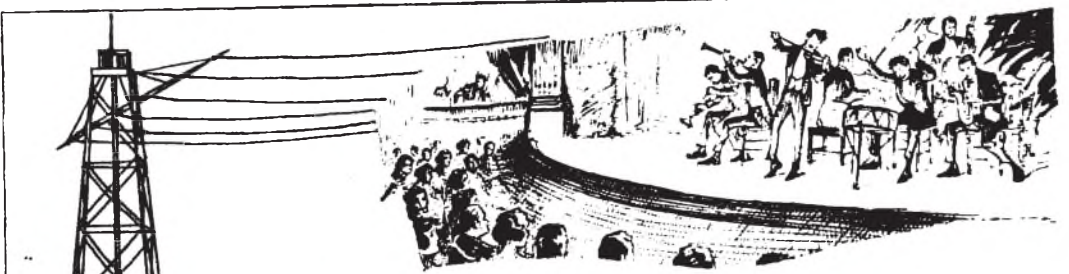


# QST

*A Magazine published by the  
American Radio Relay League  
and devoted exclusively to*  
**CITIZEN RADIO**



**APRIL 1922**  
**20¢**



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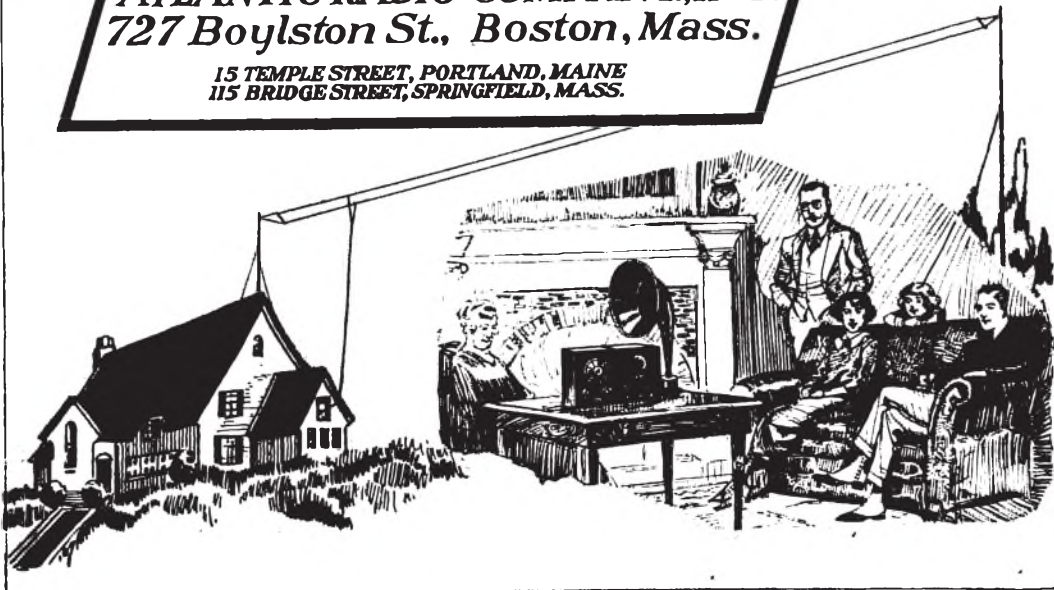
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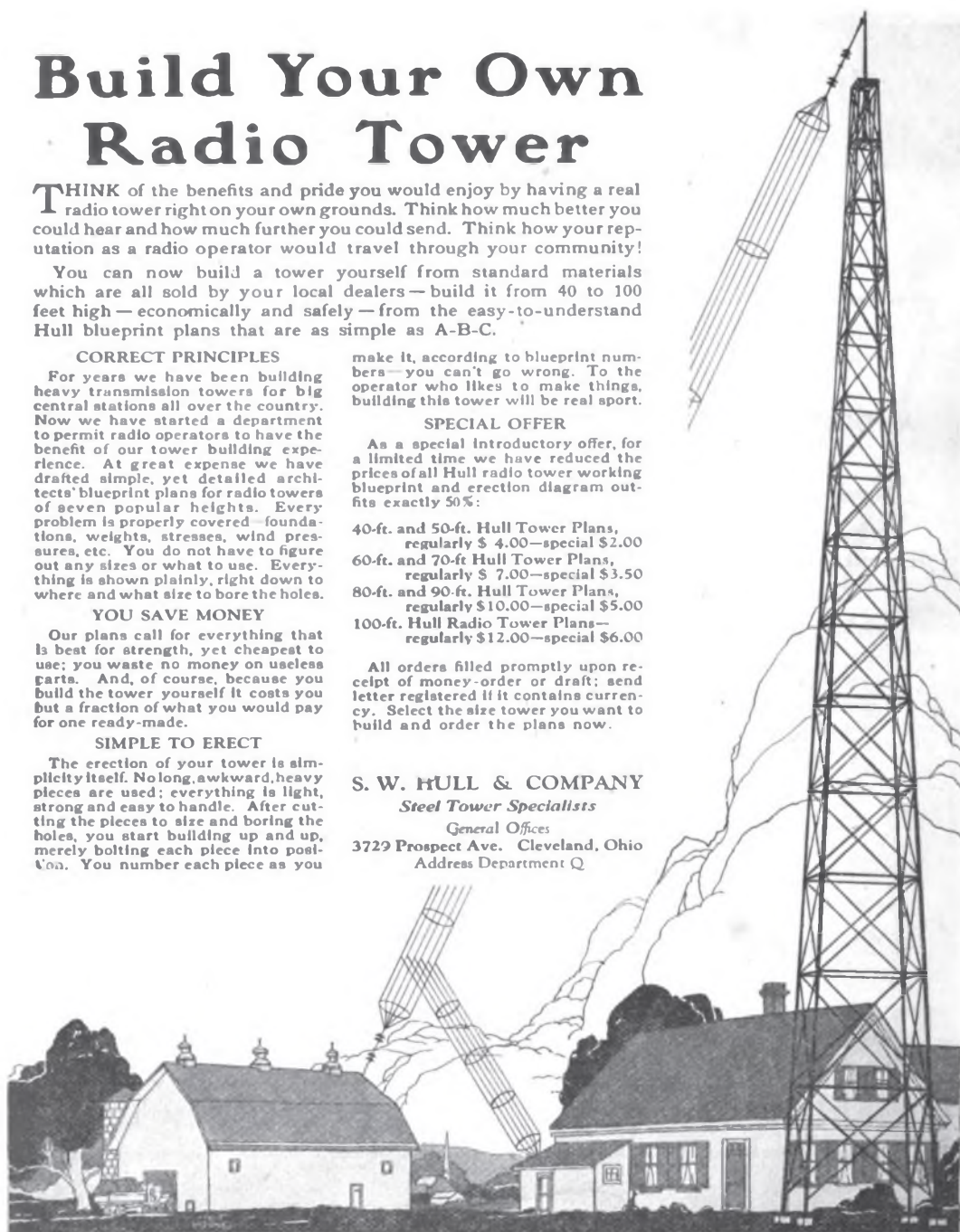
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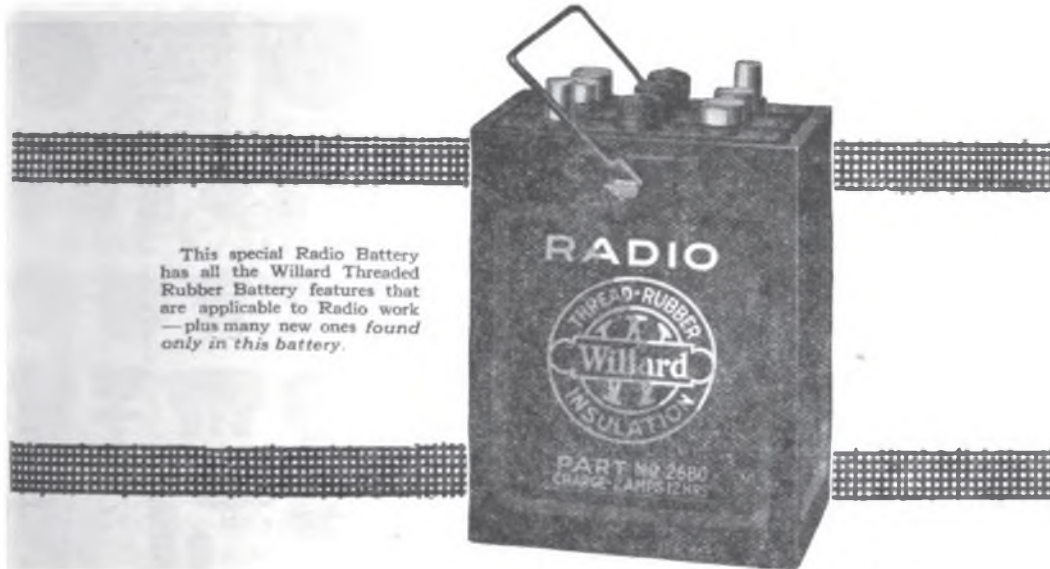
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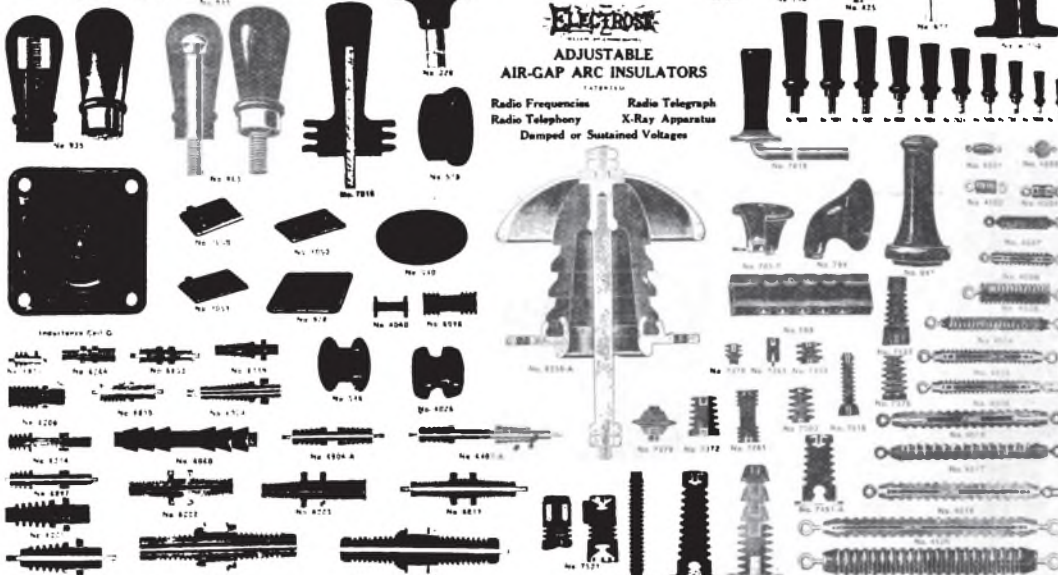
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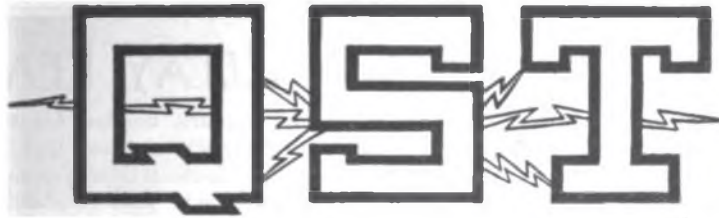


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# The Official Organ of the A.R.R.L.

VOLUME V.

APRIL, 1922

No. 9

The Washington Radio Conference	<i>K. B. Warner</i>	7
Improvements in Multi-Stage Amplifiers	<i>H. E. Bussey</i>	13
—“And It Came To Pass”	<i>S.P.W.</i>	14
Improving Antenna Efficiency	<i>M. B. West</i>	16
The Third and Fourth District Radio Convention	<i>Chas. A. Service, Jr.</i>	22
Trump Passes On		26
3ZO Tests with Venezuela		26
The Loop Receiver at 3ZY	<i>L. M. Dunnam</i>	27
The Remarkable Work of 6XAD		29
Chicago Council Gets Smith Cup		31
The Second District Convention and Radio Show		32
More About the Transatlantics		35
Editorials		37
Operating Department		40
Amateur Radio Stations—7ZU, Can. 9BD, 1BLE		49
With Our Affiliated Clubs		52
Who's Who—F. A. Hill, A. L. Groves		55
With Our Radiophone Listeners		56
“Strays”		59
Radio Communications by the Amateurs		62
A Storm Relay Route		67
Calls Heard		68
Classified Advertisements		141
QST's Index of Advertisers		143

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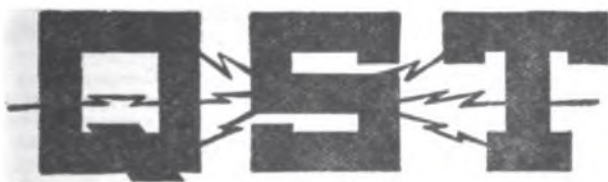
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A Magazine Devoted Exclusively to the Radio Amateur

## The Washington Radio Conference

By K. B. Warner

**A**MATEUR radio has been recognized and honored in the first eight-day session of Secretary Hoover's Radio Commission. The Commission has recommended that a wave length band from 150 meters to 275 meters be allocated to amateurs and that this be specified in the new radio law; that this band be subdivided by the Secretary for the various classes of amateur transmitters, sparks on the shortest waves, then modulated C.W. (including self-rectifying C.W.), next radio telephones (including amateur broadcasts), and with straight C.W. telegraphy on the longest waves up to 275; and it has also recommended that amateur deputy inspectors be created whereby the amateur world may police itself and maintain observance of the subdivisions within the amateur band.

These are recommendations—they are not yet in effect. At this writing the Commission is in recess while a Legal Committee, of which Representative W. H. White, Jr., of Maine, is chairman, prepares a draft of an amendment to the present radio law which will make possible the changes in the regulation of all classes of stations, and it will meet again soon to study the new bill and give consideration to the comments received on its recommendations to date.

It was of course our good old A.R.R.L. which again represented amateur radio at Washington. Representatives of quite a few affiliated clubs were on hand to help, and they too of course are A.R.R.L. We wouldn't be surprised to hear about other folks who "saved the day for amateur radio" (after every scrap we do), but we're here to tell you that the A.R.R.L. was the only one on the job.

### The Need

As everyone knows who knows anything

at all about radio, there have been dozens of attempts in recent years to revise the radio law of 1912, which is more or less outgrown technically and does not give the government sufficient regulatory powers to adequately take care of the greatly changed conditions obtaining in radio today. The past efforts looking towards new legislation have with one exception all been dismal failures because they did not make adequate provision for all of the classes of stations. The one exception was the Department of Commerce Radio Conference Committee of 1920, which examined the so-called EU-F-GB-I Protocol and finally drew up wave length allocations which were agreed to by every American radio interest and transmitted to the United States delegates to the Paris Technical Conference of last summer; at which latter meeting, however, the military interests dominated and a tentative international agreement was drawn up greatly at variance with the U. S. recommendations and promptly repudiated and discredited by all the civilian radio interests here when the Department of Commerce reported the results in November last. So that attempt, too, came to naught.

In recent months the radio game has progressed to a point where it simply cannot wait any longer for new regulations. The advent of broadcasting is the chief contributing factor. There are now well over a half-million receiving stations in the country, some sixty broadcasting stations, and rumor has it that there are some five hundred applications for broadcasting pending in the Department of Commerce. Obviously some discretion—some real horse-sense—must be used in issuing licenses of this type or conditions in the air will be entirely chaotic. Recently everyone has been talking about the efforts of the big corporations practically to control the air

for themselves, with the American Telephone & Telegraph Co., we understand, making an outright request for a monopoly on broadcasting! President Harding and most of his cabinet members have receiving sets now, and so have many congressmen and senators, and they are aware of these conditions. What was to be done about the situation? It was apparent that the law would have to be strengthened to give the Department of Commerce wide discretionary powers, with the authority to issue, amend or revoke regulations and licenses according to the trend of the art, endeavoring at all times to regulate radio so as to be of the greatest good to the greatest number of our people. And it was apparent that everybody could not be wholly satisfied simply because there aren't enough wave lengths, and that consideration would have to be given the importance of the different classes of stations and a study made of the possibilities offered by the available wave lengths. For this purpose the Secretary of Commerce was instructed to call a conference of radio experts to make a study of the situation and recommend principles to him for the governing of all of radio for the greatest good to the greatest number, keeping in mind the importance of the various services. He appointed to his committee Mr. H. P. Maxim, president of our American Radio Relay League; Dr. S. W. Stratton, director of the Bureau of Standards; Senator Frank B. Kellogg of Minnesota; Representative W. H. White, Jr., of Maine; Dr. A. N. Goldsmith, secretary of the Institute of Radio Engineers; Prof. L. A. Hazeltine, of Stevens Institute of Technology, Hoboken; Prof. C. M. Jansky, Jr., of the University of Minnesota; Mr. R. B. Howell, of Omaha, Neb.; Mr. E. H. Armstrong, of Columbia University; and one representative each from the War Department, Navy, Post Office, and Agriculture, who were, respectively, Major General Geo. O. Squier, Capt. S. W. Bryant, Mr. J. C. Edgerton, and Mr. W. A. Wheeler.

When this commission met in Washington on February 28th it was the most important radio body which had ever sat. We have every reason to hope that at last, after years of vain struggling, the radio situation is to be improved.

The first two days of the conference were given over to public hearings, at which representatives from all of the radio interests were present and given an opportunity to be heard. Then the Commission went into executive session, to formulate a plan by which the Secretary of Commerce can wisely administer radio regulation to the whole country, and to formulate a draft either of a new law or of an amendment to the 1912 law. Three committees were appointed, known as the Legal, the Technical and the Amateur Com-

mittee. Of the last-named, Mr. Maxim was chairman, with Mr. Armstrong and Professors Jansky and Hazeltine as members.

#### The Corporations Testify

The hearings were funny. First to be heard were representatives from the five big corporations whose association has caused the buzz of comment on the monopolistic conditions in the art. There was Mr. A. H. Griswold, vice-president of the A. T. & T. Co.; Mr. E. P. Edwards, of the General Electric; Mr. John Elwell, secretary of the Radio Corporation; Mr. L. R. Krumm, representing Westinghouse; and Dr. Nichols, of the Western Electric. In turn these gentlemen explained the attitude and the relations of their respective companies, told what they would like to have in new law, and made their recommendations for the general improvement of conditions. Now it seems that there is quite a bit of feeling in the air these days to the effect that the corporations are trying to hog things; that they have in effect a monopoly; that for that reason they won't sell equipment to competitors; that they could supply equipment a whole lot faster if they really wanted to; that they ought to be hung higher than Haman for the type of receiving apparatus they are putting out. In turn the gentlemen denied these charges, but they were so busy answering questions relative to these matters and the air was so charged with feeling along this line that the hearings rather took on the aspect of a Congressional Board of Inquiry!

Mr. Griswold testified that the A. T. & T.'s only interest in broadcasting was to sell toll broadcasting service. In response to inquires he stated that his company would sell transmitting equipment for broadcasting in connection with the purchaser's own business or for public service broadcasts. He explained the patent situation by describing the agreement made between A. T. & T. and G. E. at the request and approval of the government, for the merger of patent rights, the A. T. & T. retaining all commercial applications of the radiophone, the General Electric the amateur radiophone business and all classes of radio telegraphy. Radio Corporation and Western Electric entered later as an extension—it was agreed that G. E. might extend any of its rights to the Radiocorp and that the A. T. & T. might extend any of its to W. E. Still later, Westinghouse made an agreement with General Electric and entered in, Mr. Griswold said, A. T. & T. consenting.

Mr. Edwards thought that commercial broadcasts ought to be confined to daylight, with only entertainment in the evenings. In general, he favored control of broadcasting by big corporations and the government, and rather thought jazz should have

precedence over crop and market information, suggesting that the latter, for economy's sake, should be put out by entertainment broadcasting stations. Answering inquiries, he stated that Westinghouse and General Electric manufacture equipment under licenses from Radio Corporation, which is cross-licensed in turn. Radiocorp is the only one who can buy Westinghouse and G. E. apparatus, and must sell those makes only. He volunteered the information that General Electric were themselves manufacturing receiving apparatus and would have a line of complete sets on the market very soon, which he thought were of the single-circuit type. He stated that by the latter half of March their tube production would be between fifty and sixty thousand per month; that they manufacture tubes only on order from the Radio Corporation but that they are now being made at three times their former rate.

Mr. Elwell, secretary of the Radio Corporation, made a good clean-cut statement, suggesting that stations be classed in the order of their importance as follows: government, civil departments, maritime, educational, entertainment, amateur, public service. He thought legislation should safeguard life at sea and the future of the amateur. He put his company clearly on record as favoring the recognition and encouragement of the amateur. He asked permission to file a statement for the benefit of the commission, explaining the patent situation, the relations between the companies with which his was associated; the policies in the sale of apparatus, etc. The testimony of his company on these subjects accordingly was never public property. Unfortunately Mr. Elwell could answer practically no questions, particularly along this line, and in every case stated that the answer to said questions would be contained in the statement he wished to file.

Mr. Krumm, assistant sales manager of Westinghouse and in charge of their broadcasting stations, objected to the interference that anybody's five-hundred dollar limited commercial broadcasting station could cause to Westinghouse's \$15,000-stations. He thought twelve to fifteen broadcasting stations would be enough for the country, and proposed the band from 300 to 400 meters for them.

Dr. Nichols of course is a scientist, and knew his subject technically, in marked contrast to the other gentlemen. Testifying for Western Electric, Dr. Nichols thought fifteen good broadcasting stations enough for the country, and thought they logically ought to be on shorter waves because of the greater "cyclage" there. On the other hand, he thought the more important subject was ship-to-shore radiotelephony, and as several bands were desirable for that and there was objection to it being raised to a point over 1000

meters, he thought the broadcasts could very well be raised instead.

Mr. Cooper, of the Ship Owners Radio Service, proposed subdivision of amateur services over a band from 200 to 350 meters and a similar sub-division of commercial phones, advertising broadcasts on 400 meters, general entertainment broadcasting, etc., 1500 to 1700; and commercial telephony from 900 to 1200. Hurray for Sorsinc.

Mr. Max Loewenthal, of San Francisco, representing the Pacific Radio Trade Assn., told the committee of the schedule of time divisions satisfactorily employed on the West Coast, and that they there would welcome government regulation.

#### Amateurs Are Heard

Thus ended the first day. On the second morning amateur representatives were heard. They were represented by an A.R. R.L. delegation composed of Paul F. Godley, Vice-President Chas. H. Stewart, and Secretary K. B. Warner. Again that paragon of radio amateurs, Paul Godley, rendered a valuable service to the game—he very splendidly presented the case of the amateurs: their need for a band of waves versus a fixed limiting wave length; the desirability of subdividing the band for the different classes of stations; the need for grading amateur operators into two classes, with beginners on a different wave length, etc. He pointed out the fact that most of the trouble broadcast listeners have been experiencing thru interference has been due to the wretchedly broad-tuning receivers that have been supplied them in the belief that they are incapable of mastering a modern tuner, and in particular called the attention of the Secretary to the publicity that in recent months has appeared in the press characterizing the amateur repeatedly as "the American small boy" and saying that he must be curbed because he was interfering with everything, etc. This publicity has been so consistent, so much along the same line wherever it appeared, that in the minds of many amateurs it is considered as inspired propaganda from unfriendly interests. Some of these newspaper items have attempted to put the Secretary in the position of saying that the amateurs must be curtailed, but we want to tell the world that Mr. Hoover has spoiled all that stuff for all time henceforth. Here is his reply:

*"I would like to say at once that anyone starting any such suggestion that this conference proposes or had any notion of limiting the area of amateur work was simply fabricating. There has never been any suggestion of the kind, never any discussion of the subject in any shape or form. The amateurs were asked to be represented in the conference and they are represented here today, and the starting*

*of that sort of information is one of the most treacherous things that can be done. So I wish to sit on that right at the start—that the whole sense of this conference has been to protect and encourage the amateur in every possible direction."*

Newspaper propaganda to the effect that the amateur—"the American small boy"—is an infernal nuisance and must be "curbed" has been noticeable by its absence since the Secretary's statement. Flock o' Hi's!

A.R.R.L. Secretary Warner followed Mr. Godley in the witness chair and was also heard in the interests of the amateurs. In common with the rest of the amateur delegates he particularly urged that the commercial broadcasts be placed on a band above 1000 meters, where interference from ships and the occasional conflicts with local amateurs that will be practically unavoidable as long as novice listeners use single-circuit tuners would be minimized, pointing out that the present broadcast wave of 360 meters could only be regarded as an invasion of what has always been regarded as the amateur realm—up to 375 meters. Vice-President Stewart followed, supporting the same views, recommending 325 to 425 meters for ship-to-shore telephony, and showing from a study of the current International Convention that there is nothing to prevent the United States from placing the commercial broadcasts on a higher band, say above 1000 meters.

Representing independent commercial companies were Mr. Perry E. Wiggin of the Radio Electric Co., Pittsburgh; Mr. L. F. C. Horle, of the Federal Tel. & Tel. Co., Buffalo; Mr. Thompson of the DeForest company; Mr. H. J. Breckel of the Precision Equipment Co., Cincinnati, etc. All of these men had a good word to say for the amateurs, particularly Mr. Wiggin, who of course is our A.R.R.L. City Manager for Pittsburgh and also represented the Radio Engineering Society (affiliated) of that city.

Then came representatives of various interests who were concerned with radio-telephony—The New York Public Service Corporation, the Philadelphia Police Department; the "Detroit News", the National Retail Dry Goods Assn., the U. S. Shipping Board, the Boy Scouts, the Public Health Service, etc., each presenting his side of the story. Several sharp skirmishes took place between conflicting interests, generally with the oft-referred-to corporate interests on one side of the fence. It was *good* in spots. Regardless of the truth of the statements or the possibility of proving them, almost everybody except the representatives of the several big companies seemed to feel that a monopoly of radio did exist, far beyond that contemplated by the separate patents granted them; that they were earnestly endeavoring to hog the whole

air and deliberately fostering discontent where it helped their interests; selling apparatus only where they wanted to and holding down their competitors even when they couldn't make apparatus fast enough to supply the public need in a field that must be regarded as a public utility, etc. They got raked over the coals in high fashion and spent considerable of their time on the defensive, which it was obvious they had not contemplated when they arrived at the conference. Good judgment prevailed in the Commission, however, and the big companies should be well satisfied with the provisions recommended from their uses.

#### The Commission's Recommendations

Finally the hearings were over and the Commission went into executive session. It was the Editor's good fortune to be permitted to attend the meetings as advisor to Mr. Maxim and he only wishes that it were permissible to tell the gang all the interesting talk that went on, but the deliberations of course were confidential. The big plan is that an amendment is to be proposed to the 1912 law, giving the Department of Commerce wide discretionary powers in classifying stations and assigning wave lengths, powers, operating hours, etc., for each of the various classes. The principal duty of the Commission was to outline guiding principles for the administration of radio for the greatest good to the greatest number—in other words, to recommend to the Department what it should do when it received the wider authority now universally recognized as essential to it.

First off, the Commission divided broadcasting into four classes, as follows:

Government—meaning material of national interest, to be broadcasted from government stations of about 600 mile range. Public—meaning material of general public interest (informational and educational services) such as market and crop reports, weather forecasts, health services, etc., as might be broadcasted from University stations, etc., normal range to be 250 miles.

Private—meaning the broadcasting of entertainments, news, etc., by the owners of such stations as the Westinghouse ones, etc. This is the big popular class. Normal range, 50 miles.

Toll—meaning transmissions from such stations as contemplated by A. T. & T. at present, which will be leased for the broadcasting of entertainment, news, etc., under toll. Range, 50 miles.

The recommendations of the Commission have now been made public by the Department of Commerce. They make the following proposals for the disposition of various wave lengths:

Below 150 meters—reserved.

- 150 to 275 meters—Amateurs.
- 200 to 275 meters—Technical and training schools.
- 275 to 280 meters—City and State public safety broadcasting.
- 310 meters—Restricted special amateur telegraphy.
- 310 to 435 meters—Private and toll broadcasting.
- 500 to 525 meters—Aircraft radio.
- 525 to 650 meters—Mobile radio telegraphy.
- 650 to 750 meters—Mobile radio telephony.
- 700 to 750 meters—Government and public broadcasting, 700 miles inland.
- 750 to 850 meters—Radio compass.
- 850 to 950 meters—Aircraft radio.
- 950 to 1050 meters—Radio beacons.
- 1050 to 1500 meters—Government and public broadcasting.
- 1500 to 1550 meters—Aircraft radio.
- 1550 to 1650 meters—Fixed station telephony.
- 1850 to 2050 meters—Government broadcasting.
- 2500 to 2650 meters—Mobile radio telephony.
- 2850 to 3300 meters—Fixed station telephony.
- 5000 to 6000 meters—Transoceanic telephony.

#### Amateur Provisions

The following recommendations of the Commission relate directly to the amateur proposition and are of the highest interest to us amateurs:

"That the status of the amateur be established by law.

"That the limits of the wave length band allocated to the amateur be specified in the law.

"That the wave length band allocated to the amateur be from 150 to 275 meters.

"That the Secretary of Commerce subdivide the amateur allocation into smaller wave length bands for the various classes of amateur transmitting apparatus, at his discretion but in the following order of wave lengths, starting at the shortest wave: spark, interrupted or modulated continuous wave telegraphy, telephony, continuous wave telegraphy.

"That for the purposes of self-policing among the amateurs, amateur Deputy Radio Inspectors be created, elected from their number by the amateurs of each locality, every licensed amateur having the right to vote; that upon receipt of notice of such election the Radio Inspector in charge of the district in which such amateurs are located shall appoint the person chosen a Deputy Radio Inspector, serving without compensation or for the sum of one dollar per year if compensation is legally required; that the duty of such Amateur Deputy Inspector shall be to en-

deavor to the best of his ability to accomplish, under the direction of the District Radio Inspector, the observance by amateurs of the Radio Communication Laws and Regulations of the United States and the observance of such local co-operative measures as are agreed to in each community for the minimization of interference between the various groups of the public interested in radio; that such Amateur Deputy Radio Inspectors be clothed with whatever authority may be necessary in the opinion of the District Radio Inspector."

The Commission urged that the present regulations governing experimental stations remain in effect, and regarding amateur broadcasting it was recommended that amateurs be permitted to carry on broadcasting within the wave length band assigned by the Secretary of Commerce to amateur radiotelephony. Plainfield, (N. J.) papers please copy!

The special restricted amateur wave of 310 meters is for use by a limited number of inland stations and only where it is necessary to bridge large, sparsely-populated areas or to overcome natural barriers.

There was considerable talk at the hearings about the abolition of the amateur spark. While QST has consistently boosted C.W. in the knowledge that it was the real stuff, it subscribes heartily to the sentiment expressed by all the amateur representatives at the hearings, which views were shared by many others; namely, that the prices on C.W. apparatus, particularly tubes, are entirely too high at this time to justify any such thing as a law forbidding spark, which would require that every station owner purchase tubes and other apparatus from the one combination of companies controlling all the patents, especially when the patent-holders cannot supply the demand nor do they license other companies to manufacture these products. Everyone seemed willing to admit, however, that when good C.W. apparatus and tubes became widely available at decent prices, the amateurs would be willing to forsake the spark upon reasonable notice. Thus we find the Commission recommending "that the Secretary of Commerce at his discretion prohibit at any time the use of existing radio transmitting apparatus and methods which result in unnecessary interference, provided that such action should not be taken unless more satisfactory apparatus and methods are commercially available at reasonable prices and until an adequate time interval is allowed for the substitution of the more satisfactory apparatus."

The Commission likewise gave much attention to the radiating proclivities of autodyne receivers, particularly of the single-circuit type where the oscillating antenna

current may be quite appreciable, and adopted a recommendation very similar to the above paragraph respecting spark and arc apparatus only this time applied to the use of existing radio receivers which cause the radiation of energy.

#### Broadcasts Not Raised

The Commission was unable to see the practicability of putting the last two classes of broadcasts on a higher wave, say above 1000 meters, as seems so very desirable; not out of consideration for the short-wave receiving apparatus now in existence but from a purely technical con-

sideration. A radio telephone requires a band of cycles, as everyone knows. Possibly 10,000 cycles is a fair estimate of what is required for a decent phone. This puts it strictly on a basis of "cyclage", and the more the cycles the more phones that can be operated in a given band of wave lengths. Thus there is room for less than a dozen phone waves in the whole band from 1050 to 1500 meters, whereas something over two dozen can be accommodated in the much smaller wave-length band from 310 to 435 meters. Up to this writing, then, we have failed in our desire to get the broadcasting raised to a higher wave, and it seems likely that we will continue to have it as a next-door neighbor. This means that we amateurs have an educational job on our hands, and it is going to be up to us to convince our listening-in neighbors that there are lots of other sources of interference than our transmission.

The Commission has recommended that the status of the amateur be specified in the law, that is, that he be named as one of the classes of stations which shall always be established by the administration, and that the amateur wave length allocation, 150 to 275 meters, be specified in the law. This we regard as essential—for a thousand reasons. We have to thank our present guarantee in the 1912 law for our present existence—several times we would have gone up the flue if it hadn't been impossible to abolish us without changing the law, which is always a hard matter. With waves reserved below us, and the broadcasts clamoring above us, big combinations lobbying at Washington for more

cycles and our existence based purely on temporary classification of the Department of Commerce, subject to fluctuation by official proclamation, we'd be in a sweet pickle. The fact that the biggest broadcasting field is to continue right above our heads where some conflicts with the novice public are unavoidable, with their consequent unpleasantness and embarrassment and complaints to the government, etc., is the big reason why we amateurs must all insist that we get our guarantee of continued existence written right into the law as it is at present. The present Secretary of Commerce and our good Chief Radio

Inspector, Mr. Terrell, are splendid friends of the amateurs, but some day somebody else may be in their respective offices and the amateur future might be worth about two cents. Altho contrary to the plan of the proposed amendment which would leave the specification of classes and wave lengths subject to change at the discretion of the Department, we feel that an exception can be made with propriety in the case of the amateur because his wave

length band is at one end of the spectrum and his province can be defined and all other frequencies left subject to change without disturbing the operation of the scheme. This has an added advantage in stabilizing the use of the frequencies near us, for what company would want to put their millions into equipment that might be made junk of by sudden shift in the amateur wave?

*We must have our status written into the new law. Remember that, A.R.R.L. men, whenever you see a copy of a new radio bill, and be governed accordingly*

The proposed allocation of 150 to 275 meters to us amateurs, sub-divided among our various classes of transmitters, will make a wonderful improvement in our operating conditions, where we already have some 15,000 transmitting stations; and with government approval of our A.R.R.L. scheme for self-policing, we can look forward to sunny prospects in the amateur world.

### President-Governors' Relay Succeeds

**I**N spite of terrific atmospheric conditions over almost the entire country on the first two nights of the tests and widespread unfavorable conditions on the last night, the President-Governors' Relay was a success and a total of forty out of forty-eight messages were delivered to the White House.

A couple of the messages seem to have been unable to get out of their home state, and a few of the Democratic governors couldn't see the joke and declined to furnish a message to the Big Chief.

A complete story of the Relay, with texts of the various messages and dope on who handled them, will appear in the next QST.

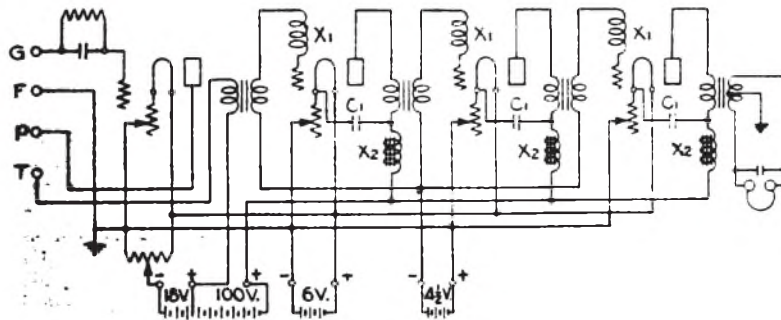
## *Improvements In Multi-stage Audio Amplifiers\**

*By H. E. Bussey, 4A1*

**I**T is not the purpose of this paper to claim any discoveries, or to take to the author any credit for the results secured by the application of the measures which will be described—probably some of them are known to you. I am indebted to various Engineers in the Research and Radio Departments of the General Electric Company for the suggestions which have vastly improved the operation of the audio amplifier in my case.

Local noises and lack of expected amplification per stage have not, prior to the advent of so much telephone reception, been as objectionable as it is at present. If we may improve the amplifier so that the same results can be accomplished with fewer stages, then we have gained a decided advantage in both economy and ease of operation.

In order to prevent interaction between stages, it is proposed that thorough shielding be used for both magnetic and static effects, and to completely enclose each stage as well as the detector on all sides, top and bottom, with a 1-16 inch sheet steel shield. An amplifier was built unshielded with provision so that shields could be applied to see what, if any, difference could be noted. Without the shields in place, two stages could be operated, but with far less amplification than should be expected. Three stages were not possible due to howl and other noises. Shields as described were put in place, the inter stage wiring being carried through slots in the inter stage shields, and the improvement was remarkable. The shields and transformer cores were connected to the positive end of the B battery. The shielding was certainly a step



The ideal amplifier is one which in each stage takes the signal from the preceding detector or stage, and without reacting in any way on the preceding stage, repeats what is delivered to it and amplifies it as much as possible without distortion before delivering the signal to the next stage. Troubles are experienced in attempting to do this from electromagnetic and electrostatic reaction of one stage on another, if measures are not taken to prevent it. Added to the reaction between stages local oscillations may start within a stage and tend to upset the amplification constants of the tube. These oscillations may apparently be of very high frequency, and if so, may not be audible, or may be of the audible frequencies and result in the well known howl so familiar to all of us.

in the right direction, but all interaction was not eliminated even by this means, as a certain amount of coupling back still existed through the common plate battery. In order to overcome this an iron core choke,  $X_2$ , was inserted in the plate lead of each stage and a 1 mfd. condenser,  $C_1$ , inserted as shown in the diagram. The improvement at this point was very great—three stages working much quieter than two had before and signal audibility per stage very nearly doubled. The quality of telephone speech also seemed much clearer. The iron core chokes consist of the 110 volt winding of a standard bell ringing transformer. This choke as well as the condenser is installed inside the shielded case of the stage to which it belongs.

The complete shielding of the transformers alone was tried first, but that did not seem to effect noticeable improvement. The

\*Read before Third and Fourth District Convention, February 17, 1922.

filament rheostats, tube sockets, wiring, etc., all seem to be a source of troublesome coupling back.

A further refinement has been added to lessen the possibilities of the tubes oscillating at very high frequencies as previously mentioned, in the form of radio frequency chokes, X<sub>1</sub>, consisting of 25 turns of No. 30 D C C wire wound in a single layer on a wooden form 1 in. in diameter. These are inserted on the tube socket and connected in the grid lead of each tube.

In audio amplifiers of several stages the miscellaneous popping and grinding noises sometimes present are from a variety of causes, but the majority of them are eliminated by the foregoing measures. Some of the more common ones not eliminated are bad contacts at any point. All joints in wiring should be soldered securely. Dry cells run down are unsuited for use in plate circuits. Several good dry batteries are now on the market designed for a minimum of such disturbances. Poor contacts in fila-

ment circuits, such as poorly designed rheostats and storage cells in bad condition, also cause noises. Much has been said of the necessity of good B batteries, but of equal importance are the filament battery and filament connections, as some of the most objectionable noises come from this source.

Loose contacts in tubes and tube sockets, and poorly made grid leaks should also come in for inspection and elimination.

For those who wish still further refinement, the use of an output transformer is recommended. This transformer permits the use of any ratio of tube impedance to phone impedance desired, by change in transformer design and permits the use of more rugged low resistance phones than when used directly in the plate output circuit. An added advantage is that the center point of the transformer secondary may be grounded and minimize the objectionable coupling back from the operator wearing phones, to the tuning element.

## ***“And It Came To Pass”***

### ***The Episode of the Much-Married Ham and the Radio Widow***

*By S. P. W.*

**A**ND it came to pass that a certain dial-twirler reached the age when shaving becometh a nuisance and not a novelty, and the latest dance step arouseth more interest than Einstein's theory of relativity, and as is the habit with young men, he falleth in love. And lo, as time passeth, he confuseth osculations with oscillations, and spooning with tuning, and his spark no more roareth thru the ether, or whatever the latest theory contendeth that sparks roar thru. Yea, he disappeareth from the list of “Calls Heard,” and his friends wonder.

In the fullness of time he asketh HER the fatal question, and she accepteth him. The final Hook-up is consummated, even as it is ordained, and the couple go forth on their honeymoon and they shed rice and smiles as they go, for such is the custom.

But on the nineteenth day thereafter, they return to the home town, and take up their residence in Bungalow Row. And lo, no sooner do they return that he erecteth a pole in the back-yard, and fixeth a staff to the ridge-pole. And in the course of time an aerial swingeth; lo, it is complete even unto a lead-in and ground.

And his wife asketh him wherefor, saying “Why stringest thou those wires?”

“Why clutterest thou up the attic with junk?”

“Why poundest thou so on divers con-

traptions, whereof I know not the name?”

“Why bringest thou thy friends to track thru my perfectly clean house?”

“Why——” But list to thine own wife when thou takest one unto thyself, for each inquireth the same.

He trieth valiantly to explain the mysteries of radio; he persuadeth her to enter into the operating room. But she crieth out when the spark crasheth in the gap; she claimeth that the cans hurt her ears, that the head-band pulleth her hair, and other heresies. She complaineth that the buzzing of the sparks giveth her headache; she seeth no good in radio, and departeth downstairs. And it was so for years, even to the number of the fingers on one hand.

The war cometh and goeth, and the aerial and set goeth and cometh back, as was ordained in Washington. And with the return of the set cometh strife. Our hero's wife setteth down her foot; she saith all manner of harsh things against radio. She beggeth and pleadeth, she threateneth to return to the domicile of her maternal parent; she doeth all manner of things to prevent the return of radio in her household.

She saieth unto him, “My lord, I wish not to be even as the wives of the golf bugs, and to be called a ‘radio widow,’ for ‘radio taketh up thy evenings, and maketh



thee to neglect thy wife. Thou speakest of regenerators in thy sleep, yea, thou mutterest and groanest and cursest QRM. Thou comest to bed in the small hours, and wakest me to rave of DX. Of my past experience do I know that thou makest of radio a nuisance and an abomination; surely this thing shall not be!"

Yet the aerial did blossom forth again, and the old set cometh to light. And in the course of time, a new set assembleth itself, and five-watt tubes glow where the spark was wont to crash, for wherefore can a set be modern, and yet use a spark? His wife sulketh and gnasheth her teeth, and extracteth much largess in the form of flowers, sweets and knick-knacks ere she cheereth up.

But the set endureth; it was, and is, and always shall be, for when the bug biteth, he biteth deep; the virus pulseth to the far parts of the body and sinketh in; even matrimony faileth to eliminate it.

Time passeth, even as it is wont to do, and lo, it worketh wonders; a miracle is wrought in the household of our friends. For Ye Editor insisteth upon a happy ending, and how can anything be happy when thy wife hateth thy hobby, and stirreth up strife accordingly? Yea, a miracle is needed, and behold, it is chronicled in this wise.



The time cometh when the phones fill the air with sweet noises (provided only that their modulation be good!) and our hero thinketh unto himself "My storm and strife loveth music, else why runneth she me in debt for a Victrola, and why carteth she home numerous records therefor?"

And he reasoneth further "An it be she loveth music, why loveth she not radio? For it has come to pass, even as the singer of old hath predicted, that 'our nights shall be filled with music, and the cares that infest the day shall collapse like a trick loose-coupler, and silently fade (we'll say they "fade"—ED.) away,' or words to that effect." And he pondereth much on the matter, till he decideth upon a plan.

The next night he bringeth home the

Magnavox that belongeth to the Club, and he borroweth two extra stages of amplification. He departeth immediately from the dinner table, and ascendeth to the radio shack. He hooketh up his instruments cunningly, he lighteth his tubes even unto the fourth step. He testeth exceedingly, and looketh frequently upon his watch until it be the time for KDKA to start.

Then he switcheth in the Magnavox and openeth all the doors. He tuneth for the carrier wave, and findeth it. The shriek soundeth throughout the house, being amplified exceedingly, and he heareth with falling heart the reproaches of his wife. At last soundeth the voice of the operator, as he announceth a selection by an orchestra of much note, (wherein no pun is intended) and our hero chuckleth unto himself, and brighteneth up his tubes.

And lo, in a second the sweet sounds of the orchestra burst forth most powerfully, and the lilting strains fill the house. It is good radio weather, and the static QR Neth not. Our hero sinketh back in his decrepit armchair, and thinketh good thots of everything and everybody saving three "5" stations that QRM on 360 meters.

And it came to pass, even as he had planned, that his wife rusheth to the radio room, and registereth joy and amazement. She listeneth with rapture to the smooth voice of KDKA announcing a tenor solo, and closeth her eyes dreamily at the love song she heareth.

And then she bombardeth her husband with questions, saying, "Why hast thou not told me of this wonder? How cometh it that we hear sweet sounds, when we used to hear only trick buzzes? Whence cometh this music?" and divers other things.

He answereth her with dignity, saying "In the past hast thou spoken all manner of evil things falsely against radio, so I gathered that thou wouldst not be interested!" And he assumeth an expression of wounded pride, and registereth indifference.

But she, being wise in the ways of men, as are all women, saith unto him sweetly, "How marvelous of thee, my lord, to operate these instruments! How wise art thou to master all this junk! My man art thou, and truly, I am proud of thee!"

And he acteth, even as would thou and I, like unto the small boy praised in front of the class by the teacher, and he saith, "Aw, it is a simple matter! Thou tunest with this dial, and regeneratest with this" and he suiteth the action to the word, and showeth her much. He explaineth all things unto her, and teacheth her to operate proficiently. Her sensitive woman's fingers learn easily the accurate adjustments, she comprehendeth the functions of the rheostats and learneth even to forget not to throw the lightning switch.

And it came to pass that night that the

Radiofonus Fanerii, a bug of the genus Radio, did bite the wife of our hero, and she exhibiteth the usual symptoms. She studieth catalogs and catalogs and diggeth into old radio magazines. She maketh salad



dressing with transformer oil, and baketh pieces of wire and calleth it macaroni au Marconi. She cutteth doughnuts on a spiral and frieth them into O.T.'s. She substituteth a call book for the cook book, and taketh out a membership in the A.R.R.L. She joineth the Radio Club and delighteth in the title of "OW." She learneth the Code, and becometh a regular ham; her

husband exulteth exceedingly, and saith unto himself "This is my work!" and he is much puffed up.

\* \* \* \* \*

For his birthday she giveth him two steps of amplification and for Christmas a Magnavox of his own, and evenings she sitteth on the arm of his chair and whistleth "D-o-y-o-u l-o-v-e m-e?" and he whistleth back; "dit-dit-dah, dah-dit dah-dah-dah, dit-dit dah!" and rejoiceth exceedingly. Which maketh the happy ending that Ye Editor hath insisted upon.

(As a matter of fact, our hero's wife told him just the other day that he shouldn't spend another cent for that darn-fool radio set till she got a new coat and a new hat that Lord knows she's needed for a year, and that she couldn't see why on earth a grown-up man wanted to monkey around with that sort of thing, and why didn't he—but there! You married hams will get me, and the single ones will never understand till they go thru it, so why continue with the harrowing details? You've had your happy ending, anyway!)

## Improving Antenna Efficiency

By M. B. West

Every time Mr. West writes an article he "starts something". Probably this is some more of the same. It is especially commended to the power-factor sharks of last season's discussion. This paper has been prepared with care and its arguments regarding power-factor are supported by Prof. J. H. Morecroft in his latest text-book. Personally we do not subscribe to all of it and it is unpleasant to have all of one's radiation theories completely upset, but the subject-matter below and the manner of its handling will start every one of us to thinking—and that means progress. With knowledge of what we are doing, then, and wishing it understood that we haven't decided whether to believe this or not, we prayerfully present Mr. West's latest.—Editor.

THE "riot," which was with so much difficulty just barely averted by the timely and vigorous use of the gavel by Chairman Mathews when the subject of "power factor" was brought up at the technical meeting at the Chicago Convention, demonstrated one thing to me very clearly. That was the seeming fact that no one really understood exactly what happened in a simple oscillation circuit, or, if any one really understood, no one seemed able to tell. And, if there was so much difference of opinion concerning the action of the one fundamental circuit on which all radio work is based, it must of necessity follow that much of our work was, relatively speaking, "in the dark," and the question was of more importance than really appeared at the time.

While it is not the purpose of this article to re-open the discussion on power factor, the question of what really happens in an oscillatory circuit is of such importance that an explanation will, of necessity, refer to the subject.

Fortunately, "Principles of Radio Com-

munication," 1921, by J. H. Morecroft, devotes considerable space to the subject, and, insofar as I am able, I will follow the explanation given by him without the mathematical formulae. We will first consider a simple oscillatory circuit, Fig. 1, which may be considered as the closed circuit of a spark transmitter, the gap being replaced by a switch. Assume that the condenser is charged to a given potential, which is shown as point (a) in Fig. 2. If the switch (S) is now closed, current will immediately begin to flow through the inductance (L) and resistance (R), and will be represented by the solid line in Fig. 2. While flowing, the current will build up a magnetic field in the inductance (L). Quoting Morecroft, "The maximum current occurs one quarter of a cycle after closing the switch, nearly." The effect of the resistance is to make the current greatest shortly before the quarter cycle is reached. "Now this could have been predicted from the consideration of energy in the circuit: before the switch is closed all the energy is in the condenser." "One quarter cycle after

closing the switch the voltage across the condenser is zero so all the energy must be in the coil." The current flowing through the coil has set up a magnetic field around the conductors and as this field collapses it generates an electromotive force in such direction as to maintain the current flow,

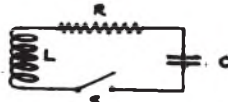


FIG 1

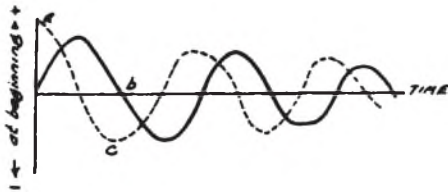


FIG. 2



FIG 3

and current continues, this time charging the condenser in the reverse direction until we have at one half cycle zero current again and again a potential across the condenser. In other words, the energy is back in the condenser again, with the difference that the plates that were charged positively at first are now charged negatively, and vice versa, and that some of the energy has been lost in heating the resistance. Thus we have the energy oscillating "back and forth between the coil and condenser and being wasted during the transfer." And, assuming a decrement of 0.3, this gives a "power

factor of  $\frac{.3}{\pi} = .0955$ : the phase difference" of the current and potential "is therefore 84.5°."

We are told, however, that at resonance "the capacity reactance and inductance reactance are equal and opposite" and that the current "is limited only by the resistance." This is true and can be best explained by reference to Fig. 3. Here we have a simple oscillatory circuit, as in Fig. 1, with the switch closed, but with the inductance loosely coupled to a source of alternating current of the same frequency as that to which circuit (A) is tuned or is resonant. In this case the current in circuit (A) will be in phase with the potential or voltage in circuit (B). Insofar

as circuit (B) is concerned, circuit (A) has no reactance, and the power factor of circuit (B) is not affected by it. Insofar as the relation between the potential in (B) and the current in (A) is concerned, the power factor is unity. But the potential in (A), provided the resistance is negligible, is 90° out of phase with the current in (A), and the power factor is near zero. Remembering the telegram from the Bureau of Standards—"the current is in phase with the IMPRESSED potential"; in case of Fig. 1, the impressed potential has ceased to exist when oscillations occur, and in the case of an arc transmitter, the impressed potential is a direct current, so cannot have a phase relation. However, the principle is still true, for, in a free oscillating circuit, the current is in phase with the impressed potential, or would be if there was an impressed potential. However, when we consider the current in Fig. 1 in its relation to the potential in that circuit, its power factor can never become unity unless the resistance is of such value as to dissipate the power during the first quarter cycle, in which case the power factor would be unity and no oscillations at all would occur. On the other hand, the voltage in circuit (A), Fig. 3, bears only a very indirect relation to that in circuit (B). The voltage in (A) is the counter-electromotive force generated by the inductance in its own circuit. This, in turn, depends on the current in (A), [the current in (A)] is limited only by the resistance in (A) and the rapidity with which the current changes in intensity. It follows logically that if we decrease the resistance in (A), we will increase not only the current but also the potential. As we can never do away entirely with the resistance in (A), it follows also that if we use a small value of inductance and a large value of capacity, we will have low voltage and heavy current, and that with a small capacity and large inductance we will have a small current and high voltage. But, regardless of the relative values of inductance and capacity, if we reduce the resistance, we increase the current and potential proportionately, and if we were able to reduce the resistance to zero, we would have both unlimited current and infinite voltage, no matter how small the initial power applied.

As understood, insofar as radio communication is concerned, power is radiated usefully from an antenna in two ways: by electrostatic lines of force, which may be considered a function of the volts or potential, and by electromagnetic lines of force, which may be considered as a function of the current. As both current and potential are increased by decreasing the resistance, it follows that a study of re-

sistance would be important.

In radio work, when we speak of resistance, we mean, usually, everything which consumes power in the circuit, and Morecroft defines effective resistance thus: "The effective resistance of a circuit is equal to the amount of power." (watts) "consumed by the circuit divided by the square of the current required to supply this power." Power is expended in an antenna in several ways, and, in practice, the measurement of power loss is usually made by inserting in the antenna circuit a resistance sufficient to cut the current flowing to half its original value.\* When this is done, the resistance inserted is equal to a resistance that would dissipate the same power as the antenna does, and consequently these power losses are all classed together as the "effective resistance" of the antenna. And, as we have seen, anything that is done to reduce the effective resistance of the antenna will increase both current and potential, so it follows that decreasing the effective resistance will increase the proportion of power that is usefully radiated.

It fortunately happens that the measurement of effective resistance is one of the simplest measurements in radio work. The reader is referred to Bucher's "Experimenter Manual," "Bureau of Standards Circular No. 74," and other textbooks on the subject. In these days of C.W., almost any serious-minded experimenter has, or can get with small expense, all the apparatus necessary; and actual measurements of resistance, even if the methods used are not so precisely accurate, will upset a lot of ideas many of us have as to just what is best in antennae, as well as other pieces of radio apparatus.

In order to point out some possible practical uses of the data secured by antenna resistance measurement, we will consider some of the problems that many of us have met at one time or another. For instance, we have often been told that there is one best wave at which an antenna should be operated to secure best results. This has often been considered as having a definite relation to wave length, and has often been stated as at a point about twice the fundamental of the antenna. This is often far from correct, as this point is always the wave length at which the antenna has the lowest effective resistance. Actual measurement of the effective resistance of a number of antennae shows conclusively that no two have the same characteristics. An antenna has a different effective resistance for every wave length to which it may be tuned, and it is well to take a series of measurements over quite a broad band

\*This value varies with the nature of the excitation current.—Editor.

of waves in order to get as much data as possible from which to draw conclusions as to what changes would be advisable. Fig. 4 approximates the curve obtained by measurement in the case of one antenna. It was desired to operate this antenna over a band of wave lengths. In attempting to tune it, it was found impossible to secure anything resembling a satisfactory condition of resonance at 425 meters, although the fundamental was 350 meters; at 600 and 700 meters the radiation and decrement were good; and at 900 meters, the decrement was again bad. Signals were excellent on 600 meters and 700 meters, but broad, faint and unsatisfactory on the other waves. Examination of the resistance curve indicated the presence of conductors in the

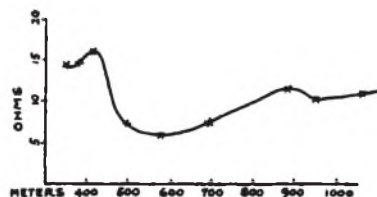


FIG. 4

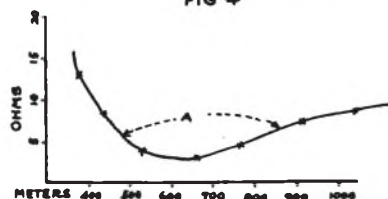


FIG. 5

neighborhood that were at resonance with the antenna at near 400 meters and 900 meters. Thorough grounding of a nearby metal roof completely removed the "hump" at 400 meters, and when the transmitter was tuned to 900 meters, and the key held down while search was made in the neighborhood with a wave meter, it was found that the system of gas piping in the building was carrying heavy current at that wave length. Bonding the gas pipes to other pipes at frequent intervals almost completely removed the "hump" also, and the result was a curve very nearly like that in Fig. 5. Upon retuning, the antenna operated very satisfactorily on all wave lengths between 425 and 900, with no one markedly better than the others, and with decrement and antenna current in direct proportion to the resistance at the various waves to which the transmitter was tuned.

Another antenna measured gave a curve as in Fig. 6. As it was desired to operate this antenna as far as transmitting was concerned on 200 meters only, it was obvious that if it was shortened slightly, this would bring the point of lowest resistance to 200 meters. When this was

done antenna current was increased from  $4\frac{1}{2}$  to 6 amperes, and the sharpness of the wave and signal strength were both increased proportionately. Other uses of these measurements will suggest themselves to those who take the trouble to make and use them. It should be comparatively easy to reduce the resistance of an amateur antenna to something like .5 ohm, which would mean an antenna current of something like  $4\frac{1}{2}$  amperes from a ten-watt transmitter.

If we admit that the voltage of the antenna bears no relation to the applied voltage, but is the counter-electromotive force set up by the current flowing through the inductance of the antenna system, then it is evident that, as the greatest current will flow at the wave length at which effective resistance is lowest, the combined values of current and potential will be greatest at that wave length also. As the antenna radiates energy in the form of electrostatic waves and magnetic waves, which may be considered as functions of potential and current respectively, it follows that the greatest proportion of the total energy applied will be actually radiated at that wave length at which the antenna has the lowest resistance. As the electromotive force generated by the inductance depends not on the amount of current flowing through it, but upon the rapidity with which the current changes in intensity, it follows that, for a given current, if we increase the frequency (or decrease the wave length) we will increase the potential of the antenna, and so may increase the proportion of power radiated, provided both current and inductance remain the same. If, to reduce the wave length, we remove inductance only, we will have the same current at higher frequency flowing through less inductance, and the increase will be relatively small if any. In fact, if to reduce the wave length it is necessary to remove any great proportion of the inductance, the voltage may actually be lower at the shorter wave. On the other hand, if we lower the frequency (lengthen the wave), we usually add inductance only, and the additional inductance added to lower the frequency really increases the potential of the antenna system. Thus, the values of potential actually secured are not proportional to the changes of frequency through a given inductance (which would result in higher potential for higher frequencies) but often the reverse, as they are the result of the counter-electromotive force generated by the amount of inductance used to secure the wave length desired. When we decrease the wave length, we immediately begin to "climb up" to a point of higher resistance on our resistance curve and cannot maintain the same current as at the longer wave.

Both current and voltage fall off, and we do not radiate nearly so large a proportion of the energy we apply to the antenna. Consequently, there seems to be something wrong with the "dope" we have had for so long concerning radiation resistance. If we concede that the power actually radiated depends on both current and potential, then, knowing that these values are both greatest at lowest effective resistance, that portion of the resistance curve close to the fundamental cannot be considered as radiation resistance except inasmuch as the higher frequency at the shorter wave length increases the potential. In fact, actual results as to signal strength bear out such assumption, and attempts to operate C.W. transmitters close to the funda-

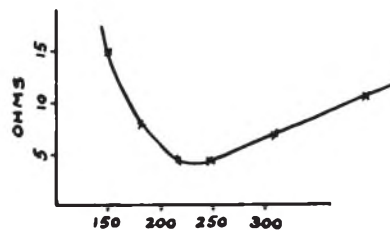


FIG. 6

mental wave length in order to take advantage of the supposed higher "radiation resistance" have proven that "it can't be did." It is often better to cut off part of the length of the antenna in order to reduce the capacity, so as to be able to operate the antenna at its point of lowest resistance. This does not necessitate removal of inductance and consequent lowering of potential, and, in several cases, has resulted in marked increase in signal strength, even when the height of the antenna was lowered materially.

As the effectiveness of an antenna in actually transmitting signals to distant points depends not only on the power actually radiated, but on its effective height also, the amateur is confronted by a "pretty problem" indeed. In consequence, so as not to decrease that precious "effective height," he puts in enormous ground systems, uses very large conductors, puts up many wires, and goes to all sorts of extremes in order to better conditions. And much of this effort is wasted, because we have never had any definite rule to judge as to the effectiveness of these various measures. Actual measurement of resistance gives us that "rule." For experiment recently I put up a two-wire antenna of the same length as a six-wire one, and very much to my surprise found that the two wires had less resistance than the six. And the two wires actually gave greater antenna current than the six. However, when

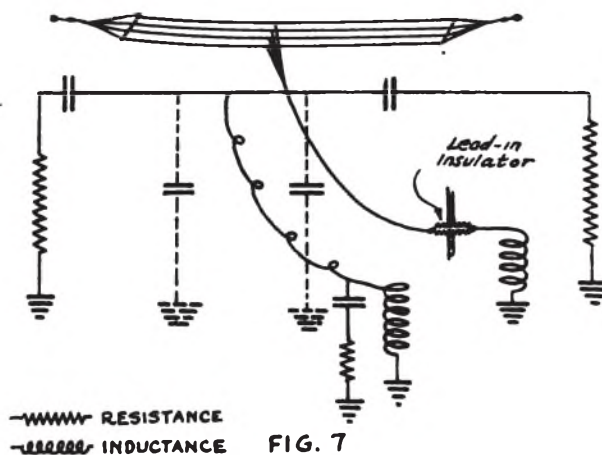
the two wires forming the lead-in were twisted together, the resistance actually increased from 6 ohms to 14 ohms, with correspondingly lower antenna current and signal strength. This was surprising, as I supposed that twisting them together would result in lower capacity only. After measuring a few antennae, I came to the conclusion that a good many of the opinions that I had formed concerning the effectiveness of various methods were entirely wrong. This especially, because the conditions disclosed by measuring the resistance were in exact accord with what the station was actually doing in the way of signal strength at distant stations. One station in particular has been a "Jonah." We have built antenna after antenna, tuned and retuned, piled on the power till something "blew up," secured antenna currents varying from 6 to 40 amperes, but with the result each time that when we had the greatest antenna current we had the weakest signal. Measurement of resistance at last disclosed the difficulty. The resistance curve showed several "humps" at critical points, was high over the entire range of waves, and the remedy was obvious. The ground system, while extensive, consisted of three long copper strips, buried deeply, and was totally inadequate for the station.

When one begins to lower the effective resistance of an antenna some surprising conditions are disclosed. Antenna current goes up, of course. Insulators begin to "let go" that have been perfectly satisfactory for a long time. The antenna begins to brush, and with C.W. especially, things get hot in the most unexpected places. Losses are disclosed that were not at all evident before.

Fig. 7 shows an antenna and the equivalent diagram of the effect of its various parts. It will be noted that the insulators have been shown as condensers shunted by resistances, including the entering insulator; and that is really what they are. Unfortunately, many of the insulators furnished for radio work are not only made of material that has high dielectric losses, but they are so constructed as to have considerable capacity in themselves. It is evident that current will flow through their capacities in the direct proportion that the sum of these capacities bears to the capacity of the antenna as a whole. One antenna that I measured showed such a surprising value of capacity that the insulators were removed and measured separately, and it was found that the capacity

of the insulators represented one-third of the entire capacity of the antenna. That means that one-third of the power that actually got into the antenna passed through the insulators, and, consequently, could do very little toward making signals at the distant station. If the resistance of the path through these insulators were high, due to various losses in circuit, then these losses would be included in the measurement of effective resistance. But, should the insulators be made of good material, free from dielectric loss, and connected in such a manner that the circuit through them had low resistance otherwise, the measurement would disclose low resistance, and yet a considerable portion of the power applied would pass through them and do no useful work. In one case it was found that the current flowing in the antenna lead was 2 amperes less outside the entering insulator than it was when measured inside. Yet, when a new entering insulator was provided and this loss corrected, the antenna resistance remained practically the same.

When we sum it all up, it is evident that most of the methods used by amateurs to improve their stations were based on sound principles, and for that reason were effective. Many of them were not nearly so important as supposed, and it is entirely probable that many things that can readily



be done to improve the effectiveness of our stations have been overlooked entirely.

Consideration of the problem from this standpoint seems to me to indicate that the antenna system is probably the least efficient part of the equipment that goes to make up a radio station, and it is certain that it can be very greatly improved indeed. In fact, an antenna has been experimentally erected, of size suitable for amateur use, which has a resistance of less than .2 ohm; this would mean, with a 1000

watt transmitter, 33% efficient, an antenna current of about 40 amperes, and that would certainly win in any Trans-Atlantic test.

As to receiving conditions, results are in all cases as advantageous. Here we have the impressed potential applied to the antenna as a whole, rather than to a portion of the inductance. Again, the current in the antenna is limited only by its resistance, and the potential is that generated by this current passing through the inductance. Therefore the amount of energy that will accumulate in a receiving antenna, all other conditions remaining the same, is in direct proportion to its effective resistance.

Suppose we have an antenna of 12 ohms resistance and that when the receiver is coupled to it, the added effective resistance

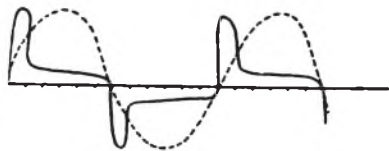


FIG 8

of the receiving set is equivalent to 2 ohms. In such a case, 6/7 of the power received is consumed in losses in the antenna itself, and only 1/7 in producing the signal. However, should the antenna resistance be reduced to 1 ohm, the effective resistance of the receiver remaining the same, only 1/3 the power received will be expended in the antenna and 2/3 will be available for producing the signal. In practice, this 2/3 is not required for signals of appreciable strength, and the effective resistance added to the resistance of the antenna by the secondary of the receiver as ordinarily coupled and used is considerably less than the estimated two ohms, but the principle is as illustrated above. And with the low resistance, the antenna presents higher impedance to frequencies other than those to which it is tuned, and so tunes more sharply and is much superior in regard to selectivity. These results and the conclusions drawn are in exact accord with results obtained at stations at which such changes have been made. Of course this explanation takes no account of the "negative resistance" characteristic of regenerative receivers under certain conditions.

Now, to "hark back" to the article in February 1921 "QST" and the subsequent discussion. Certain questions were asked, but the discussion did not go very far in answering them. I believe that when these problems are considered in the light of the explanation given it will be clear that the results obtained are in direct relation to the principles outlined.

One thing is as yet unexplained. Why does the little tube set with 5 or 10 watts cover the same range that the 1 K.W. spark does? I can so far see but one explanation that seems at all probable. Aside from the question of the relative sensitiveness of heterodyne reception the explanation perhaps lies in the form of the wave emitted by a tube transmitter. It is possible that the wave form of the high frequency current generated by the tube transmitter is such that the current rises sharply at certain points and so generates in the inductance of the antenna a considerably greater potential than would be the case if the wave was a pure sine wave. Referring to Fig. 8, if the wave was as the heavy line, the potential resulting would be approximately six times as great as that resulting from the pure sine wave, as shown by the dotted line. [But the harmonics generated by this non-sinusoidal wave form are awful!—Ed.]

Actual oscillograms taken of the plate current in vacuum tube transmitters show great wave form distortion, and conclusions drawn from them indicate clearly that the greatest efficiency results when conditions are such as to produce maximum distortion.

Consideration of the foregoing leads to the inevitable conclusion that appreciable radiation can only take place from an antenna when the phase relationship between the current and potential is such as to secure the greatest possible values of current and potential for the power applied.

It is a well known fact that radio frequency currents can be transferred from one circuit to another at non-resonance with almost equal efficiency as at resonance, but in this latter case the values of potential and current are so small (current and potential are in phase to a great extent under non-resonance conditions) that very little radiation results.

## Amplifiers versus Detectors

By L. Q.

WASHINGTON THOMPSON wasn't this negro's name but that's near enuf right.

He used to brag about the way his mule could kick.

One day a neighbor asked how well the mule worked.

"Wuk? Dishyeh mule don't wuk. He kick! Dot his speshulty—yessah—he kick—he don't wuk!"

Moral—Don't think you've a good receiver because it's got lots of kick—because 9ZN comes in all over the place. Does it go *somewhere*? Or does it just stay nearby and kick?

## The Third and Fourth District Radio Convention

Reported by Chas. A. Service, Jr.

**T**HIS is the story of a bang-up convention the boys of the Third and Fourth Districts staged some six weeks ago in the City of Speeches. No, it is not a post-mortem because that convention is far from being a corpse in the minds of those who heard the call and hurried to the Hotel Raleigh from Pennsylvania, New Jersey, Delaware, Maryland "and all points south" on a zero February morning to find one of those warm southern receptions waiting at the station and hotel; and in about the space of one electron emission, mind asserted itself over matter and every ham, super-ham, near-

he's wrong, two "bottle-workers" fingering knuckle-dusters and a lead pipe all aglow to tune up on an unprotected spark man, hams hiking hither and yon like unattached electrons until attracted to some positive young oracle with more regard for a flow of soul than the pure light of reason, hams in groups, in festoons, in waving lines and tight pressed knots, hams freely oscillating and hams damped down by OW's or YL's, all actuated by a single impulse, to get all out of the Convention the Convention had to offer—and they weren't disappointed!

By the way, Hill, 4GL, of Savannah, Georgia, and Harrod, 4II, of Orlando,



ham and hamlet was spreading his doctrine or lapping up knowledge from somebody else's think-tank. Whoso wanted an audience had but to work his jaws faster than his neighbor and straightway he was surrounded by an eager, buzzing group like flies around a gum-drop; subject matter made no difference. There were hams from whose lips dripped facile cosine-thetas and components and characteristics and things, while the more earth-earthy took a worm's-eye-view of radio and covertly asked who wanted to buy a spark set cheap.

But this is an ante-room impression; a dozen steps, the rapid exchange of words and notes with the door monitor and the lucky lad or lass passed within the portals of the exhibit room, to be greeted by that sight of sights, the radio ham at ease. Imagine exhibit tables around the walls manned by designing demonstrators and sweating salesmen with one eye on business and the other on their vacuum tubes, surging crowds of craning hams, knots of open-mouthed Marconis around the leading exponent of C.W., itching to tell him where

Florida, were there from the Fourth District, sent there by popular subscription raised by the boys in those States to represent them. How's that for A.R.R.L. spirit, fellows? And those contributions were raised in about ten days, too!

When things began to look like the 1907 Wall Street panic, the first meeting was announced and by dint of much persuasion the O.M.'s and O.W.'s were induced to sit down and keep quiet while Mr. Terrell, Chief Radio Inspector of the Department of Commerce, formally opened the Convention. That opening speech started things off right; here it is verbatim. What is your reaction?

### Officers, Members and Friends of the American Radio Relay League:

"I thank you for your invitation to attend the Third Annual Convention of the Third and Fourth Radio Districts.

"I have been asked to tell you that you are welcome here. I think you would prefer to be shown and this we shall endeavor to do. No one need be told he is welcome in



Washington. It is your city. You will also be welcome in Room 509, Department of Commerce, and a visit by you will be appreciated.

"I had the pleasure of attending your National Convention in Chicago last August. At that time I was requested by our Secretary, Mr. Hoover, to obtain from the members of the American Radio Relay League their views as to where the Department of Commerce can be of the best service to them. I renew that request.

"You have no doubt seen in the newspapers articles concerning the radio conference which the Secretary will call, at the request of the President, to investigate the development and use of the radio telephone. I understand the American Radio Relay League is to have a representative on the committee which will conduct this investigation. You will have an opportunity to present your views and make recommendations which may be useful to the commit-

Third District, February 10.....	1,664
Fourth District, February 10.....	294
Fifth District, January 31.....	614
Sixth District, February 8.....	1,474
Seventh District, February 2.....	644
Eighth District, January 31.....	2,250
Ninth District, February 8.....	2,664

Total.....14,179

"An increase of approximately 4,000 since the first of last July

"Receiving stations are not recorded and we have no reliable information as to the number. I expect the Secretary would be willing to give another cup to the amateur who can guess the exact number, if he can prove it.

"Broadcasting promises to become one of the most valuable functions of radio, if properly protected and regulated. It will no doubt be one of the most important problems to be considered by the coming radio conference and I hope some plan can



tee in reaching conclusions affecting the use of radio by the amateurs. It is fortunate for you that you have an organization composed of practically all of the foremost amateurs of this country, recognized as being law-abiding, unselfish, and progressive. This organization is Uncle Sam's best training school for radio operators and radio engineers of the future.

"There is at present, and I hope there always will be, just one amateur radio organization of the amateurs, by the amateurs, and for the amateurs. Your power and influence for good can be fully realized only through united and unselfish effort. I hope there will never develop any personal jealousies or factional differences to disrupt your splendid spirit of co-operation, so valuable to yourselves and so helpful to us.

"It may interest you to know how many licensed amateur radio stations there are in the United States, as indicated by the latest reports from each district.

First District, February 8.....	2,440
Second District, January 24.....	2,135

be devised which will insure its successful use. The benefits to the public through radio broadcasting are almost unlimited. The service rendered should be determined by the public if its full value is to be realized.

"You can lead a mule to water, but you can't make him drink. You can broadcast what you like but the public will not listen to it if it is not what they want to hear.

"With the rapid development of inland radio, amateur stations and broadcasting, we are confronted with the problem of investigating complaints of interference. With our present force we have been unable to give much attention to inland radio. Until recently radio has been in the hands of people who had some knowledge of its use. Now we have receiving sets in the hands of farmers, farmers wives, bankers, grocers, and everybody who wants to be fashionable. They have no knowledge of adjusting the apparatus; in fact, I have heard much of the apparatus is so simply constructed that selectivity is impossible.

"I think we are going to find it necessary

to call upon the American Radio Relay League for volunteers, dollar-a-year men, to act as deputy radio inspectors in each State, until we can get an appropriation sufficient to meet this emergency. I believe we are going to find it necessary to have a radio inspector in each state, possibly two in each state, provided with a transmitting and receiving set, to keep in touch with actual radio operating conditions, regulating the schedules and giving advice to the new users of radio. As I view it, there is a big job ahead of us and we will need your co-operation.

"I am reasonably sure there must be a change in allocation of wave lengths.

"I believe it is going to be found necessary to ask the amateurs to release the special amateur wave length of 375 meters to make room for broadcasting. What do you think of the following wave lengths for the amateurs: 175, 200, 225 and 250 meters. And what do you think of assigning them something like this: 175 for tele-

cial Amateur operators license? To be issued to amateurs who have had, say ten years experience; code speed 15 or 20 words a minute. But to be issued only to amateurs who have not had their licenses suspended or have been fined for a violation of the law. Such licenses not to be renewable if a violation is recorded against the holder.

"We would like to know if the amateurs desire us to print monthly a list of the new amateur stations licensed; something like the Radio Service Bulletin (wild applause). We may not have the money to do this but if it is wanted and needed we may be able to get the money, if we can show there is sufficient demand and need for it. The cost of publishing our lists comes out of our appropriation but this money is not returned to us when the publications are sold. It goes back into the Treasury through the Printing Office.

"Before leaving you, I want to thank you for your splendid co-operation during the



The Banquet on Feb. 18th

phones and broadcasting; 200 to the beginners, either spark or C.W., during the period of their first license; 225 to CW exclusively after two years' experience, and 250 to special amateurs for either spark or CW. To do this it will be necessary to have a change in our present law to provide for the use of 225 meters by the general and restricted amateurs, as they are now limited to 200 meters. This question may come up at the coming radio conference and you should have your recommendations ready.

"You have demonstrated you can work across the Atlantic on 200 meters. Unless you contemplate a test with China you should be willing to release the 375 meters wave length, which will be badly needed for broadcasting.

"What do you think of our having a Spe-

cial Amateur operators license? To be issued to amateurs who have had, say ten years experience; code speed 15 or 20 words a minute. But to be issued only to amateurs who have not had their licenses suspended or have been fined for a violation of the law. Such licenses not to be renewable if a violation is recorded against the holder.

"We would like to know if the amateurs desire us to print monthly a list of the new amateur stations licensed; something like the Radio Service Bulletin (wild applause). We may not have the money to do this but if it is wanted and needed we may be able to get the money, if we can show there is sufficient demand and need for it. The cost of publishing our lists comes out of our appropriation but this money is not returned to us when the publications are sold. It goes back into the Treasury through the Printing Office.

"Before leaving you, I want to thank you for your splendid co-operation during the

past almost ten years; which co-operation has been valuable and has been appreciated. I hope and believe it will continue. Long live The American Radio Relay League!

Courtesy begets courtesy, co-operation breeds co-operation, and this signal recognition of the amateurs and the American Radio Relay League by the Department demonstrates what high ideals a steadfast campaign against radio lawlessness and a ready willingness to assist the Department at all times, will do toward cementing the already firm entente cordial.

A short breathing spell and time to tuck away a Raleigh lunch and the afternoon technical meeting got off to a fine start with Dr. Miller, of the Naval Radio Laboratory leading. "Antenna Design and Ra-

dio Measurements" was the subject and was followed by a whole raft of good papers and speakers, dealing with antennae and ground, wavemeters, CW design, theory and operation, audio and radio frequency amplification and about everything else worth while. These papers will come out in QST soon.

Came evening and those with sufficient strength and newcomers were turned loose again in the exhibit rooms and told to go to it. Those with the hoof and mouth disease, who had been hoofing it around all day, withdrew to their rooms to talk it over all night; many spirited arguments took place behind locked doors. An absorbed group gathered about the code table where speed birds scribbled fast and furiously and someone won a pair of Baldwins.

The second and last day of the Convention went off with a rush, starting with a fleet of plate glass rubberneck buggies that took the whole crowd to the Anacostia Naval Air station to see NOF and the multiple tuned antenna and then back across the Potomac to that gray haired father of all high powered stations, NAA, just in time to "hear time" at noon. Some noise! That picture of the gang was taken with one of those rotary camera affairs that pivot on a stand and "shoot" only one section at once; they say Bradley Martin of the Phila. Amateur Radio Association tried to fool 'em and get in the picture twice after the camera had started by running from one end to the other before the camera got there but the camera man tripped him on the run and held him down til it was over.

The afternoon saw everybody lined up for the rectifier battle in which Mr. Kruse backed the chemical rectifier, Mr. Baker the kenotron, and Mr. Tyzzer the Amrad "S" tube. When every ham had satisfied his scientific appetite and stretched preparatory to shunting his neck with a hard boiled collar for the banquet, "The Young Squirt" blew in, made himself quite at home—which was what he paid the money for—and proceeded to write "The Old Man" his impressions of the Convention and especially the banquet. Here's what he had to say:

"I am here to tell the world that I was at the Third and Fourth District Convention! That is, I arrived just before the banquet. Were you there, Old Beeswax? If not, why not? I'll bet you couldn't have found anything rotten at that Convention with a fine toothed comb.

"When I arrived at the Hotel Raleigh I found about 'steen hundred Hams and Ohmlettes on the job; they were grouped together in little knots talking about everything from leaky dielectrics to leaky roofs after the crowd has finished erecting a fifty

foot stick thereon. A little fellow who looked about as old as the bird who crawls from the Pears Soap bathtub took me in tow and gave me a dissertation on grid bias. He was some little fellow. more power to him!

"I also met the Y. L. and she sure is one of the boys; got to admit I couldn't make the eyes behave. I'm here to tell you, you ancient, tottering old knocker, the Y.L. is O.K. She talks like a regular fellow and she is sinusoidal all the way. Hold me back, crowd, my hand is trembling.

"Then the exhibits; was there much on exhibit that was rotten? I guess not! Every product displayed was A-1, even to the young feller that White and Boyer of Washington had on exhibition. He was courteous and thorough in his demonstration, but it ain't right, gang, for any he-animal to be so good looking.

"Hewitt and Meyers and their gang dragged me out to chow and we talked over Godley and things un-Godley and Prohibition. When we had finished we were in fine spirits and Hewitt was shooting traffic across the pond using a cat's back on a winter's night as a master oscillator. Gents, the spirits are willing to show how weak the flesh is.

"After coaling up, I was introduced to the Back Bone (but not the Jaw Bone, that's Warner) of our A.R.R.L. I met Mr. Maxim! I guess he suspected that I had stolen a "P" tube because his big round eyes looked me through and through, but b'lieve me, he's a fine fellow, gang, and I wish that all of you could shake him by the hand as I did in the Hotel Raleigh. Seriously, though, he seems anxious to meet us poor fish. Speaking of which, I want'er say right here that I admired Mr. Maxim's soup and fish suit. It did not look rotten, Beeswax, it looked magna-glorious.

"Now comes the honorable banquet. Oh boy! That banquet! Was it rotten—NIX—many times NIX. The only rotten thing was the gentleman whose voice wended its way to the loftiest heights, an African voice with a two hundred meter wavelength, a 10-amp. radiation and an illegal decrement, which proclaimed to the adolescent radiators that its owner was a Sheik. It would take all the august galantry of the gentleman for whom the hotel was named to admit that he was a Sheik. He was a CRIME.

"Say, you ancient Tree-Toad! I'm here to chortle that Kruse and Service accompanied by Haig and Haig and that Third and Fourth District Committee know how to get up a banquet. For once in our young lives we all had enough to eat. I saw one ham stow away two men's feed, put six or eight slices of the lignum vitae in his pocket, declare that that was what he called

a man's feed, rub his hands together and saunter off. His name is Meyers.

"The fish was clean, even though it was called Potomac River Bass. Chicken soup was served in fore and aft cups. Some spooned it, some mouthed it, others used it as finger bowls. The soup was all there but Bidwell said he guessed the chicken waded through it with gum boots on.

"But I've got to cut the banquet proper short, as I want to get to the other part. Some show! The ham from Baltimore is a good actor, he knows his stuff but I want all you fellows to glimpse his partner as far as it is in my power to portray her. I stood by quite stoically during the first part of the performance but when the honorable ham fell asleep and the hamerino appeared to him in a dream and a smile and a dress made of molecules and electrons, my none too constant decrement got away from me and my pulse broke all speed records. Gosh, gang, it was good!

"By this time, Kruse was batting hell out of the air with a Magnavox. Kruse was Chairman and Will H. Hays never acquitted himself better than our Kruse. Chief Inspector Terrell put over a short speech, followed by that ever popular Inspector Cadmus. Hiram Percy Maxim was then introduced and spoke words of wisdom, as is usual with him, followed by Warner and Schnell outlining the future policies of our "QST" and its Operating Department. I must mention Tom Appleby's description of 3ZO which was illustrated by a stereoptican. I am sure that it was appreciated by all, but after Tom had described the home life of a whole family of 250-watt tubes, who shall say that many a winter overcoat was not hocked the next day in Washington?

"The end came at last as ends usually do and I was whisked away and introduced to "Chain Lightning Hill," who acknowledged me in the dignified words, "How are you, Scup?" Then he dragged me off to see 3ZY with his tribe of rebels, and after riding ten days on the Washington Lectrics, we arrived half an hour later, to be greeted by a hearty "Welcome, fellows!" Just imagine it, at twelve thirty A.M. he made us *welcome*. Is that rotten, Old Wouff-Hong? Dunnam even broke out a flock of sandwiches for us! That's what it means, crowd, to belong to this A.R.R.L. of ours. Fellars like Dunnam abound in the radio fraternity; may their shadows never grow less!

"Gosh, the wife is yelling for me to go to the store. The raisins have given out again and no one with any pep can keep house nowadays without raisins. So long, gang. Cul, but anyone who wasn't at that Convention missed something."

"The Young Squirt" got about everything in that went on at the banquet, ex-

cept the results of the election of next year's officers. Baltimore received the highest vote for the next Convention city, with Bateman, 3APT, of that city President of the Third District Council and Convention; Harry Lyon, 3RP, Vice-President; and H. A. Snow, 3ZE, this year's Convention Manager, next year's Secretary-Treasurer. The third District looks to Baltimore and these men to put across an even better convention in 1923 and backs them to the limit—but they'll have to go some!

### Trump Passes On

WITH much sorrow we have to chronicle the death of Robert Kitts Trump (9BT), which occurred on February 14th at the home of his grandparents at Ottawa, Kansas. His biography appeared in "Who's Who" in but the February num- of QST.

Bob was one of our old stand-bys in eastern Kansas and his absence will be keenly felt. He was only twenty-three years old, death resulting from tuberculosis following a long illness of four years which came indirectly from influenza contracted while in the Navy during the recent war. He was sent to Phoenix in an effort to improve his health but was not materially helped and returned to Kansas for his last days.

9BT was in operation up to the last and was a good live A.R.R.L. station, doing much good work in its territory. We join in an expression of sincere sympathy for Trump's relatives and many friends.

### 3ZO Tests With Venezuela

3ZO, the station of Mr. Horace A. Beale, Jr., at Parksburg, Pa., is participating in radio tests with Venezuela thru arrangements with the state Department of that country made by Dr. E. H. Valutini, 3d, 3AAE, of Philadelphia.

The tests commence on March 15th and continue until March 25th, covering the hour from 10:30 p.m. to 11:30 p.m. NAA time. The Venezuelan stations participating are stations AYA, AYB and AYC. One of these transmits promptly at 10:30 for five minutes, then alternating with 3ZO in five-minute transmission periods.

3ZO is on 350 meters, C.W., for these tests, while AYA, AYB and AYC use 1600 meters, tube C.W., output 1 k.w. Listening stations in Venezuela will continuously tune from 200 to 350 meters, so there is a good chance of other American amateurs being heard as well.

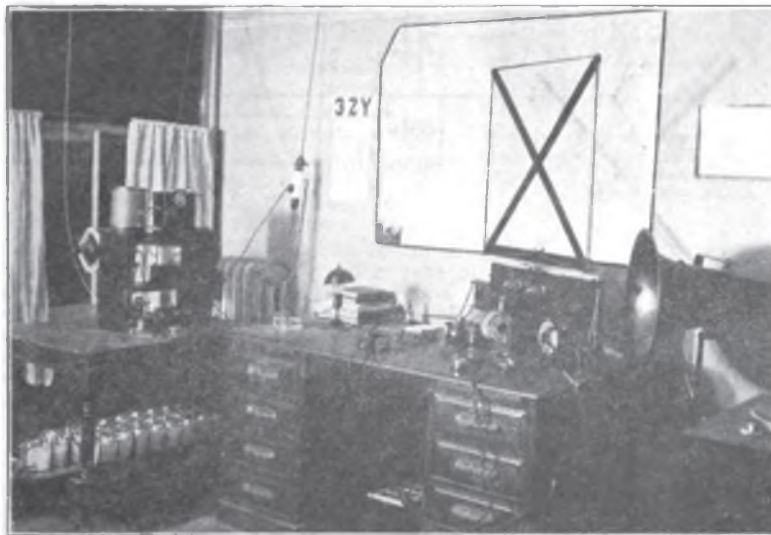
We certainly hope these tests will be successful, as it will establish amateur communication with South America for the first time and, as our Transatlantic Tests did in France, probably open the way to another international A.R.R.L. trunk-line.

## The Loop Receiver At 3ZY

By L. M. Dunnam

**A**FTER monkeying with loop reception on several occasions with various hook-ups and nil results during the past two years the writer had long since given it up as a bad job and impracticable with less than an Armstrong super-heterodyne circuit. However, one night during the latter part of January, when static was unusually bad, the antenna and ground were disconnected from the receiver and by careful tuning

make-shift loop a permanent one was constructed, 25"x26", wound with four turns of wire and a still lower tap taken from the secondary coil. This loop was mounted on top of the receiver cabinet, revolving on a pivot, and controlled by means of a pulley and cord-belt arrangement with a knob at the lower right-hand corner of the receiver cabinet; this in order to avoid body-capacity effects when using the hands near the loop coil. Still better signal strength was had



two C.W. stations, 1ARY and 8AWP, were picked up, signals QRZ but readable. The possibilities of a loop as an enlarged portion of the secondary coil, allowing greater absorption of energy, were quickly realized. An old discarded frame about 19"x19" wound with three turns of small wire was dug out of the junk pile, propped on top of the receiver cabinet and connected in series with the secondary coil, a lower tap being taken off of the latter to compensate for the added inductance of the loop. In a few minutes about a dozen other C.W. stations were logged, 1ARY and 8AWP much stronger than without loop. With the result that the writer is now a confirmed advocate of the loop for relay work. In nearly all cases the signals were easily read, to the almost utter exclusion of static, "mush" from sparks, interference from NAA and other sources.

After the results were noted with the

with this loop. However, since the photograph was taken, another frame has been mounted in the same manner, the present one being 25"x42" and wound with three turns of No. 18 enameled, and corresponding improvement in results has been noted.

The loop is not efficient for spark. The most of the few logged were heard with the detector tube oscillating, hence on their mush notes, though several were heard on their true tones. On the other hand, KDKA, WBL and other radiophone stations were heard perfectly clear with fine audibility, in fact audible a few feet from the loud-speaker at times.

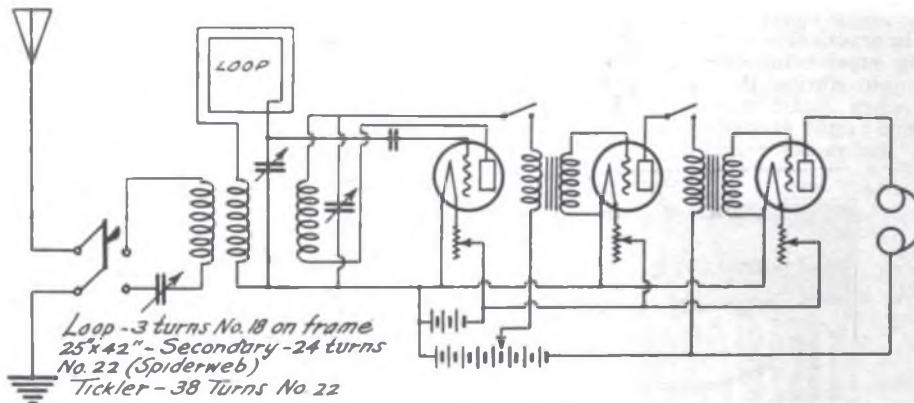
Practically all C.W. stations that can be heard with the antenna and ground are readable on the loop. While the sparks rarely are heard and interfere only in extreme cases from broadly tuned stations such as 8XE when near the wave being worked, distant low-powered C.W. sets,

down to five and ten-watts are easily worked. The furthest stations heard at 3ZY on the antenna and ground have been heard on the loop, the most distant being 6ZZ located at Douglas, Ariz., who was read with perfect ease. Break-in work has been carried on with many stations, 1's, 2's, 8's and 9's included.

It has been argued that much of the energy in the loop is obtained from a coupling

Since the loop has been in operation, about four weeks, an even 200 stations have been logged, the majority of which were readable on one step only.

If anyone trying the stunt fails to hear the usual 'racket' when he turns on his tubes, don't get disgusted and ditch it, just try a little careful tuning and hear the C.W.'s roll in, minus the nerve-racking extraneous noises.

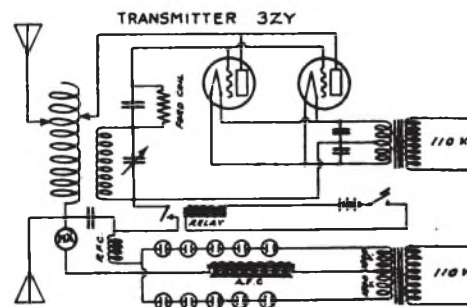


effect to the antenna lead. While it is admitted this may be true to a certain extent the directional effect of the loop and various experiments with the antenna lead, such as grounding it and shifting its position, go far towards disproving this claim. The directional properties of the loop on C.W. signals are not very pronounced but they are so as to sparks and in every case where the location of a spark transmitter is known the loop indicates its true direction, regardless of the relation of the loop to the antenna. Local DX sparks can be so reduced in strength as to permit distant C.W. stations to be read within five or ten meters of the spark's true wave.

The beauty of it all is that there is absolutely nothing remarkable about the performance at 3ZY, and the average station with a good one or two-stage audio-frequency amplifier can duplicate it. It is hoped every DX station will give it a try-out in the interests of a much larger volume of traffic which can be handled through interference and static.

While trouble may be experienced in obtaining good results from the loop when variometers are used, due to their minimum inductance, it is only a matter of about one hour's work to make up a couple of spiderweb coils of proper inductance for a tickler and secondary and a loop such as is in use by the writer, which can be readily connected in any detector circuit. Solid wire, No. 18 to No. 22, is recommended for coils and loop. Litz was tried on both, with results no better, if as good.

Detailed wiring diagrams of the transmitter and receiver and a photo of the station complete are illustrated herewith. The output of the transmitter is from 3.8 to 4.2 amperes with an input of from 450 to 500 watts. The furthest points worked to date are Minneapolis and New Orleans, with signal reports from Mexico and Porto Rico. The antenna system, a one-wire



slant 80 feet high and a three-wire counterpoise extending in opposite directions from each other, is quite a handicap, which cannot be overcome on account of physical conditions.

Much credit for the performances and appearance of the station is due Mr. Herbert A. Wadsworth (3JJ), second operator at 3ZY.

In conclusion, the writer asks that anyone giving the loop suggestions a tryout kindly advise him of the results.

## The Remarkable Work of 6XAD

**I**n a recent issue of QST prominence was given the reception of signals from 6ALE at 1ES, it being stated that to the best of our knowledge it was the first time that 6-signals were heard in New England. Altho that claim has been disproved by the buzz of comment that immediately resulted in the unearthing of a couple cases of prior reception of sixes in the First, most of our correspondents overlooked the fact that we were talking about these two districts in particular, and cited many better low powered transcontinental or near-transcon records. Even so, however, it has brought a lot of interesting data to light and therefore serves a useful purpose.

Most of these records center around one station, strange to say, and are in existence largely because of the most remarkable work of station 6XAD, Mr. Lawrence Mott, of Avalon, Catalina Island, California. We believe we are safe in saying that Mr. Mott is doing the best work of any American amateur today in point of both transmission and reception, having repeatedly copied stations all up and down the Atlantic Seaboard and in turn having had his own signals reported many times from a larger number of points in the same territory. And it has not all been bare reports of signals heard—6XAD has frequently worked many of these stations,

passing messages back and forth with the ease of local communication. Of course equal credit belongs to the various indi-



Mr. Lawrence Mott, 6XAD



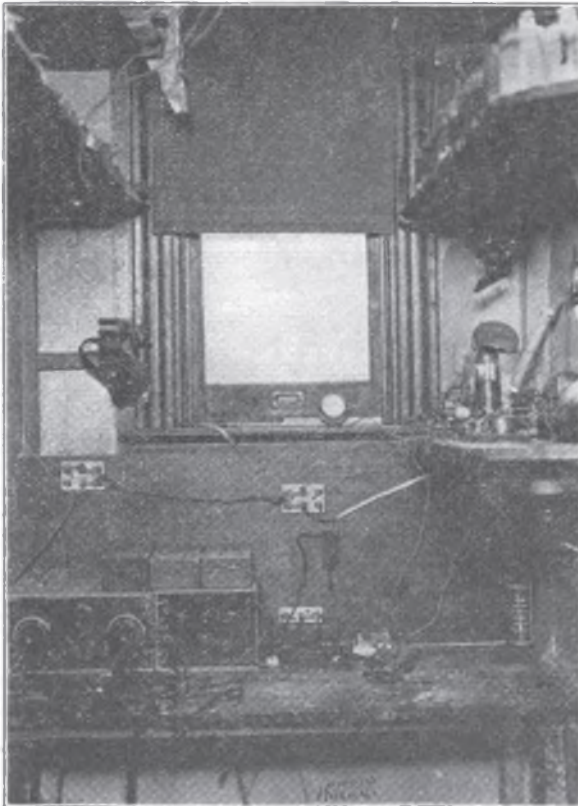
Mr. Mott's station—6XAD

vidual stations who have participated, but these records are possible largely because of the existence of 6XAD—he is the kingpin in the story. And we do not see at 6XAD a flock of 250-watt tubes as characterized 1BCG, nor yet Armstrong-Super tuners, but a transmitter of four Western Electric VT-2's and a conventional tuner using a detector and generally one, sometimes two, stages of audio amplification! All of which goes to show that it can be done.

Our hat is off to Mr. Mott and his confreres who are doing this splendid work in the advancement of Amateur Radio and C.W. in particular. As a typical example of 6XAD's reception, take 3FS at Philadelphia, using generally three of the tubes so conservatively known as "5-watters," but who, using but two of them, has been heard dozens of times at Avalon. Isn't that going some? And 3AQR at Hershey, Pa., who



Above, 3FS of Philadelphia. Below, 3ALN in Washington.



not only has been heard on four occasions but has been worked for a couple of hours and messages passed, 3AQR using one 50-watter. And 3ALN in Washington, also with a single 50-watt tube, who has been worked three times and messages exchanged. 8JL in Cleveland and 9AJA in Chicago raise 6XAD and chew the rag without schedule and almost whenever they want to, almost as if they were in the same city. 8AWP in Syracuse, on their small set of three 5-watters, antenna current 2.4 amps., same old story; 6XAD copied in Syracuse twenty minutes after daylight. We also have record of 6XAD working with 8BSS and 8BUM in Cazenovia, N. Y., who were audible a hundred feet from the phones, and Mr. Mott reports signals from 8BO, Detroit, one 5-watt; 8VY, Kalamazoo, two 5-watt; 3EM, Baltimore, one 50-watt, from whom a complete message was copied; 3LR, Washington, and 1ARY, Burlington, Vt., each using a single 50-watt; and 4FT at Atlanta, using two 50's. 6XAD of course is reported from many other places, including 1BLN, 2FP, 3HJ, 3BHW, 3JJ, 6ZAC in Honolulu, Canadian 3JI and 4CB, 8KW, 8KF, 8EW, 8AXI, 8ZAC, 9JQ, 8BGD, 8ZG, 8BRL, 9RC, 9ZN, 9JQ, etc.



We are fortunate in having a photograph of 3FS, which belongs to Mr. Chas. G. Benzing, of Philadelphia. The three 5-watt tubes are supplied with 700 volts from a 16-jar chemical rectifier, putting 2.6 amps in an inverted L aerial 45 ft. long of 6 wires, 60 ft. high. With two tubes, as used when reported at 6XAD and incidentally 7FQ at Tekoa, Wash., the antenna current is 2 amps. 3ALN, H. F. Hastings in Washington, D. C., uses a single 50-watt-er with about 1400 volts from a chemical rectifier, the tube space current being 150 mils and the antenna current 3.5 amps. Mr. Hastings reports that 6XAD has been heard frequently, generally swinging slowly, and will fade out a few seconds at a time and then be in steady for a half hour.

All of the above transmission from 6XAD has been on the "low-power" set of four 5-watt tubes, I.C.W. Mr. Mott also has a

100-watt set on 370 meters, straight C.W., which has been reported from Hamilton, Bermuda!

All of these results are truly wonderful considering the low powers used. They are second in distance only to the remarkable performances in the Transatlantics, but this work between Avalon and the east has been done on no pre-arranged schedules and almost nightly 6XAD has been in communication over some such distances. It should be borne in mind, to be fair, that a so-called 5-watt tube is capable of much greater outputs and that most of the men using them are probably getting 20-watts out of them, but the results are remarkable none the less. And the beauty of it is that any station with proper antenna and ground system and properly adjusted can duplicate these performances!

## Chicago Council Gets Smith Cup

**T**HE Chicago Executive Radio Council has been awarded the S. W. Smith Cup for the most outstanding achievement in Citizen Radio during the summer season of July 1—November 1 of last year!

As announced in QST last July, Mr. Seymour Wemyss Smith of "The Hartford Courant", ardent member of the A.R.R.L. and the Radio Club of Hartford, offered a silver loving cup to be awarded for distinctive achievement in the amateur world under the auspices of the League, and Mr. S. Kruse was good enough to act as Chairman of a Committee of Judges and handled the matter with his customary thoroughness. His committee consisted of one man from each radio district, as follows:

- Irving Vermilya, Marion, Mass.....1ZE
- A. A. Hebert, Nutley, N. J.....2MP
- S. Kruse, *Chairman*, Washington, D.C. 3ABI
- E. H. Merritt, Atlanta, Ga.....4XC
- John M. Clayton, Little Rock, Ark.....5ZL
- A. E. Bessey, Sunnyvale, Cal.....6ZK
- Royal Mumford, Vancouver, Wash.....7ZJ
- A. J. Manning, Salem, Ohio.....8ZG
- R. H. G. Mathews, Chicago.....9ZN

These judges were all asked to submit nominees for the cup from the district they represented, and meanwhile an article in QST made a similar request of the general membership. Twenty-odd entrants were received and tabulated by the Chairman and submitted to the Committee for voting. Scoring was on the following basis: a vote for first place counted 5, second place 3, third place 1; a vote for "no award" counted 0 in all three places. The ballot was as follows:

Chicago Executive Radio Council, for the conception and staging of the first national amateur radio convention and also for their past work in conceiving, putting into practice and proving the workability of the "Chicago Plan" which has become the national standard in the conduct of citizen radio communication .....21 points

H. W. Castner, Portland, Maine, for his noteworthy work in the organization of the Maine region.. 7 "

C. L. Austin, Portland, Ore., for the design of the tube set used at



The Smith trophy

his station, 7XF..... 6 points  
 Boyd Phelps, Minneapolis, for a technical article entitled "Radio Below 200 Meters"..... 6 "  
 L. C. Young, Naval Air Station, Anacostia, D.C., for his persistence and operating skill which contributed to a large extent in the fine performance of station NSF, the first powerful short-wave C.W. station..... 5 "  
 L. A. Kern, Univ. of Michigan, for the organization of a radio press service..... 3 "  
 J. K. Hewitt, Brooklyn, for the first definitely established trans-continental amateur tube work, between station 2FP, installed by him, and station 6ALE at Reedley, Cal. .... 3 "  
 H. J. Tyzzer, Medford, Mass., for the design of various Amrad specialties..... 3 "  
 J. L. Reinartz, So. Manchester, Conn., for the origination of the Reinartz C.W. Tuner..... 3 "  
 E. R. Bateman, Baltimore, for organization work in the Baltimore metropolitan district..... 1 "  
 H. H. Lyon, Washington, for operating skill and station performance as evidenced by the concerts sent from station WJH, formerly 3NR..... 1 "  
 There were no votes for ten other candidates.

By an overwhelming vote, then, the Smith Trophy, carrying with it the honor of recognition of substantial contribution to the game, goes to the hard-working Chicago gang who first demonstrated their co-operative ability in the formation of the justly-famous "Chicago Plan" for the division of working hours and who put across the First A.R.R.L. National Convention in Chicago last September. Chairman Kruse, in reporting for his committee, says:

"The distribution of the members, un-animous nature of the vote, and general satisfaction expressed at the result, as-

sure me that the cup has been well awarded and that it is not the mere expression of a small group that the Chicago Executive Radio Council has done the outstanding deed in favor of citizen radio which Mr.



Mr. Seymour Wemyss Smith

Smith had in mind when presenting us with the cup. It is my very real pleasure, therefore, to report that in awarding to the Chicago Executive Radio Council the Seymour Wemyss Smith Cup for distinctive achievement in Citizen Radio we express not merely the opinion of nine men but the opinion of the American Amateur who is the American Radio Relay League."

We heartily second the motion! Three big cheers for the Chicago Council!

## The Second District Convention and Show

EVERY attendance record for radio conventions and shows went to smash at the second annual affair of the Second District Executive Radio Council, held in New York on March 7th to 11th at the Hotel Pennsylvania. Over forty thousand people attended the show in the five days, with an average of four thousand on the floor all the time, and literally thousands were turned away because there wasn't room for them to get in. Over sixty exhibitors were

in charge of their respective booths, the show this year occupying the entire Butterfly Room in addition to the Roof Garden—and next year it looks like they will need Central Park to accommodate the gang.

One of the most important things that came out of this stupendous affair was the establishment of a better understanding between the new-comer listeners and the old-time amateurs. It is an undisputed fact that this actually happened. The public met the amateur and liked him. The ama-

tour was everywhere and he knew all about everything and could explain it. His jargon of technical talk completely caught the fancy of the members of the general public, and the New York papers in their accounts of the affair and their cartoons reflected not the viewpoint of the rather unhappy novice listener but the spirit of the real amateur! This to our surprise, for

formed the conclusion that it consisted of the amateurs plus their fathers and mothers and uncles and aunts and cousins and grandparents—and that means that it was still an amateur crowd.

The show was officially opened at 8 p.m. on the 7th with approximately three thousand people present. Various demonstrations were given, including that of E.

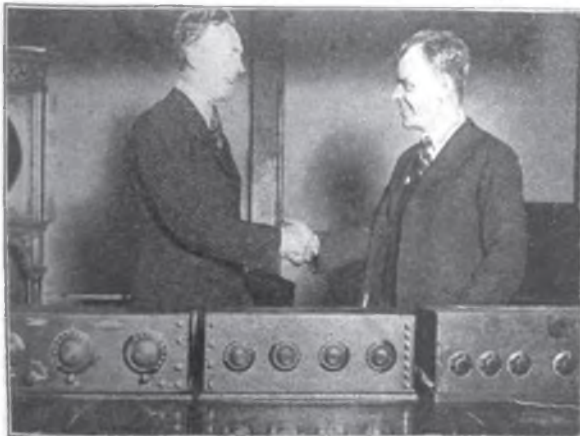


The Banquet at the Pennsylvania Hotel

we had feared the amateur would be swamped at this Show. And the banquet! Man, dear, there were only eleven hundred folks present, and who do you reckon they were? It was an amateur gang in its sympathy and spirit, almost entirely so, and looking around the big ball-room we

D. Glavin's wireless-controlled automobile, which particularly delighted the crowds. On the following days the show opened at 2 p.m. with various meetings held in the big ballroom of the hotel. On the evening of the second day Mr. W. C. White of the General Electric Company gave a very interesting talk on "Vacuum Tubes and Their Operation" and Paul Godley described further his experiences in Scotland during the A.R.R.L. Transatlantic Tests in December. By courtesy of one of the large electrical corporations, movies of what happens in a vacuum tube were shown.

One of the interesting events of the Convention was the code speed contest. This was won by Mr. Jose M. Seron, a receiving operator of the Radio Corporation of America whose home is at Mamaroneck, N. Y. He attained a speed of 49.5 words a minute with only three errors. Mr. B. G. Seutter, last year's winner, copied at the same speed but with four errors. Mr. Seutter's record of last year was 48.6 words per minute with two errors. A code speed contest was also held for women,



At the Show—Paul F. Godley of Transatlantic fame and Jack Binna, here on the first S.O.S. Photo by Keystone View Co.

Miss Ruby Yelland winning with a speed of 30.5 words per minute with perfect copy. Her closest competitor was Miss Marianna Olive Chicken with a speed of 30 words per minute, with Miss Marian Brown third, same speed.

In the Butterfly and Roof Garden there always was a big crowd viewing the exhibits and the amateurs were completely swamped by the vast number of people who came to see the latest developments in the radio art more out of curiosity than anything else. As many people attended in one day as did during the whole convention last year.

Really new features and designs of apparatus were badly lacking, due probably to the enormous demand for equipment already on the market not allowing the manufacturers a chance to make new designs and start their manufacture. QST will publish description and photographs of the few new pieces of apparatus that were displayed, in an early issue.

The foremost event of the Convention was the radio banquet to which every radio man looked forward as a happening of much importance. On the evening of the last day 1100 people gathered in the main banquet room of the hotel for what was undoubtedly the largest radio banquet ever held. After a few words from Chairman J. O. Smith, everybody fell to and stuffed themselves while entertainment was furnished by many of the artists that have given the programs from WJZ and WDY. After the eats were stowed away, Chairman Smith introduced the various members of the Convention committee and complimented them on their work. A roll call by districts was then called and representatives found present from all districts except the sixth and seventh. The first speaker of the evening, Mr. John V. L. Hogan, of the Westinghouse Electric and Manufacturing Company was called upon and he discussed the relation of the amateur to the manufacturer, mentioning that the amateur was the manufacturer's most important asset. Following Mr. Hogan General Squier, Chief Signal Officer of the Army, was introduced and given a hearty cheer. Lieut. Commander D. C. Patterson was next on the program and gave a short discussion of the history of the radio in the navy, making it impressive that the amateur should not forsake the telegraph for the telephone. Mr. David Sarnoff, Commercial Manager of the Radio Corporation of America, then followed and discussed the policy of the Radio Corporation of America and their policies toward the amateur. He mentioned that it would be proper to talk of many amateurs as commercials and many of the commercials as amateurs when accomplishing results was taken into consideration. Major Roy H. Coles, Chief Signal Officer of the Second

Corps Area of the Army which includes the second inspection district of the Department of Commerce, was the next speaker and discussed army radio in general and the great problem of getting operators in time of need. He complimented the second district amateurs on their operation and expressed his desire to have them cooperate with the Army. Next in order was a roll-call of the well known amateurs of the second district which was ac-



A popular habit at Conventions—autographed program as a souvenir

companied with much enthusiastic applause. At the conclusion of the roll-call the trophies were presented to the winners of the various code contests. The next speaker on the program was Arthur Batcheller, Chief Radio Inspector of the Second District, but who unfortunately could not be present, being in Washington at the time. He was represented by H. L. Bogardus, assistant inspector. Dr. A. N. Goldsmith then told of the work of the recent radio conference in Washington of which he was a member, representing the Institute of Radio Engineers. Next in order came the roll-call of all the clubs affiliated with the

(Concluded on page 48)

## More About the Transatlantics

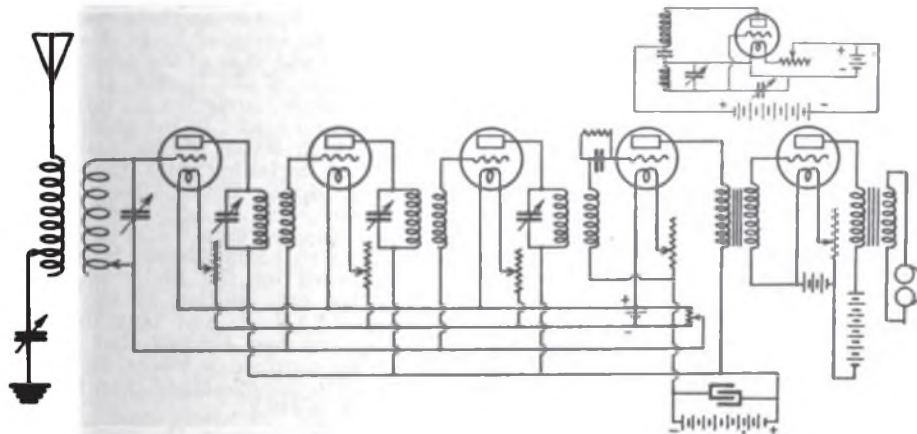
**I**N our last issue we mentioned some of the results of our recent Transatlantic tests by the English amateurs. Complete information was not available at the time of the above writing and it since develops that some of the statements therein were incomplete.

We are indebted to the "Wireless World" for further information and an accurate report from the British amateurs. The following stations were heard and correct code words copied: 1AFV, 1ZE, 2BML, 2FP, 2ZL. The following were heard during the free periods: 1BCG, 1UN, 1RU, 1XM, 2ZC.

steps of audio-frequency amplification. Ediswan ES-4 valves were used for the high frequency amplifiers and a Mullard "Ora" for the separate heterodyne.

Mr. Burne's antenna consisted of an inverted L type of two wires supported by a mast in the garden and one on the house, being 56 and 46 feet high respectively. The aerial is within the G.P.O. limits (a total length of wire, 140 feet) being 45 feet long and having a download of 50 feet.

The radio-frequency transformers are particularly interesting and are of the semi-tuned type. The transformer "for-



Mr. Burne's Circuit Arrangement

In England there were prizes offered for the best reception and Mr. W. R. Burne of Sale, Cheshire, was the first prize winner, Mr. H. H. Whitfield, of Birmingham, second prize; while Mr. W. E. F. Corsham of London and Mr. R. D. Spence of Aberdeenshire were joint third prize winners.

The apparatus used by the English amateurs was quite different from that in general use in this country. Some rather unusual outfits were constructed especially for the tests and we refer our readers to the February 4th and February 18th issues of the "Wireless World" wherein a complete and detailed description of the successful receivers was given.

The apparatus of Mr. W. R. Burne is of particular interest inasmuch as he heard seven different stations. We are reproducing a circuit diagram of his apparatus showing three steps of radio frequency amplification, detector and one stage of audio amplification. During the tests from three to six radio frequency valves were used with an occasional addition of one or two

mers" were turned out of solid 1¼-inch ebonite rod, a groove ¼th of an inch deep containing the primary and secondary windings consisting of 30 and 35 turns of No. 38 D.S.C. copper wire, the secondary wound over the primary. These transformers were good for 180 to 325 meters with the shunted variable condensers made for the occasion.

The second prize winner, Mr. H. H. Whitfield, who heard 1AFV, 1BCG, and 2ZL, had a particularly interesting arrangement which contained some rather unusually constructed apparatus. His receiver used two steps of radio-frequency amplification, a detector and two steps of audio amplification. A three-coil tuner with single layer coils was used with long wooden handles to vary their couplings. All of his apparatus was homemade and especially for the occasion.

Mr. Corsham of London, joint third prize winner, used a detector and two steps of audio amplification, being very similar to the arrangements in general use in this country. Mr. R. D. Spence, the other third

prize winner, used three steps of transformer-coupled radio-frequency amplification, a detector and two audio amplifiers.

The apparatus of Mr. J. R. Forshaw, also a prize winner, consisted of one step of radio-frequency amplification, a crystal detector and one step of audio-frequency amplification. 1BCG was heard by Mr. Forshaw and he reports fading signals when a steam train passed by his house which he attributes to the cloud of steam and smoke emitted from the engine.

The English amateurs are certainly to be complimented on their fine work and we only hope that they will now be able to hear American signals frequently and in the very near future that we may be in direct communication with them.

#### Interest in France

THE French amateurs took an intense interest in the tests, copying each morning Mr. Godley's daily reports of the results of his listening, creating what Dr. Pierre Corrot, editor of their amateur magazine "La T.S.F. Moderne", calls "a most palpitating romance". Their only information was second-hand and they were rather hard put to it to make heads or tails of the cryptic radiograms they copied from MUU. Thus we find them wondering what in the world a "Beverage" antenna might be, their dictionary saying that a "beverage" means "a drink" or a "potation".

In Godley's second telegram, his statement "Heard one able yacht during free for all period sinkgap fading" completely got their animal. Quoting Dr. Corrot, "...a most remarkable sentence. It appears that Mr. Godley heard very well indeed during the open-all period accomplished or able yacht! He therefore heard nothing from America. It is not astonishing under the prevailing atmospheric conditions."

Two days later Godley had reported 1BCG. "This time here we are! A warm rain is falling; the wind has calmed and the atmospheric have diminished in intensity. And Mr. Godley has heard one boy cast George who called him on continuous waves.... But who might be this "Boy throws George" who confirms the success of the transatlantic test? What a peculiar language Mr. Godley talks!"

And then, fellows, do you remember Godley's long message, the one with the thrill:

*"One London — TC — American Radio Relay League Hartford Conn U.S.A. — Heard one ram unit two fox pup two boy mike love stop Code words of these three verified Coursey stop Also heard cables from following spark one able ram yacht one boy dog tare two boy king two dog nan three boy pup also following contin wave on able ram yacht one boy cast george one boy dog tare one boy george fox one yacht king one xray mike two fox*

*dog two easy have eight able cast fox eight xray vice stop Strong and reliable— Godley".*

Dr. Corrot continues: "Here is a puzzle for us! A correspondent writes us: 'I'll be damned if I understand anything of this mystery where rams, dogs, foxes, yachts and even X-rays play such an important part!!! Might this not be a code?'"

"Yes, it is one! Let us consider the second part of this telegram. 'Code words of these three verified Coursey'. This shows us that the preceding sentence treats of the transmission of three American amateurs, pre-arranged words transmitted by whom have been verified by Mr. Coursey. And if we remember that the calls of the American amateurs are all issued with a number followed by two or three letters; if we notice that in the first sentence there are exactly three numbers (1, 2, 2) each one followed by two or three words; if we remember the story of Fritz, Karl, Walter & Company and that of the telephone girls, 'A like Andre, B like Bertha, C like Cecily' — we are immediately led to think that in order to avoid errors in reception they have replaced each letter of the calls received by a word beginning with that letter: A like Able, B like Boy, C like Cat, D like Dog, E like Easy.... etc. And now all at once we discover that the pretended yacht which was so accomplished, 'one able able yacht', heard on the night of December 8th, is the code station of the American amateur 1AAY... and that the remarkable 'one boy cast George' that called Mr. Godley on continuous waves on the night of Dec. 10th is none other than the station whose call is 1BCG.

"There still remain the words 'sinkgap fading' which are most incomprehensible even when we know that 'sinkgap' is an abbreviation for synchronous rotary spark gap. It just confirms in us once more the idea of an international language which exists and which is used with success, and which is the necessary complement to radio telegraphy and even more so to radio telephony. What good do the words we receive do us if we do not understand them?"

"The puzzle-telegram of Dec. 12th reveals to us in its turn that on the memorable night of the 10th and 11th the following were heard: 1RU, 2FP, and 2BML, whose code words were verified by Mr. Coursey, also the calls (cables is certainly a mistake; Mr. Godley must have written calls, perhaps not very legibly) of 1ARY, 1BDT, 2BK, 2DN, and 3BP, and finally the C.W. stations 1ARY, 1BCG, 1BDT, 1BGF, 1YK, 1XM, 2FP, 2FD, 2EH, 8ACF and 8XV, eighteen stations heard on the same night (strong and well) of which one, 1BCG, was heard the night before and two, 1ARY and 1BDT, were heard on spark and on C.W."

(Continued on page 39)

# EDITORIALS

## de AMERICAN RADIO RELAY LEAGUE



### The New A.R.R.L. Board

AS our members all noted, the A.R.R.L. had an election of a new Board of Direction for the two-year period beginning on the third Saturday in February. Ballots were circulated in middle January and every member of the League had the opportunity of helping choose our governing body for the next term.

Twenty-two names were on the ballot, and the seventeen receiving the highest numbers of votes were to be elected. The returns were canvassed at the Board meeting held at Washington on Feb. 18th, during the Third-Fourth District Convention, and it was found that the membership had elected the following men for the new body: Harvey Mitchell Anthony, of Muncie, Ind.; H. A. Beale, Jr., 3ZO, Parkeburg, Pa.; A. E. Bessey, 6ZK, Sunnyside, Cal.; V. F. Camp, 2RL, Brightwaters, L. I.; F. M. Corlett, 5ZC, Dallas; C. E. Darr, 8ZZ, Detroit; W. C. C. Duncan, Canadian 9AW, Toronto; A. A. Hebert, 2MP, Nutley, N. J.; F. A. Hill, 4GL, Savannah; Dr. A. E. Kennelly, of Harvard University; S. Kruse, Cambridge, Mass.; H. P. Maxim, 1AW, Hartford; F. H. Schnell, Hartford; C. A. Service, Jr., 3ZA, Bala, Pa.; C. H. Stewart, 8ZS, St. David's Pa.; K. B. Warner, Hartford; and M. B. West, 9DEA, Waukegan, Ill.

Dr. Kennelly and Messrs. Beale, Darr, Duncan, and Hill will be new faces on the Board, the remainder being re-elected from the previous board. Good men all, we feel, and we are particularly pleased to have a Canadian amateur sitting at the big table. We hope that Canadian amateurs will keep him posted on ways in which the League can help them.

After the new Board had been installed it proceeded to elect new A.R.R.L. officers for the two-year period. Hiram Percy Maxim, founder of the League and our pilot thru all the torturous years of our childhood as an organization, was unanimously returned to the chair as our President. Similarly we have Mr. Hebert continuing as Treasurer (and a very good one he is), Schnell our Traffic Manager, and Warner as the hard-working Secretary, while Mr. Stewart, a real old-timer and our best advisor in legislative matters, becomes

our new Vice-President, succeeding Mr. Service, who declined the nomination.

These are the men that you have chosen to steer our ship of state for the next two years. They will do their best to serve you.

### Amateur Self-Policing

ONE of the dreams of our A.R.R.L. now bids fair to become true very soon. It is that we may be permitted to police ourselves by means of representatives chosen from the midst of us amateurs and deputized to act as assistant radio inspectors with enough authority to insure respect of their orders.

Of course for a long time we have had our local traffic managers, our co-operative rules and our division of operating hours—ever since there was a "Chicago Plan"—and the local radio inspectors have given us hearty co-operation and as much of their time as they could spare. But there has been a lack of authority and our executive councils and division officials have not always been able to back up their demands for good behavior when meeting up with the occasional refractory individual who lacks respect for the laws and the rights of others.

Secretary Hoover tells us that he is looking to us amateurs to take care of ourselves. He knows full well that we have been doing it pretty successfully right along, but there will be more of us and in particular a big inspection problem will come about when we start subdivision of the amateur band for the various types of our transmitters. The worst punk can see that the hope of benefit in the new system depends upon its rigid observance. Secretary Hoover says we must do that job ourselves, and so our A.R.R.L. has asked that provisions be made for Amateur Deputy Inspectors, and the Radio Commission now sitting in Washington has approved the idea, as is reported in our leading article in this issue. The deputy inspectors would be elected by all the amateurs in a community, and of course that means that the local affiliated clubs will be the logical places for getting together and selecting the men.

The adoption of the plan is not yet assured but with the Department of Commerce proposing it, we amateurs ourselves wanting it, and the Commission recom-

mending it, we can expect it soon. We will have more to say about it then. Meanwhile think it over, fellows.

### A Word to the Novice

WE have a new term in radio nomenclature: *novice*, meaning one of the beginners in the fascinating game of wireless attracted by the phone broadcasts, as distinguished from the old-time *amateur*. We don't know who started the use of the word *novice*, and both classes of course are really *amateur*, but a differentiating word is a good thing to have and it will do as well as any.

This then is a word to the novice. There are a few hundred thousands of you now, and there will be millions shortly. To all of you these lines are addressed.

Won't you let us amateurs help you? We'll be glad to. We went thru the mill ourselves, you know—every one of us—and we know exactly what you are up against. Forgive us if sometimes we cannot repress a smile at some of your stunts. We do not grin in unkindness—we're only recalling the days when we used to try all the trick circuits we could hear of, when we used to ask a million questions, when we used to scratch our heads to figure out where this old telephone ringer or that old spark coil could be used to bring in better signals: the days when we used to be thrilled thru and thru at hearing a single signal!

We all agree that it is the most fascinating game that ever happened, don't we? We've fought it all out, you know, we amateurs, until today honestly we believe we are crackerjacks at short-wave reception. We've tried about everything under the sun and now we know just how to build our tuners and our amplifiers and how to adjust them to get the best operation out of them. We'll be glad to help you in exactly the same way. We have radio clubs in every town and we want you to feel welcome to come around and get acquainted. We regard you as much a regular fellow as ourselves, and we'll be darned glad to have you in with us!

We amateurs have transmitting stations too, most of us. And we are able to work perfectly amazing distances by dot-and-dash telegraphy, talking to each other often over distances of a thousand miles. In our American Radio Relay League we have a network of air lanes covering the entire country, and every night we handle hundreds of free messages for the sport of it, passing them on to the next fellow in the proper direction. Last month we had a definite record of 30,000 messages handled. This is a big business and it's valuable training, and we have a wonderful cooperative machine built up to make it possible.

We would like for you to know when you hear our dots and dashes that it isn't "the American small boy" playing around, but an organization of thousands of young men who are about a more or less serious business, engaged in mastering a complex art. With our amateur transmitters we have sent a friendly message from the Atlantic Coast to the Pacific and got the answer back to the Atlantic in a total of six and a half minutes! We conveyed messages from the governors of the individual states to President Harding over our traffic system in early March. For months we lent our services to the Bureau of Standards and helped in the collection of a world of data on the cause of the mysterious fading-out of signals. And recently we carried on tests with amateurs in England and nearly three dozen of our stations were heard over there! Really we are doing things, and in doing them we are advancing the art and keeping ourselves ready to serve our country again as operators if ever again we are needed.

We've been at this for fifteen years, and that experience is yours for the asking. Wireless isn't all success, and we can give a lift in the bad places. Radio hasn't been near perfected yet, and it's still subject to interference from a dozen sources. Leaky electric light lines make a noise like a spark set holding down the key and frequently will prevent any of us in an entire city from hearing a thing for night after night. Elevators, X-ray machines in hospitals, violet-ray machines, welding machinery—dozens of such devices—make a horrible clatter on the air. The transmitters on ships and commercial and government stations sometimes get out of adjustment and put a smother all over the tuner. We amateurs have been blamed for most of this, and to our certain knowledge in case after case where it wasn't an amateur transmitter at all. Please be fair to us, won't you?

Do you know that some of the receiving tuners being marketed today are not worth a damn, in our humble opinion? The manufacturers make them simple in the mistaken belief that you can't operate a real modern tuner. We threw them away years ago because they won't tune sharply enough to do us any good. Yes, we mean to say that they are a relic of by-gone days, and yet they are being made today by the hundreds of thousands for listening to concerts. Do you realize that there are 15,000 of us amateurs transmitting, with most of us crowded together near 200 meters? It's about as if there were 15,000 telephone broadcasting stations working at the same time at that place on your tuner where you get the music. Say, wouldn't you have a sweet time trying to hear the one you wanted? We had to grow away from these kind of instruments in order to pick out



our man from the thousands of others, and we use loosely-coupled tuners that have selectivity in order to do this. They are not hard to learn to operate, in spite of rumors to the contrary, and the results are surely worth the trouble even if they were. Of course you hear local amateurs on such tuners as you use—we'd hear our whole gang if we tried them for our amateur reception, and we'd get nowhere. But we know from our experience that if you'll get a selective tuner you will very rarely hear an amateur or a ship, unless you tune for them, and you'll get the broadcasts even better too.

And some day we fear this listening business will begin to pall. You'll want to transmit. There's room for you, Old Man, and when you come to the place where you want to climb in with the rest of us in the dot-and-dash transmitting business you'll be a regular amateur and will find our gang waiting for you.

To make a long story short, here's the helping hand of the American Radio Relay League, our national amateur organization!

### Funds For Inspection Service

IT is now practically assured that the Inspection Service of the Department of Commerce will have adequate funds for carrying on its activities. The shameful way in which this branch of the government has been restricted financially in the past thru petty politics is well known to all of us amateurs. But for the fiscal year 1923 \$80,000 was asked for enforcing the radio communication laws and, in addition, on March 3d Director Dawes, of the Bureau of the Budget, recommended another \$50,000, pointing out that in the past two months there has been a tremendous development in the radio field, particularly in broadcasting, with some 600,000 listening-in stations now to be served and safeguarded. As Secretary Hoover states, "The interference caused by these broadcasting stations with each other and with the regular use of radio communication both in connection with safety to life at sea and for commercial purposes has been followed by demands from all sections of the country that immediate steps be taken to remedy a condition which is rendering this popular and important use of wireless impossible. Our present force is entirely insufficient to cope with this emergency."

When General Dawes, the man who has slashed the dickens out of almost every request for appropriations, recommends still more money for the enforcement of the radio laws, it is safe to say it will be forthcoming. President Harding approved the request and sent it to Congress the same day, and it is understood that there is no question but that our Inspection Service will now come into its own. The additional

\$50,000, it is contemplated, will provide an additional assistant radio inspector and another radio clerk in each of the district offices. Hurray!

We of the A.R.R.L. can take a little of the credit for this increased appropriation. Our League has been working in this direction for many months, and we can feel that we helped to bring about the improvement.

### MORE ABOUT THE TRANSATLANTICS

*(Continued from page 36)*

Good for the Frenchmen! They figured it out exactly right, and give them credit, fellows. They will be good chaps to work with when international amateur radio becomes a commonplace. And, by the way, it gives us great pleasure to record that, possibly largely as a result of our own A.R.R.L. Transatlantic Tests, the bars have been jet down in France and amateurs there are being licensed to use 200 meters and 100 watts of C.W. Soon we hope that they, like the British, will be ready to test to us and give us the privilege of repaying them for their kindness in listening for our signals.

Once having discovered the "system", "La T.S.F. Moderne" had no more trouble and proceeded in its article to interpret the succeeding Godley messages with difficulty. When Mr. Coursey let it be known that American stations were heard as well by the British amateurs, they said: "Bravo, British Amateurs! You have shown that without special installations Old Europe in spite of its hindrances can show itself to the haughtiness of Young America."

Dr. Corrot considers that the tests were a very valuable contribution to the art from a viewpoint as yet little known. "The short wave lengths, it was said, would not carry! Well, you see, they do carry. There now remains an indisputable fact whose explanation is yet to be found. Our sincere scientists do not hide their astonishment. These results, they say, are truly surprising; to cover more than 6000 kilometers with wave lengths of the order of 300 meters and with a power of about a kilowatt! It seems to them most difficult to find an explanation even somewhat satisfactory in the light of the knowledge which we possess on the propagation of waves. Perhaps, they say, we should think about the reflection of the waves from the higher strata of the atmosphere. In any case it would be premature to take up a position before more complete experiments and study may be made. Other formulæ in hand show that this had to come and that it could not have been otherwise. Wave lengths of 200 meters would be, all in all, more preferable than those of 800 to 1000 meters.

"Meanwhile let us not exaggerate for it is a far cry from these experiments to a

*(Continued on page 54)*

# The Operating Department

F. H. SCHNELL, Traffic Manager  
1045 Main St., Hartford, Conn.



**H**OW many of you fellows in the Operating Department realize that 245 men represent the small number of good, live, snappy leaders who keep our ball of relay traffic rolling? How many of you take a bona-fide interest in reporting activities of A.R.R.L. members in your section? Why should the number of live wires be limited? It should not be limited, therefore we are going to make room for about 500 more men. Now we are not interested in dead timber! We want and insist upon having the very best material we can find. We shall accept

office with the prefix of assistant except that of the Assistant Division Manager.

The report of activities of the Operating Department will be confined to relay routes and traffic handled. Primarily, the purpose of the A.R.R.L. is the relaying of friendly messages without charge. And they must be DELIVERED. Each division will be allotted a certain amount of space in QST every month for its report and that space will be determined by the actual number of amateurs in each division and the amount of traffic handled. Such reports will be compiled by the Division Manager

## Message Traffic Report By Divisions

FEBRUARY

DIVISION	C.W.			SPARK			TOTAL		
	Stns.	Mgs.	MPS	Stns.	Mgs.	MPS	Stns.	Mgs.	MPS
Atlantic	49	2529	52	25	1643	66	74	4172	63
Dakota	8	269	34	26	2443	94	34	2712	80
Delta	6	297	50	10	1253	125	16	1550	97
East Gulf	9	616	68	11	542	49	20	1158	58
Midwest	8	362	43	12	940	78	20	1302	65
New England	2	92	46	10	956	96	12	1048	87
Norwestern	2	41	22	18	1006	56	20	1047	52
Ontario	1	24	24	3	99	33	4	123	31
Pacific	6	332	55	11	1572	143	17	1904	112
West Gulf	7	94	13	36	3080	86	43	3174	74
Roanoke	12	349	29	11	222	20	23	571	25

Total 110 5005 45 173 13756 80 283 18761 67

Total Messages, Spark, 13756, 74%

Total Messages, C.W., 5005, 26%

applications from everyone and the best men will be selected for the various departments. The reason for this is the fact that the entire Operating Department is being overhauled. When we get through overhauling it we will have the organization so perfected that it will function under all conditions not barring even static.

The present scheme will provide for 18 Division Managers; 48 to 60 Assistant Division Managers (one for each state); 300 to 500 District Superintendents depending, upon location; (the office of Assistant District Superintendents will be discontinued) 100 to 300 City Managers; and all other titles will be discontinued being absorbed by men appointed to some one of the above offices. There will be no

or his appointee and must contain nothing but interesting facts concerning routes and traffic handled. Special mention of good work will be made when necessary to bring out such work. No individual report of messages handled will be made in the division reports, but the complete summary for each division will be shown each month with the station handling the greatest amount of messages honored as in the past. What we want is team-work or co-operation, not individual glory hunting. We want every man to work as part of his divisional machinery in order to make the division stand out prominently in relay affairs of the League.

The Dakota Division walks off with first honors this month and it looks like 600

messages or more are necessary to cop the prize.

\*\*\*\*\*  
 ● YANKTON COLLEGE, 9YAK  
 ● Yankton, S. D.  
 ● 604 Messages  
 ● Dakota Division  
 ● \*\*\*\*\*

**MID-WEST DIVISION**

L. A. Benson, Mgr.

**DISTRICT OF IOWA, P. A. Stover,**  
 Asst. Div. Mgr.: The following appointments are made for the State of Iowa to take effect immediately:

Asst. Division Manager: P. A. Stover, 9YA, 213 E. Market St., Iowa City, Iowa. District Supt.: D. R. Watts, 9ARZ, Clear Lake, Iowa. Supt. of Routes: K. R. Bloomer, 9KQ, 430 Harrison St., Burlington, Iowa. City Mgr. Des Moines: A. J. Tingley, 9DEH, 829 E. 28th St., City Mgr. Davenport: R. W. Sears, 1012 High St., 9MS. City Mgr. Clinton: D. I. Bailey, 525 Kenworth Court, 9CS.

The Asst. Div. Mgr. reserves the right to cancel any of the above appointments if at any time the duties of the officer are not properly carried out. City managers are needed for the following cities: Cedar Rapids, Council Bluffs, and Muscatine. Make applications to Asst. Div. Mgr. All station operators in the state are requested to mail a card to the Asst. Div. Mgr. before the fifteenth of each month stating the number of msgs handled and other information of value. All stations that report will be given due recognition in the district report.

The following routes are working satisfactorily: #1, 9ZA, 9BAP, 9DOF, 9ARZ, 9YAE, 9ZU. #2, 9CS, 9ACN, 9YA, 9DRA, 9AMU, 9JN or 9YI, 9OO or 9AUX, 9DBS. #3, 9AWX or 9UG or 9MS, 9ACN, 9YA, 9DRA, 9DEH or 9IY or 9OA, 9DJX, 9AEQ, 9HT. #4, 9KQ, 9PL, 9ABY, 9YO, 9AEQ, 9HT. #5, 9ARZ, 9DOF, 9YI or 9JN, 9IY or 9DEH or 9OA, 9YO. #6, 9ZA, 9DVO, 9YA, 9ACN, 9OZ, 9SL. If you want on these routes write us stating your qualifications.

9ACN is proving a valuable station on routes #3 and #2. 9FK and 9CS are high men in their section. 9AEQ gives us the following: 9DMB is on again and is proving an ideal relay station. 9XAJ at Bedford is working on 425 now and will QSR at any time. 9AEQ is changing to CW and with two fifty watters. 9MS and 9AWX roar in and are on almost any time after eleven; we have no msg report from them. 9ZU is coming into his own again and is working both spark and CW. 9YAE is helping to keep that district clear also and is doing some remarkable DX work. They maintain a constant watch, this being made

possible by having five good operators to draw from. Among the CW boys that are keeping the air hot are 9DOF, 9BAP, 9AMU and 9JN. Most of these installations are ten watt and on less than 200 meters. 9DEH, 9IY and 9OA are putting Des Moines on the map and between them they keep the city open every night.

**DISTRICT OF KANSAS, F. M. Ende,**  
 A.D.M. Fort Riley, Kansas: The new A.D.M. assumed the duties of that office just twelve days prior to the date of this report with the consequence that the data at hand is incomplete.

Hutchinson is a hot spot for relay west and exceptionally business-like work has been done by 9DSD, 9DUG, 9ALU, and 9ALV.

9ALU is always QRV between 2 and 4 A.M. being unable to carry on much traffic before this hour because of blinking all the lights with his spark set. (Get on the C.W. band-wagon O.M.) 9AUG did such good work in December that his performance was commented on in the report for Missouri and he continues to be a very consistent station. He is an invaluable link in the low power "dalite" C.W. route extending across the northern part of the state:—9ASD, 9DVB, and 9DTA to 9AOG to 9BOW and 9ZE. *Wanted, a C.W. station in Western Kansas to hook up to 9BOW.*

While Kansas is an exceptional locality for transmission and reception, the QRN season is more violent than in any other state in which the writer has used a receiver. Anticipating this, the Route Manager has adopted the policy of moving traffic by short jumps (C.W. preferred) to collecting stations situated close to the more powerful DX stations which will operate on schedule. Traffic will move "dalite" to collecting stations a few miles from DX stations and just before schedule time will be given to them en mass. 9DZE and 9PS will keep Wichita open almost constantly while 9RV and 9BOA will do the same in Emporia with 9DTS at Ottawa acting as collecting station with three operators accepting traffic at noon and from 7 to 10:30 P.M.

**New appointments:—**

Route Manager, 9PS, Ray Youngmeyer; City Mgr., Wichita, 9PS, Ray Youngmeyer; City Mgr., Emporia, 9RV, F. A. Miller; City Mgr., Lawrence, 9AOG, C. Himoe; City Mgr., Hutchinson, 9DSD, P. Wiley; City Mgr., Glasco and vicinity, 9AEY, E. Beardmore.

**MISSOURI, G. S. Turner, A.D.M.:**—Radio activity is due for a big boom in this state because of the new and very competent officers who have just been appointed. Plenty of things are happening down here in the Middle West and really this state is not as dead as some people imagine it to be.

The new officers who have been appointed for Missouri under the Division Managers new plan are, Mr. C. L. Klenk of St. Louis, Mo. District Supt. for Eastern Missouri, Mr. J. Abercombie of St. Joseph, Mo. District Supt. for Western Missouri. For Route Manager, Mr. O. McDaniels of 9YM fame has been chosen. Now fellows, that you know who they are, let us one and all get behind them and push. Give them your heartiest support and soon you will be surprised with the results.

Traffic has slowed up considerable in and around Kansas City the past month due to the numerous radio concerts that are



being sent out every evening from one or more of the broadcasting stations located in or near here. No work can be done at any time before eleven or twelve P.M. because of these concerts so the only fellows who handle traffic now are honest-to-goodness 'boiled owls. One of these birds, 9FM of Kansas City, deserves special mention because of the very efficient work he has done on a small 20-watt CW set. There are a few other stations in and around K.C. who deserve special mention but not because of any snappy relay work or long distance records. No! It is because of QRM and unlawful operating.

Stations 9EX, 9FA and 9NE, all operating small C.W. stations in St. Joseph are doing excellent work.

Going East out of K.C. and Independence we now have two new C.W. stations, one 9BNO and 9SJ. 9YM and 9DZI of Columbia are both doing fine work. Jefferson City, located in the central part of the state now has another DX station. It is owned and operated by the State Board of Agriculture. No call has been assigned it as yet but you who are acquainted with Corwins gentle voice (old 9ABD) will recognize him thru the QRM.

Appointments for St. Louis are as follows: Fred W. Schramm, 9DFQ, City Manager; Kent Ravenscroft, 9WT, 1st Ass't Dist. Supt.; Lorraine Jones, 9ACB, Ass't Dist. Supt.; Leslie Essington, 9BED, Ass't Route Manager.

DISTRICT OF NEBRASKA, John G. O'Rourke, Asst. Division Mgr.: Traffic has

been moving in the regular winter manner in this district during the past month. To date the following men have been appointed; Edwin R. Anderson, District Supt., Fred Ray Bullis, Asst. Supt. over the counties of Douglas, Sarpy, Washington, Dodge, and Saunders. Edward Mars, City Mgr., South Omaha Section of Omaha. The office of Route Mgr., and several Asst. District Superintendents have not been filled.

Not much traffic has been handled through Lincoln during the past month. 9AYS continues to do good work though on his C.W. which has caused many of the local men to give up the old spark. 9DQE reports being heard by many of the eastern fellows. 9DNC continues to be the most consistent traffic man in this section. 9WI, of York, Nebr., deserves credit for the efficient manner with which he has been relaying traffic into and from Kansas. He clears south most consistently through 9DSD. 9AIS, Sanders, of Hooper, in the north, sends in the following report; Blew up the spark set and have installed C.W. (getting to be an old story). Using two five watt tubes he has been working consistently over distances up to 500 miles. 9AIS has handled about sixty messages during the past month. He reports 9AJS is using two fifty-watt tubes with great success. 9BOQ also of Blair let his stove get to hot and burned up everthing but his receiving set. He has been using ten watts C.W. At last we have several good prospects located in Fremont. Oakland stations, too, are beginning to appear on the air.

#### ATLANTIC DIVISION

C. H. Stewart, Mgr.

New York City has been the scene of good relay work for the month with numerous stations on the air every night. In the upper Bronx 2XK has been the link between Manhattan and the Hudson River Route. No report was received from 2CT. A daylight route into Connecticut has been established with 1VQ and 1BKG. In spite of heavy QRM, considerable traffic has gone over this route simply because the gang has been observing the rules and regulations of the Council. 2ALG is rigging up a new antenna. The West Side Zone is represented by 2AEO, 2BEA, 2BGM and 2CHK. A manager for the Washington Heights Zone will be announced next month.

New Jersey traffic is moving in all directions except into Connecticut due to lack of stations on the air. Practically all traffic was handled by the following stations: 2OM, 2ALY, 2ACO, 2AML, 2AXH, 2AAF, 2DX,—spark. The CW stations were 2AOU, 2OF, 2OM, 2BNZ, 2AJF, 2AZZ, 2AOS, 2SQ, 2CDR, 2AGB, 2ASD, and 3CG. F. W. Applegate has been appointed City

Manager of Trenton. V. J. Braidwood has been appointed official station for Wildwood, Cape May and vicinity. Traffic stations doing good relay work are 3FP, 3BA, 3FB, 3BFU, and 3NB.

Brooklyn stations reporting last month are 2TS, 2BQU, 2AGC, 2RM, 2WB and 2PF. (Need a little help in Brooklyn so some stations will not be closed up—T.M.)

In the Hudson Valley District we find our good old reliables on the job every night with three new stations—2CE, 2ARK and 2NS. Of the old timers we find 2BM, 2DA, 2BB, 2AAC, and 2BK. (Who says they do not come back? It is reported that Runyon, ex-2ZS is all set with a powerful CW transmitter. We extend him our glad hand and wish him well and hope that he will make a report every month of his activities.—T.M.)

H. J. Brainard has been appointed city manager of Buffalo. 8QB has deserted the spark for CW and is reaching out F. B. 8BBK has done the same. 8BUM has worked 6XAD several times.

The most active stations in Pennsylvania are 8PN, 8AKW, 8ASB, 8QC, 8PT, 8BIL, 8AIO, 8BRL, 8LF, 3ZS, 8HR, 3AQR, 3ZO, and 3DM. Traffic to any one of these stations is sure fire delivery and they are on the job for all traffic.

Maryland has just five active stations in 3ZN, 3EM, 3AC, and 3HG, but these five can be relied upon for traffic in any direction.

L. M. Dunnam has been appointed district superintendent for the District of Columbia. No difficulty is experienced in traffic for Washington with such splendid co-operation of all stations. 3ALN has worked 6XAD several times. 3LR has been heard on the coast. 3JJ has broken into the DX column on several instances. The most prominent stations for last month were 3ZY, 3ALN, 3JJ, 3AFU, 3XL, 3AHU, 3KM, 3CI, 3ARN.

#### EAST GULF DIVISION

B. W. Benning, Mgr.

Although a great deal of traffic has been handled in this Division this month, our report is a rather limited one, due to a number of the District Superintendents attending the Convention and the consequent failure of the Assistant Division Manager to receive the information necessary for the compilation of a complete report.

Bradentown, Fla.—City Manager Clough has aroused much interest by his radio demonstrations at the Midwinter Fair. West Palm Beach, Fla.—4DZ and 4BC continue to do good work (DX) on their spark sets, but no report of messages handled sent in. St. Petersburg, Fla.—4JY and 4IW, C.W., are beginning to come through. A number of new stations are being installed

thanks to the efforts of City Manager Hall who is to be complimented on his good work in organization and boosting of interest.

Jacksonville, Fla.—There are five spark sets in Jax. All need better tuning to enable them to do DX work. We shall expect City Manager Clark to get in behind these and put them in good shape! 4ZE with the best antenna in the State, reports 121 messages handled on C.W. 4BP has his spark roaring, and will handle traffic from now on. 4EZ has a good spark set.

Orlando, Fla.—4II handled 70 messages on C.W., The Dist. Supt. wishes to heartily thank the A.R.R.L. men of Florida for making it possible for him to attend the Convention as Delegate. He discovered a thousand new ideas, which he will put to good and efficient use in his organization work throughout the State.

Atlanta, Ga.—A city boasting a bunch of genuine good fellows in the radio game—and a big bunch, too. Heretofore, it has done rather mediocre work in DX work, considering the large number of stations, but which this month did such a roaring relay business that a genuine Aurora Borealis still hangs over the city. LISTEN! FIVE HUNDRED SEVENTY FIVE messages handled! They did it like this—4FT, 280 messages, C.W.; 4CG, 86 msgs, 10 C. W. and 76 spark; 4AU, 85 msgs, spark; 4YA, 15 msgs, spark; 4CO, 30 msgs, spark; 4HS, 25 msgs, spark; 4BI, 18 msgs, spark; 4EH, 10 msgs, C.W.; 4ZF, 10 msgs, C.W.; 4HW, 10 msgs, C.W.; 4GM, 6 msgs, spark. The record made by 4FT is certainly an enviable one for this section. It is true his antenna is atop one of the "skyscrapers" but for this we will hand him a large sized laurel wreath for his accomplishment.

4FT has also made some distance records, having been heard six times on the Pacific Coast and having worked a station in Boulder, Colorado. Yet we do not lose sight of the good work done by all the others; many of them working under most adverse conditions. All stations in Atlanta are heartily co-operating in keeping down local QRM, and the general efficiency in handling DX work has been increased several hundred per cent on this account. A good deal of traffic heretofore given 4GN or 4FD for Florida points is now being handled direct with Florida stations, and this service is expected to be improved to a great extent in the early future. 4EA and 4CX are helping move quite a bit of traffic that was formerly mailed over certain dead spots. The Atlanta Radio Club is now installing a set, and the schedule is that this set will be in continuous operation every night. It is being installed by Messrs. Edwards 4CG, Pigford 4BX, and Ward 4AU. You will recollect the At-

lanta bunch told us some time ago to WATCH THEM!

Athens, Ga.—The habitat of OM 4AG. This is slyly slipped in the middle of the report just to remind folks that the OM's key is covered with cob-webs at present. However, he lubricated it sufficiently to squeeze thru twelve messages this past month—all spark.

Macon, Ga.—Ah, here we see that 4DH, of LaGrange escaped with his life and attended the Convention! No wonder we received no report from him! 4GU at Macon handled 3. 4AS at Macon handled 10. 4BK handled 90 messages with that "bottle" set he put in not long ago. 4AS is installing a C.W. set—10-watts. 4JH and 4BW while having handled no messages are doing some DX work and will probably soon get in line. Mr. C. H. Humphreys is putting in a 15-watt C.W. set.

Midville, Ga.—4GU and 4FD have long handled a big bunch of spark traffic to and from Florida points. 4FD has been tinkering with C.W. lately, and while he was thus occupied 4GN managed to jam thru 100 messages with his spark while 4FD connected to the extent of an even dozen. He will come, however!

Savannah, Ga.—4GL attended the Convention, and returning to Savannah threw so much at our erstwhile industrious Dist. Supt. that he fainted dead away. Hodge is in business on Bull Street and should have been immune, but 4GL must have a nasty left. If he sends with it we know he has—that forty per. In justice to all parties concerned we cannot do better than report, verbatim, the telegram received from 4BY on the 24th inst. after the doctors brought him around.

"Hodge 124 Hill 174 Hahne aerial down. Intermittently in communication west. Otherwise no report." Which means that 4BY handled 124 messages C.W. 4GL handled 174 messages C.W.

#### DELTA DIVISION

Hubert E. deBen, Acting Mgr.

All the Districts have shown exceedingly fine form and we are especially glad to note the increased activity in the Tennessee District. Supt. Hutcheson and his C.M.s deserve much credit for the good work they have been doing both in organization and traffic work.

We are pleased to announce that the Pullen Brothers, 5ZAB, Houma, Louisiana have been appointed Traffic Chiefs of the division. In the future all traffic reports should be forwarded direct to them and should be in their hands not later than the 20th of the month. The district reports follow:

ARKANSAS:— Mr. Kinsolving reports a great deal of activity prevailing through-

out his district with many new stations in operation. Hot Springs:—The amateurs there have at last put Hot Springs on the radio map in red letters. There are quite an enthusiastic number of stations with 5JB standing out as doing the "big work." 5JB has a 50-watt C.W. transmitter which raises some rumpus in the air. Arkadelphia: 5MA is doing good work with his 100-watt phone set. Conway: 5UE is treating the ether rough these days. For a new man he is exceptionally good. Morrilton: 5UC breaks out now and then and sometimes handles a clump. Why not come on more regular, UC? Little Rock: Same lineup as usual, viz: 5ZL, 5JD, 5SM, 5RO, and a couple of new ones, 5CR and 5JF. The absence from the air of 5ZL and 5JD worked havoc on our traffic total.

LOUISIANA—Houma: 5ZAB, Pullen Brothers, have proven beyond a doubt that their station is one of the most efficient and consistent in the country. An excellent example of what a good station in the hands of a couple of good ops can do. How that C.W. does carry, though! Although never having transmitted on C.W. 5ZAB has been reported over a dozen times and as result, they have threatened to make themselves heard on same. Plaquemine: 5KC, Vincent Rosso, is still knocking the ether for a goal out his way. He has made many improvements in his transmitter with the result that his sigs come in twice as loud as formerly.

Shreveport: 5ZS still works in spasms. Shreveport has now a wealth of stations but none other than ZS have succeeded in reaching over the city walls as yet. New Orleans: Much activity here with DX lineup as follows: 5XQ, 5LA, 5ZAP, 5AA. Brother Lehde gave us quite a pleasant surprise the other night when he handled six with 9ZJ with hardly a break. 5LA with his C.W. transmitter is also putting 'em over the plate.

MISSISSIPPI: University: 5YE is back on the air. It took Prof. Kennon nearly all winter to get started but judging from YE's sigs his efforts will be well compensated.

TENNESSEE: February was a record month for this district. More traffic was handled than any previous month. Knoxville: 5UU has been handling traffic in fine shape. 5WS has a 50-watt transmitter in operation and will be ready to handle traffic shortly. 5XK has disposed of his rock crusher and will replace it with a 50-watt C.W. transmitter. Chattanooga: 5MB has his 20-watt C.W. transmitter going and his signals have been reported from Buffalo, N. Y. 5AAG has opened up with a ten-watt C.W. Nashville: 5AAB, 5AAM, and 5NM, all have installed C.W. 5AAB has a 1KW with which he has been doing some good DX work. 5FV has disposed of his

spark transmitter and has gone to 50-watt C.W. on which he can be heard handling traffic any night. 5ER has gone back to the ole rock crusher having been unable to handle any traffic on his C.W. transmitter since December. Memphis: We are indebted to Mr. John C. Flippin, 5LF, for the following report: 5NZ has opened up with a 20-watt C.W. transmitter and is doing good DX work. 5KU has the best C.W. station in Memphis and is doing fine work. He has no difficulty handling traffic north. Wind Rock: 5DA is away from the set most of the time, but when he IS on we all



know it. He has handled most of his traffic on spark but promises to have his 50-watt C.W. going again soon.

**DAKOTA DIVISION**

**Boyd Phelps, Mgr.**

9YAK, Yankton College, Yankton, S. D., has become a real relay station for east and west traffic between 9ZN and 7's in Montana. 9AIG at Sioux Falls, S. D., is a reliable station for traffic in all directions but a great deal of his business comes thru 9AMB and Canadian 4CB. 9EA at Duluth deserves a great deal of credit in putting his city on the map and in working the Twin Cities regularly over territory heretofore unworkable.

Especial mention is due the stations on the Emergency Traffic Route who established communication during storm conditions when all of the land lines were down. A detailed report of this route appears elsewhere in QST.

**ONTARIO DIVISION**

**A. H. K. Russell, Mgr.**

The past month has been excellent for wireless work, but the broadcasting programmes have cast rather a damper over the relaying of messages.

No reports have been received from Districts Nos. 1 and 2, 4 or 6. The Division Manager would drop dead if he ever got all the Districts to report in one month. This time only Toronto and Kingston have been heard from and Kingston reports only 15 messages handled by 3HE, mostly over short distances. Tests run between these two districts worked satisfactorily from 3GE

to 3HE but no signals were heard from 3HE.

In Toronto and vicinity quite a few stations have been in relay work, 3FO being most active with 49 messages, 3EI with 35, and 3GE with 15. All the above were on spark 9AL on CW handled 24 messages.

District No 4 has no report this month from 3BP, who came for a while to Toronto to try his luck, but who gave up in despair and went back to Newmarket, saying that he could do more DX in a night there than in a month in the city with its thousand little qrmers. We believe him, and are glad his spark is not in Toronto to add to it.

**ALASKAN DIVISION**

**Roy Anderson, Mgr.**

In spite of the fact that we had excellent weather for radio no one in the division heard anything in the way of stations that amounted to very much. Nothing further to report.

**PACIFIC DIVISION**

**J. V. Wise, Mgr.**

John F. Gray of Del Mar, California has been appointed Assistant Division Manager. Other appointments will be announced later.

District A: The traffic route to the east has been in operation with 6ZZ and 6TV handling the bulk of traffic. 6AAH takes everything for Phoenix in addition to some eastbound traffic. 6RS will handle everything for the northern end of the state.

District B: 6ZB works C.W. on 375 and spark on 200. We have a new "OW" with us at 6BAZ who is reaching out very well.

District C: This is the C.W. district. 6EN will act in place of 6ZN until further notice. Practically all stations are QSO Denver and a direct route is being established. 6ZR, 6ZK and 6ZAF have been heard in Honolulu. Among the good working C.W. stations are 6XAQ, 6ALU, 6CU, 6KA, 6KY and 6JD. The sparks are 6ZAL, 6ZR, 6ALU, 6AMN, 6GP, 6ACY, 6ALD, 6BDZ, 6ADL, 6OD and 6OL.

District D: Mr. Winsler, 6AIF has been appointed Supt. of this district to which has been added the counties of Kern, Kings, and Tulare. San Bernadino has been transferred to "C." 6AIF clears with 5ZA and 6ZA and is the only station working at present, C.W. and spark.

Districts E. F. G. H. I: 6AS has been appointed Supt. of District "F" and 6GF of District "H." Practically every station in these districts has been able to work in all directions and no definite traffic routes have been established. 6AIX in Yreka is very close to the Oregon line and will handle northern traffic.

District J: 6ZO with his C.W. opens up another route east via 6ZA. 6QR is an old standby for traffic over the central route to the east and handles his share north and south as well.

#### NEW ENGLAND DIVISION

G. R. Entwistle, Mgr.

The New England Division is undergoing a reorganization at the present time, the old relay routes are being polished and new ones are being whipped into shape.

Robert L. Northrup, 1COA, has been appointed executive assistant to the division manager. R. P. Siskind, 1ES, has been appointed City Manager of Boston succeeding P. J. Furlong who cannot give sufficient time to League work to do it justice.

D. Mix, 1TS, Assistant Division Manager, Connecticut.

H. W. Castner, 1UQ, Assistant Division Manager, Maine.

P. Robinson, 1CK, Assistant Division Manager, Eastern, Mass.

A. S. McLean, 1JQ, Assistant Division Manager, Western Mass.

J. F. Sullivan, Assistant Division Manager, Rhode Island.

L. G. Pollard, 1ARY, Assistant Division Manager, Vermont.

#### ROANOKE DIVISION

W. T. Gravely, Mgr.

Reported by A. G. Heck, 8CHO

Because of the resignation of F. L. Bunker and K. K. Kramer who could not give enough time to carry on League work, Taylor M. Simpson of Winston, N. C. will handle the entire state until other appointments can be made.

J. F. Key has been appointed Assistant District Supt. of northern Virginia.

Outside of the report from 4EA there has been little activity to report in eastern North Carolina. Outlets to the south are very good through 4GL, 4GN, and 4BY. Some traffic has been going through 4EN, and 4CX.

3AOV is reaching out to the south and west and good work is being done by 3HL, 8ZX, 3BHX, 3BNM, 3AAL, 3BHS, and 8ZAA. 3RF, 3CA, 3BIY, and 3APA handled most of the traffic.

We miss the good old stations around Norfolk of 3EN, 3XY, 3ACT, 3ACJ, 3ADJ and 3ACK. What is the matter and when will you all be back?

In West Virginia 8SP has been the leader as a vast amount of traffic has been going through during the past month. 8AUE, 8WD, 8AXY, 8BDB, and 8CHO have come in for their share without a flinch.

Just in time comes word from Richmond that 3TJ and 3MO have had a siege of the flu but are recuperating rapidly with C.W.

and spark to help them. 3BLF on C.W. has handled some traffic, and has a day-light schedule with 3BHL of Crozet.

#### NORTHWESTERN DIVISION

H. F. Mason, Mgr.

Extensive re-organization has been under way in this division.

Montana Section: About four stations in Montana have done consistent work through the static and northern lights which have prevailed during the past month. These are 7ZU at Billings; 7VZ at Libby; 7XB at Bozeman, who is working on 450 and has been logged off S. Carolina on a crystal; and 7LY, the A.D.M.'s station. 7EX is doing good work.

Washington Section: H. G. Reichert, 7CE, of Tacoma, our new A.D.M. is just getting things lined up and reports as follows: Traffic has moved briskly through Tacoma during the past month, stations handling DX being 7BC, 7BG, 7WM, and 7VZ on spark, and 7QE and 7CE on C.W. Incidentally, these are the only stations handling traffic on C.W. in the division. Miss 7CB will be on the air again. 7QE has been doing very good work on I.C.W. and has developed a near DX set. 7CE is planning a larger C.W. installation. 7BC reports early morning communication with 7MP a very easy matter, and has handled the bulk of the Tacoma traffic east.

D.S. Kinsey, 7PO of Seattle reports that most of the traffic there is being handled by 7IY, 7PO, and 7BK. Work can be done with 7FI, 7CK and 7MP at times but fading is bad. What we need is shorter jumps in getting the eastern traffic over the mountains and it may be that C.W. is coming to the rescue. 7RN of Cashmere and 7AAV of Wenatchee are both QSA on C.W. and as they are both located about midway between Seattle and Spokane there will be a clear ticket east. Seattle traffic has been moving regularly south to the sixes of whom a fair number are very consistent. Canadian 9AX, 9BD, and 5AK are worked to the north even though bad QSS. Canadian 4CB, at Morse, Sask. is also QSA is Seattle. 7SC of Seattle has moved to Aberdeen but he writes that he will have both spark and C.W. going again soon and will cut through the QSS which exists between there and Seattle.

Idaho and Central Section: 7YA, 7ZM, and 7YL are keeping things moving in fine shape on 375. Eastbound traffic on 200 however is nearly at a standstill. Old reliable 7FI is out with condenser trouble.

Oregon Section: Our old friend Royal Mumford of 7ZJ fame has been appointed Asst. Div. Mgr. and is lining things up in fine shape. 7BJ, at Vancouver, Wash., has been doing consistent work during the past month. 6AGF seems to be his best bet in the south with 7GE and 7FI to the



east and 7BK in the north. 7NN and 7KJ are also worked regularly. The Signal Corps at Vancouver Barracks signing CL8 have recently installed a 375 meter spark for the purpose of handling relay traffic. They work 7BC to the north and 6ZAE, 6KY, and 6KA to the south. 7ZU and 7YA have been worked from CL8 on their 15-watt fone, and the voice from a similar set at 7YA is very QSA here. 7ZJ is now handling A.R.R.L. traffic on schedule with 6ZAC of Hawaii who gives his QSL via mail. Bulk of traffic goes to 6ZK, 6ANG, 7ZU, 7ZM, 7YS and 7BK.

In Portland, 7JW, 7GJ, 7ZT, and 7BB are handling the bulk of the traffic. Owing to the fact that the higher power relay stations usually QRX early in the evening during the music broadcasts, relay traffic is handled at later hours and has fallen off. 7GJ managed to get in touch with 9YAK one morning when the QRM let up a bit. 7ED is back on the job again, clearing traffic in his accustomed manner. 7ZB is installing C.W.

C. A. Lockwood, 7TJ, the new D.S. at Salem reports heavy traffic, the most of which came through 6EX, 6AGF, 6AS, while in the 7th district most of it was handled with 7BC, 7BK, and 7JW. Eastern traffic is being routed through 6QR during the break in the 200 meter route in the Idaho section. Mr. Lockwood is to be commended on the manner in which he carries out his policy of sticking to the key until the hook is clear. 7IN of Salem is at present out of commission. The local radio club at Salem has appointed 7TJ traffic chief with two assistants, 7HA and 7MU. 7GO is doing good on C.W. Eugene traffic is being routed through 7YJ and 7OH of Corvallis. In Eugene many of the fellows are working out in fine shape. 7IW, 7HF, and 7MF are on the air every night. 7QT has recently come on the job with a ten-watt C.W. set. 7IL, 7HN and 7MF also have five watt sets.

Mr. Thibodo, our D.S. at Seaside, Ore. is with us again. 7KS is also back on the job after remodeling and has worked 7HF, 7TO, 7IW, and 7HM, 7NZ, 7NY, and 7NF have been heard on the air and we welcome these prospective relay stations.

#### WEST GULF DIVISION

F. M. Corlett, Mgr.

SOUTHEAST TEXAS DISTRICT; Port Arthur territory is still out. Beaumont still dead. Kountze, Texas, writes words of encouragement thru their representative station 5ZAJ, but as yet are N.D. at Houston. At present our only relay east is 5ZAB which is located beyond our border. 5XB continues to be our star station under the able leadership of "Doc" Tolson. Mr. Tolson has just recently been appointed Asst. District Supt., and is giving us the

best that is in him. Bryan, Texas is fast coming to the front. 5MX is installing a ten-watt C.W. set at Bryan. 5QQ has opened up a much needed gap between 5XB and Dallas. 5XB announces that they will not accept traffic between the hours of 7 P.M. and 8:45 P.M. thru courtesy to the concert broadcasting stations, with which they interfere.

SOUTHCENTRAL TEXAS DISTRICT; 5XU with its corps of operators, holds the air most of the time. 5ZU says that his 100-watt C.W. set is measuring up to his most sanguine expectations. San Marcos never heard anymore altho it has three fine stations; 'smatter Stephens? Elgin with 5KP and his C.W. and sink set is on the air every nite and has had flattering reports from wonderful distances on both voice and C.W. using 15-watt set. 5XU handles most of the traffic for this district.

SOUTHWEST TEXAS DISTRICT; GP4 at Kelly Field Airdrome takes first place this month. What's the matter 5ZAK, can't you find that condenser? We often hear of shot condensers but a condenser that disappears is a new one on us. Sgt. Clark at



Laredo is probably the busiest station as he maintains a regular schedule with Eagle Pass and San Antonio daily clearing all traffic. 5MT is doing splendid work with a ten-watt set, working well into Kansas and Illinois. 5UF having the usual condenser and gap troubles. 5ZAE, 5CH, and 5ZAK have recently made a visit to Houston, and as this report goes to press, all three are rebuilding their stations. 5ZR is on occasionally but does not maintain a regular schedule. This district regrets the loss of San Antonio City Manager Rayburn, but because of other duties and his removal from the city, his resignation was tendered and acted upon. 5ZAK is constructing a new C.W. set of 200-watts. Many busy stations failed to make their usual reports this month, including 5TT, 5TG, 5CQ, 5ZW, 5ZAA, 5NK, and 5JI. Please note this, and in the future see to it that your District Supt. gets this information on the 15th of each month.

NORTH TEXAS SECTION: D.S. Martin of Amarillo reports radio activities in his District continue to increase and a number of receiving stations are under con-

struction. Experimenting amateurs continue to enjoy the radio phone concerts, the preaching and other radio phone experiments.

5IF is continuing to relay traffic between east and west assisting 5ZA to get the stuff across. The usual route for west traffic being to 6ZZ and 6TV. 6ZZ being the most effective and consistent owing to the QRM from ninth and fifth district stations. 6TV is QSA at 5IF but closer stations crowd him out. 6AAH and 6APP are trying to establish relay schedules with 5IF but the same QRM prevents them being readable for traffic.

Traffic north has been going via 9DUG, 9ZAC, 9ABV, 9WI, 9DEZ and 9DSD. Stations 9DSD and 9ABV have been most consistent for both transmitting and receiving of traffic in their direction.

Traffic for east, southeast and northeast has been handled through 5FO, 5HK, 5IR, 5IS, 5XU, 5NC, 5NK, 5XJ, 5BY and 5PE. 5PE, 5HK and 5XU have been most consistent. The others have been QSA and were good relays at the time they were worked.

The NORTH CENTRAL DISTRICT is still plugging along in grand style and has managed to run up a few messages. 5NS, 5FI, 5QQ, are keeping things hot up their way. Edwin Gaston of the Granbury territory has been appointed City Mgr.

D.S. Neel, Dublin, Texas is having a hard time of trying to hear from some of the stations in the northern part of his District and would appreciate a letter from any of the stations up that way.

Abilene is getting along, 5YN being the most consistent station at this time.

Alton McCallan of Stamford has been appointed City Mgr. of that City.

Brownwood is doing some fine work and is ahead of most of us in as much as they have one of the liveliest clubs in this District.

All stations in Dublin are running fine with 5IR the star station. 5XJ has been crippled a great deal as one of the best operators, Mr. House has moved away.

5AO, Hamilton has been reaching out, but the fierce winds that have visited this part of the country lately, got the best of his aerial. Mr. Jordan has been appointed City Manager of Hamilton.

Report from NORTHEAST TEXAS is slim this month. Colwell reports traffic still moving in fine shape.

E. R. Mansnerius 5NC, Dallas desiring to show Mr. D. W. Hume, F.D.D. of Government Saving Division the power of amateur radio, suggested to Mr. Hume to give him a message destined to all Postmasters in Texas, New Mexico and parts of Oklahoma. Mr. Hume consented and received the surprise of his life. Mansnerius broadcasted this message nightly from his

station, likewise giving it to every station he could raise and further kept the pot boiling by sending a copy of said message to 5NK at Houston, 5IF at Amarillo, 5ZA at Roswell, N. M., 5IS at Greenville, 5XJ at Dublin asking them to go to the limit in getting a copy to every station in Texas and New Mexico. With the untiring efforts of these real bugs and others Mr. Hume's office was flooded with letters and messages from postmasters and several good sales resulted from same. Mr. Hume wishes to thank the above parties and all members of the A.R.R.L. who did their bit in putting this over and is so enthused over it he has come back for more, giving Mansnerius another message.

## SECOND DISTRICT CONVENTION

(Continued from page 34)

Second District Executive Radio Council and a rising call of all the A.R.R.L. members present, which included approximately two thirds of those present. F. H. Schnell, our Traffic Manager, was next on the speakers' list and gave a report of the President's-Governors' Relay which was run just prior to the Convention. Following our Traffic Manager, Paul Godley of Transatlantic fame discussed further some of his Transatlantic experiences and international amateur radio. He was presented with a large bronze tablet commemorating his work in Scotland, the gift of the amateurs of the second district.

All of the amateurs present who were successful in the Transatlantic tests were then introduced the following being on hand: 1AFV, 1BCG, 1XM, 2AJW, 2BK, 2DN, 2EL, 2FD, 2ZL and 8XV. Our President Hiram Percy Maxim was the next speaker on the list but was unable to attend, a telegram being read expressing his regret at his inability to be present, because of illness. Sickness also robbed the banquet of two other interesting talkers, Mr. E. H. Armstrong and Mr. George E. Burghard.

J. Andrew White, editor of "Wireless Age", told some amusing anecdotes on broadcasting and related some of his experiences operating at the broadcasting station WDY. The last speaker on the program was our secretary-editor, K. B. Warner, who spoke on the relations of the A.R.R.L. at the radio conference at Washington and the policies that were being followed.

At the conclusion of the banquet a reception was given to Paul Godley and everyone had a chance to shake with the man who made the A.R.R.L. Transatlantic successful.

This was the final event of the convention, and everyone declared it a very successful one and long to be remembered.



# Amateur Radio Stations



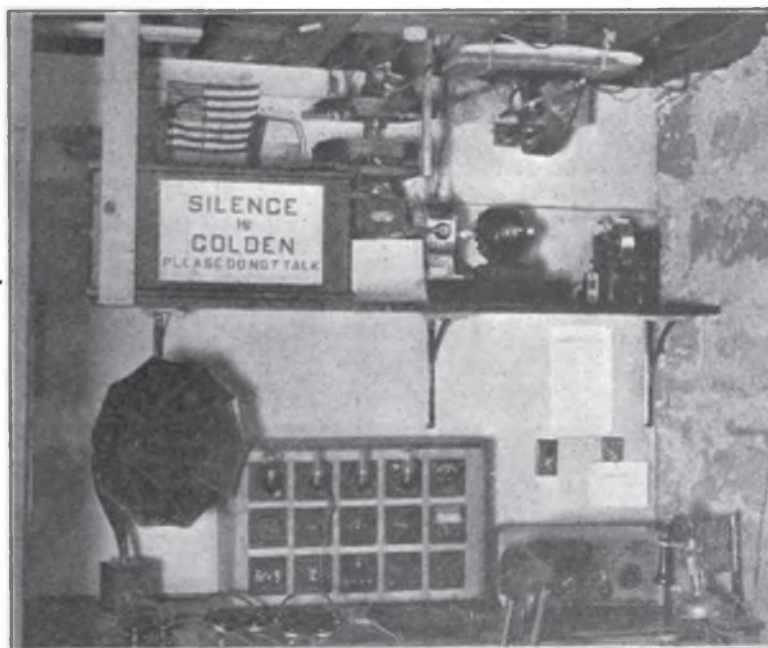
## 7ZU, Polytechnic, Montana

7ZU is the station of Glenn E. West and has been particularly active in transcontinental relay work during the past season, being one of the connecting links with the Northwest.

The antenna is a 17-wire vertical fan supported on two masts 65 feet high and 70 feet apart. The masts are in three sections, the first being 30 feet high by six inches square, while the remaining two are

United Wireless "coffin," Dubilier .007 mfd. condenser, Benwood sink gap and a rather interesting oscillation transformer, being made of heavy multiflex braided copper ribbon, the size of which gives an effective width of eight inches in the primary coil and four inches in the secondary. The antenna current is 4.9 thermo-couple amperes on the 375 meter wave.

The receiver is entirely home-made and



of two-inch galvanized pipe. Eleven guy wires are used to stay each mast. The ground system consists of a Rounds' round ground using old hot water tanks evenly spaced in a circle 40 feet in diameter and buried to a depth of four feet. A heavy insulated wire runs from each tank to the oscillation transformer. This gives a most effective ground system and certainly one of low resistance.

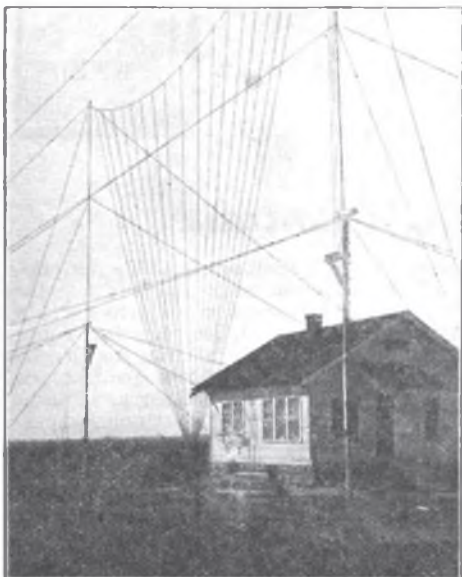
The transmitter uses a one kilowatt

comprises a short wave regenerative set using variometers with a detector and three-stage amplifier, the third stage being used only when the Magnavox is in circuit.

7ZU is located at a very strategic point and serves as a kind of clearing-house for coast-bound traffic. Regular schedules are maintained with 7ZJ at Vancouver, Washington, and 9YAE at Le Mars, Iowa. These jumps are both around 900 miles and very consistent work has been done in spite of

the distance. Signals from 7ZU have been reported frequently on both coasts and the working record is approximately 2200 miles.

## Canadian 9BD, Vancouver, B.C.



A new 100-watt C.W. set has just been added and it is hoped that it will maintain good consistent communication during the summer season and be of help in working through some of the fierce Ninth District QRM. The plate supply is from a 1500 volt motor-generator unit of 250 watts capacity. Further details are lacking but we will wager that the C.W. set will be heard in a goodly portion of the country.

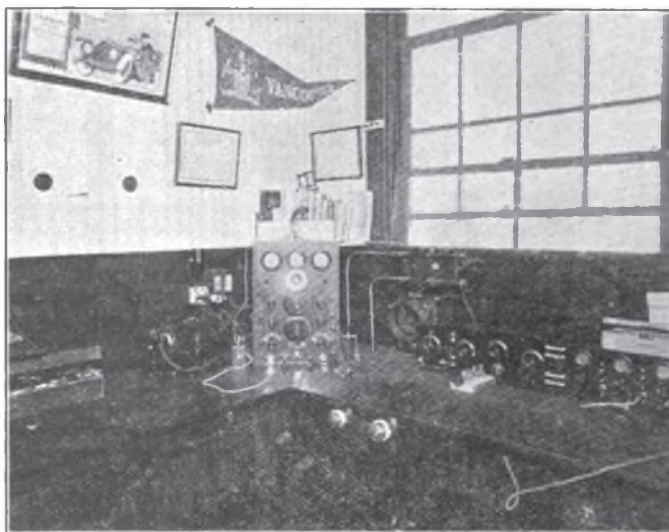
We take pleasure in presenting this month one of the star stations of our Canadian cousins of the Northwest. 9BD is located in the Barron Hotel, Vancouver, and owned by William D. Wood. It is a special licensed station for operation on 200 meters, with spark and valves.

The spark transmitter, which is enclosed under the table, consists of a 1-kilowatt Thordarson transformer, Benwood sink gap, condenser of four Marconi jars giving a total capacity of .012 mfd., and an extra heavy O.T. A 1-kilowatt United Wireless "coffin" is so arranged that it may be used in place of the Thordarson. The spark transmitter uses a tuned counterpoise with the regular ground and an antenna current of 3.8 amps is obtained on a 480 spark note, and 4.6 amps on a 240 spark note.

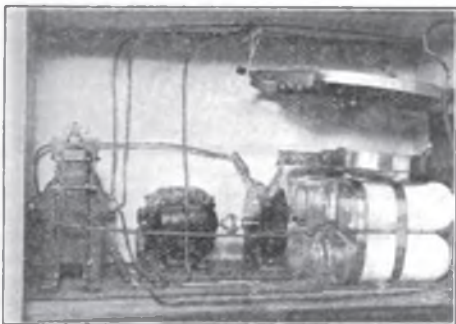
The antenna and counterpoise are located on the roof of the hotel which is 110 feet above the street level. A 41-foot pole supports the free end and a 36 foot pole the lower closed end. The aerial proper is an inverted L of seven wires with a cage lead-in, giving a total length of 100 feet. A counterpoise is used, being a duplicate of the antenna and 80 feet long. A ground is also used and the counterpoise tuned with the small O.T. under the antenna switch, which results in better antenna characteristics.

Like most of the progressive stations, 9BD has a C.W. transmitter to work with when the conditions are not suitable for spark and which has been reported up and down the Pacific coast and across the Rockies, to 4CB in Saskatchewan who has

Station Interior  
At Canadian 9BD,  
Vancouver, B. C.



been worked successfully. The C.W. transmitter uses four Western Electric VT-2's in a reversed feedback circuit which has



been very popular of late. The plate potential is supplied by a 500-volt motor-generator unit which may be seen in the photo-

graph near the transmitter panel. Controls are so arranged that either phone or C.W. may be used. The phone circuit uses two tubes as oscillators and two as modulators in a Heising system and has given a very good range, being heard in Portland, Oregon, a distance of approximately 350 miles. The antenna current is 1.5 amps. with an input of 50-watts on a wave length of 230 meters.

The receiver consists of a Radio Shop regenerative tuner with a home-made detector and two stage audio amplifier. A long wave loader may be inserted in place of the series condenser, which loads up the regenerator to 1800 meters with good efficiency.

9BD has taken an active part in the relay work in the Northwest and his signals have been reported on both spark and C.W. up and down the Pacific coast and the spark has been copied in Hawaii by a ship operator.

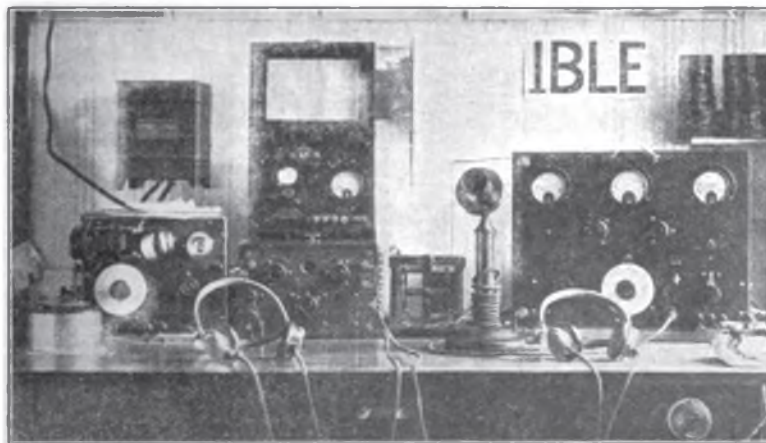
## 1BLE, Boston, Mass.

Here is the station of Mr. Alfred Brust at 1289 Massachusetts Ave., Arlington Heights, Boston, which has done very good work with its 20-watt C.W. transmitter and phone.

The antenna is an inverted L, two wires 90 feet long and 5 feet apart at a height of 50 feet. A counterpoise is used and con-

usual three-coil circuit, a detector and a two-step General Radio amplifier, on which amateur stations from all districts except the sixth and seventh have been copied, as well as the long wave commercial and naval arcs.

The call 1BLE has just been re-issued and Mr. McNamara, the operator, is an-



sists of six wires spaced 5 feet apart, centered directly under the antenna.

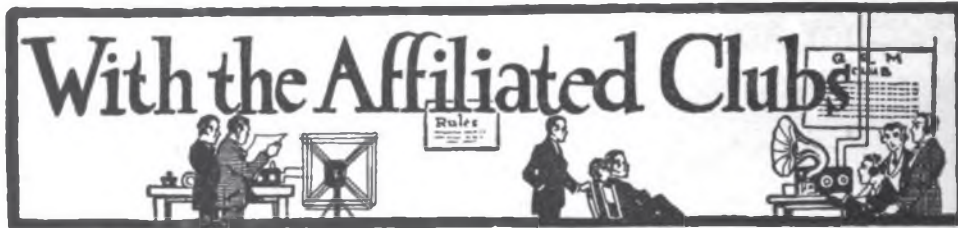
The transmitter is a twenty-watt outfit using Radiotrons and is so arranged that two tubes may be employed as oscillators and two as modulators in a Heising system. The oscillating circuit is a Colpitts. Convenient switching arrangements are provided whereby phone, straight C.W. or buzzer modulated may be used. The antenna current approximates  $1\frac{1}{2}$  amperes.

The receiver uses honeycomb coils in the

xious to receive further reports on his signals.

### Correction Notice.

The advertisement of the Crosley Mfg. Co., on page 131, March QST, describing the Crosley Harko Senior Radio Receiver was, through a typographical error, made to read: "The hook-up is special—of our own design and is now regenerative." This should read: —"and is NOT regenerative." —Ed.



**T**HE A. R. R. L. has the pleasure of announcing the completion of affiliation of the following societies as of Feb. 17, 1922:

Huron Radio Club, Huron, So. Dakota.  
 Amateur Radio Association of Parker, Parker, So. Dakota.  
 Twin City Radio Club, Minneapolis, Minn.  
 Holland Radio Association, Holland, Mich.  
 Chantien Valley Radio Club, Crafton, Pittsburgh, Pa.  
 Groton Radio League, Groton, N. Y.  
 Asbury Park Radio Club, Asbury Park, N. J.  
 The Reading Radio Club, Reading, Pa.  
 The Trumbull Radio Club, Niles, Ohio.

Some of the club papers that we find great pleasure in reading and which were received last month were:

Wouff Hong, by I. R. R. L. Iowa.  
 Rome Radio News, by Y.M.C.A. Radio Club, Rome, N. Y.  
 Radio Digest, by Springfield Radio Ass'n.  
 Delta Division News, By A.R.R.L. Delta Division.  
 The Oscillator, by Y.M.C.A. Radio Club, Sioux Falls, S. D.  
 Kick Backs, by Twin City Radio Club, Minneapolis, Minn.

**The Chelsea Radio Association (N. Y.)**  
 Meetings are held every Thursday night at 8 o'clock in the Hudson Guild Clubhouse, 436 W. 27th St. At the last meeting Mr. Wilson of the Western Electric Co. talked on the construction, care and practical operation of vacuum tubes. A large crowd of members listened to Mr. Wilson's very interesting talk.

**Lansdowne Radio Association, (Lansdowne, Pa.)**

The Lansdowne Radio Association now has about 25 members after starting out with 8 members two months ago. Plans are now being made to install a complete transmitter and receiver for relay work. Meetings are held every Tuesday evening at 8 o'clock in the rear of No. 16 Wycombe Ave. Visitors are always welcome.

**Lowell Radio Club (Lowell, Mass.)**

Club members of the Lowell Radio Club entertained members from the Interstate

Radio & Research Club of Haverhill, E. M. Robinson, of Boston showed pictures of the action of Vacuum Tubes. Walter Butterworth, Assistant Radio Inspector of the first district made an interesting talk on the enforcement of Government regulations. Refreshments were served during a general Ham Fest in which all indulged.

**Rocky Mountain Radio Association**

At a recent meeting, Professor Hyslop of Denver gave an interesting lecture on the fundamentals of radio, demonstrating same with tuning forks and pendulums. The Olinger Hylander Radio Club also of Denver was affiliated with the Rocky Mountain Radio Assn. at the last meeting.

**The Houston Radio Club**

The Houston Radio Club held its Second Annual Banquet and "hamfest" in the Y.M.C.A. Banquet room, on Saturday nite, February 11th. The decorations were unique, and featuring a theme of Americanism. Beautiful silken national flags were everywhere in evidence and the color scheme of the red, white and blue, together with "stars of the ether" decoration was most effective. A perfectly constructed antenna system in miniature was the table motif and with Southern Pine and Spanish moss forming runners for the center of the table. The illumination of the table was augmented by tapers in the national colors. After dinner talks were made by the prominent visiting guests and officers of the A. R. R. L. Among the prominent out of town guests were: Mr. Frank M. Corlett, of Dallas, Division Mgr. of the West Gulf, and A. R. R. L. Director; Mr. L. B. Henson, of the Police and Fire Signal Dept. of Dallas, Asst. Div. Mgr. in charge of Police Broadcasting; Porter T. Bennett, of Dallas Radio Club; W. A. Tolson, Asst. District Supt. East Texas of A & M College, E.E. Dept. and a score of visiting operators. February 12th was devoted to informal get-together meetings and tours of inspection.

**Norwich Radio Club**

Some of the recent means of increasing interest in radio club organization were carried out by the Norwich Radio Club. Spelling contests or radio terms, Edison questionnaires on radio in general, alphabetical contests of radio terms, etc., are

some of the things which has given the club an increase in membership.

#### M. I. T. Banquet

The third annual banquet of the M.I.T. Radio Society was held on February 25th under auspices of the Boston Executive Radio Council and the Massachusetts Institute of Technology Radio Society. During the afternoon a splendid exhibit of apparatus held the attention of every amateur who attended. Promptly at 6:15 o'clock 480 joined in and enjoyed a delicious dinner. Several comic movies were shown along with the pictures of the stations that were successful in spanning the Atlantic Ocean during the Transatlantic Tests. Im-

R. R. L. Convention with a resume of what had been done in the past and outlined plans for the future. The convention was held at Lansing, Mich. on Feb. 10th and 11th.

F. D. Fallain of Flint, Mich. acted as toastmaster at the banquet. The delegates were welcomed to the city by Max Henderson, President of the Central Michigan Wireless Association. Mr. Parkhurst, assistant eighth district radio inspector spoke on the coming changes in radio regulations. Immediately after the dinner everyone adjourned to the Majestic Theatre where a program was heard from the Detroit News Service station. Saturday morning Prof. N. H. Williams of the U. of M. gave a



mediately after the banquet some confusion at the door aroused the gang to its feet and who should come bumping through the crowd but The Old Man with a hand bag. He told of his expensive experience with vacuum tubes and when he opened his bag to exhibit his last tube out jumped the cat.

F. D. Webster was toastmaster and he introduced several speakers among which were Sumner B. Young, chairman of the Boston Executive Radio Council, F. H. Schnell, traffic manager of the A. R. R. L., Dr. E. F. W. Alexanderson, chief engineer of the Radio Corporation of America, and Dr. Frederick S. Dellenbaugh of M.I.T. Walker Memorial was the scene of this well managed affair which came to a close near midnight.

#### Michigan A.R.R.L. Convention

Clyde E. Darr, Superintendent of Michigan opened the first annual Michigan A.

lecture in which he explained by using slides how the ether waves are produced and the necessity for exact tuning in each circuit.

In the evening R. C. Wyckoff of 8YG explained the operation of the C. W. set at 8YG. It is said that many spark sets were on sale following this lecture as the spark hounds had been converted to C. W. (We need a few more conventions like this to lay the spark to rest forever.) T.M.

#### The Milwaukee Amateurs' Radio Club

The Milwaukee Amateurs' Radio Club was founded in 1917. Up to the time of our entrance into the war the club made great progress in the amateur field but activities were discontinued during the early spring of 1917. The club became active immediately after the lifting of the ban on amateur radio and at the present time is doing world's of good in developing the

amateur situation in Milwaukee by catering to all classes of radio enthusiasts. Meetings are held at 8:00 o'clock every Monday evening except the third Monday in the Trustees' room of the Milwaukee Public Museum. Our limited space forbids publishing the complete history of the club which shows a splendid spirit of team-work. Copies of the history of the club can be had by writing to the club at 601 Enterprise Bldg., 2nd and Sycamore Sts. Milwaukee, Wis.

#### A Contest

The Arkansas Valley Radio Association, a recently organized association to promote radio throughout the Arkansas River Valley and to aid the American Radio Relay League is holding an interesting contest. The headquarters for this organization are at Wichita, Kansas, where at



the last meeting it was decided to give a cup as a trophy to the station obtaining the longest distance record of actual communication.

Here is a view of the handsome cup

The purpose of this contest is to stimulate interest in radio communication throughout that particular section of the country during the month of April. It is planned that if this contest is successful and meeting the approval of the A.R.R.L. members in that territory, another contest will be held embracing the entire country including Canada. No one will be allowed to compete that does not hold a li-

cense. Special licensed stations and experimental stations will not be considered. For the present contest, stations in Texas, Oklahoma, Colorado, Arkansas, Missouri, Nebraska and Kansas are eligible. Every report must be accompanied by a verification of the station worked, the distance in miles, and a complete description of the station. All reports must be in by May 20th, so that the cup may be awarded by June 1. All communications and reports should be mailed to O. W. Taylor, 1350 South Francis St., Wichita, Kansas.

#### MORE ABOUT THE TRANSATLANTICS

(Continued from page 39)

regular commercial service. If in a single night Mr. Godley received eighteen American stations, nevertheless for six other nights he did not receive a single one. It is true that with the small power employed and the great distance to cover the obstacles made by atmospherics took on considerable importance. But may we not say that the moonlight had on its part an effect of enormously enfeebling the signals?

"But what is most striking is the curve of the results obtained, the number of stations received having been successively 1, 0, 18, 7, 0, 0, 0, 0, 0. Now December 15th was the day of the full moon and Mr. Godley did not hear anything but feeble signals from the 12th on, including the 15th which was a beautiful moonlight night. We know that short waves are particularly sensitive to the absorbing effects of light. Transmission over a great distance with small power must have made this effect particularly noticeable, and if really long waves are manifestly influenced by the variations in luminosity which eclipses of the sun produce, is it not perhaps reasonable to suppose that a simple moonlight night might make feeble to the point of rendering illegible signals transmitted on a wave length of 200 meters from a distance of more than 6000 kilometers?"

"The 'Wireless World' on its part puts forth the hypothesis that the inequality of the reception might be due to large cyclonic disturbances which were produced on the Atlantic during the test. In order to verify this it is about to consult the documents of the Meteorological Office.

"Whatever may come of these facts, further experience will doubtless clear them up and we can still say that our American and English comrades have rendered great service to Science and have helped the cause of radio amateurs. Thanks to them, and thanks to the transatlantic transmission realized under conditions heretofore deemed impossible with only amateurs transmitting as well as receiving, perhaps we shall hear less said of us, and with but a shade of superb disdain, "Oh yes, do you know that this is the man who made himself up a detector out of tinfoil!"



# Who's Who in AMATEUR WIRELESS



F. A. Hill

We take great pleasure in presenting to our readers this month Mr. Frederic A. Hill of Savannah, Ga., better known through the air as the wielder of that wicked bug at 4GL. Mr. Hill was born in Philadelphia "some time ago," being too bashful to tell us his age. He had a transitory existence in Mexico for twelve years and journeyed to the Philippines, China, Japan and Borneo for several years in the capacity of a newspaper man and radio bug. He returned to the United States in 1914, locating in Chicago where he operated a quarter kilowatt "sawmill" under the call of 9KJ. In 1915 he removed to southern territory and has remained there since, with the exception of eighteen months on board vessels of the United States Shipping Board. The last two years Mr. Hill has been serving as Shipping Board assistant

*(Concluded on page 61)*



A. L. Groves

Here's another man we wanted to see. Haven't you been wanting to know all about the man who has supplied us with such detailed information on honeycomb coils and his own famous single layer coils?

Mr. A. L. Groves was born September 11, 1888, at Brooke, Va., and attended the public schools at Brooke and Fredericksburg, Virginia, later attending the Dale Military Academy where in 1904 he brought down the wrath of one of the Professors on his head because he had strung up a telegraph wire between two buildings and the "hum" of the wire kept the Prof. awake. Mr. Groves regrets that they didn't know anything about spark gaps at that time or the "hum" on the wire might have been of a different tone. That was the beginning of his inquiries into the electrical world and he tells us that he can't re-

*(Concluded on page 61)*

## With Our Radiophone Listeners

### General Electric Announces New Radio Broadcasting Station WGY

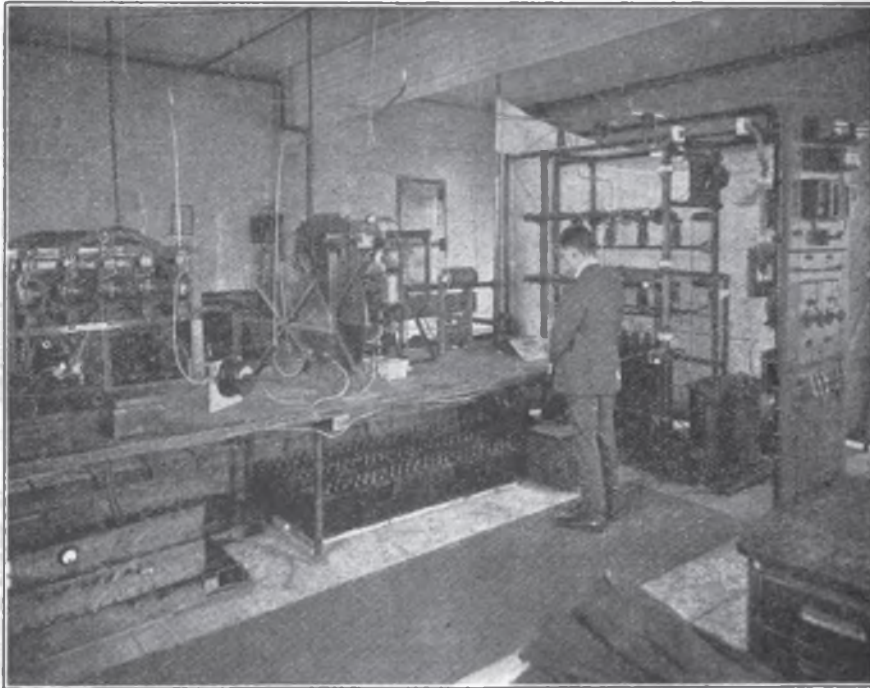
A radio broadcasting station, more powerful than any now sending out programs, has been installed by the General Electric Company at its plant in Schenectady, N. Y.

From the roof of a five story factory building, two towers 183 feet high and spaced 350 feet apart, support an antenna at such height as to give the wireless waves unobstructed freedom in all directions.

no indication of the distance this station may be heard.

Broadcasting stations with but a fraction of the power of the G-E Station have been heard at distances of 2,000 miles or more under favorable atmospheric conditions.

The General Electric station has been licensed to operate on a 360 meter wave length under the call letters WGY. It is equipped with the most modern of radio apparatus, including the multiple tuned



The interior of WGY, Schenectady, N. Y.

This station has not been regularly operated nor has advance announcement been made of the impromptu or test programs sent out, which would cause amateurs to be listening, yet letters have been received from such distant points as Cedar Rapids, Iowa, Minneapolis and Santa Clara, Cuba, the latter place 1450 miles distance, announcing that the programs have been heard. These reports come from operators who, in an evening's experimenting with their receiving sets, have accidentally come upon the waves from Schenectady and are

antenna which, because of its many advantages, has been installed in Radio Central, the world's most powerful commercial station at Rocky Point, L. I., and other transoceanic stations of the Radio Corporation of America.

A three room studio, where the programs are produced, is located in a Company office building, 3000 feet from the transmitting station. One room is used as a reception room for the artists, where they may sit and chat until their time on the program arrives without danger of inter-

fering with what is going on in the studio. The second room is the studio, where a concert grand piano, victrola, an organ and other equipment for the artists are to be found. Here a number of portable microphones, which are commonly known as pick-up devices, can be shifted about to locations best suited for the reception of announcements, musical numbers, or whatever may be sent out. In the room on the opposite side of the studio is apparatus for amplifying the sound waves before they are transmitted by wire to the broadcasting station.



The antenna at WGY

A switchboard in the studio, which lights a red light when the station is in operation thus warning persons in the room that whatever they might say will be sent out to thousands of ears of an invisible audience, is within reach of the studio director at all times. Not until he throws a switch can anything reach the antenna. A telephone attached keeps him constantly informed just how the program is going out and allows him to change position of the artists or microphone if such is necessary to improve the tone quality of the entertainment.

With the exception of the small pick-up devices or microphones and the switchboard, there is nothing in this room to indicate it as different from any musical studio.

In the apparatus room, the sound waves are put through a number of steps of amplification by means of vacuum tubes which increases their volume thousands of times. The amplified sounds are then put into a

wire and sent to the broadcasting station, where they enter another bank of vacuum tubes, known as modulators or molders of the electric waves.

Direct current at a high voltage is necessary for the operation of a transmitting station. To obtain this, a 220 volt alternating current line, which is but little higher than the voltage used for lighting purposes in the home, is boosted to 30,000 volts by means of a transformer. This voltage is then applied to a number of vacuum tubes, acting as rectifiers, which change the alternating to direct current. Placed between the rectifier and the modulator or molding tubes, is a high power oscillator tube. The electric power entering this tube sets the ether into vibration and upon these vibrations the electric waves, molded into shape in the modulator tubes, are sent to the antenna to go out into space.

#### Ship-to-Shore Telephoning

Thomas H. Rossbottom, General Manager of the United States Lines, is the recipient of hundreds of telegrams and letters of congratulation on account of his pioneer work in using the wireless telephone in communication with the big liner "America" a short time ago.

Maritime history was made by Mr. Rossbottom in his use of the wireless telephone in receiving the report of his Captain and in transmitting orders to the ship. This is the first time in history that the commander of a merchant vessel has made his report to the operator by wireless telephone, and that orders from the operator were transmitted to the ship by the same medium. The occasion for this was the arrival of the Steamship America on March 6.

While the America was still considerable distance from Ambrose Channel Lightship Mr. Rossbottom was connected up thru the powerful station at Deal Beach, N. J. Within ten minutes after the call was made Captain William Rind of the America was on the telephone. After an exchange of greetings Captain Rind told Mr. Rossbottom the speed he was making, and the time he expected to reach Quarantine. Mr. Rossbottom in reply gave his instructions to Captain Rind concerning the special arrangements which has been made with the Public Health officials at Quarantine station for the passing of the vessel beyond the sunset hour.

Mr. Rossbottom and Captain Rind conversed for several minutes. Mr. Rossbottom talked over the telephone at his desk, the one that is normally used in his daily business, and without any special appliances. In talking to the ship Mr. Rossbottom's orders went over the telephone wire to Deal Beach, N. J. There in the big transmitting plant his words were con-

nected to the radio and were shot out from the antenna to the America's aerial and down to a receiving telephone at which Captain Rind listened. Captain Rind's words in reply were sent from the aerial on the steamship to the big receiving station at Elberton, N. J., and then came over the telephone wires to the office of the United States Lines at 45 Broadway.

#### NEBRASKA WESLEYAN UNIVERSITY STATION 9YD

A broadcasting station has been erected at Nebraska Wesleyan University, University Place, Nebraska, for the purpose of sending out the weather forecast and market reports which are received daily from the Bureau of Markets, at Lincoln, Nebraska. The reports are first sent out by code on a 1-kilowatt spark transmitter with an approximate range of 200 miles and later repeated by telephone which has a range of 100 miles under normal conditions. The schedules are as follows:

Weather forecast and news bulletin, daily except Sunday, 8:50 to 9:00 a.m..

Market and weather forecasts, daily, 4:00 to 4:15 p.m.; and Saturday, 12:15 p.m.

Concerts and lectures Tuesdays and Thursdays, 9:30 p.m.

The station of the Doubleday-Hill Electric Co., WQY, at Pittsburgh broadcasts concerts on the following schedule:

Daily except Saturday and Sunday, 4:30 to 5:00 p.m.

Saturdays, 1:00 to 1:30 p.m.

Sundays, 4:00 to 5:00 p.m.

Night schedule, Monday, Wednesday and Fridays, 9:30 to 10:00 p.m.

The radio telephone is coming into prominence in Australia and a station is now in operation at Dunedin, New Zealand, that has been heard in Wellington, New Zealand by Mr. A. McClay, A.R.R.L. member, a distance of approximately 400 miles. The station at Dunedin was using a very small transmitter but a much larger one is to be installed soon and amateurs all over New Zealand will be able to listen to the concerts.

#### San Francisco Bay Radio Telephone Schedule

Broadcasted on 360 meters

Every afternoon except Sunday—3:30 to 4:30 P.M., Atlantic Pacific Radio Supplies Co., Concert; 4:30 to 5:30 P.M., Leo J. Meyberg, Press, Market and Concert.

Every night except Sunday—7:00 to 7:10 P.M., Atlantic Pacific Radio Supplies Co. Press, Sports and Foreign; 7:10 to 7:20 P.M., Hotel Oakland, Press, General News; 7:20 to 7:30 P.M., Leo J. Meyberg, Press, Financial and Weather.

Sunday—10:00 to 11:00 A.M., Leo J. Meyberg, Concert; 11:00 to 12:15 A.M.,

Trinity Center, Sermon; 12:15 to 1:00 P.M., Warner & Linden, Concert; 7:00 to 9:00 P.M., Presidio, Concert and Instruction.

Monday—7:30 to 8:30 P.M., Colin B. Kennedy, Concert and Industrial News; 8:30 to 9:00 P.M., Leo J. Meyberg, Concert.

Tuesday—12:15 to 1:00 P.M., Warner & Linden, Concert; 7:30 to 8:15 P.M., Hotel Oakland, Concert; 8:15 to 9:00 P.M., The Radio Shop, San Jose, Concert.

Wednesday—7:30 to 8:15 P.M., Atlantic Pacific Radio Supplies Co., Concert; 8:15 to 9:00 P.M., Herrold Laboratory, San Jose, Concert.



Getting the latest dope by radio.

Photo by Underwood and Underwood.

Thursday—7:30 to 8:30 P.M., Leo J. Meyberg, Concert; 8:30 to 9:00 P.M., Colin B. Kennedy, Concert.

Friday—12:15 to 1:00 P.M., Warner & Linden, Concert; 7:30 to 8:15 P.M., The Radio Shop, San Jose, Concert; 8:15 to 9:00 P.M., Hotel Oakland, Concert.

Saturday—7:30 to 8:15 P.M., Warner & Linden, Concert; 8:15 to 9:00 P.M., Atlantic Pacific Radio Supplies Co., Concert.

#### Westinghouse Broadcasting News

"Radio Broadcasting News," a weekly newspaper, has been established to mark the first anniversary of KDKA, the Westinghouse broadcasting station at East Pittsburgh, Pa.

About one year ago the Westinghouse company broadcasted its first program (Concluded on page 61)

# Strays



In C.W. transmitting circuits where shunt power feed is used, necessitating a radio-frequency choke, amateurs always have had difficulty. A big honeycomb coil is commonly used for this purpose, altho it is well known that a tuned circuit consisting of a small honeycomb coil and a shunt condenser resonated to the wave length used, is much more effective. However, it's troublesome and the voltages build up terrifically. Here's the answer: use a variometer—any garden variety of short-wave variometer. Simply insert it in any circuit that needs a radio-frequency choke and adjust it to where it chokes the best, which in parallel-supply transmitters is where the antenna current is highest.

Dr. Louis Cohen, chief of Army Radio Research, is said to have perfected a stray eliminator that really works. We hope that some dope on it can be given to the world soon. We understand it has been tested in Army stations in Texas, where by the way they have *some* static. In this case the strays were so severe that it could barely be determined that the other station was transmitting, yet with the eliminator in the circuit the signal could be read nicely and there were no disturbances. Sounds like a dream, doesn't it?

The Navy research folks have discovered a way of eliminating the mush from arcs. This is stright dope. Praise God from whom all blessings flow! The improvement is to be installed in the various Navy arc stations as rapidly as appropriations will permit.

Entries in the competition for the Herbert Hoover Cup for 1921 closed on March 1st. A goodly number of entrants came forward with their material, of course, and the Secretary's cup will be honoring America's best home-made amateur station as soon as an award can be determined.

NOF, sometimes NSF, in Anacostia, D. C., the Navy's amateur-built and amateur-operated station, has been heard "more than once", as Mr. Dow puts it, at 6ZAC in Hawaii, a Great Circle distance of 4780 miles, using buzzer-modulated I.C.W. Fine business, "LC"—congratulations!

Mr. Dow, incidentally, reports 9XM and 9YAE as the latest heard. Soon he's to have a transmitter. Mr. A. H. Babcock has built a duplicate of 6ZAF for him—two 50-watt tubes, self-rectifying—and it was recently tested out in Berkeley and copied OK by Dow, and is now enroute to him by steamer. Perhaps by the time this issue is in circulation 6ZAC will be on the air, and if only a little quiet air can be got on the West Coast to listen for him—Oh Boy! Isn't that a relay for you!

3ZO says that radio men talk about only two subjects—and radio is one of them.

Rumor had it during the Transatlantics that a radiophone signing WQM had been heard in London. This station cannot be located and information concerning it will be appreciated. It was at one time assigned to a phone station of the Kansas Gas & Electric Co. at Wichita, Kansas, but was dismantled at the outbreak of war and has not been in operation there since.

We were surprised to learn while in Washington attending the Radio Conference that the Navy Department in the design and purchase of their equipment are following the proposals of the so-called Paris Technical Conference of last summer, which was a preliminary to the forthcoming International Communications Conference. Our surprise is due to the fact that we don't believe the determinations of the Paris Conference have a ghost of a show of being adopted. They have been completely discredited and repudiated by the commercial and private interests in this country, as being at total variance with the pre-meeting agreements of all U. S. interests. The military representatives of every country dominated the Paris meeting and their findings gave the military interests the big end of everything in radio. By the trend of the times we should say that this viewpoint is quite likely to be an unpopular one by the time the International Conference sits.

6ALE, Lindsay at Reedley, Calif., is now 6ZF, and is putting up a new aerial for his Z wave. He continues to copy 2FP quite often, hearing him several times on the

night of Feb. 17th and copying him practically solid for several hours on Feb. 20th.

Foolish question No. 1,088,333: What organization represented Amateur Radio at the Hoover Conference?

**Read 'Em and Weep**

On the night of Jan. 20th at 10:30 p.m., F. W. Applegate, 3FP of Trenton, N. J., heard 6ALE and copied a msg. addressed to 2ZL.

6FU, C. F. Filstead of Los Angeles, using one 5-watt tube with 1100 volts on the plate, was heard by 9AIG, Sioux Falls, S. D., on Jan. 28, a distance of 1350 miles.

9AMB, Mr. D. L. Hathaway at Denver, was heard on Nov. 6th by G. C. Farmer on the Str. West Prospect while 3300 miles west of San Francisco or 4300 miles from Denver. One fifty-watt tube with 1250 volts d.c. was used at 9AMB.

Mr. J. B. Cugginano of Brooklyn using a flivver coil has been copied at Hillsboro, N. H., by 1AHF. 250 miles on a spark coil is certainly fine work.

Mr. Wesley Robinson at St. Mary's, Ga. is regularly copying Avalon-Long Beach phone. The first time we have heard of anyone in the east copying it direct.

8XV at Edgewood, Penna., was reported by 6OM of Los Angeles on Jan. 14 and Jan. 20th.

2BEK of Manasquan, N. J., using one 5-watt tube with but 90 volts of B battery on the plate, has been logged several times at 9IN, approximately 900 miles from Manasquan.

2GK heard 6ZA and has confirmed the reception on Jan. 8th. 6ZA used two fifty-watt tubes with an antenna current of 3.8 amps.

It is a well established fact that a C.W. transmitter using A.C. plate supply or poorly filtered rectified A.C. causes considerable local QRM. This of course modulates the C.W. output and for various reasons can be heard over a very broad range of wave lengths within a limited distance. It would be mighty convenient to be able to measure this apparent decrement inasmuch as it is quite a factor in local QRM restrictions. Can anyone furnish any enlightening information on this subject?

5ZQ, ex 5PG, is a new station in Oklahoma. His QRA is W. H. England, Ponca City, Okla.

The old Fessenden 100-kilowatt 500-cycle

synchronous set at NAA has developed trouble in the generator and has not been in use for some time. A 35 kilowatt Telefunken 500-cycle quenched transmitter is being used and it is believed that if it shows itself satisfactory the big old stand-by will be dismantled. The 35 kilowatt set was the one in use at Old Sayville before the war. The antenna current is slightly higher than with the 100 kilowatt set, being around 100 amps. on the present 2650 meter broadcasting wave. Reports indicate that the signals are being heard just as good as with the smaller set but a very peculiar note has been noticed. A tube set has been tested out but no information is available at this time.

1ZE says if you will hook a husky variable condenser across the high-frequency side of your magnetic modulator and tune it down till your antenna current falls off one half, you will eliminate A.C. or D.C. noises and modulate 100 per cent. more volume.

Mr. J. C. Ramsey, 1QR has recently obtained an experimental license for special work under the call of 1XA. Some very interesting work is being carried on and some of the results will be mentioned at an early date.

Most of these would-be news reporters get their tongues twisted when they start thinking of radio. One reporter mentions that the stations instruments were tuned at about 60 meters and that that meant they were tuned to be most receptive to atmospheric disturbances at a distance of 60 meters above the earth. *Maybe!*

Some of you fellows that are particularly adept with the pen scratch off a few cartoons and send them into the QST factory.

Someone asked us the other day if the 20 Mule Team borax in a chemical rectifier was to put the kick in it. We replied that that must be where the kick comes from when you get hold of it.

3XM at Princeton, N. J., has recently had a very serious fire, destroying the transmitter completely and a good share of the receiving apparatus. Mr. Richardson informs us that 3XM will not be in operation until next fall. Fortunately no one was injured in the fire, which occurred in the building while the set was in operation. We are sorry to lose 3XM, as it was one of the active third district stations.

Farmer to 1ZE: "Did you get all the rock out down at your place Don't hear any more blastin'".

1ZE: "Blasting—oh—you mean my old coffin spark outfit—ha—I've got some TNT in bottles now".

San Fernando, California, possesses one of those real outsiders that have the interest of Citizen Radio at heart. Willis A. Rowe, who runs a garage, charges the storage batteries of most of the gang there free of charge. A Willis A. Rowe would be a welcome man in most every town.

#### WESTINGHOUSE BROADCASTING NEWS

(Concluded from page 53)

from KDKA. Interest in the programs became so great that in the latter months of 1921 there came to the company an insistent demand on the part of "listeners-in" that they be informed "in advance" of the programs to be broadcasted from KDKA. With this demand—good-naturedly given, yet insistent—"Radio Broadcasting News" was born. Today, with only a few issues off the press, it is a fixture. It has come to stay because public opinion has demanded it. The birth of this newspaper marks one of the many great forward steps in the marvelous history of the advancement of radio broadcasting.

Radio developments are the chief items published in "Radio Broadcasting News," which derived its first circulation list from those friends of radio broadcasting, who, after "listening in" on the KDKA programs, wrote to the Westinghouse Company expressing appreciation of the broadcasting service.

The publication gives in word and picture news concerning various broadcasting programs and pictures of artists who entertained radio enthusiasts. A feature of each issue is the program to be broadcasted nightly during the week following the date of issue of the newspaper. Copies will be sent to all persons desiring to receive the newspaper who send their names and addresses to the Editor, "Radio Broadcasting News," Department of Publicity, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

#### A. L. GROVES

(Concluded from page 55)

member when he wasn't trying to figure out the purpose of the little green glass bottles on the poles. After such a notable career he spent several years on his father's farm and finally went to work at Brooke as a telegraph operator in October, 1906, where he has remained ever since. In 1910 a Mrs. Groves appeared on the scene and there are now a couple young Groves' to listen to the radiophones.

In July of 1912 he thought he had completed his first station but found that he was badly mistaken and doesn't seem to have accomplished that yet. A "1500 meter" loose coupler and a crystal detector were the main features and the won-

derful feats of hearing time signals from Key West and copying the west coast naval stations were finally accomplished. Sometime later he picked up the phones and heard a flock of amateurs pounding away and thought it was the usual 600 meter commercial traffic but discovered there were such things as amateurs and thereafter camped on the low waves and became a full fledged amateur, copying middle-west stations, which was a wonderful achievement in those days. Since such early days his station has been a continually changing one, for the better or worse, on first the long and then the short waves,—and he is still at it.

We are indebted to Mr. Groves for much valuable information on honeycomb coil reception on both long and short waves. His well known single-layer coils are in use in many stations today and have frequently accomplished noteworthy receiving records.

In addition to the above qualifications he is an ardent A.R.R.L. supporter and a frequent contributor to QST, wherein many of his articles on receiving have appeared.

#### F. A. HILL

(Concluded from page 55)

radio supervisor at Norfolk and radio supervisor at Savannah, where this narrative now finds him.

We don't know just how long ago Mr. Hill started to think about radio but he makes mention that his thoughts ran along that line before returning from the East in 1914 so we can see that he has been with the game a long time and is considered one of the old timers at it. He says that he is addicted to late hours and will probably pass out of this life with the phones on.

4GL has made itself heard over many thousands of miles and is one of the best known 4th District C.W. stations. Ships over a thousand miles west of Portland, Oregon, have reported 4GL during favorable conditions and his twitter has been copied in the Atlantic over two thousand miles out from Savannah. Mr. Hill's fist is well known and one needs to only hear a few letters from him to identify it. To our knowledge there isn't a man that can count fast enough to tell how many words a second he sends. 4GL handles a lot of traffic monthly with 8ZY of Washington and is one of the best traffic handlers of his district. The 8ZY-4GL combination can be heard almost every night ripping them off at top speed. No wonder they call him "Chain-Lightning Hill!"

Mr. Hill has recently been elected on the Board of Direction of the American Radio Relay League and we know will be a mighty valuable man in that capacity.

# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.



## Lower Wavelengths

Ingersoll, Ont.

Editor, QST:—

There has been a great deal said regarding lower wavelengths, but to the best of our knowledge very few amateurs have taken the matter to heart. We are therefore taking this opportunity to outline our personal experience as regards operation below 200 meters.

3GN uses a  $\frac{1}{2}$  K.W. Thordarson, 25 cycle, oil immersed plate glass condenser, O.T. of three inch ribbon, and a specially constructed non-sink gap. A new gap is in the course of construction, having teeth three inches in width but otherwise identical with the gap now in use.

When 3GN was first put in operation a modified Round's ground was employed. The wavelength was 192, and radiation from 2 to 2.5 hot wire amperes. It was at once apparent that the apparatus was not doing its best, and improvements were at once commenced.

A counterpoise was erected and used exclusively instead of the ordinary ground. The wavelength was 170 meters, and at the end of five hours testing and adjusting, the reading was 2.7. Then more insulators were used in the counterpoise, leads shortened, and this followed by still more adjustments. Within a week's time the reading had reached 3.0 then 3.2 and finally 3.5. Under ideal conditions we have been able to get a reading of 4.6 to 5 amps., though we now run between 3. and 3.5. All these readings were taken with seven inch coupling, and using an Eldredge Meter. the wavelength, as stated above, was 170 meters.

From the above it is evident that quite as good work is possible on wavelengths below 200 as is being done on 200 and over. However, the low wavelength has a decided disadvantage, which in our opinion it is up to the manufacturers to correct when designing receivers. The radiated wave of 3GN is very sharp, being practically inaudible on 360 meters at a distance of five blocks, even when a four step amplifier is used. In consequence the receiver must of necessity be able to tune efficiently to 170 meters or we are not heard. Apparently there are a great many who are unable to tune this low, or else

do not trouble to listen in on this wavelength believing it is dead.

We do not mean to say that all, or in fact any, of the receivers now on the market are not capable of tuning to 170 or less. We do find however that they are not being built for as efficient operation on 140 to 170 as they are from 170 to 250. This is doubtless natural, because so very few stations are working between 140 and 170 meters.

We therefore believe that the answer to the more general use of lower wavelengths lies with the manufacturers of receivers, and especially the prominent advertising of the sets themselves. We shall watch for developments with much interest.

Everyone is aware of the fact that very few spark stations are working below 180 meters. Consequently there is a minimum of QRM and the use of these lower wavelengths offers a new field for amateur communication. It would certainly avoid so much jamming on 200 meters: and need we also mention the little point of keeping within the law?

A few days ago we received a letter a most sarcastic and disparaging letter, from a certain flying officer located some one hundred miles away. He informed us in no uncertain terms that we were on 360 meters because we seriously interfered with phone reception from KDKA. Now we take pride in the fact that we have been able to get good results on 170 meters, with a very low decrement, and consequently we were at first incensed at what appeared to be a deliberate falsehood. However upon considering that he was quite evidently new to the game we decided to look into the matter and find out where the trouble really lay. We verified the wavelength and decrement, and then began inquiries. What we have found out will likely be of interest to the Westinghouse people.

Mr. Gowan, of Kitchener, has already noted that KDKA has a double wave, or perhaps to be exact a harmonic. We have verified this report, and several local amateurs have noticed the same thing. This second wave or harmonic is on 170 meters or else very near it, and the flying officer above mentioned made an error in his conclusion that it was 3GN who was on 360 meters.



For our peace of mind we would like to hear from the Westinghouse people, as the second wave or harmonic is more than audible, and we haven't the time to explain the thing to every would-be amateur who thinks he has something to complain about.

Thanking you for your valuable space, we beg to remain

Very truly yours,  
H. R. Byerlay, 3GN.

### Cages vs. Flattops

1814 East First St.,  
Duluth, Minn.

Editor, QST:—

In the article in the January QST describing the antenna system at 3DH, Mr. Richardson states that the current in the conical cage antenna is divided evenly among the six wires, "whereas, if a flat top were used, approximately 60% of the energy would be found in the two outer wires." He also says that the cage aerial gives better results than the aerial used previously. He implies that the superior efficiency of the cage aerial is due to the uniform distribution of current, but a little figuring will show that it cannot be. A six wire flat top aerial having 60% of the current in the two outer wires would have about 33% higher resistance than an equivalent cage the resistance referred to is that of the horizontal portion only, without leadin or counterpoise). If two aeri-als, one a flat top and the other a cage, consisted of six wires of No. 12 copper 50 feet long, the h.f. resistances would be approximately .166 ohms and .125 ohms respectively. If the current in the leadin was 2.5 amperes (250 watts input in a 42 ohm aerial) the mean value of the current in the horizontal portion would be between 1.5 and 2.0 amperes. Taking the larger value, the resistance loss would be .666 watts in the flat top and .500 watts in the cage. A grand total of one-sixth of a watt is saved by the cage antenna!

With an input of 250 watts, the antenna at 3DH radiates 80 watts and dissipates 170 watts in the form of resistance and dielectric losses, according to data given by Mr. Richardson. Therefore the conical cage antenna is .1% more efficient than a flat top antenna of the same dimensions.

The symmetrical arrangement of the wires in a cage aerial equalizes their inductances, but it does not equalize their capacities, and so cannot equalize the currents in them. The only way to make the currents absolutely equal would be to build a cylindrical counterpoise, and put the cage aerial at the center of it. A better plan would be to build a flat top aerial with small wire in the middle and large wire at the edge, the size of each wire being proportional to the current it carries.

I have no quarrel with anyone who makes a cage leadin, as that form has lower resistance than the usual loosely twisted bunch of wires; but I believe that a man who builds a cage aerial is wasting his time.

Sincerely yours,  
R. A. Braden.

(Hop to it, fellows—let's have it out and learn what we really think is best—Ed.)

### Re Our January Editorial

New York City

Editor, QST:—

I cannot but take exception to the attitude expressed in your editorial headed *Excelsior* in the January QST. I do not know who the "eminent radio engineer" mentioned may be, but he cannot be very eminent if he made the remarks credited to him. This is shown in part by the fact that Mr. Edwin H. Armstrong, one of our best radio engineers, has given a great deal of time and effort to putting the amateur Transatlantics across, which he would have been hardly likely to do, had he thought there was no chance of success. Everybody knows that exceptional distances on extremely small powers can be obtained under certain conditions. It must be remembered that the first transatlantic, to Glace Bay, was carried on with an actual radiated energy of a few hundred watts in conjunction with an untuned crystal receiver. The editorial in question gives the impression, which I can hardly believe to be true, that you do not differentiate between amateur service and commercial service. Transatlantic commercial service, to compete successfully with the cables, must of course give twenty-four-hour-a-day service three hundred and sixty-five days a year. Any real radio engineer will tell you that in long distance transmission, the power required for continuous service may be several thousand times the power necessary to get through under "decent atmospheric conditions," to quote your article.

One of the writer's stations, WSA, has on several occasions worked ships at 5000 miles, yet would you yourself install a 10 K.W. synchronous transmitter operating on 600 meters for commercial service over this distance? Do you suppose Dr. Alexander would have allowed the Radio Corporation to spend several million dollars at Port Jefferson if the same results could be obtained with six 5-watt tubes and a dozen pieces of 2x4? Also do you imagine that the best of the short wave stations that got across could handle much traffic in the average August mid-day?

I do not for one moment wish to belittle a splendid achievement, but I do object, and I think justly, to the attitude that radio amateurs have done something con-

sidered impossible by radio engineers of standing.

Let me emphasize once more that the commercial radio engineer is interested in general in twenty-four-hours-a-day service, while the amateur is, naturally, interested primarily in working the greatest distance under the extremely limited conditions as to power and wavelength which he is allowed. The radio engineer who states that communication cannot be obtained under the conditions of your transatlantic test is not worthy of the name of radio engineer, nor is the amateur who says that such communication is practical, money-making commercial communication, worthy of the honor of being called such.

Very truly yours,  
Bowden Washington  
Chief Engineer,  
Independent Wireless Telegraph Co., Inc.

#### Who Is Signing 7AJ?

3015 North 26 Street,  
Tacoma, Washington

Editor, QST:—

Who is the bird in the east who signs 7AJ? I have received reports at 7AJ being heard by seven different men in the east and each time circumstances have proven that it was not the writer's station that was heard.

Several months ago I received a card from 8LX, saying that he, 8CH, 8ASF, and 8LF had heard 7AJ on several occasions. Neither the wave, time, nor tone agreed with mine. About a month ago I received a card from 9BMN, saying that he had heard my C.W. I have no C.W. set. A week ago I got another card from the op at 8YAA and 8AXC, stating that he also had heard my C.W.

I do not think that all these men are at fault, they undoubtedly heard a 7AJ but what 7AJ? Nigger in the woodpile somewhere.

I shall be duly thankful to anyone who can tell me howcum.

Very truly yours  
F. B. Mossman, 7AJ.

#### Hooray!

DEPARTMENT OF COMMERCE

Bureau of Navigation  
Washington, February 2, 1922

Editor,  
American Radio Relay League,  
Hartford, Conn.  
Sir:

This office has received your letter of the 28th ultimo, suggesting that the street addresses of owners of special land stations be published in the "List of Radio Stations of the United States," in addition to the names of the cities in which the stations are located.

In reply this office desires to thank you for the suggestion and beginning with the "Radio Service Bulletin" for this month, which is supplemental to the list of stations, the full addresses of the owners will be published.

Respectfully,  
A. J. Tyrer,  
Acting Commissioner.

#### Humidity and Fading

209 So. State St.,  
Ann Arbor, Mich.

Editor, QST:

An old timer can hold his peace only about so long and the last copy of QST has lead me to express some of the ideas that I've wanted to get off my chest for a long time!

The immediate cause of this out break is the article of Mr. Jacob Jordan in the December issue. Mr. Jordan's data while most interesting are almost worthless. He has hit, I believe, one of the most important causes of fading. That is to say the fading that is due to the variation of wave length and which may be corrected by retuning the receiver. The other types of fading I believe are not so easily accounted for.

Mr. Jordan does not attempt an explanation of the variation in wave length but I have always believed that this variation was due to the variation of the dielectric constant of the space between the antenna and the conducting layer. In our case it is the water vapor in the air. The dielectric constant of the suspended water vapor would be anywhere between 80 and infinity, depending on how pure the water vapor was. It can easily be seen that the capacity of the antenna would be increased at least 80 times if the space were filled with water; hence the wave length would be increased 900%, other things remaining the same. Isn't it logical to believe that a reasonable amount of water in suspension would alter the wave length a noticeable amount? If Mr. Jordan had given us the absolute humidity instead of the relative humidity I should venture to say that we would find that the change in wave length would vary roughly as the square root of the ABSOLUTE humidity. It is to be understood in the above that I am not trying to explain any type of fading except the type that can be corrected by retuning.

Another point that has interested me was the power factor question. I believe that both parties are right for after all it is just ones point of view. *If one is outside the circuit* and considering the freely oscillating circuit as a whole then I should say that the *P.F. was unity*. On the other hand if we are *within the circuit* and talking about any particular part of it I should say that the *P.F. was approximately zero*.

Here is a point in connection with this that reduces some of the arguments to an absurdity. In an ordinary radio circuit the P.F. is approximately equal to the phase displacement and the decrement is "pi" times the phase displacement or as a very good approximation, Decrement = 3.1416 times Power Factor.

In light of the above do our friends on the Pacific Coast still insist that they want their P.F. as large as possible? If they do they must necessarily demand that their decrement shall be as large as possible. The question is: do they?

If anyone doubts the logic of this I refer them to an article by Dr. Dellinger in the Feb. 1919 issue of The Proceedings of the Institute of Radio Engineers.

There! I feel greatly relieved.

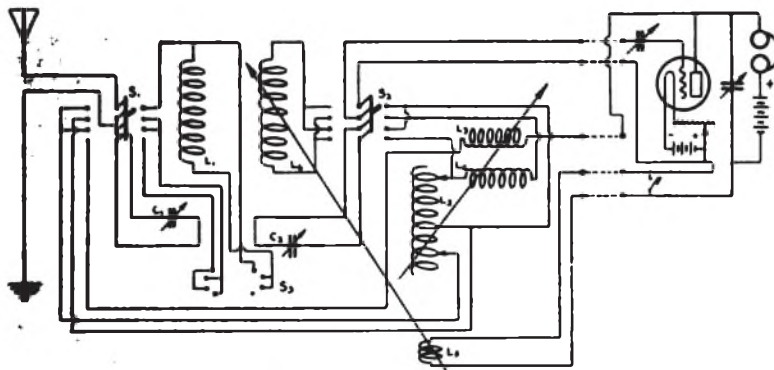
Sincerely yours,  
 Ross Gunn, B.S.  
 Pre-war 8JA and 8ZO.

**A Combination Tuner**

819 Sheridan Ave.,  
 Akron Ohio, R #24.

Editor, QST:

Am enclosing a diagram that shows how to combine Mr. J. L. Reinartz's CW tuner with a honeycomb coil set. Mr. Reinartz's tuner was described fully in the June 1921 QST.



I decided to try the tuner and didn't care to go to the expense of purchasing any new condensers so combined the tuner with my coil set. The diagram is self-explanatory but I will give the names of all the instruments to be sure that everything is clear.

S<sub>1</sub> and S<sub>2</sub> are cam (anti-capacity) switches while S<sub>3</sub> is the usual primary condenser switch. C<sub>1</sub> primary condenser and C<sub>2</sub> secondary condenser. L<sub>1</sub> primary coil; L<sub>2</sub> secondary coil. L<sub>3</sub> is the tickler and should be cut out when using the CW set. L<sub>4</sub> is the main CW inductance, L<sub>5</sub> the plate inductance, and L<sub>6</sub> the grid inductance. L<sub>7</sub>, L<sub>8</sub>, and L<sub>9</sub> are the CW inductances and can readily be made by anyone by following Mr. Reinartz's directions.

The two cam switches should be coupled together so that one knob will work both, having the CW wires, say on the left, and the ones from the coil on the right.

Room can be found on almost any panel for the CW inductances as they occupy very little room. The same can be said of the cam switches so there is no excuse for not having a good CW tuner right in your shack, at very little expense.

Hope that you will find this of some interest

Respectfully yours,  
 E. Ulmont Fisher.

**More on Tuning Honey-Combs**

Wooster, Ohio.

Editor, QST:

After reading Mr. Jessup's letter in December QST concerning honeycomb tuning it seems to me that he doesn't say as much as he should about primary tuning. It is really quite an art to learn to correctly tune the primary and adjust the primary and tickler coupling on any wave length, CW or spark, and I believe that most of those who think that good work can not be done on honeycombs have never learned to use them correctly.

When the primary is tuned to the same wave as the secondary it is very hard to make the tube oscillate, and it is usually

possible to put the tickler coupling to maximum and with the primary coupling very loose get very sharp tuning and strong regeneration. We will consider the primary and secondary each tuned to 200 meters, and the tickler tightly coupled. With the primary tightly coupled the set will oscillate below 190 meters and above 210. By varying the secondary condenser the station is found which we will consider is on exactly 200 meters. The primary coupling is next loosened, which will increase regeneration. When the primary coupling is very loose the tube will oscillate at all waves, but with a little tighter coupling it will oscillate only below 197 and above 203 meters. The looser the coupling the

narrower the space that the tube does not oscillate and consequently the greater the regeneration and the sharper the tuning. Slight adjustments of the primary condenser may be necessary to keep the primary tuned exactly to the incoming signals.

If the tube oscillated too easily when tuned this way loosen the tickler coupling slightly.

The selectivity of a tuned plate circuit can not be compared with that of a honeycomb circuit that is carefully tuned. An operator who doesn't know just what wave his primary has been tuned to may be surprised to find how small a coil is needed to get the primary down to 200 meters, but even 10 turns in the primary is enough to give ample coupling when the primary is carefully tuned.

If there is no condenser across the tickler a coil of 75 or 100 turns will usually be necessary.

Very truly yours,  
Victor Andrew, 8BPP.

#### A Love-Letter

Editor, QST:

Why is it that every Arc Station has to fizz and spit and ding and dong and clong and bang and buzz and bizz and beller and wail and pant and rant and howl and yowl and grate and grind and puff and bump and click and clang and chug and moan and hoot and toot and crash and grunt and gasp and groan and whistle and wheeze and squawk and blow and jar and jerk and rant and jingle and twang and clack and rumble and jangle and ring and clatter and yelp and howl and hum and snarl and puff and growl and thump and boom and clash and jolt and jostle and screech and snort and snarl and slam and throb and crink and quivver and rumble and roar and rattle and yell and smoke and smell and shriek like hell on every wave length from ten meters up to infinity and then can't get their traffic through?

A. Victim.

#### A Trip to the U.S.S. Ohio

Editor QST:—

While in Philadelphia a short time ago, I had the honor of visiting the Philadelphia Navy Yard. In the course of the day we went aboard the Navy radio ship the U.S.S. Ohio. At that time I thought it was just an ordinary battleship, but in a few minutes, much to my surprise I found out that it contained a lot of interesting radio apparatus and some interesting radio operators. Walking down one of the aisles, I heard a voice saying this: "When in the course of human events it becomes necessary for IB\*SH!R\*%&\*! (explosion) and at first I thought it was a school room. You can imagine my surprise when I peeped in the door and beheld

a blond haired fellow in very ragged overalls bending over a piece of apparatus and what he was saying to it would never be found in the Congressional records. It was a startling array of apparatus that greeted my eyes. It appears that this chap, who's name I afterwards found out was Dan-nals, had been working with some kind of a transmitter and it would not 'mote! That was the cause of the explosion. After sitting in the room for a while talking to a fellow by the name of Garrett (who was born on Staten Island of very ancient Dutch parentage) the blond haired one started again; "Four score years and ten ago," ???Z\$C!\*!BF&5 another explosion. By this time the air became very warm and I thought I better move. I then wandered around until I heard the old familiar quenched spark hissing and brave like I started to investigate where it was coming from. Thru a doorway I crawled and behold: what mine eyes seen were enough to make any amateur turn green with envy. Arcs-sparks and gosh only knows what. After straightening up I was afraid to move. All kinds of sets, rubber mats on the floor and a tall, dark haired individual giving orders to some young chaps who seemed busier than a one armed paper hanger with the itch! This tall gentleman's name I afterwards found out to be Manuel and that he was Czar over the spark and arcs. While talking to me he told me that he did not know anything about radio which seemed awful funny to me for his orders seemed to be sensible and the young men working there seemed to know what he wanted done. After he had issued a lot of orders to the future operators about what he wanted done, he escorted me upstairs again to the ships radio room (The first place I walked into) and introduced me to some other men there who were no doubt very important personages for they had a lot of gold braid on their sleeves and walked around like they owned the ship. After listening to WJZ roaring in (only 5 steps) they started a tube set going, which used two small P tubes for puncturing the air. While looking at the ammeter, I saw 13 amperes registering and thought it was out of order or crazy with the heat, but they assured me it was in good health and working O.K. Visions of my one little amp. in the air came back to me. It was just getting interesting when in breezed a fellow with more gold braid than any of the rest and they all saluted with a smile and became very humble in manner so I breezed out before they thru me out. Well this is all I lamped on this visit but when the opportunity presents itself again, I am going to pay them another visit.

Yours 'till the grid leaks

B. B. Attery.

Hi!

East Pittsburgh, Pa.  
February 1, 1922

Mr. Harold Hotaling,  
106 Forest Street,  
Gloversville, N. Y.  
Sir:

In reply to your recent card in which you mention the effect of Northern Lights on Radio, I will state that this phenomena never effects radio waves. It usually causes trouble to telephone and telegraph circuits, but so far has not been noted on radio work.

Yours very truly,  
Westinghouse Elect. & Mfg. Co.,  
C. W. Horn,  
Radio Service.

**Lower Wavelengths**

Huntington Park, Cal.

Editor QST:—

Concerning the article by Mr. Forant in the Dec. QST about spark coil transmission, how about 150 meters for the work? It would be possible to work thru any sort of QRM on 200 by using this wave. What say?

If some of these transformer hams and the transformer stations that aren't hams would install a spark coil set operated on 150, 175 or even lower waves to do their local work it would reduce the QRM on 200 VERY CONSIDERABLE, besides I want someone to work with down there.

Yours for less QRM  
Frederick J. McClung.  
6ASQ

**Absorption Modulation**

Lyndhurst, New Jersey

Editor, QST:—

Of late I have been reading quite a bit about the now famous "1DH hook up" for a small powered phone set, but up to date have not seen anything about getting perfect speech using the absorption loop method of modulation.

I have for the past three months been experimenting with a single tube set as described in August 1921 Issue of QST and find that by having fewer turns in the grid coil and putting it over the main inductance the radiation is greatly increased.

I am at present getting nine-tenths (0.9) of an ampere radiation with 350 volts on the plate; 35 to 45 milliamperes space current and 1.8 amperes at 7 volts on filaments.

For modulating the voice I put a complete turn around the grid coil and attach it to the hand microphone. It seems that the grid coil acts as a transformer when used in this way; there is no loss in radiation as when using the loop around the main inductance and if any loss is noticed

it might be one half of a tenth, but that returns when the transmitter is spoken into.

I am using rectified A.C. for high voltage, using an old transformer with a split winding and an electrolytic rectifier.

Stations 20 to 25 miles away tell me that there is no hum, or in fact, anything that might distort the voice.

Yours respectfully,  
Fred Siefert, 2AOG.

**A Storm Relay Route**

**D**URING the latter part of February a terrific ice storm and blizzard passed over Minnesota and the adjacent territory and completely destroyed all of the wire communication connections of Minneapolis and St. Paul with the outside world. Amateur radio came to the rescue and established a remarkable network throughout the district and restored communication with the outside world.



All wire service went out on the evening of February 22d at 6 p.m. The "Minneapolis Tribune" appealed to 9XI, University of Minnesota, to get news for its morning issue and to make an attempt to get in communication with the outside world. Accordingly 9XI fell to and succeeded in raising 9ZJ in Indianapolis thru terrific QRN, but before any copy could be secured from Indianapolis he was forced to break off due to increasing atmospherics. At 2:00 a.m. 9XI was in communication with 9AXF at Chicago but before any traffic could be handled, the Associated Press had gotten a line through to Chicago, via Vancouver, Denver and St. Louis and were handling their traffic over that roundabout route. This line too went out early in the morning and the entire A. T. & T. service with it. The telephone people set out to repair the lines immediately but requested that some of the Minneapolis and St. Paul stations get in touch with  
(Concluded on page 75)

# Calls Heard



## HEARD DURING FEBRUARY

### Unless Otherwise Specified

Amateurs reporting lists are requested to see instructions appearing at the head of this department in previous issues, and to observe the following additional instruction.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner, and then make a second paragraph in identical form listing the C.W. stations.

#### W. E. Clyne, Cristobal, C. Z.

Spark: 5MI, 5XU, 5ZA, 9YC.  
C.W.: 1AZW, 1BDL, 1BKQ, 2CCD, 2XI, 3FS, 3HG, 3ZY, 4CO, 4ID, 4ZE, 5ZAA, 8BEP, 8BUM, 8AGZ, 8CLD, 8ABV, 8WB, 8GV, 8AXK, 8XK, 8AIM, 8XV, 8ZZ, 9AL, 9AYS, 9DCF, 9FM, 9NX, 9FS, 9XAQ, 9ZAC, 9ZL.

#### Can. 3JI, Toronto, Ont.

C.W.: 1FB, 1IN, 1PT, 1QN, 1QP, 1QR, 1QZ, 1TH, 1UN, 1XA, 1ZE, 1AAP, 1AFV, 1AGI, 1ARY, 1AVI, 1AWB, 1AZW, 1BCF, 1BEA, 1BEP, 1BES, 1BFU, 1BKQ, 1BUA, 1BWJ, 1CKE, 1CIK, 1CIT, 2BB, 2BG, 2CT, 2EH, 2FP, 2OF, 2SQ, 2VA, 2VH, 2AER, 2AJF, 2AKO, 2ALR, 2AMO, 2ANZ, 2AWA, 2AWF, 2BBB, 2BCF, 2BEA, 2BEB, 2BCH, 2BLT, 2BNZ, 2BRC, 2BUW, 2CCL, 2IBZ, 2BG, 2CA, 2CG, 2FR, 2FS, 2HG, 2HJ, 2IZ, 2KM, 2NH, 2RD, 2RF, 2SQ, 2YQ, 2ZO, 2ZY, 2AAD, 2AA, 2ADT, 2AHK, 2ANL, 2ANY, 2APA, 2APQ, 2BEC, 2BFU, 2BLF, 2BK, 2BQ, 2EU, 2EW, 2FT, 2GL, 2ID, 2FV, 2IX, 2NZ, 2AC, 2CG, 2CI, 2HJ, 2IQ, 2IR, 2JS, 2JU, 2LW, 2NE, 2NI, 2OA, 2OH, 2OS, 2PX, 2QM, 2QY, 2SP, 2UK, 2VK, 2WR, 2XK, 2XV, 2ZG, 2ABO, 2ACF, 2AHK, 2AFN, 2AGI, 2AID, 2ALB, 2ANJ, 2AQB, 2AOG, 2ARI, 2ARU, 2ARW, 2ASV, 2AUB, 2AWP, 2AWY, 2AWZ, 2AXC, 2AXK, 2AXO, 2AYZ, 2BBK, 2BDO, 2BFX, 2BLW, 2BMA, 2BNI, 2BOX, 2BQF, 2BQL, 2BUM, 2BWH, 2BZY, 2CAG, 2CAH, 2CAV, 2CAZ, 2AGT, 2CLN, 2ZAE, 2EA, 2HK, 2IU, 2JL, 2KP, 2LE, 2LQ, 2LT, 2US, 2WK, 2WO, 2XM, 2ZG, 2AAS, 2AAY, 2AEJ, 2AFH, 2AIV, 2AJA, 2AJH, 2AJP, 2AKD, 2AKR, 2ALS, 2AMU, 2ARK, 2ASB, 2AWM, 2BJB, 2BRL, 2DAM, 2DTJ, 2DTS, 2DYN, 2YAM, 2BG, 2SJ.

Spark: 1AW, 1CK, 1CZ, 1RV, 1ADC, 1ARY, 1BDT, 1BHO, 1BOQ, 1BVB, 1CHJ, 2BK, 2BM, 2BY, 2CI, 2EL, 2FD, 2JU, 2KM, 2OM, 2SZ, 2TS, 2WY, 2ABM, 2ACW, 2AHU, 2AWF, 2AXK, 2BTJ, 2CIC, 2AC, 2DM, 2HG, 2QP, 2UD, 2VS, 2XM, 2AIC, 2AJD, 2AQH, 2ARM, 2ARN, 2AUW, 2BJT, 2BQ, 2EA, 2GN, 2CP, 2FA, 2FS, 2JJ, 2KY, 2LB, 2LI, 2NO, 2NZ, 2OQ, 2RQ, 2SP, 2TT, 2UC, 2WO, 2XE, 2ADO, 2AFB, 2AFG, 2AHQ, 2AGK, 2AHQ, 2AHS, 2AID, 2AIO, 2AJT, 2AKQ, 2AMZ, 2AOT, 2APB, 2ASL, 2AVT, 2AUE, 2AWP, 2AXX, 2BAC, 2BAZ, 2BFH, 2BOF, 2BYP, 2CAY, 2CBJ, 2AV, 2BP, 2CP, 2JQ, 2TO, 2UH, 2VL, 2YB, 2YQ, 2ZJ, 2AAP, 2AGR, 2AIS, 2AMS, 2AZE, 2DIW, 2DWP, 2BA, 2GN.

#### Can. 2DK, Sutton, Que.

Sparks: 1AAX, 1ADC, 1ADL, 1AEV, 1AFZ, 1AHF, 1AHL, 1AIT, 1AKC, 1APO, 1ARY, 1ASF, 1ASZ, 1AZK, 1AZW, 1BCF, 1BDI, 1BEP, 1BGC, 1BHR, 1BIR, 1BLE, 1BJE, 1BJS, 1BQL, 1BRQ, 1BTL, 1BV, 1CHJ, 1CK, 1COK, 1DZ, 1GM, 1HK, 1IA, 1LZ, 1QD, 1QP, 1RV, 1SD, 1SN, 1UN, 1YB, 2AID, 2AXX, 2ARB, 2AER, 2AIM, 2ARM, 2AAF, 2AWF, 2ABM, 2ARK, 2BM, 2BQ, 2BSC,

2BBN, 2BK, 2BJO, 2BY, 2CHJ, 2DA, 2EL, 2FP, 2JZ, 2JU, 2OM, 2OO, 2TU, 2XM, 2XK, 2AQB, 2BFU, 2CG, 2DH, 2DM, 2FO, 2HG, 2HJ, 2KM, 2UQ, 2YP, 2ZO, 2EA, 2ZA, 2ACF, 2AFA, 2AFS, 2AMB, 2AMZ, 2APP, 2AXO, 2AYN, 2BFX, 2BUM, 2CG, 2RC, 2TC, 2NI, 2VW, 2XE, 2XA, 2XG, 2ZA, 2ZG, 2ZO, 2ZP, 2YB, 2YC, 2ZN.

C.W.: 1ARY, 1ASF, 1AVB, 1AYL, 1AXI, 1AZW, 1BDI, 1BEA, 1BES, 1BKQ, 1BQL, 1BRQ, 1BSD, 1BWJ, 1BWP, 1CAK, 1CGS, 1CLZ, 1EZ, 1IN, 1QF, 1QN, 1QP, 1PT, 1RD, 1RZ, 1TS, 2AAB, 2AKO, 2AWL, 2AYV, 2BFZ, 2BJO, 2BSC, 2BYW, 2CBT, 2FP, 2ADX, 2AQR, 2CC, 2FS, 2HJ, 2GC, 2ZO, 2ADG, 2AGZ, 2AWY, 2BMA, 2BUM, 2JS, 2JU, 2ZZ.

#### Can. 3GG, Timmins, Ontario

1AWB, 1ARY, 1AYW, 1BDI, 1BUA, 1BWY, 1IO, 1MX, 1TS, 1XM, 2AAB, 2BAK, 2BEJ, 2BTJ, 2BFX, 2CBG, 2FP, 2QL, 2TS, 2VA, 4ID, 4FT, 5UU, 5FV, 5ASB, 5AIM, 5AWY, 5AXE, 5AQE, 5APT, 5ALV, 5AUO, 5AIZ, 5BU, 5BF, 5BEK, 5BEF, 5BUQ, 5BZY, 5BDO, 5BOZ, 5BK, 5CP, 5CBR, 5CGM, 5EA, 5FA, 5HJ, 5KP, 5NI, 5PX, 5RH, 5SP, 5TK, 5UK, 5UC, 5V, 5YV, 5ZG, 5AIV, 5AF, 5AKF, 5AGR, 5AJB, 5AAV, 5ATM, 5AY, 5BED, 5BJV, 5DBQ, 5DFX, 5DV, 5DZQ, 5DNT, 5DZY, 5DWP, 5DKV, 5DXT, 5EA, 5GK, 5IO, 5IV, 5KP, 5LW, 5LE, 5OL, 5QE, 5TV, 5UL, 5VL, 5WK, 5YQ, 5YAK, 5YO, 5YB, 5YC.

#### 3IL, Kingston, Ont.

C.W.: 1AAD, 1AFV, 1AGI, 1AJS, 1APP, 1AVI, 1AWB, 1AYL, 1AZW, 1AZX, 1ADC, 1BDI, 1BEA, 1BES, 1BH, 1BHO, 1BJH, 1BJO, 1BKQ, 1BKR, 1BOQ, 1BQE, 1BRQ, 1BSD, 1BSN, 1BTL, 1BUA, 1BYK, 1BWJ, 1CAK, 1CIK, 1CIT, 1CML, 1CQO, 1EZ, 1IN, 1QP, 1RD, 1TS, 1WT, 1XM, 1ZE, 2AAB, 2AJF, 2AJP, 2AL, 2AQF, 2AWL, 2AWS, 2AYF, 2AYV, 2BBB, 2BB, 2BEA, 2BEB, 2BEH, 2BGH, 2BML, 2BYT, 2BNZ, 2CAV, 2CC, 2CCU, 2CGO, 2FP, 2HI, 2JW, 2KP, 2NQ, 2NZ, 2OC, 2SQ, 2AQR, 2AFB, 2AL, 2AJD, 2AL, 2AP, 2ADI, 2BEC, 2BG, 2CZ, 2CC, 2FS, 2HJ, 2HG, 2RW, 2SQ, 2EW, 2GL, 2HJ, 2IN, 2ADJ, 2AP, 2AGZ, 2AIM, 2AIO, 2AOO, 2AQF, 2AQR, 2AWN, 2AWZ, 2AXY, 2BEF, 2BFX, 2BK, 2BNI, 2SEJ, 2XK, 2XV, 2XXF, 2YV, 2AKM, 2AIV, 2AJP, 2BRL, 2BXH, 2BY, 2CFP, 2ED, 2EM, 2HJ, 2NI, 2ALS, 2AZ, 2ADG, 2BET, 2BV, 2BEJ, 2HA, 2IO, 2NI.

Spark: 1ADL, 1ADP, 1FZ, 1AKZ, 1APJ, 1ARY, 1BFE, 1BOQ, 1CZ, 1EA, 1NZ, 1RV, 1ZP, 2ARD, 2ARK, 2ACW, 2AHU, 2AJW, 2BAA, 2BNZ, 2BW, 2BOY, 2FP, 2OM, 2QW, 2RP, 2TJ, 2UH, 2XK, 2ZW, 2ARM, 2DM, 2EM, 2FB, 2GM, 2HJ, 2TA, 2UQ, 2AFY, 2AK, 2AKQ, 2AL, 2AJ, 2AWP, 2BO, 2BU, 2BX, 2TE, 2XE, 2XM, 2AET, 2AM, 2AGR, 2BP, 2BHR, 2DW, 2KI, Canadian (2HE), 2HF, 2HN, 2NE, 2KG.

#### Can. 4CB, Morse, Sask.

Spark: 5BY, 5FM, 5FO, 5IF, 5KI, 5MK, 5XB, 5XU, 5YG, 6APH, 6ATQ, 6AWH, 6BIG, 6IC, 6SJ, 6QR, 6XH, 6ZAM, 7BD, 7BS, (7CC), 7CD, (7CK), (7EX), 7GD, 7GJ, 7HW, 7IY, 7JD, (7LY), 7ME, (7MP), 7NR, 7NZ, 7OT, 7TJ, 7WG, 7XA, 7XB, 7YA, 7YG, 7YJ, 7YL, 7ZJ, 7ZM, 7ZO, 7ZP, 7ZT, (7ZU), 7ZV, 9AAP, 9ABV, 9ACB, 9AFZ, 9AGN, (9AIG), 9ALP, 9AMU, 9ANF, 9DOW, 9ARZ, 9ATM, 9AUF, 9AUZ, 9AVC, 9AVS, 9AVZ, 9AWR, 9AYW, 9BBM, 9CA, (9DEH), 9DEW, 9DEG, 9DKG, (9DOC), 9DNC, 9DSD, 9DZQ, 9EX, 9HI, 9HT, 9INF, 9ISM, 9LW, 9MR, 9NR, (9PI), 9PW, 9RY, 9SA, 9SY, 9TI, 9TY, 9UU, 9WI, 9XI, 9XV, 9YAJ, 9YB, (9YAK), 9ZX, Can. 4AC, (4AO), (4BV), 4DN, 4EI, 9BD.

C.W.: 4BQ, 4FT, 4ZE, 4BY, 5AAM, 5PU, 5ZA, 5ZX, 6AAT, 6AIF, 6APE, 6ASV, (6AWT), 6EN, 6KA, 6KS, 6XAD, 6ZA, 6ZAM, 6ZF, 6ZZ, 7AWS, 7ABS, 7HW, 7JD, 7LU, 7NF, 8CLD, 8LY, 9AAO, 9AAV, 9ADO, 9AJA, 9AJF, 9AJH, (9AJP), 9AJR, 9AKB, 9AKC, 9ALS, 9ALU, 9AM, (9AMB), 9ANS, 9AS, 9AUL, 9AVA, (9AWM), 9AXA, 9AXF, 9AYS, (9BBF), 9BIZ, (9BJI), 9BJV, 9BSG, (9BVI), 9BTT, 9BUG, (9DCF), 9ED, 9DFA, 9DGJ, 9DJM, 9DKY, 9DNG, 9DOF, 9DQM, 9DSW, 9DTH, (9DTM), 9DTS, 9DTW, 9DUN, (9DVA), (9DZQ), 9EA, 9EE, 9FM, 9JL, 9KP, 9JLV, 9NG, 9NN, (9NX), 9OO, (9PI), (9PS), 9URI, 9WD, 9XAV, (9XAQ), (9XI), 9XJU, 9YG, 9YS, 9ZAC, (9ZAF), 9ZE, (9ZIF), Can. (9BD).

1DZ, Medford, Mass.

Spk.: 1CE, 1II, 1QO, 1YB, 1ADL, 1ARY, (1BCF), 1BOQ, 1BRQ, 1BSZ, 1BVB, 2BB, 2BM, 2EL, 2GK, 2JZ, (2OM), 2PF, 2RD, 2SR, 2SZ, (2TF), 2TS, 2TU, 2WB, 2ABM, 2AHU, 2AJE, 2AQE, 2ARK, 2AXK, 2BCF, 2BJO, 3EL, 3FB, 3FO, 3FP, (3HJ), 3GP, 3JZ, 3KG, 3OU, 3RL, 3PB, (3TA), 3UC, (3UD), 3UQ, (3XM), 3ZO, 3ABB, 3AQH, 3ARM, 3AXK, 3BFU, 4BY, 4IE, 4ZD, 5BY, 5PY, 5CH, 5EO, 5JJ, 5LB, 5LQ, 5OE, 5OU, 5PL, 5RQ, 5UC, 5WO, 5XE, 5XF, 5YV, 5ZW, 5AFG, 5AJX, 5AMD, 5AOS, 5AGF, 5APP, 5AVR, 5AXC, 5AXO, 5AXK, 5AWP, (5AYN), 5BUM, 9OX, 9RC, 9ZJ, 9ACB, 9DCX.

C.W.: 1PT, 1QJ, 1QP, 1ZE, (1BES), 1BDI, 2PZ, 2VA, 2AHF, 2AJE, 2AKP, 2AWL, 2BEE, 2BEC, 3FM, (3EL), 3ZY, 3ALN, 3AQR, 4FT, 4GL, 4ID, 4ZE, 5AN, 5FV, 5BK, 5GY, 5IB, 5JM, 5OS, 5VY, 5XV, 5AGZ, 5AIN, 5AQF, 5AWP, 5AXM, 5BAE, 5BDK, 5BUM, 5CIA, 5CLD, 5LE, 5WC, 5AJA, 5ALS, 5BRL, 5BSG.

1CMK, Holyoke, Mass.

C.W.: 1AGI, 1ARY, 1AZW, 1BEP, 1BDC, 1BDI, 1CPZ, 1BUA, (1BFU), 1BWJ, (1II), 1XM, (1QP), 2AWL, 2AWP, (2AAB), (2BNZ), (2AQU), 2AFP, (2AYV), 2AJF, 2AYI, 2AGB, 2EL, 2BB fone, 2BB, 2CCL, 2BTJ, (2ALU), (2CG), (2BIY), (2AJD), (2BLF), 2AQR, 2BG, 2AIG, 2HJ, 2ZO fone, 2BIJ, 2ZAB, 2VW, 2EM, 2ASO, 2SQ, 2VS, 2IL, 2ALN, 2APQ, (4ID), 4DC, 4AZ, 4GL, 4DB, 4CO, 5FV, 5EK, 5ACF, 5AQV, 5ADG, 5BBK, 5ACX, 5TB, 5AOA, 5AGZ, 5AWP, 5XAE, 5CAZ, 5CFP, 5QM, 5BXH, 5AXK, 5LF, 5KS, 5AWM, 5RO, 5AEV, 5TB, 5NB, 5LQ, 5IO, 5KP, 5ALS, 9DW, 9WK.

1CIK, St. Paul's School, Concord, N. H.

C.W.: (1AET), 1ALV, 1ARY, (1AWB), 1AZW, 1BDI, 1BEA, 1BEP, (1BES), 1BIR, 1BJS, 1BOI, 1BOQ, 1BQE, 1BUA, 1CNF, 1IL, 1IN, (1OE), 1OT, 1PT, 1XM, 1ZE, (2AAB), 2ABM, 2AJA, (2AJF), 2AJW, 2ALD, 2ANZ, 2AMO, (2AQH), 2AWK, 2AWS, (2AYV), 2AZF, 2AZZ, 2BEB, 2BEF, 2BEH, 2BG, Can. (2BG), 2BND, 2BNZ, (2BRB), 2BTJ, 2FP, 2IPD, 2KP, 2KW, 2SQ, 2TS, 2VA, 2VH, (2XK), 2AAD, 2AAK, 2ADE, 2AFZ, 2AHU, 2AIC, (2ALN), (2AJD), 2APD, 2AQH, 2AQR, 2BAG, 2BD, 2BEC, (2BG), 2BHL, 2BLF, 2BZ, 2CC, 2CO, 2CAA, 2DY, 2FS, 2HJ, (2KM), 2KW, 2MO, 2NH, 2QY, 2QV, (2EW), (2SJ), 2XE, (2ZO), 2ZY, 4BY, 4GL, 4ID, 5FV, 5UU, 5AFG, 5AGZ, 5AHK, (5AIM), 5AGT, 5ALD, 5ANJ, (5AOA), 5AQF, 5AQV, 5AWP, 5AWW, 5AWZ, 5AXK, 5BAE, 5BFE, 5BFK, 5BK, 5BNJ, 5BNU, 5BNI, 5BRL, 5BT, 5BTO, 5BUM, 5BZY, 5CGT, (5HT), 5LB, 5LF, 5LG, (5NI), 5OS, 5OW, 5PX, 5QM, 5TB, 5UF, 5UK, 5VY, 5WR, 5ZG, 9AAY, 9AJA, 9AJH, 9AKD, 9BRL, 9DAX, 9DY, 9HY, 9KP, 9PS.

Spark: (1ADL), 1AHF, (1BNK), (1CZ), (1OE), 2ABM, 2AHU, 2BJO, 2CES, 2CHE, 2OM, 2PR, 2TS, 2QW, 2AIC, 2APD, 2ARN, 2DM, 2OM, 2OU, 2TA, (2UC), 2UG, 2AFG, 2APB, 2AXX, 2LB, 2SP, 2BHV.

1NY, Belmont, Mass.

C.W.: 1DH, 1FB, 1PD, 1PO, 1PT, 1RD, 1ZE, 1AJG, 1APP, 1ATW, 1AVR, 1AYD, 1BDI, 1BDS, 1BES, 1BKQ, 1BKR, 1BWJ, 1BYG, 1CGG, 1CLZ, 1COC, 1COD, 1CBA, 1CRW, 1CSM, 2AAB, 2AFP, 2AJF, 2AWL, 2AQV, 2AYV, 2BGM, 2BJO, 2BNZ, 2BEC, 2BTJ, 2CCD, 2CGB, 2FF, 2FD, 2FP, 2LO, 2SQ, 2WT, 2PZ, 2CM, 2CZ, 2EM, 2FS, 2RW, 2UC.

2XM, 2ZO, 2ZY, 3AAG, 3ADX, 3ALN, 3AQR, 3BER, 3BFU, 3BLF, 3BNU, 4BY, 4GL, 4ZE, 5AW, 5FV, 5UU, 5OS, 5QM, 5VY, 5XV, 5PX, 5ZG, 5ZZ, 5AHS, 5AIM, 5AIO, 5AGZ, 5AQF, 5ARI, 5AOU, 5AVO, 5AWP, 5AWY, 5BBK, 5BDO, 5BDU, 5BRL, 5BUM, 5BXH, 5BZJ, 5CLD, 5AJA, 5AKR, 5AZE, 5BRL, 5IO, 5KP.

1BGI, Bangor, Me.

C.W.: 1AC, 1AK, 1CP, 1CY, 1DF, 1FB, 1II, 1LP, 1PT, 1QN, 1QP, 1QR, 1RD, 1RV, 1TS, 1UN, 1WV, 1XF, 1XK, 1XM, 1XX, 1YB, 1YK, 1YN, 1ZE, 1AFP, 1AFU, 1AIG, 1AJP, 1AMQ, 1ANQ, 1ARY, 1AVR, 1AWL, 1AXI, 1AYL, 1AUR, 1AZW, 1BAS, 1BDC, 1BDI, 1BEA, 1BEC, 1BEA, 1BEP, 1BES, 1BIF, 1BIR, 1BIS, 1BKE, 1BKQ, 1BLA, 1BLE, 1BMY, 1BQE, 1BQI, 1BRP, 1BSD, 1BUA, 1BWJ, 1CAK, 1CGS, 1CIV, 1CLL, 1CLN, 1CLZ, 1CNF, 1CJH, 1CUH, 1DEA, 1XAD, 2BA, 2BB, 2BG, 2CC, 2CS, 2DH, 2DK, 2EH, 2FD, 2FP, 2HI, 2KL, 2KU, 2NN, 2NZ, 2OM, 2RB, 2RM, 2RP, 2UD, 2VA, 2VH, 2WP, 2XQ, 2AAB, 2AAK, 2AGB, 2AJF, 2AJR, 2AJW, 2ALR, 2ANQ, 2AVU, 2AWF, 2AWK, 2AWL, 2AYV, 2BAK, 2BAS, 2BAY, 2BBB, 2BCF, 2BEA, 2BEB, 2BFZ, 2BGL, 2BGM, 2BIS, 2BNZ, 2BRB, 2BRC, 2BYW, 2CDA, 2AS, 2BF, 2BG, 2BS, 2BZ, 2CA, 2CC, 2CG, 2DH, 2DM, 2FS, 2GM, 2HX, 2IY, 2KM, 2LH, 2LR, 2MO, 2RF, 2RW, 2SQ, 2VW, 2WF, 2YR, 2ZC, 2ZO, 2ZV, 2ZY, 2ADT, 2AHK, 2AIS, 2AJB, 2AJD, 2AQH, 2AQR, 2ASV, 2BEC, 2BHL, 2BIJ, 2BLF, 4BY, 4DC, 4GL, 5AN, 5FV, 5UU, 5AW, 5BK, 5BS, 5BZ, 5DR, 5GQ, 5HJ, 5IQ, 5IV, 5JL, 5JQ, 5JS, 5KS, 5NI, 5OW, 5PU, 5QB, 5QM, 5SP, 5UJ, 5UK, 5VJ, 5XA, 5XV, 5ZG, 5ZY, 5ZB, 5ABO, 5AGC, 5AGO, 5AGZ, 5AHR, 5ALY, 5AME, 5AMQ, 5APH, 5AFT, 5APW, 5AQF, 5AQO, 5AQV, 5ASG, 5AWP, 5AWY, 5AXC, 5AXO, 5AYZ, 5BBE, 5BDE, 5BFX, 5BGX, 5BIX, 5BNJ, 5BNS, 5BNI, 5BUM, 5BUZ, 5BXA, 5BXH, 5BXS, 5BZY, 5CAZ, 5CFP, 5CMZ, 5AL, 5DV, 5HR, 5HW, 5IO, 5AAY, 5ARK, 5AKD, 5BLO, 5DWJ, Can. 2BG.

Spark: 1AW, 1BH, 1CM, 1DZ, 1FV, 1GM, 1GQ, 1HK, 1OJ, 1OT, 1RV, 1TS, 1YB, 1YD, 1AEV, 1AFZ, 1AHL, 1AMD, 1APO, 1ARM, 1ARY, 1AZK, 1BCF, 1BDT, 1BIR, 1BIS, 1BOQ, 1BVB, 1CAK, 1CHJ, 1CIK, 1XAH, 2BK, 2BM, 2BY, 2DN, 2EL, 2FP, 2OM, 2XK, 2XQ, 2BJO, 2LC, 2OU, 2XM, 2ZA, 2ZV, 2AY, 2EA, 2JQ, 2MZ, 2SP, 2XE, 2ZY, 2ACF, 2AXO, 2BER, 2BEP, 2HR, 2KGE, Can. 2BP.

1BKQ, Worcester, Mass.

C.W.: (1FD), 1FF, 1LZ, 1MX, 1NE, (1ON), (1PT), 1RD, (1XM), 1ZE, 1AGI, (1ARY), 1AVI, 1AVR, 1AWB, 1AZW, 1BAL, 1BDI, 1BEA, (1BKR), (1BLE), 1BQE, 1BQK, 1BLQ, 1BRQ, (1BSD), 1BUA, (1BWJ), 1BYG, 1CAC, 1CEC, 1CDZ, (1CGS), 1CIK, (1CLL), 1CMK, 1CNI, 1COA, (1COD), 2BB, 2BT, 2CG, 2DA, 2DN, 2ER, 2FP, 2KP, 2LD, 2NZ, 2PZ, 2RM, (2SQ), 2TF, 2TU, 2VA, (2VH), 2WI, 2AAB, 2AAG, 2AFP, 2AJF, 2AJW, 2AKO, 2AKV, 2ALR, 2AWF, 2AWL, 2AYV, 2AYZ, 2BAK, (2BBB), (2BCF), 2BEB, (2BEH), 2BEJ, 2BML, (2BNC), (2BNZ), 2BSC, 2BTJ, 2CBG, 2CCD, 2AW, (2BA), 2BG, 2BZ, 2CA, 2CM, 2EM, (2FM), (2FO), (2FR), 2FS, 2HF, 2HJ, (2IZ), 2JH, 2LR, 2RW, 2SH, (2UQ), 2WJ, 2XM, (2ZO), (2ZY), 2ZZ, 2AAD, (2AAE), 2ABT, 2ADT, 2ADX, 2AFP, 2AJP, (2ALN), (2ALU), 2AMG, 2ANO, 2ANX, 2APQ, 2AQH, (2AQR), 2ARN, 2BAG, 2BAR, 2BEC, 2BFU, 2BIY, 2BLF, 2BNU, 2XAA, 4BY, 4CO, 4DC, 4DY, 4FT, 4GC, 4GL, 4HW, 5DA, 5FV, 5UU, 5ZA, 5AV, 5BB, 5BK, 5BT, 5DR, 5HJ, 5JJ, (5JL), 5JU, 5KS, 5LB, 5MP, (5NB), 5NI, (5PX), 5QB, 5QM, 5QY, 5RM, 5RO, 5SE, 5SP, 5TB, 5TN, (5UK), 5VL, 5VY, 5WE, 5WK, 5WY, (5XV), 5ZG, 5ZZ, 5AAY, 5ACF, 5ADG, 5AGO, 5AGZ, 5AIG, 5AIM, 5AIO, (5AJV), 5ALB, (5AMK), 5AOA, 5AOC, 5AOT, 5APN, 5APT, 5AQN, (5AQV), 5ARD, 5AWH, 5AWM, (5AWP), (5AXC), 5AXK, 5AXM, 5AXO, 5AXY, 5AYS, 5AYT, 5AYY, 5BAE, 5BBK, 5BBW, 5BDO, 5BDU, 5BIL, (5BNJ), 5BRC, (5BRL), 5BUM, 5BUQ, 5BXA, 5BXH, 5CAZ, 5CFP, 5CLD, 5ZAC, 5DV, 5FM, 5HW, 5IO, 5JI, 5KP, 5UH, 5WU, 5XI, 5AAV, 5ACY, 5AHK, 5AIV, 5AJA, 5AJH, 5AKR, (5ALS), 5ARK, 5AYH, 5BRL, 5DTJ, 5ZIF, 5ZAF, (NOF).

Sparks: 1ADL, 1AKG, 1ARY, (1ASF), (1CHJ), 2CT, 2DN, 2ER, 2FP, 2JO, 2AQI, 2BJO, 2BG,

3FP, 3HJ, 3OU, (3TA), 3UD, 3ARM, 3AB, 3BO, 3FT, 3UC, 3WO, 3WU, 3XE, 3ABY, 3AGK, 3AIB, 3AIM, 3AKQ, 3APP, 3AWF, 3AWP, 3BDY, 3BSS, (3BXX), 3BP, 3AAW, 3DCX. Can. 3BP, 3EI, 3KG.

2AQU, Newark, N. J.

Spark: 1ADC, 1ADL, 1AHL, 1AKC, 1AKG, 1ARY, 1ASF, 1AW, 1AZK, 1BDT, 1BOQ, 1BQA, 1BRQ, 1BVH, 1BYG, 1OE, 1RV, 1WQ, 1ZE, 2AHU, 2DA, 2GK, 2XQ, 3AHK, 3AIC, 3AJD, 3ALN, 3AUW, 3BCQ, 3GX, 3HG, 3HJ, 3OU, 3QN, 3UC, 3XM, 4CP, 4CX, 4EA, 4GN, 5PY, 5XA, 5BM, 5ACF, 5AFG, 5AHH, 5AJT, 5ALO, 5AMZ, 5ANO, 5APE, 5ARD, 5AUY, 5AWU, 5AXY, 5AYC, 5AYN, 5BAZ, 5BBO, 5BEP, 5BHV, 5BRL, 5BUN, 5EO, 5LB, 5NO, 5QC, 5SP, 5TT, 5UC, 5WD, 5WO, 5XE, 5YAE, 5YH, 5YN, 5YV, 5ZAA, 5ZAC, 5AAU, 5AGB, 5APH, 5APS, 5BP, 5DCX, 5DF, 5DIW, 5DLX, 5DWF, 5DZI, 5PB, 5UH, 5YAE, 5YB, 5YQ. Can. 3GN.

C.W.: 1AFV, 1AGI, 1AIP, 1AMQ, 1ARY, 1AVR, 1BDI, 1BEA, 1BKQ, (1BQE), 1BUA, 1BWJ, 1BYG, 1CAK, 1CGS, 1COD, 1MX, 1QN, 1QP, 1TS, (1XX), 1ZE, 2AAB, 2AWF, 2EH, 2AAD, 2AAG, 2AAO, 2AAY, 2ADT, 2ADX, 2AJD, (2ALE), 2ALN, 2ANJ, 2AQR, 2ARV, (2ASO), 2BEC, 2BG, 2BHL, 2BJ, 2BLF, 2BZ, 2CM, 2FS, 2HG, 2HJ, 2LC, 2NE, 2RM, 2SM, 2XAA, 2ZO, 2ZY, 4BK, 4BQ, 4CO, 4FT, 4GL, 4ID, 4IL, 4YA, 4ZE, 5NZ, 5UU, 5ZA, 6JD, 6PT, 8ABO, 8ABV, 8ACR, 8ADG, 8AGO, 8AGZ, 8AHZ, 8AIG, 8AIM, 8AJV, 8AMK, 8AOC, 8APT, 8AQP, 8ARD, 8ARI, 8AVD, 8AWF, 8AWP, 8AWY, 8BBK, 8BDE, 8BET, 8DK, 8BFX, 8BK, 8BLT, 8BO, 8BOX, 8BRL, 8BUM, 8BUQ, 8BVK, 8BXH, 8CAB, 8CGX, 8CW, 8EJ, 8LX, 8NL, 8OC, 8PX, 8UK, 8VJ, 8VY, 8WA, 8WA, 8WR, 8XV, 8XX, 8ZAE, 8AAS, 8AAV, 8ACE, 8AJH, 8AMU, 8AS, 8AXF, 8BED, 8BRL, 8BSG, 8DTJ, 8DV, 8DYN, 8DYT, 8IO, 8KP, 8YJ, 8ZL.

2AVE, Jamaica, L. I.

C.W.: 1FF, 1NE, 1AGI, 1AOL, 1AZW, 1BDI, 1BES, 1BQE, 2DN, 2FP, 2GA, 2JJ, (2MM), 2RB, 2RM, (2RY), (2SQ), 2UJ, 2VA, 2XJ, 2ADT, 2AEQ, 2AJR, 2AMO, 2ANZ, 2AQU, 2AU, 2AV, 2AZZ, (2BCF), 2BEB, 2BEH, 2BFZ, 2BIV, 2BJQ, 2BKE, 2BLP, (2MW), (2BNC), 2BNL, (2BQW), (2BTW), (2BUO), (2BWA), (2BWW), 2BYW, 2BZV, 2CAF, 2CAH, 2CCD, 2CDK, (2CDW), (2CEC), (2CKQ), 2CIR, 2BG, 2CG, 2CM, 2FS, 2VW, 2YM, 2ZO, 2ZY, 2AAD, 2AAG, 2AFB, 2ALN, 2APZ, 2AQE, 2BAG, 2BLF, 2BLU, 2XAA, 2ZAB, 4AZ, 4CO, 4EH, 4EW, 4FT, 4GL, 4ZE, 5NZ, 5UU, 5ZA, 5BK, 5BO, 5JU, 5LB, 5LF, 5LW, 5NB, 5SP, 5UK, 5VJ, 5VY, 5XV, 5ZG, 5ZV, 5ABV, 5AGZ, 5AIM, 5AIO, 5AOA, 5AQP, 5AQV, 5AVD, 5AWI, 5AYT, 5AWP, 5BBK, 5BRL, 5BUM, 5BVK, 5XAD, 5JR, 5KP, 5AAV, 5AJA, 5AJH, 5AXF, 5BLO, 5BRK, 5YAM. Can. 3CZ.

Spk: 1LZ, 1AGX, 1BQL, 1CHJ, 3AC, 3GE, 3GX, 3HJ, 3UD, 3AJD, 3ARM, 3ASH, 3AUW, 3BGT, 4EA, 4ET, 5HK, 5PY, 5EW, 5IH, 5IN, 5JJ, 5JL, 5LB, 5OD, 5SP, 5UC, 5WE, 5XE, 5WO, 5YH, 5BM, 5ACF, 5AHH, 5AHS, 5ALO, 5AMZ, 5AOI, 5APB, 5AUY, 5AWY, 5AXC, 5AXY, 5AYN, 5BBO, 5BEN, 5BHU, 5BHV, 5BKC, 5BUM, 5BXC, 5BXX, 5AV, 5VL, 5ZJ, 5AAW, 5ACY, 5API, 5DIO, 5DKV. Can. 3GN, 3KG.

2ACW, Schenectady, N. Y.

Spark: 1ACO, 1ADL, 1AHF, 1ARY, 1AZK, 1BCF, 1BDI, 1BHR, 1BJE, (1BOQ), 1BQA, 1BRQ, 1BZ, 1CHJ, 1GM, 1LZ, 1OZ, 1RV, 1YB, 2AAF, 2ABM, 2AIM, 2ARK, 2BJO, 2BK, (2BM), 2BSC, 2DI, 2EL, 2NB, 2OM, 2PF, 2TS, 2WB, 2XK, 2AAB, 2AFS, 2AHK, 2AK, 2ARN, 2AUW, 2BFU, 2BGT, 2CC, 2FP, 2GX, 2HG, 2HJ, 2PB, 2PU, 2QW, 2UC, 2UD, (2UQ), 2ZX, 4EA, 4CX, 5AAA, 5AAB, 5ACF, 5ADQ, 5AFA, 5AFB, 5AFG, 5AGK, 5AHE, 5AHS, 5AJT, 5AKQ, 5ANW, 5AUY, 5AXC, 5AXO, 5AXQ, 5AYN, 5BEP, 5BDV, (5BFH), 5BHV, 5BMC, 5BOG, 5BVS, 5CEB, 5CF, 5CFX, 5CG, 5CH, 5EO, 5EW, 5FS, 5FT, 5IN, 5LB, 5MZ, 5NI, 5OP, 5PL, 5QC, 5QE, 5QQ, 5SP, 5UR, 5VQ, 5WD, 5WO, 5XE, 5YM, 5ZP, 5AAP, 5AAV, 5ACB, 5ACL, 5AOE, 5APB, 5AV, 5AVP, 5CA, 5DFK, 5DFX, 5DKV, 5HR, 5JN, 5RC, 5UU, 5YAC, 5YAE, 5YB, 5YQ. Can. 2CI, 3BA, 3BP, 3EH,

3EI, 3EO, (3FO), 3GE, 3GN, 3JL, 3KG.

C.W.: 1AJS, 1BEA, 1BGF, 1BKQ, (1BUA), 1BYK, 1CGO, 1CMD, 1CNF, 1PT, 1UJ, 1XX, 1XY, 2AAB, 2AJF, 2AJR, 2ANZ, 2BAY, 2BEA, 2BGI, 2BNZ, 2BRC, 2VA, 3ADT, 3ADX, 3AHH, 3AQE, 3BEC, 3BG, 3CG, 3FS, 3OQ, 3TJ, 3ZO, 3ZY, 4EW, 4GL, 4LP, 5BM, 5FV, 5UF, 5AVO, 5AWP, 5AWY, 5AWZ, 5BDO, 5CA, 5DR, 5XK, 5ZX, 5ZZ, 9AJA, 9ALS, 9ARK, 9DKH, 9DV, 9PS, 9MU, 9ZY.

2BII, East Orange, N. J.

Spark: 1ADC, 1ADL, 1AIL, 1AKQ, 1AMD, 1AMQ, 1APO, 1ARY, 1AYQ, 1BDT, 1BGF, 1BHO, 1BJE, 1BOQ, 1BQL, 1BRQ, 1BSZ, 1BTL, 1BVH, 1BVH, 1CK, 1CP, 1CZ, 1GM, 1HK, 1IN, 1LZ, 1MA, 1OJ, 1ON, 1RV, 1SN, 1SO, 1UL, 1WQ, 2DA, 2GK, 2PV, 2SZ, 3AJD, 3ARN, 3ARY, 3BHM, 3CG, 3GM, 3GX, 3JL, 3NB, 3TA, 3XM, 4AU, 4BG, 4DH, 4EA, 5DA, 5XU, 5ABM, 5ACD, 5ACF, 5AFA, 5AFG, 5AIO, 5AKO, 5AKQ, 5ALO, 5ANW, 5AOT, 5APB, 5ARD, 5AUV, 5AVO, 5AWP, 5AWU, 5AWY, 5AXC, 5AXO, 5AXQ, 5AXY, 5AY, 5AYN, 5BBO, 5BCO, 5BDY, 5BFM, 5BFV, 5BLO, 5BRL, 5BK, 5BXC, 5BXX, 5BZC, 5CP, 5CQ, 5DX, 5DY, 5EA, 5HR, 5IH, 5IN, 5J, 5JP, 5JQ, 5KY, 5LH, 5MT, 5SF, 5SP, 5UC, 5UP, 5VQ, 5WD, 5WE, 5XE, 5YU, 5YV, 5ZAY, 5ACB, 5ACY, 5AGR, 5AIU, 5AJH, 5AR, 5AYH, 5AZE, 5BP, 5BXP, 5DBQ, 5DCX, 5DIW, 5DK, 5DKH, 5DWP, 5DXM, 5OX, 5RC, 5UH, 5UM, 5UU, 5UZ, 5ZJ, 5ZL, 5ZP, 5GE.

C.W.: 1AGW, 1AQZ, 1ARY, 1AVI, 1AVR, 1AWB, 1AZW, 1BAI, 1BDI, 1BDG, 1BEA, 1BJE, 1BKQ, 1BQE, 1BUA, 1BWJ, 1BYG, 1CGO, 1CGS, 1CIK, 1CJH, 1COA, 1ES, 1FF, 1II, 1IV, 1PT, 1QE, 1QN, 1UJ, 1XM, 1XX, 1ZE, 2BY, 2AAG, 2AAN, 2ACQ, 2ADX, 2AFB, 2AHK, 2AIG, 2AJD, 2ALI, 2ALN, 2ANQ, 2AQR, 2ASO, 2BEC, 2BEK, 2BFQ, 2BHL, 2BHM, 2BLJ, 2BLF, 2CG, 2CO, 2DH, 2FR, 2FS, 2HG, 2IZ, 2KM, 2NH, 2OU, 2RW, 2UH, 2ZAB, 2ZY, 4AZ, 4BY, 4CO, 4DK, 4EN, 4FF, 4GL, 5FT, 5FV, 5UU, 5ZA, 5ZAD, 6ALE, 6ZA, 6ZB, 8AJV, 8AKS, 8ALB, 8AMB, 8AMD, 8AML, 8AMM, 8ACF, 8ADG, 8AGF, 8AGZ, 8AIG, 8AIM, 8AIO, 8AMZ, 8AOG, 8AOC, 8ARI, 8ARK, 8ASG, 8ASK, 8AVD, 8AWP, 8AWZ, 8AXK, 8AXO, 8AXQ, 8AYT, 8AZF, 8BBD, 8BBK, 8BDB, 8BDO, 8BET, 8BFX, 8BK, 8BLD, 8BO, 8BOX, 8BRL, 8BTP, 8BUM, 8BUQ, 8CAZ, 8CFK, 8CGM, 8GS, 8GV, 8HJ, 8IV, 8JL, 8LB, 8LW, 8LX, 8MB, 8ME, 8NB, 8NV, 8OH, 8OS, 8SJ, 8SP, 8UJ, 8UK, 8VJ, 8VY, 8WB, 8WL, 8WM, 8WO, 8WR, 8XK, 8XV, 8ZAE, 8AAS, 8AAV, 8AAV, 8AAV, 8AIG, 8AJA, 8AJH, 8AKD, 8AKR, 8ALS, 8AYS, 8BED, 8BRL, 8BSG, 8KP, 8SJ, 8ZAF. Can. 2BG, 3BP, 3GN, 3KE, 3KG.

2BND, Oceanport, New Jersey

1ADL, 1AEV, 1AGI, 1AOL, 1ARY, 1AZJ, 1BCV, 1BDC, 1BFX, 1BIL, 1BKA, 1BKQ, 1BOQ, 1BPZ, 1BQE, 1BWY, 1BYX, 1CAK, 1CAL, 1CDR, 1CLI, 1DWJ, 1DF, 1GM, (1IV), 1OE, 1OG, 1PM, 1RU, 1TJ, 1UN, 1UQ, 1ZE, 2ADL, (2AVU), 3AA, 3ADT, 3AHK, 3AIC, 3ANJ, 3AWK, 3BEC, 3BHL, 3BIV, (3BZ), 3CC, 3DH, 3FD, 3HG, 3XM, 3ZAB, Can. 3BP and 3FO, 4BY, 4CE, 5EA, 5EL, 4GL, 5ACF, 5AFD, 5AFV, 5AGZ, 5AHR, 5AJT, 5AMK, 5AMQ, 5AOF, 5AQZ, (5AQF), 5AWP, 5AXO, 5AYN, 5AYS, 5AYV, 5AZH, 5BCO, 5BEP, 5BFX, 5BNI, 5BOX, 5AP, 5BK, 5BO, 5BP, 5DE, 5DR, 5DY, 5EO, 5II, 5IF, 5IQ, 5IV, 5JL, 5JQ, 5JS, 5OE, 5OI, 5QY, 5SP, 5RU, 5TT, 5WC, 5WE, 5WS, 5XE, 5XH, 5XS, 5XU, 5YH, 5YN, 5ZR, 5ZV, 5ZZ, 9AAV, 9AIV, 9AKR, 9AMB, 9DWP, 9EI, 9LQ, 9LR, 9WU, 9YQ, 9ZJ, 9ZN.

Spark: 1BOQ, 2KB, 2NB, 2OM, 3AAM, 3AC, 3AIC, 3AN, 3AJD, 3EJ, 3GZ, 3HG, 3IA, 3OU, 3QW, 3RA, 3SF, 3UC, 3VS, 3WF, 3YH, 4EA, 4GN, 5DA, 5PY, 5XA, 5AFD, 5AFG, 5AJT, 5ARD, 5ATU, 5AZC, 5BAZ, 5BEF, 5BEG, 5BEP, 5BHV, 5BXA, 5BRD, 5EH, 5OD, 5QE, 5SF, 5RQ, 5UC, 5UD, 5AAJ, 5AEK, 5AGR, 5AIR, 5AOE, 5ASJ, 5BP, 5CP, 5DSO, 5DWP, 5EP, 5FS, 5GX, 5UM, 5VL, 5WK.

C.W.: 1AYL, 1BGF, 1CGO, 1CLL, 1PT, 1TS, 1UN, 2AAB, 2AWA, 2AFP, 2BEH, 2BYW, 2IB, 2KP, 2OF, 2AAV, 2AHK, 2AJE, 2AJD, 2ALN, 2ANY, 2APT, 2AQR, 2BA, 2BAG, 2BG, 2EJA, 2BKS, 2BLF, 2BS, 2BZ, (2FQ), 2FS, 2GN, 2HG, 2IB, 2KM, 2MZ, 2RF, 2RM, (2SG), 2VS,



3WF, 3XAA, 3XT, 3YH, 3ZM, 3ZN, 3ZO, 3ZY, 4BQ, 4DC, 4DS, 4EW, 4GX, 4XD, 5FV, 5KU, 5UU, 8AAI, 8AGF, 8AGH, 8AIM, 8ALB, 8ALT, 8ANB, 8APT, 8ARP, 8ASV, 8ATV, 8AUZ, 8AWZ, 8AYZ, 8AZI, 8BAC, 8BDO, 8BDU, 8BFX, 8BNI, 8BO, 8BT, 8BUG, 8BYE, 8CAZ, 8CBR, 8CGX, 8CRG, 8GV, 8HJ, 8IQ, 8JS, 8PX, 8VJ, 8YM, 8ZX, 9AAS, 9AAV, 9AIV, 9AJP, 9AKD, 9AKR, 9BBF, 9BRL, 9DBU, 9DDW, 9EI, 9IO, 9KP, 9PI, 9PO, 9OF.

3AQW, Trenton, N. J.

Spark: 1AED, 1AEV, 1ADL, 1ADR, 1AHL, 1AMD, 1AFO, 1ARY, 1AZK, 1AW, 1BDT, 1BHR, 1BOQ, 1BSZ, 1CH, 1CHJ, 1CK, 1COK, 1DY, 1GM, 1HO, 1IA, 1II, 1ILZ, 1RV, 1VQ, 1WQ, 1YB, 1YD, 2ARK, 2ARY, 2AWS, 2AZY, 2BB, 2BFX, 2BK, 2L4, 2BJP, 2BY, 2CT, 2DR, 2EL, 2FP, 2NB, 2OM, 2QR, 2RV, 2GK, 2TS, 2TU, 2XQ, 3AC, 3ACE, 3ACM, 3AHK, 3AIA, 3AIC, 3AIB, 3AID, 3AK, 3AP, 3AQR, 3AOR, 3AOV, 3ARM, 3ASP, 3ASY, 3ARN, 3ATZ, 3AUW, 3BFA, 3BP, 3CC, 3DR, 3EH, 3FB, 3GE, 3GN, 3HJ, 3HG, 3HX, 3EO, 3IT, 3KT, 3LK, 3MN, 3NB, 3OU, 3PB, 3QR, 3QW, 3TA, 3UD, 3VW, 3XC, 3XF, 3XM, 3YP, 3YV, 3ZA, 3ZO, 3ZV, 3ZQ, 3ZS, 3XAE, 4BI, 4BQ, 4BX, 4CG, 4CX, 4DH, 4EA, 4ED, 4ET, 4FR, 4GN, 4YA, 4YB, 5DA, 5FO, 5FV, 5PY, 5XA, 5XB, 5XU, 5ZA, 5ZAB, 5ZAF, 5AC, 5AK, 5ACF, 5ADR, 5AFA, 5AFD, 5AFG, 5AGK, 5AHS, 5AHY, 5AHH, 5AIT, 5AJT, 5AKQ, 5ALO, 5AMZ, 5AOH, 5AOT, 5APB, 5AUE, 5AUX, 5AVJ, 5AVT, 5AWP, 5AXC, 5AXO, 5AXY, 5AYI, 5AYX, 5BAC, 5BBO, 5BBU, 5BEP, 5BFH, 5BFM, 5BHV, 5BN, 5BRL, 5BRC, 5BNI, 5BVS, 5CF, 5CH, 5CHV, 5DY, 5EA, 5EF, 5EO, 5EW, 5FH, 5KG, 5LW, 5MZ, 5QC, 5QQ, 5RQ, 5SP, 5TH, 5TT, 5TY, 5UC, 5VQ, 5XE, 5YN, 5AYN, 5YAA, 5ZAC, 5ZAE, 5ACY, 5AEG, 5AFD, 5AIR, 5AOE, 5ASJ, 5AWX, 5AZE, 5BP, 5CP, 5DBE, 5DCK, 5DFX, 5DZH, 5DKV, 5DQQ, 5DSO, 5DWP, 5DXM, 5DY, 5DUY, 5EE, 5FS, 5HR, 5MC, 5ME, 5TT, 5UH, 5US, 5UU, 5YB, 5YC, 5YM, 5YQ, 5ZJ, Can. 5BP, 5CG, 5FO, 5GE, 5JL, 5KG, 5LI.

C.W.: 1ADL, 1AFV, 1AIP, 1AOL, 1ARY, 1AWB, 1AVR, 1AVA, 1AYL, 1BCF, 1BCG, 1BDC, 1BDI, 1BGF, 1BH, 1BHJ, 1BQE, 1BQK, 1BKQ, 1BTL, 1BUA, 1BWJ, 1BSD, 1BSS, 1CAK, 1CIV, 1CLB, 1CLI, 1CNF, 1COD, 1ES, 1FF, 1MA, 1NE, 1PT, 1QN, 1TS, 1UN, 1XJ, 1XM, 1ZE, 2AAB, 2AAX, 2ACH, 2ADV, 2AID, 2AJP, 2AJW, 2AKO, 2AFP, 2AQ, 2AWF, 2AWL, 2AYV, 2AYI, 2AYR, 2ANZ, 2AZZ, 2BAD, 2BAK, 2BAY, 2BEA, 2BEB, 2BFZ, 2BGM, 2BLP, 2BML, 2BNZ, 2BQK, 2BUA, 2BVH, 2CBT, 2CCD, 2CCP, 2CIC, 2FD, 2FP, 2FS, 2FZ, 2KP, 2LE, 2NZ, 2OF, 2KW, 2PZ, 2QR, 2TB, 2XHI, 2XJ, 2XI, 2WP, 3AAD, 3AAE, 3AAG, 3AAN, 3AAY, 3ACC, 3ACQ, 3ADT, 3ADX, 3AEG, 3AEV, 3AFU, 3AJB, 3AJD, 3AKU, 3ALE, 3ALN, 3ANJ, 3ANO, 3ANU, 3APA, 3APQ, 3AQP, 3AQH, 3AQI, 3AQR, 3AWI, 3AXY, 3BAG, 3BEC, 3BFQ, 3BHL, 3BIY, 3BLF, 3CA, 3CAA, 3BZ, 3CC, 3DH, 3FM, 3FR, 3FS, 3HG, 3HJ, 3HX, 3IH, 3IW, 3JJ, 3KD, 3KM, 3IZ, 3LZ, 3MO, 3NH, 3NN, 3OT, 3PB, 3QV, 3RM, 3RW, 3SH, 3SM, 3TA, 3VS, 3VW, 3XL, 3XY, 3YP, 3ZN, 3ZO, 3XAA, 3XHD, 3ZAB, 3ZAC, 3ZAE, 3ZB, 3ZC, 3ZD, 3ZE, 3ZL, 3ZM, 3ZN, 3ZO, 3ZY, 4BE, 4BF, 4BI, 4BQ, 4BY, 4CE, 4CL, 4DC, 4EL, 4EU, 4EW, 4FO, 4GL, 4GU, 4ID, 4II, 4LE, 4XC, 4YK, 5CV, 5DA, 5FV, 5NZ, 5UU, 5ZAD, 5BW, 5ALE, 5AAI, 5ADG, 5AGO, 5AGZ, 5AIO, 5AHR, 5AJV, 5ALB, 5ANR, 5AJO, 5AMM, 5APW, 5AQF, 5AQV, 5AQZ, 5AWM, 5AWP, 5AWY, 5AWZ, 5BEX, 5BFX, 5AYZ, 5BDO, 5BK, 5BT, 5BQM, 5BNI, 5BUM, 5BUQ, 5BRM, 5BRC, 5BRL, 5BXA, 5BXH, 5BYE, 5CF, 5CGX, 5DR, 5GV, 5HJ, 5JM, 5JS, 5JU, 5LJ, 5LX, 5NI, 5OC, 5PX, 5RO, 5RQ, 5OS, 5SP, 5TB, 5TH, 5UD, 5UK, 5VY, 5WO, 5WY, 5WA, 5WR, 5XE, 5ZZ, 5ZAC, 5ZAE, 5AAY, 5AJA, 5AKR, 5ALS, 5AMB, 5ARK, 5BLO, 5DNY, 5DXN, 5DV, 5HW, 5II, 5IO, 5KP, 5PN, 5PS, 5WD, 5WC, 5WK, 5ZY. Can.: 3BP, 5AL. Fone: 1XAD, 1XE, 2BB, 2LO, 2XAI, 2XI, 2XJ, 2AYI, 2AYR, 2AYZ, 2BAK, 2CAP, 3HJ, 3XU, 3YQ, 3ZO, 3AWI, 3BRW, 3AWP, 3AXC, 3UV, 3XM, 3BNO.

3ZAB, Roanoke, Va.

C.W.: 1AGI, 2BGA, 2RQ, 2SQ, 2KW, 2AU, 2WS, 2BNZ, 3APD, 3ZY, (3APA), 3CA, (3BIY), (3RF), 3APB, 3BZ, (3SQ), 3ADE, 3BG, 3BLF, 3CM, 3CT, 3FS, 3AAD, 3AW, 3BEC, 4BQ, 4ID, 4EN, 4EW, 5UU, 5FV, 5DA, 5NZ, 5AWP, 5BNW, 5AWM, 5BAL, 5JM, 5BAX, 5LW, 5ANR, 5AHR, (5AIM), 5AOA, 5AQF, 5XV, (5BEX), 5AWZ, (5AGZ),

5BK, 5AXK, 5AYZ, 5AGO, 5AJ, 5AKD, 5IO, 5JL, 5BHI, 5BRK, 5BLO, 5BRL, 5ANS, 5KP, 5AAY, 5AAS, 5AOU, Spark: 2ABB, 3APD, 3BG, (3AAL), 5AU, 5BR, 5ARY, 5DN, 5YMC, 5BV, 5AKQ, 5WT, 5XE, 5ADQ, 5ZN, 5GC, 5XM, 5DF, 5RC, 5BIW.

3ZY, Washington, D. C.

C.W.: 1FF, 1QN, 1UN, 1UJ, 1PT, 1ZE, 1AFV, (1AGI), 1AIP, 1AJS, (1ARY), 1AZW, (1BDI), 1BEA, 1BES, 1BTL, 1BUA, 1CAK, 1CIK, 1BWJ, 2DN, 2EH, 2FP, 2KP, 2LO, 2PZ, 2RB, 2SQ, 2VA, 2XA, 2XK, 2ZS, 2AAB, 2AFP, 2AQ, 2AYI, 2AKO, 2AJP, 2AYV, 2AJA, (2ANZ), 2BML, 2BEE, 2BLP, 2BGM, 2BEA, 2BFZ, 2BCF, 2BAK, 2BYS, 2BEB, 3AS, 3BA, (3BZ), (3CG), (3CA), 3CC, 3CM, (3FM), 3FS, 3HJ, (3HG), 3IZ, (3RF), 3SQ, 3TJ, (3ZO), 3AWF, 3AJD, 3AQR, (3AAG), 3AAY, 3AQH, 3AAD, (3AHK), 3BQY, 3BIO, 3BJL, 3BLF, 3BHL, 4AZ, 4BQ, 4BY, 4BK, 4DC, 4EB, (4FT), (4GL), 4GX, 4ID, 4YA, (4ZE), 5FV, 5LA, (5UU), 6ZZ, (5BK), 5BA, 5BO, (5CW), 5DR, 5GS, 5GV, 5HJ, (5JL), 5JU, (5LX), 5LW, 5NI, 5OS, 5OC, 5OW, 5PX, 5QB, 5SF, 5UK, 5VY, 5VJ, 5WR, 5XK, 5XV, 5ZG, 5ZZ, 5AIO, (5AMM), (5AQV), 5AWP, 5AQF, 5AXK, 5AIG, 5AWY, 5AJW, 5AMD, (5AWZ), 5AXC, 5ASB, 5AGZ, 5AQO, 5AIM, (5ACF), 5AVH, 5AWM, 5ARW, 5AYZ, (5BUM), 5BQM, 5BCA, 5BXH, 5BRC, 5BOX, 5BFX, 5BNI, 5BDO, 5BUX, 5BNJ, 5CAZ, 5CLD, 5CGT, 5CHO, 5YAA, 5QM, 5AS, 5AG, 5DV, 5IO, 5LE, 5NX, 5HW, 5SJ, 5WO, 5XM, (5ZL), 5ZY, 5AWM, (5AAV), 5AJP, (5AJH), (5AJA), 5ALS, 5AKD, 5AAY, 5BRL, 5DYN, 5XAQ, 5NS, 5DFI, 5DKA phone, 5WBL phone, 5NZO, (5WUBC).

Sparks: 2OM, 3AHK, 4EA, 5EW, 5XE, 5AYN, 5AJT, 5AFG.

3FM, Philadelphia, Pa.

Spark: 1AKG, 1ABY, 1BHR, 1CHJ, 2BK, 2FP, 2OM, 3AHK, 3CAA, 3BP, Can. 5BN, 5RQ, 5UC, 5WO, (5XE), 5ACF, 5ARD, 5AIC, 5AXY, 5BBO, 5BBU, 5BP, 5CA, 5UU, 5AAW, 5AGR, 5DKV. C.W.: 1PT, 1ZE, (1AGI), 1AMS, 1AVR, 1AWB, 1AWH, 1AZW, 1BDI, 1BEA, (1BES), (1BKQ), (1BWJ), 1CAK, 1CGG, 1CGS, 1CIK, 2FP, 2NZ, (2PZ), 2XJ, 2AAG, 2ADL, 2AJP, 2AWL, (2AYV), 2BNZ, 2BYS, 2CBG, 2CCD, (3BA), 3CG, (3EM), 3KM, 3LR, 3SJ, (3TJ), (3XM), (3ZO), (3ZY), 3AAG, 3AHE, (3ALN), (3BFU), 3BLF, 3BMJ, 4AZ, 4CO, 4CL, 4FT, 4GL, 4ZE, 5FV, 5UU, 5BK, 5BO, 5CW, 5GS, 5GV, (5IV), (5JL), 5JS, 5KH, (5LW), (5LX), 5NI, 5OC, 5OS, 5PX, 5QM, (5RQ), 5UJ, (5UK), (5VJ), (5VY), 5VY, 5ACF, 5ADR, (5AGZ), 5AIM, 5AIO, 5AJV, 5ALB, 5AMD, 5AME, (5AMM), 5APN, 5AQF, 5AQV, 5ASO, 5ATU, (5AVH), 5AWF, 5AWP, 5AXC, 5AXK, 5BK, 5BCA, 5BDE, 5BDO, 5BET, 5BFX, 5BOX, (5BRL), 5BTO, 5BTP, 5BUM, 5BUX, 5BXH, 5CAZ, 5CGT, 5CGY, (5CLD), 5AR, 5AS, 5FM, 5HW, (5IO), 5JL, (5KP), 5XI, 5ZL, (5AAV), 5AJA, 5AJH, 5AJP, 5ALS, 5AXF, (5AYH), 5BKZ, 5BLO, 5BPQ, 5BSG.

4KC, Ashville, N. C.

1BCG, 1AW, 1AAW, 2QR, 2ALY, 3AM, 3EL, 4EL, 4BY, 4ZO, 4AF, 4AQ, 4LT, 4GH, 4DS, 4GL, 4AS, 4GM, 5AR, 5SA, 5LP, 5AW, 5CA, 5FQ, 6AR, 6EL, 6FA, 6BK, 6NR, 6YN, 6MR, 6AE, 7DA, 7AS, 7PQ, 7ES, 7GA, 7HE, 7GE, 7ER, 8CX, 8BCL, 8BUN, 8BK, 8HA, 8ALY, 8AM, 8PE, 8CA, 9XM, 9PL, 9AR, 9ZN, 9PL, 9ZL, 9CR, 9CS.

4GE, Savannah, Ga.

Spark: 3AOV, 4AS, 4BQ, 4BC, 4CP, 4CX, 4DZ, 4EH, 4GU, 5AA, 5DA, 5FO, 5GI, 5HK, 5TG, 5XA, 5YL, 5ZAB, 5ABV, 5AEK, 5AFG, 5AYN, 5BEP, 5CP, 5DJ, 5EB, 5UC, 5XE, 5YM, 5ACB, 5AEK, 5AOJ, 5AQM, 5DGX, 5DFX, 5DLX, 5DQQ, 5DHZ, 5MC, 5PE, 5YC. C.W.: 1TS, 1UN, 2AAB, 2AAG, 2AGB, 2ZG, 2ZL, 3BHL, 3BJJ, 3BLF, 3BZ, 3LR, 3RF, 4BK, 4BQ, 4CO, 4AZ, 4EM, 4EU, 4EW, 4GU, 4HW, 4HO, 4ID, 4XD, 4ZE, 5AAM, 5DA, 5EK, 5FV, 5JB, 5KU, 5LA, 5NZ, 5UU, 5ABV, 5AOA, 5AKR, 5AWZ, 5BFX, 5BOX, 5CAZ, 5CQU, 5GV, 5JL, 5UJ, 5XK, 5BLO, 5BRL, 5DTW, 5DWP, 5DYN, 5IO, 5NX.

4YA, Atlanta, Ga.

2AAB, 2ALR, 2CBG, 2AKO, 2PF, 2BEG, 2OM, 2ZO, 3FS, (3ZY), 3BLF, 3CM, (3XM), 3BIY, 3ZC, 3BZ, 4EW, 4AG, 4BY, 4EU, (4AS), (4EB), (4BK), (4BQ), 4ZE, 4DZ, 4EA, 4GU, 5AA, 5HK, (5XA), 5ZL, (5NZ), 5ZAB, 5ZX, 5EK, (5XB), 5ZAP, 5ZZ, 5KP, 5PY, 5GI, 5EY, 5RA, 5LA, 5AJ, (5UU), 5YM, 5YI, (5FV), 5KU, 5FJ, 7VY, (8AIM), 8YU, 8AWP, 8VY, 8BOX, 8AJV, 8UC, 8BK, 8BFX, (8AYM), 8AVH, 8AQF, 8AFG, 8AMD, 8BGU, 8AGZ, 8ACF, 8DJ, 8BEP, 8AUE, 8BEX, 8ZY, 8FS, 8ASB, 9JU, 8WD, 8BK, 8XK, 8XF, 8ZW, 8SP, 8VX, 8AFC, 8DHG, 8YAE, 8XE, 9HK, 9YC, 9BVL, 9YE, 9BJV, 9IO, (9DUN), (9BED), (9AS), 9AFW, 9AQ, 9DEJ, 9EA, 9ACK, 9ARI, (9AJH), 9WU, 9EI, (9AJA), 9XI, 9LF, 9DTS, 9BBE, 9DKM, 9PS, 9PL, 9YMM, 9VQ, 9ASP, 9CAK, 9APA, 9AKR, 9JL, 9BO, 9DQ, 9TV, 9ALO, 9AUA, 9DIW, (9AIQ), 9EM, 9XM, 9FT, 9ZW, 9XJ, 9DCF, 9YA, 9ARK, 9KS, 9YAK, 9AMQ, 9BAW, 9DSD, 9WT, 9ZJ.

4GM, Atlanta, Ga.

Spark: 2EH, 2FP, 2OM, 3AFD, 3AFU, 3AOV, 3EQ, 3UC, 3YV, 4AS, 4BE, 4BQ, 4CX, 4DH, 4DK, 4EG, 4EZ, (4FD), 4GH, (4GN), 4GU, 5AA, 5BY, 5DA, 5EA, 5ER, 5EW, 5FO, 5GI, 5HK, 5IM, 5JD, 5JO, 5KU, 5NK, 5PE, 5PY, 5SM, 5SO, 5TG, 5XA, 5YG, 5ZZ, 5ZAB, 8AY, 8AGV, 8AJZ, 8ANO, 8ANW, 8ARD, 8AXC, 8AYB, 8AYN, 8AZP, 8BAZ, 8BFX, 8BHV, 8CP, 8SP, 8UC, 8VH, 8VQ, 8VY, 9AOJ, 9ARK, 9AZE, 9BLO, 9DCX, 9DFX, 9DHZ, 8YV, 9AU, 9AAW, 9ACB, 9AEG, 9AGR, 9AMS, (9DKV), 9DQ, 9DMJ, 9DNI, 9DXE, 9DYU, 9DZY, 9KO, 9LF, 9MC, (9OX), 9PG, 9RC, (9RY), 9UE, 9UU, 9VQ, 9VZ, 9ZB. C.W.: 2FP, 3AIN, 3BLJ, 4BQ, 4BY, 4FD, 4ZE, 5FV, 5KU, 5XA, 5BK, 8AWP, 9AJA, 9ALS, 9CFP, 9GY, 9IO, 9NX, 9YM.

5IF, Amarillo, Texas

5AA, (5AE), (5BI), (5BM), (5BY), (5EK), 5ER, (5FA), (5FO), 5HL, (5HK), (5HZ), (5IB), (5IQ), (5IR), (5IS), (5JD), 5JI, 5JL, 5JR, 5JX, (5KP), 5LB, 5LO, 5LX, (5MJ), 5MM, 5MP, (5MY), (5NC), 5NH, (5NK), 5NR, (5NS), (5OF), 5OH, 5PD, (5PE), 5PG, 5PX, (5QA), (5QI), 5QO, (5QS), 5QY, (5RA), 5SM, 5TG, 5XA, (5XB), (5XJ), (5XT), (5XU), 5YI, 5YN, 5YQ, (5ZA), 5ZD, 5ZJ, (5ZL), 5ZN, 5ZS, (5ZU), (5ZX), 5ZAA, 5ZAB, 5ZAC, 5ZAE, (5ZAF), 5ZAG, (5ZAK), 4BQ, (6TV), (6ZZ), (6AAH), 7MO, 7ZU, 7ZV, (9PS), 9RT, (9RY), (9TI), (9TL), (9UG), 9UU, (9HT), 9JN, 9KO, 9LF, 9MS, (9NR), (9OA), 8YU, (9AU), 9EL, 9ET, 9GN, (9HI), 9HM, 9VE, (9WI), (9WU), 9XJ, 9YA, 9YM, 9YO, 9ZJ, 9ZN, 9ZY, 9YAE, 9YAJ, 9YAK, (9ZAC), 9ZAF, 9AAS, (9ABV), 9ACB, 9ACN, (9AEG), 9AEP, 9AFC, 9AFL, 9AFW, 9AEZ, 9AIF, 9AIG, 9AJH, 9AJT, 9AKR, 9ALS, (9AMA), 9AMB, (9AMD), (9AMS), (9ANF), (9ANO), 9AOE, (9AQE), 9AQM, 9AQR, 9ARG, 9ARI, 9ARJ, 9ASJ, 9ASL, 9ASO, 9ATN, 9ATV, (9AUL), (9AUO), 9AVC, 9AVE, 9AVG, (9AWX), (9AYV), (9AYW), 9BAF, 9BBF, 9BOW, 9DEH, 9DEY, 9DFL, 9DJB, 9DJX, 9DKQ, 9DKV, (9DPB), 9DPE, 9DPH, (9DSD), (9DUG), 9DVA, 9DWP, 9DXX, (9DZE), 9DZR.

5AQ, Miami, Okla.

Spark: 5AA, (5BY), 5EK, 5ES, 5EW, 5FO, (5HJ), 5HZ, 5IF, 5IQ, 5IR, 5JD, 5KC, 5LA, 5LB, (5LO), (5NH), 5NK, 5QA, 5QQ, 5TG, 5UH, (5WI), 5XA, 5XB, 5XU, 5XL, 5ZA, 5ZL, 5ZZ, 5ZAB, 5ZAK, 7ZO, 5ZU, 8IQ, 8MC, 8UC, 8VY, 8BC, 9BP, 9DW, 9EE, 9FK, 9HT, 9JN, 9KO, 9LW, 9MC, 9MS, 9PE, 9RC, 9UH, (9UU), 9WT, 9WU, 9WX, 9YM, 9YO, 9ZA, 9ZN, 9ZX, 9AAP, 9ABV, (9ADR), 9AEG, 9AEY, 9AFX, 9AGN, 9AGR, 9AIF, 9AKD, 9AKR, 9AMU, 9AOE, 9AOU, 9APS, (9APX), 9AQM, (9ATN), 9AUL, 9AVI, 9AVX, 9AWA, 9AYA, 9AYV, 9BEK, 9BJB, (9DKV), (9DNI), 9DNS, (9DPB), 9DQ, 9DSD, 9DUG, (9DXD), 9YAC, 9YAE, 9YAK. C.W.: 1BCG, 2FP, 4FI, 4GL, 4II, 4YA, 4YG, 4KM, 5EK, 5FV, (5JB), 5LA, 5ZA, 5ZAK, 8AQ, 8BK, 8VY, 8XV, 8BOX, 9BS, 9FM, 9KM, 9NX, 9PS, 9WS, 9XI, 9AGR, 9AJA, 9AQR, 9AYS, 9BDV, 9BED, 9BLO, 9BSG, (9DHB), 9DTS, 9DUN, 9DUP, 9DYN, 9YAM, 9ZAF.

5LA, New Orleans, La.

C.W.: (3ZY), 3HG, 3AKR, 3AQR, 3BLF, 4AS, (4BK), 4BQ, 4BY, 4CO, 4EB, 4EW, 4EH, 4EL, 4FH, 4FT, (4GL), 4GU, (4II), 4ID, 4XD, 4XF, 4ZE, 5ER, (5FV), 5EK, 5IR, 5KP, (5MT), (5ZA), 5XJ, 5UU, (5NZ), 5ZX, 5KU, 5ZU, 5ZAK, 5BK, 5BO, 5CG, 5CW, 5GV, 5IV, 5SI, 5SP, 5VY, (5WY), 8XK, 8XV, 8ZL, 8ZV, 8ARW, (8AGZ), 8AGO, 8AWZ, 8AQH, 8AWA, 8AQF, 8AXC, 8AAP, 8AIO, 8AIM, 8ABV, 8AKJ, 8AQR, 8BQJ, 8BOX, 8BFX, 8BVR, (8BEX), (8BXH), (8BZC), 8BRL, 9AT, 9BV, 9DY, 9EL, 9FM, 9HK, 9II, 9IZ, 9JL, 9JR, 9NX, 9PG, 9LY, 9SJ, 9WU, 9XI, 9ZL, 9ZW, 9AII, 9AUA, 9AAY, 9AWM, 9AJH, 9AAS, 9ALH, 9AMB, 9AYS, 9AKD, 9APH, 9AIE, 9AVN, 9AJA, 9AEQ, 9ALU, 9AMU, 9AIG, 9BBF, 9BED, 9BIG, 9BOW, 9BIK, 9BJB, 9SG, 9DIG, 9DKP, 9DKI, (9DZQ), 9DTM, 9DFL, 9DCF, 9DPE, 9DTW, 9DHB, 9YB.

5MB, Chattanooga, Tenn.

C.W.: 2BAY, 2LO, 2AWF, 3AEV, 3AQR, 3BIY, 3CA, 3HG, 3RF, 3ZY, 4AS, 4BD, 4BK, 4BY, 4EB, 4EH, 4ER, 4EL, 4CY, 4GL, 4II, 4YA, 5AN, 5BX, 5FV, 5FX, 5JD, 5JI, 5KU, 5LA, 5SU, 5WS, 5ZA, 5ZAB, 5ZW, 8ACS, 8ACV, 8AFG, 8AQR, 8AQP, 8AWP, 8AWZ, 8BDB, 8BJV, 8BLF, 8BK, 8BOV, 8BIQ, 8JU, 8WA, 8WI, 8YT, 8ZAC, 9AAS, 9AAV, 9AIK, 9AJH, 9AJP, 9AK, 9AKO, 9ARK, 9AUA, 9AVN, 9BED, 9BIZ, 9BLD, 9DPE, 9FM, 9PG, 9SJ, 9ZB. Spark: 2AHU, 2BK, 3AOV, 3DV, 3HG, 4AG, 4AH, 4AU, 4BI, 4CP, 4DH, 4EA, 4EV, 4GH, 4GL, 4GN, 4GU, 4HS, 4JS, 4NB, 4BQ, 5AAG, 5DA, 5ER, 5EW, 5FO, 5GU, 5HK, 5IF, 5JD, 5PY, 5XA, 5XB, 5XH, 5XU, 5XV, 5YL, 5ZAP, 5ZL, 8AFD, 8AIZ, 8AP, 9AWY, 8BEP, 8BO, 8BRL, 8CGZ, 8CFQ, 8JJ, 8SP, 8UC, 8US, 8WD, 8XE, 8YN, 9ABC, 9ACL, 9AEG, 9AGR, 9AIF, 9AIR, 9AIV, 9ATN, 9AWQ, 9AW, 9DCX, 9DI, 9DS, 9DXM, 9FN, 9GX, 9JN, 9LF, 9MC, 9QR, 9UH, 9VA, 9VE, 9VH.

5ZZ, New Orleans, La.

1ARY, 1BCG, 2EL, 2FP, 2NZ, 2AJF, 2ZL, 2AWL, 3AL, 3BL, 3BP, 3BZ, 3CA, 3MO, 3NZ, 3AHK, 3AJD, 3BHL, 3BLF, 4AE, 4AN, 4AS, 4AT, 4AU, 4BI, 4BK, (4BQ), 4BY, (4CG), 4CN, 4CP, (4DH), (4EH), 5EI, (4EL), 4FB, 4FD, 4FF, 4FT, (4GL), 4GN, (4GU), 4HW, (4YA), (4ZC), 4ZE, (5AE), 5BM, 5BY, 5DA, 5EK, 5ER, 5EW, (5FA), (5FO), 5FV, 5GI, 5GV, (5HK), 5HZ, 5IC, 5ID, 5IF, 5IR, 5IS, (5JD), 5JI, 5KP, 5KT, 5KU, 5LB, 5LO, 5LX, 5MA, 5MF, 5MY, 5MT, (5NB), 5NC, 5NF, (5NH), (5NK), 5NQ, 5NS, 5NZ, 5OF, 5OH, 5PD, 5PE, (5QA), 5QQ, 5QS, 5QZ, 5QY, 5QX, 5RA, 5TG, 5UC, 5UE, 5UJ, 5UU, (5XA), 5XB, 5XI, 5XJ, 5XK, 5XR, 5XT, 5XU, 5YB, (5YI), 5YN, 5ZA, 5ZC, 5ZD, 5ZI, (5ZL), 5ZO, 5ZR, 5ZS, 5ZT, (5ZU), 5ZW, 5ZX, 5AAM, 5ZAA, 5ZAF, 5ZAG, 5ZAK, 5ZAM, 5ZAN, 5BK, 5BO, 5BU, 5CP, 5CW, 5DE, 5DR, 5EA, 5FI, 5FQ, 5HA, 5HJ, 5II, 5IQ, 5JL, 5JM, 5JP, 5JQ, 5LQ, 5LK, 5NZ, (5OI), 5ON, 5RB, (5SP), 5TN, (5UC), 5UJ, 5UK, 5VJ, 5VR, 5VY, 5XE, 5XK, 5XV, 5YM, 5YN, 5YR, 5YT, 5ZC, 5ZN, 5ZR, 5ZW, 8ZY, 8APB, 8ACF, 8ACL, 8ADE, 8AFB, 8AFD, 8AFG, 8AFW, 8AFS, 8AGK, 8AJK, 8AJT, 8AKS, 8AMB, 8AND, 8ARD, 8ARC, 8AUH, 8AQF, 8AQR, 8AWZ, 8AYN, 8BEN, 8BEP, 8BFH, 8BHV, 8BIB, 8BOS, 8BOX, 8BPL, 8BRL, 8BUM, 8BCK, 8ZAA, (8ZAC), 9AU, 9BP, 9DV, 9DW, 9EL, 9ET, (9FS), 9FU, 9FZ, (9GC), 9GN, 9GX, 9HD, 9HI, 9HJ, 9HM, 9HR, 9HS, 9HT, 9IO, 9IY, 9JN, 9JQ, 9KO, (9LF), 9LW, 9LQ, 9MO, 9ME, 9MN, 9NH, 9NQ, 9NR, 9NX, (9OA), 9OR, 9OX, 9PD, 9PS, 9QE, 9QH, 9RV, 9RY, 9TL, 9TV, 9UV, 9UG, 9UH, 9UU, 9VG, 9VI, 9VV, 9WC, 9WI, 9WP, 9WU, 9XT, 9XJ, 9XM, 9YA, 9YB, 9YC, 9YM, 9YO, 9YQ, 9YT, 9YAE, 9YAK, 9ZB, 9ZJ, 9ZAC, 9AAK, 9AAP, 9AAS, 9AAV, 9AAY, 9ACB, (9ACL), 9ACN, 9AEG, 9AEK, 9AEY, 9AFF, 9AFL, 9APX, 9AGH, (9AIF), 9AIO, 9AIP, 9AIR, 9AIV, 9AJH, 9ALS, 9AMA, 9AMB, 9AMK, 9AMQ, 9AMS, 9AMT, 9AMV, 9ANF, 9ANO, 9AOS, 9APB, 9API, 9AQA, 9AQE, 9AOJ, (9AQM), 9AQK, 9ARK, 9ARZ, 9ASJ, 9ASL, 9ATI, (9ATN), 9AVN, 9AVP, 9AWN, 9AWX, 9AWU, (9AWZ), 9AXU, 9AYV, (9AZA), 9AZE, 9BBF, 9BCX, 9BDS, 9BED, 9BLO, 9DAZ, 9DCX, 9DKQ, 9DKV, 9DPH, 9DMJ, 9DQL, (9DQQ), (9DUG), 9DRA, (9DSD), 9DTN, 9DWP, 9DWJ, 9DXM, 9DYU, 9DZJ, 9DZK, 9DZY.

6AOW, Riverside, Calif.

Spk.: 51P, 50P, 5XU, 5YQ, 5ZA, 5ZJ, 6AH, 6AS, 6OH, 6OL, 6OM, 6PJ, 6PO, 6PR, 6QK, 6QR, 6RS, 6SJ, 6TF, 6TO, 6TU, 6TV, 6UW, 6VK, 6VX, 6VZ, 6WZ, 6XH, 6ZF, 6ZK, 6ZR, 6ZU, 6ZX, 6ZZ, 6AAF, 6AAH, 6AAU, 6ABM, 6ABP, 6ABX, 6ACY, 6ADI, 6AEH, 6AEI, 6AFN, 6AFP, 6AGF, 6AGP, 6AHA, 6AHD, 6AHP, 6AHQ, 6AHU, 6AHV, 6AHX, 6AHZ, 6AIB, 6AIF, 6AIN, 6AIT, 6AIU, 6AJT, 6AKL, 6AKR, 6ALD, 6ALP, 6ALU, 6ALV, 6AMI, 6AMK, 6AMN, 6ANG, 6AOE, 6AOR, 6ARK, 6ASA, 6ASV, 6ATH, 6ATP, 6ATQ, 6ATU, 6AUU, 6AVL, 6AVR, 6AWB, 6AWH, 6AWX, 6ZAE, 6ZAL, 6ZAM, 6BAJ, 6BCB, 6BCJ, 6BDZ, 6BFE, 6BGH, 6BIP, 6BIU, 6CK, 6DP, 6FH, 6HY, 6JW, 6JD, 6LN, 6LY, 6MP, 6TP, 6TY, 6YA, 6YJ, 6YG, 6ZE, 6ZJ, 6ZM, 6ZT, 6ZU, 6ZV.

C.W.: 4UL, 5ZA, 5XU, 6AK, 6EB, 6EN, 6GD, 6GY, 6IV, 6JD, 6JJ, 6KA, 6KY, 6MY, 6PJ, 6VM, 6ZA, 6ZB, 6ZR, 6ZT, 6ZZ, 6AAG, 6AAT, 6AIF, 6AKW, 6ALU, 6AOZ, 6ATG, 6AWP, 6AWT, 6XAD, 6XAF, 6XIAQ, 6BAF, 6BGG, 6BIF, 6BHG, 6XB, 6WH, 6WD, 6ZY, 6AMB, 6BBI, 6DTM, 6DVA, 6ZAF.

6AJU, Farmington, Calif.

Spk.: 5ZA, 6ACR, 6ADA, 6AEH, 6AEW, 6AIX, 6ALD, 6ALU, 6ATP, 6ATQ, 6BAZ, 6EB, 6EN, 6GT, 6IS, 6IV, 6JW, 6KS, 6LC, 6MH, 6OD, 6OL, 6OT, 6QR, 6SJ, 6TV, 6UP, 6VZ, 6WI, 6ZAA, 6ZAL, 6ZB, 6ZZ, 6BA, 6BH, 6BJ, 6BB, 6CU, 6CW, 6FI, 6GD, 6HM, 6JD, 6KB, 6KS, 6LO, 6MP, 6TP, 6TW, 6TQ, 6TY, 6YJ, 6YL, 6ZM, 6ZN, 6ZO, 6ZT, 6ZU, 6AX, 6XQAQ, Can. 9BD.

C.W.: 5ZA, 6ALE, 6ALU, 6ASV, 6AY, 6DA, 6GD, 6VM, 6WV, 6XK, 6ZA, 6ZAF, 6TX, 6QT, 6KP, 6YJ, 6ZS, 6AQZ, 6UK, 6AOS, 6AMB, 6AYU, 6BEX, 6BBI, 6DTM, 6NX, 6WD, 6XAQ, 6ZAF.

Radio 6ZE ex 6ALE, Redkey, Calif.

2FP, 4BY, 5IU, (5XJ), 5YQ, (5ZA), (6EB), (6EN), (6EP), (6EK), (6GT), (6IV), (6JD), (6LC), (6MH), (6PO), (6QR), (6TU), (6VK), (6ZB), (6ZE), (6ZX), (6AAG), 6AAT, (6AAU), (6ABW), (6ACK), (6AFN), (6AHP), (6AIF), (6ALU), (6ALV), (6AMN), 6ZAM, (6BAJ), (6BFE), (6BDK), (6BGH), 6XQAQ, (6BA), (6BK), (6CK), (6DN), (6NX), (6LY), (6MP), (6TP), 6NN, 6OM, (6QT), 6TJ, 6YA, 6YJ, (6ZM), 6ZO, 6ZT, 6ZV, 6ZU, 6JL, 6VJ, 6AGZ, 6BBL, 6NX, 6WD, 6AJA, 6AMB, 6AYS, (6AYU), 6BEX, 6BBI, 6DTM, (6DVA), 6XAQ, (6BD, Can.)

6RR, Los Angeles, Cal.

Spk.: 5ZA, 5YQ, 5XU, 5ZJ, 6AK, 6QR, 6NM, 6OT, 6SJ, 6TV, 6PJ, 6UO, 6VW, 6XH, 6ZK, 6ZU, 6ZZ, 6ZK, 6AEH, 6AOP, 6AIN, 6AMK, 6AWH, 6JD, 6MP, 6YA, 6YG, 6XJ, 6ZM, 6ZT, 6ZU, 6ZZ, 6YAL, 6ZX, 6LS.

C.W.: 5ZAK, 6EC, 6GD, 6KU, 6PJ, 6PT, 6NM, 6NX, 6CM, 6ZA, 6ZB, 6ZZ, 6ZE, 6AAT, 6AAG, 6AIF, 6ALE, 6AVJ, 6AZX, 6ASV, 6AWP, 6ZAF, 6ZAK, 6ZAM, 6XAD, 6XAF, 6CS, 6OG, 6TQ, 6VY, 6JL, 6XV, 6ZY, 6AGZ, 6BOX, 6AX, 6BD, 6JD, 6NX, 6JL, 6HA, 6HW, 6PS, 6WD, 6WU, 6PM, 6XU, 6ZL, 6ZV, 6AIG, 6AJA, 6AKS, 6AMB, 6AYU, 6BEX, 6BBI, 6DTM, 6DVA, 6XAQ, 6ZAF, 6ZAC, Can. 9BD, 4CB.

F. H. Stephens, Dilly, Ore.

Spk.: Can. 5AK, 6ABX, 6AGF, 6AHP, 6AIX, 6ALD, 6ALV, 6ALX, 6AMN, 6ARK, 6AS, 6ATQ, 6AUU, 6AZM, 6BIP, 6EX, 6FF, 6FH, 6FK, 6GE, 6GT, 6KM, 6OH, 6OL, 6PO, 6PR, 6ST, 6TO, 6TU, 6VK, 6VX, 6WZ, 6XH, 6ZAE, 6ZAM, 6ZK, 6ZR, 6ZX, 6ZU, 6AAV, 6BA, 6BG, 6BH, 6BK, 6BZ, 6CC, 6CD, 6CK, 6CN, 6DD, 6EO, 6FJ, 6GE, 6HF, 6HM, 6KE, 6KG, 6KJ, 6LY, 6MF, 6MP, 6NN, 6NW, 6NZ, 6OM, 6PC, 6PT, 6QC, 6TJ, 6TO, 6VO, 6VX, 6VZ, 6WG, 6WM, 6WT, 6XB, 6YA, 6YJ, 6YL, 6ZM, 6ZU, 6ZV, 6AVZ; Can. 9BD, 9ZX.

C.W.: Can. 4CB, 5YA, 6AIF, 6ALU, 6DY, 6EN, 6IBG, 6JD, 6JJ, 6KA, 6NX, 6PE, 6RR, 6VM, 6XAF, 6XQAQ, 6XH, 6ZA, 6ZE, 6ZF, 6ZG, 6ZZ, 6YK, 6HS, 6HT, 6NF, 6PV, 6RN, 6XO, 6JL, 6AJA, 6ALS, 6DVA, 6WB, 6XM.

7SN, Seaside, Ore.

Spk.: 6AK, 6AS, 6BB, 6BM, 6BK, 6CV, 6EX, 6FH, 6GG, 6HC, 6KC, 6KR, 6KM, 6LC, 6LU, 6OH, 6SU, 6TU, 6UO, 6VK, 6VX, 6ZK, 6ZX, 6AAU,

6ABH, 6ABM, 6ABW, 6ABR, 6AGF, 6AIX, 6AFN, 6ARK, 6AID, 6ARC, 6ALV, 6AVG, 6AVB, 6ALA, 6YS, 6YA, 6ZM, 6MP, 6NN, 6ZJ, 6YJ, 6BH, 6OY, 6TJ, 6VO, 6YM, 6BJ, 6HF, 6MU, 6WM, 6IW, 6CK, 6CN, 6ZT, 6IY, 6ZU, 6MP, 6BC.

C.W.: 6WZ, 6NR, 6EN, 6GD, 6KAD, 6ALE, 6AAT, 6AIF, 6ABX, 6AAG, 6AOZ, 6AFN, 6AWT, 6RN, 6TQ, 6XP.

Can. 9AX, 9BD, spar.: 4CB, C.W.

7HD, Seaside, Ore.

7BH, 7CN, 7FI, 7GE, 7HF, 7IW, (7KS), 7LY, 7MP, 7NZ, 7OY, 7RN-C.W., 7VO, 6AAU, 6AHA, 6ARK, 6AR, 6ZY, C.W.-6AIX, 6FH, 6VM.

7PO, Seattle, Wash.

Spk.: 6AH, 6AK, 6BC, 6EB, 6EX, 6FH, 6GX, 6HF, 6IV, 6KM, 6LC, 6NL, 6OH, 6PO, 6PR, 6QR, 6TU, 6VX, 6XH, 6ZX, 6AAV, 6AAL, 6ABW, 6ABX, 6AFN, 6AGF, 6AHR, 6AIF, 6AIU, 6AJT, 6AKL, 6JW, 6KE, (6KG), (6KJ), 6KM, 6KS, (6LA), 6CN, 6FL, 6GJ, 6HF, 6IN, 6IW, (6IY), 6JT, 6AS, 6AW, (6BA), (6BC), (6BG), 6BH, 6BJ, 6LW, 6MF, 6MU, 6MY, 6NL, 6NN, (6TJ), 6VX, 6VO, 6VZ, (6WM), 6YA, 6YJ, 6ZP, 6ZT, 6ZU; Canadians: 6BI, 6FE, 6MK, 6AX, 9BD.

C.W.: 6AIF, 6ALE, 6AWT, (6CE), (6QE); Canadians: 4CB and 9BD.

8CBJ, Lockport, N. Y.

Spk.: 1CK, 1HO, 1OE, 1RV, 1WQ, 1APO, 1ARY, 1BDT, 1BOQ, 1CHJ, 2BK, 2EM, 2DA, 2DN, 2EL, 2OM, 2TJ, 2TS, 2VW, 2AER, 2ID, 2ARK, 2AWP, 2CIC, 2AC, 2DM, 2FE, 2HJ, 2QW, 2UD, 2AGT, 2AIC, 2AUW, 2BFU, 4CM, 4EA, 4GN, 5DA, 5BQ, 5EB, 5FT, 5HG, 5IH, 5JJ, 5NZ, 5OD, 5UC, 5WD, 6WZ, 6ACF, 6AFG, 6AHU, 6AIO, 6AKQ, 6ANB, 6AOT, 6APB, 6ARS, 6AVD, 6AVT, 6AYN, 6BAZ, 6BEP, 6BFM, 6BHV, 6BUM, 6CAY, 6BP, 6CP, 6DI, 6FS, 6HW, 6IB, 6LZ, 6TL, 6UH, (6VL), 6YN, 6ACN, (6AGE), 6AIR, 6AKR, 6AMQ, 6APH, 6AQA, 6AQM, 6ARK, 6ASJ, 6AVP, 6AWU, 6AZE, 6AZM, 6DBU, 6DKV, 6DLX, 6DSO, 6DVN, 6DWF.

C.W.: 1QP, 1RD, 1UJ, 1UN, 1XM, 1XX, 1ZE, 1AFV, 1APZ, 1AOL, 1AZW, 1BCF, 1BDC, 1BDI, 1BEP, 1BKQ, 1BQE, 1BUA, 1BWJ, 1CHL, 1CIT, 2FP, 2VA, 2ZL, 2AFP, 2AWS, 2BBE, 2BJO, 2BNZ, 2BTJ, 2BZ, 2CA, 2CG, 2FS, 2HG, 2NH, 2ZO, 2AAV, 2AFB, 2AJD, 2ANJ, 2AQF, 2BAG, 2BHL, 2ZAB, 4BQ, 4DS, 4EW, 4GL, 4ID, 5DA, 5FV, 5BK, 5GV, 5HJ, 5JS, 5KS, (5NB), 5NI, 5OS, 5SP, 5TB, 5UK, 5VJ, 5ZX, 5ADG, 5AGZ, 5AIM, 5AMK, 5ANB, 5AQF, 5ASV, 5AWM, 5AWP, 5AWZ, 5BDO, 5BZ, 5BNJ, 5BUM, 5EXH, 5BXX, 5BZY, 5CAZ, 5CER, 5CGM, 5IO, 5KP, 5AAS, 5AJP, 5AJW, 5AKD, 5BBF, 5BMN, 5BBL, 5DAX.

8BET, Toledo, Ohio

C.W.: 1AZW, 1BDI, 1BEA, 1BKO, 1ZE, 2FP, 2FT, 2WI, 2ZL, (2AAD), (2AAO), 2AFU, 2ALN, 2AQR, (2BA), 2BBB, 2BEC, 2BLF, 2CG, 2CM, 2HJ, 2LO, 2NZ, 2QV, 2SZ, 2ZY, 4BY, 4DC, 4FT, 4GL, 4HO, 4ID, 4KL, 5FV, 5NZ, (6UU), 6JD, 6ADG, 6AGX, 6AGZ, 6AIG, 6AIM, (6AIO), 6AMD, 6AMM, (6AOG), 6AOZ, 6API, 6APW, 6AQV, 6ATV, 6AWP, 6AWZ, 6BDO, 6BEX, (6BK), 6BO, 6BOX, (6BOZ), (6BPE), 6BRL, 6BUM, 6BUN, (6BXA), 6BXH, 6BZC, (6CAB), 6CBE, (6EA), (6GA), 6IV, 6IY, 6JJ, 6JL, 6JM, 6JW, 6KS, 6LX, 6NI, 6OW, 6PX, 6SP, (6UJ), 6UO, 6VJ, 6XAE, 6AAV, 6AEQ, 6AGR, (6AJA), 6AJH, 6AJP, 6ALS, 6AMU, 6ANZ, 6AOQ, 6AS, 6AT, 6BBF, 6BDF, 6BED, 6BLO, 6DAM, 6DCF, 6DV, 6EA, (6EL), 6FM, (6FO), 6HJ, 6HW, (6IO), 6NV, 6NX, 6WU, 6XI, 6ZL.

Spk.: 1XM, 2OM, 3XM, 5LA, 5XU, 6AFG, (6AHI), 6AXC, 6AYN, 6BBO, (6BEJ), 6BEN, (6BEP), (6BFH), (6BFN), (6BIU), (6BRY), (6BVH), (6CBZ), (6CGE), 6EA, 6UC, (6UR), 6XE, 6YAE, 6ZP, 6AAP, 6AGR, 6ALM, 6ASJ, 6AXU, 6CA, 6DF, 6DMJ, 6HJ, 6MS, 6UU, 6WH, 6YAK.

8AAU, Canton, Ohio

Spk.: 1AHL, 1AX, 1ON, 1XX, 2AJE, 2BEJ, 2BFX, 2BB, 2BJ, 2FP, 2GK, 2OM, 2TF, 2XQ, 3AAB, 3AHK, 3ATZ, 3ARW, 3BEX, 3CG, 3CM, 3EL, 3FO, 3OG, 3UD, 3WJ, 3XM, 3XQ, 4AG,

4CX, 4CJ, 5HK, 5PY, 5XA, 5XB, 5XP, 5XU, 5YA, 5YE, 5YW, 5ZL, 5ZW, 5ZZ, 8AJX, 8AOK, 8AAK, 8AIZ, 8AYN, 8APB, 8AFG, 8AQF, 8AYE, 8AWT, 8AKQ, 8AXK, 8ALM, 8BIW, 8BVS, 8BFM, 8BSV, 8BKC, 8BRA, 8CLF, 8CCU, 8CGZ, 8CA, 8CP, 8DJ, 8EB, 8EJ, 8EK, 8FA, 8FE, 8FZ, 8GW, 8IP, 8JJ, 8JR, 8KE, 8KG, 8KI, 8LB, 8LC, 8OE, 8OT, 8QQ, 8SP, 8TK, 8VQ, 8VW, 8XE, 8XF, 8XR, 8YAE, 8YE, 8YM, 8YN, 8WZ, 8ZAE, 8ZA, 8ZP, 8ZY, 9AAP, 9AOU, 9AEX, 9ACB, 9ALO, 9ARR, 9ARG, 9AXU, 9AZA, 9AC, 9BEE, 9BP, 9CA, 9CB, 9DFX, 9DDQ, 9DCX, 9DFO, 9DSO, 9DAR, 9DIW, 9DH, 9DY, 9FM, 9FS, 9GK, 9GY, 9HR, 9IO, 9IL, 9JU, 9KE, 9KI, 9MC, 9OK, 9OX, 9QJ, 9RC, 9RY, 9SI, 9TV, 9UU, 9WK, 9WN, 9WS, 9WT, 9WU, 9XE, 9XI, 9XM, 9XX, 9YA, 9YB, 9YC, 9YQ, 9YAE, 9YE, 9YM, 9YO, 9XAG, 9ZL, 9ZJ.

C.W.: 1AAB, 1AGI, 1ABL, 1ARY, 1AW, 1BCG, 1BDI, 1BDJ, 1BEL, 1BEM, 1BES, 1BRQ, 1BV, 1BKQ, 1BEI, 1BG, 1CMK, 1DF, 1ON, 1RD, 1TS, 1XA, 1XJ, 2AFP, 2AYU, 2AJF, 2AAX, 2ANV, 2BEB, 2BFZ, 2BNQ, 2BEJ, 2CCD, 2JW, 2NE, 2SQ, 2VA, 2ZK, 2ZN, 3AKO, 3AAD, 3AAK, 3AAT, 3ANY, 3AQ, 3ARM, 3BER, 3BEX, 3BGV, 3BIY, 3BTJ, 3BLF, 3BEC, 3BFU, 3BAV, 3BSL, 3BRC, 3BRX, 3CBQ, 3CM, 3FS, 3IQ, 3KG, 3KO, 3RW, 3ZE, 3ZO, 3ZY, 3ZZ, 4BK, 4BY, 4EW, 4FT, 4GK, 4GL, 4KK, 4II, 4GE, 4YA, 4YB, 4ZE, 5AAM, 5AN, 5CX, 5DQ, 5EK, 5FV, 5IX, 5JB, 5KP, 5LA, 5NQ, 5NZ, 5PY, 5UU, 5YE, 5ZE, 6ALE, 7AA, 7DM, 8AAG, 8AQQ, 8AOU, 8AFD, 8AUS, 8ANJ, 8AJT, 8AJD, 8AVD, 8AMG, 8ARD, 8ASB, 8AJV, 8ALB, 8AIM, 8ALV, 8ARV, 8AQZ, 8ASB, 8AKD, 8ABV, 8AYQ, 8ARW, 8ARQ, 8AGZ, 8AHE, 8AMF, 8APV, 8AQF, 8ASO, 8AWP, 8AZV, 8ASX, 8AZE, 8AIO, 8AKK, 8AWN, 8AJF, 8AUS, 8ARS, 8AWY, 8ADG, 8AUX, 8ATU, 8AJB, 8AWZ, 8AGZ, 8AYT, 8ALE, 8AWF, 8BEX, 8BVO, 8BDO, 8BVY, 9BOX, 8BFX, 8BNO, 8BUM, 8BUS, 8BDI, 8BEF, 8BKR, 8BPI, 8BUQ, 8BLT, 8BBW, 8BLW, 8BK, 8BO, 8BR, 8BU, 8BX, 8CEM, 8CGX, 8CAH, 8CGZ, 8CLD, 8CEN, 8CA, 8GB, 8GV, 8HD, 8JL, 8JM, 8JU, 8JV, 8NI, 8RM, 8SP, 8TX, 8VC, 8VO, 8VY, 8VB, 8WI, 8XK, 8XU, 8YAW, 8YM, 8ZAE, 8ZF, 8FG, 8ZV, 8ZX, 8ZZ, 9ASL, 9AFF, 9AXF, 9AJS, 9AKD, 9AJA, 9ALS, 9AJH, 9ANS, 9ARG, 9ATV, 9AFT, 9AYH, 9AJV, 9AYV, 9AMU, 9AAY, 9AS, 9AT, 9BJ, 9BFT, 9BWX, 9BBF, 9BDF, 9BRL, 9CP, 9DEJ, 9DDW, 9DTJ, 9DTS, 9DFA, 9DAM, 9DWN, 9DB, 9DJ, 9FS, 9HK, 9HW, 9II, 9IO, 9JL, 9JN, 9JU, 9JR, 9KP, 9NX, 9OX, 9PS, 9QA, 9QE, 9RY, 9SJ, 9WV, 9XJ, 9XT, 9XM, 9YAM, 9YAJ, 9YB, 9YC, 9ZAC, 9ZA, 9ZY.

9AOG, Lawrence, Kansas

Spk.: 5AR, 5BM, (5BY), 5EH, 5EW, 5FA, 5FI, 5FO, 5FP, 5HK, 5HZ, 5IR, 5IS, 5JF, 5JR, 5KP, 5LB, 5LO, 5MP, 5NH, 5NS, 5OH, (5PG), 5PU, 5QI, 5RA, 5RW, 5TG, 5TU, 5WC, 5XA, 5XAB, 5XB, 5XJ, (5XU), (5YI), 5YL, 5ZA, 5ZAB, 5ZAG, 5ZC, 5ZL, 5ZW, 5ZZ, 7ZO, 7ZV, (8AMZ), 8ARS, 8ATU, (8AVT), 8BBU, 8BEP, 8CP, 8IN, 8JJ, 8MR, 8OH, (8QC), 8UB, 8VL, 8WO, 8ZN, (9ACL), (9AEY), (9AHZ), (9AIG), (9ALU), (9ANO), (9ANQ), (9AOJ), (9AQC), (9AR), (9ARG), (9BCF), (9BKK), (9BSA), (9CAK), (9DJB), (9ARZ), (9ASK), (9ASO), (9ATN), (9AYW), (9DGN), (9DJX), (9DLC), (9DNC), (9DS), (9DSN), (9DTA), (9DTS), (9DVF), (9DXW), (9DZE), (9DZI), (9FU), (9HI), (9RY), (9YAK).

C.W.: 1XM, 2FP, 2QR, 3AJD, 3HG, 3BEC, 3NB, 4BK, 4BQ, 4BY, 4CO, 4EL, 5EK, 5FV, 5IR, 5KP, (5KV), 5MT, 5RP, 5SI, (5YI), 5ZA, 6AIF, 6WV, 6XAD, 6AGZ, 6AIO, 6AMA, 6AMD, (6AQH), (6AQV), 6AR, 6ARD, 6AWP, 6AKK, 6BEF, 6BFX, 6BOX, 6BRF, 6BRL, (6BUM), 6BVR, 6DR, (6IQ), 6IV, (6JL), 6NL, (6OH), 6SP, 6UJ, 6VJ, 6WA, 6XV, 6ZAE, 6ZL, (6AJA), (6AJH), (6AJP), (6AMB), (6AQR), (6ARG), (6ASD), (6AUA), (6AVN), (6AYS), (6AZP), (6BBF), (6BED), (6BIZ), (6BJV), (6DDW), (6DKX), (6DPL), (6DTA), (6DZQ), (6EX), (6FM), (6JL), (6XI), (6ZL).

9BMN, Sedalia, Missouri

Spark: 5AC, 5BY, 5CJ, 5EH, 5EW, 5FO, 5GI, 5HK, (5IR), (5JD), 5JF, 5KP, 5LB, 5MF, 5OF,

5PY, 6QA, 6QS, 6QQ, 6RA, 6RM, 6TG, 6TS, 6UC, 6UG, 6XB, 6XU, 6XI, 6XR, 6YG, 6ZA, 6ZAB, 6ZAG, 6ZI, 6ZJ, 6ACF, 6AFG, 6ANO, 6APG, 6ATU, 6AWP, 6AX, 6AXC, 6AXY, 6AYN, 6BA, 6EB, 6HD, 6IUY, 6JJ, 6LB, 6NZ, 6UC, 6UB, 6WO, 6XE, 6YN, 6YU, 6ZAC, (6AAG), 6AAW, 6AAP, 6AC, (6ACB), 6ACL, (6ACN), 6AEG, 6AEK, 6AFW, 6AGN, 6AGR, 6AIF, 6AIG, 6AIU, 6AIX, (6AJN), 6AJP, 6AK, 6ALS, 6ALU, (6AMA), 6AMS, (6ANF), 6ANO, 6ANQ, (6AOJ), 6AP, 6APB, (6APN), 6APS, 6AQA, 6AQM, 6AR, 6ARG, 6ARN, (6ARZ), 6ASK, (6ASN), 6ATN, 6AU, 6AUL, 6AUV, (6AVK), (6AVC), (6AVZ), 6AV, 6AX, 6AYW, 6AZA, 6AZE, 6BCC, 6BEP, (6BSA), 6BTN, 6BTQ, 6BUZ, 6DAG, (6DAZ), 6DCX, 6DDV, 6DDZ, 6DEH, 6DFA, 6DFX, (6DGI), 6DZH, 6DIW, (6DKQ), 6DKV, (6DLX), 6DMJ, 6DMM, 6DMP, (6DPB), 6DPH, 6DQ, 6DRO, 6DRX, 6DSD, 6DSM, 6DSO, 6DUU, 6DWF, 6DXM, 6DXT, 6DXV, (6DYO), 6DZE, (6DZI), 6DZY, 6CA, 6EE, (6FK), (6FS), 6HL, 6HR, 6HT, 6IY, 6JAA, 6JN, 6KI, 6KO, 6LF, 6LJ, 6LW, 6MC, 6MS, 6NQ, 6NE, (6OA), 6OX, 6PS, 6QJ, 6RC, 6RY, 6SC, 6TU, 6TV, 6UK, 6UU, 6UW, (6VB), (6VW), 6WT, 6WW, 6WY, 6XI, 6XM, 6YA, 6YAC, 6YAE, 6YAJ, (6YM), 6ZH, 6ZL, 6ZV.

C.W.: 2FP, 3AQR, 4BY, 5AN, 5FV, 5KU, 5NZ, 5UU, 5ZA, 5AOZ, 5AQV, 5AXK, 5AZE, 5BFX, 5BXA, 5HJ, 5JL, 5SP, 5XV, 5AAV, 5AJA, 5AJP, 5ALS, 5ARK, 5AS, 5ASD, 5ASF, 5AUA, 5BBF, 5BIX, 5BLO, 5BNO, 5BRL, 5DAX, (5DTA), 5DTM, 5DPZ, 5DYN, 5DZQ, 5FM, 5HW, 5IO, 5KP, 5LP, 5LQ, 5QY, (5SJ), 5XAB.

9IO, Newport, Ky.

(1AGI), (1AZW), (1BDI), 1BEA, 1BES, (1PT), 1TS, (1XM), 1ZE, 2AAB, (2AJW), (2AWF), 2AWL, (2AWS), 2AYV, (2BB), 2BAK, (2BFZ), (2BNZ), (2BRC), 2BNJ, (2FD), (2FP), 2VA, 2ZL, 2XQ, (3AAD), 3AAE, 3AHK, (3ALN), 3AQR, 3APA, (3BA), (3BG), (3BHL), 3BLF, (3BV), 3CA, 3CC, 3CM, (3EM), (3FM), (3FS), (3HG), (3HJ), (3KM), (3QV), (3RF), (3SQ), 3ZO, 3ZY, (BK), (4BQ), 4BY, (4DS), 4EB, 4EL, (4EN), 4EU, (4EW), (4FT), (4GL), 4ID, 4ZE, 5DA, 5EK, (5FV), 5HK, (5JB), 5KU, 5NZ, 5XA, 5ZA, 5ZX, 6XAD, (8AGO), (8AGZ), (8AIG), 8ALB, 8APN, 8APT, (8AQF), 8AQV, (8ARD), 8ARW, 8ASB, (8AWP), (8AWY), (8AWZ), (8BK), 8BO, (8BOX), (8BRL), 8BUM, (8BXA), (8BXH), (8CFP), 8CI, (8CW), 8DR, (8EA), 8II, (8JL), (8JU, 8LF, 8MP, (8NI), 8OC, 8PX, (8SP), (8UJ), (8UK), 8VJ, (8VY), 8WA, (8WI), (8WR), (8WY), 8XV, 8ZG, (8ZIE), 8ZZ, 9AAP, (9AAS), (9AAV), (9AJA), 9AJH, (9AJP), 9AKD, 9AKR, (9ALS), (9AS), (9AT), (9AUA), 9AXF, (9BBF), 9BKZ, 9BLO, 9BRL, (9DCF), 9DDW, (9DTJ), (9DTW), 9DUN, (9DV), (9DYN), 9EL, (9IZ), 9JL, 9KP, 9NX, 9OO, 9PS, 9QE, 9SJ, 9US, (9UW), 9WU, 9XAG, 9XI, 9ZAC, 9ZAF, 9ZL.

9BLD, McLean, Ill.

Spark: 4BQ, 4CX, 4DH, 5AC, 5AIO, 5BK, 5CB, 5DA, 5EK, 5ER, 5EW, 5FO, 5HK, 5IC, 5IG, 5IK, 5JF, 5KP, 5LA, 5LB, 5LO, 5MF, 5NH, 5OF, 5PG, 5QA, 5SK, 5SM, 5TG, 5TU, 5UC, 5XA, 5XK, 5ZA, 5ZN, 5ACF, 5AFG, 5ARD, 5ARS, 5AYN, 5BAZ, 5BCO, 5LC, 5UK, 5XE, 5YE, 5ZAC, 5ZV, 5ABH, 5ACB, 5ACL, 5AEG, 5AFR, 5AGR, 5AHZ, 5AIG, 5AIB, 5AMA, 5ANG, 5ANH, 5AOE, 5AOJ, 5AOS, 5AOU, 5AP, 5APB, 5AQM, 5AQU, 5ASL, 5ATL, 5AUL, 5AVL, 5AWV, 5AXV, 5AZA, 5AZE, 5AZF, 5BAW, 5BCU, 5BHR, 5BIJ, 5BIT, 5BMN, 5BNT, 5BO, 5BP, 5BS, 5BSA, 5BKZ, 5CA, 5DAG, 5DBU, 5DDH, 5DEU, 5DEW, 5DFX, 5DHG, 5DHS, 5DKV, 5DLX, 5DMP, 5DPZ, 5DQ, 5DSD, 5DSS, 5DSO, 5DTS, 5DUV, 5DYU, 5DYY, 5DZE, 5DZQ, 5DZK, 5DZY, 5FM, 5FS, 5GI, 5HI, 5IB, 5JN, 5LF, 5MC, 5MS, 5OX, 5RC, 5RY, 5TC, 5TV, 5UA, 5UU, 5VW, 5WI, 5XI, 5XT, 5YA, 5YAM, 5YAN, 5YX, 5ZAC, 5ZS, 5ZX.

C.W.: 4BQ, 5FV, 5HE, 5KV, 5UU, 5ZX, 6ZZ, 6AGZ, 6AIG, 6ASM, 6BOX, 6CLD, 6AAO, 6AAU, 6AJA, 6AJH, 6AKR, 6ALS, 6AS, 6AWM, 6AX, 6BEE, 6BBF, 6BED, 6BEG, 6BIZ, 6BLO, 6BNO, 6DBV, 6DCI, 6DCR, 6DHB, 6DKX, 6DWS, 6DYN, 6HK, 6KP.

## A STORM RELAY ROUTE

(Continued from page 67)

Chicago. Work was started at once by 9XI, 9ZT and 9AJP, the latter two stations on C.W. At 10 a.m. communication was established with 9DR at Buffalo, Minn., and as that station has a very favorable location it was used as a central station the remainder of the day. Mr. Wallace at Buffalo raised 9MF at St. Cloud and 9QE at Fairmont (all C.W.) before noon. At noon St. Cloud was in touch with Brainard and with 9BAC to the north of there. Fairmont on the other hand had gotten in touch with New Ulm, Minn., and before the end of the afternoon had also established the network to 9YAE in Le Mars, Iowa. The entire system was checked every hour. Le Mars was in touch with Davenport and through him to Roodhouse, Ill., 9MC, at 4:00 p.m., when the re-establishment of the telephone line removed the necessity of longer maintaining the network just as Chicago traffic was about to be started.

Although there was a wire line through to Chicago it was not capable of handling any more than official communication service of the company and they could not touch any news service so the amateurs were again asked to help. The two sta-

tions 9XI and 9ZT with the wonderful "silent co-operation" of the rest of the Twin City amateurs set out to get into communication with Chicago. This was done at 11:30 and the press service was just about to file with the radio station in Chicago when once more the lines were restored. In the meantime the evening press from NAA had been copied and given the papers. This matter was gladly used and the amateurs were given over a column of space on the front page on the Minneapolis Tribune and other Twin City papers.

The real value of the entire affair is in the fact that such a communication network could be built up and maintained in daylight by amateurs without any previous arrangement. *That Citizen Radio can serve in an emergency is an undisputed fact* in the Twin Cities and thereabouts. Much credit is due to the stations establishing this network and especially to Mr. J. F. Carpenter of 9XI, managing the city of Minneapolis, for his early grasp of the situation, intelligent routing of messages, and his fortitude in sticking on the job forty hours without sleep.

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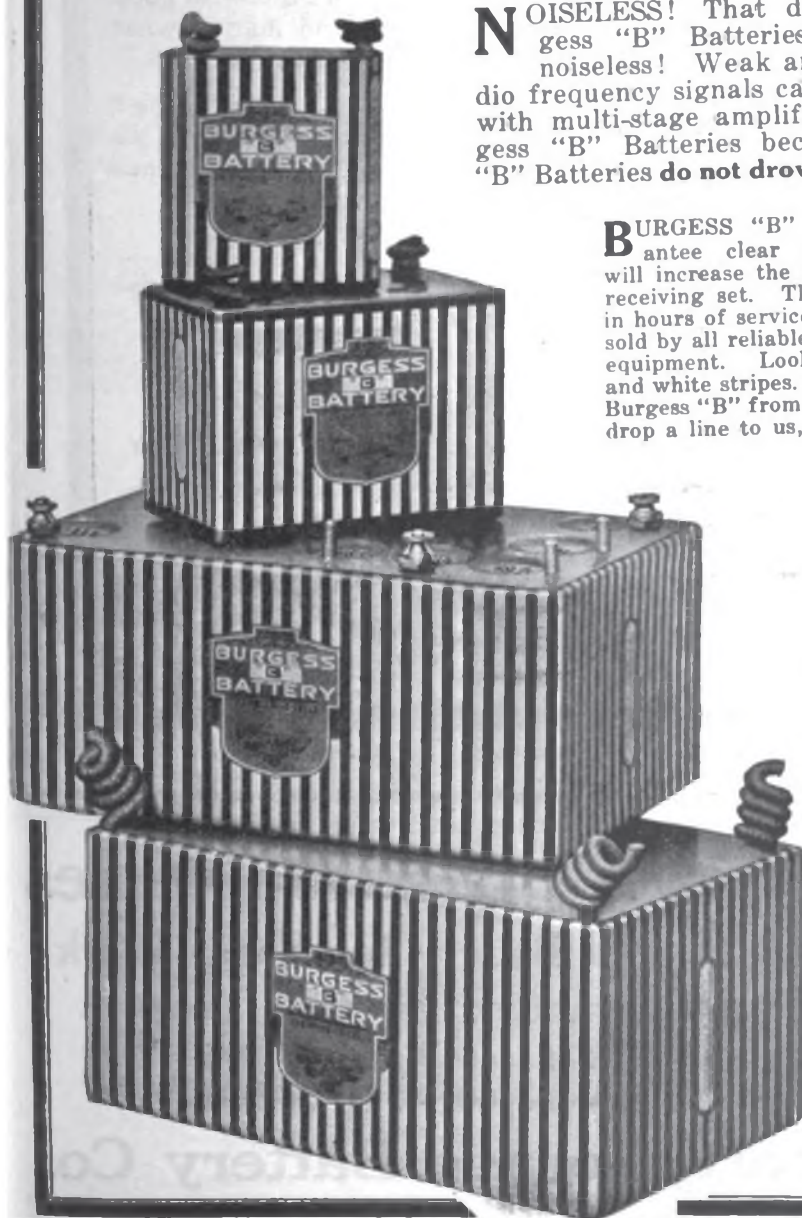
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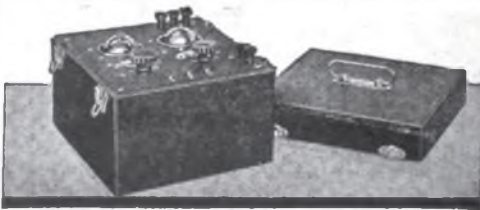
The Radiohome Receiver

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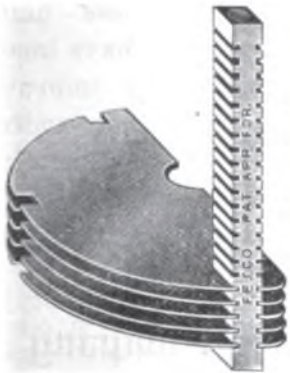
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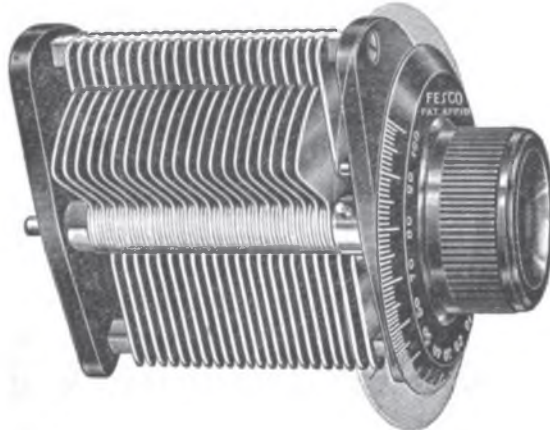
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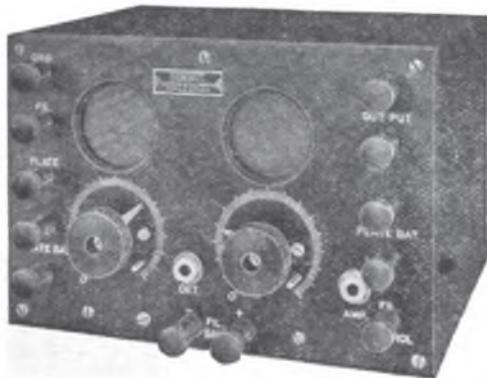
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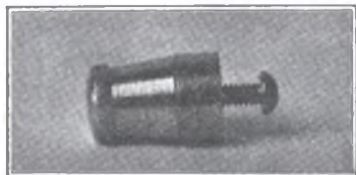
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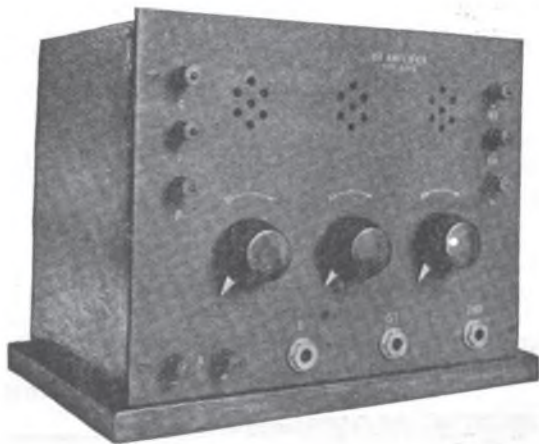
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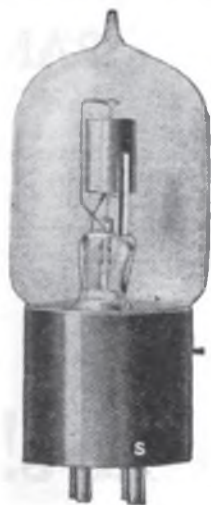
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Equipped with the SHAW standard four-prong base

**ATLANTIC-PACIFIC RADIO SUPPLIES COMPANY**  
NATIONAL DISTRIBUTORS FOR THE MOORHEAD LABORATORIES, INC.  
**638 MISSION STREET—SAN FRANCISCO—CALIFORNIA**  
**EASTERN OFFICE—5 KIRK PLACE—NEWARK, NEW JERSEY**

Henry M. Shaw, President

use A-P tubes for efficiency

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

# INSULATION

is the prime factor in building wireless apparatus inasmuch as it must have great dielectric strength, be moisture proof, mechanically strong, and yet easily machined.

These qualities are all embodied in

## GENUINE BAKELITE-DILECTO

*"The Perfect Insulation"*

which we manufacture in sheets, rods, tubes and special shapes.

Bakelite-Dilecto should be used for panels, coil cores, and other insulating parts in your wireless outfit.

Write our nearest office for full information about all of our products.

### THE CONTINENTAL FIBRE COMPANY Newark, Delaware

New York, 233 Broadway  
Pittsburgh, 301 Fifth Ave.  
Los Angeles, 411 S. Main St.

Chicago, 332 S. Michigan Ave.  
San Francisco, 525 Market St.  
Toronto, Ont. Canada,  
89 Wellington Street, West.

# QST

## Pittsburgh Amateurs!

You will find us in a position to supply your needs in radio supplies

Westinghouse, Amrad, DeForest, Acme, Murdock, Federal & Brandes  
Complete Antenna and ground equipment.

—PARTS—

Come in and  
See Us  
QUALITY

**DEVON**  
ELECTRIC CO. INC.

Mail Orders  
Promptly Filled  
SERVICE

613 LIBERTY AVENUE,

PITTSBURGH, PA.



## APEX SERVICE

All orders shipped same day as received.

Give us a trial and we will give you SERVICE.

Price Bulletin sent on request. Local Amateurs invited to call and see our line. Open all day and every evening.

APEX RADIO CO., Inc.,

1105 W. 69th St., Chicago, Ill.

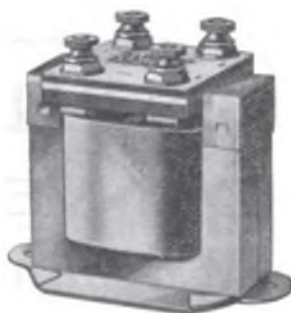


**THE  
THORDARSON  
AUDIO FREQUENCY  
AMPLIFYING  
Transformer**

**is now standard with many well known manufacturers**

**That should be sufficient guarantee that it is right.**

**SHELL  
TYPE**



**PRICE  
\$4.00**

**Each transformer supplied fully mounted in an ingenious, nickeled frame with substantial terminals mounted on a bakelite terminal board.**

**The terminal board is on the top, the only logical place for a terminal board. The transformer is wound with silk covered wire.**

**BACKED BY THE "GOLD MEDAL" LINE.**


**PRICE, AS ILLUSTRATED - - \$4.00**

**Thordarson Electric Mfg. Co.**

**517 S. Jefferson Street,**

**Chicago**

CONDENSITE  
**CELORON**  
*makes high type*  
**Radio Panels**



**WHEN** you think of insulation, think first of Condensite Celoron, for this remarkable material is a radio insulation of the very finest type—extremely high in surface and volume resistivity—extremely high in dielectric strength—and low in dielectric losses. It is adaptable to every machining process—takes an attractive finish—and engraves cleanly. You can obtain it in sheets, rods and tubes of standard size; in two colors—natural (brown) and black.

Write today for complete information.

**Diamond State Fibre Company**  
 Bridgeport, (near Phila.) Pa.  
 Branch Factory and Warehouse,  
 Chicago

In Canada: Diamond State Fibre Co.,  
 of Canada, Ltd.  
 Toronto

**Try REYNOLDS RADIO Service**

**“9ZAF” from DENVER “9ZAF”**

**Kennedy RECEIVING OUTFITS Grebe**

<b>PHONES</b>		<b>ANTENNA WIRE</b>	
Baldwin	Brandes .	}	Aluminum No. 14 per lb. ....\$1.00 (about 250 ft.)
Murdock	Federal		Copper No. 14 per lb. .... .60 (about 90 ft.)

**REYNOLDS RADIO CO. Inc. 613 19th St., DENVER, Colo.**

**DISTRIBUTORS | Dealers Write for Proposition**

High-Grade  
**WIRELESS**  
 HEAD RECEIVERS, MICROPHONES,  
 KEYS, JACKS, PLUGS, ETC.

*American Electric*  
 COMPANY  
 Manufacturers CHICAGO, U.S.A.

**RECEIVE ON AN Indoor Coil Aerial**




Chart and tables giving proper number of turns to put on coil for any wave lengths covering 0 to 3600 meters 50c; 3600 to 24000, 50c. Stamps not accepted. C. A. DAVIS & CO., 2371 Champlain N. W., Washington, D.C.

# MURDOCK

## *radio necessities*

---



No. 56 Phones

**M**URDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noises and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days.

Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices \$5.00 to \$6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, sockets and detectors, and the new Murdock Rheostat.

*Buy Murdock apparatus from your dealer.*

---

# Wm. J. MURDOCK Co.

"IT SPEAKS FOR ITSELF"

## ARKAY <sup>LOUD</sup> RADIO HORN



\$5.00

Make your own Loud Speaker by simply inserting one of the 'phones from your head set.

The Arkay Radio Horn is so designed as to reproduce signals, speech and broadcasted music without distortion, giving a pure and natural tone.

The Arkay Horn is carefully constructed of brass throughout, finished in either black, hard rubber finish, or full polished nickel as desired.

Its construction is such that it will fit any of the popular makes of radio receivers. This is accomplished by means of an adapter concealed under the base, which is provided with an opening to permit the horn to set over the receiver cord. Construction of the adapter is sufficiently rigid to prevent vibration, thereby eliminating any over-tones or distortion of signals, speech or music.

Arkay Horns work equally well on one or two stages of amplification.

If not obtainable at your dealers, we will forward one direct, upon receipt of purchase price, plus the postage to your station.

Shipping weight 4 pounds.

Price, Black enamel, without 'phone	\$5.00 each
Polished nickel without 'phone	6.00 each

Dealers write for our proposition. Immediate delivery.


DISTRIBUTED BY

Indianapolis, Ind. Hatfield Electric Co. Newark, New Jersey. Economy Auto Supply Co., Inc. Radio Distributing Co. Pittsburgh, Pa. Ludwig Hommel & Co. Robbins Electric Co.	New York City Continental Radio & Electric Corp. Manhattan Electrical Supply Co., Inc. Ship Owners Radio Service, Inc. Toledo, Ohio Marshall-Gerken Co.
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MANUFACTURED BY

**RILEY-KLOTZ MFG. CO., 21 Mulberry St., Newark, N. J.**


## WIRELESS DISTRIBUTORS



Handle  
B. & P.  
**INSULATORS**

**Aerial  
Necessity  
Insures  
Safety  
and  
Perfect  
Insulation**

**No. 1**



**Immediate Delivery**  
Write for Exclusive Territory and Quotation

### Banister & Pollard Co.

206-208 Market St., Newark, N. J.

## HYGRADE SPECIALS

*Save You Money*

7 Stranded Copper Aerial Wire	
100 Feet	.85
Radio Service V.T. Sockets	.80
Crosley V. T. Sockets	.55
22 1/2 V. Cyclone Small B Battery	.90
22 1/2 V. Cyclone Large B Battery	1.60
22 1/2 V. Eveready B Battery	1.50
45V. Cyclone Large Variable B Battery	2.75
22 1/2 V. Large Eveready Variable B. Battery	2.50
Binding Posts (rubber Cap) per doz.	.75
.0005 MF. Grid Condensers	.25
.002 MF. Phone Condensers	.25
Variable Grid Leaks 1/2 to 3 meg-ohms	.65
Electrose Ball Insulators 28c each, per doz.	3.00

### Marko Storage Batteries

6 Volt 40 Amp.	10.00
6 Volt 60 Amp.	13.50
6 Volt 80 Amp.	17.00
6 Volt 100 Amp.	21.50

*We do not charge for crating Above batteries are fully charged when shipped. The above prices are F. O. B. New York.*

### Hygrade Electrical Novelty Co.

41 West 125th Street. New York.

# Condensite



**I**F the molded insulation of your radio set is made of Condensite and the panel of Condensite-Celoron, you will have a combination that for appearance and lasting service will have no equal.

No other material possesses in such a high degree the properties essential to radio insulation.

We do not manufacture finished parts but upon request will gladly send the names of the leading radio concerns who make their instruments of Condensite.

Condensite-Celoron is a waterproof fibre especially adaptable for panel work.

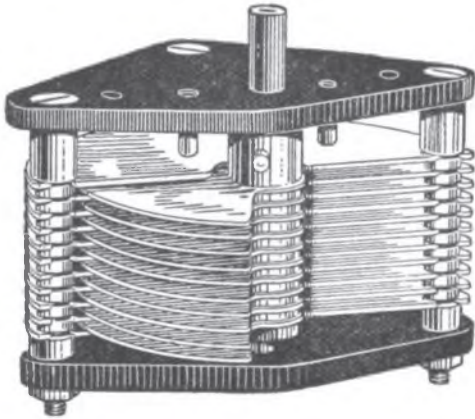
It can be obtained in sheets, rods and tubes of standard size; in two colors, brown or black, from the Diamond State Fibre Company, Bridgeport, Penna.

**CONDENSITE COMPANY OF AMERICA**

BLOOMFIELD NEW JERSEY

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

# HECO



## VARIABLE CONDENSERS

Made in 23 and 43 plate. Spacing of plates and casting of pillars and plates give uniform capacity at all times. Spring bearings assure even tension and good contact. Parts made and assembled under direct supervision of our radio engineers.

We can positively guarantee 24 hours shipments on all orders.

#100 23-plate .0005 MFD List \$4.00  
#200 43-plate .001 MFD List \$4.50  
Prices do not include knob, dial, or scale.

Special proposition open to jobbers and dealers.

**HATFIELD ELECTRIC COMPANY**  
INDIANAPOLIS, IND.

**QST de ANTHRACITE RADIO SHOP, P. O. Box 3, Scranton, Pa., successor to Shotton Radio Mfg. Co., of this city.**

We wish to announce that we will carry at all times, a complete line of parts, as well complete sets representing the leading manufacturers.

*Service - is our watchword.*

A Trial will convince you.

Send 5c. for our catalog of Parts

**ANTHRACITE RADIO SHOP, P. O. Box 3, Scranton, Penna.**

## VARIOMETERS AND VARIOCOUPERS



These instruments are wound with extra heavy wire to reduce the resistance, and have special long bearings with a spiral spring inserted to insure a perfect and self cleaning contact at all times. The taps on the Vario-Coupler are arranged in two groups. Furnished with round or square base.

Variometer as illustrated ..\$6.00  
Vario-Coupler as illustrated 6.00

Round or Square Base

Get them at your dealer's.

**SIMPLEX RADIO CO.**

1013-15 Ridge Av., Phila. Pa.



# "Chi-Rad" Apparatus



## New Storage "B" Battery

A real storage "B" Battery for your Radio Set at a price every Amateur and Experimenter can afford to pay. Can be used on receiving apparatus as source of plate potential on both Detector and Amplifier tubes. Ideal as source of energy on small Radio Telephones or C.W. Transmitters.

Simple and easy to re-charge from your lamp socket

Price per cell \$0.50  
Add PP on  $\frac{1}{2}$  lb.  
per cell.

and will last for years with ordinary use.

### SPECIFICATIONS:

Cut shows cell one half natural size.

Voltage per cell 2 volts.

Pasted Plates—ready formed for initial charge.

High Ampere Hour capacity—will operate one detector tube 1000 hours with one charge.

Shipped dry with simple directions for preparing the electrolyte.

Mahogany Tray for holding ten cells \$1.00 extra

Dealers:—Get our discounts on this new Battery—your customers will want them!

### REMOVAL NOTICE

About April 1st we will move to 415 South Dearborn Street where we will open a High-Grade Ground Floor Salesroom. With greatly increased space we will carry every make of good Radio Apparatus and will endeavor to have

"The Finest Radio Retail Salesroom in Chicago."

**CHICAGO RADIO APPARATUS CO., Inc.**

415 South Dearborn Street,

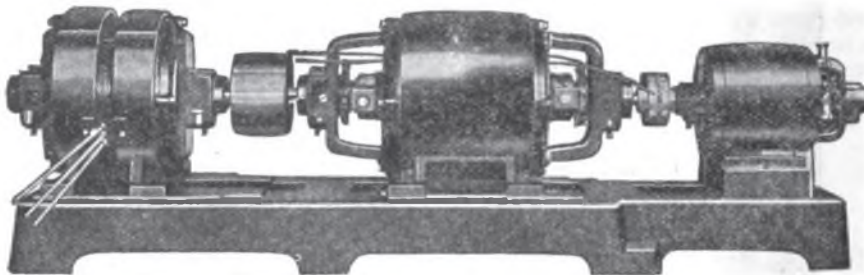
Chicago, Ill.

TRADE **E S C O** MARK

MEANS THE LAST WORD IN  
MOTORS, DYNAMOTORS, GENERATORS, MOTOR GENERATORS  
Designed and Developed by PIONEERS  
In Perfecting High Voltage Apparatus for Wireless Operation

## ESCO PRODUCTS ARE STANDARD

Sold by PRINCIPAL DEALERS Everywhere  
Used by LEADING EDUCATIONAL Institutions



This Outfit Enabled 1BCG—GREENWICH, CONN., to be among the first to get across the Atlantic in the recent Amateur Contest

Ask for Bulletin 237  
Listing over 200  
Combinations.

**ELECTRIC SPECIALTY COMPANY**  
215 South St., STAMFORD, CONN., U.S.A.



### *Amplify your signals with ACME Transformers*

Acme Transformers in your vacuum tube amplifier equipment, magnify voice and music as well as code without distortion and without howling. They are priced as low as specialized quantity production permits, with due regard for quality. At all Radio dealers.

### **Acme Apparatus Co.**

194 Massachusetts Ave.,  
Cambridge, Mass.

*Transformer and Radio Engineers and  
Manufacturers*

# HERE

## RADIO CITIZENS

Complete stocks carried for immediate shipment of the following apparatus:

Grebe Murdock  
DeForest Adams-Morgan  
Acme Radio Corporation  
C. Brandes, Inc.  
Federal Telephone & Telegraph Co.

### FREE BULLETINS PRICE LISTS

Get the new lowest prices on apparatus and supplies. Bulletins and price lists mailed FREE on your request. Send for them today.

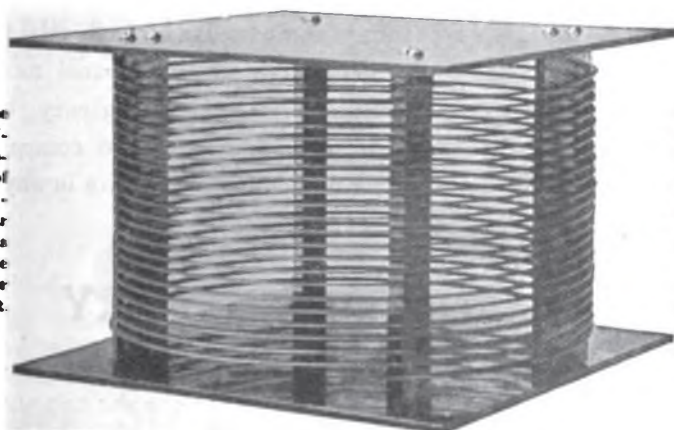
**Nash Electrical Service Co.**

Marshall, Ill.



## We can't make ALL of the radio apparatus — so we just make the BEST of it

The use of the WIMCO INDUCTANCE assures you of maximum results from your CW outfit. Its low resistance means greater antenna output.



Used everywhere where the best apparatus is desired. Order from your Dealer. Price 25 turn size \$10.00, Grid Coll \$2.00 extra.

WIMCO CW 100 INDUCTANCE

The following data on the resistance of the WIMCO C.W. INDUCTANCE was furnished by the Washington Radio Laboratories, Washington, D. C. It was measured for ten turns, this being the average number of turns in use on most amateur aerials at 200 meters wave length;

Wave length	H. F. Resistance
150	.71 ohms
200	.85 ohms
250	.95 ohms

(effective inductance 80.5 microhenries at 200 meters)

Full description of this inductance, and circuit diagram is contained in the WIMCO catalog, mailed anywhere on receipt of 15 cents in stamps.

**ANNOUNCING THE "STANDARD" AUDIO FREQUENCY AMPLIFYING TRANSFORMER.** We are distributors for the new Standard amplifying transformer designed for Cunningham and Radiotron tubes, 9 to 1 ratio, equal to any transformer on the market, and are in position to make immediate deliveries. Price \$5.00 fully mounted and thoroughly guaranteed. DEALERS—JOBBER WRITE.

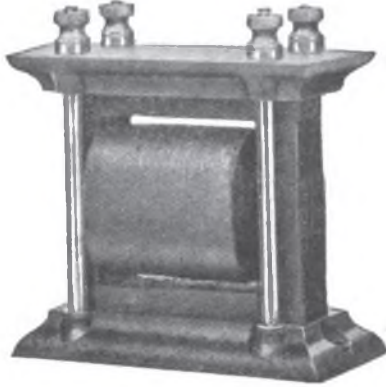
**REMLER APPARATUS—CUNNINGHAM TUBES—FROST REGENERATIVE RECEIVING SETS—CLAPP-EASTHAM AND FEDERAL PRODUCTS—HIPCO PLATE BATTERIES—WORKRITE VARIOMETERS AND COUPLERS—KLOSNER VERNIER RHEOSTATS—FADA APPARATUS—BRANDES AND BALDWIN HEADSETS**

### 8ZV WIRELESS MANUFACTURING CO. 8ZV

CANTON, OHIO

JOBBER—MANUFACTURERS

## Chelsea No. 50 Amplifying Transformer



Was designed for use with the present day models of vacuum tubes, and when so used produces remarkable amplification, with minimum noise. It is well adapted for table mounting or may be panel mounted in any position. Its high efficiency together with its neat appearance and compactness, makes it a predominating feature in any radio receiving equipment.

### IMMEDIATE DELIVERY

Price as shown ..... \$4.50  
 Unmounted ..... 3.75

*Bulletins sent upon request*  
 Purchase from your dealer. If he does not have it, send to us.

### CHELSEA RADIO COMPANY

160 FIFTH STREET,

CHELSEA, MASS.

### RAY-DI-CO PRICES DEMAND QUICK ACTION! LET YOUR EYES TRAVEL OVER THESE SPECIALS, THEN ACT!

RAY-DI-CO Variometer Set \$13.50

Completely set up. Consists of two Variometers and one tapped variocoupler. Only the highest grade mahogany used in forms,—non-shrinking, non-cracking, limit stops on rotor. No grating sounds from sliding contacts.

\$10.00 Knocked down complete with hardware.

#### FORMICA PANELS

9x14x $\frac{1}{8}$ .....\$1.75	9x21x $\frac{1}{8}$ .....\$2.25
9x14x $\frac{1}{4}$ .....2.50	9x21x $\frac{1}{4}$ .....3.75
7x18x $\frac{1}{8}$ .....1.75	12x21x $\frac{1}{8}$ .....2.75
7x18x $\frac{1}{4}$ .....2.50	12x21x $\frac{1}{4}$ .....5.00

IMMEDIATE DELIVERY. Mail orders given prompt attention. If your dealer cannot supply you order direct from this ad.

### THE RAY-DI-CO ORGANIZATION

1547D N. WELLS STREET,

CHICAGO, ILL., U.S.A.

## KECO-RADIO STORAGE BATTERIES



Are the highest grade batteries built especially for wireless instruments.

Solid oak box, natural finish, highly varnished. 6 volt, 7 heavy "Cristol" plates per cell, 50 amps.

We are one of the largest builders of exclusive high grade Wireless Batteries in the country. Thousands in use. Sold by all leading dealers or shipped direct from factory, 15.75, with book of uses and abuses of the storage battery.

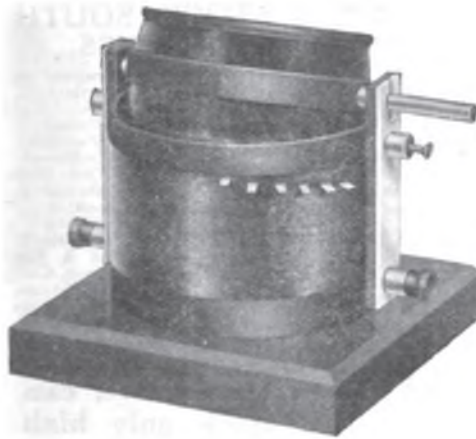
### KALB ELECTRIC COMPANY

7223 MANCHESTER AVENUE,

ST. LOUIS, MO.



**Price**



**\$5.00**

## **Super Standard Vario Coupler**

Single turn variations cover entire primary winding on the Formica tube. For both table and panel mounting.  $\frac{1}{4}$ " Brass rods in Rotors. Binding post connections. Green silk wire. Range 150-600 Meters.

**New Knob and Dial \$1.00—Sockets \$1.00**

### **IMMEDIATE DELIVERY**

**New Non-Regenerative Set**

**In cabinet with detector unit included**

**\$32.50**

**MANUFACTURERS—JOBBER—DEALERS**

## **OUR NEW CATALOG IS READY**

Our new catalog is ready with complete descriptions and illustrations of our entire line VARIOMETERS, VARIOCOUPERS, DETECTORS, AMPLIFIERS, DIALS, SOCKETS, RHEOSTATS, NON-REGENERATIVE RECEIVING SETS, BINDING POSTS, CONTACT KNOBS, STOP PINS, SWITCH LEVERS COMPLETE AND SMALL ACCESSORIES

**We are territorial Distributors for Radio Corporation, Westinghouse, Magnavox, Baldwin, Remler, Cunningham, Riley-Klotz "ARKAY HORN", Federal, Rhamstine, Acme, Weston and Jewell Meters, Hipco B Batteries, Cooper storage Batteries, A. P. Tubes, etc.**

**Send us your Orders for Head Sets, Dials and Knobs, Sockets, Magnavox, Arkay Horns.**

## **THE MARSHALL-GERKEN CO.**

**Manufacturers & Jobbers**

**TOLEDO**

**OHIO**



**ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS**

# RADIO APPARATUS

LARGEST STOCK SOUTH  
PROMPT DELIVERIES

SERVICE

QUALITY

E. Batteries Radiaco Small 22½ V. ....	\$1.50	Sockets Paragon .....	\$1.00
E. Batteries Radiaco large-tapped 22½ V. ...	2.65	Sockets Murdock .....	1.00
E. Batteries Eveready large-tapped 22½ V. ...	3.00	Sockets G. A. ....	1.50
Tubes UV200 Radiotron Detector .....	5.00	Sockets DeForest .....	1.20
Tubes UV201 Radiotron Amplifier .....	6.50	Rheostats Paragon .....	1.50
Tubes UV202 Radiotron Trans. 5 watt ..	8.00	Rheostats DeForest .....	1.65
Tubes UV203 Radiotron Trans. 50 watt ..	30.00	Rheostats Gen. Radio .....	2.50
Tubes C300 Cunningham Detector .....	5.00	Rheostats Remler-Jr. ....	1.00
Tubes C301 Cunningham Amplifier .....	6.50	Remler Rheostat .....	1.50
Tubes Electron Relay Detector .....	5.00	Rheostats Parkin .....	.75
Tubes A & P Amplifier .....	6.50	Corwin Dial & Knob 3" ..	1.00
Phones Murdock 2000-ohm .....	4.50	Corwin Dial & Knob 3½" ..	1.20
Phones Murdock 3000-ohm .....	5.50	Dial and Knob Chelsea ..	1.00
Phones Brandes Superior .....	8.00	Transformers, Acme Unmounted ..	4.50
Phones Brandes Navy .....	14.00	Transformers, Acme Sem-mtd. ....	5.00
Phones Baldwin Type C .....	12.00	Transformers, Acme Mounted .....	7.00
Phones Baldwin Type E .....	13.00	Transformers, Federal .....	7.00
Phones Baldwin Type F .....	14.00	Transformers, UV712 .....	7.00

We have only listed a few items above, can furnish anything required for your set—we stock only high grade products.

Acme Apparatus  
Clapp-Eastham  
DeForest  
Wm. Murdock

Federal  
Firth  
Radio Dist. Co.  
Radio Corp.

Brandes  
Adams-Morgan  
Chelsea  
Magnavox

Remler  
Signal  
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N. Baldwin Co.

## ROSE RADIO SUPPLY

604 GRAVIER STREET,

NEW ORLEANS, LA.

Send 10c for Catalog



### Galena and Radiocite

Million point, supersensitive crystals from our own mine in Arizona. Used by all radio companies.

#### Radio Supplies BY MAIL

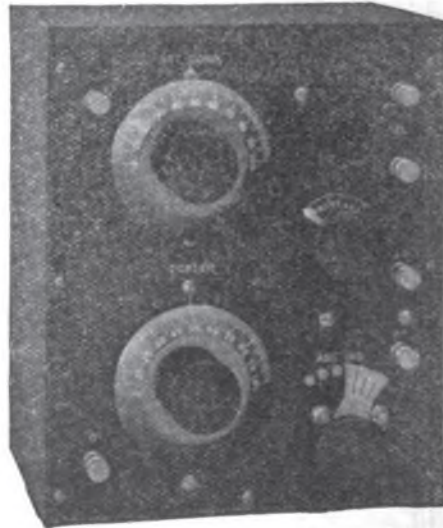
Crystals, mounted 30c, unmounted 25c.  
Condenser, fixed receiving ..... \$1.00  
Insulators, aerial ..... .25  
Binding Posts ..... 07c. up  
Contact points ..... per 1000 \$15.00  
Tuning Coils ..... \$3.50 & \$4.00

Mail orders promptly filled. All crystals carefully tested and inspected.

#### The RADIO SHOP of NEWARK

41 So. Orange Ave.,  
Newark, N. J.

### Clapp Eastham H R tuner



This tuner brings all the  
RADIOFONE BROADCASTING  
to your home. See it in Akron, Ohio, at

The Radioart Store

318 Ohio Bldg.

Radio 8UX

# Greater Amplification

*Than Any Other On The Market !*

**NO HOWLING !**

**No Plate Circuit Tuning Adjustments**

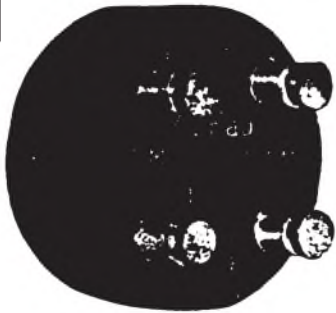
**Equally Effective on Phone, C.W. or Spark.**

**Radio Frequency Amplification at Short Wave Lengths.**

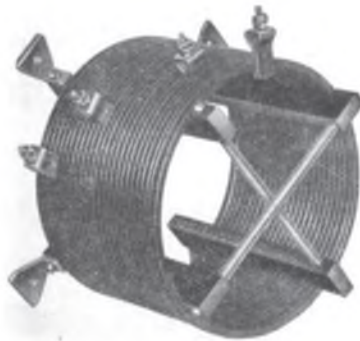
Here is a new departure in Radio Transformers. MU-RAD combines REGENERATION and straight R. F. AMPLIFICATION in a single unit. Type T-11 shown above can be used with any type of tube. With diagrams and full instructions, \$9.00 each.

**Our Guarantee**

We guarantee our T-11 Transformers to give greater amplification than any other on the market when properly used or you receive your money back.



THE above photo shows our new 3-story building in the heart of the St. Louis business district. Our mail order department is complete in itself and we give you immediate service on all mail orders. Send 10c in stamps for our catalog today.



**The Only "CW"  
PANEL  
INDUCTANCE  
On The Market**

This is the only "C.W." Inductance made for panel mounting. The copper ribbon is wound on FORMICA supports, giving highest possible insulating qualities. Each Inductance furnished with four of the new type BENWOOD PATENTED HELIX CLIP which will fit either a round or flat surface. Each clip furnished with moulded insulated handle which enables tuning of the set with current on.

Standard size, as shown in cut, consists of 25 turns of edgewise wound soft drawn copper strip  $\frac{3}{8}$ -inch in width and  $\frac{1}{16}$ -inch in thickness. Turns are full 6-inches in diameter. Type A-1 (as shown)—each \$8.50. Type A-2—50 turns, ideal for stations requiring more than 250 meter wave, price each \$12.50.

**For Prompt Shipments—BENWOOD  
"World Wide Mail Order Service"**

Our enormous mail order business has built up because of the service we render our customers. Your order will be filled at once or letter of notification will be sent you the same day explaining any cause for delay. Send 10c in stamps for the new Benwood Radio Catalog which comprises the latest price directory. We can show you how to save money by buying from us direct by mail.

**THE BENWOOD CO., INC., 1114 OLIVE STREET  
ST. LOUIS, MO.**

# T & H Radio Company

Largest Radio Stock In Mid-West

Immediate Deliveries

All items listed are in stock in large quantities.

## CW APPARATUS

UV202 5 watt Radiotron . . . . .	\$8.00
UV 203 50 watt Radiotron . . . . .	30.00
UV216 Kenotron Tubes . . . . .	7.50
UV217 Kenotron Tubes . . . . .	26.50
UR542 Porcelain Socket . . . . .	1.00
UR541 Porcelain Socket . . . . .	2.50
PR535 Filament Rheostat . . . . .	3.00
PR537 Filament Rheostat . . . . .	10.00
UP1719 Grid Leak . . . . .	1.10
UP1718 Grid Leak . . . . .	1.65
Acme CW Inductance . . . . .	8.00
Acme 200 Watt CW transformer . . . . .	20.00
Acme 500 Watt Power Trans. . . . .	25.00
Acme Choke Coils, single . . . . .	6.00
Acme Choke Coils, double . . . . .	8.00
Acme Modulation Transformer . . . . .	5.00

## RECEIVING APPARATUS

UV200 Radiotron, detector . . . . .	\$5.00
UV201 Radiotron, amplifier . . . . .	6.50
Electron Relay, detector . . . . .	5.00
A. P. Amplifier tube . . . . .	6.50
Grebe CR9 with amplifier . . . . .	130.00
Grebe CR8 150-1000 meters . . . . .	80.00
Grebe CR5 150-3000 meters . . . . .	80.00
Magnavox, 14" horn . . . . .	45.00
Burgess #2156 "B" Battery . . . . .	3.00
Burgess Tapped "B" Battery . . . . .	2.75
Baldwin Receivers type C . . . . .	12.00
Baldwin Receivers type E . . . . .	13.00
Baldwin Receivers type F . . . . .	14.00
Brandes "Superior" receivers . . . . .	8.00
Acme Amplifying transformers . . . . .	5.00
Honey Comb Coils, all sizes	

Inquire for monthly stock sheet, shows our complete stock each month. \_CW and radiophone catalog sent any address when four cents in stamps accompanies inquiry.

5th District Distributors for Ideal Apparatus Co.

# T & H Radio Company

ANTHONY,

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KANSAS

## RADIO PANELS

SAVE MONEY on our special 30 day offer. Our panels are made of genuine

## BAKELITE DILECTO

XX Grade Black (Polished Surface)

used for the past 5 years as a standard WIRELESS insulation by U.S. Navy. Universally recognized by radio engineers as the most efficient insulation for radio sets. We are specialists dealing exclusively in radio panels and have ready for immediate delivery the following sizes— $\frac{1}{8}$  inches thickness.

6 x 9 Price \$1.15	6 x 19 Price \$3.40
6 x 12 " 1.50	12 x 18 " 4.50
8 x 12 " 2.00	6 x 21 " 2.60
6 x 18 " 2.25	12 x 14 " 3.50
9 x 12 " 2.25	

We will cut special sizes to your specifications at 2 1/2 cents square inch.

### RADIO PANEL SPECIALTY CO.

Sales Office: 50 Church St., Room 1869, New York City

Enclosed find \_\_\_\_\_ for \_\_\_\_\_ Bakelite Panels size \_\_\_\_\_

NAME \_\_\_\_\_

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CITY OR TOWN \_\_\_\_\_ STATE \_\_\_\_\_

## 10c. Charges Your Storage Battery AT HOME WITH AN F-F Booster

So You will never have to give up, in disgust when working a distant station.



Is it not gratifying to feel that your filament battery will always be ready when you want it? You know what its like to have friends call to "LISTEN IN" & then find your battery dead. F-F Battery Boosters are automatic and operate unattended. Screw plug in lamp socket, Snap Clips on Battery Terminals and see the gravity come up.

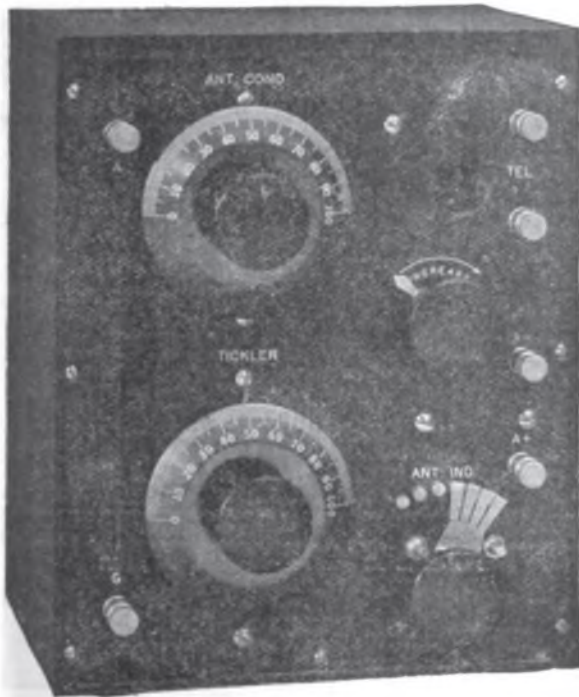
The AMMETER shows you just the amount of current flowing. Both waves of current are rectified thru adjustable and easily renewable carbon electrodes which maintain a constant efficiency and last for thousands of hours. Everything Complete in One Compact, Self-Contained, Portable Charging Unit. F-F Boosters are Magnetic Rectifiers for 105-125 Volt 60 Cycle Alternating Current. PRE-WAR PRICES: Bantam Type 6 charges 6 Volt Battery at 6 Amperes \$15 Bantam Type 12 charges 12 volt Battery at 5 Amperes \$15 Type 166 Charges 6 Volt Battery at 12 Amperes \$24 Type 1612 Charges 12 Volt Battery at 7 Amperes \$24 Type 1626 Charges Both 6 and 12 Volt Batteries \$36 Shipping Weights Complete 12 to 15 Pounds

Order from your Dealer or send check for Prompt Express Shipment. If via Parcel Post have remittance include Postage and Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge batteries from Farm Lighting Plants, Direct Current Circuits and D.C. Generators. For Group Charging use our Full Wave Automatic F-F Rotary Rectifier of 100 Volt, 36 cell capacity. Order Now or Write for Free BOOSTER Bulletin No. 31 or ROTARY 31A

OFFICES & WORKS  
The France Mfg. Co. CLEVELAND, OHIO, U.S.A.

Canadian Representative: Battery Service & Sales Co. Hamilton, Ontario, Can.

# Here's The Receiving Set You Are Looking For—



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

The specifications tell the story to the expert and the C-E guarantee of satisfaction protects every purchaser of a Clapp-Eastham Type H. R. Regenerative Receiving Set—expert and amateur alike.

If you're looking for 100% satisfaction—regardless of price—ask your dealer to show you this set. He may be temporarily out, but it's well worth waiting for—or you can write us direct.

If you haven't already received a copy, you should send 6c in stamps for the C-E Radio Catalog—it covers every essential radio requirement.

## THE CLAPP-EASTHAM TYPE H. R. REGENERATIVE RECEIVER

PRICE \$40.00

You can pay more money for a receiving set—if you want to—but you can't get any better results or greater satisfaction at any price.

Since we put this set on the market, we've been literally swamped with orders. Dealers, radio "fans," novices—everybody who has tried the instrument has become a booster for it.

Regeneration is perfect on all wave lengths between 180 and 825 meters. The range or distance from which signals are received and the clear, sharp tones are a revelation to the experienced radio man as well as to the person who "listens in" for the first time.

*Panel-- Formica, hand-somely decorated.*  
*Cabinet-- Solid Mahogany.*  
*Condenser -- Balanced type, 2 Rotary, 3 Stationary plates. Built on Verner.*  
*Dials -- Indestructible metal. White figures on black ground.*  
*Antenna Inductance-- Wound in Formica Tube.*  
*Plate Inductance -- Wound on molded ball.*  
*Binding Posts-- Black rubber covered.*  
*Switch-- Fan Blade.*  
*Rheostat-- C.E. Type H 400.*  
*Circuit -- Single circuit regenerative. Licensed under Armstrong U. S. Patent No. 1113149.*  
*"B" Battery -- Contained in compartment inside cabinet or external as desired.*

## CLAPP-EASTHAM COMPANY

RADIO ENGINEERS *and* MANUFACTURERS

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CAMBRIDGE, MASS.

127-20

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Send to KLAUS—"Radio Headquarters" for special discount lists and bulletins on apparatus and equipment. Our service department offers dealers assistance and advice on radio problems. We distribute "tested" apparatus. We know the equipment we send you is right. We want all Agents and Dealers to get our special proposition on the best lines of apparatus made.

Get our Prices on these lines of apparatus

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Write today to---

**KLAUS RADIO CO.**

Dept. 100

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Illinois



**FIRST TESTED THEN SOLD**

## AMATEURS, EXPERMENTERS, DEALERS

We beg to announce our appointment as distributors for  
**BALDWIN, BRANDES, MURDOCK, CLAPP-EASTHAM, CHELSEA,  
FIRTH, A B C, DEFOREST, MARSHALL-GERKEN** and others  
**SPECIAL THIS MONTH**

Bakelite Cut any size— $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$ , 1  $\frac{1}{2}$  c, 2c and 2  $\frac{1}{2}$  c per square inch.  
Mail Orders Promptly Filled.

**Pittsburgh Radio and Appliance Co., Inc.**

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"Pittsburgh's Radio Shop"

Exclusive 8th District Distributors for  
"IDEAL" C W APPARATUS



## Radio Frequency Transformers

Type RT-1, for the amateur and broad-  
casting range, 175-500 meters.

(Patent Pending)

**\$6.00**

Will work on all tubes.

The only completely shielded iron-core  
R. F. Transformer

**RADIO SERVICE LABORATORIES, Inc.**

ASBURY PARK, NEW JERSEY





# New "Read 'Em" Binding Posts

16 Styles

Antenna

Ground

Condenser

Tickler

Variable Condenser

A—Battery—

A—Battery +

B—Battery—



B—Battery +

Plate

Detector

Phonea

Secondary

Primary

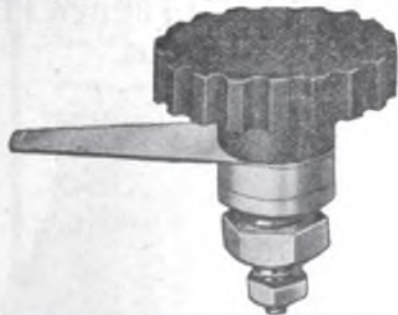
Grid

Filament

Complete Post and Knob 15c each

The enormous demand for these "read 'Em" binding posts, prompted us to put in a large stock to take care of our friends. Our stock is complete.

We are in equally fine position to fill orders promptly for binding posts made up of exactly the same high grade material and workmanship—the same in every way, without the knob engraved @ 12c. each.



SWITCH ARM TYPE S. A. 3

Price .....\$ .50 Each

Knob—1 1/4" Knurled Bakelite

Lever—1 1/2" Phosphor Bronze Nickeled

Bushing—to fit up to 3/8" panel.

Type S. A. 1—Price.....\$ .40 Each

Same as above with 1" radius knob.



SWITCH ARM TYPE S. A. 4

Price .....\$ .50 Each

Knob—1 1/4" Fluted Bakelite

Lever—1 1/2" Phosphor Bronze Nickeled

Bushing—to fit up to 3/8" panel.

Type S. A. 2—Price.....\$ .40 Each

Same as above with 1" radius knob.

Send Us Your Orders Now

Orders will be shipped the day they are received. Send in your order early.

## THE KUEBLER RADIO COMPANY

124 St. Clair Street

Toledo, Ohio

AMPLIFICATION  
**Mu-Rad RADIO Laboratories**  
 DISTANCE

**R. F. TRANSFORMERS**  
 Types T-11, T-11a, T-11b



**WAVELENGTH RANGE**  
 160-500 meters

**RADIO FREQUENCY AMPLIFICATION**

Introducing two new MU-RAD R.F. amplifier transformers Type T-11a and T-11b. We have again anticipated the entire field in multi-stage R.F. amplifier design. Users already know the fine results obtained by using two or three MU-RAD T-11 transformers for 2 or 3 stage amplification; but we have developed and protected our rights in a method for obtaining still greater amplification. The load in the plate circuit of a vacuum tube is reflected into the grid circuit thru the grid-plate capacity, and maximum amplification for more than one stage can therefore only be obtained by proper recognition of this fact in its influence upon the design of the transformers in each stage. Other manufacturers use the same transformers in every stage. MU-RAD uses different transformers for SUPER-AMPLIFICATION.

For one stage amplification, use Type T-11 between amplifier tube and detector. (Usually equivalent to two stages with other transformers.)

For two stage amplification, use T-11a between first and second amplifier tubes and Type T-11 between second amplifier tube and detector.

For Three stage amplification, use Type T-11b between first and second amplifier tubes, Type T-11a between second and third amplifier tubes, and Type T-11 between third amplifier tube and detector. DEALERS: Write.

- R.F. Amplifier transformer Type T-11 .....\$6.00
- R.F. Amplifier transformer Type T-11a..... 6.50
- R.F. Amplifier transformer Type T-11b..... 7.00

**MU-RAD LABORATORIES, Asbury Park, New Jersey; St. Louis, Mo.**  
**THE BENWOOD COMPANY, Inc., ST. LOUIS, MO.** Distributors west of Mississippi River.

**Ask Sorsinc**



The highly professional service which our seasoned radio men give—backed by complete stocks of the leading lines of equipment make it well worth your while to ask



before buying. We know from experience what each piece of apparatus will do.

**Our Interesting Booklet**

—the most comprehensive in print, sent for 6 cents in stamps. Get your copy now!

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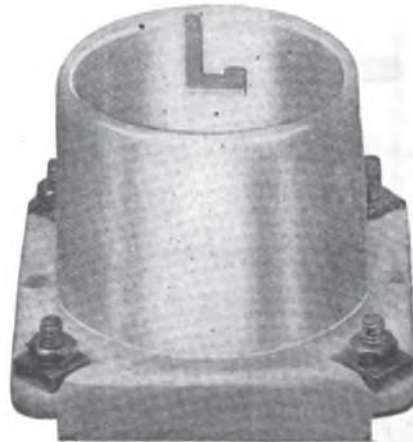
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 Branch Offices and Dealers Everywhere  
**"THE LARGEST RADIO CHAIN STORE SYSTEM IN THE WORLD"**

SORSINC, 80 Washington St., New York, N. Y.  
 Herewith 6 cents in stamps to pay mailing expense on my copy of your latest booklet.

Q-4-2

**The Original - At The New Price**

50 cents each



The original socket with the concealed bayonet slot.

The old adage: "Imitation is the sincerest form of flattery" still holds!

Ask Your Dealer or Write Direct to:

**JOY and KELSEY**

4021 West Kinzie St.

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"We give all we can for what we get—  
—instead of—  
—getting all we can for what we give."



# The Prince of Wales

could well be called the world's greatest known press-agent. With much pomp and ceremony he is received everywhere.

Your order received, "pomp" becomes "prompt" and the ceremony consists of the service we render our customers.

**REGENERATIVE RECEIVERS**

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No. CR-5 Grebe super-special 175-3000 meters with detector complete	80.00
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No. CR-9 Grebe 175-3000 meters complete with det. & 2 stage amplifier	130.00
No. CR-6 Grebe 175-680 meters with det. and 2 stage amp. phone & series cond.	200.00
No. RA Westinghouse, 180-700 meters, very selective, mahogany cabinet	68.00
No. RC Westinghouse, RA receiver and DA Det. Amplifier combined in one cabinet, a splendid unit, compact	130.00

**KENNEDY EQUIPMENT**

Type 110 Universal	\$250.00
Type 2201 Intermediate	125.00
Type 281 Short Wave	80.00
Type 525 Amplifier	85.00
Type 521 Amplifier	58.00

**RECEIVING SETS (Crystal)**

"Aeriola Jr.," Westinghouse, complete with Brandes "Superior" phones	\$25.00
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No. UV-200 Radiotron detector	\$6.50
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No. UV-202 Radiotron 5 watt	8.00
No. UV-203 Radiotron 50 watt	30.00
No. UV-204 Radiotron 250 watt	110.00

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No. 783 Eveready 22½ volts	\$2.25
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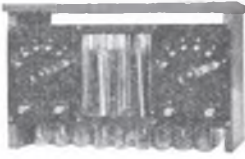
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No. 56 Murdock 2000 ohm	\$5.00
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No. C Baldwins	12.00
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No. F Baldwins	14.00
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A complete stock of standard apparatus enables us to fill your most exacting needs

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Please include sufficient postage with all mail orders



## Storage Batteries

Designed Especially For

# WIRELESS

"Cheapest in the long run"



### KICO "B" BATTERIES

KICO storage "B" batteries will end your "B" battery troubles. YEARS of Real service, saving you money in the end. One charge lasts from three to six months while in your detector plate circuit. Short-circuiting, over-charging or standing idle DOES THEM NO HARM. Durably constructed of the best materials and highly finished making a piece of apparatus which will fit in any station. Can be charged from your A.C. line in one hour after the first charge which takes about four hours. All batteries are supplied with chemicals, rectifiers and directions for setting up. One quart of distilled water puts your battery into service. Money back if unsatisfied within three months trial. Prices as follows

	Plain	With Panels
24 cells 32 V.	\$4.00	\$11.00
36 cells 48 V.	10.00	12.50
56 cells 68 V.	12.00	16.00

### KICO "A" BATTERIES

No more ACID EATEN rugs or furniture. Truly a PARLOR battery, designed especially for wireless den, yet sturdy enough to kick over starter on Ford, Chevrolet or any car taking a battery 9"x7". Box and jars moulded in one piece from ACID-PROOF composition much tougher than hard rubber. A Box that will NOT crack, break or leak in battery use. 6 volt 80 to 100 A.H. capacity, guaranteed for 18 months but will last for years if used only for wireless @ \$24.00

We also manufacture the following sizes designed especially for C.W. work, assembled in especially treated, durable hard wood boxes with hard rubber jars and covers with deep sealing space, sealed with great care to prevent leakage. Guaranteed 18 months.

6 volt 80-100 A.H.	\$20.50
8 volt 80-100 A.H.	27.00
10 volt 80-100 A.H.	33.00

Batteries shipped fully charged ready for use with hydrometer and full instruction for upkeep. Special sizes built to your specifications.

Circulars furnished upon request.

**KIMLEY ELECTRIC CO., 290 Winslow Ave., Buffalo, N. Y.**

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Mail your orders to us. We can supply you with the BEST at the BEST PRICES. Shipments made within 24 hours after receipt of order.

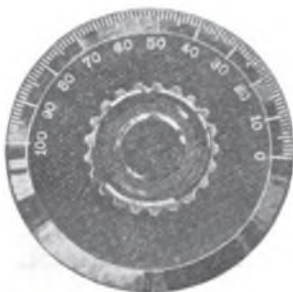
CATALOGUE  
122  
AT YOUR  
SERVICE

## THE SERVICE RADIO EQUIPMENT CO.

Designers—Manufacturers—Distributors

225 SUPERIOR ST.,

TOLEDO, OHIO



Dial No. 23

## THE QUALITY DIAL

Diameter 3"

Made for 3/16" and 1/4" Shafts.

**IMMEDIATE SHIPMENTS TO DEALERS**

## THE RADIO ELECTRIC COMPANY

3807 Fifth Ave., W.

PITTSBURGH, PA.

# Type "Q" Receiver

AN IDEAL RECEIVING SET FOR LONG  
AND SHORT WAVE AND RADIO  
TELEPHONE RECEPTION



This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector.....\$35.00

## Duck's New Radio Catalog No. 16



Send 25c in coin carefully wrapped today for copy of the greatest radio catalog ever put between the pages of two covers.

### 275 Pages--A Catalog DeLuxe

Never in the history of radio was such a catalog printed. The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many text books selling for \$2.00, and \$1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

Send 25c in coin, (carefully wrapped) for new catalog. The great cost of this elaborate catalog prohibits distribution on any other basis.

## The William B. Duck Company

243-245 Superior Street

Toledo, Ohio



Type TAW, Flush Model

## A New Bulletin

### ON SMALL RADIO INSTRUMENTS

is now ready. It covers not only our line of three and one-half inch **thermal** instruments, but also our lines of A.C. and D.C. instruments in the same size cases. All ranges required in modern radio work are included. You will be interested in this Bulletin which gives full details. In writing us mention Bulletin No. AG-10. **IT IS FREE!**

**ROLLER-SMITH INSTRUMENTS ARE SOLD BY ALL GOOD DEALERS**

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Electrical Instruments, Meters and Circuit Breakers



MAIN OFFICE:  
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ACE "ACE RADIO CONCERT RECEPTOR" ACE

**Type TRU Concert Receptor \$50.00**  
(Licensed under Armstrong Patent 1,113,149)

This unit is especially designed for the efficient reception of Radio Telephone Concerts from even the most distant Broadcasting Stations. The ease with which this Receptor can be installed and the extreme simplicity of operation make it ideal for use by even the most in-experienced. No previous knowledge of radio necessary to secure results.

We stock a complete line of Radio Supplies and maintain a *prompt, reliable* Mail Order Service that reaches all over the world.

Send 5c in stamps for catalog to Dept. "D".

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Manufacturers & Distributors of Radio Apparatus  
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## Prepared Radio Measurements

with  
**Self Computing Charts**

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A new WIRELESS PRESS book. Published as a real help to amateur radio. Obviates the necessity of long and involved mathematical calculations. A ruler or transparent triangle takes the place of intricate figuring and the results will be correct every time.

**PRICE \$2.00**

### The WIRELESS AGE

*The magazine that meets all your expectations.*

When its new you find it in the AGE. Every step in radio progress is fully and carefully described. You miss a lot of good things unless you read the AGE. \$2.50 per year, Postage outside U. S. 50c.

**SPECIAL OFFER ONLY**

Prepared Radio Measurements & The Wireless Age 1 Year **\$4.00**  
Outside U. S. 50c. Extra

This offer expires Dec. 15, 1921.

**WIRELESS PRESS INC.**

**328 Broadway, New York**



## Signal Service To Radio Electricians

Signal Radio Apparatus is *built complete* in Signal shops from designs developed in the Signal Laboratory by Signal Radio Engineers.

Before you spend a dollar on Radio equipment, check up the *Signal Line* against the field and the first step is to secure all Signal Literature. It's free—write today.

Write today for latest literature and name of nearest dealer.

**Signal Electric Manufacturing Company**  
Menominee, Michigan

# EBY BINDING POSTS AGAIN MADE A TREMENDOUS HIT AT THE NEW YORK RADIO SHOW



Corporal  
(Brass—13c)  
with stud & nut



Sergeant  
(Brass—20c)  
with  
screw & washer

Our 4 latest posts (BUDDY, SERGEANT, JUNIOR and JUNIOR H) sure won the hearty approval of every manufacturer, dealer and amateur who saw them at the SHOW.

The 4 posts shown are especially suitable for RADIO use and our increased facilities enable us to NOW MAKE PROMPT DELIVERIES.

LEADING MANUFACTURERS have adopted our posts and DEALERS everywhere are carrying an attractive stock.

To the AMATEUR who is building his own, here's your chance to equip your set with THE BEST BINDING POST ON THE MARKET. Ask your dealer to show you THE EBY LINE.

EBY POSTS SERVE, SAVE AND SATISFY



Junior—15c  
(including nut)



Ensign H—20c

THE H. H. EBY MANUFACTURING CO., 605 ARCH ST., PHILADELPHIA, PA.

## DEALERS AND RADIO CITIZENS

Order Your Needs From Our  
**LARGE AND COMPLETE ASSORTED STOCK**  
PARTS OF ALL KINDS COMPLETE SETS  
LARGEST STOCK RADIOTRONS AND KENOTRONS IN U. S. A.  
ALL TUBES SHIPPED PREPAID

Write for our new price list No. 100-T



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Branches:

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## Radio Special Storage Batteries

4 Volt, 60 Amp.....\$10.00  
6 Volt, 40 Amp..... 12.00  
6 Volt, 60 Amp..... 14.00  
8 Volt, 60 Amp..... 18.00  
Fully Charged. F.O.B. Boston. No Charge

For Crating.  
Guaranteed for One Year  
Manufactured by

**W. & G. TUFTS**  
336 Newbury St., Boston, Mass.



# Read what Godley says

Radio Corporation of America  
233 Broadway  
New York City,

As the representative of the American Radio Relay League in England during the recent Trans-Atlantic Amateur Transmission Tests, I wish to call your attention to the assistance given by all members of your organization from whom assistance was asked, and the cheerful, wholehearted manner in which it was given.

I have endeavored, both in the written accounts of my experiences as well as in verbal reports of it, to point out the great value of this assistance, and to call attention to the fact that Radio Corporation Detector Tubes Type **UV 200** were used during the reception at Ardressan in conjunction with the regenerative receiver and 2-stage tone, frequency amplifier. These tubes functioned admirably, and the results obtainable was a surprise to the several British amateurs who saw them in operation.

All Radio Relay men with whom I have spoken concerning the matter since my return are deeply grateful for the co-operation given by your company, and fully appreciate that the completeness of the success of the ventures would have been lacking in great degree but for your co-operation.

Respectfully,

*Paul F. Godley*



It was a great triumph for the amateurs when they sent messages across the Atlantic to Scotland. But it was also a Radiotron triumph. Read what Paul F. Godley says in the letter here reproduced in facsimile.

There are two Radiotrons available for reception. For Detection — Radiotron UV — 200, the popular tube used by thou-

sands of amateurs and novices because of its long life and super-sensitiveness. Price \$5.

For Amplification — Radiotron UV — 201, the amplifier tube which gives maximum amplification without distortion and which, like UV — 200, is used throughout the nation for radiophone broadcasting reception. Price \$6.50.

*Ask your nearest Dealer for Radiotrons*

**Radio**  **Corporation**  
*of America*  
Sales Department, Suite 1803  
233 Broadway, New York City



# RHAMSTINE\*

PRODUCED THE

## ADAPT-O-PHONE

FOR A LISTENING WORLD

Developed from a special study of the requirements of a Radio Age, the Rhamstine\* Adapt-O-Phone brings added satisfaction to your hours "listening in."

Scientifically designed and balanced so that the sounds from your two receivers are clearly and correctly amplified. The Adapt-O-Phone is twenty inches high, attractively finished and reasonably priced.

**Price \$12**

without receivers  
Add 25c for Postage and Packing;  
west of Rocky Mts., 40c.

**J. THOS. RHAMSTINE\***

2152 E. LARNED STREET.

DETROIT, MICH.

\*Maker of Radio Products

## Keep Your Battery Fully Charged

WITH A

# Riggs Rectifier

The simplest, lowest priced and most efficient RECTIFIER on the market. Has only ONE adjustment and is absolutely fool proof.

No amateur wireless outfit, or up to date private garage is complete without this RECTIFIER, by means of which your wireless, or automobile battery is kept fully charged.

Sent parcels post East of the Rocky Mountains upon receipt of price,

**\$12.50**

Your money back, if you are not FULLY SATISFIED

**THE RIGGS MFG. CO.**

URBANA, OHIO

Attractive Proposition to Dealers

## When you think of Radio think of JONES

I am located in my new store and carry a large stock of all standard makes of sets and parts.

PHONES	RECEIVING SETS
Holtzer-Cabot 2200 ohms ..... \$8.00	General Electric Crystal ..... \$18.00
Brandes Superior 2200 ohms ..... 8.00	DeForest Crystal .25.00
Brandes Navy 3200 ohms ..... 14.00	Aeriola Jr. .... 25.00
Federal 53-W 2200 ohms ..... 8.00	Federal Jr. .... 25.00
Federal 52-W 3200 ohms ..... 10.50	
CONDENSERS	TRANSFORMERS
Chelsea 13 ..... \$4.75	Chelsea Radio .... \$4.50
Chelsea 24 ..... 4.25	General Radio .... 5.00
General Radio 2247A ..... 5.50	Coto-Coil ..... 5.00
DETECTOR BULBS	Amrad ..... 6.00
Radiotron UV200 . \$6.00	Moorhead V.T.-1.. 6.50
Electron Relay .. 5.00	
AMPLIFYING BULBS	
Radiotron UV 201 . \$6.50	
Moorehead V.T.-1. 6.50	

Parts for making your own Regenerative Receiving Set

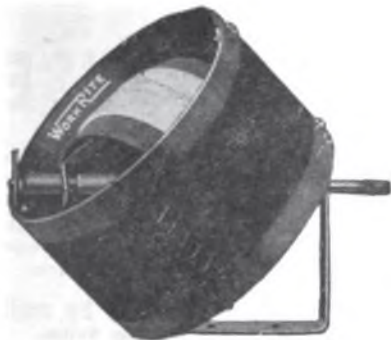
Bakelite Variometer wound.....	\$8.00
Bakelite Bank-wound inductance.....	4.50
Switch arm—double arm.....	.75

**JAMES H. JONES**

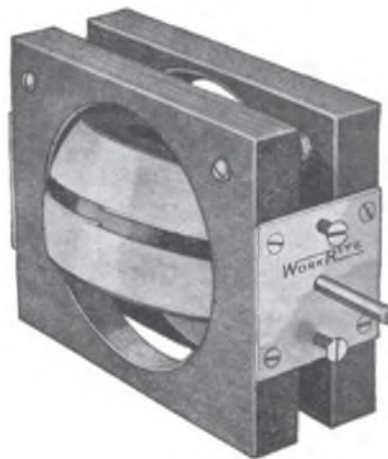
Radio Apparatus

94 Massachusetts Ave., Boston, Mass.

# "WORKRITE PRODUCTS WORKRITE"



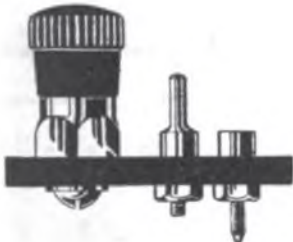
**Finest  
Material  
Finest  
Workmanship  
Finest  
Finish**



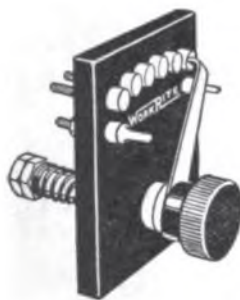
Here is the "Tuner Team" that radio fans have been going wild over wherever shown. Most dealers have their entire allotment sold before shipment is received. "They certainly do Workrite" is the verdict of all users.

One Workrite Variocoupler and two Workrite Variometers are guaranteed to give you a tuner that cannot be excelled by anything on the market.

**WORKRITE VARIOCOUPLER OR VARIOMETER IN ATTRACTIVE  
BOXES \$6.00 EACH**



**Workrite Binding Posts.....\$0.12**  
**Workrite Switch Points..... .04**  
**Workrite Switch Stops..... .06**



Just what you want. Remove the parts and use the block as a template for drilling your panel. Put up in neat individual boxes. Complete Workrite Switch Sets, \$1.00. Switch arm only, with bushing, 50c.

## TYPE "A" WORKRITE HYDROMETER

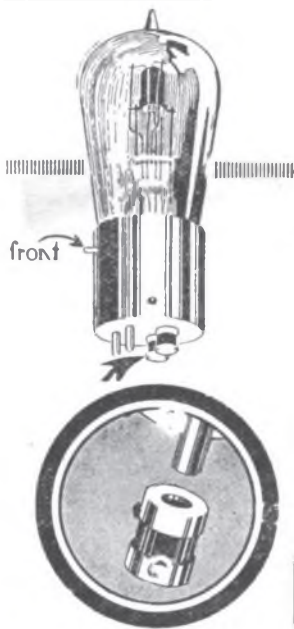
Double the life of your battery by giving it proper care. Fill and test it regularly with a Workrite Hydrometer. Never let it become discharged below 1150, or it will soon be ruined. Full instructions for testing and care of battery with each "WORKRITE." Get one now! Price, \$1.00



Insist that your dealer furnish a "WORKRITE." Accept no substitute. If he cannot supply you, we will ship direct by mail prepaid.

**JOBBER AND DEALERS—Write or Wire for Discounts**

**The WORKRITE Mfg. Co., 5603 Euclid Ave.  
Cleveland, Ohio.**



## You Need Never "Burn Out" a Tube!

At few cents cost you can have absolute protection of your Vacuum Tubes with the new

# RADECO SAFETY FUSE

(Patent pending)

Placed where every bit of juice must go through it before reaching the filament, this tiny fuse makes it absolutely impossible for any excessive amperage, even if from accidental "short", to burn out a filament. Fuse sits directly on filament terminals of any standard bulb in any standard socket and does not affect efficiency.

Come only in Packages of four

## 4 for \$1

Order by mail or from your dealer

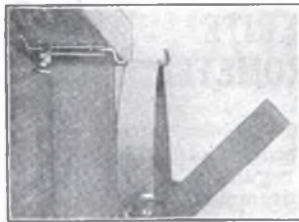
Carrying capacity 1-2, 3-4, 1, 1 1-2, 2, 2 1-2, and 3 amperes.

**DEALERS!** Order this "live" one while we have stock on hand for quick delivery. Write today for dealer's prices.

**RADIO EQUIPMENT CO.,** 630 Wash'n St., Boston, Mass.  
New England's Oldest Exclusive Radio Store

## "UNIVERSAL"

### Introducing the Radio Hookswitch



Pat. Applied for  
not even have to remember. We have solved the problem for you, and besides have found the most convenient and inconspicuous place for your 'phones; on a hook under the edge of the table. The Universal 'Radio Hookswitch' simultaneously acts as a phone hook and a vacuum tube switch. More than one may be connected in parallel. Complete with screws and lug.

**NICKEL PLATED \$1.25 prepaid**  
**GOOD PROPOSITION TO DEALERS**

**UNIVERSAL RADIO & MFG. CO.**  
Dept. H2

1809 Carter Ave., Bronx, New York

**KEEP THE PHONES OFF THE TABLE**

"Gee-whiz  
I FORGOT TO  
TURN OFF MY  
TUBES

Good night  
Battery!"

How many  
times, Brother  
Amateur, have  
you spoken the  
above words?  
But you will  
forget no more  
—NO, you will

## The Sixth Edition Is Ready!

It includes all the  
**LATEST PRICES**  
**ON EVERYTHING**  
SEND NOW  
FOR YOUR FREE COPY  
of this

**INDISPENSABLE  
PRICE DICTIONARY**

### Western Radio Electric Co.

637 So. Hope St. 274 Twelfth St.  
Los Angeles, Cal. Oakland, Cal.

OPERATING KINEMA THEATER  
RADIOPHONE

Call KOG—Los Angeles

# Better Results and Longer Life from Your Tubes



**Filament Voltmeter**



**Filament Ammeter**



**Plate Voltmeter**



**Antennae Ammeter**

Every make of tube should be operated at some specific voltage.

Tubes function best within extremely narrow limits. Unless you operate within these limits it is impossible to obtain the best results, and tube replacement expense runs up rapidly. It is foolish to regulate your tubes by the degree of illumination of the filament.

In the early days of power plants, operating engineers attempted to maintain voltage by the brilliance of a pilot lamp. Today, *such a practice is absolutely unheard of*. Voltage is established and maintained by means of accurate and reliable voltmeters.

In the very near future of radio, the filament voltmeter will be regarded as absolutely indispensable.

Will you follow the wise practice of voltmeter filament control *now*, or will you wait until bitter experience convinces you of your error?

Our Circular "J" describes in detail Weston Filament Voltmeters and other important instruments invaluable to owners of up-to-date receiving and transmitting sets. Send for a copy without delay, if your dealer cannot supply you.

Address

*Radio Department*

**Weston Electrical Instrument Co.**

158 Weston Ave.,

Newark, N. J.

Branches in all the Principal Cities



Tel.  
Back Bay  
5 9 6 4

899 BOYLSTON ST.  
BOSTON, MASS.



*RADIO today is commanding the interest of more people than any other industry! Splendid opportunities are NOW available for those who are alive enough to see the possibilities. My fifteen years experience in Radio tells you that FORTUNES will be made within the next five years for those who train themselves now and take advantage of the present opportunities.*

The EASTERN RADIO INSTITUTE is the OLDEST, LARGEST and BEST EQUIPPED Radio School in New England. THOUSANDS of satisfied graduates tell our story best!

Day and Evening classes. Start any Monday.

REMEMBER:—Our ORGANIZATION with YEARS OF PHENOMENAL EXPERIENCE and SUCCESS is behind EVERY man who enrolls!

"Ask any man in Radio—he will tell you!"

Our illustrated prospectus for the asking.

F. D. PITTS, Director.

— i t ' s h e r e  
THE HI-GEE

**C.W. AND PHONE RECEIVER**

This set is unexcelled for C.W. work and the reception of musical concerts.

**SPECIFICATIONS**—The Hi-Gee receiver comes to you completely assembled but un-wired, in a quartered oak cabinet with hinged cover. All controls are mounted on a formica panel 7x12, and all connections are made to clips attached to sub-panel within the cabinet. Condenser and rheostat are controlled by special vernier attachments. **THE ONLY RECEIVER** on the market with these specifications.

Moderately priced at ..... \$25.00

With the first 25 receivers sold from this ad we will supply absolutely free a Radiotron detector tube, and a Hi-Gee "B" battery.

Get your order in now for immediate delivery. This is one of the greatest bargains of the year.

**OTHER SPECIALS**

Improved HI-GEE Variometers ..... \$4.00

Improved HI-GEE Vario-couplers .... 3.48

HI-GEE "A" BATTERIES, 2 year guarantee, 6-60 ..... 12.95

6-80 to 100, \$20.95. HI-GEE "B" Batteries

\$0.90, tapped \$1.10, best grade, plain \$1.20.

All shipments prepaid except storage batteries

Get Our New Bulletins

**Hi-Gee Radio Manufacturing Co.**  
**MARION ILLINOIS**

116

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

**CLARION "A" BATTERIES**

Type R-2 6V-60A.H. .... \$20.00

Type R-3 6V-80A.H. .... 25.00

This is the finest finished battery you can buy. It is guaranteed for two years. Here are some of its special features; solid oak case, wax finished, polished top, acid proof terminals (real binding posts) special designed cell tops, acid cannot reach the outside of case.

**OTHER MODELS**

6-40 Special ..... \$8.00

6-80 Special ..... 16.00

6-60 Type H.V. .... 17.50

6-80 Type H.V. .... 20.00

— □ —  
We carry in stock a complete line of Radio Supplies. Send for Bulletin.

**Clarion Radio Shop**

347 Main St., Poughkeepsie, N. Y.

Quality



Service

DISTRIBUTORS OF LEADING MAKES OF RADIO GOODS  
GOOD GOODS—GOOD STOCK—GOOD SERVICE

- No. UV-200 Radiotron Detector ..\$5.00
- No. UV-201 Radiotron Amplifier . 6.50
- No. UV-202 Radiotron 5 Watt Tube 8.00
- No. UV-203 Radiotron 50 w. Tube 30.00
- No. UV-216 20 Watt Kenotron .. 7.50
- No. UV-712 Amp. Transformer .. 7.00
- No. PR-535 Filament Rheostat .... 3.00
- No. PT-537 Filament Rheostat for  
UV-203 & 204 Tubes .....10.00
- No. PX-1638 Grid Chopper ..... 7.25
- No. UP-1638 325 w. Transformer 25.00
- No. UP-1016 750 w. Transformer 38.50
- No. UC-1631 Filter Condenser .. 1.35
- No. UC-1632 Filter Condenser .. 1.85

We have the above and all other Radio Corporation Products including the NEW General Electric Tuner Type AR-1300 .....50.00

New General Electric Amplifier Type AA-1400, 1 Stage Radio Amplification, Audio Detector, 1 Stage Audio Amplification ..\$75.00

New UV-1714 Radio Frequency Transformers .....\$6.25

- Moorhead ER Detectors ..... 5.00
- Moorhead VT Amplifiers .....6.50
- Clapp-Eastham HR Receiver ....\$40.00
- Clapp-Eastham HZ 2 Stage Amplifier ..... 40.00

The above is a wonderful set and has taken the country by storm. The HR Receiver is complete and will receive phone without the amplifier. HR and HZ are now furnished in mahogany cabinets and price changed from \$35 to \$40.

C.E. Maximus Amp. Transformer \$4.50

This is new and very efficient. We have a complete stock of all other CE apparatus.

- All Sizes of "B" Batteries
- Weco Moulded Socket .....\$0.75
- Large Hard Rubber Binding Posts .12
- Small Hard Rubber Binding Posts .10
- Weco Moulded Dial ..... 1.00
- Baldwin Type C Phones .....12.00
- Conn. Tel. & Electric Phones 3000 Ohms ..... 7.00
- Murdock 2000 Phones ..... 5.00
- Murdock 3000 Phones ..... 6.00
- Murdock Sockets ..... 1.00
- Paragon Rheostats ..... 1.50
- Paragon Sockets ..... 1.00
- Federal Open CKT Jacks #1421-W .70
- Federal Closed CKT. Jacks #1422-W ..... .85
- Federal Plugs #15 ..... 1.75

Complete line Remler Goods, Signal and Murdock Condensers.

Distributors of ACE Batteries.

SEND IN YOUR ORDER NOW!  
YOU WILL LIKE TRADING WITH US

**Whitall Electric Co., Westerly, R.I.**

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DEALERS WRITE FOR PROPOSITION



Ask Your Dealer to Show You



**THE HORNE**  
Radio Appliances

Particularly

**Lightning Arresters  
AND  
Grounding Devices**



The Horne "Drive" Hydroground

COMBINED SWITCH AND ARRESTER

---MAKERS OF---

V-T Vacuum Tube Sockets  
Variable Condensers  
Vario Couplers  
Variometers  
Detector Units  
Receiving Sets  
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HORNE  
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Lightning Arresters  
Combined Switches  
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We make everything in Radio Except Head Phones and Tubes  
10c. brings complete catalog

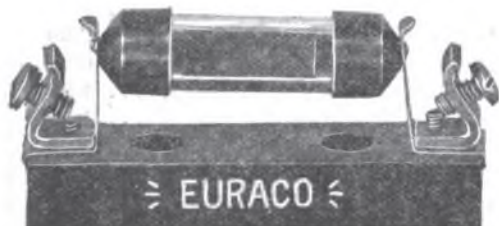
**THE HORNE MFG. CO.,**

**243 Mercer St., Jersey City, N. J.**

**"Euraco" Mica Condenser**

PRICE 60 CENTS

Designed to Fit Standard Grid Leak Base



Composed of Copper and Mica, Entirely Hand Made.  
Compact, Interchangeable, Most Efficient

Following Capacities in Stock:

- .00025 Mfd.—Correct for Super Heterodyne and UV-201.
- .0001 Mfd.—For special and experimental circuits.
- .000025 Mfd.—Correct for Radio-Audion RAC-3 valve.
- .0005 Mfd.—Correct for Radiotron UV-200

Condenser Mountings:

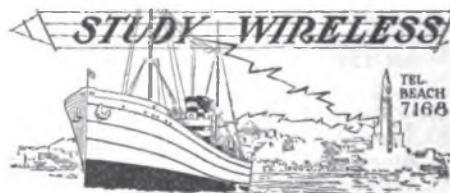
- Bakelite Base with Single Mounting..\$.40
- Bakelite Base with Double Mounting.. .60
- Bakelite Base with Triple Mounting.. .80

Interesting Proposition for Dealers

**EUROPEAN RADIO CO.**

Mfrs. of Multi-Stage Amplifiers, C.W. & Special Equipment

1342 East 22 St., Brooklyn, N. Y.



We offer for the first time a special

**CORRESPONDENCE  
COURSE in CITIZEN RADIO**

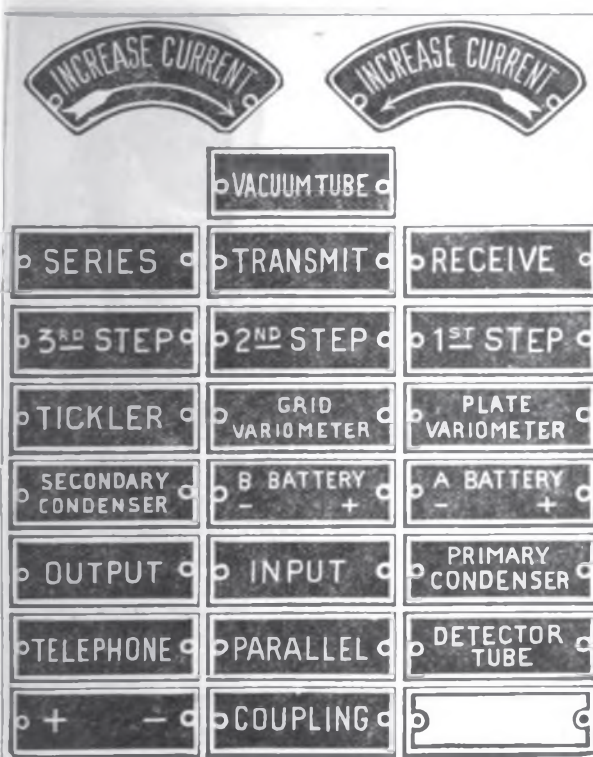
giving complete non-technical instruction in fundamentals of Radio and practical explanation of "hook-ups" and a hundred details amateurs need to know.

Send 25c in stamps for first lesson

The surplus of experienced commercial operators being absorbed, our school is again in position to guarantee positions for graduates. Both land and sea jobs now open. Our school has most successful record. Send for catalog.

**MASSACHUSETTS RADIO and  
TELEGRAPH SCHOOL, Inc.**  
18 Boylston St. Boston, Mass.





**"RASCO" BRASS NAME PLATES**

Illustrations are in full size. Order by name. The two top plates, "Increase current," list at 10c each, illustrations full size. All others are 5c each. We also have these, not illustrated: Phones, Loading Coil, Aerial, Ground, Secondary, Primary, Audion, Detector, Off, On, each 5c. In dozen lots, 50c prepaid.

NEW. The white plate in the lower right-hand corner is blank, and made of such material that you can write your own lettering on it with pencil, ink or China ink. Price each 5c.

**"RASCO" AUDIO FREQUENCY TRANSFORMER**

This transformer has been developed by us after comparing all the various transformers on the market. This transformer is guaranteed to equal any on the market today. The primary and secondary are very carefully built and are impregnated with a certain wax in vacuum. The stampings are of the best silicon steel. Only the very best material is used throughout.

Realizing the fact that most amateurs desire to "make their own" we furnish this transformer unassembled. Directions which accompany the transformer are such that anyone can put the parts together in about ten to twelve minutes. This saves you considerable money, for the reason that manufacturers who assemble the transformers must charge you for the assembling work.

Illustration as shown is in full size. The weight complete is ten and one-half ounces. Note also that we ship all goods prepaid. We pay the freight.

No. 1100 "Rasco" Audio Frequency Transformer NOT ASSEMBLED, prepaid

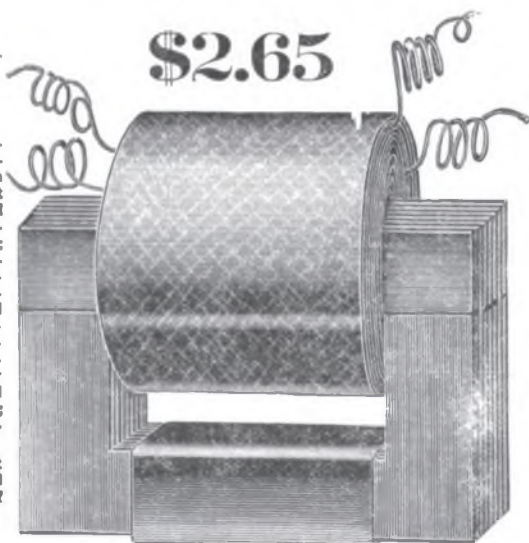
**A COLOSSAL EVENT  
THE "RASCO" CATALOG**

There are many radio catalogs, but the "Rasco" catalog marks a radical change for the simple reason that it

**Contains 50 Vacuum Tube Hook-Ups**

This is the one and only radio catalog containing such wonderful free information. Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector; detector and one-step amplifier; regenerative circuit; DeForest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier. Inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; C.W. transmitters; self-rectifying 2 tube C.W. transmitter; V.T. transmitter with 6 volt battery; radiophone using plate and grid modulation; one tube radio transmitter and receiver; experimental radiophone; radiophone using Colpitts oscillator circuit.

The catalog contains 186 illustrations. On account of its great cost, this catalog cannot be distributed free of charge. It will only be mailed upon receipt of 15c IN STAMPS OR COIN



**WE GUARANTEE EVERY ORDER  
SHIPPED WITHIN 24 HOURS**

**DEALERS  
Get Our Special Proposition**



**98-100 PARK PLACE, NEW YORK CITY**

Factories:  
Brooklyn, N. Y.—Elbridge, Md.

Remember that this business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be side-tracked by us. A trial order will make you a life customer. You can order from the above illustrations. "We can only stick you once." Try us with a 50c order.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# MAGNAVOX

---world's standard loud speaker



The reproducer with the movable coil

No set is complete without a Radio MAGNAVOX. It is the one piece of apparatus known to radio which will faithfully reproduce *either* radio signals, radio music or radio telephone speech in *any* volume without distortion. There is **NO** substitute for the Radio MAGNAVOX. No extras or adjustments required. Simply sit back, listen, entertain, and enjoy. Where power amplification is desired, use a new two or three-stage MAGNAVOX Power Amplifier. Ask your dealer for a demonstration.

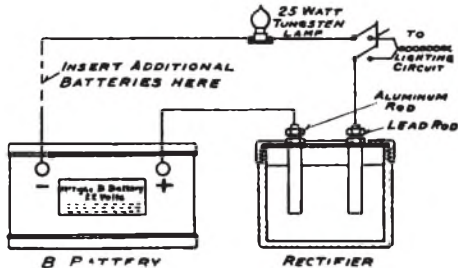
THE MAGNAVOX CO., Gen. Office, OAKLAND, CAL.  
NEW YORK OFFICE, 370 7th Ave., Penn Terminal Bld.

In writing please address the MAGNAVOX office nearest you.

Type R-3 Radio MAGNAVOX, as illustrated, with 14" horn, beautiful and durable as it is efficient. There is **NO** substitute for the Radio MAGNAVOX. Any one can operate it, every one can enjoy it. Only one ampere necessary to energize the field. The few simple instructions necessary, free with each outfit. Price—\$45. Buy from your dealer.

**NO set complete without a MAGNAVOX**

## The McTighe Storage B Battery



The McTighe Storage B Battery is of alkaline type and is practically indestructible. Its capacity is ample for a several stage amplifier and a one hour charge will last for several weeks in ordinary service. No injury is caused by accidental short circuit or by standing idle.

The Battery is contained in an attractive case. Cells are held rigidly in place, and tight fitting cover prevents evaporation.

As many as four units in series can be charged from one rectifier on 110 volt A.C. lighting circuit.

Write for descriptive leaflet, or better, order a Battery and rectifier today.

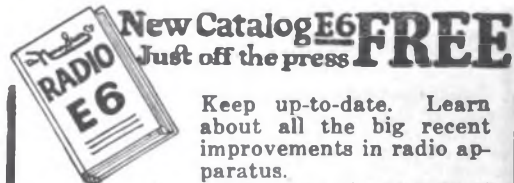
Dealers:—The McTighe B Battery has no shelf depreciation.

Battery .....\$4.00  
Rectifier ..... 1.50

Add Postage.

**ECONOMIC APPLIANCE COMPANY**

Successor to  
**McTIGHE BATTERY COMPANY**  
Irwin, Pa.



24-Hour Service

We pay all Shipping Charges

Get the latest

Don't buy till you see this catalog.

Keep up-to-date. Learn about all the big recent improvements in radio apparatus.

84 pages chock full of best and biggest values of America's 51 leading manufacturers. Most complete, includes everything.

### Two N-S LEADERS

Red-Head Radio phones, 8000 ohms, military head band with cord

complete Per pair **\$8.00**

Arlington Tested Crystals; Galena or Silicon.

Certified super-sensitive Per crystal **25c.**

Write for Big Free Catalog Today

**THE NEWMAN - STERN CO.**  
Newman-Stern Bldg., Cleveland, Ohio

### WARNING

Do not discard your spark sets. They will prove invaluable later on.

If you want to make your present spark set approach a C.W. set for results:

Write to

**ROY C. BURR**

19515 Tiverton Rd., Cleveland, O.

# L. P. F.

LOWEST POWER FACTOR

## G.A. Standardized Instrument Panels

**L. P. F.** should be your choice for all instrument panels not only because of its freedom from losses at high frequencies but because of its mechanical advantages.

Bureau of Standards tests show that it has the Lowest Power Factor of any sheet insulation, 0.7% against 3.5% for the best substitute material, and these tests were made at the low wavelengths at which losses are most marked.

In appearance L. P. F. has polished jet black surfaces which take a handsome grain finish and do not turn grey. In dimensions L. P. F. panels are accurate to  $\frac{1}{16}$  in., with true right angle corners, smoothly cut. You can drill, tap, file and cut L. P. F. more easily than other panels. You can throw them across the room but they will not chip or crack. You can subject them to the severest tests and L. P. F. panels will come out on top every single time.

Moreover, in buying L. P. F. you get its electrical and mechanical advantages at a lower price than is charged for inferior substitutes. You can get these panels from your local dealer or directly from the G. A. Company. And remember that every panel carries a yellow label bearing the name "L. P. F." and the G. A. trade mark. A panel which does not bear this label is not L. P. F.

Length	Width	Thickness	Weight	Price
5 ins.	2½ ins.	$\frac{1}{16}$ in.	3 oz.	\$0.33
5 ins.	5 ins.	$\frac{1}{16}$ in.	6 oz.	.66
10 ins.	5 ins.	$\frac{1}{16}$ in.	12 oz.	1.31
10 ins.	10 ins.	$\frac{1}{16}$ in.	1½ lbs.	2.62
15 ins.	10 ins.	$\frac{1}{16}$ in.	2½ lbs.	3.93
5 ins.	7½ ins.	$\frac{1}{16}$ in.	½ lb.	.99
10 ins.	7½ ins.	$\frac{1}{16}$ in.	1 lb.	1.97
15 ins.	7½ ins.	$\frac{1}{16}$ in.	1½ lbs.	2.97
20 ins.	7½ ins.	$\frac{1}{16}$ in.	2 lbs.	3.74
5 ins.	2½ ins.	$\frac{1}{8}$ in.	2 oz.	.24
10 ins.	2½ ins.	$\frac{1}{8}$ in.	4 oz.	.45

If it doesn't bear the yellow label, it isn't L. P. F.

## RADIO and MODEL ENGINEERING

Did you see the article in the December R and M on a rectifying unit for undamped wave telegraph and telephone transmitters, or the one on tuned plate receiver for 150 to 600 meters? Better send for that issue before it's too late. And you want the dope on radio telephone receiving sets in the January number. There were also some handy ideas that will take the kinks out of your shop work too.

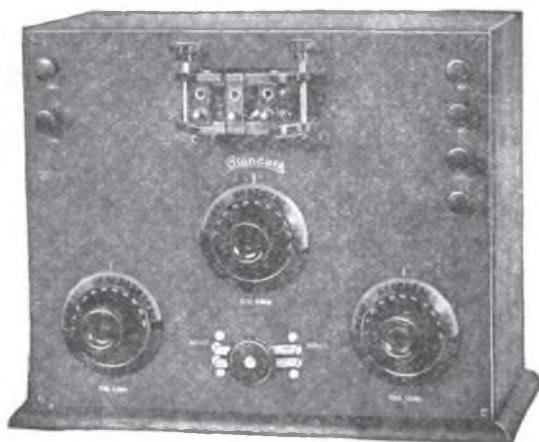
When you send in for these back issues put in a dollar extra for a year's subscription to start in with February. R and M gives you the best in strictly practical, construction articles.

BACK COPIES PREVIOUS TO DECEMBER 1921 ARE NOT AVAILABLE

**The General  
Apparatus Co., Inc.**

88 PARK PLACE, NEW YORK  
Represented in every city of the United States and Canada where radio work is done. Send 10c. in stamps for the new G. A. catalog.

## THE STANDARD PLAN—"ASSEMBLED BUT NOT WIRED"



MULTIPLE WAVE TUNER

The Standard plan of distributing high-grade Radio instruments,—fully assembled but not wired,—is ideal for the experimenter who wishes to incorporate his own circuit and at the same time save the wiring cost. The Standard Assembling Co. does all the actual panel drilling and assembling, which is essentially machine work,—and leaves the wiring, which is hand work, for you to do. This offers you an average saving of 20% or more and is the only way in which you can secure correctly machine made instruments without paying for the expensive hand wiring, which you can do just as well. The multiple wave tuner shown here is an example of the Standard plan. It comes to you fully assembled but unwired for \$45.00, a clear saving of at least \$10.00 on what you would ordinarily pay for such a high-grade instrument.

*This tuner will be shipped anywhere in the United States upon receipt of one third the purchase price. Examine the instrument carefully and if acceptable, remit the balance. If you are not perfectly satisfied, simply return the instrument and we will refund your deposit. If you do not wish to order at once, send a stamped return envelope for our literature describing the complete line of Standard instruments.*

**STANDARD ASSEMBLING CO. 91 BRIDGE ST., N. Y. C.**

### NOISELESS DEPENDABLE GUARANTEED



**"B" Batteries for Vacuum Tubes**  
22½ to 100 Volts  
19 Different Sizes—Plain and Variable  
**NOVO MANUFACTURING CO.**  
424 W. 33d St. 531 So. Dearborn St.  
NEW YORK CHICAGO

### TIN FOIL

(Special)

For Condensers and Lining Panels—24 sheets per lb. Size Sheet—6" x 12".

40c lb. Full Instructions Add Postage.

**W. SOLBERG**

620-46th St., Brooklyn, N. Y.

## Wireless Amateurs Attention!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

### SPECIAL!

Vacuum Tube Sockets.....	\$1.25
Rheostats .....	1.25
22½ Volt "B" Batteries.....	1.50
Rasco Dials .....	.60
Rubber Binding Posts.....	.20
Tested Galena .....	.40
Laterat Wound Coils. All Sizes.	

SEND 5c FOR OUR NEW PRICE LIST

**J. M. PAQUIN,**

THE ELECTRICAL SHOP

787 Queen St. West, Toronto, Ont.

### FIVE \* SEE \* EYE

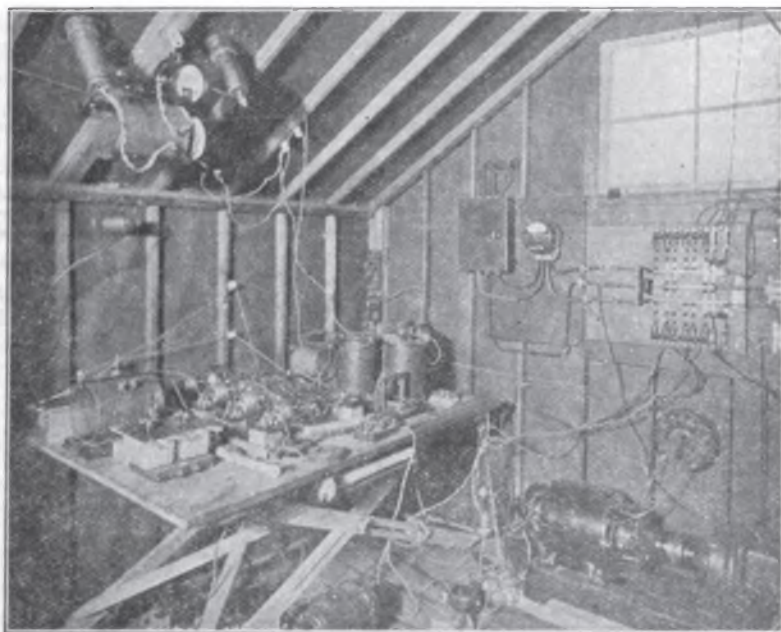
I specialize on CW transmitting and receiving equipment. QRN's coming on—so get that CW set gg and get thru.

Thordarson CW transformers—for 5 watts.....\$7.50  
Clapp-Eastham type HR Short Wave sets.....\$35.00  
Thor. Amplifying Transformers—Burgess Batteries—  
—FADA rheostats—Paragon sockets—Arkay Radio-horns—tubes—etc.—Glad to answer all inquiries—write—

FIVE \* SEE \* EYE—FROST, TEXAS,  
(In Central Texas) M. B. Patterson, Mgr.

# Dubilier Condensers Helped to Make Radio History

"No circuit is stronger than its weakest link." When 1BCG sent its now historical message across the Atlantic, a perfect co-relation of parts and apparatus was necessary. Everything from the commutator on the generator to the lead-in insulator in the roof had to function "just so". During the preliminary tests, the operators of 1BCG were constantly confronted with condenser trouble. One after another, the condensers would break down. It is always best to use the right thing in the right place, so two Dubilier Mica Condensers were placed in the circuit and the weakest link was immediately repaired. From that moment on, the condensers were forgotten because they could be trusted—they were reliable.



Are your condensers the weakest link in your circuit? There is a Dubilier Condenser to meet your every need. Dubilier Condensers are different because their construction is patented and they are manufactured by a controlled process. Send for literature describing them today.

The next time you visit your radio dealer, ask to see Pacent Radio Essentials. We sell apparatus plus service.

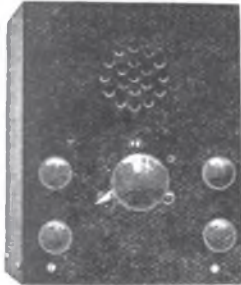
## Pacent Electric Company, Inc.

150 Nassau Street,

New York City

Member Radio Section Associated Manufacturers of Electrical Supplies.

# QUALITY AMPLIFIER UNIT



Entirely complete ready to operate.  
Parts cost as much as the finished ultra efficient high power amplifier.

Unequaled for loud speaker work with regular or power tubes.

Gives wonderful results with power tubes using high voltage without danger of burning out windings.

Use as many stages as you like.

Fully shielded with aluminum grounding plates eliminating howling.

Quality square coil 10-1 ratio transformer, is the best produced today combined with Bakelite ratchet and rheostat, Eby clamping binding posts, Bus bar wiring an unusual special circuit and beautiful workmanship to produce this remarkable instrument gives clearest, strongest signals you ever heard.



## \$12.50 Immediate Delivery

Quality Hi-Power Amplifying Trans. The Trans. with the square coil and without air gap 10-1 ratio.

There is a reason! Ask why?

### Quality Loud Speaker

Unsurpassed in acoustic Quality and Tone Volume. No rough surfaces to obstruct and distort sound waves. No tin pasteboard or plaster used but of solid cast aluminum mirror finish sound chamber.

- Filament Voltmeters .....\$3.75
- Baldwin Phones.....12.00
- Quality Phonograph loud speaker attachment .....10.00
- Bakelite Sockets ..... 1.00
- 3" Bakelite dials ..... .50
- Murdock Rheostats ..... 1.00

Watch for our new Variable condenser—smaller—more efficient and compact, than any other.

Variometers Variocouplers with new special design winding. Ultra efficient single circuit tuner 125 to 2500 meters wave length.

## QUALITY RADIO SHOP, Richmond, Indiana



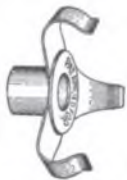
### Stramcy Products

#### STRAMCY LILY HORN

Made of fibre.  
Highest efficiency,  
Best tone quality,  
Lowest price.

#### STRAMCY COUPLER

Couples any Radio telephone to tone arm of principal makes of phonographs.



Dealers write to  
**RADIO DISTRIBUTING CO.**  
8 West Park St. Newark, N.J.

### Get Your Genuine Skinderviken Transmitter Button



Thousands used for  
**WIRELESS**

telephone and experimental purposes. Complete instructions sent with each button. Write for free literature.

#### K-ELECTRIC CO., N. Y.

15 Park Row, Room 612  
Price \$1.00 postpaid

## "SHRAMCO PRODUCTS"

Amateurs: Send 5c in stamps today for our new Catalogue L showing complete line of parts, raw materials and high grade apparatus.

Dealers: Write for our attractive proposition.

**The Shotton Radio Mfg. Co.,**  
INCORPORATED  
8 Market St., Albany, N. Y.

## NEW MOTORS

FOR ALL PURPOSES  
STANDARD MANUFACTURERS  
PROMPT DELIVERY

ALL SIZES UP TO 5 H.P.

### We Specialize In Small Motors & Generators

ALL PHASES AND FREQUENCIES IN STOCK AT ALL TIMES

Largest exclusive Mail Order Small Motor dealers in the world.

CHAS. H. JOHNSTON, Box 19, West End, Pittsburgh, Pa.

WIRELESS, TELEPHONE GENERATORS  
500 VOLT - 100 WATT - 3400 R. P. M.  
FOR MOUNTING MOTOR GENERATOR SETS.

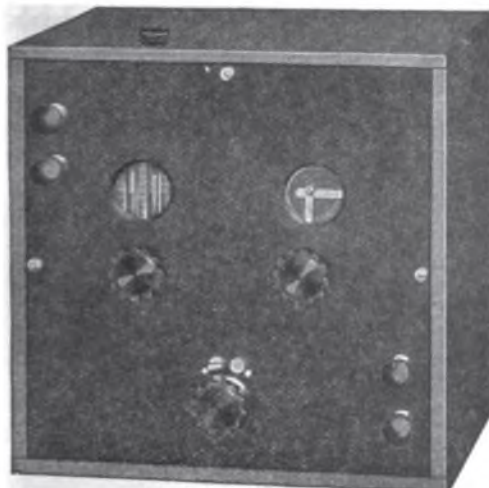
\$28.50 EACH

WRITE FOR CATALOG



## CAN'T YOU GET THE MESSAGES WHEN YOU HAV'N'T THOSE THINGS ON?

How Often Have You Had to Answer That Question?



Patiently you have explained to your visitor that only by keeping the phones on are you sure of getting the message, and that you have to write each word down as it comes in. But, oh boy! No more now! The Hall Relay will run it off on a sounder buzzer or ring a bell at the first impulse. If you use the tape recorder in connection with it, you get a permanent ink record on tape of each dot and dash. And as for time signals—Ring them off on a 20 inch gong if you like or blow a siren on NAA signals. If you get them good in the phones, the relay will do the rest.

**THE HALL RADIO RELAY**  
is manufactured solely by  
**THE KARLOWA RADIO CO**

Rock Island,

Ill.

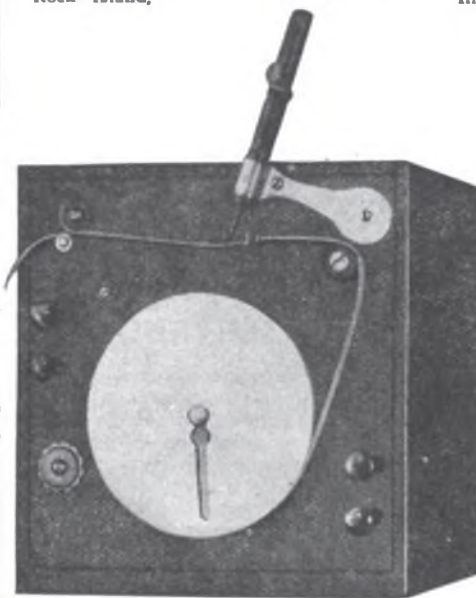
Place Your Order at Once To Insure Early Delivery

### STOP GUESSING

Make a Permanent Tape Record of  
Weather Reports Relay Messages  
News Dispatches Market Reports Storm Warnings  
Stock Reports Transatlantic Traffic

Put Those Time Signals on a Siren  
Relay Complete.....\$125.00  
Tape Recorder..... 35.00

Our new DeLuxe Catalog and Manual is ready for distribution. Fifty 9 1/2 x 11 1/2 pages full of the newest and only the best, in radio telephone and telegraph receiving and transmitting apparatus. A complete description of the Hall Relay is given. This manual will be mailed you upon receipt of 15c in stamps, which will be refunded on your first order of \$2.00 or more.



### IF IT'S RADIO—AND WORTH WHILE—WE HAVE IT

Our prestige has been built on the character of the merchandise we sell. Our service and quality giving ability, may be judged by the fact we distribute the products of the Radio Corporation of America

Clapp-Eastham Co.

Westinghouse Mfg. Co.

Wm. J. Murdock Co.

Acme Apparatus Co.

American Radio & Research Corp.

Chelsea Radio Co.

Baldwin Phones

Eveready and Higwell Batteries

Brandes Phones

DeForest Company

Formica Insulation Co.

Sole Manufacturers of Hall Relays and Recording Apparatus  
The newest addition to the K line of wireless instruments is the K Vernier Attachment, a universal type, in that it is adaptable to any style condenser and dial. A small handsome knob that takes little room, does not project unduly, and does not "clutter" up the receiving panel.

There is no set in existence that is not improved wonderfully by the addition of this little device. In tuning CW and radiophones, a difficulty often experienced with the standard condenser is the impossibility of securing that exact adjustment required to bring in the music clearly, and free of troublesome and disconcerting back-wave screeches. The K-35 Vernier Attachment eliminates this. After a coarse adjustment by means of the dial, the little vernier button is pressed forward, and a slight turn either way, as needed, serves to bring in a maximum signal of clearness not obtainable by the first adjustment.

The K-35 Vernier Attachment is suitable for any instrument using a dial control.  
K-35 Vernier Attachment, complete—45c—six for \$2.50—(Plus postage)

"Coast" Key

We were the Originators of the  
"The Universal Vernier Attachment"

Unit Cabinet Receivers

## KARLOWA RADIO CO.

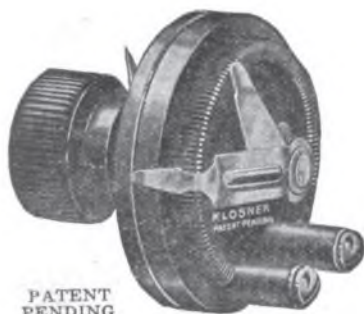
Main Office—606 BEST BLDG.,

ROCK ISLAND, ILL.

J. Edward Jones—Box 22—Palo Alto, Cal.—Pacific Coast Distributor

Clapp-Eastham Co.—Eastern Distributors

**MAKE NO MISTAKE  
THE  
KLOSNER VERNIER  
RHEOSTAT**



PATENT  
PENDING

is the only Vernier Rheostat made having the exclusive feature of using but

**ONE SINGLE KNOB**

for both rough and fine adjustments. This feature allows the symmetrical appearance of the single knob to be retained when mounted on a panel with other instruments, and, at the same time adds to the simplicity and ease of operation in obtaining the necessary fine adjustments for best results from the modern critical vacuum tubes, especially when receiving phone and C.W. signals.

We invite comparison with any other filament rheostat now made. Look for the name **KLOSNER** moulded on the base.

Your dealer has them or send direct to us.

**PRICE \$1.50**

Shipping weight, One pound.

A two cent stamp brings interesting literature.

Made only by the Originators.

**The Klosner Improved  
Apparatus Company**

Dept. Q4

2404 Crotona Ave., New York City  
N. Y.

**WARREN RADIO LOOP**

**N  
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If Dad says—

“NO AERIAL ON THIS HOUSE”  
don't allow his QRM to worry you but purchase a

**WARREN RADIO LOOP**

The LOOP that made the Radio Rolier Chair famous on the Boardwalk at Asbury Park, N. J.

Is just the thing for an apartment or den. Is light in weight and easily portable.

Is produced under a new principle of winding.

Is wholly enclosed, thereby protecting the winding.

Is used in place of an outside aerial.

Is a regular indoor aerial.

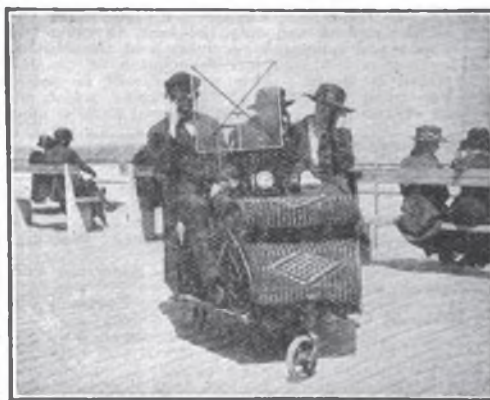
Is adapted for receiving in moving vehicles.

Takes the “tic” from static.

Eliminates all danger from lightning.

Can be used with any receiving instrument.

Can be used without tuner.



This picture of the Radio Roller Chair showing the Warren Radio LOOP was used as cover designs on “Wireless Age” and “Radio News” and featured in many other magazine and newspapers in the United States.

Send your order through your dealer or direct to us with his name.

Type-A-737 (300-700 meters) . . . \$10.00

Type-A-7236 (175-1000 meters) .. \$12.00

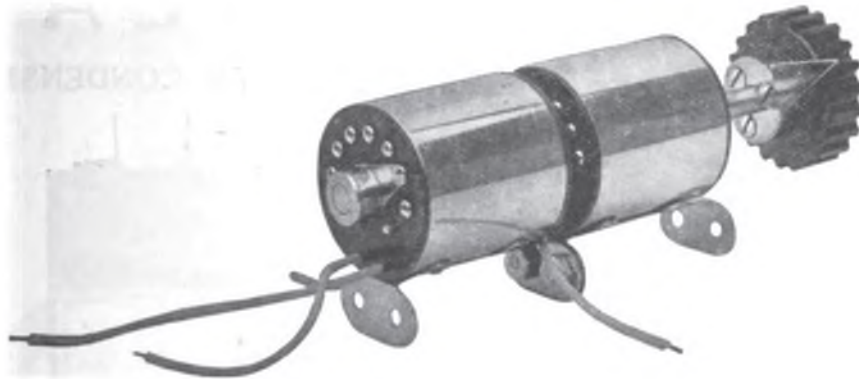
**V-DE-CO RADIO MFG. CO.**

DEPT. R, ASBURY PARK, N. J.

Send for bulletin—No. AIOI



# Radio Frequency Amplifier



Pat. Appld. For

There is nothing that opens up a wider field on the receiving end for the amateur and experimenter, than radio frequency amplification.

After an extensive investigation of the various types of tube couplings possible for radio frequency amplification, we have developed the above units (two are shown) with a view to giving maximum efficiency and greatest ease of control, at a reasonable price.

Tuning each stage is not necessary. Only one adjustment necessary to cover fairly wide bands of wave-lengths with several stages.

Transformers for several stages can be mounted in tandem with single control which greatly simplifies the manipulation of the set.

Remember that radio frequency amplification will increase the range, the selectivity and the satisfaction you can get from your receiver. A loop antenna will be far more effective with radio frequency amplification.

These units will cover wave-lengths from 180 to 750 meters.

**TYPE 5000 RADIO FREQUENCY AMPLIFYING TRANSFORMERS,  
\$5.50**

## COTO-COIL CO.

87 WILLARD AVE.,  
PROVIDENCE, R. I.

THE FOLLOWING DEALERS CARRY OUR APPARATUS—CALL IN AND SEE THEM

SOMERVILLE RADIO LABORATORY

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Providence, R. I.

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HUGHES ELECTRIC CORP.,

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STERLING HARDWARE & ELECTRIC CO.,

Jamestown, N. Y.

RUSSELL MFG. CO.,

Niagara Falls, N. Y.

RADIO SUPPLY SERVICE,

Mount Vernon, N. Y.

JATH WIRELESS CO.,

Buffalo, N. Y.

RADIO ELECTRIC CO.,

Pittsburgh, Pa.

LANCASTER ELEC. SUPPLY & CON. CO.,

Lancaster, Pa.

R. SELWAY COLLMUS,

Baltimore, Md.

JONES ELECT. & RADIO MFG. CO.,

Baltimore, Md.

WHITE & BOYER CO.,

Washington, D. C.

CARTER ELECTRIC CO.,

Atlanta, Ga.

HERBRICK & LAWRENCE,

Nashville, Tenn.

SMITH NOVOTOY ELEC. CO.,

Charlotte, N. C.

NOLA RADIO CO.,

New Orleans, La.

JULIUS ANDRAE & SONS CO.,

Milwaukee, Wis.

INDUSTRIAL RADIO SERVICE,

Saginaw, Mich.

DETROIT ELECTRIC CO.,

Detroit, Mich.

WM. HALL ELECTRIC CO.,

Dayton, Ohio

SALZER ELECTRIC CO.,

Cleveland, Ohio.

WIRELESS MFG. CO.,

Canton, Ohio.

MARSHALL-GERKEN CO.,

Toledo, Ohio.

PRECISION EQUIPMENT CO.,

Cincinnati, Ohio

RADIOELECTRIC SHOP CO.,

Cleveland, Ohio.

SCIENTIFIC ENGINEERING CO.,

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DODGE'S RADIO INSTITUTE,

Valparaiso, Ind.

TELEPHONE MAINTENANCE CO.,

Chicago, Ill.

WESTERN RADIO CO.,

Kansas City, Mo.

WESTERN RADIO ELECTRIC CO.,

Los Angeles, Cal.

ALTADENA RADIO LABORATORY,

Altadena, Cal.

SCIENTIFIC EXPERIMENTER, LTD.,

Montreal, Canada.

# EVERYTHING Radio!

**W**E are authorized jobbers of the following companies:

Radio Corporation  
Westinghouse  
A. H. Grebe  
Remler Manufacturing Company  
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W. J. Murdock Company  
Federal Telephone & Telegraph Co.  
F. A. D. Andrea  
Acme Apparatus Company  
And Others

## PHILADELPHIA WIRELESS SALES CORPORATION

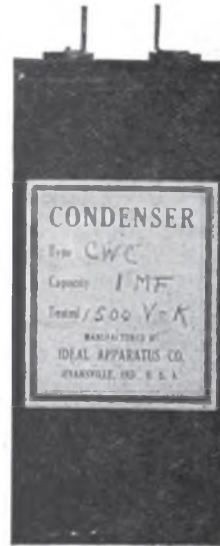
*Jobbers and Dealers in Radio.*



1633 PINE STREET, PHILADELPHIA

# IDEAL

## FILTER CONDENSER



Type ICC

The Ideal Condensers have met with great favor in radio circles throughout the country, all because of their super-efficiency.

Recently designed to stand potentials of 2000 Volts without puncturing, and at no increase in price.

These attractively priced condensers may be obtained from any of the dealers listed below. They will furnish you with complete information regarding the IDEAL LINE.

1 Mfd 2000 Volt Condenser . . . \$2.00  
2 Mfd 500 Volt Condenser . . . 1.50

Somerville Radio Lab., Boston, Mass.  
Benwood Company, Inc., St. Louis, Mo.  
Pitt. Radio & Appli. Co., Pitts., Pa.  
Hemple Electric Co., Omaha, Nebr.  
Klaus Radio Co., Eureka, Ill.  
Standard Radio Co., Los Angeles, Calif.  
Nola Radio Co., New Orleans, La.  
John R. Koch, Charleston, W. Va.  
Cino Radio Mfg. Co., Cincinnati, O.  
T & H Radio Company, Anthony, Kansas  
Wireless Mfg. Co., Canton, Ohio  
Northern Radio Co., Seattle, Wash.

C-W CATALOG FREE  
IDEAL APPARATUS COMPANY  
EVANSVILLE,

"9XAH" INDIANA "9XAH"



*Enjoy Wireless Music  
In Your Home*

Hear, in your own parlor the marvelous wireless music, the prominent speakers, market reports and latest news before it is even on the press.

Get all this free entertainment and enlightenment when you want it without stirring from your fireside by installing an inexpensive receiving outfit and a

## STROMBERG-CARLSON RADIO HEAD SET

The No. 2-A Radio Head Set comprises four distinct units; two Receivers, Head Band and 5 foot Cord

**The Receivers**  
Receivers are equipped with a one-piece bipolar permanent magnet, of high grade magnet steel; provided with phenol fiber spool heads, slotted soft iron pole pieces, corrosion proof diaphragm, enameled copper wire coils. All parts are encased in a receiver shell of cast non-magnetic insulating material, that is unaffected by either moisture or temperature changes. Each coil is wound to 500 ohms. The coils are connected in series. This gives a combined resistance of 2000 ohms for the 4 coils of a No. 2-A Radio Head Set.

**The Head Band**  
A head band is furnished of the spring wire type, covered with heavy brown webbing, correctly shaped, light in weight and comfortable to the operator. Knurled thumb screws are provided on both ends to permit locking the adjustment after it is once fitted to the head. Exposed metal parts are nickel finished. Another feature of merit, in regard to the design of this head band is a provision for separating the receivers which permits two observers listening in on a circuit simultaneously with but one Stromberg-Carlson No. 2-A Head Set.

**The Cords**  
Each No. 2-A Radio Head Set is equipped with a 5-ft. brown silk, moisture proofed, receiver cord which is forked in two branches, one branch for each receiver. This forked construction permits two persons to use the head set simultaneously when desired—a feature of great convenience.

PRICE \$7.50

**Stromberg  
Carlson Telephone Mfg.  
Co.**

Send me your free  
bulletin 1029-Q  
describing your No.  
2-A Radio Head Set.

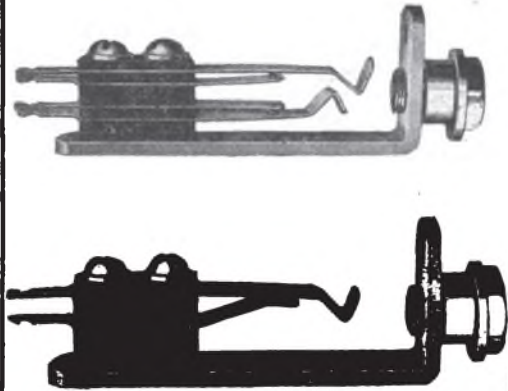
Name .....

Address .....

Mail coupon for booklet 1029-Q describing these Radio Head Sets  
**Stromberg-Carlson Telephone Mfg. Co.**

ROCHESTER, N. Y.  
Branches at Chicago, Kansas City, Toronto.  
Address nearest Office.

# FIRCO JACKS



FIRCO Jacks were not offered until our engineers were assured they had produced the best Jack on the Market. They are now working on some very radical innovations in Firco products, which will be announced in an early issue of this magazine.

These Jacks have heavy Sterling Silver Contacts, Special Alloy nickel-silver springs, giving highest resiliency. Single and Double Circuit closed. Single circuit open. Three spring and five spring automatic filament control.

## FIRCO BULL DOG PLUGS

*"The harder you pull, the tighter it grips"*

Used with Firco Jacks, the one plug that you DO NOT need a screw driver or soldering iron to connect.

*Immediate delivery through your local dealer.*

### John Firth & Co.

18 BROADWAY, NEW YORK

## Install this RTS Standard Detector Panel



Front of Panel

ONLY  
**\$5.95**

Assembled

(Without tube)

Prepaid by  
Insured  
Parcel Post



Back of Panel

# RTS

Here is a correctly designed panel made of best grade Formica. Its signal strength is unequalled by any other tested in our laboratory. The exclusive use of silver plated wire greatly increases its efficiency.

We guarantee the RTS Detector panel to be exactly as represented and will refund your money if you are not satisfied.

Order **TODAY** before the price goes up.

## RTS BUSHING LEVER

This Bushing Lever is well designed and beautifully finished. The knob is the well known Marconi type. Spring lever is 1 1/4" long with ground ends insuring smooth adjustment. A guide bushing raises the lever to proper height for all switch points.

PRICE 60c.

## New Catalog and Signal List

Send today for new illustrated catalog which also gives list of signal abbreviations.

## RADIO TESTING STATION

Dept. R-4, Sturgis St. BINGHAMTON, N. Y.

## FROM CAT WHISKERS UP—

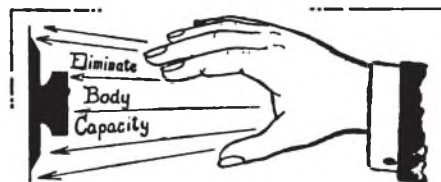
We can supply everything that's best in Radio. 1 or 101 of any article to user or dealer. Same day shipments.

*Inquiries are welcome*



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Wholesale and Retail  
WESTINGHOUSE MURDOCK  
RADIO CORPORATION  
BRANDES, FEDERAL, DeFOREST  
and many others

AT EAST PITTSBURGH, PA.—NEXT DOOR TO KDKA



## Does Your Hand to the Knob Spoil Your Tuning?

You can Eliminate by sending 50c. for One, or \$1.00 for Three Sets of well-made Parts, Post paid, to equip your Instruments in a Few Minutes and Not change their Appearance.

State diameter of your dials.

## RADIO LABORATORY

259 Thomas St. West Haven, Conn.

**Another**



**Achievement**

## The TELMACOPHONE

Here is the height of Telmaco perfection. Equipped with Baldwin Type C Unit, Inverted horn, reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians. Complete in every detail.

Don't be misled into buying a loud speaker offered for less, and expect satisfaction; for a loud speaker of quality cannot be sold for less. Only after the most exhaustive tests and comparisons with the other loud speakers; and only after the most thorough research, laboratory tests, and field demonstrations has the Telmacophone been perfected, and offered now, for the first time to the public.

Telmaco Amplifiers, Receivers, Detectors, Variometers, and Variocouplers have earned a national reputation for quality, endurance and satisfaction not excelled by any other line. You can expect equal satisfaction from the Telmacophone.



*No extras to buy.  
Nothing to get out  
of order.*

Price  
Complete \$20.00 Fully  
Guaranteed

Price without Baldwin Unit,  
but with cap attached, \$14.00.

We advise the purchase of the Telmacophone without unit for those who have Baldwin Unit of their own.

If you haven't our complete catalog "P", be sure to write for it now. Dealers! We are distributors for nearly all standard lines. Full discounts on the Telmacophone. Write for proposition on our complete line.

RADIO DIVISION

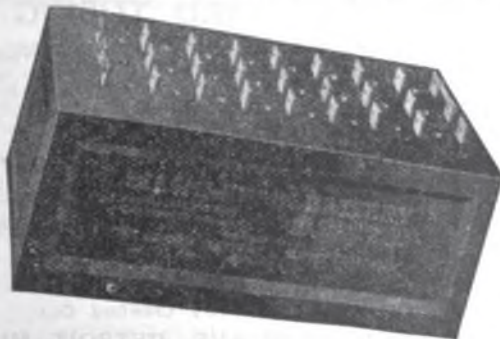
**Telephone Maintenance Co.**

20 S. Wells St.,

NEW ADDRESS

Chicago, Ill.

## BIESMANN STORAGE "B" BATTERY



Here's What the Radio World Has Long Been Looking for. No "B" Battery to be replaced. Takes care of Detector and Amplifier.

Twenty-four cells, individually tapped permitting use of any voltage from 2 to 50 volts in steps of two volts each.

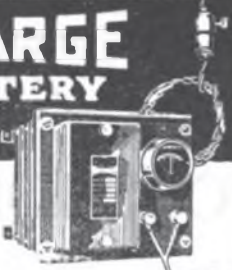
Electrolyte is semi-solid; cannot spill or leak. Container is one piece cast composition block. Highly polished and neat in appearance. Pasted type plate especially developed for Radio Service.

Battery may be charged with any vibrating rectifier by using the circuit provided with battery. Copy of instructions furnished with each battery. PRICE - \$14.00  
Jobbers and dealers! Write for proposition without delay.

RADIO DIVISION  
TELEPHONE MAINTENANCE CO.  
New Address: 20 S. Wells St., Chicago, Ill.

# HOMCHARGE YOUR BATTERY for A Nickle

A perfect rectifier at last, fully automatic and fool-proof in every respect. It can be operated by anyone.



## The HOMCHARGER

Connects to any alternating current lamp socket, gives a taper charge—will fully charge any "A" battery over night. It is selfpolarizing. Connect your battery either way and it will always charge. Automatically disconnects battery when power is interrupted. Restarts charging when connections are restored. Adjustable for wave form, frequency and voltage. Contains only one moving and two wearing parts, lasting thousands of hours, replaceable as a unit for \$1.00. The highest charging rate, greatest efficiency, and simplest of any rectifier selling for less than \$100.00. Bulletin 628 proves it. Ask for your copy.

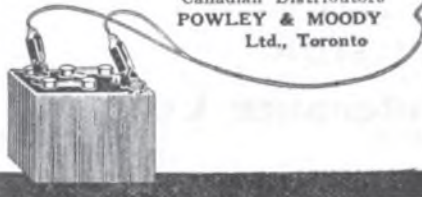
Manufactured in sizes for charging three or six cell batteries from both alternating and direct current circuits. Cannot injure battery—will last a lifetime—approved by underwriters—satisfaction guaranteed. For sale by all Radio, electrical and accessory dealers or shipped express prepaid for purchase price—\$18.50. (\$20 West of the Rockies.)

### ATTENTION MOTORISTS:

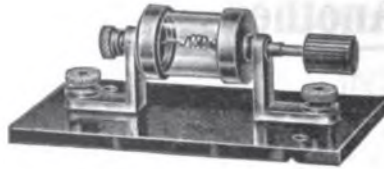
Send for special bulletin 58 showing how easy it is to "HOMCHARGE" your battery.

THE AUTOMATIC ELECTRICAL DEVICES CO.  
127 West Third St., Cincinnati, Ohio

Canadian Distributors  
POWLEY & MOODY  
Ltd., Toronto



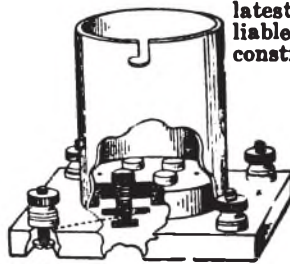
## Crystal Detector Stand, No. 1200



\$2.45 Postpaid

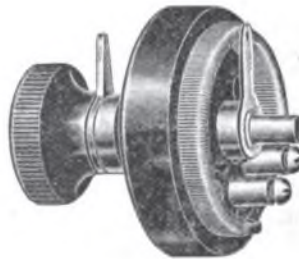
Dust-proof. No vibration. Flexible adjustment. Can be set rigidly.—Tested sensitive. Galena mounted in Woods metal sold @ 35c.

## Audion Bulb Socket, No. 1150



latest in absolute reliable contacts. Study construction shown in diagram. "ON TOP OF ALL" quality, and sells for \$1.00 only. Highly nickel polished & polished black compo base.

## Rheostat, No. 1175



is constructed with metal bearing for shaft, therefore more durable than others. Designed for use on panel or table. Resistance 5 ohms, \$1.00 postpaid.

**CONTINENTAL ELECTRIC CO.**  
117 East 129 St., New York, N. Y.  
Get our prices for Switch Points, Binding Posts and other parts.

## THE RADIO ENGINEERING CO.

formerly  
New England Radio Engineering Co.

Design and construction of special Radio Apparatus, complete installation of receiving and transmitting equipment.

Consulting service on Amateur problems with special attention to tube work.

Send 2c. stamp for bargain list.

380 LaGrange Street  
BOSTON 32, MASS.

## CARDBOARD TUBING

IN ANY LENGTH UP TO 28 INCHES

	Per in. or Fraction	Per Ft.
2 1/2, 3 and 3 1/2 in. diameter . . . . .	3 1/4c	30c
4 and 4 1/2 in. diameter . . . . .	4c	36c
5 in. diameter . . . . .	4 1/2c	42c
5 1/2 and 6 in. diameter . . . . .	5c	50c
2 1/2, 3, 3 1/2, 4 in. diameter have 1/4 in. wall;		
4 1/2, 5 and 6 in. diameter have 3/8 in. wall		

Postage extra; shipping weight 1 lb. per ft.  
NO stamps accepted on orders.

## MICHIGAN RADIO CO.

(Formerly Jeffery Crawford Co.)  
2173 HILLGER AVE., DETROIT, MICH.

Price \$12.00 F.O.B. N.Y. City



Pat's  
Pend'g

# INTRODUCING THE KING "AM-PLI-TONE" A RADIO SURPRISE

**Listen to the Concerts, News and Dance  
with a KING "AM-PLI-TONE."**

Just slip your head phones on the "AM-PLI-TONE" and you and your friends will be SURPRISED.

Polished Cast Aluminum Body with Nickle Plated Base and Horn. No sheet Metal is used, the "Tinny" Sound is Left Out. The VOLUME is DOUBLED because TWO head phones are blended into one POWERFUL tone.

NOTICE: All infringers of this device will be vigorously prosecuted.

**A big hit—a big seller and immediate deliveries. Dealers and distributors what more can you ask? Write today for territory--KING "AM-PLI-TONE"**

82 Church St., New York City



Dept. R.  
MILLDALE, CONN.

### RADIO PANELS—

Marked off, drilled, grained, buffed. Large holes cut for meters. Send drawing with exact dimensions for estimate. We guarantee quick service, accuracy and satisfaction.

RADIO PANEL SHOP  
1103 S. Third St., Evansville, Ind.

### SPECIAL PRICES THIS MONTH

On Grebe, Clapp-Eastham and Amrad Sets

MASSEY RADIO COMPANY  
The Radio Store, Winchester, Va.

### WIRELESS TELEPHONE AND RADIO APPARATUS (Complete Sets)

CLARK & MILLS ELECTRIC COMPANY  
ELECTRAGISTS

75 Newbury St., BOSTON  
Tels. Back Bay 365 & 366 & 8296  
1444 Massachusetts Ave., CAMBRIDGE  
Tel. University 1189

### RADIO CONSTRUCTION CO.

Manufacturers of all kinds of Wireless Telephone and Telegraph apparatus. Panel drilling and engraving a specialty. Binding Posts, stops, switch points, nuts and screws of all sizes.

42 Maverick Square  
Winthrop Block East Boston, Mass.

### SHREVEPORT

THE HEART OF THE FIFTH DISTRICT  
We stock leading makes of—

### RADIO APPARATUS

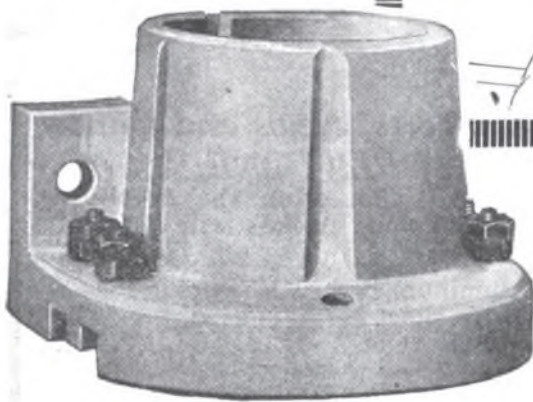
MAIL ORDERS A SPECIALTY

Shreveport Radio Supply Co.

P. O. Box 600, 222 Texas St., Shreveport, La.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# CROSLEY V-T SOCKET



PRICE

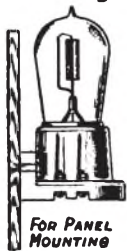
**60¢**

*Better—  
Costs Less*

Now the CROSLEY V-T Socket has been adopted by several of the leading manufacturers of radio apparatus, as standard in their products. There are many good reasons for this universal acceptance. Here are some of them.

The Crosley V-T Socket is made in one piece, of porcelain—the very same material that is used in the base of vacuum tubes—consequently it is of high dielectric value. The bayonet catch is imbedded in a heavy wall of porcelain, that is for all purposes, unbreakable. Soldering irons will not melt this socket and it is ideal for power tube work.

The design positively eliminates all possibility of short circuiting filament across high voltage B Battery.



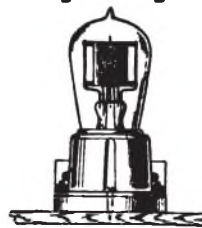
FOR PANEL MOUNTING

Almost every leading jobber and dealer in radio equipment, the whole country over, is handling the CROSLEY V-T Socket—NOW. The demand is heavy and its popularity is sweeping the country.

The low price needs no apologies—large production alone makes it possible.

Everyone now says the CROSLEY V-T Socket is "Better—Costs Less."

Buy from your Dealer. He has it or can get it for you.



FOR BASE MOUNTING

*To the few Jobbers and Dealers who are not handling the CROSLEY V-T SOCKET, we make the suggestion to get in line.*

**CROSLEY MANUFACTURING COMPANY**

Radio Dept. Q-9,

Cincinnati, Ohio

134

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

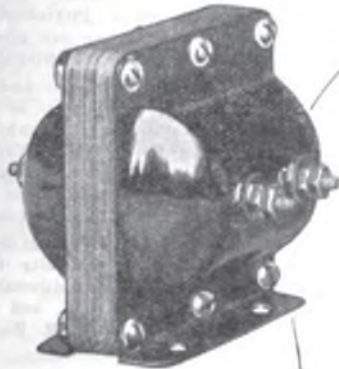
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# Announcing the **CROSLEY SHELTRAN** Audio Frequency Amplifying Transformer

RATIO **9 TO 1**

Completely  
Shielded



HIGH grade materials and excellent workmanship, combine to give the CROSLEY SHELTRAN the great efficiency and attractive appearance so often lacking—except in the most expensive transformers. At the same time, we incorporated in the design of the SHELTRAN all the characteristics that are necessary to obtain maximum amplification from the modern vacuum tubes. These tubes with their high amplification constant, operate most effectively at large fluctuations in the grid potential. The ratio of turns is 9 to 1.

The CROSLEY SHELTRAN has a base area of 1 1/4 in. x 2 1/2 in., net weight 12 1/2 oz. The overall length is 2 1/2 in., overall height 2 3/4 in. and the overall width is 2 1/4 in.

Price complete, ready to mount . . . \$4.00

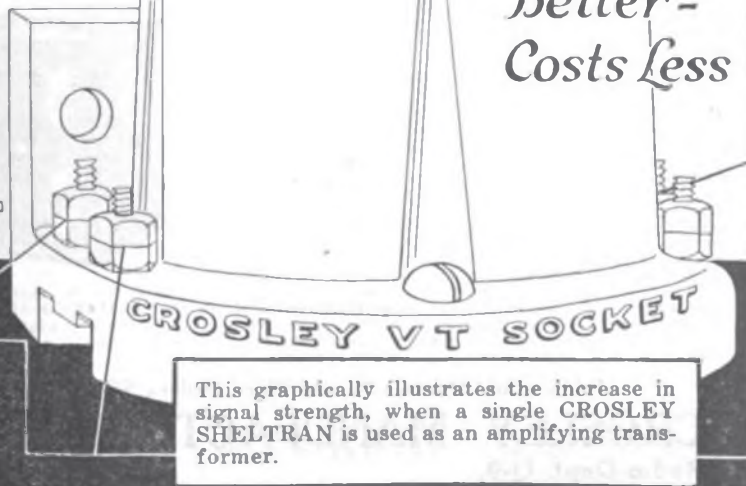
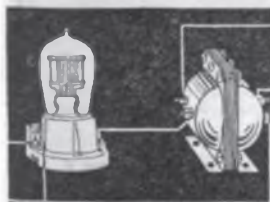
Jobbers and Dealers:  
Order now for early deliveries

**CROSLEY  
MANUFACTURING  
COMPANY**

Radio Dept. Q-9  
Cincinnati, Ohio

**\$4.00**

*Better -  
Costs Less*



This graphically illustrates the increase in signal strength, when a single CROSLEY SHELTRAN is used as an amplifying transformer.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

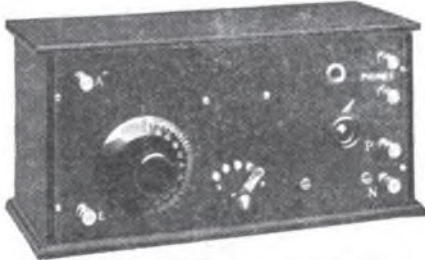
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# Satisfied Users of HARKO SENIORS

have written this advertisement

Read what expert Radio men think of the CROSLY HARKO SR.



The HARKO SENIOR was developed to supply the demand for a low-priced, efficient receiving outfit, having a range of from 150 to over 600 meters, thus bringing in on the average amateur antenna—amateur stations, radio telephones and commercial stations, operating up to and including 600 meters. Ship and stations on the Atlantic Coast are easily copied in Cincinnati. Radio telephone concerts and voice, from Newark, New Jersey and other New Jersey phones in addition to Pittsburgh and other phones, are regularly copied in Cincinnati. It is just the thing for receiving radio telephone concerts.

This instrument is a combination tuner and audion detector. It consists of a tapped inductance, a CROSLY VARIABLE CONDENSER, CROSLY Model "A" Rheostat, CROSLY V-T SOCKET, CROSLY GRID CONDENSER and Leak. The hook-up is special—of our own design and is non-regenerative.

Parts are mounted on panel of formica or other similar dielectric composition. The whole thing is mounted in a mahogany finished cabinet 11½ inches wide, 6 inches high and 4¾ inches deep.

This set is very efficient. The price is remarkably low.

The HARKO SENIOR is sold complete as described without tube, "B" Battery, "A" Battery or phone, as is usual with such apparatus.

PRICE .....\$16.00

## THE CROSLY TWO STEP AMPLIFIER

"Better -- Costs Less"

To meet the demand for a moderately priced, efficient two-step Amplifier we have developed the one illustrated on this sheet. This consists of CROSLY Rheostat, Sockets and Transformers, mounted on panel of formica or other similar dielectric composition, complete with binding posts which are marked and tap switch for changing from one to two steps.

The CROSLY TWO-STEP AMPLIFIER is designed to work well with practically any audion detector hook-up. The phone posts on the detector connected to input binding posts on the amplifier panel. The phones are then attached to the phone posts on the amplifier and the positive and negative posts connected with the "A" Battery. Two leads with clips come out of the rear of the cabinet to be connected with the "B" Battery.

The CROSLY TWO-STEP AMPLIFIER cabinet is designed to match up uniformly with either the CROSLY Detector Unit, the HARKO JUNIOR or the HARKO SENIOR. The size of the cabinet of the Two-step Amplifier is 11½ inch wide, 6 inches high, 4¾ inches deep.

Price of the CROSLY TWO-STEP AMPLIFIER without tubes, "A" or "B" Batteries, complete as shown in the illustration, is.....\$25.00

Jobbers and Dealers Should Place Orders NOW for Early Deliveries

# CROSLY MANUFACTURING COMPANY

Radio Dept. Q-9,

Cincinnati, Ohio

"Have just hooked up the Harko Senior and Two-Step Amplifier. Detroit came in like a house-a-fire." Ray-Di-Co Organization, Chicago, Ill.

"Have received the Harko Senior. On test this set picked up the Radio phones at Pittsburgh and Detroit Tuesday night. On the whole we are pleased with the set." Ashtabula Radio Sales Co., Ashtabula, Ohio.

"I received your Harko Senior today and we gave it a trial and considering the simplicity of operation, it worked beyond our expectations. In conjunction with a Two-Stage Amplifier, we heard WBL, WJZ, KDKA and others. They were not loud but were quite clear and the most noticeable thing about it, there was no C.W. carrier audible." Romeo Radio Shop, Romeo, Mich.

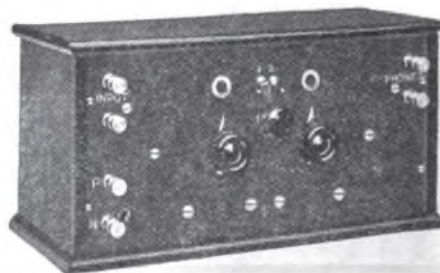
"We received the Harko Senior Receivers. We tried one of them out and had no difficulty in picking up Detroit voice and music, also from Milwaukee and Pittsburgh, Pa. They seem to work O.K., and we think they are wonderful for the money." H. R. Rodecker, Washington C. H., Ohio.

"Harko Senior O.K. We indorse same and back it with our own guarantee. Speaks for itself. Using one-step Amplifier and Harko Senior were able to hear Pittsburgh, Chicago, Detroit and NOF." Hoopeston Radio Shop, Hoopeston, Ill.

"We are in receipt of your Harko Senior Receiver and are certainly getting good results with it in this locality." Wright Electric Co., Scottdale, Pa.

"Last evening late I cut in and got Denver fine on the Harko Senior. Think I will have some business in a short time when the weather gets alright again." H. T. Hain, Lock Box 262, La Crosse, Kansas.

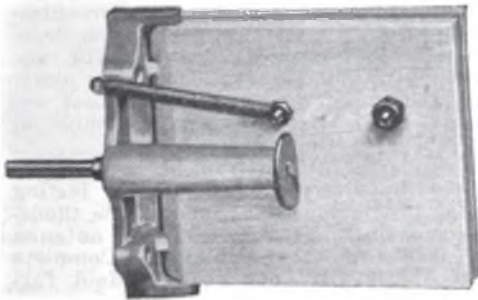
"We received your set and found it to receive all the musical concerts from KDKA and the like with the commercials coming in strong on 600 meters. It is a distance of nearly 800 miles from Pennsylvania as near as we can figure." Androscoggin Radio Supply Co., 42 Blake St., Lewiston, Maine.



# Crosley Variable Condensers

**"Better—Cost Less"**

Variable Condensers that do the work—that's the only kind we make. The Auto Electric Service, of Rockport, Maine writes:—"Our station has your Condensers in use and we get KDKA with a Two Step Amplifier loud enough to hear in the next room with the phones on the table. This we could not do with any other make of Condenser." It's the same story everywhere they are used.



**MODEL "C"**

The principle of this instrument needs no introduction or explanation—it is made right and it works. This model differs from the other CROSLLEY models in the size of the plates, the material of which they are made and the capacity. The plates are made of porcelain, ground true on the contact surfaces before the copper and mica are applied. The capacity is conservatively rated at .001 Mf. and the extremely low capacity makes it ideal for use where a condenser is specified up to .001 Mf. capacity. It is especially recommended for radio phone work as it will not shower or break down, tested under a thousand volts. Furnished ready to mount on panel or in a cabinet, with 1/4 in. shaft standard or 1/8 in. shaft optional.

Price each, without knob and dial ..... \$2.25  
 Same, with knob and dial ..... 2.75  
 Same, with knob and dial and mounted in mahogany finished cabinet, complete with binding posts ..... 3.50

## CROSLLEY KNOBS AND DIALS

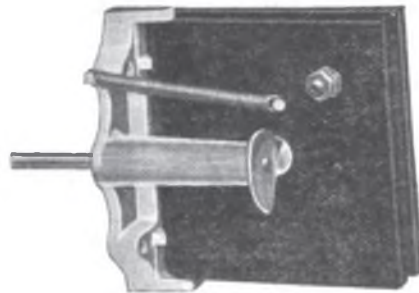


Extremely well made of brass, stamped from a solid piece and finished with a high grade, durable black laquer. The figures stamped in the dial and enameled with white enamel. Overall diameter of dial 2 1/4 in. Furnished for 1/4 in. shaft, standard or 1/8 in. optional.

Price, Knob and Dial complete 50 cents

Most Jobbers and Dealers are now carrying CROSLLEY VARIABLE CONDENSERS. If yours does not, send order to us direct, with your dealers name and address. We will ship prepaid.

**CROSLLEY MANUFACTURING COMPANY**  
 Radio Dept. Q-9, Cincinnati, Ohio

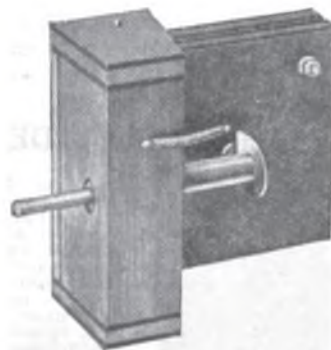


**MODEL "B"**

Like all CROSLLEY VARIABLE CONDENSERS the Model "B" has no appreciable body or hand capacity and is easier to tune in C.W. and I.C.W. than any other condenser made. Conservatively rated capacity, .0005 Mf., but tests in the Laboratories of one of the leading universities of the country have shown the maximum capacity of this model to never be less than .0008 Mf. and frequently running better than .001 Mf. The Model "B" CROSLLEY Variable Condenser has best quality laminated wood plates and a die cast metal frame. Extremely neat in appearance. Furnished, ready to mount on panel or in a cabinet, with 1/4 in. shaft as standard and 1/8 in. shaft optional. This model occupies a space on the panel of 1 1/2" x 3 3/4" and 3 1/4" deep.

Price, each without knob and dial ..... \$1.75  
 Same, with knob and dial ..... 2.25  
 Same, with knob and dial and mounted in mahogany finished cabinet complete with binding posts ..... 3.00

## MODEL "A"



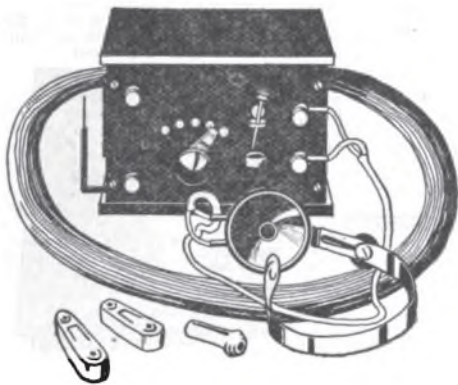
This instrument needs no further introduction to radio men. Thousands have been sold and are now in use. The conservatively rated capacity is .0005 Mf. and like the other CROSLLEY models, it is a universal condenser for C.W. and other transmission work as well as receiving. Every CROSLLEY Variable Condenser

is tested to withstand 1000 volts before shipment. Just try this test on most air condensers providing you have no further use for the instrument. The frame of this model is made of wood; the plates are high grade laminated wood which function perfectly under all conditions.

Price each, without knob and dial ..... \$1.25  
 Same, with knob and dial ..... 1.75  
 Same, with knob and dial and mounted in mahogany finished cabinet, complete with binding posts ..... 2.50

# CROSLY RADIO APPARATUS

"Better—Costs Less"



## HARKO RADIO RECEIVER

The most compact and complete efficient crystal receiving outfit on the market. Designed for the amateur who wishes to get started in this wonderful game. The illustration shows complete outfit ready to hook to aerial, fones and ground wire. Will tune from 200 to 600 meters, bringing in spark, voice and music with average amateur antenna. NAM, Norfolk, Va. and ships at sea copied in Cincinnati.

A wonderful little instrument. Price complete with battery, interrupter for testing crystal, instructions, etc. \$9.00. One thousand ohm single head set, 125 ft. antenna wire, insulators, etc. \$6.00 extra. Complete outfit \$15.00. If your dealer cannot furnish, we will ship direct prepaid.

## Crosley Radio Storage Battery

The CROSLY RADIO STORAGE BATTERY has been developed as a special "A" Battery for radio work and is especially designed to take care of vacuum tube filament current and other purposes where six volts are required.

Do not compare the CROSLY RADIO BATTERY with the three, five or seven plate lighting batteries generally offered for radio work. The CROSLY RADIO BATTERY is a standard 11 plate, heavy duty automobile type battery for radio work. It has greater than 80 ampere hour charging capacity.

The size of the CROSLY RADIO BATTERY is 7 5/8 in. long, 7 15/16 in. wide and 9 in. high, overall.

Every battery is shipped fully charged and ready to hook to your vacuum tube or tubes.

Price each, fully charged .....\$17.00



## CROSLY DETECTOR UNITS

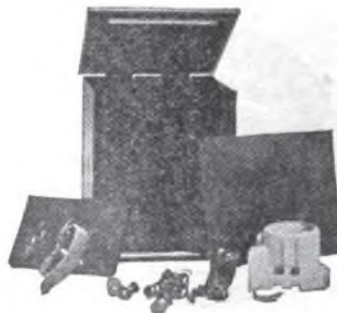


These are furnished in two ways:

Completely wired and mounted as shown on the left, or knocked down as shown on the right. Mounted—everything ready to hook to your set. Suitable for many different hook-ups. Formica panel: mahogany finished cabinet. Matches up with the CROSLY TWO STEP AMPLIFIER.

Price, completely assembled, as shown on the left.....\$7.50

Price of all parts, including formica or other panel or high grade dielectric composition, not drilled as shown on the right .....\$6.00



# CROSLY MANUFACTURING COMPANY

Radio Dept. Q-9,

Cincinnati, Ohio

# --More CROSLY RADIO PRODUCTS

"Better--Costs Less"

## Crosley Cabinets



The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions etc. Realizing the demand for attractive stock cabinets of various

sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbated in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels.

Wood used is either gum or mahogany in dark antique or red mahogany finish or in quartered oak in natural or antique finish. Specify type of wood and finish in ordering. Lids or tops are hinged. Sizes and prices are:

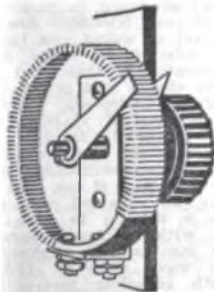
For Panel Size	CABINETS Inside Dimensions			Mahogany or Quartered Oak	
	High	Wide	Deep	Gum	Oak
6x7	5 1/2"	6 1/2"	7"	\$2.50	\$3.85
6x10 1/2	5 1/2"	10"	7"	2.75	4.40
6x14	5 1/2"	13 1/2"	7"	3.30	5.55
6x21	5 1/2"	20 1/2"	7"	8.90	7.30
9x14	8 1/2"	13 1/2"	10"	8.70	6.80
12x14	11 1/2"	13 1/2"	10"	4.40	6.80
12x21	11 1/2"	20 1/2"	10"	5.25	10.60

Cash must accompany order. No C.O.D.'s. We pay transportation charges.

## FORMICA PANELS

We can furnish genuine formica panels 1/8" thick, cut to the following dimensions: 6x7; 6x10 1/2; 7x9; 6x14; 7x12; 6x21; 7x18; 9x14; 12x14; 14x18; 18x21. Price of panels—2 1/2¢ per square inch. For odd sizes order the next largest size; we will trim. We pay postage.

## CROSLY RHEOSTATS



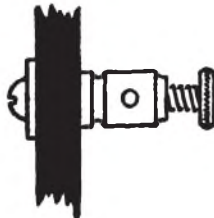
Complete with knob, pointers, etc. as shown in illustration. Our unique construction permits mounting on panel of any thickness up to and including 3/8": non-corrosive resistance wire.

Model "A"—overall diameter 1 1/2". Resistance 7 ohms, one ampere without heating. Suitable for detector or amplifier tubes. Price 60c each.

Model "B"—Resistance 4 ohms; will carry 3 amperes without heating. Suitable for detector, where very

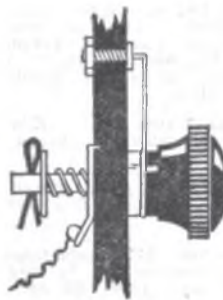
accurate adjustment is required and for 5 watt power tubes. Price \$1.25.

## CROSLY BINDING POSTS



Barrel 3/8" x 1/2". Not too small nor too large, just the right size.

Nickel plated. Complete with base screw and washer as illustrated. Price, 8c each or 90c per dozen.



## CROSLY TAP SWITCHES

Note unique construction assuring constant tension. Composition knob, nickel-plated switch arm and bushing. Note stationary washer with soldering lug, making possible buss wire connection. Price 40c each. Better—Costs Less.

SWITCH TAPS for above, brass nickel-plated, complete with brass nut, 3c each, 30c per dozen or \$2.50 per hundred.

## CROSLY VARIOMETER PARTS



This set consists of two stators, one rotor, the necessary hardware shown in the illustration. Shaft for knob and dial is 1/8" diameter. The wood parts are furnished either in poplar or mahogany.

The average radio man has his own ideas about the kind of wire and the number of turns that he wishes to use, depending upon its purpose, so we leave that to the purchaser. The operation of winding and setting up is very simple, but the parts that we list are difficult for the amateur to make. They are made in our own large wood working plant on special automatic machinery that make possible very accurate quantity production.

Price of Variometer parts, described above, made of poplar wood, is \$1.50 (including wood parts and hardware).

If wood parts are made of mahogany \$1.75.

If winding form is desired, it can be used for winding one or more variometers. Price is 30c additional.

## CROSLY VARIOCOUPERS



CROSLY VARIOCOUPERS consist of formica tube, rotor and brass hardware. It is made with the same care and accuracy as the CROSLY VARIOMETER.

Price, complete as shown in the illustration, not wound or assembled, \$1.50. Rotor only 40c.

If your dealer does not handle any of the above parts, you may order direct. We will ship prepaid. Dealers and Distributors: Every item shown above should be in your stock. Write for proposition.

**Crosley Manufacturing Company**  
Radio Dept. Q-9, Cincinnati, Ohio

## CLASSIFIED ADVERTISEMENTS

Five cents per word per insertion, in advance. Name and address must be counted. Copy must be received by the 10th of month for succeeding month's issue.

**WANTED:** 500 Volt, 100 Watt Generator. State all particulars. R. H. Beaumont, Jr., Radnor, Pa.

**FOR SALE:** General Radio type 145 wavemeter, (new) \$35.00; Amrad wavemeter, \$6.00. 43 plate \$167 Murdock condenser. Station type Vocaloud, \$24.00. Packard 1KW transformer. Regenerative tuner in cabinet, \$22.00. 2-step amplifier in cabinet, \$26.00. Arthur L. Walsor, Cheaning, Mich.

**SELL:** Regenerator \$30, detector 2 step \$25, 1/4 K.W. set \$25. Inquire J. Pascal, 85 Sherman Avenue, Staten Island, N. Y.

**SELL:** Trusco all-wave tuner, detector panel, \$70.00; or Trusco regenerative, detector, \$40.00. Box 967, Ogden, Iowa.

**C.W. STUFF:** Tuska Transformer \$13, Inductance with clips \$6, rheostat \$2.50, ammeter \$5, 1/2 mfd condenser \$1, 2 burnt out 5 watt tubes \$2 each, P. Lindauer, 1014 11 St., Lorain, O. 8CER.

**3J1 Is Calling! Please Stand By!** Calvert's Short Method of Learning the Continental Code. Printed on highly-glazed cardboard 7x16 1/2 inches. 35c brings it to you with a copy of International Abbreviations, free! Positively, one of the simplest methods ever devised. This issue only at this price. 3J1 Now Signing Off. 1 Pay Postage. G. W. Calvert, Lansdale, Pa. 3J1.

**FELLOWS HERE'S A BARGAIN:** 9DP will be sold. 1 K.W. Spark Transmitter, Switch board, Paragon, Universal Arc Receiver, Two step, Baldies, storage batteries, aerial, etc. \$340.00 takes all radio apparatus I have. Will sell parts separately. Write for list and description. E. H. Hartnell, Salem, Wisconsin.

**WANTED:** 6 V., 350 V. Dynamotor. A. J. Higson, 84 Romaine Avenue, Jersey City, N. J.

**MUST SACRIFICE Super Regenerative:** Perfect phone reception, 180-600 meters Turney Regenerative, audion and crystal detector, two stage amplification, external tuner and tickler connections, three condensers with verniers, vernier detector rheostat, Formica panel, telephone switch controls, jacks. Complete with bulbs, B battery, Connecticut phones. \$75 First money order takes. Arthur Osborn, 311 E. Daniel, Champaign, Ill.

**SELL:** Efficient 1/2 K.W. Transmitter, complete; including Dubilier Condenser. Enclosed Rotary and Marble Control Panel for best offer. Clarence M. Voll, 49 Pawnee Parkway, Buffalo, N. Y.

**COMPLETE STATION EQUIPMENT OF 8BQ:** 1KVA transmitter with D.X. record. Grebe CR-2, Det. 2 stage with all accessories. Very reasonable, guaranteed. H. Walleze, Danville, Penna.

**WANTED:** 2 Western Electric V.T.'s. J. Weiss, 219 East 83d St., New York City.

**1/2 K.W. TELEFUNKEN** 500 cycle transmitter mounted heavy engraved bakelite panel, aluminum angle frame complete with meters, key rheostat, self-excited generator and AC motor mounted on rubber, spare gaps, condensers, \$300.00. Radiophone on bakelite panel, with two new VT2s, transmitter, switches, condensers, dynamotor 30-350 volts \$60.00. All F.O.B. Seattle. Fotos. Obradovic, 5103 Meridian, Seattle.

**AERIAL WIRE**—100 foot coils; 7 strands \$22 Hard Drawn Copper 90c; Tinned \$1.50; No. 14 Hard Drawn Copper 55c; Postage weight 2 pounds per coil. Chas. L. Manning, 1558 Miller Street, Utica, New York.

**BARGAIN:** One Kilowatt Type H-1 Acme, panel mounted \$25. Benwood Aluminum Enclosed Gap and R & M 3400 RPM Induction motor \$30. Both \$50. Guaranteed A-1 Condition. Still being used. Radio 9VZ, C. W. Kleman, 2011 Garrard Street, Covington, Ky.

**FOR SALE:** 2 C. D. Tuska Variometers, one Radio Shop coupler and dials. Price \$15. H. A. Williams, 204 S. Third, Bozeman, Montana.

**AMATEURS**—Write for list of receiving apparatus. Good condition. B. Dudley, 4809 Fletcher St., Chicago.

140

**SELL**—1 KW Type T2 Thordarson \$24; oil immersed condenser \$15; Benwood gap with standard motor \$15; Murdock line protector \$4; Acme anti-light-blinker \$6; heavy United Wireless 10 amp. key \$4; Holtzer Cabot 3000 ohm phones, like new \$7. All good condition. First money order takes all or sold separately. Paul D. Mohr, Emma, Penna.

**EDISON B BATTERY ELEMENTS.** Make your own. Can be recharged and lasts for years. 200 ampere hour A batteries, guaranteed, \$35.00. Harry Morrell, 52 Goffe St., New Haven, Conn.

**BARGAIN:** One K.W. Thordarson Flexible transformer \$15. Thordarson Oil Condenser \$15. Thordarson Oscillation Transformer \$6. Gap motor with Thordarson disc \$6.00. Kermel aerial ammeter \$5. Overland Key \$3.00. All guaranteed. J. Pinkston, Valdosta, Ga.

**SELL:** Duck Co.'s one-step with Federal—New—\$10.00 prepaid. J. D. Blitch, Lexington, Va.

**RADIOTRON DETECTOR** \$4.00. Amplifier \$5.00, new tubes. Both \$8.75. Prepaid. Wesley Robinson, Jr., St. Marys, Georgia.

**WE CAN SHIP IMMEDIATELY**—Burgess 22 1/2 volt "B" Batteries \$3.00 and the following Rhmatine products—Adapt-O-Phone \$12.00, Amplifying Transformer \$3.50, Socket \$1.00, Plug and Jack \$1.50, Jack only \$0.85. Postage prepaid. The L and B Radio Shops, Dept. Q, 6185 McMillan Ave., Detroit, Michigan.

**FOR SALE:** DeForest RS200 utility receiver \$20.00, 3 circuit regenerative detector and one step \$50.00, 1/4 HP 1400 R.P.M. 25 cycle motor \$15.00, 1/10 HP 3400 R.P.M. 60 cycle new \$19.00 and new 1/4 HP 1750 R.P.M. 60 cycle motor \$14.00. Thomas A. Reid, 8CLD, Springfield, Ohio.

**WANTED:** O.T., changeover switch, etc. 1CUK, J. W. Packard, Canton, Mass.

**C.W. TRANSFORMERS Unmounted.** 200 watt with one 550 volt secondary \$8.00; with two 550 volt secondaries \$8.50. All have 350 volt taps. Postpaid. Money back guarantee. Milton Zumpe, 1332 Mishawaka Ave., South Bend, Ind.

**BUILD YOUR OWN WIRELESS Telephone and Musical Receiver, Don't Wait for a Set. We Hear Chicago, 900 Miles, Fine on Good Nights. Pittsburgh, Newark and New York Come in Good and Loud—You Can Do the Same on a Single Bulb. There is Radio Music in the air each evening, and the living voices of the artists can be reproduced in your own home and enjoyed by you and your friends. Are you satisfied with your receiving set or would you like to build one that will receive over 6,000 miles on a single bulb and quit experimenting? One that will be equal to any regardless of claims and price—with which you can hear Honolulu, California, German, South American, French and English stations and practically all of the high powerful foreign and domestic stations, as well as amateur stations as far west as New Mexico, and the phone and music. Anyone can assemble this outfit and wire it up, and the remarkable ranges that may be obtained will surprise you. Why not make a set up to date and efficient? Don't experiment with unknown circuits. We will promptly mail you our sample diagram of a complete short and long wave receiver, 175 to 20,000 meters, together with complete instructions for wiring and assembling, price of each part and where they can be bought, leaving nothing to guess about, on receipt of fifty cents in coin or stamps. Here is a diagram no one can afford to be without. Virginia Novelty Company, Desk A, Martinsburg, West Va.**

**1000 VOLT 750 WATT D.C. generator** excellent condition \$70. C.W. transformer 500 watt 10 and 500 volts \$10. Twin cylinder Indian motorcycle engine slightly used \$40. Philip Stout, 1621 Riverside Drive, Knoxville, Tenn.

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U.V.201 \$6.50 and A.P. amplifiers \$6.50; We will supply free of charge your choice of either of these six premiums—Latest FADA rheostat \$1.00, No. 810 Remler Smooth Running Rheostat \$1.00, Paragon V.T. socket \$1.00 Murdock V.T. socket improved contact type \$1.00 DeForest V.T. socket \$1.00, FADA panel mounting V.T. socket Bakelite base \$1.10. Either of the Federal single, closed or double circuit jacks listed respectively at \$0.70, \$0.85 and \$1.00 will be given as premiums with each Federal 220W amplifying transformer \$7.00 or R.C. of A. U.V.712 \$7.00 and the U.V.1714 Radio Frequency Amplifying Transformer. FADA 5 ampere Nichrome power rheostats \$1.35 or R.C. of A. U.R. 542 Porcelain V.T. socket supplied free of charge with each \$8.00 U.V. 202 power tube or A.P. Moorhead 5 watt Type C power tube \$7.50 for C.W. or Radiophone transmission or power amplification. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods subject to return within five days. Twelve hour service. Postage and insurance prepaid by us, thereby saving time and money. Remember us. The Kebler Radio Laboratories, Dept. Q, Abilene, Kansas.

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Variometers \$3.00; Vario-couplers \$3.00. Immediate shipments. Bengier-West Mfg. Co., 135 Cooper St., Brooklyn, N. Y.

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**SELL:** Navy type loose-coupler, \$5.00; 1 KW Packard, \$10.00; Ford coils, \$1.00 each. F. B. Hoselton, Webb City, Mo.

**500 VOLT GENERATOR**, \$15.00; 1/4 h.p. R. & M. Induction Motor, \$15.00; Acme 200 watt mounted CW Transformer, \$15.00; Acme 150 watt filament heater \$10.00; 2 Amrad basket balls, \$5.00 each; 80 amp Storage Battery, New, \$15.00. A. Hengelbrok, 922 Washington, Newport, Ky.

**FOR SALE:** \$175.00 worth of New Standard Radio equipment. Champ Clark, Anthony, Kans.

**AMRAD** synchronous motor, Benwood rotor, electrodes complete \$25. 1PI.

**REGENERATIVE RECEIVER.** Combined medium wave cabinet and detector two-step. Fine on 200 meter C.W. Worth \$125, Sell \$55. Brandes Superior \$5.50, variable \$2.50, variable fixed, eighth horse induction motor \$10, crystal detector, load coil, Amrad dials, baby knife switches. Few sockets, amplifying transformers, rheostats. O. R. Wimpy, 116 Sheetz, LaFayette, Indiana.

**FOR SALE:** Thordarson half kilowatt Transformer, Dubiller Condenser, Benwood Rotary without motor, International Radio Oscillation Transformer, 0-5 Ammeter Dubiller Kickback Preventer. Has worked five hundred miles. Bargain at \$75. H. C. Richards, 254 Main St., Norwalk, Conn.

**RECTIFIER PLATES FOR C.W.** 72 square inch piece of aluminum \$0.75. 72 square inch piece of lead \$0.60. Log book, 100 pages 50 cts. Philadelphia Radio Supply, 5714 Hazel Ave., Philadelphia, Pa.

**NAVY STANDARD** 1/4 KW Quenched 500 cycle Panel Transmitter with automatic starter and Motor-generator, Tunes up to 952 M., good condition \$225. Marconi 1/2 KW Synchronous 500 cycle Cargo Type Transmitter with Motor-generator \$110. French 1/2 KW Field-transmitter \$47.50. Other Government Apparatus Cheap. Eaton, 1915 S. Twelfth, Phila., Pa.

**DUAL GRIP CLIPS** Lock to your A or B battery terminals. Can be used for tapping the circuit anywhere at one tenth the cost of plugs and jacks. Post paid, 25c each or 5 for \$1.00. Variable B batteries,

22 1/2 V., \$2.00 & \$3.00. Assorted coil springs, 75 for \$1.00. The Dual Tool Company, 12428 Euclid Ave., Cleveland, Ohio.

**FOR SALE:** New 25,000 volt Thordarson \$30.00. Cosradio O.T. \$12.00. Klitzren gap \$18.00. All for \$55.00. Write for details. 7LN.

**ALUMINUM.** Absolutely pure machine cut aluminum strips for chemical rectifiers, 1/8 in. stock, 6 in. long; 1/2 in. wide 10c, 3/8 in. wide 8c. Radio Aluminum, 13 Grant St., Natick, Mass.

We have plant and equipment to manufacture complete components or parts for wireless apparatus, for distributors and manufacturers. Based on extensive mechanical experience, our production and workmanship will compete with market demands. Diamant Tool & Mfg. Co., Inc., 91-97 Runyon St., Newark, N. J.

**SPECIAL RADIO BATTERY:** The same as used by ZBML in Transatlantic Test, Capacity 80-Ampere hours. Case will not absorb acid, therefore will not stain floors. Price \$22.00. Neils Larsen, Riverhead, N. Y.

**DETECTOR PANELS** \$4.50, wood variometer not assembled \$9.50. For DX work, Tesco tuner \$5.75 each. Crystal detector \$1.75. 5 watt CW set \$25.00. West Electric V.T.2, each \$7.25. Swap 350 watt motor-generator set type Midget, new 20 watts. Other bargains, send stamps for list. Mack's Radio Shop, Ansonia, Conn.

**FOR SALE:** Grebe CR3 \$40.00. Grebe detector and two step with bulbs \$60.00. Thordarson 1/4 K.W. enclosed Signal Gap, Murdock Oscillation and five sections Murdock condenser. Complete set \$25.00. General Radio five amp. H. W. A. \$5.00. Brandes Navy Phones \$5.00. E. P. Dooley, 719 E. Miner St., South Bend, Ind.

**WANTED:** Wavemeter Navy type S.E. 965 as advertised December QST page 72. Also want used Wireless course complete. C. Bramer, 2140 South Harding Ave., Chicago.

**FOR SALE:** Condenser Acme bargain. Cannings, 4249 Russell, St. Louis.

**40% OFF LIST PRICES**—of parts used (parts cost \$112.45) takes 15 watt (3 tube) CW & fone set now in use at 9ANR. 0-3 HWA, \$4.75; UV203 socket, \$1.75; P837-15 amp. rheostat, \$7.85; Marconi VT-1, \$2.65; New 2 fil. audiotron, \$4.25; used 1 fil. tron, \$2.25, amp. trans. \$2.75. F. Pierce, 2415-19 Ave., Rock Island, Ill.

**SELL:** OT-10 DeForest Radiophone transmitter, without motor generator, used only a few times; Grebe CR-3 receiver. Best offer takes them. James P. Buxton, Patchogue, N. Y.

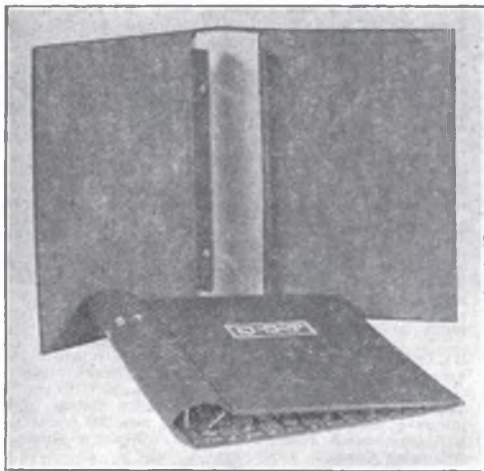
Preparing for college and will sacrifice entire up-to-date high power radio outfit as follows: \$55 Z-nith regenerator \$40. \$45 Proudfoot detector and 2-step amplifier \$35. \$15 Western fones \$8. \$20—100 amp. hour battery \$10. 3 tubes (Marconi and electron relay worth \$20) \$10. \$15 loud talker \$5. Entire lot as above for quick sale \$90. Also \$75—500 v. Motor generator \$45. \$15 Acme 375 v. C.W. transformer (never used) \$10. \$45 Thordarson 1 kilowatt "R" \$25. Benwood gap with induction motor (worth \$50) \$30. Also miscellaneous C.W. equipment send for list. Above equipment in perfect condition and good as new. Harold Lewis, 323 Wesley Ave., Oak Park, Ill.

**FOR SALE:** One K.W. spark transmitter complete \$70. For further information write Robert Faudree, Chester, W. Va.

**BUILD RADIO SETS.** We supply parts or complete units. Catalog 15 cents. Easily understood assembly drawings. Crystal Detector Set, Non-regenerative Receiver, Regenerative Receiver, 2 Step Amplifier 25 cents Each. All five \$1.00. No stamps accepted. Hatfield Airfone Company, Owego, N. Y.

\$25.00 buys my 1/2 K.W. spark complete. A bargain! P. T. Pordue, Salem, Va.

**BARGAIN FOR SALE CHEAP:** Complete 1 KW. Synchronous Spark transmitter consisting of Benwood 10" disc, Aluminum housing, 1/4 horsepower Synch. motor, Mahogany cabinet with oil immersed glass condenser, 1 KW Thordarson Silicon steel transformer, Marconi Key with 1/2" silver contacts, Marconi Aerial Switch with base insulators, Thordarson Oscillation Transformer, St. Louis Battery charger. All for \$100.00. Everything new and best working condition. Lewis Pupich, 2312 Greenview Ave., Chicago.



**BINDER WITH TWO CLIPS  
POSTPAID—\$1.50**

There is only a limited supply of these binders on hand, which we will furnish for \$1.50 apiece, with two clips, postpaid. Act NOW and avoid disappointment. Address your order and make your remittance payable to

**THE AMERICAN RADIO RELAY LEAGUE, HARTFORD, CONN.**

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Your set looks better and works easier in a cabinet than it does strewn all over a table, doesn't it? Right!

Your copies of QST are as valuable to you as your pet pieces of "junk." Of course!

You no longer have to stack your magazines in an unhandy pile, or scatter them around where the copy you most wanted to keep will likely get lost. We are illustrating herewith the "QST Cabinet," a binder especially made up for preserving your QSTs, keeping them clean and together in order for quick and easy reference.

The QST binder is in dark red with gold "QST" on back and front. To mount your QSTs, just punch two holes through the binding edge of the magazines, string them on the two clips we furnish, and fasten through the eyelets shown in the cut.

# TUSKA

\$1.10



Type 211

\$7.00



Type 233

\$1.10

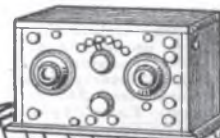


Type 212

The Tuska Variocoupler is completely moulded. The rotor and primary are wound with green silk wire. Not only is the instrument striking in appearance but highly efficient in design.

Send 5c for Catalog #2

**THE C. D. TUSKA CO.**  
HOADLEY PLACE, HARTFORD, CONN.





—FOR YOUR CONVENIENCE—

# QST'S INDEX OF ADVERTISERS IN THIS ISSUE

Aeame Apparatus Co.....	94	Massey Radio Co.....	133
American Electric Co., Inc.....	88	Michigan Radio Co.....	132
American Radio & Research Corp.....	Fourth Cover	Missouri Radio Supply Co.....	105
Anthracite Radio Shop.....	92	Mu-Rad Laboratories.....	104
Apex Radio Co., Inc.....	86	Murdoch Co., Wm. J.....	89
Atlantic Radio Co.....	Second Cover		
Atlantic Pacific Radio Supplies Co.....	85	Nash Electrical Service Co.....	94
Automatic Electrical Devices Co., The.....	132	Newman-Stern Co., The.....	130
		Novo Mfg. Co.....	123
Banister & Pollard Co.....	90		
Benwood Co., Inc., The.....	99	Pacent Electric Co., Inc.....	123
Brady Elec. & Mfg. Co.....	76	Paquin, J. M.....	122
Brandes, Inc., C.....	78	Patterson, M. B., 5Cl.....	122
Bridgport Storage Battery Co.....	78	Philadelphia Radio Sales Corp.....	128
Bunnell & Co., J. H.....	75	Pittsburgh Radio & Appliance Co., Inc.....	102
Burgess Battery Co.....	77	Precision Equipment Co., Inc., The.....	108
Burr, Roy C.....	120		
		QST Binder.....	142
Chelsea Radio Co.....	96	Quality Radio Shop.....	124
Chicago Radio Apparatus Co., Inc.....	93		
Clapp-Emetham Co.....	101	Radioart Store, The.....	98
Clarion Radio Shop.....	116	Radio Audion Co.....	1
Clark & Mills Electric Co.....	183	Radio Construction Co.....	133
Classified Advertisements.....	140	Radio Corporation of America.....	111
Condensite Company of America.....	91	Radio Electric Co., The.....	106
Connecticut Tel. & Elec. Co.....	Third Cover	Radio Equipment Co., (Boston).....	114
Continental Electric Co.....	132	Radio Engineering Co.....	132
Continental Fibre Co., The.....	86	Radio Laboratory.....	130
Continental Radio & Elec. Corp.....	144	Radio Panel Shop.....	183
Corwin & Co., A. H.....	75	Radio Panel Specialty Co.....	100
Coto-Coll Co.....	127	Radio Service Laboratories.....	102
Crosley Manufacturing Co.....	134-135-136-137-138-139	Radio Shop of Newark, The.....	98
		Radio Specialty Co.....	119
Davis & Co., C. A.....	88	Radio Testing Station.....	130
DeForest Radio Tel. & Tel. Co.....	80	Ray-Di-Co.....	96
Delancey, Felch & Co.....	110	Reynolds Radio Co., Inc.....	88
Devon Electric Co., Inc.....	86	Rhamstine, J. Thos.....	112
Diamond State Fibre Co.....	88	Riggs Mfg. Co., The.....	112
Doubleday-Hill Electric Co.....	82	Riley-Klotz Mfg. Co.....	90
Duck Co., The Wm. B.....	107	Roller-Smith Co.....	108
DX Radio Co.....	84	Rose Radio Supply.....	98
Eastern Radio Institute.....	116	Scientific Experimenter, Ltd.....	80
Eby Mfg. Co., The H. H.....	110	Service Radio Equipment Co., The.....	106
Economic Appliance Co.....	120	Ship Owners Radio Service, Inc.....	104
Electric Specialty Co.....	94	Shotton Radio Mfg. Co., The.....	124
Electrose Mfg. Co.....	4	Shreveport Radio Supply Co.....	133
European Radio Co.....	118	Signal Electric Mfg. Co.....	109
		Simplex Radio Co.....	92
Federal Tel. & Tel. Co.....	82	Solberg, W.....	122
Firth & Co., Inc., John.....	130	Southwest Radio Supply Co., The.....	84
Formica Insulation Co., The.....	83	Star Cabinet & Radio Shop.....	82
France Mfg. Co.....	100	Standard Assembling Co.....	122
		Stern & Co., Inc.....	81
General Apparatus Co., Inc., The.....	121	Stramey Products.....	124
General Radio Co.....	76	Stromberg-Carlson Telephone Co.....	129
Grebe & Co., A. H.....	79		
		T & H Radio Co.....	100
Hartford Battery Mfg. Co., The.....	183	Telephone Maintenance Co.....	131
Hatfield Electric Co.....	92	Thordarson Electric Mfg. Co.....	87
Hi-Gee Radio Mfg. Co.....	116	Taft, W. & G.....	110
Hommel & Co., Ludwig.....	110	Tuska Co., The C. D.....	142
Horne Mfg. Co., The.....	118		
Hull & Co., S. W.....	2	U. S. Light & Heat Corp.....	75
Hygrade Electrical Novelty Co.....	90	United Electric Stores Co.....	130
		Universal Radio & Mfg. Co.....	114
Ideal Apparatus Co.....	128		
		Virginia Radio Co.....	84
Johnston, Chas. H.....	124	V-De-Co.....	126
Jones, James H.....	112		
Joy & Kelsey.....	104	Western Radio Electric Co.....	114
		Weston Electrical Instrument Co.....	115
K Electric Co.....	124	Whitall Electric Co.....	117
Kalb Electric Co.....	96	Willard Storage Battery Co.....	8
Karlowa Radio Co.....	125	Wireless Mfg. Co.....	95
King "Amp-li-tone", The.....	133	Wireless Press, Inc.....	108
Kimley Electric Co.....	106	WorkRite Mfg. Co., The.....	113
Klaus Radio Co.....	102		
Kloesner Improved Apparatus Co.....	126		
Kuebler Radio Co., The.....	108		
Magnavox Company, The.....	120		
Marshall-Gerken Co., The.....	97		

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COMPLETE \$258.50

*Erect aerial, hook on batteries,  
insert tubes and listen*



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**T**ESTED, proven units are combined in this outfit to make a complete set without a weak link. The tuner is the famous Paragon R.A., Ten regenerative receiver,—the worlds leading short wave tuner. To this is added its companion instrument, Paragon DA-2 Vacuum Tube Detector and two-step amplifier. Then comes the Radio Magnavox, which sends wireless telephone concerts as well as code, clearly all over a room or hall without detracting from the original tonal qualities. For sharp tuning head phones are provided—Baldwin type "C" standard of the world. Every item of accessory equipment is supplied—of a quality consistent with the Paragon instruments that form the heart of this set. This includes 3 Radiotron vacuum tubes, 3 Eveready "B" Batteries,

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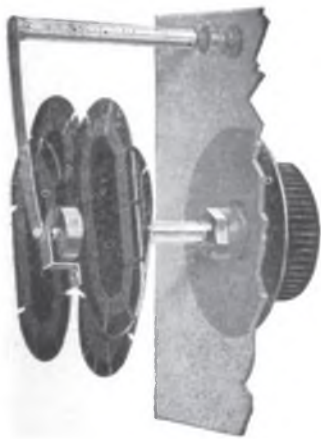
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**RADIO AND ELECTRIC CORP.**  
**DEPT. B4. 6 WARREN STREET, N. Y. C.**

*"New York's Leading Wireless House"*

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## A New Variometer

*With Four Outstanding Advantages*



Large ratio of maximum to minimum inductance. (Increases wave length range.)

Weak external field, uni-directional.

Requires small space.

Permanent in adjustment.

This new CONNECTICUT Variometer is furnished mounted on panel, in mahogany finished box, or unmounted.

The rods for mounting are threaded to fit panel up to  $\frac{1}{4}$  inch thickness.

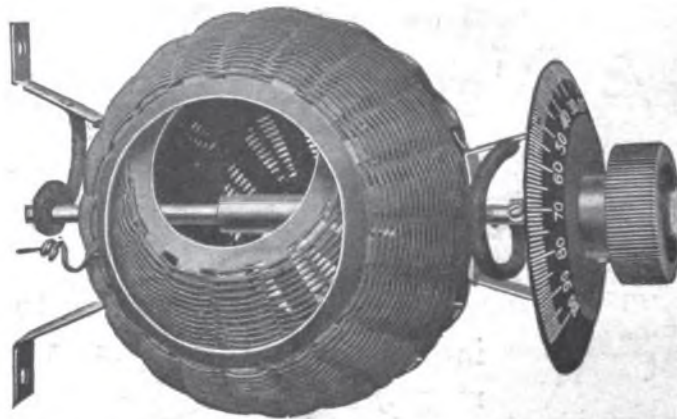
This and other CONNECTICUT Radio Apparatus are described in our new Bulletin A9.

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There are SIX styles of Amrad Variometers and Vario-couplers—each a BASKETBALL. The unique method of winding, high electrical efficiency, trim appearance, lightness and rigidity, have won for BASKETBALLS an enviable reputation.

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Variometers: \$6.10, \$6.75 and \$9.50.

Vario-Couplers: \$6.90, \$7.50 and \$13.00.

*Bulletin O mailed Free on request, describes the Amrad BASKETBALL Variometers. Complete catalog 10 cents in stamps.*

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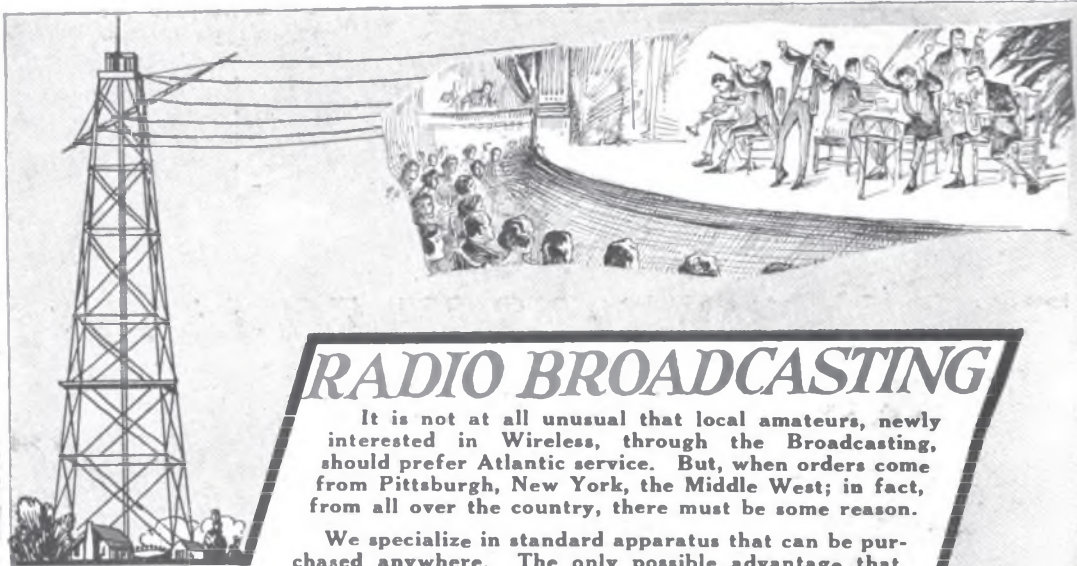
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**AMERICAN RADIO RELAY LEAGUE**  
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## **RADIO BROADCASTING**

It is not at all unusual that local amateurs, newly interested in Wireless, through the Broadcasting, should prefer Atlantic service. But, when orders come from Pittsburgh, New York, the Middle West; in fact, from all over the country, there must be some reason.

We specialize in standard apparatus that can be purchased anywhere. The only possible advantage that makes thousands of amateurs prefer to deal with Atlantic is in the service they receive.

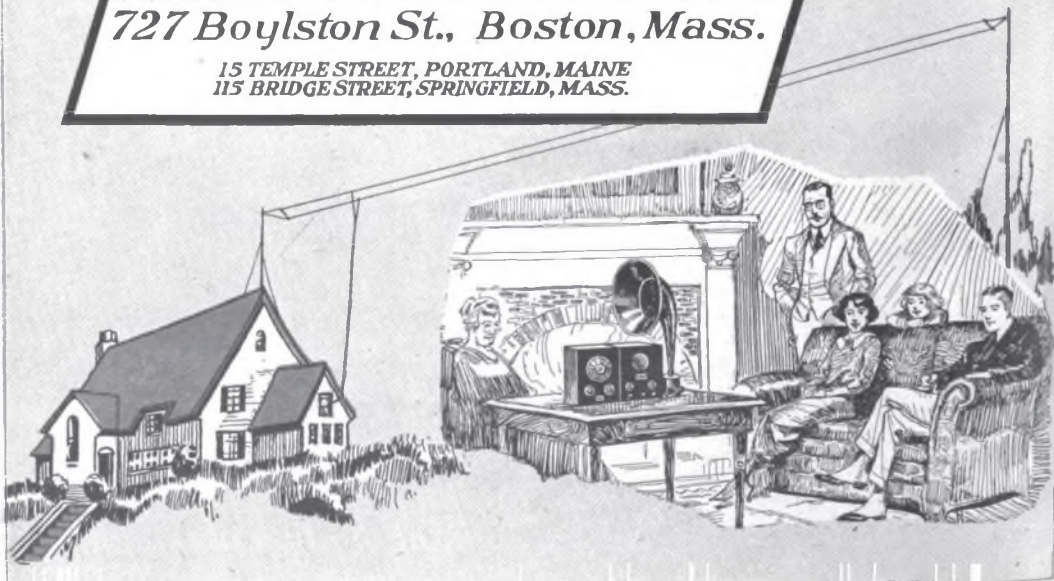
Of course, we have established a reputation for answering all inquiries frankly and promptly. When we offer suggestions to a customer, we never recommend an expensive outfit when a \$25.00 or \$50.00 set will meet his particular needs. Many customers leave the entire choice of their equipment to us and in every case, they have expressed complete satisfaction with our choice.

We have prepared three Bulletins, 19, 20 and 21 which describe a wide choice of standard equipment to receive wireless telephone broadcasting. These will be sent free on request to any reader of QST.

The Radio Corporation's "C.W." manual and catalog 25c. per copy.

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**727 Boylston St., Boston, Mass.**

**15 TEMPLE STREET, PORTLAND, MAINE**  
**115 BRIDGE STREET, SPRINGFIELD, MASS.**



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Price  
AUDION  
and  
Receptacle  
\$4.50



AUDIO  
FREQUENCY  
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RADIO  
FREQUENCY  
AMPLIFIER  
  
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## Full Size FIRST UNIVERSAL AUDION

Manufactured under DeForest Patents No. 841,387 and No. 879,582

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RAC-3 Audions are not critical to A or B battery adjustments.

Low battery consumption. Filament current 0.5 amp. at 4 volts, maximum. Plate voltage 2 to 22 volts.

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Perfect oscillation for use in regenerative circuits.

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Maximum insulation between filament plate and grid terminals resulting from new type of tube and receptacle.

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Audion base caps and Receptacle block moulded Grade A Condensite.

Receptacle block is designed to permit built-up panel construction for amplifier panel. Circuit connections may be made from front, back or sides.

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This tube is not sold or purchased to be used as a detector of wireless waves. Any use or sale of it for such use renders the vendor or user liable to prosecution for infringement of patent. This tube is sold for use in tandem with another device acting as a detector for the purpose of amplifying either radio or audio frequency currents or as a generator of high frequency electrical oscillations.

After November 7th, 1922 the RAC-3 Audion will be available as a Detector and no longer limited for use in tandem with another device acting as a detector.

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# A Real Radio "B"

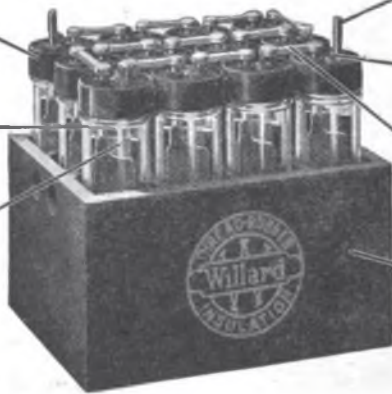
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Glass Jars. Leak-proof. Allow clear view of solution-level.

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They may be strong mechanically yet be attacked by acids.

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**INSULATION**  
**MADE IN AMERICA**  
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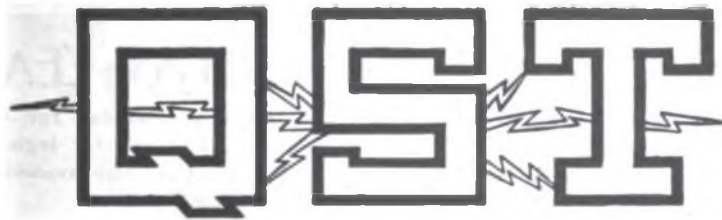
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# The Official Organ of the A.R.R.L.

VOLUME V.

MAY, 1922

No. 10

3ZO—An Amateur Paradise	7
Rotten Broadcasts	<i>The Old Man</i> 12
An Efficient Tuner for Short Waves	<i>H. J. Goddard</i> 15
The Governors-President Relay	<i>K. B. Warner</i> 17
Police Chiefs Relay	<i>F. H. Schnell</i> 21
An Electromagnetic Changeover Switch	<i>Harold L. Olesen</i> 22
Report on Receptions by British Amateurs in the Transatlantic Tests, December, 1921	<i>Philip R. Coursey</i> 23
The Importance of High Voltages for Amateur Spark Communication	<i>S. Kruse and D. W. Richardson</i> 27
Hawaiian Relay Established	32
Editorials	33
The Operating Department	35
Who's Who— <i>B. W. Benning, A. J. Lorimer</i>	46
With the Affiliated Clubs	47
"Strays"	49
With Our Radiophone Listeners	51
Calls Heard	55
Amateur Radio Stations—5HK, 9AAS	61
Radio Communications by the Amateurs	64
Classified Advertisements	132
QST's Directory of Advertisers	135

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THE AMERICAN RADIO RELAY LEAGUE, Inc.  
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A Magazine Devoted Exclusively to the Radio Amateur

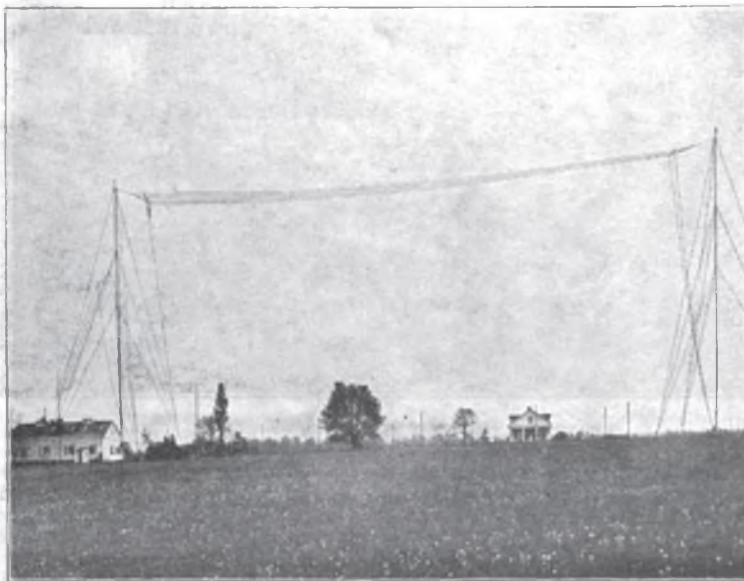
### 3ZO---An Amateur Paradise

**R**ADIATES there a ham with soul so dead who never to himself hath said—"Gee, if only I had the jack wouldn't I have a bird of a station!"

Such a station is that of Mr. Horace A. Beale, Jr., of Parkesburg, Pa., a director in our A.R.R.L. In fact Mr. Beale has three of them, 3ZO, 3XW and 3OI. This story, however, concerns itself chiefly with the main station, 3ZO. It almost ruins

running everywhere from single 5-watters up to sets using four 250-watt tubes? Say, how would you like to be turned loose in such a place for a week or so!

Just such a place Mr. Beale has built for himself at 3ZO. It is impossible to do this station justice in our limited space, and the photographs and descriptions herein can only hope to cover the high-lights of this remarkable station.



The Aerial System at 3ZO

us financially to pay for cuts of 1% of the good photographs available of 3ZO alone, so 3XW and 3OI are reserved for a future occasion.

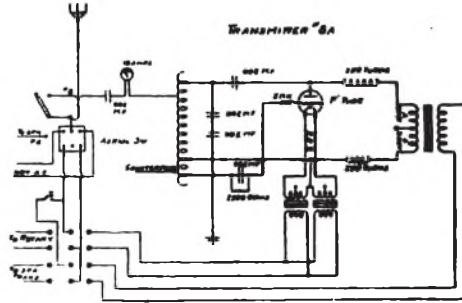
Say, fellow amateurs, can you imagine a station with a miniature Bureau of Standards for a "shack", a half dozen or so good masts, four or five operating rooms, ten receivers and twenty transmitters, the latter

First off, 3ZO has for its quarters the entire second story of a frame building, especially outfitted for the purpose. There is a main office and operating room, several small sound-proof operating rooms, a complete work-shop, a store room, a sleeping room, a kitchenette—everything. All the walls are lined with sheet zinc for shielding. An elaborate plug and jack system makes

it possible to plug in on any receiving booth from any other receiving station, and enables the owner to be plugged in anywhere from his desk chair.

Mr. Beale has surrounded himself with an efficient personnel for handling the activities of his station. Mr. Thos. Appleby, Jr., of Philadelphia, is the radio engineer of the station and has designed practically all of the equipment. The station is under the direction of Mr. Wynne Colman, who also builds the apparatus to Mr. Appleby's specifications, assisted by Mr. Edward Sandrus. There are two operators, Miss Bertha Hilton, "B", and Mr. Fred Mergenthaler, "F". Miss Cora Hilton, stenographer and record-keeper, and Mr. Warren Thompson, official chauffeur for

a description of the masts. There are several small ones but two real ones that



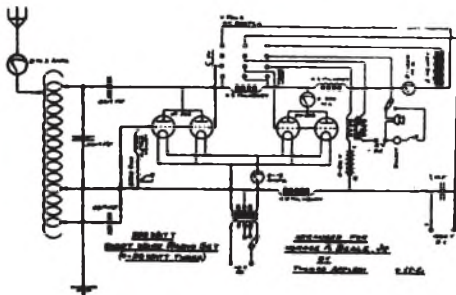
are worth talking about. These are of



The Main Operating Table

the traffic department, complete the personnel.

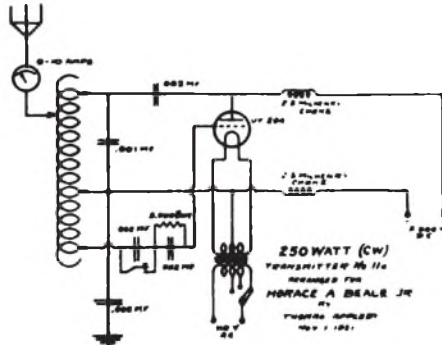
Pausing to get a good breath, we pass to



welded steel tubing, 200 ft. overall, standing 15 ft. in concrete and rising 185 ft. above the ground. Spaced about 375 ft. apart, these masts support a 5-wire flat-top on which a DeForest 1/2 k.w. arc set operates on a wave length of 2500 meters under the call 3XW. Up to a short while ago the 875-meter work was done on a slanting flat-top 145 ft. long which was attached to the nearest mast at a point 105 ft. above the ground. More recently the big flat-top has been taken down and a single wire 200 ft. long suspended by hempen ropes between the two masts, with a slanting lead about 200 ft. long running down to the station. The aerial has a fundamental of about 500 meters and by means of a series condenser transmission is

effected on 375 meters with much better results than on the old slanting flat-top.

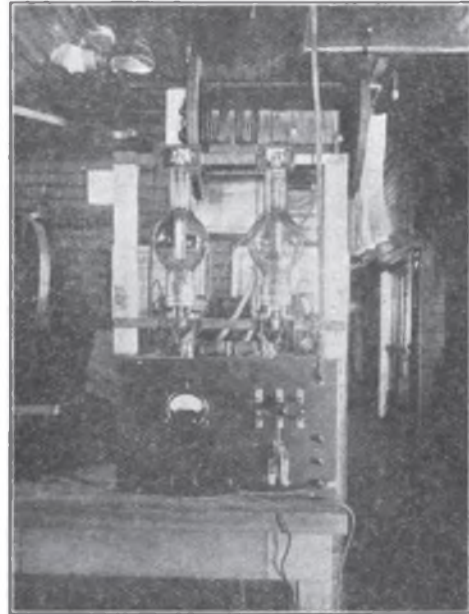
Besides a half-dozen or so DeForest phones and various home-made phones of small power, something like fifteen transmitters have been designed at 3ZO and most of them actually constructed. Not all of them, of course, are still in commission, and we don't even know what some of them were. No. 4 was the spark set as shown in one of our photographs, but this has now been junked and only C.W. is used. No. 5 is a phone using four 50-watt tubes, two as oscillators and two as modulators, which is the beautiful cabinet set with the slanting panel to be seen in the same photograph with the spark, and of which we present the wiring diagram. No. 8, behind the receiving set in the same photo, was a 375-meter telegraph set using four 50-watters in an A.C. self-rectifying circuit. Since the view was made this set has been replaced by No. 8-A, using a single 250-watt "P" tube, wiring diagram shown, also



self-rectifying A.C. No. 11-A is a similar set using one U.V.204 but on 3000 volts D.C., and its hook-up also is presented. No. 13, of which we have a photograph, is a beast employing two 250-watt U.V.204's on 375 meters, also self-rectifying. Then there's No. 14, a 200-meter transmitter

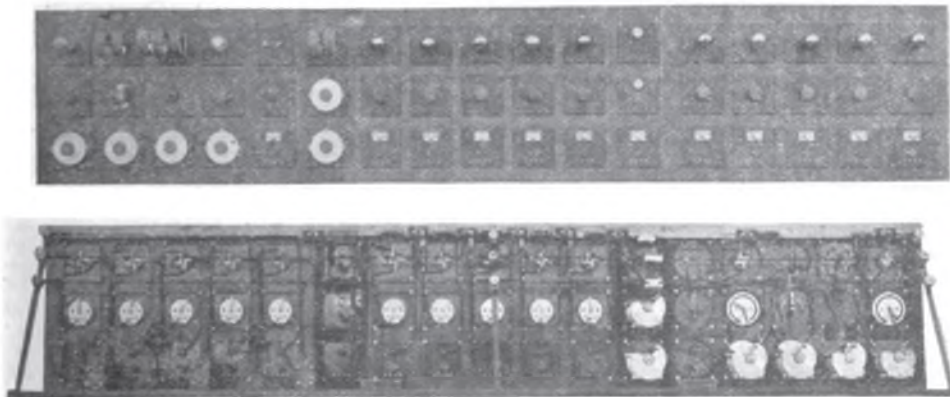
working on a small two-wire aerial we forgot to tell about, which uses two U.V.203's with A.C. on the plate. The diagram for this set is shown too.

No. 11, the pride of them all, is still in course of construction and considerable ex-



The No. 13 Transmitter

perimenting is being done with it to get all features correct before it is finally built up into a good job, as all of 3ZO's sets are. In the photograph, then, we see a temporary panel of boards on which the various meters and controls are mounted until the preliminary work is completed. This set has a main battery of four 250-watt tubes and is a phone, two of the tubes being



Front and rear views of the Superheterodyne





machine, giving 110 volt direct current for any desired purposes, and a small Crocker-Wheeler motor-generator unit giving 500 volts, neither of which show in our photo. At the other end of the room are two more machines. We forgot to ask what the one was against the distant wall, being lost in admiration for the beauty in the foreground. This is a special machine, of Eck make, rated at 1.5—2 k.w. at 3000 volts output. At the far end is the induction motor which drives it and at the near end is the separate excitor for the generators, while the latter, two in number, are in between all coupled in a row thru flexible couplings. It is a beautiful machine and incidentally attains full speed in two seconds.

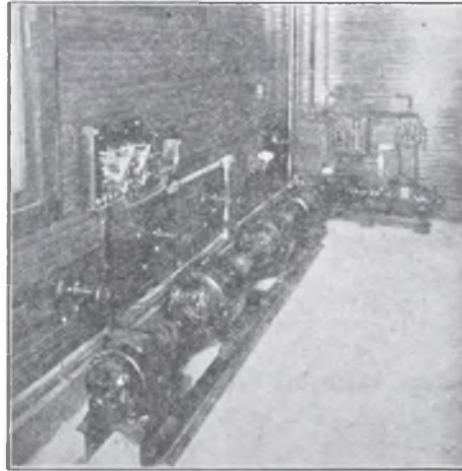
In the line of receiving apparatus 3ZO



How'dya like to have a mast like this?

is almost as well outfitted as it is in transmitters. There's a honeycomb set with built-in detector-three-step, a miscellany of outgrown sets, while the main dependence is put upon a Grebe CR-3 with Grebe companion tube equipment. In one of the smaller operating rooms where the No. 5 phone set is now located is an "Aeriola Senior" operating with two steps of audio amplification which Mr. Beale has built up using the new Westinghouse coated-filament tubes which are a standard part of the "Aeriola Senior", in conjunction with Acme transformers. In another room with the 200-meter C.W. set is a Westinghouse "RC" and likewise an Armstrong superheterodyne built up at the station. This is an immense set, stretching all the

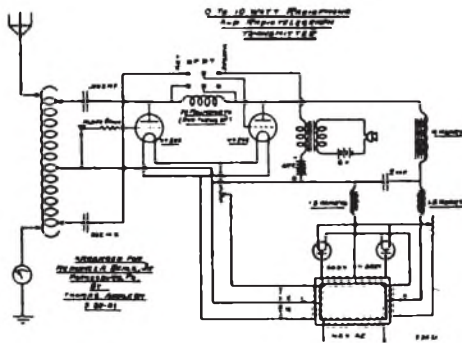
way across the room, and is composed of fifty-one DeForest "units". Referring to the photographs, three sets of honeycomb coils are to be noted. The first two are for



A Corner of the Generator Room

the separate oscillator; the next group of three are for the first detector which by the way uses regeneration, whence the third coil; while the next pair couple on the radio-frequency amplifier of five stages. The last five tubes are audio amplifiers. No provision seems to have been made for a second detector in this set, nor does it appear in the wiring diagram we have, and this probably accounts for the rather unsatisfactory performance so far obtained from it.

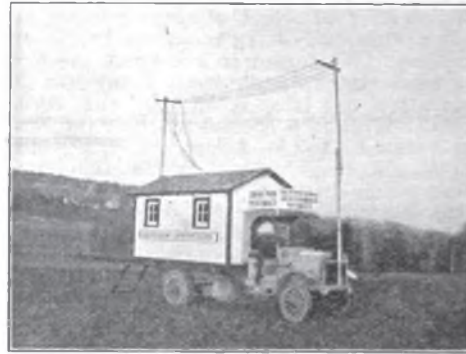
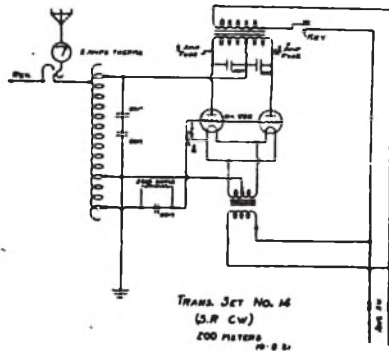
Then there is 3OI, a portable station consisting of a small special house mounted



on a 5-ton truck and sporting a neat little flat-top overhead. Inside the house is a roomy operating table, an oil stove, and a Delco gas-engine lighting outfit which also furnishes juice for sets from time to time installed therein. 3OI is devoted primarily to

the interests of the Chester County Radio Assn., an organization of several hundred

We could go on and on—there's ten times as much equipment and supplies at 3ZO



Portable Station 301

members which has been fathered by Mr. Beale.

as in the average supply store—but what's the use? 3ZO is a monumental station, and Mr. Beale is to be congratulated!

## Rotten Broadcasts

By The Old Man

**S**AY, Son what are we coming to, anyway! If this daggone broadcast stuff keeps on increasing something is going to bust open. The air is so chock full of jingles and jazz and foxtrots and speeches and advice as how to peel potatoes and bedtime bunk that it isn't fit to breathe any more. Darned if I don't think folks will be going crazy pretty soon.

Time was when a man could go home after work, eat his supper and read the paper, play with the kids awhile, and then put the phones on and spend a pleasant evening telegraphing around over the various states, passing the time of day with old friends and making new ones, while the little wife sat alongside fixing the socks and the children's clothes. Now-a-days it takes a brave man to light the bottles and put on the phones. From three hundred meters to four hundred it is one grand smother of stuff they call music and speechifying and what-not, all tangled and snarled up until if you listened to it long enough the bats would begin to show in your belfry, as sure as hellsamantrap. I used to be able to stand for it, when it was only 8XK and later, KDKA, and a couple of amateurs grinding out bum phonograph records. But when the whole blooming country starts to yapping and yowling and hollering, and all of them trying to bawl their heads off on three hundred and sixty meters, it just simply unseats a man's reason. I tell you one thing—if they don't go easy pretty soon, not only will the great American public degenerate into a lot of snickering imbeciles but three hundred and sixty meters

will get worn out and we shall never be able to get her back to normal. Just think of asking any wave length to carry all this hogwash, night after night, month in and month out! Old three sixty was a good old wave, but she will never be able to look her neighbors in the face again when these broadcast hounds get through with her. I swear I don't believe she will ever be able again to carry a respectable dot and dash.

What in blazes they all think they are getting out of broadcasting beats me. What can any one possibly get out of shooting a lot of stuff out that he can't tell about himself? He really does not know if it is getting out good, bad, or indifferent, nor whether any one is listening to him or not. And yet he will squander his money and sit up all night and wear his nervous system down to the quick, building a broadcast station so he can play worn-out phonograph records into it, hour after hour. What possible fun can there be connected with this sort of thing!

It makes my blood boil sitting at my little old set and listening to this butchering of perfectly good radio weather. Who started this foolish business anyway? And what in heaven's name are you chaps up there in Hartford doing, that you let this daggone sloop get going? You have the Wouff Hong right there at hand. Goshamighty I would have worn the old blunderbuss out before I would have let these musical itsaboos get started. Some day I am going to crank up the flivver and run up there to Headquarters and commandeer that Wouff Hong weapon and also the Bloody Retty-

snitch, which I am told Kruse built down at the Bureau of Standards. Then by Heck, with the Uggerumph between my teeth and possibly with my Old Betsy going along with her wild-cat screech, just to give atmosphere to the occasion, I am going to run amuck among the broadcasters. There will be less and better broadcasting and the fear of God will be in the heart of every designer of a modulation transformer when I get through. By gravy, I have remained quiet for some time, after smashing in the slats of the Young Squirt and strewing his vitals over the landscape, but I'm not going to be meek and humble any longer. My dander has risen, I smell of burning insulation, and nothing but gore and wrecked radio telephone broadcast stations is going to satisfy me.

I don't blame Mr. Hoover for calling a Conference. I would have called somebody a worse name than that. It's high time some conferring was done. In fact, it's time somebody conferred a wallop upon somebody and got this mess straightened out.

Why Mr. Hoover overlooked me and my Old Betsy in this matter passes understanding. Between Old Betsy and me we would have saved a lot of valuable time, and report has it that Mr. Hoover believes in saving time. All that would have been necessary would have been for Mr. Hoover to advertise for every owner of a broadcast station to come to Washington and take his place in the line. Then I would have borrowed a respectable 220 volt, five horse induction motor from "LC" over at NSF and hooked her up to Old Betsy. As fast as Mr. Hoover had questioned the Broadcasters and satisfied himself as to their guilt, I would feed them feet first to Old Betsy. We could have turned the residue over to the garbage collectors to haul away. A couple of days would have done the job. The five horse motor might have to be wiped off before we returned it to "LC" and possible the Old Girl might need some cleaning up, but that would have only taken a few minutes. Think what a lot of trouble would have been sunk for keeps. The air of an evening would have returned to its old-time sweetness. The kids could go on with their Ford coils and their sticky vibrators and their horrible fists, and at ten o'clock we older birds could have come onto the air and handled traffic and have had all the old time thrills and have got enough and gone to bed by midnight. Oh Boy! And to think it used to be that way once!

But 'tis not to be any more. The Secretary of Commerce saw fit to have me and Old Betsy remain in the Eighth District, and instead of spitting on his fists and wading in, with my assistance, he preferred to call in the High Brows and allocate wave lengths and urge in polite language that radio apparatus, controlled lock stock and

barrel by a certain corporation, be freely available and at reasonable prices. That's the gentlemanly way to do it, I confess. But dod blast my suspenders if I believe it will clear up the air around three hundred and sixty meters nor get fifty watt tubes down to four ninety eight in the department stores. Gosh, but I wish he had consulted me in this matter. By Golly, you know boys, I believe I would have made a record on cleaning up that job.

Daggone that squawking soprano at KTPA! She certainly has yowled enough by this time. Gurrdd, but why did she select that thing to sing! Sounds like a funeral dirge badly out of adjustment. I



"I would feed them feet first to Old Betsy"

wonder if the proprietors get samples of the goods before they accept them. Impossible! They certainly never would have put this squall out onto the air if they had heard it first. Some kind of inspection is needed. Zowie, she puts my teeth on edge! Oh dear, I wish I were dead! That female has catawalled now for a full fifteen minutes. Here Kitty, I need thee. Poor woman, I suppose somebody loves you. I'll bet a cooky you haven't an idea in the world what you are doing. Could any woman in her right mind yowl away like that if she realized a quarter of a million of her fellow countrymen were writhing in anguish and wishing to gawd she would hurry up and get it over with. Say, as I sit here smoking myself to death and cursing broadcasting and waiting for the time to come when I can tickle that old key, I can't help thinking of my sins and how different everything is in radio from what it used to be. It used to be that we had only ourselves to fight. It was all in the family then. But now the public are in the game. The dumb-bell with the hundred dollar receiver—the kind that knows no difference between 200 and 500 meters—is the one we must watch now. He wants SILENCE, and doggone little of that, and every time he hears any-

thing in the air except what he wants to hear, whether it is static or induction or a bubbly "B" battery, he froths at the mouth and writes his chum Senator Snigglefritz in Washington that the amateurs are spoiling this wonderful radio which is just beginning, and that a law ought to be passed at once shutting the amateur up. And by Heck, the old fat slob



"Final Authority has started up!"

firmly believes he is right. He really believes that Citizen Radio began with his buying a receiving set and learning how to get KDKA. He never heard of our A.R. R.L. He never has had a glimmer pass over his benighted intelligence that the amateurs ever did anything but annoy broadcast listeners. He is so sunk in black ignorance that he never heard of Paragon Paul Godley, nor 9ZN nor K. B. Warner, nor the Candlers of St. Marys, nor the Transcons nor Fred Schnell, nor 4GL, nor by golly, T.O.M. He is a solid citizen and consequently he is a bad one to have fighting you. But some day the light of knowledge will bore through his dome and he will be around wanting to join the Radio Club and asking what's the best way to learn the code.

Listen—yes, the Pittsburgh Yowler has finished. Mr. Flannigan is now going to favor with a viol. solo, with Miss O'Houlligan at the piano!! Lord help the poor suffering listeners to-night! Listen to that piano thump, and mind the vacant spots in the violin playing. This will most likely be another ten-minute bout. And all this perfectly good battery juice going to waste. I wonder why I don't kick this junk into the river and take up auction bridge? Gee, but I wish I were dead!

Ohmy gawd Final Authority has started up! That's his fone. I know the sixty cycle hum. Now listen to him count and whistle "Rock of Ages". He's off. His voice sounds as though he were inside a tin

cracker box. Listen to her wheeze. Blot out everything from the bottom of the scale on my tuner up to the top of the long wave coil. Ye gods and little fishes! I simply cannot endure it. Let's put out the bulbs and write a bit to kill time.—Stand still a minute, Kitty.

My next door neighbor has it in for Final Authority. Somehow he found out who was responsible for the big noise in the air and he asked me the other night whether something couldn't be done about him. I remember the occasion when Final got in wrong with my neighbor and it is worth telling, while we wait for the broadcast bull to spend itself. It seems that Final had arranged a coup, as the say in La Belle France. He had copped the big singers at the concert that came to town and after their part of the programme was finished, Final hustled them out to his house and got them to sing into his phone. He had just secured his limited commercial broadcasting license and he thought he was some hot stuff. Some how or other, his phone worked well that night and I will have to confess the singing was pretty good. It woke up the little wife at our house and she paid attention for the first time. She considers most radio phone music as not worth spitting on.

It so happened that on that same night my neighbor decided to give a little phone party at his house. He told me his guests arrived and they waited for KDKA, Detroit



"Wait until the dumb-bells get poisoned with these little dit-dit's"

and Washington and had just heard the "Detroit News" tell something they were going to do, when—crash—bang—Final Authority came rattling the diaphragms with his special concert. Detroit was blanketed, as was everything else. The guests thought it was Detroit and were thrilled to the marrow bones. But Neighbor Jones had to let the cat out of the bag, and he said that when they found that it was only coming from their own town they lost all interest. They wanted to hear De-

troit. The rottenest jazz from Detroit would have been ten times more interesting than the finest stuff the world afforded from their own town. They wanted the thrill of long distance, and I had to smile as I thought of what we amateurs have been through all the past years. The thing that has held us together and kept the interest year after year has been just this very selfsame long distance stuff. Daggone if I don't believe it's going to be the same with these dumb-bells. They are going to get fed up with the near-by stuff and the concerts and the speeches giving detail specifications as to how to peel potatoes, and one by one they are going to begin wondering about the little chirps and the little buzzings down on two hundred. By and by some of them will get to know the numerals when they hear them, and then they will borrow a call book somewhere, and when they get so they can catch the district the signal is coming from, it will be all off for the cheap broadcast stuff. They will either slough off completely and sell their sets or will get the bug and become amateurs.

That's my guess and I'm not far wrong, for I see the rash breaking out on Neighbor Jones already. Say, isn't it funny, how those little dots and dashes get you? DAH-DAH-DAH-DAH—DIT. DIT-DIT-DIT-DIT-DIT. DIT-DAH-DAH-DAH-DAH. DAH-DAH-DAH-DIT-DIT. Those two quick little DIT-DIT-s on the end mean the good old EIGHTH DISTRICT, and I suppose every fellow has the same home feeling about his own district. Wait till the dumb bells get poisoned with these little DIT-DIT's and it will be all off with the broadcast concerts and the lectures on potato peeling.

Well, it's ten thirty, boys, and there is old 1AW calling 3ALN and telling him "msgs", and his fist sounds like it might be the Old Chief at the key. Gosh, but it sounds good. Guess I better oil up the Old Girl and get in myself. Seems like a good night and we ought to clear the old pin off by the looks.

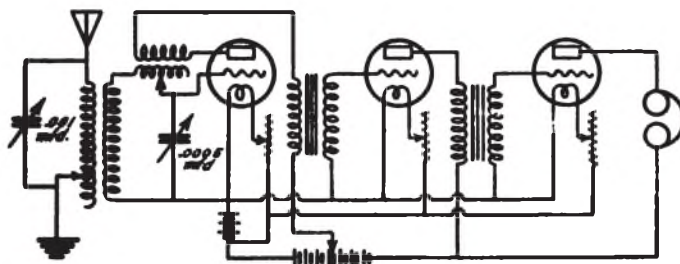
Well, old timers, 73 to all of you, and by Heck let's hold fast to our good old dot and dash stuff. GN SK

## An Efficient Tuner for Short Waves

By H. J. Goddard, 9ZX, 9EE

**T**HE short wave tuner described in the following article is offered to the amateur, not as a substitute for an expensive variometer set, but rather as a tuner, easily and cheaply constructed, that will prove nearly if not entirely as efficient as the best standard receivers on the market today. Its range is approximately from 180 to 600 meters, it oscillates freely over the entire wavelength range, and functions equally well

scribed to the writer by Mr. H. J. Burhop, 9ZL, this tuner was designed, so far as I know, by Mr. Melvin Herman, 9FN, and to both of these men I am indebted for the constructional data. I would not go so far as to say that this tuner is better than the variometer set in question; but I do say that in my case at least, it has proven only slightly less sensitive than the variometer set and considerably more selective.

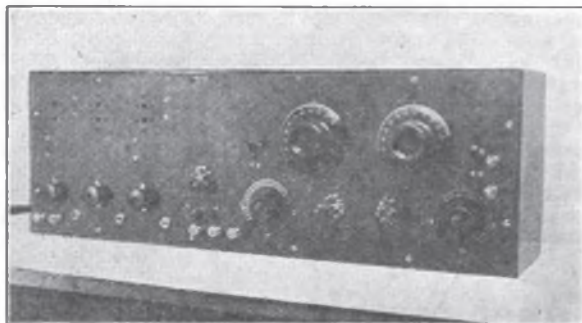


for spark, C.W. or phone reception giving wonderful amplification of all signals. It belongs to the tickler type of receiver and uses single-layer coils as inductances. It has been pointed out to the writer that its dead-end losses and the use of capacities are detrimental to efficiency; but, be this as it may, the amateur who constructs one of these tuners is very likely to do as have several others who have tried it—discard his variometer set. Originally de-

Briefly, the tuner consists of four coils. These coils may be wound upon cardboard tubes if desired but bakelite or formica tubing on account of its greater strength and permanence is to be preferred. Two of these tubes are 5 inches inside diameter and two are 4 inches inside diameter. All four are 1½ inches in length (or width). Upon one of the 5 inch tubes is wound 24 turns of No. 26 DCC wire tapped every 6 turns (4 taps). This is the primary wind-

ing. The other 5 inch tube is made up exactly the same as the first and constitutes one half of the secondary winding. Upon one of the smaller tubes wind 24 turns of No. 26 DCC, but taking off no taps; this is the second half of the secondary winding. The remaining small tube is wound with 36 turns of No. 26 DCC, no taps. This is the tickler winding. The direction of winding is immaterial, but all windings may well be in the same direction.

The untapped portion of the secondary



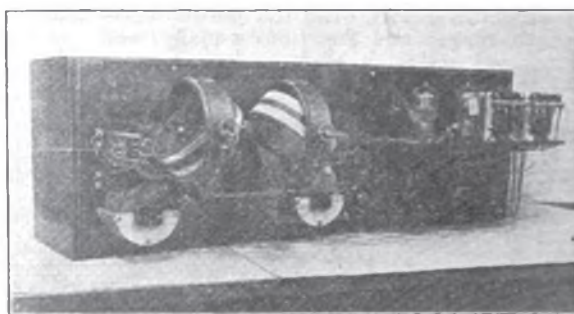
is now mounted upon shafts so that it will rotate within the primary winding. In like manner, the tickler winding is mounted to rotate within the tapped portion of the secondary. We now have what amounts to two variocouplers. These are mounted upon the panel, the two portions of the secondary connected in series and the primary and secondary taps brought out to switches upon the panel. The ends of the tickler winding are connected to the plate and phones as usual; the terminals of the secondary are attached to the grid and filament, and the primary connected to the aerial and ground. A 43-plate variable condenser is connected through a switch so that it may be placed either in series or shunt with the primary and a similar condenser, but of 23-plate size, is arranged so that it may be either shunted across the secondary or cut out altogether. The writer recommends that condensers equipped with verniers be used since the set tunes very sharply.

#### Suggestions on Operation

To a person unaccustomed to this tuner, it is likely to be disappointing at first. Its selectivity is such that it may be discarded before it is given a fair trial. It is usually best to bring the tickler control nearly to the oscillating point at the outset then varying the primary and secondary controls until the signal is heard, then reducing re-

generation slightly until the adjustment of the primary and secondary are completed and the signal strength is the greatest that can be obtained without oscillation. In general, let the inductance predominate. If now the tickler control is manipulated the signals will come in greatly amplified. This tickler control, however, is very critical and a change of even one degree on the scale will make a world of difference.

It will be noted from the accompanying photographs of the writer's set that the condensers are mounted upon the lower portion of the panel. This disposition of the condensers places them where they may be controlled with the arm resting upon the operating table being especially valuable in following a swinging signal which can usually be done by varying the vernier of the secondary condenser without touching the other controls. It might be pointed out that the writer's set is built left-handed; in other words the condenser and switch at the right control the primary while those on the left control the secondary. This left-handed feature is carried throughout the entire set, the right hand tube being the detector, and successive stages of amplification being disposed at the left of the detector. This places the most frequently used controls nearer the body and in the most convenient position relative to the transmitting key. It will be found advantageous to shield the panel, at least in front of the tuner proper, either with tinfoil or copper sheets, these being



grounded. Shielding of some sort is almost a necessity; but the writer finds that shielding of the secondary condenser alone answers very well.

In conclusion the writer wishes to say that he will be very glad to answer any questions regarding the construction or operation of this tuner that may occur to the prospective builder.

## The Governors-President Relay

By K. B. Warner

**A**MATEUR radio again demonstrated its capabilities, and at a most opportune time in the legislative situation, in our A.R.R.L. Governors-President Relay on March 6th, 7th and 8th when messages to President Harding were received and delivered at the White House from forty of the forty-eight states. Messages failed to start from five of the remaining states, while three started but failed for one reason or another to reach Washington. Considering the bad weather that prevailed during much of the tests, that is a splendid performance and again we have the consciousness of a hard job well done.

### The Scheme

As announced in an earlier QST, the preliminary arrangements were very simple. Our Operating Department prepared a schedule of starting times and the Division Managers were asked to solicit or arrange for the securing of a message to the President from the Governor of each state in their respective Divisions. No hard and fast rules applied in this relay and the work was individual in each state, making real co-operation count. There was no fixed plan for handling the messages, no predetermined routes; they were to move on each of the three nights as opportunity afforded, in all the flexibility of routine relaying. The plan was remarkable in its success and we amateurs showed again that we are what one of the Governors called us: "Minute Men of radio".

### The Receiving Machinery

The Washington end was beautifully organized by the Washington Radio Club under the administration of its president, H. A. Snow, 3ZE. At a club meeting two nights before the tests the plans were completed and 3IL, Strang, the club's chief operator, selected as a concentrating station for the delivery of the messages; 3IL and 3ZE as control stations, and 3ZY and 3ALN as the operating stations to work with outside stations who had the messages. Both 3ZY and 3ALN are C.W. and do not interfere with each other. 3ZY was manned by its owner, L. M. Dunnam, and H. J. Wadsworth of 3JJ, while the operators at 3ALN were its owner, H. F. Hastings, and Snow of 3ZE. A perfectly working machine was the result and but one case of avoidable interference marred the performance.

On the first night, March 6th, the atmospherics were awful and logs from all over the country show that operating conditions were generally rotten thruout the land. Nevertheless 8 messages got thru these

almost impossible conditions, one direct from a state capital in the form of Connecticut's message which was picked up from 1AW by 3ZE, while 7 others came in by various routes. On the second night static was still bad at 10 p.m. but practically nil after midnight, and messages from 15 additional states were received besides a second receipt of many of the previous night. On the night of the 8-9th the air was very good and a total of 17 more states were corralled, making 40 in all. With 5 not starting and 3 failing to arrive we account for our 48 states. During this



last night as time grew short the gang automatically QSK's messages they knew were safe in Washington the preceding nights, relieving the air of this extra traffic, and all hands concentrated in an effort to locate the missing messages.

3ZY was the star of the Washington team with credit for 27 messages received, while 3ALN got 12; and one, Connecticut's, was received direct by 3IL and 3ZE. Out-of-town honors in the eastern states where the messages were concentrating go to 9ZJ, 4GL, 8AXY and 3ZO.

### Delivery of the Messages

A little unfortunately for us, right in the midst of the relays the President left Washington for a short vacation in Florida and was out of the city upon the conclusion of the tests. The messages were delivered at the White House on the 9th by the Washington Radio Club, accompanying the following letter, but had to await his return to the city.

2020 First S., N. W.  
Washington, D. C.  
March 9, 1922

Sir: The attached forty messages from Governors and State officials have been handled entirely by amateur radio operators who are members of the

American Radio Relay League. They are the result of a three days relay known as the "Governors'-President Relay" which was instituted and operated under the supervision of the League. The traffic was handled on the nights of March 6, 7 and 8 in accordance with the plan of operation mapped out by the Traffic Manager. Reception at Washington was effected by two stations of members of the Washington Radio Club which is affiliated with the American Radio Relay League.

The members of the League are always at your command and are willing to do anything in their power to further the interests of their country.

Very respectfully,  
(signed) Harry L. Strang,  
The President, Chief Operator,  
The White House Washington Radio Club

Upon his return the President acknowledged the messages with the following letter:

The White House,  
Washington,  
March 21, 1922

Mr. Dear Mr. Strang:

Returning from his brief southern trip, the President finds the radiograms of greeting from the Governors of States, which were gathered thru the interest and activity of the American Radio Relay League, and forwarded to him.

Availing himself of the courtesy extended by you, he will be glad if your organization will convey to the Governors his appreciations and thanks for their kindly expressions. He wishes me also to thank all the members of your organization who have participated in bringing to him this remarkable greeting.

Very sincerely,  
(signed) Geo. B. Christian, Jr.  
Secretary to the President.

#### The Messages

The messages are so interesting that we publish their full text below. We sincerely wish it were possible to give the complete routing of each message but logs are insufficient on some, the fact that some messages were duplicated on successive nights makes it impossible to identify the route of any given night's message, some moved by several routes, and in many cases they were copied out of the air by eastern stations and plunked into Washington ahead of their routine appearance. We will give with each message a list of stations known to have participated in its handling on some one of the three nights as gathered by an inspection of logs at hand, but wish it understood that the lists are not complete and in no sense accurately portray the route over which the respective message moved.

**ALABAMA**—Montgomery, Mar. 8.—His Excellency, Warren G. Harding, Washington, D. C.—Congratulations on reserve of radio minute men for national emergencies.—Thomas E. Kilby, Governor of Alabama. Moved 5XA to 4GL to 3ZY.

**ARIZONA**—Phoenix, Mar. 7.—Hon. Warren G. Harding, President, United States, Washington, D. C.—Congratulations on the magnificent heights of your first years administration.—Thomas C. Campbell, Governor of Arizona. Some real participation in this one: 6AAH, 6ZZ, 5IF, 9DSD, 9ACB, 90X, 8BBU, 8YN, 8VY, 8AGO, 8AXY, 8ALN, 8ZU, 4GL, 9KO, 9BED, 9DMJ, 8AGZ, 4ZC, 3ZY.

**ARKANSAS**—Little Rock, Mar. 8.—President Harding, Washington, D. C.—Greetings and felicitations on prospect of freeing ourselves of shackles of miles and slow delivery.—Thomas C. McRae, Governor of Arkansas. Known to have passed thru 5JD, 8AOI, 9AGR, 8FT, 8AJV, 8AJX, 8BBU, 8AXY, 8ALN.

**CALIFORNIA**—Sacramento, Mar. 8.—President Harding, White House, Washington, D. C.—California sends heartiest greetings and best wishes to you and Mrs. Harding.—William D. Stephens, Governor of California. Credited to 6GF, 7MF, 6ZX, 6ZAM, 9AVZ, 5ZA, 9DZJ, 9ZJ, 3ZY.

**CONNECTICUT**—Hartford, Mar. 6.—President Harding, Washington, D. C.—Connecticut congratulates you upon your assured success of national conference so ably led by you.—Everett J. Lake, Governor of Connecticut. 1AW to 3ZE.

**DELAWARE**—Dover, Mar. 7.—President Warren G. Harding, White House, Washington, D. C.—Greetings and best wishes from the state of Delaware.—William D. Denney, Governor of Delaware. 3ZO and 3ZY.

**FLORIDA**—Tallahassee, Mar. 7.—President Warren G. Harding, White House, Washington, D. C.—The people approve your efforts to promote world peace. Congratulations.—Cary Hardee, Governor of Florida. 4II to 3ALN, direct.



**GEORGIA**—Atlanta, Mar. 6.—President Harding, Washington, D. C.—Greetings to President and Mrs. Harding from Governor and Mrs. Hardwick.—Governor and Mrs. Hardwick. Handled by 4AU, 8AJD, 8BDB, 3ARN, 4FT and 3ZY.

**IDAHO**—Boise, Mar. 7.—President Harding, Washington, D. C.—Cordial greetings from the state of Idaho.—D. W. Davis, Governor of Idaho. Early routing unknown; 9YAE to 9ZJ to 3ZY.

**ILLINOIS**—Springfield, Mar. 8.—President Warren G. Harding, Washington, D. C.—Accept Illinois greetings and heartfelt thanks for your efforts to insure world wide peace.—Len Small, Governor of Illinois. Direct 9ASL to 4BY to 3ZY.

**INDIANA**—Indianapolis, March 7.—President Harding, Washington, D. C.—Greetings from Indiana to the honored President of the United States. Congratulations on the splendid accomplishments your first year.—Governor McCray of Indiana. 9ZJ to 3ZY.

**IOWA**—Des Moines, Mar. 7.—President Warren G. Harding, The White House, Washington, D. C.—Accept the salutations of the State—Iowa wishes you all happiness.—N. E. Kendall, Governor of Iowa. Passed thru 9DEH, 9AFW, 9AAW, 8WD, 2FP, 3ZY.

**KANSAS**—Topeka, Mar. 7.—President Warren G. Harding, Washington, D. C.—Kansas sends cordial greetings and felicitations.—Henry J. Allen, Governor of Kansas. Try to figure this out: 9RV, 5MZ, 9DZQ, 8AQR, 5QI, 5XU, 9HI, 9DTA, 9DZQ, 9IF, 8AOI, 9AGR, 8FT, 8AJV, 8AJX, 3ZO, 3ZY.

**KENTUCKY**—Frankfort, Mar. 7.—President Harding, Washington, D. C.—I am happy to send you the greetings of your thousands of friends in Kentucky.—Edwin P. Morrow, Governor of Kentucky. 9IO, 9EI, 9OX, 9AAW, 8BBU, 4GL, 3ZY.

**LOUISIANA**—Baton Rouge, Mar. 7.—Hon. Warren G. Harding, Washington, D. C.—American soil and American genius are the cornerstones of American greatness.—John M. Parker, Governor of Louisiana. 5AA, 5JD, 5XU, 9ZJ, 3ZY, 5ZU, 4GL.



SABA, 8AOI, 9AGR, 8FT, 8AJV, 8AJX; but also direct 8LA to 8ZY.

**MAINE**—Augusta, Mar. 8.—Warren G. Harding, President, White House, Washington, D. C.—I congratulate you upon your first years administration and send you and Mrs. Harding greetings from the state of Maine.—Percival Baxter. 1APO, 1BHJ, 1BRQ, 1ARY, 8FM, 8ZO, 8ZY.

**MARYLAND**—Annapolis, Mar. 6.—President Harding, White House, Washington, D. C.—The Governor and people of Maryland send their greetings and best wishes to President Harding.—Governor Albert C. Ritchie. 8AJD to 8ALN.

**MASSACHUSETTS**—Boston, Mar. 6.—Warren G. Harding, President United States, White House, Washington, D. C.—Cordial greetings from Massachusetts which remains steadfast in support of your earnest and successful efforts to establish peace in the world and better conditions at home.—Governor Channing C. Cox. 1XM, 1ZE, 1COA, 1SN, 2OM, 2BEA, 8ZY.

**MICHIGAN**—Lansing, Mar. 6.—Warren G. Harding, President United States, Washington, D. C.—I take the opportunity afforded to me by amateur radio operators of the country of sending to you my heartiest greetings and well wishes.—Alex J. Groesbeck, Governor of Michigan. 8ZF, 8ZZ, 8BO, 4GL, 8ZY.

**MINNESOTA**—Minneapolis, Mar. 8.—President Harding, Washington, D. C.—The state of Minnesota greatly interested in development of radio and appreciates all that you and your administration are doing in its behalf.—J. A. O. Prou, Governor of Minnesota. 9XI, 9ZJ, 8ZY, 9YAE.

**MISSOURI**—Jefferson City, Mar. 6.—Hon. Warren G. Harding, President, Washington D. C.—Through our Missouri marketing bureau broadcasting station I salute you by wireless.—Arthur M. Hyde, Governor of Missouri. 9ACB, 9ARQ, 9ZB, 8XU, 9YM, 9ZJ, 8ZY.

**MONTANA**—Helena, Mar. 7.—President Harding, White House, Washington, D. C.—Montana is confident of her future under your administration—Montana sends greetings.—Story, Lieutenant Governor. 7XB, 7ZU, 7LY, 9AVZ, 9HI, 9DMJ, 8WI, 8AXY, 8ALN; also 9YAE to 9ZJ to 8ZY; also 9WU to 8BO to 4GL to 8ZY.



**NEBRASKA**—Lincoln, Mar. 8.—President Warren G. Harding, Washington, D. C.—Sincere good wishes for success in problems that confront you.—F. A. McCoove (instead of Gov. McKelvie.) 9AGR, 8AOI, 8FT, 8AJV, 8AJX, 8BBU, 8AXY to 8ALN.

**NEVADA**—Reno, Mar. 8.—President Warren G. Harding, Washington, D. C.—Greetings from Nevada transmitted by the nation's brightest boys and girls.—Emmett D. Boyle, Governor of Nevada. 6QR, 6AAH, 6QR, 7LY, 7ZU, 9AVZ, 9WI, 9DEH, 9AAW, 8EB, 9YAE, 9ZJ, 4GL to 8ZY.

**NEW HAMPSHIRE**—Concord, Mar. 7.—Warren G. Harding, President United States, Washington, D. C.—For peace and the hope that it inspires New Hampshire is profoundly grateful.—Albert O. Brown, Governor of New Hampshire. 1BAE, 1ADL, 1XJ, 1XM, 1ADT, 2TS, 8ZO, 8ZY, 8XE, 1AW to 8ALN.

**NEW JERSEY**—Trenton, Mar. 7.—President Harding, Washington, D. C.—I welcome the opportunity to extend greetings by the latest demonstration of the genius of our youth—the wireless.—Governor Edwards. 8ZO to 8ZY.

**NORTH DAKOTA**—Bismark, Mar. 8.—President Harding, Washington, D. C.—North Dakota con-

gratulates you on your stand on the Great Lakes to St. Lawrence tidewater route believing the completion of such a project will materially aid in the development of this great northwestern country.—R. A. Nostes, Governor of North Dakota. 9FX, 9WU, 8BO, 4GL, 8ZY.

**OHIO**—Columbus, Mar. 7.—Warren G. Harding, President of the United States, Washington, D. C.—Benefit of wireless such as to warrant every possible encouragement.—Governor H. L. Davis. 8BBU 8AXY to 8ALN.

**OKLAHOMA**—Oklahoma City, Mar. 7.—President Harding, Washington, D. C.—May your efforts to limit armaments be successful.—J. B. A. Robertson, Governor of Oklahoma. 5HK, 9DMJ, 8ARD, 9CS, 9AAW, 9WI, 8WD, 2FP to 8ZY.

**OREGON**—Salem, Mar. 8.—President Harding, Washington, D. C.—Boys of the Radio Association of Salem, Ore., branch of the A.R.R.L. ask me to convey greetings for them to you by radio and extend to your their most sincere compliments and good wishes.—Ben W. Olcott. 7MP, 6AGF, 9IF, 9DTA, 8XU, 9ZJ, 8ZY.



**PENNSYLVANIA**—Harrisburg, Mar. 7.—Warren G. Harding, President, White House, Washington, D. C.—My dear Mr. President—It gives me pleasure to extend to the President of the United States the greetings of nine million loyal and patriotic Pennsylvanians—I am pleased indeed to assist amateur radio operators in their efforts to popularize this very important system of telegraphy.—Cordially yours.—William C. Sproul, Governor of Penn. This "book" via 8AGT, 8AQR, 8AAY, 8ZO and 8ZY.

**RHODE ISLAND**—Providence, Mar. 6.—Hon. Warren G. Harding, Washington, D. C.—Hearty congratulations and best wishes for future.—Emery J. SanSouci, Governor of the state of Rhode Island. Only record 8AJD to 8ALN.

**SOUTH DAKOTA**—Pierre, Mar. 8.—President Harding, White House, Washington, D. C.—Appreciating value of wireless and interested in A.R.R.L. South Dakota sending greetings.—W. H. McMaster, Governor of South Dakota.—9DEH, 9AAW, 8EB, 7LY, 7XB, 8HK, 9DMJ, 9WI, 9DSD, 9AVZ, 9PL, 8AXY to 8ALN.

**TENNESSEE**—Nashville, Mar. 8.—President Warren G. Harding, White House, Washington, D. C.—No better service to the country could be performed by Congress and your administration than to authorize the completion of the Muscle Shoals project and the acceptance of Ford's offer to lease it.—A. A. Taylor, Governor of Tennessee. 8FV, 8SP, 8ALN.

**TEXAS**—Austin, Mar. 7.—President Harding, Washington, D. C.—The federal prohibition law permitting federal judge to assess light punishment for violation of that law encourages those criminal inclined to become professional bootleggers.—Pat M. Neff, Governor of Texas. 8ZU, 4GL, 9YAE, 9ZJ to 8ZY.

**UTAH**—Salt Lake City, Mar. 8.—President Harding, Washington, D. C.—Best wishes for the success of the national relay.—Chas. P. Mabey, Governor of Utah. 6ZAJ, 68J, 6AFD, 9XAG, 9APN, 9YAE, 9ZJ to 8ZY.

**VERMONT**—The President of the United States, Washington, D. C.—Greetings and best wishes from the Green Mountain State.—James Hartness. 1ARY, 2AAB, 8FM, 1XM, 8ZO, 8ALN, 8ZY.

**VIRGINIA**—Richmond, Mar. 7.—President Warren G. Harding, Washington, D. C.—May I take

advantage of this opportunity to send you greetings on behalf of the Old Dominion?—E. Lee Trinkle, Governor of Virginia. 3BLF, 3ZY.

WASHINGTON, Olympia, Mar. 8.—President Harding, Washington, D. C.—Congratulations on a successful year—Louis F. Hart, Governor of Washington. 7ZP, 7BC, 7BK, 7VZ, 7HI, 7XB, 9YAE, 9ZJ, 3ZY.

WEST VIRGINIA—Charleston, Mar. 8.—Pres. Warren G. Harding, White House, Washington, D. C.—West Virginia sends greetings by radio to President Harding.—E. F. Morgan. 8SP to 3ZY.

#### The Messages That Didn't Arrive

Some of the governors were out of town, some ill and some too busy, and three messages got hung up en route, so that eight states were not heard from in Washington:

COLORADO—None of the logs received report anything on this message and it is believed that it never started.

MISSISSIPPI—Didn't start on Mar. 6th or 7th but left 5YE at 11:15 p.m. C.S.T. on the 8th and apparently got stalled in the Ninth District until too late.

NEW MEXICO—No message furnished by the governor in response to the District Superintendent's request.

NEW YORK—It is difficult to believe that New York's message could have failed but such is the case. It left Albany via 2PV, to 2BM in Hudson, N. Y., who gave it to 2DA in Poughkeepsie on the last night. The latter acknowledged it and endeavored to QSR but finding it impossible to raise anyone thru the QRM, and knowing it was the last night, endeavored to QSK it back to 2BM. We must record that the message was stuck at 2DA.

NO. CAROLINA—The governor declined to take part and no message was started.

SO. CAROLINA—No message started.

WISCONSIN—Instructions to District Superintendent miscarried and no message was secured from the governor.

WYOMING—Message left 7ZO on the 7th to 9WI, who gave it to 9DMN. Later it was recorded at 9AZA in Wisconsin, who was heard late on the last night making valiant efforts to unload it on somebody east but to no avail, and it died there, to the best of our records.

#### Gleaned From Logs

That Arizona message must have been greased. It went thru to the east every night with precision. On one night for example we definitely disclose its relaying thru five stations in an elapsed time of 13 minutes. That's real relaying! Not only did the Arizona fellows see their message moving nicely by "short" jumps but on the last night 6ZZ on his C.W. gave it direct to 8AGZ in E. Cleveland, whom he works regularly, a distance of 2000 miles. The latter couldn't raise anyone in Washington, however, and in desperation gave it to 4ZC in Florida, who QSR'd.

A few of the routes traversed were ludicrous. For instance the New Hampshire went to 1XM on the first night but apparently died there and on the second

night 1ADL gave it to 8XE in Pennsylvania as the only DX he could raise. The latter heard 1AW working Washington and so passed it back to New England, making the perfectly wonderful routing 1ADL-8XE-1AW-3ALN. Sounds more like tennis.

9ZJ, Indianapolis, has the distinction of being the station putting the largest number of messages into Washington for their first official receipt there. His log is interesting:

"Mar. 7-8. 11:17 p.m. Mo. msg. recd fm 9YM. 11:33 p.m. Texas msg. from 9YAE. From 1:20 to 1:25 a.m. worked 3ZY, giving him Mo., Tex. and Ind. msgs. 1:41 a.m. Idaho messages from 9YAE. Gave this to 3ZY at 2:02 a.m.

"Mar. 8-9. Fine night. 11:06 p.m. Washington msg. from 9YAE. 12:20 a.m. Minn. msg. from 9YAE. 12:30 a.m. Mo. msg. from 5XU. 12:32 a.m. Minn. msg. again from 9XI. 12:34 a.m. Ore. msg. from 5XU. 12:38 La. msg. from 5XU. 1:14 a.m. Utah's from 9YAE. From 1:45 to 2:10 a.m. worked 3ZY, giving him Utah, La., Ore., Minn., Mo., Wash., and Ind. msgs. 2:18 a.m. Nevada's de 9YAE. 2:35 a.m. Calif.'s from 5ZA. Gave Cal. and Nev. msgs. to 3ZY at 2:50 a.m. 3:02 Mont. msg. from 9YAE; gave this to 3ZY at 3:14 a.m." (All figures in Eastern Time.)



9YAE did great work in the northwest country, handling the messages from Texas, Idaho, Washington, Minnesota, Utah, Montana and Nevada—all passed to 9ZJ.

8BO with a single 5-watt tube covered some remarkable distances, handling the Montana and North Dakota messages from 9WU in Ellendale, N.D., and the Michigan message from 8ZZ. On the 8th, calling 3ZY, 4GL replied with a "Shoot" so he stepped on 'er and 4GL QSL'd for 1, 2, 3 in his w.k. style. 8BO had barely given his "tnx nil nw" when the only 5-watter on the premises gave a sigh and turned over dead. It was a great end for a good tube and 8BO thanks his Lady Luck it held out until he QSR'd. Some distances for real relaying on one tube.

Another remarkable bit of C.W. work

was that of 5LA, New Orleans. 5ABA in Baton Rouge, securer of the message, phoned it to 5LA as his set was "out". 5ZAB, the starter, failed to start the message and 5LA as substitute dumped it right into 3ZY at 10:35 p.m. on the 7th and again on the next day he did the same thing at 10:09 p.m. 5LA uses three 5-watters with 1.9 amps. in the aerial.

1SN had a rotten time with the Massachusetts message on the second night. All evening long he tried to raise somebody who could copy him but no soap until 1:36 a.m. when finally he got a GA from 2OM. After resending some jammed parts he got an OK at 2 a.m. and his log shows his relief: "The rep of Mass. is saved—by 2OM, hero!"

5ZU got the Texas, Louisiana and Arizona messages and, hearing 4GL cranking that Ford of his, dropped them on him at 30 per and got the usual "OK 1, 2, 3". Three minutes later he had the satisfaction of hearing his messages going north from 4GL. Hill did good work, a batch of the messages passing thru his station.

That Utah message could tell a rotten story. 6ZAJ started it to 7MP on the 6th and was about half way thru it when the power went off. The trouble wasn't located for several days, when it was discovered that a neighbor had cut one of his distant-control wires to stop the lights flickering. What an opportune time! Meanwhile 6ZAJ phoned the message to 6SJ in Salt Lake but the latter blew his condenser when he tackled the job and had to phone it to 6AFD. Finally it got started via radio at 10:20 Mountain Time on the 7th, 6AFD to 9XAQ to 9APN, and reached Washington OK on the last night.

3ZO relayed the Penn., New Jersey, Delaware, Kansas, Vermont, New Hampshire and Maine messages. At 1 a.m. on the 9th he learned that the messages from Maine and New York had not yet reached Washington and made special efforts to pick them up. The New York one never was found but the Maine one was got from 3FM at 2:15 a.m. and given to 3ZY at 2:34. It didn't leave Maine until the last night, suffering various delays in local stations before it left the state.

9AVZ of Pierre, S.D., pulled a good one. On the second night he had the Nevada message safe on his pin and—but let his log tell the story:

"12:05 a.m. Went to bed and set alarm for 2 a.m.

"7:05 a.m. Woke up. Didn't hear alarm at 2 o'clock. And Nevada message still on the hook! Called CQ but nobody on."

But he got it off OK that night to 9WI!

#### Acknowledgments

The greatest praise and thanks are due the Washington Radio Club for the good work that made possible the success of these tests. We understand the fellows there, particularly the ones officiating in the relay, are forming a Sun Dodgers chapter of the Boiled Owl fraternity, and none will dispute their eligibility!

Thanks and congratulations are extended all the participating stations, and Headquarters also wish particularly to thank the large number of operators sending in logs for the nights in question, whose kindness in this respect has made available the data for this article.

## Police Chiefs Relay

By F. H. Schnell, Traffic Manager

**D**URING the month of March we enjoyed the success of the Governors-President Relay, which was the gathering of a number of messages and delivering them to one central point. The Police Chiefs Relay will be just the reverse of that. We are going to have one message which is to be distributed all over the United States and Canada by the A.R.R.L. and DELIVERED to your police chief.

The International Association of Chiefs of Police will meet in San Francisco during the week of June 19th. Chief August Vollmer, who is head of the organization, is going to invite every police chief to the convention and he is going to invite him by amateur radio. He will send a message which can be given to your police chief by

you and he is counting on the A.R.R.L. to DELIVER this message to every police chief in every village, hamlet, burg, city or town in the United States and Canada. WE CAN AND WILL DO IT. We must DELIVER it or the police chief will be without an invitation. We could set down definite schedules for the handling of this message but in order to derive some fun and a great deal of competitive sport from it we want every A.R.R.L. member to do his bit towards the success of the relay. Therefore there will be no schedules, no definite stations to handle it. We shall be "minute men of radio". We are going to have some real fun and plenty of excitement. Don't miss it! It makes no difference if you operate just a receiving station—you can supply messages and DELIVER them

and that is all that is necessary. There will be plenty of transmitters.

Here is the scheme:

Dates—June 3rd, 4th, and 5th.

Time—Sometime between 10:00 P.M. and midnight your local standard time some station will break loose with the message. The call letters of this station and the time of starting will not be made known. The message will come as a surprise right out of a clear sky. It will be broadcasted once at ten words a minute, each word being sent twice. Once a station broadcasts the message, that station will cease firing. That will be the start of the message.

The next thing to do is to copy it exactly as it is sent. Make at least two copies of the message. Then DELIVER one copy immediately to your police chief and have him sign the other copy with the date and time of receipt. (Have a heart and don't get him out of bed at two or three in the morning; get one of his representatives to sign for the message if the chief cannot be reached at that ungodly hour.) The copy of the message bearing the signature of the recipient must be sent to the Traffic Manager, 1045 Main St., Hartford, Conn., in

order that we may determine how many messages were delivered. This is very important. After you have DELIVERED your message and gotten your receipt, it is your turn to broadcast the message sending at the rate of ten words a minute and repeating each word twice. After you have broadcasted it once, cease firing.

The things to remember are these—make two copies of the message; DELIVER one to the chief and get his signature on the other; return the one bearing the chief's signature to A.R.R.L. headquarters (THIS IS MOST IMPORTANT BECAUSE IT IS THE ONLY WAY WE CAN DETERMINE THE EXACT NUMBER OF MESSAGES DELIVERED—DON'T NEGLECT THIS—WE WANT TO DELIVER ONE IN EVERY PLACE THAT BOASTS A POLICE CHIEF OR SHERIFF); broadcast the message only once sending each word twice at ten words per minute—give the little fellows a chance to copy it. Be sure and include your call letters when you send the copy of the message to the A.R.R.L. that we may give credit to every station DELIVERING a message. You yourself must report this.

## An Electromagnetic Changeover Switch

By Harold L. Olesen, Ex-2BQT

IN laying out a station the owner generally finds that he has the choice of a long roundabout antenna lead and the changeover switch within easy reach of the receiver or a short direct antenna lead and the changeover switch out of reach. Obviously each layout has its advantage and likewise its faults. For the owner who is going to do a lot of work the out of reach changeover switch is a bother—it delays coming back and generally means jumping up to reach the switch. On the other hand the indirect antenna lead often causes trouble and is to be avoided whenever possible.

The photograph shows a very simple device that puts an end to the antenna changeover switch location problem. It consists of a double pole double throw switch operated remote control by the aid of solenoid magnets. The construction is so simple that no detailed drawing need be given. The following notes will be of general interest.

Size of switch base 1x8x11"

Size of blades  $\frac{1}{2}$  x  $\frac{3}{4}$  x  $7\frac{1}{2}$ "

Distance between blade pivot centers  $3\frac{3}{8}$ "

Size of solenoid tube 1x9"  $\frac{1}{4}$ " thick

Size of each coil 2x3x $\frac{1}{4}$ "—wire only

Size of plunger  $\frac{3}{4}$  x  $8\frac{1}{2}$ "

Wire—about one pound of #26 DCC on each coil when used on 110V. A.C.

Trumbull switch lugs used by remounting them on fibre blocks.

The coils must be spaced apart slightly so as to make the centers of the coils far enough apart that the plunger will be out from under one center when under the other. The length of travel of the plunger is determined by the distance between coil centers.

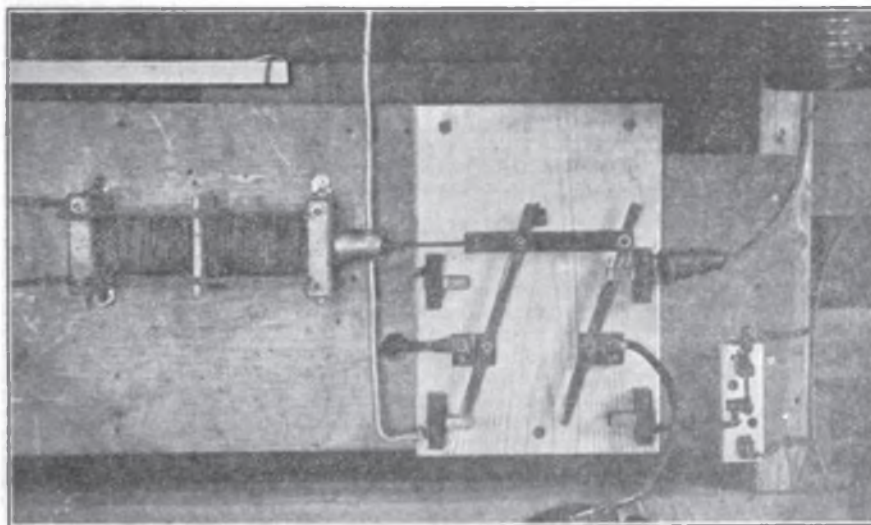
The easiest way to adjust the finished switch is to change the length of the arm that connects the plunger to the cross arm on the switch blades. Shorten it if the blades do not travel far enough to the right and lengthen it if they do not travel far enough to the left.

It is important that the tube be slotted lengthwise if a metal tube is used and the solenoid is to be operated on AC, in order to minimize any eddy current losses.

This switch can be located at any convenient place that will make the antenna lead as short and direct as possible. The control buttons are placed near the transmitter key at 2BQT. The transmitting key is located directly in front of the sounder and the control buttons to the right of the key. The rheostat and switch on the front edge of the table are in the 110V. AC leads

to the transmitter. By this arrangement the station can be operated from a seated position in front of the receiver or from a

For those who desire that the changeover switch turn on the power to the transmitter a third blade can be added between



position in an adjacent building where a second receiver and a second set of key, sounder, buttons, rheostat, and switch is located.

the present two. For those who are not using the tuned counterpoise-ground system the second blade can be used for power or may be omitted.

## ***Report on Receptions by British Amateurs in the Transatlantic Tests, December, 1921***

*By Philip R. Coursey, B.Sc., A.M.I.E.E.*

Mr. Coursey is assistant editor of the "Wireless World" and the "Radio Review", England's leading radio periodicals, and, as our readers recall, was in charge of the arrangements on the other side in our A.R.R.L. Transatlantic Tests. In this interesting article he tells us the story of the tests from the viewpoint of the British amateur.—Editor.

**F**ROM the British point of view the most striking feature of the recent Transatlantic Tests is the establishment of the fact that low power 200 meter signals have been heard over long ranges even with the limited aerial facilities allowed in Great Britain. For the first regular Transatlantic Test that was organized, i.e., in February, 1921, a remarkable amount of enthusiasm was shown, even by users of the simplest types of receiving apparatus, and the failure of those tests definitely to establish communication seriously damped the ardour of many for the second series of tests.

The failure of the first tests (February, 1921) I do not in any way attribute either to our listeners on this side, or to the apparatus they were using, but simply to the fact that the tests lasted only three nights. In the tests just completed, I think we have

conclusively shown that the transmission of the signals across the Atlantic cannot be relied upon to take place *every* night, as the atmospheric phenomena in the intervening space are too variable. Hence in the February tests lasting only three nights, the chances that anything would be heard were, as we see now, quite small—we should indeed have been very lucky if anything at all had been picked up on that occasion.

That being so, it may well be asked why signals from American amateurs have not been intercepted in this country before now. The reason, I think, is to be found in the five hours difference between our Greenwich Mean Time and your Eastern Standard Time (or the still greater difference between G.M.T. and the more western states), coupled with the fact that as a general rule, very very few of our men sit

up till the "wee sma' hours" of the morning unless there is something special to listen in for. Since no relay work or the transmission of ordinary form of messages between amateur stations is allowed in the British Isles, there is no inducement to listen-in over long periods, unless the incentive is provided by some special signals or tests, such as the recent ones.

If one may draw conclusions from the articles and comments published in QST

and other American radio magazines, the opinion has been held apparently, by many in the United States, that the main reason why American amateurs signals have not been previously heard in England is not that stated above, but rather due to the "inferiority" of British receiving apparatus, and statements have more than once been made to the effect that if we used "regenerative" receivers with variometer tuning all would be well. In this connection, one or two points may well be borne in mind; viz:—

1—Although given the same general principles, radio workers in different countries may develop apparatus along different lines, it by no means follows that the resultant products differing both in appearance and in mode of use, are necessarily in any way very different in effectiveness and efficiency.

2—The fundamental principle of "regeneration" is primarily that of feeding back amplified energy from the plate circuit of the tube to the grid circuit. This being so, the exact mode in which the feed-back is effected is not of first importance provided that it is capable of fine adjustment and its use does not interfere with the proper functioning of the receiver. Variometer tuning of the plate circuit provides a fine adjustment for getting the valve into the sub-oscillatory position which is so desirable for the reception of spark signals, the feed-back being mainly through the inter-electrode capacity of the tube plus any other stray coupling that may be present. "Reaction coupling" (as we generally call it) of the plate circuit back to the grid is a more positive way of accomplishing the same result especially when the reaction

(or "tickler") coil is tuned, in which condition we frequently use it.

3—Since all the pre-war British amateurs' radio apparatus was confiscated by the British Post Office during the war and removed into Government stores, the resumption of wireless activities after the war in nearly every case necessitated the building of new apparatus—the earlier apparatus when returned often not being in a fit state for use again. Naturally

then under these conditions C.W. apparatus is used almost exclusively, with the result that our present receiving apparatus is in most cases designed primarily for C.W. work—in which case the sub-oscillatory state of the tube is not required—since it must either be oscillating, for "audodyne" reception, or a separate heterodyne oscillator tube must be used. The former is naturally the method most favored by the average radio amateur. For this arrangement the tuning of the a node circuit is effected quite as easily with a fixed coil and a variable condenser as with a variometer, and in fact in some cases the former method has advantages.

4—The value of the tuned plate circuit is quite well recognized by most British amateurs and was employed by

the most successful receiving stations during the Tests, for the stages of radio frequency amplification used in front of the detector tube. Of course Mr. Godley as a visitor was granted more privileges than are normally allowed to the British amateur, who except in special cases is restricted to an aerial with a total amount of wire including down leads of not more than 140 feet, or 100 feet if only a single wire is used. Hence a companion of the ten or eleven stations heard by our amateurs on aerials of this size, with the twenty-three heard by Mr. Godley on his aerial of 850 feet is not so unfavorable, especially as only one Britisher used more than six valves all the time. It may here be of interest to note that 1BCG was read on a set consisting of two valves and a crystal detector by J. R. Forshaw of Omskirk near Liverpool.

To turn now to greater detail of the results—these are summarized in the cable-

### 1ARY Spark Heard in France

QST is in receipt of a letter from Dr. Pierre Corret, editor of the French amateur radio magazine "La T.S.F. Moderne", advising that one of their readers, Mr. G. Perroux, of Paris, on February 5th copied the signals of 1ARY, University of Vermont, Burlington, Vt., on their spark set.

Mr. Perroux used a single-wire antenna about 35 ft. long with a slanting lead-in about 55 ft. long. The tube equipment consisted of one valve as a regenerative detector and three valves as audio-frequency amplifiers.

It is most remarkable to contemplate the reception of spark signals in France on this simple equipment! Mr. Perroux agrees with us that it is an unquestioned freak. He came in on the end of a transmission just to hear ".....ar 1ARY" and no further signals were received, but this much was copied without the slightest doubt as to the identity of the station.

Congratulations all around on another peach of a record—and spark this time!

Cape Girardeau. The same old routes are in operation besides this new route. 9AJN at Jefferson City clears thru 9MC in Roodhouse, Ill., very easily in daylight.

**PACIFIC DIVISION**  
J. V. Wise, Mgr.

C.W.		SPARK	
Sta.	No. Msgs.	Sta.	No. Msgs.
6ZB	37	6ZZ	194
6AK	4	6GT	176
6ZX	2	6ZX	155
		6HP	107
	43	6OL	32
		6FH	30
		6ZB	1
			695

Southern Section—Lack of promptness in submitting reports is mainly responsible for the apparent poor showing of the Southern Section. A fairly large volume of traffic is really handled, but due credit cannot be given in QST unless we know of it by some other means than hearsay. Contrary to expectations, no regular traffic routes have been layed out, owing to the extreme difficulty of finding a sufficient number of stations willing to stand regular watches; however, there are enough stations operating at will to ensure messages going through in reasonable time.

C.W. is making a better and better showing, aided by the fact that so many of the reliable sparks are changing to the new order; long distance jumps east will soon be almost exclusively handled by this means. The fact that C.W. still has some drawbacks is apparent in that it cannot be copied satisfactorily in San Diego through NPL arc mush on 375 meters, although a powerful spark carries through.

The new Pacific Plan of traffic regulation, with its machinery for enforcement, is solving the QRM problem for all time. This plan having been endorsed by all Pacific Coast Radio Clubs, it is not surprising that amateurs are making the traffic officers' job an easy one by a universal willingness to co-operate for the common good.

The only known exception to this rule is in San Diego, where a small group of operators have combined in an effort to evade the new rules and use the air according to their own sweet will, without regard to anyone else's convenience. The most industrious members of this group have been barred from all further participation in A.R.R.L. work, and all stations are requested to note their calls, so that no traffic may be handled with them. The list follows: 6HH, 6ADA, 6AEH, 6BKH. The license of 6HH having been revoked by the Department of Commerce, the boycott will not apply against the per-

sons to whom it is reissued. 6BKH, under his old call, 6XZ, has already been under A.R.R.L. boycott for about a year.

District "A" (Arizona)—Our worst QRMers, the 6's, have been QRZ all season. Traffic from the west comes through very well from nearly all the C.W.'s, even the 5 watt stations; about forty messages were received from 6XAQ, who is doing exceptionally good work. Going east, about 100 messages each way were handled with 5IF (C.W.); other eastern stations regularly worked are 9DSD, 5ZAK, 5XU, 5IR, 5ZAC, 9AEG, etc. The majority of the work in Arizona is handled by 6ZZ; others doing good work are: 6AAH, 6ASV, 6GS, 6AFP, 6ZC. 6TV cleared traffic west very well for a time on spark, but is no longer heard and is supposed to have closed up.

District "B" (Arizona)—Riverside County reports only one station handling traffic, 6GT. As heard on the air, there have been many stations in this district showing increased activity. Among these are the following, which are doing good DX work; 6GT, 6FK, 6OE, 6EV, 6BAZ, 6TW, 6ACJ, 6AHF, 6AGK, 6AKC, 6AQY, 6AUC, 6BJV and 6AJH. Inactive hams please note that 6AJH, still on his back in bed following his fall with his mast, has his headset on the major part of the day and is doing all in his power to help put District "B" on the map. 6ZB's 20 watt C.W. has been copied in New Jersey, according to a card recently received. 6BAZ, our sole 7L (OW) has reached out as far as Sacramento on her 1/2 K.W. spark. 6FK and 6AGK will soon be added to the C.W. ranks. Now you fellows in District "B," let's get together and get all of our reports in when they are due, so as to have a real showing in the future.

District "C"—The natural trend is toward C.W.; nearly all the good old sparks are gone. C.W. stations now handling regular traffic are: 6JD, 6ZG, 6EN, 6KA, 6CU, 6KY, 6RR, 6EA, 6EB, 6ZN, 6ALU, 6XAQ, 6JD and 6EN are both using two 50 watt tubes, 6KA and 6RR are using one 50 watt, and the rest are using one or more 5 watts. On February 22nd, 6KA exchanged greetings with 8JL, Cleveland, Ohio, and 6EN handled traffic with him without QTA on either end. 8JL reported that both could be read with the phones on the table.

6EN has also handled traffic with 8XV, and is going to establish a definite transcon schedule with him. Nearly all the sparks that are handling traffic are in or around Pasadena; among them are: 6MH, 6OL, 6OM, 6ADL, 6ACY, 6AMN, 6ALD, 6ALU, 6LC, 6GP. (6LC is so loud in San Diego that he often cannot be distinguished from a local spark.) An Assistant District Superintendent will be appointed for Pasa-

dena. Los Angeles is the star region for traffic.

District "D"—The only two stations heard in this district are 6ZU and 6ALF C.W. and spark.

District "E" & "F"—We find the old reliable on the job as usual. 6TU and 6OX in particular are doing excellent work followed closely by the Santa Cruz fellows. 6AS reports the gang doing fine work, but to get any material out of them to be used in a report, so far, has been impossible.

A number of stations in the vicinity of the Bay have been copied by 6ZAC in T.H. so this proves the stations are O.K. and all we need is a word from their operators. Adjoining District "F" is District "G." This District will also have a District Superintendent next month. 6EX and 6AH are kings of sparks in Oakland yet; and have been on the job very regularly. 6HP in Richmond is doing fine work and on little power too.

District "H," 6GF, Superintendent—This district has suffered the loss of most of its A1 stations this last month. The rebuilding bug hit them all at once, altho we have no word of an increase in wages. 6FH, and 6ZX, were left to handle most of the work and had little trouble in doing it. Both these stations are now equipped with C.W. and spark, 6ZX using C.W. on 375 and 200; spark on 200 only.

District "I"—The only station heard in this entire district last month was 6AIX, who goes north fine, but not south, and for this reason he can only get a limited amount of traffic.

District "J"—6BIP has made his appearance on the air with a good spark set. 6ZO is back in Reno and is installing a C.W. and fone set. 6MO has been reported as QRK in Washington, D. C. However, he is not handling traffic regularly. A spark in use at 6UO. 6AJR of Reno has been an old reliable all this last month. His spark is making good now.

#### ROANOKE DIVISION

W. T. Gravely, Mgr.

Heavy sleets and storms have played wild with a good many stations in the division this month but still the old faithfuls have been on the job and traffic has moved through with fair rapidity. The number of C.W. stations is on the increase.

8SP has joined the ranks of the illustrious for his sigs have been heard by 6AME and 7ZS. He has now been heard in every district. Fine work, OM, hope you will be able to make an every-day thing out of it soon. West Virginia leads in the number of msgs. handled and in general efficiency for the month. There are now several stations that form almost constant watch, probably the star station being

8AXY who is using spark to fine advantage. 8AFD, 8WD and 8AEU all spark doing fine work. 8AXY is reported to stay up all the time. Wonder how he ever finds time to sleep. 6's and 7's are copied by him 'most any time.

Virginia seems to be quiet for the time being, due to several good stations being out on account of sleet and sickness of operators. Several daylight stations have been opened up, among them being 3BLF and 3BII. There is need of a good station in Petersburg—who wants the job? General activities for the month have been a little under par.

North Carolina is gradually getting in better shape. There have been added several new C.W. stations during the month, one at Asheville and another at Shelby. Stations in general have been doing very good work but bad weather conditions have somewhat hampered activities. Asheville is within daylight range of Winston-Salem who has a daily schedule with Danville 3BZ. Charlotte, Shelby, Greensboro and Salisbury are all on within daylight range of the Manager's station, making it easy for the Division Manager to communicate with the whole Carolina end of his route by short jump routes.

Traffic in general for the month has not been up to the previous months' record. Several stations that had previously handled considerable traffic have been out with aerial trouble, on a number of occasions. Co-operation is the thing that will get results for the division and if everyone is on the job and puts some life into things then the old division will go to the top and hold the place that the Manager hopes for it to assume.

#### DELTA DIVISION

H. E. deBen, Acting Mgr.

Stn.	C.W.		SPARK	
	No.	Msgs.	Stn.	No. Msgs.
5LA	42		5DA	75
5JB	21		5AA	69
5WF	7		5JD	69
			5KC	36
	70		5YE	15

264

Relaying in the Division slackened up to some extent during the past month due mainly to the steadily increasing QRN. However, we are determined not to give Old Man QRN another summer victory and accordingly are working out short jump relay routes throughout the Division. All stations desiring appointments on these routes are invited to communicate with their District Superintendent. It is hoped that by organizing short jump relay routes, with stations located from 50 to 100 miles apart, and with the aid of



C.W. that we will be able to pierce the worst QRN. In this day of radio frequency amplification, loop aerals, and highly efficient transmitters, the feat should not be a difficult one to accomplish.

Arkansas—5JB, Roy Disheroon, has been appointed City Manager of Hot Springs and is doing fine work with his C.W. set. 5UE has been appointed official relay station for Conway. 5JD continues to do good work. 6ZL has just returned from St. Louis chuck full of pep and a head full of knowledge—we know things are going to wake up now. Bro Jawn learned a lot about controlling QRM out St. Louis way and will no doubt show us how it's done.

Louisiana—5KC has been handling a goodly bit of traffic of late and his sigs continue to increase in strength. Two newly licensed stations now on the air: 5ABA 10 watt C.W., and 5AAT ½ K.W. spark at Baton Rouge, also plenty of squeak boxes. 5ZAB out of operation due to remodeling and installation of C.W. transmitter. Manard, City Mgr. of Nola, reports that the only stations working DX are: 5HO on 50 watts C.W., 5LA on 15 watts C.W., and 5AA on ½ K.W. spark. 5HO, a newcomer in the League, has a 50 watt bottle pouring 3 amps in the antenna and has been reaching out to real respectable distances. 5LA is still using 15 watts but gets out even better than formerly.

Mississippi—5YE is still the only DX station in the state of Mississippi and is indeed well capable of taking care of all Mississippi traffic. 5YE has handled much traffic during the past month.

Tennessee—All DX stations continue to do good work in spite of bad weather conditions. 5FV is heard nightly and is handling his portion of the traffic. 5KU has been appointed City Manager of Memphis. Mr. King has a 20 watt C.W. set which is putting the traffic over in fine style. 5DA continues to defy the elements out his way and we take the liberty to predict that this will be one station that will cause OM QRN to utter a groan.

**ONTARIO DIVISION**  
A. H. K. Russell, Mgr.

Stn.	C.W.		SPARK	
	No.	Mgs.	Stn.	No. Mgs.
9AL	30		3EI	32
3EI	5		3JL	18
			3GN	17
	35		3BA	14
			3QJ	4
				85

March has been excellent for relay work, but as usual the D.M. has the greatest difficulty in coaxing the different districts to make reports, and he hereby appeals to the various members of the A.R.R.L.

throughout Ontario to unite in an effort to make the monthly report a really representative report of relay work throughout the division. We have this month only reports from the Districts Nos. 2 and 3.

Gowan reports aerals springing up like mushrooms all over his district. 3TP has opened up a phone transmitter and if he can be induced to use CW he will give 3BA a run for his money. 3QJ is being changed to 3TY. 3SB is still putting in that CW set. 3GN states that sigs from Toronto are rarely heard there, and then QSS very badly, tho strong and steady in Windsor. He reports 3MN clears London traffic regularly, and 3DL helps out lots. Tillsonburg 3RV and 3TA are both good.

Toronto district No. 8 has done well. 3EI reports working as far as Miami, Florida, with his ½ K.W. while 3JI, a new 5 watt tube set, in nine days from opening up handled 5 messages and worked to Iowa.

No reports have been received from other districts but Rogers 3BP was heard working 6BO one night this month on his C.W. set.

The new laws are not yet in force in Canada, but an inkling that they are easing is that Ottawa has issued an order that on opening of navigation all C.W. stations are empowered to carry on on the winter wave, i.e., 200 meters. Spark stations on the contrary return to the summer footing, i.e., 50 and 100 metres. That sounds like ding dong bell for the poor old pebble squashers.

**NORTHWESTERN DIVISION**  
H. F. Mason, Mgr.

What's the matter, fellows? Don't let the first splash of summer static, or the radio telephones get your goat. Stay on the air, and be one of our RELIABLE stations. With the coming of summer it's going to be harder to clear traffic, and we need your help. We are calling on EVERY station to send in a report of activities to his nearest division officer on the 15th of the month. Don't let yours be missing.

Eastern Section—Traffic has been moving in good shape, although many of the operators were off on account of the flu a good part of the time. 7ZU and 7XB report few messages handled. 7LY also indulged in the flu, but was on strong during the Pres.-Gov. relay. The C.W. fever has at last taken the state of Montana and there will be a couple of good CW sets in Helena soon, and a 20 watt set at 7XB which will be followed by a 100 watter. They plan to work both Seattle and Chicago direct. F.B., 7MP of Bozeman takes the honors for most messages handled this month, and has worked 54 stations, even in spite of a crippled condenser.

Central Section—Activities in this section have taken a dip since 7NL, 7FI, and 7ZS are off the job. This leaves 7ZM

and 7YA on 375 the only stations handling any amount of traffic, and even 7YA reports hard times. As this section is depended upon for handling practically all of the eastern traffic from the western part of Washington and Oregon, it is essential that at least one good 200 meter station be on the job.

**Washington Section**—Puget Sound stations continue to work consistently, especially to the south. Stations handling the bulk of the traffic are 7BC, 7BK, 7QB and 7HI. 7GE at Pasco, Wash., is also doing good DX, but no reports. 7QB has a schedule with 4CB (Canadian) to handle eastbound traffic on C.W. Down at Grays Harbor, 7SC is installing C.W., I.C.W., spark and fone, and reports activities on the increase since he arrived. 7KJ and 7NN are the principal stations there at present.

**Oregon Section**—7KE, newly appointed D.S. at Myrtle Point, Oregon, reports that he is working easily into the 6th District, covering 600 miles on a quarter kilowatt. 7OX is putting up a half K.W. set for DX work.

In Portland: 7DP has been clearing traffic on C.W. Sparks who have been doing DX are 7JW, 7ZT, 7GJ, 7ED and 7ZJ. The number of messages handled, tho, is extremely low, and is a very poor showing against what these stations have done in the past. 7ZK of Vancouver, Wash., is back on the job, surprising the fellows with a 500 cycle spark. No reports from Eugene or Salem although 7MU at Salem is reaching out on spark since 7TJ has gone to sea. 7HD, D.S. at Seaside, has his transmitter going again and is QSA through the division.

#### EAST GULF DIVISION

B. W. Benning, Mgr.

C.W.		SPARK	
Stn.	No. Msgs.	Stn.	No. Msgs.
4GL	475	5XA	192
4BY	329	4EZ	56
4FT	200	4AU	55
4II	142	4GN	46
4BF	121	4BI	45
4BQ	65	4HS	35
4YA	48	4GM	25
4CO	40	4FD	24
5XA	36	4DZ	12
4AZ	30	5GI	13
4ZE	30	4DH	9
4EL	25	4GU	5
4IW	25	5ON	1
4GE	18		
4AS	15		518
4ZF	10		
4BK	9		
5ZI	1		

1619

Florida—4ZE is trying some of the

new tuners for the coming season. He has a regular route now with 4DZ, which opens South Florida. 4FS has completed his C.W. set and is in line for traffic. 4BC continues to do DX and is improving his set for summer work. 4DZ is doing regular work with 1BQE, 3EZ and 4GN. This opens South Fla. in good shape. 4AW, our last winter's standby, has started a C.W. set. W. E. Wood, 4BS, has gallantly offered a report for Miami and we thank him. Miami has 10 licensed amateurs, with sets ranging from spark coils to 1 K.W. sets; 4ES has a good station and is going to install C.W. At St. Petersburg the local club is building a set to specifications and are having nightly code practice. 4IW, C.W., is on the air and does regular DX. 4BF broke loose about three weeks ago. This fine station has already been reported QSA on the Pacific Coast several times.

4II has been reported QSA in Burlington, Ia., and Newmarket, Ontario. Supt. Harrod is pleased to say that every city manager has been striving this month to show that the land of Palms and Placid Lakes contain real radio men. 4ZC is doing fine work, having worked into 34 states and Canada.

Alabama—City Mgr. Ansley of Birmingham reports that their one and only spark DX station, 5GI, was closed down for the most of the month, following a complaint made to the R. I. that he, 5GI, was interfering with radio-phone reception—the receiving station making the complaint was located about two blocks away and using two steps of R. F. amplification!!! Hi. 5GI has been given permission to open up again. This trouble of interfering with radio-phone reception will probably cease if the plans of the B'ham Wireless Assn, are adhered to. 5ZI, C.W., has broken through to 5XA and 8ARS and has handled one message. He reports that there are six licensed amateurs in Anniston. Mr. J. K. Moore has been appointed City Mgr. of Gadsden.

In Montgomery, City Mgr. Brooks reports that all DX work has been given up due to the fact that all the possibilities are spending their time listening to the phone concerts. (We wonder if they listen all night. DX work doesn't start before 11:00 P.M.) 5NI has given up blowing condensers on his rock crusher and is building a low powered phone set. 5XR has installed C.W. City Mgr. Barnett of Mobile advises that the Radio Inspector recently visited Mobile and assisted by the chief operator of NGT tuned all the amateur stations there. 5KB is on 200 and 5JZ on 195 meters. Two new 5 watt C.W. stations are 5ACO and 5ACB.

5XA in Auburn has been the old standby and is still trying to do the work that 20

or 30 stations ought to be doing in this state. The 10 watt C.W. set is putting out .8 of an amp. and 750 miles is easy work for it.

South Carolina—4LA at Spartanburg has been absent from that city for some time and communication between 4LA and 4EG has been suspended. 4EG has established communication with 4AS at Macon, Ga. 4LA, 4IB, 4HR, 4HG and 4FI are in operation. Supt. Etheredge thinks that much progress will be made by his state during the next month and that we will have some reliable relay routes through the state by May.

North Georgia—Supt. Hight reports ports his district quite active during the past month. Extreme interest in radio has been exhibited by citizens in general. 4BQ made a talk before the Kiwanis Club of Rome, his subject being "Amateur Wireless and The American Radio Relay League." By request he repeated this talk before the Rotary Club and the Berry's Industrial School. 4BQ's CW signals are being heard all over the United States and Canada; he had 42 reports from the Pacific Coast in 20 days of operation, such reports including Vancouver, B. C., Seattle, San Francisco, Los Angeles, and Sacramento.

Middle Georgia—Midville 4GN has no trouble in working Fla. stations, having handled traffic with 4EZ. 4FD junked his CW for spark again. 4DH is putting in a 50 watt CW set. 4AS in Macon has been reaching all over the country with his new 10-watt CW set and is handling a good bit of traffic. 4GU, also on 10 watts of CW, has been stepping about over DX. 4BW reports that he has at last found a condenser that will hold his gravel grinder and is getting over the back fence. 4JH has installed a 50 watt CW set in place of his 10 watt and is in line for relay work at the present writing. 4BK swore off radio again. (HI—This is the fifth time Rankin has quit in the past 6 months. He will come back in a few days—he always does.)

South Georgia—That famous combination of 4GL, 4BY, 4EL, and 4GE smashed all our traffic records again this month and seem to be real angry that Atlanta had the nerve to nose them out of first place last month. Supt. Hodge reports that steady communication is held with Florida stations 4ZC, 4BF, 4IF, and 4II. Reliable communication is had with 5XA of Auburn, Ala., and 4FT of Atlanta. Won't some of you new radio men of Talbetten, St. Marys, Waycross, Boston, Valosta, Beuna-Vista and other places get in touch with Supt. Hodge? In Atlanta, 4FT was decreased somewhat this month due to the fact that the "Atlanta Constitution" is using the station temporarily for a broadcasting station.

**DAKOTA DIVISION**

Boyd Phelps, Mgr.

All district superintendents are busy lining up stations in the smaller towns for summer relay routes over which messages must be handled to insure delivery. The Southern Minnesota District is particularly lively in this respect and it had occasion to show its worth during the isolation of the Twin Cities when storms cut off all communications.

**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF QST, published monthly at Hartford, Conn. for April 1, 1922.**

County of Hartford }  
State of Connecticut } ss.

Before me a Notary Public in and for the State and county aforesaid personally appeared K. B. Warner, who, having been duly sworn according to law, deposes and says that he is the business manager of QST 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 448, 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, The American Radio Relay League, Inc., Hartford, Conn.; Editor, Kenneth B. Warner, Hartford, Conn.; Managing Editor, (none); Business Manager, Kenneth B. Warner, Hartford, Conn.
2. That the owners are: (Give names and addresses of the individual owners, or, if a corporation, give its names and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock). The American Radio Relay League, Inc., an association without capital stock, incorporated under the laws of the State of Connecticut.
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 they are none, so state.) None.
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 on the books of the company but also, in cases where the stockholder or security holder appeared 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 books 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 so stated by him.
5. That the average number of copies 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).

K. B. Warner  
Sworn to and subscribed before me this 24th day of March, 1922.

Wm. Lacey Wells, Notary Public  
(My commission expires February 1, 1925.)

# Who's Who in AMATEUR WIRELESS



**B. W. Benning**

"Our Genial Division Manager"—as all the fellows in the East Gulf call him—was born in Atlanta, Ga., March 9, 1897. Having been interested in electricity since 1909 he was the easy victim of the bite of the wireless bug in 1913. The first symptom of this awful disease was inflicting a coherer and other miscellaneous junk upon the household. In 1915 he graduated (with all due honors) from the spark coil class and for two hideous months radiated so much QRM on the DX men of the city that they threatened several different kinds of murder. He was finally taken into the Atlanta Radio Club and educated by pre-war 4CL, 4BY, 4AT, and 4DG. Installing a 2 K.W. open core transformer with electrolytic interrupter in 1916, he blossomed out with the call 4DX. "DX" was a good call but didn't mean anything.

During the war he served in the Navy

(Concluded on page 54)



**Albert J. Lorimer**

Born Nov. 7, 1897, at Farnham, Quebec, Canada, our Quebec Division Manager launched his radio career soon after. Troubles with land-line telegraphy in 1912 turned his interests to radio. Passing from the coherer to the potato detector stage, and from the spark coil to the quarter kilowatt, this rival of Marconi stepped forward in the world.

In 1915 he moved to New York City and entered the service of the Western Electric Co. When the lid was lifted he was located in Montreal and operated Canadian 2BF with a ½ K.W. quenched outfit and worked 2TF at Schenectady with fair regularity. Later when the resulting QRM hindered VCA the spark set was gotten rid of and a 250 watt I.C.W. installed, resulting in a great increase in range. 2BF is now being relocated at Farnham and will soon be heard from.



**C**LUBS wishing information on how to become affiliated with the American Radio Relay League can secure same by addressing a letter to the Traffic Manager, A.R.R.L., 1045 Main St., Hartford, Conn., who will be glad to furnish the necessary application blanks. There is no charge for affiliation. Every good radio club, society, or association is eligible for affiliation.

The Detroit radio clubs have adopted a novel scheme for enforcing their regulations. They have several blanks of different colors which are used to report viola-

Andrew White and W. A. Easton. The dance was held February 24th.

Interesting lectures are given every week and one of the most important of all will be a lecture by Paul F. Godley, our hero of the Transatlantic Tests. His subject will be the "regenerative receiver". The club extends an invitation to surrounding organizations of the second district to send their delegates to this meeting which will be held on Tuesday evening May 9th at 8 P.M. sharp.

The officers are R. H. Horning, pres.; G. Bosler, vice pres.; C. A. Reberger, sec.; H. Ryder, treas.; H. Luttgens, traffic manager; P. J. Larsen, technical advisor.

The following papers were received dur-



Officers and members of the High Power Committee of Roselle Park Radio Club, and set used at radio dance. Left to right, Wm. Pinter (sitting); M. C. Lane, P. J. Larsen; C. A. Reberger, sec.; R. H. Horning, president; G. Bosler, vice-pres.; H. T. Ryder, treas.; F. Schiffler, J. Smith, and H. Luttgens (sitting).

tions. When a station is violating the regulations several amateurs sign a blank and send it to the station and another copy to the radio inspector. For the first offense a blue blank is sent for warning. No mention is made of other colors except red—and a red blank means action by the radio inspector. The scheme works splendidly and as yet no one has received the "red ticket".

**Roselle Park (N. J.) Radio Club**

The first affair attempted by the club was a dance with the music furnished by WJZ through the courtesies of Major J.

ing the month and we advise all of you to read your local paper as some very vital points can be cleared up in your locality through the medium of such means for distributing information.

Totem Radio News—official organ of Totem Radio Club.

Delta Division News—by Delta Division A.R.R.L.

The Radio Log—by Radio Club of Brooklyn.

The Michigan Radioist—by Central Michigan Wireless Association.

The Oscillators—by Radio Engineering Society of Pittsburgh.

The Modulator—by Radio Association of Greater New York.

The Oscillator—by Y.M.C.A. Radio Club of Sioux Falls, S.D.

Kickbacks—by Twin City Radio Club.

#### Scenic Highway Radio Club (Clinton Ia.)

The club held its annual election February 13th and is pleased to announce the following names to serve for 1922: G. A. Gummeson, pres.; W. Pringle, vice pres.; G. Stukas, sec'y-treas.; J. Baker, corres. secy.

Four operators will handle traffic on the new 1 K.W. spark set which is in operation. Single circuit tuners are used extensively by members of the club. (Come on—give us some dope on them.—T.M.)

#### Ypsilanti (Mich.) Radio Association

The meeting of the past year consisted of code practice and lectures. The membership has nearly doubled in that time though there are but three licensed amateurs. F. N. Furlong has been elected president vice F. F. Sims who left for the Naval Academy.

#### Southern Ontario Radio Association

New officers for the coming year were elected at the last regular meeting: R. E. Moore, pres.; K. S. Atkinson, vice pres.; R. C. Hunt, treas.; C. R. Waage, secy. The advisory committee consists of D. Aitchison, W. Baker, and R. Bridwell. The welcoming committee—C. Lane, G. Brett, and J. Green. The traffic committee—R. Moore, R. Bertrand, and H. Wilson.

#### Haddonfield (N. J.) Radio League

New officers for the coming year are: E. Farrington, pres.; J. L. Barnes, vice pres.; E. Braddock, secy.; G. Barnes, treas.; J. G. Haydock, chairman of technical committee.

Regular meetings are held every other Saturday evening at the home of Thomas Sherrod.

#### Fort Worth (Tex.) Radio Club

The semi-annual election of officers was held March 2nd. The following officers were elected: Prof. O. R. Garrett, pres.; R. L. Harris, vice pres.; M. Smith, secy and treas.; O. Yeary, sgt.-at-arms. Prof. Garrett will start a series of lectures that will cover the field from beginner up.

#### Mystic Valley (Mass.) Radio Club

At the last meeting new officers were elected for the year of 1922: E. Baker, pres.; L. Gordon, vice pres.; E. D. Austin,

secy.; L. Hitichens, treas. The club will be glad to exchange correspondence with all radio clubs. Address all mail to the secretary at 1 Kern St., Malden, Mass.

#### Philadelphia Amateur Radio Association

At a meeting on March 6th, a paper on



Photo of Roselle Park Radio Club members and their apparatus, on the night of the affair

"British Aircraft Tube Transmission" was read by W. B. Martin.

Some very amusing questions on radio which were taken from a New York newspaper were read by the president. A discussion on "radio frequency amplification" was led by H. Van Sciver. The discussion was fully covered. (We would like to know the result of the discussion.—T.M.)

#### Hudson Amateur Radio Club (N. Y. C.)

The Hudson Amateur Radio Club meets Saturday evenings at the Columbia Preparatory School, 301 West 8th Street, New York City.

Mr. Stern of the Western Electric Company spoke on various types of antenna in common use; Mr. Gawler of the Radio Corporation of America spoke on the history of the Amateur Radio in the New England States, and Mr. D. S. Brown of the Radio Club of America gave an interesting talk on the theory of vacuum tubes with their application to modern receiving circuits. Mr. C. G. Kilbourne, our Vice President, also spoke on getting the most out of our C.W. sets. We have also been favored with short talks by different members of the club.

Over sixty percent of the members are licensed amateurs holding either first or second grade licenses.

The club is a member of the Second District Executive Council.

#### 8AGZ Heard in Hawaii!

The latest station to be reported by Mr. Dow, 6ZAC in Hawaii, is 8YT, formerly 8AGZ, the station of Mr. C. J. Carter at East Cleveland, Ohio. 4500 miles on 100 watts, 375 meters. Fine business!

# Strays



Regarding the article on loop reception by 3ZY in last QST, the experiments have been continued and it was found that the large two-turn tickler was not as good for regeneration as tuning the plate circuit with a variometer, and the latter plan has been adopted. All of the secondary was then placed on the loop itself. The result now is that with two stages of audio amplification a lot of DX C.W. is being heard readably all over the room.

To check the possible effect of the antenna, the set was taken to a vacant lot—and better results got than ever.

Irving Vermilya, "VN", 1ZE-ex-1HAA, "Amateur Number One", old-time brass pounder, manager of Marconi's old WCC, and more lately Senior Shift Engineer at WBJ, Marion, Mass., left the employ of the Radio Corporation on April 10th to become the manager of the new radio department of a New Bedford firm, Slocum & Kilburn. Going to carry everything from crystals to 99-stage amplifiers, VN says, and even going to run a 250-watt broadcaster. Regular pirate!

We know that all of Familiar's friends join us in wishing him best of luck in his new job.

"To hell with C.W."—1ZE, August 15, 1921.

"I am now in favor of passing a law against all sparks—no excuse for them."—1ZE, March 31, 1922.

## Who put the broad in Broadcast?

The Weston Elec. Inst. Co. of Newark, N.J. announce the appointment of the following Sales Representatives:

Shiefer Electric Co., Inc., with offices at Rochester, Buffalo and Syracuse, for upper New York State and Erie, Pa.

L. D. Joralemon, Otis Bldg., Philadelphia, for Pennsylvania, Delaware, Maryland and District of Columbia.

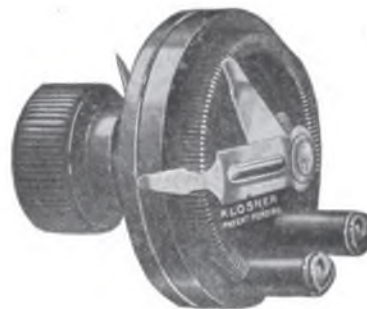
Warren C. Graham Co., Carondelet Bldg., New Orleans, for Louisiana, Mississippi and Lower Alabama.

The Anthracite Radio Shop, P. O. Box 3, Scranton, Pa., of which Roy C. Ehrhardt is treasurer, has succeeded the Shotton

Radio Mfg. Co. in that city, the latter company now being located in Albany.

S. M. Kintner, who is well known for his research and engineering work in the development of radio apparatus, has been appointed manager of the research department of the Westinghouse Electric & Manufacturing Company, succeeding C. E. Skinner, who has been made assistant director of engineering in the Westinghouse company. He will be located in the research laboratory building near East Pittsburgh, Pa.

Here is an illustration of a new vernier rheostat, the Klosner, which is especially designed for gaseous detector tubes requiring critical adjustment. In addition to the regular rheostat winding it has a



second resistance consisting of a single turn of the same wire running around the base of the device and provided with another contact arm. A single knob actuates either slider, the shaft to which the vernier is attached pulling out to engage a clutch on which the main contact arm is mounted.

The young lady across the way says she heard that nice Mr. Hanson of 9XM say he had gotten rid of his corona. She supposes the poor man will have to keep up his correspondence in long-hand hereafter.

The young lady says Mr. Hanson said the stations along the Mexican border just eat up all the C.W. he can feed them. She says she just can't keep up with all those new breakfast-foods anyhow!

9YAE of Le Mars, Ia., informs us that at present they use spark instead of C.W. as reported in the March issue.

Allow us to extend our condolences to A. Ham Wright. He asked a friend what he could do with his pet Tron tube having a broken-off grid lead and was advised that it would make a fine bobber for a fish line. He is now being held by the County Game Commissioner on a charge of fishing with lights!

A new way to test amplifier tubes: tap with a hammer to determine the degree of hardness.

We understand WLB-9XI is broadcasting potatoes on 485 meters. Moral: Run your lead-in to the dining room.

**DID IT EVER OCCUR TO YOU THAT:** An old 4D coil has a good filter condenser in the base?

It is NOT more blessed to give than to receive in radio?

When giving long calls you might fade out before you get to your call?

200 meters was meant to use?

At the rate VT's are being manufactured the world's supply of vacuum may soon be exhausted?

The study of radio will drive you nuts sooner or later?

G. R. Hammond, of Olwein, Iowa, sold out 9ZQ and turned in his Special a year ago with the foolish idea he would quit radio. Now he is back again as 9HE. Radio can't be quit!

1BN is now W. A. Jecusio, 47 Day St., Ansonia, Conn.

8SE has moved to Box 1044, Uniontown, Pa.

Ad in "Denver Post": "Wireless receiving set with andiron doctor, cheap". Why use vacuum tubes?

Breathes there a Ham with soul so dead,  
Who after reading QST for Feb.  
Did not exclaim aloud with joy,  
This is my Native Land, "Oh Boy!"

### Read 'Em and Weep

8BO of Detroit has been using a single five-watt tube for nine months and on it has handled traffic with 4BF of St. Petersburg, Fla., 9WU of Ellendale, N.D., and is consistently heard by 6XAD.

8HJ of Elmira, N.Y., has been heard very QRK on 10 watts by 6XAD.

4GL (described in February QST) using three five watt tubes has been reported 1700 miles west of Vancouver.

2AYV has been reported on 10 watts over a foot from the phones by 7JS at Anacortes, Wash., using one tube.

5ZA uses two fifty watt tubes, one as

oscillator and one as modulator, and has been reported on phone very loud in Canada, New Jersey, Virginia, Minnesota, New York, and many other places 1,000 to 1,800 miles distant.

6ZE has again been copied in Hawaii, this time with eight-tenths of an ampere from two five-watt tubes.

6ZZ has been heard on one tube, one wire aerial, and one-circuit tuner at Watertown, Mass., also at 1BWD at Calais, Me.

6PT on five watts and 6KA on C.W. and spark have been heard QSA on one tube by 8FT.

8SP of Fairmont, W. Va., using 10<sup>00</sup> watts C.W. has been copied by 6AMF. Riverbank, Calif., and 7ZS, Pullman, Wash.

4CO has been reported by Canadians 5CN and 9BD, both of Vancouver, B. C., and has heard 6XAD, 6ZZ, and 6ATG.

8AGZ sends us a list of 34 Pacific Coast stations who have heard him.

8AGO of Pittsburgh reports working 6BO for a half hour on fifteen watts, very QRK and slight QSS.

The statement made in the January QST concerning the first time a First District station had heard a Sixth District station has caused considerable comment and incidentally has brought in a lot of good records. Arthur E. Ericson at Beverly, Mass., reports that he has heard 6KA and 6ALE at least twice a month, confirming all reception, previous to that mentioned in QST.

In this day and age of everyone getting interested in radio we find the best "experts" behind the counter selling tuners in department and hardware stores. The following is quoted from a circular letter of a large concern: "—capacity up to 400 meter wave length on one battery and higher with two batteries." Also in "The Wireless Man" by F. A. Collins, "The sending key is similar to that of the telegraph except that it is unusually large and made entirely of wood... At a signal the powerful dynamos are released and the whirr and rush of the machinery suddenly fills the air. As the wooden key is pressed the thundering report of the spark stuns one's ears..."

### Wot tha Dosh Dat!

*Two hams were testing out a VT.*

First Ham: "The first test we are going to run will tell whether it is a stable tube or not."

Second Ham: "How does a stable tube act? Hey?"

First Ham: "It makes a hoarse noise in the phones."

Word has reached us that our fellow amateur William R. Klorig of 4404 W. 16th St., Chicago, passed away on Dec. 29th. He had many friends among radio men in Chicago and those outside may re-

(Concluded on page 54)



## With Our Radiophone Listeners

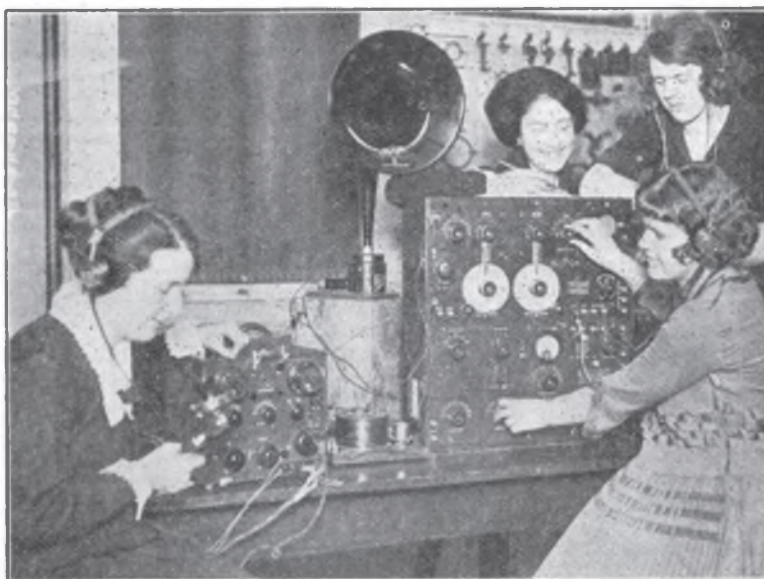
The following is the revised schedule of the Amrad station WGI (formerly 1XE) at Medford Hillside, Mass., wave length 350 meters: Police reports nightly at 7:55 p.m. followed by sermons and music on Sunday, business reports on Monday, bedtime stories for children on Tuesday and Thursday, special music on Wednesday, code practice on Friday, and news on Saturday.

The University of Wisconsin, call WHA, has been a prominent pioneer in the middle-west broadcasting, doing it solely from the amateur standpoint. Daily, except Sunday, from 12 noon to 12:25 the market report and weather forecast is sent by 4 K.W. spark on a wave of 485 meters. This is

stores entering the broadcasting field. In Philadelphia we have WFI—Strawbridge & Clothier, WIP—Gimbel's, WOO—Wanamaker's, as well as WGL—T. F. J. Howlett, ex-3AWI.

The Doubleday-Hill Electric Co., of Washington, D. C., wish to announce that their new station WMU will put on a program every afternoon from 4:30 to 5:30 and also Thursday and Friday from 7:30 to 8:30.

The Atlantic (Ga.) Journal's station WSB broadcasts concerts on 360 meters and news bulletins, market reports, and weather reports on 485 meters.



—Photo by Underwood & Underwood

**RADCLIFFE COLLEGE GIRLS OPERATE NEW RADIO STATION**—These students are sending messages to their parents in various parts of the country by radiophone from Radcliffe College, Cambridge, Mass. Miss Eleanor Brennan is shown seated at the right, "tuning in." At the left, speaking into the transmitter, is Miss Katherine Miller of Salem, Ohio. Standing in the rear is Miss Margaret Cunningham taking down messages and Miss Susanne Dunn, of Erie, Penn., is listening in.

immediately repeated on the same wave by phone, together with special notices and announcements. On Saturdays the complete program for the coming week is given. Time signals are sent at 12:55 p.m. The regular concert is sent on 360 meters Friday evenings from 8 to 8:45, and in addition a lecture on radio subjects is given on the same wave Saturday afternoons at 1 p.m.

We note with interest the department

### Broadcast Stations

The Department of Commerce announces the following list of licensed broadcast stations as complete up to March 10th.

All of these stations employ the 360-meter wave for the broadcasting of music, concerts, lectures, etc., and those marked with the asterisk (\*) in addition broadcast market or weather reports on 485 meters, the official wave for that class of work.

Owner	Location	Call
Allen, Preston D.	Oakland, Calif.	KZM
American Radio & Research Corp.	Medford Hillside, Mass.	WGI
Atlantic-Pacific Radio Supplies Co.	Oakland, Calif.	KZY
Ramberger, L., & Co.	Newark, N. J.	WCR
Bible Institute of Los Angeles, Inc.	Los Angeles, Calif.	KJS
Church of the Covenant	Washington, D. C.	WDM
City of Chicago	Chicago, Ill.	WBU
Cox, Warren R.	Cleveland, Ohio	WHK
Crosley Mfg. Co.	Cincinnati, Ohio	WLW
DeForest Radio Telep. & Teleg. Co.	New York, N. Y.	WJX
Detroit News, The	Detroit, Mich.	*WWJ
Doubleday-Hill Electric Co.	Pittsburgh, Pa.	KQV
Doron Brothers Electric Co.	Hamilton, Ohio	WRK
Duck Co., Wm. B.	Toledo, Ohio	WHU
Dunn & Co., J. J.	Pasadena, Calif.	KLB
Electric Lighting & Supply Co.	Hollywood, Calif.	KGC
Examiner Printing Co., The	San Francisco, Calif.	KUO
General Electric Co.	Schenectady, N. Y.	WGY
Gilbert Co., A. C.	New Haven, Conn.	WCJ
Gould, C. O.	Stockton, Calif.	KJQ
Hamilton, Mfg. Co.	Indianapolis, Ind.	WLK
Hatfield Electric Co.	Indianapolis, Ind.	WOH
Herrold, Chas. D.	San Jose, Calif.	KQW
Hobrecht, J. C.	Sacramento, Calif.	KVQ
Howlett, Thos. F. J.	Philadelphia, Pa.	WGL
Karlawa Radio Co.	Rock Island, Ill.	*WOC
Kennedy Co., Colin B.	Los Altos, Calif.	KLP
Kluge, Arno A.	Los Angeles, Calif.	KQL
Kraft, Vincent I.	Seattle, Wash.	KJR
Lorden, Edwin L.	San Francisco, Calif.	KGB
Marshall-Gerken Co.	Toledo, Ohio	*WSZ
Metropolitan Utilities District	Omaha, Nebr.	*WOU
Meyberg Co., Leo J.	San Francisco, Calif.	KDN
Meyberg Co., Leo J.	Los Angeles, Calif.	KYJ
Missouri State Marketing Bureau	Jefferson City, Mo.	*WOS
Montgomery Light & Water Power Co.	Montgomery, Ala.	*WGH
Newspaper Printing Co.	Pittsburgh, Pa.	WPB
Northern Radio & Electric Co.	Seattle, Wash.	KFC
Palladium Printing Co.	Richmond, Ind.	*WOZ
Pine Bluff Co., The	Pine Bluff, Ark.	WOK
Pomona Fixture & Wiring Co.	Pomona, Calif.	KGF
Portable Wireless Telephone Co.	Stockton, Calif.	KWG
Precision Equipment Co.	Cincinnati, Ohio	*WMH
Precision Shop, The	Gridley, Calif.	KFU
Radio Construction & Electric Co.	Washington, D. C.	WDW
Radio Corporation of America	Roselle Park, N. J.	WDY
Radio Shop, The	Sunnyvale, Calif.	KJJ
Radio Telephone Shop, The	San Francisco, Calif.	KYY
Reynolds Radio Co.	Denver, Colo.	*KIZ
Rike Kumler Co., The	Dayton, Ohio	*WFO
Rochester Times Union	Rochester, N. Y.	*WHQ
Seeley, Stuart W.	East Lansing, Mich.	*WHW
Service Radio Equipment Co.	Toledo, Ohio	WJK
Ship Owners Radio Service	New York, N. Y.	WDT
Union College	Schenectady, N. Y.	WRL
University of Minnesota	Minneapolis, Minn.	*WLB
University of Wisconsin	Madison, Wis.	*WHA
Warner Bros.	Oakland, Calif.	KLS
Wasner, Louis	Seattle, Wash.	KHQ
Westinghouse Electric & Mfg. Co.	Springfield, Mass.	WBZ
Westinghouse Electric & Mfg. Co.	Chicago, Ill.	KYW
Westinghouse Electric & Mfg. Co.	Newark, N. J.	WJZ
Westinghouse Electric & Mfg. Co.	East Pittsburgh, Pa.	KDKA
Western Radio Electric Co.	Los Angeles, Calif.	KOG
Western Radio Co.	Kansas City, Mo.	*WQQ
White & Boyer	Washington, D. C.	WJH
Wireless Telep. Co. of Hudson County	Jersey City, N. J.	WNO

Practically all of the above stations have concert hours various evenings in the week. We have received many of their schedules, so many in fact that it would completely fill an issue of QST if we tried to print them. Most of the above have printed sheets for distribution, giving the evenings per week of concerts, lectures, news, etc. We therefore suggest that our readers interested write to the prominent stations in their vicinity and ask to be put on the mailing list for the weekly announcements of the coming week's program.

step amplifier and loud-speaker the family may be enjoying a concert when suddenly there will be a roar like a fire siren tearing thru the room that will make you jump. Or it may moan and groan, sending the children scampering to their mother; or render a hair-raising shriek not unlike that of a woman being murdered,—all in the midst of an otherwise beautiful concert or Unkle Wiggily story. Such occurrences happen nightly in most cities. The trouble is not with your outfit, neither is it due to amateurs sending, in

The photo on this page shows the station operated by the Signal Corps at Fort Wood, Bedloes Island, New York Harbor. The broadcast service is sent on 1400 meters with a 3K.W. set every evening from 9 to 9:55 p.m., call letters WYCB. The development of interest among amateurs and the establishment of contact with them by this and other means, will, it is hoped, result among other things in making practicable the building up of a complete radio net of qualified amateur stations who can and will be willing to assist the regular Army radio net in the transmission of official business during emergency or otherwise.



**An Appeal!**

Have you ever listened in to a concert and heard a lot of funny (?) noises, squeals, howls, etc.? With a good three-

the strict sense of the word. The trouble is caused by the listeners themselves!

Briefly the action is this: under certain conditions a receiving set may act as a miniature transmitter. Signals from such a set often carry several miles so it is not unnatural that with several such sets in the same block the noise may be terrific. This transmission only happens when the set is oscillating. Single circuit tuners, such as are common on the market for broadcast receiving because of their simplicity of operation, are especially violent in sending out waves.



—Photo by Underwood & Underwood

W. D. Terrell, Uncle Sam's Chief Radio Inspector at the Department of Commerce, who has been simply deluged with work since radio reception became a popular pastime. Mr. Terrell, boss of the amateurs, is known, respected and admired by the entire A.R.R.L.

After adjusting the tuning element of the set it will be noticed that when advancing the "tickler" or "regeneration" control the signals will increase in loudness up to a certain point. At this point there is a click or thud, beyond which the set oscillates and produces waves of its own. This condition is to be guarded against for the reasons stated above—it makes a transmitter out of your receiver.

Broadcasting stations have a "carrier wave" on which the voice and music travel but which is inaudible unless the receiving set is adjusted to the oscillating condition. In tuning slowly with the set oscillating these waves first become audible at a very high pitch and as the tuning knob is slowly



—Pitcher by Underwood & Underwood  
Every other magazine has published this picture so we suppose we might as well too. Originally entitled "Send Me a Kiss by Wireless," members of our staff respectfully suggest that the title might be improved—for example, "Radio telegraphy versus telephony," or why not "See the Shaft—on the Variometer."

turned the note decreases in pitch until it is so low it is inaudible for a short space, then rises to the higher audibility limit as the rotation is further continued. In this short space where the "carrier wave" is inaudible, music and voice may be picked up, which may or may not be badly distorted. This is just the stunt many of our listeners proceed to do. During this time their receiving sets are sending out waves which almost surely interfere with other listeners.

We do not mean to bring wrath upon such people as we believe not one in a hundred realizes what he is doing. We want you to know for your own information what happens and incidentally to take considerable blame off the shoulders of amateurs who own transmitting stations.

In Canada, England, and several other countries receiving stations are required to be licensed because of the interference it is possible for them to produce. We hope this will not be necessary in this country.

It will not be if the listeners can co-operate as relay amateurs have learned to do in the past.

Do not adjust your receiving set as described above. Keep it in a non-oscillating condition. The "tickler" or "regeneration" (whichever it is called on your set) should be kept well below the oscillating point, for tho the signals increase enormously when on the edge of oscillation, they will be badly distorted and as a general rule not as understandable. Don't interpret us as meaning weaker signals are clearer. The tuning should be as near perfect as possible so as to be on the exact wave and the most energy utilized. What we mean is, for the clearest and most understandable reproduction, do not "crowd" the signal too much by excess regeneration, and above all, for the sake of your neighbor, do not allow your set to oscillate.

#### B. W. BENNING

(Concluded from page 46)

and Marine Corps. Graduating from the Naval Radio School at Paris Island, S.C., in June, 1918, he did his share of guard duty just missing going to France as the Armistice was signed. In March, 1919, he was shipped to Port-Au-Prince, Haiti, where he nursed the generators and punched brass at NSC until discharged in October. He returned to Atlanta and stood the commercial exam, erecting station 4BZ in February, 1920. His present ambition as D.M. is to put the East Gulf Division on the top of the traffic percentage column and keep it there.

#### "STRAYS"

(Concluded from page 50)

member him as in charge of subscriptions to QST at our booth at the National Convention. We deeply mourn his loss.

#### WOULDN'T IT BE WONDERFUL—

If Henry Ford would buy up all the spark transmitters in the second district and use them for ship moorings?

If First Grade Commercial Operator's tickets could be bought like a dog's license?

If static could be used to charge the storage batteries?



# Calls Heard



## HEARD DURING MARCH

### Unless Otherwise Specified

Amateurs reporting lists are requested to see instructions appearing at the head of this department in previous issues, and to observe the following additional instruction.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner, and then make a second paragraph in identical form listing the C.W. stations.

#### Heard By 6NW While Operating Str. "WTT"

565 miles south of Ketchikan, Alaska, Mar. 1: Can.: 5AZ, 5DA, 5FE, 5NA, 9BD. U.S.: 6AJR, 6BIU, 6EA, 6FH, 6HY, 6IB, 6IC, 6MZ, 6OG, 6OL, 6NZ, 6WO, 6VK, 6VX, 6ZU, 7BH, 7GJ, 7KE, 7LO, 7NZ, 7WG, 7YA.

300 miles south Ketchikan, Mar. 2: 6AGF, 6AJR, 6EX, 6IC, 6TU, 6VX, 6ZX.

38 miles south Ketchikan, Mar. 3: 7YA, 7YL, 7ZM.

20 miles south Ketchikan, Mar. 4: 7HD, 7KS.

Heard by Opr. Mexican S.S. "Mexico"

At Guaymas, Sonora, Mexico: 5BI, 5BY, 5EH, 5EW, 5FA, 5FK, 5IF, 5IQ, 5IR, 5KP, 5LB, 5NH, 5NS, 5OF, 5QQ, 5QT, 5RA, 5TD, 5TG, 5VO, 5WC, 5XT, 5XU, 5YQ, 5ZU, 5ZW, 5ZAD, 5ZAF, 5ZAG, 5DA, 5GR, 5GS, 5KC, 5LC, 5OL, 5QR, 5ZX, 6ZZ, 6AAH, 6AAK, 6AAW, 6ADA, 6AED, 6AEH, 6AMN, 6ASV, 6AUD, 6AVR, 6BGH, 6AEG, 6YAL, 6GT, 6OD, 6UK, 6AJH, 6APP, 6AOE.

At LaPas, Lower Calif.: 6AS, 6BG, 6EX, 6GR, 6HH, 6HB, 6LC, 6AFE, 6ALD, 6AWX, 6BGH, 6ZAL, 9BSD.

At Mazatlan, Sinaloa: 5AE, 5AL, 5BY, 5HK, 5IF, 5IQ, 5IS, 5JI, 5QQ, 5XB, 5XU, 6HY, 6KC, 6LC, 6OL, 6ZR, 6ZU, 6ZX, 6AEH, 6APP, 6AMN, 9DZE.

At San Blas, Nayarit: 5IQ, 5JI, 5NK, 5QS, 5XB, 5XD, 5XI, 5XU, 5XG, 6EN, 6JI, 6LC, 6AHF, 6AJH, 6AVR.

At Manzanillo: 5JI, 5QA, 5TG, 5XB, 5XU, 5XG, 5ZE, 5ZAA, 9AEG.

#### Reported by D. L. Cawman, Operator, S.S. "J. R. Gordon. Detector One-Step"

Jan. 22—90 miles east Key West. Spk: 2FP, 3ACE, 3AJD, 4BQ, 4DZ, 4GN, 5ZAB, 5ZAG, 5XU, 8YM. C.W.: 1QN, 3BEC, 3BLF, 3ZB, 9ARK.

Jan. 23, 200 miles east Miami. Spk.: 2FP, 2JU, 4BC, 4GN, 9YC, 9APS, 4ZC, 5YI. C.W.: 1IV, 1QN, 2AVU, 4BY, 5EK, 8WA, 8AXK, 8BOX, 8BRL, 9ARK.

Jan. 24, 450 miles east Miami: Spk.: 2FP, 2DR, 2OO, 2OM, 2BJO, 3FB, 3AHK, 3AJD, 4BC, 4DH, 4DZ, 4BF, 5AA, 5NB, 5XU, 8UC, 8XE. C.W.: 1ARY, 2NZ, 3BA, 3DH, 3AJD, 3ZO, 8ADG, 9BLO.

Jan. 25, 680 miles east Miami: Spk.: 1RV, 2FP, 2OM, 3FB, 3EJ, 3ACE, 3AUW, 4EA, 4AU, 4DZ, 8AJW, 8BHD, 8AFD, 8XE. C.W.: 1BKQ, 2AAB, 2AWK, 3DH, 3FS, 3AQH, 4GL, 5FV, 8AQV, 9NX, 9AJA.

Jan. 26, 850 miles east Miami: Spk.: 1HO, 1APO, 1BOQ, 2BM, 2FP, 2OM, 3ARM, 4EA, 4DZ. C.W.: 2DK, 2AAB, 2AUV, 2BRB, 3AHK, 3BEC, 3BLF, 3AQR, 8NI, 8WY, 1BDI.

Jan. 27, 900 miles east Miami: Spk.: 2OM, 2ARY, 1XM, 3FB, 4EA. C.W.: 3AHK, 4BK, 5FV. Heavy QRN.

Jan. 28, 1150 miles southeast New York: 1UN on C.W. Very heavy QRN.

Jan. 31, 1687 miles southeast New York: Spark, none. C.W.: 1XM, 2FP, 8BUM.

Feb. 2, 2100 miles southeast New York: No sparks. C.W.: DF1, 1XM.

March 5th on return trip, 2450 miles southeast N. Y. C.: Spark, 2EL, 2JZ, 1CZ, 1BDT (copied complete msg fm 1BDT). C.W.: 1XM, 2AWL, 2XQ, 4BY, 8XV, 9KP (3000 miles).

Mar. 6, 2280 mi. S.E. N. Y. C.: No sparks. C. W.: 2NZ, 2AWL.

Mar. 7, 2100 mi. S.E. No sparks. C.W.: 1XM, 3BA, 4BQ, 4BY.

Mar. 11, 1400 mi. S.E. N. Y. C., 1AKG on spark; 2NZ, NOF, C.W.

Mar. 12, 1250 mi. S.E. N. Y. C. Spk.: 2TS, 3FB, C.W.: 1XM, 1ZE, 2BML, 4BY, 4GL, 8ADG.

Mar. 13, 980 miles southeast New York: Spk.: 2EL, 1CJA, 1LF, 1COK, 2TS, 2OM, 2AGA, 3FB, 4DZ, 8XE. C.W.: 1BAS, 2BEH.

#### 1VT-1BWD, Calais, Maine

C.W.—1ADL, 1AFV, 1AIP, 1AJF, 1AJP, 1AKG, 1AKQ, 1AKR, 1ARY, (1ASF), 1AWP, (1AZW), 1AZX, 1BAS, 1BBW, 1BCF, 1BCD, 1BDE, (1BDI), 1BEA, (1BEP), 1BH, 1BKO, (1BKQ), 1BKR, 1BLE, 1BOC, (1BQE), 1BQI, 1BRQ, (1BSD), 1BTL, 1BUA, 1BUB, (1BWJ), 1BYX, 1CAK, 1CGE, 1CGS, 1CIK, 1CIT, 1CIV, (1CK), 1CLA, (1CMK), 1COD, 1CZ, 1EZ, 1FD, 1II, 1ON, 1PR, 1PT, 1QP, 1UN, 1XM, (1YK), 1ZE, 2AAB, 2AAG, 2ABZ, 2AJA, 2AJF, 2AWF, 2AWK, (2AYV), 2BA, 2BAK, 2BEA, 2BGM, 2BLP, 2BML, 2BNZ, 2BQD, 2BT, 2BTW, 2BUM, 2CBW, 2CBy, 2EH, 2FP, 2NZ, 2OF, 2SQ, 2UD, 2UF, 2VA, 2VH, 2XQ, 2ZK, (3ADX), 3AJD, 3AJU, 3AMW, 3ANJ, 3ANY, 3APA, 3APD, 3AQR, 3BAG, 3BEC, 3BFU, 3BG, 3BHL, 3BNU, 3BF, 3BQ, 3BTK, 3BUQ, 3BUV, 3CG, 3CZ, 3FS, 3HG, 3IZ, (3JJ), 3KM, 3LR, 3NH, 3QZ, 3RW, 3SY, (3TA), 3XL, 3ZO, 3ZY, 3ZZ, 4BHL, 4BY, 4GL, 4KM, 4ZC, 4ZE, 5ZA, 8ACF, 8ACZ, 8ADG, 8ADZ, 8ACK, 8AGV, 8AGZ, 8AIM, 8AIU, 8AM, 8AME, 8AMN, 8A00, 8ANR, 8APT, 8AQF, 8ARK, 8ASG, 8AVD, 8AUH, 8AWM, 8AWN, 8AWP, 8AWX, 8AXK, 8BDU, 8BEF, 8BFX, 8BK, 8BLJ, 8BO, 8BUQ, (8CBJ), 8CFS, 8CFP, 8CKM, 8CKO, 8DV, 8HM, 8IQ, 8JO, 8KA, 8KS, (8NB), (8OZ), 8PL, 8QR, 8QZ, 8RW, 8SE, 8SP, (8TB), 8UK, 8VY, 8WE, 8XE, 8XV, 8ZAE, 9AAP, 9AAV, 9AAZ, 9AJA, 9ARK, 9AXF, 9BSG, 9BWU, 9CEP, 9DP, 9IO, 9VY, 9WC, 9WE, 9XI.

Spark—1ARY, 1AW, 1BDT, (1BH), (1BJC), 1BJZ, 1BQA, 1BRQ, 1CHJ, 1CNI, 1GN, 1LZ, 1SN, 1XM, 2BPF, 2JZ, 2OM, 2PV, 3GN, 8BSS, 8ADG, 8XE.

#### 1BOE, Southport, Conn.

Spark—1AA, 1ABZ, 1ADL, 1AKH, 1AJP, 1AKG, 1APO, 1AQO, 1ARY, (1AVW), 1AYQ, 1AZT, 1BCF, 1BDT, (1BGC), (1BGW), 1BJE, (1BKQ), (1BM), 1BMT, 1POQ, (1BQC), 1BQL, 1BRQ, 1BSD, 1BSZ, 1BVE, 1BVH, 1BYT, 1CIL, 1CJA, 1CK, (1CM), 1CNM, 1COK, (1CSP), 1CUS, 1CZ, 1FW, 1GM, 1HO, 1JT, 1OZ, 1RX, 1SN, 1UJ, 1WQ, 1YE, 2ABM, 2ACU, 2ACY, 2AGA, 2AHU, 2AJE, 2AL, 2AWF, 2AXK, 2BFS, 2BFX, 2BJO, 2BK, 2BO, 2BRS, 2BY, (2BZV), 2CT, (2DI), 2DO, 2DX, (2EL), 2FP, 2OK, 2HJ, 2IG, 2JZ, 2NZ, 2OM, 2OX, 2PF, 2RG, (2RM), 2SH, (2TS), 2TU, (2WB), 2WV, 2XK, 3AJD, 3AN, 3ARM, 3ARN, (3FB), 3FP, 3GX, 3GZ, 3NB, 3OU, 3YV, 4AS, (4BC), 4DQ, 4DZ, (4EA), 4GN, 5XA, 8AFA, 8AFB, 8AFD, 8AFG, 8AHH, 9AOT, 9APB, 8ARD, 8AVT, 8AVY, 8XY, 8AYN, 8BAZ, 8BCO, 8BEP, 8BSY, 8CH, 8EO, 8FI, 8FT, 8HG, 8HY, 8KG, 8LB, 8LH, 8NZ, 8PL, 8PQ, (8RQ), 8SP, 8TY, 8UC, 8WC, 8XE, 8YV, 8ZN, 8ZP, 9AAP.

9AGR, 9AIR, 9AZE, 9DCX, 9RC, 9UH, 9UU, 9ZJ. Can. 3BP, 3FO, 3GE, 3GN, 3JL, 3KG.

C.W.—1ABB, 1ABV, 1ADL, 1AJP, 1AOL, 1AWB, 1AZW, 1BDI, 1BEA, 1BGF, 1BKP, 1BQE, 1BSD, 1BUA, 1BVA, 1BWJ, 1BYX, (1CAC), 1CGS, 1CIK, (1CJZ), 1FF, 1II, (1IV), 1NE, 1ON, 1OZ, 1QP, 1RD, (1RZ), 1SQ, 1UJ, (1VQ), 1XM, 2AAB, 2ABZ, 2AEQ, 2AFP, 2AJA, 2AJF, 2AJR, 2AKO, 2ANZ, 2AQU, 2ARO, 2ASH, 2AVU, 2AWL, 2AWS, 2AYV, 2AZZ, 2BCF, 2BDM, 2BEA, 2BEB, 2BEH, 2BFF, 2BFK, 2BFZ, 2BGA, 2BGM, 2BLP, 2BML, 2BMR, 2BND, 2BNH, 2BNZ, 2BPD, 2BQA, (2BQU), 2BQW, 2BRB, 2BSC, 2BTJ, 2BUA, 2BUM, 2BYW, (2BZV), 2CAH, 2CBT, 2CBW, 2CCD, 2CEC, 2CFA, 2CFI, 2CFT, 2CFY, 2CHL, 2CIM, 2CIZ, (2CRO), 2DK, 2EH, 2FC, 2FD, 2FP, 2FZ, 2KP, 2KU, 2KV, 2LH, 2NZ, 2OF, 2RY, 2SC, 2SQ, 2UJ, 2VA, 2VC, 2VH, 2WR, 2ZK, 2ZL, 3AAE, 3AAG, 3ALN, 3AQR, 3BA, 3BAG, 3BHL, 3BIJ, 3BIY, 3BLF, 3CA, 3CM, 3IL, 3LR, 3MO, 3NH, 3QZ, 3RF, 3SQ, 3ZO, 3ZY, 3ZZ, 4AS, 4BF, 4BY, 4DC, 4EH, 4GL, 4GU, 4ID, 4II, 4LP, 4YA, 4ZC, 4ZE, 5AAM, 5FV, 5IF, 5KU, 5ABV, 5ADG, 5AGO, 5AGZ, 5AHK, 5AJT, 5AJV, 5ALB, 5AMF, 5AMM, 5ANC, 5AQF, 5AQV, 5AQZ, 5ARK, 5ARW, 5ATR, 5AWM, 5AWP, 5AWR, 5AXC, 5BBD, 5BCL, 5BDO, 5BDU, 5BEX, 5BFX, 5BTL, 5BNU, 5BOG, 5BRL, 5BSS, 5BZH, 5CAZ, 5CBJ, (5CFS), 5CGY, 5CLD, 5CNA, 5CNS, 5COO, 5DV, 5GE, 5HM, 5IQ, 5LB, 5QZ, (5TB), 5UK, 5VY, 5WR, 5ZAE, 5ZM, 5ZX, 5ZZ, 9AAV, 9AKR, 9ARK, 9ATA, 9BRL, 9DAX, 9GC, 9KP, 9UH, 9XL.

1BPR, Cambridge, Mass.—All C.W.

1FO, 1II, 1ON, 1QP, 1RZ, 1XZ, 1YK, 1ZE, 1ADL, 1ARL, 1AWB, 1AZW, 1AZX, 1BEA, 1BEP, 1BES, 1BGF, 1BKP, 1BRQ, 1BSD, 1BUA, 1CAK, 1CGS, 1CIK, 1CJH, 2FD, 2FZ, 2KP, 2KU, 2NZ, 2OF, 2PZ, 2SQ, 2TP, 2VA, 2VC, 2VH, 2WR, 2WT, 2XQ, 2ZK, 2ZS, 2AAB, 2ABZ, 2AFP, 2AJF, 2AJR, 2AQF, 2AQU, 2AWF, 2AWL, 2AWS, 2AYV, 2AZZ, 2BAK, 2BCF, 2BEA, 2BEB, 2BEH, 2BEM, 2BFQ, 2BFX, 2BGI, 2BGM, 2BML, 2BNC, 2BNZ, 2BRC, 2BTJ, 2BUM, 2BXD, 2BYW, 2CCD, 2CCU, 2CDA, 2CFA, 2CGQ, 2BA, 2BG, 2BZ, 2CC, 2CG, 2CM, 2FS, 2HG, 2HJ, 2IZ, 2JH, 2KM, 2LR, 2NO, 2PB, 2QV, 2QZ, 2RF, 2RW, 2VW, 2XL, 2ZO, 2ZY, 2ZZ, 3AAD, 3AAY, 3ADT, 3ADX, 3ALN, 3ANJ, 3APS, 3APQ, 3AQH, 3AQR, 3BAG, 3BFU, 3BHL, 3BIY, 3BKS, 3XAA, 4AS, 4BQ, 4BY, 4DC, 4FT, 4GL, 4ID, 4II, 4LP, 4YA, 4ZC, 4ZE, 5FV, 5IF, 5BK, 5BO, 5BU, 5DV, 5GE, 5HJ, 5HT, 5IQ, 5JL, 5JU, 5KH, 5KS, 5LX, 5MP, 5OS, 5QM, 5QZ, 5RQ, 5SE, 5SP, 5TB, 5UK, 5VY, 5WR, 5XE, 5XV, 5ZX, 5ACF, 5ADG (dalite), 5AGO, 5AGZ, 5AIM, 5AIO, 5AMK, 5AMM, 5AND, 5ANJ, 5AOA, 5AOG, 5AQF, 5AQV, 5ARK, 5ARW, 5AVD, 5AWM, 5AWP, 5AWY, 5AXC, 5AXK, 5BBD, 5BBK, 5BCL, 5BCL, 5BDO, 5BDU, 5BEX, 5BFX, 5BTL, 5BNU, 5BRL, 5BSS, 5BSS, 5BTO, 5BUQ, 5BZH, 5BZY, 5CAZ, 5CBJ, 5CFF, 5CFS, 5CKM, 5CLD, 5CNS, 5COO, 5YAA, 5ZAE (dalite), 9EI, 9FZ, 9HH, 9HW, 9IO, 9IZ, 9KP, 9UC, 9UH, 9WA, 9ZL, 9AAP, 9AAS, 9AAV, 9AAY, 9AJA, 9AKR, 9ARK, 9AYH, 9BRL, 9BSG, 9DAM, 9DAX, 9DYN. Canadian 2BG, 3BP, 3CZ, 9AL, 9AW.

F. G. Sands, Danbury, Conn.

C.W.—1ADL, 1AJP, 1ARY, 1AVR, 1AWB, 1AZW, 1AZX, 1BAS, 1BEA, 1BEP, 1BES, 1BDC, 1BGF, 1BGF, 1BKP, 1BKQ, 1BKR, 1BLE, 1BSD, 1BTL, 1BUA, 1BWJ, 1BYX, 1CAK, 1CGS, 1CIK, 1CIV, 1CJO, 1CJZ, 1CK, 1CLI, 1COD, 1CPZ, 1CRH, 1DAC, 1EZ, 1FF, 1II, 1IV, 1IJD, 1OW, 1ON, 1QN, 1QP, 1RD, 1RZ, 1TS, 1UJ, 1VJ, 1VG, 1VT, 1XM, 1ZE, 2AAB, 2AAZ, 2ADL, 2ACH, 2AFP, 2AJF, 2AJW, 2AQU, 2AVU, 2AWF, 2AWJ, 2AWL, 2AYV, 2BAK, 2BCA, 2BEA, 2BEH, 2BEM, 2BFG, 2BGI, 2BGM, 2BHL, 2BML, 2BNZ, 2BRC, 2BSC, 2BSS, 2BTJ, 2BUM, 2BYW, 2CBT, 2CC, 2CDA, 2CEC, 2CGQ, 2KH, 2FD, 2FP, 2ID, 2JJ, 2KU, 2KV, 2NZ, 2CP, 2FZ, 2SM, 2SQ, 2SY, 2WI, 2VA, 2XQ, 2YD, 2AG, 2ACO, 2AGT, 2AJD, 2AJN, 2ANQ, 2ANY, 2APA, 2APQ, 2AQR, 2AVY, 2BAG, 2BFG, 2BHL, 2BKS, 2BNU, Canadian 3BP, 3BPQ, 3BQ, 3BU, 3BY, 3CA, 3CC, 3FP, 3FR, 3FZ, 3GL, 3GT, 3ID, 3HJ, 3JD, 3KM, 3LR, 3NH, 3VW, 3WF, 3XL, 3ZAB, 3ZO, 3ZY, 3ZZ, 4BY, 4BQ, 4DC, 4ID, 4II, 4ZC, 5UN, 5ACF, 5ADG, 5ADJ, 5AGO, 5AIG, 5AIN,

5AJT, 5AJV, 5AND, 5ANJ, 5ANR, 5AOP, 5ARK, 5AVD, 5AWM, 5AWP, 5AZZ, 5BDR, 5BDU, 5BEX, 5BIZ, 5BOX, 5BUG, 5BXA, 5CBI, 5DV, 5EV, 5GE, 5HM, 5JS, 5NV, 5OS, 5OZ, 5QY, 5SE, 5SF, 5TB, 5UK, 5ZAE, 5AAY, 5AJA, 5ARK, 5BLO, 5BRL, 5IO, 5KP, 5PF.

Spark—1ADL, 1APO, 1ARM, 1ARY, 1AW, 1BEP, 1BOE, 1BOP, 1BOQ, 1BQA, 1BVH, 1CGS, 1CK, 1COK, 1HO, 2ABM, 2AHU, 2AJE, 2BJO, 2CKF, 2CT, 2EL, 2FP, 2GP, 2GX, 2JZ, 3AAB, 3ACM, 3AIC, 3AJD, 3AK, 3ALD, 3ALN, 3ARM, 3GN, 3GX, 3IJD, 3JW, 3NB, 3OU, 3RW, 3US, 3VW, 3YP, 3YV, 3AHH, 3AHS, 3BRL, 3CFS, 3XE, 3ZA, 3ZP.

2BLL, Paterson, N. J.

C.W.—1ABB, 1AJP, 1ANY, 1ARY, 1ARV, 1AWF, 1BDC, 1BEP, 1BKQ, 1BQ, 1BMO, 1BUA, 1CAK, 1COD, 1XM, 1XX, 3AAV, 3AFB, 3AJD, 3ALN, 3AQH, 3AZR, 3BAG, 3BGL, 3BHL, 3BLF, 3BNU, 3BZ, 3CC, 3CM, 3GN, 3IL, 3LL, 3MN, 3QZ, 3RW, 3VA, 3VV, 3ZO, 3ZY, 3ZZ, 4BQ, 4BY, 4DC, 4FT, 4GL, 4PT, 4ZC, 4ZY, 5AN, 5UU, 5AGK, 5AGN, 5AGO, 5AGZ, 5AIM, 5AJN, 5AJP, 5ANR, 5AOA, 5AOP, 5AQF, 5ARU, 5AWM, 5AWP, 5AXC, 5AXR, 5AZV, 5BAZ, 5BBD, 5BBK, 5BBO, 5BCL, 5BDO, 5BFF, 5BET, 5BFX, 5BK, 5BNV, 5BO, 5BOX, 5BR, 5RL, 5BUG, 5BY, 5BYE, 5BZC, 5CKO, 5GE, 5IB, 5IK, 5IP, 5JU, 5LW, 5MP, 5PT, 5PX, 5QZ, 5RY, 5SE, 5SM, 5SP, 5UK, 5WO, 5WR, 5VY, 5XK, 5XV, 5XY, 5ZAE, 5ZN, 5ZV, 9AAV, 9AAV, 9ARK, 9AWA, 9BDU, 9BMM, 9BRL, 9EI, 9IO, 9KP, 9OU, 9ZAC, 9ZJ, 9ZL. Can. 3BP.

Spark—1ARY, 1AWD, 3NB, 3ARD, 3BSY, 3RQ, 3XE.

2AWF, Albany N. Y.

Spark: 1AA, (1ADL), (1BHR), (1BJS), (1BOP), 1BOQ, 1BQA, (1BQL), (1BRQ), (1BYG), 1COK, (1GM), 1HO, 1QO, (1RV), (1SN), 1UB, 1UL, (1WQ), 2AAF, 2AIM, 2AJE, 2ARY, 2BJO, 2DA, 2DI, 2EL, 2JZ, 2OM, (2RM), 2TS, 2WB, 3ACM, 3AGT, 3AJD, 3AK, 3AN, 3ANJ, 3AQZ, 3ARM, 3RDU, 3BKQ, (3EH), 3FB, 3FP, 3HJ, 3OU, 3QW, 3TA, (3UD), 3YK, 4BC, 4CX, 4EA, 4FD, 5AAP, 5ACF, 5AFB, 5AFD, 5AFG, (5AHH), 5AJT, 5ANW, 5APB, 5AUY, 5AXO, 5BAH, 5BCO, 5BEP, 5BFH, 5BSS, 5BSY, 5BUN, 5DY, 5EO, 5EV, 5EW, 5FT, 5LB, 5LH, 5PL, 5OE, 5QC, 5RQ, 5WO, 5WZ, 5XE, 5YN, 9AAP, 9AAW, 9ACB, 9AGR, (9AIR), 9DCX, 9DFX, 9DIO, 9DWP, (9GX), 9KI, 9MC, 9UH, 9YB, 9YQ, 9ZJ, Can.: 3BP, (3FO), 3GE, 3JL.

C.W.—(1ADL), 1AJP, 1AMQ, 1AWB, 1AZW, (1BGF), 1BVS, 1BWJ, (1CAK), 1CGS, 1CJZ, 1CKP, 1CLN, 1CMK, 1RZ, 1UJ, 1ZE, 2AAB, 2AFP, 2AID, 2AJE, 2AKO, 2ALR, 2AMO, 2AZO, 2AZZ, (2BBB), 2BEM, (2BGI), 2BML, 2BND, 2BRC, 2BUM, 2CAT, 2CBG, 2CFI, 2EH, 2FP, 2FQ, 3KP, 2SQ, 2VH, 2WI, 2WT, 3AAD, 3AAE, 3ADT, 3ANJ, 3ANQ, 3APA, 3APQ, 3ASO, 3AWA, 3BFG, 3BG, 3BHL, (3BJJ), 3BIY, (3CC), 3CG, 3CM, 3FS, 3HJ, 3IZ, (3KM), 3RI, 3US, 3VW, 3ZN, 3ZO, 4BQ, 4BY, 4CD, 4CO, 4DC, 4EH, 4FT, 4GL, 4II, (4LP), 4YA, 4ZC, 4ZE, 5AAM, 5DA, 5EK, 5FV, 5KU, 5ACF, (5AJT), (5ALB), 5ALV, 5AMD, 5AQF, 5AQV, 5ARW, 5AVH, 5AWY, 5AWZ, 5BDU, 5BEX, 5BK, 5BOX, 5BRL, 5BTO, 5BUN, 5BZG, 5BZH, 5CFS, (5CKO), (5COO), 5DV, 5HJ, (5IQ), 5OW, 5PN, (5QZ), 5RQ, 5VY, 5WR, 5XAE, 5XE, 5ZG, 5ZZ, 9AAP, 9AAS, 9AAV, 9AJA, 9AKD, 9ALH, 9ASL, 9BED, 9BRL, 9DAX, 9EI, (9KP), 9PF, 9ZL, Can. 2BG, 3BP.

2AVE, Jamaica, L. I.

C.W.—1II, 1ON, 1PR, (1RZ), 1VQ, 1XM, 1YK, 1AIP, 1AJP, 1AJS, 1ANR, 1ARY, 1ASF, 1AVR, 1BQE, 1CAC, 1CAK, 1CJH, (2AB), (2FC), (2RY), (2AAB), (2AEH), (2AEQ), (2AJF), (2AMX), (2ATJ), (2AVU), (2BNC), (2BQW), (2BRM), (2BSC), (2BUQ), (2BWA), (2BWW), (2CDW), 3BA, 3BG, 3CA, 3FS, 3GH, 3HG, 3IL, 3LR, 3QZ, 3RP, 3ZY, 3AJD, 3ALE, 3ALN, 3ANJ, 3APQ, 3AQH, 3AQR, 3BAG, 3BEC, 3BFU, 3BHL, 3BOF, 3BQV, 3BUV, 4BF, 4BQ, 4BY, 4CO, 4DC, 4GL, 4JH, 4KK, 4XD, 4ZC, 5FV, 5BK, 5DV, 5HJ, 5HM, 5HT, 5LX, 5NB, 5OS, 5OW, 5QB, 5QM, 5QZ, 5SP, 5VY, 5XE, 5XV, 5ZE, 5ZY, 5ACF, 5ADG, 5AGO, 5AGZ, 5AIO, 5ALB, 5ANC, 5AOA, 5AQV, 5ARK, 5ARW, 5AWP, 5AXC, 5AXK, 5BBB, 5BBK, 5BCL, 5BDB,

8BDU, 8BQV, 8BSS, 8BZH, 8CAZ, 8CFS, 8ZAE, 9DV, 9EI, 9KP, 9PS, 9SO, 9WA, 9WQ, 9ZL, 9AAV, 9AJA, 9ASL, 9BRL, 9BSG, Can. 9AL.

Spark—1HK, 1ARY, 1AZK, (2DO), (2ALB), (2AQN), (2ASU), (2AUY), (2BAU), (2BCK), (2CEJ), (2CGT), (2CJS), 3FB, 3GM, 3HJ, 3RW, 3AGT, 3AIC, 3AJD, 4BI, 4BS, 4EA, 8EW, 8FT, 8MZ, 8RQ, 8UC, 8VW, 8VY, 8WD, 8WO, 8XE, 8ZE, 8AFG, 8AHS, 8AJX, 8ALO, 8ANW, 8AXQ, 8AXX, 8AXY, 8AYN, 8BCO, 8BGT, 8BRL, 9OX, 9UH, 9VL, 9AAW, 9ACB, 9AGR, 9AIR, 9AWZ, 9DMJ, 9DZY, Can. 8GN.

2BYA, Schenectady, N. Y.

Spark—1AA, 1ADL, 1AJE, 1APX, 1ARY, 1AV, 1AW, 1AVR, 1BFZ, 1BJS, 1BRQ, 1BWL, 1COK, 1DZ, 1FR, 1GM, 1LZ, 1RU, 1RV, 1SN, 1SW, 1WQ, 2ABM, 2AJE, 2ANM, 2AWF, 2BK, 2BLW, 2BM, 2BYG, 2CHW, 2CIE, 2EL, 2GX, 2OM, 2PV, 2RM, 2SZ, 2TS, 2AB, 2AJD, 2ARM, 2ARN, 2FB, 2FD, 2HJ, 2OK, 2QW, 2UD, 2UX, 2VW, 2XM, 2ZO, 4BK, 4EA, 8AAV, 8ACF, 8AFA, 8AFB, 8AFG, 8AHH, 8AHS, 8AIW, 8APB, 8ARK, 8AXO, 8BCO, 8BAZ, 8CX, 8EM, 8OD, 8SP, 8XE, 9OX, 9UH, 9ZJ.

C.D.—1ADL, 1AFV, 1AJF, 1AJP, 1AMQ, 1APJ, 1ARK, 1ARY, 1AVR, 1ASF, 1AZW, 1BAS, 1BCF, 1BDC, 1BEA, 1BEP, 1BGF, 1BKR, 1BKQ, 1BLE, 1BRQ, 1BQE, 1BSD, 1BSG, 1BUA, 1BWJ, 1CAK, 1CAN, 1CGG, 1CGS, 1CIK, 1CIT, 1CJH, 1CJZ, 1CLN, 1COD, 1CPQ, 1FB, 1IL, 1ON, 1QP, 1PT, 1RD, 1RH, 1RR, 1TS, 1UJ, 1UN, 1XAE fone, 1XM, 1ZE, 2AAB, 2ABQ, 2ADP, 2AGD, 2AGV, 2AAR, 2ADV, 2AJF, 2AJR, 2AKO, 2ARZ, 2AUU, 2AWJ, 2AWL, 2AWS, 2AZZ, 2BA, 2BAK, 2BCF, 2BEA, 2BEH, 2BEM, 2BG, 2BGZ, 2BML, 2BND, 2BNZ, 2BQI, 2BQV, 2BRB, 2BRC, 2BTJ, 2CCD, 2CCU, 2CFM, 2CGO, 2CZS, 2FZ, 2IG, 2JJ, 2LP, 2OF, 2PZ, 2RD, 2RP, 2SQ, 2VA, 2XI fone, 2XJ fone, 2VH, 2ZK, 2ZO, 2ZS, 2AAD, 2AAG, 2AAV, 2ADT, 2ADY, 2AIG, 2AJD, 2ALN, 2ANQ, 2ANY, 2APD, 2ARK, 2AQH, 2AQR, 2AS, 2AZO, 2BAG, 2BEC, 2BFG, 2BHL, 2BHY, 2BG, 2BNU, 2BP, 2BRW, 2BFB, 2BTK, 2BUL, 2BUR, 2BY, 2BZ, 2CA, 2CC, 2CG, 2CTZ, 2DM, 2FB, 2FR, 2FS, 2GN, 2HB, 2HD, 2HX, 2IL, 2IZ, 2JH, 2JR, 2KR, 2QZ, 2SM, 2TY, 2VW, 2ZO, 2ZW, 2ZY, 4BF, 4BQ, 4BY, 4CC, 4DC, 4DS, 4EH, 4FL, 4GL, 4GX, 4ID, 4IL, 4LP, 4XD, 5AN, 5BM, 5FV, 5KP, 5NZ, 5UU, 5ZA, 8ACF, 8AGO, 8AGZ, 8AIM, 8ANJ, 8ANM, 8AOA, 8AQF, 8AQV, 8AQZ, 8AOO, 8ARD, 8AR, 8AWM, 8AWP, 8AWZ, 8AX, 8AXC, 8AXK, 8BY, 8BD, 8BDC, 8BDU, 8BCL, 8BDS, 8BEF, 8BFX, 8BIL, 8BLT, 8BNJ, 8BOX, 8BRC, 8BRL, 8BYS, 8BEF, 8BFX, 8BIL, 8BTL, 8BNJ, 8BOX, 8BRC, 8BRL, 8BU, 8BUR, 8BVK, 8BSS, 8BXA, 8BY, 8BZ, 8BZA, 8BZC, 8BZH, 8CAZ, 8CBJ, 8CGY, 8CKM, 8CKO, 8CNS, 8DV, 8GE, 8IB, 8IQ, 8JL, 8JS, 8JU, 8LW, 8OS, 8PC, 8RZ, 8QD, 8SP, 8TB, 8TF, 8UK, 8VQ, 8VY, 8PT, 8WR, 8XV, 8ZE, 9AAP, 9AAU, 9AAV, 9AKD, 9ANC, 9ANF, 9APB, 9ARK, 9ASS, 9BLO, 9BRL, 9BSG, 9DYN, 9IO, 9KP, 9LQ, Can. 9AL.

3FM, Philadelphia, Pa.

C.W.—1ON, 1QP, (1XM), 1ZE, (1ARY), 1ASF, 1BAS, (1BKQ), 1BSD, (1BWJ), 1CAK, 1CGS, 1CIK, 1COD, 2EH, 2FP, 2NZ, 2UD, 2VA, 2XQ, 2ZK, 2AJF, (2YV), 2BEA, 2BMA, 2BQD, 2BRB, (2BSC), 2BTJ, (2BWA), (2BA), (2EM), (2GH), 3HG, 3IL, 3JJ, 3LR, 3QZ, (3ZO), (3ZY), 3ZZ, (Can. 3BF fone and C.W.), 3AAG, 3AQR, (3ALN), (3BAG), 3BIF, 3BLF, 3BNU, 4BF, 4BY, (4RY), 4PT, 4GL, 4IL, (4YA), 4ZC, 5BM, 5FV, 5IF, 5XA, 5ZA, 8AM, 8BK, 8BO, 8DV, (8EV), 8GE, 8CW, 8HJ, 8LX, 8QB, 8QY, 8SP, 8TB, 8UK, 8WI, 8VJ, 8VY, 8XV, 8ZG, 8ADG, 8ADR, (8AGO), 8AGZ, 8AJV, 8ALT, (8AMM), 8AGF, 8AQV, 8ARK, 8AVO, (8AWP), 8AWZ, 8AXC, 8AXK, 8BBK, 8BOX, (8BRL), (8BSS), 8BYE, 8BZH, 8BZJ, 8CAZ, 8CFS, 8CGY, 8CKO, 8ZAE, 9AG, 9DV, 9EI, 9HW, 9HY, 9IO, 9KP, 9UH, 9XM, 9ZL, 9AAV, 9AAV, 9AJA, 9BRK, 9BRL.

Spark—1AW, 1GM, 1AKG, 1ARY, 1BHO, 2GK, 2OM, 2SZ, 2AHU, 8EA, 8EW, 8FT, 8OX, 8RQ, 8UC, 8VR, 8XE, 8AFD, 8ARD, 8AXC, 8AXY, 8AYN, 8ZAC, 9AAW, 9AGR, 9AWZ, 9ZJ.

3CA, Roanoke, Va.

C.W.—1AJF, 1ANQ, 1AWB, 1AZW, 1BWJ, 1CAC, 1CAK, 1CJZ, 1QP, (1VQ), 1XM, 1ZE, 2ADL, 2AJE,

2AQF, 2AVE, 2AYV, 2AZZ, 2BEA, 2BEB, 2BFX, 2CCD, 2CCU, 2FP, 2NZ, 2VH, 2ZK, 3AAD, 3AAE, 3AAG, 3AAV, 3ADX, (3AEV), (3AJD), (3ALN), 3ANQ, 3ANY, 3ANZ, 3APQ, 3AQH, (3AQR), 3AQS, 3AS, 3BA, 3BFU, (3BG), 3BHL, 3BNQ, 3BRL, (3BZ), 3CAA, 3CC, 4FM, 3FS, 3GG, 3HJ, 3HL, (3JJ), 3KM, 3KU, 3QV, 3QW, (3QZ), 3IA, 3TJ, (3VW), 3XT, 3ZE, 3ZO, 3ZY, 4ABM, (4BQ), 4BY, 4CL, (4CO), 4DC, (4DS), 4EB, 4EH, (4GL), 4GU, 4HB, (4ID), 4IL, 4KC, 4KK, 4LP, 4XD, 4YA, (4ZC), 4ZE, 4YA, (5DA), 5EK, 5FV, 5LA, 5NZ, 5ZA, 8ACF, 8ADG, 8AFD, 8AFZ, 8AGO, 8AGZ, 8AIG, 8AIM, 8AIO, 8AJT, 8AJV, 8ALB, 8AMZ, 8APW, 8AQF, 8AQV, 8AQZ, 8ARK, 8AWD, 8AAM, 8AWZ, (8AXK), 8AXE, 8BAE, 8BCJ, 8BL, (8BDU), 8BEB, 8BEC, 8BED, 8BEF, 8BEX, 8BFL, 8BGE, 8BJV, 8BK, 8BLT, (8BO), 8BOX, 8BQC, 8BU, (8BXA), 8BZB, 8CAG, 8CAZ, 8CFS, 8CH, 8CHO, 8CKO, 8CLD, (8DV), 8FT, (8GE), 8HJ, 8IQ, 8LB, 8NI, 8RQ, 8SP, 8UK, 8VJ, 8VY, 8WB, 8XB, 8XE, 8XR, 8ZX, 8ZZ, 9AAS, 9AAP, 9AAV, 9AIR, 9AJA, 9AJH, 9AKA, 9AL, 9AUT, 9AXK, 9AYH, 9BHG, 9BLO, 9BSG, 9DAX, 9DXW, 9DIF, 9DYN, 9IF, 9IL, 9IO, 9KP, 9LE, 9WA, 9ZG, 9ZE, 9ZL, Can. 8BP, 8GN, 9AL.

3IL, Washington, D. C.

Spark—1AMD, 1AW, 1BWJ, 1BYK, 1BZZ, 2AJE, 2AQI, 2BBL, 2BPF, 2BRC, 2BY, 2GK, 2JI, 2JS, 2UD, 2WC, 3AIC, 3AN, 3ARD, 3BPO, 3EI, 3FB, 3FP, 3HJ, 3OU, 3ZS, 5EK, 8ABY, 9AFP, 8AHH, 8AJD, 8ARD, 8ARK, 8AUV, 8AXY, 8AYV, 8BCO, 8CKM, 8JZ, 8KQE, 8LB, 8QE, 8TF, 8UC, 8UK, 8WD, 8ZW, 9AAW, 9ARD, 8BRZ, 9DCX, 9OX, 9SK, 9SN, 9UH, 9UU, 9YA, 9YAE, 9YC, 9YQ, 9ZJ.

C.W.—1AJP, 1ARY, 1ASF, (1AWB), 1AZW, 1BDT, 1BEP, 1BGF, 1BKQ, 1BSD, 1BTL, 1BUA, 1BWJ, 1CAK, 1CMK, 1IL, 1PT, 1RD, 1UL, (1XM), 1ZE, (2AAB), 2AIC, (2AJF), 2AJW, 2AQU, 2AWF, 2BAK, (2BEA), 2BEH, 2BML, 2BNC, (2BNZ), 2BRC, 2BSC, 2BUM, 2CCD, 2CGO, 2FAF, 2FD, 2FP, 2FZ, 2KP, 2KU, 2KY, 2NZ, 2WI, 2VA, 2XQ, 2ZK, 2ZS, 3AAD, 3ADT, 3AJD, 3AJE, 3ANJ, 3APA, 3AQR, 3BEC, 3BFU, 3BGZ, 3BP, (Can.), 3BPK, 3BUR, 3BZ, 3CC, 3CG, 3CM, 3EI, 3EM, (3FS), 3GN (Can.), 3HG, 3KB, 3QZ, 3VW, (3ZO), 5FV, 5HO, 5IF, 5KU, 5LA, 5NZ, 5XAC, 5ZAO, 4AS, 4AZ, 4BF, 4BQ, 4BY, 4CX, 4DC, 4DS, 4EH, 4EU, 4FT, 4GL, 4IL, 4IV, 4LP, 4YA, 4ZO, 4ZM, 6ZZ, 8ACF, (8ADG), 8AGK, 8AGO, 8AGZ, 8AHK, 8AHS, 8AIM, 8AJV, (8ALB), 8ANJ, 8AOO, (8AQV), 8AQZ, 8ARW, 8AWM, 8AWP, 8AVY, 8AXC, 8BCL, (8BDB), 8BDO, 8BDU, 8BEL, 8BFX, 8BK, 8BLT, 8BNI, 8BO, 8BU, 8BZB, 8BZJ, 8BZV, 8DR, 8DV, 8EO, (8EV), 8EW, (8GE), 8IB, 8IQ, 8CAZ, 8CBJ, 8CFS, 8CGY, 8CLW, (8CNS), 8COO, 8JU, 8KH, 8OS, (8OW), 8PC, 8QB, 8QM, 8QZ, 8SE, (8SP), 8UK, 8VY, 8WI, 8WY, 8XE, 8YAA, 8ZAE, 8ZG, 8ZZ, 9AAV, 9ABF, 9AJA, 9AKP, 9AL, (9ARK), 9AXF, 9AYH, 9AYS, 9BDO, 9BRL, 9EI, 9HW, 9IL, 9IO, 9PS, 9RI, 9RZ, 9SO, 9WU, 9ZG, 9ZL.

3ZO, Parkesburg, Pa.—Worked

1IL, 1XM, 1ADL, 1AZK, 1BDF, 1BGF, 1BKQ, 8ZE, 8AFG, 8AHS, 8AJX, 8ALO, 8ANW, 8AXQ, 1BSD, 1CIK, 1CJZ, 2PZ, 2AYV, 2BWA, 2CEC, 3BA, 3BZ, 3DM, 3EM, 3FM, 3FS, 3HJ, 3IL, 3JW, 3LP, 3QV, 3QW, 3QZ, 3RW, 3UO, 3UX, 3ZM, 3ZS, 3ZY, 3AAD, 3ACS, 3ADZ, 3AIC, 3AJD, 3ALN, 3ANJ, 3AQH, 3AQR, 3ARM, 3ASK, 3AUV, 3AWW, 3BJT, 4BF, 5FV, 8CV, 8LX, 8VY, 8YD, 8ZZ, 8AWP, 8AXY, 8BBK.

4EZ, Jacksonville, Fla.

Spark—1ARY, 1BEO, 2EL, (2FP), (3ARN), (4AS), (4AU), (4BC), (4BI), 4CG, 4CP, (4CX), (4DZ), (4EA), (4FD), (4FP), (4GM), (4GN), 4GU, (4HS), (4IX), 5GI, 5QA, 5SM, (5XA), (5AAB), 8AV, 8IH, 8ARS, (8BAZ), (8BBU), 8BRL, (8BXX), 9BK, 9GX, 9LF, 9OX, 9QM, (9UH), 9VL, (9AGR), 9DCX.

C.W.—1XM, 1AJP, 1BQE, 2FP, 3BZ, 3AJD, 4BK, (4DS), (4JH), 5DA, 5FV, 6KA, 8IO, 8IQ, 9AAS, 9AZH.





9YM, 9ACB, 9AOU, 9AYW, 9ARK, 9BLJ.  
 C.W.—1UQ, 1ZE, 1ANQ, 1AQJ, 1AJP, 1ARY, 1AWS, 1BKQ, 1BUA, 1CAK, 2BL, 2BF, 2CA, 2SV, 2TG, 2ZK, 2ANY, 2AQH, 2AJE, 2AJW, 2BEA, 2BEB, 2BIU, 2BLJ, 3BL, 3BG, 3BL, 3NH, 3RF, 3AJK, 3AQR, 3BEA, 3BHL, 3BRL, 4BQ, 4BY, 4DC, 4DS, 4ID, 4ZC, 4ZY, 5CH, 5LA, 5WO, 5ZA, 5X5, 5BK, 5DU, 5LF, 5LU, 5MG, 5OW, 5SP, 5XE, 5XK, 5ZA, 5ZR, 5ABO, 5AGO, 5ALM, 5AMM, 5ADG, 5AOZ, 5AWP, 5BBB, 5BED, 5BCL, 5BCF, 5BDB, 5BDU, 5BEF, 5BFX, 5BFZ, 5BCH, 5BRL, 5BRM, 5BUN, 5BZH, 5BZO, 5CAZ, 5CEE, 5CTZ, 5AW, 5EI, 5FQ, 5FZ, 5KP, 5WA, 5WW, 5AAW, 5AJA, 5AJK, 5AKD, 5AKR, 5ANQ, 5AOU, 5ARK, 5AYN, 5AYW, 5AJ, 5BBU, 5BEA, 5BBU, 5BED, 5BLO, 5BRL, 5CRL, 5DKY, 5DYN.

SBIL, Warren, Pa.

C.W.—1ADL, 1AJP, 1ARY, 7AZX, 1BDC, 1BEP, 1BGF, 1BKQ, 1BSD, 1BWJ, 1CA, 1COD, 1EZ, 1ON, 1PR, 1PT, 1QF, 1QP, 1RD, 1XM, 1YK, (2AAB), 2AJA, 2AJF, 2APQ, 2AQU, 2AWF, 2AWL, 2AYI, 2AYY, 2BDM, 2BEA, 2BGM, 2BJP, 2BML, (2BNZ), 2BQD, 2BQU, 2BRB, 2BSC, 2BTJ, 2BXP, 2BZU, 2CEC, 2CFI, 2CFT, 2CGO, 2EH, 2FP, 2FZ, 2KP, 2KU, 2KV, 2LH, 2NZ, 2OF, 2SQ, 2WT, 2ZK, 3AAG, 3AAO, (3AA), 3AFU, 3AJD, 3ALN, 3ANO, 3ANS, 3ANY, 3AOD, 3APD, 3AQF, 3AQH, 3AQR, 3ATZ, 3AVY, 3BA, 3BAG, 3BEC, 3BFG, 3BHL, 3BLF, 3BNU, 3BOF, Can. 3BP, 3BUR, 3BZ, 3CA, 3CC, 3HG, 3HJ, 3IL, 3IZ, 3KM, 3LR, 3NH, 3QZ, 3RP, 3RY, 3SM, (3SQ), 3VW, 3ZO, 3ZY, 3ZZ, 4BF, 4BQ, 4BY, (4DC), 4DQ, 4DZ, 4EH, 4EL, 4EH, 4GL, 4ID, 4JB, 4LP, 4YA, 4ZC, 5AAM, 5DA, 5FV, 5HO, 5LA, 5NZ, 6XA, 8ADG, 8ADP, 8AGO, 8AHZ, 8AIO, 8AIS, 8AIZ, 8AJV, 8ALD, 8ALV, 8AMQ, 8AOG, 8AOD, 8AQF, 8AQR, 8AQV, 8AQZ, 8ARD, 8AWM, 8AWP, 8AWY, 8AWZ (fone), 8AXC, 8BDB, 8BDU, 8BEX, 8BFX, 8BGF, 8BK, 8BLT, 8BNJ, 8BQ, 8BUN, 8BVK, 8BYD, 8BZC, 8BZF, 8BZY, 8CAB, 8CKO, 8CG, 8GE, 8HJ, 8HM, 8IQ, 8NV, 8OW, 8PC, 8PT, 8SE, 8SP, 8VJ, 8VY, 8WY, 8ZAE, 9AAP, 9AAS, 9AAV, 9AA, 9AIV, 9AJH, 9ARK, 9ASL, 9AAM, 9AYH, 9BLO, 9BRL, 9BSG, 9CKD, 9DAX, 9DOF, 9DV, 9DYN, 9EI, 9FM, 9FZ, 9HW, 9IO, 9KP, 9LE, 9PF, 9UC, 9WA, 9ZL.  
 Spark—1AW, 1HO, 1RV, 2AER, 2AHU, 2BFX, 2BJO, 2EL, 2FP, 2OM, 2RM, 2WB, 3AJD, 3AOW, 3AFT, 3FB, 3HJ, Can. 3KG, 3QZ, 3YV, 4AG, 4BI, 4BQ, 4CX, 4DQ, 4EA, 4GN, 4PFD, 4AHH, 4AIZ, 4ARD, 4AXY, (4AYM), 4AYN, 4BAZ, 4BRL, 4BSY, 4CH, 4CHV, 4CP, 4EB, 4EW, 4FT, 4OD, 4OI, 4RQ, (4TY), 4YR, 9AAW, 9ACB, 9AIR, 9ASJ, 9DCX, 9OX, 9UH, 9VL.

Leonard Strobel, Akron, Ohio

Spark—1AW, 2DN, 2FP, 2WB, 2WC, 3AJD, 3BCM, 3BM, 3NY, 3TA, 4AG, 4AK, 4AS, 4CX, 4EA, 4GN, 5BA, 5JD, 8AAS, 8ABA, 8ADQ, 8AFD, 8ALD, 8AOK, 8APD, 8ASY, 8AU, 8AUG, 8AWY, 8BAZ, 8BHV, 8BMP, 8BRL, 8CJ, 8CO, 8CP, 8EF, 8ER, 8EW, 8HY, 8IN, 8LB, 8LY, 8MG, 8MT, 8NO, 8RX, 8SP, 8TU, 8VA, 8VY, 8WL, 8XE, 8YN, 9ACB, 9ACM, 9AEG, 9AIR, 9AKM, 9ALA, 9ALO, 9AOU, 9AVL, 9AX, 9AZA, 9AZK, 9BIM, 9CP, 9DB, 9DEV, 9DHZ, 9DIW, 9DKY, 9DQ, 9DRP, 9DSO, 9DUX, 9DYX, 9DZZ, 9GX, 9OX, 9VR, 9VW, 9WE, 9YA, 9ZB.

C.W.—1AJL, 1ALW, 1AOE, 1ASF, 1BAJ, 1BOL, 1BG, 1BGL, 1BKL, 1BKQ, 1CK, 1XAD fone, 1XM, 1YK, 1ZE, 2AAB, 2AWL, 2BB fone, 2BRB, 2BE, 2CA, 2CFT, 2CI, 2FP, 2HQ, 2OG, 2OP, 2SZ, 2UD, 2WT, 2WZ, 2ZK, 3AL, 3BD fone, 3BG, 3BHL, 3BVL, 3FW, 3GZ fone, 3AZ, 3ZY, 3ZZ, 4AAM, 4ADE, 4AX, 4BY, 4BLF, 4BQ, 4BY, 4CM, 4CY, 4DF, 4DQ, 4EL, 4EU, 4FV, 4GL, 4GR, 4ID, 4XD, 4XQ, 4XY, 4XZ, 4YC, 4ZAB, 4ZC, 4ZZ, 5DA, 5DR, 5FV, 5GZ, 5MA, 5TU, 5ZL, 5ZW, 5ZZ, 8AB, 8ACF, 8AIM, 8AIV, 8AJ fone, 8ALV, 8AMU, 8ANX, 8AOG, 8APD, 8ARM, 8ARU, 8AW, 8AWY, 8AXK, 8BBK, 8BCM, 8BDO, 8BUM, 8BV, 8BYM fone, 8CP, 8DU, 8DV, 8OR, 8OW, 8QZ, 8RE, 8AZ, 8VY, 8WE, 8WR, 8XU, 8ZZ, 9AAP, 9AAU, 9AAV, 9ABA, 9ADB, 9AEZ, 9AKR, 9ALP, 9AMR, 9AMS, 9ARK, 9AW, 9AWB, 9AYU, 9BBF, 9BDP, 9BF, 9BP, 9BRL, 9BAX, 9DEW, 9DF, 9DJ, 9DP, 9DTA, 9DV, 9EI, 9FZ, 9IM, 9IO, 9KP fone, 9VL, 9VV, 9WK, 9WM, 9XW, 9YB, 9ZJ fone.

8AGO, Pittsburgh—All C.W.

(111), 1QP, (1RD), 1XM, 1ZE, 1AZW, 1BUA, 1CAK, (1CMK), 2BG, 2FP, (2NZ), 2SQ, 2WI, 2WT, 2XQ, (2ZK), 2ZS, (2AAB), 2AJF, 2AMO, 2AQH, (2AYV), 2AWL, 2BAK, 2BEA, (2BEB), (2BEH), (2BFFZ), 2BGT, 2BNC, (2BTJ), 2BYW, 2CCD, (3BA), 3BZ, 3CA, 3CC, 3CA, (3EM), (3FM), (3FS), 3GH, 3HG, 3HJ, (3IZ), 3JJ, 3KM, 3LR, (3QV), (3QZ), (3WW), 3XL, (3ZY), (3AAD), 3AAG, 3AA, (3ADX), 3ANJ, (3ALN), 3APQ, (3AQH), (3AQR), 3ASO, 3ASW, (3BFS), (3BFU), 3BHL, (3BLF), 3BTK, 4AS, (4AZ), (4BF), 4BQ, 4BY, 4DQ, (4EU), 4FT, (4GL), 4II, 4KC, 4LP, 4XD, (4ZC), (4ZE), 4YA, 5DA, 5EK, 5FV, 5HO, 5JB, 5NZ, 5PM, 5UU, 5WO, 5ZA, 5AAM, (6BO), 6ZZ, 6XAD, (8BK), (8BO), 8BU, (8GE), 8GW, 8HJ, (8IH), 8IQ, (8KH), 8PC, 8QB, (8SE), 8VJ, (8VY), (8UK), 8WY, 8ZG, 8ZZ, 8AAN, (8ADG), 8ADM, 8AGZ, 8AIL, (8AIM), 8AIS, (8AMD), 8AMF, 8ANC, 8AQZ, (8ARI), 8ARK, 8ARW, 8AVD, 8AVO, (8AWM), (8AWP), 8AWY, 8AXK, 8BBD, 8BCA, 8BEI, 8BEY, 8BFX, 8BGV, 8BLT, 8BLW, 8BOX, (8BRM), 8BUN, 8UX, (8BXA), (8BYZ), 8CJX, (8CLD), (8DV), 9EI, 9FM, 9FZ, 9HW, 9HY, 9IF, (9IL), (9IO), (9IZ), (9KI), (9KP), 9LE, 9LQ, 9PS, 9PW, 9QE, 9SL, 9SO, (9UC), 9WA, 9WK, 9XI, 9ZE, 9ZG, 9ZL, 9AAS, (9AAV), 9AA, 9AEQ, 9AJA, (9AJH), (9AKD), 9AMD, 9AMU, 9ANE, 9AOA, 9AQA, (9ARK), 9ARN, 9ASD, (9ATE), 9AYH, (9BED), 9BJB, 9BLC, 9BLO, (9BRL), 9DAM, (9DAX), 9DCF, 9DOF, 9DUN, (9DZQ), 9XAI, 9ZAE, Canadians (8BP), (3IZ), (3FO), 9AL.

8XE, State College, Pa.

(1ADL), (1AHL), 1APP, (1AW), 1AWB, 1AX, (1AZW), (1BKQ), 1BIR, (1BOP), 1BWJ, (1CZ), 1HO, 1MB, 1MX, (1RV), 1SN, (1XM), (1ZE), (2AGC), 2AJW, (2AQI), (2BB), 2BGM, 2BK, 2BJO, 2BFF, 2BML, (2BRC), (2BUM), 2CT, 2EH, (2EL), (2FP), 2OF, (2OM), 2PR, (2RM), 2VA, 2WB, (2ZL), (3ABB), 3AIE, 3AJD, 3AK, 3ARD, (3ARR), 3AUW, 3BAG, 3BHL, 3BJJ, 3BLE, 3BP, 3BZ, 3CN, 3EH, 3EI, (3FB), (3FM), 3HAY, 3HL, 3HR, 3IP, 3MB, 3QF, (3QZ), (3TA), (3TJ), 3UD, 3UQ, 3XA, 3XW, 3ZAB, (3ZO), (4AS), 4DS, (4DZ), (4EA), (4EL), (4GL), (4GN), 4JB, 5AAB, (5FJ), (5FY), 5GI, 5NH, 5SM, 5XA, 5XB, 5YG, 5YH, 5ZAF, (8ACF), (8AIM), (8AIT), (8ARD), (8AUE), (8AUY), (8AXE), (8AYN), (8BEF), (8BEJ), (8BHV), (8BFS), (8CHO), (8DZ), (8IH), (8JJ), (8PI), (8QE), (8SP), (8UC), (8WM), (9AAP), 9AJ, 9AJA, (9AQV), (9ASJ), (9AXG), (9AZA), 9BRL, (9CP), 9DAX, (9DGX), (9DLX), 9DQ, 9DRR, (9DWP), 9DY, (9FS), 9IO, 9KT, 9OF, 9MC, 9OX, (9UH), 9VL, 9VZ, (9YC), (9YE), (9XE), 9ZL.

9ZJ, Indianapolis—Every District

Spark—2EH, 2OM, (3BP Can.), (3FO), 3KG, (3ZO), (3ZS), (4YA), 5EK, 5JD, 5KC, 5SM, 5QA, 5XA, (5XB), (5XI), (5XU), (5YE), (5ZAF), (5ZE), 5ZR, (5XQ), 7ZM, (8AGO), 8ARS, (8AXY), (8BRL), (8IN), (8LQ), 8MZ, 8OD, 8WO, 8XE, (8YAE), (8ZA), (8ZN), (8ZP), (8YU), 9ACB, 9AEY, 9AIG, 9AIR, 9AMS, 9AOG, 9ASJ, (9AWU), (9AZE), (9BGP), (9BK), (9DXE), 9DZY, 9DMJ, 9GY, 9LF, 9OX, (9PB), 9RY, 9WU, 9WX, 9XAQ, (9XI), (9XM), (9YAE), (9YAJ), (9YAK), (9YB), (9YM), (9YQ), 9ZAF.

C.W.—1XM, 2BEA, 2BFX, 2BNZ, 2CCD, 2FP, 2FS, 2NZ, 3ALN, 3BG, 3BP Can., (3HJ), 3XW, (3ZO), (3ZY), 4CY, (4FT), 4GL, 5EK, 5ND, (5ZA), 6ZG, 6ZZ, 8AGO, 8AIO, 8ANJ, 8ARK, 8ARW, 8AVD, 8BBU, 8BCL, 8BDD, 8BK, 8BNJ, 8BO, 8XX, 8CBJ, 8CQS, 8DV, 8QZ, 8UK, 8UY, 8VY, 8WO, 8XE, 8YD, 8ZZ, 9AAS, 9AJA, 9AKR, 9AMO, 9BRL, 9DOF, 9FD, 9IL, (9RV), (9XM), 9ZAF, 9ZG.

9APK, Chicago—Every District

Spark—(1ARY), 1XM, (2BJO), (2BK), (2FP), 2JZ, (2OM), 2PV, (2ARB), (3AJD), (3ALN), 3XM, (3ZA), 4CG, (4DH), 5AQ, (5BY), (5HK), (5JD), 5LO, 5IR, 5IF, 5PE, 5PG, 5QQ, 5QS, 5SM, 5FO, 5FV, (5NS), 5XA, 5XU, 5ZE, 6LC, (6XAG), (7KG), (7MP), (7ZV), 7ZU, 8ABO, (8AFA), 8AFD, (8AID), 8AIO, (8AIT), 8AOL, 8APP, (8ARD), 8ARS, (8AVO), (8AVT), (8AWU), 8AVH, 8AXY, 8AYE, (8BBU), (8BBY), (8BCO), 8BDV, (8BDY),

8BEF. (8BEN), 8BEP, 8BFM, (8BFX), 8BFY, 8CAY, 8CGY, (8CP), 8EA, (8EB), 8FA, (8FT), 8FZ, 8GA, (8JJ), 8KY, 8LB, 8RM, 8RQ, (8UC), 8WD, 8WO, 8BX, (8BXC), (8BXX), 8YR, 8BQC, 8BOI, 8XE, 8YN, 8ZAA, 8ZAC, (8ZF), 8ABV, 8ACB, (9ACL), (9ACP), (9ADI), 9AEG, 9AEP, 9AIF, 9AIG, 9AIP, 9ALP, (9ALU), 9ANO, 9ANP, 9AOJ, (9APS), (9AQZ), (8ARG), 9ARZ, (9ASJ), (9ASK), (9AUA), 9AVK, 9AVZ, 9AYH, 9AYW, 9AZE, (9BCF), (9BIJ), 9BDJ, 9BMN, 9BRT, 9BSA, (9DEH), 9DBY, (9DGV), (9DHW), 9DIX, 9DIZ, 9DKQ, 9DNC, (9DPB), 9DHH, 9DSW, 9DAG, 9FK, (9HR), 9JN, 9KA, (9MS), (9OA), (9OX), 9RY, (9UH), 9XT.

C.W.—1BKQ, 1COD, (2FP), 3ALN, 3ALR, 3AJD, 4CO, 4BQ, (6ZZ), 8AGO, (8AIO), 8AQV, 8AWM, 8AWP, 8AXK, 8BBK, (8BLW), 8IQ, 8BRL, 8BSS, 8BYR, 9AOG, 9BDV, (9DTA), 9ADI, 9QE, (9XI), 9ZAF, 9ZL, 8QB.

9BBE, LaSalle, Ill.

C.W.—1RU, 1XM, 1AFV, 1ARY, 1BCG, 1CAK, 2DN, 2EL, 2FD, 2FF, 2FT, 2KP, 2UF, 2WF, 2WL, 2XB fone, 2ZL 2ZZ, 2AAX, 2AWL, 2BGM, 2BML, 3AM, 3DH, 3FB, 3FT, 3IW, 3LR, 3MO, 3QZ, 3XM, 3ZO, 3AAB, 3AEV, 3AHK, 3AQR, 3ARN, 3BLF, 4BA, 4BF, 4BK, 4BQ, 4CC, 4CO, 4CX, 4EL, 4FT 4GL, 4NX, 4SS, 4ZC, 4ZO, 5FV, 5HO, 5JD, 5LA, 5NK, 5NZ, 5RZ, 5UU, 5XB, 6ZZ, 8BK, 8CI, 8DX, 8GE, 8HM, 8HP, 8II, 8IQ, 8JQ, 8LF, 8LU, (8LX), 8NQ, 8NX, 8OH, 8QQ, 8RQ, 8SP, 8UJ, 8VJ, 8VY, 8WR, 8XE, 8XK, 8XV, 8ZG, 8ZZ, 8ABV, 8AGV, 8AGZ, 8AIO, 8AIM, 8ALE, 8AOA, 8AOD, 8AQF, 8AQV, 8AWP, 8AWZ, 8BCI, 8BDU, 8BEF, 8BFX, 8BNE, 8BOW, 8BOX, 8BRC, 8BRK, 8BXA, 8ZAE, 9EL, (9HK), (9IF), 9IO, (9JL), 9KP, 9LQ, 9PI, 9PS, (9QE), 9RM, 9WA, 9WT, 9XD, 9YB, 9ZG, (9ZL), 9AAP, 9AAS, 9AAV, 9AAY, 9ABU, 9ACB, 9AJA, (9AJH), 9AKD, 9AKR, 9AMB, 9ANE, 9AQR, 9ARK, 9ASL, (9AYS), 9BAC, 9BAP, 9BBF, (9BEO), (9BFH), 9BIZ MB, (9BUH), (9DBV), (9DCR), 9DDY, (9DKH), 9DTA, 9DYE, (9DYN), 9DZW, 9XAC, 9XAM, 9YAM, Can. 3BP, 9AW.

Spark—1AW, 1DJ, 1SN, 1TS, 1AKG, 1AWZ, 2BK, 2EL, 2OM, 2RU, 2WB, 2WL, 2AJW, 3AC, 3AM, 3DH, 3DM, 3EL, 3HJ, 3IW, 3MS, 3UC, 3ZO, 3AQR, 3BE, 4BQ, 4CX, 4DH, 4FD, 4GN, 4JB, 5AA, 5AF, 5AI, 5BY, 5DA, 5DU, 5ED, 5EG, 5EK, 5ER, 5EW, 5FJ, 5FO, 5HK, 5IS, 5JD, 5MF, 5PY, 5QA, 5QS, 5SR, 5TD, 5TG, 5UU, 5XA, 5XB, 5XI, 5XJ, 5XM, 5XS, 5XU, 5YI, 5YL, 5ZA, 5ZL, 5ZS, 5ZW, 5ZX, 5ZZ, 5ZAB, 5ZAK, 8BP, 8CP, 8DW, 8EA, 8EB, 8ER, 8EW, 8FI, 8FK, 8FN, 8FT, 8GO, 8G, 8HG, 8HM, 8IN, 8JJ, 8KS, 8LH, 8LJ, 8MR, 8NZ, 8OI, 8PO, 8QA, 8QQ, 8RU, 8SP, 8TK, 8TT, 8UC, 8WI, 8XE, 8XS, 8YN, 8YT, 8ZD, 8ZN, 8ZP, 8ZR, 8ACF, 8ACN, 8ACR, 8AFB, 8AFD, 8AFF, 8AFK, 8AGK, 8AGO, 8AHH, 8AIB, 8AJX, 8AMD, 8AMZ, 8ANO, 8ARD, 8ARS, 8ATU, 8AWP, 8AYN, 8BBU, 8BEP, 8BNA, 8BRL, 8BUN, 8DBO, 8ZAA, 9AP, 9AU, 9BE, 9BF, 9BP, (9CA), 9CP, 9CS, 9EE, 9EL, 9ET, (9FK), 9FS, 9GC, 9GP, (9HK), 9HM, 9JN, 9JM, 9KO, (9KY), (9LF), 9LW, 9MC, 9ME, 9MF, 9MS, 9NQ, 9OX, 9PN, 9PS, 9RC, 9TL, 9UH, 9U, 9VM, (9VW), 9XI, 9YA, 9YB, 9YC, 9YD, 9YO, 9ZJ, 9ZN, 9AAP, 9ABL, 9ACB, (9ACL), 9ACN, 9AEG, 9AEQ, 9AEY, 9AFF, 9AFK, 9AGN, 9AGR, 9AHE, 9AIC, 9AIG, 9AIR, (9AJH), 9AJZ, 9AMA, (9AMR), 9AMS, 9AMT, 9ANO, 9AOU, (9APB), 9APK, 9APQ, 9AQE, 9ARZ, 9ASH, 9ATV, 9AUA, 9AUH, 9AWX, 9AYW, (9AZA), 9AZF, 9BBU, 9BCX, (9BDF), 9BHE, 9BHM, 9BHO, 9BIC, (9BIJ), (9BJA), 9BJT, 9BSA, (9BSC), (9BSJ), 9BSO, (9BTA), (9BUO), (9BYF), 9BYM, 9DBU, 9DEH, 9DEU, (9DEV), (9DFX), (9DHD), (9DHz), 9DIG, 9DKV, 9DLX, 9DMP, 9DMW, 9DPQ, (9DQR), 9DQQ, 9DRJ, (9DRN), 9DSJ, 9DUG, 9DWP, 9DXI, 9DXM, 9DYU, 9DYY, 9DZQ, (9DZU), 9DZY, 9TTI, (9RA? PSE), 9YAK.

9AHC, Ellendale, N. D.

C.W.—1ARY, 1XM, 2FP, 4AZ, 4EH, 4XD, 4YA, 5DQ, 5EK, 5FV, 5HO, 5KP, 5LA, 5MT, 5OI, 5ZA, 5ZAC, 6KA, 6XAQ, 6ZZ, 7ZU, 8ABO, 8AGO, 8AJV, 8AM, 8APT, 8APV, 8AQF, 8AQV, 8ARD, 8ARW, 8AVO, 8AWM, 8BDU, 8BFX, 8BLW, 8BNJ, 8BO, 8BOX, 8BRL, 8BSS, 8BZC, 8BZY, 8CAZ, 8CFS, 8CJX, 8CX, 8HM, 8HZ, 8IQ, 8JL, 8LX, 8MP, 8OS,

8OW, 8OZ, 8QM, 8UK, 8VY, 9AAP, 9AAV, 9ACB, 9ADF, 9AEQ, 9AFB, 9AIF, 9AJA, 9AJH, 9AJP, 9AMB, 9AMU, 9ARK, 9ARZ, 9ASF, 9ASL, 9ATE, 9WL, 9AWM, 9AXF, 9AYS, 9AZH, 9BAF, 9BBF, 9BED, 9BGH, 9BJB, 9BJI, 9BLO, 9BP, 9BRL, 9BSG, 9BTT, 9BUM, 9BCP, 9BYP, 9CAO, 9DCF, 9DCW, 9DGG, 9DKY, 9DOF, 9DQM, 9DTH, 9DTM, 9DV, 9DVL, 9DX, 9DXN, 9DYI, 9DZQ, 9EW, 9FM, 9Z, 9HT, 9IF, 9IL, 9JG, 9PC, 9PI, 9PS, 9QD, 9QE, 9SL, 9SO, 9VE, 9VK, 9WA, 9WK, 9XAQ, 9XI, 9YF, 9ZE, 9ZL, Canadian 3BP and 4CB.

Fone—9AG, 9AKX, 9ASF, 9BNO, 9PI, 9RZ, 9XAQ.

Spark—5EW, 5FO, 5HK, 5HZ, 5IF, 5LB, 5LO, 5NK, 5NS, 5PE, 5QI, 5SM, 5XB, 5XD, 5XU, 5YG, 7MP, 7XB, 7ZV, 8AY, 8AYN, 8BEP, 8BFH, 8LB, 8ABV, 9ACB, 9ACN, 9AEG, 9AEY, 9AFK, 9AFW, 9AGR, 9AHZ, 9AIG, 9AMI, 9ANF, 9ANP, 9ANQ, 9AOJ, 9AOU, 9APN, 9AQN, 9ASF, 9ASK, 9ASM, 9ASP, 9ATN, 9AUA, 9AUL, 9AVX, 9AVZ, 9AWZ, 9XU, 9AYW, 9AZA, 9BGX, 9BHG, 9BMN, 9BOF, 9BRI, 9DEH, 9DEU, 9DJX, 9DKS, 9DPB, 9DSD, 9DUG, 9DUI, 9DXS, 9DXW, 9DZY, 9FX, 9GC, 9HI, 9IY, 9KI, 9LF, 9LW, 9MC, 9MS, 9OF, 9PI, 9RC, 9RY, 9SN, 9TI, 9UG, 9VL, 9WI, 9WY, 9XAI, 9XT, 9YAE, 9YAJ, 9YAK, 9YAL, 9YB, 9YQ, 9ZB, 9ZC, 9ZJ, Canadian 3GN.

Rev. 9AOR, Pequot, Minn.

C.W.—4FT, 5BQ, 5DD, 5EK, 5HO, 5KP, 6XO, 6XAD, 7HH, 7WE, 8AIM, 8AWG, 8AXK, 8BCA, 8BEX, 8BFX, 8BGA, 8BH, 8BO, 8BOX, 8BSS, 8CFS, 8II, 8LY, 8PN, 8RQ, 8UK, 8VY, 8WI, 8XAE, 8ZZ, 9AAI, 9AAP, 9AAU, 9AAV, (9ABB), 9ADF, 9AEG, 9AFB, 9AFX, 9AGN, 9AJA, 9AJH, (9AJP), 9AJS, 9AKD, 9AKK, 9AKR, 9ALH, 9AOU, 9AQQ, 9ASF, 9ATE, 9ATX, (9AUA), 9AUM, 9AVM, 9AWM, 9AWP, 9AXK, 9AYR, 9AYU, (9BAF), (9BAV), 9BBF, 9BDO, 9BDU, (9BED), (9BFG), 9BGH, 9BIO, 9BII, 9BJV, 9BLW, 9BOW, 9BRL, 9BSG, 9BUM, 9DB, 9DCS, 9DFA, 9DFX, 9DG, 9DGE, 9DGG, 9DHA, 9DHC, 9DIG, 9DIM, 9DKY, 9DOF, 9DQM, 9DSG, 9DSW, 9DTH, 9DTM, 9DTS, 9DV, 9DXS, 9DYT, 9DZJ, 9DZQ, 9DZY, 9EI, 9EW, 9EX, 9FM, 9FW, 9FZ, 9HW, 9IL, 9IO, 9JL, 9KP, 9LJ, 9LL, 9LQ, 9NV, 9PI, 9PS, (9QE), 9SL, 9SW, 9UC, 9VK, 9VY, 9WQ, (9WU), 9WX, 9XI, 9XAQ, 9YAE, 9ZG, 9ZL.

Spark—5IS, 5JD, 9AAW, 9AEY, 9AIG, 9AIM, 9ANQ, 9ARZ, 9ARR, 9ASK, 9ATN, 9AUA, 9AVX, 9AVZ, 9AWZ, 9AXR, 9AYS, 9AZA, (9BAL), 9BIZ, 9BXC, 9DES, (9DGV), 9DIH, 9DKS, 9DNC, 9DSO, 9DZY, 9LW, 9MP, 9XT, 9YB, 9YM, 9YAC, 9YAJ, (9YAK), 9ZC.

9DPX, St. Paul, Minnesota

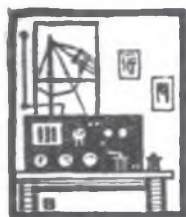
Spark—5AQ, 5EW, 5FO, 5HK, 5IF, 5JF, 5LB, 5NY, 5PU, 5SM, 8BBU, 8BXX, 9HG, 9HI, 9KI, 9LW, 9MC, 9MS, 9NQ, 9OA, 9OI, 9SN, 9VL, 9WI, 9WT, 9ABV, 9ACB, 9AEG, 9AFK, 9AGR, 9AHZ, 9AIF, 9AIG, 9AIK, 9ALO, 9AOJ, 9ASO, 9ATN, 9AUI, 9AVZ, 9AWZ, 9AXU, 9AYW, 9AZH, 9BRL, 9DCX, 9DEL, 9DFX, 9DJX, 9DKQ, 9DKS, 9DNC, 9DSD, 9DSO, 9DZI, 9DZJ, 9DZY.

C.W.—2KQ, 2BEA, 3BQ, 3AQR, 4BQ, 5EK, 5FV, 5HO, 5LA, 5NZ, 5OI, 5DV, 5GE, 5IO, 5MP, 5OS, 5OW, 5UK, 5WA, 5ABO, 5AIO, 5ALB, 5AMM, 5ANC, 5AOG, 5APT, 5AWM, 5AXK, 5BBX, 5BCO, 5BDU, 5BEF, 5BNJ, 5BUM, 5BXA, 5BZC, 5CFS, 5CGM, 5ZAE, 5EW, 5FZ, 9HW, 9HY, 9IO, 9KP, 9LQ, 9PS, 9QE, 9WA, 9ZE, 9ZG, 9ZL, 9AAP, 9AAV, 9AAZ, 9ABF, 9AIN, 9AJA, 9AKD, 9AOR, 9ARK, 9ATE, 9AWM, 9AYH, 9AYS, 9AZF, 9BAF, 9BBF, 9BED, 9BGH, 9BJB, 9BLO, 9BNO fone, 9BUM, 9DCR, 9DFL, 9DKY, 9DOF, 9DSM, 9DTS, 9DUN, 9DYN, 9DZQ, Canadian 3BP, 4CB.

9APW, St. Paul, Minnesota

C.W.—1ARY, 2FP, 3AQR, 3ZO, 3ZOV, 4BQ, 4FT, 4ZC, 4CY, 4BY, 5EK, 5ZA, 5LA, 5VR, 5UI, 5OI, 5ND, 6ZZ, 6XAD, 6ZF, 7HW, 8BE, 8DV, 8SP, 8VJ, 8VY, 8XV, 8ZZ, 8AGZ, 8AIM, 8AOG, 8APT, 8AQF, 8AWM, 8BDO, 8BLW, 8BFX, 8BUM, 8CAZ, 8CFS, 8CGM, 8ZAE, 9BY, 9DB, 9DK, 9FM, 9HW, 9KP, 9IO, 9JL, 9PI, 9RY, 9WU, 9ZY, 9ZX, 9ZR, 9ZL, 9VK, 8YQ, 9YF, 9AX, 9AAP, 9AAV, 9AAO, 9AAY, 9AOU, 9AAS, 9AJA, 9AJS, 9ATN, 9AVM,

(Concluded on page 67)



# Amateur Radio Stations



## 5HK, Oklahoma City, Okla.

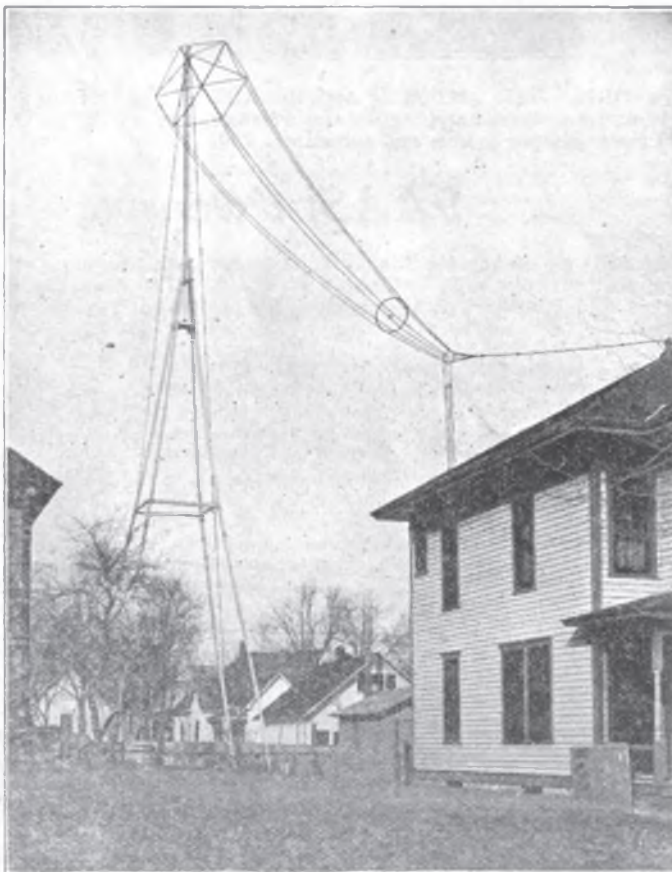
The spark set 5HK of Le Roy Moffett, Jr., at 312½ North Broadway, has been heard in nearly all states. The picture shows a selection from over 600 cards and letters he has received since September.

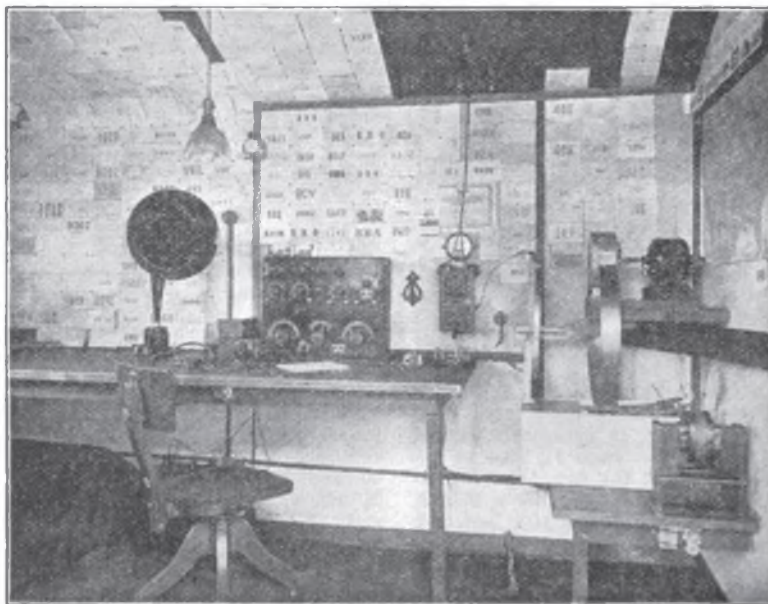
The antenna system is especially interesting. The aerial is a cage 12 feet in diameter, 93 feet high at the top, tapering to a bottom 3 feet in diameter with a 9-inch lead-in, the total length being 105 feet. A counterpoise is used, fanning out 80 degrees and covering all of the yard back of the shack and the yard to the left of the picture.

The transmitter has proven very efficient. The transformer is a 1 K.W. Acme. The condenser is a HE one and stands the gaff OK. It is an oil-immersed affair composed of 58 copper plates each separated by four 8-by-10 photo plates. The primary is a single turn of 2½ inch copper ribbon 22 inches in diameter and the secondary is made of 24 feet of ¼ inch strip. The gap is a Benwood eight-toothed driven by a variable speed motor, but as shown theoretically elsewhere in this issue the low tone is found to be best. We like this arrangement of the closed circuit, with the single-turn primary cut at the bottom for the condenser and at the top for the gap. Leads are minimized and the greatest efficiency secured thereby. With constant effort an antenna current of seven thermocouple amperes has been obtained.

The receiver is a Z-Nith regenerative with two steps of audio amplification, Baldy phones, Magnavox, W.E. and A.P. tubes.

5HK has been reported QSA from Boston, Mass., Seattle, Wash., Eugene, Oregon, Canada, and the Isle of Pines. He has worked 8RQ in Pennsylvania, 7ZU in Montana, and 6XAD in California. A 100 watt C.W. set will be going shortly to work





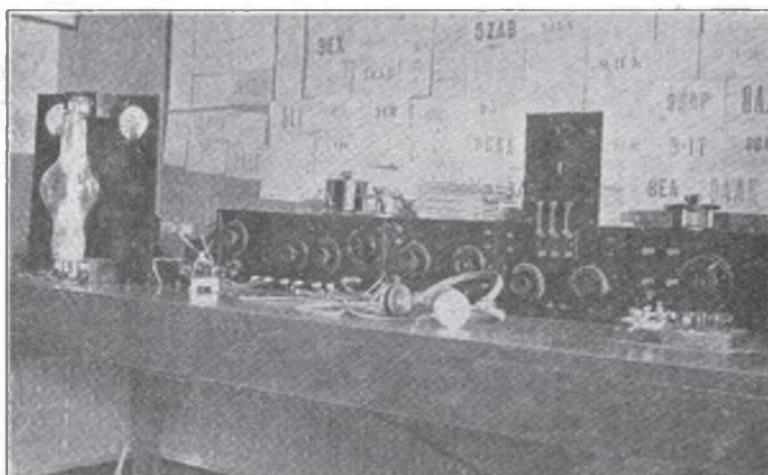
thru QRN. This station is strictly A.R. R.L. and has been handling on the average 100 messages per month and sometimes 200.

If school work didn't cause so much QRM he would probably QSR more.

## ***9AAS, Owensboro, Ky.***

9AAS, one of our leading C.W. stations, is almost entirely built by Robert W. Field, owner and operator, at Owensboro, Ky.

on the house, the flat top being 90 ft. long. The counterpoise is 12 ft. from the ground and has the same length and number of

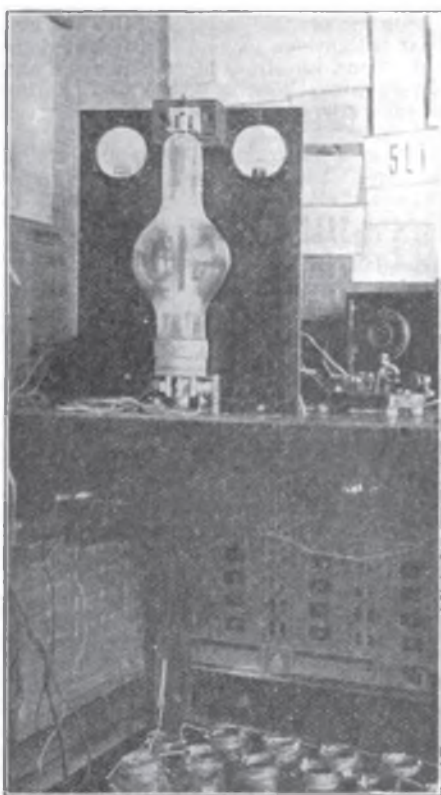


The antenna is a nine wire inverted L supported 70 ft. high at one end by a persimmon tree and 60 ft. high by a pole

wires as the antenna:

The transmitter has just been changed from a 50 watt tube to a 250 watt U.V.204

with the result that cards have been coming in faster than it is possible to answer. The circuit used is similar to number nine in the Radio Corp's C.W. catalogue except that only one tube is used. Except for the tube, grid leak, and condensers, nearly all the set is home-made. The power transformer has the low voltage filament winding directly over the primary. The high voltage winding is on the other leg and delivers 2200 volts on each side of the mid-tap. The rectifier consists of 36 quart fruit jars although 26 seems best as it



gives better radiation due to lower resistance. The elements are of aluminum and lead, aluminum wire has been found satisfactory in every way for the aluminum electrodes, used with a saturated solution of borax. With  $9\frac{1}{2}$  volts on the filament the antenna current is  $3\frac{1}{2}$  amperes. Some trouble was experienced at first in getting the tube to run without overheating but it now runs fairly cool.

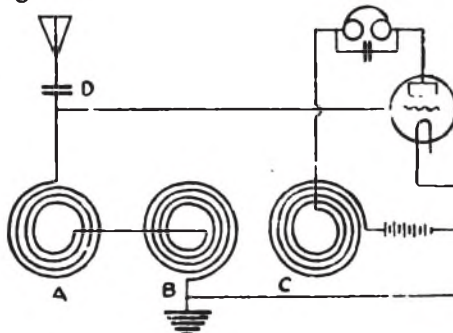
The receiver is regenerative with detector and two-step, all home-made. For plate voltage an 80 volt lead plate test tube battery is used.

9AAS has been reported in every district but the sixth, including Canada, and is an example of an excellent station where most

of it is home-made. The cost of such a station about equals the best one k.w. spark set and there is not a particle of doubt but that it is better.

### A Two-Control Tuner

ONE of the entrants in the S.W. Smith Cup Contest described a novel spark wave tuner proposed by Mr. J. E. Parker, 3XK, which was used at 3ABI in Washington with marked success. During the transcontinental relays the No. 1 west-bound message was followed until it reached the Sixth District, 5ZA being copied solid at a time when no other Washington station could hear him at all.



It is equally applicable to spark and C.W., and its performance is said to be greatly superior to all the usual varieties of single-circuit tuners. It is simplicity itself, A, B, and C being the three coils of a Turney "Spider-Web" Tuner, mounted on swinging doors. There are but two controls. A and B serve as a hinged variometer, B being the fixed coil and all tuning being done by swinging A. C is a tickler coil and regeneration and oscillation are controlled by swinging the door carrying it.

At 3ABI, on an average amateur aerial, when fixed condenser D had a capacity of 0.001 mfd. the wave length range of this set was from 150 to 240 meters.

Try it.

#### ALL OUT OF MARCH

The great demand occasioned by the publication of the improved Reinartz tuner in our March issue has completely exhausted our supply of that number. However, we have a limited supply of June, 1921, issue, in which complete information was given on the original tuner, hundreds of which are giving splendid performance in amateur stations. While they last, 20 cents the copy.

QST, 1045 Main St., Hartford, Conn.

# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.



## Telegraphy's the Thing

Dayton, Ohio.

Editor, QST—

Your editorial in March 1922 QST was read with much interest.

In dealing with the subject "Phones and Amateur Radio" it seems that an important point has not been brought out. What is the chief use of radio communication, anyway. I think it is the transmission of intelligence from point to point in the least possible time. Right here, we of the "TELEGRAPHERS" group, have a powerful argument. The long years of successful commercial traffic carried on by the Western Union and Postal Companies has proven the superiority of the telegraph over the telephone for the ACCURATE transmission of intelligence. The A.R.R.L. is altogether for the RAPID transmission of messages, and that is the fundamental usefulness of radio telegraphy.

The radio telephonists, both the listening classes and the transmitting classes even including the commercial broadcasting stations have no claim to actual utility, they only have popular support. They cannot argue that it is necessary, for instance, to transmit music from Pittsburgh to some distant point instantaneously. Even the lectures which are transmitted have no urgency demanding their transmission in a short space of time. I do not think the radio telephone has any logical claim to the ether, and I think our government should be made to see this point.

Let's use this powerful argument in furthering our interests: That radio communication has its greatest value in the rapid transmission of intelligence. The amateur relay men and commercial telegraphs should have preference over the phones.

Yours for RADIO TELEGRAPHY,  
Paul R. Fenner,  
Director, Dayton Radio School,  
Former Editor Pacific Radio News.

## Arc-Light QRM

Philadelphia, Pa.

Editor, QST—

I am a regular subscriber to QST. I have searched every month through it for some data on the elimination of arc light induction but so far I have been disap-

pointed. I will give you the conditions under which I labor and if you in your next issue will print something which will enlighten me on this subject I shall be under great obligations to you. I live about three doors from an elevated car line and under this elevated there is a string of arc lights on each side with a space of about thirty feet between each arc. My aerial, which is a four wire flat top, is parallel with this arc line. I was using a crystal detector when I first heard this noise and then changed to a regenerator and tube detector thinking I could eliminate this noise. Instead it came in louder and at a friend's suggestion I shunted a variable condenser from the ground to the B Battery. This also did no good. I then erected an aerial at right angles to the arc line but this also was useless. I now started to get at my ground. I had been using buried chicken wire for a ground and I tried the radiator and then a tin roof but it did not make the slightest difference. I am at the end of my resources and look to you for help.

Thanking you in advance, I remain  
A Very Disheartened Ham.

(We regret to say that we do not know an effective way of getting around this trouble—and it has kept many a good station quiet for a season at a time. Does anybody know any way around it? If so, please let us have the dope at once, for publication. Some hope is held in the balancing-out scheme, whereby a second aerial or perhaps preferably a loop would pick up additional arc-QRM and couple it into the tuner in the reverse direction from the regular aerial, thereby cancelling out the QRM and leaving the signals collected on the main aerial. Anybody tried this with success? Help!—Ed.)

## Rotten Routing

90 Mountain Ave.,  
Summit, N. J.

Editor, QST—

In reading a letter of Staff Sgt. Walkeen, published in January QST, I noticed that he says one should QSR a msg. to keep it going. That is very good as far as it goes but it seems to me that too many amateurs

QSR just to keep the msg. going and not to get it to its destination. The lack of judgment shown in relaying some msgs. is appalling. I have QSRed east and hrd the msg. come back from the south a week later to another station in the same town. It might better to delay a msg. a short time rather than QSR in the wrong direction just to get rid of it. Many a msg. never gets to its destination because it goes around in circles until someone gets wise to the fact that the information in it is too old to be any good and therefore throws it in the waste paper basket.

Most of this trouble could be remedied by a little thought and possibly the use of a map.

73, CUL.

Leonard Richards, 2AFR.

### Keep Your Eyes Open

Lebanon, Ind.

Editor, QST—

List to my sad tale. Honest,—I've got a real kick coming this time. It isn't often that I get peeved enough to want to break into print, except of course, when something begins to interfere with the great old game, radio.

Now I honestly believe that the radio manufacturers are going to queer this kitty of ours unless we rise up wrath and get the wouff houg to working. The case in point is this—No long since a prominent radio man, sales manager of an eastern manufacturing concern of long standing, came to Indianapolis and indulged in a speech the substance of which may be summed up as follows—The people who are putting in expensive radio sets to receive wireless music do not want to hear this dah-de-dah stuff—they are not going to take the time to learn the code—and, if interfered with, are going to raise considerable protest.—Thus, unless the amateur lays off between the hours of 6 and 11 P.M., he will simply be legislated out of existence.

For the past ten years his firm, and all the rest of 'em, depended upon me and the hundred thousand other dah-de-dah amateurs to keep them going. The amateur made possible the development of the apparatus we have today, and some of our best designers come from that same gang. But, now that the manufacturers have a new and extremely gullible field for their operations, we are going to be "legislated out of existence very promptly".

Laying aside the fact that, this attitude makes us peevish, let's see if there isn't a solution to the problem:—

The amateur has a definite place in this scheme of affairs. Wouldn't the Signal Corps be in a heluvafix with this Radiola gang for ops? And everybody enjoys the concerts, for some really worth-while music is being sent out. I don't mean this Vic-

trola stuff that we have to stand for most of the time, though.

Thus why can't the manufacturers build a set for the amateur that works from 100 to 300 meters, and another for the Radiola outfit that responds to the band of wave lengths between 600 and 1,000. The unused section between 600 and 1,000 meters would be very satisfactory for radio music, and any amateur can get it after about three minutes work connecting a honeycomb coil. There is plenty of room for both of us, so let's stop this impending fight right now before it is too late. Otherwise it will mean the scrapping of a lot of apparatus.

Whenever an amateur game of any kind is commercialized, it is promptly relegated to the scrap heap. So let's get busy and start something.

Sincerely,

Bayard Shumate, 9KR.

### Welcome Brother

326-18th St.,  
Toledo, O.

Dear QST:—

I am a new reader of your magazine and get a devluvolot of amusement out of it. But I want to tell you how I feel about all this.

I first became interested in radio through radio music (?) and having been a professional musician for the past eighteen years I naturally became interested in the possibility of home folks enjoying good music at home. I purchased a number of radio magazines among which was QST and it goes without saying that I soon felt my lack of enlightenment on radio most keenly. Asking for some information at a local supply concern I was advised to cultivate the acquaintance of someone who knew and little by little I would pick it up! That is like that famous bit of advice: "Send your boy to college and the boys will educate him."

I bought books on the subject only to find that they were so mathematical that I could get little out of it, it having been some 20 years since I looked a quadratic in the face.

I had just begun to feel this was a cold, cold world and that you just had to know before you could understand what anyone was trying to tell you about radio and O joy, QST comes out with "Getting Started Listening" in the March issue. I read and understood every word of it. No, I know that it is not explanatory of the principles of wireless which I so much crave but it is *something*. Just give me time and I will get the principles. Just give me time and I will come to the point in this letter.

I started this thing interested in fone only, and was willing to listen to most anything so long as it came over the ether. But drivel is drivel and doubly so when it comes over the radiophone. Occasionally

some worth-while stuff comes over the wireless fone but 90% of it is worse than garbage from a musical festival. Being a musician, I detest jazz. When a person learns to appreciate—that is, listen to—music he no longer cares for jazz. Some folks prefer bologna to sirloin; folks with the same comparative musical tastes demand jazz, and get it, worse yet, *by way of radio*.

So I have lost interest in fones and want to learn all I can about telegraph receiving and transmission. Dear QST, couldn't you find space for a little information each month for us who want to know about radio and—there are thousands of us. Slip the mathematics to us gradually and we will assimilate in small doses.

Very truly yours,  
Ben F. Boyer.

### Back to Earth

Norfolk, Va.

Editor, QST—

In reading over the January number of your valued paper, "QST", I note the following under "Strays":—

"Recent news service pictures show a cow-person on horse-back with a portable radio set, overhead antenna, etc., all prepared to round up stray cattle. The thing that bothers us is what do they do for a ground—have a binding post in the horse's side?"

I imagine you have had many restless nights, pondering over this deep problem, and thinking that perhaps you might be relieved by any solution, good, bad or indifferent, may I suggest that the ground lead be attached to the horse's (g)irth? It is only a simple problem in mathematics to subtract the "g".

Being an ex-Signal Corps man, I once had the pleasure (?) of "spilling over" one of the brutes referred to, and while I found the transmitter was very efficient a highly-damped ground offered poor reception. I am for hooking the antenna to the bridle and the ground lead as suggested above.

With kind regards, I am,  
Yours truly,  
R. I.

### A Spark Coil C.W. Set

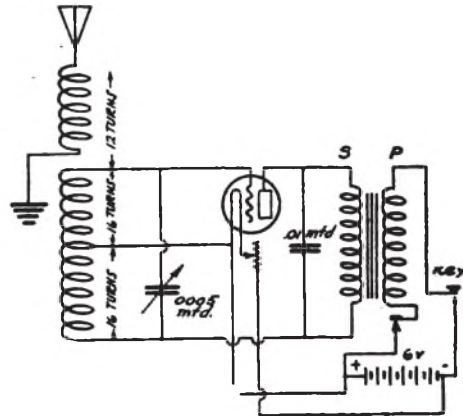
2065 Belmont Ave.,  
Bronx, N. Y.

Editor, QST—

QST readers may be interested in my spark coil C.W. set. A diagram is here given.

I have found by experiment that inductive coupling will give better results than conductive coupling on a set of this type. By putting a 2 volt flash light bulb in the antenna circuit, the set can easily be adjusted to resonance. The apparatus needed is a Quaker Oats tube or any other 4 inch tube, a roll of insulated annunciator wire, a .0005 mfd. variable condenser (a

small Murdock is just right), a U.V.201 amplifier tube or any other hard tube operating off 6 volts, a rheostat, a ½ or 1 inch spark coil, a .01 mfd. fixed mica condenser to lower secondary voltage and pass high frequency.



Twelve turns are wound at the top of the tube for the antenna inductance. A space of 2 inches is left and the grid-plate coil is wound. This consists of 32 turns with a tap at the center. The only tuning element is the variable condenser. If the set does not oscillate then reverse the connections to the primary of the spark coil. A toy step-down transformer can be used to light the filament.

With this set I have no trouble working 55 miles daylight. This set can be used to radio-phone 1 mile if a microphone is placed in primary of spark coil and the vibrator tightened.

Samuel Kopelson,  
2BCF.

### Rotten Msg.-Delivery

2111 So. Franklin St.,  
Denver, Colo.

Editor, QST—

Being a very enthusiastic amateur and working for the success of amateur radio, I am taking the privilege of expressing my idea of the present day conditions of amateur relay stations.

First of all I wish to say that I, myself, have sent many relay messages to different points, mostly east of Denver, to localities that have many large relay stations, but I am sorry to say that *not a one* out of at least twenty messages has ever reached its final destination. Why? Why should a station accept a message if he does not intend to or cannot, deliver it?

I will name the destinations of a few recent messages sent from here (Denver) so you may see just why I have a good base for my argument. First we have Chicago, Ill. When you ask a relay man if he can



QSR Chicago, why he will always say "Sure, that will be easy", yet I have never succeeded in getting a message delivered there, even after hearing the message given to a Chicago relay station. Then comes La Crosse, Wis. This is a large radio center, yet I have never succeeded in getting a message there. Then we have Aurora, Ill., about thirty or forty miles from Chicago; Rockford, Ill. approximately eighty-two miles from Chicago, and again we have no success in getting messages to any of these points. Again, I ask, what is the trouble? It isn't the radio relay league proper, it's the stations representing them improperly.

Mr. Editor, if you look at this subject as serious as I do, I am sure you will give it a little thought. I would appreciate it very much if you would consider publishing this problem in an early edition of the QST as I would like to hear some one else's opinion on this difficulty.

R. C. Schryver, 9AWL.

#### CALLS HEARD

(Concluded from Page 60)

9AYS, 9AWM, 9QE, 9AOG, 9AFB, 9AZH, 9BJB, 9BOG, 9BXY, 9BRG, 9BRS, 9BSG, 9BLO, 9BAF, 9BFX, 9DHE, 9DDW, 9DSW, 9DJI, 9DYN, 9DVA, 9DZQ, 9DTH, 9ZG, 9ARK, 9ASF, 9DTS, 9DBG, Canadian 4CB, 3BP.  
 Spark—Canadian 3JL, 3FO, 3EI, 3GN, 3BP.  
 U.S.—4BQ, 3XM, 5SM, 5DD, 5XB, 5XU, 5FO, 5HK, 5XA, 8YU, 8JJ, 8CP, 8YN, 8BEP, 8BEP, 8ZP, 9APA, 9HI, 9HT, 9HR, 9KI, 9IY, 9OF,

9JQ, 9MS, 9MC, 9LW, 9OA, 9WT, 9WI, 9TI, 9ZX, 9XM, 9ZO, 9RC, 9AAP, 9AIF, 9AIG, 9AZA, 9AVZ, 9AYW, 9ANF, 9AMQ, 9AEG, 9AFK, 9AVP, 9DEH, 9DMC, 9DMK, 9DUG, 9DSD, 9DSM, 9DSO, 9DIW, 9BKW, 9DFA, 9DZY, 9DZI, 9DZE, 9YAJ, 9YAE, 9YAK, 9YAC.

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American Radio Relay League,

Hartford, Conn.

## Of Interest to Display and Classified Advertisers

We are pleased to announce that this issue of QST is running 50,000 copies. The recognized merit of QST as the best magazine for the progressive radio amateur and experimenter—its nation-wide prestige as the publication of the American Radio Relay League, THE national association of amateurs, has resulted in an enormous yet healthy demand, and consequently greatly increased circulation. For the last number of months QST has grown by thousands with each issue, and this growth continues unabated. Of interest to the up-to-date advertiser is the fact that paid-in-advance circulation is growing in proper proportion to counter sales.

QST's unquestioned value to the progressive manufacturer and dealer is therefore immeasurably greater. The axiom that apparatus of merit can be most profitably advertised in QST is truer than ever.

Classified advertising is six cents in advance, as explained at the head of that department in this issue. Display advertising rates will be promptly mailed any reputable manufacturer or dealer. Please address:

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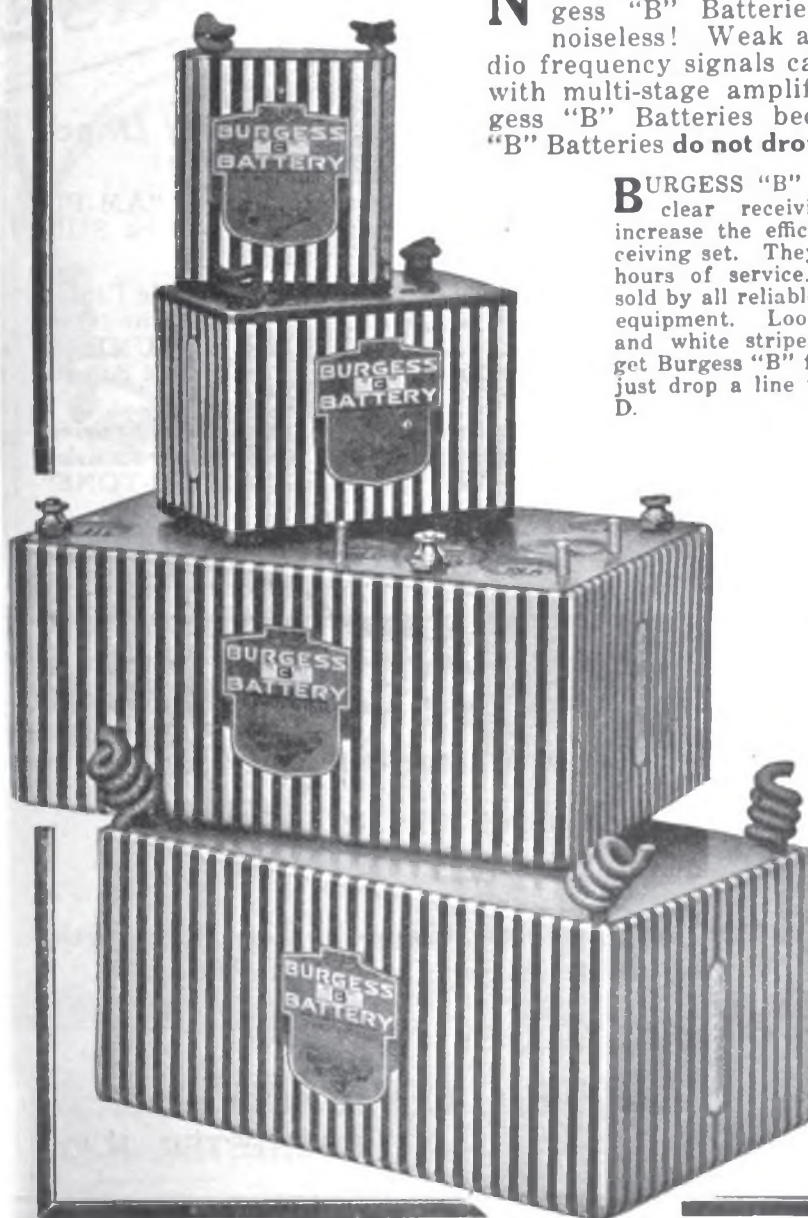
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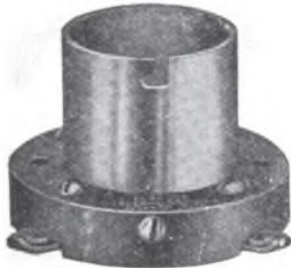
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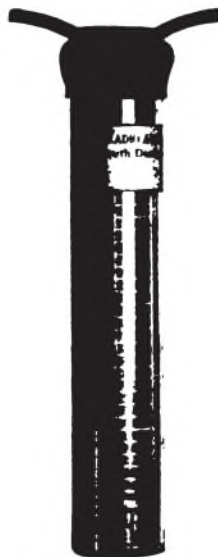
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