
WLW	Crosley Mfg. Co.	Cincinnati, Ohio
WMA	Arrow Radio Laboratories.	Anderson, Ind.
WMB	Auburn Electrical Co.	Auburn, Me.
WMH	Precision Equipment Co.	Cincinnati, Ohio
WMU	Doubleday-Hill Electrical Co.	Pittsburgh, Pa.
WNJ	Shotton Radio Mfg. Co.	Albany, N. Y.
WNO	Wireless Telephone Co. of Hudson County, N. J.	Jersey City, N. J.
*WOC	Palmer School of Chiropractic.	Davenport, Iowa
WOE	Buckeye Radio Service Co.	Akron, Ohio
WOH	Hatfield Electric Co.	Indianapolis, Ind.
WOI	Iowa State College	Ames, Iowa
WOK	Arkansas Light & Power Co.	Pine Bluff, Iowa
*WOO	John Wanamaker	Philadelphia, Pa.
WOQ	Western Radio Co.	Kansas City, Mo.
*WOR	L. Bamberger Co.	Newark, N. J.
WOS	Missouri State Mktg. Bureau.	Jefferson City, Mo.
WOU	Metropolitan Utilities District.	Omaha, Nebr.
WOZ	Palladium Printing Co.	Richmond, Ind.
WPA	Fort Werth Record.	Fort Worth, Tex.
WPE	Central Radio Co.	Kansas City, Mo.
WPB	Nushawg Poultry Farm	New Lebanon, Ohio
WPI	Electric supply Co.	Clearfield, Pa.
WPJ	St. Joseph's College	Philadelphia, Pa.
WPM	Thomas J. Williams	Washington, D. C.
WPO	United Equipment Co.	Memphis, Tenn.
WQX	Walter A. Kuehl	Chicago, Ill.
WRK	Doron Brothers Electric Co.	Hamilton, Ohio
WRL	Union College	Schenectady, N. Y.
WRM	University of Illinois	Urbana, Ill.
WRP	Federal Institute of Radio Telagraphy,	Camdan, N. J.
WRR	City of Dallas (Police and Fire Signal Department),	Dallas, Tex.
WRW	Tarrytown Radio Research Laboratory,	Tarrytown, N. Y.
*WSB	Atlanta Journal	Atlanta, Ga.
WSL	J. & M. Electric Co.	Utica, N. Y.
WSN	Ship Owners Radio Service.	Norfolk, Va.
WSX	Erie Radio Co.	Erie, Pa.
WSY	Alabama Power Co.	Birmingham, Ala.
WSZ	Marshall-Gerken Co.	Toledo, Ohio
WTG	Kansas State Agr. College.	Manhattan, Kans.
WTP	George M. McBrde.	Bay City, Mich.
WVP	Signal Corps, Bedloe's Island, N. Y. Harbor,	N. Y.
WWB	Daily News Printing Co.	Canton, Ohio
WWI	Ford Motor Co.	Dearborn, Mich.
*WWJ	The Detroit News.	Detroit, Mich.
WWL	Lovola University.	New Orleans, La.
WWZ	John Wanemaker	New York, N. Y.
WAAB	Valdmer Jensen	New Orieans, La.
WAAC	Tulane University	New Orleans, La.
WAAD	Ohio Mechanics Institute.	Cincinnati, Ohio
WAAF	Chicago Daily Drovers' Journal.	Chicago, Ill.
WAAH	Commonwealth Electric Co.	St. Paul, Minn.
WAAJ	Eastern Radio Institute.	Boston, Mass.
WAAL	Beamish Electric Co.	Minneapolis, Minn.
WAAK	Gimbel Brothers	Milwaukee, Wisc.
WAAM	L. R. Nelson Co.	Newark, N. J.
WAAN	University of Missouri	Columbia, Mo.
WAAP	Otto W. Taylor	Wichita, Kans.
WAAQ	New England Motor Sales Co.	Greenwich, Conn.
WAAS	Georgia Radio Co.	Decatur, Ga.
WAAW	Omaha Grain Exchange	Omaha, Nebr.
WAAX	Radio Service Corp.	Crafton, Pa.
WAAY	Yahrling-Raynor Piano Co.	Youngstown, Ohio.
WAAZ	Hollister-Miller Motor Co.	Emporia, Kans.
WAJT	Kelley-Vawter Jewelry Co.	Marshall, Mo.
WAJU	Yankton College	Yankton, S. D.
WAJV	Indien Pipe Line Corp.	Princeton, Ind.
WBAA	Purdue University	West Lafayette, Ind.
WBAB	Andrew J. Potter	Syracuse, N. Y.
WBAD	Sterling Electric Co. and Journal Printing Co.,	Minneapolis, Minn.
WBAF	Fred M. Middleton	Morristown, N. J.
WBAG	Diamond State Fibre Co.	Bridgeport, Pa.
WBAH	The Dayton Co.	Minneapolis, Minn.
WBAJ	Marshall-Gerken Co.	Toledo, Ohio
WBAN	Wireless Phone Corp.	Paterson, N. J.
WBAO	James Millikin University.	Decatur, Ill.
*WBAP	The Star Telegram.	Fort Worth, Tex.
WBAU	Republican Publishing Co.	Hamilton, Ohio
WBAV	Erner & Hopkins Co.	Columbus, Ohio
WBAW	Marietta College	Marietta, Ohio
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.
*WBAY	American Tel. & Tel. Co.	New York, N. Y.
WCAB	Newburgh News Printng & Publishing Co.,	Newburgh, N. Y.
WCAC	John Fink Jewelry Co.	Fort Smith, Ark.
WCAD	St. Lawrence University.	Canton, N. Y.
*WCAE	Kaufman & Baer Co.	Pittsburgh, Pa.
WCAG	Daily States Publishing Co.	New Orleans, La.
WCAH	Entrekin Electric Ce	Columbus, Ohio
WCAJ	Nebraska Wesleyan University,	University Pl., Neb.
WCAK	Alfred P. Daniel	Houston, Tex.
WCAL	St. Olaf College.	Northfield, Minn.
WCAM	Villanova College	Villanova, Pa.
WCAD	Sanders & Stayman Co.	Baltimore, Md.
WCAP	Kalamazoo College	Kalamazoo, Mich.
WCAQ	Tri-State Radio Mfg. & Supply Co.,	Defiance, Ohio
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.
WCAS	William Hood Dunwoody Industrial Institute,	Minneapolis, Minn.
WCAT	South Dakota State School of Mines,	Rapid City, S. Dak.
WCAU	Philadelphia Radiophone Co.	Philadelphia, Pa.
WCAV	J. C. Dice Electric Co.	Little Rock, Ark.
WCAW	Woodmen of the World.	Omaha, Nebr.
WCAX	University of Vermont.	Burlington, Vt.
WCAY	Kesselmen O'Driscoll Co.	Milwaukee, Wisc.
WDAC	Illinois Watch Co.	Springfield, Ill.
WDAE	Tampa Daily Times.	Tampa, Fla.
*WDAF	Kansas City Star.	Kansas City, Mo.
WDAH	Mine & Smelter Supply Co.	El Paso, Tex.
WDAI	Hughes Electrical Corp.	Syracuse, N. Y.
WDAJ	Atlanta & West Point R. R. Co.,	College Park, Ga.
WDAK	The Courant	Hartford, Conn.
WDAL	Florida Times Union.	Jacksonville, Fla.
WDAM	Weston Electric Co.	New York, N. Y.
WDAD	Automotive Electric Co.	Dallas, Tex.
WDAP	Midwest Radio Central, Inc.	Chicago, Ill.
WDAQ	Hartman-Riker Elec. & Mach. Co.,	Brownsville, Pa.
WDAR	Lit Brothers	Philadelphia, Pa.
WDAS	Samuel W. Walte	Worcester, Mass.
WDAU	Slocum & Kilburn.	New Bedford, Mass.
WDAV	Muskogee Daily Phoenix.	Muskogee, Okla.
WDAX	First National Bank.	Centerville, Iowa
WDAY	Kenneth M. Hance.	Fargo, N. D.
WEAA	Fallain & Lathrop.	Flint, Mich.
WEAB	Standard Radio Equipment Co.,	Fort Dodge, Ia.
WEAC	Baines Electric Service Co.	Terre Hauts, Ind.
WEAD	Northwest Kansas Radio Sup. Co.,	Atwood, Kans.
WEAE	Virginia Polytechnic Institute.	Blacksburg, Va.
*WEAF	Western Electric Co.	New York, N. Y.
WEAG	Nichols-Hinaline-Bassett.	Edgewood, R. I.
WEAH	Wichita Board of Trade & Landers Radio Co.,	Wichita, Kans.
WEAI	Cornell University.	Ithaca, N. Y.

WEAJ University of South Dakota, Vermillion, S. Dak.
WEAK Julius B. Abercrombie.....St. Joseph, Mo.
WEAM Borough of North Plainfield, North Plainfield, N. J.
WEAN Shepard Company .....Providence, R. I.
WEAD Ohio State University.....Columbus, Ohio
WEAP Mobile Radio Co., Inc.....Mobile, Ala.
WEAQ Y. M. C. A.....Berlin, N. H.
WEAR Baltimore Am. & News Pub. Co., Baltimore, Md.
WEAS Hecht Company .....Washington, D. C.
WEAT John J. Fogarty .....Tampa, Fla.
WEAU Davidson Brothers Co.....Sioux City, Iowa
WEAV Sheridan Electric Service Co...Rushville, Nebr.
WEAW Arrow Radio Laboratories.....Anderson, Ind.
WEAX T. J. M. Daly.....Little Rock, Ark.
WEAY Will Horwitz, Jr.....Houston, Tex.
WEAZ Donald Redmond .....Waterloo, Iowa
*WFAA A. H. Belo & Co.....Dallas, Tex.
WFAB Carl F. Woese.....Syracuse, N. Y.
WFAC Superior Radio Co.....Superior, Mich.
WFAO Watson, Weldon Motor Supply Co., Salina, Kans.
WFAF Henry C. Spratley.....Poughkeepsie, N. Y.
WFAG Radio Engineering Laboratory, Waterford, N. Y.
WFAH Electrical Supply Co.....Port Arthur, Tex.
WFAJ Hi-Grade Wireless Instrument Co., Asheville, N. C.
WFAM Times Publishing Co.....St. Cloud, Minn.
WFAN Hutchinson Elec. Service Co...Hutchinson, Minn.
WFAQ Missouri Wesleyan College and Cameron Radio Company .....Cameron, Mo.
WFAS United Radio Corporation....Fort Wayne, Ind.
WFAT Daily Argus Leader.....Sioux Falls, S. D.
WFAU Edwin C. Lewis, Inc.....Boston, Mass.
WFAV University of Nebraska.....Lincoln, Nebr.
WFAW Miami Daily Metropolis.....Miami, Fla.
WFAY Daniels Radio Supply Co...Independence, Kans.
WFAZ South Carolina Radio Shop....Charleston, S. C.
WGAB QRV Radio Co. .....Houston, Tex.
WGAC Orpheum Radio Stores Co.....Brooklyn, N. Y.
WGAO Spanish Am. Schl. of Telegraphy, Ensonada, P. R.
WGAH New Haven Elec. Co.....New Haven, Conn.
WGAJ W. H. Glass .....Shenandoah, Iowa
WGAK Macon Electric Co.....Macon, Ga.
WGAL Lancaster Elec. Supply & Const. Co., Lancaster, Pa.
WGAM Orangeburg Radio Equipment Co., Orangeburg, S. C.
WGAN Cecil E. Lloyd .....Pensacola, Fla.
WGAQ W. G. Patterson .....Shreveport, La.
WGAR Southern American.....Forth Smith, Ga.
WGAS Ray-di-co Organizatioo.....Chicago, Ill.
WGAT American Legion, Dept. of Nebr., Lincoln, Nebr.
WGAU Marcus G. Lumb.....Wooster, Ohio
WGAW Ernest C. Albright.....Altoone, Pa.
WGAX Radio Electric Co., Washington Courthouse, Ohio
WGAY North Western Radio Co.....Madison, Wisc.
WGAZ South Bend Tribune.....South Bend, Ind.
WHAA State University of Iowa.....Iowa City, Ia.
WHAB Clark W. Thompson.....Galveston, Tex.
WHAC Cole Brothers Elec. Co.....Weterloo, Iowa
WHAD Marquette University.....Milwaukee, Wisc.
WHAE Automotive Electric Service Co., Sioux City, Ia.
WHAF Radio Electric Co.....Pittsburgh, Pa.
WHAG University of Cincinnati.....Cincinnati, Ohio
WHAH J. T. Griffin.....Joplin, Mo.
WHAI Radio Equipment & Mfg. Co..Davenport, Iowa.
WHAK Roberta Hardware Co.....Clerksburg, W. Va.
WHAL Lansing Capitol News .....Lansing, Mich.
WHAM School of Music, Rochester Univ., Rochester, N. Y.
WHAO F. A. Hill.....Savannah, Ga.
WHAP Dewey L. Otta.....Decatur, Ill.
WHAQ Semmes Motor Co.....Washington, D. C.
WHAR Paramount Radio & Elec. Co., Atlantic City, N. J.
WHAS Courier Journal & Louisville Times, Louisville, Ky.
WHAV Wilmington Elec. & Sopply Co., Wilmington, Del.
WHAW Pierce Electric Co.....Tampa, Fla.
WHAX Huntington Press .....Huntington, Ind.
*WHAZ Rensselaer Polytechnic Institute....Troy, N. Y.
WIAB Jeslyn Automobile Co.....Rockford, Ill.
WIAO Ocean City Yacht Club.....Ocean City, N. J.
WIAE Mrs. Robt. E. Zimmerman.....Venton, Ia
WIAF Gustav A. DeCertin.....New Orleans, La.
WIAH Continental Radio Mfg. Co.....Newton, Ia.
WIAI Heers Stores Co.....Springfield, Mo.
WIAJ Fox River Valley Radio Supply Co., Neenah, Wisc.

WIAK The Stockman Journal.....Omaha, Nebr.
WIAP J. A. Rudy & Sons.....Paducah, Ky.
WIAQ Chroniele Publishing Co.....Marion, Ind.
WIAS Burlington Hawkeye-Home Elec. Co., Burlington, Ia.
WIAT Leon T. Neel.....Tarkio, Mo.
WIAU American Sec. & Sav. Bank.....Le Mars, Ia.
WIAV New York Radio Laboratories, Binghamton, N. Y.
WIAW Saginaw Radio & Elec. Co.....Saginaw, Mich.
WIAX Capital Radio Co.....Lincoln, Nebr.
WIAY Woodward & Lothrop.....Washington, D. C.
WIAZ Electric Supply Sales Co.....Miami, Fla.
WJAB American Radio Co.....Lincoln, Nebr.
WJAD Jackson's Radio Eng. Lab.....Waco, Tex.
WJAE Texas Radio Syndicate.....San Antonio, Tex.
WJAG Huse Publishing Co.....Norfolk, Nebr.
WJAJ Y. M. C. A. .....Dayton, Ohio
WJAK White Radio Laboratory.....Stockdale, Ohio
WJAL Victor Radio Corporation.....Portland, Me.
WJAM D. M. Perham.....Cedar Rapids, Ia.
WJAN Peoria Star & Peoria Radio Sales Co..Peoria, Ill.
WJAP Kelly-Duluth Co. .....Duluth, Minn.
WJAR The Outlet Co. .....Providence, R. I.
WJAS Pittsburgh Radio Sopply House, Pittsburgh, Pa.
WJAX The Union Trust Co.....Cleveland, Ohio
WJAZ Chicago Radio Laboratory.....Chicago, Ill.
WKAA H. F. Paar & Republican Times, Cedar Rapids, Ia.
WKAC Star Publishing Co.....Lincoln, Nebr.
WKAO Charles Loof .....East Providence, R. I.
WKAF W. S. Radio Supply Co. and Wm. Schack, Wichita Falls, Tex.
WKAG Edwin T. Bruce, M.D.....Louisville, Ky.
WKAH Planet Radio Co.....West Palm Beach, Fla.
WKAK Okfuskee County News.....Okemah, Okla.
WKAL Gray & Gray.....Orange, Tex.
WKAN Alabama Radio Mfg. Co.....Montgomery, Ala.
WKAP Dutee Wilcox Fliot.....Cranston, R. I.
WKAQ Radio Corporation of Porto Bico, San Juan, P. R.
WKAR Michigan Agri. College.....East Lansing, Mich.
WKAS L. E. Lines Music Co.....Springfield, Mo.
WKAV Lacoota Radio Club.....Laconia, N. H.
WKAW Turner Cycle Co.....Beloit, Wisc.
WKAX Wm. A. MacFarlane.....Bridgeport, Conn.
WKAY Breneu College .....Janesville, Ga.
WLAC North Carolina State College....Baleigh, N. C.
WLAF Johnson Radio Co.....Lincoln, Nebr.
*WLAG Cutting & Washington Radio Corp., Minneapolis, Minn.
WLAH Samuel Woodworth .....Syracuse, N. Y.
WLAJ Waco Electrical Supply Co.....Weco, Tex.
WLAK Vermont Farm Mach. Co.....Bellows Falls, Vt.
WLAL Tulsa Radio Co.....Tulsa, Okla.
WLAM Morrow Radio Co.....Springfield, O.
WLAN Putnam Hardware Co.....Houlton, Me.
WLAO Aothracite Radio Shop.....Scranton, Pa.
WLAP W. V. Jordon .....Louisville, Ky.
WLAQ A. E. Schilling.....Kalamazoo, Mich.
WLAR Mickel Music Co.....Marshalltown, Iowa
WLAS Hutchinson Grain Radio Co....Hutchinson, Kans.
WLAT Radio and Specialty Co.....Burlington, Iowa
WLAV Electric Shop, Inc.....Pensacola, Fla.
WLAW New York Police Dept....New York City, N. Y.
WLAX Greencastle Community Broadcasting Station, Greencastle, Ind.
WLAY Northern Commercial Co. of Alaske, Fairbanks, Alaska
WLAZ Hutton & Jones Elec. Co.....Warren, Ohio
WMAB Radio Supply Co.....Oklahoma City, Okla.
WMAC F. Edward Page....Fernwood, Cazenovia, N. Y.
WMAF Roond Hille Radio Corp.....Dartmouth, Mass.
WMAG Tucker Electric Co.....Liberal, Kans.
WMAH General Supply Co.....Lincoln, Nebr.
WMAJ Drovers Telegram Co.....Kansas City, Mo.
WMAK Norton Laboratories .....Lockport, N. Y.
WMAL Tranton Hardware Co.....Trenton, N. J.
WMAM Beaumont Radio Equipment Co., Beaumont, Tex.
WMAN Broad Street Baptist Church....Columbus, Ohio.
WMAP Utility Battery Service.....Easton, Pa.
WMAQ The Chicago Daily News.....Chicago, Ill.
WMAR Waterloo Electrical Supply Co...Weterloo, Iowa
WMAT Paramount Radio Corporation....Duluth, Minn.
WMAV Alabama Polytechnic Institute.....Auburn, Ala.
WMAW Wahpeton Elec. Co.....Wahpeton, N. D.
WMAX K. & K. Radio Supply Co...Ann Harbor, Mich.
WMAY Kingshighway Presby. Church....St. Louis, Mo.
WMAZ Mercer University .....Macon, Ga.
WNAB Park City Daily News.....Bowling Green, Ky.
WNAC Shepard Stores .....Bostoo, Mass.

WNAO Oklahoma Radio Eng. Co.....Norman, Okla.
WNAF Enid Radio Distributing Co.....Enid, Okla.
WNAG Rathert Radio & Electric Co.....Cresco, Iowa
WNAH Manhattan Radio Supply Co..Manhattan, Kans.
WNAJ Benson Co. .....Chicago, Ill.
WNAL R. J. Rockwell.....Omaha, Nebr.
WNAM Ideal Apparatus Co.....Evansville, Ind.
WNAN Syracuse Radio Tele. Co.....Syracuse, N. Y.
WNAP Wittenberg College .....Springfield, Ohio
WNAQ Charleston Radio Elec. Co....Charleston, S. C.
WNAR C. C. Rhodes.....Butler, Mo.
WNAS Texas Radio Corporation and Austin Statesman, Austin, Tex.
WNAT Lenning Bros. Co.....Philadelphia, Pa.
WNAV People's Tel. & Tel. Co.....Knoxville, Tenn.
WNAW Henry Kunzmann .....Fortress Monroe, Va.
WNAX Dakota Radio Apperatus Co....Yenkton, S. D.
WNAY Ship Owners' Radio Service....Baltimore, Md.
WOAA Dr. Walter Hardy.....Ardmore, Okla.
WOAB Valley Radio .....Grand Forks, N. D.
WOAC Maus Radio Co.....Lima, Ohio
WDAD Friday Battery & Elec. Co.....Sigourney, Iowa
WDAE Midland College .....Fremont, Nebr.
WOAF Tyler Commercial College.....Tyler, Tex.
WOAG Apollo Theatre .....Belvidere, Ill.
WOAH Palmetto Radio Corp.....Charleston, S. C.
WOAI Southern Equipment Co.....San Antonio, Tex.
WDAJ Ervin's Electrical Co.....Parsons, Kans.
WOAK Collins Hardware Co.....Frankfort, Ky.
WOAL Wm. E. Woods.....Webster Grove, Mo.
WOAN James D. Vaughan.....Lawrenceburg, Tenn.
WOAQ Portsmouth Radio Ass'o.....Portsmouth, Va.
WOAR Henry P. Lundskow .....Kenosha, Wisc.
WOAS Bailey's Radio Shop .....Middletown, Conn.
WOAT Boyd Martell Hamp.....Wilmington, Del.
WOAU Sowder Boiling Piano Co. .....Evansville, Ind.
WOAV Penns. National Guard.....Erie, Pa.
WOAZ Penick Hughes Co.....Stanford, Texas
WOAX Franklyn J. Wolff.....Trenton, N. J.
WDAY John W. Wilder .....Birmingham, Ala.
WPAA Anderson & Webster Electric Co.....Waco, Tex.
WPAB Pennsylvania State College...State College, Pa.
WPAC Donaldson Radio Co.....Omulgee, Okla.
WPAD Wieboldt & Co.....Chicago, Ill.
WPAF Peterson's Radio Co.....Council Bluffs, Iowa
WPAG Central Radio Co., Inc.....Independence, Me.
WPAH Wisconsin Dept. of Markets.....Waupaca, Wisc.
WPAJ Doolittle Radio Corperation...New Haven, Conn.
WPAK No. Dakota Agricultural College...Fargo, N. D.
WPAL Superior Radio & Tel. Equipt. Co., Colombus, Ohio
WPAM Awerbach & Guettal.....Topeka, Kans.
WPAP Theodore D. Phillips .....Winchester, Ky.
WPAQ General Sales & Eng. Co.....Frostborg, Md.
WPAR R. A. Ward.....Beloit, Kans.
WPAS J & M Electric Co.....Amsterdam, N. Y.
WPAT St. Patrick's Cathedral .....El Paso, Tex.
WPAU Coocordia College .....Moorhead, Minn.
WPAV Paul Tinetti & Sons.....Laurium, Mich.
WPAW Radio Installation Co., Inc....Wilmington, Del.
WPAX S-W Radio Co., J. R. Sbumate, Jr. Thomasville, Ga.
WQAA Horace A. Beale, Jr.....Parkersburg, Pa.
WQAB Southwest Missouri State Teachers College, Springfield, Mo.
WQAC E. B. Gish.....Amarillo, Tex.
WQAK Appel-Higley Electric Co. .....Dubuque, Iowa
WQAL Cole County Tel. and Tel. Co.....Mattoon, Ill.
WQAP American Radio Co.....Lincoln, Nebr.
WQAQ West Texas Radio Co.....Abilene, Tex.
WRAA Rice Institute .....Houston, Texas
WRAM Robert E. Compton & Carthage College, Carthage, Ill.
WRAN Black Bawk Elec. Co. .....Waterloo, Iowa
WRAR Jacob C. Thomas.....David City, Nebr.
WRAU Amarillo Daily News.....Amarillo, Tex.
WRAY Radio Sales Corporation.....Scrantoo, Pa.
WSAJ Grove City College .....Grove City, Pa.
WSAS State of Nebraska.....Lincoln, Nebr.
WSAV Clifford W. Vick, Radio Construction Co., Houston, Tex.
WTAC Penn Traffic Co.....Johnstown, Pa.
WTAU Ruegy Battery & Elec. Co....Tecumseh, Nebr.
WTAW Agricultural & Mechanical College of Texas, College Station, Tex.
WWAC Sanger Brothers .....Waco, Tex.
WWAO Wright & Wright, Ioc. .....Philadelphia, Pa.
WWAH General Supply Co.....Lincoln, Nebr.
WWAX Wormen Brothers .....Laredo, Tex.

Canadian Broadcasting Stations

CFAC Radio Cerporatioo of Calgary, Ltd., Calgary, Alberta
CFCA Star Publishing and Printing Co., Toronto, Ontario
CFCB Marconi Wireless Telegraph Co. of Canada, Ltd., Vancouver, B. C.
CFCO Canadian Westioghouse Co., Ltd., Winnipeg, Manitoba
CFCE Marcooi Wireless Telegraph Co. of Canada, Halifax, Nova Scotia
CFCF Marconi Wireless Telegraph Co. of Canada, Ltd., Montreal, Quebec
CFCH Abitibi Power and Paper Co., Ltd., Iraquois Falls, Ontario
CFCI Motor Products Corporation, Welkerville, Ontario
CFCN W. W. Grant Radio, Ltd.....Calgary, Alberta
CFCX The London Advertiser.....London, Ontario
CFPC International Radio Development Co., Fort Frances, Ontario
CFTC The Bell Telephone Co. of Canada, Toronto, Ontario
CFUC University of Montreal.....Montreal, Quebec
CFVC Roy Russell Brown...Courteney, British Columbia
CFYC Victor Wentworth Odlum.....Vancouver, B. C.
CFZC Canadian Westinghouse Co., Ltd..Montreal, Quebec
CHAC Radio Engineers, Ltd.....Nova Scotia, Halifax
CHBC The Albertan Publishing Co.. Calgary, Alberta

CHCA Radio Corporation of Vancouver, Ltd., Vancouver, B. C.
CHCB Marconi Wirless Telegraph Co. of Canada, Ltd., Toronto, Ontario
CHCC Canadan Westingbouse Co., Ltd., Edmonton, Alberta
CHCF Radio Corporation of Winnipeg, Ltd., Winnipeg, Manitoba
CHCQ The Western Radio Co., Ltd., Calgary, Alberta
CHCS London Radio Shoppe.....London, Ontario
CHCZ The Globe Printing Co.....Toronto, Ontario
CHFC John Millen & Sons, Ltd.....Toronto, Ontario
CHCX B. L. Silver.....Montreal, Quebec
CHIC Canadian Westinghouse Co., Ltd., Hamilton, Ontario
CHOC Canadian Westinghouse Co., Ltd., Vancouver, B. C.
CHVC Metropolitan Motors, Ltd.....Toronto, Ontario
CHXC J. R. Booth, Jr.....Ottawa, Ontario
CHYC Northern Electric Co.....Montreal, Quebec
CJBC Dupois Freres .....Montreal, Quebec
CJCA The Edmonton Journal, Ltd., Edmonton, Alberte
CJCB James Gordon Bennett, Nelson, British Columbia
CJCD T. Eaton Co.. Ltd.....Toronto, Ontario
CJCE Vancouver Sun Radiotelephones, Ltd.. Vancouver, B. C.

CJCF News Record, Ltd.....Kitchener, Ontario
CJCG Manitobe Free Press Co., Ltd., Winnipeg, Manitoba
CJCH The United Farmers of Ontario, Toronto, Ontario
CJCI McLean, Holt & Co., Ltd., St. John, New Brunswick
CJCN Simons Agnew & Co.....Toronto, Ontario
CJCS Eastern Telephone and Telegraph Co., Ltd., Halifax, Nova Scotia
CJCY Edmund Taylor .....Calgary, Alberta
CJGC London Free Press Printing Co., Ltd., London, Ontario
CJNC Tribune Newspaper Co., Ltd., Winnipeg, Manitoba
CJSC The Evening Telegram.....Toronto, Ontario
CKAC La Presse Publishing Co.....Montreal, Quebec
CKCB T. Eston Co., Ltd.....Winnipeg, Manitoba
CKCD Vancouver Daily Previnces.....Vancouver, B. C.
CKCE Canadian Independent Telephone Co., Ltd., Toronto, Ontario
CKCK Leader Publishing Co., Ltd., of Regina, Regina, Saskatchewan
CKCR Jones Electric Radio Co., St. John, New Brunswick
CKCS The Bell Telephone Co. of Canada, Montreal, Quebec
CKCZ Canadian Westinghouse Co., Ltd., Toronto, Ontario
CKKC Radio Equipmeot and Supply Co., Toronto, Ontario
CKOC The Westworth Radio Supply Co., Hamilton, Ontario
CKQC Radio Supply Co. of London.....London, Ontario
CKZC Salton Radio Engineering Co., Winnipeg, Manitoba

Laughter on the Radio Wave

Marriages By Radio

(H. I. Phillips, in The *N. Y. Globe*)

THE use of the radio for matrimonial ceremonies has been ruled illegal. It is held that mistakes enough are being made under the old-fashioned system.

Marriages over the radio have aroused agitation in several States, but it has remained for the attorney general of New York to issue a formal ban. The bride and groom in the case involved contended that there was no difference between broadcasting marriages and broadcasting the other fight news. A radio matrimonial service should be sent out, they contended, the same as any other storm warning.

The attorney general was firm, however, and thus disappear all chances of husbands getting divorces on the ground they got the wrong wife due to static conditions.

Likewise, all prospects of wives winning separations on contentions that they got husbands from W J K when they expected them from K D W.

In fact, several serious errors of the sort have been reported already. A Newark (N. J.) druggist thought he was being married by radio to a prominent Detroit society girl a few weeks ago. He discovered two nights later that, owing to crossed carrier waves he had married the author of the Uncle Piggly-Wiggly stories.

In Chicago a well-known roofing manufacturer perfected all arrangements to take as his mate by radio the prettiest girl in Cos Cob, Conn. Through broadcasting errors he was united in wedlock to the "Rutgers College Glee Club in Songs and Instrumental Music, 8.45 P. M."

As a matter of fact, inquiry revealed he had a very close call from being married to "Sousa's Band in New and Novel Program, 9.10 P. M."

And what happened to the Cos Cob beauty? You'll never guess, Dudley. She found she had become the wife of both the Bison City Four and the keeper of the Arlington official time.

A New York woman who had divorced four husbands tried a radio marriage to a fifth and discovered she had become wedded to "the Fenwood Beach Firemen's Fife and Drum Corps in Patriotic Melodies." Some people said it served her right.

And then there is the matter of confusion in broadcasting the wedding ritual itself. Listen in for yourself:

Minister: "Do you snap-snap-click-click-snap Beatrice Marmalade take this eggs closed firm to be your Oil Can preferred, bid 34; asked 36 lawfully wedded woodchuck and chipmunk fable by Thornton Burgess?"

Answer: "Nothing could be finer than to be in Carolina, etc."

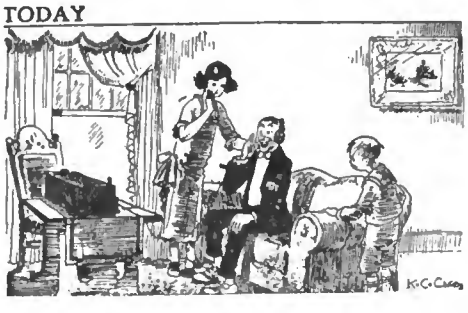
Minister: "Do you, George buzz-buzz take this muskrat story by Dr. Oat to be your lawfully wedded-oom-pah-oompah-ta-ra-ra-ta-tum?"

Answer: "I love the name of Nelly Kelly."

Minister: "I pronounce you symphony concert and bedtime story."

YESTERDAY

TODAY



—*N. Y. Globe*

Wise Crack-les

Readers of THE WIRELESS AGE are urged to sharpen their wits and send in their Wise Crack-les to this column. Get busy, you merry-makers, and if you originate a laugh, pass it along for the rest of us to enjoy.

FOND Father: This broadcasting stuff, it makes me sick. A bunch of good stevedores and factory hands were ruined when they got into radio!

Second Ditto: You can't get no argument out of me on that, brother. They wouldn't let my Willie sing for the radio either!

One receiving set that has difficulty in catching everything broadcasted is an ash tray. —*Evening Telegram.*

A radio fan in Illinois has brought suit to quiet his radio neighbor who hogs the ether. The question must be settled. Whose universe is this, anyway? —Minneapolis *Journal.*

Out of Step

He wondered why "The Blue Danube Waltz" didn't sound just right. He was using a two-step amplifier.

—Crosley *Weekly.*

Well, What's the Answer?

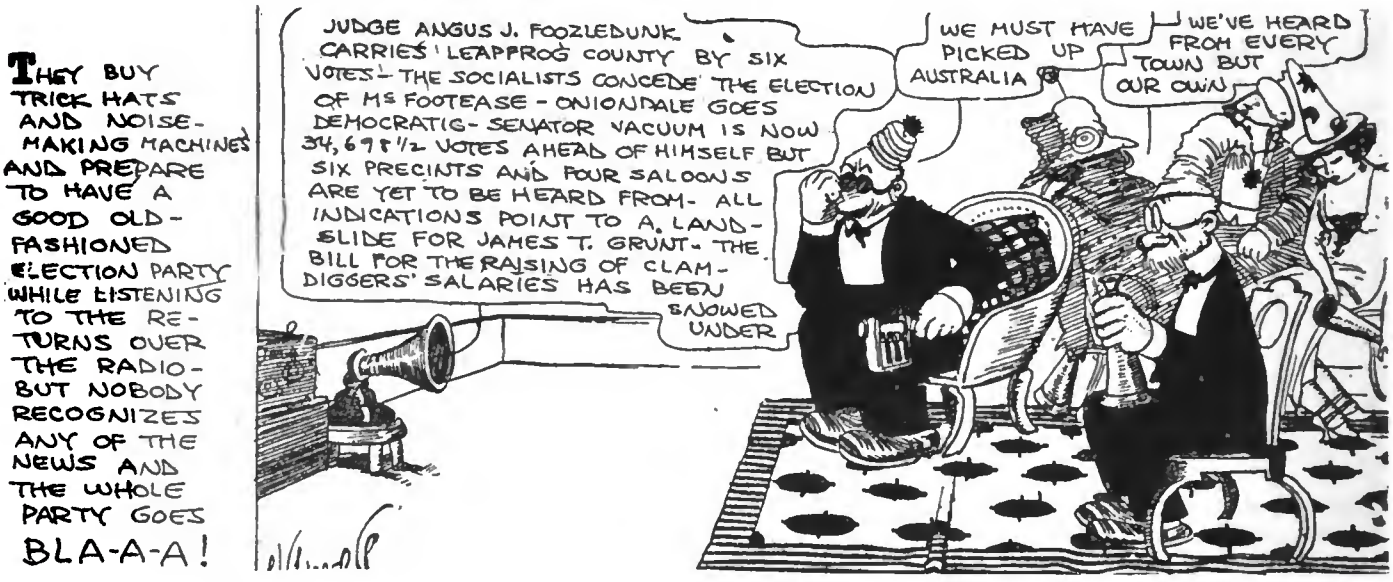
THE modern schoolboy knows wireless from A to Z and can rattle off the terms with a fluency that staggers the casual dabbler in the new art. In some sections of the country, however, only rumors of the wonders of wireless have seeped in and the native isn't always quite sure what it is all about.

In Bleecker, a little hamlet outside of Gloversville, N. Y., a progressive farmer was erecting poles for his aerial, the other day, for the purpose of getting crop reports and weather forecasts.

A neighbor happened along, and learning that the work had something to do with wireless, asked: "which pole does that feller sing off of?"

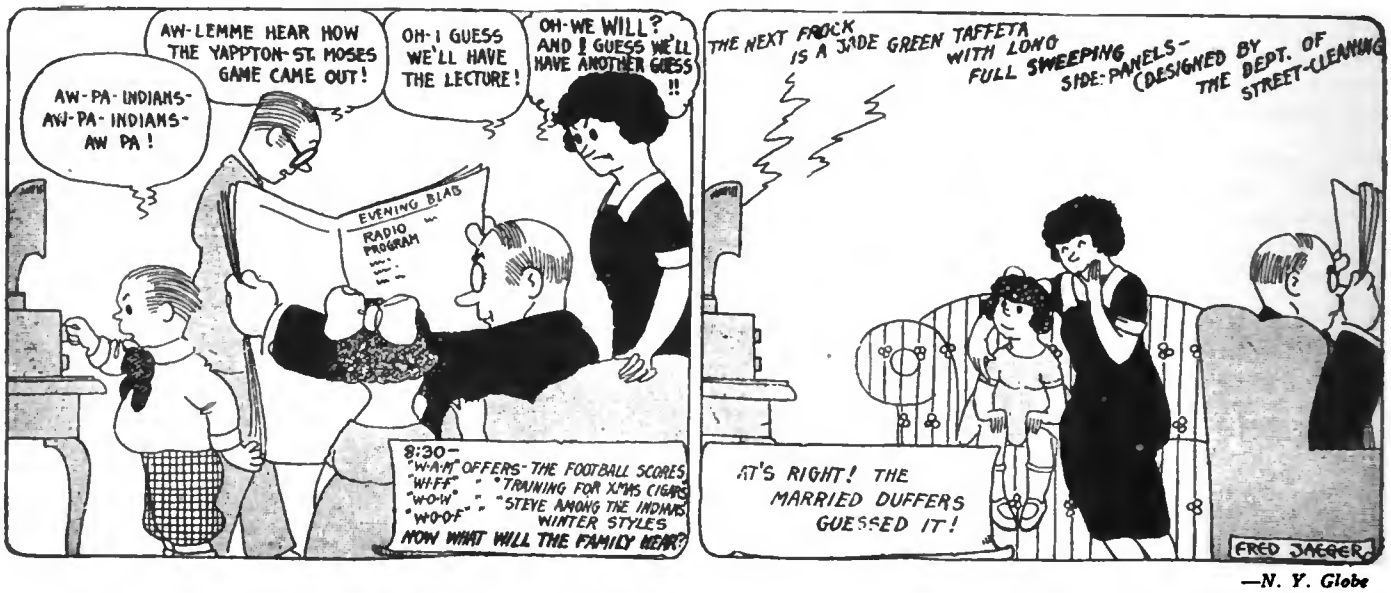
When Wireless Waves Whirl Wittily

OUR OWN WEEKLY RADIO RAVINGS



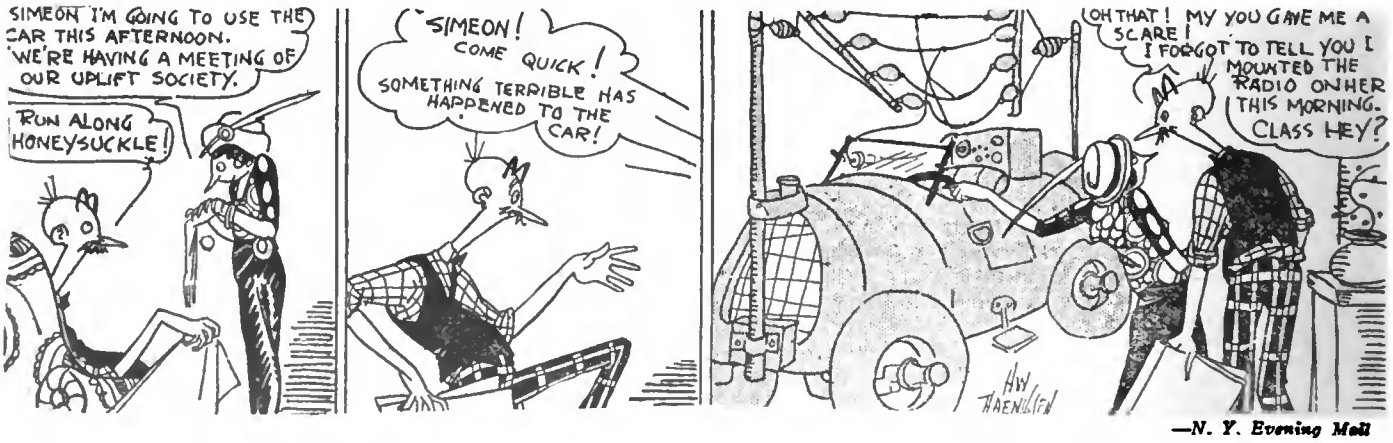
—*N. Y. Evening Mail*

JEVER KNOW IT TO FAIL?



—*N. Y. Globe*

SIMEON BATTS



—*N. Y. Evening Mail*

WORLD WIDE WIRELESS

Tropical Radio Co. Builds New Station

IN order to give constant radio communication between the United States and Central America, the Tropical Radio Company is erecting a powerful transmitting station at Hialeah, near Miami, Fla. The station will cost about $200,000 and will use high power vacuum tubes, enabling transmission not only in the conventional dots and dashes, but also by voice. The Tropical Company, which is a subsidiary of the United Fruit Company, handling its radio traffic, will probably experiment extensively with voice transmission when its new tubes are placed in operation.

Already the company is handling radio business off the coast, using the old 3-kw. Marconi station at Miami Beach, recently leased from the Navy Department and licensed as WAX. The location of the new station on the long arm of Florida, which projects farther towards the southern continent than any other point in the States except a small portion of Texas, is believed an ideal location.

Situated on a plot of ground covering 90 acres, two 437-foot transmitting towers, located about 1,000 feet apart, will soon be erected to hold aloft the great transmitting aerials. Apparatus of the latest type, including the new Langmuir 200-kw. tubes, is being built by the General Electric Company.

To avoid interference, the receiving apparatus will be located in a building five or six miles distant from the transmitting plant. Three antennas, reaching out in different directions for from one-half to two and a half miles in length, will be erected to catch the long distance messages from the south. These receiving aerials are of the low-lying type, being erected on 40-foot poles. In the receiving station itself, several loops to aid operators in reception and eliminate directional interference will be installed. Operation at the station is to be under the direction of R. G. Mackenzie, who will have a crew of about twelve men.

Prospects for traffic with Central American and far distant southern stations are good. The United Fruit Company itself is now building radio stations in practically all Central American countries. Recently a new station at Tegucigalpa, Honduras, established radio communication for the first time with the United States with a message to President Harding. Next year another large station at Nicaragua will be opened, it is reported.

Within a year the United Fruit Company's ships will be equipped with radio-telephone apparatus as well as telegraph sets, and it is expected that this newer means of radio communication will be employed extensively. Recently radio engineers of the company succeeded in telephoning via radio between the New Orleans station and a station at Almirante, Panama.

When the President addresses Congress he now speaks not only to the Senators and Representatives, but also to radio listeners, his speech being broadcast by NAH. Above, preliminary tests being held. The microphones can be seen in the foreground and on the ceiling the horns of a local amplifier so all in the House can hear.

Weather Forecasts From NAT

ADDITIONAL weather forecasts and warnings are being broadcast from NAT, the U. S. Naval Radio Station at New Orleans. These broadcasts, on a wave of 1,832 meters, are for the district included in Louisiana, Arkansas, Oklahoma and Texas, and comprise weather forecasts, river conditions and a summary of the conditions over the United States twice daily. The schedule calls for a broadcast at 10:30 A. M. and 10 P. M., 75th meridian time.

Radio Brings New Barometer

AN interesting indirect result of the use of radio by airplanes has been the development of a new type of altimeter by the U. S. Bureau of Standards. Until the radio compass was developed for airplane use, planes did not dare ascend during a fog. Now, however, that the radio compass makes flying possible during the heaviest fog, pilots no longer hesitate to ascend, knowing that they will not lose their way. In descending in a fog, however, the radio compass gives them no indication of their height and the aneroid barometer, while supposed to indicate altitude, is subject to error due to varying barometric pressures in different weathers. The new altimeter consists of a standard barometer used in conjunction with a movable dial, whereby a correction can be made by the pilot for the error in reading brought about by stormy conditions. Thereby he is enabled to know at all times his actual height above the ground, and, guided by the radio compass, can descend in the thickest fog.

New York Talks to England

THOUGH it has been known for some months that the development of the new water-cooled high-power vacuum tubes described in these pages last October gave new emphasis to the commercial practicability of transoceanic radio telephony, it was not until 9 p. m., Eastern Standard Time, on January 14, 1923, that the first official and public test was made. At that time the new tubes were used at the Rocky Point station of the Radio Corporation of America as a transmitter for the voice of H. B. Thayer, president of the American Telephone & Telegraph Co., who spoke into his office telephone at 195 Broadway, New York City. In England, American radio engineers who had been sent there for the purpose, with special receiving equipment, heard Mr. Thayer's voice perfectly, as well as Marconi and others who participated in the test. A group of tubes rated at 12.5 kw. each, was used to put 100 kw. in the antenna at Rocky Point.

This marks an important step forward toward the time when it will be as easy to carry on two-way telephone conversation across the sea as it now is to telegraph.

Navy Again to Experiment With Radio Control

IMPORTANT maneuvers in radio control of a battleship and in radio range finding will be made by vessels of the United States Navy early in March, in Panama Bay. The famous S. S. *Iowa,* of Spanish War renown, which last year was operated under radio control and both bombed and fired upon by heavy guns, will again be the target. It will maneuver without a single person on board, its movements being controlled from the S. S. *Shawmut,* operating a special radio transmitter which will govern every movement of the distant *Iowa.*

The target ship will be sent out to sea under radio direction, and when she is out of sight indirect fire at her will be undertaken by the aid of radio observation and spotting furnished by airplanes.

The *Iowa* is a 25-year-old warship, which has served more than her time. For the past two years she has been known as Coast Battleship No. 4, honored here and abroad as the first radio-controlled ship of war. Her actual bombardment with heavy gunfire from the *Mississippi* occasioned considerable interest last year, not alone in the Navy, but in Congress. The Navy seeks to determine whether its present methods of range finding and fire-control, and the instruments used, are efficient, and this is the first time an opportunity has been afforded. The effect of gunfire on armored vessels is well known, as other ex-battleships, including ex-German craft, have been anchored and blown to pieces by our expert gun pointers and trainers. Last winter it was planned to try them out, using the *Iowa* while under way, after the airmen had practiced bombing her with dummy bombs, but lack of funds and fuel prevented.

Literally, the *Iowa* is a modern, steam "Flying Dutchman" without skipper or crew. Some time ago far-sighted radio engineers of the Navy developed a special method of radio-telegraph control for the *Iowa* based upon the inventions of John Hays Hammond, Jr., and aided by engineers of the General Electric Company. Today it works perfectly; her water and oil tanks are filled, her oil-burning boilers and engines are started by a skeleton crew of caretakers. Her control ship takes her over, and the crew abandons ship. By means of radio her engines are speeded up and slowed down, her rudder is thrown to port or starboard or maintained at a desired angle, and she performs within a fraction of a second at the will of the "master mind" aboard the control ship, which may be as far as ten miles distant. A special feature of her equipment prevents her running away, stopping her if the control is broken or the aerials are shot away. If no radio control signal reaches her "electric-mechanical brain" for so long as fifteen minutes, the fires are extinguished, the engines stopped and everything shut down. This enables the crew to again board her, repair any defects and start her on another "Flying Dutchman" cruise.

Five basic problems of gunfire will be undertaken with the old *Iowa* as a moving target in an effort to simulate as nearly as possible war-time conditions.

As it is not desired to sink the *Iowa,* special projectiles will be used. They will have very thin walls and super-sensitive fuses. These shells will be filled with high explosive charges, and it is expected that when direct hits are made they will all explode on the armor plate of the vessel and break up rather than penetrate her. The vessel is twenty-five years old, however, and has not been kept in the same condition since the war as a vessel in active service. She is far from the last word in warships and her armor and water-tight compartments are not modern. It is possible, therefore, that if she is hit many times at weak points she may sink, but the Department desires that the five tests be made without any such mishap. Her radio control apparatus is of considerable value, being the first remote control system for a full-sized sea-going vessel in the world. Then, too, future radio-control development in the Navy will undoubtedly be based upon this, the first radio warship.

A board of about five officers will be convened to make a study of the tests and report with regard to the outcome of the tests, with recommendations as to modifications of fire control and improvement of instruments.

Captain W. D. Leahy, commanding the *Shawmut,* will control the *Iowa* during the manuevers, with Lieutenant Commander R. F. McConnell in charge of radio installations. Ensign Hertz will also assist in the radio control work.

When the President addressed the special session of Congress that convened on Nov. 20, this apparatus in the basement of the Capitol was used to amplify the currents from the microphone in the House of Representatives. From this Western Electric installation, directly under the historic chamber, wires led to the Navy radio station, NAH, for broadcasting the President's voice so all could listen

Radio Conquers Storms

THE severe storms that whipped the North Atlantic into fury during the last week of December and the first week of the new year failed to interfere with radio communication with ships at sea, and across the ocean, from shore to shore. Throughout the disturbances, which reached great intensity and delayed even the largest and most powerful ships, radio operation continued unhampered. The storms were reported by seamen to be the worst in fifteen or twenty years, and all ships were from one to four or more days late in making port on both sides of the ocean. Had it not been for radio, much needless anxiety would have been caused. In one case, that of the S.S. *Digby,* the ship was seven days late, but communication was constantly maintained with her.

English Marconi Director

THE Rt. Hon. F. G. Kellaway, P. C., has been appointed a director of Marconi's Wireless Telegraph Company, Ltd. Mr. Kellaway was formerly postmaster general of England and therefore is thoroughly acquainted with communication problems and with their radio solutions.

Trans-Atlantic Amateur Tests Successful

Signals from Hundreds of American Amateur Stations Heard in England, France, Holland and Switzerland—American Amateurs Report Signals from Two Stations in England and One in France

THE third annual series of Trans-Atlantic tests between the amateurs of the United States and Europe, which were conducted by the American Radio Relay League, December 11 to December 30, inclusive, resulted in a deluge of American signals in Europe and a spattering of European signals in America.

In addition to these stations, the calls of 32 others were heard, including one located in Porto Rico.

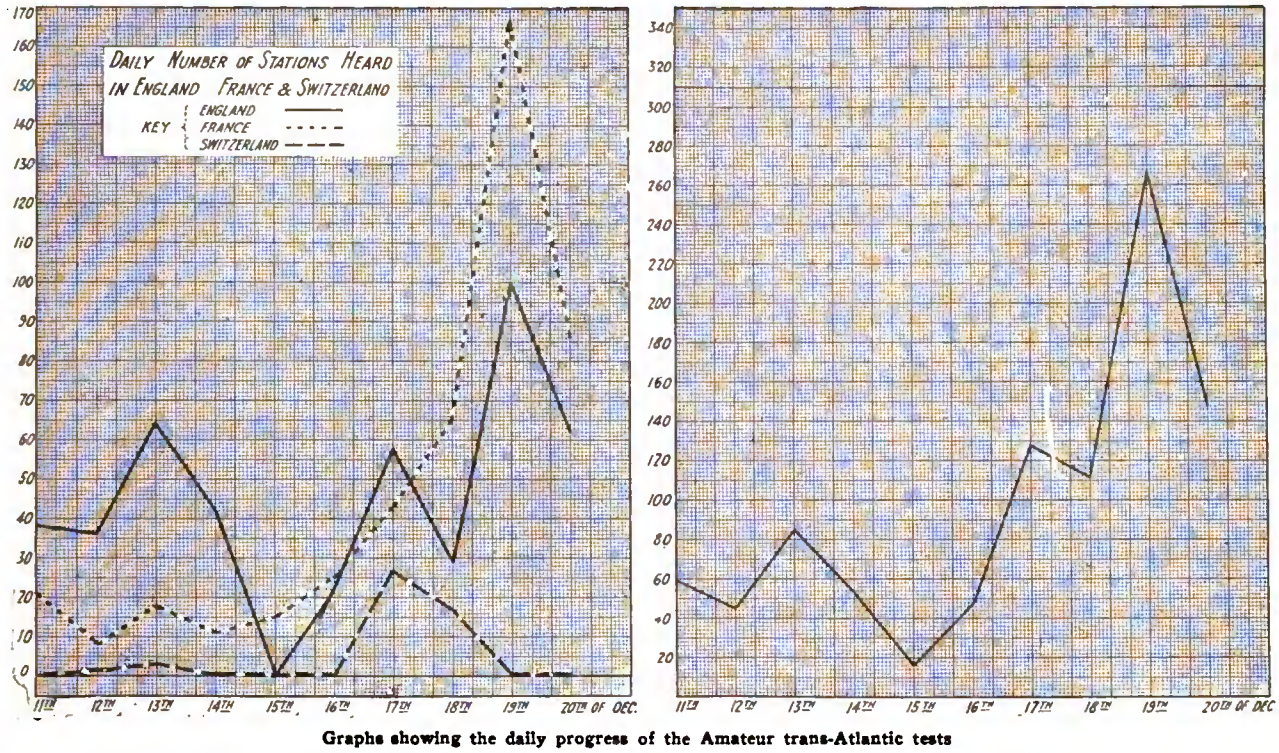
Following nights carried out the promise of the first night and so many other stations were heard on some of them while working at odd times that the total ran up close to a thousand for the ten days of the tests. The English listeners reported that so many American stations were heard on some nights that bad jamming resulted.

In addition to being reported from England and France many American stations were reported from Holland and Switzerland, and in many cases this reception has been verified.

The reception of signals from several stations on the Pacific Coast was reported, but verifying these reports was not possible, as the stations were heard during the free-for-all period and did not transmit code words.

The outstanding distance feature of the tests so far verified, is the reception of signals in England from station 6ZA, located at Salt Lake City, Utah; and in France from 5ZA, Roswell, N. Mex. The overland oversea airline distance between Salt Lake City and England is approximately 5.500 miles and between Roswell and France about the same. It is understood that 100-watt continuous wave transmitting sets were used at both 5ZA and 6ZA.

An unusual feature of the tests was the recording of signals from station 1CMK on a dictograph record by J. H. D. Ridley, of Burndept, Ltd., London. THE WIRELESS AGE made ar-



Graphs showing the daily progress of the Amateur trans-Atlantic tests

On the first night of the eastward tests, December 11, approximately 25 stations, the code words of which were verified were heard in England and France. These included many of the best-known stations in the eastern part of the country, several of which were heard in England last winter and some of which had been reported from England previous to the actual tests of this year.

Total Number of Stations by Districts Heard During Tests—Code Word Verified

	English	French	Swiss	Total
First District	60	19	3	82
Second District	75	18	2	95
Third District	35	3	1	39
Fourth District	6	1	1	8
Fifth District	1	0	1	2
Sixth District	1	0	0	1
Seventh District	0	0	0	0
Eighth District	33	12	2	47
Ninth District	3	1	0	4
			Total,	278

Total Number of Stations by Districts Heard During Free-for-All Periods

	English	French	Swiss	Total
First District	52	117	7	176
Second District	66	112	10	188
Third District	34	65	8	107
Fourth District	11	6	1	18
Fifth District	5	2	0	7
Sixth District	0	7	0	7
Seventh District	0	0	0	0
Eighth District	15	79	9	103
Ninth District	3	9	2	14
Miscellaneous	63	2	0	65
			Total,	685

rangements to have this cylinder sent to New York and intended to broadcast it from Station WJZ, the Radio Corporation—Westinghouse Station, at Newark, New Jersey, but the cylinder unfortunately, was accidentally broken in handling. An attempt to make another permanent record of American amateur signals is to be made.

For the first time in history the amateurs of America succeeded in speaking to the amateurs of Europe by voice. Reception of voice communications from American amateur stations has been reported from both England and France. The general amateur station of Harry H. Carman, Freeport, L. I., which uses three 50-watt tubes, Radiotrons UV 203, and which was fully described in the December issue of THE WIRELESS AGE, was heard on voice in England at two different times during the tests. The experimental station of the Rensselaer Polytechnic Institute, Troy, N. Y., 2XAP, was reported as having transmitted a Christmas message to friends in France, by voice. The special amateur station of G. C. Cannon, New Rochelle, 2ZK, was also reported to have been heard on voice on the first night of the tests by English listeners.

Careless forming of characters by many American amateurs prevented acknowledgment of their signals by listeners in Europe, and the French particularly, had a difficult time in attempting to unscramble some of the mysterious combinations of dots and dashes which reached them. While these Morse-defying characters undoubtedly came from America, it was impossible to identify them. Anyone who listened on this side during the transmitting periods can easily sympathize with the French in their efforts to decipher characters "what ain't and never was."

During the first week of the tests the amateurs in America were considerably puzzled as to the identity of station "Zero Marie Xavier" (O-MX) which was several times reported from France as having been heard there. It was at first assumed that it was an error in reception, but as the French continued to report it for several days, it seemed that they certainly must be hearing such a call. Then it was assumed that someone on this side was "kidding" the French listeners. One brilliant amateur suggested that it was being used instead of the international "QRN"—meaning atmospherics—and that the French were therefore reporting reception of Old Man Static, or X's, as atmospherics are known in Europe. However, a correction finally came through from the French observers, which stated that station OMX was located in Holland, and the operator had evidently been conducting some tests on his own account.

List of Stations Heard in England During Free-for-all Periods.

1GV, 1II, 1OR, 1RQ, 1RY, 1XB, 1XK, 1XM, 1YK, 1ZE, 1AJP, 1AZW, 1BCG, 1BDG, 1BDI, 1BDT, 1BEP, 1BES, 1BET, 1BKA, 1BKQ, 1BMK, 1BRQ, 1CDO, 1CDX, 1CKG, 1CKP, 1CMK, 1CNJ.

2EL, 2FP, 2GJ, 2GK, 2HW, 2KG, 2KL, 2LO, 2LY, 2NZ, 2UD, 2ZK, 2ZS, 2AFP, 2AWF, 2AWL, 2AXO, 2BLP, 2BMC, 2BML, 2BQU, 2BQT, 2BRB, 2BYS, 2CBW, 2CJW, 2CKL, 2CKR, 2CQZ, 2CSL, 2CTN, 2XAM, 2XAO, 2XAP, 2XAQ.

3BL, 3CC, 3EB, 3HG, 3HQ, 3JJ, 3XM, 3XR, 3YO, 3ZW, 3ZZ, 3AFP, 3AQR, 3AUU, 3BFU, 3BGJ, 3BGT, 3BLF, 3BNU, 3BVL, 3BYC.

4BX, 4BY, 4EA, 4EB, 4FB, 4OI, 4ZS, 4ZW.

5BV, 5NK, 5XK, 5AAM, 5GBZ.

8AD, 8AR, 8BK, 8BX, 8DB, 8GQ, 8SP, 8ADG, 8AQO, 8ATF, 8ATU, 8AXC, 8AXE, 8BUM, 8BXF.

9AL, 9IM, 9ZN.

List of Stations Heard in France During Free-for-all Periods

1AW, 1BS, 1CK, 1CN, 1FB, 1GH, 1GK, 1GV, 1II, 1IT, 1IW, 1MV, 1NI, 1NX, 1OR, 1PG, 1RD, 1UN, 1XM, 1XO, 1XU, 1XZ, 1YK, 1ZE, 1ADL, 1AGK, 1AJP, 1AKG, 1ARY, 1ASF, 1AWO, 1AWP, 1AZL, 1BAT, 1BCC, 1BCF, 1BCG, 1BDA, 1BDI, 1BDJ, 1BDK, 1BDT, 1BEP, 1BES, 1BET, 1BGF, 1BKQ, 1BRQ, 1BWJ, 1CDN, 1CDO, 1CDR, 1CDX, 1CKP, 1CMK, 1CNF.

2AF, 2AW, 2EI, 2EL, 2ER, 2FP, 2FW, 2GC, 2GI, 2GK, 2GR, 2GY, 2HJ, 2KA, 2KP, 2LI, 2LO, 2LY, 2NZ, 2RB, 2RP, 2UD, 2XC, 2ZE, 2ZK, 2ZL, 2ZS, 2AAA, 2AFB, 2AFP, 2AHO, 2AWF, 2AWL, 2AYV, 2BDJ, 2BGL, 2BLF, 2BLK, 2BLM, 2BLP, 2BML, 2BQD, 2BQH, 2BQT, 2BQU, 2CBW, 2CBX, 2CJD, 2CJN, 2CJW, 2CKN, 2CKR, 2CPD, 2CQF, 2CQZ, 2XAO, 2XAP, 2XAQ.

3AH, 3BG, 3BL, 3BM, 3BO, 3CC, 3EX, 3FA, 3FX, 3GN, 3HG, 3HM, 3HZ, 3IN, 3SG, 3TJ, 3WR, 3XM, 3XN, 3YU, 3ZW, 3ZY, 3ZZ, 3AFB, 3AQR, 3AUU, 3AZQ, 3BCN, 3BES, 3BFU, 3BGA, 3BGT, 3BLF, 3BLZ, 3BNU, 3BSY.

4AU, 4BY, 4EA, 4EB, 4GT.

5XK.

6AV, 6GZ, 6KA, 6ZA, 6ADG.

8AK, 8AM, 8AW, 8AX, 8AZ, 8BU, 8IB, 8JB, 8LA, 8MG, 8ML, 8MR, 8MZ, 8NF, 8SP, 8UE, 8WR, 8XE, 8YD, 8ZW, 8ADG, 8AIO, 8AQO, 8AOZ, 8ATB, 8ATU, 8AVO, 8AWF, 8AWP, 8AXC, 8AZO, 8BRK, 8BSL, 8BSS, 8BSY, 8BTV, 8BXF, 8BXH, 8CKR, 8CVA, 8CYK.

9OM, 9OX, 9AUL, 9CJC, 9DFB, 9DWC, 9DWQ.

List of Stations Heard in Switzerland During Free-for-all Periods

1II, 1NX, 1ST, 1XY, 1AZW, 1BDT.

2EL, 2RP, 2AYV, 2CBX, 2CJN, 2CKR, 2CPD, 2XAO, 2XAQ.

3HG, 3OT, 3XM, 3ZH, 3ZW, 3ZZ, 3BFU.

4EA.

8ML, 8UE, 8VQ, 8AQO, 8AXE, 8BRC, 8BSS, 8CJH.

9CM, 9DFB.

As the detailed report shows, approximately 1,000 American amateur calls were registered in Europe during the ten days of the eastward tests. The actual number of stations heard is, of course, considerably less, as many of them were reported several times. So far as is known, signals from stations using C. W. transmitters only were heard.

As a summary therefore, it can be definitely stated that American amateur station signals can be heard in England during the good radio months of the year, and when conditions are good, as often as the European listeners care to sit up till early morning and listen for them, the best hours for reception there being reported as during the hours after midnight.

The westward transmission tests by English and French amateurs followed the eastward transmission. They started on December 22, and continued until December 31. The result was that for the first time in history of radio communication the signals of English and French amateur stations were heard in America and two of the English stations verified by means of the code letters which they transmitted.

The first reception of signals from English stations which was accomplished on the second night of the tests, was reported by A. B. Tyrill, Riverhead, L. I., and F. Kral, Washington, D. C., who heard signals from English 2FZ, the station of the Manchester Wireless Society, Manchester, England. Later on in the tests signals from English 5WS, the station of the Radio Society of Great Britain, at Wadsworth, near London.

Only one reception of French signals was officially reported. Gene E. Withom, of Brooklyn, 2CGZ, reported hearing French station 8AB, owned and operated by Leon Deloy, at Nice, France, on the night of December 26th. Mr. Withom, who is 16 years old, and who has been an amateur for only a few months, stated that he heard 8AB send a few words in French and then finish with his call letters 8AB. Only one tube was used by Mr. Withom in this record-breaking and unparalleled reception. As no code word was copied by Mr. Withom the identity of the transmitting station could not be verified.

That any signals at all were heard during the westward tests is, of course, very gratifying to American amateurs and to the English and French who transmitted them, but the fact is that the results were anything but satisfactory to the great number of listeners who were unsuccessful and whose hours of listening resulted in nothing but a bedlam of interference from amateur stations on this side, the operators of which either did not know or did not care that westward amateur trans-

Stations Heard in England—Code Word Verified

1FP....B. L. Barrett.....47 Forest St., Springfield, Mass.
1GV....H. H. Tilley.....Woolworth Bldg., Providence, R. I.
1XM....Mass. Institute of Technology.....Cambridge, Mass.
1YK....Worcester Polytechnic Institute.....Worcester, Mass.
1ZE....I. Vermilya.....24 Allen St., Marion, Mass.
1AHZ...H. N. Dole.....27 Columbus Ave., Haverhill, Mass.
1AJP....N. W. Bishop, Jr.....301 Park Place, Bridgeport, Conn.
1AKG...S. K. Hefferman.....28½ Grove St., Salem, Mass.
1ASF...A. F. Sise.....31 Powder House Road, Medford, Mass.
1AZW...H. Toumanjanian.....16 Finley Place, Newport, R. I.
1BAS...Paul S. Hill, Jr.....334 Main St., Saco, Me.
1BCF...Levi G. Cushing.....South Duxbury, Mass.
1BCG...Minton Cronkhite.....North St., Greenwich, Conn.
1BDI....F. E. Handy..414 H. H. Hall, Univ. of Me., Orono, Me.
1BDU...B. H. Chace.....39 Chester Ave., Winthrop, Mass.
1BEP...F. L. Vanderpool.....Litchfield, Conn.
1BET...College of the Holy Cross.....Worcester, Mass.
1BGF...P. O. Briggs.....52 Girard Ave., Hartford, Conn.
1BKQ...Worcester County Radio Association..566 Main St., ...Worcester, Mass.
1CJA....G. E. Nothnagle, 176 Waldemer Ave., Bridgeport, Conn.
1CMK...P. H. Bloom.....682 East St., Holyoke, Mass.
1CNF...W. S. Aleen..... St. Mark's School, Southboro, Mass.
1CNK...H. R. Watson.....25 Wilson St., Burlington, Vt.

2EL.....H. H. Carman.....217 Bedel St., Freeport, L. I., N. Y.
2FP.....R. G. Barber.....52 Herriman Ave., Jamaica, N. Y.
2GK.....A. G. Kastenmayer....417 Paige St., Schenectady, N. Y.
2GM....W. Grumbacker.....514 West 170th St., New York City
2GR.....J. M. High Jr., 254th St. and Independence Ave., N. Y. City
2HW....F. M. Hanna.....1211 Hutton St., Troy, N. Y.
2KF.....H. D. Selvage, 45 Durand Place.....Irvington, N. J.
2LO.....N. Dunham, 103 South First Ave., Highland Park, N. J.
2NZ.....E. R. Raguse.....151 Main St., Tottenville, N. Y.
2UD....U. R. Ross.....1057 61st St., Brooklyn, N. Y.
2ZK.....Cannon G. Curtis...183 Drake Ave., New Rochelle, N. Y.
2ZL.....J. O. Smith.....3 Corona Ave., Valley Stream, L. I.
2AFP...G. O. Milne .....142 Totowa Road, Paterson, N. J.
2AHO...Wm. M. Derrick.....58 North 6th St., Newark, N. J.
2AWF...Elmer Wirsing.....33 Quail St., Albany, N. Y.
2AWL...R. S. Johnson.....White St., Red Bank, N. J.
2AYV...N. Van Heuvel, 413 Magnolia St., New Brunswick, N. J.
2BLP...L. B. Matthews.....Main St., Locust Valley, N. Y.
2BML...H. H. Beverage, Box 13, Great Pond Rd., Riverhead, L. I.
2BQU...H. F. Kuch....610 Delafield Ave., Staten Island, N. Y.
2BQT...H. L. Olesen..Box 129, Main St., Riverhead, L. I., N. Y.

2BRB...E. M. Glaser.....845 East 13th St., Brooklyn, N. Y.
2CKN...B. M. Francisco.....12 N. Jay St., Schenectady, N. Y.
2CQD...W. G. Beck.....145 Third Ave., W. Roselle, N. Y.
2CQZ...R. M. Morris.....827 Gross Ave., Elizabeth, N. J.
2XAP...Rensselaer Polytechnic Institute.....Troy, N. Y.

3BG.....P. C. Peterson...Hock Road and Ashland, Folcroft, Pa.
3CC.....C. W. Weber.....Huntington Road, Abington, Pa.
3CG.....V. M. Wintermute.....47 Spring St., Newton, N. J.
3EB.....A. Byrne.....5137 Columbia Ave., Philadelphia, Pa.
3FS.....C. G. Benzing....2425 South 12th St., Philadelphia, Pa.
3NH....W. C. Buttfield..2 Rockview Hts., No. Plainfield, N. J.
3XM....David Richardson .....Princeton, N. J.
3YO....Lafayette College .....Easton, Pa.
3ZW....Walter A. Parks.....Washington, D. C.
3ZZ.....Aloysius A. Kubiac.....Craddock, Va.
3AFB...R. T. Shaw.....1914 Park Drive, Wilmington, Del.
3AUU...W. M. Lamb.....1421 Farmer St., Petersburg, Va
3BGT...C. S. Risley, Rumson & Ventnor Avs., Atlantic City, N. J.
3BLF...C. R. Hofmann.....202 Addison St., Richmond, Va.
3BNU...O. A. Hiskey.....22 W. Fairview St., Bethlehem, Pa.

4BY.....J. E. Hodge.....911 Abercorn, Savannah, Ga.
4KM....L. K. Rush.....22 Cherry St., Atlanta, Ga.

5XK....Philip Stout .....Knoxville, Tenn.

6ZZ.....H. L. Gooding .....Douglas, Ariz.

8BK.....Cleveland Radio Research Laboratory—Operator, A. P. Tyler..2048 E. 79th St., Cleveland, Ohio
8KG....J. W. Kidd.....404 Lafayette St., Niles, Ohio
8ML....F. Murphy..Grd. Div. and Warner Rd., Cleveland, Ohio
8SP.....A. Kisner.....809 Coleman Ave., Fairmont, W. Va.
8UB.....F. J. Maslyk.....Prospect St., Box 2, Elyria, Ohio
8UE.....N. Schaefer.....32 Broadway Ave., Lancaster, N. Y.
8XE.....Pennsylvania State College.....State College, Pa.
8YD.....Shaw Technical School .....East Cleveland, Ohio
8AQO...J. E. Page.....Fernwood Farm, Cazenovia, N. Y.
8ATU...J. K. Marcus.....87 Kelly St., Rochester, N. Y.
8AWF...E. M. Prentke....10013 Somerset Ave., Cleveland, Ohio
8AWP...S. Woodworth.....425 Brownell St., Syracuse, N. Y.
8AXC...E. Manley.....328 4th St., Marietta, Ohio
8BXH...H. C. Hedges.....35 12th Ave., Columbus, Ohio

9AL.....J. A. Thomsen.....3407 LeMoyne St., Chicago, Ill.
9AUL...L. C. Smeby..1504 West Broadway, Minneapolis, Minn.
9DYN...D. & M. Koerner .....Kempton, Ill.

Stations Heard in France—Code Word Verified

1GV.....H. H. Tilley.....Woolworth Bldg., Providence, R. I.
1XM....Mass. Institute of Technology.....Cambridge, Mass.
1XX....Brown University .....Providence, R. I.
1YK....Worcester Polytechnic Institute.....Worcester, Mass.
1ZE.....I. Vermilya.....24 Allen St., Marion, Mass.
1AKG...S. K. Heffernan.....28½ Grove St., Salem, Mass.
1ASF...A. F. Sise.....31 Powder House Road, Medford, Mass.
1BCF...Levi G. Cushing .....South Duxbury, Mass.
1BCG...Minton Cronkhite .....North St., Greenwich, Conn.
1BEP....F. L Vanderpool .....Litchfield, Conn.
1BET...College of the Holy Cross .....Worcester, Mass.
1BGF...P. O. Briggs.....52 Girard Ave., Hartford, Conn.
1CMK...P. H. Bloom.....682 East St., Holyoke, Mass.
1CNF...W. S. Aleen.....St. Mark's School, Southboro, Mass.

2EL.....H. H. Carman....217 Bedell St., Freeport, L. I., N. Y.
2GK.....A. G. Kastenmayer...417 Paige St., Schenectady, N. Y.
2LO.....N. Dunham..103 So. First Ave., Highland Park, N. J.
2ZK.....Cannon Geo. Curtis 183 Drake Ave. New Rochelle, N. Y.
2ZL.....J. O. Smith.....Valley Stream, L. I., N. Y.
2AWF..Elmer Wirsing .....33 Quail St., Albany, N. Y.
2AWL...R. S. Johnson.....White St., Red Bank, N. J.
2BML...H. H. Beverage, Box 13, Great Pond Rd., Riverhead, L. I.
2CQZ...R. M. Morris.....827 Gross Ave., Elizabeth, N. J.
2XAP...Rensselaer Polytechnic Institute .....Troy, N. Y.

3ZW....Walter A. Parks.....Washington, D. C.
3AFB...R. T. Shaw.....1914 Park Drive, Wilmington, Del.
3BLF...C. R. Hofmann.....202 Addison St., Richmond, Va.
4BY.....J. E. Hodge.....911 Abercorn, Savannah, Ga.
8BK.....Cleveland Radio Research Laboratory (Operator) A. P. Tyler, 2048 E. 79th St., Cleveland, Ohio
8IB.....R. C. Higgy.....50 18th Ave., Columbus, Ohio
8ML....F. Murphy..Grd. Div. and Warner Rd., Cleveland, Ohio
8UE.....N. Schaefer.....32 Broadway Ave., Lancaster, N. Y.
8AIO....C. W. Daizell....212 Spring Ave., East Pittsburgh, Pa.
8AQO...J. E. Page.....Fernwood Farm, Cazenovia, N. Y.
8ATU...J. K. Marcus.....87 Kelly St., Rochester, N. Y.
8AWP...S. Woodworth.....425 Brownell St., Syracuse, N. Y.
8BXH...H. C. Hedges.....35 12th Ave., Columbus, Ohio
9DWK..A. R. Ueleke.....301 South High St., Jackson, Mo.

Stations Heard in Switzerland—Code Word Verified

1GV.....H. H. Tilley.....Woolworth Bldg., Providence, R. I.
1XM....Mass. Institute of Technology.....Cambridge, Mass.
1AZW...H. Toumanjanian.....16 Finley Place, Newport, R. I.
2GK.....A. G. Kastenmayer...417 Paige St., Schenectady, N. Y.
2AWL...R. S. Johnson.....White St., Red Bank, N. J.
3AFB...R. T. Shaw.....1914 Park Drive, Wilmington, Del.
4BY....J. E. Hodge.....911 Abercorn, Savannah, Ga.
5ZA.....Louis Falconi .....Roswell, N. M.
8AIO...C. W. Dalzell....212 Spring Ave., East Pittsburgh, Pa.
8AQO...J. E. Page.....Fernwood Farm, Cazenovia, N. Y.

Atlantic tests were under way. Many special ultra-sensitive receiving sets were built and operated during the tests, but all to no purpose, owing to nearby interference. As one operator who had had a pair of phones clamped to his head for ten nights, six hours a night, expressed it: "There may be only 20,000 transmitting amateurs in the United States, but 200,000 of them were working during the tests."

The series of storms which swept over the ocean during the tests were undoubtedly responsible to a great degree for the varying daily results in the number of American stations heard in Europe.

Hardened ocean voyagers who have crossed the Atlantic scores of times were unanimous in declaring that the storms which prevailed in mid-ocean during the week before Christmas were the worst of their experience.

Capt. Henri Boisson of the *Savoie* of the French line, which arrived in port on December 26, forty-eight hours overdue, said that he had spent 32 years on the sea and never before remembered encountering such mountainous waves and such terrific wind.

"There were waves which from the base to the crest measured more than 100 feet," he said. "I cannot recall in all my years of experience such turbulent seas or such drastic changes in the weather. Last Tuesday the barometer dropped six points in an hour, an unprecedented occurrences within the span of my memory."

Radio Waves and Attenuation

By L. P. Burt

THERE seems to be widespread interest in the development of a satisfactory transmission formula. The Austin-Cohen formula does not cover the field for transocean work in which at present there is so much interest. Solving the Austin formula for receiver current with constant power output for various wavelengths indicates less superiority for the longer waves than experience shows, as the commercial companies are climbing still higher on the wavelength scale for transocean work. Also the old formula is entirely empirical so far as the coefficients go, at least, and the question of "effective height" remains a matter of experimental observation and argument among engineers. Taking a value for antenna height widely different than the actual, even when the ground system is complete and the station close to water does not seem logical. Explanation on the basis of the Hertzian doublet in which the node of the voltage loop is below the conducting surface does not sound logical either.

In the past attempts at deriving laws of attenuation have been applied to transocean signals, since it is in these that the commercial companies are interested. The curves for many very obvious reasons have yielded points that wandered all over the curve sheet for which at least three or four very plausible reasons in each particular case can be advanced. It would seem that the method of attack is basically wrong since curves must be taken with one variable at a time while the others are made to "stand still." The extensive work of the government in which trained weather men took extensive observations failed to establish even an approximate law connecting signal strength and any observable weather condition.

In the anxiety to solve the problem the companies have gone into the field rather than the laboratory. It would seem better to return to the methods of Hertz, which were the exact methods the physicists use today to study radio's short-legged brother, the light wave. It should be comparatively easy to set up an oscillator for very short waves, say one meter or less. Perhaps this is too short for tubes but there is no serious disadvantage in a spark set similar to that used by Righi, save the introduction of the decrement term into the results. Then a level uniform conducting surface can be found with a radius of 500 wavelengths, say, and the field intensity at any point measured. This should give a good start on distance attenuation and scattering factor. The relative size of the quantities eliminates the curvature of the earth and the much-debated Heaviside layer action. By measuring the field after dark and in daylight, further information can be gained. By using the set-up on different soils and over wet earth the effect of the conducting surface when plane can be studied.

After the laws are studied for a plane surface, much more could be learned using artificial curves and natural obstructions to map out fields where radio shadows exist. Reducing the wavelength much more would simplify this work, but it is doubtful if the laws derived for even a few meters wavelength could be extrapolated to commercial values and found to agree with the nicety with which Steinmetz's laws checked when carried into radio frequencies. Curves taken by government observers of the attenuation of searchlight beams of light of different colors, or wavelengths, show that there are many turning points in the curve. Whether this curve is uniform according to some simple law at lower frequencies of radio, a series of experiments would have to tell.

Some may claim that even if the exact laws are known, the weather changes over a long stretch will be such that it will be hard to change power output to follow them without breaking up service. The telephone engineers have the same problem and find it necessary to make frequent transmission measurements to maintain voice frequency service, to say nothing of the carrier current system which is much more sensitive to changes. They may be able to adapt the carrier to special cable and leave the open wire lines but the radio people will have to stick to the regions of space and by finding out the laws may be able to devise new systems of radio. Certainly the telephone men did not derive line attenuation formulae by making straight-away transmission measurements on a trans-continental line with all kinds of variables between terminals as the radio people have been doing. The only way radio investigators can avoid these troubles is to limit the field of their work to such an area as they can collect data on and can feel is not influenced by an erratic variation of the entire terrestial electrical field or other unknown cause which produces the rapid swinging of apparent signal direction as well as intensity. This latter has been observed too much to be denied and recent electrical disturbances have shown that the entire earth passes through rapid and tremendous changes which make one wonder that the weak radio wave gets through at all. Even yet more is found out about lightning by a Leyden jar than by experimenting with a thunderstorm and it may be true also that laws of radio transmission now unknown can be found out by an amateur with spark coil equipment like that of Hertz or Righi working over a mile radius. Trained men working from different continents have not announced the answer, but it will come. At any rate the amateur who reads the original work of Hertz will find much that will help him and it almost seems that this patient investigator right at the start found out things that the radio engineers could have used had they thought that this old-time amateur was of that kind whose work never grows old nor whose suggestions fail to give a hint to a mind working out later ideas.

A New Non-Oscillating Tube

A Novel Principle Governs the Operation of a Detector Designed to Eliminate Distortion and Capacity Effects and to Secure Maximum Response Without Regeneration

A NEW type of detector tube was described and demonstrated before the Institute of Radio Engineers late in December by Harold P. Donle, chief engineer of the Connecticut Telephone and Electric Company.

He explained that this new tube has no grid, and has no useful period of oscillation, but he claimed for it sensitiveness equal to a standard detector tube used in a circuit where increased signal strength is secured by means of regeneration, or semi-oscillation. In addition the new tube when in its most sensitive condition, does not seem to generate energy in an antenna to produce interference with other nearby receivers. The new tube also appeared to have another quality in that it is not sensitive to body capacity effects while being tuned or adjusted for maximum response. Maximum response to signals of a given wave length is accomplished by varying the neutralizing potential of the input circuit of the tube.

The construction of one form of this tube is illustrated diagrammatically in figure 1 where F is the filament, A is the anode, which may be of metallic sodium in the bottom of the tube, and H is the heater which is a short length of resistance wire cemented to the outside of the glass directly underneath

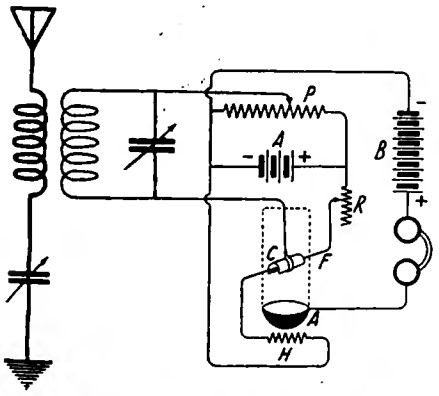


Figure 2—Circuit showing connections for the new tube

the anode. This heater maintains the anode at proper operating temperature. C is the "collector" electrode of sheet metal bent into a "U" and positioned above the filament, with its open side toward the anode.

In operation the tube may be connected to the circuit, shown in figure 2, which is simply a two circuit tuner

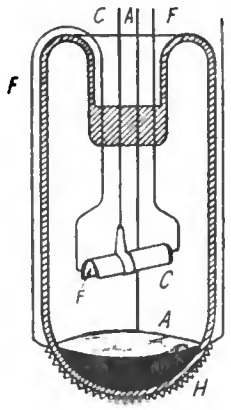


Figure 1—Diagram of the Donle tube

with one terminal of the secondary connected to the collector electrode of the tube and the other to a contact operating on resistance connected directly across the filament battery terminals. The remainder of the circuit is as used with any simple detector.

The adjustment of the collector potential is the only one necessary for efficient operation other than the usual variation of capacity and coupling of the tuning circuit. The potential of the "B" battery is not at all critical and usually may be varied between ten and thirty volts without much effect on response.

Mr. Donle secured a response with this tube in a plain circuit equal in magnitude to the response from a regenerator, using maximum non-oscillating regeneration. A regenerative circuit under this condition of critical adjustment gave very considerable distortion.

On the other hand, the new detector created no noticeable distortion, and, as it does not oscillate over its useful range, it cannot create any interference with other receivers.

The response of the tube is greatly improved by very weak coupling between the circuits. This is due to its very low input impedance, which also makes the proportion of capacity and inductance of the secondary circuit for maximum results quite different from those for other tubes. Although the new detector can be used successfully in an ordinary two-circuit tuner, results will fall short of the maximum unless means are available for selecting the best value of secondary inductance.

In this tube there is an electron flow from the filament to the collector, the magnitude of this current being due in part to the relatively large area of the collector and to its close proximity to the filament. It, therefore, receives an equivalent of large electron flow when it is at the same potential as the negative end of the filament. In order to reduce this flow an opposing potential —which may be taken from the "A" battery—is introduced into the circuit between the collector and filament. This potential is called the neutralizing potential and is used as abcissas of curves shown in figure 3, which show the variation in anode and collector currents Ia and Ic with variation of neutralizing potential En, and also the collector current when the anode circuit is open I'c. The curves labeled Ic-I'c is the difference between the collector current with the anode circuit completed and opened. This last curve is interesting in that it apparently takes into consideration various phenomena concerned in the operation, and its slope is practically a direct index of the functioning of the tube as a detector.

These curves show some of the fundamental characteristics of the tube.

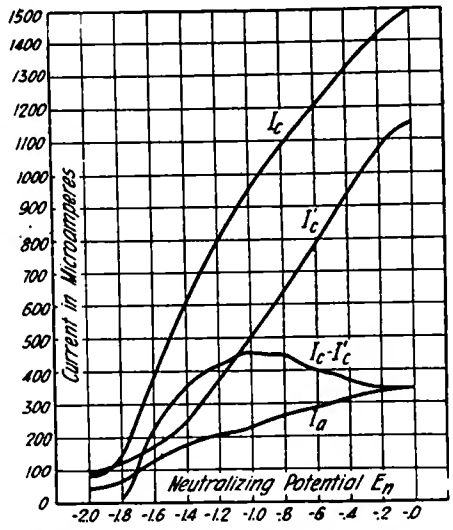


Figure 3—Characteristic curves of the gridless tube

The abrupt bend in the collector current at En=—1.8 is a point at which maximum detection would be expected to take place, according to the usual conception of detection as being due to rectification over a section of the characteristic slope where the rate of change is large. One would also gather from this curve that the effect of a signal impressed would be to increase the average value of the col-

lector and anode currents. Although some detection takes place on this part of the curve, in magnitude it is incomparable to that secured over the sensitive portion of the slope. The point of maximum sensitivity for these curves is at En = —1.4 volts, which is at a relatively flat portion of the collector current curve and considerably above the lower bend. Furthermore, a signal impressed on the collector circuit always gives a decrease in collector current regardless of whether the characteristic curve at the sensitive point is concave or convex, many examples of both types having been observed. It should also be noted that this point of maximum sensitivity occurs somewhat above the center of the Ic-I'c curve. Another point of interest in connection with these curves is the values at

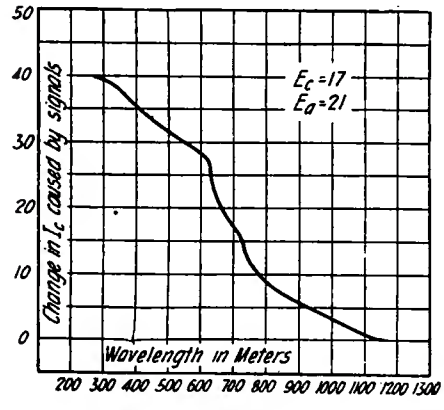


Figure 4

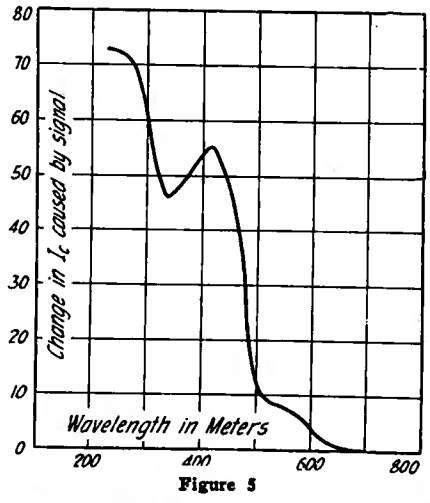


Figure 5

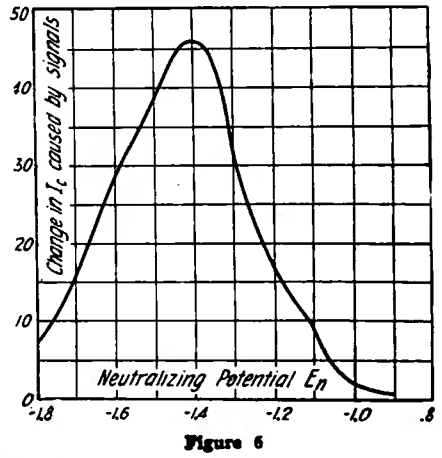


Figure 6

Characteristic curves of the Donle tube under various conditions of operation

example. The possibilities indicated by this curve in the elimination of interference are obvious.

Figure 6 shows the variation in collector current at various values of En due to an impressed signal of constant frequency on the collector circuit. Thus it represents the range of the neutralizing potential for a signal, and gives some idea of the ease of adjustment of this variable for maximum signal. This adjustment is obviously broad and allows a relatively wide variation of neutralizing potential for an audible signal, making it simple and easy to locate the point of maximum sensitivity.

Although the collector current pulsates at low frequencies, the tube is entirely ineffective as a heterodyne receiver due to the almost negligible detection at this frequency. As can be observed by an examination of figure 4, no appreciable detection takes place until the signal frequency is at least four or five times the fundamental pulsation frequency.

Since slow changes in the collector circuit current are reflected in the anode circuit, a decrease of the average value of the collector current will result in a like decrease in the anode current, but this occurs without any appreciable amplification. By experiment on a large number of tubes the ratio of change of power in collector circuit to resulting power change in anode circuit was found to be approximately unity.

The action of this tube depends upon ionization produced by electrons emitted from the filament. The use of an easily vaporized anode metal allows great possibilities in the way of controlling ionization, in part because it becomes possible to secure a very sharp density gradient of atoms available for ionization, and to supply these atoms continuously at the proper rate required for operation, thus leaving unrestricted the mean free path beyond the zones of ionization.

Sodium is a convenient metal of this type, but similar useful effects have already been secured from a variety of differently composed anode materials. In practice the heater is connected in series with the filament, and the two are thus controlled simultaneously.

At first thought it would seem necessary to allow a considerable time after lighting the tube filament before the anode would become sufficiently hot. That is, however, not the case, for on account of the following most interesting phenomenon:—When the filament is first lighted the anode receives a small amount of heat by direct radiation from the filament and there will be, even at this relatively low temperature, a considerable emission of particles from this anode. This emission will, however, decay with time, and in a period of possibly one hour it will have reached a small fraction of its initial value. However, with the external heater connected in series with the filament, as described above, when the filament is lighted the anode will commence to receive heat from this heater. Its effect in raising the anode temperature will be necessarily slow on account of the interposition of the glass wall of the tube, but the temperature of the anode will be increased by this heater at a rate approximately correct to compensate for the decay of the initial emission, and thus the emission of particles from the anode will become fairly constant within a few seconds after the filament of the tube is first lighted.

The result of this combination of affairs is that when the tube is lighted it is almost immediately in operative condition, although in some cases a slight re-adjustment of neutralizing potential is later necessary to maintain a maximum sensitivity.

operating potentials of collector and anode currents, the collector current usually being two to four times that of the anode.

Figure 4 shows the change in collector current of the sodium tube for impressed signals of different wave lengths. The ordinates of this curve show in micro-amperes the actual decrease in collector current caused by a signal of variable frequency, but of constant amplitude. This curve shows that the response for the particular tube on which this data was taken becomes small above the wave length of 1,000 meters, and that below this wave length detection increases rapidly. This might seem to indicate a limited wave length band of operation for this type of tube, but the entire shape and position of this curve depends upon the relative potentials of the tube electrodes and upon their proportions and relative positions. It is possible radically to change this curve by a simple variation of the neutralizing potential. It is also possible by a proper selection of values to secure a serrated form of this curve of which figure 5 is a typical

Design of Amateur 10-Watt Radiophone Using 110-Volt A. C.

By Samuel C. Miller

THERE is no doubt that the best way of obtaining the necessary filament and plate supply for any set whether it be a transmitter or receiver, is by some method whereby the 110-volt supply furnished in a majority of homes is utilized. All that should be required is the screwing of a plug into a socket, the same as in attaching a lamp and turning on the current, thereby putting the set immediately into an operative condition. The advantages that are obtained in utilizing this convenient source of power for radio are so numerous that it is certainly quite easily realized why many experimenters are working on this problem, especially in using A. C. for receivers.

In transmitter design, the A. C. problem is not as serious as in a receiver. In receiver work, however, the energy or signal that is obtained from a transmitting station is very much smaller compared to the hum induced by the local A. C. supply, and with the addition of audio-frequency amplifiers in the receiver not only is the signal increased in intensity, according to the number of steps used, but also this objectionable hum is increased in the same proportion, although the use of filters and special circuits help somewhat.

As we are interested in this article in the design of a transmitting set, we will confine ourselves to transmitters only. Practical circuits for A. C. sources of supply will be submitted with data and constants that are essential to the building of a complete set. The use of various sources of power supply will be discussed and their relative merits and disadvantages emphasized.

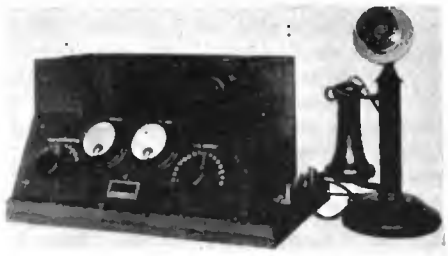


Figure 2—Front view of transmitter with controls and indicating instruments

Relative Value of Various Kinds of Power Supply—110-Volt A.C. Supply

The usual method of obtaining power for the filaments and the plates is by using storage batteries for the filaments and a motor-generator set, with a voltage output high enough to give satisfactory potential on the plates for proper operation of the set. But by using 110 volts A. C. without storage batteries, or a motor generator, it becomes necessary to change this available supply into two different forms of power; namely, a low voltage supply for the filaments, which can be A. C. and a high voltage supply for the plates, which must be changed or rectified to D. C., The advantage in the use of A. C. for the filament of the tube is that the emission of electrons at all points from the filament is uniform along its entire length, whereas in the case of using storage batteries or D. C. in lighting the filament and taking for example an inverted "V" type filament, one leg of the "V" is more negative at all times in respect to the plate than the other leg, therefore emitting more electrons to the plate and causing a shorter life of the tube, in comparison to one using A. C. for its supply. There also develops in filaments using D. C. what is known as a hot spot, usually occurring at the most negative point and resulting in very rapid disintegration of the wire at that point, lessening the life of the tube considerably.

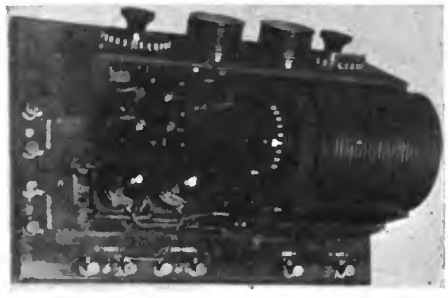


Figure 3—Perspective top view of the transmitter

Another advantage in the use of an A. C. supply is that the voltage obtained from the line can be stepped up to any desired voltage by means of a properly designed transformer. As the plate voltage required for the best operation of the standard 5-watt vacuum tube is about 350 to 500 volts, it can be readily seen that in order to obtain the same radio output with 110-volt D. C. line supply on the plates, either a motor generator set is required to step-up the voltage or if using the 110 volts without a motor generator, more tubes in parallel are needed to give the same output.

Although the use of A. C. requires a rectifier unit for the plate voltage yet this outfit can be very reasonably constructed at the cost of approximately one-fourth to one-fifth that of a good motor generator set. The data for construction of such an outfit is also given below. Also the cost of the storage battery for lighting the filaments must be added to the cost of the motor generator because in A. C. the filament supply is obtained from a suitable tap on a common transformer used also for the plate supply.

In conclusion of this discussion of the relative merits of different sources of power supply, most of the advantages are in favor of the alternating current supply, because the proper voltages can be obtained for the filament and plate without the use of storage batteries and a motor generator set.

Construction of a 10-Watt Radiophone Set Using A. C.

One of the main essentials in the construction of this set was to obtain long dis-

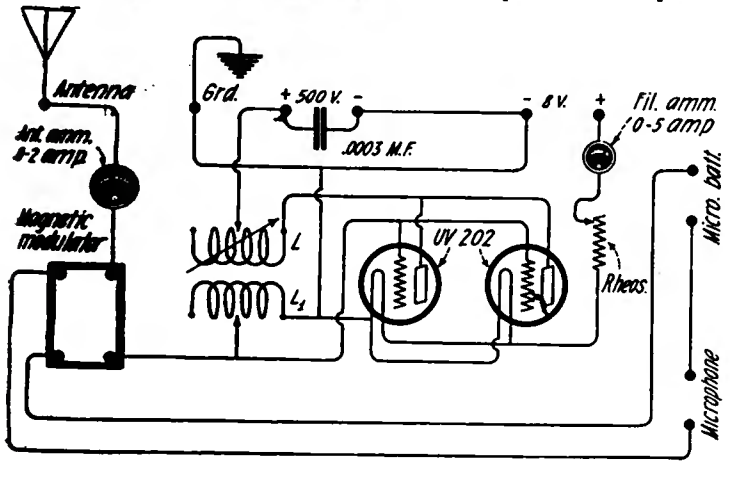


Figure 1

Circuit diagram of 10-watt radiophone transmitter with magnetic modulator for voice

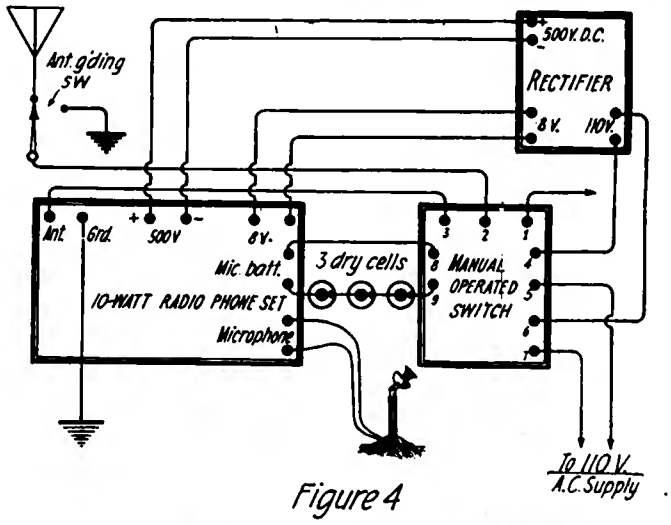


Figure 4

Interconnections for transmitter, rectifier unit, switch, power supply, antenna and ground

tance transmission with a given number of tubes (2), combined with good modulation Although the circuit which requires one tube as an oscillator and one tube as a modulator gives very good modulation and is universally used, yet for small power outfits, a good modulation can be obtained with about 1.4 times the power output, by using the two tubes in parallel, with a magnetic modulator in the antenna circuit. I have found that in using the magnetic modulator for outputs up to 20 watts, results are obtained which are even better than a set using any other circuit, even that employing the "plate choke coil" method of modulation. An explanation of the behavior of the magnetic modulator will be given further along in this article.

The number of parts used have been reduced to the lowest possible number and a set has been constructed which will operate reliably with only two necessary adjustments in the oscillating circuit. By means of one switch the wave length is set at the desired value and by means of a second switch (which varies the plate coupling) and a movable coil, an adjustment for securing maximum antenna current is provided. No available grid coupling is provided, it having been found possible to operate efficiently over the range of wave lengths by connecting the grid to one terminal of the antenna tuning coil.

The circuit is shown in figure 1. The plate circuit consists of the plate coupling coil L, in series with the source of plate voltage. A small condenser C is placed across the 500-volt terminal in the set, so that the radio frequency current need not travel down to the supply and back again, but is shunted across through the condenser. Coupled to the plate circuit is a circuit consisting of the antenna coupling coil, antenna, ground and the grid connection. This circuit contains an antenna ammeter and radio frequency winding of the magnetic modulator. No grid condenser and leak are employed as in sets below an output of 20 watts; a larger output is obtained without these. The circuit has been designed to operate on antennas from 0.0003 to 0.0006 microfarads capacity and from 4 to 12 ohms antenna resistance, giving a wave length range from 150 to 300 meters with an output in the antenna of about 10 watts.

Construction of Units—Antenna Tuning Coil

The coil consists of 18 turns of No. 18 bare wire wound on a 4¾-inch outside diameter micarta form. The form is to be threaded with a pitch of 5 threads to the inch. The winding has 11 taps taken off at the following turns: 6, 7, 8, 9, 10, 11, 12, 13, 14, 16 and 18. These taps are brought to a switch on the panel. This winding is spread to insure suitable coupling to the plate coupling coil over the entire range of wave lengths.

Plate Coupling Coil

The plate coupling coil consists of 40 turns of No. 18 D.C.C. copper wire wound on a 4-inch O.D. form. It is tapped at the following turns, 16, 17, 18, 19, 20, 25, 30, 35 and 40, making nine taps in all. These taps are brought to a switch mounted on the end of the coil. The length of winding is 2 inches. This coil slides inside of the antenna tuning coil; the triangular sliding rod arrangement can be seen in the photograph in figure 3, and is recommended as a simple and reliable method.

Magnetic Modulator

The unit used is that sold by the Radio Corporation of America as model UT1643. It consists essentially of a high frequency winding connected in the antenna circuit and coupled to a D.C. winding connected in series with the microphone circuit. These windings are wound in a special way over a core consisting of laminated punchings made from Alexanderson's sheet iron, a very thin metal enameled on both sides.

The operation can be briefly explained as follows: The magnetic modulator is a device which utilizes the properties of iron at radio frequencies to control the output of a vacuum tube. As the current in the microphone circuit is varied due to speech, the resistance in the high frequency winding is also varied due to the losses in the iron. With large microphone currents the resistance is low, while with small currents it is high.

Radio Frequency By-Pass Condenser

This is an 0.003 mfd. (within 10 per cent.) mica condenser, built to withstand 500 volts D.C., and a radio frequency current of 1.4 amperes at 150 meters wave length. This condenser is used in the set to by-pass frequency across the 500-volt terminals.

Tube Sockets

The sockets are the same as used for receiver tubes. Care should be taken that there is good insulation between the plate and either one of the filament terminals, as the insulation should withstand 500 volts, the potential that is applied to the plate of the tube.

Filament Rheostat

As the current required for each UV202 tube is 2.25 amperes at 7.5 volts across the tube terminals, the filament rheostat must be able to carry 4.5 amperes without excessive heating. It should have a total resistance of 0.2 ohm so that between the minimum and maximum settings of the rheostat a current regulation is obtained of 4.35 and 4.75 amperes, when using an 8-volt storage battery.

Ammeters

There are two ammeters required for this set, one to indicate the filament current and one for antenna current. As the maximum current that the filaments will draw will not be over 4.75 amperes, the indicating ammeter should have a scale reading of 0-5 amperes. The antenna ammeter can be either of the hot-wire or thermocouple types and should have a scale reading of 0-2 amperes.

Binding Posts

The relative position of the binding posts have been located in regard to the convenience in which the various elements are connected to the set.

Send-Receive Switch

This is a manually operated knife switch, a drawing of which is shown in figure 6 and which performs the following functions:

a—Connects antenna to receiving set.

b—Opens microphone circuit. The reason for operation "b" is that the operator will otherwise leave his dry cells on after shutting down the set and greatly shorten their life.

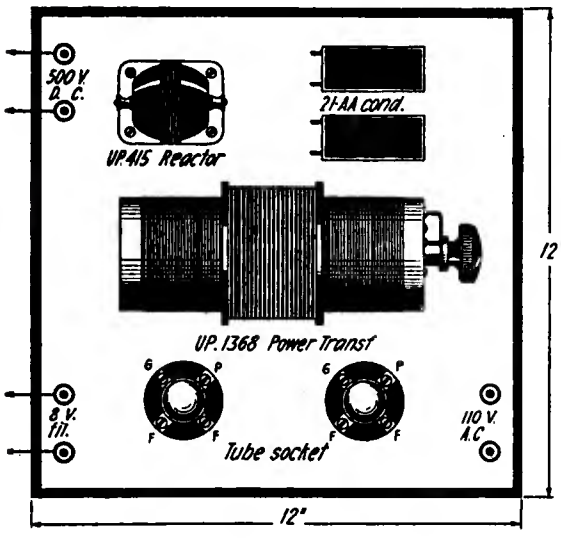


Figure 6

Layout of rectifier unit

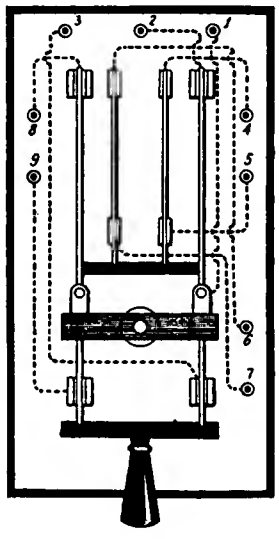


Figure 5

Details and connections of manually operated change-over switch

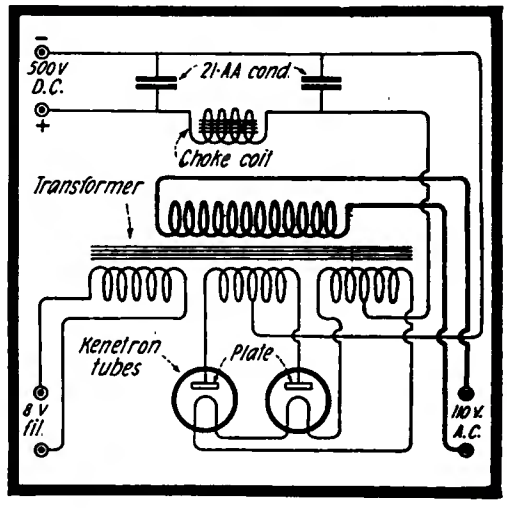


Figure 7

Wiring diagram of the kenotron rectifier unit

c—Breaks both sides of the A.C. line, thereby interrupting the transformer primary current and shutting off filaments and plate voltage.

In the sending position, the antenna is connected to the transmitter and the other operations named above are reversed.

TELEPHONE DESK STAND

This is a standard Western Electric Company Type 20CJ desk stand, equipped with a No. 284W microphone.

A. C. RECTIFIER UNIT

The use of this unit in connection with the transmitter is shown in figure 5. The entire unit consists of the following:

TUBES

There are two Kenotron rectifier UV216 tubes required which give rectification of both halves of the cycle or what is more commonly known as full wave rectification. The sockets for these tubes can be the same as used for the transmitting tubes UV202.

TRANSFORMER

The transformer is the model UP1368 made by the Radio Corporation of America. It has a primary winding that can be operated from a 50/60-cycle supply with a voltage variation from 102.5 to 115 volts. There are two secondary windings, one for the filaments that is capable of delivering an output of 75 watts at 7.5 volts and the other for the plates capable of delivering an output of 175 watts at 1100 volts to the outside wires, although only 550 volts is impressed upon each kenotron.

FILTER

A filter is required which consists of two Western Electric 21AA condensers with a capacity of 1 microfarad each and an iron core choke coil which can be a Radio Corporation plate circuit reactor UP415. This combination of choke coil and condensers constitutes an arrangement whereby the 60 cycles is prevented from getting to the plate and causing a hum.

ASSEMBLY OF PARTS

The assembly of the units for the transmitter described in detail above is shown in the photographs figures 2 and 3. Figure 2 is a front view of the set with the desk stand attached. On the front panel (bakelite) that is slightly slanted, are mounted the antenna and filament ammeters, the wave adjustment contact switch and a filament control switch. A rheostat that has been described in a preceding paragraph can be substituted for this switch. The panel is set into a box that is made in two sections. One section consists of the lower part into which the panel is set and the other is a hinged cover which when opened as shown in figure 2 reveals practically the entire inside of the set. The whole is placed on a base which extends about 1½ inch on the right side and back, and also allows enough space for placing the necessary binding posts. These posts are mounted on bakelite strips to give the necessary insulation. Figure 3 is a plan view of the set with the box removed and shows more clearly the location of the binding posts, the antenna and plate coils and the magnetic modulator which is located in front of the two tubes.

Figure 6 gives a plan view of the rectifier and shows the placing of its various parts. The parts are mounted on a wood base 12x12x½ inches treated with a coat of shellac. Care should be taken to mount the binding posts on bakelite strips with at least 1 inch distance between posts. Figure 7 is a wiring diagram of the rectifier.

Figure 4 gives a complete inter-connecting wiring diagram that is required between the radiophone set, rectifier, manually operated switch, power supply, antenna and ground.

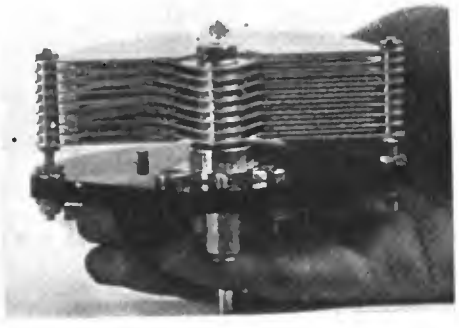
New and Efficient Navy Condenser

By S. R. Winters

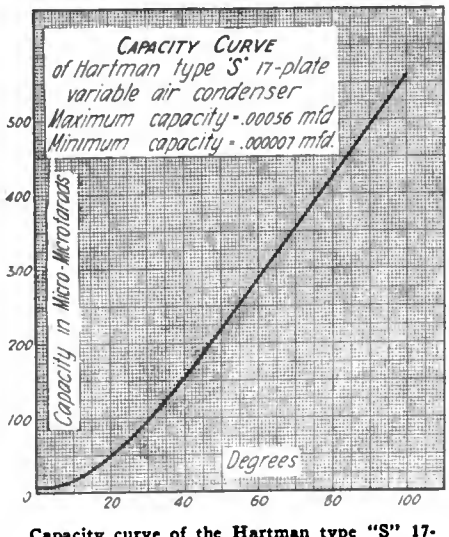
A VARIABLE air condenser recently designed by Alfred Crossley of the Radio Division of the Bureau of Engineering, United States Navy Department, is entitled to recognition by reason of its perfection, both in structural details and the results obtained in preliminary trials. Foremost among the things which makes this design noteworthy may be mentioned its composition. Contrary to the ordinary condenser, it is insulated with a hard rubber compound. This is of special composition and contains less than one per cent. of free sulphur. Tests of insulating materials at the Bureau of Standards, United States Department of Commerce, indicate that hard rubber of this low sulphur content sustains less than one-fourth of the dielectric losses usual to other materials.

By reason of its structure the condenser affords a capacity greater than that of the average 17-plate unit, and an almost uniform variation. When the instrument is at zero setting the capacity between the stationary and movable plates is 7 micro-microfarads. Swinging to the other extreme, if the seventeen plates are nested at maximum position the capacity can be measured in terms of 560 micro-microfarads. The dip in the revolving plates is so delicately adjusted to accomplish desired results that a very gradual "feed-in" is insured.

The effect of the latter, when measured in terms of efficiency, signifies that there is a corresponding gradual increase in the wave length range instead of a rapid expansion at the lower end of the scale from 0 to 30 degrees. The latter condition is said to be common with semicircular designs of condenser plates. Therefore, if we are to accept the usual conservative claims of the inventor, the Crossley condenser affords a more liberal wave length range than existing types of instruments of the kind employed in radio receiving and transmitting circuits. The ratio of this variable air condenser may be expressed in relative terms of from 50 to 300 meters, whereas other designs operate between the wave lengths of 100 to 300 meters.



The hard-rubber insulated variable condenser completely assembled



Capacity curve of the Hartman type "S" 17-plate variable condenser

The graph of the capacity curve illustrated represents the operating characteristics of the Hartman type "S" 17-plate variable condenser which follows the design of the Crossley condenser. It has a maximum capacity of .00056 mfd., and a minimum of .000007 mfd.

The Operation of Receiving Tubes from a D. C. Power Supply

By Abraham Ringel

THE storage battery and the necessary charging and maintenance are, without doubt, the most objectionable features of a radio receiving set. Various methods have been devised for operating the tubes from alternating current power lines and are fully described in many previous issues of THE WIRELESS AGE. But the problem of tube lighting from D.C. power lines seems to have been neglected.

It is true that eighty per cent. of homes in the United States supplied with electricity use alternating current. But there are many places where direct current is used. There are over a quarter of a million farm power plants alone which generate 32 volts D.C. Large sections in New York and other cities furnish 110 volts and 220 volts D.C. Considering the comparative ease of operating an amplifier from a direct current power supply, it indeed seems strange that so litinformation is available on this matter.

The writer has been operating oscillators and amplifiers from a 240-volt D.C. line for many years and has found them just as reliable as when operated from storage batteries. The D.C. line has an additional advantage in that no external B batteries are necessary—and if so desired, provision may be made for using a portion of the voltage to apply a negative bias to the grids. The expense of the additional equipment required is only a small fraction of the cost of a good storage battery.

Before describing some practical circuits, the writer wishes to explain the essential method involved. Every radiotron works at approximately 1.0 ampere filament current. At this current, the voltage drop across the filament is 5.0 volts. When a storage battery is used for lighting, all the filaments are in parallel, and the total current drawn from the battery is the sum of the currents flowing through the individual filaments. Thus, if three tubes are used, the total current consumption is 3.0 amperes, the voltage drop across all three still being 5.0 volts. The voltage of the storage battery is 6 volts and it is necessary to insert resistance in series to provide for the 1 volt drop, so that the filament voltage be 5 volts.

In operating an amplifier from a D.C. power supply, the filaments are connected in series, instead of in parallel because of the inefficiency of the latter method. There is some disadvantage in connecting the filament in series since all the tubes must operate all the time and when one of the filaments burns out, the circuit of all is opened. All must be tested to determine the defective one. But, inasmuch as the life of the average UV201 is well over 1,000 hours, such an event is a rare occurrence.

If it is desired to run a 3-tube amplifier from a 110-volt line, it is important to know the exact value of the resistance to be connected in series with the filaments, so that too much current should not be drawn. The tubes themselves take up a drop of 5 volts x 3, or 15 volts. The series resistance should provide for a drop of 110-15 volts or 95 volts at 1 ampere Applying Ohm's Law, the resistance is 95 ohms. This resistance may be in any form whatsoever: lampbank, rheostats or fixed resistances. The writer has tried all three and has obtained best results by using a combination of fixed resistance units, as are made by the Ward Leonard Electric Co., and ordinary filament rheostats in series. The latter provides a fine adjustment of the filament current, in other words acts as a vernier rheostat.

The Ward Leonard resistance units are ideally suited for such uses and are made in various convenient sizes. These resistances should be able to carry a current of 1 ampere without becoming too hot. For the convenience of the experimenter, the writer will enumerate some of the resistances and their current carrying capacity, which are made by the Ward Leonard people. These units cost but little and are thus little more expensive than ordinary lamps.

ENAMELED RESISTANCE UNITS OF WARD LEONARD COMPANY'S "DM" SIZE

Catalogue No.	Ohms Resistance	Maximum Current
DM 125	125	1.27
DM 90	90	1.49
DM 62	62	1.80
DM 45	45	2.19
DM 31	31	2.54
DM 22	22	3.00

In some cases, where the generator hum is quite audible, it is advisable to connect choke coils and condensers in the circuit so that the D.C. is absolutely without ripple. It is generally a good policy to do this in all cases. because central station generators sometimes do go bad. These choke coils are connected in the plate voltage supply leads. With 32-volt farm lighting units, it is practically impossible to filter out the commutator ripple, because of the relatively few commutator segments and there it is necessary to shut off the charging generator and work from the 32-volt storage battery alone.

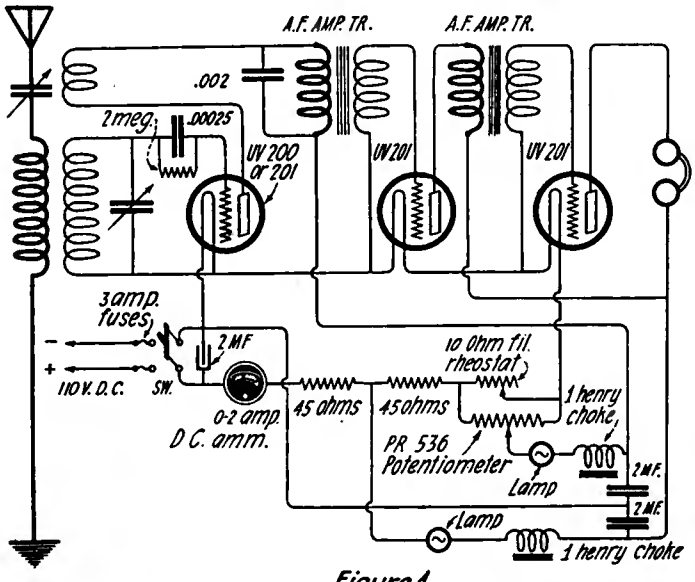


Figure 1

Circuit diagram of detector and amplifier tubes operated from 110-volt D. C. power line

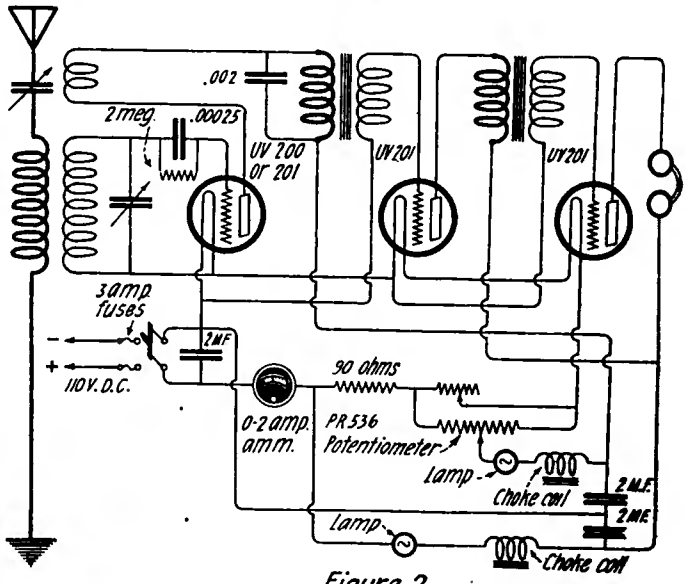


Figure 2

Circuit for 110 volts on plates of amplifier tubes with a negative bias of 5 volts on the grids

I. CIRCUITS FOR OPERATION FROM 110-VOLT D.C. LINE

Figures 1, 2 and 3 show various circuits for 110-volt D.C. operation. In figures 1 and 2, three tubes are used and from the above calculation, 95 ohms resistance must be provided. In figure 1, two Ward Leonard 45 ohm units are used in series with an ordinary filament rheostat. The interesting feature here is the method of obtaining the plate voltages. The voltage on the detector tube may be varied between 15 and 25 volts by adjusting the slider of the potentiometer which is connected across the 10-ohm filament rheostat. The voltage on the amplifier plates is obtained by connecting after the

first 45-ohm unit. The choke coils are connected in the leads running to the plates and 2 microfarad condensers inserted as shown in the wiring diagram. This arrangement is very effective in reducing the line hum. A switch and fuses should of course be used. These are of the standard types and are obtainable at all electrical supply stores. As a precautionary measure, 10-watt lamps are in series with the choke coils, so that in case of accidental short circuit, the transformers and phones will not be injured.

All the apparatus indicated is standard. The 2-microfarad condensers should be capable of withstanding 110 volts. Ordinary paper condensers as made by the Western Electric Co., General Electric Co., or the Federal Telegraph and Telephone Co., are suitable. The 0-2 ampere D.C. ammeter, although not strictly necessary is advisable, so that no more than 1.0 ampere is drawn.

The circuit of figure 2 is practically the same as figure 1, except that a higher plate voltage is applied to the amplifier tubes, of the order of 100 volts—which necessitates the use of a negative bias of 5 volts to the grids. The voltage for the detector tube is obtained as before. Since 100 volts are desired on the plates of the amplifiers, a single 90-ohm Ward Leonard unit is used—and the plate voltage is obtained by connecting to the positive side as shown in the diagram. A 5-volt negative grid voltage is obtained in the amplifier tubes by completing the grid circuit through the secondary of the amplifying transformer to the negative leg of the filament of the preceding tube. Thus, we make use of the line for filament, plate, and grid supply.

Figure 3 illustrates the operation of a 6-tube amplifier consisting of three radio, a detector and two audio tubes from 110 volts D.C. Since six radiotrons are used, we must allow for a drop of 30 volts because of the filaments—which leaves 80 volts to be accounted for by the series resistance. This resistance must be 80 ohms. The Ward Leonard resistances DM62 and DM22 are satisfactory here. Although this gives a resistance of 84 ohms, the operation will be but slightly affected by the corresponding decrease in filament current.

A separate stabilizing potentiometer is required with each radio frequency tube. Inasmuch as the plate voltage of the detector tube cannot be very easily adjusted, it is recommended that a UV201 be used instead of a UV200. No negative bias on the grids of the audio frequency tubes is required because the plate voltage does not exceed 75 volts. The stabilizers take care of biasing the grids of the radio frequency tubes.

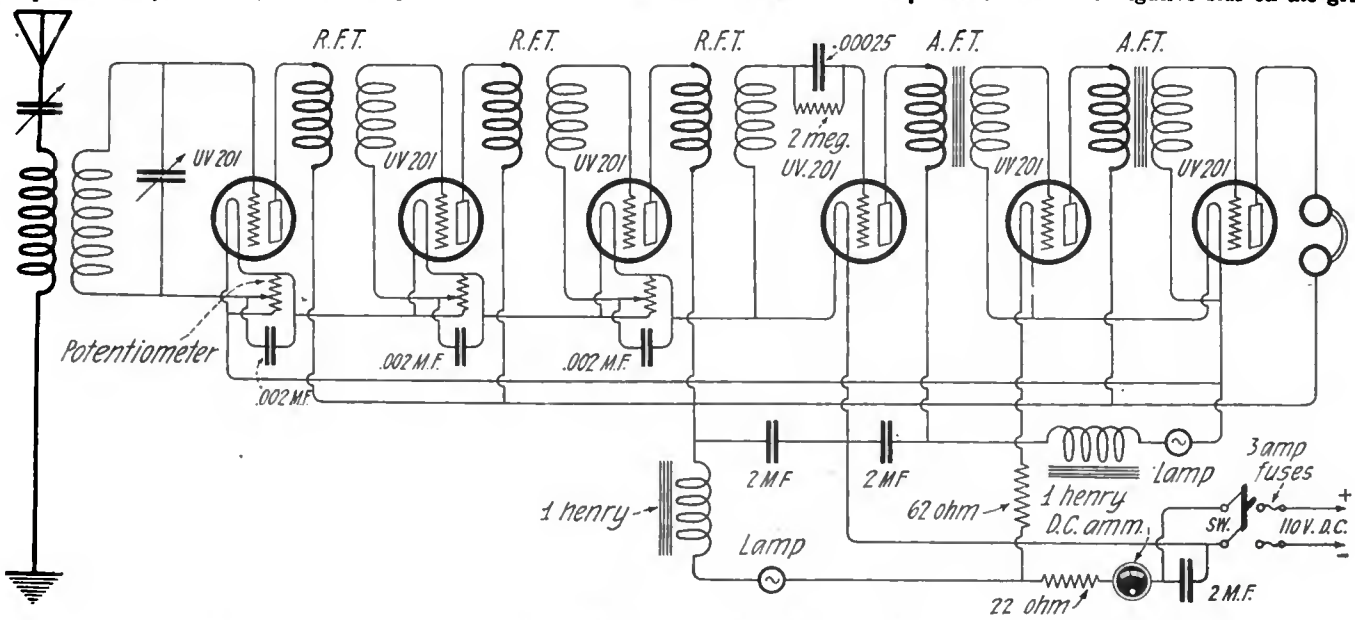


Figure 3—Hook-up of six-tube receiver—three radio-frequency, detector and two audio-frequency, operated from 110-volt D. C. line

II. Circuit for 32-Volt D.C. Plant

Figure 4 shows how a 3-tube outfit may be connected with a 32-volt farm lighting line. Since operation is impossible while the generator is running, the 32-volt storage battery alone is used when it is desired to receive. In that case no choke coils or condensers are

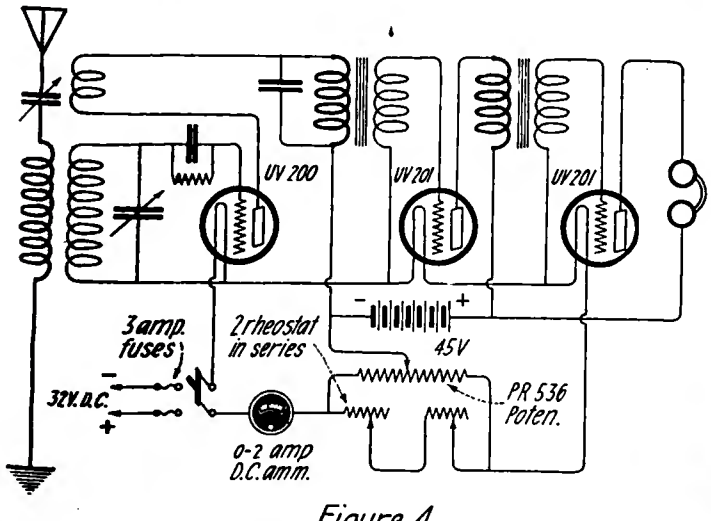


Figure 4

Detector and two-stage audio-frequency amplifier operated from 32-volt D. C. farm lighting unit

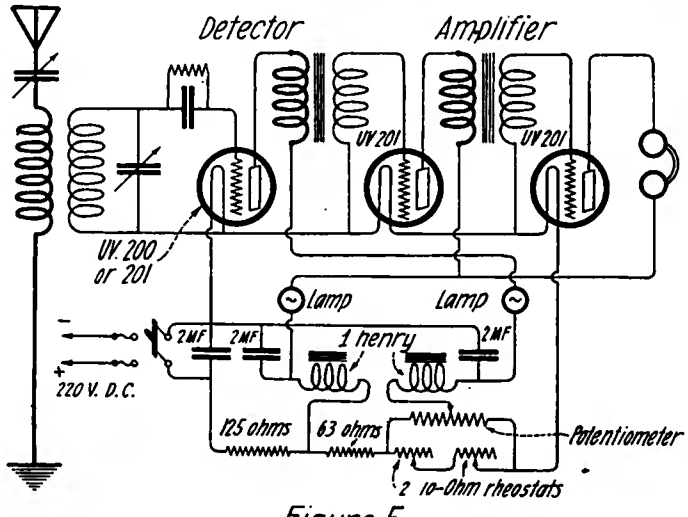


Figure 5

Detector and two-step amplifier operated from 220-volt D. C. power line

This circuit is unsuited for other types of tubes where the filament current is not 1.0 ampere. For the choke coils, the writer has used the Radio Corporation 1-henry filter reactor choke coil and the 110-volt winding of a bell ringing transformer with equal success.

required. The series resistance consists of two 10-ohm filament rheostats connected in series. The plate voltage of the detector tube is obtained through the potentiometer indicated and may be varied between 15 and 32 volts. "B" batteries are required.

(*Continued on page* 83)

Radio Reminiscences of an Amateur

By Herbert Warren Dodge

WHEN vacuum tubes were scarce and aerials were few, away back in 1915, I first took an active interest in wireless communication. At that time the World's Exposition in San Francisco was being held and the main exhibit that attracted my attention was the radio display. To this building I made my way every time I attended the fair and studied the instruments with awe. To me, like thousands today, it seemed impossible that signals could be transmitted through the air without the aid of wires. From that time on I became an ardent radio fan.

I began looking around the supply stores, not very well stocked in those days, to see if I could find some cheap efficient receiving set with which to begin my experiments in radio. The prevailing type of receiver was the galena set with either a single tuning coil or a loose coupler for regulating the wave length. A small fixed condenser and possibly a variable condenser, with the head receivers, completed the equipment. After much searching I at last located a set that appealed to my pocketbook and had the appearance of being well-designed. This instrument was purchased and I set about installing it.

There was the difficulty! The beginner today can consult and study numerous books and popular radio magazines to obtain the desired information about operating a receiver; the kind of antenna to erect, how to put it up, how to connect the instruments most effectively, how to get the maximum efficiency out of the set, and many other details are given whereby the novice can profit. In those days it was different. Books were few and out of date, mostly. There was only one real wireless magazine, THE WIRELESS AGE, and extraordinary as it was then, it was nothing compared with the same publication today.

As I knew little or nothing about the subject of radio telegraphy I decided to make the acquaintance of a neighbor possessing a transmitting and receiving station. This operator was Ernest Fabian, 6TH before the war, and one of the first licensed amateurs in San Francisco.

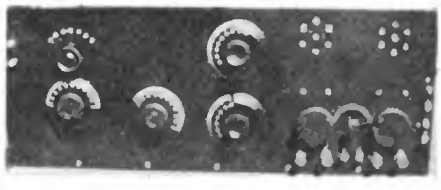
Every evening I visited his station and listened in on his set, which was a neat and efficient mineral receiver. Well do I remember the terrific crash of the spark across the gap of his rotary as he conversed with some friend in San José, fifty miles distant, or another operator across the Bay. What a contrast to the sets of today! Every time 6TH started sending he would have to carefully ground his galena detector, lest the induction of the transmitter affect the mineral's sensitiveness. Usually the "spot" was lost anyway and by the time he located another sensitive edge the message from the other operator was half finished.

Having once made an acquaintance with Fabian I learned much from him. I could connect up a receiver, tune in stations, in fact I learned all there was to know about his set. I could sit down and throw on the aerial switch and tune in any number of different spark stations within three hundred miles from San Francisco. I could easily

The writer experimenting with tree antennas

operate the set but—I didn't know the Continental Morse Code! Therefore the only station I could receive and make sense out of was the radio telephone broadcasting station located at the Fairmont Hotel in San Francisco. Although the broadcasting apparatus was only about six miles distant I had to hold the receivers tightly to my ears so that nothing was missed. Real sharp tuning apparatus for telephone reception was unknown then and the incoming voice or phonograph music was rather distorted.

So far I had progressed nicely with the exception of learning the code. Then came



The home-made vacuum tube set constructed at 6AP

the troublesome part! It would be interesting to know just how many people engaged in wireless today know the code. Not very many, I warrant, with all the broadcasting stations sending voice and music. It was necessary then to learn the code, however, and besides I wanted to pass the government amateur license test. The code speed then was only five words per minute compared with double that speed now. Although every opportunity was utilized in practicing it was not until late in 1916 that I could receive the allotted speed.

Then came the crucial moment when I had the head phones on my ears and the assistant radio inspector, Mr. Hayes, tentatively pressed the key preparatory to sending the test. Omnigraphs were rarely used then and the inspector himself sent the test by key and buzzer. Neither was the applicant required to transmit as he is now. The code test was not long and soon I handed the inspector the message I had copied, which he glanced at curiously. Informing me that I had successfully passed the test, he handed me the examination questions which I answered in writing.

On December 26, 1916, my call was assigned and I was officially known as 6VV. At last I was a licensed amateur and privileged to transmit on two hundred meters! I immediately started the construction of a half-kilowatt transmitter but the outbreak of the war prevented me from completing it.

Thousands lost interest in wireless when the Government shut us down, but I continued practicing with the test buzzer and key. This practice enabled me to pass the examination easily when the ban was lifted, and the speed raised to ten words per minute.

Late in 1919 I was issued license number 16, one of the first given out after the conclusion of hostilities, and was assigned the call letters 6AP.

The period after the conflict can be rightly termed the "Vacuum Tube Era." Records in transmission were continually being broken and receiving distances were noteworthy. As yet I had not changed my outfit. My little galena detector served me well enough for the time being. Living in San Francisco I had little difficulty copying ships at sea up to a distance of two thousand miles. Upon one occasion I intercepted every message Admiral Jellicoe, the British naval officer, sent to the Canadian stations while he was sailing the Pacific.

Finally I succumbed to the vacuum tube and constructed the set shown in the illustration.

In the transmitting line I did little, having made no phenomenal records as had some of my friends along the coast. I was content with working stations up to one hundred miles away.

Before the war I had a hobby of experimenting with antennas. I constructed aerials all over the neighborhood, and ran indoor aerials throughout the house, comparing the different results obtained.

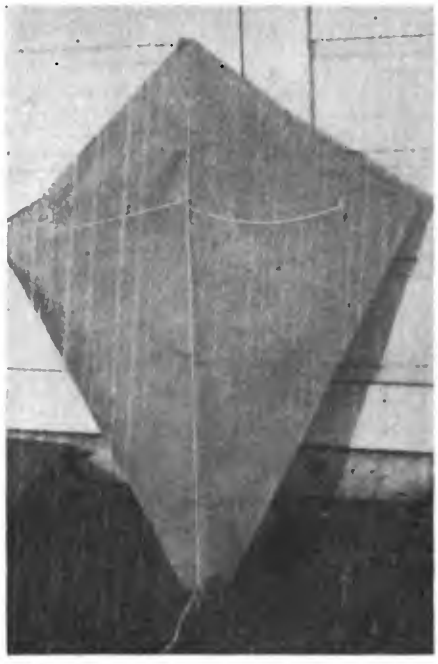
At that time KET, Bolinas, California, sent out the time signals on 2,400 meters and I usually experienced difficulty receiving this high wave length. Having some No. 30 D.C.C. wire on hand I decided to erect an aerial with it, despite its thinness. Four blocks away on a high hill there was an abandoned telephone pole, and I attached one end of the wire to this pole and unwound 1,200 feet of the wire. There was a great sag in the wire. This long antenna brought in the time signals sufficiently loud to be heard 150 feet from the receivers with a mineral detector. An attempt was made to receive the long-distance high-powered stations, but the aerial blew down with the first high wind.

In the beginning of 1920 there was a little talk about kite aerials, and I promptly ex-

perimented with one, with noteworthy results. The kite used was constructed in about an hour and was four feet in height. Instead of making use of ordinary paper, blue-print cloth was utilized, this offering better resistance to the wind and rain. With this material the kite could be flown in all sorts of weather, even staying up in the night with the fog.

No. 20 D.C.C. wire was firmly attached to the band in front of the kite instead of string and the kite was flown in this manner. It was sometimes possible to have the kite remain up almost vertically. Beyond doubt this is the best kind of antenna to have as the nearer straight up and down the wire the more efficient the aerial will be. Signals from stations as far away as three hundred miles "locked" the tube, the Canadian, Alaskan, and other distant transmitters were picked up with ease. The radio telephone station at Avalon, California, was also heard loudly with the kite antenna. By actual comparison the kite proved four times more efficient than any other type of aerial.

Tree antennas were also experimented with. The illustration shows the way trees are used. A spike about eight inches in length with some No. 14 wire soldered to it is driven into the trunk of the tree, preferably oak. By experimenting the best point for reception was found at about two-thirds of the way up the trunk. Here the signals were heard loudest. Using a single bulb signals were copied up to about seventy-five miles in the daytime.



Kite used in experimenting with kite aerials

In 1920 I took out a Commercial Operator's License intending to go to sea, but after the effects of a voyage to Los Angeles by water, I gave up the idea and remained ashore dabbling with amateur radio.

Radio in the old days was nothing compared with what it is now. Ask any of the old timers. In those days one could sit down and copy a complete message from any station that happened to be sending, while recently I counted as many as sixteen different stations working at the same time, all on the same wave! In 1915 if three persons transmitted on the same wave length at the same time it was a marvel.

It would be putting it too mildly to say that radio has advanced a thousand per cent since 1915. Imagine guiding ships in fogs by wireless then! Or think of a vessel obtaining bearings by the radio compass, locating ore deposits by wireless waves, aiding in capturing criminals, sending out market and stock quotations by wireless, or any of the thousand wonders accomplished by wireless today. Try to picture a modern wireless set, on the other hand, ten years from now!

Flat Spiral Inductance Data

By M. Wolf

IN the best type of existing amateur transmitting stations the most approved form of inductance is the flat spiral wound with copper ribbon. This form of inductance is superior for transmission work to the other types for a number of reasons. In the first place thin copper strips offer less resistance for a given length of the wire than other types, due to there being less skin effect with this wire. In the second place flat spirals may be wound so that there is a minimum of solid insulation and a maximum of air insulation. Thus leakage is minimized and the self-healing qualities of air insulation may be effectively utilized.

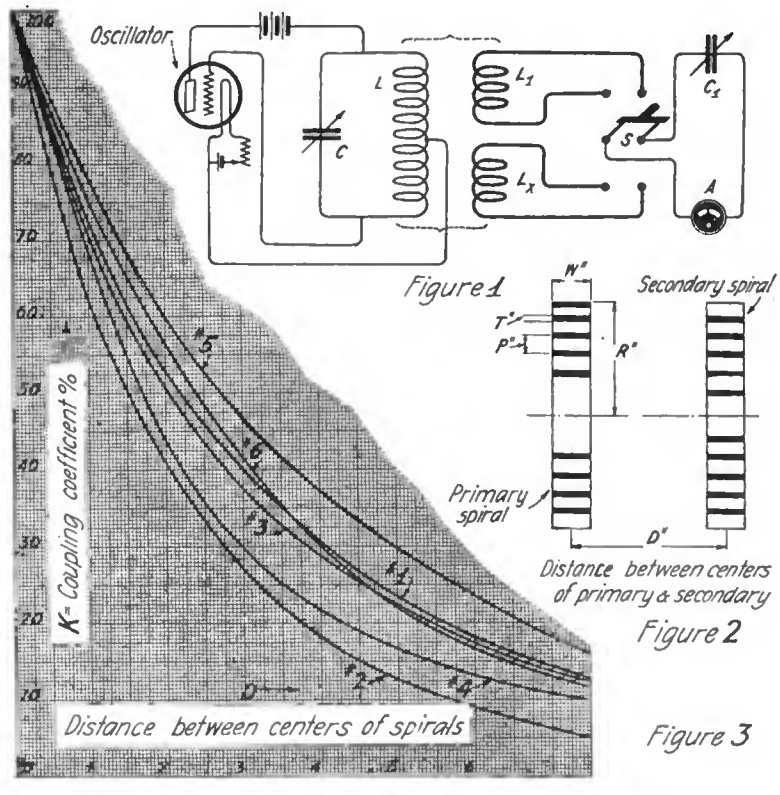
However there does not seem to be very much information or data available on the subject of flat spirals. In the design of the transmitting circuit it is very often necessary and is always desirable to know the values of self and mutual inductances of spirals and coupled spirals and to know the coefficient of coupling. In certain work which the writer was engaged in it was necessary to have such information. Calculation of the mutual inductances and coupling coefficient of spirals is extremely complicated and tedious, so a series of measurements were made instead and data secured on flat spirals which will no doubt be welcomed by a good many amateurs. These results are given here.

Measurements were made of the self inductance, mutual inductance and coupling coefficients, on a variety of flat parallel spirals. The complete winding specifications are also given so that the results here given may be of use to others when designing such coils.

Before giving the data it might be of interest to outline the methods used in measuring the self and mutual inductance of these coils.

MEASUREMENT OF SELF INDUCTANCE

A vacuum tube oscillator employing a 5-watt UV-202 tube was set up as indicated in figure 1. Coupled to the oscillator coil was the circuit shown in the same figure, in which L_1 was an inductance of known value and C_1 a calibrated variable condenser, maximum capacity 0.0005 mfd., Lx was the spiral under measurement whose inductance was unknown. *A* was a hot wire milli-ammeter used as resonance indicator, and S a double pole double throw switch for connecting either the known or unknown inductance in circuit.



Constructional details of coils, circuit used and coupling curves for flat spiral inductances

The switch S is thrown so that the known inductance L_1 is in circuit. L_1 is coupled to the oscillator loosely and the variable condenser C_1 varied until the meter A registers a maximum. Then the oscillator circuit is in tune with the circuit being measured, hence

$$LC = L_1C_1 \qquad (1)$$

The switch S is now thrown so that the unknown inductance Lx is in circuit and again the variable condenser is varied until the ammeter registers the resonance position. If the reading of condenser C_1 is now C_1'', then since the circuits are in resonance we have

$$LC = LxC_1'' \qquad (2)$$

From equations (1) and (2) we have

$$L_1C_1 = LxC_1''$$

Therefore

$$Lx = \frac{L_1C_1}{C_1''}$$

Since we know the values of L_1 and C_1 and C_1'', we can calculate Lx. In this way the self inductances of the various spirals hereafter described were measured.

MEASUREMENT OF MUTUAL INDUCTANCE

The mutual inductances of pairs of spirals were now measured as follows. The same oscillator circuit was set up and the same circuits used all around, except that in place of the unknown coil Lx, I now connected the two spirals whose mutual inductance was to be measured. These spirals were connected in series so that their fields added and the self inductance of the combination was measured in the same way as described above for a single spiral. In this manner L_1 and L_2 the self inductance of each of the two spirals and Lt the total self inductance of the two spirals when adding was determined. From the following formula for the mutual inductance M, we were able to calculate the mutual inductance

$$Lt = L_1 + L_2 + 2M$$

Therefore

$$M = \frac{Lt - L_1 - L_2}{2}$$

Coupler No.	Np	Ns	Pp	Ps	Rp	Rs	W	T	Lp	Ls
	Primary Turns	Secondary Turns	Primary Pitch	Secondary Pitch	Outer Radius Prim.	Outer Radius Second.	Width of Strip	Thickness of Strip	Prim. Self Induc.	Second. Self Induc.
			Inches	Inches	Inches	Inches	Inches	Inches	microhenries	microhenries
1	14	14	0.3	0.3	6.75	6.75	0.5	1/32	46.8	46.8
2	22.5	22.5	9/64	9/64	4 9/16	4 9/16	0.5	1/32	68.2	70.7
3	11	14	3/8	0.3	6 5/8	6 3/4	0.5	1/32	27.7	46.8
4	17.5	16	3/16	3/16	4 9/16	4 5/8	0.5	1/32	40.3	37.3
5	21	21	0.3	0.3	9	9	0.75	1/16	116	120
6	6.5	14	0.75	0.3	6.75	6.75	0.75	1/32	7.85	47

TABLE I

The spirals were measured in this way for mutual inductance with various degrees of separation. Then the coupling coefficients were calculated from the following equations, since the self, and mutual inductances of the various pairs of coils were known.

$$k = \frac{M}{\sqrt{L_1L_2}}$$

The table below gives the various constants of the various pairs of coils used in the measurements. The following notation is employed:

N_P number of turns in the primary spiral.

N_s number of turns in the secondary spiral.

P_P pitch of primary spiral (see figure 2).

P_s pitch of the secondary spiral (see figure 2).

R_P outer radius of primary spiral (figure 2).

R_s outer radius of secondary spiral (figure 2).

W width of the copper strip employed.

T thickness of the copper ribbon.

Lp self inductance of primary spiral in microhenries.

L_s self inductance of secondary spiral in microhenries.

The above table gives all the constants of the different spirals and their measured self-inductances. Mutual inductances were measured for the six different combinations of couplers above given, and numbered from 1 to 6. Mutuals were measured with separations between the centers of the spirals from 0 to 7 inches, measurements being taken at each inch. The coupling coefficients for the different combinations at the various separations were then calculated and plotted in the attached graph. Each curve is numbered to correspond with the number of the particular coupler given in the table. It will be seen that the coupling falls off rapidly at the start as the separation is increased from zero and then falls off more slowly as the distance between spirals gets larger.

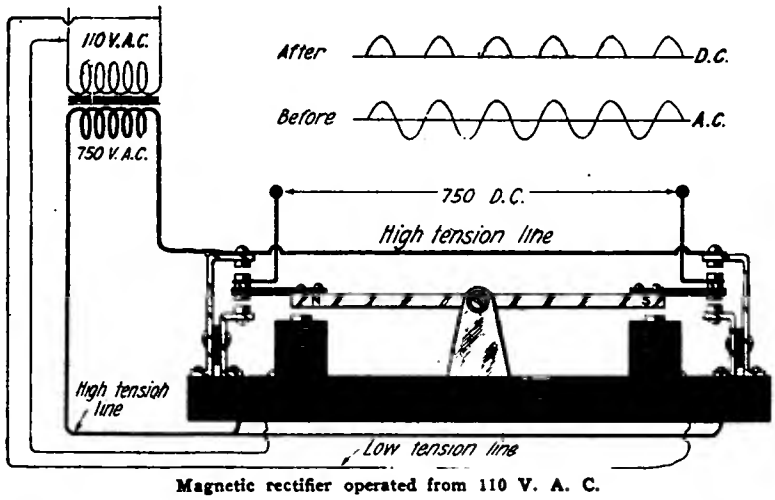
The data given above were taken on typical spirals as used in actual oscillator sets and it is hoped they will be of use to others who contemplate putting in transmitters employing flat spiral inductors.

An Efficient Magnetic Rectifier

By Howard Hughes

ASK any ham that has built his own C-W set what was the hardest unit to construct. Ninety per cent. will say, "My rectifier." I know because I had the same trouble myself, until I happened to read about some one getting good results with a magnetic rectifier. So I built the rectifier described below and I must say it is the best thing I have run up against so far.

This rectifier not only rectifies both halves of the cycle, but saves the builder the trouble of a mid-tap and the power winding of your transformer. It also does its work neatly and efficiently. There is only a slight humming as the contacts make and break. The sketch gives a general idea of the construction, also the wiring hook-up. No dimensions are given as this rectifier may be built to any scale convenient to the constructor to fit in with other apparatus on hand. As may be seen a permanent bar magnet is pivoted at the centre of balance and mounted on a V-shaped standard of brass or iron, with the poles suspended over two electro-magnets. The magnets were taken from a 6-inch skeleton bell and rewound with 8 layers of No. 24 S.C.C. wire, 65 turns to the layer, making sure that they are wound in the same direction.



Magnetic rectifier operated from 110 V. A. C.

At the ends of the bar magnet are attached two pieces of bakelite with an 8/32 bolt with key contacts at the ends. This bolt also acts as the H.T.D.C. binding posts.

The other contacts are made as described above and mounted on pieces of heavy brass strip bent as shown. They are separated by fibre bolted between them. All contact points should be filed to meet squarely to prevent sparking. The principle upon which this rectifier works is the simple law of magnetic repulsion and attraction of like and unlike poles respectively.

EXPERIMENTERS' WORLD

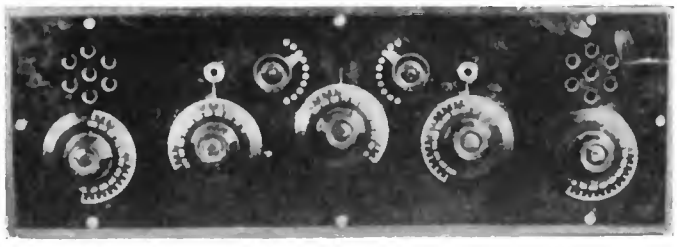
Views of readers on subjects and specific problems they would like to have discussed in this department will be appreciated by the Editor

My Super-Regenerative Receiver

By Norman A. Martin

(First Prize $25.00)

THE way the Armstrong super-regenerative circuit will pick up signals too weak to work anything else in the receiver line is simply wonderful. There is no other word for it. But the most wonderful thing about the circuit is the way it will successfully resist all efforts to tune it for hour after hour and then, when the would-be tuner has just about given up and admitted his defeat, will gently permit itself to be tuned and proceed to tell the world that Mr. Whoosit at WHICH is going to play Kitten on the Keys—one minute please.



Front view of cabinet

The first super-regenerative hook-up appeared in a Sunday newspaper on July 2, and the next morning I stormed all available radio stores looking for big honeycombs, resistances and 1-henry chokes. In the course of a few weeks I had all of them. Then I built the set.

It whistled, howled, squealed, etc., etc., but darned if it would talk. Nor would it dit-dit-dit-da. So I changed the chokes and the resistances and the honeycombs and the C batteries, and again had a set which would do everything but talk. It even burnt out a phone.

Then somebody else published a hook-up and I cussed the original author for being a blunder—and the new set wouldn't do anything but produce the harmonics of heterodynes that Godley wrote about. In rapid succession I built sets from several other publications and they nearly ruined my ears, but darned if they would tell bed-time stories for the children. About that time Mrs. M. threatened to sue Major Armstrong for alienation of affections so I quit and went to the movies for a few evenings.

But the blame thing had me worse than radio frequency ever had. So, in the comfort of my living room, I read the articles on it. And found that the articles which were so very specific about the size and location of L-4 and R-1 were infernally secretive about how to tame the beast. So I sneaked back upstairs.

The first step, according to theory, was to produce a 12 or 15,000-cycle current by means of an oscillator. This was easy. I checked the number of cycles by whistling octaves from C on a mandolin. Then I hooked the oscillator to a detector connected up with a regular honeycomb mounting. A heavier diaphragm in my single phone in order to save my remaining ear and a mere hundred volts plate battery for the same reason—and I was off again. Systematically I tuned, and tuned, and tuned for three solid hours. And suddenly, after all available cuss words were used up the blame thing jumped up and yelled; it didn't speak, it yelled, "This is 3XW, Parkersville," etc., etc. What a sensation!

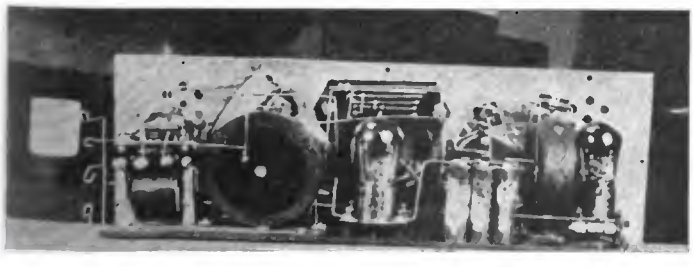
That was with a 75-turn honeycomb primary and a 150-turn tickler. The next thing was to tame it thoroughly and then put it in a cage. The first took practice and quite a lot.

In order to make it more easy to tune the honeycomb primary was replaced by a 70-turn tapped coil and the 150-turn honeycomb tickler was mounted on a shaft the same as the rotor of a vario-coupler. The filter recommended didn't filter very well so it was discarded and a few dozen others tried instead.

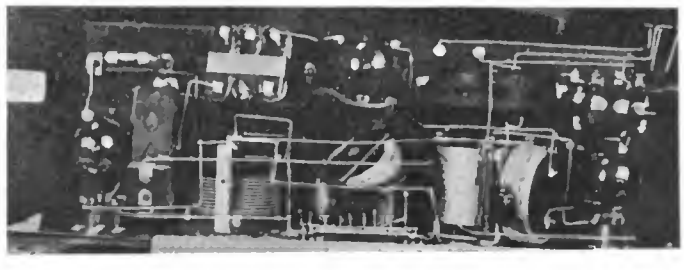
In trying the filter circuit the signal strength suddenly doubled for no apparent reason. Investigation showed the filament connection broken off the transformer secondary (UV712). Putting it back decreased the signal strength so I left it off. I didn't understand why it worked, but reasoned that it must be connected to the filament in some way. Probably through the primary-secondary capacity. If this were true a change in the capacity might improve matters. The micadon box was brought out and .0015 between the secondary-filament and primary-battery leads greatly increased the strength again. So it stayed that way. (Note the Acme A-2 took .002 for best results.)

As to the filter: Theoretically the best filter has no resistance, but consists only of impedance and capacity. The filter originally used by Major Armstrong didn't comply with those conditions and the high resistance used—24,000 ohms—necessitated quite a lot more B battery than seemed necessary so I discarded it. Using the UV712 transformer a .005 mfd. fixed condenser across the primary furnished sufficient capacity to by-pass the oscillator note, so it was adopted. When it came to putting the set in a cabinet there wasn't room for the transformer and an Acme A-2 was substituted—.005 isn't quite right but it is sufficient unless the frequency of the oscillator is greatly reduced for very great amplification. And when great amplification is used the note isn't audible anyhow, so I didn't monkey with it any more.

The loop used may be most any size; the one I generally use is 30 inches square with 17 turns (prism) spaced three-eighths of an inch. This is furnished with a switch and tapped every turn. Three hundred and sixty meters comes in on everything from 4 turns up to 17. The loop, however, is too wide in proportion to its size and the result is slight directional effect and interference from carrier wave heterodyne. A helical



Rear view of the super-regenerative receiver



Top view of the super-regenerative set

loop of 36 inches on a side with turns spaced about one-quarter of an inch is better for cutting out interference.

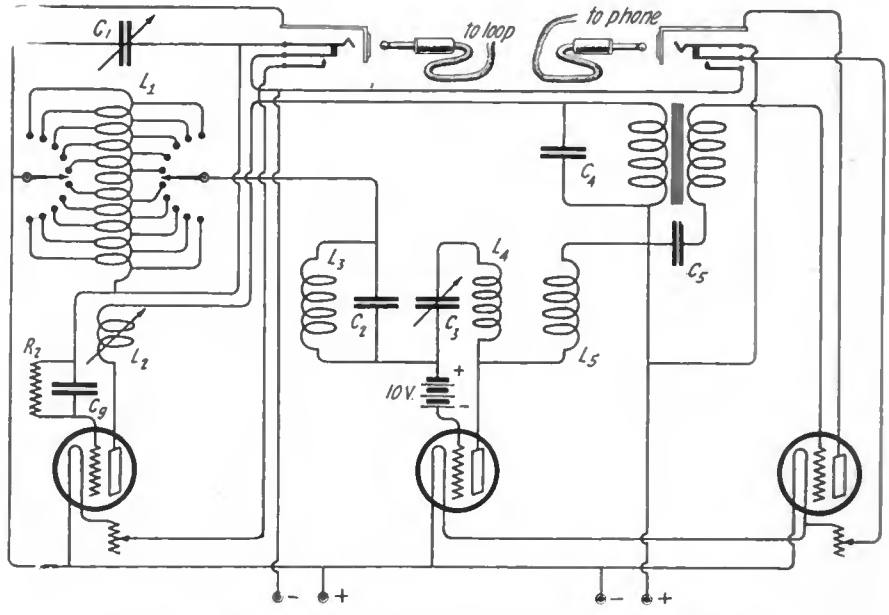
In tuning this set for 360 to 400 meters the tickler should be set at about 70 and the oscillator condenser at 25. The primary condenser is then increased from 0 toward 100; in increasing this condenser a space of 15 or 20 "degrees" will be found where the set roars terrifically; signals can be found most easily by turning the condenser with one hand and the tickler with the other and always keeping the condenser one or two points below the roaring point. After the best results are obtained readjust the tickler and oscillator condenser for the loudest and plainest signals.

I have also used this set with good results on an indoor L antenna of four No. 24 bare wires spaced one foot and 25 feet long. This, however, is not of much use except for the direction in which it points.

On my outdoor aerial—4 wires 135 feet long and 40 feet high—the set is almost useless. Anything within 500 miles paralyzes it. When nothing else is going, however, the set will, on a big antenna, pick up signals that an ordinary regenerative set hardly dreams of getting, and when it does get them it works a Magnavox. It is apparently a light racing car and is not equipped to act as a furniture van.

If I were rebuilding the set I would leave off the taps connected to the oscillator grid and simply connect the two grids together. As the variation of strength of the high-frequency current seems to be of little use, I would also try using a grid leak instead of the "C" battery on the oscillator.

The set is mounted on a 7x21 inch panel, set in a cabinet 6½ inches deep inside. There is almost enough room left to put a tube inside, and it seems remarkable that it is that sparks come in fine with the oscillator tube turned completely out. C. W. of course requires it lit.



Circuit diagram of three-tube super-regenerative set. R_2 = 2 megohm; C_1 = .0006 mfd.; C_2 = .002 mfd.; C_3 = .0015 mfd.; C_4 = .005 mfd.; C_5 = .002 mfd.; T = Acme "A-2" Transformer; C_6 = .0005 mfd.; L_1 = 70 turns No. 22 enamel on 3½-inch tube; L_2 = D. L. No. 150; L_3 = D. L. No 1250; L_4 = D. L. No. 300; L_5 = D. L. No. 1500; all tubes = UV-201

the thing will work at all when it apparently violates all rules as to keeping the parts separate. But it does.

Most of the amateurs are so mean they won't send slow enough for me to read them but I have been able to read enough to know that the set will get almost anything in that line. One peculiar thing about

On phone it consistently gets almost anything desired between Kansas City—900 miles west—and Medford Hillside—500 miles east. KDKA—50 miles—and WGY—300 miles—work the Magnavox so loud as to be not only audible but readily understandable over 300 feet away and increased distance makes but little difference.

Making a Super-Regenerative Receiver

By George W. Grauel

(Second Prize $15.00)

WITH the discovery of the super-regenerative receiver there has been another advance in radio. Just about thirty-six years ago radio, in its first stage, was discovered. The simple crystal detector circuit was used. Then came the two-element vacuum tube detector, which developed into the three-element vacuum tube, which type of tube is used today. From the three-element tube came the discovery of the regenerative receiver, and as the outcome of the regenerative receiver we have the super-regenerative receiver which is the greatest of all.

Before taking up the technical and non-technical phases of this receiver, from a practical standpoint, let us look into its theoretical operation.

The action of a super-regenerative circuit is more clearly understood from the resistance standpoint. There are three methods by which super-regeneration is possible.

I. When the negative resistances are varied with respect to the positive.

II. When the positive resistances are varied with respect to the negative.

III. When both positive and negative resistances are varied simultaneously.

The third type is recommended to give the best practical results to the average inexperienced operator.

The third type of circuit will be taken up; first the more complicated with multiple-control using a loop aerial, and then the more simple set, without multiple-control, which makes the operation and results more

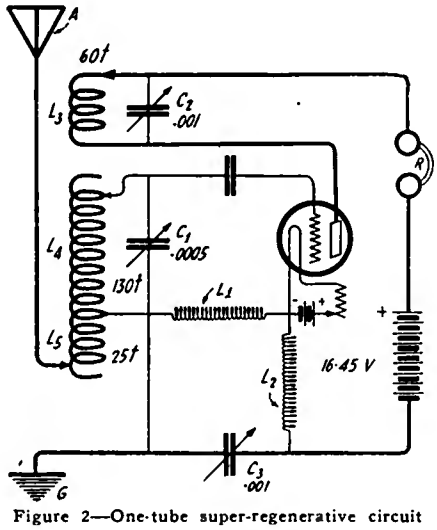


Figure 2—One-tube super-regenerative circuit

practical. For the theoretical circuit see figures 1 and 2 respectively.

Figure 2 represents the one-tube circuit which is found to give good results. Multiple control in this circuit is not necessary. The tuning is done by means of C_1 and C_2, operating at a fairly broad wave length, when the inductances are properly set. There is no need for change in coupling between L_3, L_4, and L_5. The action between the coils L_4 and L_5 acts as if it is through shock excitation, and the adjustment on L_5 has little to do with the wave length.

The construction and set-up is as follows: The inductances L_3, L_4 and L_5 are wound on a 2½-inch bakelite tube 6 inches long with number 24 or 26 DCC wire. The windings are started ¼ inch from the end of the tube, 60 turns in all, taps are taken off at the 15th, 30th, 45th and 60th turns. This constitutes L_3, the tickler coil, which has no coupling change. Next wind L_4 (which is not connected to L_3) in the same direction as L_3, taps being taken off at the 5th, 10th, 15th, 20th and 25th turns. This is the primary inductance. The 25th tap should be longer than the preceding taps so it may be recognized as the last tap of L_4 and also that it is the ground tap, which is also the beginning of coil L_5. The wire is not cut but is continued in the same direction, taps being taken off at the 40th, 60th, 80th, 100th and 130th turns. These inductances with condensers used with a 150-

foot aerial will have a wave length of approximately 600 meters.

The coils L_1 and L_2 may be Honeycomb or DL coils being L_1-1500 and L_2-1250; or a variable coil for long wave lengths is still better, as described in THE WIRELESS AGE for September, 1919.

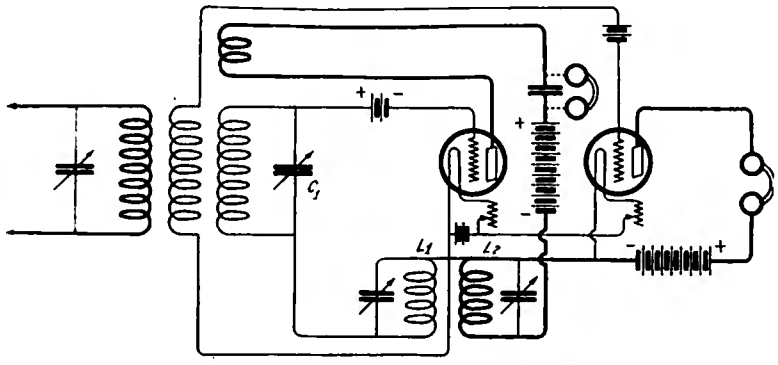


Figure 1—Two-tube multiple control super-regenerative circuit

These coils L_1 and L_2 may be constructed by using two 2½-inch tubes 2 inches long. The windings are number 22 DCC wire wound in layers of 32 turns in each layer. The layers are separated and windings kept straight by using shellacked paper between each layer of wire. The taps are taken off at the 7th, 14th, 23d, 28th, and 33d layers. The total turns are 1,056. For L_2 the windings are the same as for L_1, but taps are taken at the 10th, 17th, 20th, 24th and 27th layers. These coils are wrapped with tape, shellacked, and baked in an oven to render them moisture proof.

The condensers C_2 and C_3 are of .001 mfd. capacity. C, is .0005 mfd. The voltage of the B battery may be varied from 16 to 45 volts using a Radiotron or Cunningham amplifier tube. With harder types of tubes a higher potential may be easily used. In a test signals 25 miles away were easily heard using a Radiotron 201 with the plate voltage of but 22½ volts.

An aerial and ground give the best results as the loop as yet has not proven entirely satisfactory with any set.

This type receiver works exceptionally well for C.W. signals of short wave lengths, spark stations are not received so well. Time and patience are required for the best results.

To operate and adjust the set, first set C_1 near the zero point; L_3 is adjusted at about the middle of the coil; C_3 is set at about 45°; the long wave coils L_1 and L_2 are set at about 90°; then explore the entire range of C_3 for a hum or C.W. whistle. C_1 controls the wave length and after a signal is heard at C_3 by adjusting C_2 the loudest results are obtained. When rough sounds are heard adjust C_3, L_1 and L_2 or the B battery voltage. When the B battery is too high and C_2 has a high capacity the tube will squeal or give abnormal sounds that are unpleasant to the ears. As the super-regenerative set is still young it will take considerable experimenting for us to operate it as Mr. Armstrong does. However, its results are worth the effort that may be put into it.

Assembling a Super-Regenerative Receiver

By J. T. Lansing

(Third Prize $10.00)

MY OUTSIDE acrial blew down in a thunder storm last Summer, and I decided not to replace it, but to develop a single bulb outfit which could be used with inside aerial for broadcast reception. Note my viewpoint, which is that of a layman interested in broadcast reception only; I cannot claim to be a "ham."

As shown in the attached sketch the circuit used is the Armstrong "flivver," with only slight changes. Little comment is needed on this except to point out that two variocouplers are used. The one in the usual location is the conventional commercial article, while the other was home-made to get more turns. Incidentally the only material purchased specially for the hook-up were the DL coils and extra B batteries

As to results, with this hook-up, from Montclair, N. J., I normally receive local broadcasting loud enough so that the receivers can be placed on a Sheltone horn and heard ten feet away without effort. This can be done, with care, on 22½ volts of B battery, but the results with 67½ volts are sufficiently better to be worth while. When properly adjusted for 360 meters, it is possible to put on the headset, turn up the rheostat until the meter indicates 1 amp., and listen to whatever broadcasting is going on without touching the adjustments. I have received from WGY at Schenectady, but when spread out on a table the parts are so affected by body capacity that I have not spent time trying for distant stations pending proper shielding. I have had no difficulty in separation of 360 and 400 meter stations. Code, C.W., I.C.W. and spark can be heard, but do not cause interference.

Regarding filters, I tried several and then discovered that they were not needed, as the oscillations can be made inaudible by decreasing the adjustment of the .001 variable condenser from its maximum setting.

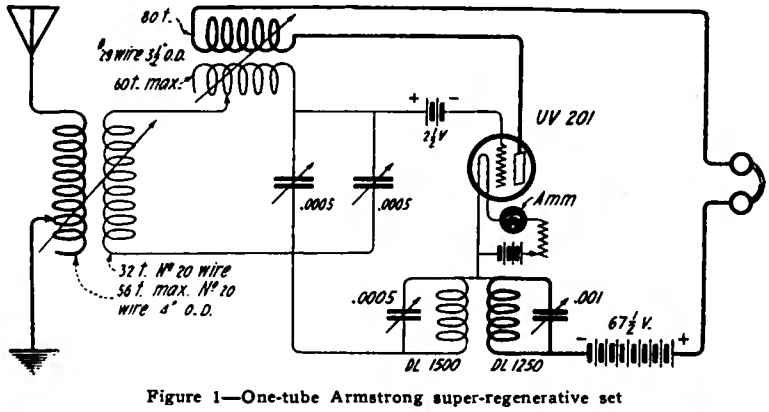


Figure 1—One-tube Armstrong super-regenerative set

As to acrial, reception can be had without aerial or ground. A loop has been tried, but for horn reception a two-foot loop, used as an aerial—one end open, and a ground seem to give better results. This loop has ten turns spaced about half an inch apart.

To operate, the secondary condensers are placed at minimum, the .0005 across the 1500 DL at minimum and the .001 at maximum. The feedback is manipulated to start audible oscillations and until they just stop with a "rushing" sound. They are then restarted by moving the secondary variable condenser to maximum. This is moved slowly towards minimum setting until the signals are heard, but not sufficiently to stop oscillations—hence the vernier.

The .0005 condenser shunting the 1500 DL is next adjusted for maximum signal strength and finally the .001 to make oscillations inaudible and for finer adjustment.

Though tuning is somewhat critical in a one-tube Armstrong super-regenerative receiver, the operating experience gained and the novelty of securing practical results with one tube in place of three is quite pleasing to one who cannot even claim to be a "ham." The three-tube circuits do not require such fine adjustments as the single-tube, so perhaps the uninitiated will prefer to experiment with them.

How Far Will My Set Receive?

By Jesse Marsten

THE editors, whose job it is to answer the questions submitted by the readers of radio magazines and papers, have been deluged with questions on the distance range of receivers. These questions have ranged from the sublime to the ridiculous (mostly the latter), from questions giving the minutest detail of the construction of the set to questions reading "I have a loose coupler with galena crystal, how far can I receive?" It is evident from the nature of the questions that the enquirers have no conception of the factors influencing the radiation of electro-magnetic waves. This article will endeavor to set forth in a simple way the factors determining the range of transmitters and receivers. It is hoped that all novices who have asked this question in the past, who are doing so at present and who will be tempted to in the future, will read this article, digest the information and thereby save many a question and answer editor from mental irritation.

In the first place, let it be said here once and for all, that no receiving set has any definite distance range which can be assigned to it. This is because the range of a receiver depends upon so many variable factors, and very seldom are these variable factors the same for any two sets. To make this clear, consider the following analogy. Imagine a man stationed in an open field, this man and his ear being the receiver. Suppose the transmitter to be a whistle which is blown to give a note of a certain intensity. The further away this whistle is from the receiving man the lower will be the intensity of the signal received, until a point is just reached where the receiver barely hears the signal. This distance between whistle and receiving man may be called the maximum range of the receiver under the given conditions. Suppose now a more powerful whistle is used. It will be evident that this whistle may be moved out a greater distance and the receiver will still be able to hear the whistle and thus the range of the receiver is increased. Consequently the first factor which influences the receiving range of the receiver is the power of the whistle.

Suppose now that instead of the transmitting whistle and receiving man being placed in a clear open field there are intervening obstacles such as buildings. The sound waves now have to travel over and around these obstacles in order to reach the ear, thus expending much energy wastefully. As a result, any given whistle will have to be moved closer to the receiver to be just barely heard, which means that the maximum receiving range has been decreased. Thus a second factor affecting the range of receivers is the nature of the intervening medium through which the sound waves pass.

The above considerations have been based on the assumption that there are no other noises or whistles present. Suppose that between the whistle transmitter and receiver there is another whistle, this one much more powerful, say a steam whistle. If this whistle is blowing while the distant transmitter also is blowing it will be clear that the steam whistle will drown out the other, thus preventing the receiver from hearing the whistle that is less powerful. Or suppose that there are in the neighborhood of the receiver a number of very weak whistles, which are blowing at the same time that the distant transmitter is going. There will be such a conglomeration of noises due to the nearby whistles that the receiver may have considerable difficulty in hearing the distant transmitting whistle. In other words, the range of the receiver now depends upon such factors as the presence of more powerful whistles than the one the listener is trying to hear, and the presence of interfering noises.

These facts are familiar and evident to most people when put in this way. Well, the same things apply when we consider the question of the range of radio receiving sets. The factor which is a measure of the distance range of a receiving set is the current in the receiving antenna. Obviously the greater the received current is, the greater will be the range of the receiver. This received current is dependent upon a number of different factors, some of them enumerated in the simple analogy given above. There has been developed a semi-empirical formula for the received current in an antenna which takes into account a good many of these factors and shows how it varies. This formula may be expressed as shown in the following equation:

$$I_r = A I_s \frac{h_s h_r}{\lambda d} \xi^{-\frac{k d}{\sqrt{\lambda}}}$$

in which A is a constant

h_s is the height of the transmitting antenna

h_r is the height of the receiving antenna

I_s is the effective current in the transmitting antenna

I_r is the received current in the receiving antenna

λ is the wave length at which signals are transmitted

d is the distance between sending and receiving stations

$\xi^{-\frac{k d}{\sqrt{\lambda}}}$ is a factor called "attenuation factor" which takes into account the decrease in wave energy due to absorption of energy as a wave travels through its medium.

This equation shows at once why it is difficult to talk of the range of any particular receiver. In the first place, the received current is seen to depend upon the current in the transmitter, or the power of the transmitter. Thus the range of a receiver for one transmitter may mean nothing when we begin to talk of other transmitters. The more powerful the transmitter is, the greater will be the range of any receiver for a given set of conditions, and vice versa. In other words, unless one knows something about the power of the transmitter one cannot tell anything about the range of a receiver. Secondly, as far as the transmitter is concerned, the equation above tells us that the received current also depends upon the height of the transmitting antenna. Thus for the same power in the antenna that transmitter will have a greater carrying power or range, other conditions being equal, whose antenna height is the greatest. It is for this reason that all transmitting stations are built with high antennas.

The equation further shows that the received current depends directly also upon the height of the receiving antenna, the greater this height the greater the range of the receiver. While this is true theoretically, there are factors which arise in practice which vitiate this conclusion. These factors will be considered later on in the article.

In the equation, the factor of the radiated wave length enters in the denominator, showing the dependence of the received current on wave length. The range of a given receiver under given conditions will therefor be different for different wave lengths.

The last factor, namely $\xi^{-\frac{k d}{\sqrt{\lambda}}}$ is the above mentioned "attenuation factor." This factor takes into account the medium of transmission of the electromagnetic waves. Naturally, as the distance of the receiver from the transmitter increases there will be a decrease in the received current. Apart from this decrease there is still a further decrease due to the fact that the medium in which the waves travel is imperfect and considerable of the energy is therefore absorbed. Thus the presence of vegetation in the path of the waves, steel buildings and structures such as bridges, etc., will have a considerable effect on the signal strength at the receiver and will diminish it considerably. Thus if transmission were effected over sea where the path is clear and unobstructed the range of a receiver would be greater than otherwise, all other conditions being the same. Furthermore, the condition or type of ground has considerable to do with this also. The theory of wave propagation shows that the feet of the waves are in touch with the ground over which they pass. The greater the conductivity of the ground the better will be the propagation of the waves, the less the attenuation. Since sea water is a good ground, transmission is better across sea water than across dry land. Thus the range of a receiver is again seen to be dependent upon another variable factor.

Apart from the above factors which make a determination of the range of a receiver almost impossible, or indefinite at least, there are numerous other uncertain factors which make such a determination extremely unreliable. Thus the element of interference enters here just as in our example of the whistle transmitter. If there are a number of transmitters working in the vicinity of the receiver the signals from a distant station may be drowned out by the interference, in spite of the fact that the

(*Continued on page* 82)

Some Helpful Inductance Curves

By S. Solomon

THERE are many inductance formulas which enable the experimenter to design his inductance coils accurately. The simplest use to which these formulas may be put is to calculate the inductance if you know all the other constants such as: length and diameter of former, number of turns and size wire, and the inductance is then easily determined. Even this simple calculation is very often cumbersome. But generally the task which the amateur has is considerably harder, namely he knows what inductance he wants but does not know most of the other factors.

The experimenter who builds his own would like to refer to a curve, find the inductance he wants, say 125 microhenrics, and then read off from the curve at once, the number of turns, the size wire, etc. This would be ideal of course, but would require considerable work in preparing such a set of curves. However, there are a great many amateurs who have built their coils and have calibrations on them, and if they would publish some of the data they have, many amateurs who build coils would be helped greatly thereby and the above aim would be more easily reached.

I have had occasion to build a number of coils and from measurements and calculations have made a number of curves which serve the above purpose. These curves are not universal of course and cover just a few possible types which the amateur is likely to build. However they have been very useful to me and thinking that they might likewise be useful to others they are here given. These curves are naturally taken on practical coils which the amateur very often finds useful in his work.

Curves No. 1 and No. 2 were taken from actual measured values of the inductance. No. 1 was wound on a 1¼" diameter dilecto tube, and No. 2 on a 4-5/32" tube, both being wound with No. 26 D.C.C. wire. The number of turns corresponding to any particular value of inductance desired can be read off the curve at once. Curve No. 3 was taken from a coil wound on a 4" dilecto tube with No. 18 D.C.C. wire. Inductance in these three cases is given in microhenries.

Curves No. 4, 5, 6, 7 and 8 were obtained by calculation. These curves are for bank wound coils having 2, 4, 5, 6 and 12 layers, and will be found useful in the design of coils for medium and long wave receivers. The curves are designed for wire which winds about 17 turns per inch, which corresponds roughly to either No. 15 S.S.C. or No. 15 enamel, or No. 16 D.C.C. The diameter of the tubing is also 4". The 4" tube was used as this type of tubing is most common in the average type of receiver.

The use of these curves will readily suggest itself to the constructor. If he desires an inductance of say 1 millihenry, examination of curve No. 4 will show that 114 turns of either No. 15 S.S.C. or No. 15 enamel, or No. 16 D.C.C. wire will do the trick on a 4" tube with two-layer bank winding. Similarly with the other curves.

These curves have been of considerable use to the writer and are given here in the hope that other amateurs who build their own coils will find them useful and time saving.

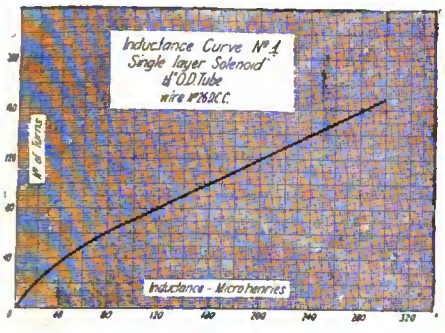


Figure 1

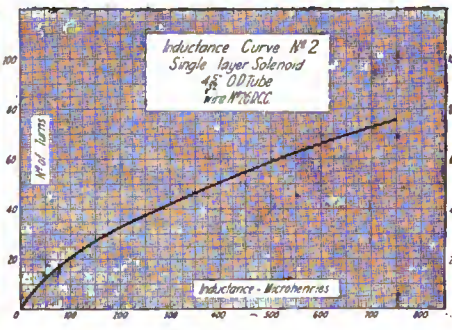


Figure 2

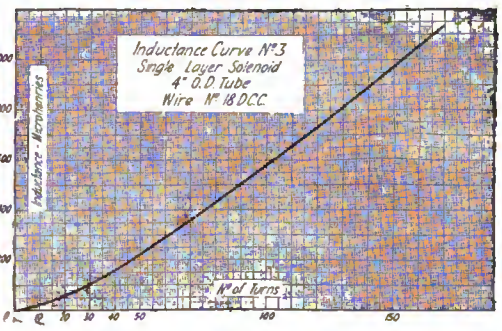


Figure 3

Various inductance curves

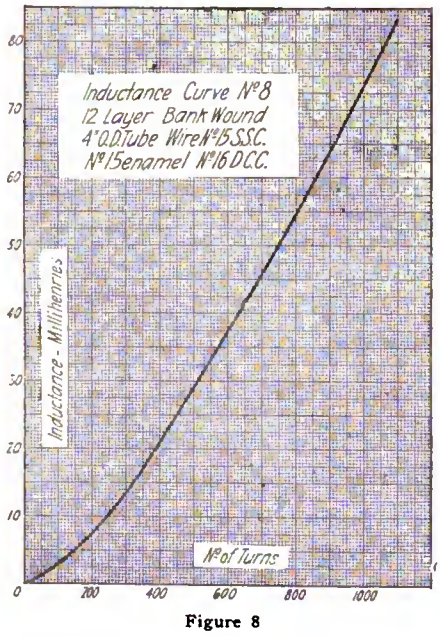


Figure 8

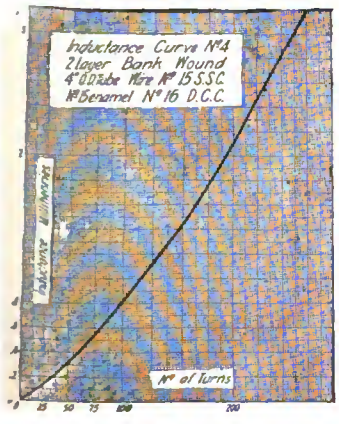


Figure 4

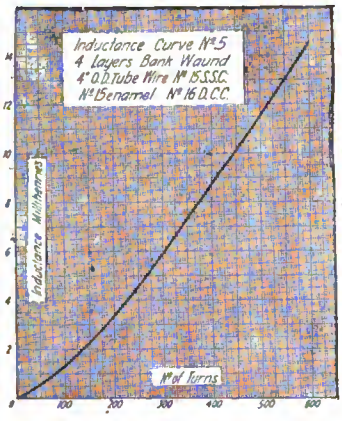


Figure 5

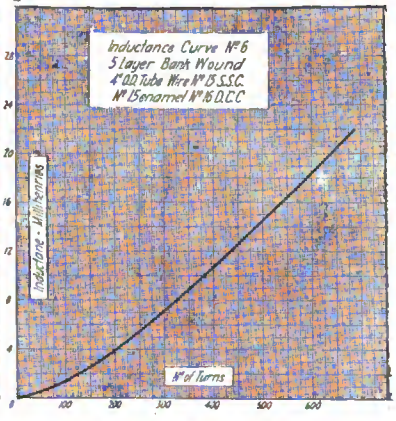


Figure 6

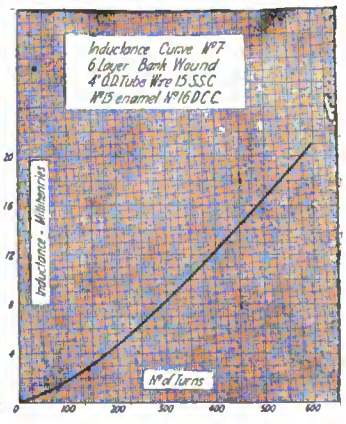


Figure 7

Inductance curves for different size coils

Extraordinary Results with a Crystal Set

By Stuart Babcock

TO the person who wishes to build a very efficient crystal set and does not want to spend much time or money, the following should be of great interest, as only a day or two is needed to build the set and the price complete may be kept well below $10 for all material.

After a good deal of experimenting I have found that I get as good, if not better, results with a little coil which I will describe.

The coil itself may be constructed from some stiff cardboard, a few toothpicks, and some old wire, together with a little shellac. Any size wire from about 28 to 36 will do. That from an old telephone receiver will work very well.

Lay off the cardboard into two 2-inch circles and cut them out. After giving them two good coats of shellac, divide the circumference of one of them into 35 parts and mark the points. Draw lines from these points to the center and lay 35 toothpicks on these radii, sticking them with shellac. They should project in on the circle a little over half an inch. Now stick the other disk on the toothpicks directly over the first, thus holding the toothpicks between them. After the shellac has dried, clip off the ends of the toothpicks, leaving about ¾-inch projecting. Figure 1 shows the completed form with half of the toothpicks in position.

The wire is wound over and under every two toothpicks, thus crisscrossing it in a manner to make the coil very efficient. After winding 5 turns around the form in this manner, twist a loop about 3 inches long in the wire and continue. After the first 5 turns are on, the winding should appear as in figure 2, when looked at from above. Wind 40 turns, making a loop after every 5 turns, then beginning with No. 41, wind 5 more, making a loop on each one. By means of these taps the amount of wire in the coil may be varied.

Figure 3 shows how the set is connected up. A is the coil, B, the detector, and D the phones. Using this single coil Atlanta, Schenectady and Newark have been heard very clearly here in Northern Illinois, and nearby stations come in very loud.

The switches may be made easily, or may be bought. When first trying out the set switches may be dispensed with and temporary connections used. About 25 or 30 turns are the best to receive radiophone on, and 40 or 45 will be found to be about right for 600-meter commercial stations.

Somewhat better results will be obtained if a secondary coil (E, figure 3) is connected up and used, the detector, condenser and phone being simply taken out of the primary circuit and placed as shown in dotted lines. This coil may have from 35 to 60 turns, and is wound like the other one; 35 turns will be found to work well for radiophone.

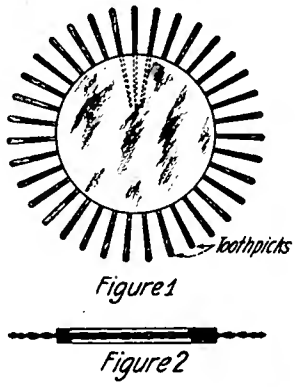


Figure 1

Figure 2

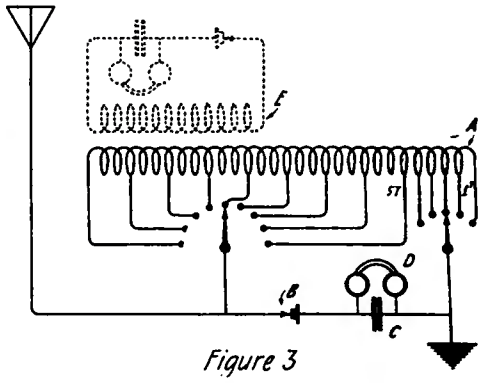


Figure 3

Constructional details and hook-up of flat spiral wound coil

Hints on Receiver Efficiency

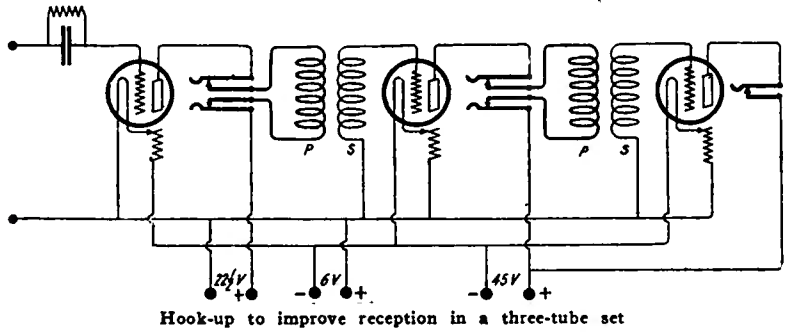
By E. Singer

MAXIMUM efficiency shows up in radio greater than in any other endeavor. When two neighbors, both interested in radio and both using the same circuit and same make of apparatus, start talking about stations heard, often one has better results than the other. One goes back to his set proudly, while the other looks over his set, tightens the connections and wonders why it is that he cannot get any distant stations. Here is where efficiency comes in.

In tube circuits where the detector and amplifiers are supplied from the same battery the following hook-up is very effective: To give the proper potential to the grids of the tubes run a wire from the negative filament connection on the detector socket to the rheostats of the amplifier tubes. Connect the ground side of the secondaries of the amplifying transformers to this common return wire.

For best results from transformers always connect the plate of one tube and the grid of the next to the primary and secondary terminals that are exactly opposite to each other. Where shielded transformers are used always ground the shielding and set the transformers approximately 4 inches apart and at right angles to each other.

Do not run wires parallel to each other—old advice but important. If parallelism can't be avoided, make the wires a little longer and space them further apart. For looks as well as technical reasons run wires in straight lines and bend them in square corners.



Hook-up to improve reception in a three-tube set

Be sure to wipe joints where soldering paste is used. Take extra care on jacks as a good deal of noise is caused by the paste soaking into the insulation between the blades.

Noise and howling is very often caused by cheap sockets. Bakelite sockets should be used. The sockets should always be raised above the bottom of the cabinet to prevent leakage.

Where there is a little space to spare in tube units and price permits a potentiometer is recommended. The results obtained from this added instrument is surprising.

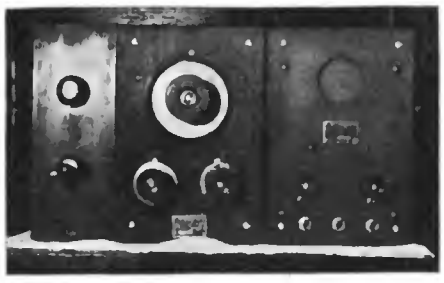
Other causes for noises are grid wires running near plate wires, poor plate batteries, loose connections, poor grid leaks and apparatus loose on the panel.

In the original Armstrong circuit using two variometers and one variocoupler wonders can be accomplished if the proper precautions are taken. There should be a minimum amount of coupling between variometers and variocouplers. A safe distance between variometers is eighteen inches with the variocoupler midway between them. The back of the panels should be shielded with tinfoil or some other metal and this shielding in turn grounded. Care must be taken so that the shielding does not touch any of the metal parts of the set. This shielding will prevent the body capacity from having any effect upon the tuning.

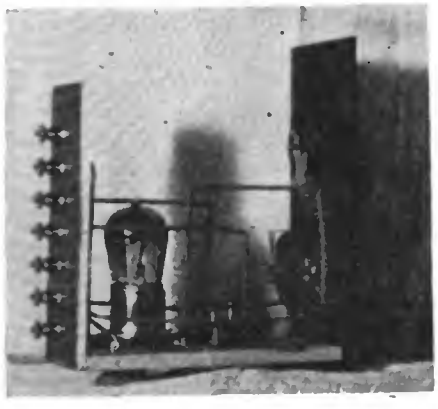
A Radio-Frequency Amplifier Attachment

By L. W. Van Slyck

THE piece of apparatus about to be described is by no means new, but is presented merely for the purpose of encouraging more amateurs and radiophone enthusiasts to use radio-frequency, by demonstrating to them how simple it is. Even if one stage of radio-frequency did not amplify at all, there are still two very good reasons why it should be attached to every audio-frequency outfit. In the first place, a marked improvement in the clarity of the phone signals and a reduction of static will be noted, and second, re-radiation will be reduced to a minimum, and most of the time—with a properly adjusted receiver—entirely eliminated. This is becoming very important in some localities at present—see article in the November issue of THE WIRELESS AGE. Further, an increase in signal strength will be noted, especially on the weak signals.



Front view of panel showing arrangement of r. f. amplifier, tuner, detector and a. f. amplifier



The radio-frequency unit

The particular outfit illustrated here was designed especially for use in conjunction with the Westinghouse R. C. Receiver, but may be easily adapted to any receiver by clipping the two wires which run from the tuning apparatus to the detector bulb on the tuner side of the grid condenser. The four ends thus formed correspond to the four top binding posts on the Westinghouse outfit. On this instrument it is necessary only to remove the two top straps, and connect as shown in figure 2. The same "A" and "B" batteries are used for the radio-frequency attachment as are employed for the detector and audio amplifier.

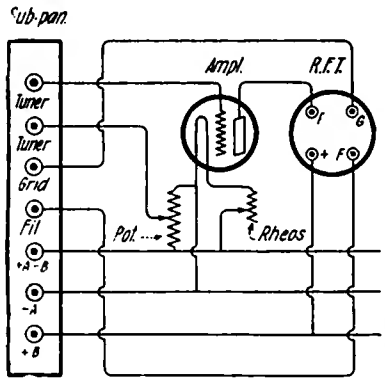


Figure 1

Wiring diagram for radio-frequency attachment

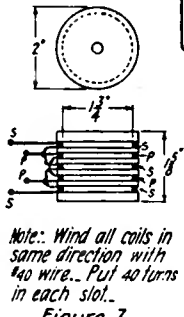


Figure 3

Radio - frequency transformer for 200-500 meters

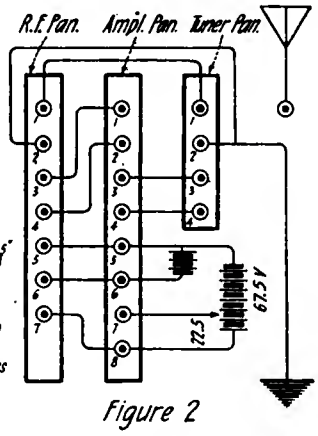


Figure 2

Panel connections using Westinghouse receiver

The actual dimensions of the box are left to the reader, but I wish to call his attention especially to the sub-panel for terminals. This is a very convenient method, because it makes it possible to entirely remove the instrument from its case without removing any connections.

The panel was constructed of ¼-inch bakelite and given a satin finish by the application of sandpaper—always rubbing in the same direction. A 200-ohm vernier potentiometer and a rheostat, a socket and a radio frequency transformer, complete the bill of material. The vernier attachment on the potentiometer is not absolutely necessary. The radio frequency transformer may be constructed, if so desired, as shown in figure 3. This size will cover a range of wave lengths from 200 to 500 meters very efficiently.

With this attachment on the Westinghouse, using a single wire 125 feet long and 40 feet high, the writer has no trouble in receiving KHJ at Los Angeles—1,800 miles—on any good evening.

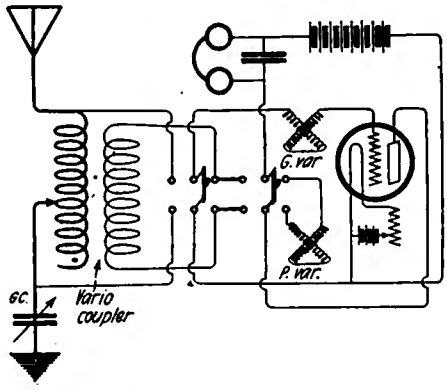
Substituting a similarly constructed three stage radio frequency amplifier, and using the detector and two-stage audio as before, and a 30-inch loop, practically the same results were obtained as with a one-stage radio-frequency amplifier, detector and two-stage audio-frequency amplifier and an outside antenna. The construction and operation of the three-stage, however, should be preceded by familiarization with the one-stage if one is inexperienced in radio frequency.

A Combination Circuit

By Ora Caldwell

MANY amateurs upon building their own set are undecided as to what circuit to use. Some experienced radio men suggest and recommend one set and others recommend another. The two most popular sets among amateurs are the single circuit tuner, which employs a vario-coupler, using the stator for a tuning inductance and the rotor for a tickler or regenerator with the usual addition of a ground series condenser and the three-circuit tuner using a vario-coupler with the rotor in the grid circuit and a grid variometer and a plate variometer. The two circuits are both desirable. The single circuit tuner is much easier to tune but the three-circuit tuner is a great deal more selective. A means by which both could be used with a small additional expense, should prove of interest to the radio public in general.

By the addition of a standard twelve-spring switch and a ground series condenser to the material necessary for a three-circuit tuner both of the above described sets can be had. The diagram herewith shows the proper connections. If it is desirable to eliminate the ground condenser when employing the three-circuit tuner simply slip an ordinary clip such as is used for fastening heavy envelopes, over the edge of one of the rotary plates so that at position of maximum capacity the head will make contact with the stationary plate. This will short the condenser.



Optional single-circuit and three-circuit tuner arrangement

With this set the "ham" can be content with the knowledge that he has a set better than his buddy, in fact he has two sets.

If the twelve-spring switch is undesirable or hard to get, two D. P. D. T. switches of the Clapp-Eastham panel mounting type will fill the same place and do the job equally well.

NEW APPLIANCES AND DEVICES

Brandes Girl "Salesman"

DEMONSTRATION is the surprisingly effective method used by the majority of radio salesmen nowadays in selling not only complete sets, but their components. Evidently C. Brandes, Inc., decided to capitalize this excellent habit when they planned a counter display stand for the well-known Brandes "matched tone" headset. The idea when worked out took the form of a girl's head, which is being placed on more and more dealers' counters every day. The bust is life-size, of bronze, and at the ears there are depressions of exactly the right size to receive the phones, while over the head are two shallow grooves in which the headband

The Brandes "Salesgirl"

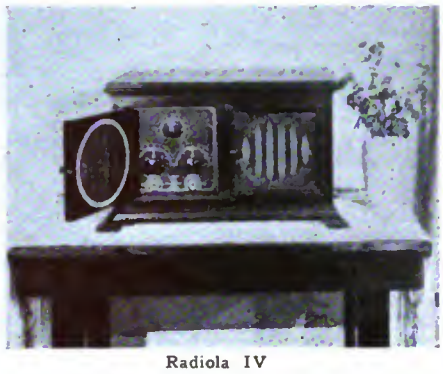
fits. When this smiling Brandes girl has been put on the counter and fitted with a head set, she is a silent, but effective, sales help.

Radiola IV

A NEW type of radio receiving set with a self-contained loud speaker, which operates entirely on dry cells and has an equal or better reception range than the average two-stage set using storage batteries for the filament current has been perfected by the General Electric Company for the Radio Corporation of America.

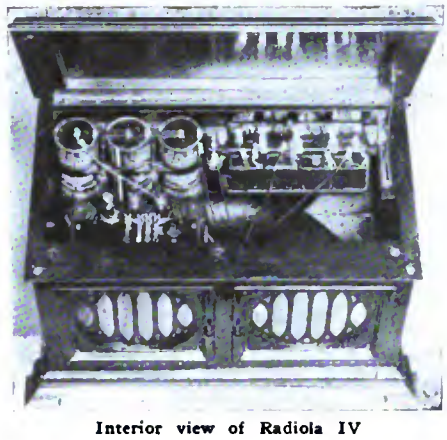
This set is known as the Radiola IV and is contained in an attractive mahogany cabinet with none of the tuning or other knobs visible and with no external wiring except two silk covered cords reaching from the rear of the cabinet to the antenna and ground. It uses three of the new type GE tubes which consume but sixty milliamperes filament current per tube or .06 of the current used by the present type UV-201 tube.

The "A" battery, which is the storage battery in ordinary receiving sets, consists of three dry cells similar to those used for



Radiola IV

door bells. These supply the filament current at four and one-half volts. The "B" battery consists of four, 22½ volt units, which supply ninety volts to the plates of the tubes. There is also a "C" battery, consisting of a small three-cell flashlight dry battery supplying 4½ volts to the amplifier grids. This combination insures the highest quality of loud speaker signals. Radiola IV is a handsome and efficient receiver and is proving popular for drawing rooms everywhere.



Interior view of Radiola IV

Explains Phone Acoustics

"ACOUSTICS and the Telephone" is a new booklet by the Connecticut Instrument Company devoted to the subject indicated by the title, and probably will be of interest to all users of headsets for broadcast reproduction. The booklet describes in detail the complex character of sound, and does it in plain language, too, so that everyone can understand. After making clear the handicaps of metallic diaphragms, taking ten pages of interesting matter for the purpose, the writer of the booklet wrote four more pages, almost as interesting, about the advantages of the non-metallic diaphragm of the CIC headphone. The booklet contains enough general information on its subject to recommend itself to seekers after facts, as well as headsets.

Day-Fan Radio Parts

THOSE who admire fine molding work in radio parts have a new line offered for their approval, the Dayton Fan & Motor Co., having placed on the market the Day-Fan variometer and a companion variocoupler. These are of the same size and general design, and are good jobs of molding. The windings of the stator are inside the mold in each case, giving maximum inductance between stator and rotor. In order to reduce distributed capacity, bank winding is used on both stators and on the rotor of the variometer. The instruments are small in size and are provided with adjust-

Day-Fan molded variometer

ments for mounting on base, panel, or back, as desired. All trimmings are nickel plated. Besides the variometer and variocoupler just described, the Dayton Company is making audio-frequency transformers, condensers, rheostats, knobs and dials, and plans to extend the list in the near future.

New Ludwig-Hommel Catalog

LUDWIG-HOMMEL & COMPANY, Pittsburgh, Pa., has issued price list No. 200, which strikes a new note in radio literature, being an unusual combination of both price list and catalog. All articles in the list are classified alphabetically with prices directly opposite, it being unnecessary to turn back to any separate tabulation. Illustrations are most numerous and include everything from elaborate receiving sets to the most minor parts, such as grid condensers and plugs. The price list is well printed on coated paper and has twenty pages 8½" x 11", bound in heavy brown art stock.

Fada Prize Awarded

THE result of the prize contest conducted some time ago by Frank A. D'Andrea has just recently been announced. The prize, a two-step Fada amplifier, No. 106-A, was awarded to T. R. Goldsborough, United States Patent Office, Washington, D. C. The contest was conducted to bring out desirable names for the small "Fada Men" used in advertising Fada products.

Dubilier Radio Products

THOSE who have been following the development of the radio industry since the public first displayed its tremendous interest in broadcasting have not been surprised at the increasing use of Dubilier condensers of various types. The company is well known to old timers in the industry, having achieved a reputation based on the performance of its products in actual service, over a period of years. At the present time the emphasis upon receiving sets has brought certain of the Dubilier condensers into prominence, especially the various models known under the general name of Micadons. These are made in a number of types and capacities.

The Micadon, fundamentally is the same in each type, being a condenser made in small capacities, using the best grade of India mica as a dielectric and employing a black molded composition for mounting. Each model has connectors of different types, suitable for the use for which it is intended.

Thus the Type 600 Micadon, available in capacities from .0001, .00025, .0005 mfd., has Fahnestock connectors and grid leak clips, this being made especially for use in grid circuits. There is another model of the Type 600 condenser available in capacities from .001 to .005 mfd., which is provided with screw terminals and without a grid leak mounting.

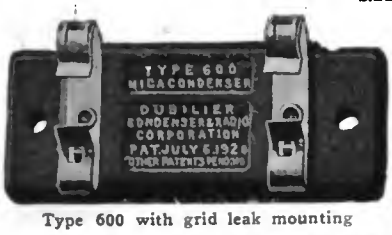
Type 601 Micadon is another Dubilier condenser and is going into increasing use, as its very convenient form enables a number to be connected in series or in parallel in a minimum amount of space. They may be connected in parallel, to increase their capacity by passing bolts through the eyelets. Machine screws may be used to connect them in series in order to obtain selective capacities in between the steps of .0001, .00025, .0005, .001, .002, and .0025 in which this type is available. Type 601 also is offered with three different types of connectors, 601-T for adjustable mounting over binding posts, type 601-G with grid leak clips and type 601-D with extended tabs for soldering.

Another Micadon is 610, which has the same general characteristics as the Type 600, but is provided with screw terminals, slightly larger and is especially recommended for capacities from .003 mfd. and up, including .004, .005 and .01 and .02.

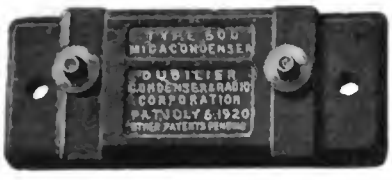
In all these Micadons the construction is such that the plates and dielectric are held so firmly as to prevent vibration under great variations of the current applied to them. It frequently has been found that howling in receiving circuits arises from condensers whose capacities vary due to slight movements in their elements. The patent process used in Dubilier condensers results in the manufacture of a condenser having a fixed capacity.

The newest Dubilier condenser is the Variadon, which is exceedingly novel as it is a variable condenser not larger than the ordinary dial. It is offered in three capacities, .0004, .0006 and .001. In this condenser India mica is the dielectric, and variation in the capacity is obtained by varying the separation between the plates. The device may be mounted either on the front or rear of the panel, and is 3 inches in diameter with a graduated scale, knob and pointer.

MICADONS



Type 600 with grid leak mounting



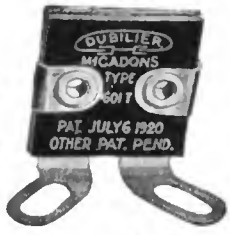
Type 600 without grid leak mounting

Type 601-G

Type 601-D

Type 610

Type 601

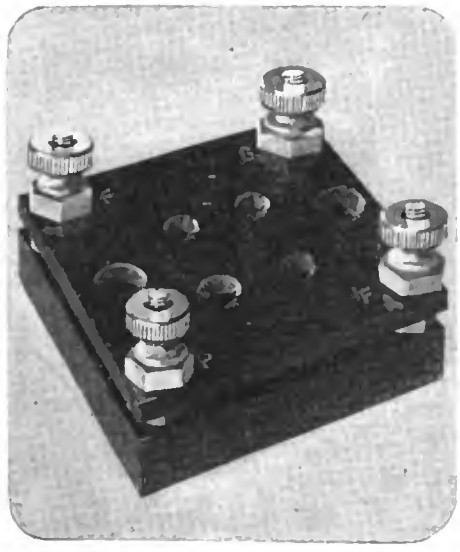


Type 601-T

Variadon variable condenser

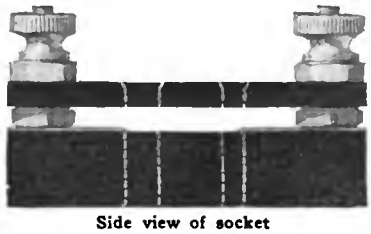
Asco Socket for WD-11

THE increasing popularity of the WD-11 dry cell tube in the hands of amateurs has led to the production of a special socket for it by the Akron Specialty Co., Akron, O.



The Asco tube socket

The socket, known as the Asco No. 11, consists of two square blocks of insulating paneling, the lower block ⅜ inch thick, and the upper ⅛ inch, separated 3/32 inch. A binding post in each corner of the assembly has connected to it a strip of spring bronze extending down into the socket holes of the lower block, to make contact with the appropriate pins or legs of the tube. Each post is marked so that improper connection should be impossible. The workmanship on the socket is good, and the contacts are automatic and positive.



Side view of socket

Explains Portable Meters

A FOLDER entitled "Handy Instruments for Everyday Use," giving information about its portable ammeters and voltmeters, has recently been issued by the Westinghouse Electric & Mfg. Co.

These meters, which are made in three types and a number of capacities, are especially well suited for automobile and radio testing and for general experimental work.

Star Insulate

IN addition to the well-known products of "Insulate" (black shellac composition) and "Hi-Heet" phenol composition, General Insulate Company has shown for the first time at the Radio Show which has just closed in New York, an entirely new product—"Star Insulate"—a material that has great mechanical and dielectric strength and resiliency, which can be moulded to almost any shape, either thick or thin and any color, opaque or translucent.

The Monthly Service Bulletin of the

NATIONAL AMATEUR WIRELESS ASSOCIATION

Guglielmo Marconi, *President* | J. Andrew White, *Acting President* | H. L. Welker, *Secretary*

Founded to promote the best interest of radio communication among wireless amateurs in America

THE Milwaukee Amateurs' Radio Club, which was founded in 1917, is enjoying an active and successful season. The society meets weekly at 7:45 p. m. on Thursdays in the trustees' room of the Milwaukee Public Museum. Meetings have been well attended, and the membership is increasing.

At the annual election of the Board of Directors seven members were chosen, and the chairmanship given to C. N. Crapo, 9VD. In addition to several committee chairmen the board appointed the following officers: H. F. Wareing, president; E. T. Howell, 9CVI, vice president; H. G. Fawcett, secretary; E. W. Ruppenthal, 9AYA, treasurer; L. S. Baird, business manager.

The meetings and papers committee has arranged for several talks. E. R. Stoekle, Ph.D., of the University of Wisconsin, spoke on the subject of "The Vacuum Tube As a Radio Detector and Amplifier." E. D. Nunn, a Milwaukee radio engineer, demonstrated a receptor of his own design and gave a short talk on radio-frequency amplification. At a special informal meeting a "ham-fest" was held with F. H. Schnell, traffic manager of the A. R. R. L., as guest and principal speaker. "The Construction of a High Voltage 'B' Storage Battery" was the title of an address by Marian Szukalski, Jr., 9AAP. Ben A. Ott, 9ZY, and K. C. Maas, 9AZA, recently visited the society and gave talks on state organization. This resulted in the calling of a traffic meeting where several tests were arranged for and seven relay trunk lines within the State of Wisconsin were laid out.

The technical committee, headed by E. T. Howell, Sc.M., and R. E. (radio engineer) Lathrop, 9ATX, vice president of the Waukesha Radio Amateur Club, has submitted several reports on topics of timely interest. The "S" tube has been discussed; super-regeneration explained; an analogy given for oscillating tubes; and the Hartley and reverse feed-back C. W. circuits contrasted.

A spirited spark-C. W. debate was put over with great success. The argument waxed hot, and the sound of the gavel was frequent. A contest in defining technical radio terms caused many lines to be spelled down, but resulted in adding a store of words to the members' vocabularies. Several meetings have been devoted in part to discussions of the proper design and construction of aerials in way of collecting data for this club's contribution to the antenna symposium number of QST.

The Milwaukee Amateurs' Radio Club

Before the opening of the transatlantic tests, Dist. Supt. C. N. Crapo outlined the procedure of transmitting and reception and presented a table giving a comparison of Greenwich, England, and Central standard time. The last meeting of the year was devoted to a gathering of old-time "hams" and early members of the society. Reminiscences were in order, and the days before the law of 1912 were recalled as well as many mentions of pre-war activities and calls. The annual group picture of the members was taken.

Membership appeals alike to the "DX" man, the experimenter, and the novice. There are three grades of membership, the first grade requiring that the member hold a U. S. radio operator's license. Dues are fifty cents a month. Visitors and prospective members are welcome at all meetings. The club stands ready to help the newcomer by teaching him the code and enlarging his acquaintance among radio amateurs.

IN the last few months the Radio Inspectors of the various districts have found it necessary to stop transmission by many amateurs, because the operators had changed the equipment of their stations without notifying the inspectors. When a station license is issued for transmitting, such license covers only the apparatus and equipment described in the application. If an operator changes his transmitter from spark to the continuous wave type, or makes any other changes in the equipment of a station as described in the original application, the radio inspector should be immediately notified in writing of the change. New application blanks will be sent to the operator by the inspector and these must be promptly filled out and returned to the inspector accompanied by the existing license for cancellation. If the apparatus as described in the new application complies with the law and the regulations of the Department of Commerce, the inspector will issue a new license, reassigning the same call letters whenever possible.

WHAT is undoubtedly a long-distance record for transmission and reception of signals from American amateur stations was established during last November. The operator of a ship then 100 miles off the coast of China reported reception of the signals of four amateur stations, two located directly on the Pacific Coast and two inland. The four amateurs whose signals were heard are F. E. Nikirk, Los Angeles, Calif., 6KA (also reported from Europe during the Trans-Atlantics); H. L. Gooding, Douglas, Ariz., 6ZZ (also heard in Europe); C. E. Capwell, Oakland, Calif., 6NZ, and E. C. Danette, Colusa, Colo. The maximum distance covered by these amateur signals was close to 6,000 miles.

The Pacific Ocean, especially in winter, is a wonderful place for radio. Applications for small islands will be credited in the order in which they are received.—Ed.

UNITED States Civil Service Examinations are listed below. Applications for these examinations may be had from the local secretary of the Civil Service Board at your Post Office, or, if not available there, may be secured from the U. S. Civil Service Commission, Washington, D.

C. The examinations are held simultaneously on the dates given in several cities in each state, applicants presenting themselves at the nearest examining office.

Junior Engineer. Vacancies in the Bureau of Standards, for duty in Washington, D. C., or elsewhere, at $1,200 to $1,500 a year plus bonus. The examination will be held March 7, and will include electrical, mechanical, civil, chemical, ceramic, radio and materials engineering subjects, which the applicant may select. In addition, competitors will be rated on general physics, mathematics through calculus, practical questions on each subject chosen, and education, training and experience. Applicants must be either a graduate of or senior student in a college of recognized standing.

Junior Physicist. Vacancies in the Bureau of Standards, for duty in Washington, D. C., and elsewhere, at $1,200 to $1,500 per year with bonus. Examination March 7, with following optional subjects: heat, electricity, mechanics, optics, radio, physical metallurgy. Other requirements same as above.

Junior Technologist. All particulars same as above, except that optional subjects for examination as rubber, leather, paper, textile, oil and general technology.

ON the afternoon of November 30 last, signals from the amateur station of the Hon. Lawrence Mott, 6XAD, Avalon, Catalina Island, California, were heard at 3EL station, Washington, D. C., using a detector only—no amplification. The signals were heard several times between the hours of 3 and 5 P. M., and undoubtedly constitutes a record for trans-continental daylight work. The reception of signals from exceptionally distant points is frequently experienced by amateur operators during the late afternoons of winter particularly, and is known as "twilight" work. It frequently happens that signals from far distant stations which are ordinarily heard only during the early morning hours, the ideal time for long-distance work, will be heard for a short time at twilight and then disappear entirely, not to be heard again until midnight, or later on in the night when conditions are ideal for long-distance reception.

ON the night of January 4 last, 6XAD was in communication with Stations 2FP and 3ARO for about forty minutes in each case. Both stations heard 6XAD and called, and Major Mott responded and two-way trans-continental work was carried on successfully between the stations.

BROADCASTING of weather reports, forecasts and storm warnings from the U. S. Navy stations at Key West, Fla., and Point Isabel, Tex., now is done on a new schedule. NAR, Key West, now transmits at 10 p. m., on 5,700 meters CW and 1,988 meters spark. NAY, Point Isabel, transmits at midnight, noon and 7 p. m., on 5,000 meters CW and 2,250 meters spark. The time given above is for the 75th meridian. Hurricane warnings are broadcast as soon as received and repeated at two-hour intervals until midnight on both wave lengths.

Silas Scoggins Slips Us Some Real Dope

Brooklyn, N. Y.

Dear Honorable Editor:

I want to tell you about the wonderful radio receiver I made all by myself without help, aid, or assistance from anyone whatsoever.

First, I got an old packing-box. I got the oldest I could get, because I think a radio receiver should be made out of old wood, just like old violins are made out of old wood—the older they get the sweeter they sound.

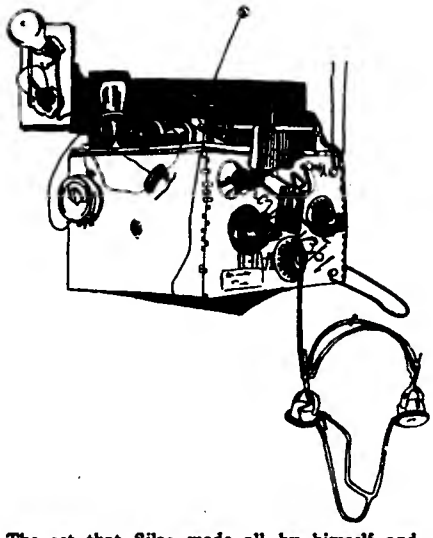
Then I wound three spider-web coils on old cardboard that I got by cutting up an old cardboard sign that advertised a masquerade ball at the old Brooklyn Academy of Music many years before it burned down, on Montague Street, I think it was, before I was born or came East from Missouri. Then I put it all together with an aerial, and condensers and ground and everything.

I wouldn't be bothered with batteries, because they're not very lasting, so I just ran the Brooklyn Edison Company's direct current through two lamps, side by each, and then I ran it right into the Radiotron UV200 and out again, and through a rheostat, and I don't get much hum from the commutator that the Edison Company's got in their sub-station. First I got some hum, and then I put on a voltmeter to see how things were going, and that stopped the hum, by gum, and so I left the voltmeter on so the hum would stay stopped, and I can always see if the voltage is right which is not necessary because it is always right anyhow. But it wasn't quite right at the start. It was a little over six volts, which the Radio Corporation says is too much for their UV200 if you want to keep it lasting. So I had an old coil that came off a medical battery, and I put that on next to the voltmeter so that some of the current could leak off before it got to the UV200, and then the voltmeter said it was all right because it was just a little more than 5 volts and I get all the stations fine, and I get the code from the Brooklyn Navy Yard so loud that I can't hear WOQ, which is at Kansas City, which I used to hear on my uncle's farm in Missouri. But sometimes I hear WGY, Schenectady, WOC, Davenport, Iowa, WSB, Atlanta, and WIAK, Omaha, and all the New York and Newark stations all the time, and WJZ is very good, and I always watch for it. I am enclosing a sketch of my set, that a young artist I know made for me, and a diagram of the circuit, so you can see how my set is made and make one yourself, and get wonderful results like I do, and if you want any more information just ask for it, as I am very obliging.

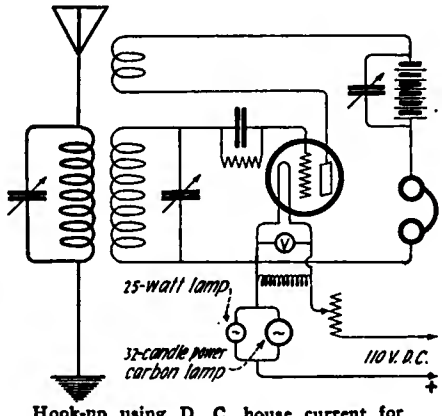
Yours truly,

SILAS SCOGGINS.

P. S.—One night I wasn't sure whether I had Milan, Italy, or an Opera Star at WJZ.



The set that Silas made all by himself and it works



Hook-up using D. C. house current for filament

Care of Radio Storage Batteries

FEW radio operators have ever gone into the subject of battery care enough to understand thoroughly the use of the battery hydrometer. It is a fact that most articles on the subject of radio receiving fail to stress sufficiently the importance of battery care. It would appear to the ordinary readers that a battery is merely a piece of apparatus used to supply current to the vacuum tubes or telephone.

The hydrometer used by battery men is simply a gauge of the weight or specific gravity of the battery solution. Considering distilled water as a standard, any other liquid which weighs the same as an equal volume of distilled water under the same conditions of temperature and pressure is said to have a specific gravity of one. Sulphuric acid weighs more than water, so that when it is used to make up the battery electrolyte, the solution naturally weighs more than distilled water. It is the combined weight of the water and acid which is measured.

If the battery is fully charged, the battery solution should weigh 1.250 times as much as water. This is commonly stated as "twelve-fifty" and so marked on most hydrometers. When a battery has discharged, acid in the electrolyte is taken from the solution and combined with the plates, thus weakening the solution and bringing it nearer the weight of water. A totally discharged battery would register 1.100 on the hydrometer. With charging, a reverse process takes place and the acid leaves the plates to re-enter the solution. Naturally the solution becomes heavy and the hydrometer notes the difference.

There is no occasion to add acid to a discharged battery.

New Radio Receiving Tube

A NEW and improved vacuum tube for radio which uses but one-fourth the filament current of the present type Radiotrons has been perfected. This tube can be used either as a detector or an amplifier and is interchangeable in all receiving sets now using Radiotrons UV-200 or UV-201 tubes.

The outstanding features of the new tube are:

The filament current is but one-fourth that required for the UV-201, which means the storage battery will last four times as long without recharging.

Quieter operation, no tube noises.

Greater amplification due to greater filament and plate area.

Greater electron emission, about five times that of the present type tubes. Much less distortion of received signals and greater volume when used in connection with a loud speaker.

Better detector than the UV-201.

This new tube is known as the UV-201-A and was shown for the first time by the Radio Corporation of America at the recent American Radio Exposition in New York City.

Operators in Demand

THE American shipping business has improved considerably during the past two or three months, with the result that many ships that had been tied up in harbors all over the United States are putting out to sea again, some of them for the first time in three years. In consequence there has been a sudden increase in the demand for radio operators holding commercial licenses, and some lines have been put to it in order to fill the necessary berths. According to Rudolph L. Duncan, director of the Radio Institute of America, not a single licensed operator is now on the waiting list of that institute.

How Far Will My Set Receive?

(Continued from page 72)

receiver may actually be able to read the distant transmitter when the interference is gone. Furthermore, there is the question of static interference which alters the case.

What determines the range of the receiver or the ability of a receiver to read a signal of a certain strength is not the actual value of the received current as it is the ratio of signal strength to interfering noises, and in the particular case of static, the ratio of signal to static intensity. Consequently at certain times when static interference is negligible a given receiver may have a very great range, while at other times when static is strong that same receiver will have a very small range, showing how relative the expression "range of a receiver" is.

The formula for the received current in an antenna showed that it increased with the height and therefore the range also increased with the height of the receiving antenna. It was then stated that this was true theoretically, but other factors vitiated this conclusion.

These other factors are the interferences that exist, such as static. Not only is the received current increased when the receiving antenna height is increasd, but static interference is also increased. As a result the ratio of signal to static is not increased and hence the range is not increased. It is for this reason that large antennas are not desirable for receiving purposes. In fact, the receiving antennas are getting smaller and smaller. Witness the growing popularity of the loop antenna. The reason for this is that static has a small effect on these and by proper amplification the signal strength may be increased without increasing the effect of static, thus increasing the signal-to-static ratio, and hence the range. But all these considerations merely go to show how difficult it is to talk about or decide the range of a receiver.

Then again there is the seasonal and daily variation of signal strength which has to be considered. It is well known that reception varies from month to month, poor results being obtained during the hot Summer months, and best results being obtained during the cold Fall and Winter months. The range of a receiver would therefore have to be referred to the season of the year for accurate results. The formula discussed above for the value of the received current is based on daylight conditions. Conditions during the night are different, however. At night, reception improves markedly and the range of a receiver therefore increases. The unusual distances covered by transmitters and receivers as reported by amateurs generally take place at night time. This is because atmospheric conditions are different at night.

During the daytime the action of sunlight has a certain ionizing effect on the atmosphere, which has the effect of decreasing the efficiency of transmission. Furthermore, there is the effect of refraction of the waves during daytime which is not present at night, and which also results in decreased efficiency. The range of a receiver therefore is seen to be dependent upon the time of the day during which reception takes place.

It sometimes happens that unheard-of

distances are covered by low power transmitters and relatively inefficient receivers, and at other times an efficient receiver cannot hear a powerful station at a short distance. These uncertain conditions of reception and transmission are due to atmospheric conditions which cannot be predicted or accounted for, and which prevent any determination of ranges.

Finally, when ranges of receivers are talked about, the question of amplification must be considered. One or two stages of radio frequency amplification may increase the range of a receiver three or four times, or much more.

All these considerations simply go to show that the range of a receiver is a most indefinite quantity, dependent upon numerous uncertain conditions which cannot be considered in any calculations. They show how absurd it is to talk about the range of sets as a known quantity, and it is for this reason that question and answer editors often become impatient of such questions. The best way to decide what the range of your receiver is, is to try and receive and note what maximum distance you cover.

The Operation of Receiving Tubes from a D. C. Power Supply

(*Continued from page* 65)

III. Circuit for 220-Volt D.C. Line

Figure 5 illustrates the operation of a standard 3-tube circuit from 220 volts D.C. The only important features are the resistances used in series with the filaments. The total resistance is easily computed by the method described above and a suitable combination is made of the resistance units that can be obtained.

IV. Use of Ordinary Lamps Instead of Resistance Units

As mentioned previously, ordinary electric lamps are equally effective as the series resistance elements. The writer attaches a table which gives the resistances of some standard sizes of lamps.

110-volt Lamps		220-volt Lamps	
Watts Rating	Resistance Ohms	Watts Rating	Resistance Ohms
10	1200	10	4800
25	480	25	1900
40	300	40	1200
50	240	50	960
60	200	60	800
100	120	100	480

If the experimenter wishes to obtain a desired resistance, he will be compelled to use a number of lamps in parallel. In the circuit of figure 3, for example, to obtain 60 ohms, two 100-watt 110-volt lamps in parallel are required; for 20 ohms, six 100-watt 110-volt lamps in parallel are necessary. Since such lamps cost from 75 cents to a dollar each, the total will be six to eight dollars for lamps alone—whereas if resistance units of the Ward Leonard type are employed the cost will be only two dollars.

In the 110-volt circuits the resistances must dissipate about 100 watts of energy and in the 220-volt circuits, nearly twice that amount. Accordingly the resistances should not be completely enclosed in any cabinet—some provision should be made for ventilation and cooling.

STATIONS WORKED AND HEARD

Stations worked should be enclosed in brackets. All monthly lists of distant stations worked and heard which are received by the 10th of each month will be published in the next month's issue. For example, lists received by November 10th will be published in the December issue. Spark and C. W. stations should be arranged in separate groups.

2BLQ, C. V. RUSLING and 2BHF, R. A. TANNAHILL, Newark, N. J. (December.)

1dq, 1ii, 1on, 1qp, 1aap, 1aok, 1ayz, 1bas, 1bes, 1bhr, 1bkq, 1bom, 1bxx, 1cac, 1cdr, 1cmk, 1cpn, 3bq, 3bz, 3cg, 3ci, 3cq, 3fu, 3hg, 3iw, 3jj, 3jt, 3kl, 3lp, 3mo, 3nh, 3pz, 3rf, 3sm, 3tj, 3xm, 3afb, 3ajj, 3bfq, 3bhm, 3bij, 3blf, 3bob, 3bof, 3bnu, 3buv, 3bva, 4ea, 4gl, 4nt, 5da, 5fv, 8ak, 8ax, 8bk, 8bo, 8ij, 8ju, 8sa, 8ue, 8xe, 8uf, 8vq, 8wr, 8zd, 8zw, 8zy, 8zz, 8abv, 8agc, 8aiw, 8alf, 8amo, 8amq, 8anb, 8aqc, 8awp, 8awr, 8axc, 8azf, 8bea, 8bef, 8brn, 8bnj, 8bnu, 8bnz, 8boq, 8boz, 8bqq, 8brc, 8brm, 8bsy, 8btr, 8bvt, 8cay, 8cmi, 8cmy, 8ctn, 8cwz, 9ii, 9iq, 9lq, 9uu, 9aaf, 9aix, 9awm, 9bds, 9bqu, 9yaj.

Canadian.—3co, 3jt, 3aj.

3BMN, RAYMOND J. CARR, Petersburg, Va.

1bka, 2nz, 2zl, 2nz, 2xap, 5xk.

CANADIAN—2az, 2hg, 3co, 3dh, 3jt, 9al, 9bz.

S. T. DONNELL, Lampasas, Texas.

C. W.—2awf, 3bdj, 5xa, 5vo, 5fv, 5do, 5xv, 5ek, 5zo, 5tu, 5kp, 5ym, 5zaw, 5xb, 5kc, 5zag, 5xu, 5zb, 6zx, 7zv, 8zw, 8cmi, 9caa, 9zt, 9qf, 9akut, 9dky, 9dwk, 9xl, 9pi, 9cuc, 9vkt, 9ami, 9bev, 9aqa, 9apw, 9bik, 9alp, 9aix, 9yik, 9aou, 9ox, 9yak, 9amy, 9ahh, 9ccw, 9ccv, 9awm, 9dcg, 9bsg, 9xaq, 9ccm, 9cfi, 9bsi, 9dbv, 9bazg, 9bri.

Spark—5xac, 5rp, 5tu, 5zr, 5ug, 5zaw, 5ok, 9mc.

Fone—5xx, 5za, 5ir, 5zaf, 5faa, 5xu, 5adz, 5xb, 9zaf, 9ej.

6ZY, THOS. A. MARSHALL, Honolulu, Hawaii.

1adl, 1bkq, 2xap, 3cm, 3zw, 3hg, 4ea, 4ck, 5xv, 5zb, 5xd, 5my, 5acf, 5qi, 5zak, 5nk, 6bru, 6bjr, 6bpz, 6zaf, 6apz, 7zu, 7na, 8axc, 8ib, 8ks, 8xae, 8yd, 8sb, 8fq, 8aea, 8cxw, 8bxa, 8pd, 8bde, 8zae, 8bfm, 8ow, 8ml, 9cy, 9aul, 9at, 9aau, 9arz, 9ox, 9yw, 9al, 9dwk, 9dyg, 9ami, 9am, 9djb, 9vk.

SPARK—BQ3, Vancouver Barracks.

ADDITIONAL LIST

1bcg, 1bdi, 2pw, 2gr, 2zs, 2po, 3bv, 3bli, 3aao, 3yo, 4id, 4kk, 4bv, 5ak, 5sm, 5xk, 5uj, 5gi, 5tc, 5ek, 5cn, 5px, 5za, 6xad, 6cbi, 6boo, 6bcr, 6cc, 6brf, 6bvw, 6if, 6biq, 6xk, 6en, 6ku, 6ka, 6bjq, 6bqf, 6bpi, 6zz, 6bqc, 6bjy, 6zh, 6rm, 6arb, 6anh, 6ajr, 6awt, 7bj, 7adp, 7an, 7hd, 7nm, 7sc, 7sf, 8ab, 8bk, 8sp, 8bpl, 8vy, 8azd, 8bkc, 8aqc, 8beo, 8ey, 8fu, 8aq, 8aiw, 8dac, 8na, 8aim, 8brm, 8cur, 8asv, 8atu, 8axc, 8awp, 8bdw, 8cgp, 8cgx, 8caa, 8ft, 8qk, 8ue, 8uz, 8xe, 8zy, 8na, 9dqu, 9cmk, 9aou, 9dsd, 9ps, 9kp, 9bey, 9aph, 9dqm, 9avc, 9aw, 9bju, 9bri, 9bed, 9abu, 9biw, 9afk, 9blg, 9anq, 9bxq, 9bgh, 9bbf, 9bkh, 9bqw, 9bbs, 9bkp, 9bhi, 9bch, 9cr, 9ccv, 9cde, 9dsm, 9dxn, 9dqm, 9gk, 9lz, 9xac, 9zn, 9yaj, 9bji.

8CP, O. PALMER, 233 East 11th St., Holland, Michigan (November)

CAN—3dh, (3ji), 3nb, (3yh).

1azw, 1bes, 1bjn, 1cjh, 1cmk, 1bka, 1jk, (1qp), (1sd), 1ze, (2aim), (2ayv), (2blm), (2brb), 2cbw, (2cfb), 2cnv, (2ig), 2su, 2vw, (2cqz), 2zl, (2zs), (3as), 3aag, (3afb), (3agc), (3anj), 3apt, 3auu, (3ava), (3bfq), (3bhm), (3bho), 3blf, 3brw, 3cm, 3ut, 3qv, 3pz, (4bb), 4bx, (4eb), 4fg, (4ft), 4jk, 4lv, (4lp), 4km, (4kc), (5aec), (5dn), 5eg, (5er), 5is, 5ma, (5mb), 5mo, 5nn, (5nv), 5pf, (5sm), (5tc), 5tj, (5uo), (5we), 5xa, 5zg, 5zs, 5zt, (8aig), (8aim), 8alc, (8aol), (8amr), 8atc, 8axb, (8axc), (8axm), (8awz), 8bcy, 8beo, (8bgl), (8bgo), (8bke), 8bjx, (8btl), (8buc), (8bwk), (8bws), (8bxx), (8caz), (8cgu), (8cjz), (8cjh), 8coi, (8cpd), 8cve, (8cwp), (8ctn), (8cxf), (8kg), (8nz), (8dat), 8sb, (8ss), (8rm), 8uz, (8vy), (8yn), (8zb), (8zf), (8wv), (9aaw), (9afk), (9aey), (9ahh), (9aip), (9aiy), (9ajp), (9alw), (9anq), (9aon), (9aot), (9ape), 9aou, (9apw), (9aqr), 9aqz, 9arr, 9ase, (9atn), (9bcf), (9bct), 9bds, (9bed), (9bey), (9bfg), (9bkj), (9bcx), (9bhq), (9blg), (9bqw), 9bra, 9bri, 9brx, (9bsp), (9bsz), 9brk, (9bvy), (9bvz), (9bxn), 9bxb, (9bvp), (9bzi), (9cda), 9cba, 9cfi, (9cfk), (9cgk), (9chf), (9chn), (9cjc), (9cmm), (9cpy), (9cte), (9ctr), 9cvr, (9cxs), 9czs, (9dge), (9dfb), 9djb, (9dbv), 9dkv, (9dlx), (9dnh), (9doj), 9dqu, (9dsl), (9dta), (9dyn), (9dyy), (9dwq), (9dxn), (9ex), (9gk), (9lq), (9uf), (9ox), (9pf), (9vk), 9vz.

9BXT, ELVIN B. CHAPMAN, Giltner, Nebr. (December.)

CW—1cn, 1fb, 1gv, 1ii, 1kc, 1un, 1xu, 1yk, 1ary, 1bas, 1bes, 1bka, 1bkq, 1bwj, 1ckp, 1cmk, 1cmp, 1cve, 2bg, 2fc, 2fp, 2gi, 2gk, 2kf, 2nz, 2ot, 2su, 2ud, 2wr, 2xq, 2ayv, 2bbb, 2bea, 2bml, 2bmr, 2bqd, 2bqu, 2brb, 2bys, 2cjn, 2ckr, 2cpd, 2xao, 2xap, 2xaq, 3bz, 3fs, 3hg, 3hx, 3iw, 3lk, 3mb, 3oe, 3ot, 3rf, 3su, 3tj, 3xm, 3yo, 3zo, 3zw, 3zz, 3aqr, 3aro, 3atg, 3auu, 3bec, 3ber, 3bfm, 3bfu, 3bhm, 3bkc, 3blf, 3blz, 3bnu, 2bob, 3bof, 3bss, 3buv, 4bq, 4by, 4co, 4ea, 4eb, 4eh, 4hi, 4hw, 4kc, 4kf, 4kl, 4km, 4lj, 4lp, 4oi, 4ya, (5be), 5bw, (5cn), (5di), 5dw, (5el), 5ek, 5es, 5fv, 5ft, 5ga, (5gj), (5gr), 5ik, 5ir, (5ix), 5jb, 5kc, 5kn, 5lb, 5ml, 5mo, 5my, 5mz, 5nk, (5nn), 5ns, 5nv, 5pf, (5pv), (5px), (5qi), 5qs, 5rh, 5rr, 5sf, (5ss), (5ta), (5tc), 5tj, 5tm, 5tp, 5tx, 5uj, 5un, 5uo, 5uu, 5vo, 5we, 5xa, 5xk, 5xt, 5xw, 5zb, 5zs, 5aah, 5aar, 5aat, 5aby, 5aec, 5aer, 5aqi, 5xaj, (5zag), 5zak, 5zas, (5zav), 6cc, 6ea, 6if, 6lu, 6lv, 6ka, 6jd, 6rm, 6vm, 6zh, 6zt, 6zz, 6abx, 6anh, 6arb, 6avd, 6avn, 6awt, 6bbh, 6boe, 6bun, 6bvy, 6xad, 7bh, 7lu, 7ly, 7hm, 7sc, 7zc, 7zo, 7zu, (7zv), 7abb, (7afw), 7ad, 8aa, 8ab, 8bo, 8cy, 8fq, 8ft, 8fu, 8hh, 8hn, 8ib, 8ij, 8ju, 8kg, 8ml, 8oi, 8pd, 8qk, 8rj, 8rv, 8sb, 8sl, 8sp, 8sh, 8tt, 8ue, 8up, 8vq, 8vy, 8xe, 8yn, 8zf, 8zw, 8zz, 8abe, 8adg, 8adu, 8adz, 8aea, 8aeb, 8aeg, 8aeh, 8ago, 8agz, 8aih, 8aim, 8ajx, 8alc, 8alf, 8alr, 8ame, 8anb, 8apt, (8apv), 8apw, 8aqo, 8ard, 8asc, 3asv, 8atx 8avd, 8awr, 8awz, 8axb, 8axc, 8azd, 8azq, 8bcy, 8bdc, 8bde, 8bef, (8bek), 8bfb, 8bfh, 8bfm, 8bfr, 8bgl, 8bho, 8bic, 8bju, 8blc, 8blq, 8bnh, 8boq, 8bow, 8boz, 8bpe, 8bpj, 8brc, 8bry, 8btl. 8bur, (8but), 8bvr, (8bwa), 8bwy, 8bwz, 8bxa, 8bxe, 8bxx, 8byo, 8bzd, 8bzy, 8caa, 8cau. 8caz, 8cbo, 8cbx, 8cdz, 8cep, 8cgj, 8cgm. (8cgx), 8cia, 8cih. 8cim, 8cjh, 8cjy,

8cjz, 8cmy, 8coj, 8cpd, 8crb, 8cwc, 8cwp, 8cxf, 8cxk, 8cyb, 8cyt, 8czk, 8czr, 8xae, 8zae. Over 250 nines head including these worked:

(9ex), (9fm), (9hk), (9if), (9lq), (9ql), (9yu), (9aap), (9abv), (9ain), (9anf), (9ano), (9aot), (9aps), (9asf), (9avc), (9avz), (9bey), (9bfq), (9bgh), (9bgw), (9bie), (9bij), (9bjc), (9bko), (9bvy), (9bwe), (9bwm), (9bxa), (9bxy), (9cba), (9ccv), (9ceh), (9cin), (9cip), (9cit), (9cjj), (9cki), (9clf), (9cmk), (9cpy), (9cvo), (9cxv), (9czu), (9daw), (9dct), (9def), (9dkq), (9dmj), (9dnb), (9dqe), (9dqu), (9dsl), (9dta), (9dtm), (9dwk), (9dwq), (9dyy), (9eak), (9ecs), (9ecz), (9zaa).

Canadians: 2fc, 3bv, 3ds, (3fa), 3il, (3ji), 3ko, (4ab), (4br), 4bv, 4dk, 4hh, 9ac, 9bs.

SPARK—(5tu), (9ht), (9bsq), (9bwj), (9cbl), (9cle), (9clf), (9cms), (9dnc), (9eak).

S. F. NIELSSEN, S. S. "Porto Rico," December 11th, 1922, while laying in Mayaguez, P. R.

9:44 1ber, 10:40 1ajc, 11:20 1ajp, 7:40 2cjn, 7:40 2gl, 8:01 2zs, 8:40 2gq, 10:04 2cqz, 10:06 2zk, 10:42 2ayv, 11:04 2afp, 11:26 2fp, 11:50 2bol, 12:04 2zs, 7:50 3zw, 7:50 3hg, 7:58 3jj, 11:00 3fs, 11:28 3yo, 7:55 4ea, 8:55 4bf, 10:20 4bx, 8:34 5nk, 11:56 5uj, 11:58 5di, 11:44 6zh (qsa, one tube, called cq), 8:04 8brc, 9:00 8bvr, 9:08 8vq, 9:10 8brl, 9:13 8ue, 10:47 8oi, 11:54 8azf, 9:17 9aop, 9:20 9dyn, 9:22 9dsm, 11:32 9bp.

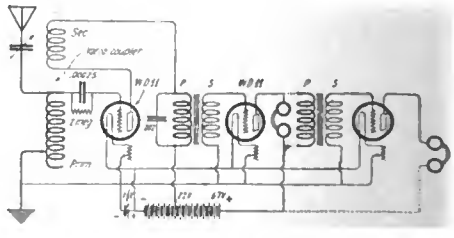
Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.

Positively no questions answered by mail.

E. G. Kane, Plainfield, N. J.

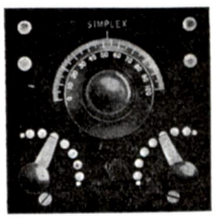
Q. How may I improve my hook-up? It is a reconstructed De Forest crystal set using original tuning coil and same case. Have only been able to get WJZ, WEAM, WOR and sometimes WAAM. WEAM and WJZ always heard at once. Get considerable howling and whistling.



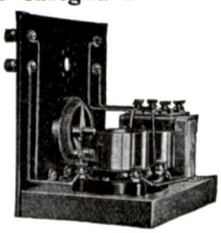
A. You will get greater selectivity by using the following hook-up which requires that you purchase a variocoupler with 50 to 60 turns each on both primary and secondary. This receiver is regenerative and you will probably receive distant stations. Why not add another step of amplification, so that you can work a loud speaker? The connections for this are also indicated in the diagram.

SIMPLEX

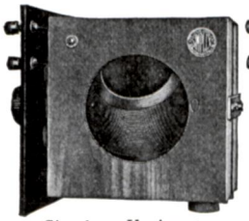
—that's your safeguard



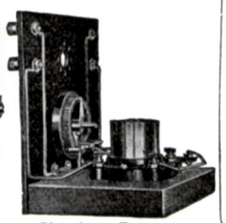
Simplex Vario-Coupler Panel



Simplex Amplifier Panel



Simplex Variometer Panel



Simplex Detector Panel

SIMPLEX PANEL UNITS make it possible to try out the many different hook-ups without disassembling panel, which is a decided advantage.

SIMPLEX RADIO CO.
1013-15 Ridge Ave. Phila., Pa.

They Last a Life

BRA
vacu

RADIO PRO

With the development
desire for more compl
tory equipment, comes
absolute protection from the elements and from static interference.

Brach Vacuum Arresters dominate their field. They last a lifetime unless hit by a direct stroke of lightning.

Unscrupulous manufacturers of Air-Gap Arresters have made statements implying that Brach Arresters lose vacuum. These statements are intended to mislead and are not founded on truth.

Listed by the Underwriters' Laboratories

L. S. BRACH MFG. CO.
NEWARK NEW JERSEY

Also Makers of Solderall—Best for Soldering Radio Connections.

Coast Representatives
Pacific States Electric Co., San Francisco, Los Angeles, Oakland, Seattle, Portland, Spokane.

"EURACO" PRODUCTS
(Guaranteed)

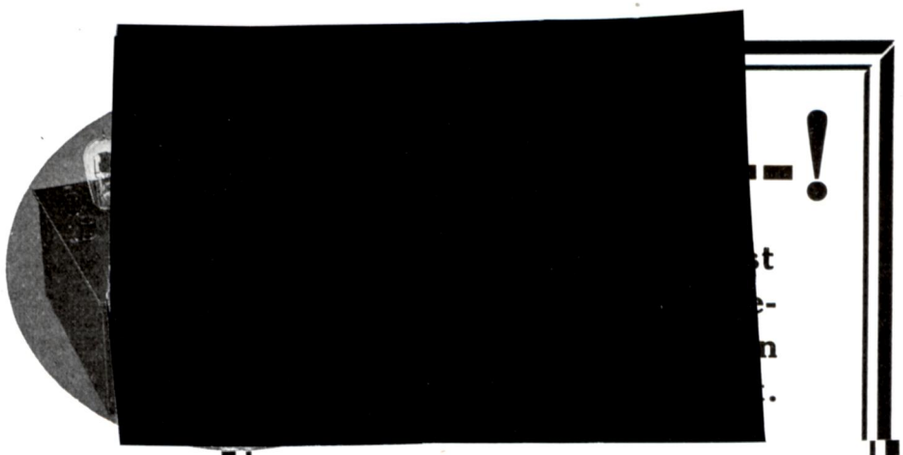
Compact—Interchangeable—Most Efficient—Accurate.

60 Cents per Unit.

60 Cents per Unit.

Mica Condensers—Grid Leaks—Mountings.
Interesting Proposition for Dealers.

EUROPEAN RADIO CO.
1342 East 22nd Street Brooklyn, N. Y.



From 1,000 to 3,000 Miles on Small Loop

$110.00
(without tubes, etc.)

Descriptive Booklet on request.

Dealers: Write for proposition.

This 3-Step Radio-Frequency Amplifier Detector Set:

1. Operates in any location—steel buildings included.
2. Reproduces with a tone quality almost unbelievable and positively solves the problem of "static" and other interferences.
3. Requires no technical knowledge whatsover to operate.

Ware
TYPE AD2
R-F AMPLIFIER-DETECTOR
RECEIVER

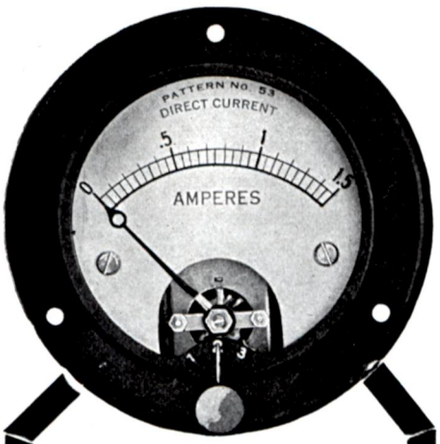
WARE RADIO CORP'N
160-162 Duane St., New York, N. Y.

RADIO—From the Inside

Learn Radio from the inside. Complete course covering arc, spark and vacuum tubes. Day and evening classes. Position guaranteed. First month's salary pays tuition. Call, write or phone—now!

"The Best Radio School in the East"
"A JOB FOR EVERY GRADUATE"

Y. M. C. A. Radio School
149 East 86th Street New York City
TELEPHONE LENOX 6051



Triplex Filament Meter

Filament control by the use of proper instruments in receiving sets is the trend of the times. The Jewell triplex filament instrument, made as an ammeter or voltmeter, places on your panel the proper means for controlling the filaments of three tubes. It has a self-contained mechanism for switching to either tube and being of small size, can be accommodated on the most compact tube set.

Price $10.00

We were the first to supply a complete line of miniature radio instruments of uniform size. Ask your dealer or write to us for complete radio circular.

Jewell Electrical Instrument Co.
1650 Walnut St. Chicago

The first man to listen over a 'phone

didn't hear very much. Today he listens with comfort and complete understanding. The difference is due to better apparatus.

The AMERTRAN

super audio frequency amplifying transformer

gives 38.6 times audibility in your receiving, *without distortion*. Two stages (2 AMER TRANS) give 1490 times audibility. It is doubtful if the substitution of any one thing in a radio set could make such a notable improvement as the installation of AMERTRANS.

Price $7. Ask your electrical dealer, or sent carriage charges collect. (Wt. 1 lb.)

American Transformer Company, 179 Emmet St. **Newark, N. J.**

Designers and builders of radio transformers for over 20 years

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High Efficiency Head Receivers

LIST PRICES
$6.00 to $12.00

Made by a factory, with over 30 years' experience in manufacturing good receivers.

THE TEST TELLS

Ask for full data

American Electric
COMPANY
State and 64th Streets Chicago, U. S. A.

If you use Amplifying Tubes

you can make your Victor talking machine a RADIO LOUD SPEAKER, with a "Beeko" Radio-Phono attachment.

Sample by mail, 40c.

Liberal discount in quantities.

J. H. BUNNELL & CO.
32 Park Place, Dept. W
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GENUINE GERMAN MAUSER

Half pre-war prices

$12.95

Latest model 9 shot automatic. Shoots standard cartridges—lies flat in pocket — World's famous **Luger** 30 cal. **$20.75 — Hand Ejector Revolver,** swing out cylinder 32 cal. **$16.95.** 38 cal. **$17.95.** All brand new latest models. **Guaranteed genuine imported.**

25 cal. 32 cal. $13.95

Pay on Delivery Plus Postage **SEND NO MONEY**

Satisfaction guaranteed or money promptly refunded

$6.95 **25 cal. Pocket Automatic;** 25 cal. **Blue Steel Army Automatic $8.45;** 32 cal. **$10.45; Officer's Automatic,** 3 safeties, 25 cal. **$11.95; Military Trench Automatic,** 32 cal. 10 shot extra magazine **FREE, $11.65.** Just like you used over there. **Imported Top Brake Revolver.** 32 cal. **$8.65;** 38 cal. **$8.95.**

Universal Sales Co. 141 B'way, Desk 28 New York

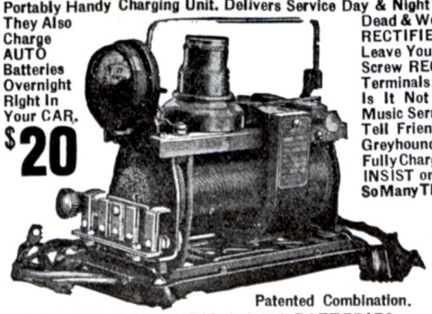
RADIO "A" & "B" STORAGE Batteries CHARGED at Home For Few Cents With "PATENTED FULL WAVE" 100-130 Volt 60 Cycle A. C. Automatic Magnetic

F-F RADIO RECTIFIER

Eventually You Will Buy An F-F RECTIFIER. **Why Not Now? The Sooner You Buy It; The More You Save**

It CHARGES All 6 Volt RADIO "A" & AUTO Batteries; & All RADIO "B" & LOUDSPEAKER Storage Batteries Up To 120 Volts In Series Inductively At Home Overnight. Disconnecting & Multiple Connections Unnecessary. Charging Circuits Separate. Nothing Like It Made. No Chance For Grounds Or Short Circuits. No Skill Required. AMMETER eliminates Guess Work. It Costs You Less To Buy An F-F RECTIFIER than To Be Without One. You PAY for ONE whether You Buy One Or Not, for It Costs An Average Of $2. for Charging & Rentals Every Time An Auto Battery Is Charged By Others, but Only A Few Cents When You Charge Your Own From A Lamp Socket With An F-F Battery Boosting RECTIFIER. If You Have Never Known The Delightful Feeling Of Having Your Storage Batteries Always Fully Charged for RADIO & AUTO You Will Experience A New Thrill When You Have An F-F RECTIFIER Which Gives You A Fully Charged Battery Overnight At A Cost of A Few Cents & A Pleasant Feeling Of Things Well Done. Those Who Own Them Feel Their F-F RECTIFIER is Their Faithful Friend. It Charges Automatically & Being Clean Can Be Placed Anywhere. Nothing To Slop Over Be Filled Burn Out Need Attention Or Cause Trouble. Both Waves Are Rectified Thru Infusible Carbon Rectifying Brushes, Maintaining Constant Efficiency Uninterruptedly. While Its FULL WAVE Delivers RAPID TAPER CHARGE recommended By All Storage Battery Manufacturers. The F-F RECTIFIER is A Complete Compact Portably Handy Charging Unit. Delivers Service Day & Night Automatically & Will Charge A Dead Battery. Do Not Think Battery Is Dead & Worn Out Simply Because It Will Not Start Your Car. Buy An F-F RADIO RECTIFIER & Fill It With LIFE. It SAVES MORE than Its Cost & Lasts Lifetime. Leave Your Battery In Car, Or Where Ever It Is, Without Even Disconnecting It Screw RECTIFIER Plug In Lamp Socket, Snap RECTIFIER Clips On Battery Terminals; Turn Switch & Battery Will Be Charged In Morning At Cost Of Few Cents. Is It Not Gratifying To Be Ready For All RADIOPHONE BROADCAST Music Sermons & News When Friends Call? Never Having To Be Careful Of, or Tell Friends Your Batteries Are Dead & to Feel Your Car Respond Like A Greyhound, Spinning Engine With Power When You Throw In STARTER? Fully Charged Battery Starts Car Quick & Requires Fewer Expensive Replacements. INSIST on The F-F RECTIFIER. Built By A Master of The Art in 7 TYPES. **So Many Thousands Are Being Sold It Has Made Possible These POPULAR PRICES**

They Also Charge AUTO Batteries Overnight Right In Your CAR.



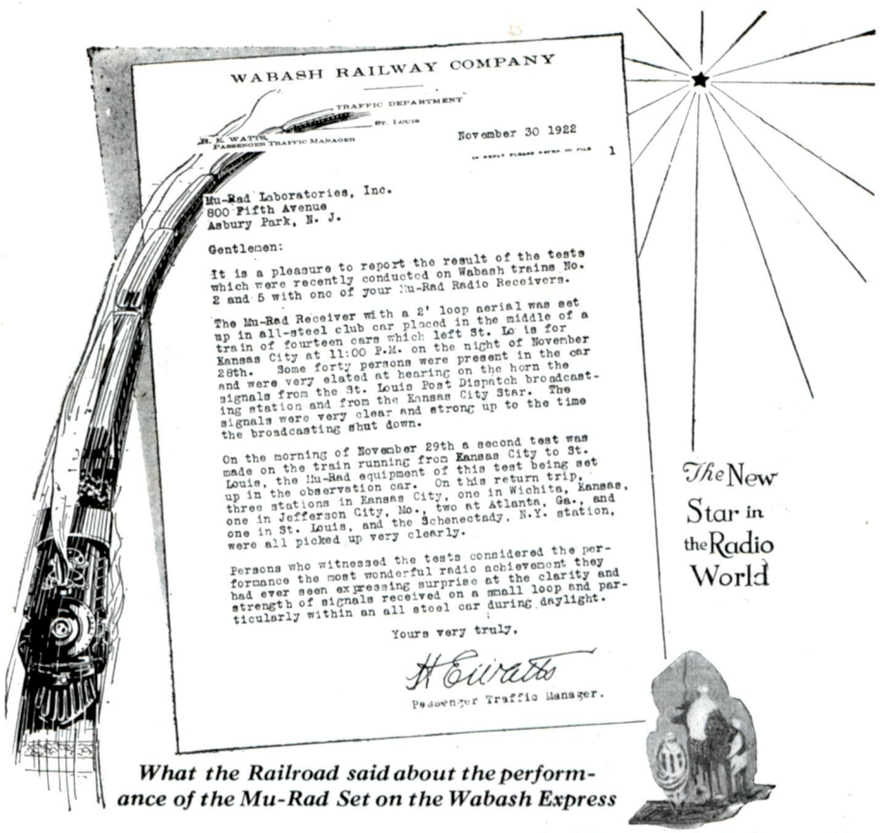
$20

Patented Combination. CHARGES "A&B" RADIO & AUTO BATTERIES.

TYPE 6 Charges 6 Volt Radio "A" & Auto Batteries At 6 Amperes..$15
TYPE 12 Charges All 12 Volt Batteries At 5 Amperes.....$15
TYPE B Charges All Radio "B" Storage Batteries Up To 120 Volts $15
TYPE A-B is a Combination of Types 6 & B.....$20
TYPE 166 Charges All 6 Volt Batteries At 12 Amperes.....$20
TYPE 1612 Charges All 12 Volt Batteries At 7 Amperes.....$20
TYPE 1626 is a Combination of TYPES 166 & 1612.....$28
All TYPES But "B" Also CHARGE AUTO BATTERIES.

The Lower 3 Are Large TYPES Built for Heavy Batteries, or Where Charging Time is Limited. SHIP PINGWEIGHTS Complete With AMMETER & BATTERY CLIPS 11 to 15 lbs. Purchase From Your DEALER Or Mail Check for Prompt Express Shipment. If Via PARCEL POST have Remittance Include Postage & Insurance Charges, or WRITE us To Ship TYPE desired C.O.D. Other F-F Battery Boosters Charge Batteries From Farm Lighting Plants & D. C. Circuits & for GROUP CHARGING Economy Use Our 8 Ampere 12 Battery Capacity Automatic Full Wave F-F ROTARY RECTIFIER described In ROTARY BULLETIN 34A ORDER Now, or WRITE Immediately for FREE Descriptive RADIO & AUTO BOOSTER & ROTARY BULLETINS 34A & 34

FRANCE MFG. CO. General OFFICES & WORKS: CLEVELAND, OHIO, U. S. A. Canadian Distributor: The Jack V. Elliot Co., Hamilton, Ontario Canada



What the Railroad said about the performance of the Mu-Rad Set on the Wabash Express

Mu-Rad Radio Frequency Amplification

Triumphs in Test on Express Train

THE entire radio world is agog at this latest supreme achievement—the reception of radio programs inside a steel car, with no outside aerial or ground, moving at express speed—the severest test ever given any receiving apparatus.

A striking demonstration of the *great sensitivity*, extremely *accurate selectivity* and absolute *simplicity of operation* of Mu-Rad Receivers.

The difference between Mu-Rad and other apparatus is great enough to be worth your while insisting on Mu-Rad Receivers. Guaranteed reception of 1,000 miles.

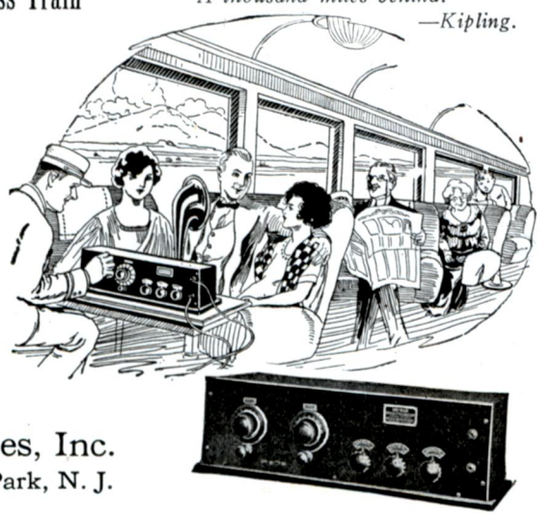
Type MA 12	Type MA 13
3 stages R. F., and detector	3 stages R. F., and detector and 2 stages A. F. .....
$128	**$160**

Dealers: Write for interesting proposition

Mu-Rad Laboratories, Inc.

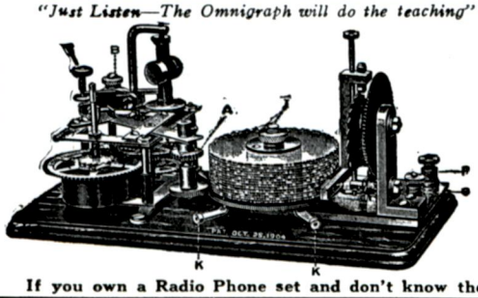
808 Fifth Avenue, Asbury Park, N. J.

"They copied all they could copy,
But they could not copy our mind;
We left them tearing and swearing
A thousand miles behind."
—Kipling.



Learn the Code at Home with the Omnigraph

"Just Listen—The Omnigraph will do the teaching"



THE OMNIGRAPH Automatic Transmitter will teach you both the Wireless and Morse Codes—**right in your own home**—quickly, easily and inexpensively. Connected with Buzzer, Buzzer and Phone or Sounder, it will send you **unlimited messages**, at any speed, from 5 to 50 words **a minute.** THE OMNIGRAPH is not an experiment. For more than 15 years it has been sold all over the world with a money back guarantee. The OMNIGRAPH is used by several Depts. of the U. S. Govt.—in fact, the Dept. of Commerce uses the OMNIGRAPH to test all applicants applying for a Radio license. The OMNIGRAPH has been successfully adopted by the leading Universities, Colleges and Radio Schools.

Send for FREE Catalog describing three models, $14 to $30. DO IT TODAY.

THE OMNIGRAPH MFG. CO.
16A Hudson St. New York City

If you own a Radio Phone set and don't know the Code—you are missing most of the fun

Advertisers' Index

Amateur Radio Stations of the United States

Supplementary List brought up-to-date from January WIRELESS AGE

First District

1 AFA William J. McKee, 45 Kenwood Ave. Worcester, Mass.
1 AIU Chester L. Warren, Fort Adams.....Newport, R. I.
1 AJG Charles T. Kerr, 10 Depot St.....Poultney, Vt.
1 AJL Francis G. Sands, R. F. D. No. 5....Danbury, Conn.
1 AKT William B. Senior, 37 Mechanic St..Pawcatuck, Ct.
1 ALB Harry F. Dence, 29 Russell Ave.....Newport, R. I.
1 ALD Edwin J. Gates, 9 Denver Ave.....Edgewood, R. I.
1 ALJ Harry H. Johnson, Clark Ave....Short Beach, Conn.
1 ALK G. Emerson Pray, York St.....Poultney, Vt.
1 ALL Laurence M. Harding, 22 Dean St..Bridgewater, Mass.
1 ALR Sherman F. Bassett, Park St.....Harwich, Mass.
1 ALT Herbert A. Herring, 68 College Ave..Waterville, Me.
1 ALU Gaston G. Tardif, 102 Knox St.....Lewiston, Me.
1 AMB Squire William Bateman, 26 Railroad St., Methuen, Mass.
1 AMG Carl D. True, 8 Elm St.....Yarmouthville, Me.
1 AMI Willard R. Ballou, 27 Meriden Ave..Southington, Ct.
1 AMJ Roger M. Browning, 321 Naple St....Norwich, Conn.
1 AML Harry L. Olson, 6 Union St....E. Greenwich, R. I.
1 AMM Abraham Bettigole, 62 Howard St..Springfield, Mass.
1 AMP Paul A. Girard, 119 Bushnell St....Hartford, Conn.
1 AMW Henry P. Thomas, 88 Bay State Road..Boston, Mass.
1 AMY Ralph H. Sherman, 42 Taylor Ave..S. Norwalk, Ct.
1 ANJ George H. Allen, 16 Bacon St.....Waltham, Mass.
1 AOA St. George's School Radio Club.....Newport, R. I.
1 AOC Allen P. Wilson, 307 Bacon St.....Waltham, Mass.
1 AOE Jerome Freedman, 1333 Iranistan Ave. Bridgeport, Ct.
1 AOF Gilbert C. Rich, Crescent Road.....Sharon, Mass.
1 AOJ Richard G. Buzby, R. F. D. No. 1, E. Main St., Westfield, Mass.
1 AOQ Herbert P. Blair .....Piermont, N. H.
1 AOT Harry Haymond, 51 Sheldon St....Springfield, Mass.
1 AWP Richard W. Pratt, 120 Main St....Hingham, Mass.
1 AZF William A. Somerby, 142 Church St..Newton, Mass.
1 BQ James H. Nicholson, 46 Smith St.....Portland, Me.

CHANGES OF ADDRESS

1 BAN Killian V. R. Lansingh, 18 Abbott St., Wellesley, Mass.
1 BEB Gordon L. Walls, 28 Chestnut St....Waverly, Mass.
1 BFY John W. Hawes, 32 Highland St.....Onset, Mass.
1 BHL Edwin H. Hamlin, 36 E. Mansfield St. Hartford, Ct.
1 BHQ J. M. E. Powell, 44 Hanmer St....Burnside, Conn.
1 BRL Charles W. Wight, 17 Ridgewood Pl..Bridgeport, Ct.
1 BWJ Edgar S. Parsons, 151 W. Central St..Natick, Mass.
1 BYQ Edward H. Lambert, 84 Main St..N. Andover, Mass.
1 IU Moses B. L. Bradford, 60 Main St.....Concord, Mass.
1 MQ Michael A. J. Sannella, 235 Lexington St., E. Boston, Mass.

Eighth District

RE-ASSIGNED CALLS

8 AU C. Allen Ingals, 90 S. Linwood Ave., Crafton, Pa.
8 CC Frank W. Ehrenfried, 10 Orchard Ave., Bellevue, Pa.
8 FU E. J. Allen, 634 Jefferson Ave.....Defiance, O.
8 PU Robert R. Richholt.....Holgate, O.
8 AAH Herbert T. Dalrymple, 157 W. State St., Akron, O.
8 ACV Mrs. W. T. Van Alen, 3 T St....New Brighton, Pa.
8 AGL Wm. A. Yarborough, 20 Arlington Court, Charleston, W. Va.
8 AGM Charles Hayek, 3044 W. 44th St.....Cleveland, O.
8 AJM Raynal W. Andrews, Jr., 972 Harvard St., Rochester, N. Y.
8 AMY Gilbert H. Hathaway, 155 Warwick Ave., Rochester, N. Y.
8 AQL Charles W. Brestle, 1 Ingram Ave., Crafton, Pa.
8 ARK George A. Nay, 725 Virginia Ave., Fairmont, W. Va.
8 ARV Joseph J. Elias, 6371 Army St.....Detroit, Mich.
8 ARY Charles C. Hines, 2325 Cass Ave.....Detroit, Mich.
8 ASC R. Stuart Weeks, Ridge St.....Richmond, Mich.
8 ASJ Charles E. White, 83 Washington St., Binghamton, N. Y.
8 ASU Thurston J. Rowland.....So. Euclid, O.
8 ATE Herbert Snyder, 76 Pine St.....Binghamton, N. Y.
8 ATP Howard Baye, 6th Ave.....So. Charleston, W. Va.
8 AUH Dayton Mahaffey, 171 Dennison Parkway, Corning, N. Y.
8 AUR Kenneth Williams, 729 W. Franklin St., Jackson, Mich.
8 AVQ Percival J. Smith, 601 S. Main St., Charlotte, Mich.
8 AWJ J. F. Corcoran, 118 Hamilton St., Ogdensburg, N. Y.
8 AWS John D. Colvin, 111 George Ave.....Parsons, Pa.
8 AXL Robert G. McHugh, 35 Taynton Ave., Binghamton, N. Y.
8 AXM Maynard J. Columbo, 26 River St. Plattsburg, N. Y.
8 AYJ Stephen L. Dunigan, 333 Glen Ave., Springfield, O.
8 AYQ Gustave Weiss, 1167 Jay St.....Rochester, N. Y.
8 AZC Levon R. McDonald, 321 N. Dewey St., Owosso, Mich.
8 AZS Ferris MacA. Smith, 122 Garfield St., Elmira, N. Y.
8 BJA Earl Stine, 122 Kingman Ave., Battle Creek, Mich.
8 BAI Henry M. Burt, Jr., 1507 Francis St., Jackson, Mich.
8 BAL William D. Settle, Main St.....West Lafayette, O.
8 BAN Craig F. McKinney, 121 Prospect St., Ithaca, N. Y.
8 BAQ Warren M. Columbia .....Burgettstown, Pa.
8 BBE Oliver Sterling, Jr., Prospect St....Romeo, Mich.
8 BBF J. Mark Moore, 406 N. Market St..East Palestine, O.
8 BDT Elroy J. Barkley, 391 Alice St. East Palestine, O.
8 BEY Howard R. Stevenson, 8341 Mack Ave., Detroit, Mich.
8 BFE Charles R. Bell, 282 Union Ave.. Williamsport, Pa.
8 BFZ Leander J. Steiner, 1107 W. 28th St.....Erie, Pa.
8 BGX Kenneth H. Wildern, Mather Hall.....Olivet, Mich.
8 BIK Carl J. Schleve, 1030 Dodgson Court....Dayton, O.
8 BJY Wilfred E. Brown, 526 Second Ave.....Olean, N. Y.
8 BKQ Earl A. Shulenberger, So. Main St., West Salem, O.
8 BNK Nathan R. Mahrle, 912 S. Jackson St., Jackson, Mich.
8 BRD Dean A. Lewis, 1501 Egleston Ave., Kalamazoo, Mich.
8 AQS John F. Weiss, 648 Park Ave.....Amherst, O.

CHANGE OF ADDRESS

8 CZ Harold G. Jones, 806 E. Vine St.....Mt. Vernon, O.
8 EK Sidney S. Breenwood, 814 Broad St., St. Joseph, Mich.
8 FX Ralph P. Thetreau, 5012 Sheridan Ave., Detroit, Mich.
8 PM Alfred M. Martin, 2119 Perry Park Ave., Detroit, Mich.
8 TI Charles Eckel, 951 E. Grand Blvd....Detroit, Mich.
8 TS Walter B. Lacoek, 456 W. Broadway, Granville, O.
8 VN Edward B. Landon, 130 Avenue F, East Pittsburgh, Pa.
8 AEA Benjamin Gurr, 111 Louisiana Ave....Detroit, Mich.
8 AIH Russell A. McBride, 204 Pierce St., Birmingham, Mich.
8 AKI Wm. K. Aughenbaugh, 1432 12th Ave., Altoona, Pa.
8 AKQ Ward W. Watrous, Jr., 16 S. Main St., Athens, Pa.
8 AQA Frank M. Thiefels, 5135 Sheridan Ave., Detroit, Mich.
8 AQR Harold D. Osgood, 3128 Canton Ave., Detroit, Mich.
8 AQZ John A. Perry.....McClure, O.
8 ABN Herbert T. Jenkins, 5625 Vinewood Ave., Detroit, Mich.
8 BDM Lloyd F. Kridler, 89 Owen St.....Detroit, Mich.
8 BRE A. Herman Gates, 7th and St. Catherine Sts., Lewisburg, Pa.
8 CBE Charles L. Terrel.....DeGraff, O.
8 CCK Hamilton Haywood, 607 Grant St.....Buffalo, N. Y.
8 CCZ George D. Oertel, 707 Wolf St.....Syracuse, N. Y.
8 CHP Cecil B. Delaney, 3232 W. 46th St., Cleveland, O.
8 DAG Howard S. Pyle, 3549 Kroger Ave.....Cincinnati, O.

Ninth District

9 ASP F. K. Legler, 603 W. Second St., Redfield, S. Dak.
9 BEN P. M. Wright, 418 E. Jefferson Ave., Wheaton, Ill.
9 BGJ Gustaf A. Gummeson, 503 Third St...Clinton, Ia.
9 CER Henry S. Jerabek.....Silver Lake, Minn.
9 CIX Henry T. Messerly, 727 S. Wood St., Staunton, Ill.
9 DGY A. J. Arnot, 2008 Deer Park Blvd., Omaha, Nebr.
9 DMG John G. Montague and Fred Meyer, 175 23d St., Milwaukee, Wisc.
9 DOB Fred. B. Ferris, 405 N. Washington St., Abingdon, Ill.
9 DOJ Herbert L. Pendleton, 2020 Kansas Ave., Kansas City, Mo.
9 DOR George F. Lytle, 760 E. Elm St., Springfield, Mo.
9 DRI T. D. Phillips, 222 Lexington Ave., Winchester, Ky.
9 DTB Harry H. Hall, 6225 Ingleside Ave....Chicago, Ill.
9 DVM T. G. Colvin, 3d and Elizabeth Sts., Augusta, Ky.

EXPERIMENTAL

9 XQ Quincy Electric Supply Co., 1033-35 Maine St., Quincy, Ill.
9 XR The Colin B. Kennedy Co., 6400 Plymouth St., St. Louis, Mo.
9 XU Midwest Radio Central, Inc., 140 E. Walton Pl., Chicago, Ill.

TECHNICAL AND TRAINING

9 YR Westminister College .....Fulton, Mo.
9 YAR Lawrence College .....Appleton, Wisc.
9 YN Missouri School of Mines and Metallurgy, Rolla, Mo.

SPECIAL

9 ZT D. C. Wallace, 54 Penna Ave., Minneapolis, Minn.

CHANGES IN ADDRESS

9 ABF Robert J. Woolsey, 7242 Oleander St., Chicago, Ill.
9 AFD Leo J. Arthurs, 1521 "O" St.....Lincoln, Nebr.
9 AIF Charles T. Norton, 2116 Lincoln Way....Ames, Ia.
9 AWB T. W. Schwamb, 215 N. Leonusrd St..Liberty, Mo.
9 AYV Robert H. Owen, 1400 Broadway....Boulder, Colo.
9 BK R. F. Fowler, 658 E. Armstrong St., Frankfort, Ind.
9 BN Marcus Green, 1050 Buena Ave.....Chicago, Ill.
9 BDR Harold M. Pirie, 1317 1st Ave., N., Ft. Dodge, Ia.
9 BER Raymond O. Wise, 2602 Lincoln Way....Ames, Ia.
9 BFC Edmund C. Lipp, 1018 Hilker Place...Racine, Wisc.
9 BJK Stuart G. Ellis, 6295 Logan St.....Denver, Colo.
9 BLP L. P. Niessen, 239 Percey St., Waukesa, Wisc.
9 CCH Thaddeus Hien, 613 Third Ave., Milwaukee, Wisc.
9 CZD W. G. Shirkey.....Richmond, Mo.
9 DEH Albert J. Tingley, 1338 Clark St., Des Moines, Ia.
9 DKB L. H. Weeks, 908 Washington St., Detroit, Minn.
9 DKI Edward Hardebeck, Meramar and Henderson Sts., Clayton, Mo.
9 DQE R. E. McCormick, 1450 "Q" St.....Lincoln, Nebr.
9 GD Harold D. Jones, 4315 S. Bryant Ave., Minneapolis, Minn.
9 JE Philip S. Westcott, 1244 39th St., Milwaukee, Wisc.
9 LC W. E. Woods, 4 Jefferson Rd., Webster Groves, Mo.
9 LE C. W. Brestle, 2331 N. New Jersey St., Indianapolis, Ind.
9 AMG Leon L. Rentschler, 715 13th St.....Auburn, Nebr.
9 YAC Superior State Normal School, 18th and Grand Sts., Superior, Wisc.
9 YAE Western Union College, Tenth St.....LeMars, Ia.
9 AAQ T. F. Leonard, 224 Lincoln Ave., Rensselaer, Ind.
9 YN Missouri School of Mines & Metallurgy, Rolla, Mo.
9 IC Albert E. Jeffrey, 1159 E. 54th Place....Chicago, Ill.
9 TD Hobart D. Ashlock, 729 S. 10th St...Noblesville, Ind.
9 VBS Anton Mix, 910 Adams St.....Waukegan, Ill.
9 DX Jay F. Carpenter, 1124 University Ave., Denver, Colo.
9 QE Ivan Bulock, 718 E. Second St.....Fairmont, Minn.
9 EX Julius Abercrombie, 819 N. 32rd St., St. Joseph, Mo.
9 DYY Marvin Eichorst, 858 N. 15th St...Manitowoc, Wisc.
9 SL Jay Nagle Edmondson, Parsons College..Fairfield, Iowa
9 APZ Everett Vogel, No. 6 Beech Ave.....South Gate, Ky.
9 UL Carl Sherman Tunwall, 11th and 1st Ave., N., Ft. Dodge, Iowa
9 BCA John C. Kuesport, 602 E. Haney Ave..So. Bend, Ind.
9 AFT Eugene W. Applebaum, 910 Addison St..Chicago, Ill.
9 BWP Edward J. Possell, 5317 W. 25th St.....Cicero, Ill.
9 KE Edwin A. Beane, 912 E. 61st St.....Chicago, Ill.
9 ON C. Frank Smiley, 7834 Lagoon Ave.....Chicago, Ill.
9 ADN Laurence W. Franklin, 1123 South St..Lafayette, Ind.
9 DFR Merritt Clair Haigh, 14th and Pleasant View Drive, Des Moines, Iowa
9 AEK Harmon B. Deal, Iowa State College....Ames, Iowa
9 AMW Howard Hill Smith, 603 E. Springfield Ave., Champaign, Ill.
9 BEB Linton H. Flocken, 612 W. Illinois St..Urbana, Ill.

CALLS RE-ISSUED

9 QP W. P. Corwin, 3936 Westminister St., St. Louis, Mo.
9 WQ LeRoy Schilling, 3956 Zuni St.....Denver, Colo.
9 HV C. T. Hanes, 138 N. Lawrence St., Wichita, Kans.
9 OY Walfred W. Swanson, 1912 5th Ave., S., Minneapolis, Minn.
9 ST W. W. Weedfall, 3407 Olive St...Kansas City, Mo.
9 TU Humboldt High School, Humboldt and Augusta Sts., St. Paul, Minn.
9 TY Roy C. Frey, 2215 Spring St.....New Albany, Ind.
9 UQ K. A. Hawkinson, 1302 Rosemont Ave., Chicago, Ill.
9 UR C. W. Dean, 3151 Boulevard Pl., Indianapolis, Ind.
9 VM A. Millington, 100 E. Elm St.....Canton, Ill.
9 VW J. J. Michaels, 1352 Komensky St....Chicago, Ill.
9 WQ W. P. Corwin, 3936 Westminster St., St. Louis, Mo.
9 WW Faye Clark Walker, 315 Long Ave.....Chicago, Ill.
9 ARI W. W. Doller, 521 Pike Ave..Canon City, Colo.
9 AEK R. Ebenschweiger, Crescent Spring Pike and Locust St., Erlanger, Ky.
9 ALF R. F. Kramer, 1117 Clement St.....Joliet, Ill.
9 ARP W. Ehlers, 715 Weghorst St.....Indianapolis, Ind.
9 BBC Wayne Bowser, 311 W. Graham St.....Dixon, Ill.
9 BBK Austin R. Van Dolah .....Cheney, Kans.
9 CDU Louis E. Metcalf.....Greenfield, Ill.
9 CZW Henry Besler, Jr., 620 More St....Manhattan, Kans.
9 DAC T. A. Hunter, 29 W. Court St.....Iowa City, Iowa
9 DAJ L. P. Aldrich, No. 3 N. 5th St....Ft. Dodge, Iowa
9 DIK A. H. Dangerfield, 115 S. Cherokee St., Girard, Kans.
9 DMB Walter E. Smith.....Grayville, Ill.
9 DOM Phil Konkle, 53 Jefferson St.....Winterset, Iowa
9 DPF R. B. McCartney, 3120 Vine St....Lincoln, Nebr
9 DQB Ben Holman, 1134 Superior Ave., Sheboygan, Wisc.
9 DUE Eugene A. Traber, 2117 41st St.....Omaha, Nebr.
9 DUN R. V. Whitsitt, 1565 N. Edward St., Decatur, Ill.
9 DUQ W. L. and A. J. Tifer, 2873 Exeter St., Duluth, Minn.
9 DXP R. C. Machler, 1203 Lee St.....Evanston, Ill.
9 DYQ Clare E. Mosher.....Rockford, Iowa

CHANGES IN ADDRESS

9 AE R. N. Jones, 204 Langan Hall.....Grinnell, Iowa
9 AKG G. H. Salter, 1910 16th St.....Moline, Ill.
9 AOJ C. N. and J. K. Nebal, 1320 Anthony St., Columbia, Mo.
9 AXF Morris MacCabee, 4445 Broadway.....Chicago, Ill.
9 ARK M. J. McKee, 3804 Central Ave...Indianapolis, Ind.
9 BAA C. Schoenhard, 2251 "B" St.....Granite City, Ill.
9 BAX B. F. Miller, 226 N. Orchard St....Madison, Wisc.
9 BQM David M. Hedlund.....Madrid, Iowa
9 BVZ J. T. Hood, 1344 W. 34th St....Indianapolis, Ind.
9 COT G. S. Banks, 744 N. 3rd St.....Minneapolis, Minn.
9 CXC A. W. Brown, 315 N. Meridian St...Lebanon, Ind.
9 CYL C. R. Griesbacher, 748 Hicks St....West Allis, Wisc.
9 DGN N. Lupu, 2641 Hennepin Ave., Minneapolis, Minn.
9 DLT M. B. Magers, 2720 Patee St.....St. Joseph, Mo.
9 FL J. Carl Pilgrim, 205 S. 18th St.....St. Joseph, Mo.
9 LG Darl F. Wood.....Bloomington, Ind.
9 MJ M. D. Piersol, 3227 Edgar Ave.....Maplewood, Mo.
9 VI Hale T. Cottrell, 115 E. 13th St...Owensboro, Ky.

EXPERIMENTAL

9 XV S. E. Adair, Union Station Plaza, Kansas City, Mo.

ADDITIONAL CALLS

9 EEA Paul M. Segal, 824 Equitable Bldg....Denver, Colo
9 EEB Ernest E. Dinsmore, 111 S. Maple St..Ottawa, Kans.
9 EEC Waldo C. Shoemaker, 358 E. 2d St...Ottumwa, Iowa
9 EED Jesse L. Holiday, R. F. D. No. 3.....Auburn, Ill.
9 EEF Arthur Hady, 1304 Marquette St.....Racine, Wisc.
9 EEG James F. Abbott, 1103 Cleveland St...Evanston, Ill.
9 EEH D. Wesley Correll, 1311 Frederica Place, Milwaukee, Wisc.
9 EEI Frank C. Schnepper, 326 2d St., S. E...Cresco, Iowa
9 EEJ Ralph W. Smyth, N. Main St..Park Rapids, Minn.
9 EEK Benjamin F. Adcock, Jr., 116 W. Hickman St., Winchester, Ky.
9 EEL Ralph Lampe, 819 47th Ave., E.....Duluth, Minn.
9 EEM Charles E. Wells, 505 E. Court St., Richland Center, Wisc.
9 EEN Henry D. Robb, Hathaway Court, Hutsell Apts., Winchester, Ky.
9 EEO Reginald Bates, 866 Calumet Ave...Hammond, Ind.
9 EEP Alfred Haagenson, Jr. .....Barnesville, Minn.
9 EEQ Holland O. Watson, 713 Oregon St..Hiawatha, Kans.
9 EER Lowell S. Orth, 1412 N. Adams St.Mason City, Iowa
9 EES Arthur Myers, 1451 S. 15th St.....Omaha, Nebr.
9 EET Frederick L. Cason .....Dewitt, Mo.
9 EEU Aloysius J. Weiss, 5335 Adams St....Chicago, Ill.
9 EEV Harry W. Rubinstein, 777 26th St..Milwaukee, Wisc.
9 EEW Robert Bowman, 1011 S. Main St....Ottawa, Kans.
9 EEX James Frants, 1510 E. 63d Pl.....Chicago, Ill.
9 EEY Max H. Edwards, 148 W. Gilman St..Madison, Wisc.
9 EEZ Lancaster V. Pottinger, 518 W. 9th St.Owensboro, Ky.
9 EFA Hugh J. Jeson, 203 E. 3d Ave.....Caney, Kans.
9 EFB Archibald M. Bryan, 1405 S. Carr Ave..Sedalia, Mo.
9 EFC Cunningham Bros., 404 Price St.....Columbia, Mo.
9 EFD Hopkinsonville High School Radio Club, Box 208, Hopkinsonville, Ky
9 EFE R. E. McCollough, 712 E. 7th St., Coffeyville, Kans.
9 EFF M. C. Ferguson, 703 Marquette Ave., S. Milwaukee, Wisc.
9 EFG R. S. Starkweather, 1044 Lake Shore Blvd., Evanston, Ill.
9 EFH C. H. Morgan, 905 S. 6th Ave., W., Newton, Iowa
9 EFI T. B. Lowell, Natural Bridge and Florissant Rds., Normandy, Mo.
9 EFJ R. Lloyd White, 3015 Labadie Ave., St. Louis, Mo.
9 EFK H. R. Hopfinger, 1829 Arizona St., Oshkosh, Wisc.
9 EFL A. W. Brady, 1205 E. Madison St., South Bend, Ind.
9 EFM J. Alden, 723 N. Ninth St., Kansas City, Kans.
9 EFN George R. Moir.....Wolverton, Minn.
9 EFO S. J. Lambert, 713 Washington St., Iowa City, Ia.
9 EFP A. G. Erickson, 828 N. 3rd St., Marquette, Mich.
9 EFQ Lester Layzell, 620 Oak St.....Taylorville, Ill.
9 EFR W. W. Pearce, 427 Steele St.....Waukegan, Ill.
9 EFS Lee Jensen, 109 N. 7th St.....Marshalltown, Ia.
9 EFT Howard R. Robertson.....Hubbard, Ia.
9 EFU Lynne H. Hull, R F D No. 1 .....Eureka, Kans
9 EFV Friends University.....Wichita, Kans
9 EFW R. G. Shmel, 602 E. Main St.....Casey, Ill.
9 EFX R. V. Stratford, 411 High St.....Beatrice, Nebr.
9 EFY Harry Hoshall, 6600 Normal Blvd.....Chicago, Ill.
9 EFZ John S. Surber .....Francesville, Ind.
9 EGA Paul D. Maxwell, 2212 Douglas St....Omaha, Nebr.
9 EGB Caeser Aimone, 408 4th St...Iron Mountain, Mich.
9 EGC Gordon Perrin, 1449 15th St.....Milwaukee, Wisc.
9 EGD Cullen Harris, 1602a Semple Ave...St. Louis, Mo.
9 EGE Rolla Brown, 3261 N. Jefferson Ave...St. Louis, Mo.
9 EGF William Jackson, 311 Fayal Rd.....Evelath, Minn.
9 EGG Clarence R. Rogness .....Kenneth, Minn.
9 EGH R. H. Jackson, Jr., 415 N. Carroll St., Madison, Wis.
9 EGI G. P. Ward, 236 W. State St. .....Springfield, Mo.
9 EGJ Edgar M. Knepper, Box 97.....Maitland, Mo.
9 EGK George Scheuer .....Monterey, Ind.
9 EGL N. B. Jones, 1218 N. 11th Ave., Fargo, N. Dakota
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9 EGN W. F. Meyers, R F D No. 1, Box 90, Freeport, Ill.
9 EGO John W. McManigal, 113 W. 8th St...Horton, Kans.
9 EGP Sidney E. Cleveland.....Goldfield, Iowa
9 EGQ J. G. Boehm, 3534 Narragansett St., Chicago, Ill.
9 EGR Joseph Oltobell, 604 Douglass Ave., Eveleth, Minn
9 EGS H. E. Carpenter, 3403 S. Third Ave., Minneapolis, Minn.
9 EGT E. E. Trommer, 2516 Chestnut St., Milwaukee, Wisc.
9 EGU C. L. Barker.....Henning, Minn.
9 EGV G. H. Powers, 312 Oak St.....Evansville, Ind.
9 EGW R. T. Inman, Riverside Drive.....Beloit, Wisc.
9 EGX F. M. Redman, 6 Wellington Apts., Fargo, N. Dak
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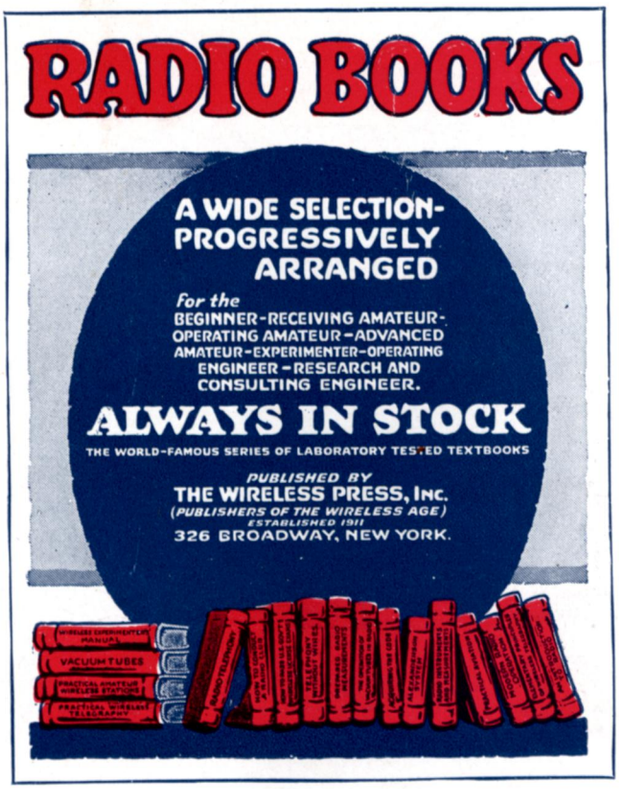

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