You have asked for it. You have looked for it. You have hoped for it. And here it is—a transmitting tube for telephone and telegraph C-W transmission, built right up to British and to French Government specifications, including the SHAW standard four prong base.

The plate is nickel, a special molybdenum grid is provided, and the high vacuum permits operation on plate potentials of 500 volts without breakdown. Capacity is about 12½ watts, and any number may be used in parallel—four make telephone conversation possible over 25 miles, telegraph signals over 50 miles.

Adopted by De Forest Radio Co. as the standard transmitting tube in all De Forest sets of less than ¾ k. w. capacity. Licensed under the De Forest Audion and Fleming patents. Other patents applied for and pending.

PRICE $7.50
ORDER FROM
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PACIFIC RADIO SUPPLIES CO.
638 Mission Street
San Francisco, Cal.

ATLANTIC RADIO SUPPLIES CO.
8 Kirk Place
Newark, N. J.

Distributors for Moorhead Laboratories, Inc., Manufacturers of

A-P Transmitting Tube

To be used only in apparatus manufactured by De Forest Radio

Tel. & Tel. Co.
C. J. Cunningham

announces

THE IDEAL AMATEUR TUBE

in this new

AudioTron Detector Type C-300

WITH STANDARD FOUR PRONG BASE

Type C-300 possesses combination properties—it functions as a highly sensitive spark detector, an Audio-Frequency Amplifier, an Oscillator for regenerative amplification and C W reception, a radiophone detector and amplifier—with the added advantages of low B Battery (18-22½ volts) ease and permanency of adjustment, uniformity and quietness.

Type C-300 is produced by an entirely new process of manufacture. Gas action must be coupled with electron emission for high signal audibility and sensitivity as a detector. In the past it has been impossible to control this necessary gas content during manufacture and also obtain uniformity. Put Type C-300 to the test as we have in comparison with all previous types of tubes. I am confident of your answer.

Produced in large quantities entirely by machinery in the largest vacuum tube factory in the world has made it possible to offer Type C-300 at the remarkable price of $5.00. Every tube is carefully inspected and tested and is guaranteed free of all mechanical and electrical defects.

Cunningham Type C 301 High Vacuum Amplifier

is designed to meet the demand for the Navy Type amplifier and regenerative receiver. The internal structure and exhaust permit operation at plate voltages of 40 to 100. $6.50 Amplification constant 7 to 9 with internal impedance of 20,000 to 12,000 ohms. Price

SEE YOUR DEALER TODAY and get your copy of Bulletin C-300 describing these new tubes. If your dealer cannot supply you send us his name and address and we will mail you a copy without charge.

Service and Quality since 1915 Guaranteed by

C. J. Cunningham

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ROTARY GAP No. YM-1
A new development in the rotary line has been made expressly for Young & McCombs. Improvements on the well-known saw tooth rotary wheel make this gap the equal in tone and efficiency to any selling for twice the money. It is the only gap on the market which will run smoothly and reliably in either a horizontal or vertical position. Can be run in a vertical position while screwed to the wall. Rotor is machined cast aluminum with formula center. Has liberal sparking space and is drilled for either 1/4 or 3/16 shaft. Variable motor speed switch in base.
PRICE—Completely Assembled—$15.00

SAW-TOOTH 16-POINT ROTOR
$4.50

ROTOR BASE AND STANDARDS
$7.00

“COOTIE” KEY No. YM-6
The “Cootie” key is the snappiest sending device offered on the market for reliable spacing of characters. Large standards, formula knob, substantial silver contacts suitable for use up to 2 kw. The double action of the “Cootie” key lends an individuality to your sending. Price, Nickel-plated $25.00.

UNIT SECTIONAL CABINET RECEIVERS

VM-7b
A typical unit sectional cabinet receiver is here shown. We are the sole originators and designers of this type of receiver. Cabinets are of quarter-sawn oak with “Early English” finish. Bawilite panels. Audion cabinet contains 60 volt variable “B” battery. This set, with proper honeycomb coils, is operative from 150 to 20,000 meters. Amplifiers may be added to these sets in any number. The crystal detector cabinet includes an enclosed buzzer and battery. All instruments can be supplied separately or in complete sets.

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WESTERN REPRESENTATIVE—Leo J. Meyberg Co., San Francisco, Calif.

When writing to Advertisers please mention this Magazine
RADIOTRONS VACUUM TUBES for Amateur or Experimental Use

The facilities and resources of the world-famous RESEARCH LABORATORIES of the General Electric Company have been concentrated upon the development and design of a new series of VACUUM TUBES for Radio Detection and Amplification. The RADIO CORPORATION OF AMERICA now offers to the Wireless Experimenters two distinct types, each adapted to a particular field of usage.

RADIOTRON U. V. 200, the first of the series, is a Detector and Audio Frequency Amplifier of unusual capabilities, which operates from a single standard plate battery. Best detector action occurs at plate voltages between 18 and 22½ volts, with a filament current of approximately 1 ampere, and with a grid condenser and grid leak. U. V. 200 is particularly adapted to amateur regenerative circuits. A trial in such circuits will be the most convincing.

NOTE—A special "A" or filament battery potentiometer for close adjustment of the plate voltage of U. V. 200 will shortly be placed on the market by the Radio Corporation.

RADIOTRON U. V. 201, the second of the series, is an unexcelled Amplifier of the PLOIOTRON type, which may be used for Detection and for Radio or Audio Frequency Amplification. Normal plate voltage, 40 (two standard "B" batteries). Voltages up to 100 may be used on the plate with increasing amplification. Amplification constant, 6.5 to 8 at 40 volts on the plate, 8 to 10 at 100 volts on the plate.

Note to Amateurs, Dealers and Jobbers
Radiotrons are manufactured by ultra-scientific methods laid down by America's foremost tube experts. No guess work—each tube bears the stamp of electrical manufacturers of world-wide reputation. A uniform product is assured. All tubes fitted with standard four-prong base. Filaments operate from 6 volt battery with rheostat.

LIST PRICES

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A complete line of vacuum tube ACCESSORIES are now in manufacture and will shortly be available.

Dealers and Jobbers: We have an especially attractive proposition for you. Write us at once.

Address all orders and enquiries to

SALES DIVISION

COMMERCIAL DEPARTMENT, Radio Corporation of America
233 Broadway, New York City

The Radio Corporation's tubes are covered by patents dated November 7th, 1905, January 15th, 1907, and February 18th, 1908, as well as by other patents issued and pending. Tubes licensed for amateur and experimental use only. Any other use will constitute an infringement.

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PARAGON RA-TEN

Amplifying
Short Wave
Receiver

Licensed under Armstrong and Marconi Patent, 1,113,149.

You'll Hear Stations You Never Heard Before

---With This New Paragon!

The PARAGON R. A. Ten covers amateur, commercial and navy wave-lengths. Advanced engineering design, combined with superior insulation and accurate controls, enables you to hear the weak station plainly and with proper selectivity, THAT ONE STATION ONLY. Here are a few outstanding features:

- Wave length, 160 to 1000 meters
- Amplification, 100 times
- No dead end losses whatever
- Vernier attachments on all controls.

The original R. A. 6 was the acknowledged superior of any other set on the market. This NEW triumph of Adams Morgan Co. is as far ahead of the R. A. 6 as that was ahead of all others.

All amplification is obtained without change of spark tone. Objectionable effect of change of note is entirely eliminated. Coupling has scale of 180 degrees.

The cabinet is of quartered oak; overall size 20 5-8 inches by 8 inches by 7 1-2 inches. Fitted with genuine Bakelite panel, knobs and dials. White filled engravings. Truly an instrument to be proud of.

Every set sealed and guaranteed for two years.

PRICE EIGHTY-FIVE DOLLARS

Send for our Special Bulletin on the Paragon R. A. Ten. Interesting and complete. Drop post card today.

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Sole Distributors of the Paragon RA-TEN

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When writing to Advertisers please mention this Magazine.
The ACME SPARK TRANSFORMERS have the highest efficiency, highest power factor, highest spark frequency and lowest price of any on the market.

The ACME C. W. POWER TRANSFORMERS are for use with rectifying tubes for supplying high voltage direct current and for lighting filaments.

The ACME MODULATION TRANSFORMERS are essential for large power tubes.

The ACME AMPLIFYING TRANSFORMERS are the result of experiments by transformer engineers. Correct ratio and impedance.

The ACME AMPLIFIER and ACME DETECTOR contain in a small space what so often required considerably more.

The ACME CHOKE COILS are 1 1-2 Henries for use in C. W. power circuits.

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**Acme Apparatus Company**

21 WINDSOR STREET, CAMBRIDGE 39, MASS.

TRANSFORMER AND RADIO ENGINEERS AND MANUFACTURERS
Let these Tubes Enlighten Your Station on Christmas Eve

A SUGGESTION
What better gift could you give your radio friend than a vacuum tube and a subscription to "Pacific Radio News?"

We are going to give them to you FREE of charge. Read this wonderful Christmas offer!

OFFER NUMBER 1—THE A. P. V. T. TUBE
Given free with a four year subscription to "Pacific Radio News." Specify whether an Oscillator, Amplifier or Detector tube is desired. Add 25c for mailing charges. These tubes sell for $6.00 and $7.00. They are genuine and guaranteed by the manufacturer.

OFFER NUMBER 2—THE NEW CUNNINGHAM AUDIO-TRON TUBE
Given free with a four year subscription to "Pacific Radio News." The regular price of this tube is $5.00. Add 25c for mailing charges. All tubes are genuine and guaranteed by the manufacturer.

OFFER NUMBER 3—THE NEW A. P. TRANSMITTER TUBE. Will carry 12.5 watts.
Given free with a five year subscription to "Pacific Radio News." All tubes are guaranteed by the manufacturer. Regular price $7.50. Add 25c for mailing charges.

OFFER NUMBER 4—THE NEW PARKIN .001 PANEL MOUNTING VARIABLE CONDENSER
Given free with a two year subscription to "Pacific Radio News." Add 10c for mailing charges.

OFFER NUMBER 5—THE PARKIN PANEL RHEOSTAT FOR PANEL MOUNTING.
Given free with a one year subscription to "Pacific Radio News." Add 10c for mailing.

Important! These premiums will be awarded on extensions, new subscriptions, or to those who desire to secure subscriptions from individuals.

PACIFIC RADIO PUB. CO.,
50 Main St., San Francisco, Cal.

Herewith is $......... and ..........cents for mailing charges. Please send the apparatus described in offer number ........... and "Pacific Radio News" for ........... years to:

Name ................................................
Address ............................................

Make it a Radio Christmas!
Now Dad—Hear the tenor

"I can listen in on all the radio concerts now, Dad. Those Baldwin phones you bought me for Christmas are corkers. Just listen to that famous tenor singing over the wireless telephone. Every note records just as clearly as though it were a phonographic reproduction right here in our own home."

Actually Baldy Phones reproduce in identically the same manner as do the high grade phonographs. Instead of a heavy iron diaphragm, as in most phones, a selected grade of mica is used. This is much more susceptible to distortion and as a result responds more readily to the thousands of overtones and harmonics of the human voice or any musical instrument.

Baldy's are the most sensitive phones in the world. This is attested to by the fact that the leading radio engineers, with every facility at their command for testing the audibility and sensitiveness of every make of phone, choose Baldwin for their personal use.

Our new booklet will give you some interesting facts about Baldwin Phones, in addition to prices. Ask your dealer for a copy. If he can not supply you write direct, giving his name and address.

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U. S. Bureau of Standard Wave-meter
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Brownlee Adjustable Phones

Baldy PHONES
FOR LAND
SEA
AND IN THE AIR
TO ALL RADIO MEN, THOSE WHO WILL UNDERSTAND

CHRISTMAS is here. Merry Christmas. Peace, Good Will, Happiness and Contentment for all is abundant. One Christmas has passed since the great world war, but it has not been till this Christmas that all the boys have returned home, become settled and ready to appreciate all that Christmas means.

There is something about Christmas that brings cheer to the saddest heart, and if it does not, isn’t there something wrong? Aren’t there some of us, who, somehow or other, are never at rest without just decrying about this or that being wrong? What’s the trouble? No resonance! YOU, who are not happy this Christmas, or rather, think you are not, just take a look at your hot wire meter, first, and see if the needle isn’t waltzing with the ZERO mark. But don’t waste time looking at the ammeter. Start in cleaning house. Don’t just fix up the condenser with new connections, don’t sandpaper your spark gap points, or just re-wire the old “junk heap.” Build yourself a house on a stone foundation, as the parable says. Tear everything out, and build anew.

Resign your membership in the Inefficient Club; join the American Society of Efficientists. And remember this, men, there are no different grades of membership—all are the same—just plain MEMBER. A man in the One Inch Coil class rates as high as the man in the One Kilowatt Transformer class, just as does the Galena expert rank with the Vacuum Tube hound. So don’t “bellyache” about not being able to join.

Now that you are a member, keep this in mind: your source of current supply is UNLIMITED. You can have all you want. Just a word to the wise will be sufficient here; if you have a spark coil use six or eight volts of the unlimited direct current and if you use a transformer use the unlimited source of alternating current and use the right voltage. Next, but before hooking up your coil or transformer, fix everything up nicely. Get each and every receiving instrument in tip top shape, discard the ones that are really more of a drag than a help and ask Dad. or Santa Claus, for some new ones if you really need new ones.

Be sure that everything is right, though. Don’t work in the dark; remember there is LIGHT. For instance, don’t use three No. 19 copper wires for a lead-in to an antenna having four No. 12 wires. That is wrong. DO THINGS RIGHT; ALWAYS RIGHT. If there is any point you are in question about remember that you can procure the information without trouble from good books, or write us; we’ll tell you.

And when you are ready, tune up. Fix yourself so that you only radiate PURE WAVES. Also be sure of your WAVE LENGTHS and SHARPNESS. Of course, even a Radio Inspector would concede that it is not so necessary to be SHARP in every sense of the word, but you must not be over two hundred meters.

Now we assume that you are ready to send and receive. The next word of caution is this: SEND WITH WISDOM. Don’t be selfish, don’t take it all for yourself; think of others. Send at a speed which is such that each character is perfect, and perfectly spaced.

These words of wisdom have been written from the Unlimited Source of Supply, those who heed will have a very Merry Christmas, those who do not will not fare so well. You may have to read this over again, but you will understand with a little study. Merry Christmas to you, all of you, and think, too, that even static can be eliminated.
THE RADIO CONVENTION—A STEPPING STONE TO PROGRESS

LEFT—Major J. F. Dillon.
Honorable Chairman of the Convention.

RIGHT—Willard E. Lufkin,
Chairman of the Convention Committee, who has full charge of the affair.

Illustrations by J. L. SABO

THE Pacific Radio Convention at San Francisco, California, November 25th, 26th, 27th and 28th, will bring to the attention of the public the magnitude of the radio industry and provide one of the greatest mediums of intercourse between radio men ever held.

Never before has an attempt been made to bring radio men together with the purpose of exchanging ideas, demonstrating the fruit of their efforts, and for enjoying good fellowship in the profession, as in the coming Pacific Radio Convention. Each and every man who is affiliated with the radio industry and who does not come to San Francisco to profit by the convention will miss a rare opportunity of educating himself to future possibilities in the radio field. All radio men should make it a point to be there, because there is a place waiting for every man in the "game" at San Francisco during the convention.

THE FIRST CONVENTION MEETING

The first meeting will take place on Thursday morning, November 25th, Thanksgiving Day, at 10 a.m. This meeting will be the opening of the convention and only radio men will be in attendance. It is expected to open the convention with a speech by Mayor Rolph of San Francisco, given by radio telephone from his residence.

Major J. F. Dillon, Radio Inspector for the Sixth Radio District, is the Honorable Chairman of the convention. Nearly every Pacific Coast radio man and many others know Major Dillon as a fine character, a loyal and true friend, and a man unconcerned with petty prejudices which, in this day and time, are so common in radio circles. Major Dillon is one of the men who will make the convention a success.

The Chairman of the convention committees is Mr. Willard E. Lufkin, formerly a lieutenant in the Signal Corps of the United States Army. Mr. Lufkin is responsible for the financial success of the undertaking and has carried out his duties in a manner worthy of the highest commendation. He has been devoting his entire time to the management of the affair, and will be one of the principal figures of the convention. The responsible duties as chairman of the main committee were accepted by him after three former chairmen had declined to carry on the work.

The convention activities will be at 2400 Sutter street, near Divisadero street, in the auditorium of the S. F. Gymnastic Club. Take a No. 1, 2, 4, 24, or Municipal street car direct to the convention. Arrangements have been completed to seat 1000 radio men.

THE SECOND DAY OF THE CONVENTION

On Friday, November 26th at 8 p.m., the most phenomenal and magnificent radio show will open. Amongst the exhibitors will be the following:

Pacific Radio Supplies Co.
De Forest R. Tel. and Tel. Co.
Leo J. Meyberg Co.
The Colin B. Kennedy Co.

They Will Be Coming From All Over.

People in the Vicinity Will Know There's Something Doing.
to attend the show, and radio men are requested to bring as many friends as they can, to show them the wonders of wireless.

THE RADIO BANQUET

The Radio Banquet will be given on Friday, November 26th, at 7 p.m. in the banquet hall of the S.F. Gymnastic Club. The proverbial everything "from soup to nuts" will be served, and not only that, but some novel and interesting "stunts" will be shown also. It is expected that over 200 men (radio only) will attend. A good time for all is predicted and radio jokes and speeches will help to digest the dinner.

THE RADIO BALL

The Radio Ball will be a gala event. It will be held in the ball room of the Century Club of San Francisco. The affair will be invitational. The guests will be given an unusual treat in the form of a radio musical surprise. All menfolk will be those who are actively interested in radio. One hundred and twenty-five couples will be invited to attend.

In the January, 1921, issue of Pacific Radio News there will be a full account of the proceedings of the Pacific Coast Radio Convention.

There will be some attraction - I'll say!
BORDEAUX RADIO STATION SUCCESSFUL

The mammoth radio station at Bordeaux, France, for which the parts were manufactured in the plant of the Federal Telegraph Company at Palo Alto, and which were installed and tested by representatives of the local concern, has passed all tests satisfactorily and is now being operated by the French government, according to information received by Haradan Pratt, acting chief engineer of the Palo Alto plant, from Chief Engineer R. R. Beal and J. A. Miller, both of the Federal Company, who are still in France observing the operation of the station.

Considering the fact that the Bordeaux station is the largest ever built, it is interesting to the engineering world to know that in the entire thirty-day period of tests the station operated with perfect success without a single break or interruption, and it was never necessary at any time to make any changes or modifications of magnitude, so that the engineers from the Palo Alto factory were able to leave the station in the hands of the French operators after the tests were completed.

During the testing period, the French operators and engineers were trained to operate the station, and have been able to do so without any further assistance from the installing crew.

Signals from the Bordeaux station were observed by other radio stations scattered over the world, including those of the United States navy in the Hawaiian Islands and the Philippine Islands. Reports received at the Palo Alto plant since the completion of the tests indicate that good, clear signals were obtained on all occasions. According to officials at the local factory, the Bordeaux project has more than fulfilled the highest expectations of the builders.

Characteristics of Bordeaux Station

The equipment for the Bordeaux station was designed and built in the Federal Telegraph Company's factory here in 1918 and the installation was made in France for war purposes by the United States Navy Department, which contracted with the Palo Alto company for the equipment. The government of France provided the foundations and buildings for the project. The apparatus is contained in a large power house and the overhead antenna network of copper wires is held in place by eight self-supporting steel towers covering an area of 4000 by 1400 feet. The towers are 820 feet high and weigh 550 tons each. They are the largest and best erected of any radio station in the world.

The magnitude of the Bordeaux station may be realized when it is noted that the antenna structure is nearly one mile long.

Power to operate the station is obtained from the City of Bordeaux over a transmission line, and when operating at full power from 1000 to 1200 kilowatts of energy are necessary continuously.

Another unique feature of the station is the unusual length of the electric waves it produces. The longest wave lengths used for radio communications previously have been those employed at the naval radio station at Annapolis, Md., the equipment for which was built in Palo Alto. The Annapolis station uses a wave length of little over a mile long. The Bordeaux station, during its tests, used a wave length almost one and one-half miles long. These enormous wave lengths permitting the waves to travel for long distances have been one of the features of the performances of the Bordeaux station.

Better Service Than Cables

The field for wireless development is considered by the radio experts to be extremely promising since wireless communication presents advantages over the cable line system, being able to give better service than cables and not involving the heavy cost of cable building and cable ship maintenance.—Palo Alto "Times."

Results of Honolulu Test To Be Announced at Convention

O N SATURDAY and Sunday, November 20th and 21st, at midnight, Honolulu time, the Hawaiian Transmitting Contest will take place. Dozens of applications to partake of the test have been received of late, but it has been necessary to limit the number of contestants to fifteen in order to avoid confusion and delay.

A radiogram bearing the date of October 26th has been received from Mr. M. A. Mulroney, expert radio aide at the Pearl Harbor Naval Station, reading as follows:

"Tests arranged November twenty-first; letter follows."

Another radiogram received the same day from Mr. T. Hall states that the test will be held on the 20th and 21st at midnight, Honolulu time, and the fullest co-operation is guaranteed.

As we go to press we are still without written word from Mr. Mulroney, probably due to delays in the mail. A letter from Mr. T. Hall dated November 2nd is at hand and he has this to say:

"I suppose you received my radio in reference to the test. I saw Mulroney and he states that he has written you. I am moving my receiver to the College of Hawaii as the induction in the business section of Honolulu is fierce."

"I will get the schedule from Mulroney this week and have wired 6EZ to call me independently on the evening of the 20th and 21st as I know that I can get him.

"I will send our station log for publication in the 'Pacific Radio News'—provided that we hear anything. Let's hope for the best."

The following stations have been entered for the test:

D. B. McGown (6ZE), San Francisco (C. W.).
H. Berringer (M1J), Burlingame, Cal. (Spark).
A. E. Bessey, Sunnyvale, Cal. (6ZK) (Spark).
H. R. Shaw (6BN), San Francisco (Spark).
Seefred Bros., Los Angeles, Cal. (6EA) (Spark).
M. H. Finley (6PQ), Santa Ana, Cal. (Spark).
G. Arnold (6AT), San Jose, Cal. (Spark).
R. Mumford (7CU), Vancouver, Wash. (Spark).
Wm. Wood (6KL), Oakland, Cal. (Spark).
L. D. Meater (6AK), Walnut Grove, Cal. (Spark).
J. V. Wise (6EJ), Walnut Grove, Cal. (Spark).
M. S. Jackson (6J1), (Spark).
L. Van Gorder (6OC), San Francisco (Spark).
L. F. Aufdenkamp (6SK), Laguna Beach, Cal. (Spark).
E. M. Sargent (6ZA), California Theater, San Francisco (Spark and C. W.).

The schedule for the test has been transmitted by radio from stations 6BN and 6ZE, and the contestants have been supplied with further instructions by mail. The time for the test is 3 a.m., San Francisco time, on both occasions.

The results of the contest will be announced at the opening session of the Pacific Coast Radio Convention and the winners will receive prizes on that day. The De Forest radiophone in the California Theater has also been entered for the test. The equipment is being recommissioned and every effort will be made to reach Honolulu on the buzzer and bulb. Mr. D. B. McGown expects to have a tube set in operation, and 6BN is burning midnight oil with the object of finishing his new installation several days before the contest is called. Further details will be published in our next issue.
RADIO DEVELOPMENT & STANDARDIZATION

THE AMRAD GAP

Much has been said pro and con rotary gaps and quenched gaps. Both gaps have been found to be good gaps, but the quenched gap has certain inherent advantages about which there seems to be considerable foggy knowledge. Briefly, the quenched gap causes the transmitter to radiate maximum energy on a single wave length reducing interference and increasing range. Further, the quenched gap is practically silent in operation even when operating at full power.

More in detail, a rapid quenching action quickly stops further discharge of the transmitting condenser after the first and most powerful oscillations have passed. Thus, the induced energy is concentrated entirely on the antenna allowing it to radiate on a single sharp wave length and preventing a wasteful re-transfer of energy back into the primary oscillating circuit, a condition almost inevitable wherever ordinary plain or rotary gaps are used.

A properly designed quenched gap therefore allows closer coupling. This insures a greater percentage of available energy actually put into the antenna and substantial increase in transmitting range. Moreover, the emitted wave conforms to Federal regulations respecting decrement. With a strict enforcement of the Federal regulations and the great increase of interference between stations operating on amateur wavelengths the properly designed quenched gap offers the most ready solution to a serious problem.

It has been said that a quenched gap operates best with 500 cycle current. This is not in accordance with the facts. Frequency does not affect the efficiency of the gap itself. In the case of 200 meter operation 60 cycle current is much more desirable since the slower period permits a saturated condenser charge before each train of oscillations takes place. The question has been asked whether it is possible to obtain a good spark note with 60 cycle current. The answer is "yes." A clear rythmical note of either 60 cycles or 120 cycles frequency may be obtained by adjusting the number of gaps in circuit and the value of resistance in series with the a. c. transformer primary.

Some quenched gap sets produce a "mushy" note because the operator fails to use sufficient resistance in the primary power circuit. This causes the spark to "axe" in the gap, producing the "mushy" note. The importance of using sufficient resistance in the primary power circuit does not seem to be fully appreciated by a few operators. Figs. 1, 3 and 4 emphasize this point. Fig. 2 shows the characteristic wave form of the ordinary rotary gap.

No special knowledge is required for the operation of a quenched gap. Explicit instructions are included with most of the better types on the market and the operator simply needs follow these. As regards upkeep, the quenched gap has a long life for everyday use—not abuse. It is neither liable to wear out or break provided the ordinary operating instructions are followed.

THE STANDARDIZATION OF APPARATUS DESIGN

A discussion of the possibilities of standardization and its bearing on experimental radio equipment

By K. H. Stark*

When a company is organized to manufacture radio equipment, or when an existing organization takes up this work, much time and money must be spent in the preliminary design of the apparatus to be sold. Once in production, any changes is very expensive. Then, if it is found necessary to discontinue the manufacture of an instrument, unused special parts lay a heavy toll on the profits realized on other apparatus.

Shortly after the armistice, plans were laid for the organization of The General Apparatus Company, Inc. Before a single instrument ever went to the shop, or before there was any shop, the entire development of radio apparatus design was carefully reviewed, and, at the same time, a careful study was made of the ideas of experimentalists and their peculiar requirements.

Development of Apparatus Design

A brief resume of the methods employed by various manufacturers in this country and Europe, leading up to the present practice, is of interest.

Back, in what some of us like to call the "early days" a radio installation was hardly more than a laboratory set-up, for each instrument was an experiment in itself. The result would not now be called a receiver or a transmitter.

As time went on, instruments were developed which operated with some degree of dependability. They were fitted together on whatever kind of framework suited the ideas of the designer. These methods sufficed for a number of years. No protection was afforded to the equipment against dust and dampness. It was at this stage that the first experimental radio equipment was brought out. An amateur station was then a collection of instruments, screwed to the table or sliding around loosely, and connected by an indiscriminate net work of wires.

Probably the first enclosed receivers were those of the Marconi Company, made on horizontal panels. Adjustments protruded from all sides as well as from the top. Many credit the Emil J. Simon Company with the first vertical panel transmitter. One of the earliest vertical panel receivers was used on a U. S. Army field set.

By the first of 1917, practically all commercial companies had adopted this practice. Some experimenters were making their sets that way, too, and three or four manufacturers of amateur equipment had fallen in line.

In 1918 a new departure was seen in radio equipment. An English airplane set and a trench outfit were sent to the United States. The sets were divided into units, connected by plug and cord systems. Here was something new, but not the ultimate refinement.

Finally, at the time the G. A. Company was organized, Mr. M. B. Sleeper, who was consulted about the problem which we were attempting to solve, worked out what we now call the "five by five" system of design, better known among experimenters as the G. A. Standardized Construction.

Before going into details of this method and other points of standardization, an analysis will be given of the experimenters' ideas regarding apparatus design, collected through correspondence and conversations with many of the most active men and boys in radio work.

What Experimenters Want

To catalog for a report the ideas of experimenters on apparatus design would be as difficult as to write a book on the political opinion of the American people. No two

(Continued on page 140)
JAPANESE wireless interference and port discrimination against American steamers and passengers is declared to be working a hardship for Americans in the Orient, according to officers of the American steamer Ecuador, which arrived here recently from the Far East.

C. E. Dixon and R. Thornberg, wireless operators of the Ecuador, declared that it was nearly impossible to send messages ashore to Yokohama or Kobe when nearing the Japanese ports. They state their calls for recognition go unanswered by the Japanese operators, who insist in breaking their messages when communicating with other American vessels.

"I shudder to think what Japanese wireless operators would do if an American steamer in the Orient should send radio calls for assistance. Their tactics are detrimental to commerce and to safety," declared Thornberg. "They seem to take delight in garbling our messages and holding up our calls from one to four days.

"Two American girls, before arriving at Yokohama, sent a wireless ashore to a friend, in which they mentioned the name of a song. Because of the peculiarity of the song's title the Japanese Secret Service thought it was an American spy code. When the two girls arrived at their hotel they were subjected to third degree examinations while a squad of Japanese soldiers stood guard outside their hotel door."—San Francisco " Examiner."

A NEW record for the radio station at St. Martin's College, Lacey, Wash., was made Sept. 22. Signals from the college station were picked up by H. Paul Wills at Wichita, Kan., a distance of more than 1500 miles. Mail advice just received by the college told of the remarkable performance.

THE Shipping Board has renewed its annual contract with three radio companies, officials stated. The companies involved are the Radio Corporation of America, the Shipowners Radio Service, and the Independent Wireless Telegraph Service.

Under the agreement which has been renewed these companies undertake to maintain the radio apparatus on the 1200 vessels owned by the board in good working order. For this they are paid $30 a month, making a total for the fleet of $432,000 a year. The new contract extend for one year from October 1.

The radio equipment is owned by the board and the services of the companies are to maintain it in efficient order.—S. F. "Commercial News."

AN aerial torpedo, which carries no crew, but which may be controlled hundreds of miles away by wireless, has been perfected by Charles S. Price, a prominent British aeronautical engineer.

The extraordinary craft has been successfully tested and is said to have attained speeds greater than the fastest airplane. By means of a number of delicate electrical devices, the controller of the machine is able to determine its exact location at any time during flight. The inventor has been able to use it for photography, although with uncertain results.—L. A. "Examiner."

AN agreement is reported to have been reached on the subject of the future of the great German wireless station at Ellwese, Hanover, between the German High Frequency Company and the French claimants. The Telefunken Gesellschaft also is interested in this settlement.

By its terms the French company is to be compensated by money payment, and is to be given the right to use certain German patents abroad which were in dispute. Ellwese is to be turned into a German limited company, in which the German High Frequency Company and the Telefunken Gesellschaft are shareholders. The station, which played a large part in German propaganda during the war, is to be devoted to transoceanic wireless service.

The French Compagnie Generale de Telegraphe sans Fil claimed the Ellwese station as its property on the ground that the German High Frequency Company ceded to it in 1912 the right to take the station over by December 31, 1914, and that this right had now been revived under the peace treaty.—London "Times."

THE station and operator licenses of Chas. Wilson (6 LE), 3040 Benvenue street, Berkeley, Cal., have been suspended for an indefinite period by the radio inspector of the San Francisco district. Wilson was accused of sending on a wavelength of 410 meters which resulted in causing interference with commercial traffic.

WHAT is said to be the longest conversation on record, although of few words, is reported by the Bell Telephone Company in a direct communication from a ship 200 miles out on the Atlantic to the phone station on Catalina Island.

Chief Radio Operator S. W. Mitchell, of the steamer Gloucester talked by radio phone to the land telephone station at Philadelphia, where his message was received by the land lines without relay and conveyed direct to Long Beach by way of New York, Pittsburg, Chicago, Omaha, Denver, Sacramento, Fresno and Los Angeles. At Long Beach the radio telephone to Catalina Island caught up the message without relay and carried it direct to the island station, where it was received by Chief Radio Operator E. E. Spicer at Avalon.

The total distance is 4100 miles, almost one-sixth the circumference of the globe. Several amateur radio operators in Los Angeles listened in on the message and caught it with full clearness.—L. A. "Express."

A 3 K. W. Radiophone set has been installed in the stock exchange at Amsterdam, Holland. It is expected that communication with the United States will be established from this station during the evening hours.

THE International Radio Telegraph Company announces that it opened its coast radio station at Siasconset, Nantucket Island, Mass., radio call WSC, on October 13th.

As is well known to all old radio men, this island has long been the location of commercial and naval stations and because of its particularly advantageous location will undoubtedly be very generally used by incoming European ships in getting off their traffic on long waves and at long range.

The station tax is 12 cents per word. The station is now equipped to receive long waves, damped or undamped, with heterodyne reception and for the present will utilize spark transmitters, but general enlargements are now contemplated.

Experienced operators will be provided and this company expects to furnish the highest type of service at this station, which because of its low land line charges on most messages routed to the West will undoubtedly be one of the busiest stations on the Atlantic Coast.

PLANS have been perfected by the Navy Department for the erection of a number of compass radio stations along the Alaskan Coast, and the erection of a radio telegraph station at Cold Bay, according to F. E. Dunklee, radio engineer. Mr. Dunklee is to get certain data for use in connection with the establishment of the proposed stations during his stay here.
GUESTS on Marconi’s yacht, cruising in the Mediterranean, danced to the wireless music of an orchestra playing in London.

Well, well, this opens up possibilities, doesn’t it?

If you see a man and maid cheek-dancing along Main street in your village, it may be that they have suddenly caught the wireless output of some Broadway cabaret.

If Mrs. Jones of Kennebunkport drops the breakfast dishes and spends the day with Mrs. Brown at the continuous movies, it may be that her husband’s dinner is preparing by wireless, conveyed from Mrs. Robinson’s cooker at Yuma.

If the Reverend Mr. Psaltrey rebukes your absence from the morning services, you can claim that you caught it by choiceless.

Maybe blowouts and punctures will all be promptly prepared by wireless, conveyed from Akron.

And maybe, at some time in the future, political campaigns will be conducted by liarless!—L. A. “Record.”

A M E R I C A N ships reaching ports of the United Kingdom after December 1 must be provided with wireless or risk a fine of five pounds. This is the information received by Major J. F. Dillon, radio inspector for the Bureau of Navigation. After next month American vessels in British ports will be subject to the same regulations regarding wireless as ships flying the Union Jack. The order applies to all passenger vessels and to other craft of 1600 tons or over.

E Q U I P P E D with a wireless telephone as a safety measure in case of emergency, making it the first vessel so equipped, the British bark Manrewi will depart from this harbor shortly.

One of the chief reasons for this precaution, it is stated, is because the vessel will carry a full cargo of California gas. The cargo is consigned to New Zealand and is being shipped by the Petroleum Products Company of this city.

The apparatus was installed by A. F. Pendleton. It is a complete set, including telegraph instruments, but as the bark will not have an operator in her crew only the wireless phone will be utilized.

Captain R. G. Holmes, master of the craft, looks forward to much enjoyment during the voyage across the Pacific. He declares that he will be able to listen in on all telegraphic and other wireless communication between the large ocean liners and in case of emergency will be able to call out over the Pacific for a radius of 1000 miles by his own voice.

This marks the inauguration of wireless telephones aboard sailing vessels, according to local shipping men. John D. Spreckels recently installed a wireless phone aboard his yacht Venetia.—S. F. “Examiner.”

T O R O N T O Ont., October 15.—Preparatory to building a huge wireless station for communication between Canada and England, the Marconi Wireless Company of Canada, has purchased 23 acres of land about nine miles from Toronto. It is understood that this is the first of a chain of wireless stations with which it is expected to dot Canada and encircle the British Empire.

P R O B A B L Y the most unusual “sandman” program ever given for a group of children anywhere took place at the Children’s Hospital, when songs and music came out of the “clear sky” via the wireless telephone.

Directors Roth and Partington of the California Theater planned this treat for the little “shut-ins” through the courtesy of Ellery Stone of the Lee De Forest Radio Company. A special receiving station and Magnavox were installed at the hospital for the event.

S A N F R A N C I S C O’S first fog since the establishment of the United States naval radio compass bearing stations permitting a vessel to secure her bearing outside the heads, checked the Golden Gate and gave a demonstration of the new wireless signal arrangement.

According to Commander S. D. McCoy, chief of the operators at this port, the service gave very good results and proved its feasibility in assisting ships to navigate safely to anchorage in the harbor.

T H E Rev. J. M. Skinner of the Presbyterian Church in Stockton, preached a sermon in a wireless telephone, which was heard at many points within a 100 mile radius of Stockton. His voice was heard at stations in six surrounding counties.

T H E mascot of a certain naval radio station was a hungry looking black cat. “—and what do you call him?” asked the newly assigned op. “His ribs are of such prominence that we call him Helix,” answered the chief.

V I O L I N 18 PL A Y E D BY WIRELESS WAVE

COPENHAGEN, November 6.—A discovery which is predicted to effect a complete revolution in wireless methods was made public here when a violin was made to play and talk by wireless.

A violin was placed on a wall, while in a room some distance away a melody was played into a sending apparatus. Those present were greatly astonished when the melody automatically repeated itself on the violin. Later the human voice was transmitted, and a sensation was created when the violin repeated quite distinctly the spoken words.

The patent rights of this discovery are held by two young Danish engineers, named Johnsen and Rahbeck, who developed it three years ago. It is based on the previously known fact that certain substances, under electrical treatment, receive similar magnetic qualities.—S. F. “Recorder.”

B I G W I R E L E S S S TA T I O N P L A N N E D FOR PALO ALTO

Three big wireless stations in California, these, with one at Portland, Ore., to make up its Pacific Coast equipment for long distance transmission business, are being planned by the Federal Telegraph Company. The California stations are to be at Palo Alto, Los Angeles and San Diego.

Work here is to be started as soon as permission to raise necessary funds is granted by the Railroad Commission. For this purpose the company asks permission to issue and sell $500,000 worth of 8 per cent serial gold notes, payable in annual equal installments of $100,000 each.

At present the Federal is using the Pacific Telephone and Telegraph telephone lines for transmitting messages received at the South San Francisco wireless station. This contract expires shortly.

The company is handling an average of 50,000 messages a month, an increase of almost two and one-half times the business of 1917.—S. F. “Recorder.”

F E D E R A L T E L E G R A M C O M M E N D E D

R. S. Griffin, engineer-in-chief of the United States Navy, has written to President R. F. Schwartz of the Federal Telegraph Company, congratulating the company on the excellent results obtained with the duplicate 1,000 kilowatt arc equipment installed in the Lafayette radio station at Croix d’Hins, France. Admiral Griffin says:

“The results of the thirty-day tests of this equipment, recently completed, are very satisfactory to the bureau, the comparative strength of Lafayette’s signals as measured at distant stations being from three to five times as great as those received from other European high power stations and solid copy being consistently obtained not less than twenty-two hours out of the twenty-four, regardless of the periods of the day during which fading of signals occurs and notwithstanding the fact that the tests were conducted during the most unfavorable static season.”

Griffin also compliments R. R. Beal of the Federal system under whose supervision the construction work was completed.—S. F. “Examiner.”
A SERIES PARALLEL SWITCH
By K. Jefferson

NOT being satisfied with results obtained from the construction of series-parallel switches described from time to time, the writer has experimented with and received successful service from the switch hereby described.

By referring to Figure 1 it will be seen that the construction of the switch is quite simple. Figure 2 is a detail of one of the contacts. Figure 3 is a wiring diagram. Figure 4 is a diagram showing another use of the switch as in the case of charging batteries.

In figure 1, A is the contact arm of an ordinary rotary switch. B is a strip of insulating material. A and B must be mounted on the shaft in such a manner as to rotate together. If the two contact points E are placed 1-8 inch apart and the slot in C is cut to a width of 1-8 inch, very good results will be obtained. The builder can use his own judgment in regard to the other essential dimensions.

Figure 4 shows a method of using the switch to divide a set of batteries while being charged. After charging, the two sets of batteries are again placed into series connection for use. A divided inductance or a pair of inductances can be used in like manner. When connected in series they can be used for increasing wave lengths, and in parallel for reducing resistance.

NEW CALL LIST ISSUED

THE list of AMATEUR RADIO STATIONS OF THE UNITED STATES is now ready for distribution and can be obtained for 15 cents from Superintendent of Documents, Government Printing Office, Washington, D. C. Stamps will not be accepted. The list contains all call letters of amateur stations issued to June 30, 1920. A similar publication, COMMERCIAL AND GOVERNMENT RADIO STATIONS OF THE UNITED STATES, is also ready for distribution and can be obtained from the above address at 15 cents per copy.

Stations copied and worked at 7AD—F. J. Brott, 10 Walk, 1 Madison Park, Seattle, Wash., September 9 to October 26, 1920.

6AJJ, (6AAT), 6AW, 6ABP, 6ABX, 6ACR, 6AG, 6AJ, (6AK), 6AH, 6AI, 6AE, 6AN, (6BJ), 6BN, 6BQ, 6CC, 6CO, 6CP, (6CV), 6DK, 6DF, (6EJ), 6EP, 6ER, (6EX), 6FE, (6FS), 6FH, 6GQ, 6GN, 6H, 6JL, 6JM, 6JN, 6QJ, 6KM, 6MZ, 6NE, 6NO, (6OH), 6QK, 6QM, 6QR, 6RQ, 6SK, 6TC, 6ZK, 6ZE.

7AE, (7AW), (7BG), (7BH), (7CC), (7CE), (7CU), (7CW), (7DA), 7DP, (7ES), 7FH, (7FO), 7FV, (7QG) (7GV), 7HN, (7IN), 7JP, 7JW, (7YS), 7ZH.

CARDBOARD TUBES
By C. Chandlee Pidgeon

HERE'S a way to knock the "H" out of the H. C. W. (High Cost of Wireless.) Cardboard tubes are used daily in the construction of coils of various descriptions. It was my desire to construct a regenerative receiver and difficulty was encountered in securing the proper size tubes. While glancing around the house I found a small Quaker Oats box, 4½ inches in diameter, a Quaker Corn Meal box, 4 inches in diameter and a Morton's or Diamond Crystal Salt box, 3½ inches in diameter. These tubes are of the ideal size for the regenerative tuners and couplers. A Spotless Cleanser box is three inches in diameter. The only size that I could not find was one with a four-inch diameter. I have made small loose couplers from a section of an oats box and a section of a Shaker Salt box. The cardboard works very satisfactorily and I am now incorporating it in a three variometer receiving set. The tubes can be baked in paraffin or some other insulating compound for added efficiency to the finished instrument. Several coatings of insulating varnish will help to stiffen the tubes and prevent warping in damp weather.

BIG STATION TO BE ERECTED IN SUNNYVALE

THE inhabitants of Sunnyvale, California, with the exception of Mr. A. E. Bessey, are rejoicing over the news that the Federal Telegraph Co. is planning on the construction of a high power arc station at Point Sunnyvale. The cost of the plant will aggregate about $160,000. The foundation will be laid soon as the steel frame-work is already on hand for the superstructure. The towers will be 600 feet high. Mr. Bessey (6BR) will wear the same smile on his countenance that Mr. McGowan (6ZE) wears when the beach station of the U. S. Navy "opens up" with more mush on 200 meters than enough.

NAPA RADIO CLUB HOLDS OPEN HOUSE

THE Napa Amateur Radio Club held its first open house on October 28th. The open house was a "full house" on the occasion and several interesting addresses were made. Mr. Hildebrand of the Willard Storage Battery Company spoke on the benefits of organization and Mr. Clark of the Pacific Gas and Electric Company outlined the future possibilities of electricity. Mr. M. L. Webb was the announcer of the evening and gave a practical demonstration of radio work on the club's transmitting and receiving equipment.
PART IV.

Fig 10 shows two types of positive electrode entrances. A shows a circular disc of Bakelite having a hole through its center through which the electrode enters the chamber. To illustrate the application of the rule given above, the minimum dimensions are given. B shows another design in which a thick ebony-asbestos block is used. The use of this construction makes possible a considerable reduction in chamber volume and is a type commonly found in converters designed to use illuminating gas or other gases rich in carbon. By using several blocks, it may be seen that any possible path for leakage may be made very great.

In the design of experimental arcs, it is not recommended that the negative electrode be grounded to the chamber as is commonly the case with commercial arcs. The reason for this is quite obvious. Small arcs, as a rule, are used with coupled oscillating circuits, and the negative side is not ordinarily grounded. Grounding the negative side to the chamber would, therefore, make the chamber a live part insofar as its relation to other parts of the apparatus is concerned.

Magnetic circuit entrances into the chamber should be of approximately the same section as that of the core adjacent to the entrances.

A poppet valve should be provided to relieve the chamber of excessive pressures caused by gas explosions within it. The outlet area will, of course, depend upon the volume of the chamber and for small arcs within the scope of this article, an area of about 1/2 square inches will be found sufficient. This valve is usually a spring loaded, conical seated affair, fitted to one side of the chamber. Placing this valve in the bottom of the chamber is to be avoided, if practicable, because particles of carbon falling into it often cause sticking. It will be found convenient in most cases to install the poppet valve in the chamber inspecting manhole cover, thus leaving the bottom of the chamber available for receiving deposits of soot and other refuse which will naturally deposit there and which may be removed through an opening provided for that purpose.

The electrode cooling system should be such that both electrodes benefit by it. An abundance of water should be continuously forced against the copper tip of the positive electrode during the operation of the arc. A water jacket should house the negative electrode holder also. Isolated water circulating systems are recommended for each electrode as considerable inefficiency will result from connecting electrodes electrically with a water conductor which possesses a low high-frequency resistance. In cases of larger arcs, the power consumed by this resistance is such a small fraction of the total output that this precaution need not be taken, but in arcs operating at 500 volts input and having a power output of one kilowatt, a decrease in efficiency of five per cent may result from this source. A convenient arrangement for water circulation is the use of two large bottles fitted up to discharge their contents by gravity through each electrode cooling system.

A magnetic flux density of 4000 to 8000 gauss in the air gap may be used and, in general, the efficiency of the arc will be found to increase up to the point where the 8000 gauss value is reached. If the flux density is greater, difficulty will be experienced in maintaining the arc. At this value of field strength, sudden changes in the input current or a sudden change in the amount of energy taken from the closed oscillating circuit are liable to extinguish the arc permanently and striking will have to be resorted to in order to start it again. Either the closed or open form of magnetic circuit may be used with equal success. The construction of the solenoids should be such that they will not be affected by the heat of the arc chamber or by any potential that the body of the converter is liable to possess due to leakage or induction. The use of spools constructed of Bakelite will eliminate the possibility of trouble from either of these sources. One quarter inch Bakelite is recommended for this purpose. If the core is circular in section, a combination of sheet stock and tubing will solve the spool problem very satisfactorily.

After the solenoids are wound, a single layer of bare copper wire or a copper cylinder should be placed over the outside layer of the winding to shield it from the destructive effect of induced currents from high-frequency leads in the vicinity.

The administering of gas into the chamber is an absolute necessity. Alcohol (denatured, wood, or grain) may be used by dropping it into the arc or upon some heating device for volatilizing it within the chamber. For small arcs, the latter method is preferred as it avoids the production of irregularities. Some designers provide a small electric heater inside the chamber upon which the alcohol is made to drop, others provide a small metal or earthenware plate, some distance above the arc and heated by it, upon which the alcohol is dropped. Ordinary coal gas as used for illuminating purposes may be administered into the chamber and used with a high degree of success, and often the arc output may be increased as much as thirty per cent by the use of this substance. When using this substance, however, great difficulty is liable to be encountered in attempting to maintain insulation for any great length of time without cleaning out the chamber. A great amount of soot forms which soon blankets all exposed insulation inside the chamber, render-

(Continued on page 138)
THE AUDION OSCILLATOR

By R. A. HEISING

(Continued from the November issue)

This in turn produces an oscillation current (Curve IV) which is in phase with it on account of the frequency being the resonant frequency. The oscillation current in flowing through $L_s$ produces an e. m. f. 90 degrees out of phase (Curve V). This e. m. f. transferred to the grid mesh of which it is a part must be given an opposite sign (for reasons stated before) and it is then observed to be the original voltage applied to grid.

6. Simple Vector Diagram

The phase relations are shown in the Vector form in Fig. 5. The grid voltage is $E_i$. The alternating space current is $I_s$. The voltage produced in $L_s$ by $I_s$ is $E_s$ and this produces the oscillation current $I_o$. The latter in flowing through inductance $L_o$ produces the voltage drop $E_l$. This because of oppositely assumed positive directions in meshes $g$ and $o$ must be reversed and is the grid voltage $E_i$.

7. Vector Diagram Including Resistance

In previous explanations the assumptions were made that the oscillation circuit resistance was zero, and that all the plate alternating current passed through the inductance $L_s$. To show the relations in the actual circuit it is preferable to arrange the circuit as shown in Fig. 6 with the positive directions in the branches (instead of in the circuits) indicated by the arrows. The plate and grid inductances are assumed to have no mutual between them, and each element of the oscillation circuit has its own resistance.

The elements of the oscillation circuit as arranged are called the external circuit to distinguish them from the internal circuit of the audion. Such an arrangement of inductances and capacity has a reactance—frequency curve, as measured between the points connected to the plate and filament, of the form shown in Fig. 7. The resonant frequency for the oscillation circuit as a series circuit occurs at $+$ which is at or near the point at which the reactance of the parallel arrangement changes sign. The frequency of oscillation in this type of circuit always occurs just below the resonant frequency on account of the resistance in the circuit elements. This
shown analytically, and can be proved by the vector diagrams. The external circuit will therefore have an inductive reactance when attached to the audion as an oscillator. The circuit is looked upon as an external circuit in series with an audion which contains a fictitious generator of voltage $E$ and internal resistance $R$. The voltage of the fictitious generator is $E_a$ where $E_a$ is the voltage applied between grid and filament and $\mu$ is the amplification constant of the audion.

In Fig. 8, the voltage applied to the grid is $E_a$. The fictitious plate circuit generator voltage is then $E = \mu E_a$ and is in phase. Due to the inductive reactance of the external circuit, the alternating space current $I_a$ lags. The alternating space current in flowing through the external circuit produces a resistance drop $I_a R$, where $R$ is the external resistance, and a reactance drop of $I_a X$, where $X$ is the external reactance. Attention is here called to the fact that voltage drop $I_a R$ is opposite to the direction in which $I_a$ flows, and $I_a X$ is 90 deg. behind $I_a$. This is not according to a conventional method used by some engineers but it agrees strictly with Faraday's law of the sum of the e. m. f. in a closed circuit being zero. The two counter e. m. f. produced by $I_a$ add up into the external counter e. m. f., or drop, $E_a$, an e. m. f. produced entirely by $I_a$. Equal and opposite to $E_a$ is the e. m. f. $E_a$ which is that part of $E$ which is consumed by $E_a$.

Within the audion $I_a$ produces another resistance drop $E_a$ also opposite in direction to $I_a$. $E_a$ is added to $I_a R$ and $I_a X$ produces a counter e. m. f. equal and opposite to $E$ making the sum of the e. m. f. in the circuit zero. The voltage applied to and across the external circuit is then $E_a$ which is equal and opposite to the external drop $E_a$. It is the driving voltage for the external circuit. The external driving voltage applied across inductance $L_a$ causes a leading current $I_a$ (Fig. 9) to flow. It is less than $90$ deg. behind $E_a$ because of resistance in $L_a$. $E_a$ also causes a leading current to flow through the other arm $C + L_a$ which is almost $90$ deg. ahead ($I_a$). The sum of the two currents is $I_a$ the alternating space current. $I_a$ is larger than $I_a$ because the operating frequency is below the resonant value and the inductive reactance of $L_a$ will then be less than the capacitive reactance of $C + L_a$. The current $I_a$ in flowing through the inductance $L_a$ produces a resistance drop $A$ and a reactance drop $B$. The sum of these is $E_a$ the voltage applied to the grid.

The impossibility of this circuit operating above resonance can be shown from Fig. 9. The grid voltage $E_a$ must always be in phase with $E$ as $E = \mu E_a$. $E_a$ is the vector sum of $A$ and $B$ which are voltage drops in $L_a$. $I_a$ will be just 90 deg. ahead of $E_a$ if the resistance of $L_a$ is zero, but any resistance in $L_a$ produces the drop $A$ and $I_a$ is forced more than 90 deg. ahead of $E_a$. Then, as $I_a$ is a leading current produced by $E_a$, it can be 90 deg. ahead of $E_a$ if the total resistance in $C$ and $L_a$ is zero, but with resistance the angle is reduced and $E_a$ must be moved closer to it and ahead of $E_a$. Stated in a few words we can say: (1) the angle between $E_a$ and $I_a$ must always be over 90 deg., (2) the angle between $I_a$ and $E_a$ must always be less than 90 deg., therefore $E_a$ must always be ahead of $E_a$ and $E_a$ which means an external circuit of inductive reactance and (from Fig. 7) a frequency below resonance.

8. Vector Diagram With Mutual Inductance Between $L_a$ and $L_b$.

Fig. 10 is a vector diagram like that in Fig. 9 as regards voltages, currents and notation. If there is mutual inductance between $L_a$ and $L_b$, the current in $L_a$ produces an e. m. f. in $L_b$ which is either $e_b$ or $e_a$ depending upon whether the mutual inductance is negative or positive. By a positive inductance is meant a coupling such as to make the total inductance in the oscillation circuit greater—that is $L_a = L_a + L_b + 2M$. If the mutual is positive $I_a$ reduces the voltage applied to the grid, and increases the external reactance, thereby causing the oscillation frequency to drop further than the resonant frequency. A negative mutual inductance makes the oscillator less likely to oscillate than a positive value.

(To be continued)

*Nichols, Physical Review, August, 1917, and June, 1919.
A CHANGE OF HEART

By F. S. JENKINS

THE day before Christmas was raw and blustery with flurries of snow in the air, and the evening was colder yet with great gusts of frigid wind playing hide and seek around New York's gloomy canyon-like streets.

Old Ben Collins was hurrying up Warren Street on his way from work, to home and a hot supper. He was a crusty individual, full of Q. R. N. of the grinder and growler variety. Buttoned tight in his shiny greatcoat and with a rusty derby jammed down on his head, it would be hard to imagine him the famous editor that he was.

Glancing in a brightly lighted store window, his eye was attracted by a peculiar array of articles for sale. Near by, stood a young man of jovial countenance, gazing interestedly at the assortment. Under his arms were two large packages.

Halting in his stride and stepping nearer, Ben's sharp eyes roved over the display. Finally, his curiosity getting the better of him, he inquired: "What's all this junk, young man?"

The "young man," turned toward his questioner and with a smile exclaimed: "Junk! That's no junk. Those are instruments for amateur wireless."

"Well that's junk all right," grumbled Collins. "There's one of those young idiots up on my street, with a lot of wires hoisted above his house. Dem fool makes all the lights in my place blink when he monkeys with his crazy contraption. Sits up till all hours annoying the neighbors. Ought to be a law against 'em, I say."

The young man's expression slowly changed from a smile to a frown at this tirade. As the gruff voice finished, he replied: "Say, listen here sir, if you've about ten minutes, I know a little story that I think will change your opinion of these amateurs. Just step in this doorway here, where it's not so cold and windy and I'll spin you the yarn."

Ben's appetite for news got the better of his appetite for food. "I'm from Missouri," he growled.

Lighting a cigarette, the young man began: "Long about four bells in the third watch, on the evening of December 19th, the freighter 'Ponyta' was plowing along through a fifty mile gale off Atlantic City. The wind was off the port quarter and with a heavy deck load and a cranky turbine, she was making heavy weather of it. Finally the plates on number one hold, no longer able to contain the strain, began to start, and large volumes of old Neptune's kingdom poured in. The storm increased in violence and the plates continued to open. The bulkhead began to give and to make matters worse, the turbine on the port screw failed entirely. At last matters got so bad the 'old man' ordered 'Wireless' to send out a call for help."

"Now you probably don't know, sir, but it's a fact, that in the ether, there are so-called 'dead spots' dreaded by all sea-going radio men. Through these spots radio waves can seldom pass. Signals can sometimes be exchanged with one station, sometimes two, sometimes none at all. This will explain what follows:"

"Down on the coast of New Jersey, about a half mile below the Nantoloking Coast Guard Station, lives a little crippled chap named Tom Binny. His father is an old fisherman of little ambition, so consequently the family's circumstances are very meager. Due to the isolation of his home and his useless leg, the poor kid has practically no playmates. He is of a scientific turn of mind and so, due partly to this reason and partly on account of his loneliness, he started to dabble in wireless. The mild interest soon became intense and he spent every cent he could get on parts and instruments. He had little enough to spend, Lord knows, but he finally evolved a receiving set which for looks was nil but for works was good up to eight hundred miles in daylight. He had to content himself without a sending set as no city current was available and storage batteries were too expensive."

"On this same evening of December nineteenth, he had been listening in as usual to the busy ship traffic up and down the coast. His father was over visiting a neighbor and his mother was down at the village buying their frugal supplies, so he had a quiet evening all to himself."

"Long about five bells he decided to turn in. He laid his phones down and reached for the canvas to cover the beloved set when, clear as a bell from the receiver on the table, came the electrifying call of the spark:

"Sos sos sos de kyzp in distress 59 miles east Point Pleasant forward hold flooded turbine disabled need help at once will take to boats in two hours.

"Jamming the phones back on his head, Tom feverishly scribbled down the words as the ship rushed through the ether."

"Again and yet again the cry for help rang in his ears, yet the radio traffic of ship and shore station alike continued on, undisturbed."

"What was wrong? Why didn't they answer? These thoughts flashed through his mind as he nervously tuned up to catch a reply."

"All at once the answer dawned on him. The disabled ship was in one of those dead spots he had read so much about and he was evidently the only one who had heard the call."

"There was only one thing to do. He must hobble at top speed to the Coast Guard Station at Nantoloking and give the alarm."

"Catching up his crutch and the scribbled message, he stumbled out the door and up the beach as fast as his one good leg would take him. Over and over he kept repeating as he fought his way through the icy darkness: 'Oh God, let me be in time! Please let me be in time!'

"What with the shifting sand and the bitter wind, his progress became more and more feeble, until at last, as he reached the station gate he sank down exhausted, unable to go a step further."

"Five minutes later, one of the guards, coming from the boat-house hard by, stumbled over the little huddled body and carried it inside. Tight clasped in his hand was the message."

"For the next fifteen minutes, the wires to New York and Philadelphia were humming with the report of the disaster, and an hour later the 'Ponyta's' crew, officers and men, were safe aboard the Revenue Cutter 'Senapa.'"

"Eh? Oh Tom's coming around all right. Still in bed from the effects of his trip, but getting better every day."

"Is it a true story! It sure is! I'm the opp. that sent the SOS and this here," indicating the packages under his arms, "is the finest receiving set I could find. The crew of the Ponyta bought it and I'm delegated to go down and present it as a Christmas gift. Guess the kid won't be tickled, eh?"

"Ihuh!" retorted Collins, in a low tone, "Still think it's junk, but," fumbling in his pocket and pressing a fifty dollar note into the operator's hand, "Here, maybe the kid will need a disngus, or something, that you've forgotten."

CRITICISM ON LOWENSTEIN EQUIPMENT IS ASKED

Brooklyn, N. Y., Nov. 10, 1920.

Paul R. Fenner, Editor,

Pacific Radio News,
50 Main St.,
San Francisco, Calif.

Dear Sir:

The Lowenstein Radio Company, Inc., 397 Bridge street, Brooklyn, N. Y., have manufactured a number of radio transmitting sets for the U. S. Navy, which have been in service on American ships for some time. Being desirous of hearing from the operators who have used a Lowenstein set, we take this means of communicating with them through your good offices. What we want is honest criticism from the man on the job, so that we may be guided by him in our future work.

We shall be glad to hear from any operator who has used one of our sets.

Very truly yours,

LOWENSTEIN RADIO CO., INC.

G. H. Lewis.
OLD FERRIS glanced up at his son Jack, and muttered, "Guess it's all off, boy. They wouldn't even offer to try out the invention." He ceased speaking and bowed his head in his hands.

"That's all right, dad," replied Jack Ferris, "I'll take the apparatus down to Johnson, of the Airway Express Company, tomorrow. I know he will listen to me, as we attended college at Berkeley together. He's a fine fellow," concluded Jack.

"Well, Jack, I hope he appears in favor of the appliance. It certainly would be of extreme advantage to his company if he decided to install it on his airplanes."

The device referred to was a rather compact box, at that moment resting upon the table before Jack. The cabinet contained his father's invention, the "repeller." Delicate instruments controlled by radio were inside the box, representing years of experimenting and testing. Although a patent had been issued, Ferris could interest no radio company in San Francisco with his invention. All were too skeptical to believe that radio could be utilized to actually repel any other object containing an antenna and radio instruments.

However, Tom Ferris was ready to prove all he had said his contrivance would do. But the prominent radio companies could not be bothered by "cranks," and deaf ears were turned to him.

"Here it is nearly Christmas," mused Ferris, "and I was hoping—yes, praying, that someone would purchase the "repeller" so we could buy that little home out in Sunset that Mary was admiring. That would be a nice Christmas present, but I guess there's no use talking about it. Five thousand dollars is a lot of money," he ended with a sigh.

"Yes," said Jack, "mother is in love with that little cottage. Well," he added hopefully, "Johnson may buy the invention."

"I earnestly hope so," responded his father dejectedly.

At nine o'clock the next morning Jack Ferris was in consultation with his college chum, Fred Johnson, manager of the Airway Express Company.

"Jack," said Fred slowly, at the end of a half hour, "your proposition seems O. K. to me, but we'll have to test it out and see if it is as true as you say. Let's go out to Warner Field now; the Eagle is in the hangar, and we'll try it out on her." So saying he rose and made his way to the street, Jack following with the precious apparatus under his arm.

Soon they arrived at the field near the ocean and the Eagle, a super-plane, was wheeled out.

A problem confronted them: Upon what would they test out the "repeller"? Certainly another plane could not be used, as there was too great a risk of wrecking it with the powerful action of the "repeller."

Johnson, ever-alert, said: "I've got it! Wait a second," and with that he entered the hangar and in a few minutes drove out an automobile with a fan-shaped antenna erected on top.

"Friend of mine used to be interested in radio-automobiles," he explained, "and he put a set on this one. He's out to sea now, so we can use it," he continued.

The Eagle was also fitted with modern radio apparatus and Jack connected up the "repeller" and they left the ground, first having turned on the filament of the audion detector in the automobile and stationing a man to watch it.

"Now!" said Jack when they were at a height of a thousand feet. He pressed the key, and a low purring sound seemed to come from the box.

"The work is all over," explained Jack. "Let's land now and see whether the auto moved backward or not."

When the Eagle came to a stop the man left in charge of the radio-auto ran up to them and said: "Say, Mr. Johnson, a funny thing just happened while you were up there. The old flyer suddenly began to go backwards and a humming sound seemed to come from those radio instruments. I can't make it out; the engine wasn't even going," he said mystified.

"Yes?" inquired Jack eagerly. "Well, Fred, I guess that convinces you?"

"It does, Jack, and I'll take a week's option on the invention and install it immediately on the Eagle. And, by the way, I think I'll require your services as radio operator, too."

II.

STEAMSHIPS are not the only vehicles of locomotion that send their position reports by radio. Seven o'clock that evening Jack Ferris sat in the radio room of the Eagle with the receivers on his head listening to the station at San Francisco working a ship in the Pacific.

"Airplane Eagle, S. F., for Seattle, 50 miles north of Sacramento at 8 p. m. Sig. Williams, Pilot."

This was the message Jack transmitted to the government station at San Francisco when that operator had concluded with his message to the ship.

The Eagle had left that afternoon for Seattle with a special consignment of gold. The Airway Express Company was called upon to deliver the cargo because of the rapid means of transportation. Carrying gold was unusual and the pilot expressed his reluctance to Ferris.

A few miles north of the capital a heavy wind was encountered which slowed up the Eagle considerably and forced her to attain higher altitude.

Jack was still listening at midnight and was surprised to hear abnormally loud signals in his receivers. Furthermore the station was calling the Eagle and throwing in the dynamo switch he answered them.

The message he copied was as follows: "Airplane Eagle. Stop immediately and land or we will open fire on you."

That was all! What could it mean? Hastily making his way to the pilot room he showed the message to Williams.

"I knew it!" exclaimed the pilot, "some other machine following us in the air intending to steal the gold shipment. I didn't like to leave San Francisco with such a cargo, but they wanted it in Seattle by tomorrow. We haven't even a rifle!" he said ruefully.

"So that was it!" Jack, with a pair of night glasses to his eyes, discerned another plane about a half-mile away following them.

Back in the radio room Ferris listened again for the other plane. Only a few amateurs in California could be heard. The "repeller!" It dawned upon Jack like a flash. He would wait until the hostile craft drew nearer, then he would direct his apparatus upon the plane and press the key—

He could conceive the effect of the powerful instruments. At such a height it would mean sure death to the crew of the bandit airplane unless the pilot could save the machine from falling by manipulating the rudders.

Again the plane was calling the Eagle.

"We are only a quarter of a mile from you. Stop and land."

"We are bound for Seattle," flashed Jack, "and intend to get there as soon as possible."

The other plane did not answer by radio, but it did by a shot which snapped a stay-wire. The next bullet pierced the wall of the radio cabin and lodged itself in the wood above Jack's head.

"That was close," muttered Ferris, "they must be very near. Guess it's time for action."
DO YOU KNOW

THAT in a transmitting tube circuit a grid leak is absolutely essential, and that it must be of the right resistance or the tube will not oscillate properly?

THAT a 220 volt D. C. shunt wound motor, running at twice its normal rated speed, will serve as a source of plate potential for that tube set you are building?

THAT the voltage output of this machine will be about 400 volts?

THAT it is essential that the commutator be kept clean when a motor-generator set is to be used for a tube transmitter if all humming is to be eliminated?

THAT a pure undamped wave for amateur work will carry much better than a spark, but that special means are usually necessary to receive it?

THAT Government equipment designed to receive undamped signals on short waves is provided with a "Rotary Tone Condenser," which is a specially constructed condenser resembling a rotary spark gap in appearance, which is rotated by a small motor. The condenser is connected across the secondary of the receiving tuner, and when rotated at the proper speed increases or decreases the secondary capacity in such a manner that a 500 cycle note is obtained from the received undamped signal?

THAT a number of perfectly good spark sets will be sold for a song because the owners are building tube sets?

THAT this may be years from now—judging from the time that it takes some of the builders to complete the sets?

THAT the filament of a power tube must always be lighted to full brilliancy before the plate current is applied?

THAT neglect of this will often cause the burn-out of all tubes in use?

THAT when using a wavemeter with a hot-wire indicating meter to measure the wave of a tube or other undamped transmitter care must be taken to go up and down the wavemeter scale slowly or the resonance point may be passed over entirely and no readings obtained?

THAT it will be an honor as well as a souvenir to take home a commercial license issued to successful candidates by the Radio Inspector at the Radio Show of the Convention?

Your Classified Advertisement in "Pacific Radio News" will reach the class of amateurs who need apparatus. Don't throw your old apparatus away—there may be a dozen of our readers who are looking for the very instruments that you no longer need.

WHAT OUR READERS WANT TO KNOW


Editor "Pacific Radio News,
San Francisco, Cal.

Dear Sir:

In your November issue I notice a letter from amateur 6BJ in regard to the strength of his signals received by many Pacific Coast amateurs. I have heard 6BJ many times and must say that I have never rolled in on a single bulb. But say, Editor, O. M., how much power is this gentleman using? Is that the secret of those "ton 'o brick" signals? Would like to know exactly how much power said station was using prior to September 1st.

Another thing: Why under the sun are all the best part of the "sixers" starting to use these double action keys? Don't we have enough trouble receiving now, with fading signals, QRM, QRN and other things without these "ops," with a double action hacksaw blade slinging a bunch of gaff at us in some double-jointed manner? Really, Editor, I would like to hear the opinion of the brotherhood on these keys and their use. Remember—I am speaking of the homemade variety resembling a rebuilt copper or hacksaw blade and not the Martin Vibroplex or any other standard speed key. A good Vibroplex or speed key in the hands of a man who knows how to use it is indeed worth while, in fact I believe that the world's record in wire telegraphy was made with one of these keys. This shows their worth, but I'll wager the operator has practiced with it for many moons before he made that record—73.

TEN-NIN-O.

It's not the key that makes the fuss—it's the operator who is using it. 6BJ swears on a stack of Bibles that he has never used over a half k. w.

The Admiral Line steamer President the first mercantile vessel on the Pacific to be equipped with wireless, will also be the first to have the wireless telephone installed. The Radio Corporation announces that the system will be installed in the near future.

CALLS HEARD BY 6EB

(6AH), 6AJ, 6AM, (6AN), 6BB, (6BN), 6CP, 6CV, 6DP, (6EX), (6FE), 6GO, 6HK, 6HQ, (6JN), 6KL, (6PR), (6QR), 6SK, 6TC, (6ZK), 7GQ and KIX.

UNLISTED SECURITIES


Stocks

Bid  Ask

Moorhead ...........................................12c .......
National Radio ..................................19c ..25c
Poulsen ..............................................2½ .......

 
SIXTH DISTRICT AMATEUR STATIONS—Continued.

Call  Name                        Address          
6ADW  A. McDonald                 1376 Washington St.    Los Angeles, Cal. 
6ADX  F. G. Beck                  417 C Street.              Wilmington, Cal. 
6ADY  S. Ayres                     51 Third Street.           San Francisco, Cal. 
6ADZ  Electric Lighting Supply Co., 210 W. 3rd St.   Los Angeles, Cal. 
6AE  W. W. Bell                    1807 Alameda Ave.          Alameda, Cal. 
6AEB  A. M. Fontaine               4127 Woodruff Ave.         Oakland, Cal. 
6AEC  O. Bernhard                  Boy Scouts' Camp.            San Francisco, Cal. 
6AED  S. Griffen                   1825 Fourth Street.         San Diego, Cal. 
6AEE  W. W. Grundell               1911 Eddy Street.           San Francisco, Cal. 
6AEG  P. E. Parker                 420 E. Chapman Ave.        Fullerton, Cal. 
6AEH  N. B. Wells                 2827 Union Street.          San Francisco, Cal. 
6AEI  E. L. Albright               2331 University St.        San Diego, Cal. 
6AEJ  H. Blackman                 .                               Winton, Cal. 
6AEK  H. Lane                       53 Cambridge Way.          Piedmont, Cal. 
6AEL  C. Harris                     454 17th Ave.               San Francisco, Cal. 
6AEM  T. A. Cutting                67 First St.                Campbell, Cal. 
6AEN  P. T. Scott                   Rt. 2, Box 177A.            Fullerton, Cal. 
6AEO  O. C. Frei                     1016 S. Oxford Ave.        Tolena, Cal. 
6AEP  F. Lopez                                4001 Porter Street.       Oakland, Cal. 
6AER  S. Lassen                    1472 85th Ave.              Oakland, Cal. 
6AQ  Polytechnic High School, Science Dept.     First Ave and Frederick St. San Francisco, Cal. 
6AEP  R. Walker                    1712 Russell St.             Berkeley, Cal. 
6AES  M. L. Hoffman                432 Walsworth Ave.          Oakland, Cal. 
6AET  C. Schonmaker               199 Douglas St.              San Francisco, Cal. 
6AUX  Leo J. Meyberg Co. 428 Market St.  San Francisco, Cal. 
6AUX  A. W. Hart                     30 Grand Ave.              Oakland, Cal. 
6AUX  Leo A. Myers               1091 Harrison St.             Santa Clara, Cal. 
6AUX  R. W. Baker                   1983 South Ninth East St.  Salt Lake City, Utah 
6AUX  Boy Scouts' Troop No. 1         National City, Cal. 
6AUX  Boy Scouts' Troop No. 18       San Diego, Cal. 
6AUX  Boy Scouts' Signal Headquarters          San Diego, Cal. 
6AUX  E. M. Ellis                       1524 S. California St.     Stockton, Cal. 
6AUX  V. Green                        211 Ellen Ridge Ave.        Los Gatos, Cal. 
6AUX  H. G. Hopkins                  Rt. 2.                            Yuma, Arizona 
6AUX  E. Newton                         1161 Benton St.               Santa Clara, Cal. 
6AUX  O. D. Packard                        1428 Olive St.            Paso Robles, Cal. 
6AUX  University High School Radio Club, 48th and Webster Sts. Oakland, Cal. 
6AUX  N. W. Rathbun                        330 Fourth St.          Colusa, Cal. 
6AUX  B. E. Ellis                       343 24th Ave.              San Francisco, Cal. 
6AUX  G. W. Harriman                   2500 Irving Ave.            Clifton, Arizona 
6AUX  J. F. Ives                         2108 Grove St.               Berkeley, Cal.

RADIO CLUB DIRECTORY

Published every month. It keeps you posted on important meetings.

United Radio Telegraphers' Association, Pacific Coast Division—Rooms 418-420, 24 California St., San Francisco Cal. Phone Douglas 2706. All commercial operators eligible for membership. Address communications to above address.

San Francisco Radio Club, Inc. S. F. Gymnastic Club, Sutter and Divisadero Sta., San Francisco, Calif. Meetings every Tuesday evening at 8:30 P. M. Visitors welcome at any meeting except first meeting of the month. Meeting fee $2.50. Monthly dues 25c. For experimental and commercial radio operators, address communications to the secretary.

The EDITOR'S MAIL BAG

Our Readers Are Invited to Send Contributions for Publication in this Department.

Pacific Radio News, 50 Main Street, San Francisco, Calif.

Gentlemen:

7YG—Oregon Institute of Technology of Portland Y. M. C. A.—broadcast election returns for the benefit of amateurs on the night of November 3rd.

The estimate of the 600 stations (licensed and receiving only) of the Seventh Naval District within range is, of course, low because it is known here that many six-stations as far south as Los Angeles heard us, though, of course, our local election returns did not interest them greatly.

7YG used a 2KW, Simpson type, 500-cycle Transmitter of Kilbourne & Clark Co. manufacture, on 330 meters. Power in put used was 1 KW and the radiation was but 10 amperes. The decrement was .055 so that the signals carried well and this decrement permitted local stations to work easily on 200 meters.

A great deal of interest was shown among amateurs in their "hamming" after each report. Several requests for "repeat" came back but this was impossible because of the volume of work to get out.

It was tried as an experiment and the appreciation shown has induced us to lay plans for a 15-minute local press service every night at 9:30 p.m. when news of interest, especially to the Northwest, will be available to amateurs before they could obtain it from the morning papers.

We will advise you when these plans are complete and would appreciate your announcing it in your columns then more definitely. Very truly yours,

A. J. TWOGOOD, Dean, Engineering Schools, Oregon Institute of Technology, Portland Oregon, Nov. 4, 1920.


Editor, "Pacific Radio News":

Just to let you know that your magazine is very much appreciated in this locality. In particular I would like to compete in the contest for transmission to Honolulu. My opinion is that whether or not the test will prove satisfactory will depend largely on weather conditions.

It seems that whenever a test is mapped out for a definite date, especially a long distance test, the weather conditions always fail to co-operate. However, I am willing to try my luck at it.

Please tell Mr. Mumford to listen for 7CU on 230 meters at any convenient time and I will take particular care to have my station in tip-top shape.

Truly yours,

Mumford Bros. Radio 7CU.

(Continued on page 147)
THE following communications have recently been received by 2QR and the accompanying photograph shows the radio telephone equipment that carried the human voice to Scotland.

October 30th, 1920.

Editor, Pacific Radio News,
San Francisco, Calif.

Dear Sir:

Herewith a new photograph of Station 2QR, owned by myself and my son Harold. Quite a lot of new equipment has been added since the last photograph was taken. We have made several distance records on radio phone transmission, copies of the different letters received relative thereto being enclosed herewith.

The letter from Scotland is self-explanatory, and while we are loathe to believe that it is possible, or that it can be true, yet Mr. Benzie states the facts exactly as they were, which makes the thing more puzzling, and in view of the enormous importances of his letter, we have written him for further and more substantial details of this record, and will advise you more fully later.

Please note that to date we have been reported as being received very QSA on our radio phone at Bristol, Conn., Ashland, Ohio, Canton, III., and Napanee, Ont.

Hoping that you may find the photograph and our description of interest, we are,

Yours respectfully,

HUGH ROBINSON,

Station 2QR,
13 Walnut Street, Keyport, N. J.

Copy of a letter received from Scotland by 2 QR.

Denmill Cottage
Petersculler,
Aberdeenshire, Scotland.

12th, Oct. 20

Dear Mr. Robinson:

I write to say that my friend and I received your transmission on Oct. 6th to your friend, I could not be sure of this gentleman’s name, but we heard the record “Roamin’ in the Gossam’ in” by Harry Lauder and the other tune very clearly; also that your power at the time was 100 watts. I write you this as no doubt you will be interested to learn that you can be heard over here with so small a power.

I was using 3 valves. I would be greatly obliged if you could transmit again (radio phone) say three weeks after you mail your letter to me as the letters take some time to reach here. As regards time two hours after the transmission referred to above would suit, hoping you will manage to co-operate in our tests.

Your transmission was received here at about 6 p. m. G. M. T., so if you could transmit two hours later than the time you transmitted on October 6th it would suit me nicely as this would be about 8 p. m. G. M. T. As I do not know how long your time is after ours, this is the only way we could arrange anything definite.

Yours faithfully,

(Signed) GEO. W. G. BENZIE.

P. S. The above letter received by Station 2QR, Mr. H. H. Robinson, No. 13 Walnut Street, Keyport, New Jersey.

Copy of letter received by Station 2QR Mr. H. H. Robinson, No. 13 Walnut Street, Keyport, N. J.

Napanee, Ont.
Oct. 28th, 1920.

Radio Station 2QR
13 Walnut Street,
Keyport, N. J.

Dear Sir:

I am in receipt of your letter of the 20th inst. requesting me to let you know if it was your radiophone or spark set I heard. It was the phone set.

You came in QSA, but the voice was indistinct. I am using one British V-24 triode valve and tickler circuit with De-Forest coils.

Hoping that this information is satisfactory, I remain, with 73’s,

Yours sincerely,

(Signed) W. A. EATON.
186 Exeter Terrace,
RADIO 3FE.

Napanee, Ont.

Dear Friend 2QR:

I heard your radio phone Sunday night and am anxious to know what you were using. I have a short wave regenerative set and three step amplifier, but was just using the regenerative alone when I heard you. Static is bad here, so can’t use the amplifier much. I heard that you were using a De-Forest phone set, but your voice was very clear and distinct, and I missed the usual hum that the local ones give.

Would appreciate a description of your set.

Well c’lo’m. “73’s.”
(Signed) GEORGE B. SEARS (SLB).

THE station shown in the accompanying half-tone is that of Mr. Louis Falconi of Roswell, New Mexico. Many of our Pacific Coast amateurs will be interested in the equipment on account of the reliability of communication that it has established. 5ZA has combined efficiency with SYSTEM in the installation of his apparatus. His instrument table is devoid of any unnecessary equipment. Signals from this station have been reported heard at Fort Pierce,
Florida; Princeton College, N. J.; Pittsburgh, Pennsylvania; Valley City, North Dakota; Portland, Oregon; Los Angeles, California, and many other distant points. Satisfactory communication has been established with amateur stations at a distance of more than 1000 miles.

The transmitter consists of both rotary and quenched gaps, Thordarson 1 K. W. transformer, pancake oscillation transformer, oil immersed condenser constructed of copper sheets and glass and a radiation meter. The transmitter is mounted on an angle iron frame and assembled into one complete unit, thereby avoiding the use of unnecessary leads in the oscillating circuit. The rotary gap is of the belt driven type with the motor mounted on back of the panel.

The switchboard on the table controls the power circuit. A large ammeter indicates the power input. Under the table may be seen the "A" and "B" batteries as well as a vibrating rectifier for charging the filament battery.

The receiving equipment consists of a long wave receiver using honeycomb coils. A short wave receiver is also used for amateur work and is of the variometer regenerative type. The upper small cabinet houses the long wave units, while the lower cabinet houses the short wave apparatus and a two stage amplifier. The amplifier is connected in such a manner that it may be used with either receiver. Plugs and jacks are used for varying the amplification steps and for the telephone connections.

The aerial is constructed of four wires, eighty feet in length and of an average height of sixty feet.

EATNESS and efficiency prevails at 6WM, a photograph of whose station we show herewith. The transmitting equipment, not shown in the photo, consists of a ½ K. W. Thordarson transformer, 12 tooth rotary gap, 3 sections of Murdock condenser units, pancake type oscillation transformer and 5 K. W. transmitting key. The aerial is of the four wire type, 100 feet in length. Stranded tinned copper wire is used and a cable of 19 strands of No. 8 solid copper is used for a ground lead. The receiving set shows up clearly in the photo. A two-step amplifier and several variometers have been added to the receiving equipment since the photo was taken.

Statement of Ownership, Management, Circulation, Etc., Required by the Act of Congress of August 24, 1912

Of Pacific Radio News, published monthly at San Francisco, California, for October 1, 1920.

State of California, County of San Francisco—ss.

Before me, a notary public, in and for the state and county aforesaid, personally appeared H. W. Dickow, who, having been duly sworn according to law, deposes and says that he is the owner of the "Pacific Radio News," and that the following is to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Pacific Radio Publishing Company, 50 Main street, San Francisco.

Editor, Paul R. Fenner, 50 Main street, San Francisco.

Managing editor, none.

Business manager, H. W. Dickow, 50 Main street, San Francisco.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) H. W. Dickow, 50 Main street, San Francisco.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgagees, or other securities are: (If there are none, so state) Paul R. Fenner.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances 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 of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ——. (This information is required from daily publications only.)

H. W. DICKOW,

Owner.

Sworn to and subscribed before me this 23rd day of September, 1920.

(Seal) MARGUERITE S. BRUNER,

Notary Public in and for the City and County of San Francisco,

State of California.

My commission expires January 8th, 1922.

STATIONS WORKED BY 6OC

6FS, 6AK, 6EJ, 7CU, 7BP, 7DA, 7IN, 6FE, and 6OH.

The following stations report hearing 6OC with good audibility: 6SK, 6JD, 6EA, 6AJ, 6DP. A home-made ¼ KW transformer, Benwood gap and oil condenser are the essential parts of the transmitter used by 6OC. With this equipment he succeeds in getting four amperes into the air.

CALLS HEARD BY 6JD

Heard: 5ZA, 9LR, 6AH, 6AS, 6CV. Worked: 7CU, 7ZI, 7DA, 6OH, 6DP, 6AV, 6OR 6BQ, 6GE, 6PJ, 611, 6BN, 6IN, 6EX, 6AN, 6ZE, 6JR, 6BJ, 6CQ, 6AT, 6QM, 6UM, 6EJ, 6AK, 6EP, 6L, 6ZB, 6MZ, 6AE, and 6AM. Stations 6Jl 62M and 6MZ can be worked any time, day or night.

CALLS HEARD BY 6EA

(Additional)

Stations heard are: 5ZA, 6ABX 6AH, 6AM, 6NE, 6PJ, "RI", "SF". (QRA?) Stations worked are: 6AE, 6AK, 6DP, 6EJ, 6FE, 6JF, 6JN, 6JR, 6OH, 6QM, 6QR, 7ZI. Anyone hearing 6EA please write. All letters answered.

6BB, the 500 cycle spark station at the University of California Radio Club, is penetrating the ether as far north as Vancouver and as far south as Los Angeles. The power input is ½ K. W. and stations in Reno, Nevada, have been worked of late. Propaganda relating to the 12th amendment on the California ballot has been broadcasted every Tuesday evening.
ERRATA
Through a mistake in re-copying the original wiring diagram of the article entitled "A Short Wave Regenerative Receiver of High Efficiency and Unique Control" in our November number, the connection between the grid condenser and grid proper was omitted. Unless this circuit is completed the receiver will not function properly.

CHELSEA
VARIABLE CONDENSERS
(Die Cast Type)

| No. 1. | 0.001 m.f., mounted | $5.00 |
| No. 2. | 0.0006 m.f., mounted | $4.50 |
| No. 3. | 0.0011 m.f., unmounted | $4.00 |
| No. 4. | 0.006 m.f., unmounted | $4.00 |
| Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large scale reading to hundredths, high capacity, amply separated and accurately spaced plates. Unmounted types will fit any panel and are equipped with counter-weight. |

Purchase from your dealer; if he does not carry it, send to us. Bulletin sent upon request.

CHELSEA RADIO CO. 13 Fifth St., Chelsea Mass. Manufacturers of Radio Apparatus and Moulders of Bakelite

AERIAL MAIL SERVICE IS INAUGURATED TOO EARLY; RADIO SYSTEM UN- COMPLETED.

THAT the aerial mail service from San Francisco to New York was established by order of Second Assistant Postmaster-General Prager at least two weeks too soon became obvious recently when it was learned that a mail plane had dropped from sight and was supposed to be lost somewhere in the Nevada desert.

The radio system by which the San Francisco field will be able to keep in communication with the planes and the landing fields clear across the continent has yet to be completed. Nor have the ships now carrying mail "over the hump" and across the plains been equipped with wireless. As a result a pilot leaving here is out of communication with the flying field and is liable to lose his bearings.

Had Montgomery Field been fully equipped and ready for the task imposed upon it by the Second Assistant Postmaster-General, Pilot John L. Eaton would not have been lost in the Nevada desert, the critics of the air mail service point out. The radio at that field would have picked up trace of him almost at once, it is declared.

Had the plane been fully equipped with wireless telegraph and direction finder, to be installed on all airplanes, that will notify the pilot the instant he swerves from his course, Pilot Eaton would not have been the object of a state-wide search.—S. F. "Bulletin."

The five bulb radio telephone set of the Radio Telephone shop that was heard in Vancouver, Washington, will be on exhibition at the Radio Show of the Pacific Coast Convention. Mr. A. F. Pendleton, manager of the Radio Telephone shop, will give daily demonstrations of the equipment.

Christmas Suggestions for the Radio Amateur

PUT De Forest Radio Apparatus on your Christmas list. Here are two instruments that will greatly increase the efficiency of your set.

Type T-200 Multi-Wave Tuner
Responds to any wave length, 150 to 25,000 meters. Contains triple adjustable coil mountings; Vernier primary and secondary tuning condensers; primary condenser switch; all mounted on engraved Bakelite panel and in handsome cabinet; size, 13x18x12 1/4. Price (without tubes) $85.00

Type P-300 Combination Audion-UltraAudion and One-Step Amplifier
Specially designed to fill a real need for an instrument of this kind in the average amateur station. When used in connection with the T-200 Tuner shown above, it completes a receiver of unequalled efficiency. Cabinet size, 12 1/4x8 1/4x7 3/4. Price (without tubes) $75.00
Send 10 cents in stamps and get the De Forest Catalogue "D" giving complete descriptions of these cabinets, as well as many other quality instruments.

DeForest Radio Tel. & Tel. Co.
Inventors and Manufacturers of High Grade Radio Apparatus
1415 Sedgwick Ave., N. Y. City
LEE DE FOREST, INC.
Western Distributors
453 Third St., San Francisco

6 BN'S SPARK SET FOR SALE
1 Rotary control rheostat ... $2.00
1 Primary input regulator ... 2.50
1 6-p.t. 3450 RPM rotary ... 25.00
1 Motor with 6-p.t. disc 4000 RPM ... 12.50
1 Thordarson Oil Plate Condenser ... 25.00
1 Murdock Oscillation Transformer ... 4.00
1 0-5 Hot Wire Ammeter ... 3.00
1 3 1/2 K.W. Thermometer (new type) ... 35.00
1 C.W. 500-v. Transformer ... 5.00
Numerous Binding Posts, Contacts and Knobs

Hollaway & Shaw-6BN
1175 Washington St., S. F., Cal.
Trans-Pacific Radio Operators Log

By W. Breniman
and G. E. Knudsen

A 32-Page Pamphlet containing reliable data on Pacific Coast Radio stations, call letters, weather reports, time signals, wave length data, press schedules, etc.

EVERY COMMERCIAL OPERATOR SHOULD HAVE A COPY

Ready For Distribution on November First
Price 50 cents

W. BRENNIMAN
Room 420  24 California St.
San Francisco, Calif.

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LEARN WIRELESS At Home Big Concerns In Need of Operators
By Mail

Many attractive positions are now open in Commercial Land Radio Service, Merchant Marine, Radio Supply Factories, Lake and Ocean Steamship Lines, Telegraph Companies and U. S. Shipping Board, and others are constantly being added. However you are not obliged to travel if you secure a position at one of the land radio offices which are steadily increasing in number.

Big Concerns In Need of Operators

Many attractive positions are now open in Commercial Land Radio Service, Merchant Marine, Radio Supply Factories, Lake and Ocean Steamship Lines, Telegraph Companies and U. S. Shipping Board, and others are constantly being added. However you are not obliged to travel if you secure a position at one of the land radio offices which are steadily increasing in number.

Instruments Furnished Free

In addition to all books and equipment which we supply you, we furnish FREE to every student, aNatrometer, which consists of an instrument for calibrating and receiver. You receive the instrument after your examination and you own it as your personal property upon completion of your course.

The Natrometer automatically sends you messages in International Code and acts as though you were coming to you from a station a thousand miles away. You learn the code entirely without the use of signals.

Send for Free Book

Write today for FREE catalogue containing interesting and valuable information.

National Radio Institute
Dept. P N
Washington, D. C.

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HERE IT IS

Lattice Wound Variometers Especially Designed

TO IMPROVE THE SHORT WAVE REGENERATIVE CIRCUIT

Realizing the need of a neat, compact and highly efficient variometer for the modern receiving set, we have produced one which we feel will meet the requirements.

Type 7 is assembled ready for panel mounting and can be easily mounted by simply drilling a ½-inch hole in the panel.

Type 12 is a complete unit and consists of Type 7 mounted on a 4½x4½ bakelite panel incased in a mahogany finished cabinet. Four binding posts are provided so that leads can be connected to any side.

Both types are furnished with a standard 3-inch dial and knob and make a very attractive instrument.

PRICES (Charges Prepaid)

<table>
<thead>
<tr>
<th>Type</th>
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<tr>
<td>Type 7G (for grid circuits)</td>
<td>$ 7.50</td>
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<td>Type 7P (for plate circuits)</td>
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<td>Type 12G (for grid circuits)</td>
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<td>Type 12P (for plate circuits)</td>
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Sole Agent and Distributor
1001 N. Lockwood Avenue
Chicago, Ill.

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<td>De Forest, Back Mounting</td>
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<td>Parkin, Front Mounting</td>
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**ALL POSTPAID**

Western Radio Electric Company

550 South Flower St.
Los Angeles, Calif.

**Grid Condensers**

Hermetically sealed. 100 per cent efficient. Not subject to changes of atmosphere. Efficient performance guaranteed. A recent patent permits the construction of very small capacitances in very small compartments.

**Crescent City Radio Company**

Dept F.

P. O. Box 1104.

New Orleans, La.

When writing to Advertisers please mention this Magazine

**ARC RADIO APPARATUS**

(Please note from page 127) When the arc is used, it is necessary to reduce the arc temporarily useless. It is recommended, in cases where the conveter is designed to use coal gas, kerosene, gasoline, acetylene or other gas having a heavy solid product of combustion, that the arc be so designed as to provide additional insulation within the chamber.

The choke coils, of which there should be one in each leg of the supply circuit, are for the purpose of smoothing out ripples in the input current and for the purpose of preventing high-frequency surges from entering the supply circuit where they might cause damage to windings such as are found in meters and other light electrical machinery. These inductances should have a value of at least one henry, which, unless a great amount of wire is used, will require the use of an iron core. A quality too often overlooked in the design of choke coils for high-frequency circuits, is the minimizing of winding capacity. This is very essential, for, in order to prevent high-frequency surges from entering the supply circuit, the distributed winding capacity must be negligible. Their inductance need only be a fraction of that which is required in the supply circuit for stabilizing the supply current and for producing a high potential when the arc is extinguished during each cycle. The field coils are generally depended upon to furnish this additional inductance.

The frequency of oscillation of an oscillating circuit containing an arc is not, strictly speaking, a function of the capacity and inductance in that circuit. For example, the fundamental equation,

\[ f = \frac{\omega}{2\pi L C} \]

does not necessarily hold and as a matter of fact, can seldom be used with accuracy. This results from the fact that the arc resistance is continually changing with the wandering of the arc around the electrodes, and because the oscillations directly produced by small arcs are generally non-sinusoidal. Invariably, oscillograms show this to be the case with small arcs. If heat reception is used, this fact will evidence itself by the continual changing in the frequency of the audible signal.

Insofar as the design of oscillating circuits for use with arcs is concerned, this deviation presents no especially difficult problems, as the variations are not so great that small adjustments of inductance or capacity will not compensate for them.

Mica condensers are recommended for the closed circuit if one is used, but these should be specially designed to withstand the high potentials frequently found. Certain Navy Standard jars are very good, also. These have a capacity.
of 0.002 microfarad each and a bank of four jars (series-parallel arrangement) having a total capacity of 0.002 microfarad will be found admirably well adapted for use with arcs up to 5 K. W. capacity.

For the smaller arcs, one jar, filled with oil to prevent sparking, and for cooling purposes, will suffice.

Inductances should be wound with stranded wire to minimize high-frequency resistance. The best installations use a special “Litz” composed of hundreds of strands of enameled copper wire braided over with one covering. For small experimental installations, the commercial stranded lamp cord (one conductor) may be used, and this may be wound upon any non-metallic form.

No separation between turns other than that provided by the insulation will be necessary. For arcs larger than the 2 K. W. size, larger conductor and additional separation between turns will be necessary.

A very satisfactory inductance unit may be constructed by making a spool of two large phonograph records and a small circular disc of wood at the center. The wood disc should have a thickness equal to the diameter of the wire over the insulation, and this will make possible the winding of a spiral inductance with any flexible wire. Several of these units may be mounted upon a horizontal rod for convenience in adjusting the value of mutual or self inductance. Formulae and data for the design of inductances and capacities may be found in many publications already on the market, hence their appearance here would be highly superfluous. Bulletin No. 74 of the Bureau of Standards is recommended for any information in this direction that may be necessary.

(To be Continued)

A NEW antenna has been erected on the roof of the Humboldt Bank Building, San Francisco, for the radiophone station in the California Theater of Lee De Forest, Inc. This change, together with several other improvements made by the company’s engineers, has already resulted in increased strength of telephonic and telegraphic signals. According to present plans this station will furnish the music for the radio ball to be held at the Radio Convention.

It may be of interest to our readers to know that on Sunday, September 12, from 11:23 a. m. up to when the NPG arc sent the noon time signals, POZ was heard by 6EA. His audibility was readable on a single Audiotron, using the ultra-sound hook-up with a homemade “Eaton” oscillator connected on a 200 meter transmitting antenna (45 feet long).
It won’t perch on the tree, but—
IT MAKES A “BIRD” OF AN XMAS GIFT

The C. R. L. Paragon, with its tremendous amplification factor and extreme electrical efficiency combined with mechanical perfection and convenience, makes the ideal Christmas present—and you can be sure that it will be appreciated—BUT be sure that you get the genuine C. R. L. product. Look for our name on the instrument. The genuine C. R. L. Paragon is used in almost all long distance stations throughout the country. Price, F. O. B. Chicago, $65.00.

IF A “BIRD” OF A GIFT ISN’T ENOUGH FOR HIM, ADD AN AMPLIFIGON AND MAKE IT A “WHALE”!
The C. R. L. Amplifigon detector and two step amplifier is now equipped with phone plug and jacks for detector and each step, our special 1-way battery switch with transmitting position, extra phone jacks, NON-SQUEALING transformers and many other special features. Combined with the C. R. L. Paragon, it makes up the BEST complete short wave receiver on the market today, bar NONE. Price, F. O. B. Chicago, $106.00.

Both sets fully guaranteed for TWO YEARS. Licensed under Armstrong and De Forest patents.
Special preparations made for Xmas deliveries. Write for our descriptive bulletin.

Chicago Radio Laboratory
1316 Carmen Ave. 5525 Sheridan Road (Testing Station 9ZN)
CHICAGO, ILL., U. S. A.

BAKELITE-DILECTO
The standard insulating material for all radio work. Water-proof, permanent, strong, used by all important manufacturers of wireless apparatus and others requiring the utmost in insulation.
Furnished in sheets, rods and tubes. We also manufacture VULCANIZED FIBRE in sheets, rods and tubes and CONITE, a special insulation, in sheets or rolls from .005” to .020” thick.

Let us show you how our standard products can be made to solve your insulation problems.

THE CONTINENTAL FIBRE CO.
NEWARK, DELAWARE

THE STANDARDIZATION OF APPARATUS DESIGN
(Continued from page 123) agree on details, but if the fundamentals of the experimenters’ wants are boiled down, certain conclusions can be drawn.

The first fact precipitated is that nine hundred and fifty of every thousand are not highly technical radio men. That is, they can’t give an intelligent explanation of the amplification factor of a tube, or the measurement of decrement. If someone talks of matching tube impedances, they are speechless. In fact, not more than fifty out of a thousand can work out the inductances and capacities for a receiver to operate over a given range of wave lengths.

Experimenters do not spend a great deal of money. For every station worth a thousand dollars there are five hundred which represent no more than fifty dollars in cash expended.

But here is the paradox. Every one of them wants his apparatus to look like real, commercial stuff. It must have the atmosphere of scientific instruments. Here is the manufacturer’s problem—to produce this effect of refined, yet sturdy design, and to do it at a low price. And it is a small problem.

One of the first and most important steps toward this achievement is to do design or complete sets as to produce an effect of symmetry. As the old houses with their knick-knack furnishings have passed out, so the conglomerate, helter-skelter radio station, has seen its last days. Even the casual visitor, on whom the experimenter secretly enjoys making an impression, is not convinced if the apparatus looks like a collection of assorted instruments.

Moreover, the experimenter finds himself handicapped if the equipment and its arrangement is not sufficiently versatile to permit the trying of new circuits, the introduction or substitution of different instruments, or the temporary removal of one part of a set-up.

Therefore, the optimum system of designing complete sets and supplementary or individual instruments must give, separately and collectively, that desired appearance; it must be adaptable to experimental work or permanent installations, and must meet the final, and largely controlling factor of low price.

The G. A. Standardized Construction
Mr. Sleeper’s answer to these conflicting requirements was the “five by five” system. That is, all the panels in the examples of design which he submitted were of dimensions in multiples of five. The smallest panel, only used in special cases, was 2.5 by 5 inches. The majority of the separate instruments were carried on 5x5-inch panels, while others had panels 5x10 inches, 10x10 inches, and 10x15 inches.

But it was not enough to decide on the panel sizes. Individual instruments must not only function with others of various makes,
Rotary Gap
WITH 110 VOLT A. C. OR D. C. MOTOR $12.00
WRITE FOR CIRCULAR
Radio Development Co.
P. O. Box 2114
San Francisco, Cal.

Portland Radio Exchange
RADIO APPARATUS BUILT TO YOUR SPECIFICATIONS
We also have a stock of reliable Radio equipment on hand including
the apparatus manufactured by the Radio Development Co., and Pacific
Radio Exchange.
LET US KNOW YOUR WANTS
422 Board of Trade Bldg.
PORTLAND, ORE.

Get that Boy a Wireless Set for Christmas
Nothing could be more interesting or instructive. It trains the mind
and furnishes scientific, never-failing amusement to young and old.
If you do not know just what kind of a set to buy, send an "S.O.S"
(call for help) to

Our Radio Dept.
We not only carry a full stock of Wireless supplies and sets, but
we also are prepared to give valuable advice and counsel as to the
best set to buy.
Complete set that will receive 200-mile messages for as low as
$16.00
De Forest Honeycomb Coils, General
Radio Vacuum Sockets, Moorhead
Vacuum Tubes, Audion Trans, Ear Phones, Plain Copper and Silk
Magneto Wire, Panel Rheostats, etc.

Chas. Brown & Sons
871-873 Market St., Opp. Powell

JUST OFF THE PRESS
SOMETHING NEW
Simple description of the Radio Telephone with complete circuits of a Trans-
mitter, Receiver and Amplifier. With this data any one can construct a Radio
Telephone capable of talking fifty miles. The Amplifier used with a loud speaker
intensifies the voice very clearly. 50 cents postpaid.
FOREST PUBLISHING CO.
114 State St., Boston, Mass.

Buy Your Radio Apparatus on the Pacific Coast
De Forest, Amrad, Radisco, Bunnell, Mur-
dock, Moorhead and other apparatus carried
in stock at list prices F.O.B. Seattle.
MAGNAVOX AGENCY
Arco Amplifying Transformers... $5.00
Federal Transformers ............ 7.50
Mica Grid Condensers .......... .50
Genuine Navy Rheostats ...... 2.75
45-volt "B" Batteries............ 5.00
Audion Panels ................ 11.00
Audion Panels (professional) .. 15.00
1-stage Amplifier .......... 22.50
2-stage Amplifier ........ 40.00
We reached Portland (150 miles) with our
type "O" Radiophone using AC. Why not
install one?

Northwest Radio Service Co.
609 Fourth Avenue
Seattle, Wash.

FORMICA
SHEETS - TUBES - RODS
Made from Anhydrous Redmanol Resins
Formica is a homogeneous waterproof insu-
lation with exceptionally high dielectric prop-
erties. It is readily machined and does not
warp or shrink.
Formica is the ideal material for panels and
other insulation parts of Radio Apparatus, on
account of its superior electrical and mechanical
properties, as well as its splendid appearance.
THE FORMICA INSULATION CO.
Cincinnati, Ohio

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sisco; The Wireless Shop, 511 W. Washington St.,
Los Angeles, Cal.

When writing to Advertisers please mention this Magazine
**RADIO CLUB PINS**

Special folder of designs and prices in addition to regular catalogue free on request.

**METAL ARTS CO. Dept. 9 Rochester, N.Y.**

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**ATTENTION!**

Write us for information about our new set of unit panels. Also Detectors, Amplifiers, Complete Receiving Outfits, etc.

**SPECIAL THIS MONTH—**


**HI-GRADE WIRELESS INSTR. CO. ASHEVILLE, N. C.**

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**LEARN WIRELESS AT HOME**

**The Demand for Good Wireless Operators Far Exceeds the Supply**

The New York Wireless Institute will make you an operator—at home—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course has been prepared by Mr. L. B. Krumm, formerly Chief Radio Inspector, Bureau of Navigation, N. Y. Radio experts able to impart their practical and technical knowledge to you in an easy to understand way, will direct your entire course. The graded lessons mailed you will prove so fascinating that you will be eager for the next one. The instruments furnished free will make it as easy to learn the Code as it was to learn to talk. All you will have to do is to listen.

**BIG SALARIES**

Wireless operators receive excellent salaries ranging from $125 to $200 a month and it is only a stepping stone to better positions. There is practically no limit to your earning power. Men who but yesterday were Wireless Operators are now holding positions as Radio Engineers, Radio Inspectors, Radio Salesmen at salaries up to $5000 a year.

---

This wonderful set for learning the Code furnished free with our course.

The transmitter shown is the celebrated Omnigraph used by several Departments of the U. S. Government and by the leading Universities, Colleges, Technical and Telegraph Schools throughout the U. S. and Canada. Start the Omnigraph, place the phone to your ear and this remarkable invention will send you Wireless Messages, the same as though you were receiving them, through the air, from a Wireless Station hundreds of miles away. When you apply for your license, the U. S. Government will test you with the Omnigraph—the same model Omnigraph as we furnish to our students. Ask any U. S. Radio Inspector to verify this.

**FREE POST-GRADUATE COURSE**

A one month's Post-Graduate Course, if you so desire, at one of the largest Wireless Schools in N. Y. City, New York—the 'Wonder City'—the largest port in the World and the Headquarters of every leading Wireless and Steamship Company.

**TRAVEL THE WORLD OVER**

A Wireless Operator can visit all parts of the world and receive fine pay and maintenance at the same time. Do you prefer a steady position without travel? There are many opportunities at the numerous land stations or with the Commercial Wireless or with the Steamship Companies.

**FREI INSTRUMENTS AND TEXT BOOKS**

We furnish free to all students, during the course, the wonderful receiving set exactly as produced in the illustration. THIS SET IS NOT LOANED, BUT GIVEN TO ALL STUDENTS COMPLETING THE COURSE.

**EASY PAYMENTS**

A small payment down will enroll you. We will make the payments so easy that anyone ambitious to enter the fastest growing profession—Wireless—may do so.

**SEND FOR FREE BOOKLET**

Without obligating you in any way, send for our booklet "How to Become an Expert Wireless Operator"—It is free. Mail the coupon below, or postal or letter—but do it today.

**NEW YORK WIRELESS INSTITUTE**

DEPT. 17, 258 BROADWAY NEW YORK CITY

New York Wireless Institute
Depts. 17 258 Broadway, N. Y. City

Send me free of charge, your booklet "How to Become an Expert Wireless Operator" containing full particulars of your Course, including your Free Instrument Offer.

Name
Address
City or Town
State

(when written in accordance please mention this magazine)
CONVENTION BRIEFS

Applications for seat reservations at the Convention have been received from points as far distant as North Dakota, Reno, Nev., Los Angeles, Calif., Chicago, Ills., Santa Barbara, Calif., and from other remote cities.

Mayor Rolph of San Francisco will open the Pacific Coast Radio Convention with an address over the telephone from his residence, from where it will be carried to the California Theatre and sent "into the air" by the De Forest Radiophone. By means of an amplifier and Magnavox, the address will finally reach the Convention Hall.

The Hotel Whitcomb has been selected as the official hotel headquarters for the visiting delegates and others who contemplate attending the Radio Convention. Busses will meet all incoming trains and steamers. The special rate quoted for visitors is $2.50 per day for a single room without bath and $3.00 per day and up for a single room with bath. Visitors may, of course, select any hotel but it is the desire of the Committee on Arrangements to house the entire delegation in the same hotel in order to further the acquainances of all concerned.

Out-of-town radio men who desire to attend the radio banquet and radio ball are kindly requested to make their reservations at an early date. The radio banquet will be a novel affair. The price has been set at $1.75 per plate.

The arrangement committee has undertaken the task of giving the "long distance delegates" a royal time on Thanksgiving Day. A number of members of the San Francisco Radio Club have agreed to invite the visiting delegates to their homes for dinner when the main convention is brought to a close. There will be no convention activities on the night of November 26th.

Radio Apparatus of Quality

| Antenna Wire | 60c lb. |
| No. 14 60 ft. per lb., hard drawn copper | 80c lb. |
| No. 12 60 ft. per lb., hard drawn copper | 80c lb. |
| No. 12 60 ft. per lb., soft copper | 80c lb. |

| Storage Batteries | $19.50 |
| Eveready Storage for Audion Filament—4.5—40 amp. hr. | $21.00 |
| Eveready Storage for Audion Filament—4.5—60 amp. hr. | $21.00 |

| "B" Batteries | $6.00 |
| "B" Battery—Standard Variable Voltage—40v. 6 amp | $8.00 |
| "B" Battery—Standard Variable Voltage—Navy Type | $8.00 |

| Brandes Superior Receiver | $8.00 |
| Brandes Trans-Atlantic | $8.00 |
| Brandes Navy Type | $8.00 |

| Murdock No. 56 Receiver, 1000 Ohms | $6.50 |
| Murdock No. 56 Receiver, 2000 Ohms | $6.50 |

| Vacuum Tubes | 7.50 |
| Moorehead Electron Relay | 7.00 |
| Moorehead Amplifier | 6.00 |

| Vacuum Tube Sockets | $1.00 "RVA" |
| Mica Grid Condensers | .85 |

| Signal Electric | .75c |
| Variable Condensers | 1.50 |
| Parks .001 mf, unit alone, may be mounted on any shaft | 2.00 |
| Parks .001 mf, unit with knob, shaft and pointer | 2.00 |
| Parks .001 mf, unit—complete with 3 in. black dial | 2.50 |

| Perfecton knocked down—21 plate | 3.50 |

Give Us a Trial Satisfaction Guaranteed

THE PACIFIC RADIO DISTRIBUTING CO.
POMONA, CALIFORNIA

This is To Announce . . .
that we have entered
The Radio Field

As a well-known electrical supply house we have recently opened a first class Radio Department, carrying a complete line of equipment for both the Commercial and Amateur operator. Our catalog will be issued shortly, showing our complete line of wireless goods. Send for your copy now.

ANTENNA EQUIPMENT

| Aerial Wire | BOUNDING POSTS |
| Aerial Wire | Switch Levers |
| Guy Wire | Crystal Detectors |
| Turnbuckles | Audion Detectors |
| Pulleys | Short Wave Sets |

DAVID KILLOCH CO.
57 MURRAY STREET
NEW YORK CITY

ANYTHING IN—Telephone Garfield 71

RADIO APPARATUS

Electric Supply and Repair Co.

Frank P. Herrguth Al Rosenberg
Formerly of Paul Seiler Electric Works

520 Market Street
San Francisco, Cal.

When writing to Advertisers please mention this Magazine
Knock 'Em Dead This Winter
Get a Benwood Disc
Here is a real disc

Give the old spark a chance. It will do the rest. Make your call famous throughout the country. Gives a clear musical note. The disc is a solid aluminum casting, true to the hundredth part of an inch.

Made with 4, 8, 10 and 14 points. Drilled for any size motor shaft. Has WIDE sparking points that are tapered, thus giving the quick break that is so much desired by those who know.

THE PRICE OF THIS DISC IS $8.00

Designed for 1 K. W. installations
Order from your dealer. He has them in stock. If not we can ship direct and make IMMEDIATE shipment.

Specify size of motor shaft when ordering.

9LC THE BENWOOD CO., Inc. 9KU
Cor. 13th and Olive Sts., ST. LOUIS, MO.

Materials and Parts
FOR THAT NEW SET YOU ARE BUILDING, WE HAVE IT

Brass sheet, round and square rods, sheet aluminum, fibre, bakelite and hard rubber cut to size, machine and wood screws, binding posts, switch points, knobs, insulators, switches of all types, variable and fixed condensers, and cardboard tubing.

Murdock, Acme, Tresco, Bunnell, Moorhead, Parkin and Burgess products in stock and we can give you the service you want. Our new catalogue sent for 5 cents, which will be refunded on first order for one dollar or over. Try us on your next order.

KEYSTONE RADIO CO.
DRAWER 307 GREENVILLE, PA.

(Continued from page 140) but the line of any one company must be so planned that the separate parts can be combined into complete circuits. Also, this subdivision cannot be carried out too far. Complete tube units were developed ranging from a single audion detector to a detector and two-stage amplifier. Many radio men maintained that a detector and two-stage amplifier, with three jacks, could not be put on a 5x5-inch panel, but it was done beautifully and easily. Separate condensers and inductances were worked out covering all the various requirements of tube and crystal circuits.

These instruments can be put together to form any known circuit, yet the panels, when grouped always give the finished appearance of a single panel without its disadvantages. A complete set can be added without making it unsightly.

However, this was not the whole story. With the instruments designed for standardized panels, some method of mounting them was needed. Again, Mr. Sleeper was called on, and with the writer, worked out the G. A. instrument case, now being made the subject of a design patent. It was found that, with all binding posts on the front, the advantage of the system was destroyed by the net work of wires draped over the panels.

Accordingly, a small connection panel was mounted, by square brass rods, to the rear of the main panel. Then, at the back of the box, an opening was made so that when the main panel was put on the front of the box the connection panel fitted into the opening at the rear. The top of the box was hinged to permit inspection or the changing of tubes. By doing this, all the advantages of panel mounting were retained, and the binding posts relegated to the rear where the wires could run around as much as they chose without spoiling the front.

If the panels are not fitted in boxes they can be held together by brass strips, a very satisfactory and convenient arrangement. Boxes can be purchased later if desired.

The General Use of "Five by Five"
Construction
It would not be right to take up so much of the valuable space in "Pacific Radio News" to do nothing more than tell why and how the G. A. Company adopted the "five by five" system of apparatus design. The object of this article is to show other manufacturers the advantage of the method. We all know that the average experimental station is made up of instruments from a number of companies. It is certainly desirable to have the different instruments from one company supplement each other mechanically as well as electrically. And how much it will help the experimented to raise his own standards if he can fit together in a complete set the apparatus of different companies.

The writer believes that the Western manufacturers will not fail to see the advantages of the "five by five" system as such Eastern companies as Amrad and others have seen.
To obtain the very best results use Federal Standard Accessories

TYPF ARE USED by the leading Experimenters, Manufacturers and by the Government.

The standard 226-W Audio Frequency TRANSFORMER is more popular and efficient than any other because it GIVES RESULTS. YOU SHOULD USE IT.

Our new Bulletin 102 W-B is now ready for mailing. Send 4c in stamps.

CONTAINS NEW INFORMATION

Our line of Jacks and Federal Duo-Lateral Inductances just out.

If your dealer does not have them, write the

Federal Telephone and Telegraph Company
1766 Elmwood Ave., Buffalo, N. Y.

PACIFIC RADIOSCHOOL
ARC AND SPARK SYSTEMS
THE MOST UP-TO-DATE AND EXCLUSIVE RADIO SCHOOL IN THE WEST. LATEST TYPE POLSEN 1 KW ARC TRANSMITTER AND INDEPENDENT TYPE ONE KW 600 CYCLE SPARK SET. EQUIPMENT IN ACTUAL OPERATION.
NAVY STANDARD RECEIVING SET WITH AUDION AMPLIFIER. UNDER THE PERSONAL SUPERVISION OF ADDISON S. MCKENZIE, CHIEF ELECTRICIAN, U. S. N. R. F., FORMERLY INSTRUCTOR AT NAVAL ACADEMY, SAN FRANCISCO.
435 NEW CALL BUILDING, SAN FRANCISCO

FOR PERFECT SIGNALS AND SOLID COMFORT, WEAR Brandes Matched Tone Receivers

We were not satisfied when we accomplished mechanical perfection of our receivers to such a high degree. Lightness and comfort are almost as necessary as the perfectly matched tone for which Brandes Receivers are famous.

We, therefore, equipped our receivers with an improved head band instantly adjustable to any size head. Check nuts hold the adjustment. Made of Galvanized Piano Wire, covered with strongly woven Khaki. No metal parts come in contact with the wearer's head, and the head band cannot catch the hair even when adjustments are made on the head. Other metal parts are nickel plated brass, making the head band absolutely rust proof. Our new head band is the strongest, most durable and lightest of its kind on the market.

Our receivers are now equipped with polarized indicating cords. This eliminates any danger of demagnetizing the receivers when Vacuum Valve Detectors are used.

Give yourself a Christmas present. Order any pair of our receivers, try them for 10 days in comparison with the phones you have now. If they aren't better receivers for clearness, sensitiveness, distance and comfort than what you are using, return them to us, and back comes your money immediately and without question.

C. BRANDES, Inc., Wireless Receiver Specialists
Room 819, 32 Union Square, New York City

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**NOSTAT**

"Conqueror of Static"

**Cutting The Cost of Radio**

NOSTAT ACOUSTIC TUNING CHAMBERS
IDENTICAL IN MATERIAL, WORKMANSHIP AND DESIGN
TO OUR FAMOUS MODEL 4, BUT WITHOUT TELEPHONE, BINAURALS OR BASE.

Ready for use with your own receivers, and the price—lower than that for which you could make them—$10.95

*For working through (QRM) or (QRM)*

The one piece of Radio equipment you can not afford to be without

*For Sale by*

NOSTAT COMPANY
118 St. James Pl., Brooklyn, N.Y.

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**A CHRISTMAS COMBINATION**


PACIFIC RADIO NEWS, 60 MAIN ST., SAN FRANCISCO

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**DUCK’S**

New Big-200 Page No. 14
Wireless Catalog 21 and 27

Mailed for 25¢, either in stamps or coin, which amount you are privileged to deduct on your first order of $1.00. Catalog positively not sent otherwise. This edition of our wireless catalog is the most complete and elaborate we have ever put out. It embraces everything in wireless worthwhile. As an encyclopedia of information it is invaluable. It is printed on heavy, smooth paper with a beautiful cover. Your amateur friend will tell you that there never has been any wireless catalog to take the place of Duck’s, and above all, that you can absolutely rely on the quality of every instrument listed in this catalog. A word it is all worth while catalogs in.

Improved Type Sayville Rotary Gap

Embody the latest and best features in Spark Gap Construction.

Our New Type Sayville Rotary Gap is, we believe, far in advance of any rotary gap on the market within a range of twice the price. It is the final development of many different types made in our experimental Radio laboratory. It fulfills every requirement of the ideal rotary gap. It is neat and attractive in appearance; simple and durable in construction; possesses a wonderful motor; has a cast aluminum rotary wheel, beautifully polished; every part is in perfect alignment; there is no wobbling of the motor; produces and maintains a clear and pure 500-cycle note; is instantaneous in action; permits of no dragging of the spark; has contacts of tempered flat copper of proper length and width, easily and quickly removable, and inexpensively renewable; the stationary contacts are adjustable to any length.

The picture above really does not do it justice. There is no rotary gap we have ever sold that we consider in the same class with this gap, and we have therefore, discontinued the sale of all other types listed in our catalog.

Any purchaser is privileged to return it within three days if it does not come up to all the high claims we make for it. A first-class Rotary Gap is the very heart of an efficient transmitting set, and we cannot too strongly emphasize care in the selection of this instrument if effective and dependable results are desired.

No. A1798—Improved Type Sayville Rotary Gap (shipping weight 9 lbs.)......$27.50
Renewable Rotary Electrodes (not less than five sold), each...........$0.60
Renewable Stationary Electrodes, each...........................$0.10
Type A Motor as supplied with above gap (shipping weight 6 lbs.)....10.00

---

**Do You Know**

that the ACE Type B 2-step Amplifier will give you 450 times amplification of signal? Price $20.00, ready to wire. Diagram furnished.

We manufacture and handle complete lines of Radio instruments and accessories.

Write for catalog.

"You may pay more—but you can’t buy better."

THE PRECISION EQUIPMENT CO.
2437 GILBERT AVE., Dept. P
CINCINNATI, OHIO

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**Our Paragon Rheostat**

has become the standard filament resistance unit for back of panel or table mounting. 5正能量 in diameter. 6 ohms, 150 amp.

$1.75 Postpaid
Immediate shipment.

Standard VT Socket $1.00. Why pay More?

110 Volt Variable "B" Battery, $3.00
Include Clamping on 4 lbs.
Complete in handy wooden case and adjustable phosphor-bronze "Jiffy" connectors. Better than block batteries! If one 4.4 V. unit weakens prematurely, it can be removed and replaced, thereby not impairing the total voltage—making this the best back-up in the market.

Audiontron Adaptor

Consists of standard 4-prong base with brass supporting connectors. Permits mounting tube in vertical position, so filament will not sag and touch grid.

$1.75 Postpaid
Aerial Wire 1 Per Foot
7 strands No. 26 solid copper—tin plated to prevent oxidation. Include postage on 15 lbs. per 100 feet.

$7.00 Per 100 Feet
No. 4 solid copper—triple braid—rubber covered. Include postage on 20 lbs. per 100 feet.

Lightning Switch $4.00
600 volts, 100 amps, 5.P.D.T.

Radio Equipment Co.
630 Washington St.
Boston-11, Mass.

---

**METEOR ELECTRIC CO.**

309 So. Flower St.
Los Angeles, Calif.

MANUFACTURERS AND RETAILERS OF
RADIO APPARATUS
Also Parts and Supplies
We Have An Exchange Dept.
Used Apparatus, Parts, Sold and Exchanged

CONDENSER OIL

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*When writing to Advertisers please mention this Magazine*
THE EDITOR'S MAIL BAG
(Continued from page 133)

Oakland, Calif.,
October 13, 1920.

"Pacific Radio News",
San Francisco, Calif.

Dear Editor:

I, as most other amateurs, are behind
you in your crusade to stop the unnessa-
ary QRM that many amateur stations
are causing in the immediate vicinity of
the Bay Districts.

When I read of the several letters
written by "Kicker" and Mr. Newall in
your last issue, it makes me think that
the air hogs should "get next to them-
selves" and stop this QRK and QSA
business. Things are no better than
before, in fact, they are getting worse.
The fellow making the most noise is
not the one who is doing the long dis-
tance work. I have taken the stand that
I will not answer the question QSA and
QSK, unless I know that the fellow has
just tuned his set or something of the
sort. I am asking every reader of
"PNR" to take the same stand and if
you see fit to publish this letter in your
columns I feel that it will help the cam-
paign. I ask all radio men to join me
in this absolutely necessary stand against
selfish children.

An Old Timer.

THE TELEPHONE BUG

Good Lord—where are all those radio
telephones coming from? Every night
I hear another one busting in on us. We
fellows with spark coils and transformers
had better start a league to eradicate
those music-sending animals. DeForest
is making the California Theatre work
time for his phone set. Poor old
DeSousa is hitting the ball via 6BN.
Art Hickman’s records are being worn
flat by 6UV and several fellows in Oak-
land are stepping lively between the
phonograph store and their radio station
with reinforcements in the line of need-
les and phonograph springs. The "dearly"
stuff is still hopping over the Catalina
circuit and Mr. Petersen is giving his
one-lunger the "high" out on Grove
street. Aeroplanes with phones are fly-
ing over our heads; underground phone
systems are springing up and a city
phone is on my desk. Well, I’m drunk
with the fever. Does anybody around
here want to buy a perfectly good ½
K. W. transformer with accessories?

You can buy that new apparatus with
the commission money that you realize
on subscriptions secured for "Pacific
Radio News." We have a good propo-
sition for you. Write for full details.

Turn your spare time into dollars by
securing subscriptions to "Pacific Radio
News." Any ambitious amateur can
handle our new proposition. It will in-
terest you. Write for details.
Hello Honolulu—Hello Alaska

Everybody will hear you if you open up with twelve amperes in your antenna on 4,000 meters using continuous waves from this 5 K.W. Arc Converter. Designed and constructed by the author of "The Design and Construction of a One Kilowatt Arc Converter," "Arc Radio Apparatus," etc. Signals from this converter have been reported loud at 1,500 miles during daylight. Operated by 500 volts D.C. (street railway voltage), Chamber and electrodes water cooled—just connect to fresh water service. All castings are made of bronze and carefully machined. Solenoids alone contain over one hundred pounds of copper wire. Operates best on wave lengths in excess of 2,500 meters, although with a chopper much lower wave lengths may be used. This piece of apparatus is mechanically and electrically perfect. Its service has been confined almost to research work by experienced and careful operators. Cost $600.00 to build. Weight 300 pounds. Complete with carbon rotating motor and choke coils under base.

Price $500.00, F. O. B. San Francisco
Jennings B. Dow
U. S. S. Texas, San Francisco, Cal.

HOOK 'ER TO YER BULB
The Most Wonderful Tuner in the World for $10.00
Add Parcel Post—Coils only - - - 6.00

About four months ago I purchased one of your mysterious 20,- 000 meter tuners. And today am copying PZ-TN-NFM-MUL-UCM-IDO-VOU. Haven't had much time to sit in but the best part to tell you about this black box is that all this foreign stuff comes in on a 25 foot aerial 35 feet high on one end and 20 feet on the other end. I'm always ready to recommend the black box instead of any other disfigurement made. (Signed) ERNEST F. SCHWACH, 2638 Parkside Ave., Chicago, Ill.

KNOCKED DOWN AND ASSEMBLED CONDENSERS
Which kind do you want? Made for panel mounting and are complete with scale pointer and knob. Used all over the world now and still strong. No. C.O.D. orders. Add parcel post. Buy from your dealer and send us his name if he cannot supply you. Canadian amateurs buy from local dealers or write us at nearest dealer. Formica tops and bases. Movable plates are screwed on and not clamped.

11 Plate K.D. $1.60
21 Plate K.D. 2.25
41 Plate K.D. 3.50
11 Plate assembled 2.75
21 Plate assembled 3.25
41 Plate assembled 4.25

SOLD BY YOUR DEALER OR
TRESCO, Davenport, la.

Be a sport and send 5c for our Catalog, Foreign orders solicited. Canadian Amateurs buy from Canadian dealers. All products licenced under Marconi and Armstrong Patents.

EXPERIMENTERS
who send orders to the G. A. never experience endless delays and needless letter writing.

Grid Condenser ...35c
Phone Condenser ...35c
Grid Leak Condenser ...50c
Add 5c for mailing

All Over the World

In nearly every country of every continent, from Bombay to Cape Town, from Madrid to Rio, from Sidney to Hawaii, G. A. Condensers are in service, replacing expensive fixed condensers or grid leaks and grid condensers. Many manufacturers use them as standard equipment on their apparatus. You To . . . .

THE GENERAL APPARATUS COMPANY, Inc., 570-P West 184 St, NEW YORK CITY

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Storage Batteries

are but one of several
hundred radio accessories supplied by us.
Order anything of standard make advertised elsewhere and get immediate de-
ivery in a single package, that's SER-
VICE. Send stamp for details of SAV-
ing you can make.

C-1 4 volt 20-40 amp hour $7.25
C-2 4 volt 40-60 amp hour 10.75
C-3 6 volt 20-40 amp hour 10.75
Type 'G' designed especially for lighting vacuum tube filaments. Supply limit.
T-1 4 volt 20-40 amp hour $10.75
T-2 4 volt 40-60 amp hour 14.50
T-3 6 volt 20-40 amp hour 16.25
T-4 6 volt 40-60 amp hour 20.00
Type 'H' designed for automobile trade are excellent for tube lighting.
P-1 6 volt 60 ampere hour $19.00
P-2 6 volt 80 ampere hour 24.00
Type 'F' designed for the new Ford car are also excellent for tube lighting or spark coil work.
Add 5 per cent excise tax to these prices which are FOB Marko factories Brooklyn, N. Y.

Mutual Purchasers Association
Dept. P-1 24 Stone St., New York

Here is an Unexcelled Value in a Variometer for Regenerative Work on Short Wavelengths

It is designed for use in plate and grid circuits and may be used either for cabinet mounting or otherwise. It is provided with a non-capacity aluminum diode and scale 5 inches in diameter, with a bakelite knob. Guaranteed to be equal in working quality of any variometer on the market, or your money cheerfully refunded.

Send 15 cents in stamps for our catalogue, illustrating many other values equal to the above. All apparatus either in knock-down or finished form. Dealers write for trade discounts.

OARD RADIO LABORATORIES
"Your Ears Tell"
STOCKTON CALIFORNIA

MARCONI INSTITUTE

Conducted by the greatest and most experienced radio telegraph organization in the world.
Thorough training given in radio operating, traffic, and in damped and undamped systems.
Tuition ten dollars a month for either the day or evening sessions or both combined.

RADIO CORPORATION OF AMERICA
Phone Douglas 3030
335 New Call Bid., San Francisco

Our Specialty

Just the instrument you want at the right time. When no other dealer can supply you—we can. Our most complete stock and large buying power, coupled with economical methods, enables us to offer you everything in Radio at the time you want it and at very favorable prices.

BRANDES TELEPHONE RECEIVERS

<table>
<thead>
<tr>
<th>Ohms</th>
<th>Price</th>
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<tbody>
<tr>
<td>2,000</td>
<td>$7.00</td>
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<tr>
<td>3200</td>
<td>14.00</td>
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<tr>
<td>2800</td>
<td>14.00</td>
</tr>
<tr>
<td>1000 (one phone only)</td>
<td>2.75</td>
</tr>
</tbody>
</table>

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Mail orders promptly filled. Send five cents for our new complete price list of all radio apparatus and parts today.

AMERICAN ELECTRO TECHNICAL APPLIANCE CO.
Dept. P. R. 235 Fulton Street New York

WANTED

Amateurs to Secure Subscriptions
PACIFIC RADIO NEWS
Pacific Radio Pub. Co. 50 MAIN ST. SAN FRANCISCO

GALENA TESTED CRYSTALS—Large Piece 25c
Radio Sales Co., 251 Duboce Ave., S. F.

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Classified Advertisements

ADVERTISEMENTS IN THIS SECTION ARE THIRTY CENTS PER WORD. REMIT IN ADVANCE, IN FORM OF CURRENCY, MONEY ORDER OR STAMPS. MUST ACCOMPANY ORDER.

FOR SALE: Tuning cabinet with set of 12 honeycombs, $50. If interested write for description and photo. E. BANCROFT, Sonoma, Calif.


FOR SALE OR TRADE: 1 KW Type R Thordarson Transformer. Want wireless instruments, also power tubes. Highest offer takes. No Junk. RUSSELL HUCKSTER, Sebago, Indiana.

EXPERIMENTERS—Chemicals, chemical apparatus, books, sets, everything for the laboratory. Price list 5 cents. NATIONAL SCIENTIFIC SUPPLY CO., 241 Pa Ave., Washington, D. C.

RADIO PHYSICS ATTENTION. HIGH VOLTAGE GENERATORS. We supply these motor generator sets in various capacities, especially designed for radio phone work, also low powered rotary converters, dynanmotors, fractional H. P. motors and storage batteries. We are in a position to solve your generator problems and supply machines to fit your requirements. We also have the standard RAT-DI-CO phone sets complete, or furnish any part thereof. In fact, if it is Rat-Di-Co equipment of any kind, or a set of your own design, write us stating your requirements and become acquainted with our SERVICE. RAT-DI-CO (Not Inc.) 2853 C, N. Clark St., Chicago, Ill.

MANUFACTURERS AND DEALERS IN RADIO APPARATUS: The Dayton Y. M. C. A. is opening a school in Radio Telegraphy and Telephony. They wish to purchase all makes of radio apparatus at dealers' prices and resell to operators only at a nominal discount, just enough to pay the overhead. Manufacturers interested please send catalogs, literature and discounts to Radio School, Y. M. C. A., Dayton, Ohio.

NEW SINGLE DIAL OMNIGRAPH with 12 extra dials, $10. Three Western Radio Unit Loads, brand new quartered oak case, bakelite switch front, seven tape, pan cake coils, 1-15,000 $6.00; 2-10,000, $5.00 each, postpaid. Want amplifying transformer, phones. Martyn Company, 415 98th St., San Francisco.

Attention
WIRELESS AMATEURS

THE ONLY WIRELESS MINERAL DETECTOR MADE ON A SOLID PORCELAIN BASE. See Cuts

This Mineral Detector is a most valuable device to eliminate the Amateur's troubles in Wireless Operating

PRICE $2.25 EACH
Including Parcel Post Charges

J. N. BREIDENBACH
2413 North 16th St., Phila., Pa.

Get Bigger Pay through ELECTRICITY

You will find it in HAWKINS GUIDES that what you need to know about motors. Every motor, every phase of the subject, is described, complete, to the points. In questions and answers, a complete standard course in Electrical Engineering, needed for your use today, look over.

HAWKINS ELECTRICAL GUIDES

“Insulate” Handles, Knobs
and OTHER INSULATION ACCESSORIES
for WIRELESS, etc.

Made either of the Best Substitute for Hard Rubber or “Hi-HEAT” resisting synthetic materials Manufactured by

GENERAL INSULATIVE COMPANY
1025 ATLANTIC AVE. BROOKLYN, N. Y.

“The Radio Telegrapher”

Official Organ
UNITED RADIO TELEGRAPHERS’ ASSOCIATION
Room 303
44 Broad Street, New York
Read about what’s going on among the Commercial, Navy and Army operators
ON SHIPBOARD AT SHORE STATIONS AT HOME AND ABROAD
Subscription Price $1.50 yearly, 15 cents a copy

When writing to Advertisers please mention this Magazine
“RADIOTRON” UV-200
Price $5.00
Include postage on 1 lb.

“RADIOTRON” UV-201
Hard detector and amplifier, normal plate voltage—40, but E. M. F.’s up to 128 volts may be used with increasing amplification. Use this tube in connection with UV-200 for best results.
Price $6.50
Include postage on 1 lb.

Regenerative Receiver, Type Z.R.F.
Tubes 175-500 meters. This set consists of a vario-coupler, a variometer connected in the grid circuit and a variometer connected in the plate circuit together with a grid condenser and a grid leak. B. D. plate engraved and fitted with three 3 inch dials. The best value on the market.
Price $30.00
Include postage on 5 lbs.

Variometer, Type Z.R.V.
The newest variometer. Outer shell of B. D. 4½ inch diameter, inner shell is a hard wood hull. Outer winding is form wound. Maximum inductance is 1.8 M. H., maximum inductance 1 M. H. Knobs with 3 inch dial with each instrument.
Price $6.50; without knob or dial, price $5.75
Include postage on 1 lb.

Vario-coupler, Type Z.R.C.
Same construction as Z. R. V., vario-meter listed above, complete with knob and dial, with six taps from primary coil, without switch or switch points.
Price $7.50
Complete with switch, switch points and knob to match knob on dial.
Price $9.00
Include postage on 1 lb.

A.R.Co. Variable Condenser No. A5
The new variable condenser. Especially rugged and efficient and constructed along the line of best radio engineering practice. Capacity of No. A5 101 M. F. Fifteen fixed and fourteen movable plates.
Price $6.25; with 3 in. Indicating Dial, $7.25

A.R.Co. Variable Condenser No. A6
This condenser of the same design as No. A5, but of lower capacity—.0006 M. F. These two condensers admirably fill the need of primary and secondary condensers in the receiving circuit. No. A6 has eight fixed and seven movable plates.
Price $5.00; with 3 in. Indicating Dial $6.00

A.R.Co. Amplifying Transformer
An amplifying transformer which is proving its worth. Of heavy and rugged construction. Coils are wound on a laminated core with a ratio of 4 to 15. Direct current resistance of the primary and secondary is 1000 ohms and 600 ohms respectively.
Price $5.00
Include postage on 1 lb.

The “Amplifone”
A high grade handsome finished cabinet loud-speaker, which enables you to hear signals all over your station. Even faint signals are readable without head receivers. The newest loud-speaker.
Price $20.00
Include postage on 9 lbs.

Acme Amplifier Unit
Designed to function with the Acme detector unit. Complete with rheostat, amplifying transformer, tube socket, etc., in oak cabinet.
Price $13.00
Include postage on 6 lbs.

Ground Switch
A new ground switch of especially heavy construction. 100 amperes, 250 volts D. C. or A. C. capacity. Mounted on slate base, switch parts properly mounted on heavy 2½ inch grooved pillar insulators. Height, over all, 8 inches; width, 3¾ inches; length, 11 inches.
Price $8.75
Include postage on 5 lbs.

“AJAX” Learners Key and Buzzer Set
Solid brass, lever type key, bakelite knob and high tone adjustable buzzer, with silver contacts and two adjusting screws located on top of buzzer. A wide range of tone can be had by a very slight turn of screws. All brass fittings, grained and lacquered.
Price $1.75; with flat spring key $1.25
Include postage on 1 lb.

“AJAX” Sending Key
By far the greatest value ever offered. Level type, all brass, machine milled, heavy contact, 2½ inch base and knob. Size, over all, 5x2½ inches.
Price $1.50
Include postage on 1 lb.

“AJAX” Practice and Test Buzzer
The biggest surprise value today. Clear tone, adjustable over a wide range. Porcelain base, wood cap, brass binding plate.
Price 50c
Include postage on 1 lb.

Acme Detector Unit
Fills the demand for a substantially built and carefully designed vacuum tube detector outfit to sell at a low price. Consists of rheostat, tube, dial, etc., unmounted in oak cabinet.
Price $10.00
Postage on 2 lbs.
"MODULATION PERFECT SIGNALS Q-S-A"

WAS THE ANSWER GIVEN 6BN (SAN FRANCISCO) BY 3CU (VANCOUVER, WASH.)

6BN received the same answer from 6JM (San Fernando), 6SK (Laguna Beach), 6LY (Napa) and many others. 7FH (Vancouver, Wash.) also reports hearing 6BN.

It was not a freak performance, for it was "MODULATION PERFECT, SIGNALS QSA," night after night.

Contrary to rumors, the set that accomplished these results was a stock Radio Telephone Transmitter No. RT-4, manufactured by The RADIO TELEPHONE SHOP.

SEE THIS SET AT THE SAN FRANCISCO RADIO CONVENTION, NOVEMBER 26th, 27th and 28th.

For those desirous of making their own Radio Transmitting Sets:

<table>
<thead>
<tr>
<th>INDUCTANCES</th>
<th>RHEOSTATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formica Tube, 6-inch diameter S. &amp; B. Inc., ground ten to the inch</td>
<td>General Radio 7 ohm, carries 1-2 amp. bulk...</td>
</tr>
<tr>
<td>Same, but wound with No. 14 bare hard-drawn copper wire</td>
<td>Remler small size, panel type...</td>
</tr>
<tr>
<td>TRANSMITTERS</td>
<td>SOCKETS</td>
</tr>
<tr>
<td>Telephone transmitter with extension arm</td>
<td>Remler all bakerlite...</td>
</tr>
<tr>
<td>Telephone transmitter without arm</td>
<td>General Radio...</td>
</tr>
<tr>
<td>BUZZERS</td>
<td>De Forest</td>
</tr>
<tr>
<td>General Radio Buzzer for back mounting with adjustable knob through panel</td>
<td>Acme Amplifying Transformer, fully mounted...</td>
</tr>
<tr>
<td>Century buzzer...</td>
<td>Acme Semi-mounted...</td>
</tr>
<tr>
<td>METERS</td>
<td>Acme unmounted...</td>
</tr>
<tr>
<td>All meters are 3-inch flush type unless otherwise specified. 500-volt DC voltmeter...</td>
<td>Federal...</td>
</tr>
<tr>
<td>O-100 Milliamp, meter, D'Arsonval type...</td>
<td>Acme Mod. Trans. semi mount...</td>
</tr>
<tr>
<td>O-500 Milliamp, meter...</td>
<td>Acme 200-watt CW Trans...</td>
</tr>
<tr>
<td>O-2 Amp. Meter for filament reading...</td>
<td>Acme 50-watt Trans...</td>
</tr>
<tr>
<td>General Radio O-2 1-2 amp...</td>
<td>CONDENSERS...</td>
</tr>
<tr>
<td>Eldridge O-5 raised mounting...</td>
<td>We carry a full line of receiving and sending apparatus of all kinds and makes...</td>
</tr>
</tbody>
</table>

We have been besieged of late with requests from our many customers and patrons to dispose of their surplus apparatus for them, so we have opened a USED, BUT NOT ABUSED, instrument and parts department.

This department will accept apparatus and parts of standard makes for 60 day consignment on the following conditions: We reserve the right to reject any piece of apparatus we do not consider fairly priced or not in good condition.

We will, where possible, test all pieces of apparatus before offering for sale.

Postage or express must be paid and return postage or express must be sent as with full instructions as to the original cost, price wanted, details of instruments, where return money is to be sent, and authority to sell.

No home made piece of apparatus will be accepted unless of unusual merit.

The Radio Telephone Shop will not be responsible for goods damaged while in our shop, nor for goods damaged in transit. The Radio Telephone Shop will do its best to take good care of instruments and when shipping will wrap properly.

Under no conditions will the Radio Telephone Shop buy or take in trade used apparatus, for new or used instruments.

Give us a trial. YOU WILL APPRECIATE OUR SERVICE AND WE WILL APPRECIATE YOUR BUSINESS.

THE RADIO TELEPHONE SHOP
175 STEUART STREET
SAN FRANCISCO, CAL.

Between Mission and Howard Streets, one block up from the Ferry

An Addition to the

Thordarson "GOLD MEDAL" Line

Type "RS" Transformer

<table>
<thead>
<tr>
<th>K.V.A.</th>
<th>8,000 Volts</th>
<th>$15.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ &quot; &quot;</td>
<td>10,000 &quot;</td>
<td>20.00</td>
</tr>
<tr>
<td>1 &quot; &quot;</td>
<td>15,000 &quot;</td>
<td>30.00</td>
</tr>
</tbody>
</table>

Transformers, Oscillation Transformers, Condensers Spark Gap Rotors

Thordarson Electric Mfg. Company

513 South Jefferson Street, Chicago, Illinois

New!—The "Nucleus" $36

consists of a carefully grained and finished Bakelite panel fastened to a Mission oak base, at the top is mounted a 10 General Radio Flitch Type Hot Wire Radiation Meter; a 60 Western Electric Microphone and Type J, Flash, Plate Current Milliammeter. Below is mounted a .001 Type C.S.U. Variable Condenser with Silver Plated Navy Dial Indicator. Additional instruments may be mounted and connected, thereby making a first class wireless 'phone, at minimum expense and bother. Investigate, or—

Place your order now for promptness, DEALERS—No Patent Complications, C.W. & Radiophone Accessories SEND 4c FOR BULLETIN.

DO YOU USE HONEYCOMB COILS?

Somerville Radio Laboratory
Manufacturing Designers
Wholesale and Retail Distributors
100 Heath St. SOMERVILLE, H5, MASS.
This Label

on a "B" Battery
is a definite assurance to you,
of the quality, the hard-and-fast reliability
that has characterized, always,
products backed by the name

E VERE ADY

Announcing a New
Variable Condenser

Built along the same general lines as our
SERIES "S" condenser, but heavier construc-
tion throughout. The plates are die-stamped
from 1/32" hard rolled aluminum, and are
separated by heavier spacers. Extreme rigidity,
best of materials, accurate machine work and
careful assembly are the outstanding features
of construction. At the present time we are
unable to fill orders for the SERIES "S" con-
denser, as we are unable to obtain materials
for its construction, but we can ship the NEW
SERIES "T" and the SERIES "L" VARI-
ABLE CONDENSER from stock.

REMEMBER—WE ABSOLUTELY GUARANTEE SATISFACTION OR YOUR MONEY BACK.

<table>
<thead>
<tr>
<th>SERIES &quot;T&quot;</th>
<th>PRICES</th>
<th>SERIES &quot;L&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 20 2 plate VERNIER</td>
<td>$2.00</td>
<td>No. 2300 23 plate, .00075</td>
</tr>
<tr>
<td>No. 70 7 &quot; .0001 m.f.</td>
<td>2.35</td>
<td>No. 4300 43 plate, .0013</td>
</tr>
<tr>
<td>No. 130 13 &quot; .0002 m.f.</td>
<td>2.75</td>
<td>No. 6300 63 plate, .002</td>
</tr>
<tr>
<td>No. 170 17 &quot; .0003 m.f.</td>
<td>3.15</td>
<td></td>
</tr>
<tr>
<td>No. 230 23 &quot; .0005 m.f.</td>
<td>3.60</td>
<td></td>
</tr>
<tr>
<td>No. 310 31 &quot; .0007 m.f.</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>No. 430 43 &quot; .001 m.f.</td>
<td>5.25</td>
<td></td>
</tr>
<tr>
<td>No. 630 63 &quot; .0015 m.f.</td>
<td>7.50</td>
<td></td>
</tr>
</tbody>
</table>

Include postage for one pound

Either style of condenser fitted with indicating dial
at additional cost of 75c.

Include postage for two pounds

The Wireless Shop

511 W. WASHINGTON STREET  A. J. Edgcomb  LOS ANGELES, CAL.
The Babe Ruth of Radio

You can knock home runs into the long distance field every night in the year with the dependable Grebe Radio

Type CR-3A
Short-Wave Regenerative Receiver
and Vacuum Tube Unit

This little outfit is a wonder. Complete and up-to-the-minute in every detail, its wavelength range runs up to 350 meters. It is built in conformity with our usual superior standards to fulfill the need for a moderately-priced regenerative receiver.

The CR-3A includes a variable antenna circuit, continuously variable grid and plate circuits, a specially designed coupling circuit and a standard vacuum-tube mounting with a grid condenser and leakage element. All binding posts are conveniently located on the front of the panel. The price, $45.50, is within the reach of all.

Be sure to ask your dealer about the CR-3A.

GREBE RADIO apparatus is licensed under the original Armstrong and Marconi patents

Central Radio Institute, Independence, Mo.
Continental Radio and Electric Corp., New York
Detroit Electrical Co., Detroit, Mich.
Electrical Specialty Co., Columbus, Ohio
Hurburt-Smith Electrical Co., Houston, Texas
Kelly and Phillips, Brooklyn, N. Y.

Klaus Radio Company, Eureka, Ill.
Manhattan Electrical Supply Co., New York, Chicago, St. Louis
Leo J. Meyberg Co., San Francisco, Cal.
Philet Electric Co., Inc., New York City
Phi Co., Inc., Boston, Mass.
Phi School of Wireless Telegraphy, Phila., Pa.
Western Radio Electric Co., Los Angeles, Cal.

A. H. GREBE & CO., Inc., 73 Van Wyck Blvd., Richmond Hill, N. Y.

THE NEW AMATEUR TUBE
Audiotron Detector Type C-300
WITH STANDARD FOUR PRONG BASE

TYPE C 300 possesses combination properties—it functions as a highly sensitive spark detector, an Audio-Frequency Amplifier, an Oscillator for regenerative amplification and C. W. reception, a radiophone detector and amplifier—with the added advantages of low B Battery (18-22½ volts) ease and permanency of adjustment, uniformity and quietness. $5.00

Type C-301-High Vacuum Navy Type Amplifier

TYPE C 301 HIGH VACUUM AMPLIFIER is designed to meet the demand for the Navy Type amplifier and regenerative receiver. The internal structure and exhaust permit operation at plate voltages of 40 to 100. Amplification constant 7 to 9 with internal impedance of 20,000 to 12,000 ohms. $6.50

Complete line Duo Lateral coils, unmounted, now carried in stock
Write for Prices

Leo J. Meyberg Co.
Successors to Haller Cunningham Electric Co.
428 Market Street
SAN FRANCISCO, CAL.
DUBILIER MICA CONDENSERS
YOUR STATION DESERVES ONE

"SERVIMUS"

Your radio station is not operating at top-notch efficiency unless a genuine Dubilier Mica Condenser is used in your transmitter.

Dubilier Mica Condensers are unquestionably the most efficient condensers on the market; they are used by all the Radio Departments of the United States government, and other countries, and they will be found in the stations of all amateurs who are breaking records.

THERE IS A SIZE FOR EVERY STATION

<table>
<thead>
<tr>
<th>Type</th>
<th>Watts</th>
<th>Max Tstd Voltage</th>
<th>mfd.</th>
<th>Price</th>
<th>Type</th>
<th>Watts</th>
<th>Max Tstd Voltage</th>
<th>mfd.</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>D100</td>
<td>250</td>
<td>10,000</td>
<td>.007</td>
<td>$19.00</td>
<td>D110</td>
<td>250</td>
<td>10,000</td>
<td>.01</td>
<td>$21.00</td>
</tr>
<tr>
<td>D101</td>
<td>500</td>
<td>14,000</td>
<td>.007</td>
<td>30.00</td>
<td>D111</td>
<td>500</td>
<td>14,000</td>
<td>.01</td>
<td>35.00</td>
</tr>
<tr>
<td>D102</td>
<td>1000</td>
<td>21,000</td>
<td>.007</td>
<td>45.00</td>
<td>D112</td>
<td>1000</td>
<td>21,000</td>
<td>.01</td>
<td>50.00</td>
</tr>
<tr>
<td>D103</td>
<td>1000</td>
<td>25,000</td>
<td>.007</td>
<td>50.00</td>
<td>D113</td>
<td>1000</td>
<td>25,000</td>
<td>.01</td>
<td>55.00</td>
</tr>
</tbody>
</table>

We can also quote you on condensers for receivers and C. W. transmitters, for laboratories and Phantom Antenna systems. Bulletin D1 is yours for the asking.

Inquiries requested from amateurs, dealers, jobbers, distributors and others interested.

DEALERS: Our Discounts are Generous

PACENT - ELECTRIC - COMPANY Inc.


150 Nassau Street
Telephone Beekman 5810
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SAVE RADIO $ $ BY CONSULTING

THE RADIO BUYER'S AND BUILDER'S HANDBOOK

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INC. 16 scale cutouts—in black and white

PRICE—$1.00 PER COPY


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Radio "Tricks of the Trade"—solid silver switch points for 3 to 5 cents.

Variable Duplex Oil Condensers for sending and receiving.

How to Buy Second Hand Radio and Electrical Apparatus Cheap.

A Rectifying Gap Motor which supplies "B" Battery or "A" current.

Many new and Good ideas on "A" and "B" Batteries of Little Cost.

Commercial Type Rotary Quenched Gaps of Low Cost.

Modern Second-hand Electric Motor-Generators up to ½ H.P. for $6.00.

Also many methods of saving time and money on BETTER APPARATUS

R. U. CLARK 3rd

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THREE RADISCO FEATURES

One distinct feature of Radisco Service is the close co-operative-ness of each individual Radisco instrument with the other, and the strength of signal derived from such contact is marvelous.

The other two are the Radisco Variometer and Coupler described below. It is impossible to go wrong when you use them together.

RADISCO VARIOMETER

Like all other Radisco products, it has been produced to anticipate and supply the demand for a good short-wave instrument qualified to stand the acid tests of radio work, and built at a price consistent with the cost of manufacture, which has always been a Radisco characteristic.

For the radio man who desires an instrument of this character, our Variometer makes a distinct appeal. It is made in one size and of one quality, the best. The extreme dimensions are 4 3/4 inches high, 3 inches wide, and 5 inches deep, and it is of 1/4 inch brass, just the right size to fit the No. 69 dial; forms are carefully turned from thoroughly seasoned wood and substantial brass bearings provided. The price is strictly an innovation and should appeal to the most conservative.

Number 1 Variometer $7.00
Number 1D Variometer with dial $8.50
Shipping weight 3 pounds

Radisco Coupler

Specially designed for use with the No. 1 Variometer

The stationary winding consists of 37 turns in groups of six turns and single turns. Strength and high insulation insured by use of Bakelite tubing. Brass bearings support thoroughly seasoned wooden ball; Brass shaft of standard size to fit the No. 67 Corwin dial projects far enough for Coupler to be readily mounted. The whole instrument is finished off on a neatly varnished wooden base.

No. 2 Coupler (as illustrated) $8.50
No. 2D Coupler with “dial” $9.75
Shipping weight 3 pounds

The agents listed below carry all Radisco products and they will be glad to consult with you on the new Radisco Coupler

ALBANY, N. Y.
Shotton Radio Mfg. Co.,
8 Market St.

ASHEVILLE, N. C.
Hi-Grade Wireless Instrument Co.

Baltimore, Md.
Radio Engineering Co.,
614 No. Calvert St.

BEINVILLE, QUEBEC, CAN.

BOSTON, MASS.
Atlantic Radio Co.
88 Broad Street

BROOKLYN, N. Y.
Kelly & Phillips,
312 Flatbush Ave.

CHICAGO, ILL.
Chicago Radio Laboratories,
1316 Carmen Ave.

EUREKA, ILL.
Klaus Radio Co.,
Branch, Peoria, Ill.

KANSAS CITY, MO.
McCready Radio Supply,
4th & Delaware Sts.

LOS ANGELES, CALIF.
The Wireless Shop,
511 W. Washington St.

NEW ORLEANS, LA.
Rose Radio Supply,
604 Gravier St.

NEWARK, N. J.
A. H. Corwin & Co.,
4 West Park Street

NEWCASTLE, PA.
Pennsylvania Wireless Mfg. Co.,
507 Florence Ave. “8HA”

OMAHA, NEBRASKA
O-B Radio Supply Co.,
406 Brown Building.

PHILADELPHIA, PA.
Philadelphia School of Wireless
Telegraphy, Broad and Cherry Streets.

PROVIDENCE, R. I.
45 Washington Street.

PORTLAND, ME.
Atlantic Radio Co.,
15 Temple St.

PITTSBURG, PA.
Radio Electric Co.,
3007 5th Ave.

SEATTLE, WASH.
Northwest Radio Service Co.,
609 Fourth Ave.

SCRANTON, PA.
Shotton Radio Mfg. Co.,
P. O. Box 3
Branch 8 Kingebury St.,
Jamestown, N. Y.

ST. LOUIS, MO.
The Benwood Co., Inc.,
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TORONTO, ONT., CAN.
The Vimy Supply Co.,
567 College Street.

WICHITA, KAN.
The Corwin Co.,
1725 Fairmont Ave.

Responsible Dealers: Write for interesting sales proposition on Radisco Apparatus.

If none of the above agencies are in your vicinity, or do not give you the desired information on Radisco Apparatus, communicate with

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