The WIRELESS AGE

"America's Foremost Radiophone Review"

June
25 Cents

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Mutual Conductance

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Gas Engines are rated hy their horsepower—Electric Generators are rated hy their watt or kilowatt output—Mazda Lamps are rated hy their candle-power. All of these factors actually express the efficiency of the article for the purpose intended.

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For the assistance of the public, in obtaining true musical quality and actual reproduction in hroadcast reception, this company will, from time to time, issue Service Bulletins explaining in a clear and simple manner the most important technical features that must be observed in the selection and operation of radio apparatus.

Cunningham Service Bulletin No. 1 explains the use of the fact or mutual conductance as the standard rating for vacuum tubes. The information it contains should be thoroughly known to every owner of a radio set who is interested in ohtaining maximum efficiency with a given number of vacuum tuhes. This bulletin will he mailed to you, free of charge, upon request.

Write for Bulletin 1-W explaining the uses and adoantages of the term Mutual Conductance as the correct rating for Vacuum Tubes

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Filament Current ¼ Amp. Mutual Conductance—600 micrombos at 100 volts plate and 6 volts neg. grid potential

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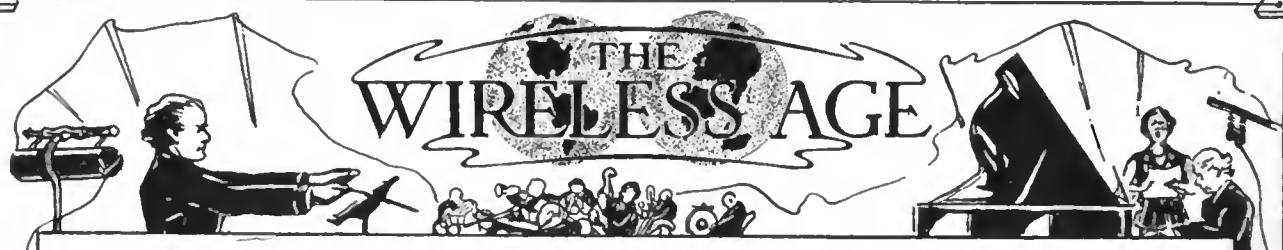

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Printed in U. S. A.

The City's Music In Vacation Times

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The Jones *Symphony* Receiver, detector and three stage, is particularly fitted for this service.

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SECOND, its simplicity of operation.

THIRD, its reliability.

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A quality rheostat for the new UV201-A and 199 Tubes. A convenient, practical instrument, equally well adapted for experimental service or permanent installations. You'll never cause unpleasant noises in the phones when you rotate the contact arm of a Type 214 Rheostat.

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Our Bulletin 914W not only describes our Amateur line, but is an educational pamphlet of value. Sent free on request.

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Manufacturers of
Radio and Electrical Laboratory Apparatus
Massachusetts Avenue and Windsor Street
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5303

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Developing this "film" into real "sound pictures" is the whole art of Radio usefulness and enjoyment.

For this, no apparatus has ever been evolved which gives results equal to those produced by Magnavox Equipment.

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As illustrated

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For use with the Magnavox Radio and insures getting the largest possible power input.
AC-2-C, 2-stage, $55.00
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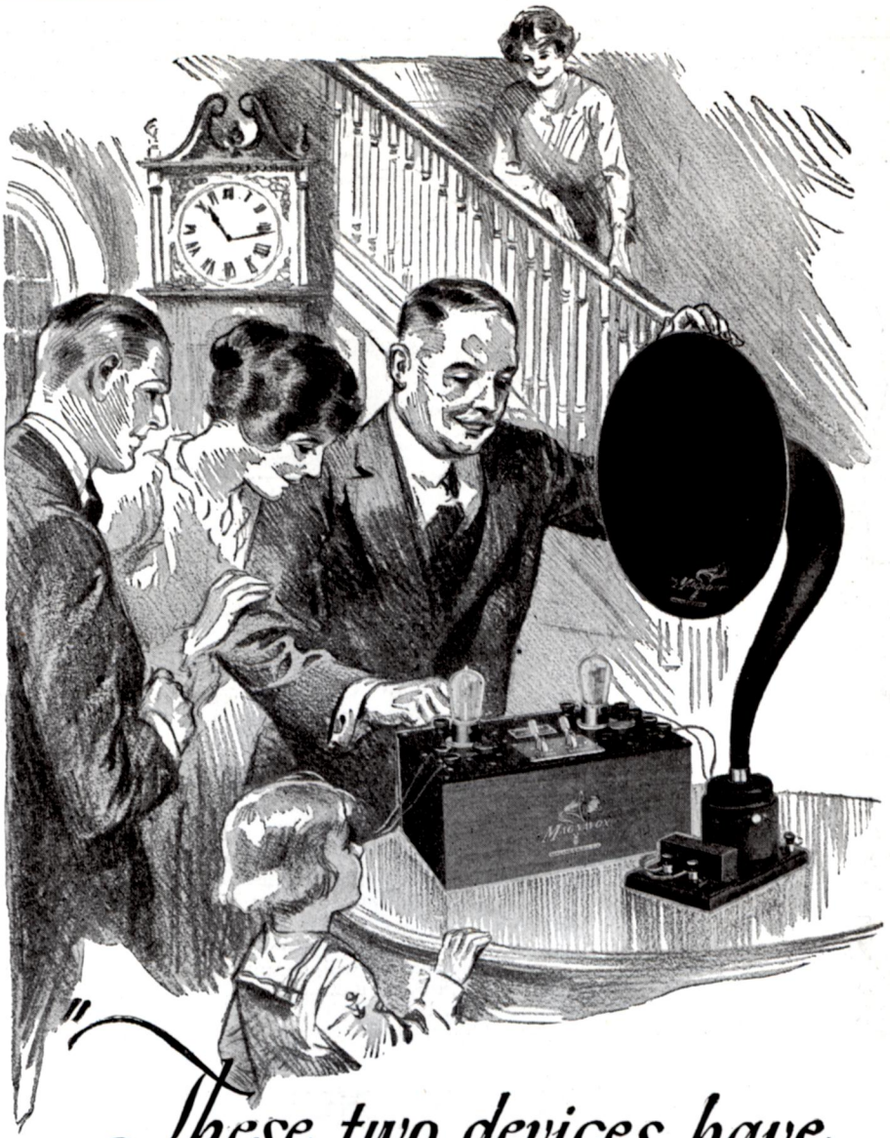
Magnavox Reproducers and Power Amplifiers can be used with any receiving set of good quality. Without Magnavox, no receiving set is complete.



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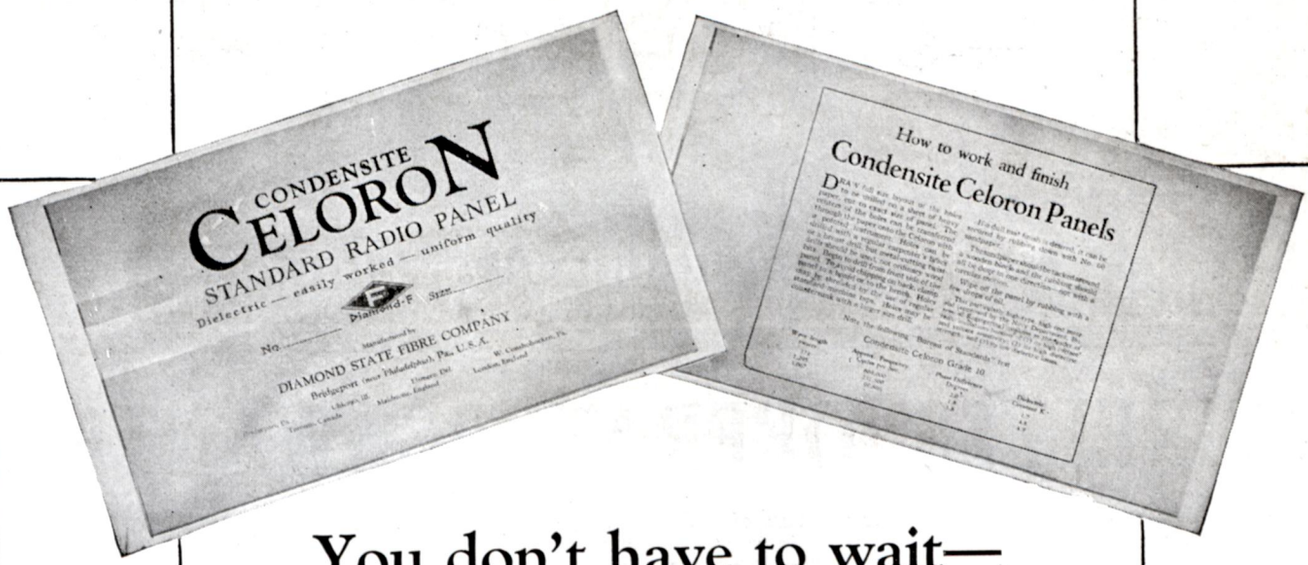

You don't have to wait—

YOU need a radio panel and you want it immediately. But you go to a dealer expecting a delay while your panel is being cut.

He, however, turns to his shelf and hands you a Condensite Celoron Radio Panel, cut and ready to carry home. All this is in a few seconds from the time you enter the store.

This isn't fiction. You can now get Celoron Radio Panels cut in standard sizes. No longer will you have to wait and pay the extra cost for having your panel cut from sheet stock.

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1. — 6 x 7 x 1/8	5. — 9 x 14 x 3/16
2. — 7 x 9 x 1/8	6. — 7 x 21 x 3/16
3. — 7 x 12 x 1/8	7. —12 x 14 x 3/16
4. — 7 x 18 x 3/16	*8. — 7 x 46 x 3/16

**This strip for cutting special sizes. Not wrapped in glassine.*

While we feature these standard sizes, Celoron comes in full-size sheets and we can supply special sizes if desired.

Condensite Celoron has long been used in connection with electrical and radio work because of its high insulating qualities, high dielectric strength, and low dielectric losses. It is easily worked, machined, drilled and tapped, and will engrave evenly without feathering. It is a laminated phenolic condensation product used by many of the leading manufacturers of radio equipment.

Select the size you need for your set. Should your radio dealer not yet have them in stock, ask him to order for you. Or write direct to us designating by number the size you need.

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We have prepared an attractive booklet, "Tuning in on a New World," which tells more about Celoron and gives lists of leading broadcasting stations in the United States and Canada, symbols used in reading radio diagrams, and several highly efficient radio hook-ups. This booklet will be of use to every radio fan and will be sent to you free of charge upon your request. Write today.

To radio dealers: Write for special dealer price list showing standard assortments

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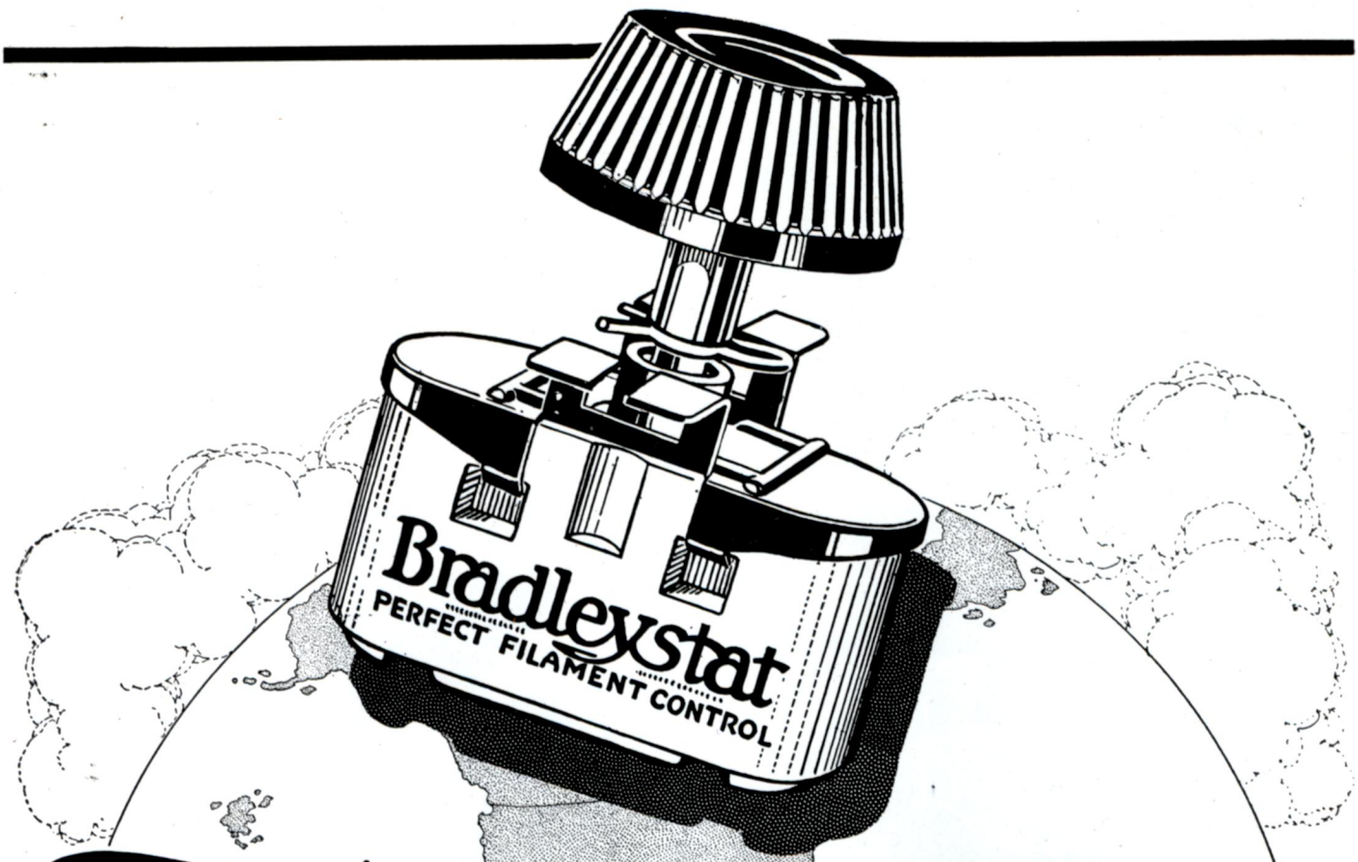

Tune Sharper & Quicker with the Bradleystat

There is no question about the superiority of the Bradleystat. Its supremacy is becoming more manifest every day. Thousands of letters from delighted radio enthusiasts, amateurs and professional radio men prove, beyond a doubt, that the Bradleystat gives perfect filament control.

A letter just received from an Ohio radio dealer reads:

"The Bradleystat has met with our entire approval. We have made it regular equipment on all Westinghouse RC sets sold by us and have installed many Bradleystats on Crosley and other receivers with perfect satisfaction."

Why strangle your radio set with a poor filament rheostat? Try the Bradleystat, tonight, for better radio reception.

The Checkered Box

is easily recognized in radio shops by enthusiasts who are looking for the best equipment in radio. Complete instructions and drilling template are included.

Retail Price, $1.85
Parcel Post 10c extra

The Bradleyometer

is a perfect potentiometer in 200-ohm or 400-ohm sizes. 200-ohm, $2.00: 400-ohm, $3.00 Parcel Post, 10c extra

The Bradleyadapter

is a high-grade adapter for WD-11 tubes with silver-plated contacts. Price, $1.00.

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Manufacturers of graphite disc rheostats for over twenty years

Bradleystat

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PERFECT FILAMENT CONTROL

In Our Opinion

NO broadcasting director can hope to please the entire audience all of the time. What does not appeal to one listener is voted "great" by another. So the fundamental of a program is infinite variety.

Be Reasonable!

As a striking example of how far apart two minds can be on such matters: Recently one broadcast listener roundly denounced the efforts of a radio comedian to entertain the listeners as "sheer rot" and an insult to the intelligence of the thousands upon thousands who were listening. In the response from another listener the same entertainer was acclaimed the greatest that particular fan had ever heard—best in the world, in fact. This was because his "clownings" had been so interesting and amusing as to make his son—a crippled boy—oblivious to the surgeon's knife as he lay upon the operating table at a nearby hospital. The happy state of mind brought about by the entertainer undoubtedly did much to strengthen the boy's will against the shock of a severe operation, and helped to start him on the road to recovery.

Both listeners spoke only their own impressions of course. Perhaps one was more thoughtful than the other; but the opinions were so widely at variance that attention was directed to the fact that listeners sometimes are quick with condemnation of a feature without giving recognition to the fact that it may have had a strong appeal to others. The very thing one does not care for may be hailed elsewhere with satisfaction and delight.

Broadcasting directors in making up their programs try to please everybody; they're hopeful, but they cannot and do not expect universal approval. But they deserve the same consideration shown the daily newspaper, which no reader would think of condemning as a whole simply because some one article in it did not appeal to him.

* * *

UNCHALLENGED is the supremacy of experience as a teacher. And from current experience it is evident that those artists and firms who coöperate intelligently with radio realize a very definite profit. As for the sceptics in the phonograph industry and elsewhere who endeavor to protect themselves by holding tightly—and stupidly—to old methods, as by refusing to broadcast or permit their performers to do so—well, they are liable to have their fears realized.

Helping the Helpful

To stand in the way of a new force is folly. It is little less foolish to watch idly by the wayside. Broadcasting is ascending rapidly. To add to its power is to be carried with it to new heights. No one can yet perceive the dizzy eminence for which it is destined.

Those who have coöperated with radio to the extent of their talents have experienced pleasurable results. Perhaps many of those who have gone to broadcasting studios have profited more than have the radio manufacturers in their factories, or their dealers in the stores.

The phonograph industry offers cases in point. The recording artists and firms who have broadcast are highly pleased with the result of their coöperation with the radio stations. Those who jealously guard their talent from the microphone are neglecting an important means of reaching the public, and are placing themselves in a disadvantageous position. One has had experience, the other has refused it.

Radio's effect is just what each makes it for himself.

* * *

IN the Good Old Summer Time! Out of doors again. And "Up at the camp where we're going they've got a peach of a radio set!"

Gaining New Admirers

Everywhere you go this summer you will see antennae. Never before have city and country, farm and town, been closer linked, or better equipped with radio receivers.

It has been said that one big need of the country is for the radio set on the farm: well, certain it is that the visitors from the city this summer will introduce many a farmer to the delights and the benefits of radio broadcasting.

This summer radio has more and better programs, the result of another year of experience; radio has more and better radio sets for the enjoyment of those programs; it has the new wave lengths; it has two very efficient dry-cell tubes, one of them new and either making the portable set fully practical; radio has more to admire and use than it had last winter.

And the summer is the time when the radio broadcasting fans carry their enthusiasm to the most remote corners of the country as they depart on vacation jaunts.

Summer is the time of contact with new people; summer is the time when broadcasting wins new devotees.

* * *

STRIKING evidence of the universal service of radio broadcasting was never more spectacularly presented than in connection with the recovery of kidnapped Verner Alexanderson, the six-year-old son of the famous radio engineer. The newspapers, as is usual in kidnapping cases, printed pictures and descriptions of the missing boy; but what gave them a new effect was the emphasis of radio broadcasting.

Finding the Lost

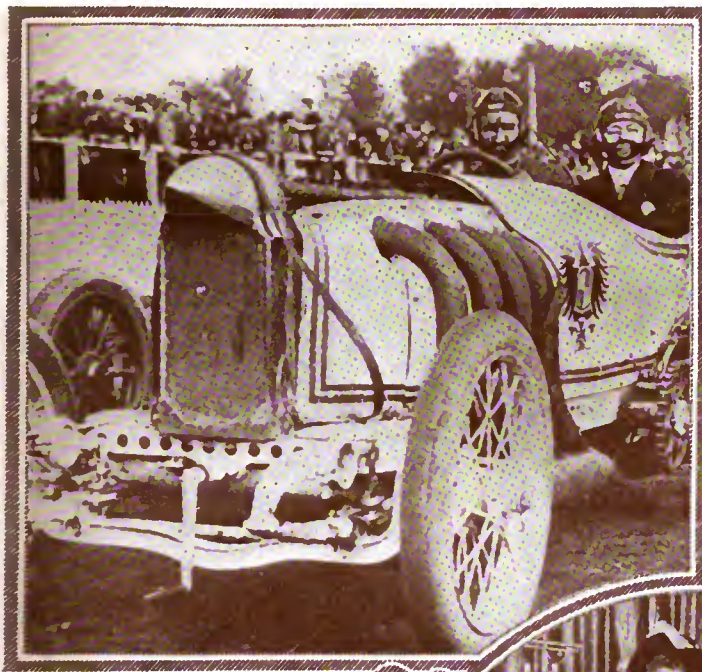
A description of Vernon was broadcast several times from WGY, WJZ and other stations, reaching the radio audience instantaneously, supplementing the slower travel of the printed publications. Even the amateurs helped by transmitting descriptions by radio telegraph. Hundreds of thousands had their attention drawn at once by radio to the need for help, and were made to peruse the later newspaper articles and illustrations with new interest.

It was one of those owners of receiving sets who reported to the authorities the location of the boy.

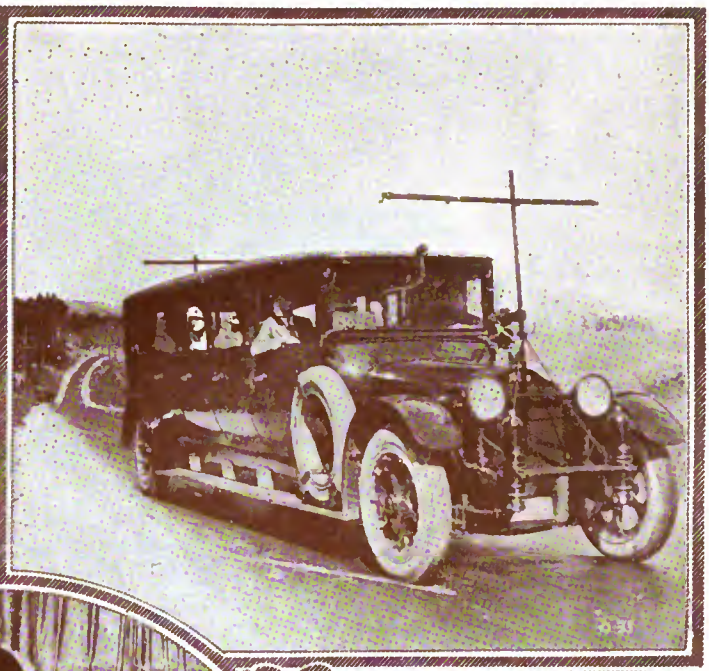
It seems peculiarly fitting that radio should have rendered such a great service to the man, Alexanderson, who has had so much to do with its development.

RIEDA HEMPEL used radio in the home to celebrate e 100th anniversary of "Home, veet Home." Why she sang the ost popular song in the world to ousands by radio is told on ge 39. She wanted—but read it!

Everywhere You Go, There's Radio On the Job



This is another of Bernays Johnson's stunts—a radio transmitter on a racing auto. He says tests proved that the driver could talk with the grandstand easily while circling the track



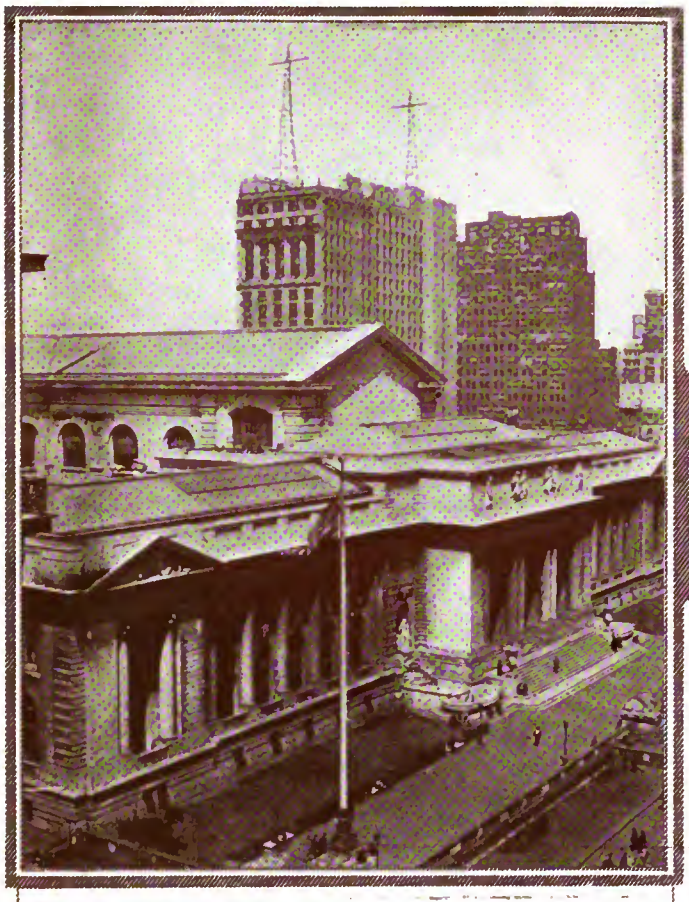
They tour this way in Ohio now that this White bus has been all fixed up with a radio receiver. The flivver in the background is trying to figure out how to enjoy the broadcast radio concerts, too

If the spirits heard Lady Doyle speak through WJZ, Sir Arthur Conan Doyle at least sat silently and watchful for the spooks while his wife spoke

"Buddy" Marshall is three years old, and therefore he can look down upon broadcasting from the dizzying eminence of those years—but he prefers to adopt the youngster as a playmate instead, even to the extent of sitting on top of him! Perhaps he's afraid he'll run away

Radio on the farm is great stuff; just think, little Miss Solomon stays home on her father's farm near Columbus, Ohio, yet she hears the bed-time stories and the music and the concerts from the big cities. Her father, H. F., likes radio, too, because of the farm market prices

Where Transmitter and Receiver Meet—In the Mail



Dedicated to the spread of knowledge—the New York Public Library, and, high in the background, the RCA's new Aeolian Hall broadcasting station

Around the world by auto and radio. Harold H. Taylor and his party will enjoy radio all the way, and, who knows, it may help them avoid Chinese bandits and such

This is "The Wave of Lake Erie" amid the spray of some 2,000 letters from the radio audience. He is E. G. Johnson, the deep bass voice of WJAX, the Union Trust Co., Cleveland, O. He used to be the "Voice of the North," but WLAG had pre-empted a similar name, the "Call of the North," so Johnson decided to be a "Wave." Sounds wet. But Canada's not so far from Cleveland. Anyhow, the radio audience feels quite close to WJAX, not only in Cleveland, but in Cuba and Saskatchewan and Nova Scotia and similar beaches on which the wave dashes

World-Famous Celebrities Who Have Been Broadcast

Louise Stallings feels a great responsibility when she sings in a broadcasting studio, as told on page 41. Her first radio performance brought her much praise

Florence MacBeth loves to sing to children and the thought of the listening youngsters adds joy to her radio performances. See page 40

Lord Robert Cecil thinks that radio broadcasting is a great peacemaker, as told on page 32. He desires to broadcast the proceedings of the League of Nations to all the world

Will the Great Artists Continue?

Victor and Brunswick Companies Say "No" to Their Exclusive Performers—All Other Recording Firms Are Willing, Even Anxious to Have Their Stars Heard—Broadcasting's Effect on Phonograph Industry

By Ward Seeley

"WILL it continue—will I be able to hear famous singers and instrumentalists by radio?" That is a question in the minds of many, including those who have a radio receiver and those contemplating the installation of one.

Two interests are concerned in the answer. First, the phonograph companies holding exclusive rights to artists' services for "mechanical reproduction." Then, the artists themselves. In most cases the individual artists are willing to broadcast to at least a limited extent. But whether or not they do so at all depends on the terms of their contracts with the phonograph companies, and the policies of those companies toward radio.

Those policies are not unanimous, for—

All important phonograph companies, except Victor and Brunswick, are co-operating more or less intensively with the broadcasting stations.

The artists who make phonograph records for these others have been heard on the air in the past, and may be expected to perform in the radio studios in the future, without hindrance from the recording organizations, and in many cases with their active support.

The two exceptions are emphatic in their assertion of their right to prohibit their exclusive stars from performing for the radio. That is why no important Victor artist has been able to broadcast personally in the past months, and why only one or two of the Brunswick artists have been heard by the radio audience.

This answers one of the questions that have arisen in the minds of many radio fans as to the attitude of the phonograph industry.

In investigating that attitude, THE WIRELESS AGE secured interviews with, or written explanations of policies from, the leading manufacturers of records and phonographs. The conclusion that the talking machine people are divided among themselves therefore is authoritative.

On just one point is the entire industry in agreement, and that is the effect of radio broadcasting upon their sales.

Wherever such sales effect is perceptible, it is favorable.

That important fact, universally agreed upon, merely lends confusion to the motives behind the situation created by the diverse policies of the recording organizations.

Business men are guided in their policies very largely by the possibilities of profit and loss. Here we have an entire industry in agreement on the fundamental assumption that radio either does not affect its sales revenue at all, or does so advantageously; yet two important members of that industry have adopted such a policy as might be expected to spring solely from fear of injury.

Statistics covering the whole talking machine field support the contention of the industry that radio certainly has not harmed it, for sales now are running at a rate equal to the best previous year, 1920. During that year about $280,000,000 was spent by the American public on talking machines and records. The business depression of 1921 cut the total down to some $200,000,000, and in 1922 to $180,000,000. However, during the first quarter of this year sales totaled about $70,000,000, and if the rest of 1923 maintains this rate the total for the year will equal, if not exceed, that for 1920.

As radio broadcasting has had its greatest development during the past year, it is evident that it has not cut into the sales of the phonograph industry.

For that matter, the majority of phonograph executives consider that broadcasting has stimulated the sale of records. It is conceded that radio fans who hear the new records by radio proceed to buy them in order to be able to play them at will; that when they hear new compositions personally performed by radio, they likewise buy the new records of those compositions; and that the general spread of musical

Ignace Paderewski makes records for the Victor Company, which says its exclusive artists shall not broadcast, but he also plays for the Duo-Art reproducing piano rolls, made by the Aeolian Company, which holds the opposite policy

appreciation by means of radio is highly advantageous.

Some of these executives, however, consider that while the sale of records may be stimulated, the marketing of talking machines may be slowed down, on the theory that the money that might be spent for a phonograph may be diverted to the purchase of a radio receiver.

It is even considered by various authorities that the fundamental position of the phonograph industry is changing. In the past its total volume of sales has consisted of some 60 per cent. in machines, and only 40 per cent. in records. Those figures, it is felt, are in process of changing places. The disc is bound to occupy the more important position.

There are some 8,000,000 phonographs in use in the United States, according to the Music Publishers' Association estimate. As there are about 30,000,000 homes, it is evident that the market is far from saturated; however, it is also certain that the "easy market" is swinging from machines to records. In favorably affecting the sale of discs, radio broadcasting thus assists rather than obstructs the current trend.

It is in recognition of that assistance that such important makers of records as the Columbia, Vocalion, Edison, and Okeh are themselves co-operating with the broadcasters to the extent of their powers—namely, by releasing their artists for broadcasting purposes.

Their feeling seems to be that by keeping their performers "off the air" they would do themselves exactly the same injury that would be done should they instruct all their dealers to rip out their demonstration booths, and stop playing machines and records for prospective customers.

Radio performances are gigantic demonstrations; the broadcasting studio is a booth in which thousands listen simultaneously yet privately.

To use broadcasting in this way is to gain by it; to prevent such co-operation is to engage in a losing fight.

Such is the majority opinion in the phonograph industry.

So there is every prospect that radio fans will continue to hear on the air the recording stars that they have enjoyed in the past months. It seems likely, too, that the public will continue to guide at least part of their purchases of records by their appreciation of the artists they hear by radio.

And that is the situation in summary. In the balance of this article THE WIRELESS AGE presents individual studies of the attitude and policies of the leading companies, the basis for the preceding general survey.

"Keep Our Contracts Inviolate," Says Victor

Broadcasting Does No Harm, But Must Be Avoided, Is View

AS the radio audience well knows, few if any artists who make Red Seal records for the Victor have been heard on the air, except through the playing of phonograph records, during the past six months. As the radio audience probably has suspected, and as was announced by radio on at least one occasion, the reason lies in the opposition of the Victor company to radio performances by their leading artists.

Fundamentally, the reason for the refusal of the Victor Talking Machine Co. to allow its exclusive artists to perform for the radio telephone is due to a desire to prevent violation of its contracts with those artists.

That may be asserted with authority.

While the various leading executives of the Victor company who made this policy plain refused to allow themselves to be quoted, the reader may place complete confidence in the accuracy of the above statement of the Victor policy as regards radio broadcasting.

In investigating the Victor attitude a representative of THE WIRELESS AGE spent many hours at Camden, N. J., in conference with the foremost executives, who spoke with authority for their various departments, while one high official, who was preparing for a trip to Europe, turned aside for five minutes to speak on behalf of the entire company.

The Victor contracts with its exclusive artists, it was explained, vest it with rights to "all mechanical reproduction by any means whatsoever" of the talent of the artists. These are

Feodor Chaliapin, the famous Russian basso, is an exclusive Victor artist, and Victor says he must not broadcast

long-term contracts, running for 25 years in the cases of such eminent musicians as the late Caruso, Alma Gluck, and similar performers. The greater portion of these contracts were entered into at a time when the radio telephone was little more than an experimenter's dream, and, of course, do not mention radio specifically.

However, it is the opinion of the Victor executives, including the legal department, that "mechanical reproduction" is a phrase that includes broadcasting by radio. By mechanical reproduction is meant, it is considered, reproduction through a mechanism of any kind. Radio broadcast transmission and reception (reproduction) is accomplished by means of intricate mechanisms. Therefore, it is a violation of contract for an artist to permit his or her performance to be broadcast. Such is the manner in which the Victor company construes its contracts.

Nevertheless it has seen fit to secure supplementary agreements with its artists, specifically mentioning radio broadcasting, and providing that the artist shall not permit broacasting unless the "written permission" of the Victor company has been secured in advance.

That supplementary agreement clinches the matter, and avoids the possibility of raising the question as to whether transmission by radio is "mechanical reproduction" within the meaning of the contract.

The courts always consider not only the letter of such contracts as may be brought before them in litigation, but also examine into the mutually understood intent of the parties at the time such contracts were entered into. A rather fine legal and engineering point might be raised should the Victor company be compelled to go into court on the question of broadcasting, and should it then be able to show no more than its original contract.

The supplementary agreement, which it apparently had no difficulty in persuading its artists to sign, ends all questions, whether propounded by legal inquisitors, by the artists, by the broadcasters, or by the general public. The Victor company considers that its exclusive contracts give it the right to

say whether or not its artists shall broadcast, and is asserting and exercising that right.

The company has said "No" to artists and broacasters, with very few exceptions.

Behind many if not most policies adopted by commercial enterprises there is a sound business reason, having to do with dollars and cents. Profits, immediate or ultimate, govern policies. The Victor company, however, does not state that any diminution in its receipts led to the adoption of its restrictive policy toward broadcasting. Its attitude is that a contract is a contract and must be protected from violation; and that radio is radio and not the phonograph.

Broadcasting is having no discernible effect on the Victor business, it is stated.

During the first six months of radio broadcasting the Victor sales took a decided slump, and this was blamed on the new method of entertainment in the home—though at that time many other lines of business were feeling a similar lack of interest on the part of the public. Then the demand for records revived, and has been increasing.

It is pointed out to the Victor executives that the playing of records by radio is in effect a compulsory demonstration; it is like dragging a vast section of the public into demonstration booths and making them hear the records if they would listen to radio broadcasting.

Is not that beneficial? was the question asked.

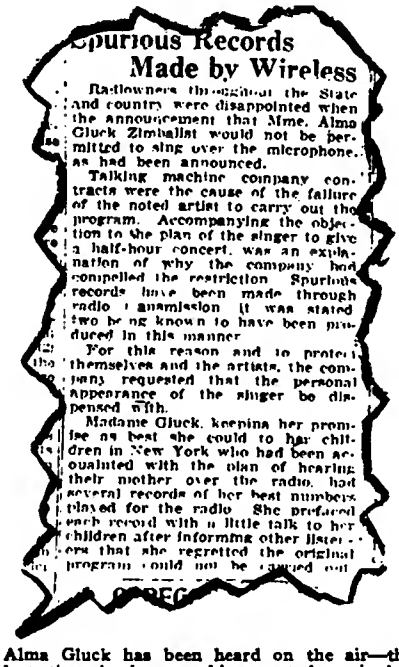
"Yes," was the answer, with the qualification that some people who find that they can hear records by radio have stopped buying them, preferring to take what they get when they tune in, rather than building up a record library so as to be able to arrange their own programs at will.

Against this class, it was acknowledged, must be placed the type that, having heard a good record by radio, goes to a store to buy it, in order to be able to play it at any time.

And also on the other side of the ledger is the type of person who begins his musical education by radio, who, originally attracted by the novelty of radio itself, starts by hearing radio and ends by listening to music. Obviously, such musical education paves the way, and a good broad way it is, for the purchase of a phonograph and records.

The net result, in the opinion of the company, is that radio strikes rather an even balance; the losses offset the gains, and the end is like the beginning.

In fact, there does not seem to be much concern about radio competition in the Camden headquarters whence has come so much enjoyment for the world. "Keep our contracts inviolate," seems to be the principal injunction. The legal mind is more concerned than the commercial one; the business heads seem to consider that radio in its present form presents the possibility of injury to income principally through what would happen if the contractual rights with artists were to be weakened by winking at even a minor violation.


Spurious Records
Made by Wireless

Radiowners throughout the State and country were disappointed when the announcement that Mme. Alma Gluck Zimbalist would not be permitted to sing over the microphone, as had been announced.

Talking machine company contracts were the cause of the failure of the noted artist to carry out the program. Accompanying the objection to the plan of the singer to give a half-hour concert, was an explanation of why the company had compelled the restriction. Spurious records have been made through radio transmission it was stated two being known to have been produced in this manner.

For this reason and to protect themselves and the artists, the company requested that the personal appearance of the singer be dispensed with.

Madame Gluck, keeping her promise as best she could to her children in New York who had been acquainted with the plan of hearing their mother over the radio, had several records of her best numbers played for the radio. She prefaced each record with a little talk to her children after informing other listeners that she regretted the original program could not be carried out

Alma Gluck has been heard on the air—the last time in her speaking, not her singing voice, as the above clipping from the Newark, N. J. "Star" tells. However, as explained in the accompanying article, the Victor company and Mme. Gluck both can secure protection against makers of records by radio

This is not to say, however, that the company is not studying radio with keen interest. "I would very much like to know," said one individual who is high in the councils of the Victor company, "how radio is going to develop in the next few months and years. If it is going to get beyond the stage of a toy for listening to distant stations; if it is going to furnish real music, enjoyable music, I would very much like to know it, and when."

There is revealed the meat within the legal shell of the contract—the Victor opinion is that broadcasting as now conducted does not furnish results that are enjoyable, nor comparable with the quality of modern phonograph recordings.

Back of that official opinion of the Victor executive lies an extensive experience with various receiving sets, none of which, in his opinion, show consistently excellent or even good results.

He cited several instances. One story was to the effect that a friend, using one of the better-known and really excellent receivers, but one more suited to the experienced amateur than to the novice, had been unable to pick up a desired program from WIP, a 500-watt transmitter in Philadelphia, a few miles away, and instead had heard dim howls from the neighborhood of Louisville. Obviously, this was due to the inexperience of the operator. The most ignorant person, it was pointed out, secures as perfect reproduction from a phonograph as does the most talented recording laboratory expert.

Naturally, the Victor company is rather content that this should be so, or perhaps it would be more accurate to say that it is content that its opinion of radio quality is a poor one. Lurking in the background is the feeling that since worth-while reproduction is not given, the radio competition is negligible and the publicity value negative. This feeling probably has had some reinforcing effect on the decision of the company not to permit its artists to broadcast, at least, not in those cases where contractual relations are such as to permit prohibition.

There is a considerable diversity in these contracts, arising out of the differing talents, fields of endeavor and desires of the artists. A person who presents recording possibilities can secure such a contract as the two parties care to negotiate. It may be exclusive, or it may not be; it may be exclusive as regards phonograph reproduction; or it may specify nothing more than the recording of a certain number of compositions. Almost endless variations are possible. One obvious and well-known arrangement of the semi-exclusive type is that by which certain pianists, such as Paderewski, record both for the phonograph and for the reproducing piano.

Another minor element among the many that have been considered by the Victor company is the possibility of making records from broadcast performances. It is known that certain phonograph and other records have been taken by radio with ease and even

VICTOR

Victor contracts must be preserved inviolate, and for that reason the exclusive Victor artists cannot broadcast without permission from the Victor Talking Machine Co. Supplementary agreements have been secured with these artists to make this policy a matter of written record and to prevent misunderstandings as to the interpretation of contracts that do not specifically mention radio.

Nevertheless, the Victor company does not admit that it is feeling any adverse effect from broadcasting. It states that its legal position, and that of its artists, is a strong one, and that protection can be had in the courts against any violation of rights that might take place, with or without the use of radio.

with good results on subsequent reproduction. The possibility of loss arising thus is apparent, however, rather than real, for both the Victor company and its artists, and in fact any other company and any other artists, would have due redress in the courts against any person or persons who should violate their rights in this manner.

In this matter of record-making there is plenty of legal precedent. The phonograph industry has been developing during the past 25 years, more or less, and in that time practically every disputed question has reached a final decision in court.

What is known as "dubbing" records, for instance, has been effectually stopped. "Dubbing" refers to the process of making a mould from a record, and using that for the production of duplicates. The courts held that while sale of a record enabled the buyer to use it, such use could not be held to include duplication.

The process of duplicating a record by playing the original before a recording mechanism likewise came under the ban of the courts, which would present a direct precedent in any suit involving radio-made records.

Protection even can be obtained against the use of special recording versions of works, when the title to such special versions rests with a company or individual.

Therefore it is easy to see that should radio be used as a link in the process of making a record, whether from another record or from the performance of the artist, redress could be had. That does not present any peril, and the Victor company does not shrink from radio on that account, except to the degree arising from the natural disinclination to place the company in such a position as to incur the necessity for legal actions. Even granted the inevitable success of such actions, their prosecution is annoying and expensive, and to be avoided.

Legally, the position of company and artist is assured. The mere use of a new method such as radio would not prevent recovery for damage done, and the securing of legal prohibition of further acts in violation of the rights of the injured parties.

Commercially, the position of the Victor company is that it is not injured by radio.

Actually, it will not permit its exclusive artists to broadcast without permission, and is not at all inclined to give such consent.

Brunswick Artists Must Get Permission

And the Company Is Little Inclined to Give It

WHEN you hear a Brunswick exclusive artist broadcasting in person you may be sure that the company has investigated the program, the object of its transmission, and the quality of the transmitter.

Keen discrimination marks the attitude of the Brunswick-Balke-Collender Co. toward radio. Certain exclusive Brunswick record artists have been heard on the air, in a few instances.

Such instances have been rare, and the subject of special negotiation. In general, the attitude of the company is against permitting their artists to broadcast, as may be seen from the following statement by A. J. Kendrick, General Sales Manager, Phonograph Division, of the Brunswick-Balke-Collender Co.:

"As yet, we have not granted permission to artists with whom we have exclusive recording contracts to sing for radio broadcasting stations. This stipulation has been waived in one or two instances of unusual character, but, until we have come to more definite conclusions pertaining to the value of the radio broadcasting of recording and concert artists, we prefer to withhold this permission, where we are empowered to do so.

"In all our exclusive artists' contracts we have a radio clause.

"We have no supplemental agreements with artists, but consider each instance individually, pertaining to radio broadcasting. We have felt radio requires some further development and improvement before a worthy transmission of an artist's work could be an entirely dependable procedure. We do not mean to state that there are not now broadcasting stations able to do justice to such an event, but we have been governed by the desire to insure our recording artists being presented to the public only under the most favorable circumstances.

"Furthermore, we have not yet decided that unrestricted appearances of our artists in that respect might, in some measure, retard the demand for their records. This is an open question, however, and as yet we have formulated no definite viewpoint.

"We have made several phonographs with combination radio sets for experimental purposes, but have no figures available which would indicate that radio has endangered or helped the phonograph business, particularly in view of the fact that the pronounced progress of the Brunswick company in the phonograph field has been such that we could not really be considered a barometer on this situation.

"However, we are inclined toward the opinion that radio, to the degree that it helps to advance good music, would assist rather than retard the phonograph business. Anything which has tended to make the home more interesting and attractive would probably help to broaden the sale of musical instruments designed for the home."

Mario Chamlee, tenor whose magic voice ranks him close to Caruso, is an exclusive Brunswick artist. If Brunswick says "yes" he may broadcast—but the "yes" is hard to hear

BRUNSWICK

Yes and No. Yes, in certain unusual cases. No, as a general rule. Exclusive Brunswick artists are prevented from broadcasting by radio clauses in their contracts, and the company insists on the contract being respected.

"Radio, to the degree that it helps to advance good music would assist rather than retard the phonograph business."

Columbia Urges Its Stars to Broadcast

Nearly All Important Columbia Performers Have Done So

"WE have no set policy directed against radio," said H. A. Yerkes, assistant general manager of the Columbia Graphophone Company. "In fact, we have urged that our exclusive artists sing for the radio whenever possible. We have even made arrangements for them to do so in certain cases. You can take the Columbia catalogue and go through it and you will find that nearly all the big names in it have been heard by radio."

That is in essence, the attitude of the Columbia Company, and Mr. Yerkes made it plain that it springs from the feeling that rather than injuring the talking machine business, radio broadcasting, if it has any appreciable effect, is beneficial. The Columbia company, like all the other talking machine manufacturers, is studying the subject with very great care. Their executives have tested out various makes of radio receivers and have even examined the possibilities of combining receivers more or less closely with Columbia machines.

The final result is this: the Columbia company considers that radio and the talking machine occupy two separate fields; that while they overlap to a certain extent, the degree of that overlapping is minor; that by careful co-operation with the broadcasters radio's effect can be made highly favorable. Co-operation with the broadcasters, in the mind of the Columbia executives, takes the form of releasing their artists for broadcasting purposes.

"Of course," continued Mr. Yerkes, "radio has a certain detrimental effect upon the talking machine industry, just as has any other newcomer in the luxury field. Most people have just a certain amount of money available for the purchase of such things as talking machines, automobiles, fashionable clothes, theatre tickets, travel and such luxuries or entertainment features. Any new luxury that comes up and attracts a large public interest naturally takes to itself part of the money that previously went into other industries. The automobile industry, for instance, when it came along took a lot of money from other people, and I believe that a great deal of the criticism of the automobile industry a few years ago was due to that fact.

"Now, radio has come along and I suppose that in some cases it may be absorbing surplus cash from homes that otherwise might devote it to the purchase of phonographs or records, but we are not the only people that radio has hit in that way. I suppose the automobile people and the theatre people and in fact anybody making or selling luxuries or semi-necessities, might object to radio on just that account.

"Personally I think that radio is a very good thing to come into the phonograph industry to the extent to which it does. It is a fact that the more competitors there are in any one industry, the better it is for that business. When there is only one company, having a monopoly, it cannot possibly create the public stir about the whole proposition that a number of companies can do, each doing its best to sell its product. The more phonograph companies have come into the field, the more people have learned the phonograph is something that they ought to have. I think radio, in that sense, by forcing a great deal of public attention upon music, is certainly doing the phonograph industry a good turn."

COLUMBIA

"We have urged our artists to sing for the radio whenever possible, and have even made arrangements for them to do so in certain cases. You can take the Columbia catalogue and go through it and you will find that nearly all the big names in it have been heard by radio."

The only detrimental effect of radio, in the Columbia opinion, is its absorption of money that the public might spend in other directions—against which the automobile people, the dressmakers, the travel bureaus and similar purveyors of luxuries may complain as well as the phonograph industry.

Al Jolson, who makes thousands laugh nightly in the theater and hundreds of thousands in their homes by phonograph, is free to amuse you by radio, too. Columbia says so

Nora Bayes, the popular comedienne, makes records exclusively for the Columbia, and so she is able to broadcast at will

Chamlee and Homer Heard

ON May 10 both Louise Homer, exclusive Victor singer, and Mario Chamlee, Brunswick star, were heard by radio. They each sang several songs during the 27th Anniversary celebration of the Volunteers of America, at the Metropolitan Opera House, New York City. The entire program was broadcast simultaneously by WJZ on 360 meters and WEAF on 400 meters, both stations including the selections by Homer and Chamlee.

Neither of these artists were paid for their songs, which they gave freely in a good cause, as an act of charity. Neither made any arrangements in regard to broadcasting. Mme. Homer has consistently refused to discuss radio with representatives of THE WIRELESS AGE, but her secretary stated that if her voice was broadcast it was without her knowledge. Precisely the same thing occurred during Easter week, when Mme. Homer sang at noonday services in one of the New York theaters, which services were broadcast, including Homer's songs.

Chamlee's manager likewise stated that no arrangements had been made in regard to broadcasting.

Vocalion Arranges Radio Recitals

Co-operation with Broadcasters Has Proved Beneficial

THE Aeolian Company likewise lists itself among those talking machine and record manufacturers who, far from placing obstacles in the way of their artists' cooperation with broadcasting stations, assist in placing them on the air.

H. B. Schaad, Secretary of the Aeolian Company made it plain that no unfavorable influence upon the Aeolian business has been noted and that in consequence, cooperation with broadcasters has been determined upon as the present policy of the company. Many prominent artists who have made Vocalion records or Duo-Art reproducing piano rolls have been heard on the air not only through their records and rolls, but personally.

"Of course," explained Mr. Schaad, "should we find that radio had a detrimental effect upon our business, we would change our policy entirely. Any business man would do that, and I do not doubt that if necessary, if the situation became severe enough, the entire phonograph industry would unite in fighting any menace that radio might develop. It might even bring the matter to the attention of the authorities in Washington, because of course no industry can be allowed to put another industry out of business, and governmental protection can be obtained for that."

The Aeolian attitude is very much similar to that of the others, namely, that the publicity value of radio far offsets any small amount of injury that might be done to the sales of records, instruments or machines. It is a fact that the company has been able to trace very definitely the sale of a number of Duo-Art pianos because of the use of these instruments in broadcasting studios.

Mr. Schaad has a novel idea regarding broadcasting: It is entirely too good. By that he means, too much music is transmitted. It is his idea that music should not be given by radio more often than three times a week, with sacred music on Sunday. More music than that tends to satiate the public—they get so much music that they become tired of it and do not want music in any other form or from any other source, and in fact even become tired of music by radio.

"Give the public not more than they want, but just a little less, enough to whet their appetites," is the summary of Mr. Schaad's theory. Such a policy he feels would have much more effect in stimulating the demand of the public for music of all kinds than the present practice of having music in the air almost continually.

VOCALION

The publicity value of radio broadcasting far offsets any damage it may do. Personal appearances of Aeolian Vocalion artists in broadcasting studios, the playing of their records, and of Duo-Art reproducing piano rolls, all are held to assist the sales of those instruments, records and rolls. In fact, it is definitely known that a number of Duo-Art pianos have been sold as a result of persons hearing them by radio.

"A little less music," enough to whet the public's desire and not enough to fill it, is the Aeolian company's only suggestion for improvement in broadcast programs. It has assisted its artists in arranging radio performances.

Rosa Raisa, leading dramatic soprano of the Chicago Opera Co., has been heard by the radio audience through the broadcasting of operas by KYW. She is an exclusive Vocalion artist, and as the Aeolian Company is willing to have its singers appear personally in the broadcasting studios, you may hear her again from time to time

Radio Aids Okeh Sales

Popular Players Broadcast in Person

"RADIO has a very beneficial effect on the sale of phonograph records," said Otto Heinemann, president of the General Phonograph Corp., maker of Okeh records, and also manufacturer of talking machine parts such as motors and tone arms. Mr. Heinemann leaned back in his chair with a contented smile.

"People who hear the latest hits by radio of course want to hear them again, and they do not want to have to wait until they are sent out again by a broadcasting station. They want to be able to play them at will. And so they go out and buy the records of those hits, and especially the records made by the artists who have played those hits by radio.

"That is why we have been making all possible arrangements to have our artists broadcast the latest song and dance hits by radio. We know that it helps the sale of records. There is no doubt about it at all.

"The broadcasting stations have been most generous in cooperating with us, welcoming our artists, and even in many cases announcing that they are Okeh artists. This is very beneficial indeed. I think radio is now a very important factor in the sale of new records."

Of all the phonograph record executives interviewed by THE WIRELESS AGE investigator, Mr. Heinemann was the most enthusiastic, and the most positive.

"How about the sale of phonographs; has radio injured that branch of the business?" he was asked.

"Yes, I suppose it has done so in various sections. However, no one can say how many sales have been lost—and no one can estimate at all how many sales of records have been gained,

Sophie Tucker sang the song "Kiss Me by Wireless" into fame, to the delight of the publishers, the radio audience, and the makers of Okeh records. Okeh says she can broadcast freely

on the other hand. It is impossible to estimate the net result."

The company is studying the situation with very great care, because of this contrasted effect of radio broadcasting upon the business, as it sees that effect. Its parts business is an important one, supplying as it does a large volume of phonograph components to assemblers and repairers of machines. Anything that cuts down the sale and use of phonographs naturally would be felt in that section of the General Phonograph factory.

Reports from the Okeh dealers are somewhat mixed. Certain dealers seem to be worried slightly by radio, and others to be sure that it is helping their sales. Mr. Heinemann spoke of a dealer who has made a conspicuous success in New York's East Side. "The population down there," he pointed out, "is almost exclusively Jewish. Those people have commercial minds, not mechanical minds. All they want to do is listen to a phonograph. They are not interested in the mechanics of radio. They don't know anything about turning dials, and they don't want to know. That dealer tells me that radio has not the slightest effect down there, and it is the same in all sections of the city where there is a large Jewish population. In other parts, however, where the boys are all experimenting with radio, perhaps a lot of money is being spent on parts that otherwise might go for records."

OKEH

"People who hear the latest song and dance hits by radio want to hear them again, without waiting to get them from a broadcasting station. So they buy the records. The personal performance of Okeh artists in broadcasting stations has been a great stimulant to the sale of their records."

That eventually the company may undertake the manufacture of radio receiving sets is evident from the name "General Wireless Co." in small type on the office door, below the General Phonograph name. But the Wireless company, so far, is one in name only, and represents an incorporation under that title in order to protect the name "General Wireless" as a running-mate to General Phonograph. When all conditions seem suitable the company will market a receiver, probably of the loud-speaker type, but at present that seems to be far in the future.

In the meantime, Okeh artists are readily available to broadcasters for personal performances. Such cooperation is enormously valuable, it is considered, much more so than the playing of Okeh records by radio.

Enthusiastic cooperation—that is the Okeh spirit toward radio.

Edison Artists Have Been Aided in Broadcasting

Company Likes to Have Its Talent Spread Before the Public

"WE are not at all concerned about radio competition," said A. H. Curry, general manager of Thomas A. Edison, Inc. "We have seen no effect on our business, in fact our volume of sales this year is running 100 per cent. over the same period last year. But I attribute that increase to the use of new merchandising methods for Edison machines.

"The Edison company," Mr. Curry went on to explain, "is not very keen about the matter of exclusive contracts with its artists, the policy being to let the quality of Edison reproduction speak for itself." Mr. Curry even stated that he was perfectly willing to have Edison artists make records for other machines, feeling that comparison of the quality of the records cannot but prove beneficial to the Edison.

EDISON

No restriction is placed on the appearance of Edison phonograph musicians in broadcasting stations; in fact, from time to time they have been assisted in making arrangements with various broadcasters.

"Radio and the talking machine are two separate things, and they do not compete, but rather supplement each other's fields of activity."

Co-operation is of mutual benefit.

Anna Case, of operatic fame and a most popular American singer, makes Edison "recreations"—and Edison is glad to have her sing for the radio

"While no definite campaign has been undertaken, the company has in a few instances aided its artists to get on the air through radio. It appreciates the enormous publicity value to be obtained in this way, and it has called the attention of its performers to the advantages of radio broadcasting.

"It seems to me that radio and talking machines are two separate things, and that they do not compete, but rather supplement each other's fields of activity," explained Mr. Curry. He analyzed the situation as follows:

The owner of a radio set has to take what happens to be in the air at the time that he tunes in, and cannot build up his own program while the owner of a talking machine can have at any moment as much variety as the extensiveness of his record library permits. In view of that fact, the Edison company feels that radio's field is more in the line of the reporting of current news, the transmission of speeches and addresses, and the description of current events such as boxing bouts and baseball and football games, rather than the transmission of music. It is in the direction of a reportorial agency, and as a forum, that Mr. Curry expects radio to develop.

The Edison company, like all the others, or rather its executives, have examined very carefully the possibilities and performances of various receiving sets, both of the commercial type and those assembled by Edison experts for the purpose of test, and its conclusions therefore spring from experience with radio receivers as well as from a study of the reactions of Edison dealers and users.

Some few dealers, as a matter of fact, are reported to have considered the installation of radio departments, but the company is a keen believer in specialization. While it places no obstacle in the way of the dealer running his own business in the manner that he may feel is best, it has told inquiring members of its dealer body that without doubt their experience with radio would not prove satisfactory, and that specialization in Edison phonographs is the best policy.

"Radio Helps Phonograph Sales"—Sonora

Making Music More Popular Means Selling More Machines

THAT any new means of giving music to the public does not hurt the established branches of the music industry, but rather builds up a new clientele, is the opinion of the Sonora Phonograph Co. In consequence, it is observing the progress of radio broadcasting with close attention but without fear. J. Wolff, vice-president of the company, when approached by THE WIRELESS AGE for his opinion, prepared the following statement:

"Because of the fact that the radio brings varied entertainment into the home, the question has been raised by a great many as to whether it will have a material effect on the phonograph business.

"Radio today, despite its wonderful progress, is still in its infancy, and it is too early to be able to say with any degree of certainty to just what extent, if any, it will affect the sale of phonographs and records.

"There is what might be termed a precedent in this respect, however, and that is the effect the phonograph had on the piano, when the former was introduced. It is a fact that pianos are just as popular today as they ever were, and the phonograph has merely added another means of entertainment.

"The phonograph today has a definite place in the home. It enables you to enjoy artists of the past as well as the present, and the upkeep expense is just what you wish to make it.

"Radio differs somewhat in this respect, as you are obliged to accept what the broadcasting stations are sending, and particularly with the musical entertainment. The only way to hear the world's leading artists as yet is through a phonograph and broadcast phonograph music compares very unfavorably with the original rendition on the phonograph. Furthermore the upkeep expense of radio is uncertain. It may be very high, and it may be very moderate, depending entirely upon how much it is used, and what luck you have with your tubes and batteries. The result you get from radio also depends entirely upon your location and the character of the building you are in.

"In my opinion radio at present is having no perceptible effect on the phonograph business, and I cannot see where one will conflict with the other in the future. It is quite possible that ultimately the phonograph may be combined with radio, but the possibility of one superseding the other is very remote indeed.

"I do not think that radio has either hurt or helped the phonograph business in any material way, but between the two I believe it is possible that it may have furthered the sale of phonograph records to some extent.

"At this time I cannot see any way in which the phonograph manufacturer can co-operate with the radio manufacturer to mutual advantage—eventually the two might work out in combination, but experience so far has proved that the phonograph dealer is not the outlet for radio, but rather the electrical dealer. Radio requires a knowledge of electricity, and is a much more complicated proposition than the phonograph, and before it can be handled successfully by the phonograph merchant he must have the necessary education and organization for the purpose."

The Sonora company, as most people know, manufactures phonographs only, and does not make or sell records.

SONORA

"Radio at present is having no perceptible effect on the phonograph business, and I cannot see where one will conflict with the other in the future . . . The possibility of one superseding the other is very remote indeed."

Phonographs did not injure the sale of pianos, as some thought they would, in the beginning. Anything that increases the public's use and appreciation of music is a good thing for all branches of the music industry.

"Standard" Works Are Free

THAT they want their copyright music broadcast free by radio stations without the payment of fees is the attitude of the Music Publishers' Association of the United States. The Committee on Radio Broadcasting of the Association has made that recommendation to the membership.

This organization is dominated by publishers of what are known as "standard compositions," though there also is included in the membership a small body of publishers of popular music, who are also members of the American Society of Composers, Authors and Publishers, which latter body wants fees from the radio broadcasters.

The two organizations therefore take opposite sides, the organization that is dominated by publishers of popular music demanding payment for radio performances, while the publishers of standard works want their music to be broadcast freely. The latter consider that broadcasting contributes to the popularization of their music, and as such is to be encouraged "until it reaches a commercial stage."

M. E. Tompkins of G. Schirmer, Inc., publishers, chairman of the Committee, in a public statement said: "Our Association, which has been in existence since 1895, represents particularly the so-called 'standard' publishers, which make up a majority of its forty-nine members, as distinct from publishers of popular music, although a number of the latter are also members.

"Our Committee has been carefully investigating the broadcasting of copyrighted music since last November. In our report, just adopted by the Association, we point out that music publishers are vitally interested in radio broadcasting as a great future user of music and that our rights in the use of our copyrighted music in public performances must be protected. However, we appreciate the fact that radio broadcasting is still in a chaotic and experimental state and that, while ultimately it will have to be placed on a commercial basis if it is to develop its potentialities, nevertheless the commercial side of the broadcasting problem has not yet been solved.

"In view of these facts and also because we desire to co-operate in developing the music possibilities of radio. we believe that we should allow the use of our copyrighted musical compositions for broadcasting without charge for the present, and without prejudice in our rights."

While the action of the Music Publishers' Association does not bind its members, but merely recommends, it is understood that most of the large standard publishers in its membership will follow the recommendations of the Association. The following representative standard publishers have definitely decided to follow the recommendations: Carl Fischer, G. Schirmer, Inc., C. H. Ditson Company, John Church Company, Boosey & Company, and Hinds, Hayden & Eldredge of New York City; Oliver Ditson Company and B. H. Wood Music Company of Boston; Paul A. Schmitt of Minneapolis and Clayton Summy of Chicago.

"Clear the Air for the Theater"

New York Producers Find Broadcasting of Plays Increases Their Box-Office Receipts

RADIO helps the theater. Such is the decision of the theatrical managers of New York City, and it is no snap judgment. It is based on actual experience, on applying the acid test of box office receipts.

If it were possible to secure "before and after" pictures of the New York producers the contrast would be as striking as in the old-fashioned patent medicine advertisements. The theatrical folk for a while frowned mightily at radio. It was keeping the people home listening to concerts when they ought to be paying money into the box office.

So they thought.

Then suddenly a part of a play was broadcast, as a daring experiment. Soon thereafter broadcasting plays direct from the theater began to be, well, not a daily occurrence, to be sure, but it became a habit, one might say.

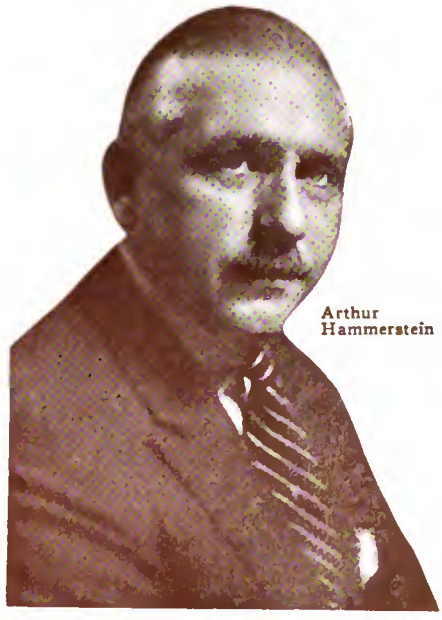
The gaunt, haunted look disappeared from the faces of the showmen, and instead, when radio was mentioned a full, happy smile burst forth.

The smile is still on the face of the manager, and on the faces of the radio audience.

Broadcasting helps the theater.

Once that fact had been definitely proved through the co-operation of the metropolitan producers with stations such as WJZ and WEAF, the managers began to study methods for closer and more frequent and more effective utilization of the new agency for popularizing their plays. The Producing Managers' Association met last April and discussed the matter, and particularly certain restrictions that had developed to curtail their broadcasting activities. They appointed a committee to work out ways and means of wiping out the restrictions, and, because of his knowledge of broadcasting, Arthur Hammerstein was made chairman of that committee.

It was a fortunate choice. Hammerstein is known as an aggressive executive, and he has had a long experience in the theatrical business. Also, he has had his plays broadcast.



Arthur Hammerstein

Arthur Hammerstein Heads Committee to Get Free Transmission of Productions

His latest show to go on the air is "Wildflower," a musical comedy with much humor and a number of song and dance hits, including "Bambalina." The first act was broadcast by WEAF.

Nothing exciting about broadcasting an act. Old stuff. But—here was something new. When the curtain went down and the radio audience expected to hear the announcer introduce the next feature on the evening's program, instead a pleasant voice asked that if any listeners went to see "Wildflower" as a result of hearing it by radio, would they please say so at the box office?

Putting the coupon in broadcasting!

And the verbal coupons flowed into the box office in a steady stream. Person after person said: "I heard you by radio the other night" as they bought their tickets.

Box office receipts jumped about $500 a night!

The check on the responsiveness of the radio audience was obviously imperfect. Many people forget to "present the coupon." But those who did registered that startling increase, of over $3,000 a week.

No wonder that the producing managers, who had known for some time that radio helped, suddenly went wild over it.

No wonder that they showed fight when the American Society of Composers, Authors and Publishers threatened to prevent the broadcasting of current plays by insisting that no broadcasting station transmit music to which the Society owns the copyright, unless a fee be paid. The broadcasting stations put the lid on copyright music, and that automatically banned many plays.

Hence the excitement in the Producing Managers' Association, hence the broadcasting committee under Arthur Hammerstein, and hence the activities of its attorney, William Klein. The law is to be invoked, if necessary, to clear the air for the free broadcasting of theatrical productions.

Klein says that contracts between the managers on the one hand, and the composers and authors on the other, give the managers all producing rights, including those by radio.

"The Society has been selling some-

(*Continued on page* 35)

Because these girls were heard on the air in the Bambalina number, which occurs in the first act of "Wildflower," the box office took in $3,000 a week. "Wildflower" now is sold out at every performance. It is a hit, and radio helped to make it so

Composers and Publishers Cut Programs

Organization Claiming Ownership of Music Copyrights Demands Fees From Broadcasters—Many Stations Have Stopped Transmitting Such Music—Other Interests Plan Legal Action

NOT so many weeks ago the radio audience in every part of the country heard it announced from broadcasting studios that certain popular music no longer would be transmitted, because of the demands of the owners of the copyrights of that music.

Notice had been served on all broadcasting stations by the American Society of Composers, Authors and Publishers that no music, the rights to which were owned by that Society, should be transmitted unless a license had been secured. Fees of varying severity were quoted, in each case representing a financial burden that the broadcaster did not feel able to bear.

The alternative to paying was to transmit other music, and that is what many stations decided to do. In the cases of stations WJZ, KDKA and KYW, the following announcement was read several times for a number of days:

An organization representing a considerable number of the authors and publishers of copyrighted music has notified us that the purchase of their sheet music does not carry with it any right to a public performance thereof for profit. Although this station gives free performances and makes no charge of any kind to the vocal and instrumental artists who participate in its programs, they claim that we are, nevertheless, indirectly conducting a performance for profit and therefore have no right to use their copyrighted music without permission. It has been—and will continue to be—our constant endeavor to furnish the public, without charge, the best programs that we can devise, but the conditions under which permission to broadcast the copyrighted music of the organization could be obtained would involve a considerable addition to the already very heavy burden of expense under which we are operating. These conditions are further fraught with possible future complications which might readily become so embarrassing as to interfere with the continued successful operation of this station, so that after a most careful study of the subject from all points of view, we have decided to eliminate from our future programs all copyrighted music, the copyright of which is owned or controlled by the organization referred to. Except for the elimination of certain copyrighted music, we shall continue our broadcasting activities as heretofore, and this announcement is made only because we believe the public is entitled to the fullest information.

The storm that broke loose was striking evidence of the power of broadcasting, and of its place in the hearts of the people. The first reaction, of course, took the form of telephone calls, and a flood of telegrams and letters.

Some of the letters recounted steps of reprisal taken by the radio fans. One man wrote: "I am so disgusted at the attitude of the composers that I have decided to buy no more of their sheet music, though I used to buy a lot of it just because I heard it by radio, and my wife also promises to buy none of it. I think that if everybody will do this, they will soon come to their senses."

The broadcasters for the time being said nothing, but some careful study was being given to the situation. Programs, for instance, had to be gone over and offending compositions eliminated. This did not materially interfere with the quality of the programs; in fact, it raised the quality, if anything, looking at it from an artistic point of view. The "tax-free" music that is available is plentiful, and much of it is of the classic and semi-classic type. However, it is admitted that there is a large public interest in the latest popular music, and it was felt that a fully-rounded radio program should contain some of it.

Meantime, the broadcasting situation and the intense popular feeling that it had aroused had been noted with keen interest by others, notably in the motion picture world, who had felt the heavy hand of the Society long ago. The Motion Picture Theatre Owners of America, representing a large portion of the movie houses, over a year ago kicked over the traces and refused to pay license fees to the Society for the use of its music. Some movie houses are still paying fees, based on seating capacity, but it is currently stated in the motion picture world that these houses are in the minority.

The Society consequently has had a large number of movie theatre lawsuits on its hands. Its method is to pick out a non-paying theatre, get evidence that it has played one composition owned by one of its members, and then bring suit in the name of that member, naming the specific composition the performance of which without permission is held to violate the copyright law. The suits have to be brought in a United States District Court. This is a long, long path, and no way presented itself to make the matter one of public interest; only the movie and music people knew about it.

Then radio broadcasting brought the activities of the Society before the public. The "outlaw" movie theatres realized that here was a big ally.

At the same time, the café and restaurant owners, who also have been split into two camps on the question of royalties to the Society, saw a new light, and began to consider ways and means of getting behind the big push of popular opinion.

Likewise the Producing Managers' Association, representing the producers of practically all the popular plays, were roused to fighting pitch by the

(*Continued on page 42*)

Top-notch orchestras such as this used to be heard on the air in last-minute song and dance hits—now some stations that used to transmit popular features such as this have stopped because of the demands of the American Society of Composers, Authors and Publishers

Lord Robert Cecil

"WE hope to broadcast the proceedings of the League of Nations from Geneva next year. It would be a very good thing for international peace"

An Interview With

Lord Robert Cecil

By R. M. Clarke

"WHY not broadcast the proceedings of the League of Nations from Geneva?"

The question was asked at the end of a prolonged grilling by newspaper reporters. Lord Robert Cecil had just arisen as a sign that the interview was over, and stood with his back to the fireplace in the library of Mr. Thomas W. Lamont's house in New York City, where he was a guest.

He turned to his last questioner with that quick smile that had endeared him to the inquisitive circle.

"We hope to do so next year," was his reply. "It would be a very good thing indeed, a very good thing."

That was the last piece in what might be called a picture puzzle, the subject of which was the famous statesman's opinion as to the value of radio broadcasting in furthering the cause of international peace. The other bits had been collected one by one during the previous hour and a half.

Only the night before Lord Robert had spoken at a dinner at the Hotel Astor, New York, to an immediate audience of some 2,000, and to the vast radio audience as well. His topic had been the League of Nations, on which he is exceptionally well qualified to speak, having played a prominent part in the peace negotiations in 1918 and 1919, and being at the present time one of England's representatives before the meetings of the League in Geneva.

With such a man, and such a subject, the newspapers were eager for personal interviews, and 3.30 p. m. on the day following his opening speech in America, was set as the time when reporters would be received in a body. This is the common practice: it saves everybody's time, and shows no favors to anybody.

THE WIRELESS AGE was represented in the group of about twenty men and women from all the New York papers and news associations, who fired question after question at the famous man.

He is a tall, lanky, stoop-shouldered Englishman, who comes from a long line of statesmen, the first of whom won distinction by having been a minister for Queen Elizabeth.

He lolled and rolled somewhat awkwardly in his low chair at the fireside, twirling a pair of steel-rimmed spectacles in his hands, and turning his kindly eyes direct upon each questioner while he responded as well as he was able to the sometimes foolish and sometimes searching questions that were put to him.

Early in the conference he modestly explained his reason for coming to America. "I am not here to instruct the American public in its own affairs," he said. "I am simply here to give such information as I am able to give on a subject that holds the interest of certain Americans. I hope to be able to tell you something worth hearing about, on the League of Nations. My object is to give information. I am not an impertinent intervener in other people's affairs."

To give information—that was a cue:

"Has not the radio telephone simplified your task of giving information?"

"Oh, yes, indeed it has," he responded quickly. "I am very much surprised at the tremendous development in it here. It is far superior to anything we have, you know. It was used at the dinner last night. The comparison between here and in Europe is astounding, and it is a very wonderful thing for reaching the public. I shall be most glad to take advantage of it while I am in this country, though of course," and here a smile, "that will depend upon the [illegible] who organize the meetings for [illegible] the various cities."

That was one piece of the picture. Questions by others developed clearly Lord Robert's great enthusiasm for the League, not as a perfect instrument, but as an organization that already has accomplished much, and shows promise of doing more.

He told how the meetings in Geneva between diplomats and statesmen who otherwise never would see each other had promoted better understandings among them. He likened the meetings to conferences between the partners in a business, held to develop the enterprise coöperatively along the most profitable lines.

While he admitted that the men in Geneva have the same nationalistic prepossessions and political aims as they have when they are in their national capitals, still he maintained that the personal contact and public discussion of the League meetings already had prevented war and made possible the taking of certain steps toward recovery by Austria. He outlined this as the first step in abolishing war.

"You have got to get rid of fear and suspicion, bred of ignorance. Moral and intellectual disarmament must come first, through encouraging all forms of international coöperation and communication."

Quickly, before he resumes:

"Do you not think that international broadcasting, which certainly is coming soon, will do much to bring about 'moral disarmament' by promoting international understanding?"

"I certainly do," he said, turning squarely to face the questioner and leaning forward in emphasis. "Anything that promotes understanding is sure to be beneficial in the abolition of militarism. It is as the French proverb: 'to know all is to forgive all,' and I should welcome international broadcasting as a great force indeed for peace."

So there is the complete picture as seen through the eyes of Lord Robert Cecil: the great need of the times is international understanding, in which radio should play a vital part, even to the broadcasting of the proceedings of the League of Nations from Geneva, that the whole world may hear.

Radio, the world peacemaker.

Making a "Party Call" on S. L. Rothafel

Wherein We Thank "Roxy" and His Artists for Those Peppy Sunday Evening Concerts from the Capitol Theater

By Mr. and Mrs. Brown-Jones

When yon hear Roxy talk about "Mike" he means the microphone. He has two of them, one in reserve in case the other goes dead; don't nnderstand that at all, for nothing ever goes dead in the Capitol radio studio, not with Roxy on the job

WE have been to see Mr. S. L. Rothafel. It was really a party call, for with the aid of radio we have been enjoying his radio parties every Sunday night for some weeks. He didn't know that we had been "among those present," but we were, chuckling and chortling with the rest of you, admiring the artists, enjoying the numbers—even appreciating the charms of certain performers, for who could help seeing in the mind's eye a beautiful girl when Mr. Rothafel ends an introduction like this: "And pretty! Oh, my!!"

Radio parties. That's what they are. Not that, so far as we have heard, Mr. Rothafel has named them so. No, all he says is this, occasionally: "This is Station WEAF, broadcasting a program direct from the Capitol Theater, New York City." But it is more than a program. None of that cut-and-dried stuff for Mr. Rothafel.

For it is he, the announcer extraordinary, the radio impresario, individual, humorous, natural, who is responsible for an hour and a half of unique broadcasting every Sunday evening. Don't say to yourself that anybody can be unique—so they can, but it takes a master showman to be unique and win his audience into the bargain. Win it this particular showman does, as any postman serving either WEAF or the Capitol Theater can tell you. Some 5,000 letters flow every week from radio listeners as a result of those Sunday evening parties in the broadcasting studio of the Capitol, a volume of mail that has broken all records in broadcasting history. And Mr. R. reads them all! No feature, so far as is known, has ever pulled so well, proved so popular, or brought more business to Uncle Sam's letter carriers.

"Betsy"
(Betsy Ayres, soprano)

Rothafel smiled at us genially, as we came in. Once the formalities of introduction were over, "Well," he asked, "am I the man you expected to see? There was a man came in here the other day who had heard me by radio, and he turned all sorts of colors and said, 'Why, you're not the man I came to see at all!' You know, talking over the radio and meeting a person face to face are different things. You get impressions in your mind that sometimes aren't borne out by the facts.

"That works both ways, too. I can't see the audience. I don't know how they like me, not when I talk to them, at least. I just talk into that little black thing, and that's all there is to it, no applause, nothing to tell you what kind of an effect you are making, not a response until the Monday mail, and Tuesday—Tuesday, that's the day when the big batch comes. Even from Havana!"

WARMER AUDIENCES

The attendance takes care of itself. What broadcasting does for us is to make our audiences warmer, especially toward artists whom they have heard by radio. When one of them comes out the applause is much heartier. It makes the houses much more friendly. They seem to feel more at home. They have got acquainted with us by radio, personally, you might say.

—S. L. Rothafel.

He leaned back in his chair. Behind him was a radio set. Pictures of artists hung on the walls. The furniture was mahogany. Curtains framed the windows. An office, and a study. As he answered the impatient telephone, one of us whispered to the other: "This office reminds me of some of the offices I have seen in France, doesn't it you?"

The telephoning finished, he resumed: "It's a difficult job, broadcasting is. I guess it may sound pretty easy to you folks who listen, but it's no cinch to get up a program to run an hour and a half and keep it moving along. I think I should create a feeling for what is going to be played, then have it played, then when it is done change that mood by saying something, and try to create maybe an entirely different atmosphere for the next piece or the next artist."

That is an excellent picture of one side of Rothafel. He is by way of being an artist himself. He takes the radio part of his job quite seriously, as a means of getting across certain moods or impressions of, not alone the theater, but of the people who are heard on the air from its broadcasting studio, and of the compositions

"Evelyn"
(Evelyn Herbert, soprano)

Melani Dowd, contralto

they interpret. He doesn't believe in divorcing personality from art, but rather in interpreting art through personality. At least that's what we gathered.

"What has been the effect of your broadcasting, on the theater audience, that is, has it increased the attendance?" we asked.

"We can't tell. It is impossible to determine whether it has increased the attendance or not. That takes care of itself. But I have noticed this: it has a psychological effect. It makes the theater audiences much more cordial. Their applause is warmer. You can feel it quite decidedly, especially when some artist comes on whom they have learned to know by radio. I think it makes the houses much more friendly. They seem to feel more at home; they have got acquainted with us, personally, you might say. Broadcasting gives us a personality."

Certainly his own personality is responsible for the success of the radio parties.

This is how they go. First, Sunday evening, at about 7.19, Rothafel begins in the studio. "I want the air!" he proclaims, and in about a minute he gets it.

"Hello, everybody!"

He gives a short description of the current program of films and music, after which there is transmitted, directly from the stage, the orchestra music accompanying the program, from the Overture, through the Weekly, the "Impressions" of some opera, and up to and including the opening of the feature film. Then the switch is turned back to connect the studio with the transmitter.

Editha Fleischer

Here is a part of what came over our set last Sunday night:

"There you are! . . . This is WEAF, broadcasting direct from a special studio in the Capitol Theatre, New York. I'm very glad to get back with you, folks. You know, I've been out West, in Kansas City, finding out why people say they're from Missouri, and I found out all right, but I'm not going to tell you. And say, there's a radio announcer out there, a fly young Irishman by the name of Fitzpatrick, who sure knows how to put it over on the air. We may be as good some day, if we keep on trying.

"Now . . . now . . . Here we go. Here comes The Blue Blond, you know, Eugene d'Ormondy Blau, the Blue Blond. He's our concert master here. He and Dr. Billy, Dr. William Axt, are going to play for us, and, oh,

Above, "Doctor Billy," or Dr. William Axt, associate conductor of the Capitol Grand Orchestra. Below, "The Blue Blond," Eugen d'Ormandy Blau, concert master

yes, Yascha Bunchuk will help out with his 'cello. It's going to be a trio, 'Forget Me Not.' All right? Let's go! . . ."

The selection is played; then:

"There you are! Isn't that nice, after having been away? Well, look who's here, look who just came in, here's Betsy, and look, here's Evelyn and Edna, and Edith!

"Here, Betsy, get here at the piano, will you, and sing us a song. It's Betsy Ayres. She's only a little bit of a mite, from Cleveland, Ohio, and pretty, oh, my! Are you ready, Betsy? . . ."

This is only one of the grand entrances to the Capitol Theater. The other is your radio set

Betsy is ready, of course, and sings. Then this is heard:

"There you are! Now you sit down over there like a good little girl and we'll call on you later. Now . . . by the way, may I say this is Station WEAF . . . Hold the wire—no, I mean Hold the Air a minute, please. . . .

"Now, Edna, you go over there and let Betsy sing the chorus of 'Carolina in the Morning.' You ought to see Betsy. I wish you could see Betsy. You know, she's the girl in 'Souls for Sale,' you know, the one the devil asks, 'is *your* soul for sale?' It's really awful foolish of him to ask her that question. . . . Are you ready? Let's go, children."

The popular song is rendered, and once again Rothafel's voice is heard:

"Now, now . . . we're going to have The Blue Blond, Eugene d'Ormondy Blau. You know, as I told you some time ago, he married. He married our harpist. Then I had to let one of them go, because we've got to have harmony in our orchestra. . . . What are you laughing at, Betsy? I don't see anything. . . . Now, he's going to play 'Cavatina,' by Ruff, no, Raff. . . ."

Then, when the strains of "Cavatina" have died away:

"Isn't that beautiful? Eugene here, he's like Bruce, Bruce Benjamin, you know, the tenor. He get's under your skin, he feels it, too, or he couldn't play it that way. . . ."

And that is the way the whole program is developed, right before your gaze, almost. Certainly more than your ears seem concerned in the matter. We have decided that the reason Rothafel reaches further than the ears is because it is more than his tongue that speaks.

"We're like a happy family here," he declared to us in his office. "Not that we haven't discipline, but we don't secure it by making people fear for their positions. There are better ways."

There are indeed, and those who have heard the proceedings in this Capitol studio, heard Evelyn Herbert's joyous laugh that Rothafel seems to produce from her, to her own amusement as well as that of everybody else, will agree that this particular kind of discipline seems to create disciples rather than slaves.

Jascha Bunchuk

Some people have expressed

to us doubts that the many artists that are heard on the Capitol programs are regular members of the staff. Well, they are. The Capitol is a tremendous enterprise. It seats 5,300 people. On Sundays, 20,000 people have been admitted to four performances. It takes a large staff to run the largest motion picture theater—and a large staff there is.

New York City.

My Dear Mr. Rothafel:

This is not the first time that I have written you and may not be the last but feel as though you ought to know that up to six weeks ago (when I built this music box) I had never been in the Capitol Theatre and since that time I have been there no less than five times and since, too, I have a wife and three girls I am forced to ask you if you know of any organization that will help me defray the expense that has now started and will continue to continue.

An enterprise of this sort can do things that smaller theaters cannot attempt. Instead of engaging artists for a week at a time, a competent corps is maintained, given the services of an expert coach, provided with individual dressing rooms that are also studios—and the Capitol thus becomes a school for its artists, as well as their concert hall.

In a way this is rendered necessary by the custom of the theater, and a popular one it is, of presenting each week what is called the "impressions" of an opera. The big scene is taken, usually, staged with great care, the singers put in costumes that are as authentic as the scenery, and thus in some ten minutes the outstanding feature of the opera is reproduced. In order to do this week after week it is necessary to have a corps of singers more or less trained to the work—and such the Capitol has. They include Betsy Ayres, Evelyn Herbert, Edith Fleischer and Elsa Stralia, sopranos; John Yeagel, William Robyn and Bruce Benjamin, tenors; Eric Bye and J. Parker Coombes, baritones; Nadia Riesenberg, Julia Glass and Edna Baldwick, pianists; and of course the principal members of the orchestra, such as "The Blue Blond," Yascha Bunchuk, Frederick Fradkin, and Dr. Melciore Aurio Cottone, the latter the organist.

Now we can say that it is not only a party that is put on the air by Rothafel—it is a family party. We bet a lot of you listeners knew that all along—because you have felt that you were a member of the family too. If you haven't, well, you're different from us, that's all.

One last word, and then we'll let you tune in on something else. Rothafel has some suprises in store. A number of big figures in various fields, such as music, the other arts, literature, even in business, have heard of what the Capitol is doing, back of the scenes as well as on the stage and in the air. They are beginning to drop in from time to time just to look things over, to become acquainted with a motion picture theater that is much more than just that. Some fine Sunday evening some one of them is going to visit the studio. Rothafel named us some names, quite in confidence, so we'll not spoil his surprise, nor yours. Just you wait!

"Clear the Air for the Theatre"

(*Continued from page* 30)

thing that it does not possess," said Hammerstein. He pointed out that it had been recognizing the rights of the managers for some years by giving them a percentage of the royalties received from makers of phonograph records.

The restrictive action of the Society he condemned vehemently, as not only an infringement of the managers' rights, but as utterly wrong from the business viewpoint.

"All the song and dance hits," he pointed out, "come from the shows. You can name only one recent popular number that is not in, or was not in, a Broadway production. The one exception is 'Three O'Clock in the Morning.' All the others were popularized by the theaters.

"A writer turns out a composition, and it may be good, it may be bad, but until he sells it to us and we put it on the stage it has hardly a chance to become even moderately successful.

"Now one of the ways to make a success of a show containing these compositions is to have them played as widely as possible, in restaurants and cafes, hotels, dance halls, motion picture theaters, and by radio. People start out by hearing the 'Bambalina' number from 'Wildflower,' for instance, and pretty soon it's just 'Bambalina.' That's the way it works.

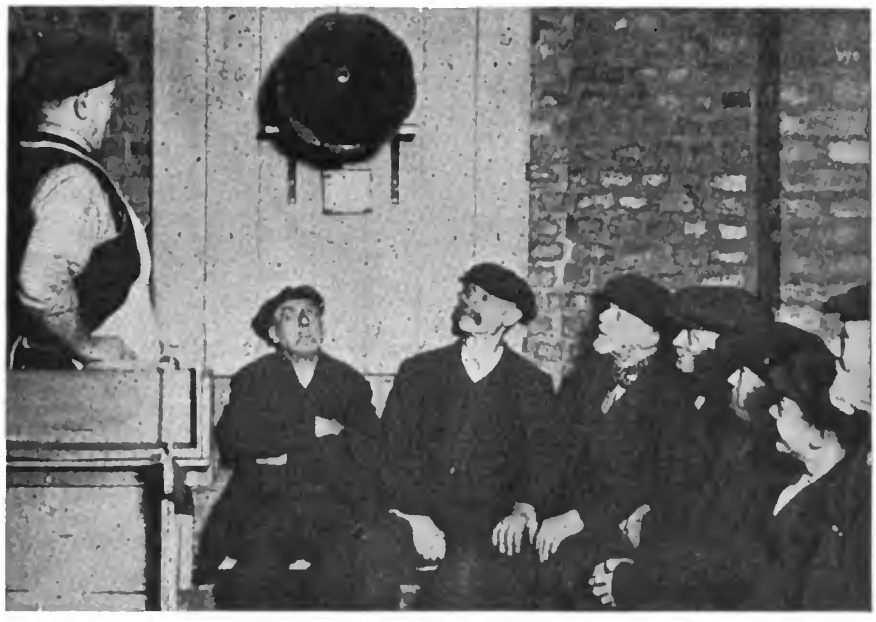
"In that sense, radio broadcasting is the greatest advertising medium the world has ever seen.

"We want to have our plays and our hits from our plays broadcast freely, without fee, license or restriction.

"All production rights, including broadcasting, rest with us. Our counsel has been instructed that if there is no other way of securing the free public use of our production rights, legal action is to be taken, probably by bringing suit for an injunction to restrain the Society from selling what it doesn't own and from preventing the broadcasters from transmitting popular music.

"The motion picture theaters also are interested in the matter, and may coöperate with us. Perhaps other organizations may aid us, too.

"The public wants to hear plays and popular music, and we want them to do so. It entertains them, and helps us tremendously. We will carry this thing to the courts if necessary and fight it out."



Recreation time is radio time in the Southwark (England) Workhouse. The inmates eagerly gather around a loud speaker made of a telephone receiver and an old phonograph horn. They don't quite know how it's done, but they like it fine

The "Radio School" Is Practicable

Experiment In Broadcasting a Lesson in Machine Accounting Proves Entirely Successful—Great Promise for the Future

By "Educator"

APRIL 4, 1923. Mark that date down in the history of radio broadcasting and of modern education—distinguished by the first organized and successful test of the broadcasting of school instruction. Officials of the New York City Board of Education, of the Haaren High School, and of the Radio Corporation of America participated in the conduct of a class in machine accounting through WJZ, and the complete feasibility of this method of education was considered to have been demonstrated conclusively.

"Of course this is like all things in the beginning," said C. E. Meleney, Associate Superintendent of the New York Board. "It is hard to tell just how far or in what direction it will go, but I do not doubt that the future will develop it very advantageously for certain scholars and certain schools."

He has been watching the success of the first radio lesson, conducted by H. W. Leyenberger, head of the accounting department of the Haaren school. Two pupils had worked before a loud speaker in the superintendent's room of the Board of Education, surrounded by some of the leading educators of New York City. In addition, a class of twenty-five, Mr. Leyenberger's regular class, was following the same lesson at the school, and one of his pupils sat at his side in the Waldorf-Astoria studio of WJZ, under the eye of Associate Superintendent Gustave Straubenmuller and the Haaren school principal, R. W. Burnham. Other educators listened in their offices or homes, and in at least one other school, at Bay Ridge, the pupils assembled in the auditorium to listen to the first radio lesson. The test was observed, therefore, from all angles.

"I rather doubt that radio will find any large application in cities having such a comprehensive school system as has New York," continued Mr. Meleney, "though that is something that only further tests can determine. We certainly wish to do more work of this kind, and will lend our co-operation at any time in working out the problems as they arise." He turned to an official of the Radio Corporation and made this indirect request: "We would like to go into this further and do some more work along this line."

Broadcasting the first school lesson—H. W. Leyenberger in the WJZ studio conducting his class in machine accounting by radio

"You certainly can count on us to do everything in our power," was the cordial response. "We will hold ourselves at your disposal for anything you wish to do. This is an exceedingly important development, and we wish to foster it with your aid."

Such were the opinions that were expressed immediately at the close of the radio lesson by the spectators in the Board of Education, and at the school itself. Educators usually are conservative, but these were enthusiastic. So, in order that the excitement of the moment might subside, and allow time for the development of fully-considered and conclusive opinions, a week elapsed before the writer consulted any other educational authorities.

Then he visited the Haaren High School, and discussed the subject quite thoroughly with Mr. Burnham, its principal; Mr. Leyenberger, the head of the accounting department, who had delivered the lesson through WJZ; and with Fred Siegal, head of the drawing department, who had made the radio arrangements. The four of us soon found ourselves in an enthusiastic debate.

"It was an entire success," announced Mr. Burnham when he was asked his opinion of the test. "It was done as an experiment, in order to test the practicality of such a use of radio in the school, and demonstrated its complete availability in that direction. However, I do not think that it will ever displace the personal work of the classroom; perhaps it may be an important adjunct here and there. Its big field is among those who cannot attend school, and there I think it possesses unlimited possibilities.

"The lecture method of teaching long has been a success, but that side of class instruction has not been touched by radio. Certainly many of the lectures now being put on the radio could be used right now. But there is much new work to be done.

"For instance, the conducting of actual class instruction, in English, let

Bay Ridge High School,
Brooklyn, N. Y.

My Dear Mr. Burnham:

I am writing to you for the pupils and Science Department of the Bay Ridge High School to let you know that we received the speeches and lesson by radio on Wednesday afternoon. The radio was installed in our auditorium through the good offices of our Radio Club which has been in existence more than a year. We were able to get a very distinct and clear message. Your speech was particularly well heard. We consider ourselves especially fortunate at having been able to listen in at the first lesson in the history of education given to a class over the radio. I know that the girls who were fortunate enough to hear it will mark April 4, 1923, as a red letter day.

Kate E. Turner,
Principal.

us say. The transmitter might be right in the classroom, and as the teacher asked each pupil to recite he or she would be required to come up and stand before it. Then the corrections would be given at the same time, and in that way everybody who happened to be listening would receive practically all the benefits of class instruction.

"Then again, it might lead to a modified correspondence school system. The present correspondence schools, though they do excellent work in some cases, are dead. There is none of the teacher's personality in them. Even the use of the phonograph for teaching languages by mail had not proved as flexible as such a subject should be. Now we can go one step further, and carry to students not only lessons, but certainly a great deal of the personality of the teacher. The papers can be made out by the pupils in their homes, and mailed into the school for correction and grading."

"Already," interjected Mr. Leyenberger, "the response from listeners shows a great public interest in the broadcasting of radio lessons. We received quite a number of letters as a result of the accounting lesson and I know that some people who have lectured on various subjects that might not be considered very popular, have received bushel baskets full of mail."

Here Mr. Siegal added enthusiastically: "Why, I think this thing is so big that you will have to have some special wave lengths for educational work. It ought not to be mixed with all the other matter that is put on the air, there is too much of it, and it is too important."

"Yes," confirmed Mr. Burnham, "I think that is very important. You know that a great many schools have radio receivers but most of the programs are given in the late afternoon and evening, so those sets are dead in the morning. There is nothing to be heard over them during school hours, or certainly not much that is of any benefit. Educational programs should be transmitted at times when the schools can make use of them, and something will have to be done to make that possible if the schools are to be served by radio."

ALGEBRA BY RADIO

Newark, N. J., April 12—Broadcasting of algebra lessons began today at Station WOR. A preliminary lesson in simple algebra was transmitted during a 15-minute period, and subsequent problems will be put on the air once a week until the subject is covered. The broadcasting is done in the early evening, when the children are at home, listening to the radio. Parents also are expected to appreciate the new service, which will refresh their memories and enable them to help their children in their studies.

"But," objected Mr. Leyenberger, "it seems to me that most of the people who are going to benefit are those who can only listen at home during the evening, people who have to work during the day."

"Yes," said Mr. Burnham, "you see there would have to be lessons broadcast day and night, too. Now there is something that I hadn't thought of before. In big cities like New York it might be that the radio could be used for official school messages. If the Board of Education had a transmitter, for instance, it might be used at a certain time each day for sending bulletins and reports, and so forth. Here is a request for a report, for instance, that is dated April 6, yet there was so much red tape required to get it mimeographed and distributed that I didn't get it until the 10th. That was a loss of time that might have been avoided by radio.

"Then there are the special teachers of single subjects, or 'directors,' as of art, or what not. They now have to spend weeks going from school to school in putting any new methods in effect, when by radio they could address all the teachers and pupils at once. Also, often a local or a visiting man of prominence will go to a school and make a short address. That ought not to be confined to one auditorium; all the schools should hear, and they could do so by radio.

"The rural school, the one-room school with a single teacher, however, is where the biggest benefit will be derived, I think. Those schools often have to abandon certain subjects because the teachers are not able to teach them. Radio lessons could be received on special subjects of that kind, and the radio might even replace the teacher if he or she should be ill for a time.

FRENCH BY RADIO

Paris, April 7 — A lesson in French was broadcasted by radio from Eiffel Tower for the benefit of 2,000 London children who were "listening in" in a school auditorium.

"But don't think that radio will displace the teacher altogether," Mr. Burnham added quickly. "Some of them have seemed worried about it. It cannot do so. The teacher is a vital part of the school; the personal contact never can be dispensed with.

"This is how it seems to me—the rural schools will benefit most by radio lessons, while the cities can use radio to best effect in administration work. The cities, however, must take the lead in developing both uses, and must give freely of their talent."

The accounting lesson that was broadcast consisted of six problems of various types, such as would be met in business offices and school accounting. Each pupil used a Dalton adding and calculating machine, in the operation of which the school gives instruction.

The problems included addition, subtraction, multiplication and division, in such forms as the drawing of a trial balance, the balancing of a customer's account, the calculating of an invoice, including percentage discounts, and similar operations, some of them based on the books of the school bank and lunch room.

Mr. Leyenberger had a pupil at his side in the broadcasting studio, and timed his lesson by his work. Those who followed the problems with pencil and paper were surprised at the

This was one of the experiments that pointed to the possibilities of schoolroom use of radio. It is an installation of a loud speaker in the Piedmont High School at Oakland, Cal. The system is connected with a telephone in the principal's office, and enables that gentleman to address all classes simultaneously

The first radio-instructed student body. This is H. W. Leyenberger's class in machine accounting, working out the problems dictated by him through WJZ. At the left are four stenography students improving the opportunity by practising taking dictation

speed with which the work was done.

"The pupils received the problem perfectly," said Mr. Leyenberger. "In fact, they caught me in an error. I read one of the figures wrong, and at the school when the whole class got a different answer to that problem we thought at first that they had all made a mistake. It was entirely my error in reading, and I think that many people who watched the test, including the newspapermen, felt that that proved, more than anything else, the perfection of the method.

"What we want to do next is to hold an inter-high school stenography contest, and then a typewriting contest. The possibilities of shorthand instruction by radio are great. You know that after the preliminary instruction almost all the work in teaching shorthand is nothing but dictation in order to get up speed. A lot of valuable teacher time is consumed in dictation in that way. That dictation could go by radio. I think it ought to go by radio, and I hope it will, soon. That is possibly the only case in which radio will cut down the need for a teacher in the schoolroom."

And now a word about the Haaren High School. It is operated, in its upper grades, along the co-operative plan first developed by Dean Schneider of the University of Cincinnati. Pupils spend half their time in the school, and the other half outside in business positions, thus combining instruction with practice. Two pupils, called a "team," hold one position, each working in it every other week. This is the system that is spreading over the country, more and more institutions of the progressive type adopting it.

Has the school once again taken the lead, this time through experimenting with broadcast instruction?

It has.

Mark down April 4, 1923, in the history of radio broadcasting and of modern education.

Prison Contributors

ACKNOWLEDGMENT is made to the following persons, on behalf of Mrs. Maud Ballington Booth, for contributions for the purpose of supplying radio equipment to prisons. The sum realized to date is sufficient to supply a loud speaker to Dannemora prison at Clinton, N. Y., which has a receiving set but no means of making it audible to any large number of prisoners. A description of this installation will be printed in an early issue of THE WIRELESS AGE.

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New Aid for Foreign Trade

WHAT is possibly the first use of radio broadcasting for the furtherance of international trade was noted recently in San Francisco when Station KFDB began transmitting messages for the foreign trade department of the San Francisco Chamber of Commerce. Every Thursday afternoon a foreign trade specialist discusses a subject relating to some phase of San Francisco's export trade. As the station is heard not only in the United States, but also in Mexico and in the islands of the Pacific, the new program is regarded as possessing considerable commercial importance. In fact the directors of the San Francisco Chamber of Commerce have passed a resolution advocating that countries bordering on the Pacific should permit the use of their government radio stations for the transmission of news reports, when such service is not provided by private companies.

Radio Church Incorporated

THE Radio Church of America has been incorporated in California, as a non-sectarian and non-denominational church broadcasting organization. The complete plans of the radio church have not been disclosed.

"THERE was only one way to pay a universal tribute to 'Home Sweet Home,' and that was to sing it into the homes by radio."

Said

Frieda Hempel

Jenny Lind's Successor, to Paul S. Gautier

Frieda Hempel at home

FRIEDA HEMPEL celebrated the 100th anniversary of the first singing of "Home, Sweet Home" by broadcasting it over the radio telephone on May 8th. Just a hundred years before, on May 8, 1823, a first-night audience at the Royal Theater, London, heard the heroine of "Clari, or the Maid of Milan" sing the simple melody. It was the great moment of the evening.

Only this song has served to bring the name of the opera down the corridors of those hundred years; the opera written by Sir Henry Rowley Bishop, with John Howard Payne as the librettist. Even so, few indeed have heard of "Clari." Most people know no more of the immortal song than is contained within its own lines—lines which, in truth, tell all that could be wished, and sometimes more than heart can stand.

"It was glorious to sing 'Home, Sweet Home' to all those people," exclaimed Miss Hempel, "and so wonderful, it scarcely seems that it could have been true! Just think of it—nearly a million people were listening to me, and deep down in every heart, the song, I knew, meant something dear, something lovable, sheltering and secure. I felt that I was singing to each of them, personally. But I wished that I could have looked into their faces. That I heard no applause made no difference, but I did miss the quick inspiring response of my listeners, the glow in their faces that always greets the first notes of 'Home, Sweet Home.'

Miss Hempel and the reporter sat together in her beautiful music room, on the eighth floor of an apartment house, overlooking Central Park. She saw her visitor's eye admiring the view and the artistic room as well.

"Do you wonder that I get lonely for my own home?" Miss Hempel asked, rather wistfully. "And I have so little time in it, really. Many times I have traveled all night just to spend a single day here with my pets and the things I love, just to be *home*. And then after a happy day I would have to get back on another train and travel for another night, to keep a concert date. Of course that isn't often possible, for many of my engagements are too far away."

"Do you often sing 'Home Sweet Home' at your concerts?" she was asked.

"Not *often*," answered the singer, with a strong emphasis on the word, "but *always*. I have also sung it many times at the Metropolitan Opera House in New York. You know in the 'Barber of Seville' and in 'The Daughter of the Regiment' there is a singing lesson scene. I interpolate some big aria in each of these, but for the encore, the only thing that seems just right is 'Home, Sweet Home.' I have so many requests for it in my own recitals, that I always give it as an encore; and it is a program number in my Jenny Lind Concerts, because it was one of her most beloved songs."

Miss Hempel was chosen to impersonate Jenny Lind at the Historical Centennial Concert on October 6, 1920, the 100th anniversary of the birth of the Swedish Nightingale, because her voice and her personality resemble so strongly those of the famous singer. Since the great success of that first impersonation, Miss Hempel has devoted herself to the Jenny Lind concerts, of which she has given more than 100, or more than Jenny Lind herself gave in this country. And she is already "booked solid" for these unique recitals until 1925.

"Perhaps this will interest you," said Miss Hempel, handing the interviewer a program of one of the original concerts given by Jenny Lind. The paper was yellowed with age. Ornate but nevertheless charming scrolls marked the page headed: "Home, Sweet Home, from the Opera of Clari, or the Maid of Milan, sung by Md'slle Jenny Lind; composed by Bishop."

Then the attention turned to an old copy of the song in the form of an arrangement for piano and voice, dating from the same period. This stood on the piano. Its cover shows a picture of a "lowly thatched cottage," with a wicker bird cage hanging outside its window, shadowed by tall trees: and old-fashioned hollyhocks at the gate. A young mother, holding her little daughter, is sitting on a low bench; the father bends over them—truly, "a charm from the skies seems to hallow them there."

"Another one of my Jenny Lind relics," explained the singer. "People are so kind and good to me, everywhere I give the Jenny Lind concerts. They bring me their most cherished treasures. For instance, after the concert in Providence, a charming lady brought me a letter that Jenny Lind had written to her grandfather, thanking him for a bird he had given her. When I had read it, I handed the precious bit of paper back, but she wouldn't take it. She said she had brought it at first just to show it to me, but after hearing me sing Jenny Lind's own songs, she felt that it belonged to me. . . . It is so touching, sometimes. I can find no words to thank them."

If the givers of those gifts saw her delight in them, and reverence, too, as they must have, certainly they were thus better thanked than in mere words.

In those cities in which Jenny Lind herself sang, Miss Hempel's concerts are given special emphasis. Usually some attempt is made to reproduce all the incidents of Jenny Lind's visit, as far as they are known, or as is possible. A particularly successful concert of this kind was staged in Springfield, Mass., with children in the costumes of 1852, and a coach and four to carry Miss Hempel to the hotel.

Children and grandchildren of people who heard the Swedish Nightingale came to hear her modern successor. Mr. Bennett, grandson of Col. William Ross, the man who paid P. T. Barnum $653 for a ticket at one of the showman's auctions, was one of the Springfield audience, as was Col. Ross's great granddaughter. It is known that after spending all that money for the ticket, Col. Ross did not go to the concert—"and I have written his grandson, Mr.

(*Continued on page* 42)

The Joy That Lives in Radio

How Singing in the Broadcasting Studio Gives Deep Satisfaction to the Artist

By

Florence MacBeth

I NEVER imagined that I could derive such joy from singing to an invisible audience. At first I thought when I was asked to radio my songs that it was a waste of energy, that nobody would hear my voice as I like it heard. And then, too, people told me I was cheapening myself by doing so.

These mistaken ideas were dispelled by my first broadcasting experience, at the station of the Kansas City *Star*, WDAF. From every quarter of the country letters poured in from radio worshippers telling me what joy they had experienced as they had listened to my voice. And instead of finding that the radio enthusiast was confined to one class, I discovered listeners in all. From every walk of life, from drawing room and attic, came messages of pleasure; and I was proud to read the expressions which denoted an intimate knowledge of the famous masterpieces of music. Since that time I have lost no opportunity to sing over the radio to the countless thousands of admirers, many of whom live in remote places and thus have little or no opportunity to listen to life's greatest blessing, the music of the human voice.

I have been endowed with a beautiful voice. Why should I not give it at every opportunity to my people? Although it is the basis of my profession, the means of my livelihood, I would be selfish if I did not give it to those whom circumstances prevent from enjoying it in the normal routine of life.

And what do you think is the happiest thought of all? To think that I am singing to as many children as adults, to know that I am inculcating in the heart of youth a love of man's greatest blessing—music.

I love to sing to children. What would I not have given for the blessing of radio when I was a little girl! I was brought up in a country town. Then, as now, the world's famous artists seldom left the beaten track so that I could hear them. Only once, when I was three years old, when Marie Tempest came to Mankato and I prevailed upon my parents to let me accompany them to the theater did I have the opportunity, and that single hearing gave birth to my life's ambition.

Florence MacBeth

Not a child but has lying dormant within its being a deep love of the finer things in life. Not a child but whose eyes brighten at the sound of music. Every childish mind is hungry for knowledge beyond its years and its experience. You and I have noticed time and time again the breathless attention of a child who is hearing or seeing something for the first time. And I know I was no exception.

If I were asked to outline a radio program, I should give greater thought to the children's needs than to the needs of adults. The latter seek chiefly amusement, recreation, something to pass the time, something to link their past with the present, the awakening of memory.

But the child seeks always the unknown, the unlearned, the mysterious, the marvelous unfolding of the countless wonders of life. And so I should make up every program with a little fairy story, a little elementary science, some historical episode, some music with a lullaby and the life story of some once poor boy or girl but now successful adult. The first to feed the imagination, the second to impart necessary knowledge, the third to inculcate true patriotism, the fourth to develop the finest gift of life and the last to awaken and foster ambition.

To me, the discovery of *radiability*—if I may coin a word—and the inventions making radio operation possible, are the most wonderful things of all times. No discovery or invention ever approached these in utility or benefit to mankind. Nothing the world has previously known ever contained or had such far-reaching possibilities. I marvel when I think of it. To me, it seems but to emphasize how able the human race is and yet how weak, how helpless; for if only after thousands of years has this wonderful thing (of which we never had the slightest conception) been revealed to us, how many more must there be, still to be revealed!

None can foresee the extent of the development which will take place during the next decade; but if in the present stage all who can will play their part in using radio for the well-being of others, then the world will just be that much better for its discovery.

I, for my part, feel radio to be a great medium for good, and so, my dear radio enthusiast, believe me, my services are always yours, not alone because of the happiness that service to my fellow-man brings me, nor because of the joy I experience in sending my voice across the ether to the untold invisible thousands who listen-in, but because I am proud to play my part in the affairs of men and matters.

The story of Florence MacBeth is one that could profitably be used as an inspiration to aspiring youth, for after several years of musical study following her childhood in Mankato, Minn., where she was born, she leaped from comparative obscurity to international fame in a single hour.

One afternoon eight years ago she was in London having a lesson with that eminent vocal pedagogue of international fame, Yeatman Griffith, with whom she had studied successively in America, Italy, Holland and England. A well-known critic called at Griffith's studio, and listening, he was impressed by the exceptional beauty and range of her voice and asked if she would mind singing to a few of his fellow critics.

Next day, at the historic Queens Hall, a slip of a girl timidly stepped out on the platform whereon had stood her renowned predecessors and, to the astonishment of a score of England's greatest critics, sang with startling precision and beauty, the most difficult pieces known to the vocal world. "Not since the advent of the immortal Patti had such a voice been heard. It is," they said, "a voice that will one day have the world in homage."

The news traveled quickly and within a few days a number of the world's most famous operatic impresarios laid seige for a contract. It was the late Cleofonte Campanini who won and within a few months the little American girl made conquest of her home country in the ranks of the Chicago Opera Company.

"I HAVE a feeling of great responsibility when I sing in a radio studio; I feel that I must do extra well for all the millions who listen"

Louise Stallings

Which Is Why

Louise Stallings

Made Such a Hit by Radio, Says Edwin Hall

"WHEN I am in a broadcasting studio I have a feeling of great responsibility," said Louise Stallings, lyric mezzo soprano. "I feel that I must do my best, my very best, for all the millions of people who may be listening to me out there.

"It is quite different from singing from a concert platform, where you can see all the people who can hear you.

"I have never felt as nervous on the stage as I did the first time I sang for the radio, because as I said, I felt that tremendous sense of responsibility. It was as if I had to do my best, and more than that, do something much better, to give all these people pleasure.

"Unadulterated Voice"

"I knew that my audience was scattered everywhere, and that I could only break through their environments with my voice. That was all I had to give by radio. It was my voice that people judge me by. But you know after all there is some support, perhaps not much, but certainly some, from such things as the crowd spirit when people are gathered together in a hall. Then the stage decorations must have some effect. The setting has some effect on the audience present in person, as well as the voice, but by radio the voice alone is heard. It has to be just pure unadulterated voice."

Miss Stallings is a rather tall and slim American girl. She sat back in her New York music room, her wraps at her side, ready to dash to the Metropolitan Opera for one of its last performances of the season.

"But how about the mechanism of broadcasting, the microphone?" she was asked. "Were you worried lest the transmitter might do something terrible to your voice, so that the listeners wouldn't hear it as it really is?"

"No, I can't say that I thought much about it. I really think that my experience with the phonograph gave me a great deal of confidence that my voice would be reproduced well. Some years ago the Columbia people made some test records of my voice, to see how it reproduced, and it was a great success.

"I was really surprised to hear how well it sounded. It seemed much rounder and fuller than I had supposed it would be, and sounded more like Schumann-Heink's than mine! So somehow I was not afraid that the radio would maltreat it. It seems to me that a voice to reproduce well must have a great deal of *legato*."

Many Letters

Perhaps it was because of her feeling of responsibility and knowledge of what was required, as well as because of the beauty of her voice, that Miss Stallings made such a hit the night she sang in one of the Ampico Distinguished Artist concerts.

Of course by "hit" is meant that she received many letters, such being the only way that a radio audience can applaud.

It was rather remarkable, in fact, that she made such an impression as she did that night, for she sang on almost a moment's notice, without previous preparation, having been called in at 8:50 p. m. to replace another singer who was indisposed.

She had been given no chance to prepare a program, her name had not been printed in the newspapers, and the public was not expecting her.

But she rose to the occasion quickly, rushed to the studio, sang one song with a reproducing piano accompaniment in order to give her pianist time to arrive, and then proceeded with some of the modern English and French songs that are on her repertoire.

French Canadians Applaud

Strangely enough, the French songs were the ones that drew forth the most enthusiastic letters. Nearly fifty were sent her from French Canadians alone, and one of them was written entirely in French. Her name not having been printed in advance in any program, the writers made all sorts of mistakes (one even wrote it "Darling"), but the songs were recognized perfectly.

How well the French ones were done is evident from the belief of the Canadians that she is French.

Quite a tribute, that.

"Unfortunately I couldn't reply in French to all those nice letters," Miss Stallings said regretfully. "Some of them were from important people, apparently. Several were written on bank letterheads, in Toronto and Montreal, and others on steamship and other business stationery. There was only one letter written by an illiterate.

"The songs I sang in French were all modern. I don't just remember now exactly what ones I sang, but some were by Dubois, and by Pierné.

"I think that makes the appreciation of the Canadians even more remarkable. If they had heard some of the old French folk songs it wouldn't have been so interesting, because you can expect the French to respond to them, but the modern songs are not so well known and not so popular, except among music lovers. So I imagined that all the French Canadian musicians and music lovers must listen to the radio.

A Sense of Unity

"It is such a tremendous thing, don't you think? It gives one such a sense of unity, unites so many different people. When I listen to the radio I lose all sense of space, it is as it the speaker or singer were right in the room with me—and just think, he may be away off, hundreds of miles distant, maybe thousands! That is the great thing about radio, and I think there is just one other—the children.

"I like to know how all the children listen who can. It means so much to them in education, without their knowing it. It is like a school for them, one that they are eager to attend. I really think that the children benefit more from radio than anybody else."

Composers and Publishers Cut Programmes

(*Continued from page* 31)

action of the Society, which was keeping off the air their plays and the musical hits of their plays. The managers contend that their contracts give them sole producing rights to the music used in their plays, and that all popular music, with hardly any exceptions, appears first on the stage. In popularizing a play, and consequently its music, the managers want the freest possible public playing of it, by radio, in cafés, and in motion picture theaters. They claim that the Society is selling what it does not possess.

Keeping this music off the air, therefore, precipitated a situation all the elements of which had been present for some time, except the all-important one of keen popular concern. Broadcasting furnished the latter.

Coöperation between these various interests is being worked out. Representatives of the Producing Managers' Association and the Motion Picture Theatre Owners of America are known to have been in conference; likewise the café and restaurant people are showing their interest; and an organization of broadcasting stations, the National Association of Broadcasters, is considering ways and means of coöperating.

The latter organization is a new one, having been formed April 25, at Chicago, and consists of a number of broadcasters in the Middle West and elsewhere. It was the ban on popular music that brought them together. Two days were devoted to sessions during which an organization was perfected, representatives of the American Society of Composers, Authors and Publishers heard, and a decision reached not to listen to the demands of that body.

Their position is that as they are not operating for profit, broadcasting of copyright works does not violate the law nor the rights, if any, of the Society or its members.

The organizers of the National Association of Broadcasters were the following stations: WDAP, WMAQ, WJAZ, WSY, WLAG, WJAS, WJAN, WOC, WGR, WWP, WTAS, WLW, WEAB, WGI and WPAD. Thorne Donnelly of Chicago is chairman of the executive committee.

During the Chicago conference Wendell Hall, a composer, spoke in support of the contention that broadcasting is to the advantage of author and publisher. He told of popularizing a song by radio, how the sales grew, and how a number that had had no great popularity finally made money when played and sung from broadcasting stations, so that the public had a chance to hear it.

There the matter rests as this issue goes to press. What the outcome will be cannot be prophesied, but it is certain that the Society has a fight ahead of it. It is faced with popular outcry, with the more or less combined forces of the theatre managers, movie houses, restaurants; and the active opposition of a section, at least, of the broadcasting stations.

Meantime, some stations are transmitting popular music, and some are not.

The loss, apparently, is the Society's.

Frieda Hempel

(*Continued from page* 39)

Bennett, to find out if he knows why," declared Miss Hempel.

"I have heard a great deal about the old concerts and the old songs," she went on, "but most of all how wonderfully Jenny Lind always sang 'Home, Sweet Home.' I have heard a great deal lately, too, about the writer of that song. John Howard Payne must have been a dozen different people, if half the stories are true. But I am glad that many of them are not. He was not a 'hungry, tattered tramp beneath a lamp post,' or a 'forlorn, homeless wanderer,' or anything of the kind.

"Even as a boy he showed great brilliancy and talent. He was born in New York, by the way. At 18, he achieved great success on the stage, and at 22, at the height of his popularity, he sailed for Europe, where he traveled for twenty years, as actor, manager, and dramatist, always with success.

"There are many versions of how he wrote his most famous song." Miss Hempel picked up a copy of Gabriel Harrison's Biography of John Howard Payne, and finding the desired page, passed the book over. "Here is Payne's own story of it." This is the way it reads:

I first heard the song in Italy. One beautiful morning as I was strolling alone amid some delightful scenery, my attention was arrested by the sweet voice of a peasant girl who was carrying a basket laden with flowers and vegetables. This plaintive air she trilled with so much sweetness and simplicity that the melody at once caught my fancy. I accosted her, and, after a few moments' conversation, I asked for the name of the song, which she could not give me, but having some knowledge of music myself, barely enough for the purpose, I requested her to repeat the air, which she did, while I jotted down the notes as best I could. It was this air that suggested the words of "Home, Sweet Home," both of which I sent to Bishop at the time I was preparing the opera. Bishop happened to know the air well, and adapted the music to the words.

"Adapted the music to the words!" echoed Miss Hempel. "No wonder the music is beautiful. I wonder if John Howard Payne knew, if Bishop knew, that they had written the greatest song in the world. It is the greatest because it is the most beloved. 'Home, Sweet Home' is the most appealing song in the language; it is the song of songs for everyone, rich or poor, famous or friendless, sheltered or homeless. It is an universal song—it belongs to everyone, and its centenary has brought forth an universal celebration.

"In the centenary celebration I wanted to pay my tribute to it by singing it to everyone, and there was only one way to do that—by radio. In no other way could I reach so many people, and in their homes. It was just the ideal thing.

"They tell me that the radio waves penetrate everything; that they are darting through this room this very minute." . . . She took a wondering look about her. . . . "Through our bodies, through our hearts, even. . . . The radio is like the song—it knows no barriers, it carries its message everywhere."

Two More G-E Stations

TWO more powerful broadcasting stations are to be erected by the General Electric Company, both of them of the same type as that of the very successful station at Schenectady, WGY. One of the new stations will be located near San Francisco, but the home of the second one has not been determined. It will be in some city in the interior of the country, however, probably at Denver, Col. Martin P. Rice, Director of Broadcasting for the General Electric Company, and Harry Sadenwater, who is in charge of the technical operation of the General Electric Broadcasting Stations, recently returned from a trip to the coast, and are known to have investigated the availability of sites not only in San Francisco and across the bay from it, in Oakland, but also in Denver and Dallas.

Italy Is Dubious

RADIO broadcasting is not heard in Italy except from across her borders, and a project for establishing a broadcasting station in Rome is being regarded rather dubiously. The government is understood to view the plan favorably, but would impose a tax on each receiving set and it is considered doubtful whether enough Italians would purchase sets and pay the tax to make it worth while to broadcast to them.

The Enemies of Sleep at WDAF

the Kansas City *Star's* Nighthawks

By John Patt
(Radio Dept., Kansas City *Star*)

Oh! Here we are—The Nighthawks in full session. The Merry Old Chief (left) is seen at the microphone with the Professor, Carlton Coon of the Coon-Sanders orchestra (right) initiating the new members

"TUNE in for WDAF, The Kansas City *Star's* Nighthawk's, the Enemies of Sleep."

That is the announcement eagerly awaited by thousands of radio fans each evening. It is the voice of the "Merry Old Chief," Leo Fitzpatrick, chief nighthawk of the flock whose radio sets are their wings.

Of all the 500-odd broadcasters in the country, the Kansas City *Star* claims to be second in installing one of the well-known 500-watt transmitters, and the first of them to begin broadcasting on a regular schedule. Trial experiments were made early in February of 1922 through the makeshift apparatus of the Western Radio Company of Kansas City. Common telephone transmitters were used, the sound currents being sent over special telephone cables to WOQ, and thence to the then thinly-scattered audience.

Realizing the vast field before it, the *Star* applied for and secured a land commercial radio license. Plans were drawn up for a new radio studio, operating and motor generating rooms, and reception facilities. Work was carried on rapidly and the call letters, WDAF, granted.

After several tests, WDAF was ready, and the *Star* officially took the air on June 5, 1922, with a dedication to the people of the Middle West. Regular concerts were given on Monday, Wednesday, and Friday nights, and it was a source of pride to note that the programs were arranged and presented almost entirely by the people of Kansas City. In addition to local talent, news bulletins were put on the air. From its news services, the *Star* was able to broadcast the baseball scores in the major leagues and the American Association each afternoon during the entire 1922 baseball season, at intervals of one-half hour. The world's series was broadcast, play by play.

Also, many celebrities, some of international renown, have appeared. Among them are William Jennings Bryan, who spoke twice from WDAF, Mme. Schumann-Heink, Cecil Arden, Jack Dempsey, Ed "Strangler" Lewis, Yvon D'Arle, Titta Ruffo, Governor Henry J. Allen, and many others. Monday evening has been set aside for popular music, Wednesday for classical, and Friday for novelties.

Leo J. Fitzpatrick, radio editor of the Kansas City "Star," snapped in action. He is more familiarly known as the Merry Old Chief of the Nighthawks. Here he is caught singing—one of his many accomplishments

Situated in Kansas City, Mo., in the heart of America, at about the center of the continent, WDAF has enjoyed every physical advantage that location could offer, and has made the most of it, as is proved by the reports of reception at great distances. WDAF is the only station so far inland that thus far has been heard in England, as reported by J. H. D. Ridley of London, in THE WIRELESS AGE. Also, A. E. Berlyn heard WDAF on January 11th in Birmingham, England.

Hawaii, Cuba and Porto Rico are nightly represented in radio audience. There have been over two hundred letters from these dependencies alone. In Hawaii there have been any number of favorable reports, among them A. F. Costa, postmaster of Wailuku, who rates the station among the California stations in respect to clearness. Two letters report that Alaska has heard WDAF many times. Every province of Canada, every state in the United States, every part of Mexico, every country of Central America, all are represented in WDAF's records of its invisible audience, in the form of telegram, letter, post card, or personal call.

There is nothing unusual in the transmitter. It is a standard Western-Electric 500-watt installation, whose main claim to fame is its radiation. It puts from 9 to 11 amperes into the antenna.

Probably the most interesting thing about WDAF is its practice of broadcasting from all over town. In all the large places of entertainment in Kansas City microphones have been in-

This is what happens when a fan writes WDAF that he has heard the Nighthawks—He gets a card like this

stalled for special programs. There are three microphones in the Newman Theatre, one each for the pipe organ, the concert orchestra, and the stage. Any one of these three can be cut in, depending on which form of theatre entertainment is in progress. At the Muehlebach Hotel are four microphones, two in the Plantation Grill Room (one for the "Merry Old Chief" and one for the Coon-Sanders Nighthawk orchestra); one in the Trianon room for Fritz Hanlein's Trianon Ensemble, whose music is broadcast on the School of the Air program; and one in the ballroom for special occasions. There is also a microphone in the Pompeiian Terrace room of the Baltimore Hotel, one in Convention Hall, and one in the Grand Avenue Temple.

On special occasions the *Star* has also broadcast from the Kansas State penitentiary at Lansing, the University of Kansas at Lawrence, the new half-million-dollar speedway at Dodson, the American Royal building, the new K. C. A. C. building, and many other places.

These remote-control events are all handled through a single board, centrally located, in a corner of the Grill Room of the Hotel Muehlebach. Here there is a small operating room, where an assistant operator is stationed. In this room has been placed an amplifying panel, to which run all the microphone lines throughout town. Any one of these may be cut in. The sound currents are here amplified and then sent by special telephone cables to the WDAF operating room on the third floor of the *Star* building. Here they are again amplified before going to the transmitter.

But, the Nighthawks. Who are they? What are they? Where? It was about them I first wrote. They are an organization of the listeners everywhere, and a direct result of transmission late at night. The radio editor of the *Star* had decided that best radio reception of distant stations was possible toward the midnight hour because there are few stations in the air at that time. For his midnight programs he chose the Hotel Muehlebach and the Coon-Sanders orchestra because they are the criterion of popular entertainment in Kansas City. He chose the name, "Nighthawks," and the unique style of initiation by banging a bell, because—well, that's where the people come in—the listeners themselves suggested name and all. Leo Fitzpatrick is a genial soul, and telegrams became so numerous and so humorous that they formed a basis for the merry old patter by the Merry Old Chief, as he was named.

The schedule of WDAF is as follows:
DAILY.
3:30 to 4:30 p. m. (Musical Matinee), concert by popular orchestra.
6 to 7 p. m. (School of the Air), Educational features.
8 to 9:30 p. m. (Evening concerts); Monday, popular; Wednesday, classical; Friday, novel.
11:45 p. m. to 1 a. m. (Nighthawk Frolic), Coon-Sanders orchestra at the Hotel Muehlebach.
SUNDAY.
4 to 5 p. m.—Band concert or religious program.

The radio staff and department of The Star:
Leo Fitzpatrick, editor and the "Merry Old Chief."
Robert M. Reed, ass't editor, program director, and reporter.
Don D. Johnson, chief engineer, operator, and expert.
John F. Patt, secretary, ass't announcer, and reporter.
Ernest R. Moorefield, announcer and reporter.
Don J. Phelps, ass't operator and announcer.
(Of course that isn't all they do—but that's enough.)

And now that we have told you the story of WDAF, it would not be fair if we didn't let you in on a big secret. Plans have been made and work is well under way on a big addition to the *Star* building which will house a modern radio department. A big, spacious studio, modern in every way, large reception facilities, and operating and laboratory rooms, will be located on the third floor. Rising from the roof for 200 feet will be immense towers for a big antenna. The new facilities will make the station better than ever.

Regularly at a little after one in the morning, the Merry Old Chief says, "Well, well, well, well, well, brother and sister Nighthawks, that will complete our session for tonight. Tune in at 11:45 tomorrow night for our regular Nighthawk frolic. This is WDAF (chimes), the Kansas City *Star's* Nighthawks, the Enemies of Sleep, signing off. Mr. Phelps, call a taxi and Mr. Johnson, shut off the juice, and let's all go home. Nighty-night."

French Night at WBZ

STATION WBZ, Springfield, Mass., gave a French night on April 11th, when the staff of CKAC, the broadcasting station of *La Presse* of Montreal, and a number of French artists visited Springfield. The station was turned over to the French and Canadian visitors for the evening under the management of J. M. Cartier, the CKAC manager, who made all the announcements in both French and English. The artists included H. Maurice Jacquet, pianist, a composer of note and director of the Opera Comique of Paris; his wife Andrée-Amalou Jacquet, who is considered the best harpist of France, having won the Grand Prize, a very beautiful harp which she brought with her to Springfield. Other artists in the concert group were: Albert C. Chamberland, violin; Yvette Lamontagne, 'cello; Blanche Gonthier, coloratura soprano; Marie Anne Asseling, mezzo soprano; Jose Delaquerriere, tenor; Aldea Lussier, accompanist; J. M. Cartier and George Wendt. This program created unusual interest throughout New England, especially among the French Canadians, of whom numbers live in the territory served by WBZ.

Ford Has Four Radio Stations

ONE of the most extensive American industrial companies making use of radio, both telegraph and telephone, for private communication among its plants is the Ford Motor Co. It has four transmitting stations at as many of its plants. KDEN is the Dearborn plant, WNA that at Springfield, O. WFD is Flat Rock, Mich., and KDEP is Northville, Mich. The Dearborn station also is licensed as WWI for broadcasting, and as an experimental station as 8XD. The Ford company has been employing radio for interplant messages since 1920. At first voice was used exclusively, and subsequently code was added. The stations are in continuous operation from 7:45 A. M. to 5:15 P. M. Comparatively little broadcasting has been done.

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?

WM. E. TAYLOR and F. WILKENS, Bolivar, Pa., writes: "I have heard since Feb. 6th, 112 stations, 31 states, 4 Canadian provinces, 2 in Cuba, and every amateur district except the sixth and seventh." He uses a single circuit tuner with one step of amplification, of his own construction.

KHJ	Los Angeles, Cal.	2,200 Miles
KDZF	Los Angeles, Cal.	2,200 Miles
KWH	Los Angeles, Cal.	2,200 Miles
KFI	Los Angeles, Cal.	2,200 Miles
KGW	Portland, Ore.	2,100 Miles
CFCN	Calgary, Alta., Can.	1,800 Miles
CJCG	Winnipeg, Man., Can.	1,100 Miles
PWX	Havana, Cuba	1,300 Miles
KFAF	Denver, Colo.	1,400 Miles
KLZ	Denver, Colo.	1,400 Miles
WBAP	Fort Worth, Tex.	1,100 Miles
WPA	Fort Worth, Tex.	1,100 Miles
WOAI	San Antonio, Tex.	1,150 Miles
WFAA	Dallas, Tex.	1,100 Miles
WAAC	New Orleans, La.	1,000 Miles
WKY	Oklahoma City, Okla.	1,100 Miles
WDAV	Muskogee, Okla.	1,000 Miles

C. E. MOCK, Le Mars, Ia., is entirely too modest about his list of stations heard. His letter apologizes for the performance of his home-made regenerative set—but as he says himself, "it's as good as some." In fact, it's better than many. Here is just a part of his list:

WGY	Schenectady, N. Y.	1,000 Miles
WMD	Auburn, Me.	1,350 Miles
WOAI	San Antonio, Tex.	1,000 Miles
WCAR	San Antonio, Tex.	1,000 Miles
WOO	Philadelphia, Pa.	1,000 Miles
WEAF	New York City	1,000 Miles

STELLARIO MARCHESE, Brooklyn, N. Y., has no trouble in picking up PWX, Havana, Cuba, nightly, as well as a number of other nearer stations, including WNAC, Boston, Mass.; WOC, Davenport, Ia.; WGY, Schenectady, N. Y., and WSB, Atlanta, Ga. Havana is about 1,200 miles distant. Marchese uses a standard regenerative set.

ROBERT GOLDENSON, Pittshurgh, Pa., has a special hook-up of his own. with which he has heard California on one tube. He hss a list of 78 stations in all, of which the more distant ones are:

KHJ	Los Angeles, Cal.	2,300 Miles
KLZ	Denver, Colo.	1,380 Miles
PWX	Havana Cuba	1,200 Miles
WBAP	Fort Worth, Tex.	1,150 Miles
WPA	Fort Worth, Tex.	1,150 Miles
WMAM	Beaumont, Tex.	1,150 Miles
WFAA	Dallas, Tex.	1,125 Miles
WKAL	Orange, Tex.	1,120 Miles
WKY	Oklahoma City, Okla.	1,050 Miles
WOAB	Grand Forks, N. D.	1,050 Miles
WIAF	New Orleans, La.	1,000 Miles
WFAV	Lincoln, Neh.	1,000 Miles
WAAZ	Emporia, Kans.	1,000 Miles

EARLE and HENRY OBERHOLTZ, Kansas City, Mo., use a loop antenna with three steps of radio frequency and one stage of audio frequency amplification. In spite of the operation of WDAF locally, they have been able to hear the following:

WGY	Schenectady, N. Y.	1,100 Miles
KWH	Los Angeles, Cal.	1,350 Miles
KFI	Los Angeles, Cal.	1,350 Miles

UBLIN PAGE, JR., Salem, Ore., who is 14 years old, keeps a log of stations heard; so far there are 134 different broadcasters listed in his log, from 26 states and 5 Canadian provinces. He uses one stage of audio frequency.

WOR	Newark, N. J.	2,250 Miles
WHAZ	Troy, N. Y.	2,200 Miles
WGY	Schenectady, N. Y.	2,175 Miles
CFCA	Toronto, Can.	2,100 Miles
KDKA	Pittsburgh, Pa.	2,000 Miles
WCAE	Pittsburgh, Pa.	2,000 Miles
WSB	Atlanta, Ga.	2,000 Miles
WGM	Atlanta, Ga.	2,000 Miles
WGV	New Orleans, La.	1,950 Miles
WSY	Birmingham, Ala.	1,900 Miles
WLW	Cincinnati, O.	1,935 Miles
WJAX	Cleveland, O.	1,970 Miles
WWJ	Detroit, Mich.	1,800 Miles
WCX	Detroit, Mich.	1,800 Miles
KYW	Chicago, Ill.	1,650 Miles
WDAP	Chicago, Ill.	1,650 Miles
WAAF	Chicago, Ill.	1,650 Miles
WEAY	Houston, Tex.	1,625 Miles
WOAI	San Antonio, Tex.	1,600 Miles
WBAP	Fort Worth, Tex.	1,500 Miles
WFAA	Dallas, Tex.	1,515 Miles
WOC	Davenport, Ia.	1,430 Miles
KSD	St. Louis, Mo.	1,425 Miles
WLAG	Minneapolis, Minn.	1,420 Miles
CJCG	Winnipeg, Man.	1,420 Miles
WOS	Jefferson, Mo.	1,400 Miles
WHB	Kansas City, Mo.	1,200 Miles
WDAF	Kansas City, Mo.	1,200 Miles
WKY	Oklahoma City, Okla.	1,350 Miles

MELVIN H. DUNBACK, Everett, Mass., in sending a list of 14 stations heard over a distance of over a thousand miles, tells us that he had listened to 50 others within the thousand-mile radius.

PWX	Havana, Cuba	1,600 Miles
KHJ	Los Angeles, Cal.	2,800 Miles
KFI	Los Angeles, Cal.	2,800 Miles
KLZ	Denver, Colo.	1,900 Miles
KFAF	Denver, Colo.	1,900 Miles
WHB	Kansas City, Mo.	1,300 Miles
WDAF	Kansas City, Mo.	1,300 Miles
KSD	St. Louis, Mo.	1,100 Miles
WKY	Oklahoma City, Okla.	1,600 Miles
WMC	Memphis, Tenn.	1,200 Miles
WDAY	Fargo, N. D.	1,400 Miles
WBAP	Fort Worth, Tex.	1,700 Miles
WFAA	Dallas, Tex.	1,650 Miles
WOAW	Omaha, Neb.	1,400 Miles

DAN SCHANSZAG, Hubhard, O., joins the long list of distance fans with a list of which he is justly proud.

WPA	Fort Worth, Tex.	1,200 Miles
WOAI	San Antonio, Tex.	1,235 Miles
WBAP	Fort Worth, Tex.	1,200 Miles
WFAA	Dallas, Tex.	1,150 Miles
KFAF	Denver, Colo.	1,300 Miles
WDAE	Tampa, Fla.	1,000 Miles
WFAN	Port Arthur, Tex.	1,100 Miles
WRR	Dallas, Tex.	1,100 Miles
KHJ	Los Angeles, Cal.	2,035 Miles
PWX	Havana, Cuba	1,500 Miles
KDPU	Cascada, Cal.	2,100 Miles
KJJ	Sunnyvale, Cal.	2,200 Miles
KGO	Altadena, Cal.	2,000 Miles
WGAD	Ensenda, Porto Rico	2,500 Miles

HAROLD H. JONES, Tulare, Cal., writes an enthusiastic letter about the Aeriola Senior, which he uses "with what I feel are astonishing results." Though he has only about an hour in the early part of each evening to listen—he works every night on a morning newspaper—he has heard 52 stations, 10 of which were over 1,000 miles distant. His list follows:

PWX	Havana, Cuba	2,600 Miles
CFCB	Vancouver, Canada	1,000 Miles
KSD	St. Louis, Mo.	1,650 Miles
WDAF	Kansas City, Mo.	1,400 Miles
WFAA	Dallas, Tex.	1,325 Miles
WBAP	Fort Worth, Tex.	1,300 Miles
KFED	Polytechnic, Mont.	1,000 Miles
CFCN	Calgary, Canada	1,200 Miles

HAVING A GOOD TIME

—N. Y. American

CHBC Calgary, Canada ..... 1,200 Miles
CHCQ Calgary, Canada ..... 1,200 Miles

LEWIS HAAAISON, Barnesville, O., has a set with three stages of amplification, but reports that he is able to hear all stations in the following list on the detector alone, except KPO:

WGM	Atlanta, Ga.	1,000 Miles
WBAP	Fort Worth, Tex.	1,200 Miles
PWX	Havana, Cuha	1,600 Miles
WFAA	Dallas, Tex.	1,200 Miles
KHJ	Los Angeles, Cal.	2,300 Miles
WOAW	Omaha, Neh.	1,000 Miles
WAAP	Wichita, Kans.	1,200 Miles
KPO	San Francisco, Cal.	2,500 Miles

HAROLD PIKE, Fairgrove, Mich., has heen obtaining good results with his single tube regenerative set, using a Moorhead tube. He has listed 117 stations in 27 states, Canada and Cuha, and has heard 32 of them in a single night:

KHJ	Los Angeles, Cal.	2,075 Miles
KWH	Los Angeles, Cal.	2,075 Miles
KFI	Los Angeles, Cal.	2,075 Miles
PWX	Havana, Cuba	1,450 Miles
WHAB	Galveston, Tex.	1,200 Miles
WOAI	San Antonio, Tex.	1,280 Miles
KLZ	Denver, Col.	1,175 Miles
KFAF	Denver, Col.	1,175 Miles
DN4	Denver, Col.	1,175 Miles
WBAP	Ft. Worth, Tex.	1,050 Miles
WPA	Ft. Worth, Tex.	1,050 Miles
WFAA	Dallas, Tex.	1,040 Miles
WAAC	New Orleans, La.	1,000 Miles
WGV	New Orleans, La.	1,000 Miles

JAMES LANDWEHA, Jeffersonville, Ind., reports hearing 77 stations in twenty-seven states, using a single WD-11 tuhe.

PWX	Havana, Cuba	1,150 Miles
KHJ	Los Angeles, Cal.	1,900 Miles

ROBERT J. CORBIN and ROY C. BARTLETT, Thomas, Okla., have picked up 68 stations in twenty-four states, Canada and District of Colnmhia.

KFAB	Portland, Ore.	1,450 Miles
WEAF	New York, N. Y.	1,425 Miles
KFJ	Los Angeles, Cal.	1,075 Miles
KWH	Los Angeles, Cal.	1,075 Miles
KPO	San Francisco, Cal.	1,275 Miles
WDM	Washington, D. C.	1,235 Miles
WCAE	Pittsburgh, Pa.	1,075 Miles
WGY	Schenectady, N. Y.	1,400 Miles
WJAX	Cleveland, Ohio	1,000 Miles
CKCK	Regina, Sask., Canada	1,060 Miles

JOHN J. O'HAAE, St. Petersburg, Fla., is more interested in reports on hearing distant broadcasting than in anything else, and submits the following list as his best performance on a single tube:

WDAF	Kansas City, Mo.	1,500 Miles
WLW	Cincinnati, Ohio	1,600 Miles
KPO	San Francisco, Cal.	2,400 Miles

ERIC GUSTAFSON, Richmond Hill, L. I., N. Y., likes to read the broadcasting DX records and sends his in:

WOI	Ames, Iowa	1,100 Miles
WBAP	Ft. Worth, Tex.	1,400 Miles
KDYX	Honolulu, T. H.	5,600 Miles
PWX	Havana, Cuba	1,500 Miles

IRA ANDREW RAYMOND, Adel, Iowa, is fourteen years old and says, "I want to tell you of the enjoyment gotten out of a radio set which I made myself and of which I am very proud." Using a detector hulb only, he has heard:

WGY	Schenectady, N. Y.	1,000 Miles

T. R. MERIDETH, Mena, Ark., got his name in the Mena *Evening Star* recently by telling a reporter ahout the work of his receiving set. The head upon the article reads, "U. S. Is getting awfully small." Some of the distant stations that Mr. Merideth has heard are:

WGY	Schenectady, N. Y.	1,250 Miles
KHJ	Los Angeles, Cal.	1,400 Miles

ALVIN A. BURTON, Salem, Ore., uses a single circuit regenerative tuner with a dry hattery tube and has forty-nine stations on his log, the more distant ones being:

WWJ	Detroit, Mich.	2,000 Miles
WLX	Detroit, Mich.	2,000 Miles
KYW	Chicago, Ill.	1,775 Miles
KSD	St. Louis, Mo.	1,750 Miles
WOC	Davenport, Iowa	1,660 Miles
WFAA	Dallas, Tex.	1,650 Miles
WBAP	Ft. Worth, Tex.	1,625 Miles
WDAF	Kansas City, Mo.	1,500 Miles
WLAG	Minneapolis, Minn.	1,450 Miles

RICHARD JONES, Bay City, Mich., has a single circuit tuner, uses a C-301 tuhe as a detector and recently heard 23 stations in one evening. He is a 16-year-old high school boy who built his own set, including even the variable condenser.

KFI	Los Angeles, Cal.	2,200 Miles
KPO	San Francisco, Cal.	2,300 Miles
CHBC	Calgary, Canada	1,650 Miles
WCAK	Houston, Tex.	1,500 Miles
WBAP	Ft. Worth, Tex.	1,350 Miles
WWL	New Orleans, La.	1,150 Miles
WFY	Wichita, Kans.	1,035 Miles

Cartoonists of the New York *Mail* Show Their Radio Wit

SIMEON BATTS — **By HAENIGSEN**

—*N. Y. Mail*

SOMEBODY'S STENOGRAPHER—Perfectly Proper — **By HAYWARD**

—*N. Y. Mail*

PETEY—It's a Gift — **By C. A. VOIGHT**

—*N. Y. Mail*

OUR OWN WEEKLY RADIO RAVINGS — **By GOLDBERG**

—*N. Y. Mail*

Laughter on the Radio Wave

"H-I-C Announcing"

Now that the confusion in the air has been deconfuhscated by Hoover and every station has a fair chance to be heard, it is high time that the announcers were selected by their ability instead of just for their looks. This Whirl of Wit leads the way, as usual, with the first original and only gen-u-whine test for announcers. Let's go!

State initials, if any.....Why?.....
Give following particulars of your voice:
Age ..... Sex.....
Blonde or Brunette.....
Married or Single.....
What languages do you speak besides English, American, French, German, Italian, Spanish and Russian?.....
Name at least ten different musical instruments that you play, including piano, violin and mouth organ.....
Pronounce the following; and explain what each means:

Andante Cantabile	Fox Trot
Scherzo	Berceuse
Waltz	Tarantella
Paderewski	Caruso
O sole mio	Filet de Sole
Irving Berlin	Tschaikowsky
Ampico	Duo Art
Ich liebe dich	Je vous aime
Haasenpfeffer	Arroz con pollo
Victrola	Vocalion

Pronounce "The Sextette from Lucia" and then sing it, not more than two parts at a time.

Can you say: "We regret to announce that Madame Highbrowski has not arrived and instead the Black and Blue Jazzbos will play 'That Radio Rag'" and get real regret in your voice?

Admitted that your services are worth $1,000 a week, how much of that will you take in fame, how much in smiles from visiting artists, and how little in cash?

Broadcasting studios have padded walls. Have you ever been in any other place where the walls were padded? If so, how did you get out? Are they still looking for you?

How do you comb your hair? What is your favorite perfume? Do you snore, puff or grunt when slumbering between announcements? Or do you talk in your sleep?

What would you do if someone called you by telephone to say that the program was rotten? You would? Do you think the jury would call it first degree murder, or only justifiable homicide?

Our idea of a good sport is the fellow who thinks that the program was worth while after the station signs off and he discovers it wasn't a distant one, after all.

ODE TO DX

Backward! Turn backward,
Oh, Time, in thy flight!
Give me New Mexico
Just for tonight.

—*N. Y. Evening Mail.*

Whether the radio will multiply the chances for education, by broadcasting classroom lectures, is doubtful. But if Sir Arthur Quiller-Couch ever broadcasts his talks on literature we'll put in a radio instrument at once.

Wonder how many cuts a term the electric companies will allow the listening-in student?—F. P. A., *N. Y. World.*

Jake's Set

Dear Mister Editor:

Seeing on top o the paper how youre wantin us to write and say was we gettin the concerts I thought Id tell you I am an the same to you mister and I got my ole RC set hitched onto 4 wires a rod and a half long up into our attic and me an mwife set an lissen to em all an we hear em from the Atlantic to the Pacific and all in between only Los Angeles aint on the Pacific and I know it mister hut a feller here used to drive his auto awful quick to Springfield and thats 40 mile an say lissen mister the son of a gun he never started takin time so long as he could see our town and quit takin time so soon as he could see Springfield and if he could do that mister I guess I can call Los Angeles the Pacific coast an get chested up about bein one o these here now coast to coast guys like Im always readin about an we hear this Rosy Raisin girl singin opra up to Chicago an believe me mister you dont haf to add no yeast an sugar an water to that raisin and then you let it set 7 days to get a kick out of it cause Im tellin you mister her singins got the kick in it aready and me an mwife we set an lissen to the music and I say hell I dont believe it anyhow an we sure do enjoy all the music an talkin an evrything an we sure are much obliged mister so no more from your friend

Jake

FREAKS OF THE FUTURE

—*Philadelphia Bulletin*

Wise Crack-les

Many a station holds its audience because the listeners are trying out new circuits.

The fellow who used to look a gift horse in the mouth now criticizes the radio programs.

Motto for loud speakers: You can't tell an orator by the noise he makes.

B. P. C. makes this observation: "Have you noticed that the old-time kid that had a special talent for picking apples in other people's orchards now spends his time picking up radio programs on a 98-cent set?"

Too many of us ask "Who is it?" when we tune in, instead of "What is it?"

Some people buy a good tube and then hook it up with a toy set.

Now is the time to sell farms to city folk—they need space for their antennas.

Tune less and listen more, is a good rule to follow.

When the program manager only tries to kill time, the audience goes dead.

A man content with his present receiver never gets a better one.

Stations that won't broadcast what the public wants, can't.

If silence is golden, then a lot of home-made receiving sets must be worth more than their makers think.

The Ham What Am

Hudson Maxim spoke over the radio on the subject: "Shall Man or Bug Inhabit the Earth?"

I thought that radio amateurs were called "hams," not bugs.—O. M. Y.

BROADCASTING STATION DIRECTORY

(Revised to May 20th, 1923)

KAO	Young Men's Christian Association Denver, Co o.	360
KDN	Lee U. Meyerberg Co.....San Francisco, Calif.	360
KFI	E. C. Anthony.....Los Angeles, Calif.	468
KFV	Foster Bradbury Radio Store....Yakima, Wash.	360
KFZ	Doerr Mitchell Elec. Co.....Spokane, Wash.	360
KGB	Wm. A. Mullins Electric Co....Tacoma, Wash.	360
KGG	Hallock & Watson Radio Service.Portland, Ore.	360
KGN	Northwestern Radio Mfg. Co.....Portland, Ore.	360
KGD	Altadena Radio Laboratory....Altadena, Calif.	360
KGU	M. A. Mulrony.....Honolulu, Hawaii	360
KGW	Oregonian Pub. Co.....Portland, Ore.	492
KGY	St. Martins College.....Lacey, Wash.	258
KHJ	Times Mirror Co.....Los Angeles, Calif.	395
KHQ	Louis Wasmer.....Seattle, Wash.	360
KJJ	The Radio Shop.....Sunnyvale, Calif.	360
KJQ	C. O. Gould.....Stockton, Calif.	360
KJR	Vincent L. Kraft.....Seattle, Wash.	360
KJS	Bible Institute of Los Angeles, Inc., Los Angeles, Calif.	360
KLN	Noggle Electric Works.....Monterey, Calif.	360
KLS	Warner Brothers.....Oakland, Calif.	360
KLX	Tribune Publishing Co.....Oakland, Calif.	360
KLZ	Reynolds Radio Co.....Denver, Colo.	360
KMC	Lindsay-Weatherill & Co.....Readley, Calif.	360
KMJ	San Joaquin Light & Power Co...Fresno, Calif.	360
KMD	Love Electric Co.....Tacoma, Wash.	360
KNI	T. W. Smith.....Eureka, Calif.	360
KNJ	Roswell Public Service Co.....Roswell, N. M.	360
KNN	Bullock's.....Los Angeles, Calif.	360
KNT	Grays Harbor Radio Co.....Aberdeen, Wash.	263
KNV	Radio Supply Co.....Los Angeles, Calif.	360
KNX	Electric Lighting Supply Co...Los Angeles, Calif.	360
KDA	Y. M. C. A.....Denver, Colo.	360
KDB	New Mexico College of Agriculture and Mechanical Arts, State College, N. Mex.	360
KDP	Detroit Police Dept.....Detroit, Mich.	360
KDQ	Modesto Evening News.....Modesto, Calif.	360
KPD	Hale Bros.....San Francisco, Calif.	423
KQI	University of California.....Berkeley, Calif.	360
KQP	Apple City Radio Club.....Hood River, Ore.	360
KQV	Doubleday-Hill Electric Co.....Pittsburgh, Pa.	360
KQW	Charles D. Herreld.....San Jose, Calif.	360
KQY	Stubbs Electric Co.....Portland, Ore.	360
KRE	Maxwell Electric Co.....Berkeley, Calif.	360
KSD	Post-Dispatch.....St. Louis, Mo.	545
KSL	The Emporium.....San Francisco, Calif.	360
KSS	Frost & Dean Radio Rsch. Lab.Long Beach, Calif.	360
KTW	First Presbyterian Church.....Seattle, Wash.	360
KUD	The Examiner Printing Co....San Francisco, Cal.	360
KUS	City Dye Works & Laundry Co. Los Angeles, Cal.	360
KUY	Coast Radio Co.....Del Monte, Calif.	360
KWG	Portable Wireless Telephone Co...Stockton, Calif.	360
KWH	Los Angeles Examiner.....Los Angeles, Calif.	360
KXD	Herald Publishing Co.....Modesto, Calif.	360
KYI	Alfred Harrell.....Bakersfield, Calif.	360
KYJ	Leo J. Meyberg Co.....Los Angeles, Calif.	360
KYQ	Electric Shop.....Honolulu, T. H.	360
KYW	Westinghouse Elec. & Mfg. Co....Chicago, Ill.	345
KZM	Preston, D. Allan.....Oakland, Calif.	360
KZN	The Desert News.....Salt Lake City, Utah	360
KZV	Wenatchee Battary & Motor Co. Wenatchee, Wash.	360
KDKA	Westinghouse Elec. & Mfg. Co...Pittsburgh, Pa.	400
KDPM	Westinghouse Elec. & Mfg. Co...Cleveland, Ohio	270
KDPT	Southern Electric Co.....San Diego, Calif.	360
KDYL	Telegram Publishing Co....Salt Lake City, Utah	360
KDYM	Savoy Theatre.....San Diego, Calif.	360
KDYQ	Oregon Institute of Technology...Portland, Ore.	360
KDYS	The Tribune, Inc.....Great Falls, Mont.	360
KDYW	Smith, Hughes & Co.....Phoenix, Ariz.	360
KDYX	Star Bulletin Publishing Co.....Honolulu, T. H.	360
KDZB	Frank E. Siefart.....Bakersfield, Calif.	360
KDZE	The Rhodes Co.....Seattle, Wash.	360
KDZF	Automobile Club of So. Calif., Los Ange'es, Calif.	360
KDZG	Cyrus Pelree & Co.....San Francisco, Calif.	360
KDZH	Fresno Evening Herald.....Fresno, Calif.	360
KDZI	Electric Supply Co.....Wenatchee, Wash.	360
KDZK	Nevada Machinery & Electric Co....Reno, Nev.	360
KDZQ	Pyle & Nichols.....Denvar, Colo.	360
KDZR	Bellingham Publishing Co....Bellingham, Wash.	261
KDZT	Seattle Radio Association.....Seattle, Wash.	360
KDZU	Western Radio Corporation.....Denver, Colo.	360
KDZV	Cope & Cornwell Co.....Salt Lake City, Utah	360
KDZX	Olad Tidings Tabernacle....San Francisco, Calif.	360
KFAD	McArthur Brothers Mercantile Co.Phoenix, Ariz.	366
KFAE	State College of Washington.....Pullman, Wash.	360
KFAF	Western Radio Corporation.....Denver, Colo.	360
KFAJ	University of Colorado.....Boulder Colo.	360
KFAN	Electric Shop.....Moscow, Idaho	360
KFAP	Standard Publishing Co.....Butte, Mont.	360
KFAQ	City of San Jose.....San Jose, Calif.	360
KFAR	O. K. Olsen.....Hollywood, Calif.	360
KFAT	Dr. S. T. Donohue.....Eugene, Ore.	360
KFAU	Independent School District....Boise City, Idaho	360
KFAV	Abbott-Kinney Co.....Venice, Calif.	360
KFAW	The Radio Den, Ashford & White, Santa Anna, Calif.	360
KFAY	W. J. Virgin Milling Co.....Central Point, Ore.	360
KFAZ	C. H. Weatherall.....Reddley, Calif.	360
KFBB	F. A. Buttrey & Co.....Havre, Mont.	360
KFBC	W. K. Azhill.....San Diego, Calif.	360
KFBD	Clarence V. Welch.....Hanford, Calif.	360
KFBE	Reuben H. Horn.....San Luis Obispo, Calif.	360
KFBK	Kimball-Upson Co.....Sacramento, Calif.	360
KFBL	Leese Brothers.....Everett, Wash.	360
KFBS	Chronicle News and Gas & Elec. Supply Co., Trinidad, Colo.	360
KFBU	Bishop N. S. Thomas.....Laramie, Wyo.	360
KFCB	Nielsen Radio Supply Co.....Phoenix, Ariz.	360
KFCD	Salem Elec. Co.....Salem, Ore.	360
KFCF	Frank A. Moore.....Walla Walla, Wash.	360
KFCH	Electric Service Station.....Billings, Mont.	360
KFCK	Colorado Springs Radio Co., Coloredo Springs, Colo.	360
KFCL	Los Angeles Union Stock Yds..Los Angeles, Calif.	360
KFCM	Richmond Radio Shop.....Richmond, Calif.	360
KFCP	Ralph W. Flygare.....Ogden, Utah	360
KFCQ	Motor Service Station.....Casper, Wyo.	360
KFCV	Fred Mahaffey, Jr.....Houston, Tex.	360
KFCY	Western Union College.....Le Mars, Iowa	360
KFCZ	Omaha Central High School.....Omaha, Nebr.	360
KFDA	Adler's Music Store.....Baker, Ore.	360
KFDB	Mercantile Trust Co.....San Francisco, Calif.	509
KFDC	Radio Supply Co.....Spokane, Wash.	360
KFDD	St. Michaels Cathedral.....Boise, Idaho	360
KFDF	Wyoming Radio Corp.....Casper, Wyo.	360
KFDH	University of Arizona.....Tucson, Ariz.	360
KFDJ	Oregon Agri. College.....Corvallis, Ore.	360
KFDL	Knight-Campbell Music Co.....Denver, Colo.	360
KFDO	H. Everett Cutting.....Bozeman, Mont.	360
KFDP	Hawkeye Radio & Supply Co....Des Moines, Iowa	360
KFDR	Bullock's Hardware & Sporting Goods, York, Nebr.	360
KFDU	Nebraska Radio Elec. Co.....Lincoln, Nebr.	360
KFDV	Gilbrech & Stinson.....Fayetteville, Ark.	360
KFDX	First Baptist Church.....Shreveport, La.	360
KFDY	South Dakota State College of Agri. & Mech. Arts, Brookings, S. D.	360
KFDZ	Harry O. Iverson.....Minneapolis, Minn.	360
KFEB	The City of Taft.....Taft, Calif.	360
KFEC	Meier & Frank Co.....Portland, Ore.	360
KFEJ	Ouy Oreason.....Tacoma, Wash.	360
KFEL	Winner Radio Corporation.....Denver, Colo.	360
KFEP	Radio Equipment Co.....Denver, Colo.	360
KFEQ	J. L. Scroggin.....Oak, Nebr.	360
KFER	Aute Electric Service Co.....Ft. Dodge, Iowa	231
KFEV	Radio Electric Shop.....Douglas, Wyo.	360
KFEX	Augshurg Seminary.....Minneapolis, Minn.	261
KFEY	Bunker Hill & Sullivan Mining & Const. Co. Kellogg, Idaho	360
KFEZ	American Society of Mech. Engrs...St. Louis, Mo.	360
KFFA	Dr. R. C. Shelton.....San Diego, Calif.	360
KFFE	Eastern Oregon Radio Co.....Pendleton, Ore.	360
KFFJ	Jenkins Furniture Co.....Boise, Idaho	360
KFFO	Dr. E. H. Smith.....Hilleboro, Ore.	360
KFFP	First Baptist Church.....Meberly, Mo.	275
KFFQ	Markschoffel Motor Co...Colorado Springs, Colo.	360
KFFR	Jim Kirk.....Sparks, Nev.	360
KFFV	Graceland College.....Lamoni, Iowa	360
KFFX	McGraw Co.....Omaha, Nebr.	360
KFFY	Pincus & Murphy, Inc.....Alexandria, La.	275
KFFZ	Al. G. Barnes Amusement Co.....Dallas, Tex.	226
KFGB	Loewenthal Brothers.....Pueblo, Colo.	360
KFGC	Louisiana State University....Baton Rouge, La.	254
KFGD	Chickasha Radio & Elec. Co....Chickasha, Okla.	248
KFGF	Buchanan Stevens & Co.....Mt. Vernon, Wash.	360
KFGH	Leland Stanford, Jr., Univ..Stanford Univ., Colo.	360
KFGJ	National Guards Mo. 138th Inf...St. Louis, Mo.	266
KFGL	Arlington Garage.....Arlington, Ore.	234
KFGM	Abilene Daily Reporter.....Abilene, Tex.	233
KFGP	Chaney Radio Co.....Cheney, Kans.	229
KFGQ	Crary Hdw. Co.....Boone, Iowa	226
KFGV	Heidbreder Radio Supply Co.....Utica, Nebr.	224
KFGX	First Presbyterian Church.....Orange, Tex.	258
KFGY	Gjelsaug's Radio Shop.....Baudette, Minn.	224
KFGZ	Emmanuel Missionary Co...Berrien Spgs., Mich.	268
KFHA	Colorado State Normal School..Gunnison, Colo.	360
KFHB	P. L. Beardwell.....Hood River, Ore.	360
KFHC	University of Oklahoma.....Norman, Okla.	254
KFHD	Utz Electric Co.....St. Joseph, Mo.	226
KFHF	Central Christian Church.....Shreveport, La.	266
KFHH	Ambrose A. McCue.....Neah Bay, Wash.	283
KFHI	Charles V. Dixon.....Wichita, Kans.	224
KFHJ	Falloh Co.....Santa Barbara, Calif.	360
KFHL	Penn Collega.....Oskaloosa, Iowa	227
KFHR	Star Electric & Radio Co.....Seattle, Wash.	360
KFIB	Franklin W. Jankens.....St. Louis, Mo.	244
KFIC	Philip Laskowitz.....Denver, Colo.	224
KFID	Ross Arbuckles Garage.....Iola, Kans.	246
KFIF	Reason Tech. Student Body.....Portland, Ore.	360
KFIQ	Yakima Valley Radio Broadcasting Association, Yakima, Wash.	224
WBL	T. & H. Radio Co.....Anthony, Kans.	360
WBS	May & Co.....Newark, N. J.	360
WBT	Southern Radio Corporation.....Charlotte, N. C.	360
WBU	City of Chicago.....Chicago, Ill.	360
WBZ	Westinghouse Elec. & Mfg. Co. Springfield, Mass.	337
WCE	Findley Electric Co.....Minneapolis, Minn.	360
WCK	Stix-Baer-Fuller.....St. Louis, Mo.	360
WCM	University of Texas.....Austin, Texas	360
WCN	Clark University.....Worcester, Mass.	360
WCX	Detroit Free Press.....Detroit, Mich.	517
WDM	Church of the Covenant.....Washington, D. C.	360
WDT	Ship Owners Radio Service.....New York, N. Y.	405
WDZ	James L. Bush.....Tuscola, Ill.	278
WEB	Benwood Co.....St. Louis, Mo.	360
WEH	Midland Refining Co.....Tulas, Okla.	360
WEV	Hurlburt-Still Electrical Co.....Houston, Tex.	360
WEW	St. Louis University.....St. Louis, Mo.	360
WFI	Strawbridge & Clothiar.....Philadelphia, Pa.	395
WFY	Cesradio Co.....Wichita, Kans.	360
WGF	The Register & Tribune.....Des Moines, Iowa	360
WGI	American Radio and Research Corporation, Medford Hillside, Mass.	360
WGL	Thomas F. J. Howlett.....Philadelphia, Pa.	360
WGM	Atlanta Constitution.....Atlanta, Ga.	429
WGR	Federal Tel. & Tel. Co.....Buffalo, N. Y.	360
WGV	Interstate Electric Co.....New Orleans, La.	360
WGY	General Electric Co.....Schenectady, N. Y.	380
WHA	University of Wisconsin.....Madison, Wisc.	360
WHB	Sweeney School Co.....Kansas City, Mo.	411
WHD	West Virginia University...Morgantown, W. Va.	360
WHK	The Radiovox Company.....Cleveland, Ohio	360
WHN	Ridgewood Times Printing & Pub. Co., Ridgewood, N. Y.	360
WHX	Iowa Radio Corporation.....Des Moines, Iowa	360
WIK	K. & L. Electric Co.....McKeesport, Pa.	360
WIL	Continental Electric Supply Co., Washington, D. C.	360
WIP	Gimbel Bros.....Philadelphia, Pa.	508
WIZ	Cino Radio Mfg. Co.....Cincinnati, Ohio	360
WJD	Richard Harrie Howe.....Granville, Ohio	229
WJH	White & Boyer.....Washington, D. C.	360
WJK	Service Radio Equipment Co.....Toledo, Ohio	360
WJX	DeForest Radio Tel. & Tel. Co., New York, N. Y.	360
WJY	Radio Corp. of America..Aeolian Hall, N. Y. C.	405
WJZ	Radio Corp. of America..Aeolian Hall, N. Y. C.	455
WKA	Landaus Music & Jewelry Co., Wilkes-Barre, Pa.	360
WKC	Joseph M. Zamoiski Co.....Baltimore, Md.	360
WKN	Hiechman-Crosby Co.....Memphis, Tenn.	360
WKY	Oklahoma Radio Shop....Oklahoma City, Okla.	360
WLB	University of Minnesota.....Minneapolis, Minn.	360
WLH	Hamilton Mfg. Co.....Indianapolis, Ind.	360
WLW	Crosley Mfg. Co.....Cincinnati, Ohio	360
WMA	Arrow Radio Laborstories.....Anderson, Ind.	361
WMC	Commercial.....Memphis, Tenn.	500
WMH	Precision Equipment Co.....Cincinnati, Ohio	361
WMU	Doubleday-Hill Elec. Co.....Pittsburgh, Pa.	251
WNJ	Shotton Radio Mfg. Co.....Albany, N. Y.	400
WND	Wireless Telephone Co. of Hudson County, N. J., Jersey City, N. J.	361
WDC	Palmer School of Chiropractic....Davenport, Iowa	484
WOI	Iowa State Collage.....Ames, Iowa	360
WDK	Arkansas Light & Power Co....Pine Bluff, Iowa	360
WDD	John Wanamaker.....Philadelphia, Pa.	509
WDQ	Western Radio Co.....Kansas City, Mo.	360
WDR	L. Bamberger Co.....Newark, N. J.	405
WDS	Missouri State Mktg. Bureau, Jefferson City, Mo.	360
WDU	Metropolitan Utilities Diatrict.....Omaha, Nebr.	360
WPA	Fort Worth Record.....Fort Worth, Tex.	360
WPG	Nushawg Poultry Farm.....New Lebanon, Ohio	360
WPI	Electric Supply Co.....Clearfield, Pa.	360
WPM	Thomas J. Williams.....Washington, D. C.	360
WPD	United Equipment Co.....Memphis, Tenn.	360
WQX	Walter A. Kushl.....Chicago, Ill.	360
WRK	Doron Brothers Electric Co.....Hamilton, Ohio	360
WRL	Union College.....Schenectady, N. Y.	360
WRM	University of Illinois.....Urbana, Ill.	360
WRP	Federal Institute of Radio Telegraphy, Camden, N. J.	360
WRR	City of Dallas (Police and Fire Signal Department), Dallas, Tex.	360
WRW	Tarrytown Radio Research Lab..Tarrytown, N. Y.	273
WSB	Atlanta Journal.....Atlanta, Ga.	429
WSL	J. & M. Electric Co.....Utica, N. Y.	360
WSY	Alabama Power Co.....Birmingham, Ala.	360
WSZ	Marshall-Gerken Co.....Toledo, Ohio	360
WTG	Kansas State Agr. College.....Manhattan, Kans.	360
WTP	George M. McBride.....Bay City, Mich.	360
WWB	Daily News Printing Co.....Canton, Ohio	360
WWJ	Ford Motor Co.....Dearborn, Mich.	360
WWJ	The Detroit News.....Detroit, Mich.	517
WWL	Loyola University.....New Orleans, La.	360
WWZ	John Wanamaker.....New York, N. Y.	360
WAAB	Valdmar Jensen.....New Orleans, La.	360
WAAC	Tulane University.....New Orleans, La.	254
WAAD	Ohio Mechanics Institute.....Cincinnati, Ohio	360
WAAF	Chicago Daily Drovers' Journal....Chicago, Ill.	360
WAAH	Commonwealth Electric Co.....St. Paul, Minn.	360
WAAJ	Eastern Radio Institute.....Boston, Mass.	360
WAAK	Olmbel Brothers.....Milwaukee, Wis.	360
WAAL	Beamish Electric Co.....Minneapolis, Minn.	360
WAAM	L. R. Nelson Co.....Newark, N. J.	263
WAAN	University of Missouri.....Columbia, Mo.	360
WAAP	Otto W. Taylor.....Wichita, Kans.	360
WAAQ	New England Motor Sales Co., Greenwich, Conn.	360
WAAS	Georgia Radio Co.....Decatur, Ga.	360
WAAW	Omaha Grain Exchange.....Omaha, Nebr.	360
WAAY	Yahrling-Raynor Piano Co.....Youngstown, Ohio	360
WAAZ	Hollister-Miller Motor Co.....Emporia, Kans.	360
WABA	Lake Forest College.....Lake Forest, Ill.	360
WABB	Dr. John B. Lawrence.....Harrisburg, Pa.	360
WABC	Fulwider-Grimes Rattery Co.....Anderson, Ind.	360
WABD	Parker High School.....Dayton, Ohio	360
WABE	Y. M. C. A.....Washington, D. C.	360
WABF	Mt. Vernon Register-News Co. ..Mt. Vernon, Ill.	294
WABG	Arnold Edwards Piano Co.....Jacksonville, Fla.	360
WABH	Lake Shore Tire Co.....Sandusky, Ohio	360
WAJV	Indian Pipe Line Corp.....Princeton, Ind.	360
WBAA	Purdue University.....West Lafayette, Ind.	360
WBAD	Sterling Electric Co. and Journal Printing Co., Minneapolis, Minn.	360
WBAH	The Dayton Co.....Minneapolis, Minn.	360
WBAN	Wireless Phone Corporation....Paterson, N. J.	244
WBAD	James Millikin University.....Decatur, Ill.	360
WBAP	Wortham-Carter Pub. Co., The Star Telegram, Ft. Worth, Tex.	476
WBAU	Republican Publishing Co.....Hamilton, Ohio	236
WBAV	Ernar & Hopkins Co. .....Columbus, Ohio	360
WBAW	Marietta College .....Marietta, Ohio	360
WBAX	John H. Stenger, Jr.....Wilkes-Barre, Pa.	360
WBAY	Western Electric Co.....New York, N. Y.	492
WBBA	Newark Radio Laboratory.....Newark, Ohio	240
WBBC	Sterling Radio Equipment Co....Sterling, Ill.	229
WCAB	Newburgh News Printing & Publishing Co. Newburgh, N. Y.	360
WCAD	St. Lawrence University.....Canton, N. Y.	264
WCAE	Kaufman & Baer Co.....Pittsburgh, Pa.	462
WCAF	Michigan Limestone & Chemical Co., Rodgers, Mich.	360
WCAG	Daily States Publishing Co...New Orleans, La.	360
WCAH	Entrekin Electric Co.....Columbus, Ohio	360
WCAJ	Nebraska Wesleyan University, University Pl., Nebr.	364
WCAK	Alfred P. Daniel.....Houston, Tex.	360
WCAL	St. Olaf College.....Northfield, Minn.	360
WCAM	Villanova College .....Villanova, Pa.	360
WCAD	Sanders & Stayman Co.....Baltimore, Md.	360
WCAR	Alamo Radio Electric Co.....San Antonio, Tex.	360
WCAS	William Hood Dunwoody Industrial Institute, Minneapolis, Minn.	360
WCAT	South Dakota School of Mines..Rapid City, S. D.	240
WCAU	Durham & Co.....Philadelphia, Pa.	286
WCAV	J. C. Dice Electric Co.....Little Rock, Ark.	360
WCAX	University of Vermont.....Burlington, Vt.	360
WCAY	Kesselmen O'Driscoll Co.....Milwaukee, Wisc.	360
WCBB	K & K Radio Supply Co.....Greenville, Ohio	240
WDAC	Illinois Watch Co.....Springfield, Ill.	360
WDAD	Central Kansas Radio Supply...Lindsborg, Kans.	360
WDAE	Tampa Daily Times.....Tampa, Fla.	360
WDAF	Kansas City Star.....Kansas City, Mo.	411
WDAH	Trinity Methodist Church.....El Paso, Tex.	360
WDAI	Hughes Electrical Corp.....Syracuse, N. Y.	360
WDAJ	Atlanta & West Point R. R. Co., College Park, Ga.	360
WDAK	The Courant .....Hartford, Conn.	360
WDAL	Florida Times Union .....Jacksonville, Fla.	360
WDAM	Westen Electric Co.....New York, N. Y.	360
WDAN	Automotive Electric Co.....Dallas, Tex.	360
WDAP	Midwest Radio Central, Inc.....Chicago, Ill.	360
WDAR	Lit Brothers.....Philadelphia, Pa.	395
WDAS	Samuel W. Wallis.....Worcester, Mass.	360
WDAU	Slocum & Kilburn.....New Bedford, Mass.	360
WDAX	First National Bank.....Centerville, Iowa	360
WDAY	Fargo Radio Service Co.....Fargo, N. D.	244
WEAA	Fallain & Lathrop.....Flint, Mich.	360

WEAB	Standard Radio Equipment Co.	Fort Dodge, Ia. 360
WEAD	Henry Radio & Elec. Supply	Atwood, Kans. 226
WEAE	Virginia Polytechnic Institute	Blacksburg, Va. 360
WEAF	American Tel. & Tel.	New York, N. Y. 492
WEAG	Nicholas-Hinaline-Bassett	Edgewood, R. I. 360
WEAH	Wichita Board of Trade & Landers Radio Co.,	Wichita, Kans. 384
WEAI	Cornell University	Ithaca, N. Y. 360
WEAJ	University of South Dakota	Vermillion, S. D. 360
WEAK	Julius B. Abercrombie	St. Joseph, Mo. 360
WEAM	Borough of North Plainfield,	North Plainfield, N. J. 360
WEAN	Shepard Company	Providence, R. I. 360
WEAO	Ohio State University	Columbus, Ohio 360
WEAP	Mobile Radio Co., Inc.	Mobile, Ala. 360
WEAR	Baltimore Am. & News Pub. Co.,	Baltimore, Md. 360
WEAS	Hecht Company	Washington, D. C. 360
WEAT	John J. Fogarty	Tampa, Fla. 360
WEAU	Davidson Brothers Co.	Sioux City, Iowa 360
WEAV	Sheridan Electric Service Co.	Brushville, Nabr. 360
WEAX	T. J. M. Daly	Little Rock, Ark. 360
WEAY	Will Horwitz, Jr.	Houston, Tex. 360
WEAZ	Donald Redmond	Waterloo, Iowa 360
WFAA	A. H. Belo & Co.	Dallas, Tex. 476
WFAB	Carl C. Weese	Syracuse, N. Y. 234
WFAC	Superior Radio Co.	Superior, Mich. 360
WFAF	Henry C. Spratley	Poughkeepsie, N. Y. 273
WFAG	Radio Engineering Laboratory,	Waterford, N. Y. 360
WFAH	Electrical Supply Co.	Port Arthur, Tex. 360
WFAJ	Hi-Grade Wireless Instrument Co.,	Asheville, N. C. 360
WFAM	Times Publishing Co.	St. Cloud, Minn. 360
WFAN	Hutchinson Elec. Service Co.	Hutchinson, Minn. 360
WFAQ	Missouri Wesleyan College & Cameron Radio Co.,	Cameron, Mo. 360
WFAT	Daily Argus Leader	Sioux Falls, S. D. 360
WFAU	Edwin C. Lewis, Inc.	Boston, Mass. 360
WFAV	University of Nebraska	Lincoln, Nebr. 360
WFAW	Miami Daily Metropolis	Miami, Fla. 360
WFAZ	South Carolina Radio Shop	Charleston, S. C. 360
WGAC	Orpheum Radio Stores Co.	Brooklyn, N. Y. 360
WGAO	Spanish Am. Sch. of Telegraphy,	Ensonada, P. R. 360
WGAH	New Haven Elec. Co.	New Haven, Conn. 360
WGAJ	W. H. Glass	Shenandooh, Iowa 360
WGAL	Lancaster Elec. Supply & Const. Co.,	Lancaster, Pa. 360
WGAM	Orangehurg Radio Equipment Co.,	Orangeburg, S. C. 360
WGAN	Cecil E. Lloyd	Pensacola, Fla. 360
WGAQ	W. G. Patterson	Shreveport, La. 360
WGAR	Southern American	Fort Smith, Ga. 360
WGAU	Marcus G. Limb	Wooster, Ohio 226
WGAW	Ernest C. Albright	Altoona, Pa. 360
WGAX	Radio Electric Co., Washington Courthouse,	Ohio 360
WGAY	North Western Radio Co.	Madison, Wisc. 360
WGAZ	South Bend Tribune	South Bend, Ind. 360
WHAA	State University of Iowa	Iowa City, Iowa 283
WHAS	Clark W. Thompson	Galveston, Tex. 360
WHAC	Cole Brothers Elec. Co.	Waterloo, Iowa 360
WHAD	Marquette University	Milwaukee, Wisc. 360
WHAE	Automotive Electric Service Co.,	Sioux City, Ia. 360
WHAG	University of Cincinnati	Cincinnati, Ohio 360
WHAH	J. T. Griffin	Joplin, Mo. 360
WHAK	Roberts Hardware Co.	Clarksburg, W. Va. 360
WHAL	Lansing Capital News	Lansing, Mich. 248
WHAM	School of Music, Rochester Univ.,	Rochester, N. Y. 360
WHAD	F. A. Hill	Savannah, Ga. 360
WHAP	Dewey L. Otta	Decatur, Ill. 360
WHAQ	Semmes Motor Co.	Washington, D. C. 360
WHAR	Paramount Radio & Elec. Co.,	Atlantic City, N. J. 360
WHAS	Courier Journal & Times	Louisville, Ky. 400
WHAV	Wilmington Elec. & Supply Co.,	Wilmington, Del. 360
WHAW	Pierce Electric Co.	Tampa, Fla. 360
WHAX	Huntington Press	Huntington, Ind. 360
WHAZ	Rensselaer Polytechnic Institute	Troy, N. Y. 380
WIAB	Joslyn Automobile Co.	Rockford, Ill. 360
WIAD	Ocean City Yacht Club	Ocean City, N. J. 360
WIAE	Mrs. Robt. E. Zimmerman	Venton, Ia. 360
WIAF	Gustav A. DeCortin	New Orleans, La. 360
WIAH	Continental Radio Mfg. Co.	Newton, Ia. 360
WIAI	Heers Stores Co.	Springfield, Mo. 360
WIAK	The Stockman Journal	Omaha, Nebr. 360
WIAP	J. A. Rudy & Sons	Paducah, Ky. 360
WIAQ	Chronicle Publishing Co.	Marion, Ind. 360
WIAS	Burlington Hawkeye-Home Elec. Co.,	Burlington, Ia. 360
WIAT	Leon T. Noel	Tarkio, Mo. 360
WIAU	American Sec. & Sav. Bank	Le Mars, Ia. 360
WIAV	New York Radio Laboratories,	Binghamton, N. Y. 360
WIAW	Saginaw Radio & Elec. Co.	Saginaw, Mich. 360
WIAY	Fox River Valley Radio Supply Co.	Neenah, Wisc. 224
WIAO	Jackson's Radio Eng. Lab.	Waco, Tex. 360
WIAF	Press Pub. Co.	Muncie, Ind. 360
WIAG	Huse Publishing Co.	Norfolk, Nebr. 360
WIAJ	Y. M. C. A.	Dayton, Ohio 360
WIAK	Whita Radio Laboratory	Stockdale, Ohio 360
WIAM	D. M. Perham	Cedar Rapids, Ia. 360
WIAN	Peoria Star Co.	Peoria, Ill. 288
WIAP	Kelly-Duluth Co.	Duluth, Minn. 360
WIAR	The Outlet Co.	Providence, R. I. 360
WIAS	Capper Publications	Topeka, Kans. 360
WIAT	Kalley-Vawter Jewelry Co.	Marshall, Mo. 360
WIAX	The Union Trust Co.	Cleveland, Ohio 360
WIAZ	Chicago Radio Laboratory	Chicago, Ill. 448
WKAA	H. F. Paar & Republican Times,	Cedar Rapids, Ia. 360
WKAC	Star Publishing Co.	Lincoln, Nebr. 360
WKAF	W. S. Radio Supply Co. and Wm. Schaek,	Wichita Falls, Tex. 360
WKAH	Planet Radio Co.	West Palm Beach, Fla. 360
WKAK	Okfuskea County News	Okemah, Okla. 360
WKAL	Oray & Oray	Orange, Tex. 360
WKAN	Alabama Radio Mfg. Co.	Montgomery, Ala. 360
WKAP	Dutee Wilcox Flint	Cranston, R. I. 360
WKAQ	Badio Corporation of Porto Riro,	San Juan, P. R. 360
WKAR	Michigan Agri. College	East Lansing, Mich. 360
WKAS	L. E. Lines Music Co.	Springfield, Mo. 360
WKAV	Laconia Radio Club	Laconia, N. H. 360
WKAW	Turner Cycle Co.	Beloit, Wisc. 242
WKAX	Wm. A. MacFarlane	Bridgeport, Conn. 360
WKAY	Brenau College	Janesville, Ga. 360
WLAC	North Carolina State College	Raleigh, N. C. 360
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn. 417
WLAH	Samuel Woodworth	Syracuse, N. Y. 234
WLAJ	Waco Electrical Supply Co.	Waco, Tex. 360
WLAK	Vermont Farm Mach. Co.	Bellows Falls, Vt. 360
WLAL	Tulsa Radio Co.	Tulsa, Okla. 360
WLAN	Putnam Hardware Co.	Houlton, Me. 360
WLAP	W. V. Jordon	Louisville, Ky. 360
WLAQ	A. E. Schilling	Kalamazoo, Mich. 360
WLAS	Hutchinson Grain Radio Co.	Hutchinson, Kans. 360
WLAT	Radio and Specialty Co.	Burlington, Iowa 360
WLAV	Electric Shop, Inc.	Pensecola, Fla. 360
WLAW	New York Police Dept.	New York, N. Y. 360
WLAX	Greencastle Community Broadcasting Station,	Greencastle, Ind. 360
WLAY	Northern Commercial Co. of Alaska,	Fairbanks, Alaska 360
WLAZ	Hutton & Jones Elec. Co.	Warren, Ohio 360
WMAB	Radio Supply Co.	Oklahoma City, Okla. 360
WMAC	F. Edward Page	Fernwood, Cazenovia, N. Y. 360
WMAF	Round Hills Radio Corp.	Dortmouth, Mass. 360
WMAG	Tucker Electric Co.	Liberal, Kans. 360
WMAH	General Supply Co.	Lincoln, Nebr. 254
WMAJ	Drovers Telegram Co.	Kansas City, Mo. 275
WMAK	Norton Laboratories	Lockport, N. Y. 360
WMAL	Trenton Hdw. Co.	Trenton, N. J. 236
WMAM	Beaument Radio Equipment Co.	Beaumont, Tex. 360
WMAN	Broad Street Baptist Church	Columbus, Ohio 360
WMAP	Utility Battery Service	Easton, Pa. 360
WMAQ	Chicago Daily News	Chicago, Ill. 448
WMAR	Waterloo Electrical Supply Co.	Waterloo, Iowa 360
WMAT	Paramount Radio Corporation	Duluth, Minn. 360
WMAV	Alabama Polytechnic Institute	Auburn, Ala. 250
WMAW	Wahpeton Elec. Co.	Wahpeton, N. D. 360
WMAX	K. & K. Radio Supply Co.	Ann Arbor, Mich. 360
WMAY	Kingshighway Presby. Church	St. Louis, Mo. 360
WMAZ	Mercer University	Maron, Ga. 268
WNAB	Park City Daily News	Bowling Green, Ky. 360
WNAC	Shepard Stores	Boston, Mass. 360
WNAO	Oklahoma Radio Eng. Co.	Norman, Okla. 360
WNAL	R. J. Rockwell	Omaha, Nebr. 360
WNAM	Ideal Apparatus Co.	Evansville, Ind. 360
WNAN	Syracuse Radio Telaphone Co.	Syracuse, N. Y. 226
WNAP	Wittenberg College	Springfield, Ohio 360
WNAQ	Charleston Radio Elec. Co.	Charleston, S. C. 360
WNAR	C. C. Rhodes	Butler, Mo. 360
WNAS	Texas Radio Corporation and Austin Statesman,	Austin, Tex. 360
WNAT	Lenning Bros. Co.	Philadelphia, Pa. 360
WNAW	Henry Kunsmann	Fortress Monroe, Va. 360
WNAX	Dakota Radio Apparatus Co.	Yankton, S. D. 244
WNAY	Ship Owners' Radio Service	Baltimore, Md. 360
WOAA	Dr. Walter Hardy	Ardmore, Okla. 360
WOAB	Valley Radio	Orand Forks, N. D. 360
WOAC	Maus Radio Co.	Lima, Ohio 286
WOAD	Friday Battery & Elec. Co.	Sigourney, Iowa 360
WOAE	Midland College	Fremont, Nebr. 360
WOAF	Tyler Commercial College	Tyler, Tex. 360
WOAG	Apollo Theatre	Belvidere, Ill. 360
WOAH	Palmetto Radio Corp.	Charleston, S. C. 360
WOAI	Southern Equipment Co.	San Antonio, Tex. 360
WOAJ	Ervin's Electrical Co.	Parsons, Kans. 360
WOAK	Collins Hardware Co.	Frankfort, Ky. 360
WOAL	Wm. E. Woods	Webster Groves, Mo. 360
WOAN	James D. Vaughan	Lawrenceburg, Tenn. 360
WOAP	Kalamazoo College	Kalamazoo, Mich. 360
WOAR	Henry P. Lundskow	Kenosha, Wisc. 360
WOAS	Bailey's Radio Shop	Middletown, Conn. 360
WOAT	Boyd Martell Hamp	Wilmington, Del. 360
WOAU	Snowder Boiling Piano Co.	Evansville, Ind. 360
WOAV	Pennsylvania National Guard	Erie, Pa. 242
WOAX	Franklyn J. Wolff	Trenton, N. J. 240
WOAZ	Penick Hughes Co.	Stanford, Texas 360
WPAB	Pennsylvania State College	State College, Pa. 360
WPAC	Donaldson Radio Co.	Okmulgee, Okla. 360
WPAO	Wiseboldt & Co.	Chicago, Ill. 360
WPAF	Peterson's Radio Co.	Council Bluffs, Iowa 360
WPAG	Central Radio Co., Inc.	Independence, Mo. 360
WPAH	Wisconsin Dept. of Markets	Waupeca, Wisc. 360
WPAJ	Doolittle Radio Corporation	New Haven, Conn. 360
WPAK	No. Dakota Agricultural College	Fargo, N. D. 360
WPAL	Superior Radio & Tel. Equipt. Co.,	Columbus, Ohio 360
WPAM	Awerbach & Guattel	Topeka, Kans. 360
WPAP	Theodore D. Phillips	Winchester, Ky. 360
WPAQ	General Sales & Eng. Co.	Frostburg, Md. 360
WPAR	R. A. Ward	Beloit, Kans. 360
WPAS	J. & M. Electric Co.	Amsterdam, N. Y. 346
WPAT	St. Patrick's Cathedral	El Paso, Tex. 360
WPAU	Concordia College	Moorhead, Minn. 360
WPAW	Radio Installation Co., Inc.	Wilmington, Del. 360
WPAY	Bangor Radio Laboratory	Bangor, Me. 360
WPAZ	Dr. John R. Koch	Charleston, West Va. 360
WQAA	Horace A. Beala, Jr.	Parkersburg, Pa. 360
WQAB	Southwest Missouri State Teachers College,	Springfield, Mo. 360
WQAC	E. B. Gish	Amarillo, Tex. 360
WQAD	Whithall Electric Co.	Waterbury, Conn. 360
WQAE	Moore Radio News Station	Springfield, Vt. 360
WQAF	Sandusky Register	Sandusky, Ohio 240
WQAH	Brock Anderson Elec. Eng. Co.	Lexington, Ky. 254
WQAJ	Ann Arbor Times-News	Ann Arbor, Mich. 360
WQAK	Appel-Higley Electric Co.	Dubuque, Iowa 360
WQAL	Cole County Tel. and Tel. Co.	Mattoon, Ill. 360
WQAM	Electrical Equipment Co.	Miami, Fla. 360
WQAN	Scranton Times	Scranton, Pa. 360
WQAO	Calvary Baptist Church	New York, N. Y. 360
WQAQ	West Texas Radio Co.	Abilena, Tex. 360
WQAS	Walter Prince Co.	Lowell, Mass. 360
WQAT	Radio Equipment Corporation	Westhampton, Va. 360
WQAV	Huntington & Guerry, Inc.	Greenville, S. C. 360
WQAW	Catholic University	Washington, D. C. 360
WQAX	Radio Equipment Co.	Peoria, Ill. 360
WQAY	Gaston Muele & Furniture Co.	Hastings, Nebr. 360
WQAZ	Greeneboro Dolly News	Greensboro, N. C. 360
WRAA	Rice Institute	Houston, Tex. 360
WRAB	Savannah Boord of Pubile Education,	Savannah, Ga. 360
WRAC	State Normol School	Mayville, N. D. 360
WRAO	Taylor Radio Shop	Marion, Kans. 360
WRAF	Radio Club, Inc.	Laporta, Ind. 224
WRAH	Stanley N. Read	Providence, R. I. 360
WRAK	Economy Light Co.	Escanaba, Mich. 360
WRAL	Northern States Power Co.	St. Croix Falls, Wisc. 248
WRAM	Lombard College	Galesburg, Ill. 360
WRAN	Black Hawk Electrical Co.	Waterloo, Iowa 229
WRAO	Radio Service Co.	St. Louis, Mo. 360
WRAP	Winter Park Elec. Construction Co.,	Winter Park, Fla. 360
WRAR	Jacob C. Thomas	David City, Nebr. 360
WRAS	Radio Supply Co.	McLeansboro, Ill. 360
WRAU	Amarillo Daily News	Amarillo, Tex. 360
WRAV	Antioch College	Yellow Spring, Ohio 360
WRAY	Radio Sales Corporation	Scranton, Pa. 360
WSAA	B. S. Sprague Elec. Co.	Marietta, Ohio 360
WSAB	Southeast Mo. State College,	Cape Girardeau, Mo. 360
WSAC	Clemson Agri. College	Clemson College, S. C. 360
WSAH	A. O. Leonard, Jr.	Chicago, Ill. 360
WSAI	U. S. Playing Card Co.	Cincinnati, Ohio 309
WSAJ	Orova City Collage	Grova City, Pa. 360
WSAL	Franklin Electrical Co.	Brookville, Ind. 246
WSAP	Seventh Day Adventist Church	New York, N. Y. 283
WSAT	Plainview Electric Co.	Plainview, Tex. 360
WSAV	Clifford W. Vick, Radio Construction Co.,	Houston, Tex. 360
WTAC	Penn Traffic Co.	Johnstown, Pa. 360
WTAS	Charles E. Erbstein	Elgin, Ill. 275
WTAU	Ruegy Battery & Elec. Co.	Tecumseh, Nebr. 360
WTAW	Agricultural & Mechanical College of Texas,	College Station, Tex. 360
WWAC	Sanger Brothers	Waco, Tex. 360
WWAO	Wright & Wright, Inc.	Philadelphia, Pa. 360
WWAH	General Supply Co.	Lincoln, Nebr. 360
WWAJ	Columbus Radio Club	Columbus, Ohio 360
WWAX	Worman Brothers	Laredo, Tex. 360
WWAY	Marigold Oardens	Chicago, Ill. 360

Canadian Broadcasting Stations

CFAC	Radio Corporation of Calgary, Ltd.,	Calgary, Alberta
CFCA	Star Publishing and Printing Co.,	Toronto, Ontario
CFCS	Marconi Wireless Telegraph Co. of Canada, Ltd.,	Vanrouver, B. C.
CFCD	Canadian Westinghouse Co., Ltd.,	Winnipeg, Manitoba
CFCE	Marconi Wireless Telegraph Co. of Conada,	Halifax, Nova Scotia
CFCF	Marconi Wireless Telegraph Co. of Canada, Ltd.,	Montreal, Quebec
CFCH	Abitibi Power and Paper Co., Ltd.,	Iroquois Falls, Ontario
CFCI	Motor Products Corporation,	Walkerville, 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 Bussell Brown	Courtenay, British Columbia
CFYC	Victor Wentworth Odlum	Vanrouver, B. C.
CFZC	Canadian Westinghouse Co., Ltd.	Montreal, Quebec
CHAC	Radio Engineers, Ltd.	Halifax, Nova Scotia
CHBC	The Albertan Publishing Co.	Calgary, Alberta
CHCA	Radio Corporation of Vanrouver, Ltd.,	Vancouver, B. C.
CHCB	Marconi Wireless Telegraph Co. of Conada, Ltd.,	Toronto, Ontario
CHCC	Canadian Westinghouse 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
CHCX	B. L. Silver	Montreal, Quebec
CHCZ	The Globe Printing Co.	Toronto, Ontario
CHFC	John Millen & Sons, Ltd.	Toronto, Ontario
CHIC	Canadian Westinghouse Co., Ltd.	Hamilton, Ontario
CHOC	Canadian Westinghouse Co., Ltd.	Vanrouver, B. C.
CHVC	Metropolitan Motors, Ltd.	Toronto, Ontario
CHXC	J. R. Booth, Jr.	Ottawa, Ontario
CHYC	Northern Electric Co.	Montreal, Quebec
CJBC	Dupuis Freres	Montreal, Quebec
CJCA	The Edmonton Journal, Ltd.	Edmonton, Alberta
CJCB	James Gordon Bennett, Nelson	British Columbia
CJCO	T. Eaton Co., Ltd.	Toronto, Ontario
CJCE	Vancouver Sun Radiotelephones, Ltd.,	Vanrouver, B. C.
CJCF	News Record, Ltd	Kitchener, Ontario
CJCG	Manitoba Free Press Co., Ltd.	Winnipeg, Manitoba
CJCH	The United Farmers of Ontario	Toronto, Ontario
CJCI	McLean, Hiolt & 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. Eaton Co., Ltd.	Winnipeg, Manitoba
CKCO	Vancouver Daily Province	Vancouver B. C.
CKCE	Canadian Independent Telephone Co., Ltd.	Toronto, Ontario
CKCK	Leader Publishing Co., Ltd., of Regina,	Regina, Saskatchewon
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 Equipment and Supply Co.	Toronto, Ontario
CKDC	The Wentworth Radio Supply Co.	Hamilton, Ontario
CKQC	Radio Supply Co. of London	London, Ontario
CKZC	Salton Radio Engineering Co.	Winnipeg, Manitoba

WORLD WIDE WIRELESS

Radio Construction in China Delayed

PLANS for the linking of China directly with the United States by means of high power radio stations, as developed by the Radio Corporation of America and the Federal Telegraph Company, have been delayed somewhat by unexpected developments at Pekin. The Chinese government is delaying negotiations in regard to the contract with the American companies, Japanese interests having raised the question of an alleged exclusive Japanese wireless concession with the Chinese government. The United States Minister, with the authority of the State Department at Washington, is making strong representations to the Pekin government, insisting upon the "Open Door," and the right of Americans in China to communicate with their home country through American means. The matter now is one of diplomatic concern, with all possible pressure being put upon the Chinese government.

New French Marine Rules

OWNERS of ships flying the French flag have been notified that within six months all French ships rated at over 500 tons must be equipped with radio apparatus. Under the new regulations, French ships are divided into two classes, the first class consisting of ships of over 2,000 tons or carrying fifty persons, including the crew, or carrying more than twelve passengers. This class must install both sending and receiving equipment and those ships of the larger size within the class will require to maintain a twenty-four-hour watch. The second class is required to have only receiving apparatus and consists of ships rated at between 500 and 2,000 tons, embarking less than fifty persons or carrying not more than twelve passengers.

Appeal for Missing Ship

THE fate of the barkentine *Alta* is in doubt. She sailed February 20 from San Pedro, Cal., in ballast for Bellingham, Wash., and is missing, with her crew of 35 men and her master, Charles Sexon and his wife, Dora. The missing ship was one of the largest sailing vessels in the Pacific Coast lumber trade, and had four masts. An appeal to all ships to watch for her has been broadcast by radio stations on the Pacific Coast. The *Alta* was not equipped with radio.

Radio for Fishermen

OWNERS of steam trawlers operating out of Cardiff, Milford Haven, Fleetwood, Hull and Grimsby, in England, have installed wireless apparatus on their ships, in order to be able to keep in constant communication with their fleets and direct their operations. Some thirty trawlers have been thus equipped by the Marconi International Marine Communication Company of London.

Plane Piloted by Radio

THERE are at least two Frenchmen who are perfectly willing to trust their lives to radio. They demonstrated it by taking a flight in an aeroplane with no pilot, but with a radio set instead. The flight of the plane was directed entirely by wireless. Capt. Max Boucher governed the plane through a transmitter on the ground, making it go through various evolutions, and finally bringing it safely to earth. Later flights were made without any passengers at all—why, the dispatches do not state.

TROUBLE IN THE AIR!

—San Francisco Chronicle

Direction Finding on Vancouver Island

THE Vancouver, B. C., Meteorological Office has just been advised by the Ottawa Government that equipment has been ordered for the establishment of a wireless direction-finding station at Pachena Point, on the west coast of Vancouver Island. This will operate conjointly with the American station of like character at Tatoosh, Washington, enabling vessels about to enter the Straits of Juan de Fuca to get cross-bearings for calculating their position, thereby rendering invaluable assistance to navigation. Had such a station existed the *Tuscan Prince* would probably not have met with the disaster which occurred on February 14th, last. It is said the apparatus should be ready for installation within two months; immediately upon its receipt tests will be made to determine the best location for permanent operation.

Radio Telephony in Brazil

COMMUNICATION by means of radio telephony now has been established between Sao Paulo and Rio de Janeiro. Early attempts were unsuccessful, says Assistant Trade Commissioner M. A. Cramer, in a report to the Department of Commerce.

Kootwyk Station Opens

OPERATION of the new high power radio station at Kootwyk, Holland, began on May 7, when a message from Queen Wilhelmina was transmitted to the corresponding station at Bandoeng, Java, 7,500 miles distant. The two stations, which link the Dutch East Indies and Holland directly, have been under construction for four years, and some 7,500,000 guilders have been spent on each. At present the traffic is not heavy enough to make it necessary to work except at night, when a wave length of 8,400 meters is used, but tests have shown that daytime transmission on 16,800 meters is possible, and will be used when traffic grows. The Kootwyk station also will work directly with England, the United States, and possibly also with Africa and South America, if desired. Both the Holland and Javan stations permit simultaneous transmission and reception.

Loss of Cables Stimulates German Radio Construction

AS a direct result of her loss of her cables and colonies after the war, Germany is building up within her borders a system of radio telegraph and radio telephone stations that is designed to be second to none. According to W. T. Daugherty, of the U. S. Department of Commerce, writing from Berlin, the loss of the cable system has made Germany dependent on her neighbors for all foreign communications save those she herself can handle by radio. The result has been a great stimulation to the radio art in Germany.

At present the central office of the Gesellschaft für drahtlose Telegraphie, located in the Oranienburgerstrasse, Berlin, controls the two great transmitting stations, Nauen and Eilvese, and the two receiving stations Geltau and Hagen. Both the transmitting stations work on schedule, Nauen with New York, Moscow, Madrid, Rome, and Bucharest; and Eilvese with Rome and Madrid. Both have trans-Atlantic press schedules as well.

Extensive changes are now in progress at Nauen, says Mr. Daugherty, designed to increase its power and the flexibility of its operating plant. Separate antennae are being constructed for the American, the Asian, and African, and the two European circuits; and a special arrangement is planned for the new Buenos Aires circuit which is to be opened to public correspondence within the next few months. The corresponding station at Monte Grande, near Buenos Aires, is to be maintained and operated by a combination of French, English, German and American radio companies.

The German Post Office station at Koenigswusterhausen, near Berlin, transmits to London, Budapest, Sofia, and Sarajevo, and its receiving station at Zehlendorf makes up the return circuit. Norddeich, a coastal station used for hydrographic reports, shipping news, and weather reports, completes this group which is known as the Main Stations Group (Hauptfunkstellen). Although communication is maintained with the foreign cities mentioned the Main Stations Group operates principally within Germany.

The feeder stations of this system, or "leading stations," operate an interior service as subsidiaries of Koenigswusterhausen. The stations located at Dortmund, Breslau, Duesseldorf, Frankfort on the Main, Hamburg, Hanover, Koenigsberg in Prussia, and Munich, are each equipped with two sending and two receiving installations, Dortmund operates a special service to Rotterdam as well.

Smaller stations, supplementing the feeder stations and equipped each with a single sending and receiving set, are located at Bremen, Darmstadt, Elbing, Friedrichshafen, Constance, Stettin, Nuernberg and Mannheim.

Ship to shore stations are 16 in number and were excepted from the system taken over by the Post Office Department in 1919.

The distribution of the wireless news broadcast from the interior transmitting stations is effected by 75 receiving stations which have no transmitting sets. Similarly equipped stations receive weather reports in nine of the principal cities.

Public wireless telephony was inaugurated in Germany on September 1, 1922, the Post Office Department and the Express Service uniting to establish the service. Subscriptions, open to the public, are based on the extent of the service rendered, and the only additional cost is the installation charge.

"Hello London, this is New York...." many other words were heard in London from the States by radio, using this loop antenna in a London building and the Rocky Point station of the RCA for transmission

Koenigswusterhausen is the broadcasting station and subscribers to the service are now located in 176 cities and towns. The material furnished so far has been confined to economic news, such as bank statements, exchange quotations, stock market listings, etc.

Colombian Radio Operating

COLOMBIA, the South American republic, is now linked with Great Britain and the rest of the world by radio, the high power transmitting station at Bogota, the capital, having been put in operation. It now exchanges traffic daily with the Marconi stations in England. Internal "feeder" stations have been erected by the Marconi Wireless Telegraph Company, Ltd., at Medellin, Barranquilla, Cucuta and Cali, in the interior of Colombia.

Denmark Studies Radio Telephone

THE wireless telephone is arousing much interest in Denmark, according to Mr. E. A. Johnson, of the American Consular Service at Denmark. Preliminary experiments and demonstrations in Copenhagen have been highly successful. Last August a test of ship-to-shore radio telephony was conducted between Copenhagen and one of the Scandinavian-American Line steamers, while the latter was off the coast of Norway, bound for the United States. The experiment, conducted by the Danish Radio Aktieselskab (Danish Radio Company, Inc.), was highly successful. This company has installed nearly all the radio equipment found on Danish vessels. It has also carried out communication between Copenhagen and Helsingor, about thirty miles north.

Development of the wireless telephone in Denmark is retarded to a considerable extent by laws prohibiting all amateur use of radio telephone and telegraph apparatus. There are only about 1,000 radio amateurs in Denmark at the present time, most of these having been created by schools, laboratories, and similar institutions, which have been able to get government permission to install transmitting and receiving apparatus for educational purposes. It is expected that following the next International Radio Conference, scheduled to take place next year, Denmark will draw up new regulations which will permit a more widespread use of radio in the Danish Peninsula. Much interest is taken in the subject by business firms as well as the general public, the one understanding the commercial value of the radio telephone and the other being quick to realize the advantage of its entertainment and educational features.

Sir Thomson Visits U. S.

SIR JOSEPH THOMSON, the famous British scientist whose researches into electricity have contributed much toward making radio telephony possible, is now in this country for a visit with his friends and a tour of inspection. On his arrival he spent much time in the Western Electric laboratories inspecting the new high power vacuum tubes made there, and other important electrical devices.

New Ship Radio

THE Radio Corporation of America has installed a radio transmitter on the S. S. *Arctic*. The ship is operated by H. Lebes & Co., San Francisco, Cal., in the northern Pacific and is a fishing and fur trade vessel.

Navy Radio Use Spreads

OFFICIAL dispatches for the U. S. Naval forces in the Near East, which formerly were sent by a complicated radio and land wire route, now are being copied directly by American warships in the vicinity of Constantinople, as sent from the Navy transmitter at Annapolis, Md. The former route was by radio to Paris, then by leased wire to Coblenz and Vienna, where radio relayed it to Constantinople. This is one more forward step taken by the U. S. Navy in elimination of wire circuits as much as possible and the substitution of radio. Another, the abandonment of the Bar Harbor station as far as international work is concerned and its transformation into a coastal station, is under way. The Bar Harbor, Me., station suffered from a severe fire some time ago, and instead of rebuilding it into its original form, the distance work it formerly did is to be handled directly at Washington, where new equipment is being assembled for reception from other continents. The Bar Harbor apparatus will be confined to work with ships off the coast. This will save reconstruction of many of the buildings there, and eliminate the expensive leased wire line to Washington.

Distance No Bar

SHIPPING and radio men in England and Australia have been commenting on the feat of the S. S. *Themistocles* in keeping in touch with England throughout its recent voyage to Australia. The ship was fitted in England with the latest Marconi apparatus, and was able to receive the land stations in Great Britain during the entire voyage down the Atlantic, to Cape Town, and then around the cape to Australia. The radio operators copied 65,000 words of ocean wireless news, or about 738 words a day, making the ship's newspaper, as well as handling the usual amount of message and other traffic.

No Army Sparks in Alaska

ALL spark sets of the U. S. Army radio stations in Alaska have been replaced with either arc or tube continuous wave transmitters. Today there are no Army sparks to be heard in Alaska, and the reliability and efficiency of the radio net there has been consequently improved by about 75 per cent over the old spark transmitters that were heritages of the early days. Since the first Alaskan station was erected, in 1903, great changes have taken place in radio practice. During last Summer many miles of land telegraph wire were taken down by the Army field signal detachment that was sent to Alaska, new radio sets taking the place of the wires that were so difficult to maintain in winter.

American Razor Blades Make a French Condenser

AT LAST a use has been found for the used safety razor blade, and all radio fans who have been searching for safe places to throw them or practical uses for them may now rejoice. According to La Science et la Vie of Paris, the blades are ideally suited for making variable condensers. Thin, yet rigid, they can be set close together and will afford a fine adjustment. Those of the Gillette type are already suitably perforated for mounting on shafts; all that is necessary is the shaft and a number of small insulating washers to keep the blades apart.

During the annual maneuvers of the Japanese army, radio played an important part in the maintenance of communications. Here is "radio central" during the practice work, located under the shadow of Fujiyama, the famous mountain

Radio Fan Saves Crew of Burning Vessel

RADIO broadcasting is to be credited with a share in the rescue of the crew of the steamship *Nika,* which was burning on Umatilla reef in the Pacific Ocean. Addison Galligan, a seaman on board the ship, had picked up a slight knowledge of the code while listening at home, and when fire broke out on board the vessel he substituted for the radio operator, who was absent. He turned on the transmitter and slowly and clumsily but unmistakably tapped out an SOS, which was picked up by the *Snohomish.* The latter altered her course and rescued the imperiled seamen.

Norway to Listen In

AN experimental broadcasting station is to be erected at Christiania, Norway, under careful control of the Norwegian Government, which will keep a watchful ear listening to the programs. Control is vested in the Norwegian Telegraph Administration, which at present requires that all companies securing broadcasting licenses must be backed by native capital.

"May Day" Is Airplane SOS

ENGLISH aviators who use radio telephone transmitting sets on their planes, instead of telegraph sets, have been puzzling over the problem of choosing a distress call for transmission by voice. The letters SOS wouldn't do, and just plain "help!" was not liked, and so "May Day" was chosen. This was thought particularly fitting since it sounds very much like the French *m'aidez,* which means "help me."

A. A. Isbell Promoted

ARTHUR A. ISBELL, who made an enviable record as General Superintendent of the Pacific Division of the Radio Corporation of America, has been appointed manager of that Division. He will have widely enlarged duties, taking general charge of trans-oceanic, marine and sales activities for the Radio Corporation on the Pacific Coast.

McAuliffe Advanced

WILLIAM F. McAULIFFE has been appointed to the position of marine superintendent and traffic manager for the Pacific Coast, by the Radio Corporation of America. He succeeds Lawrence A. Malarin, who has been promoted to the post of district sales manager. McAuliffe was formerly district manager at Seattle for the RCA, and is an old-timer, having served with the Marconi company in 1913. During the war he was an airman.

The Radio System of French Guiana

Translated from Radioélectricite

VERY few French people are acquainted with the actual facts concerning their colony of Guiana. For most of them the name merely arouses in their mind the fact that it is to that part of the tropical world that France deports many of her criminals. Nevertheless this country, which is still unexplored in great part, possesses great natural riches. At present the principal exports are gold, rosewood and balata. The trade still runs in a comparatively small volume, but this is more because of lack of means of communication with the interior of the country than because of lack of material or of demand for it. Up to the present, the various water courses constitute almost the only means of communication with the interior of the country. Laudable efforts are being made for the building of roads and a railroad has been projected. A regular airplane service now connects Cayenne with St. Laurent and during the dry season these airplanes fly up the Maroni River as far as Inini.

But, in order that the market may develop normally, a quick and reliable means of communication is essential, not only with the metropolis or principal port, but also with foreign countries. Guiana is served by a telegraph cable from Martinique, touching Paramaribo and Cayenne and then extending to Salinas in the Brazilian state of Para. Unfortunately this cable, which is old and apparently is laid upon some very bad spots on the ocean bed, is subject to periodic interruptions. In order to remedy this very disadvantageous situation the colony entered into negotiations with a French radio company, which undertook to reorganize and operate the radio station at Cayenne that had been erected on a temporary basis by the French navy during the war. Today the Cayenne station has been completed and it now assures communication by radio with Martinique, Guadeloupe and Surinam. Moreover a one-way service functions between Bordeaux and Cayenne, and by means of it commercial houses in Guiana are able to receive messages from France in less than twenty-four hours. The station also receives the press dispatches from the principal radio stations of the entire world and makes them available to the Guiana authorities and newspapers.

Cayenne, French Guiana, is only 5 degrees north of the equator

The radio telegraph station of Cayenne is situated at the east of the city at a distance of about 1 kilometer (.6 mile). There are two principal buildings, the power plant and the receiving and transmitting station proper. Two transmitting systems are used, one a spark set producing a musical tone, and the other an arc continuous wave transmitter.

The antenna is supported by a skeleton mast 100 meters (340 feet) high. This is of the umbrella type and consists of twenty-four wires, each 100 meters long. It has a capacity of about .006 mfd. and a natural wave length of about 2,200 meters. An auxiliary antenna of the cage type is used for working with ships on 600 meters.

The power plant consists of two gasoline motor driven generators, which were secured from the French navy. One of them, rated at 7 horsepower, is used for charging the storage batteries, and to supply power to the transformer of the spark transmitter. The other is rated at 70 horsepower. The cost of operating the power plant with gasoline being much too great, there has recently been installed a 40-horsepower steam engine of a modified tractor type, which takes wood fuel and which is now used for furnishing power to operate the arc set, in place of the 70-horsepower gasoline engine. There is a small workshop and a battery room included in the power plant building.

The transmitting and receiving building contains two separate rooms for the transmitters and receivers, an office for the chief operator and a shower bath. It is entirely surrounded by a veranda, in order to give protection from the exceedingly hot rays of the sun.

In the transmitting room is to be found both the arc and spark transmitters. The arc is a French SFR instrument, with an input of 15 kilowatts. An antenna inductance is provided to enable changing the emitted wave to any desired length within the range of the set. The particular method chosen for varying this inductance consists of short circuiting the required turns of the inductance.

The spark set is rated at 2 kilowatts, with impulse excitation. A special oscillating circuit has been provided, permitting transmission on waves of 600, 900, 1,250 and 2,000 meters.

In the receiving room are to be found the receiving sets, which are furnished with radio-frequency amplification, and also with the De Bellescize system for cutting down the effects of static. The receiving antenna consists of a loop four meters (13.6 feet) in diameter. It is on this loop that the Bordeaux station is copied.

Telegraphic communication between Cayenne and other centers in Guiana has been realized for some time by means of a telegraph line maintained by the present service, connecting the capital with St. Laurent and also Mana and Sinnamarie.

An interior network of radio telegraph stations now is in course of installation. Small radio stations are being erected at Regina, St. Georges, Inini and St. Laurent. Portable transmitters are also to be provided for use by the different placer gold mines.

The Regina station has been in operation for the past ten months, and is heard on a regular schedule. It has a mast 32 meters (108 feet) high supporting an umbrella antenna, to which is connected a 1-kilowatt SFR impulse-excited spark set.

The other transmitters probably will be of the same type. That at St. Georges was

Going up—the central mast for the radio station at Cayenne, French Guiana. At the right is a portion of the big loop used for receiving

The Cayenne station, showing the mast, and the deep-porticoed operating building, which contains shower baths as well as radio apparatus

scheduled for operation during March, 1923, and that of Inini will be heard next, and by 1924 the entire interior network should be functioning.

It should be noted that there are great difficulties in the way of installing and operating such stations in the interior of a tropical and wild country. All the parts and material must be transported in the small Indian canoes that throng the Maroni River. Every piece of apparatus must be dismantled as much as possible in order to avoid overloading these small boats. The river voyage takes at least twenty-four hours, and there are many loadings and unloadings required, for the river is full of rapids and falls, around which the boats and their freight must be carried.

General view of the French radio station at Cayenne, in South America near the equator

1,000-Mile Transmission From 120-Foot Triangular Loop

By J. J. Dingman

LONG distance broadcasting on a giant loop aerial, with resultant directional transmission of the voice or the controlling of the direction in which the voice travels on the air, has been accomplished by W. W. Grant, president of the W. W. Grant Radio, Ltd., at Calgary, Alberta, Canada, which firm owns and operates Station CFCN.

On the night of Saturday, March 31, and on into the morning of Sunday, April 1, Mr. Grant conducted tests in directional transmission which proved eminently successful, according to telegrams and postal communications received. CFCN at Calgary was heard clearly by 6XB (experimental license of KFDB), the Mercantile Trust Company, Telegraph Hill, San Francisco. Stations directly east and west of Calgary did not hear the signals, which proves that the human voice has been transmitted a great distance in a definite desired direction, as San Francisco is 1,000 miles from Calgary, air line.

The triangular loop aerial on which the successful tests were conducted was devised by W. W. Grant and is one hundred and twenty feet square. It is this special aerial which is the basic factor in attaining directional transmission. It is probably the largest loop antenna being used for broadcasting by any station on the American continent at the present time. It is supported by two masts one hundred and fifteen feet in height and at present is so situated that the voice can be directed north and south and within an area of a five-degree arc on each side of a true line between any two fixed points north and south of Calgary. By moving the masts, the same results could be obtained east and west. CFCN is located on Crescent Heights, in Calgary, and has an elevation of approximately 4,000 feet above sea level.

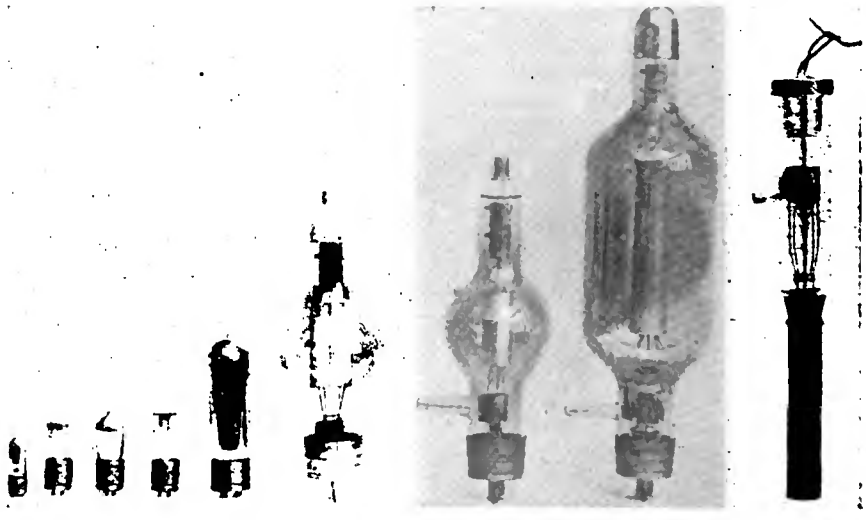
On the night of the test, CFCN was working on 440 meters and operating on an output of two thousand watts. The antenna current was 16 amperes. Interference was almost totally eliminated and signals confined to a definite restricted area, concentrating all the available power into a narrow field and multiplying the efficiency several times.

The aerial consists of five wires each 120 feet long drawn between the cross bars of the two masts, the wire being taut. There are five lead-in wires from each mast, this tending to reduce the resistance, and each of the lead-in wires is attached to one of the horizontal wires. By switching the lead-in wires the loop is easily transformed into a standard aerial

Experiments in directional transmission have been conducted in the past, but never on such a gigantic scale and with such signal success attendant upon them. Radio engineers of Canada consider this achievement of Mr. Grant's to be a most significant and important development in radio engineering. Mr. Grant is now conducting more exhaustive experiments by which he hopes greatly to improve on his present system of directional transmission.

That the initial tests were successful was amply illustrated by the numerous telegrams and other communications received. It was arranged with several operators of radiophone receiving sets in different directions from Calgary to "stand-by" at the time of the test and make reports. Communications were received from points east and west saying that CFCN signals could not be picked up at the time stipulated, while 6XB, San Francisco, and points north of the city, reported reception, with volume and modulation both excellent.

W. W. Grant, D. S. O., O. B. E., was formerly in charge of the radiophone station of the Dominion government at High River, Alberta. During the war he won recognition from the British War Office for many inventions in connection with the radiophone which were utilized on the battlefields of France. He was decorated for bravery while in active service by Sir Douglas Haig, Field Marshal of the British Army, and was made a member of the Order of the British Empire.



THE RADIOTRON FAMILY

Left to right: UV-199, UV-200 (C-300), UV-201A (C-301A), UV-202 (5-watt), UV-203 (50-watt), UV-204 (250-watt), UV-206 (1-kw.), UV-208 (5-kw.) and UV-207 (20-kw.). A comparison of size may be gained by the height of UV-204 which is 14¼ inches

A New Method for Transmitting Telegraphic Signals

By Major-Gen. George O. Squier
Chief Signal Officer, U. S. A.

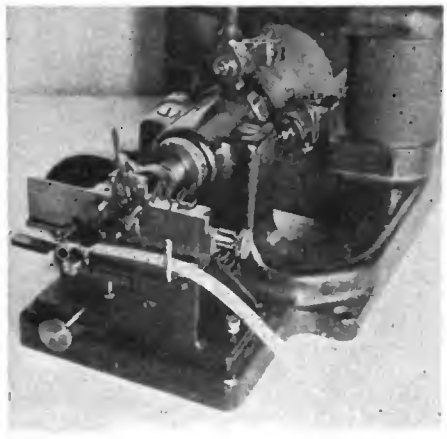
Abstract of a Lecture in the Signal Corps Lecture Course

ABOUT eighty years ago Morse invented the telegraph alphabet of dots and dashes, and the modification of it, known as the International Morse, is now the universal method of international radio telegraphy. This method is believed to be fundamentally unscientific, and the time has come to thoroughly consider a radical revision of the method of sending telegraphic messages. I do not here refer to an actual change at present in the Morse alphabet as regards the combinations of dots, dashes and spaces assigned to each letter, but I refer to the study of the correct method of sending these combinations in any circuit, whether radio, land lines, or submarine cables.

In the Morse alphabet we find the principle of different time units for dots, dashes and spaces, as the basic idea of the system. In Standard Morse a dash is three times the length of time of a dot, and the spaces between the letters and words are timed correspondingly.

These signals in International Morse are universally emitted into the ether from the transmitting antenna in the form of sudden interruptions in the antenna current, or sudden variations in this current. Present practice is drifting away from the complete interruption of the antenna current which is the worst from an interference standpoint, but the present methods of irregular variations of the current are still a long way from the possible scientific solution.

In *1915 the writer was considering the general problem of improving the transmission system for submarine cables, and in connection therewith gave study to a new form of alphabet suitable to such a circuit. A method was developed of sending an unbroken alternating current through a cable, and means provided for interpreting this alternating current into intelligible signals. This system abandoned the Morse principle of different lengths of time for the signals as being fundamentally inefficient, and adopted the plan that all individual signal units should occupy equal lengths of time, and have equal importance, whether they were dots, dashes or spaces. The signals were distinguished by varying the intensity of the individual sending elements, i. e., a dot, dash or space occupied equal time elements, but were of different intensities. The variation in intensity for signaling was effected at the transmitter at the zero phase of the resultant current flowing into the cable, so that, theoretically, at the moment of any operation upon the current there was no current to operate upon.



Transmitter for new method applicable to radio, land lines and submarine cables

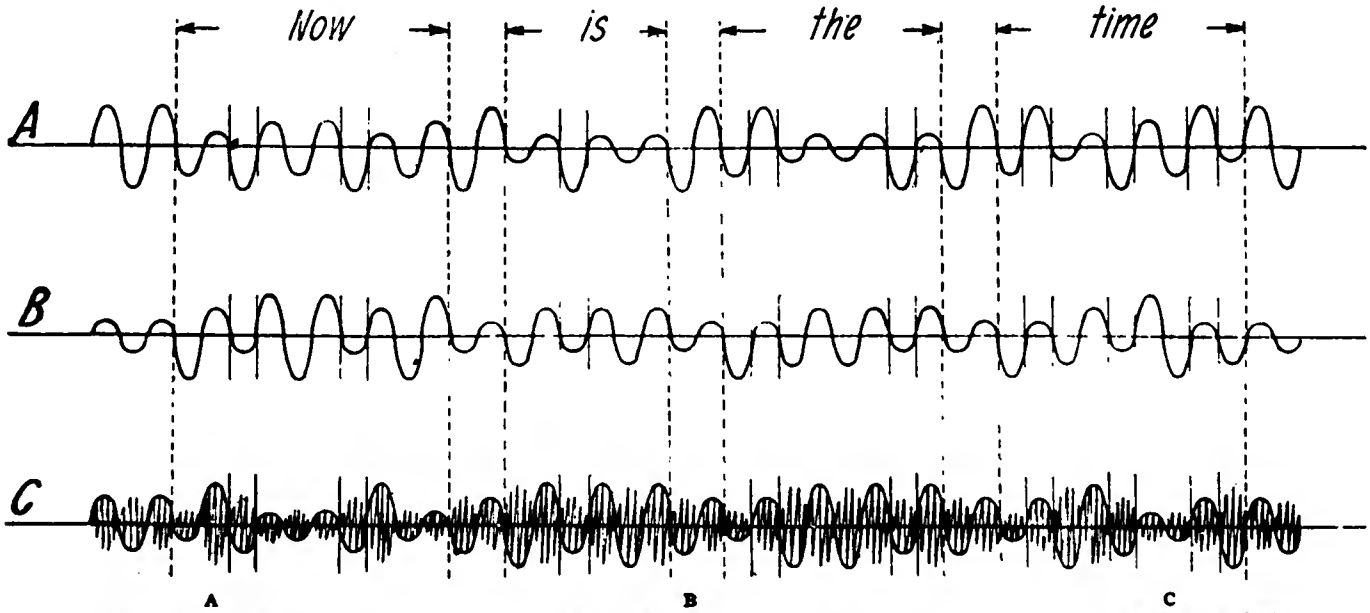
A point of fundamental importance in this method is that no two adjacent signals are of the same sign, since each semicycle is utilized to effect signaling, giving a dot, dash or space. Other things being equal, the variations in intensities for each of the three elemental signals are reduced to the minimum on the theory that the minimum possible change of the fundamental wave should be made. The reason for this is that an alternating current in the steady state, which amounts to a series of the present cable letters "a" or "n" strung together without space, can attain a speed in any form of telegraphy many times greater than any practical system, for the reason that a single sine wave is transmitted through any form of electrical circuit without distortion of any kind, and, in fact, is the only type of wave that is so transmitted.

A still more important point to be considered is the transmission of the largest volume of telegraphic business with a minimum number of signals, and from this angle the new form of alphabet has most striking advantages.

Figure 1 exhibits graphically the relative speeds of the International Morse alphabet, the present cable alphabet, and the alphabet proposed here. It will be noted that by the employment of the alphabet proposed here we gain immediately over one hundred and fifty per cent. in the speed of transmission of signals; the ratio of 8.5 to 3.2, as shown in figure 1, is 2.65.

Referring to the cable Morse alphabet, the ratio of 3.67 to 3.2 does not indicate the real advantages of the proposed alphabet. In the present cable Morse alphabet, although the signals occupy equal lengths of time, some of the letters are transmitted by adjacent signals of the same sign. In letters such as "s" or "h," for instance, three and four consecutive signals have the same sign. The additional principle of the Signal Corps

*"On An Unbroken Alternating Current for Cable Telegraphy." Proceedings of The Physical Society of London, Vol. XXVII, Part V, August 15, 1915. U. S. Patent No. 1,233,519, July 17, 1917.



A
Dot = Smallest amplitude
Dash = Medium amplitude
Space = Largest amplitude

B
Space = Smallest amplitude
Dot = Medium amplitude
Dash = Largest amplitude

C
Dash = Smallest amplitude
Space = Medium amplitude
Dot = Largest amplitude

There are three other possible permutations of amplitudes not shown here. Ratio of amplitudes of signaling units arbitrarily assumed as 1:2:3

alphabet that no two consecutive signals shall be of the same sign permits, for the first time, a continuous wave of one definite frequency being employed for the alphabet. This makes it possible to utilize, effectively, electrical and mechanical tuning, either or both.

Figure 2B illustrates graphically this method of modulating a single frequency wave, and shows the words "Now is the time" as they would be transmitted by this method, in which we arbitrarily assign the largest amplitude for a dash, the next size amplitude for a dot, and the third for the spaces between.

Figure 2A and 2C shows two other combinations.

The particular combination 2B has been tried out in actual practice on cables, and has been tested by the engineers of the British Post Office.

If we consider the present method of operating the radio telegraph stations we find that the method of sending, whether automatic or by hand, has no relation to the phase of the current flowing in the antenna. The transmitting key is opened or closed at any indefinite point of phase, with the result that in the same letter or message a large flow of current is interrupted or changed at all possible values from zero to a maximum, positive or negative.

It is well known that the sudden breaking or introduction of high impedances in an alternating current circuit produces transient phenomena which results in a whole group of harmonics being transmitted. Add to this the practical condition of performing this operation upon a current ranging all the way from zero to hundreds of amperes, and it is easily seen that the ether of space is bombarded with a mass of frequencies never twice alike even in the same letter.

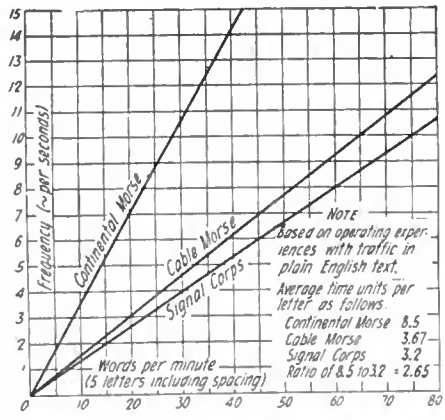


Figure 1—Comparative signaling speeds of telegraph alphabets

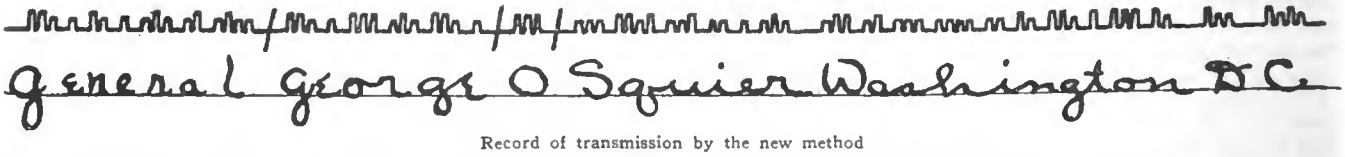
The other source of disturbances in radio is natural disturbances, generally designated as "static" or "atmospherics." Here again it is believed that the solution may be found in the method of sending proposed here, for the reason that the modulating frequencies employed are of a very low order, and it should be comparatively simple to devise instrumentalities which will enable us to differentiate between these low modulating frequencies and the higher frequencies of the "static" or any other natural disturbance. To emphasize my point, by an examination of figure 1 it is seen that a modulating frequency as low as 10 per second, which is a very high frequency for ocean cable practice, corresponds to 75 words a minute, which is far higher than any form of sound reception. A modulating frequency of 60 cycles per second, the normal power frequency, corresponds to a speed of 450 words a minute, of 5 letters each.

If this speed, for traffic reasons, is too great, it is only necessary to make the same perforations in the transmitting tape correspond to a suitable even multiple of a semicycle to reduce the speed to any desired value. For instance, by making each of the signaling units correspond to six complete cycles of current instead of one semicycle, the speed of signaling is reduced to 37½ words a minute, a commercial speed of signaling. In this method of using the alphabet, wave trains are employed as the signaling elements.

The ratio of the lowest frequencies employed in radio to the modulating frequencies here considered is of the order of thousands.

At present the radio engineer has utilized and made his own all of the audio frequency range and at least several octaves of the radio frequency range, and has devised apparatus for the amplification and rectification of both of these ranges, audio and radio. This plan proposes to enter the unused infra-audio range, which would not only add a most useful band of frequencies to those now used, but would give a band below the range of the human ear. If this band were employed for telegraphy, an additional advantage would be that it could not interfere with any radio receiving.

Finally, it is seen that by the method proposed here it is possible to modulate a single radio frequency by a number of modulating frequencies, and thus multiply the capacity of each radio frequency channel.



Record of transmission by the new method

Hints and Knacks

By Geo. C. Haseltine

ALWAYS make the "Western Union" splice. This is best made by using two pairs of pliers, or if available, a pair of connectors and pliers. Then melt up some solder in a ladle or old frying pan. It is best to build a fire for this right where the splicing is to be done, if possible, to avoid having to carry the melted solder around from place to place. Anoint the splice well with *cut* muriatic acid, and being sure the solder is good and hot, dip the entire splice into it, and hold it there until the splice gets as hot as the solder. On withdrawing it will be found that you have a splice that is fully equal to a continuous wire.

Be sure to hold it in the solder until it gets hot, otherwise the solder will form an unsightly "blob" on the splice. If any acid remains on any part of the wire not touched by solder, clean it off thoroughly.

The ordinary stranded galvanized clothes line makes a very good aerial.

I have one single wire aerial 600 ft. long made of several of these, on which I have no difficulty in bringing in the high power stations at Honolulu, Guam, and Iwaki (Japan), airline distances 3,300, 6,600 and 7,100 miles respectively, using the ordinary three coil honeycomb hook-up and one detector tube.

In using a crystal detector, suspend it with a rubber band to the under side of a shelf over your table, and it will not jar out. Mine stays in adjustment for weeks at a time.

I find that the old fashioned loose coupler is the best form of inductance for short wave crystal work, but do not put too much winding on the primary.

I am bringing in radiophone broadcasting stations, amateur spark stations and ships—the first as far distant as 1,000 miles, the second 1,200 miles and the third, all over the Gulf and Caribbean, and Mexican and California coasts, with the following installation:

Aerial 3 wires in horizontal fan shape, one northeast, one east and one southeast—each 100 feet long—from the top of a 75-foot mast; lead-in taken from their junction at top of the mast, which makes a total length of aerial and lead-in of 170 feet. Primary of small loose coupler, 24 turns No. 20 DCC on 3½-inch diameter tube, tapped each turn for five, then in groups of five; secondary 60 turns No. 28 DCC on 3-inch tube, ten taps. Ordinary crystal detector and Baldwin phones.

With this I get the radiophones, amateurs and short wave ships on the 10th turn of primary. I have a small variable condenser in shunt with the primary but seldom use it.

No. 30 gauge silver wire—to be had from any manufacturing jeweler—is fine for cat whiskers.

To letter a bakelite panel, clean the surface you wish to use with wood alcohol, to remove any greasy film, then write whatever you wish on the panel with a sharp stiff steel pen and draftsman's white ink, such as we use for writing on blue prints. When the writing is perfectly dry, take a fine, soft camel hair brush and cover it with transparent varnish to protect it.

If at any future time you wish to remove it, just dampen a rag with wood alcohol, and wash it off; the wood alcohol dissolves the varnish.

Amateur Operation in Mexico

By Harold T. Mapes

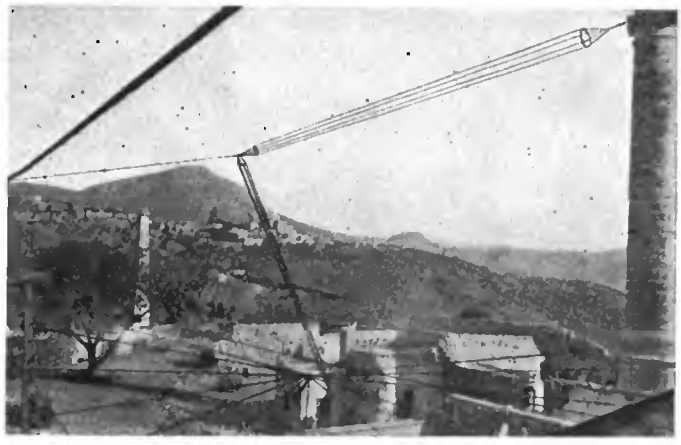
Guanajuato, Gto., Mexico.

BEFORE the war I owned and operated station 3AUC in Pennsylvania, a 1KW rock crusher, and later was the SOS operator on the steamship *Silver Shell* that successfully fought off a German submarine in the Mediterranean Sea, during the World War.

This encounter, in which radio played a prominent part, was fully described in the August, 1917 issue of THE WIRELESS AGE.

Since locating here after the war, I built an amateur experimental station, for both transmitting and receiving.

The receiver, now in use, is home-made and works about the best of any receiver that I have ever used. The circuit is that shown in the catalogue of the Radio Corporation of America, and is a five-tube circuit having two radio frequency tubes, one detector and two audio-frequency tubes. I can use any combination of these tubes from one to five, either with a variometer set or honeycomb coil set. By the use of Federal anti-capacity switches, the two radio frequency transformers are switched in or out and wave lengths from 180 to 25,000 meters can be very successfully worked. Two antenna binding posts are supplied with a switch, so that either a long or short antenna can be used. A Weston voltmeter can be switched across either the A battery reading 10 volts, B detector battery with a suitable resistance in circuit to read 30 volts and also across the total B battery with suitable resistance in circuit to read 100 volts. The panel has a copper shield on the back and the cabinet is also shielded.



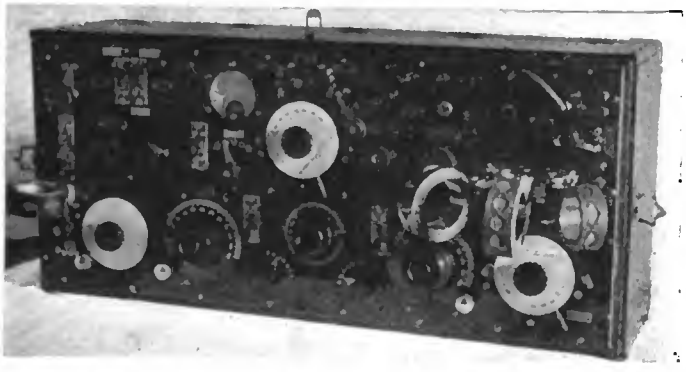
Six-wire cage antenna of BX amateur station. The illustration gives a good view of the surrounding country, including the location of the remote-controlled 20-watt transmitter

I have logged close to 500 amateur stations in every district of the United States, all over 600 miles away. Also broadcast stations from Frisco to WJZ and high power stations from Cavite to POZ have been heard on this set.

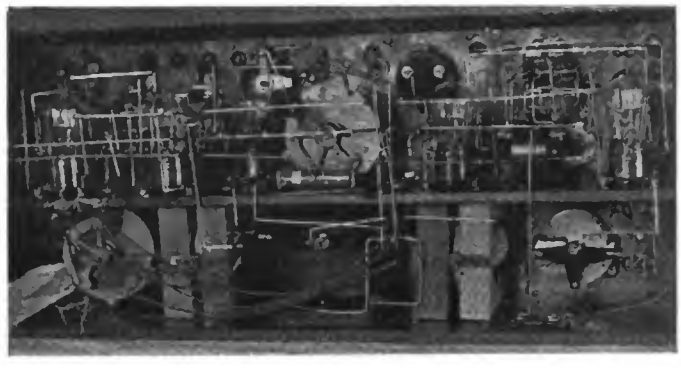
My transmitter, with an output of 20 watts, is located about a quarter of a mile distant, with remote control. The plate supply of 500 volts is obtained from a trolley circuit. With the Hartley circuit, the antenna current is 2.7 to 3 amperes on a six-wire cage 60 feet x 60 feet, with a fan counterpoise and ground. Signals from my station have been reported by 6ZY at Honolulu. The remote control allows me to listen in at the same time that I am transmitting, so that any other station I am working with can break in at any time. This works very well, provided that they are not working on my wave length.

So far the advancement of radio has been rather slow here in Mexico, but already a number of stations are in operation.

CX-Guanajuato, 20 watts, JH-Mexico City, 100 watts, AX and DB Mexico City, 20 watts each; and CM-Orizaba 20 watts, are working regularly. The call for my station is BX and I shall appreciate hearing from amateurs at a distance of a thousand miles or more who may hear my signals.



Home-made universal receiver built by Mr. Mapes and used at his station—range 180 to 25,000 meters



Rear view of the 20-watt C.W. transmitter of BX station, Guanajuato, Mexico. The Hartley circuit is used

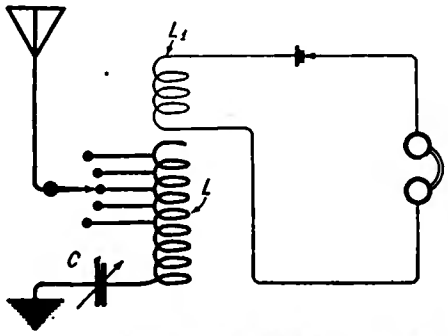
A Selective Broadcast Receiver

By G. N. Garrison, I. R. E.

THE radio sections of newspapers in general have been deluded recently by letters from broadcast listeners complaining of the fact that with their crystal or other receiving sets they cannot discriminate between the class "A" and class "B" broadcasting stations and that when both classes of stations are operating at the same time, as they generally are in the evening, instead of receiving either class clearly they are compelled to listen to "hash"—a mixture of the broadcasting from the 360 and the 400-meter stations.

Many of these letters ask that the newspapers use their influence with the broadcasting stations in an endeavor to have only one class of station broadcasting at a time.

Not a few of the letters, too, complain of interference from the spark stations of both amateur and commercial operators.



Circuit diagram of the selective broadcast receiver

This deplorable state of affairs is brought about not through any fault of the broadcasting, commercial or amateur stations, but because of poor design of the inferior receiving antenna, or because of poor tuning quality of receiving sets.

The difference in wave lengths between the class "A" and class "B" broadcasting stations is, of course, 40 meters and this translated into everyday language shows that their waves differ by more than 131 feet. Between the class "B" stations and the normal operating waves of commercial stations there is a difference of exactly 656 feet while between the amateur wave length and that of the class "A" stations, this difference

(*Continued on page* 69)

A New Dry Battery Receiving Tube Radiotron UV-199

By J. C. Warner

Research Laboratory, General Electric Company

RADIOTRON UV-199 is a new receiving tube of the high vacuum type which has been developed for operation on dry cells. For such use, it is of greatest importance that the filament current should be as small as possible and at the same time, the characteristics of the tube should not be sacrificed in making this reduction in current. That the UV-199 fulfils both of these requirements will be shown in the brief description of the tube, which is to follow:

Compared with the ordinary type of receiving tube the UV-199 is quite small, being one inch in diameter and slightly over three inches in length. Figure 1 shows external and internal views of the tube.

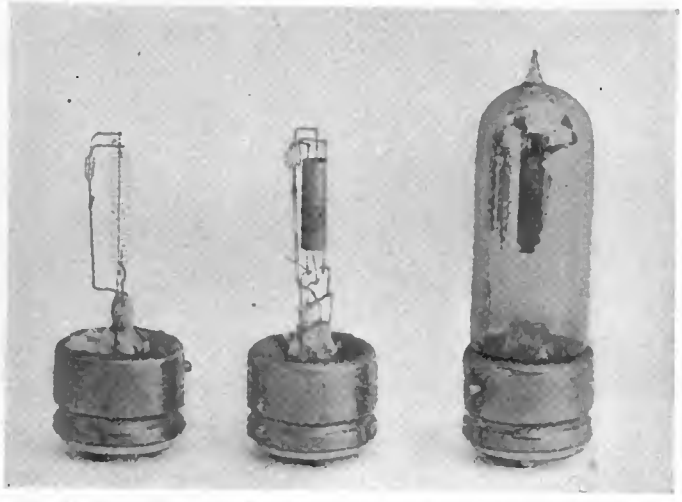


Figure 1—Internal and external views of the new tube

The filament of Radiotron UV-199 requires only 60 milliamperes at 3.0 volts, that is, .18 watt. This small current and low power consumption are made possible by the use of the new type of filament which has already appeared in the UV-201-A.

This new filament is made of tungsten, but differs from the older type of tungsten filament in that the power consumption and operating temperature are much lower. Thus, the new filament at normal temperature is a dull yellow, while the older filaments burned at a white heat.

In order to operate at such a low current, it is of course necessary that the filament be of very small size. Figure 2 shows an interesting comparison of the UV-199 filament and a human hair, the filament being only about one-fourth as thick as the hair. Both are magnified 125 times. In spite of this small diameter, the filament is remarkably strong since tungsten wire has about the same tensile strength as high grade steel wire.

It is always desirable, in order to obtain maximum life, to operate filaments at the lowest temperature which will give satisfactory results, and the rated voltage should never be exceeded.

The life of the UV-199 filament is not determined by actual burnout, but by a decrease in electron emission. This decrease is not gradual throughout the life of the tube, but usually occurs quite suddenly, and is indicated by a sudden and decided increase in the filament voltage required.

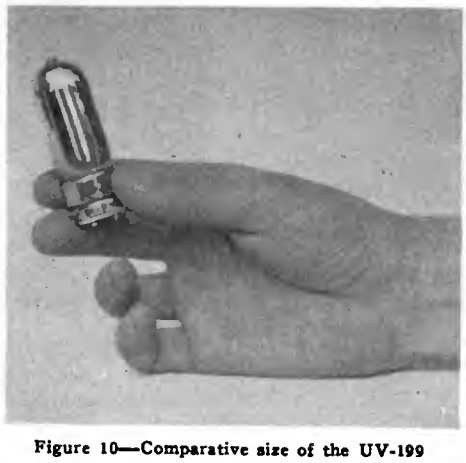


Figure 10—Comparative size of the UV-199

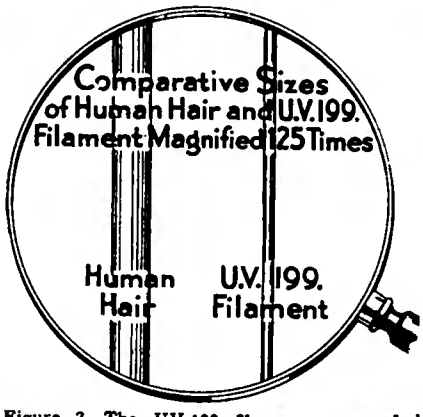


Figure 2—The UV-199 filament compared in size with a human hair

The greatest care should be taken to prevent the plate voltage from being applied accidentally to the filament. Although the normal operating temperature of the new type of filament is low and it will withstand considerably more than rated voltage without burning out, the 20 volts or more in the plate battery would burn out the UV-199 filament instantly. For protection against such accident it is advisable when experimenting, to connect an ordinary 10-watt 110-volt incandescent lamp in series with the plate battery. The resistance of the lamp is low when its filament is not lighted and it has no effect on the operation of the set, but in case of accidental short circuit the lamp will limit the current from the plate battery to a safe value. If some such protection device is not used, the tubes should be removed from their sockets when changes are being made in the connections of the set. On account of their slow action, fuses are of no value in protecting small filaments.

Occasionally, when excessive filament or plate voltage is applied to a UV-199, the electron emission may fall off to a small value although the filament is still lighted. The activity of the filament may usually be restored by operating the filament at rated voltage for ten minutes or longer with plate voltage off.

The UV-199 was designed to be operated from three dry cells in series, although storage cells may be used if proper care is taken to reduce the voltage at the terminals of the filament to 3.0 volts. On account of the small filament current of the UV-199, the ordinary 4 to 10-ohm rheostats are of no value for a single tube, and higher resistances must be used. Thus, one tube operated from three dry cells requires about 30 ohms in the rheostat, two tubes 15 ohms, and three tubes 10 ohms. If a six-volt storage battery is used, one tube requires 60 ohms, two tubes 30 ohms, and three tubes 20 ohms.

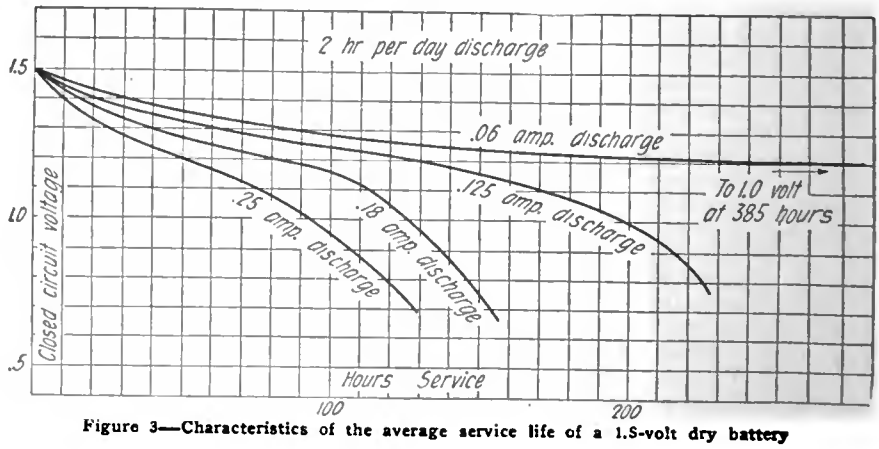


Figure 3—Characteristics of the average service life of a 1.5-volt dry battery

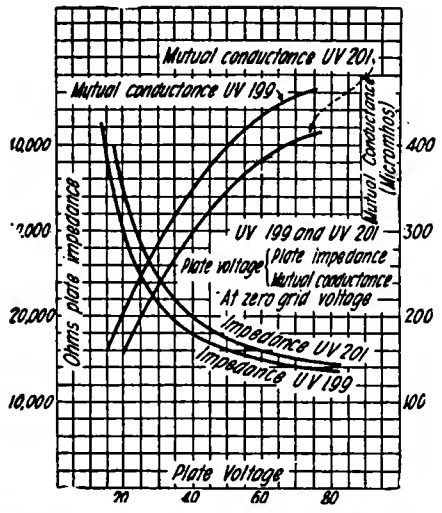


Figure 4—Variation of plate impedance and mutual conductance with plate voltage

Figure 9—Comparative size of Radiotrons UV-199 and UV-201-A

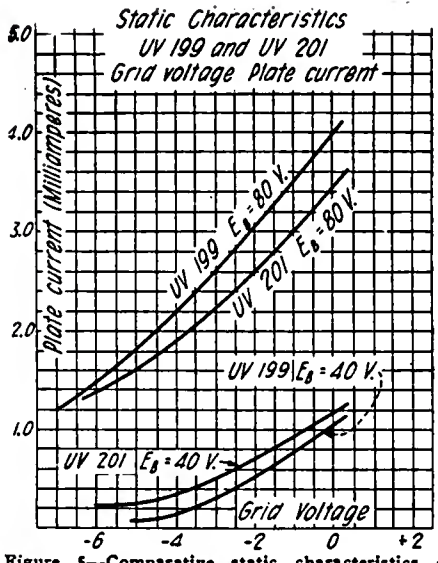


Figure 5—Comparative static characteristics of the UV-199 and UV-201 tubes

The advantages of a 3.0-volt 60-milliampere filament are obvious after a brief consideration of dry battery characteristics. Dry batteries are most efficient at small loads; hence, to obtain the greatest number of ampere hours from the battery, it is desirable to design the filament to take as small a current as possible. In this respect the UV-199 has an important advantage over tubes requiring more current. The second requirement for maximum battery efficiency is that the battery be used until the closed circuit voltage has fallen to a low value, one volt or less. The voltage of a dry cell is often thought of as being 1.5 volts, but actually, the closed circuit voltage falls below this point in a very short time after the cell has been put into service.

Figure 3 illustrates the characteristics of an average "general purpose" No. 6 dry cell. The greater economy of a low current tube is plainly shown here, as well as the importance of designing a filament so that the battery can be used down to a 1 volt per cell end point.

For one tube receiving sets designed for minimum size and weight, it is possible to use a flashlight battery to light the filament. Such a battery will supply service of one hour per day for approximately one month.

In order to describe the electrical characteristics of the UV-199, it is convenient to compare it with the well known Radiotron UV-201, or C-301. The amplification constants of the two tubes are nearly the same, averaging about 6.25 for the UV-199 and 6.0 for the UV-201 model. The output impedance of the UV-199 averages about 18,000 ohms at 40 volts compared with 20,000 for the UV-201. The mutual conductance of the UV-199 is correspondingly higher, being about 340 micromhos, while that of the UV-201 is 300. Figure 4 shows the variation of plate impedance and mutual conductance with plate voltage, and figures 5 and 6, the usual static characteristics of the UV-199 and UV-201. Figure 7 gives a comparison of the power output of the UV-199 and UV-201 in a load circuit of 20,000 ohms resistance. This illustrates the capabilities of the two tubes in a circuit similar to the usual audio frequency amplifier circuits.

These curves show that the UV-199 has better amplification characteristics than the UV-201 while consuming only one twenty-seventh as much filament power. However, it is not to be expected that the UV-199 will give as great amplification as a tube built with the same type of filament but of larger size. The UV-201-A or C-301-A is such a tube and gives somewhat more amplification than the UV-199, but it does not have the same advantages of dry battery filament excitation.

As an audio frequency amplifier the UV-199 should ordinarily be operated with 40 to 80 volts on the plate. A grid bias should always be provided in order to secure minimum distortion, and also to prevent possible plate overload at the higher plate voltages. Figure 8 shows a method of securing a small bias by utilizing the voltage drop in the filament rheostat. This is sufficient when the plate voltage is not over 45 volts and when head telephones are used, but above 45 volts on the plate and particularly when a loud speaker is used, a grid or "C" battery should be added. Figure 8 shows the proper location of this battery which should be 3.0 volts when the plate voltage is 60, and 4.5 volts when the plate voltage is 80, making certain that the positive terminal of the grid battery is connected to the filament battery. This last combination of voltages, i. e., 80 volts on the plate and negative 4.5 volts on the grid is recommended for operation of loud speakers, the addition of the grid battery and extra plate battery being amply repaid by the improvement in quality of telephone signals.

The electrostatic capacities between the electrodes of the UV-199 are very small, and for this reason, this tube is an exceptionally good radio frequency amplifier. Any of the usual circuits may be employed, and best results are obtained with about 45 volts on the plate.

In addition to its use as an audio and

(Continued on page 69)

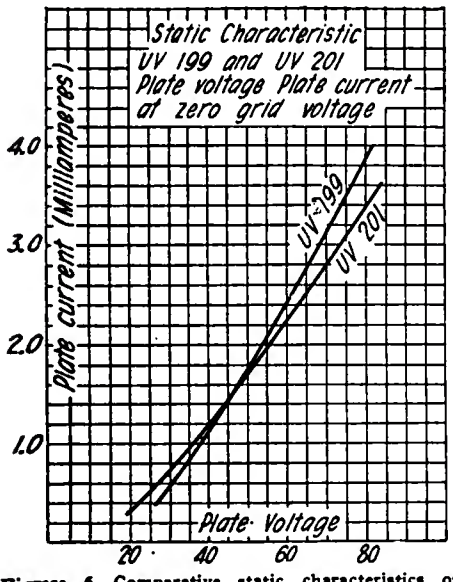


Figure 6—Comparative static characteristics of the UV-199 and UV-201 tubes

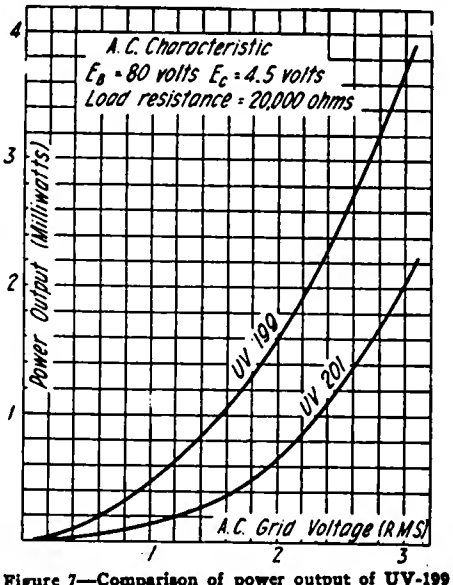


Figure 7—Comparison of power output of UV-199 and UV-201 tubes

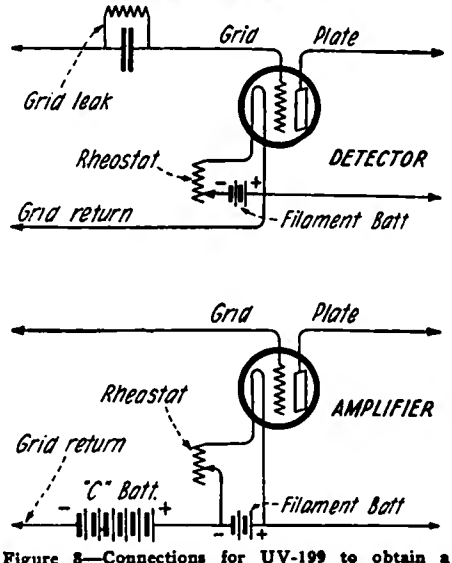


Figure 8—Connections for UV-199 to obtain a small grid bias by utilizing the voltage drop in the filament rheostat

A Universal Capacity, Inductance and Wave Length Chart

By Maurice Buchbinder

THE wave length, capacity and inductance of any circuit are connected together by the simple relation

$$\lambda = 2\pi v \sqrt{LC}$$

Where v is the velocity of light, or 3×10^8 meters per sec.

λ is the wave length in meters.

L is the inductance in henries.

C is the capacity in farads.

Using more convenient units, and reducing, we should get

$\lambda = 1885 \sqrt{LC}$ in microhenries and microfarads.

From this formula, if two of the factors be known, the third is determinable. Thus if we were to start designing a simple, unicircuit receiver, then, estimating the capacity of the antenna, we could calculate the inductance needed to tune to 400 meters for broadcasting reception. We might want to use a smaller aerial, however, and then we would have to recalculate the required inductance. Thus it is obvious how desirable it is to have an easy way of finding either L or C when one or the other and the wave length are known.

Such an easy way would be to plot on ordinary cross section paper with L as abscissae and C as ordinates for any wave length. A regular curve results, known as the equilateral hyperbola. To obtain the curve accurately many points on it need to be determined by calculation.

If however, we apply some simple mathematics to the relation $\lambda = 1885 \sqrt{LC}$ we get far simpler results and many advantages.

Squaring we get $\lambda^2 = (1885)^2 LC$.

$$L = \frac{\lambda^2}{(1885)^2 C}$$

(C in microfarads)

For 400 meters $L = \left(\frac{400}{1885}\right)^2 \frac{1}{C}$

Taking logarithms $\log L = 1.6535 - \log C$ where C is now in thousandths of a microfarad.

L is in microhenries.

This is a straight line relation. Thus we come to the important conclusion that if we plot logarithms of L and C against each other, we get an even straight line instead of a continuous curve. The plotting is therefore tremendously simplified because only two points are necessary to determine a straight line.

We can now go a step further. If instead of plotting on ordinary cross section paper, we plot on logarithmic paper, then we get a straight line curve which will read off directly L and C for the given wave length. Furthermore because of the nature of logarithmic paper the range covered is condensed very much compared with what it would be on cross-section paper.

Lines like this can easily be drawn for other wave lengths. A glance at the chart shows that we have compressed into a small space a method of finding L and C through any wave length that might arise in practice, and through an extreme range in variation for C.

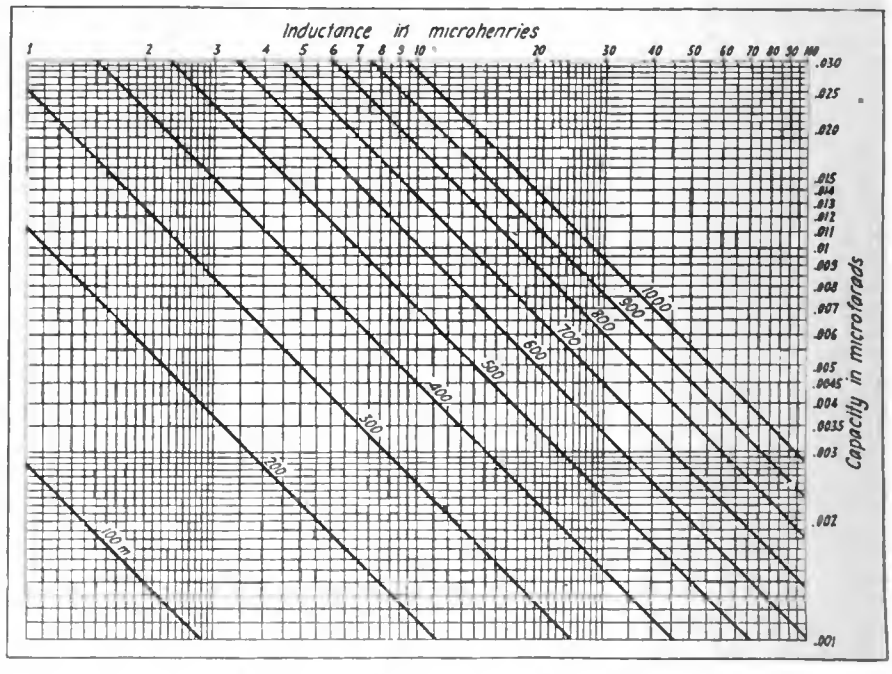
How to Use the Chart

Each line represents a wave length directly. Suppose we know the capacity and want the inductance at a given wave length. We go to the line of that wave length. Then we take the line of the known capacity and follow it across horizontally till it hits the wave length line. Vertically up from there is the inductance reading.

In conclusion we would say that a little familiarity with the working of this chart will enable one to get sufficiently accurate results and save a considerable amount of time in design and construction work.

Directions for plotting:

(a) The axes are scaled by means of an ordinary Keuffel-Esser slide rule. Care being taken to keep these axes absolutely perpendicular to each other.



The universal capacity, inductance and wavelength chart

A glance at the chart shows the capacity range to be from 0.001 to 0.030 microfarads. Should we want to read below this we mentally change this range to from 0.0001 to 0.003, at the same time multiplying the inductance range by 10 that is from 10 to 1000 instead of from 1 to 100 microhenries.

For illustration at 400 meters we see that 0.001 mfd. calls for 45.1 microhenries.

Then 0.0001 mfd. calls for 45.1x10 or .451 microhenries.

Finally, should we wish wave lengths of 1000, 2000, 3000, etc., instead of 100, 200, 300, etc., all that is necessary is to multiply both inductance and capacity scaled off the chart as given, by 10.

Thus at 400 meters:

0.001 mfd. calls for 45.1 microhenries.

Then at 4000 meters:

0.01 mfd. calls for 451 microhenries.

0.001 mfd. calls for 4510 microhenries.

0.0001 mfd. calls for 45100 microhenries.

(b) The 400-meter curve is the first one plotted

$\log L = 1.6535 - \log C$ (C is in millimicrofarads)

if $C = 1$, $\log C = 0$

$\log L = 1.6535$

$C = 1$ $L = 45.02$

This is one point.

If $C = 10$, $\log C = 1$

$\log L = 1.6535 - 1 = 0.6535$

$L = 4.502$ $C = 10$

This is the second point.

Check points may be chosen by letting $C = 2$, 3, etc., and calculating L.

(c) Any other curve is determined from the 400 meter curve by the relation that at any capacity the inductances are in proportion as the square of the wave lengths. Thus at 800 meters the ratio is $\left(\frac{800}{400}\right)^2 = 4$ to 1. If L at 400 meters is (for $C = .001$) 4.502 as above, then at 800 L becomes $4 \times 4.502 = 18.0$. Several points are taken for checking.

The Ionized Strata

By Capt. H. de A. Donisthorpe

SOME of the most interesting phenomena to be studied both by the radio engineer and enthusiast are those arising from what is known as the "ionized strata." The effects of ionization on radio reception are astonishing and are especially noticeable during the night period, when the condition of this strata is responsible for the long distant and "freak" reception experienced.

This strata is a more or less electrically conducting layer of air above the usual atmosphere which we breathe. It has lost its usual high insulating properties owing to the fact that it has become ionized.

Ionization of the atmosphere, in simple language, indicates that the particles of air have become charged with electricity, some having assumed a positive potential, whilst others have become negatively charged. The question then arises as to the cause of this ionization and to ascertain what the effect of such a strata of air has on electro-magnetic or radio waves. The ionization has the effect of rendering the air slightly conductive to electric currents, an interesting fact when it is realized that air under normal conditions is a perfect insulator.

Air becomes ionized when exposed to certain ether waves, such as those due to "X" rays, radium rays or ultra-violet rays; and also by other causes which will not be discussed in this article. There is a very interesting experiment illustrating the effect of the ultra-violet rays on air and one which indicates how it is that an ionized strata in the atmosphere can be brought about.

The apparatus required consists of an ordinary arc lamp and an electroscope (figure 1). Now, the arc lamp emits quite a percentage of ultra-violet light and if the lamp is brought sufficiently near to the electroscope, which has previously been charged, thus separating the leaves, this violet light will ionize the surrounding air causing it to become slightly conductive with the result that the gold leaves of the electroscope collapse. The electroscope can be efficiently screened from the rays given off by the arc by inserting an ordinary sheet of glass between them, as will be shown by the fact that the leaves then remain diverged.

Now, in the case of the atmosphere surrounding the earth, this becomes slightly ionized during the day time owing to the power of the ultra-violet portion of the sun's spectrum. The result is that the air which, as has been stated before, in ordinary course of events, is an excellent insulator, now becomes slightly conductive and consequently tends to somewhat resist the propagation of radio, or electro magnetic waves. The effect is approximately that of grounding; the conductiveness of the air allows the very small amount of radio energy to reach the ground and disappear before it has a chance to go very far.

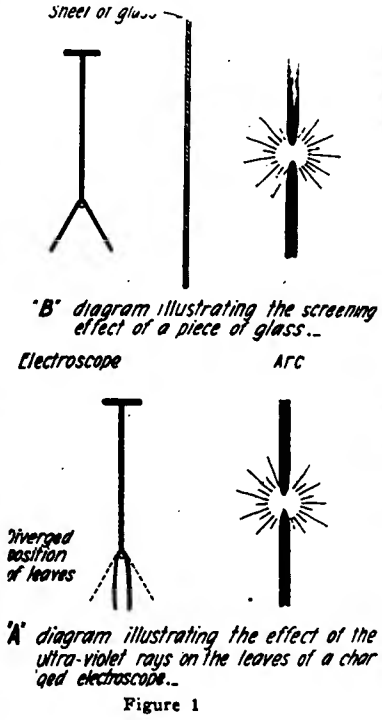


Figure 1

Now let us consider a point of the surface of the earth where night is approaching; the lower layer of the atmosphere loses the influence of the sun's ultra-violet rays and a process of de-ionization sets in for that portion, or in other words, a recombination of the positive and negative charged particles is brought about (figure 2).

An important factor in this de-ionization is the fact that this process is controlled by the atmospheric pressure, as the lighter the pressure of the air, the slower is the function of de-ionization. Now, from this, it is quite easy to see that at night the higher regions of the atmosphere take longer to return to their normal state than the lower, the latter becoming rapidly de-ionized as soon as darkness sets in. As may be expected from the foregoing, at a certain distance from the earth's surface, some fifty miles up where the pressure is very low, a kind of level is arrived at where the air never becomes de-ionized before the sun's rays of the next day appear. This brings about a moderately defined surface between the normal atmosphere and the ionized strata during the night period.

Consequently, it is easy to understand how it is that during the darkness of the night "freak" reception is obtained. The lower air, having become during this period an excellent insulator, does not offer any resistance or short circuiting effect to the electro-magnetic waves, which therefore travel greater distances than during the day.

Another reason for long distance reception at night is that the surface of this upper and permanently ionized strata is an excellent reflector of electro-magnetic waves and therefore provides a second path for the waves from the transmitter to the receiver, as is illustrated in figure 3.

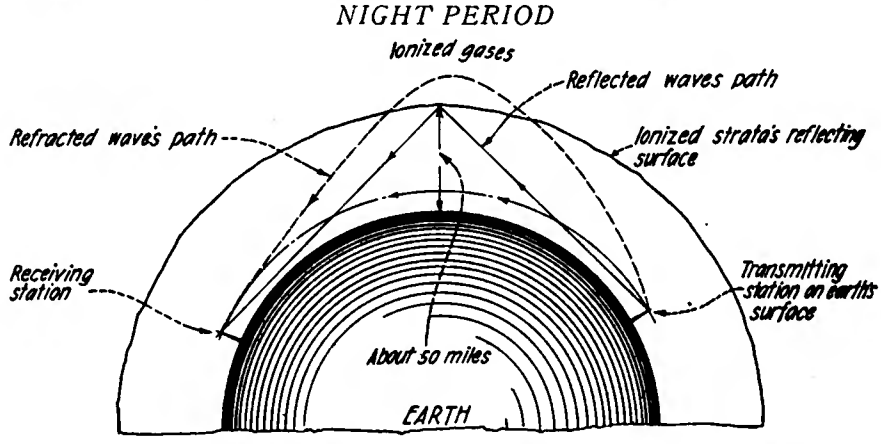


Figure 2—Paths of direct, reflected and refracted rays from transmitter to receiver

The rays may also become refracted when entering the ionized strata and bring about still yet another alternative path for the waves.

These two latter effects of the ionized strata cause considerable consternation to the experimenter with radio direction finding apparatus. The radio compass cannot be entirely relied upon during this period. The curve shown in figure 3, illustrates a record of bearings of a known radio transmitting station taken at a radio compass station periodically throughout the 24 hours.

The careful study of the ionized strata and its effects on radio waves is one that should be undertaken by the experimenter, as there are doubtless many further interesting and valuable discoveries to be made by probing into the secrets of this phenomenon.

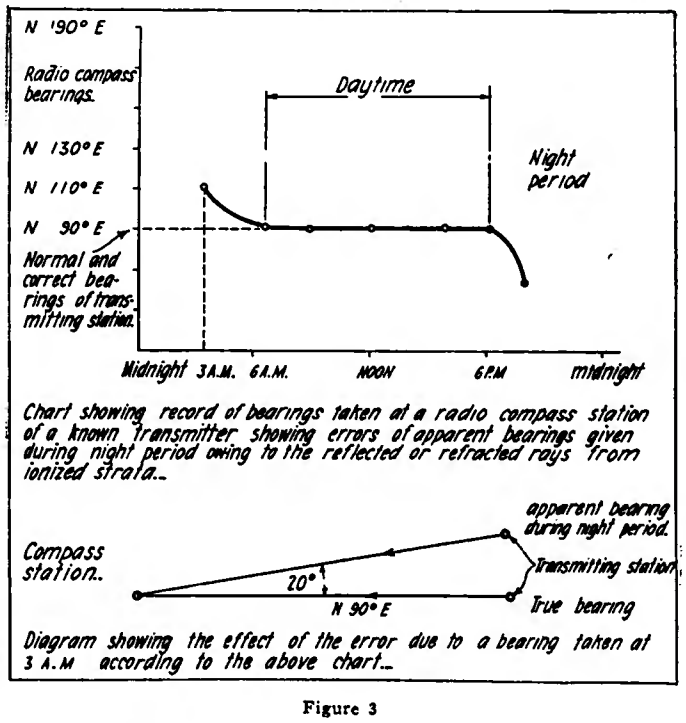


Figure 3

The Wave Trap—What It Does and How It Does It

By Jesse Marsten

THE interference which Mr. Broadcast Listener has experienced and still experiences in his reception of broadcasting has resulted in an extended discussion of ways and means for reducing and eliminating it. Numerous ways out of the muddle have been suggested, such as elimination of all spark equipment, prevention of amateur transmission during broadcasting hours, re-allotment of wave lengths, the use of multi-circuit receivers. Some of these methods are desirable and helpful, others neither desirable nor helpful. In any event these means take considerable time. Spark equipment cannot be thrown into the ocean over night, wave length allocation cannot be juggled haphazardly and many radioites have single circuit tuners which they do not care to scrap, and rightfully so, because they represent so many dollars and cents. Such remedies, while helpful, come slowly in the course of time. Meanwhile some relief from interference must be had and one of the simplest methods which shows some promise of help is the so-called "wave trap." It will be of some help to the broadcast listener to know what it does.

The wave trap may be compared to the filters commonly employed on water faucets. The object of the water filter is, of course, to retain dirt and other heavy foreign matter present in the water and permit the clear water to pass through. This is accomplished by the use, generally, of porous material which allows the liquid to pass through, but holds back solid matter which cannot get through the fine pores of the filter. The filter may therefore be regarded as having a low resistance to the passage of water through it, and a high resistance to the passage of the undesirable foreign matter. Similarly the wave trap may be regarded as a radio wave filter which permits certain waves to pass through it and does not permit other waves to pass through it. This condition is generally attained by making one adjustment which alters the resistance of the wave trap so that it has a very low resistance to the desired signal and has a very high resistance to the undesired signal.

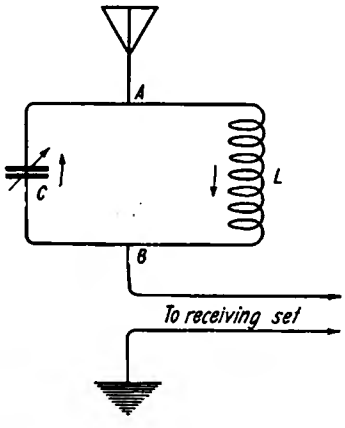
The simplest form of wave trap which the radio fan will find suitable and practicable is the circuit illustrated in figure 1. It will be seen that it consists solely of an inductance coil and a variable condenser connected in parallel with one another. The wave trap is connected in the antenna circuit in the position shown in figure 2.

How does the wave trap produce the effect described above? This question is capable of a simple mathematical analysis, but since it is the results of the analysis which interest us we will confine ourselves to the conclusions to be drawn. The wave trap circuit shown in figures 1 and 2 offers a certain effective resistance to the flow of radio frequency currents through it. This resistance which it offers to radio frequency currents—called "impedance"—is not constant but depends upon the wave length to which the wave trap circuit is tuned. The analysis shows that the wave trap circuit offers the greatest resistance when it is tuned exactly to the wave length of the incoming signal. Thus suppose a signal of 360 meters wave length flows down the antenna. If the wave trap circuit is tuned to 360 meters its impedance to this signal will be a maximum and will thus prevent the signal from passing through it.

This will be more clearly seen from a certain curve which is obtained by the following simple experiment. Suppose we set the variable condenser of the wave trap at a certain capacity and keep it fixed in this position. Now suppose we apply a radio frequency voltage across the terminals of the wave trap AB, figure 1, keeping the value of the voltage the same, but always changing the frequency of the current. If we measure the current which flows through the wave trap and draw a curve which shows the value of current against the frequncy of this current, we will obtain a curve having the shape shown in figure 3. This curve shows us that at a certain particular frequency F, the current through the wave trap was zero, but that at higher and lower frequencies than F the current was greater. If we now measure the frequency of the wave trap circuit we will find that it is exactly the same as the frequency F, namely the frequency at which the current was zero.

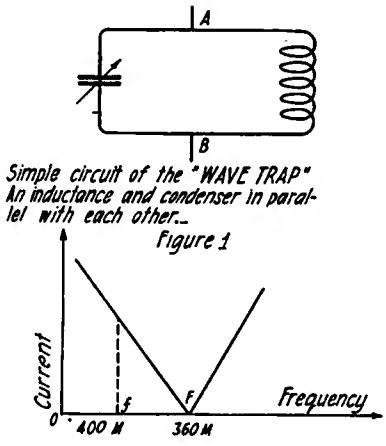
Suppose now that the reader desires to tune in on the broadcasting of, let us say, WJZ, which station transmits at 360 meters, and let us assume that he experiences considerable interference from some station at 400 meters which interference he wants to eliminate. If he uses a wave trap of the type shown in figure 2 the method of procedure will be as follows: He varies the condenser in the wave trap until it is tuned to exactly 400 meters. This 400 meters corresponds to frequency F in figure 3, at which frequency the current passing through the wave trap is zero. However, at point F, we have the frequency 360 meters, and from the curve we see that there is a large current passing through the wave trap at 360 meters. Thus the wave trap eliminates the interfering signal when it is tuned to the interfering signal, but allows other signals to pass through it. In other words the wave trap offers a very high impedance to the flow of currents of the frequency to which it is tuned, but offers a lower resistance to other frequencies.

In actual practice the method of using the wave trap is to vary the wave trap condenser until the desired signal becomes stronger and the undesired interfering signal is eliminated. When this position of the condenser is found the wave trap is tuned to the interfering signal and thus suppresses it because its resistance at this frequency is very great. It will be apparent that the wave trap will be able to eliminate only one undesired or interfering wave. By



Shows how wave trap is connected in antenna circuit. At resonance current from A to B through L is in opposite direction to that through C. Hence total current flowing through wave trap is zero at resonance.

Figure 2

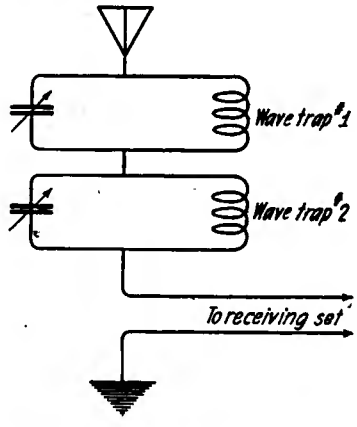


Simple circuit of the "WAVE TRAP" An inductance and condenser in parallel with each other.

Figure 1

Curve shows that when wave trap is tuned to a given frequency, as F, it does not permit current of that frequency to pass through it.

Figure 3



The use of two or more wave traps in series enables elimination of more than one interfering wave length.

Figure 4

utilizing two or more wave traps in series as in figure 4 it is possible to tune each of these traps to a different interfering signal, in this way eliminating almost all signal interference.

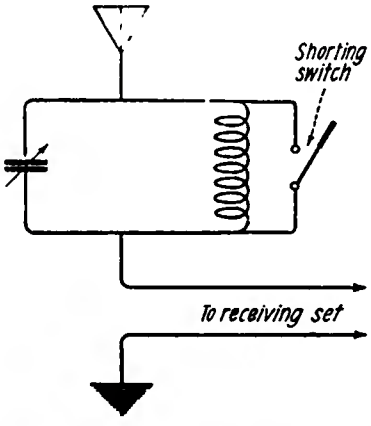
In the construction of such a wave trap one conclusion which is drawn from the mathematical analysis of the wave trap circuit is important. It is found that the lower the resistance of the inductance coil L, figure 1, the greater is the effective resistance of the wave trap circuit at the frequency to which it is tuned. In fact the analysis, shows that if the resistance of the coil could be entirely eliminated and made zero, the impedance of the wave trap circuit at its own frequency would be infinite. However, it is not possible to make a coil having no resistance, but by making it so that its resistance is extremely low we can come quite close to the ideal condition, and the wave trap will then have extremely high resistance at its own frequency, and will thus be able to suppress undesirable signals.

In the practical construction of such a trap all that is required is a variable condenser, inductance coil, two binding posts and a panel on which to mount these. If the builder desires he may enclose these in a box. The coil should be about a 3 inch outside diameter, the coil having between 25 and 40 turns of wire, No. 20 D.C.C. being suitable. The variable condenser may be a 0.0005 microfarad (maximum) affair. These constants will give a wave trap suitable for suppressing frequencies in the broadcasting range of wave lengths. Instead of winding his own coil the experimenter may buy honeycomb coils or similar affairs, the DL-35 being suitable for the above purpose. The honeycomb coils will be found to be quite advantageous for a number of these may be bought having different sizes, such as the DL-25, 35, 50. By using any of these the range of the wave trap may be extended to suppress frequencies above and below the broadcasting range. The terminals AB of the trap circuit, figure 1, are brought out to the two binding posts which are connected in series with the antenna. Where the experimenter may desire to cut the wave trap in or out of the circuit he may employ a single pole switch, in the manner of figure 5, or any other kind of similar circuit breaking device. When the switch is closed the wave trap is short circuited and thus not operating. When the switch is open the wave trap is in circuit and functioning.

In concluding this brief explanation of the action of the wave trap it is advisable to clear up a certain point which may cause confusion in the minds of those beginning the study of radio. Beginners have learned that when a circuit is tuned to resonance with a certain wave length its impedance is reduced to a minimum. In a wave trap circuit we have found that when it is tuned to resonance its impedance is a maximum. This apparent inconsistency may cause some confusion. To avoid this the following explanation is offered.

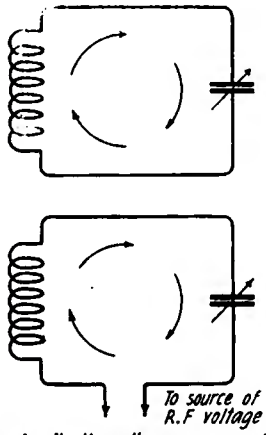
There are two types of resonance—(1) series resonance and (2) parallel resonance. Series resonance occurs in most types of receiving circuits as in figure 6 which represents, say, the secondary circuit of a tuner. In the case of series resonance the impedance of the circuit is reduced to zero for currents flowing around the circuit. This occurs when the voltage acting in the circuit is in series with the elements, as when a voltage is induced in the coil, and tends to drive a current through coil and condenser in series, as shown by the arrows in figure 7.

In the case of parallel resonance, however, which is represented by the case of the wave trap here described, we are interested in the total current flowing through the circuit from point A to point B, figure 2, not in the current flowing around the circuit. In other words we are interested in the impedance of this circuit when the voltage is applied between A and B, that is in parallel with the two elements. When this is the case we find that at resonance the impedance is a maximum, and the current is a mimimum. The reason will be evident when we consider that at resonance the capacity opposes the inductance. Hence the current flowing through the condenser from A to B must be opposite to that flowing through the inductance from A to B. Since they thus oppose each other the total current flowing through from point A to point B must be close to zero. However, this does not mean that no current flows around the circuit of the wave trap. As a matter of fact since this is a resonant circuit the impedance of the circuit is almost zero for series voltages, as explained above. Hence there may be a large circulating current flowing around the wave trap circuit in the direction of the arrows in figure 7. But none of this circulating current gets through the wave trap circuit into the receiver because the impedance of the circuit between points A and B is a maximum. Thus while a series resonant circuit gives us low impedance and high currents, a parallel resonant circuit as employed in the wave trap device gives high impedance and low currents.



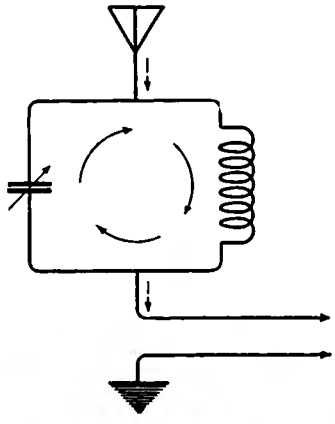
Showing how a single pole switch may be used to cut the wave trap in or out of circuit.

Figure 5



In series circuits the voltage is in series and drives the current around the circuit as shown by arrows. The impedance to this circulating current is a minimum at resonance.

Figure 6



Due to series resonance the circulating current shown by full line arrows may be large, but due to parallel resonance the current that passes through wave trap to receiver is zero. Hence eliminating interference at that wave.

Figure 7

C.W. Heterodyne Reception With Crystal Detector

THE combination of a heterodyne receiver for C.W., with a crystal detector, may seem a strange one to most American experimenters. Marcel Vagne, writing in the *Radio-Revue* of Paris points out that this combination has some great advantages in selectivity and rejection of static. "Why do those amateurs," he asks, "who have a heterodyne and have relegated the galena detector to a corner cudgel their brains over static when receiving continuous waves from distant stations?

"With galena and the heterodyne, the silence of the ether is perfect; few if any parasitic noises are heard; no more interference is noted, unless two or more stations are on exactly the same wave length. Try to get the same effect with a regenerative detector!"

[We should like to hear from any of our readers who try out this hook-up.—EDITOR.]

Practical Laboratory Instruction by the Radio Institute of America

IN addition to the regular prescribed technical course given its students the Radio Institute of America has recently inaugurated practical laboratory instruction. It includes the repair and assembly of wave meters, receiving apparatus, spark and tube transmitters. With this feature added to the Institute's method of training, its graduates are given senior operator positions on shipboard.

Radio Frequency Notes for Novices

By M. Wolf

THE wave length of a radio frequency circuit depends upon two factors: (1) Inductance, (2) Capacity. It is directly proportional to each of these factors. Hence to increase the wave length of your set you may either increase the inductance or the capacity or both. The wave length in meters is calculated from the formula

$$\text{Wave length in meters} = 1885 \sqrt{\text{Inductance (in microhenries)} \times \text{Capacity (in microfarads)}}$$

Frequency of a circuit also depends upon the inductance and capacity. It, however, is inversely proportional to these constants. Hence to increase the frequency of a radio frequency circuit you may either decrease the inductance or the capacity or both. Frequency and wave length are therefore reciprocally related to each other. If the wave length of a circuit increases, its frequency decreases. If the wave length decreases, its frequency increases. The frequency of a circuit is given in cycles per second and is calculated from the formula

$$\text{Frequency in cycles per sec.} = \frac{1}{6.28 \sqrt{\text{Inductance} \times \text{Capacity}}}$$

Inductance is the property associated with a coil of wire. Every coil of wire has inductance. Inductance is generally increased by increasing the amount of wire in the coil, or by increasing the number of turns in the coil. It may also be increased by increasing the diameter of the coil.

Capacity is the property associated with a condenser, whereby it is able to store electrical energy. A condenser generally consists of two or more electrical conductors separated by an insulator. The capacity of a condenser may be increased by increasing the size of the conducting plates, and also by decreasing the distance between the plates, and by increasing the number of plates.

When two inductance coils are connected in series the total inductance is generally larger than either one. If they are connected so that they are far apart, or so that their axes are at right angles to one another (see figure 2), then the total inductance of the two together is practically equal to the sum of their inductances. If the two coils are connected in series and the current flows through their turns always in the same direction, the total inductance will be greater than the sum of their individual inductances (figure 3), no matter how close they are to each other, or what their positions are. If two coils are connected in series so that the current flows through their turns in opposite directions, then the total inductance will be less than the sum of their individual inductances, but will generally be greater than either one (figure 4). Thus to increase the inductance of a circuit we may add coils in series to each other.

When two capacities are connected in series the total capacity is less than either individual capacity (figure 5). Capacity cannot therefore be increased by connecting in series. In fact, it is standard practice to connect a condenser in series with another to decrease the total capacity. It is thus seen that the action of capacity is opposite to that of inductance.

When two inductance coils are connected in parallel the effective inductance of both is less than either inductance. The relationship between these inductance values is the same as that between resistances when they are connected in parallel (figure 6).

When two condensers are connected in parallel the total capacity is the sum of the individual capacities. Thus to increase the capacity of a circuit another condenser may be placed in parallel with the one in circuit. Here again it is seen that the effect of capacity is opposite to that of inductance in a radio circuit, figure 7.

The resistance of a coil at radio frequencies is always greater than its resistance at direct currents. This is due to what is called "skin effect," namely the radio frequency current flows through the outer skin or surface of the wire, thus reducing the effective cross-section of the wire, and increasing its resistance. The radio frequency resistance of wire or a coil increases with increase in the frequency. Thus a coil which has a direct current resistance of 1 ohm, may have a radio frequency resistance of 3 ohms at 600 meters, and 5 ohms at 300 meters. The novice should therefore be careful when told that a coil has a given resistance. He should inquire whether it is direct current resistance or at what frequency the resistance was measured. The lower the resistance of a coil the more efficient it will be.

Resistance in a circuit limits the flow of current, that is it reduces its value. It reduces its value in both direct and radio frequency current circuits.

Inductance limits the current value in alternating and radio frequency current circuits only. This limiting of the current value is due to its "reactance." The reactance is given by the formula

$$\text{Reactance in ohms} = 6.28 \times \text{frequency} \times \text{inductance}$$

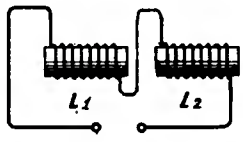
Thus the higher the frequency of the current the greater is the coil reactance. Also the higher the inductance the greater is the coil reactance.

Capacity also limits the flow of current in a radio frequency circuit. Its limiting of current values is due to its "capacity reactance." The capacity reactance of a condenser is given by the formula

$$\text{Reactance in ohms} = \frac{1}{6.28 \times \text{frequency} \times \text{capacity}}$$

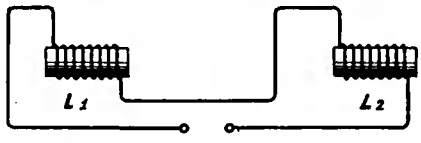
Thus the higher the frequency of the current the less is the reactance of the condenser. And the higher the capacity the less the reactance of the condenser. Thus again we see that inductance and capacity exert opposite effects.

The above effects are utilized in practice as follows. If we want to limit the flow of current at a certain frequency we employ large inductances to give a greater opposing reactance to the current. These are called "choke coils." If we want to pass through a circuit certain radio frequency currents we use large capacities which reduce the reactance. These capacities are called "by-pass condensers."

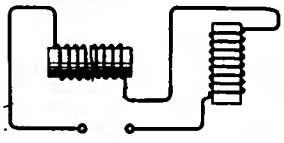


Series connection of inductances. Total inductance greater than L_1 or L_2

-1-

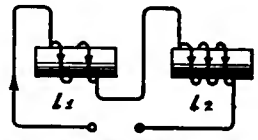


Total inductance equals sum of L_1 and L_2 practically.. Coils far apart



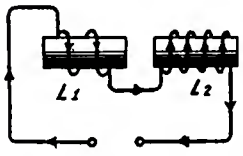
Coils at right angles

-2-



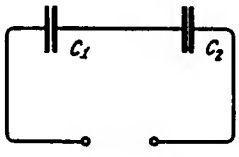
Current flows in same direction through both coils. Total inductance greater than sum of L_1 & L_2

-3-



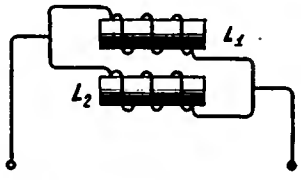
Current flows in opposite directions through coils. Total inductance less than sum of L_1 & L_2 but generally greater than either L_1 or L_2

-4-



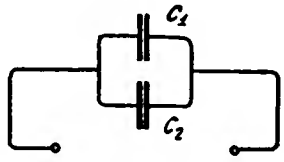
Capacities in series. Total capacity less than either individual capacity

-5-



Inductances in parallel Total inductance less than either L_1 or L_2

-6-



Condensers in parallel. Total capacity is the sum of C_1 & C_2

-7-

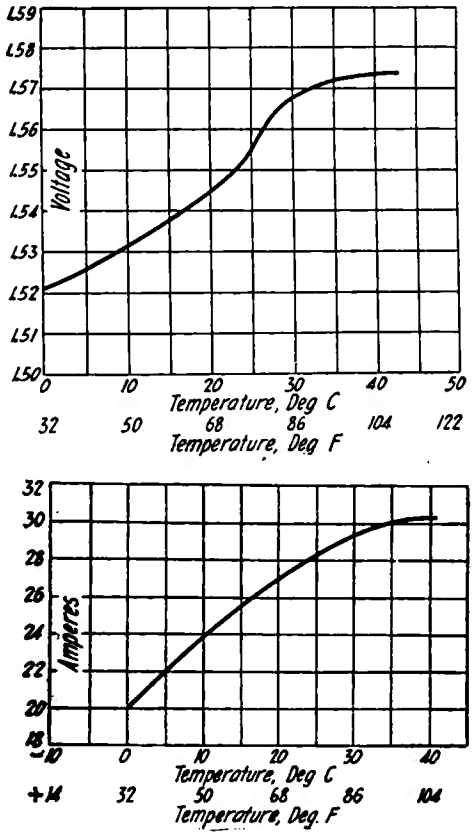
When a radio frequency current flows through an inductance a radio frequency voltage exists across the coil terminals. The greater the frequency of the current, the greater the current, and the greater the inductance the greater is the voltage across the coil. Thus when it is desired to develop high radio frequency potentials or high audio frequency potentials large inductance coils are used. Thus in radio telephony the large modulation choke coils are used to develop across them high speech voltages in order to modulate properly. Proper precautions must therefore be taken to insulate all coils across which such high potentials are developed. In receiving sets this is not so important because the received current is so very small, hence the voltage across coils is small. But in transmitting sets where the currents are large this is important.

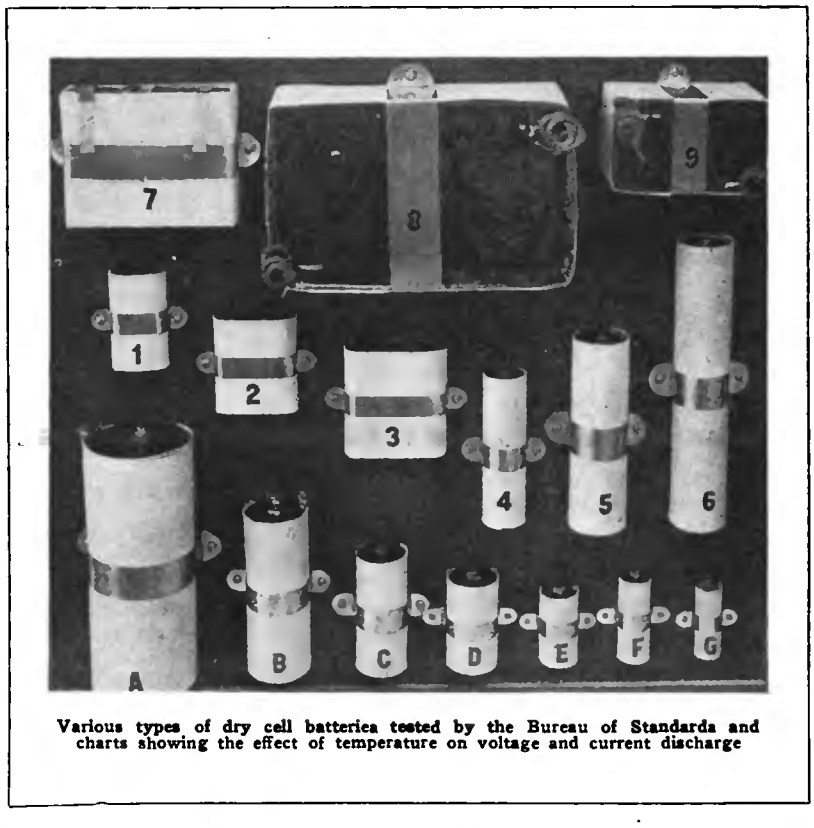
In the same way when radio frequency currents flow through a condenser a radio frequency voltage is developed across it. In this case, however, the larger the frequency, and the larger the capacity the less is the voltage across the condenser. Here again we see that capacity behaves in an opposite manner to inductance. It will generally be found that capacity and inductance are opposite in their behavior in radio frequency circuits. When two condensers are connected in series, therefore, and the same current flows through them the larger condenser will have a smaller radio frequency voltage across it than the smaller condenser. Series condensers which are of small capacity must therefore be carefully insulated in transmitter circuits, for the voltage across the terminals of the condenser may be so great that a spark or breakdown will occur. A safe margin in size and capacity should also be allowed.

What You May Expect of Dry Cells

By S. R. Winters

NOW that dry cells are finding increasing favor as a source of power for the operation of radio apparatus, the results of a recent series of experiments to determine the effects of temperature on the life and service of this kind of primary electric energy, should be of interest to users of wireless instruments. The tests in which the electrical characteristics of dry cells are revealed were conducted by G. W. Vinal and L. M. Ritchie of the Bureau of Standards, United States Department of Commerce.





Various types of dry cell batteries tested by the Bureau of Standards and charts showing the effect of temperature on voltage and current discharge

Broadly speaking, these and kindred experiments indicate that dry cells deteriorate even though they are not in service. The small cell wastes away more rapidly than the large one. Deterioration, however, can be measurably retarded by storing the cells and batteries in a cool, dry place. The user of radio apparatus when employing dry cells should not permit them to freeze, an injunction that is pertinent during the winter months. Dry cells (several million are being manufactured in the United States annually) are not to be tapped for excessive electric-current requirements. For example, No. 6 cells of American manufacture can supply electric energy economically under the following conditions: For one-half of one hour per day, one ampere; four to eight hours a day, one-fourth of an ampere, and for continuous service, 0.1 of an ampere is a reasonable demand.

The investigation of the Bureau of Standards into the effects of temperature on dry cells was made from three angles—the influence of heat and cold on the voltage, short-circuit current, and the service capacity. The investigators dismissed the subject of the effect of temperature on the open-circuit voltage as being negligible in quantity. The tests in this instance, as well as those relating to the short-circuit current and service capacity, related especially to dry cells of the common dimensions of 2½ by 6 inches. Sixteen different dry cells, including four varying brands, were retained at a fixed temperature for twenty-four hours before being subjected to measurement by a voltmeter having one hundred ohms to the volt of its scale. These cells were of the No. 6 size and of paper-lined construction. The temperature co-efficient was found to be positive within the ordinary range of temperature—that is, an increase in heat is attended by a corresponding rise in voltage.

Heat exercises a deteriorating influence on dry cells in two ways, namely, causing leakage and by increasing the rate of the chemical reactions at work in the cell. Evidence of leakage is seen when the electrolyte or chemicals ooze out around the seal of the dry cell. Hence, the injunction, "Keep your batteries in a cool, dry place." The rate of decrease of the short-circuit current was found to become less as the age of the dry cell increases—the total decrease for twelve months at room temperature being approximately twenty-five per cent. The results of these tests also indicate the importance of keeping the cells as cool as possible while in storage or in transportation.

Generally speaking, the conclusions of these tests indicate that when batteries are subjected to heavy service, a moderately high temperature is desirable; when the service demands are small, a low temperature is preferable. For instance, 122 degrees Fahrenheit is the most favorable temperature

when the external resistance is eight ohms or less. This experiment, however, was a continuous test, while dry cells are commonly in intermittent service only. For example, one table showing the effect of temperature on service capacity indicates 160 hours of service at 50 degrees Centigrade when discharging through four ohms. This number of hours, however, is less than seven days. At this temperature the deterioration of the dry cell, increased by the short-circuit current, is four per cent. a week on the average. If, however, the cells were used over a period of several weeks, the hours of real service would be much less. The lesson is to keep the temperature lower. In other words, the heat that may appear to act in the interest of efficiency in isolated instances may likewise produce such deterioration during the idle hours of the cells as to be a disadvantage.

Reliable data as to the capacity of standard designs of No. 6 paper-lined dry cells through fixed electrical resistances and at constant current rates are afforded by the recent tests of the Bureau of Standards. The conclusions clearly indicate that a gain in hours of service is possible by making the current drain light. To illustrate: For the cut-off voltage of 1.2 volts discharging through two ohms of resistance, 2.2 hours were obtained; through eight ohms, however, the dry cell gave twenty times the service, and through sixty-four ohms, 480 times the service. The results of these experiments indicative of the electrical characteristics of dry cells show that when the voltage has been reduced to one-half its initial value, the dry cell is by no means one-half discharged. The correct "barometer" of the discharge of the cell is the ratio of the energy delivered to the aggregate energy contained, determined in watt-hours. The short-circuit current was found not to be the true measure of the dry cell's capacity. Short-circuit currents cannot be accepted as a criterion that the service of such cells will exceed that of cells yielding average currents. Excessive currents are likely to produce ill effects.

The Government investigators determined the working voltage which may be reasonably expected from a dry cell at the outset of its life of usefulness under varying discharge conditions. In circuits having in excess of one ohm resistance, the initial working voltage is barely lower than the open-circuit electromotive force. While the variations in open and closed circuit-voltage are not easily computed from the value for the internal resistance of the cell, because the latter is not a constant quantity, it may be said to range from 0.04 of an ohm at heavy drains to several ohms when the discharge is light. If the dry cell discharged at equal efficiency through all resistances, a cell yielding 100 hours through 10 ohms, at a like service efficiency, should give ten hours through one ohm, and 1,000 hours through 100 ohms. As a matter of fact, the efficiency of batteries rises more rapidly for increasing resistances within the region of 60 to 100 ohms. Or, putting it differently, maximum efficiency has been found to be between 60 to 100 ohms, depending on the cut-off voltage.

The reason for an increase in efficiency of dry cells as the resistance becomes greater —consequently a lightening of the service— is attributed to the tendency toward complete depolarization. This condition is approached at 64 ohms resistance. Electric-battery experts are prone to ascribe this tendency of a reduction in efficiency for services lighter than that equivalent to a discharge through 64 ohms to local action within the dry cell. "Shelf-life deterioration" is the term employed in describing this condition. Local action devours the zinc and other constituents, reducing the useful service which the cell is capable of rendering.

Varying designs of dry cells were employed in conducting these experiments and the temperature was varied by several degrees. The net results of these tests indicate that reasonably uniform and consistent service may be expected of standard designs of dry cells when subjected to continuous discharges at a constant current and through a fixed resistance. If the dry cells are discharging at a constant current rate, the capacity in ampere-hours to any specified cut-off voltage may be readily computed—it is the product of the current by the duration of the discharge. The Government investigators favored the watt-hour capacity in preference to the ampere-hour capacity, because the former represents the actual energy that may be obtained from the dry cell. This method of measurement is difficult, however. Its handicap is the necessity of determining the average voltage, which is variable throughout the period of discharge. If, however, the discharge is made at a constant current, the average voltage is best obtained by plotting the voltage readings and integrating the curve by a planimeter. In this instance, the watt-hour capacity is the product of the average voltage by the fixed value of current and by the period of discharge to any predetermined cut-off voltage.

Methods of Obtaining Negative Potentials for Vacuum Tubes

By Bernard Steinmetz

FOR the most efficient operation of vacuum tubes it is absolutely essential in most cases to apply a negative potential to the grid of the tube. This applies regardless of whether the tube is used as detector, amplifier, oscillator, or modulator. There is a very good reason for this which can best be illustrated by means of the well known characteristic curve of the valve shown in figure 1. The larger curve gives the plate current for different grid voltages, while the smaller curve gives the grid current for different grid voltages. From this curve we see that the grid current flows only when the grid is at a positive potential. Now when the grid current flows there is an absorption of energy in the grid circuit which represents a loss. In order to avoid this loss of energy which reduces the efficiency of the valve it is necessary to keep the grid at a negative potential. This is the first reason for the necessity of applying a negative potential to the grid of tubes. In the next place when there is a positive potential on the grid and a grid current flows the resistance of the grid-to-filament path decreases. The greater the positive potential the less its resistance. This grid-filament resistance is in shunt to the circuit feeding the grid, as for example, the secondary of an amplifying transformer. It therefore has the effect of short circuiting this secondary, or reducing the voltage across it which is applied to the grid, and thus destroys to a certain effect the amplifying properties of the circuit. To avoid reduction of amplification it is essential to use negative potentials on the grid to keep the grid-filament resistance extremely high. In the third place it will be observed from the curve that as the tube is generally employed in common practice the straight line portion of the curve is on the negative side of the grid voltage. Now it is advantageous to work on the straight portion of the curve, because on this part of the curve the slope is the steepest, hence there is a maximum change of plate current for a given change of grid voltage, which means that maximum amplification is secured when working on the straight line of the characteristic. To work on this part of the curve we must use a negative potential on the grid. This applies both to the case of detector operation and amplifier operation. In the fourth place when we consider the question from the point of view of the oscillator it is also essential to operate the tube on the straight line portion not only for the reasons given above but also for the following reason. If the oscillator tube were worked say at a mean grid potential given by point B equal grid voltage changes to the left and right would produce unequal plate current changes above and below the mean plate current. This would mean that the plate current curve would be unsymmetrical, hence the radio frequency oscillations would likewise be unsymmetrical with the result that harmonics would be generated. To avoid this it is essential to operate the tube so that its mean grid potential is at the center of the straight line part of the curve, thus producing equal changes either side of it, hence a symmetrical plate current curve. To do this requires the use of a negative grid potential. Finally we have the question of the modulator tube and here again we find it necessary to use negative grid potentials not only for some reasons given above, but also for the following important one. The modulator handles the audio frequency or speech currents. If the plate current does not repeat uniformly the changes in the grid speech voltage distortion results and the modulation is poor. If the tube is operated at any grid voltage point other than the center of the straight line portion of the characteristic curve distortion will result. Thus suppose it is again operated at point

B as a modulator. A given change in grid voltage will produce less change in plate current above point B than below, because of the curvature of the characteristic. Hence the speech will be distorted, since it is uniformly repeated above and below the mean grid potential B. If, however, the grid potential is set at the center of the straight line portion of the curve a given change in grid voltage will produce the same change in plate current above and below the mean grid potential. Thus the grid speech voltage will be repeated uniformly in the plate circuit and no distortion will result. To operate the tube at this point again requires the use of a negative potential on the grid.

The above reasons will make clear to the amateur the necessity for operating tubes with a negative grid potential. Much of the trouble existing in tube sets may be traced to lack of negative potential or insufficient negative potential. Insufficient negative potential produces trouble as well as lack of it, for point B, figure 1, is at negative potential, yet it is too small to give the best operation. There are a number of different methods of securing this negative potential, some being best suited for one purpose and others for another purpose. It will be the object of this article to explain simply these different methods of obtaining negative potentials for use in the grid circuit of tubes, and to state to which applications each method is most suitable.

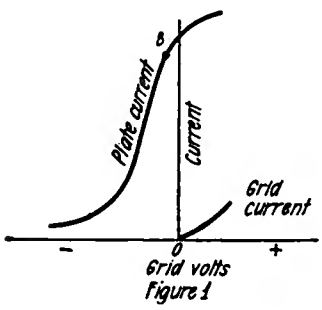


Figure 1

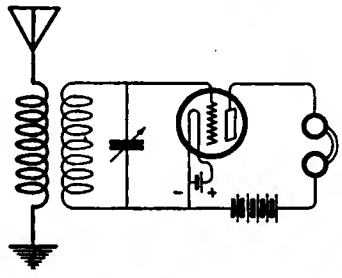


Figure 2

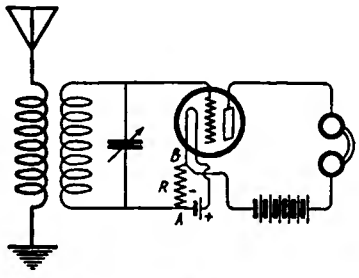


Figure 3

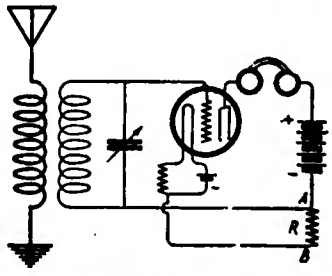


Figure 4

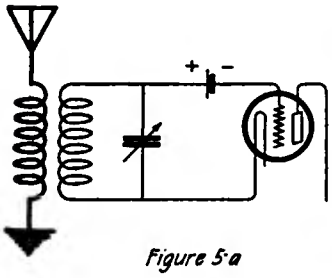


Figure 5-a

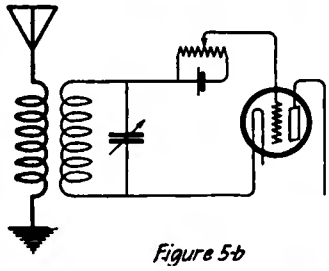


Figure 5-b

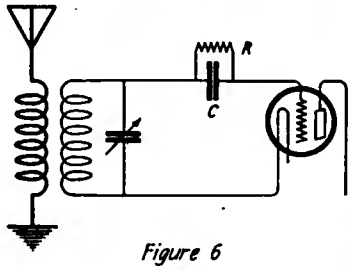


Figure 6

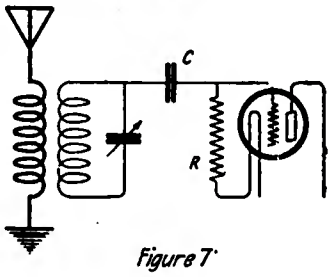


Figure 7

CONNECTION TO NEGATIVE FILAMENT TERMINAL

The first, oldest and simplest method is to connect the grid circuit to the negative terminal of the filament as illustrated in figure 2. This method, in reality, simply places the grid at the same potential as the negative end of the filament. The grid should, however, be at a potential less than that of any point of the filament. To secure this it is best to connect the grid circuit to the negative end of the filament battery when using a filament rheostat as shown in figure 3. It will be seen from this drawing that the most negative point of the filament circuit is point A, and that since the current flows from negative end of the filament, B, to point A, point B must be more positive than point A by the amount of the potential drop in the filament rheostat R. Thus with this connection the grid is more negative than the most negative end of the filament by Ri volts. Thus it is at a negative potential with respect to the filament.

USE OF BIASSING RESISTANCE

The above case of the filament rheostat is a case of the use of a biassing resistance. A modification of this plan which the writer has used effectively is shown in figure 4. Here a resistance is placed in the negative lead of the plate circuit generator or battery. The grid circuit is connected to the negative terminal of the plate battery or generator, while the filament is connected to the other end of the resistance R. It will be evident that since the plate current flows from point B to point A through the resistance, point A is at a negative potential compared to point B. Thus the grid is Ri volts negative as compared to the filament. This system was adopted with a modulator circuit for securing a negative potential on the modulator grid. The above two systems are applicable both to receiver tubes and to low power modulator tubes.

USE OF BATTERY IN GRID LEAD

The most obvious method for placing the grid at a negative potential is to use a battery in series with the grid lead connecting the grid to the negative terminal of the battery as in figure 5. Here the grid is more negative than the filament by the voltage of the grid battery. By varying the number of cells in the battery the grid negative potential may be varied. To secure finer variation of the grid negative voltage a potentiometer may be connected across the battery. This method of biassing the grid potential is suitable for detector, amplifier and modulator tubes.

USE OF GRID LEAK AND CONDENSER

In this method a small condenser and high resistance are connected in the grid circuit in either of the ways shown in figures 6 and 7. Here use is made of the fact that electrons carry a negative charge and when they flow to the grid they are prevented from leaking off it by means of the insulating condenser C. They leak very slowly off by way of the very high resistance R. But they do not leak off fast enough to neutralize the negative charge which they impart to the grid. By varying the resistance R the rate at which these negative electrons leak off may be varied and thus the negative charge on it may also be varied. This method is applicable to detectors employing the grid-condenser grid leak method of detection and also to oscillators. This is really the only method of securing a negative potential on the grid for oscillators. The reason for this is that the oscillator grid currents may be high during the very small interval of time in which they flow, hence the grid potentials are also very high. It is not feasible to use batteries since these offer too high a resistance in the grid circuit of an oscillator. This resistance which they offer is not felt so much in the other circuits such as detector or amplifier, especially since the radio frequency voltages are low.

This covers in a general way the various methods for obtaining negative potentials for the grids of vacum tubes. Some of these methods will be found to be more efficient than others. No general law can be given, in some cases a battery is found to be best, in others a biassing resistance and so on. But knowing these different methods the amateur may try various ways and choose the particular one which gives best results.

Awards to French Amateurs in Amateur Trans-Atlantics

By DR. PIERRE CORRET

THE Trans-Atlantic amateur tests were utilized in France not only for their scientific and general interest, but also as a contest, for which French manufacturers contributed numerous prizes.

It was not without some skepticism that the committee had expressed the hope of being able to distribute all these prizes to numerous winners, as it was well aware of the very slight preparation of the French amateur for the use of short wave lengths. However, results very far exceeded the most optimistic expectations.

In awarding these prizes the committee has endeavored to reward and recognize the various merits of the different stations that were able to achieve the greatest measure of success. The committee congratulates, in particular, M. Leon Deloy for the excel-

lent results of his transmission, which has brought him the honor of being the first French amateur to be heard in America and also has enabled France to figure more than honorably in the tests with Great Britain.

Hearty congratulations are equally due to the station which occupies first place among receivers, in the operation of which MM. G. Perroux, Pierre Louis, Bataille, Germond and Messe collaborated.

In classifying the contestants the committee took special account of reception with code words, not only because there was more merit in receiving them, but also because they alone enabled the absolute certain identification of the transmitters that were heard. Five points were given for each station received with code word and four points for receiving individual stations during the scheduled period, but without the code word.

In distributing the prizes the committee, moreover, has taken account, as far as possible, of the preference expressed by the winners for certain apparatus, instead of considering the commercial value of the apparatus, which moreover was not always exactly known to the committee.

TRANSMISSION

Sole winner, M. Leon Deloy heard in America "steadily during one hour" with his code word.

RECEPTION

The following French amateurs were rated in the order shown, for reception of American stations during the test:

MM. G. Perroux, Pierre Louis, R. Burlet, P. Contant, Marius Thouvais, Jean Bregi, Paul Germond, Leon Deloy, E. Sassi, J. Becquerel, J. Amiot, Barrellier, Louis Santou, M. Lardry, P. Tavenaux, Marcel Coze, A. Jouffray, Jean Bouchard, Roger Dupont, J. Maurice, Andre Faucher, P. Besson, Pierre Bourgenot, A. Clayeux, Pierre Fonteneau, Joseph Roussel, A. Vasseur.

The committee also decided to award prizes to two Swiss amateurs, who collaborated with their French brothers because of the excellent results obtained: R. Luthi, Marcel Roesgen.

On account of the great number of prizes of radio apparatus offered by French manufacturers, certain of these articles have not been awarded. The committee hopes that their donors will allow these prizes to be awarded in future tests.

Amateur Station 9ZT

THE special amateur station of D. C. Wallace, 9ZT, is located at 54 Penn Ave., N., Minneapolis, Minn. It has been in operation since the first of the year, and consistently works all districts, both coasts, and handles a fair amount of traffic.

The antenna system consists of 6 wires, 50 feet long on 12 foot spreaders, supported by two masts 60 feet and 85 feet high respectively.

The counterpoise is radial, similar to the spokes in a wheel, and consists of 25 wires at the height of 8 feet. Each wire is 100 feet long, so the entire counterpoise covers a circular area of 200 feet in diameter.

The radio room is located in a five-room bungalow, which room was planned along with the building of the house. At the time the foundations were laid, a radial ground system was put in, covering almost the entire lot. This ground system has proven of no use whatsoever, but there is a certain satisfaction in knowing that a good ground will not help in this particular instance.

The transmitter consists of one UV-204 radiotron supplied with A. C. on the filament and rectified A. C. on the plate. An electrolyte rectifier of 120 jars is located in the basement immediately under the station. The transformers for supplying the A. C. to the rectifier are also located in the basement.

The filter system is made up from twenty UV-490 condensers, and one filter reactor. The Hartley circuit is in use at the present time, giving an antenna current of 6 amperes on 100 meters, 10 amperes on 200 meters, and 10 amperes on 375 meters.

Tube transmitter and receiving equipment of amateur station 9ZT, owned and operated by D. C. Wallace, Minneapolis, Minn.

It is very easy to change from sending to receiving, as one short action switch completes the entire operation by one slight movement. The break-in system was tried, but it was found to be impractical on such high power.

The receiving set is the usual single circuit design, utilizing two wave traps—one in series with the antenna, and the other coupling the antenna to the single circuit set. This arrangement has proven most successful, in view of the fact that there are some 200 transmitting stations in the immediate vicinity, and some dozen or so of high power within a few blocks.

A short vertical single wire 50 feet over all in length is used for receiving, as it proves extremely selective, and in addition, makes an excellent antenna for work on 100 meters.

A wavemeter is used to check both receiver and transmitter, and at the time the picture was taken, as is usually the case, a new type of receiving set was under process of construction. This can be seen at the left of the picture, under the stack of postal cards received.

The transmitter is made available for voice communication by means of a magnetic modulator.

Mr. Wallace has been in the commercial service with the Marconi Company, the Navy, and at present holds a first class, first grade commercial license. The station has recently worked the west coast 18 out of 20 nights in operation. A schedule was maintained for two weeks with 1QP, South Manchester, Conn., before dinner in the evening.

The station has a very pleasant operating atmosphere, and is open for relay work during a portion of practically every night between the hours of midnight and 7 A. M.

Bureau of Standards Circulars

THE dry battery standardization work done by the Bureau of Standards, Washington, D. C., now has been fully explained in print, in Circular No. 139 of the Bureau. This circular may be obtained from the Superintendent of Documents, Government Printing Office, Washington, at 5 cents a copy. The information contained in it is the result of a conference of battery manufacturers that considered seventeen different sizes of dry cells and standardized seven of them, and eight sizes of flashlight batteries and two sizes of radio batteries. The circular gives the dimensions of the standard sizes followed by discussion of the tests and uses and the minimum performance required for each.

Descriptions of the apparatus and methods used by the Bureau of Standards in measuring the various properties of vacuum tubes and ascertaining the voltage amplification of amplifiers, have been made public. Letter Circular No. 86, "Methods of Measuring Voltage Amplification of Amplifiers," and Letter Circular No. 87, "Methods of Measuring Properties of Electron Tubes," are the two documents in question. A limited supply of these has been secured by the Bureau, which will send copies to any person who can show an actual need for them.

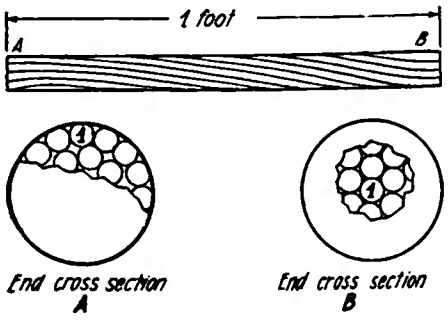
Correspondence

Editor, THE WIRELESS AGE:

In the May, 1923, issue of THE WIRELESS AGE, there appeared an article by E. T. Jones entitled "Reduction of Antenna Resistance" on which I wish to make a few comments.

Mr. Jones first states that he constructed a litzendraht antenna consisting of 5 strands of No. 24 double cotton covered wire. Those who are familiar with the principle of skin effect, will readily see that the cable described is not litzendraht, but simply 5 wires bunched in cable form, which practically gives no more signal intensity than a single solid wire.

Litzendraht as obtainable on the market, is usually made up of 48 very fine wires each about .002 inches in diameter and every one coated with enamel for insulation from each other. They are interwound into cable form in such manner that every wire within a short length, will alternately run on the outside and inside of the cable. In figure 1 is shown a length of litzendraht



with enlarged cross sections at points one foot apart. It is noticed that wire 1 is on the outside in cross section A, and on the inside in cross section B of the cable, one foot away.

The phenomena of skin effect in radio frequency, causes all the current to flow on the periphery of a wire, with no current in the core. This explains the use of tubing in inductance for radio transmitter design. In litzendraht, each wire carries current, because, as explained above, every wire runs alternately on the inside and outside of a cable. If a cable containing 48 wires, was constructed so that in a long length all the outside wires were always on the outside and the inside wires always on the inside, then only the outside wires on the periphery of the cable would carry the current with the inside wires practically useless as conductors.

The second point brought out in Mr. Jones' article, is that litzendraht is more advantageous for use as an antenna conductor than solid wire. Let us first analyze the factors responsible for the resistance of an antenna system. There are four factors, namely ohmic resistance of antenna wire, dielectric resistance, ground resistance and radiation resistance, with radiation resistance as the useful factor depending on the other three factors. Even though all proper precautions were followed in installing an antenna, the ground and dielectric resistances are factors which cannot be avoided, as they are due to the location of the receiving outfit. The ohmic resistance of the antenna is, however, a factor which can be changed and the decrease in resistance obtained by the use of litzendraht instead of solid wire will be not over ½ an ohm at the broadcasting wave lengths. Does this decrease of ½ ohm warrant the use of litzendraht at the high cost of 5c or more a foot, when the resistance of the average antenna system due to ground and dielectric losses, is 25 ohms? The net gain would be only 2 per cent. in signal intensity and many times that gain could be obtained by carefully arranging the antenna and ground system and making any necessary changes.

The third point in Mr. Jones' article, stating that the total current in the receiver is the addition of current in each individual wire in the antenna, is not correct. The current in a receiving antenna system depends on the voltage impressed on the system by the transmitting station and the total resistance of the antenna system as found by the formula $I = \frac{E}{R}$. Of course, if the antenna wire alone were to be considered, the current in it at a given voltage would depend on its resistance and therefore the more wires in parallel the less resistance and the greater the current. As stated before, however, the resistance of the antenna wire is such a small percentage of the total resistance of the whole antenna system that it is not proper to figure on the basis of the antenna wire alone but all the other factors must be taken into consideration.

F. C. MILLER.

Radiotron UV-199

(*Continued from page* 59)

radio frequency amplifier, the UV-199 functions very efficiently as a detector. In this case the grid return lead should be as shown in Figure 8, and it should be noticed that this is to the positive side of the filament battery, while the amplifier requires the return to the negative side of the battery. Not more than 45 volts should be used on the plate of the detector tube, and the adjustment of this voltage is not critical. The grid condenser should have about .00025 microfarad capacity and the grid leak resistance should be from 2 to 10 megohms, the lower value being best for strong telephone signals; while the higher resistances may be used on very weak signals when static conditions are not bad.

The arrangement of contact pins in the base of the UV-199 is not the same as in the UV-201. In the latter the grid and plate are on each side of the socket pin, and both filament contacts are next to each other. In the UV-199 the grid and plate are diagonally opposite each other, as is also true of course, of the grid and plate contacts. This gives greater convenience in the wiring of amplifiers and makes possible very short and direct connections between the tube sockets and amplifying transformers.

Figure 9 gives a comparison of the size of Radiotrons UV-199 and UV-201-A and Figure 10 shows the comparative size of the UV-199 to the average hand.

Radiotron UV-199 tubes, in common with all tubes made with the new tungsten filament, are very well exhausted and can be depended upon to give uniform and quiet operation throughout their entire life.

A Selective Broadcast Receiver

(*Continued from page* 57)

is more than 524 feet. Theoretically, a set could be designed and built that would differentiate between stations whose wave length varied but a very few meters. In actual practice, however, this is impossible, due to the resistance and other losses of the inductance windings. Rather than acting as a detriment, these very losses can be taken advantage of and a set built that will be satisfactorily selective.

The writer was recently requested to design a crystal set, with as few adjustments as possible, that would absolutely eliminate either station WAAM, on 360 meters, or, WOR, on 400 meters, when they were broadcasting simultaneously. The point from which the receiving set was to operate was 6,000 feet air-line from WOR and 10,000 feet from WAAM. Station WAAM, although nearly twice as far from the receiving set as station WOR was only one-half as powerful. The entire receiving equipment was to be enclosed in a cabinet 6 inches long, 3½ inches wide and 3½ inches deep.

It was simply necessary to design an inductance "L" whose natural wave length was 380 meters and an inductance "L" whose maximum wave length, with antenna was 410 meters and whose minimum wave length would be not less than 350 meters. These two inductances should be inductively but very loosely coupled.

If the inductance "L" had no resistance and no other losses, the circuit would not function; for then it would receive only waves transmitted on 380 meters. But any inductance, no matter how carefully made, has both resistance and distributed capacity.

In this case both coils "L" and "L'" were wound on the same cardboard tube, 2¾ inches in diameter. Inductance "L'" consisted of 65 turns of No. 22 D. S. C. copper wire which, it was found, possessed enough distributed capacity and resistance to permit that circuit to tune down to 350 and up to 410 meters.

On the same tube and at least one inch from "L'" another winding "L" was wound. This consisted of 75 turns of No. 20 D. S. C. copper wire and it was tapped every 5 turns for 25 turns, beginning at the end nearest inductance "L'". These taps are brought out to switch points in the usual manner.

Condenser "C" consisted of a 23-plate variable, having a maximum capacity of about .0005 mfds.

The taps on coil "L" are employed to adapt the circuit to the particular aerial being used and when the proper tap has once been found, no further adjustments are needed here; the tuning being accomplished entirely by the condenser "C."

Since the circuit "L'" will respond only to wave lengths to which the circuit "L" is tuned, extremely sharp tuning results.

The same circuit has since been applied to the input of a vacuum tube with equally satisfactory results.

The crystal set described will not only eliminate any undesired broadcasting station, but it is practically impossible to receive spark or other telegraph stations unless they happen to be within the comparatively narrow wave length band between 350 and 410 meters.

NEW APPLIANCES AND DEVICES

Cutler-Hammer Resistance Unit

WITH the advent of the new ¼ ampere receiving tube, there has arisen the need of a rheostat of larger resistance than the four to six-ohm types now on the market. When using a fully charged six-volt storage battery, it is necessary to insert a rheostat of about 30 ohms resistance in the circuit to properly handle the new tube. To meet this condition, the Cutler-

C-H radio resistance unit

Hammer Mfg. Company has developed a variable resistance of 25 ohms to be used with the standard rheostats now on existing apparatus. It is not necessary to remove an existing rheostat, it being necessary only to unscrew the binding nut from one terminal of the rheostat, remove the wire and slip the eyelet of C-H resistance unit over the binding post, replace the nut, tighten, and fasten loose wire to binding post on slider of C-H unit.

New Kellogg Products

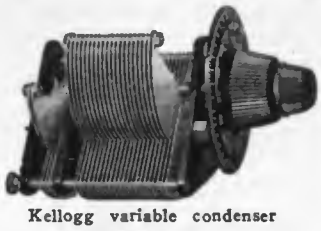
KELLOGG No. 501 variometer and No. 501 variocoupler stator and rotor shells are of heavy construction with deep ribs and formed of pure Kellogg bakelite, an attractive brown in color. The windings are properly proportioned, of well insulated copper wire, with inductance values throughout the rotor travel of 180 degrees, of from .10 millihenry to 1.40 millihenry. Positive stops, part of the permanent mould, allow the full 180 degree rotation.

Two terminals are provided for the rotor

Kellogg variometer

and three for the stator, to permit of use in all known variometer circuits. These terminals are held by spring washers under hexagonal nuts, with two contact washers under knurled thumb nuts. A heavy spring takes up all play and allows the rotor to turn with a smooth even motion. Every Kellogg variometer and variocoupler have both vertical and horizontal mounting plates of design convenient for attaching to panel or base board. The extreme diameter of the rotor is four inches and the inside of the stator, 4.146 inches. This leaves sufficient space between the rotor and stator and as the motor runs true at all times, there is no possibility of the coils or stops scraping.

On the variocoupler two rotor taps and eleven stator taps, or single-wound coil taps, are provided. The stator taps are taken off and brought through the outer shell immediately above the base mounting and between it and the panel mounting. For added inductance or increased range in the wave length, a diamond wound coil is securely mounted on the stator shell. The taps of the second coil are taken off the lowest portion, so they may be brought to



Kellogg variable condenser

Kellogg headset

the panel switch points the shortest distance possible, without interfering with the stator coil taps. The wave length of the variocoupler, without the added coil is approximately 600 meters, with the coil, approximately 2,500 meters.

The cap of the new Kellogg headset is of most approved design, the concave surface being the result of years of practical telephone receiver construction. The diameter of the cap is 2 3/16 inches, and it screws into place with heavy threads which will not allow it to slip. When two people desire to use one set or one receiver each, the head band is easily removable and as equally easy to replace when desired.

The magnet of the Kellogg radio head set is specially hardened steel. This receiver has concealed binding posts which does away with tampering or any adjusting. The magnet windings are of great accuracy, the mountings, end plates and wire insulation all being of the highest grade.

The Kellogg variable condenser is constructed of plates of heavy sheet aluminum of equal thickness. The stationary plates are securely mounted between heavy end plates of bakelite and occupy the center space at all positions.

Variable Resistance Leaks

AN improvement has been made recently in the variable resistance leaks manufactured by Chas. Freshman Company, Inc. The graduations of resistance are made more uniform, and the range over which the contact moves has been increased from 90 to 180 degrees.

Freshman resistance leak

The base of the leak is of specially treated fibre, while the leak path is composed of a high resistance material impregnated into the fibre, a feature for which long life is claimed. This leak path is waterproof and is covered by a bronze spring rotated by a small knurled composition handle. Alteration in resistance due to atmospheric changes is obviated by sealing the entire leak within the composition case.

Ace Batteries for Dry Battery Tubes

THE Ace Radio Batteries, for use with the new dry-battery receiving tubes are made in a number of forms, in one, two, three, four and six-cell blocks. The six-cell model has a voltage of 4½ volts, consisting of two groups of three cells each, connected in series, for use with the UV-199 and C-199 tubes. The other blocks are all con-

ACE radio battery

nected in parallel, having a terminal voltage of 1½ volts, for operation of the WD-11 tube. The Ace cell, while rated at 1½ volts, as a matter of fact is slightly higher, showing 1.6 volt.

Ace Model V of Precision Instrument Company

THE latest addition to the radio family of The Precision Equipment Company is the ACE Model V.

The ACE Model V is regenerative and licensed under Armstrong U. S. Patent No. 1,113,149. Radio broadcasting stations have been heard from coast to coast, as well as the station in Cuba, with this set, located in a central state.

ACE model V regenerative receiver

There has been a great deal of experimentation in connection with radio receivers and this little model contains all of the refinements of the big sets. A distinctive feature of this set, is the tickler. It is a sliding tickler in which there are no losses in the efficiency of operation as are found in the kind which depend upon a bucking of electro-magnetic fields.

The rheostat in this ACE Model V is equipped with a ball-bearing contact, which permits of easy and accurate adjustment of the filament current. In the socket, which is moulded and panel-mounted, the contact with the prongs of the vacuum tube, is positive. A feature of this ACE Model V, is the fact that it permits either use of a six-volt or a 1½-volt vacuum tube. There is a two-step ACE amplifier which may be added to this ACE Model V.

The Dictograd Radio Loud Speaker

THE Dictograph Products Corporation has placed on the market the new Dictograd Radio Loud Speaker. It is mounted in a mahogany finished hardwood cabinet. By referring to the accompanying illustration, it can be seen that an adjusting dial in the front of the cabinet increases or decreases the air gap or distance between the

Dictograd radio loud speaker

pole shoes and an especially made secret alloy diaphragm. The adjusting mechanism operates through a shaft, pinion and gear. Changing the air gap varies the pull of the magnet upon the diaphragm, thus enabling the loud speaker to be tuned up in complete harmony and resonance with the receiving set. The new arrangement for adjusting the air gap of the Dictograd Loud Speaker regulates the magnetic flux as simply as the flow of water is controlled through a faucet.

The diaphragm is of special composition, restricted solely to Dictograph Loud Speaker production. The entire unit is guaranteed against all mechanical and electrical defects for a period of one year. The horn is of spun copper handsomely finished in mahogany. The tone-arm is a die casting especially designed for resonance and lack of vibration. Each loud speaker is equipped with five feet of flexible silk cord with standard terminals.

The Dictograd Radio Loud Speaker is designed to operate on any vacuum tube receiving set using two stages of amplification, but good results are often secured on sets employing but one stage of amplification, dependent upon the type set used and the distance from the broadcasting station. This loud speaker requires no external batteries.

Non-Magnetic "Vac-Shield"

THE Orange Research Laboratories report export sales of considerable volume of "Vac-Shields" to Cuba, Mexico and European countries. These shields are designed to prevent electro-static effects between vacuum tubes which cause inter-

stage coupling and makes it difficult to tune in distant stations. They are made for the UV-200, 201, 201-A, C-300, 301, 301-A, WD -11 and WD-12 tubes.

These shields not only protect the tubes from capacity effects, but also from accidental breakage.

New "Homcharger" Instruction Book

THE Automatic Electrical Devices Company, manufacturers of the Homcharger, has recently issued a revised instruction book, containing easily understood directions for operating the Homcharger, and it also contains a paragraph devoted entirely to storage battery maintenance. The information contained in this chapter will enable anyone to obtain the best service from a battery at minimum expense.

This booklet has been mailed to all Homcharger users. Copies may be secured by any one interested for 10 cents, to cover cost of postage.

Four New Pacent Products

THE Pacent new type variable condenser, known as No. 200, includes many advantageous features. The heads are made of genuine bakelite, a material combining the best insulating and physical qualities. The plates are made of extra heavy (.025 inch) aluminum, of a special degree of hardness. All metal parts are aluminum or brass except the shaft which is needle bar steel. The brass parts are heavily nickel plated. Instead of using the ordinary method of spacing the plates with washers, the plates themselves have been machined into a spacer. These spacers can be machined to one-half thousandth of an inch, insuring absolute accuracy of spacing.

The upper bearing of the condenser comprises a ring, separated into four fingers which are finely adjusted to exert exactly

Pacent Universal Plug

the right pressure against the shaft. The continuous wide surface contact of this bearing with the shaft insures an electrical connection. In the lower bearing the stationary part is of brass and the movable part of steel. The lower bearing is adjustable and can be locked after adjustment is made. These special bearing features assure permanent alignment of the plates.

The Pacent new universal plug, No. 40, provides the same dependable biting contact as has heretofore been characteristic of the Pacent Universal Plug. No tools are required to attach the cord tip to the plug connectors. It is necessary only to insert the tip in the hole provided in the spring connector and then move the connector slightly so that the cord tip can be slipped into the slot provided in the shell of the plug. This holds the clip in a state of tension so that it bites right into the cord tip.

Another recent addition to the Pacent line is the Pacent rheostat, a combination instrument, serving equally well for panel or

Pacent rheostat

table mounting. It has a winding of special resistance wire held rigidly in place on an insulating core which will not warp.

The Pacent potentiometer follows the same general construction as the Pacent rheostat. It has a different winding, of course, and three terminals for the usual potentiometer connections.

INDUSTRIAL INKLINGS

Long Experience Back of Dictograph Products

By Trade Noter

THERE is a certain man whose efforts have placed great numbers of radio parts, such as head sets and loud speakers, in multitudes of homes all over the world and particularly the United States, who has an interesting viewpoint upon the radio industry. According to him the day has come, and in fact, has been here for about two years, when radio should drop its science that it has so carefully and persistently dinned into the ears of the public and instead of talking about methods begin to proclaim results.

This man is Mr. Charles H. Lehman, president of the Dictograph Products Corporation.

He pointed out to his interviewer that the radio industry has been unlike many other industries in that instead of experiencing a comparatively short development period and then a much longer up-hill struggle toward satisfactory volume, it has instead gone through some ten years of labor pains and is now experiencing a quick growth toward maturity, to the great astonishment and envy of the older manufacturers in other lines.

However, Mr. Lehman specifically disclaims any pretensions that the radio industry has reached full maturity, as manufacturers outside the business may be inclined to judge. He thinks that radio, despite its great size and tremendous importance in the life of the nation, is still a lumbering, clumsy, overgrown baby, just learning to walk.

What renders this viewpoint doubly interesting is the fact that Mr. Lehman occupies a position that is unique in the radio industry. He, like many others, is a comparatively recent entrant into the radio field, but unlike most newcomers, for many years before commencing the manufacture of radio equipment, he was (and he still is) one of the leading manufacturers, if not the leading one, of acoustic devices. Mr. Lehman, therefore, represents in one person that combination that is so rare in the radio industry, namely, a manufacturer and merchandiser with experience not only in radio but in a much older art, and one that nevertheless is vitally connected with perfection of results in wireless telephony.

In fact, Dictograph head sets and loud speakers represent but a department, and a comparatively small department at that, in the Dictograph business, which is international in character, with branches in the principal countries of Europe and the Orient, with factories almost as widely located, and with a variety of products, all associated with the communication of sound.

For instance, the Dictograph Products Corporation makes the Acousticon. There are thousands and hundreds of thousands of deaf people in all parts of the world who will tell you that this is the best portable loud speaking telephone for their use. It is through the development and perfection of the Acousticon that Mr. Lehman lays claim to have been the first to undertake and successfully accomplish wire broadcasting, over ten years ago. At that time an Acousticon installation was completed in the Metropolitan Opera House, New York City, with the result that deaf people in all parts of the house were able to hear the operas in their seats as clearly and as loudly as normal hearing persons sitting beside them. The system is still installed and in constant use in that famous auditorium. Since that day similar systems have been put in hundreds of other theatres and particularly in churches, throughout America and Europe. The Acousticon makes use of an extremely sensitive microphone and a still more sensitive watchcase receiver, that fits over the ear.

Another activity of the Dictograph Company, consists of the manufacture and installation of interior telephone systems. This is the familiar Dictograph telephone that is to be seen on the desks of some of America's most prominent executives, giving instant communication within the office by the moving of the lever, without any necessity for speaking directly into the transmitter, nor for applying the ear to a receiver. This system is in use in thousands of offices and factories everywhere.

These things do not seem particularly romantic, though in some cases the things that have been done have partaken of the dramatic. For the real romance of the Dictograph company's business, it is necessary to turn to the "detective Dictograph." This is the famous ultra-sensitive concealed microphone that has played such a prominent part in the work of detectives, not only those who talk through the pages of the books and magazines, but those in real life, who shadow criminals, secure evidence against them and finally bring them to the bar of justice. The detective Dictograph is something that Mr. Lehman endeavored, at first, to keep a secret, on the principle that the more widely it was known the less valuable it would be, and for a time he was successful in confining knowledge of its existence to those authorized to use it. Eventually, however, the inevitable happened and details of its remarkable advantages became public property. The full story of the detective Dictograph cannot, however, be told.

Dictograph radio products have a long and honorable service behind them. When the Dictograph head set was added to the line it was rather a simple matter for the company, as it long has been conducting experiments in apparatus of exactly that type. Dictograph receivers have been going through a process of refinement for years in order to secure devices with the maximum sensitivity for the currents used, and of maximum lightness. Since the Acousticon is designed for constant use by the deaf, thousands of whom wear the little ear piece from the time they get up in the morning until they go to bed at night, it is evident that lightness and sensitivity are essential. That they have been essential is, of course, recognized by all users of the Dictograph head set.

From head sets the next logical step is the loud speaker and here again the Dictograph company had available its past experience. Its interior telephones, for a number of years, have had loud speakers incorporated in them. Today the Dictograph loud speaker consists of what is in effect a single unit of the Dictograph head set applied to a suitable horn in the manner dictated by previous experience. The latest development in the Dictograph loud speaker, which appeared on the market only on April 1, makes use of an adjustment, by which the device may be ac-

William Dubilier Returns from Europe

WILLIAM DUBILIER, President of the Dubilier Condenser and Radio Corporation, who recently returned from Europe, brought with him information on some new radio developments, among which was a radio control system for trains developed by the Germans and installed on locomotives, which gives a signal to the engineer

William Dubilier

and which will greatly minimize collisions.

Mr. Dubilier also states that a new method has been devised for generating high frequency oscillations which is cheaper and easier to build and maintain than tubes for high power, and that this new method can be used for power up to 25,000 kilowatts. He further states that more developments have been going on in the direction of splitting oils, making insulation, and obtaining nitrogen from the air.

Commercial currents will be used in the city. Many large plants are now contemplated, one of which is to be installed in Egypt and condensers are being designed for these installations which are almost as large as a dwelling house and which will cost about $100,000 each.

commodated to music and voice of varying character. The adjustment is a tiny knob and dial, turning which varies the distance between the magnets and the diaphragm.

There are certain other modifications in the new model over the old, including the use of a special diaphragm made of silicon steel, the composition of which is carefully held secret, as it is in great part responsible for the quality of reproduction secured. In size and form the new model resembles the old that secured so many friends. It has a mahogany-finish hard-wood cabinet, a die-cast tone arm and a spun copper horn. Those who have heard this loud speaker find it admirable, while the radio engineers who have examined it are particularly interested in the phone unit, which is wound with No. 44 enameled magnet wire.

M. C. Rypinski Visiting in Europe

M. C. RYPINSKI, Vice-President and General Sales Manager of C. Brandes, Inc., New York City, is on a trip abroad and will visit the London branch of C. Brandes, Ltd., and determine the advisability of further expansion of the plan in order to keep up with the increasing demand for radio apparatus. He expects also to visit Paris and points in Germany.

"The radio business is growing rapidly in England," Mr. Rypinski said, "and the present outlook is for a good even growth throughout the coming year." Mr. Rypinski will remain in Europe for an indefinite period.

New Organization of Radio Dealers

ASSOCIATED Radio Dealers, Inc., was organized recently at the Hotel Pennsylvania by twenty of the leading dealers of New York City, with the avowed purpose of standardizing the retail radio business in this city and instilling in the minds of the radio public a feeling of confidence.

Officers are George L. Modell, president; Benjamin Ginsberg, secretary, and Gus Klein, treasurer.

Each of the member stores will prominently display the emblem of the association bearing its triple slogan, "Honest Value, Honest Dealings, No Misrepresentation."

The association is open to all dealers in the city who are willing to abide by the body's rulings and decisions. More effective merchandising is expected as the result of a new policy of co-operative buying and co-operative advertising.

Members of the new organization are: Modell's stores, Park Row Cycle, Acme Radio Company, Shearn Radio, S. S. S. Radio Stores, Perfection Radio Company, Dixie Radio Company, Brooklyn Radio Service Company, Radiophone Equipment Company, Greenhut Radio Company, City Radio Company, Klein's Radio Supply Company, Vim Radio Company, Liberty Radio, Radio Shack Stores, National Drug Stores.

Bakelite Corporation to Market Phenol

THE manufacture of phenol will soon be under way in a plant now being constructed by the Bakelite Corporation.

This enterprise is the direct result of the protection afforded by the new tariff. American consumers have always been dependent upon a foreign source of supply for this commodity and today are paying abnormally high prices due to a general European shortage and an insufficient domestic production. Phenol, an essential ingredient in the manufacture of high explosives, was manufactured in the United States in a large way during the war—the foreign supply being, of course, strictly embargoed by every belligerent country—but since then the industry went out of existence for lack of tariff protection.

The Bakelite Corporation will manufacture a surplus beyond its own needs and to this extent American consumers will be assured of a supply at as moderate prices as conditions will permit, in conformance with the Corporation's announced policy.

Phenol (carbolic acid) is used for the manufacture of synthetic resins, largely used in the radio industry, also for dyes, for pharmaceutical preparations, for disinfectants and many other purposes. It is absolutely essential not only to industry and the public health, but most important of all for the national defense in the manufacture of high explosives.

An Optimistic Address by James R. Crawford

MR. JAMES R. CRAWFORD, General Sales Manager of the National Carbon Co., New York, gave out the following interview to the newspapers at Jacksonville, Florida, during the joint convention of the Southern Hardware Jobbers and the American Hardware Manufacturers Association.

"It is little short of marvelous," says Mr. Crawford, "the way in which the United States has recovered its stride after the disrupting march of the war. All of the dire predictions of the pessimists in regard to the difficulties we would experience in re-absorbing into our industrial life the great mass of discharged soldiers, have proved false. All the wild and disquieting talk about the dangers of bolshevism and the spread of radical doctrines has likewise been shown to have had no foundation in fact.

"One of the chief factors in bringing business back to normal has been the retail dealer. By co-operating with the jobber and manufacturer, the utilization of the most modern merchandising methods, the use of newspaper advertising, window displays and other advertising material, and by teaching his clerks salesmanship, he has speeded the wheels of commerce and aided in the task of re-establishing prosperity.

"Manufacturers everywhere are facing an avalanche of orders; the railroads have so far recovered from their temporary stagnation that they are beginning to order new equipment, new steel cars, new rails, new locomotives and the result of this new work is being felt all along the line. That is one fine thing about the present move toward prosperity; when one wheel turns they all begin to turn, showing that the American industrial machine is one big unit, and the good times coming are not for any one class, but for all sorts and conditions of men."

Dr. A. W. Hull Awarded Potts Medal

DR. Albert W. Hull, scientist in the Research Laboratory of the General Electric Company, has been awarded the Howard N. Potts gold medal for scientific research, by the Franklin Institute, Philadelphia. The award was made for his studies in the crystalline structure of matter by means of X-rays and was based on a paper entitled "Crystal Structures of Common Elements" read before the Franklin Institute last year.

Dr. Hull is also one of the foremost authorities on electron vacuum tubes and has been responsible for the development of some of the latest and most interesting types, such as the dynatron and magnetron, including a million-watt power tube.

Dr. Hull was graduated from Yale in 1905, took a Ph.D. degree from the same university in 1909 and taught at Worcester Polytechnic Institute from 1909 to 1914 when he joined the staff of the General Electric Research Laboratory.

The Potts medal was established in 1906 from a trust fund left by the will of H. N. Potts of Philadelphia. It is awarded only for "distinguished work in science or the mechanic arts."

Forward Steps in Radio Merchandising

THAT the radio business is making rapid progress is amply evidenced by the constant efforts of the leading manufacturers to assist distributors and dealers in selling their products.

The latest example and one of the best of such efforts is a series of six sales building letters for radio dealers prepared and distributed by Adams Morgan, Upper Montclair, N. J., manufacturer of Paragon radio products. Copies of these sales building letters will be supplied to dealers upon request.

Preston M. Smith Now With Hartzell Sales Co.

PRESTON M. SMITH, formerly sales manager of the Dubilier Condenser & Radio Corporation, 48 West Fourth St., New York City, is now general manager of the Hartzell Sales Company, manufacturers' sales organization, who represent many of the radio accessory manufacturers. The Hartzell Sales Company maintains offices at: 623 Victory Bldg., Philadelphia, Pa.; 705 Granite Bldg., Pittsburgh, Pa.; 1028 Fourth Ave., Huntington, W. Va.; 302 Flatiron Bldg., Atlanta, Ga., and will within the month open a fifth office at Dallas, Texas.

C. Brandes, Inc., Uses 450,000 Miles of No. 40 Wire Yearly

C. BRANDES, INC., are said to be the largest consumers of No. 40 wire in the world. No. 40 wire is about the size of the average hair and is used in winding the magnets in the Brandes matched-tone head sets. The monthly consumption of this wire by Brandes is sufficient to reach one and one-half times around the earth. The average yearly use is in the neighborhood of 450,000 miles.

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 amateurs of Ohio held their annual convention at Columbus early in April, at the Hotel Columbus. Mrs. C. C. Candler, known in wireless circles as Ex. 8ZL, made an address at one of the meetings. Mrs. Candler was one of the pioneers in the early stages of radio development. Her home is in St. Mary's, O.

R. H. G. Matthews of Chicago, central division traffic manager of the American Radio Relay League, was another speaker.

An inspection tour of all the amateur radio stations in and around Columbus was made by the delegates and kept them "on the run" until late in the evening of Saturday, April 7, the last day of the convention, when the annual banquet was held. This inspection trip included stops at Fort Hayes, Columbus General Reserve Depot, East Columbus, and Ohio State University.

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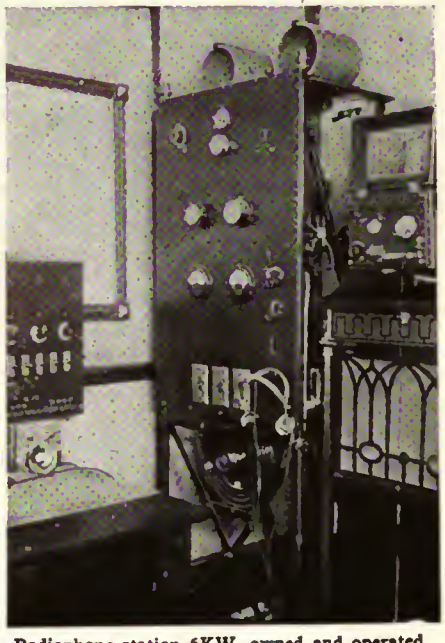
BOYS of the Germantown Y. M. C. A., Germantown Avenue and Haines Street, held an exhibition and test of two-bulb radio sets, in their auditorium recently.

Most of the sets on exhibition were the work of the boys themselves. Two dozen sets with hook-ups, antennas, wires and other apparatus were shown and demonstrated.

The affair was under the auspices of the Radio Club. K. W. Kellar and A. H. Miller were in charge.

Two hundred spectators, including relatives, parents and friends of the radiophans were present.

200-watt transmitter built by Chas. M. Srebroff of station 2BHY



Radiophone station 6KW, owned and operated by Frank H. Jones, Tuinucu, Cuba

FRANK H. JONES, whose 50-watt phone transmitter at Tuinucu, Cuba, has been heard in such a wide area in the United States, has recently increased his power to 100 watts, and is now getting out stronger than ever. As he says: "New York and New England are from 1,275 to 1,600 miles from Tuinucu, and reception there is regular and constant. In those parts I cannot put any more tacks on my map. Am heard fine and loud, according to letters and post cards, in every state east of the Rockies, in Canada east of Alberta, including regular reception in St. John's, Newfoundland, about 2,500 miles away. Acknowledgments have also been received from Mexico, Central America, Haiti, Porto Rico and steamers on the Atlantic Ocean." The call used in radiophone work on 315 meters is 6KW, and the call used for code work using straight CW telegraph or ICW on 275 meters is 6XJ.

BEFORE an audience of over five hundred people, many of them being broadcast listeners, the Milwaukee Radio Amateurs' Club, Inc., recently exhibited the General Electric Company's two-reel radio film, "The Wizardry of Wireless." Following the exhibition, I. H. Strassman, 9AHO, and E. T. Howell, Sc. M., Technical Committee Chairman, addressed the gathering on the subject of the relations between the amateurs and the radiophone people. The progress that was being made in ridding the air of unlicensed stations was spoken of, and the efforts of the traffic committee to bring about favorable feelings between the two classes was called to the assembly's attention as well as a description given of that committee's work.

"Radio Frequency Amplification Systems" was the title of a paper presented by E. D. Nunn, ex-9FE, a Milwaukee radio engineer, in which stress was laid on the use of radio frequency amplification with two variometer receptors. This lecture is the first of a series being arranged by the new program committee chairman, H. F. Wareing, prewar 9AEX, and president of the society. H. P. S. Day, Sc. B., a telephone engineer, gave the second, its title being "Vacuum Tube Characteristics," and in non-technical language the fundamentals as well as some of the applications of the thermionic valve were treated in an interesting and instructive fashion.

Upon his return from California, Charles S. Polacheck, a former secretary-treasurer, addressed the members under the title of "Some Experiences of a Wayfaring 'Ham' in the West" and told of his meeting with one of the speakers at the club last year, L. E. Grogan, formerly radio engineer to the government of Southern China. and, also, he related his experiences as being a guest at several meetings of the San Francisco Radio Club, Inc.

Crystal receiving sets mounted on old phonograph record discs by W. J. Simpson

The club's code class for radio listeners and others is meeting weekly at 7:15 p. m., Thursdays, in the Public Museum Trustees' Room, while the society's regular meetings are held at 8:00 p. m. in the same room and on the same evening.

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THE fourth annual First District Radio Amateurs' Convention and banquet was held on Saturday, March 31, in Walker Memorial Hall, Massachusetts Institute of Technology, under the auspices of the M. I. T. Radio Society and the American Radio Relay League. This is the annual gathering of New England radio amateurs. The speakers were Hiram Percy Maxim, K. B. Warner, F. H. Schnell, Paul F. Godley, internationally known amateur and writer, and George Clark, well known amateur and radio authority.

One important matter of business considered was the reorganization of the New England Executive Radio Council; officers will be elected and a new constitution adopted. The affiliated radio clubs of New England have been asked to send representatives.

This meeting was followed by an amateur "gabfest" and a manufacturers' exhibition. The evening program began with a banquet at 6 o'clock.

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A RADIO club has been organized by some of the students of the Preparatory School, Newark, N. J. One thousand dollars has been appropriated by the school directors for the purchase of a transmitter, receiver and a complete aerial and power system.

The parts were purchased, and an excellent honeycomb regenerative receiver with detector and two-step audio-frequency amplifier was constructed by members of the club. All of the principal DX broadcasting stations west of WOC and south to WSB have been brought in with regularity and clearness.

The club members were not satisfied with broadcast reception and now they have partly constructed a fifty-watt telephone CW and ICW transmitter, to handle amateur relay traffic. One of their members is 2BJT and it is expected that he will operate the transmitter until the other members secure licenses.

The transmitter will employ the well-known 1DH sure-fire circuit. A sixty-jar chemical rectifier will change the 1,500 AC to about 1,100 DC for plate power supply. Connections in the transmitter will be made with heavy copper tubing. A new 110-volt power line with a special meter installation gives ready access to thirty amperes input.

The antenna is supported by two steel masts, the tops of which are seventy feet above street level. The masts are eighty feet apart and support an eight-wire cage "T" type aerial. The lead-in is of cage construction and is approximately fifty feet long. The ground lead is about twenty feet long and runs to a special ground outside the building.

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ONE of the most unusual forms of aerials ever used by a radio broadcasting station in this section of the country is under construction at Haverford College, Haverford, Pa., where a high-power transmitting set is being installed.

The College Radio Club, which has an active membership of fifteen members, originated the project and is installing the outfit. Plans call for the opening of the station about the middle of June. Programs will be broadcast once a week.

While there are several distinctive features about this station, perhaps the "cone aerial" and "fan counterpoise" are the most interesting. The design of these and the station are the work of William S. Halstead, a Haverford College freshman.

The "cone" aerial is of six wires, with a base twenty-five feet in diameter, tapering to a point, or apex, of five inches. The "cone" points diagonally toward the ground.

This cone is suspended from a steel tower, the top of which is to be 130 feet above ground. The guy-wire supporting the small end of the cone is anchored to the smoke-stack of the power-house, at a point sixty-five feet above ground, and 250 feet away from the steel tower.

The "lead-in" wire connecting the aerial to the transmitting set, located in the Radio Club room in the physics building, is of the "cage" type, five inches in diameter.

An unusual feature of grounding is the "counterpoise-group," consisting of a fan-shaped network of wires mounted level with the ground, the radial wires connected with short wires producing a "spider-web" formation.

Provision is being made to tune the set down to amateur wave-lengths and to use either key or "buzzer" for code transmission. The set is also to be used for instruction purposes by the physics department. The regular weekly programs will consist of talks of general interest by members of the faculty, musical selections by the college instrumental and glee clubs, reports of athletic contests, debates and occasional special features.

Edward Patterson is president of the Radio Club and chief operator of the station; other operators are, William Halstead, Gerald Gross, and James Saunders.

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THE New Orleans Radio Association held its monthly meeting in the Grunewald. W. J. Uhalt made an address on the radio compass. Mr. Deiler and Mr. Dutriel spoke on "The Law and the Radio Amateur and Listener-in."

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THE Nola Radio Club of New Orleans, La., was reorganized at the amateur radio operators' meeting held recently at 134 Chartres Street.

The Nola club members were addressed by G. A. DeCortin, one of the original operators of the city; L. J. N. Dutriel, assistant inspector and T. G. Deiler, radio inspector for the fifth district.

The purpose of the club is to further and protect the interest of amateurs by helping to suppress illegal stations and by preventing interference with broadcasting.

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AMATEUR phones might be a little more popular with broadcast listeners if they would copy the style of the announcers at the W and K stations, and talk a little more plainly. Hundreds of the novices who tune down hopefully to 200 meters or above, in order to find out what it's all about, go back to 360 when they hear "Blee-blip-ahrr-yowk calling woob-rampf-skolt-humpf how am I now old man come back please." What's happened to the old Able Boy Cast Dog code that helped win the war?

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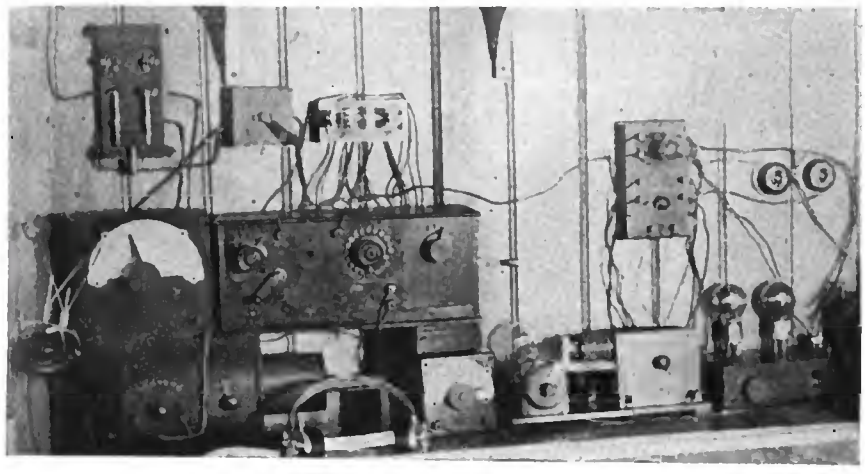
THE SHS Radio Club, of the Springfield, Illinois High School, has been gathering unto itself many laurels by its activity in experimental work. Recently it got itself in big type on the front page of local newspapers by conducting successful experiments in transmission and reception, 250 feet underground, in the Woodside Coal Mine near Springfield. This particular test was conducted with the co-operation of the mine officials and representatives of the Illinois Mine Rescue Station. The experimenters underground used a one-quarter kw transmitter and a single-wire antenna 150 feet long. The set was grounded on the railroad track within the mine and also on a trolley wire. The station was heard by a number of local amateurs. Following the successful conclusion of the transmission period the receiving apparatus was operated for a short time and the following calls copied: 8ZO, 8BNG, 8FM, 9ECZ.



Receiving equipment of English experimental station 2WT, operated by H. Chadwick, Bolton, Lancashire, England. Mr. Chadwick logged many American amateurs during the trans-Atlantic tests. The receiver consists of three tubes, 1 R. F., detector and 1 A. F.

Queries Answered

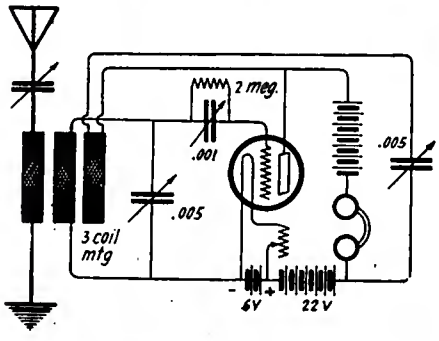
Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all 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.

W. E. Wilson, Buffalo, N. Y.

Q. I am extremely anxious to construct a radio receiving station such as outlined in your guide, "Practical Amateur Wireless Stations," page 69, employing what is shown as "Weagant's Circuit." With my limited possession of radio knowledge the sketches and description given is insufficient and I would indeed appreciate full detailed information concerning the erection and construction of a receiving set of this type, together with "dope" on connecting the various coils, taps, switches, etc.

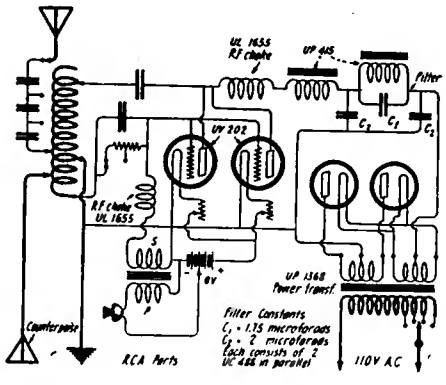
A. The article in question was written before the advent of honeycomb, duolateral, Remler and other machine wound coils. We believe that it would not only be cheaper, but much more convenient for you to use such coils instead of the innumerable tap switches and coils, and to change these coils when changing in wavelength. The circuit would then be as follows:



J. B. Williams, Dallas, Texas.

Q. Please publish a good hook-up for a ten-watt telephone transmitter, using rectified alternating current for plate, and eight-volt storage battery for the filaments.

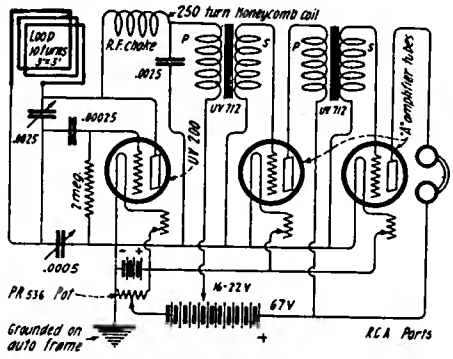
A. Below is hook-up.



Alex Biar, Kansas City, Mo.

Q. I am desirous of getting information and hook-up on a set for an automobile, using loop antenna and being non-directional.

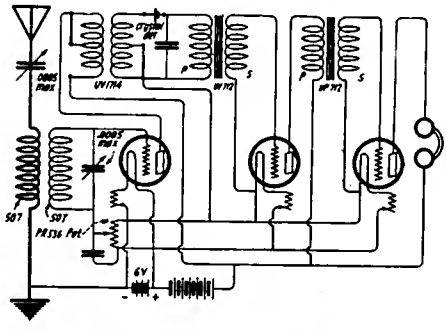
A. Below is simple regenerative hook-up for loop. In order to make it non-directional, ground the filament battery.



James Palmer, Glens Falls, N. Y.

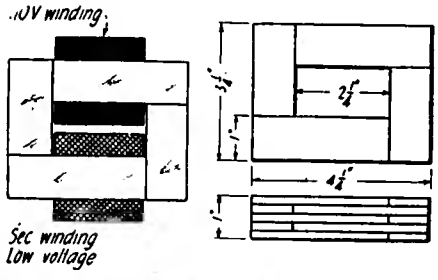
Q. Kindly furnish me with a hook-up containing 3 honeycomb coils, 2 variable condensers (of any capacity) and a crystal detector, a two-stage audio-frequency amplifier and one-stage r. f. amplifier.

A. Below is hook-up for 2 honeycomb coils; three coils cannot be used here.



Tony Larocque, Ottawa, Canada.

Q. I have a laminated iron core I got from a friend. It is probably from an old step-down transformer. The size is



shown in the diagram. What size of wire on primary and how many turns and what size on secondary and how many turns would I need to step down to these voltages, 3, 6, 9, 15 and 20?

A. Data for transformer to step down from 110 volts 60-cycle A.C.

Primary winding—440 turns No. 22 enameled wire.

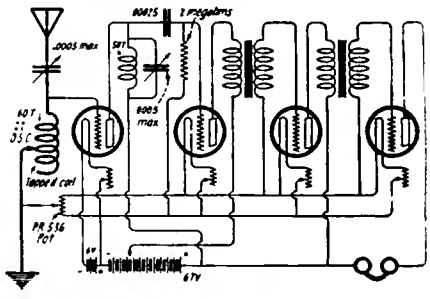
Secondary winding—total turns, 100; (a) First 40 turns wound with No. 12 enameled or S.C.C. wire with taps at 13th, 26th and 40th turns; (b) Next 30 turns wound with No. 14 S.C.C. wire with tap at end or 70th turn; (c) Next 30 turns wound with No. 16 S.C.C. wire with tap at 100th turn.

	Secondary turns	Voltage
No. 12 S.C.C. wire	12	3
	26	6
	40	9
No. 14 S.C.C. wire	70	15
No. 16 S.C.C. wire	100	20

Luther M. Pease, New Bedford, Mass.

Q. Please give me a circuit diagram or hook-up with condenser and inductance values of the Crosley model X receiver.

A. Below is hook-up similar to Crosley Model X, which consists of one stage of tuned radio frequency and two stages of audio-frequency amplification.



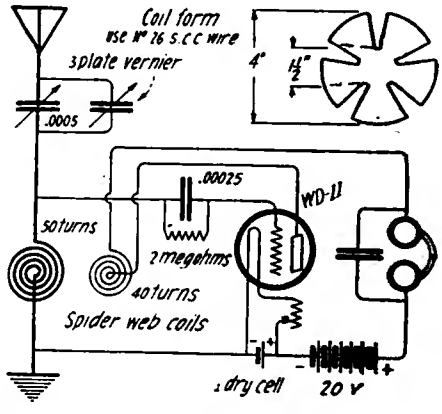
All tubes may be "A" amplifier tubes.

* * *

Harry E. Schultz, Reading, Pa.

Q. Enclosed find copy of hook-up for tube set which I tried on the Crystal Broadcast printed in your March number, page 71. I have been unable to receive anything. Kindly let me know if this hook-up is right or if it should work. Also, you will find a sketch of the aerial I am using. Kindly tell me what I can do to improve it.

A. Your hook-up is unsatisfactory for receiving distances greater than a few miles on a small antenna such as you use. Change it into a tube regenerative receiver as shown in the diagram below:



Miss Alyce Brader, Hugo, Okla.

Q. Please give me a few particulars on the De Forest audion tube, the No. 216-A Western Electric, and the new 201-A or 301-A.

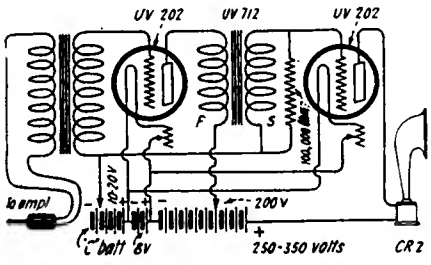
A. We have no information on the De Forest tube. Herewith are data on the other tubes.

Western Electric 216-A—Filament current, 1.0 ampere; filament voltage, 5 volts; plate voltage, 120 volts; grid bias, 9 volts; amplification constant, 6; filament to plate impedance, 5000 ohms.

UV 201-A or C-301-A (these tubes are identical)—Filament current, 0.25 ampere; filament voltage, 5.0 volts; plate voltage, 45-100 volts (20 volts as detector); amplification constant, 8; filament to plate impedance, 15,000 ohms.

Fred L. Mayer, Jr., Mt. Pulaski, Ill.

Q. Would you kindly give me a diagram in detail of a power amplifier using two five-watt tubes to be used with a two-stage radio set? Can a CR-3 Magnavox be used with the above amplifier, or should it be a CR-2? What plate voltage should be used on five-watt tubes?



A. Here is hook-up for two stage power amplifier. See pages 68 and 70 of the December, 1922, WIRELESS AGE for further information on various power amplifiers.

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 June 10th will be published in the July issue. Spark and C. W. stations should be arranged in separate groups.

2NE, A. H. SAXTON and D. M. COLE, 211 Claremont Ave., Jersey City, N. J. (March and April). CW (unless otherwise marked).

1abb, 1acb, 1adn, (1af), 1ain, 1aiq, 1alj, 1all, 1ana, 1aok, 1adc, 1adw, 1ary, 1asf, 1awe, 1aww, 1axu, 1ban, (1bdi), 1bgd, 1bkr, 1bnt, 1boq, 1bq, 1bqq, 1brq, 1bsr, 1bvh, (1byn), 1cab, 1cbj, 1cdo, 1cfn, 1ckp, 1ckq, 1cmh, (1cmp), 1cni, (cw&spk), 1cpf, 1cpi, 1crv, 1crw, 1csa, 1dl, (1fd), 1ii, 1il, 1jv, 1kw, (1pr), 1rv, 1sn, 1ts, 1wc, 1xm, (1xx), (1vk), 3adx, (3aln), (3auv), 3awa, 3apr, 3bav, 3bei, 3bgt, 3bhm, 3bjg, (3bmn), 3bof, 3brv, 3bss, 3btl, 3bvp, 3cdg, 3cfq, 3fs, 3gz, 3hh, (3hs), 3jj, 3ln, 3lp, 3oe, 3mo, 3nb, 3pz, 3su, 3sy, 3te, (3tk), 3tr, 3xal, (3zo), 3zp, 4ai, 4bx, 4by, 4db, 4eb, 4hw, 4iv, 4jk, 4km, 4nt, 4oi, 4pu, 5anx, 5ek, 5kc, 5mb, 5nz, 5uk, 5xa, 5zab, 5zav, 5zb, 6anh, 6zz, 7cd, 8al, 8adg, 8afd, 8afu, 8aih, (8ajx), 8am, 8aqj, 8aqv, 8atn, 8atx, 8aud, 8auj, 8awp, 8awt, 8axn, 8bah, 8bbe, 8bch, 8bcp, 8bcy, (8beo), 8bdm, 8bis, 8bog, 8boh, 8boz, 8bpq, 8brt, 8bvh, 8bxt, 8bxx, 8caa, 8cbq, 8ccv, 8chb, 8cgi, 8cgj, (8cgv), 8cgx, 8cjh, 8cjv, 8cjz, 8cpd, 8cpz, 8crb, 8cpc, (8ctn), 8cuu, 8cwx, 8cxt, 8ckw, 8cyt, 8cyu, 8daa, 8dfv, 8fq, 8gz, 8hj, 8jz, 8kh, 8lc, 8ld, (8nb), 8px, 8rr, 8rv, 8tj (spk), 8uf, 8vy, 8wx, 8xe, 8yae, 8yv, 8zd, 8zw, 9aav, 9aaw, (spk), 9acd, 9afk, 9aix, 9anq, 9aps, 9apw, 9ase, 9ato, 9atu, 9ave, 9bcb, 9bdb, 9bds, 9bgv, 9bhd, 9bil, 9blg, 9bop, 9brn, 9bry, 9bsd, 9bsg, 9bba, 9ccs, 9ced, 9cjc, 9cjm, 9cnv, 9cdr, 9ctr, 9ctv, 9cui, (9cvo), 9dan, 9dfb, 9dge, 9dgw, 9dkk, 9dpv, 9duq, 9duw, 9dyn, 9dyu, 9ehi, 9ei, 9eis, 9ekf, 9el, 9ep, 9eq, 9hj, 9ii, 9lh, 9of, 9ox, 9pi, 9pq, 9qr, 9rc, 9uk, 9ur, 9uu, 9wc, 9zt.

CANADIAN—1bq, 2af, 2am, 2cg, 3bp, 3bq, (3co), (3de), 3dh, 3he, 3oe, 3jl, 3oh, 3si, 3xn, 9aw, 9bj, 9bw.

3BMN, RAYMOND J. CARR, 617 Union Ave., Petersburg, Va. (April—1 tube.)

1af? (1ez) 1fd, 1iv, 1kv, 1pr, 1qp, 1sw, 1za, 1aby, 1aqm, 1arp, 1asj, 1ayz, 1bes, (1blb), 1boq, 1bsd, 1cac, 1cdo, (1cgq), 1ckp, 1cre, 1xak, 2hw, 2kd, 2ke, 2rm, 2ry, 2wb, 2wr, 2zs, 2aax, 2acd, 2afp, 2agb, 2apy, (2aqi), 2asi, 2atq, 2axf (2ayv), 2bdu, (2bgi), 2bjx, 2bkr, 2blm, 2bnz, 2bqu, 2bum, 2bwa, 2cbw, 2cei, 2cfb, 2chx, 2cjp, 2cla, (2cqz), (2cvc), 2cvj, 2cwo, 2cwp. (Threes too numerous.) 4af, 4bk, (4bx), 4by, 4dc, 4do, 4eb, (4el), 4ep, (4eu), 4fa, 4fq, 4ft, 4gv, 4hw, (4ir), 4jk, (4kc), (4lj), 4mb, 4mr, (4nt), (4od), 4pm, 4pu, 4pv, 4xd, 5cp, 5da, 5ek, 5gj, 5kc, 5mo, 5sp, 5up, 5vv, 5xa, 5agj. 8bf, 8fm, 8ft, (8fu), 8gz, 8hj, 8ib, 8ij, 8kj, 8ll, 8nz, 8te, 8tt, 8uf, (8vn), 8vq, 8wf, (8yn), (8aaf), 8aag, 8abl, 8aer, 8agq, 8aih, (8anv), 8aol, 8aot, 8aql, (8asv), 8axn, 8bbe, 8bbf, 8bda, 8bdu, (8bek), 8bhf, 8bis, (8bmg), (8bnh), 8bot, 8boz, 8bpu, 8brc, 8brm, (8brt), 8but, (8byh), (8cab), (8cdy), 8cei, 8cgi, 8chi, 8chu, 8cjy, 8cjz, 8cka, 8cko, 8cku, 8clc, 8clv, 8coz, 8cpz, (8cqh), (8ctz), 8cur, 8cuu, 8cuv, 8czz, 8dag, 8dig, 8dio, 9mc, 9ot, 9pe, 9ur, 9uu, 9vm, 9vz, 9alx, 9arp, 9awg, 9bhd, 9brk, 9bvp, 9cgk, 9che, 9cvo, 9dcb, 9dct, 9dcw, 9ddu, 9dfb, 9dmw, 9dri, 9dzx, 9ehi, 9eki.

Canadian—3ds, 3nb.

9ZT, D. C. WALLACE, 54 Penn Ave. N., Minneapolis, Minn. (April.)

1aw, (1wc), (1boq), 1ckp, 1cmp, 1cna, 2wr, 2agb, 2awl, 2bzv, 2cwo, 3ab, 3bq, 3cx, 3gc, 3jj, 3jl, 3zo, 3bfu, 3bhl, 3bnu, 4cg, (4eb), 4pu, (5cy), (5di), (5ek), (5ll), (5ny), (5nn), (5nv), (5px), (5xa), (5xy), (5za), (5abh), 6by, 6ea, 6ec, 6jd, 6mo, 6yu, 6zh, 6zw, (6zz), (6aak), (6acm), 6ado, 6alk, 6aqp, 6azv, 6bnt, (6bqc), 6bqd, (6brf), 6bun, (6bvg), (6caj), 6xad, 7iw, (7sc), 7sf, (7tg), (7zf), 7zo, (7zu), (7acm), 7adp, 7ahc, (7ahi), (7aiy), (8fl), (8gp), (8qk), (8rv), (8ada), (8apw). (8azo), (8cbi), (8cbg), (8cjh), (8cmi), (8cpd), (8cur).

Canadian—(2bn), 3co, 3ds, 3ko, 3nb, 3ni, (3si), 3ta, 3xm, 4cn, 4fn. 4hh, 9bx, 9cd, (9dy).

Book Reviews

Revised Amateur Call Book

THE Fourth Edition of the Amateur Radio Call Book is now ready. This directory, which has earned an important place in so many radio shacks and lately in so many living rooms, brings itself up to date in its newest edition, containing not only the latest calls, but much additional matter. The introductory section, which always explains the construction of a receiving set, now devotes itself to the famous Reinartz tuner, details of which are given in full.

In the lists of calls are included not only the amateurs, the special amateurs, and broadcasting stations, but also broadcasters in Canada, and numerous special lists. The latter include the commercial land stations, and the army and navy land stations of the United States; and the high power transoceanic stations and their schedules, not only American, but world-wide.

The latter list, which heretofore has not been easily obtainable, will be especially appreciated by the many amateurs who like to listen to the traffic of the world. Schedules are given in Eastern Standard Time and so far as is known this is the first time that such schedules have been given in other than Greenwich Mean Time, which is somewhat puzzling for Americans.

As before, the Call Book includes a large map of the United States in two colors, showing the radio districts, the time belts, the location of the broadcasting stations, and bearing on the margin an alphabetical list of broadcasters.

Amateur Radio Call Book. Fourth Edition, revised and enlarged. New York, Radio Directory & Pub. Co. Price $1 from the publisher or of The Wireless Press, 326 Broadway, New York City.

Electrical Text Books

A NEW text book on electricity is not a novelty, as there have been few in the past among books of varying degrees of merit. If novelty cannot be claimed for "Practical Tests for the Electrical Laboratory," certainly a high degree of merit can be assigned to it. The book, which came off the press early in 1923, is evidently designed as a guide for use of students during the electrical laboratory work. As a matter of fact it is much more than that, for each chapter in taking up different laboratory subjects, begins with a condensed, yet a most comprehensive, analysis of the principles and theories involved.

For that reason the book probably will find a certain number of general readers who are looking for condensed electrical principles to guide them in their experimental work. The book assumes a knowledge of electrical elementals, including practical work in a shop or shop course, and acquaintance with the requirements of the National Electrical Code, and, according to the preface, the authors expect that a study of electrical theory in the class room will accomplish the work done under the guidance of their book.

"Practical Tests for the Electrical Laboratory," a text book for vocational schools, by Chesley H. Johnson, M. E., and Ralph P. Earle, B. S. and E. E., 348 pages, with many diagrams and illustrations. New York, D. Van Nostrand Company. Price $2.50 from the publishers or from The Wireless Press, 326 Broadway, New York City.

Explains Super Circuits

THOSE who are contemplating experiments with super-regeneration, or who have undertaken them with dubious success—and probably nearly every radio fan falls in one or the other of these two classes—will find much of value in the 44-page booklet "Increasing Radio Efficiency Through Super-Regeneration," by C. S. Perkins and R. B. Brown, Jr. The booklet considers its subject with great erudition as regards theory and also reflects considerable experience on the part of the authors in practical work. Those who are anxious to learn the exact principles of super-regeneration in order that they may experiment intelligently certainly can profit from this booklet. It is not less valuable to experimenters who already are deep in the subject, for its excellent sections on operating methods, control methods, and circuit constants will interest the advanced operator.

Increasing Radio Efficiency Through Super-Regeneration, by C. S. Perkins and R. B. Brown, Jr. Paper, 41 pages. Price $1.00, from C. S. Perkins, Massachusetts Radio & Telegraph School, Boston, or from The Wireless Press, 326 Broadway, New York City.

Circuits Galore

THOSE who like to assemble apparatus in new hook-ups, or even who are interested in looking over diagrams will be sure to profit by or enjoy "The Amateurs' Book of Wireless Circuits," by F. H. Haynes. This is a new English book, 6 x 9½ inches in size, bound in board, and contains circuits only, after a short dictionary of symbols. Each circuit has a minimum of explanatory text, sometimes a single line being sufficient. The circuits are progressively arranged, and elaborations introduced as the skill of the worker or knowledge of the student increases. The book is essentially of a practical nature. Those who work from it will be particularly grateful for the numerous and clear switching diagrams. Being printed in England, some few differences are to be noted from American practice, but these are easily understandable. The vacuum tube, for instance, is drawn differently, and it is called a "valve." Similarly, regeneration is called "reaction," and audio frequency amplification is referred to as "note" or "tone magnification." Also, the plate of the tube is usually referred to as the "anode."

The Amateurs' Book of Wireless Circuits, by F. H. Haynes, London, 1923, The Wireless Press, Ltd., 108 pages, boards. Price $1, postpaid, from The Wireless Press, 326 Broadway, New York City.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of the Wireless Age, published monthly at New York, N. Y., for April 1, 1923.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. Andrew White, who, having been duly sworn according to law, deposes and says that he is the Editor of the Wireless Age, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Wireless Press, Inc., 326 Broadway, New York, N. Y.

Editor, J. Andrew White, 326 Broadway, New York, N. Y.

Managing Editor, None.

Business Manager, J. O. Smith, 326 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Wireless Press, Inc., 326 Broadway, New York, N. Y.

Radio Corporation of America, (Owning all the stock of Wireless Press, Inc.), 233 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

The names and addresses of stockholders of Radio Corporation of America owning or holding 1 per cent. or more of the total amount of its stock are as follows: Cameron Blaikie & Co., 44 Broad Street, New York; Jas. B. Colgate & Co., 36 Wall Street, New York; General Electric Co., 120 Broadway, New York; The International Radio Telegraph Co., 165 Broadway, New York, and United Fruit Co., 131 State Street, Boston, Mass.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company bnt also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the hooks of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as ao stated hy him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is .....(This information is required from daily publications only.)

J. ANDREW WHITE, Editor.

Sworn to and subscribed before me thia 2nd day of April, 1923.

[Seal] M. H. PAYNE,
Notary Public.

(My commission expires March 30th, 1924.)

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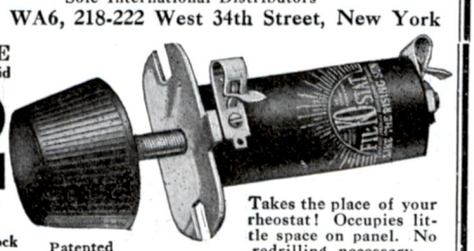

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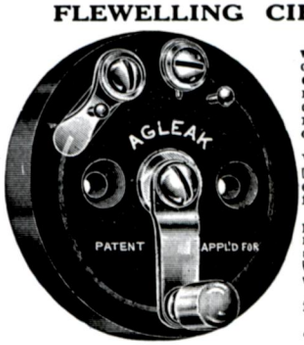
FLEWELLING CIRCUIT



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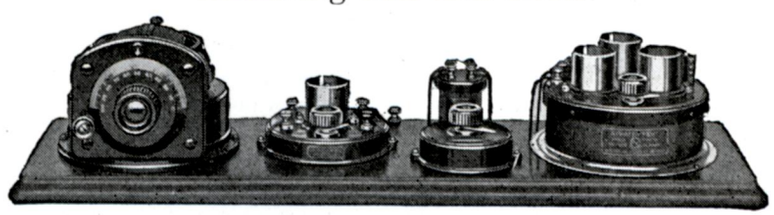

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