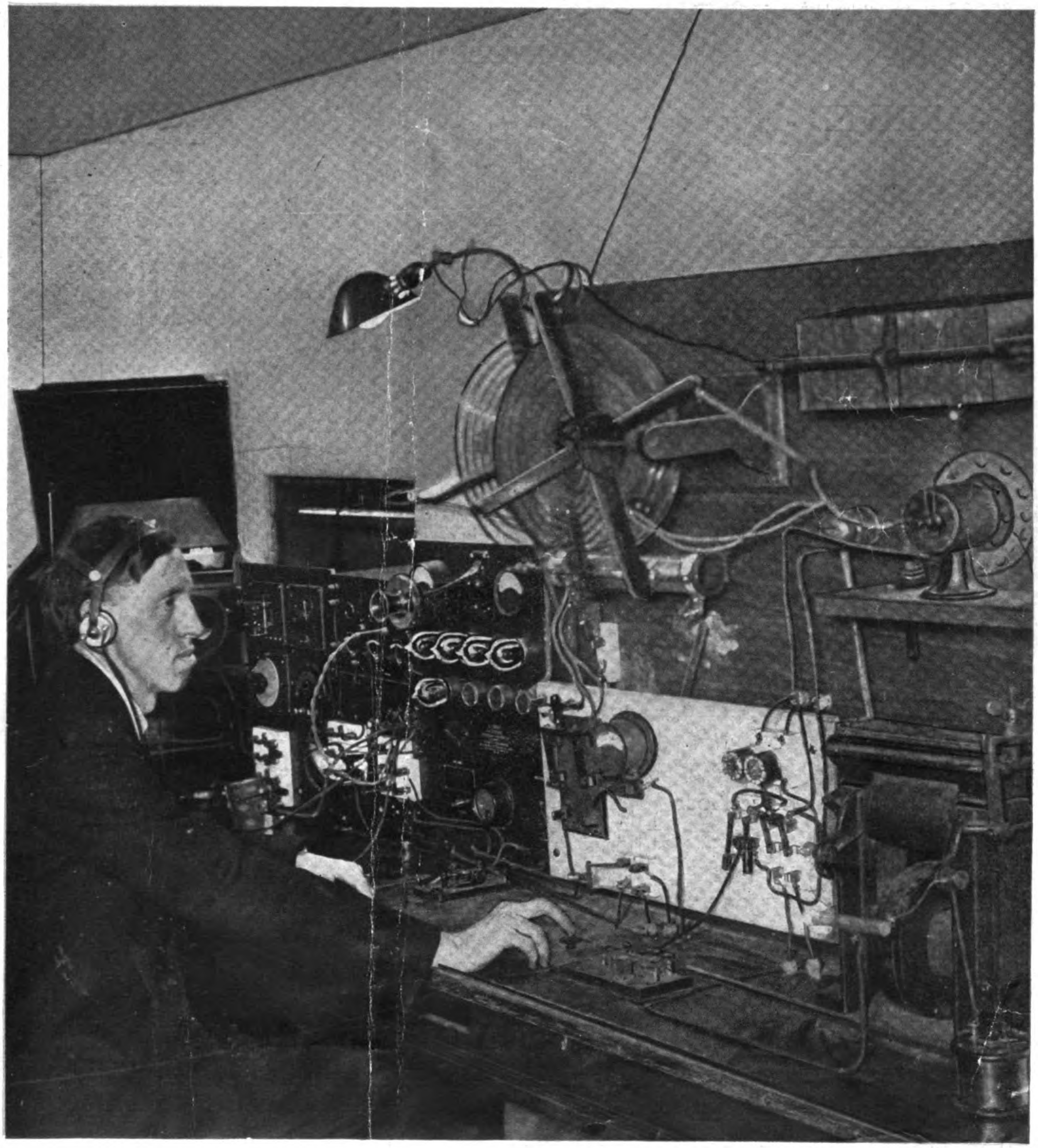
September, 1921 25 Cents

The WIRELESS AGE

Volume 8 Number 12



Prof. J. C. Jensen at key of radio station of the Nebraska Wesleyan University comprising rotary and quenched spark equipment and eight-tube radiophone

New Uses for Amateur Radio

Radiophone Fills Vacant Pulpit--Market News by Radiophone

And Many Exclusive Features in This Issue

WORLD'S ONLY MAKER

Moulded High Frequency High Tension Insulators

POTENTIALS 1,000 — TO — 1,000,000 VOLTS

Medal and Diploma received at World's Columbian Exposition Chicago, 1893

ELECTROSE
REG. U.S. PAT. OFF. & FOREIGN COUNTRIES.
INSULATION
"MADE IN AMERICA"
Louis Steinberger's Patents

Medal and Diploma received at World's Fair, St. Louis. 1904.

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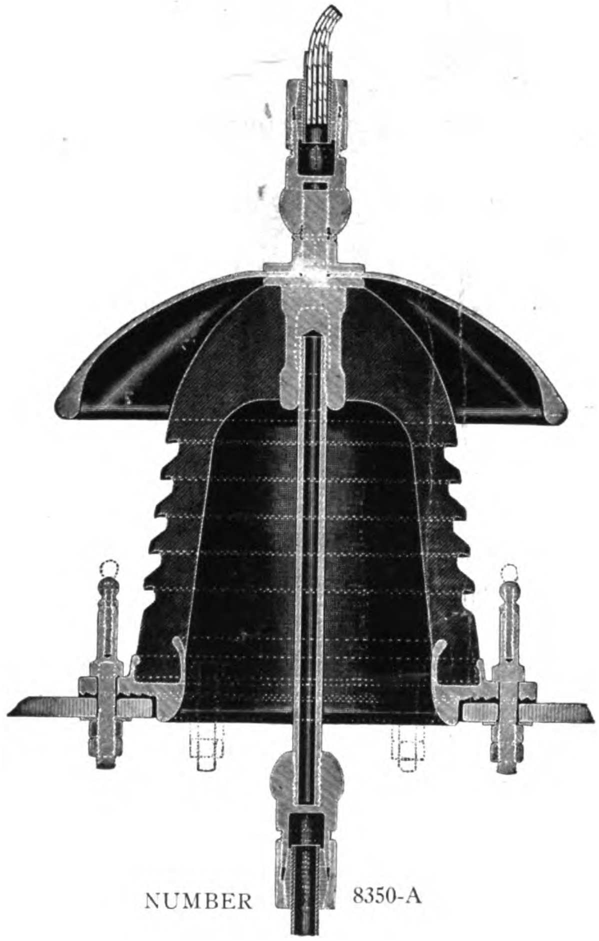
AIR-GAP

Louis Steinberger's Patents

Radio Frequencies
Radio Telegraph
Radio Telephony
X-Ray Apparatus
Damped or Sustained Voltages

Air Gap
1-4" and Upward

Maximum Dielectric Strength



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Louis Steinberger's Patents

Audio Frequencies
Transmission Lines
Sub Station Insulators
Transformer Insulators
Oil Switch Insulators
Circuit Breakers, Bus-bars, Supports, Etc., Etc.

Air Gap
1-4" and Upward

Maximum Mechanical Strength

Minimum Dielectric Loss
Minimum Weight

Minimum Cost
Minimum Physical Dimensions

Materials so proportioned that:

MAXIMUM ELECTRIC STRESSES FORMED IN AIR

EXTENSIVE TESTS under sustained radio frequency operation show:

NO HEATING

ARC-OVER ESTABLISHED IN AIR

"ELECTROSE" Insulators are standard with United States Navy and Army and Wireless-Telegraph and Telephone Companies
"ELECTROSE" is made in a number of grades for various requirements, each grade possessing special characteristics.
"ELECTROSE" Insulators—Best in the World for High Frequency Currents, Power and Transmission Circuits.

SOLE MANUFACTURERS
ELECTROSE MFG. CO.

60-82 Washington Street
66-76 Front Street
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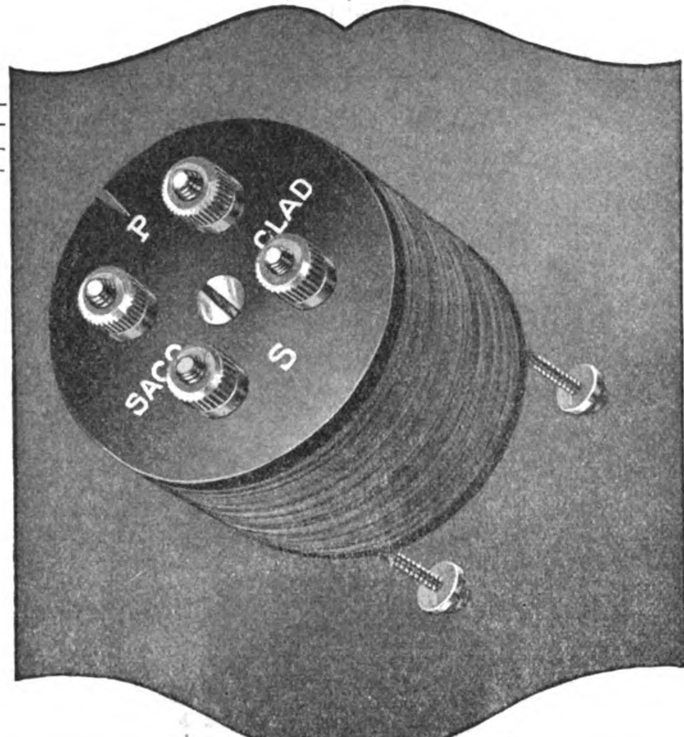
1-23 Flint Street

Brooklyn, N. Y., America

Photograph shows an ABC SACO-CLAD amplifying transformer, slightly less than actual size.



Use

ABC SACO-CLAD TRANSFORMER

No magnetic leakage-no howling

A SOLID WALL OF METAL, $\frac{3}{16}$ OF AN INCH thick, completely encloses the SACO-CLAD. *Magnetic leakage is impossible.*

The primary and secondary coils are wound around a laminated core. Every part is securely fitted *under pressure,* and the whole held together in one solid unit. Ordinary rough usage that would ruin most transformers has no effect on the SACO-CLAD.

SACO-CLAD's step-up ratio is **4 to 1,**—instead of the usual 3 to 1 or less. You can get a higher voltage in your grids, by using SACO-CLADS than with any other transformer.

SACO-CLAD transformers are designed to provide the correct ratio of impedance for present-day VTs. Six steps of SACO-CLAD amplification have been used *without any howling whatever!* And with 800 SACO-CLADS already in use, there has never been a single burnout!

ABC SACO-CLAD transformers are built entirely in the *ABC* factory, *including the windings. ABC* engineers had to design a special winding machine to use No. 40 enamelled wire, in place of the usual No. 44. And, while there never has been a single burnout, the WIRELESS EQUIPMENT CO., INC., accepts full responsibility for all *ABC* SACO-CLAD transformers. Build your amplifiers with *ABC* SACO-CLADS,—and satisfaction is assured by the unequalled *ABC* guarantee, **"Your Money's Worth or Your Money Back!"**

$5.00

ASK your radio dealer for *ABC* SACO-CLADS. If he should happen to be without them, send his name and address, with 10 cents for the new *ABC* 2-color catalogue, *"Professional Radio Equipment at Amateur Prices."* Request Catalog CW9. If there is no dealer in your vicinity, we will gladly fill your order by mail.

$5.00

Wireless Equipment Co. Inc.

Newark, New Jersey

ABC Standardized Radio SACO-CLAD TRANSFORMER

Just mail this coupon and one dime today to the Wireless Equipment Co., Inc., Newark, New Jersey, for your copy of the new ABC catalog, CW9

Name ....

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City .... State ....

Contents *of* THE WIRELESS AGE *for* Sept., 1921

VOLUME 8 — *Edited by* J. ANDREW WHITE — No. 12

RENEWALS—When subscription expires you will find a renewal blank enclosed. Return with remittance promptly.

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Yearly Subscriptions in U. S., $2.50 — **Outside U. S., $3.00; Single Copies, 25 cents**

DO AMATEURS REALIZE THE WIRELESS OPPORTUNITIES THAT AWAIT THEM?

How the President of the National Radio Institute Answered this Question When It Was Put Up to Him. What Would You Have Said? Is the World's Fastest-Growing Field Actually Going to Slip Away From Those Best Able to Cash In Big On It? These Are Questions Which Will Interest Every Radio Amateur

Mr. James E. Smith, President, National Radio Institute

THAT was one of the questions recently put up to me by a well-known authority visiting Washington. "In your opinion," he said, "do amateurs realize the wireless opportunities that await them?" For a moment I was stumped! Then I replied, "Yes, with just one 'but.' I think that amateurs are well aware of the tremendous expansion of wireless that is daily going on. They realize that it is sweeping the world like wild-fire. BUT I do not think that they realize what this means to *them*—they do not realize that they can easily get the 'plums' that the field offers. They "have the jump' on everyone else, and they should realize now that 'the fastest-growing field in the world' besides being a fascinating hobby is a wonderful, opportunity-filled field offering splendid present advantages—and growing so rapidly that the future is beyond estimation!"

I wonder if many amateurs have ever considered the fact that what is to them a fascinating hobby is also a fascinating profession, filled with big opportunities that they can easily share whenever they are ready to do so. It's only a short step for them now to a splendid field that they can put their hearts into—and offering a bigger future than older businesses which are overcrowded.

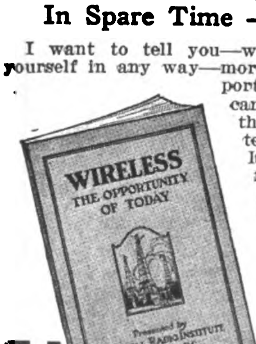
Big Opportunities Are Knocking—Are Some of Us Saying "Please Go 'Way and Let Me Sleep?"

After the caller who started me thinking about this matter had left, I jotted down on my pad some of the items which I had recently noted regarding wireless expansion. On land and on sea big opportunities are opening, and even greater uses for wireless are being found every day. No doubt you too have read these items, but I am going to have them printed here because I want to impress upon you what this tremendous expansion can mean to you.

When I read every day how wireless expansion is sweeping over the world I often say to myself, 'Big opportunities are knocking—I wonder if amateurs realize that they can cash in big on this growing field. While opportunities knock, I wonder if some aren't saying, 'Please go 'way and let me sleep.'" Of course, they aren't sleeping by any means, but I want *all* of them to know just how easy it is to fully qualify for a field which is undeniably filled with greater advantages than most others in the world today.

Easy to Qualify In Spare Time — At Home

I want to tell you—without obligation to yourself in any way—more about wireless opportunities and how you can take advantage of them. I would like to tell you about our Institute, which is officially recognized by the U. S. Dept. of Commerce and whose name heads the list of the schools recommended by the U. S. Shipping Board. This National Radio Institute was the original and is today the oldest and largest school in America teaching wireless by mail. The government allows our graduates five to ten points credit when taking First Grade Government License examinations. We have graduates in almost every part of the world who have quickly qualified through the special method through which we make Wireless amazingly easy for anyone to learn completely at home in spare time.



These are some of the main points about this Institute and I am sorry I haven't room to tell you all of them. I should like to tell you more about our wonderful new methods of teaching, about our remarkable new invention, the "Natrometer," which each student gets free, and which almost cuts in half the time necessary to learn Wireless thoroughly. Then, too, I'd like to tell you about our free Post-Graduate Course and about "Dots and Dashes," about our Diploma, our Relay League, Employment Service, and about our special easy-payment plan. But there is not enough room here to tell you all about these things so I am going to ask you to write me for a new interesting booklet we have gotten up.

Write Me For Booklet

A little coupon is being put here so that you can save yourself trouble in sending for this illustrated booklet, "Wireless, the Opportunity of Today." By mailing this coupon you will not be obligating yourself in any way and no solicitor will call upon you. But the coupon *will* bring you some mighty interesting facts about Wireless Opportunities and about how you can quickly and easily qualify for them—at home and in your spare time.

Won't you mail this little coupon at once? Whether you are a junior Radio Amateur and want to learn all about Wireless or whether you are anxious to fully qualify so as to enter the wireless profession now in one of the fine opportunities open on land or sea—write me for this booklet. All that I ask is that you write as soon as possible. And—since there is no obligation — why not write me today!

P. S.—By the way, we are making a special short-time offer, for a strictly limited time, in which we are giving all new students, our complete new course in Wireless Telephony FREE. Mail the coupon direct to me, today, and let me tell you about it by return mail. **MR. JAMES E. SMITH, President, The National Radio Institute, Dept. 279, Washington, D. C.**

MAIL THIS COUPON TODAY

Mr. James E. Smith, Pres.
National Radio Institute
Dept. 279, Washington, D. C.

Send me your FREE book, "Wireless, the Opportunity of Today." Tell me about your Institute and your Special Short-time Offer.

Name ....

Age .... Occupation ....

Address ....

City .... State ....

☐ I am interested in a sea position
☐ I am interested in a land position

What I Jotted Down

Here are the items I jotted down on my pad, showing how Wireless is growing by leaps and bounds all over the world. Let me tell you what this world-wide sweep of wireless expansion means to you and to your future.

A $20,000,000 American corporation has been formed to establish wireless stations in every part of the globe.

The Chicago Tribune now receives foreign news by wireless. Other papers are calling upon Wireless too.

Huge wireless stations are springing up all over the world. Saint Assise, France; Bordeaux, Ville Juif, and Lyons, France; Peking, China; Geneva, Switzerland; Shanghai, China; Fiji Islands; Warsaw, Poland—and these are but a few.

Many railroads are calling upon wireless to dispatch trains and carry on communication. The Lackawanna, The Louisville & Nashville, The Canadian-Pacific, The Nashville, Chattanooga & St. Louis, are some of them—New York, Cleveland, Chicago and Detroit are connected by an inter-city wireless service.

Brokers, Bankers, Merchants, Manufacturers and other business concerns are calling upon wireless. John Wanamaker, Goodyear Rubber Co., Standard Oil Co., New York Stock Exchange, are only a few.

Farmers are getting Market and Weather Reports daily by wireless in all sections of the country.

New wireless stations are springing up in every part of America. Belfast, Maine; Cape May, N. J.; East Pittsburgh, Pa.; San Francisco, Cal.; Helena, Montana; Seattle, Washington, Mobile, Alabama—these are but a few.

Three tremendous stations are operating on Long Island at Easthampton, Port Jefferson, and East Moriches.

South America is planning to establish a chain of stations at Rio de Janiero, Asuncion, Buenos Aires and Montevideo.

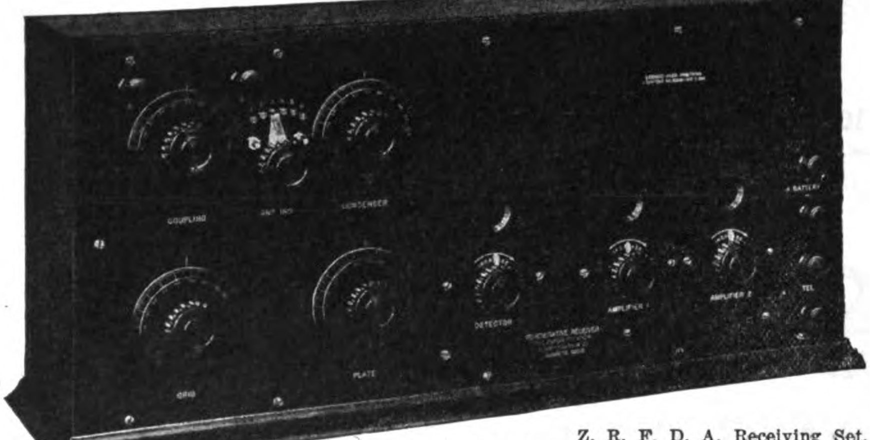
One single American concern offers wireless communication between the United States and France, England, Germany, Norway, Denmark, Sweden, Finland, Poland, Honolulu and Japan.

And these are only a few of the examples showing how Wireless expansion is spreading over the whole earth. It brings you amazing opportunities—and you can now easily grasp them.

Superlatives

No wonder you, Mr. Radio Man, are confused by the extraordinary descriptives such as best, most efficient and all the others you know so well. Do you ever stop to think that any one who can pay for an advertisement can make these claims? Fraternize with the old-time radio men and find out their opinion of Clapp-Eastham apparatus, of Clapp-Eastham service which goes with every sale and their reputation for fair dealing.

No one need experiment with unknown products unless he wants to. Your dealer will sell you our products if you insist but he is only human and is often tempted by a greater profit on an inferior product. Remember you pay this greater profit. Our apparatus will give you the greatest possible bargain, YOUR MONEY'S WORTH—you cannot hope for more. And with every purchase goes the guarantee of the oldest manufacturer of Radio Apparatus in the United States.



Z. R. F. D. A. Receiving Set.
Licensed under Armstrong U. S. Patents

Type Z. R. F. D. A. Regenerative receiving set is designed exclusively for those who require the very utmost in long distance short wave reception. It comprises two of our Z. R. V. Variometers, one Z. R. C. Variocoupler with switch, one of our famous balanced condensers and a detector and two stage amplifier.

All are mounted on a highly finished formica panel in heavy oak case with hinged cover.

Price complete except bulbs, batteries and telephones	$140.00
Same set without amplifiers, Type Z. R. F. D.	85.00
Same set without detector, amplifier, variable condenser or cabinet, Type Z. R. F.	36.00
Detector panel only, Type Z. R. D.	12.00
One stage amplifier panel, Z. R. A.	18.00
Variometer, Type Z. R. V. With dial and knob	6.50
Variocoupler Type Z. R. C., with dial and knob	7.50
Variocoupler, Type Z. R. C. with dial and knob switch and points	9.00
Balanced Variable Condenser, Type F800 with dial and knob	7.00
Two stage amplifier, Type O. Z. in cabinet	40.00

Amplifying coil, semi-mounted, Type Q. O.	$4.00
Unmounted Filament Rheostat, Type Z. R. R.	1.20
Knob and dial, 3 inch, heavy brass, black finish, composition knob	.75
Graphite Potentiometer, 5000 ohms	3.00

The Hytone Panel Transmitter

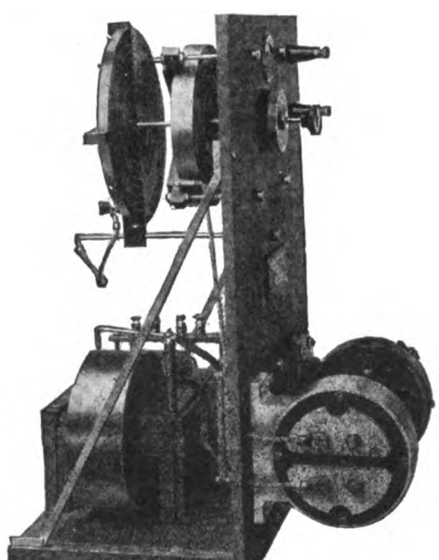
All the advantages of 500 cycle transmitters are combined in this set without the use of cumbersome and expensive motor generator sets as it operates directly on 60 cycle current. It produces a clear high pitched note which is variable at will. This set is highly efficient, with low decrement and gives sharp tuning and minimum of interference with maximum radius of communication. The set includes the following instruments all mounted on a formica panel ½ inch thick: Transformer, special low voltage type, Hytone rotary spark gap entirely enclosed in aluminum housing, Variable speed motor direct connected through flexible coupling, Mica condenser, Oscillation transformer, Thermo couple ammeter, main line switch and key.

Complete ½ K W Transmitting set as above	$250.00
Similar Transmitter 1 K W capacity	$500.00

These sets are also supplied in ratings of 2-3-5 and 10 K. W. Prices on application.

We also supply the following transmitting apparatus as shown in our complete catalogue:

Transformers, Type Z. R. L. 400 watts, especially for rotary spark gaps	$15.00
Transformers, Type L 500 watts, mounted $28.00, unmounted	22.00
Transformers, Type L 1000 watts, mounted $40.00, unmounted	34.00
Cambridge Rotary Spark Gap for use up to 1 K W including variable speed motor	50.00
Improved antenna switch	12.50
Boston Key on engraved Formica base, 10 amperes $7.50, 20 amperes	8.00
Oscillation Transformers, Type Z651	16.00



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If he won't supply our material your order will receive immediate factory attention.

CLAPP-EASTHAM COMPANY 161 MAIN STREET CAMBRIDGE, MASS.

HEADQUARTERS FOR RADIOTRON TUBES — All Types in Stock

Extending—

The Line of Westinghouse Radio Apparatus

WESTINGHOUSE ELECTRIC

Type EC Receiver, $125.00. Wave Length Range 180 to 700 Meters with Type CB Loading Coil 180 to 2500 Meters, $130.00.

Only a few months ago Westinghouse placed on the market its first radio apparatus, which met with instant favor from all. Every one looked forward to more apparatus of the same high standard of engineering design and workmanship.

The Westinghouse line is continually growing—each succeeding instrument creating more favor than the former.

If you want to keep abreast of radio, watch Westinghouse developments.

Type DA
Detector Amplifier
$65.00

Type RA Tuner
$65.00

Aeriola Junior
$25.00

Crystal Detector
$5.00

Inspect this apparatus at Booths 2 - 3 - 4 A. R. R. E. National Convention

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.
SALES OFFICES IN ALL PRINCIPAL AMERICAN CITIES

Westinghouse

Radio Apparatus

Distributors of Reliable Radio Apparatus to Schools, Colleges and Experimenters All Over the World!

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SERVICE FILLS ORDERS
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WHY NOT LET US SERVE YOU?

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WHY NOT LET IT REACH YOU?

AMPLIFYING TRANSFORMERS.

- No. UV-712 Radio Corporation, new type just out. (For radiotrons) .. $7.00
- No. 226-W Federal 7.50
- No. 231-A General Radio, new type . 5.00

MODULATION TRANSFORMERS.

- No. A-2 Acme, unmounted 4.50
- No. A-2 " semi-mounted 5.00
- No. A-2 " fully mounted 7.00
- No. 231-M Gen. Radio new type, just out! (for radiotrons).......... 5.00

AUDION CONTROL PANELS.

- No. RORH Grebe, in cabinet with tickler connections 17.00
- No. 330 Remler, with "A" Battery potentiometer 8.00
- No. P-1 Paragon, moulded type, very small and compact 6.00

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- No. 7623 Standard, small 22.5 volts .. 1.50
- N. 7625 " large 22.5 volts .. 2.65
- No. 7650 " variable 22.5 volts 3.50
- No. 766 Eveready, large 22.5 volts .. 3.50
- No. 766-A Eveready, large, variable . 3.00
- No. 763 Eveready, small, 22.5 volts . 2.25
- No. P-1 "Sorsinc," new type, just out! 22.5 volts, extra long life. .. 4.00

AMPLIFIERS.

- No. RORK Grebe two-step with automatic filament control 55.00
- No. RORD Grebe Det. and two step with automatic filament control ..75.00
- No. P-1 Amrad Type A, two step ..39.50
- No. DA Westinghouse, det. and two step, just out! 65.00

CONDENSERS. (Fixed mica type)

- No. ROCC Grebe .0002 Mf. 1.00
- No. ROCD " .0005 Mf. 1.20
- No. ROCE " .001 Mf. 1.60
- No. ROCF " .005 Mf. 3.80
- No. ROCA " .0002 Mf. and .5 meg. leak 1.20
- No. ROCB " .0002 Mf. and 3 meg. leak 1.20

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- No. MW-1 Radio corporation, .5, 1, 1.5, 2, 3 and 5 megohms complete.. 1.25
- Grid leaks only .... .75
- Bases only .... .50
- No. 21 Chelsea, variable .5 to 5 megohms 3.00

MAGNAVOXES.

- Type R-3 Magnavox loud speaker, latest model, just out! 45.00
- Magnavox Radiophone hand transmitter 25.50
- Magnavox Radiophone transmitter tone-arm 37.50

REGENERATIVE RECEIVERS.

- No. CR-2 Grebe 175-680 meters 51.00
- No. CR-3 Grebe 175-680 "Relay-special"; splendid set 65.00
- No. CR-3A Grebe 175-375 meters, with tube control, complete set 45.50
- No. CR-5 Grebe 175-3000 meters, "Super-special" with tube control, complete set. Ideal for jewelers....80.00
- No. CR-6 Grebe 175-680 meters, receiver, det. and two step amplifier self contained, complete set 200.00
- No. CR-7 Grebe 500-20000 meters "Long-wave special" with tube control, complete set. Ideal for arcs 210.00
- No. RA Westinghouse, 180-700 meters, new type, just out! 65.00

PLUGS.

- No. 50 Pacent universal type 2.00
- No. 1428-W Federal, brass 2.00
- No. 1428-W " silver-plated .. 2.50

JACKS.

- No. 1421-W Federal open circuit.... .70
- No. 1422-W " closed circuit .. .85
- No. 1423-W " two circuit 1.00
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- No. 1438-W Federal Auto. filament type 1.50

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- No. 260-W Federal hand type 7.00
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- No. 214 General Radio 2.5 Ampere type just right for one UV-202 5-watt radiotron tube 2.50
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SOCKETS.

- No. MW-1 Radio Corporation type .. 1.50
- No. 156 Gen. Radio 1.75
- No. 550 Murdock 1.00
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- No. S-3 Radio Service triple 3.50
- No. UV-203-A Radio Corporation type for the UV-203 50-watt tube 5.00

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- No. P-1 DeForest rectifying tubes for radio-phone work 7.00
- No. FF France battery booster, 6 amps. 15.00
- No. P-1 Tungar 2 amp. size complete 18.00
- No. P-2 " 5 " " " 28.00
- No. UV-216 Radio Corp."Kenotron" 7.50

TELEPHONES.

- Type C Baldwins, Navy type 16.50
- Type E Baldwins, ultra-sensitive ...20.00
- Type F Baldwins small, super-sensitive 21.00
- Brandes "Superiors" 8.00
- " "Trans-atlantics" 12.00
- " "Navy-type" 14.00
- " New headband only 1.50
- " New double cord .... .75
- Browns 4000 ohms English type.....20.00
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VACUUM TUBES (Radiotrons)

- No. UV-200 Radiotron detector 5.00
- No. UV-201 " amplifier 6.50
- No. UV-202 " 5 Watt transmitter 8.00
- No. UV-203 Radiotron 50 Watt transmitter 30.00
- No. UV-204 Radiotron 250 Watt transmitter 116.00

Note: All radiotrons sent postage and insurance prepaid to any part of U. S. A. Radiotrons always in stock.

STORAGE BATTERIES.

- No. BX-3 Harvard 6 volts 40 ampere-hours, complete 16.50
- No. BX-5 Harvard 6 volts 60 Amp-hours 18.50
- No. BX-7 Harvard 6 volts 80 Amp-hours 24.50

VARIOMETERS.

- No. 200 Tuska, moulded type 6.25
- No. 200-A Tuska, moulded type with dial 7.25
- No. 345-G Murdock grid type 7.50
- No. 345-P Murdock plate type 7.50
- No. 346 Murdock Vario-coupler 8.50
- No. ZRV Clapp-Eastham Variometer with dial 6.50
- No. ZRV-A Clapp-Eastham Variometer only 5.75
- No. P-1 Turney's spider web inductance; ideal on radio-phones 8.00

POTENTIOMETERS.

- No. 214-C General Radio "A" Battery type, 400 ohms, ideal with radiotrons 4.00
- No. 93 Remler "A" Battery type .. .75
- No. F-743 Clapp-Eastham "B" Battery type, 5000 ohms, fully mounted 3.00
- For panel mounting 2.50

RESISTANCES. (Phone work)

- No. 1 Ward Leonard 5000 ohms ... 2.25
- No. 2 " " 10000 ohms .. 3.50

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1st. Certificate of Membership.
The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President.

2nd. Aerial Pennant.
The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial masthead. Every member will be proud of the National Insignia flying from his aerial.

3rd. Membership Pin.
The National Amateur Wireless Association Pin in gold and enamel is the national emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

4th. How to Conduct a Radio Club.
This splendid book was re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 75c.

5th. How to Pass U. S. Government Wireless License Examinations.
Revised 75c edition of this popular book which should be in every Amateur's Library.

ANNUAL DUES

The annual dues of $2.50 cover your membership and entitle you to a yearly subscription to THE WIRELESS AGE, the official organ of this Association. If you are already a subscriber your term will be extended one year. Any supplements or bulletins published will also be sent you free of charge.

National Amateur Wireless Association

326 BROADWAY - - - - - - NEW YORK

It was some event

on July 2nd, when thousands of amateurs listened in on our radiophone description from the ringside of the

Dempsey-Carpentier Contest

Amateur Radio History was made that day which was the first of many N.A.W.A. days planned for the amateurs.

More events are coming

A great program is under way

Do you want to participate?

Our membership books are open to all real "doers." No "*Let George Do It*" stuff goes.

IF YOU want to get into the Amateur Organization that does something real—Now is the time.

APPLICATION FOR MEMBERSHIP

Harry L. Welker, Secy.,
Nat'l Amateur Wireless Assn.,
326 Broadway, New York.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Member in the National Amateur Wireless Association and request that you send me the complete Member's Equipment, for which I enclose herewith remittance of $1.50 Initiation Fee, covering Initial Equipment, and $2.50 for First Annual Dues, or $4.00 in all.

Name .... Age....
Street .... Call Letter & No.......
City .... State ....

PLEASE ANSWER ALL QUESTIONS

1. No. of Gov't. License .... 2. If you have none do you intend to apply for one ....
3. Name and address of Radio Clubs and their Secretaries to which you belong. ....
....
....
4. Are you now a subscriber to THE WIRELESS AGE? .....
5. Describe briefly your equipment. ....
....
....

VOL. 8. NO. 12 SEPTEMBER, 1921

THE WIRELESS AGE

WORLD WIDE WIRELESS

Progress of International Radio

E. J. NALLY, president of the Radio Corporation of America has returned from a trip through France, England and Germany. Mr. Nally reported great progress in the building of radio equipment in Europe and said that by October both France and England would have plants large enough to reach the Long Island plant of the Radio Corporation and that constant communication could be maintained.

The French plant is being constructed at St. Assise, and will be finished by October. Equipment in all the foreign stations, Mr. Nally said, is of the best, and communication from the United States to any part of Europe will be rendered very easy.

The world's largest and most powerful radio plant, the new central station of the Radio Corporation of America at Rocky Point, L. I., will be formally opened for service the latter part of August or early in September.

Two of the mammoth wings or spokes of the wheel-like arrangement of the lofty antenna towers, are complete. Twelve steel towers, each 400 feet high, compose the two wings or one operating unit. When the entire station is complete there will be twelve of these wings.

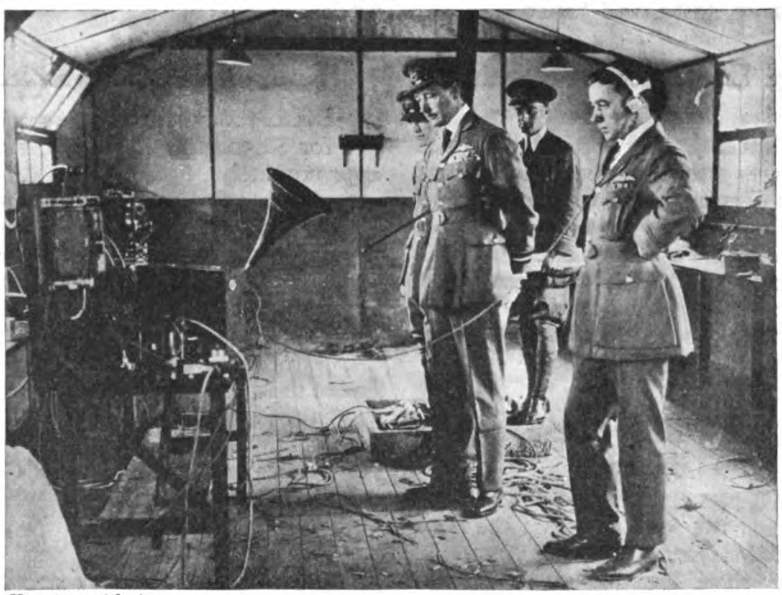
The total distance between the first and twelfth towers of the completed unit is approximately three miles. In the centre of these twelve towers stands the central power house, which is now fully completed so that in reality it will be the focus or hub of the entire system when future wings are added. Two of the 200 kilowatt Alexanderson high frequency alternators have been installed ready for operation.

The present unit is designed to communicate with Europe and will considerably aid the present high power radio stations at Marion, Mass., and New Brunswick, N. J. Later on communication will be established with South America. It is for this reason that Radio Central is often referred to as the future hub of international radio communication.

The receiving station designed to operate in connection with Radio Central is located at Riverhead, L. I., which is about seventeen miles from the big plant. This receiving centre is capable of intercepting six different messages simultaneously. The control system in use there is unique in that there are no actual receiving operators present. The aerials pick up the signals, special aplar land wire, and finally the messages are received at 64 Broad street, New York. This system thus offers extreme flexibility of operation and permits of speedy and accurate communication with Europe.

the radio lines have the advantage of direct communication. Germany is reached by the great center at Nauen, one of the largest in the world.

Most of the European business messages have been going to London or other British cable stations, where they are read and relayed by British operators. The radio company avoids this procedure by transmission from high-powered stations in direct communication with others on the Continent. That is a very desirable achievement for the protection of American business, aside from its



Keystone Photo

The inside of the radio room at the Northolt Airdrome, England, where radio communication was established with airplanes during the air pageant

Radio Service to Foreign Lands

CHEAPER communication with foreign lands has been offered by the Radio Corporation of America in offering to convey messages to Europe at 5 to 12 cents a word less than the cable charges. Beginning August 1, its regular radiogram service rate to Germany will be reduced from 36 cents to 25 cents per word. The deferred service, formerly 18 cents per word, has been reduced to 12½ cents.

The greater reduction is made for transmission to the Scandinavian countries and to Germany. With these offer of lower rates. Americans have consequently entered a new period both in wireless and cable development. President Harding urged active government encouragement to American radio and cable lines in his last message to Congress in these words:

"Between the United States and other countries not only should there be adequate facilities, but there should be, so far as practicable direct and free from foreign intermediaries. Friendly co-operation should be extended to international efforts aimed at encouragement of international communication facilities and designed to further the exchange of messages."

German Radio Firm Raises Capital

THE overseas wireless company, Drahtloser Ueberseeverkehr A-G., which was founded jointly by the two great electro-technical groups in Germany in common with the Telefunken Co., has just decided to raise its capital from 15,000,000 marks to 25,000,000 marks.

The object of the increase is to meet its bank debts.

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New International Radio Rules

THE Technical Radio Telegraphic Committee, sitting at Paris, under the chairmanship of Gen. Barrie, has adopted new international rules which will make the transmission of long distance messages much speedier. Small stations doing every day short distance transmission will be prevented in the future from "jamming" ether waves, and thus hampering important messages sent from great stations like Eiffel Tower, Nauen, Bordeaux, and Arlington.

Nations represented on the committee are the United States, Great Britain, France, Italy, and Japan.

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Urge Expansion of Spanish Radio

MADRID, July 30.—La Epoca urges the expansion of Spanish wireless services to South America by way of Teneriffe and Pernambuco. The newspaper asserts the English and American-owned cables between Spain and South America hinder Spanish commerce between Spain and the Latin-American countries.

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The Dumb May Speak to the Blind

DUMB men lecturing to the blind is one of the possibilities of the near future. Marconi representatives in England have brought about an important development in the optophone, the instrument invented by Dr. Fournier d'Albe, which enables the blind to read by sound.

Hitherto the optophone has only been able to give the benefit of its "light sounds" to one blind person at a time, but now, by means of amplifiers, experiments show that one instrument can read out loud to a class of blind persons for instructional purposes. The matter has only to proceed another stage in the improvement of the radio amplifiers, when, with an automatic tape machine, a dumb man could deliver an address to a blind audience. As he tapped out his words they would pass through the optophone and his message would be translated into sounds loud enough to reach his blind audience.

Operation Aboard Ship by Radio

AN operation directed by wireless is the novel experience of Dr. Raymond Barrett of the Brooklyn Hospital. A plea for medical advice to handle a case of infection sent out by the captain of the Vesta, a Standard Oil tanker bound for Riverside, R. I., and unable to make port because of a heavy storm, was picked up by Arthur R. Haydon, night radio operator at the Bush Terminal, South Brooklyn.

"From the description of the infected finger given to me," Dr. Barrett said later, "I judged there was danger of the entire hand and arm becoming infected. I told the captain to take an ordinary paring knife and after proper sterilization make an incision straight through the meat of the finger and put in a drain. I told him to free the muscles from the bone and raise them."

A message of thanks was received back from the captain and word that he had performed the operation according to instructions. It is assumed that the operation was successful, as no other reports of the case have been made.

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Radio Claim Bill Killed

A BILL providing for the settlement for $2,500,000 of claims, totalling approximately $30,000,000, growing out of the government's infringement of radio patents during the war, has been killed in the House of Representatives. A motion to strike out the enacting clause prevailed by a wide majority.

Opponents of the measure contended the claims should be adjudicated in the courts. The bill would have authorized the Secretaries of War and the Navy and the Attorney General jointly to make settlement.

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Radio Company Injunction Sought

ACCORDING to the San Francisco Call charges that the National Radio Company had been operating without obtaining a permit from the Arizona Corporation Commission and that it had assessed stockholders more than $180,000 illegally are pending before the United States district court at San Francisco, Cal.

Herman C. Eggers, A. G. O'Brien, Henry Eisenberg, Milton Auerbach, A. P. Pallen, Caroline W. Liebscher and Mary Martin, stating that they represent 500 other stockholders, have filed a petition for a permanent injunction against the company restraining it from doing business until the permit is secured and from collecting any more assessments.

Dr. J. A. Fleming Awarded the Albert Medal

DR. JOHN AMBROSE FLEMING, F.R.S., to whom the Albert Medal of the Royal Society of Arts has been awarded this year has been closely associated for the last 42 years with the practical and scientific developments of Electricity in Great Britain. In addition to the Fellowship of the Royal Society in 1892, his scientific work has been recognized by the award in 1910 of the Hughes Gold Medal by the Royal Society, by the Institution Premium (twice in 1903 and 1912) of the Institution of Electrical Engineers, by The Bernays Prize of the Society of Engineers and by a Silver Medal from the Royal Society of Arts.

He has always taken a great interest in popular education and as a Gilchrist lecturer for many years addressed large working class audiences in various parts of England as well as lectures on educational subjects at University College and elsewhere. He has recently completed a book entitled "Fifty Years of Electricity, the Memories of an Electrical Engineer" (to be published by The Wireless Press, Ltd.) in which he has described the chief notable achievements of electrotechnics in the last half century with many of which he has been intimately connected.

The Albert Medal was awarded to Thomas Edison in 1892 and to Dr. Alexander Graham Bell in 1902 for notable achievement in the electrical field.

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100-Watt Radiophone Works 450 Miles in Daylight

IT was recently reported that five telephone sets of the Navy type which utilize two 50-watt power tubes, (Radiotrons U.V. 203), loaned by the General Electric Company to the U. S. Forestry Service, at Missoula, Montana, for experimental work, have made it possible to maintain regular communication 205 miles overland by telephone and frequently conversation over air line distances of 450 miles. It is interesting to note that these ranges were obtained in daylight, as well as in the evening. Communication has been carried on directly between Elko, Nev., and Salt Lake City, Utah, and also between Reno, Nev., and Salt Lake City.

It might be mentioned that these portable telephone sets were not intended to provide transmission ranges over such distances and, in fact, were not expected to give reliable communication overland over distances exceeding thirty or forty miles.

Re-Birth of Radio in Germany

By CHARLES A. REBERGER

FOLLOWING the termination of hostile relations with the allied powers Germany immediately turned her attention toward the continuation of her pre-war radio developments. Coast stations prepared to receive traffic and radio compass stations arranged to give bearings. They broadcast prevailing weather conditions together with the latest marine obstruction information. The high power stations supply news so that those navigating the waters surrounding Germany may keep informed on the vital questions of the day.

Foreign vessels are given the latest data available regarding mine fields by radio broadcast and the geographical location of any drifting mines which may have been reported is made known. This information aids in guarding the safety of vessels sailing into the German seaports.

Radio equipment is being used successfully on board a number of the North Sea pilot boats. The antique method of securing the services of a reliable pilot by the aid of international flag signals is obsolete. These small craft cruise around in a certain radius, communicating with vessels bound for German ports giving and getting all information pertaining to pilots. On a recent voyage "The City of Hamburg," during a hard blow off the mouth of the Elbe river found no pilot boat in the vicinity, but radio communication soon brought the pilot boat with the pilot that had been previously engaged. Due to the heavy sea running it was impossible to come alongside to transfer the pilot so "The City of Hamburg" was ordered to proceed up the Elbe river a distance where they could put him aboard. Had there been no radio installation aboard on this occasion the ship would have been forced to lay at anchor outside until the weather abated.

Every four hours the station at Borkum Reef, broadcasts (on 800 meters) obstruction reports and the latest mine field developments. Very recently a message was transmitted to the station at Nauen (POZ) from one of the American high power stations located within a short distance of New York City. A reply was received at the American station six minutes later.

It is expected that within a short time, a large number of freight and passenger vessels will be entering the principal German seaports and the government is making preparations at the various coast stations for the handling of the traffic which is expected. Owing to the low rate of exchange at the present date, both the coast station and landline charges are small.

American Rotarians Visit London Marconi House

AMERICAN delegates to the International Rotary Convention held in London paid a visit to Marconi House, Strand, to listen to a special program of wireless telephony which was transmitted with a low power set from Chelmsford.

An exhibition of films showing some of the activities of the Marconi Company was also given to the visitors in the Company's private cinema.

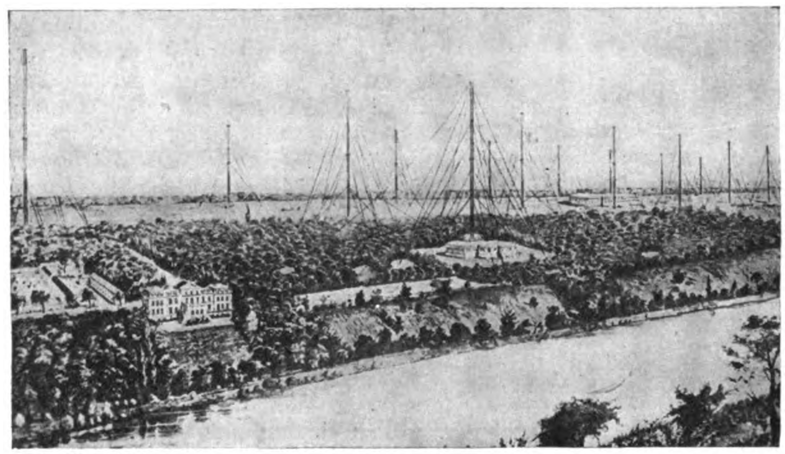
Boat-Race News by Radiophone

THE radiophone was used extensively in reporting the results of the speed boat races at the Pageant of Progress, held on Lake Michigan at Chicago, Ill., on August 4-7.

Arrangements to test the wireless telephone as an adjunct to newspapers were made by the Naval Reserve force in conjunction with the Great Lakes Naval Training Station and The Associated Press.

The subchaser 419 was sent out from the Great Lakes Station and Lieutenant Allan C. Forbes of the Naval Reserve immediately installed a wireless telephone set aboard.

The 419 cruised about the race-course, the reports being telephoned direct to The Associated Press office and thence relayed throughout the country.



Keystone Photo

View of the new French high power radio station to be erected at Saint Assise. This station will be one of the most powerful in the world

No More Isolated Canadian Settlers

SPEAKING on radio telegraphy before the Montreal Branch of the Engineering Institute of Canada, A. H. Morse, of the Canadian Marconi Company, said wireless was essential not only for the development of Canada's great unsettled territories, but for linking up important commercial centers separated by long tracts of thinly settled country, across which ordinary line telegraphic communication was subject to frequent and sometimes prolonged interruptions, due to storms, etc. It was his opinion that the future of Canada was inseparably linked up with the wide application of wireless communication.

Perhaps one of the greatest dreads of town-bred prospective settlers in Canada was the isolation that was to be anticipated. This isolation Mr. Morse held to be no longer necessary, as every farmer could be supplied with a nightly bulletin of the world's news by wireless telegraphy or telephony, even though 500 miles from the nearest large town, and, at a comparatively small expense, every settlement throughout the great north-west could be put into telegraphic or telephonic communication with the outside world. He considered it impossible to exaggerate what radio meant to Canada.

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Finland Opens Two New Radio Stations

TWO new wireless stations have been established in Helsingfors, Finland, which will provide radio communication with all Central Europe. Heretofore Finland has had only one 3-kw wireless station, the range of which did not extend much beyond Copenhagen, Denmark.

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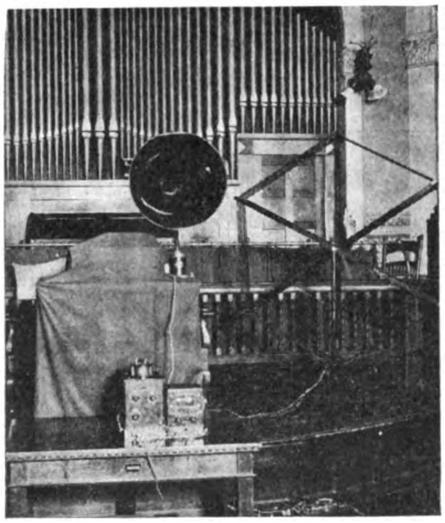
Plate Form of Antenna

IN the description of the new type of antenna in THE WIRELESS AGE of April, 1921, it was stated that Oliver Lodge used in 1897 an aerial consisting of a pair of metal plates elevated from the ground. There is no inference in that statement that Oliver Lodge originated the plate form of antenna, but nevertheless we are glad to publish the information that Marconi disclosed the idea at a still earlier date. It has now been pointed out to us that Marconi disclosed the use of aerial plates in his English patent 12,034, filed January 2, 1896.

Radiophone Fills Vacant Pulpit

THE "choir invisible" has been translated into the "minister unseen" through the cumulative wonders of radio communication. The vacant pulpit of the Herron Avenue Presbyterian Church, Pittsburgh, Pa., was supplied with an invisible pastor



The receiving set with amplifier and loop antenna installed in the pulpit

recently when the sermon being delivered at Calvary Episcopal Church, ten miles distant, was transmitted by wireless telephony to the congregation deprived of its regular spiritual advisor. The Sunday evening religious services of one house of worship was the replica of another and creeds were temporarily subservient to a common end.

The absence of the regular pastor at the Herron Avenue Presbyterian Church prompted members of the flock, who were acquainted with the reliability of radio communication, to consult the Westinghouse Electric and Manufacturing Company of East Pittsburgh, as to the practicability of having a sermon transmitted by radio. The suggestion of transmitting the sermon delivered at the Calvary Episcopal Church to the pastorless congregation in the same city was taken kindly and the execution of plans proceeded without undue formality.

A compact receiving set, consisting of a loop antenna, amplifier, and condenser, was given a commanding position on the rostrum immediately in front of the pulpit. The loud-speaking horn expounded the Scriptures.

An expectant congregation crowded into the house of worship, eager to follow the fortunes of the experiment and innovation. The voices and music of the Calvary Episcopal Church choir, rector and organ, were received with unmistakable distinctness. The disparity in Episcopal and Presbyterian forms of worship was no deterrent in following the pastor throughout the sermon. Interest was so well sustained throughout the religious services, that the proverbial sleeping brother in the amen corner was conspicuously absent.

The entire religious services of the Calvary Episcopal Church now are transmitted from KDKH on Sunday evenings. The distribution of these church services to amateur radio stations has been a weekly occurrence of many months while wireless telephony, in functioning as the "invisible pastor and choir," is of recent moment. For country-wide distribution a direct telephonic connection has been made with the house of worship. A radio operator is permitted to occupy a seat in the choir from which position he can regulate transmission.

Speculation is opportune as to the development of the innovation which employs radio as an agency in utilizing the office of one pastor to supply

The bulletin board with the announcement "Services by Wireless Telephone"

services to two congregations, although the houses of worship are ten miles apart and the flocks are of a different faith. Would it be too visionary to prophesy a centralization of the scriptural lessons whereby a centrally located pastor would exhort to a varied and remote congregation — even to the uttermost ends of the earth. Interesting speculation, to be sure! Certainly, radio in its latest adaptation has demonstrated its unbounded flexibility.

An Automatic Signal Recorder

By S. R. Winters

APPARATUS designed by Dr. E. A. Eckhardt and Dr. J. C. Karcher of the Bureau of Standards, records radio messages automatically, signals having been faithfully copied from Lyons, France, a distance of approximately 3,865 miles. While other automatic-recording devices for displacing the human ear in reception of radio signals have claims to priority of discovery, the circuit and manner of arrangement of the newest one has claim to novelty.

The recorder illustrated was designed for a specific purpose, namely, field service by the Coast and Geodetic Survey of the United States Department of Commerce. Thus, in its original adaptation, emphasis is lent to its possibilities for service to the surveyor, astronomer, and geographer. Its compactness lends itself to ready use in surveying, and the longitude of any point on the earth's surface, however, far removed from cables and wires, may be determined within two-hundredths second of time or 33 feet.

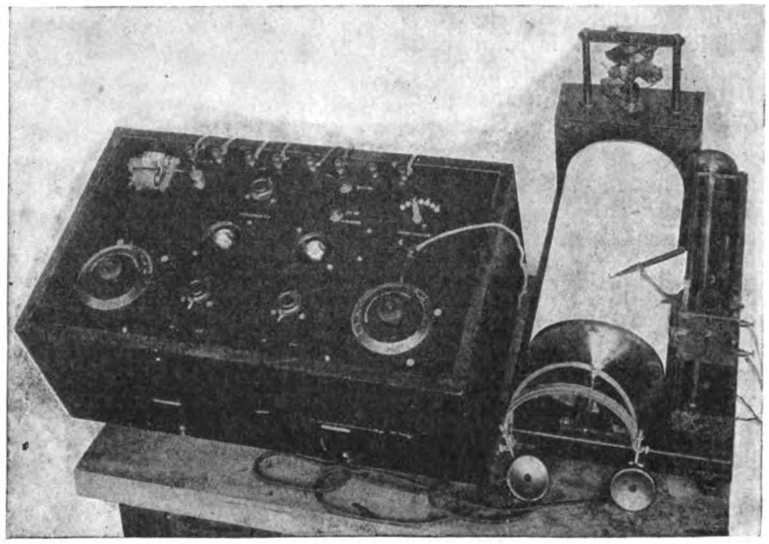
The circuit is comprised of a standard electron-tube arm, tuned in the grid circuit, as is customary practice in ordinary receiving equipment. Introduction of radio signals into the grid circuit is accomplished by use of a coil or other coupling arrangement. A potentiometer, introduced into the grid circuit, renders possible adjustment of the grid potential for retaining the regenerative circuit in a quiet or non-oscillatory state, once it is placed in this condition by other methods. If the circuit is slightly molested by incoming signals or other electrical disturbances oscillation will be given impetus and the circuit will continue in a violent oscillatory state. Restoration to a condition of quiet, once oscillation has gained headway, is feasible by placing the so-called choke coil in the intervening field of the plate and grid coupling coils.

Normally the choke coil circuit is open and will be short circuited by action of a relay. This particular relay, however, is actuated by the plate current of the oscillatory tube. Due to the negative grid potential, when the circuit is in a quiescent condition, the plate current will be necessarily small. As soon, however, as oscillation begins the mean plate current will rise sufficiently to actuate this relay; consequently, short circuiting the choking coil. The latter being of a few turns, and low in resistance, oscillation is effaced, and thereby the circuit is restored to its initial quiescent state. The relay is released and the circuit is receptive to another signal.

Releasing of the relay closes the second contact which likewise closes the circuit on an electromagnetic writing stylus. By way of illustrating the method of recording the dots and dashes, assume that a signal starts to come in, continuous oscillations are set up in the regenerative circuit, the relay being actuated opens the recording circuit and closes the short circuit on the choking coil, thus destroying the oscillations. The relay armature then opens the short circuiting contact when the choking coil starts on an excursion to close the recording circuit, but owing to the fact that the signal is still coming in, the oscillations will begin immediately upon opening of the choking circuit. The relay armature will be pulled back to again close the choking coil circuit without closing the recording circuit. Thus it is seen that the recording circuit is held open while the signal is coming in and is closed between signals. The length of time which the circuit remains open corresponds to the length of the signal. The dots and dashes are, therefore, readily recorded.

Other experimental methods designed to annihilate oscillations did not prove so successful as the one described. Mention may be made of two other ways given trial, namely, causing the relay to open the plate circuit or that of throwing a choking condenser across the plate coil. These proved particularly ineffectual for receiving weak signals from a long distance. The apparatus, as employed for receiving long wavelengths, rendered it possible when attaching an antenna directly to the grid coil of the oscillating tube, to receive and record signals in the laboratory of the Bureau of Standards, Washington, D. C., from Lyons, France. One receiving tube only is used and it is of standard design. The antenna consisted of six wires, each about 50 feet long, and placed 60 feet from the ground. The apparatus as described, supplemented with a single stage of amplification, is being supplied the Coast and Geodetic Survey for field service in making accurate longitudinal determinations.

The outfit can withstand the hardships incident to service afield, and a 50-foot 6-wire flat-top antenna 40 feet above the ground is adequate for ordinary conditions. It is contemplated that the sensitivity of the equipment is such as to record Annapolis time signals at any field station of the Coast and Geodetic Survey in the United States. The wireless recorder will be used in conjunction with a portable field antenna for receiving and recording on a chronograph drum time signals sent out from Annapolis. The local time of the place at which the observations are being made will be recorded simultaneously on the chronograph drum by means of a differentially-wound electro-magnetic-operated writing stylus. Thus a difference in the local time and 75° meridian can be read directly from the chronograph record. The radio apparatus proper may be used with any kind of chronograph drum or tape recorder. Dot and dash signals are indicated by short and long excursions of the recording pen from the datum line. In an Annapolis time signal these excursions are one-third of a second long, while the pen traces the datum line during every two-thirds of a second. The receiving equipment includes a regenerative electron tube circuit in the plate circuit of which there is a telegraph relay.



The automatic radio signal recorder

Radio Station 9YD of Nebraska Wesleyan University

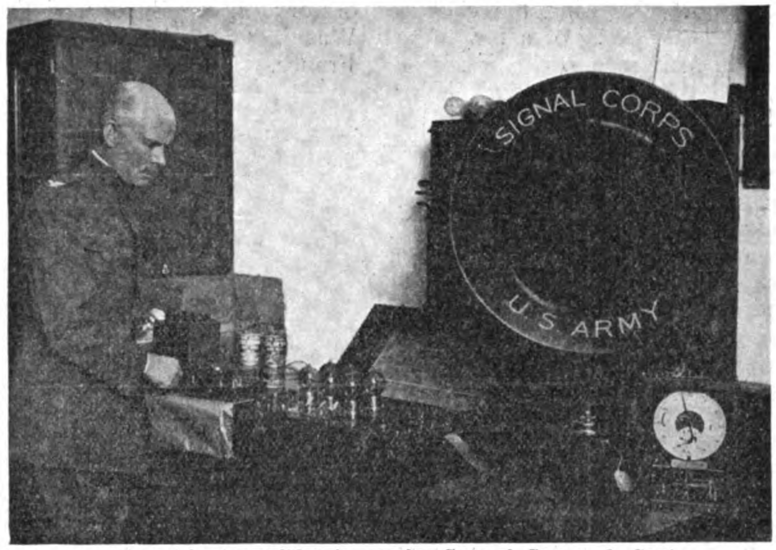
THE radio station at Nebraska Wesleyan University (9YD) is a good illustration of the amount of public service which can be rendered the general public by a central station which is always ready to disseminate the news. Except as interrupted by the World War, 9YD has gotten out a daily weather forecast at 8:50 A. M. for more than six years. An abbreviated code is used as follows: P=barometric pressure in millimeters: T=temperature in degrees Fahrenheit; F=fair; R=rain; S=snow; Z=thunderstoms; U=unsettled; C=cloudy; Q=change; X=warmer; Y=colder; M = yesterday; N = today, O=tomorrow; 1=north; 2=east; 3=south; 4=west; W=wind. Thus the forecast, P723T70W32.FXM.FNQC.UO would be transcribed: Pressure 723mm.; temperature 70°F.; wind southeast. Fair and warmer yesterday; fair today changing to cloudy; probably unsettled tomorrow. The forecast is followed by a synopsis of the day's news, both being largely copied over the State by radio enthusiasts generally as well as by school and college stations.

The present equipment, as shown in the cover illustration of this issue, consists of a 1 kw. transformer with rotary and quenched spark gap, a radiophone using 8 transmitting tubes, and a receiver with both honey-comb coils and loose-couplers and a detector and two-stage amplifier. The spark set has been heard on the Pacific Coast and on the Gulf and the C.W. from the phone has been read for more than 500 miles on 30 watts. The phone is used to supplement the spark set and also for giving evening concerts. The station is in charge of Professor J. C. Jensen of the Department of Physics, who has for a number of years offered college courses in radio theory. Just now, in conjunction with a graduate student, Mr. M. P. Brunig, he is working out the details of a system of long-distance audibility measurements with special reference to weather conditions in the intervening territory.

Amplifying Heart Beats

PALPITATION and other troubles of the heart may be diagnosed even though the patient be far removed from medical facilities—say, in the middle of the Atlantic Ocean—by application of "wired wireless," the discoverey of Major General George O. Squier, Chief Signal Officer of the United States Army. The principle involved is similar to that which made possible the multiplication of the volume of the inaugural address of President Warren G. Harding on March 4.

A demonstration recently to a group of physicians of the United States Army at the Signal Corps Laboratory, Washington, D. C., for the first time revealed working plans of the remarkable innovation. A heart transmitter designed for the specific purpose, resting by its own weight over the heart of the subject under examination, was placed in position. Passage of the blood through the various valves of the heart is responsible for vibrations in an air chamber which faithfully reproduces the manifold actions of the blood when coursing through the valves of the heart. These, in turn, are conveyed over a wire—practical application of "wired wireless"—to an amplifying equipment, consisting of a group of standard vacuum tubes. The tubes are not dissimilar to ones employed in wireless telephony and telegraphy reception. The vacuum tubes when amplified actuated a special receiver attached to a large horn, which distributed sound reflected by heart beats throughout the building. Doctors, attending the novel performance, discussed among themselves the peculiarities of the hearts of different subjects as the actions were magnified. Distance is an irrelevant factor when heart beats are to be studied by the vacuum tube amplifier.

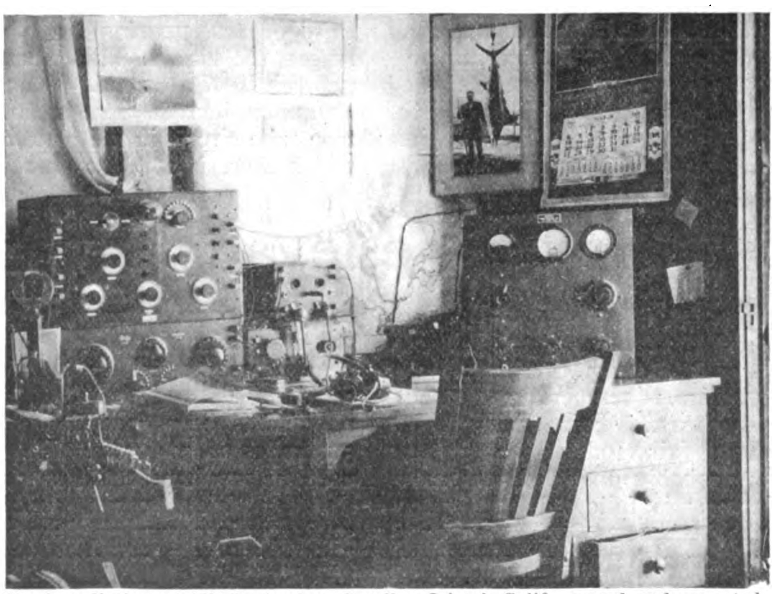


Heart-beat amplifier in use by General George O. Squier

6XAD, Catalina Island, Calif.

THE station of Lawrence Mott, 6XAD, on Catalina Island, off the coast of Southern California, is one which as Mr. Mott says has done "great execution" in radio work.

The equipment of the station consists of a Kennedy longwave, and a Grebe, type CR-3, shortwave receiver, with a Grebe 2-step amplifier that is used with both. A separate detector is used with the Grebe. That of the Kennedy is self-contained.



The installation of 6XAD, Avalon, Catalina Island, Calif., owned and operated by Lawrence Mott

The transmitter is an especially designed and built-to-order apparatus for C.W. work, using from 3 to 5 tubes. Both the VT-2's and the new Radio Corporation of America's U.V. 202 and 203 are used. The latter have proved to be most efficient and satisfactory in every way. Signals from the station have been reported QSA in Chicago, and practically from all of the Western States and also in Vancouver. The transmitter is operated on A. C., by means of a specially designed transformer. The antenna of the station is the regulation size for amateurs, ground consisting in water pipe system, and a 7 ft. by 12 ft. piece of ¼-in. copper sheet buried 8 ft. directly beneath the antenna, and midway between the masts, the highest of which is 70 feet.

Catalina Island is peculiarly well adapted for radio work, as there is practically no induction of any kind.

With the Kennedy extraordinary receiving has been done. The larger power stations of the world having been heard with one-step of amplification. Another transmitter is being built to use four of the new, and huge "iron tubes" that the Radio Corporation of America is soon to put on the market. With them it is expected to work Honolulu to the westward and New York the other way. Mr. Mott is also installing a specially designed radiophone on his yacht, which is expected to be good for 100 miles or more.

101st Signal Battalion, N.Y.N.G.

By Grant Layng, Master Sergeant

IN line with the reorganization and development of the National Guard, Company A, of the 101st Signal Battalion, N.Y.N.G. (formerly the First Signal Battalion), has devoted considerable attention during the past season to the development of its radio organization and to the training of the radio personnel.

To carry out the work, Company A, has established at the 71st Regiment Armory, 34th Street and Park Avenue, a radio station complete in every detail. Radio apparatus and equipment has been received from the Signal Corps, and in addition considerable special equipment has been furnished by the organization, or built by its members.

The transmitting aerial is a flat top one, having 5-7 S.P.B. wires, 1½ feet apart. It is 60 feet long, and L type with a 100 feet lead-in from the high end. The counterpoise consists of six wires 75 feet long, spread out in the shape of a fan, 90 feet beneath the flat top. The receiving is done on a single wire about 200 feet long extending diagonally down from the top of the tower and at an angle of 30 degrees from the transmitting aerial.

The short-wave regenerative set at the left of figure 1 consists of a variable condenser with a three-way switch in the primary circuit, a vario-coupler, two variometers, a detector and a two-stage amplifier.

The long-wave honey-comb set was designed with a view to the greatest flexibility. The set is divided into three panels with individual boxes. The first consists of the honey-comb mounting and primary condenser with a three-way switch. The second panel is the secondary circuit complete with three variable condensers and the detector. The last consists of a two-stage amplifier. All condensers are De Forest and the primary and secondary condensers have a vernier plate. V.T.-1 tubes and Baldwin phones are used.

Figure 4—Field station at Peekskill, N. Y.

Special attention is called to the distributing jack shown between the sets. This consists of two single-throw triple-pole anti-capacity switches with a common handle projecting through the top of the panel. This throws the antenna to either of the two sets and also lights the filament. Extra contacts are provided for a third set so that it is possible with a short throw to connect the antenna and a battery on any one of three sets. The phones are connected by means of a plug and cord which is inserted in the set being used. All jacks on the block are short circuiting and the upper jack also controls the six-volt battery on the loud speaker.

The spark transmitter is a ¼ kw. model 1915 Pack Set disassembled and installed in the rear of the panel. It consists of an open core transformer, Dubilier condenser, quenched spark gap and pancake oscillation transformer, radiating 3 amperes on 475 meters. The set as normally furnished used a hand generator turned by two cranks revolving at a speed of 50 R.P.M. Through suitable gearing this gives the generator a speed of 5000 R.P.M. In order to use this equipment as issued the gear was disconnected from the generator. As the unit has an exciter mounted on the generator shaft the connections were changed so that the exciter operated as a D.C. motor and the fields of the alternator were excited direct from the D.C. supply mains. Although the generator would now run up to no load speed the flywheel was not sufficiently large to carry full load when the key was pressed. It was then necessary to obtain a 1-6 H.P. 5000 R.P.M. motor and with this connected to generator shaft the unit delivered full capacity. Both the exciter motor and the external motor are connected in parallel and start through the control resistance seen on the lower part of the panel.

The telephone set also shown in figure 1 uses four V.T.-2 tubes with a plate voltage of 350 volts obtained from a 110/350 volt dynamotor. Simplicity is the keynote of this set, which has no unnecessary controls on the face of the panel. The unit was first tuned with a variable inductance and variable condensers. When the correct condenser capacity was found, fixed condensers were substituted of

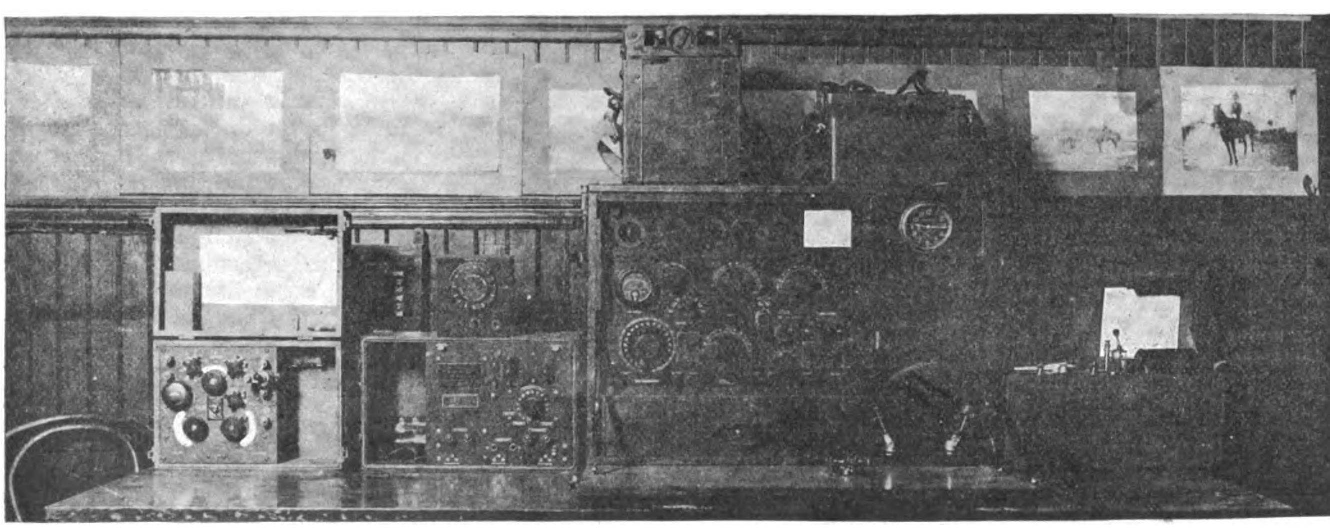


Figure 3—Experimental apparatus

the same capacity, making a set practically impossible to get out of adjustment.

A radiation of .7 ampere is obtained using two tubes as oscillators and two as modulators. It has been reported QSA on phone as far as Asbury Park.

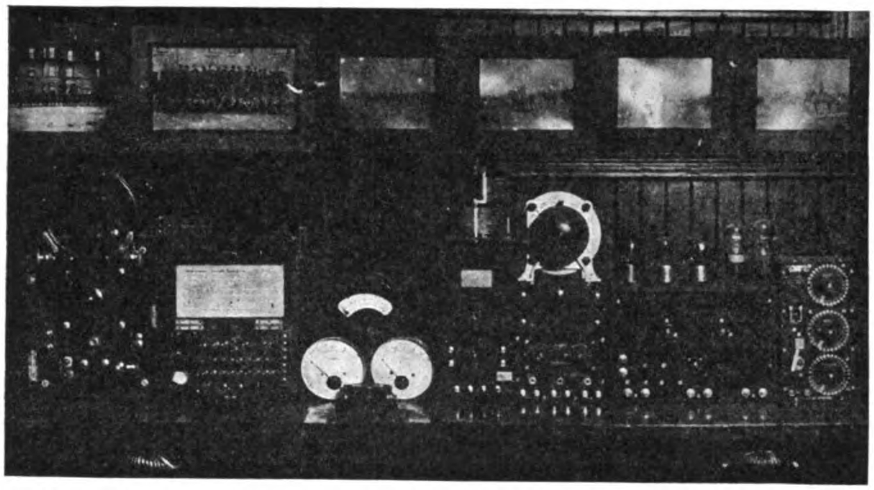


Figure 2—Standard army equipment

A recent drill was conducted by means of this phone set. The riding academy in which the mounted drills are held is about two miles from the armory and on this building a low portable antenna was erected—using the short-wave set shown and three steps of audio-amplification. Captain Gorman at the armory gave commands, which were successfully executed by the entire company on horseback.

The experimental equipment used by the members of the radio detail consists of a wavemeter, a Wheatstone bridge, a three-stage shielded audio-frequency amplifier, a two-stage amplifier, and a six-stage (four radio and two audio) amplifier, besides various types of tubes, high voltage D.C. meters and millimeters, as shown in figure 2.

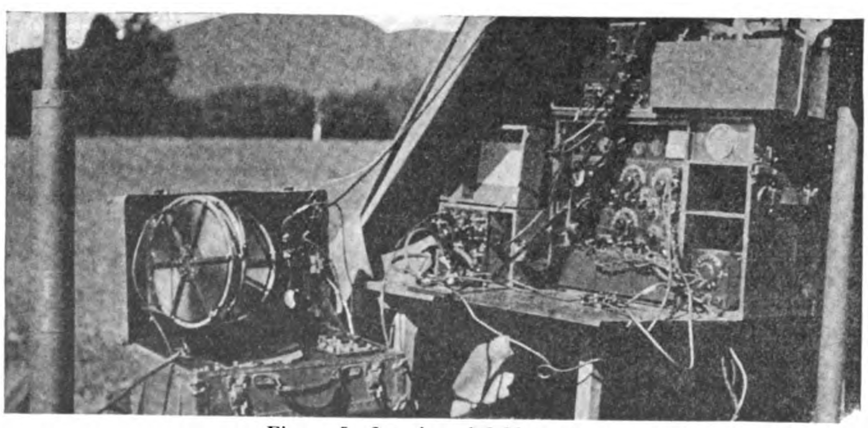


Figure 5—Interior of field station

The portable units shown in figure 3 are the newest army issue, and consist of an SCR-54A crystal set, SCR-121-A two-stage amplifier, an SCR-79A complete transmitting and receiving unit and a station wavemeter. This main set in the center of the table uses two WE-2 tubes for transmission and three V.T.-1 for reception. The power is obtained from storage batteries, one four-volt 90-ampere hour unit — shown on top of case. Three batteries are used, giving 12 volts, which light the tube filaments and runs the dynamotor shown over the clock. Normal radiation is about .8 ampere on straight CW, no method of interruption being provided. Besides this equipment shown there are four ¼ kw. mule pack sets with hand generators.

These portable units are used during the period of camp, and a typical installation erected at Peekskill, N. Y., is shown in figure 4.

With reference to operation the station is open every night between 8 and 10 o'clock, two operators being on duty. Traffic is handled with amateurs and call letters used are SC1. During the coming fall, a shorter aerial will be erected for two-hundred meter operation, at which time the call 2BGS will be used. Amateur traffic will be gladly accepted.

Radio stations are also established and are operated by members of the organization. 2BGT Radio Station number 1 is owned by Corp. Hunt, who is chief operator. There are two stations yet to be assigned as only members with the most modern equipment can be considered. The radio room is open to visitors every Monday and Thursday night, and all those interested are cordially invited to inspect the station.

In view of the present enlarging of the National Guard, there are a few openings for men interested in radio work. Instruction is given in both the mounted and dismounted drill, together with work in visual signaling and telegraph operating. All men receive Federal pay for the weekly drills and for two weeks of field service each summer. Courses are provided in radio operation, by progressive classes; that is, a man enlisting in the organization first enters the class in visual signaling and thoroughly learns the code. From this class graduates go to buzzer practice and, after attaining a speed of twenty words per minute, advance to radio instruction. Lectures on the basic principles of wireless are given during the first half of the instruction period, and actual operation, care and maintenance are taught during the second half. All men before being allowed to operate the station are required to obtain operators' licenses from the radio inspector's office, and the organization at present has 15 licensed operators.

The equipment of the organization includes horses, motorcycles and trucks, as mobile operation is an essential feature of Signal Corp maneuvers.

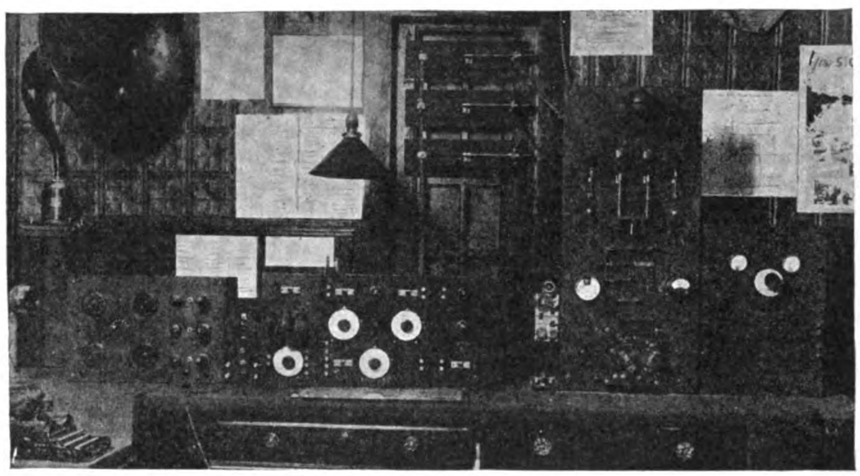


Figure 1—The main station

Poland's Transoceanic Wireless Station

A NEW radio plant will be located near Warsaw, Poland, and it is estimated that the complete project will cost about $3,000,000.

Representatives of the Radio Corporation of America and of the Polish Ministry of Posts and Telegraphs have signed a contract which will insure for Poland an international high power radio station. The contract was signed at the office of the Polish Legal Bureau, 42 Broadway, New York, and was attended by Prince Kazimier Lubomirski, Hipolit Gliwic, Edwin P. Shattuck, Stanislaw Arct, and Eugene Stallinger for Poland. E. J. Nally, President, and D. Sarnoff, General Manager, acted for the Radio Corporation of America.

Immediately after the signing of the contract, Mr. Nally and Mr. Sarnoff sent the following radiogram to the Ministry of Posts and Telegraphs at Warsaw, Poland:

> "On this memorable occasion of signing contract with your Government for erection of super power radio station in Poland for communication with United States please accept our sincerest congratulations and may we express the hope that the uniting of our countries by radio may still further strengthen and increase the friendship already existing between our people."

The radio system to be used is that which has been standardized for transoceanic communication. The station will be equipped with two 200-kilowatt Alexanderson high-frequency alternators built by the General Electric Company, and the transmitting aerial wires will be about two miles in length supported by ten towers each 400 feet in height.

The first shipment of radio apparatus will leave the United States in about six months and construction work will begin immediately thereafter. It will take approximately one year to complete the station, and it is expected that commercial radio communication between Poland and the United States will commence early in 1923.

Mr. E. J. Nally, who recently returned from Europe, where he investigated international radio communication facilities, states that although approximately ten per cent. of the Polish nationals are located in the United States—a greater percentage than any other foreign nation — Poland has never had adequate telegraph communication with North America. Heretofore, it has always been necessary to relay messages to and from America via other countries, which has subjected such communications to serious delay. However, with the opening up of the new radio station, Poland will have direct radio service with the United States of America without relay, and also with other countries within its range.

The new Polish station will have a normal transmitting radius of 4,000 miles and the Radio Corporation undertakes to provide the necessary facilities in the United States for handling traffic between the United States and Poland. This new radio circuit means another link in the world-wide wireless chain of the Radio Corporation of America. At present it maintains daily and direct radio communication tion service between the United States and France, Great Britain, Norway, Sweden, Denmark, Finland, Germany, and other European countries, as well as between San Francisco, Honolulu and Japan.

Signing of the contract between the Government of Poland and the Radio Corporation of America, for the erection of a high power radio station in Warsaw, Poland. Reading from left to right: Hipolit Gliwic, Edwin P. Shattuck, Prince Kazimier Lubomirski, Stanislaw Arct, Eugene Stallinger, Edward J. Nally, Carl R. Ganter, David Sarnoff.

Immediately after the signing of the contract, the representatives were given a luncheon at the Lawyers Club. Some timely and interesting remarks were made after the meal.

Mr. Edward J. Nally thanked those responsible for the preparation of the contract which involved considerable engineering and commercial skill and which necessitated conferences often lasting into the small hours of the night.

"Poland has the distinction of being the first foreign nation to negotiate with the Radio Corporation for a complete high power radio station," said Mr. Nally, "a project which will foster commercial relations between Poland and the United States in a most effective way and it gives me the greatest pleasure to see these negotiations successfully concluded. I hope that we shall all be present at the formal opening of the station two years hence and that we all shall meet on the soil of Poland to commemorate this great event. I further hope that we shall also be present at the culmination of the contract which we have just signed and that we shall be able to look back on the thirty-year period therein provided as one of harmonious co-operation between our two countries while fulfilling our obligations. I want particularly to emphasize," he concluded, "that now that this great project is started, we all strive to make it a success and all work to carry out what we have set forth on paper and have bound ourselves to honor. That, I believe, will be the real test of our sincerity and I look forward to doing our share in a conscientious and earnest manner. You will find that we will go much further than the letter of the contract in giving you service."

Prince Kazimier Lubomirski then responded. "For years, gentlemen," said the Prince, "our country and yours have been exchanging wireless thoughts of sympathy and understanding. I am especially elated that my country should have been the first one to benefit by the genius and resources of America's foremost radio engineers. The new station means future exchange of mutual commercial benefits, social intercourse and other important dispatches, all of which will be interpreted through the medium of the wonderful wireless system which you gentlemen will have been responsible for. Poland will soon find herself absolutely independent of other countries and agencies in order to establish communication with other nations, for radio means for us a direct and instant means of transferring intelligence without the intermediary of censorship and other delays. The closing of this contract is specially significant when I tell you, gentlemen, that we have recently arranged for a direct Warsaw-to-Paris aero circuit all of which further increases the usefulness and scope of our new station. Poland appreciates your honest efforts, gentlemen, and it does not entirely consider the matter a mercenary one. It is a direct help to our republic which like your own has emancipated from foreign bonds to the glorious freedom we now enjoy. In the name of Poland, therefore, I want to take this opportunity to sincerely thank you all, gentlemen of the Radio Corporation, for your participation in this great engineering project."

Mr. David Sarnoff, General Manager of the Radio Corporation spoke next and impressively of the epoch-making day not only for the Radio Corporation but also for the Republic of Poland.

"I wish to draw a few parallels concerning the events of this project," he said. "First, I may mention that this day marks exactly two years since the representatives of Poland first approached the Radio Corporation and opened negotiations for the erection and operation of the Polish station. Time, energy and patience have been involved in the negotiations which have successfully terminated today

"Second, it is an interesting fact that the career of the Radio Corporation began about the same time as the career of the Polish Republic and we are, therefore about the same age.

"Third, we are both undertaking an important venture of the same nature for the first time; for this contract is the first made by the Radio Corporation to erect a radio station in a foreign land and likewise it is the first radio contract made by the Government of Poland.

"Furthermore, this contract is the first obtained by any American corporation to erect and perform a service of this kind on foreign soil. We are, therefore, especially proud of the honor conferred upon us by the Government of Poland and its able representatives.

"The real test, however," continued Mr. Sarnoff, "will come when radio transmission of intelligence between the United States and Poland actually takes place. As general manager of the Radio Corporation charged with the responsibility of giving practical effect to the contract we have this day signed, I shall consider it a privilege and a personal responsibility to see to it that the United States-Poland Radio Circuit meets not only the provisions of the contract, but alike the hopes and wishes of both parties to the contract.

"The art of radio communication grows so rapidly and the peculiar geographical situation of Poland makes it so centrally located that by the time this station is constructed, Poland radio may become an important international factor. Indeed, the transmitting radius of this station should be such as to cause the voice of Poland to be heard throughout the civilized world and Poland's ability to make itself heard by the rest of the civilized world will provide your enterprising republic with a force more powerful than any army which you can afford to maintain. May I not also emphasize the important fact that we are partners in this enterprise and as in the case of all partnerships the success of one is dependent upon the success of the other."

Mr. Arct said: "No doubt, Poland has many serious problems to face and its exchange is not what it should be, nevertheless, great progress has been made and the present administration is to be complimented on the great work of Government organization which has been accomplished in the past two years. Contrary to some recent statements, Poland is far from bankruptcy and will discharge all its obligations in due time. The new radio station as well as other commercial projects will news information for the farmer.

Distribution of Market News by Radiophone

By Daniel C. Rogers

State Marketing Bureau, Jefferson City, Mo.

THE Missouri State Marketing Bureau of the Board of Agriculture, with headquarters at Jeferson City, Mo., is working out extensive plans for giving Missouri farmers government market news by radiophone.

The government market news information will be received at the radio office of the State Marketing Bureau off the leased wire of the United States Bureau of Markets. That wire will connect Jefferson City with the office of the Bureau at Washington, as well as with practically all of the large grain, live stock, hay, fruits and vegetables, dairy products, and other markets in the United States.

A powerful transmitting set will be installed at the offices of the State Marketing Bureau at Jefferson City, located in Missouri's beautiful new capital building, whose dome is 280 feet from the ground. From this central point of the State the radiophone should operate at its maximum efficiency to the advantage of Missouri farmers. The service is expected to be started early in the fall.

The Missouri State Marketing Bureau will organize the wireless amateurs in that State, of which there are several hundred widely scattered in rural communities into a State organization for receiving and distributing the market news information. A continued campaign will be made to install radiophone receiving outfits in every town of any size in the State. Newspapers, banks, rural telephone exchanges, farm bureau offices, live stock shipping associations, elevators and other headquarters interested in receiving and distributing government market news information on farm products will be requested to co-operate in this new undertaking.

During the strawberry shipping season from Southwest Missouri last May the Missouri State Marketing Bureau purchased a radio receiving outfit for receiving strawberry market news at Monett, Mo., which was undoubtedly the first radio equipment ever purchased by a State or national agency for the purpose of receiving and distributing market news information for the farmer.

Similar service is being rendered in the watermelon district of Southeast Missouri, with the big watermelon shipping season opening up in that part of the State the latter part of July.

A radio receiving set is now being operated by the State Marketing Bureau at Jefferson City to receive government market news information now broadcasted daily from the KDEL office operated by the Post Office Department at St. Louis, Mo. This information is being given to local newspapers and the Associated Press.

The plans for putting into operation this most elaborate system of distributing market news information to farmers ever undertaken by any State, or even the Federal Government, has been generally pronounced feasible by the majority of the larger manufacturers and jobbers of radio equipment.

At first no attempt will be made to expand the work in Missouri further than installing receiving sets at some important office in each of the several important towns of every one of the 114 counties in Missouri.

(Continued on page 31)

A New Negative Resistance Thermionic Device

By John Scott-Taggart

ONE of the most interesting physical phenomena is that of negative resistance. This property of certain devices is a very extraordinary one. The current through such conductors does not increase as the potential difference across the conductor increases but actually becomes less. Conversely, a decrease of potential produces an increase of current. This remarkable effect may be utilized in an infinite variety of ways. The chief application of a negative resistance device is its use to neutralize the positive or ordinary resistance of a circuit. In this way it is possible to overcome the losses in a circuit due to its ohmic resistance.

The arc and vapor lamp possess negative resistance characteristics and the properties of the former have enabled it to be used as a generator of continuous waves.

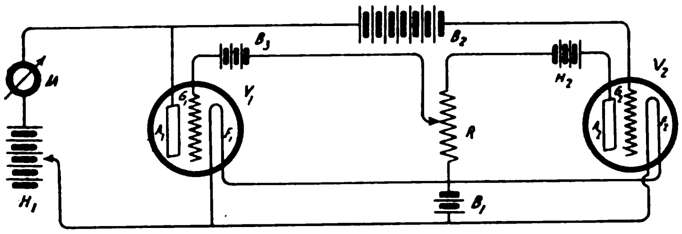


Figure 1—One form of the Biotron circuit

The device which has, however, become best known as a negative resistance for use in wireless receiving systems is the Dynatron vacuum tube. This tube takes advantage of the emission of secondary electrons from a bombarded anode.

Realizing the inherent possibilities of any device possessing stable and readily-obtained negative characteristics, the writer tackled the problem with a view to making use of the ordinary three-electrode tube. The purpose of this article is to give a short account of the principles on which the resultant device works.

The popular tendency being to give negative resistance devices distinctive names with the suffix "-tron," it has been decided to call the present arrangement the "Biotron," which, as its name almost implies, involves the use of two tubes. The Biotron circuit is shown in one form in figure 1. The anode circuit of a three-electrode tube V_1 contains a milliammeter M and a variable anode battery H_1. An electron current will take the path F_1 A_1 M H_1 F_1, giving a steady reading in M.

Let us confine ourselves for a moment to this circuit. If we increased the voltage of the battery H_1, the potential of the anode A_1 would increase and the anode current would be augmented. The circuit across which M and H_1 are connected possesses ordinary resistance. An increase of voltage produces an increase of current, while decreasing the value of H_1 would cause a decrease of current through H_1. The problem before us is to arrange matters so that the reverse effect is obtained.

Now, supposing that the increase of potential applied to A_1 be reversed in sign and applied to G_1, we will see that the negative potential on G_1 will tend to decrease the anode current of V_1. There would thus be two simultaneous effects: an increase in anode potential tending to increase the anode current and a decrease of grid potential tending to decrease the anode current. Since the potential on the grid has a much greater controlling effect than the same potential on the anode (about 5 to 10 times, usually) it is clear that the final result would be a decrease of anode current. This negative resistance effect is obtained in the Biotron by the use of a second three-electrode tube.

This tube is necessary to reverse the sign of the potential increase before applying it to the grid G_1. The filament F_2 of the second tube is connected to the filament of the first tube (preferably by using the same accumulator B_1) and the anode A_1 is connected through B_2 to the second grid G_2. The battery B_2 is used to neutralize the high potential of A_1 so that the potential of G_2 will be in the neighborhood of zero volts. It is to be understood that the circuits given here are those which most clearly indicate the theoretical action of the device. More practical circuits may be arranged for actual working.

The anode circuit of the second tube contains an anode battery H_2 and a high resistance R of about 50,000 ohms. The electron current of this valve takes the path F_2 A_2 H_2 R F_2. The steady current of about one milliampere through R will result in a steady potential drop across this

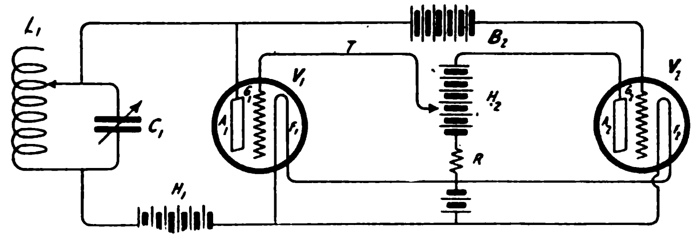


Figure 2—The Biotron used as a generator of oscillations

resistance, the potential of the top end of R being about — 50 volts. This end of R is connected to the grid of the first tube through a battery B_3 which is so connected as to bring G_1 to a suitable potential in the neighborhood of zero volts. Under normal conditions, the current through M will have a steady value. If now, we increase the E.M.F. of the battery H_1, the anode A_1 becomes more positive. At the same time, the grid G_2, which is connected to the anode A_1, also becomes more positive with respect to the filaments. The effect of G_2 becoming positive is to incerase the electron current flowing through R in the anode circuit of the second tube. This increase of current will cause an increase in the potential difference across R, making the top end of R and therefore the grid G_1 more negative with respect to the filaments. The negative potential applied to G_1 will tend to decrease the anode current of V_1. This anode current will decrease because the increase in the anode potential is greatly outweighed by the decrease in the grid potential. Moreover, the potential changes in H_1 have not only been reversed by the second tube, but also magnified on the usual principle of a resistance amplifier.

From the foregoing description it will be seen that the circuit A_1 M H_1 F_1 possesses negative resistance characteristics. A decrease of the potential of H_1 will make G_2 negative and G_1 positive. The anode current of the first tube will thus increase. In order to neutralize the ohmic resistance of a circuit all that is necessary is to include the circuit somewhere in series with H_1. The actual value of the negative resistance produced may be varied by altering the value of R or the position of the tapping T. If the resistance is of very low value or T is near the foot of R, it will be clear that the potentials communicated to G_1 will be very small and their effect may be so little as to be completely outweighed by the effect of the potential on the anode. Under these conditions the device acts in the ordinary way as a positive resistance. By suitably adjusting R, conditions are obtained so that variations of the voltage of H_1 produce no change in the current through H_1.

The second figure shows the Biotron as a negative resistance generator of oscillations, the resistance of the oscillatory circuit L_1 C_1 being neutralized by the negative resistance of the device, thus producing continuous oscillations. The battery B_3 is now shown eliminated, a tapping from the anode battery H_2 being taken to the grid G_1.

Figure 3 shows the Biotron used as a receiver of undamped or damped waves. The circuit L_2 C_2 is the closed circuit of the receiver and is connected in the anode circuit of the first tube. The resistance of the circuit is thereby lessened. The oscillations in L_2 C_2 induced from the aerial circuit are consequently much stronger than would normally be the case. Weak signals are very greatly strengthened, being from 10 to 50 times the strength usually obtained. The audible signals are produced in the telephones T which are preferably shunted by the variable condenser C_3. The circuit L_2 C_2 may be readily made to generate oscillations. Under these conditions the circuit will receive continuous waves on the beat principle. As in the case of the reception of spark signals, the circuit will rectify the incoming oscillations. The effect may be enhanced by adjusting the variables of the circuit.

In addition to the Biotron, the Eccles, Turner and Jordan arrangements and the Kalliratron employ two valves and produce a negative resistance effect. Their arrangements, however, function in a different manner from the Biotron, which is independent of retroaction. Retroaction is obtained in the other two arrangements by the use of coupling resistances. An increase of the grid potential of one tube produces an increase af anode current. This anode current flowing through a resistance communicates an amplified potential to the grid of a second tube in which the anode current has a second high resistance. The potentials across this resistance are now communicated back to the first grid and strengthen the potentials existing there. The magnified potentials are now reamplified and the process is continued. A weak impulse is in this way built up by a back and forth action which does not form the basis of the action of the Biotron. Looking again at figure 1 it will be seen that the sudden increase of the potential of H_1 will produce an instantaneous fixed decrease of anode current. This decrease of anode current does not alter the potential of A_1 and G_2 because the external circuit does not include a resistance. The decrease of anode current through V_1 does not, therefore, take any part in the operation of the Biotron. The potential applied to G_2 is simply the amplified and reversed changed in the potential of H_1 and is independent of the A_1 anode current. In the Eccles and Jordan and the Turner arrangements, the decrease of current would be passed through a second high resistance and the potentials across this would be passed back so as to affect G_2 and so produce a retroactive effect which is an essential feature of their circuits but which is not used in the Biotron. The second tube and the single resistance is simply used to obtain amplification and a reversal of the potential. It is interesting to note that the other two inventions were produced with the object of strengthening, by retroaction, potentials in the input grid circuit of a tube, whereas the writer commenced solely with the idea of an input anode circuit. This explanation has been considered necessary because at first sight the Biotron, since it also uses two tubes to produce a negative resist-

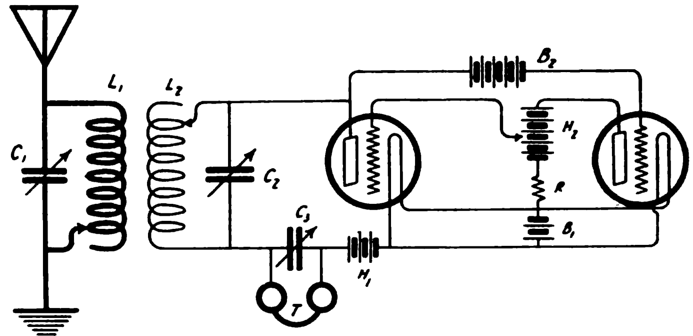


Figure 3—The Biotron used as a receiver of undamped or damped waves

ance, might be thought to resemble somewhat the retroactive devices mentioned. From the description, however, it will be seen that the resemblance is confined to the use of two tubes.

The Biotron is thus the first negative resistance device (except the arc and like arrangements) which does not utilize the phenomenon of secondary emission or of retroaction. It is a very stable and straightforward device and the value of the negative resistance is constant. The Dynatron is susceptible to small changes in filament current and the secondary emission feature does not lend itself to analysis. In the Biotron, however, the value of the negative resistance remains constant over wide variations of battery voltages and its value is readily calculable. Moreover, the value may be varied smoothly between the widest limits by means of the inter-valve resistance and the characteristic may be made as steep as desired by using more amplifying tubes before applying the potentials to G_1.

The applications of the Biotron are as diverse as those of the Dynatron and it is hoped to give further applications in these pages at some future date.

A Vacuum Tube Without a Filament

Mr. C. G. Smith and Dr. V. Bush, of Medford, Mass., have developed a vacuum tube for radio work in which no filament is employed. The idea, which belongs to Mr. Smith, according to Dr. Bush, has been in the process of development for over two years. A working model that actually performed everything that the inventors claimed for it, was exhibited before the Boston section of The Institute of Radio Engineers recently at Craft Laboratory, Harvard University.

The new tube resembles a pair of metallic salt shakers such as are used in any household, enclosed in a glass bulb. These cylinders are separated by a distance equal to the thickness of an ordinary sheet of paper. The tube is filled with Helium gas and the air removed. The ends of the tube are sealed by means of brass caps, which act as terminals.

The action which takes place in these new "S" tubes resembles that of an electric fan on a dozen or more rubber balloons in a store window. The stream of air has a controlling effect on the path the balloons must take. So it is with the permanent magnet employed to produce the field in the tube. By the use of this field the velocity of the electrons is increased and results in the breaking up of the remaining gas liberating more electrons and causing a means of passing an electric current across the gap between the two "salt shakers" in the tube. On the other hand, the control of the electrons is so perfect that it can block this flow of current if it attempts to come back in the other direction. Such a combination is termed a rectifier, and is similar to the action of any rectifier tube used, for instance in rectifying alternating current for charging storage batteries.

This new tube can also be used for this purpose. It is, in fact, in the rectifiying action of the tube that the inventors are most interested at the present time. However, they have made it operate as oscillator and amplifier, but only on wavelengths above 1,100 meters, the lower wavelengths being impracticable for operation.

A Method of Frequency Transformation

IT is sometimes desirable to employ continuous alternating currents having a frequency much higher than can conveniently be obtained by means of a high frequency alternator. In order to obtain currents of such high frequency various arrangements have been employed for transforming a continuous alternating current of a given fundamental frequency in such a way as to derive therefrom a current having a frequency harmonic to the fundamental frequency. In some of these systems means are provided small amount of direct current may be utilized to assist in tuning.

As indicated in figure 1 a high frequency alternator supplies current to a circuit which includes an inductance made up of a closed iron core 2 and a winding 3. The winding 3 is also supplied with direct current from a suitable source 4, the value of the current thus supplied being adjusted to provide the desired degree of saturation in the core 2. By this means the voltage wave produced at the terminals 5 of the winding 3, will be distorted and by connecting these terminals to a working circuit which is resonant to twice the frequency of the alternator a current may be obtained in the working circuit of double the frequency of the current supplied by the alternator. To prevent such a double frequency current from flowing in the circuit of alternator a "frequency trap"; that is, a device which offers a substantially infinite impedance to current of one particular frequency but comparatively low impedance to currents of different frequencies, is employed. This frequency trap consists of an inductance 7 and variable capacity 8 in multiple to each other and tuned for the double frequency. By means of the variable condenser 9 the circuit may be tuned to the frequency of the alternator. In the illustration the secondary circuit connected to the terminals 5, 6, is also the primary circuit of a second frequency transforming arrangement similar to the first, and includes an inductance made up of a closed iron core 10 and a winding 11, the winding 11 being also supplied with direct current from the source 12. A frequency trap consisting of inductance 13 and variable condenser 14, connected in multiple and tuned for the frequency of the alternator will cause the secondary circircuit to offer a high impedance to current of the fundamental frequency. A frequency trap consisting of inductance 15 and variable condenser 16 connected in multiple and tuned to four times the freauency of the alternator will cause the secondary circuit to offer a high impedance to current of that frequency and compel this current to flow in a work circuit connected to the terminals 17, 18 of winding 11, and including conductors 19 and 20. The frequency trap consisting of inductance 21 and variable condenser 22 connected in multiple in the work circuit and tuned to twice the frequency of the alternator will cause the work circuit to offer a high impedance to current of that frequency. By means of the condenser 23 the secondary circuit may be tuned to twice the frequency of the alternator.

It is apparent from the above description that by connecting additional frequency transforming arrangements

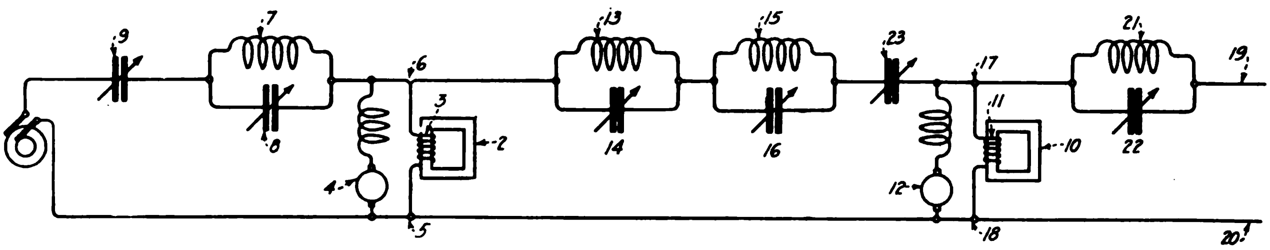


Figure 1—Circuit showing the use of a single saturated core and a single winding to effect a transformation of frequency

for distorting the wave of the current of fundamental frequency from the sine form in such a way that certain harmonics are made prominent and these harmonics are segregated in circuits which are resonant to the particular harmonic or harmonics which are to be utilized.

Mr. E. F. W. Alexanderson describes an improved and simplified system in which any desired harmonic of the fundamental frequency may be obtained by merely varying the tuning of the radiating system.

An iron core inductance is employed through which the current from the alternator flows and it is operated in such a way that it becomes saturated and thereby produces a distorted voltage wave at its terminals. The circuit which includes this inductance and the source of current of fundamental frequency is preferably resonant to the fundamental frequency and is so adjusted that it offers a relatively very high impedance to the flow of current of the harmonic frequency which is to be utilized. The distorted voltage wave produced is applied to a second circuit which is resonant to the desired harmonic frequency. This second circuit may also be so adjusted that it offers a high impedance to current of the fundamental frequency, or other means may be employed for preventing current of the fundamental frequency from flowing in the second circuit, and vice versa. If it is desired to produce a current having a frequency equal to an even harmonic of the fundamental the iron core inductance may be saturated by means of a direct current. If an odd harmonic is to be utilized this will not be necessary although in some cases a

in series with the two shown it will be possible to secure currents of any high frequency desired. The arrangement described permits of the use of a single saturated core and a single winding to effect a transformation of frequency. All of the other systems of this nature employing a saturated iron core inductance, require the use of two separate cores and separate windings for the same. Since the principal source of loss in such a system for frequency transformation is in the iron core and its windings an appreciable improvement in efficiency may be made by using a single core.

Figure 2 shows the high frequency alternator supplying current to the primary 24 of a transformer, the secondary 25 of which is included in the local circuit which comprises the winding 3 of the iron core inductance. The load circuit in this case comprises an antenna 26 provided with the tuning inductance 27. The frequency trap, which is employed in this case to give the local circuit a high impedance to the higher frequency current, comprises an inductance 28 which is so arranged that the capacity of the antenna serves in place of the condenser employed with the form of frequency trap shown in figure 1. The current of harmonic frequency may be considered as being introduced into the antenna at the point 29 at which the antenna is connected to the secondary 25. From this point there are two parallel branches of the circuit through which current can flow; one through the inductance 27, antenna 26 and the capacity of the antenna to earth, and the other through a portion of secondary 25 and inductance 28 to earth. Since these two multiple branches are tuned so as to be resonant to the desired harmonic frequency there will be a large circulating current produced between the two branches. This circulating current will be the current which produces radiation.

In order to prevent the current of a harmonic frequency from flowing through the alternator the point 29 at which the antenna is connected to secondary 25 is so chosen that the higher frequency current balances in the two sides of the secondary winding and the inductive effect upon the primary winding 24 is thereby neutralized. The method of operation whereby this neutralization is effected is explained as follows: When the system is adjusted so that the antenna itself serves as a part of the frequency trap the current circulating between the antenna and the inductance of the trap will be greater than the energy current furnished by the frequency transformer. In other words, the frequency trap acts as a transformer from a higher voltage and a lower current to a lower voltage and a higher current. The antenna current is the sum of the current flowing in the inductance 28 of the frequency trap and the current delivered from the saturated core inductance. Suppose, for example, that with an antenna current of ten amperes, five amperes are delivered from the saturated core inductance and the other five amperes are added by the resonant condition in the frequency trap. It is apparent that if the antenna proper were connected directly to the lower end of the secondary 25 the five amperes delivered from the saturated core inductance would be effective in inducing a current in the alternator circuit comprising the alternator and the primary 24. If, on the other hand, the antenna were connected to the top of secondary 25 the five amperes derived from the frequency trap would flow through the secondary 25 and be effective in inducing a current in the alternator circuit. In either case there would be undesirable losses in the alternator circuit due to the circulation of the higher frequency current therein. By connecting the antenna to the middle point of the secondary 25, however, the five amperes delivered by one branch of the higher frequency circuit will balance the five amperes delivered by the other branch and thereby neutralize the induction in the transformer and avoid the incidental losses. The current delivered to the antenna from the saturated core inductance may be considered as flowing downward through the upper part of secondary 25 and upward in the antenna. In order that the current supplied by the frequency trap shall add to this current it also must flow upward in the antenna and hence upward thru the inductance 28 and the lower part of secondary. From this analysis it is evident that the harmonic frequency currents in the two portions of secondary are in opposite directions. While in the example given the connection should be made at the middle point of the secondary, in case the currents do not divide equally in the two branches of the higher frequency circuit the connection may be made at some other point chosen so that a balance between the two currents will be obtained.

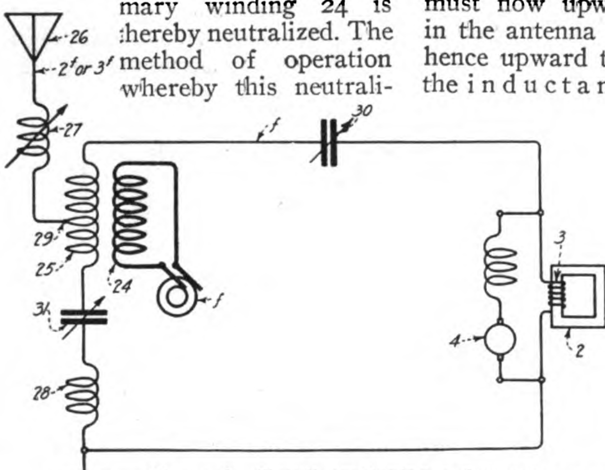


Figure 2—Circuit employing a frequency trap

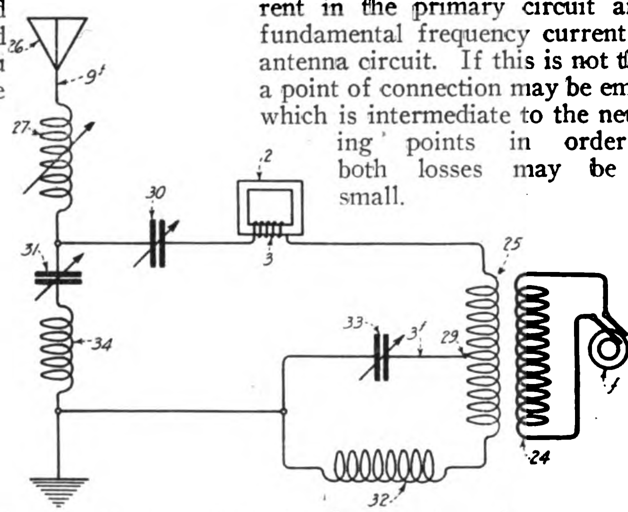


Figure 3—Circuit employing two frequency traps for tuning to low and high harmonics

This system of frequency transformation has the advantage that it is not limited in its operation to the use of any particular harmonic of the fundamental frequency. In order to bring out any one harmonic it is only necessary that the frequency trap should be tuned to that particular harmonic. Since the antenna itself forms a part of the frequency trap it is only necessary to tune the antenna for the particular frequency desired without any change in the rest of the system. In developing the even harmonics the direct current saturation of the core 2 should be employed while for the development of the odd harmonic direct current saturation will be unnecessary. It may be desirable in some cases, however, to employ a small amount of direct current in the winding 3 in order to assist in tuning.

The local circuit of the fundamental frequency may be tuned by means of the variable condensers 30 and 31. With this arrangement a portion of the voltage of fundamental frequency is impressed directly upon the antenna. By giving the capacity of condenser 31 such a value as to compensate for the inductance of the frequency trap at the fundamental frequency the wattless component of this voltage may be neutralized, and by varying the point 29 of connection between the antenna and secondary 25 the power component of this voltage of fundamental frequency may be neutralized. It may happen that the same point of connection will be suitable for neutralizing both the higher frequency current in the primary circuit and the fundamental frequency current in the antenna circuit. If this is not the case a point of connection may be employed which is intermediate to the neutralizing points in order that both losses may be made small.

While the arrangement shown in figure 2 may be utilized for obtaining currents of a frequency higher than the second or third harmonic it may be desirable in case such higher frequency currents are to be utilized, to employ a frequency trap in the circuit tuned to a lower harmonic to assist in accentuating the higher harmonics of the fundamental. In figure 3 such an arrangement is shown. The frequency trap comprising inductance 32 and capacity 33 in multiple is tuned to the lower harmonic frequency and the frequency trap which comprises the inductance 34 and the capacity of the antenna is tuned to the higher harmonic frequency. Suppose, for example, it were desired to obtain a current having a frequency equal to that of the ninth harmonic of the source 1, then the first trap would be tuned to the triple harmonic and the second trap to the ninth harmonic. By the use of the triple harmonic trap an additional distortion is introduced in the magnetic flux of the saturated core and this additional distortion has the effect of increasing the electromotive force of the ninth harmonic. In this case, as in the arrangement shown in figure 2, the effect of the third harmonic in the primary 24 is neutralized and the ninth harmonic will have no effect upon the primary circuit since it will be confined to the second frequency trap. In case the even harmonics are to be utilized the winding 3 will be supplied by a source of direct current as indicated in figures 1 and 2.

EXPERIMENTERS' WORLD

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

Detector and Three-Stage Radio Frequency Amplifier

By Frederick J. Rumford, E. E.

Assoc. A. I. E. E.

FIRST PRIZE $10.00

THIS detector and three-stage radio frequency amplifier was designed and built by the writer and operated for over a year with 100 per cent. results. It has all the advantages the radio man could desire within reason. It is simple, efficient, practical, neat in appearance, and is built of standard parts which can be purchased in most radio supply stores with the exception of the radio frequency transformers. The advantages secured are less howling, positive selectivity, and a pronounced reduction in static signal ratio. The most objectionable difficulty is very high frequencies. This will show when signals below 500 meters (frequencies above 600,000 cycles) are used, because it impairs the radio impulses or signals and produces distortion or weakness. With this particular design and hook-up it is possible to secure signals on wavelengths as low as 150 meters.

Figure 1 shows the front of the panel with dimensions and various apparatus mounted thereon. Figure 2 shows an end view of the outfit giving the locations of the radio frequency transformers, the tubes and the brackets. Figure 3 shows the general wiring diagram or hook-up used with this outfit. Figure 4 is an interior sketch of the outfit, looking from the top. It shows the method of placing the radio frequency transformers in their respective places below the vacuum tubes. Figure 5 is the transformer bobbins, three of which are necessary for this set. The A battery is 6 volts 60 amperes; B battery is 45 volts. The grid, filament and radio frequency transformer connections appear on the panel.

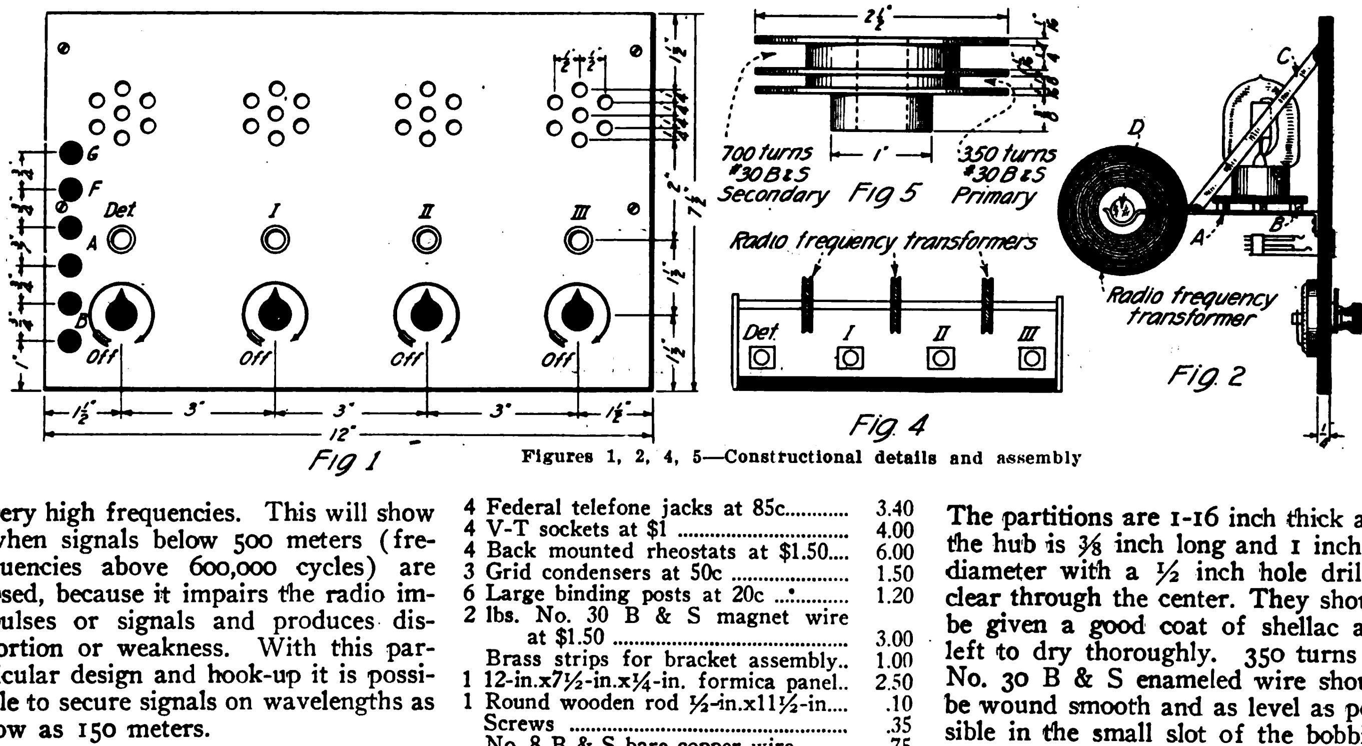
The necessary articles are listed below with approximate cost:

1 Detector vacuum tube Radiotron U. V. 200	$ 5.00
3 Amplifier vacuum tubes Radiotron U.V. 201 at $6.50	19.50
4 Federal telefone jacks at 85c	3.40
4 V-T sockets at $1	4.00
4 Back mounted rheostats at $1.50	6.00
3 Grid condensers at 50c	1.50
6 Large binding posts at 20c	1.20
2 lbs. No. 30 B & S magnet wire at $1.50	3.00
Brass strips for bracket assembly	1.00
1 12-in.x7½-in.x¼-in. formica panel	2.50
1 Round wooden rod ½-in.x11½-in	.10
Screws	.35
No. 8 B & S bare copper wire	.75
Engraving	.25
1 Telefone plug	.75
3 Wooden bobbins at 25c	.75
	$50.05

It will not require much time to build, and a screw driver and drill are all that are necessary in the tool line.

The directions given below are for the construction of the panel, which can be of either wood, formica or bakelite. The panel in question was made of formica, 12 inches long, 7½ inches wide, and ¼ inch thick. It is measured and drilled as per figure 1, and then given a good coat of varnish, a dull black being preferable. It should be sandpapered with number 0 sandpaper and rubbed to a smooth finish. The necessary parts are then mounted upon it and it is ready for assembling. The panel can be mounted in a cabinet which will give it a neat appearance.

The radio or high frequency transformers are very simple in the making. First, the builder must purchase from some wood working shop three wooden bobbins as shown in figure 5. They should be 2½ inches in diameter with slots cut ½ inch deep. The secondary slots are ¼ inch wide and the primary slots are ⅛ inch wide.



Figures 1, 2, 4, 5—Constructional details and assembly

The partitions are 1-16 inch thick and the hub is ⅜ inch long and 1 inch in diameter with a ½ inch hole drilled clear through the center. They should be given a good coat of shellac and left to dry thoroughly. 350 turns of No. 30 B & S enameled wire should be wound smooth and as level as possible in the small slot of the bobbins which are the primaries allowing enough of the wire for the necessary connections. 700 turns of the same wire should be wound in the large slots of the bobbins making the secondaries, also allowing for connections. Care should be taken not to scrape the insulation of the wire. The primary and secondary of these coils have no direct connection other than through the grid condenser. Also make sure that the windings are all done in the same direction. These coils have a ratio of 2 to 1. Three of these transformers or coils are necessary.

The transformers are fastened tight

against or on rod D, which in this particular instance is of wood ½ inch in diameter and 11½ inches long. The transformers should be spaced equally apart and between the vacuum tubes, as shown in figure 4, with the primary and hub on the left facing the panel.

The following parts are necessary for the bracket assembly. A is two brass strips ⅜ inch wide, 1-16 inch thick and 5¼ inches long. It is bent as shown in figure 2, round at one end and at an angle on the other end. The end with the angle, screws or fastens to the back of the panel and extends out from the back, which in turn holds rod D on which the transformers are mounted. B represents two brass strips ⅜ inch wide, 1-16 inch thick and 11½ inches long. C represents two brass strips ¼ inch wide, 1-16 inch thick and 5½ inches long, bent as shown in figure 2. These C strips hold up all the weight of the bracket assembly.

To attach the bracket assembly first the A strips are secured to the panel firmly then the two B strips are laid across the A strips with the V-T sockets spaced properly apart and about ¼ inch from the panel. These strips are bolted tight at each end of the panel, and they in turn are bolted to the A strip at each end, making a firm and rigid bracket support.

The V-T sockets are placed across the B strips and spaced equally apart and firmly bolted. The wooden rod D is placed upon the hooked ends of the A strips with the transformers on it. The rod D is bolted or pinned at each end to the A strips. All the tubes, etc., are mounted upon the back of the panel. The grid condensers can be mounted beneath the V-T sockets.

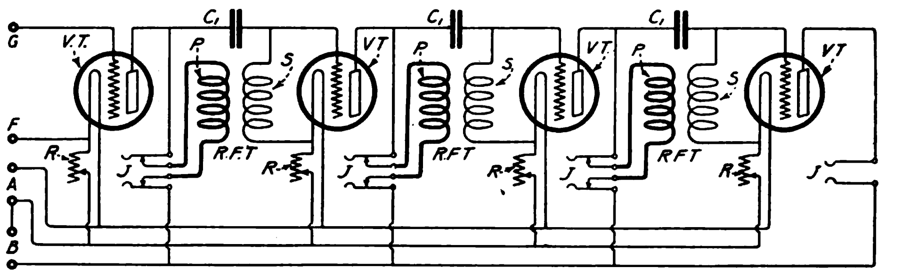


Figure 3—Wiring diagram for the detector and three-stage radio frequency amplifier

The grid condenser used in this particular instance is of .0001 mfd. fixed type. Number 8 B & S bare copper wire is used throughout the whole wiring. One wire is run direct from the negative side of the A battery beneath the rheostats where it is tapped. Another wire is run below the jacks direct from the positive side of the B battery to the end jack. The other jacks take taps off the same wire. Another wire is run direct from the positive side of the A battery over to the last tube. The other tubes tap off this wire and connect to the remaining side of the filament on the tubes. There is a jumper wire shunted across the negative binding posts of the A and B batteries, as shown in the wiring diagram figure 3. The rest of the wiring is done as shown in figure 3.

After assembling the adjustment of the whole outfit consists mainly of tuning each grid circuit to the wavelength of the grid circuit of the preceding tube. This is done by adjusting the radio frequency transformers upon the rod or shaft as shown in figures 2 and 4. After they are once adjusted the screws in the hubs of the transformers are tightened down and the adjustment is completed.

The drawings are simple and self-explanatory, but in case of any difficulty, write me a letter in care of The Wireless Age, enclosing sufficient postage for return reply and I will be glad to help to the best of my ability.

An Amateur Transformer Coupled R.F. Amplifier

By A. Reisner

SECOND PRIZE $5.00

THE subject of radio frequency amplifiers is one which seems to be shrouded in some mystery. This is perhaps due to the fact that there is very little information actually published on this subject. Another reason why many or most amateurs have no radio frequency amplifiers is that a good, operative, all-around audio frequency amplifier is more easily made than a radio frequency one, and also there is much more practical amateur "dope" on audio amplification than radio. But radio frequency amplifiers have their advantages and it will be the object here to explain this and to give details of a real radio frequency amplifier which the amateur can easily build for himself.

The radio frequency amplifier has one great advantage over the audio frequency amplifier. An audio frequency amplifier works best on strong signals, in the same way that detectors work best on relatively strong signals. But the incoming signal from the receiving antenna is very weak, and the only way to bring this signal up to the proper strength for efficient detection and audio amplification is to employ a radio frequency amplifier. Amplify the weak incoming signals and then utilize the strong radio signal thus secured for efficient detection and audio amplification. The radio amplifier can be used efficiently where a detector and audio amplifier cannot.

I have used an inductively coupled amplifier, with transformer coupling between plate and grid for the following reason. My experience with both resistance and transformer amplifiers has been that the transformer coupled amplifier gives many, many more times amplification than the resistance coupled amplifier. I have used a two-stage transformer amplifier, which has given more amplification than a four-stage resistance amplifier. Thus for a given amount of amplification the transformer coupled affair is less expensive. In order to get the same amplification with a resistance amplifier as with a transformer amplifier, the number of stages has to be increased, and this introduces difficulties in operation. Some people seem to think that the resistance amplifier is easier to handle and is more stable. However, a two-step transformer amplifier is just as easy to handle and is just as stable and probably more so than an equivalent 5-step resistance amplifier. Furthermore by making the inductances of the coupling transformers high enough the transformer amplifier can be made to cover as broad a range of wavelengths as the resistance amplifier. For these reasons I prefer the transformer amplifier, and in the following, specifications will be given which will enable the amateur to build one. It will be noticed from the illustrations that no mechanical mounting of the parts is given. This is because it is relatively unimportant and each amateur can rely on his own ingenuity in building a panel or cabinet to his own satisfaction. The important thing in the radio frequency amplifier here described is to use the proper constants in his various transformers, condensers, etc. One thing, however, should be mentioned. In wiring the set care should be taken to make all the leads as short as possible, in order to decrease the capacities and thus minimize the possibility of generating oscillations.

The schematic wiring diagram of the set is given in figure 1. As will be seen a common battery is used for both filaments, and a common battery is used for both plates. The common battery for both plates is made possible by using an inductively coupled plate-grid transformer. The same amplification results could be obtained with an auto-transformer between plate and grid, but in this case separate plate batteries would have to be employed. Consequently the inductively coupled type was chosen.

R_1 is the filament rheostat, one rheostat being sufficient for both valves. R_2 is a high resistance potentiometer, value about 6000 ohms to 10,000 ohms, shunted across the filament battery. By means of this potentiometer the necessary suitable grid voltage may be applied to the amplifier grids in order to bring the valves on the best portion of their characteristic curves, thus securing maximum amplification. The filament rheostat may be a standard 6-ohm rheostat. T_1 and T_2 are the radio frequency coupling transformers. The proper design of these transformers is the most difficult part of building a transformer-coupled radio-frequency amplifier. In order to cover a fairly wide range of wavelengths it is necessary to build the transformer so that the wavelength of each winding is approximately equal to the lowest wavelength to be received. The windings should, if possible, be aperiodic; that is, have a very high resistance, in which case the amplifier would be efficient over a very wide range of wavelengths. Tables show various constants of coils designed to give definite wavelengths, but these are not given here owing to space limitations. However, any amateur can find these tables by looking over past issues of THE WIRELESS WORLD. The writer calculated his transformers from these tables and formulae for an amplifier to receive from 500 meters to 1500 meters.

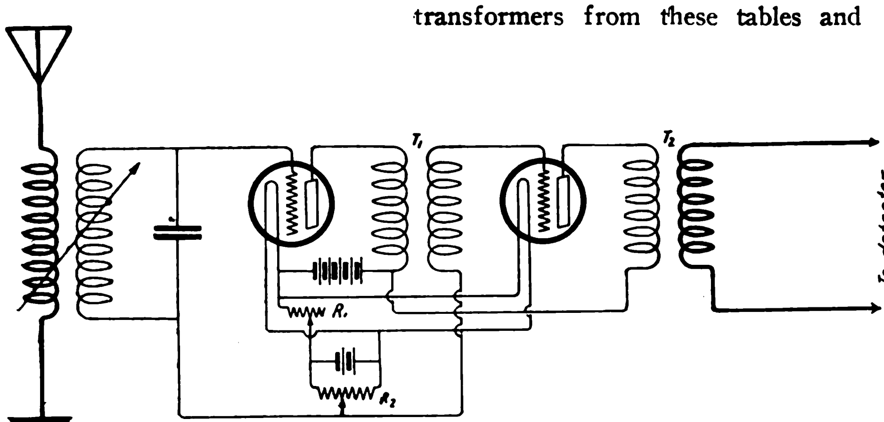


Figure 1

Figure 1—Circuit diagram of the transformer-coupled radio frequency amplifier

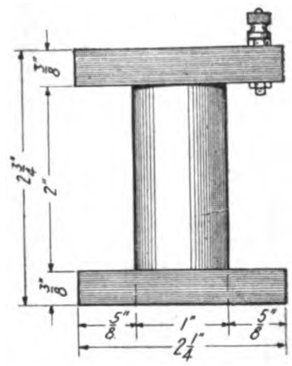


Figure 2

Figure 2—Constructional plan of the transformer

Figure 2 shows the construction of the transformer. A form made of wood is built as shown in the figure having the dimensions there shown. No. 38 S.S.C. wire is used for both primary and secondary of the transformers, each winding having the same number of turns. About 550 feet of this wire are used for each winding, giving a total number of turns per winding of 660, wound in two layers for each winding, 330 turns per layer. Between primary and secondary there should be two sheets of oil skin paper for insulation, and the transformer may be finished with a covering of bookbinder's cloth. Two binding posts are brought out at each end of the winding for the terminals. Each winding of this transformer will have a natural wavelength of about 500 meters, and the amplifier thus built will cover easily the range given above. If resistance wire is used for the winding the range of wavelengths covered efficiently by this amplifier will easily be multiplied by two or three.

It is seen that the number of parts or separate elements required in this amplifier are very small. The mechanical design is therefore very much facilitated. Great care should be taken not to run plate and grid wires close or parallel to each other, for this will increase grid to plate coupling capacitatively and may result in undesirable oscillations being generated with resulting critical operation. With these precautions taken, unusual results will be obtained with this extremely economical amplifier.

Two-Step Radio Frequency Amplifier

By S. Burdett

THIRD PRIZE $3.00

THE photographs show the front and rear of the panel removed from the cabinet, and with the connection diagram, give a clear idea of the construction.

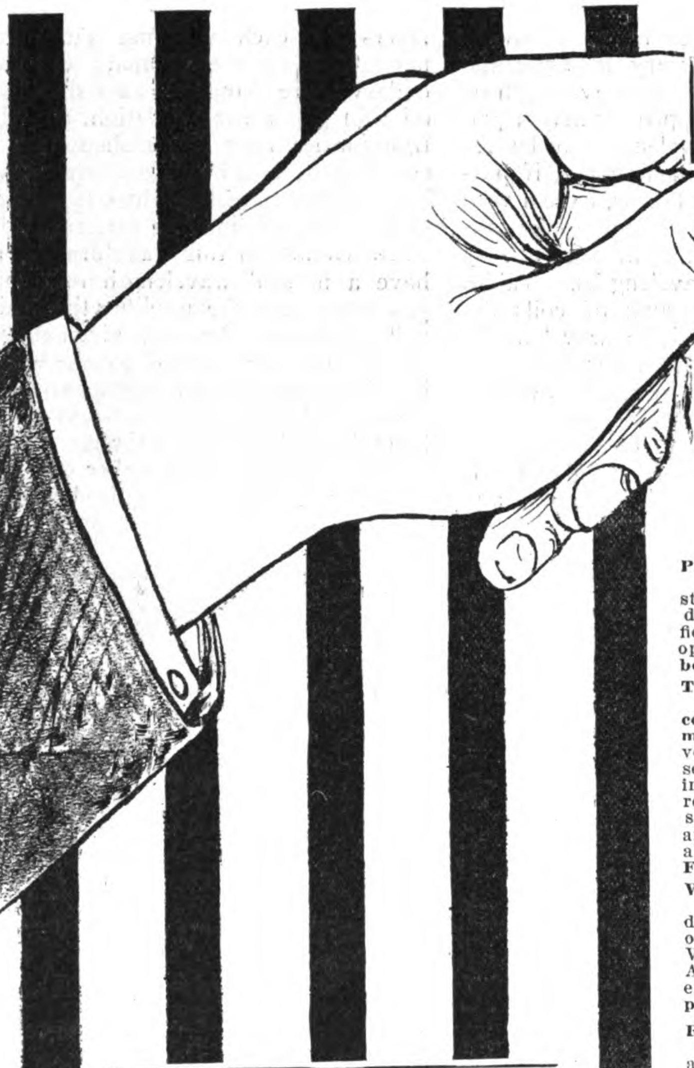
The panel is the same height as the CR3 tuner with which it is used, and the binding posts correspond. The cabinet is the same except the length. Beginning at the left end of the panel is the rheostat, Ra for the two radio-frequency amplifying tubes. The two dials are for the condensers C1 and C2. To the left and right of the corresponding windows in the top of the panel are the sockets for the inductance coils L1 and L2. These are duo-lateral coils. The grid condenser C3 and the grid leak R1 are mounted on the shelf between the tubes.

The potentiometer P and the rheostat Rb of the detector tube come next. The grid condenser C4 is mounted between the two shelves. The two small D.P.D.T. switches are for cutting the RF amplifier out of the circuit when desired. The two amplifier tubes and the bridging condenser complete the panel. These are connected in the usual manner, and are not shown on the diagram.

The two condensers C1 and C2 are .0005 mfd. The grid condensers are the usual ones for the tube used. The grid leak R1 will vary from two to five megohms, according to the tube used.

The theory on which the amplifier works, I believe, is that the circuit C1-L1, when tuned to the frequency of the received signals, forms an infinite impedance to the signal oscillations and they are all impressed on the grid of the succeeding tube, while oscillations of any other frequency go through it and are lost. In practice, select a duo-lateral coil of the proper inductance for the wavelength to be received, keeping in mind that the condenser is only .0005 mfd. instead of .001 mfd., which is the basis on which the coils are listed in the catalog.

Use as large a coil as possible, with



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a minimum of capacity in the condensers C1 and C2, when receiving short waves. After the coils are plugged in, set the condensers at minimum, and set the grid variometer at the proper setting for the wavelength to be received. Then increase the capacity of the condensers until the signal is at a maximum. This will be just before a click is heard in the phones, and the tube starts to oscillate. The plate variometer may then be advanced to increase the signal strength.

The amplification with two-step radio-frequency is about 75 per cent. of two-step audio-frequency. Static is noticeable, but is not amplified, except a slight amount on the received wavelength. I have been using the amplifier a great deal on telephone reception, and find it a great advantage over audio-frequency amplification, the only objection being a tendency to oscillate and the difficulty in tuning. Nearby high-power stations are cut out, and also nearby "hams" who are not tuned closely. The addition of vernier plates to the condensers would make tuning easier.

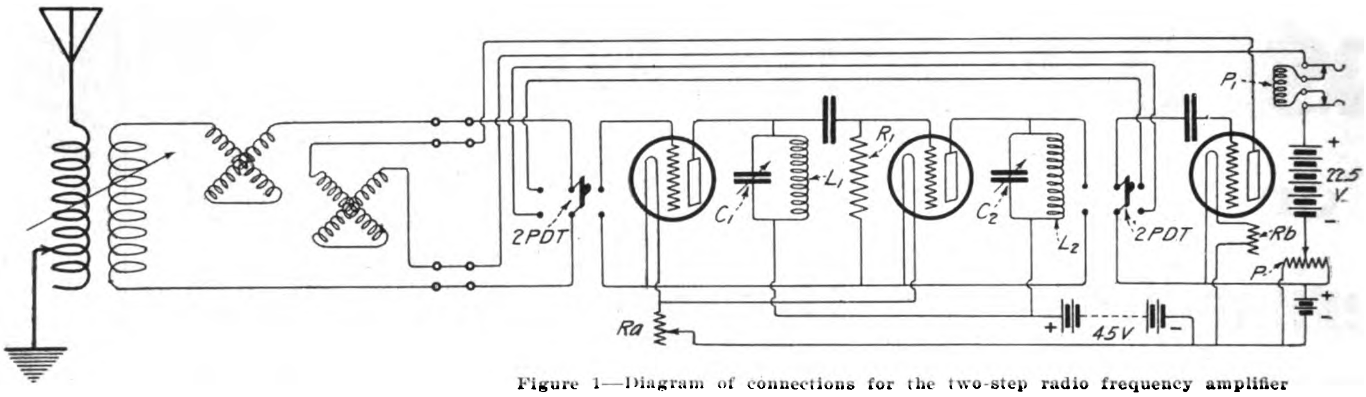
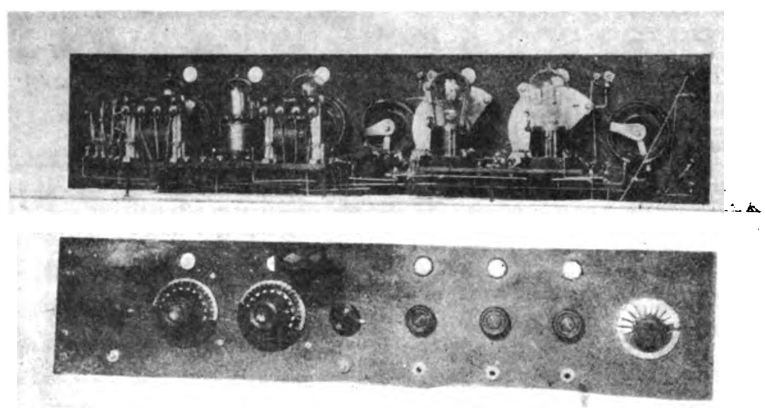


Figure 1—Diagram of connections for the two-step radio frequency amplifier



Figures 2, 3—Front and rear of panel

Efficient Design of Combined Receiver and Radiophone Transmitter

By G. N. Garrison

SINCE the article on "Efficient Design of Regenerative and Amplifier Circuits" appeared in the January issue of THE WIRELESS AGE, dozens of letters have been received from amateur throughout the country asking what kind of variometers were used, whether mica grid condensers were all right for the amplifying tubes, what make of amplifier transformer was recommended, etc. Not a few of these letters asked if it wasn't possible to so construct a radiophone that it could be used in conjunction with this circuit and, by the simple throw of a switch, use the same "B" batteries for both receiving and transmitting. It was desired that the transmitter should be capable of dependably working a distance of 15 miles with economical use of the "B" batteries—in other words, the complete circuit should be truly efficient.

The following article will describe a radiophone transmitter which is easily capable of transmitting a distance of over 20 miles in the daytime. With a plate potential of but 175 volts 30 miles has been successfully covered. The plate current at no time exceeded 19 milli-amperes and but one tube was used as both oscillator and modulator.

Referring to the drawing, the antenna inductance L consists of a cardboard tube 6 inches in diameter wound with 30 turns of No. 18 annunciator wire. This inductance should be tapped every second turn for varying the inductance of the oscillating circuit and for varying the wavelength. If a layer of insulating tape is first evenly wound on the tube and the wire wound on top of that, it will be found that the winding will stay in place indefinitely and that no shellac or other binder need be used. The radio frequency choke L-1 has an inductance of 1.3 m.h., and may be wound if desired, but a DeForest L-150 honey comb coil has been found to give excellent results. K is the regulation audio-frequency choke and helps to keep the plate of the modulator tube at a constant potential. Two bell-ringing magnets connected in series may be used for this purpose. The condenser C should have a capacity of at least .005 mfds. and is inserted in the circuit to prevent injury to the "B" batteries and condenser C-2, should the latter become short-circuited. The condenser C-2 should have a maximum capacity of .001 mfds. and should be variable. The grid condenser C-1 need not have a greater maximum capacity than .005 and should be variable until the proper value has been found. The resistance R should have a value of 5,000 ohms and the resistance of R-1 should be equal to the resistance of the secondary of the modulation transformer M-2. The object of these resistances is to keep the grid from becoming excessively heated. In the absence of these resistances the writer actually succeeded in melting the grids of three perfectly good tubes. The microphone is represented at M-1 while the buzzer is designated as B. Both are connected around a single-pole, double-throw switch so that either may be used at will.

When switch S-1 is thrown to the right and switch S-2 is closed, the grid of the second tube is modulated while the first tube acts as an oscillator. In the event of this second tube burning out or, if the constructor has but one tube available, the switch S-1 is thrown to the left and switch S-2 is opened. Conversation may then be carried on by using the first tube as both oscillator and modulator. Since the voice will carry no better than the extent to which the carrier wave is modulated, it is highly desirable to make use of both tubes, switches S-1 and S-2 being used for emergency only.

The double-pole, double-throw switch, when thrown to the left automatically connects all of the "B" batteries in series and at the same time places them across the plate and filament of the transmitting circuit. This switch and the "A" battery switch are the only ones that need to be moved when changing from the receiving to the transmission position. A three-pole double throw switch may be used for this purpose, making but one operation necessary for the transit. Two separate grounds, G and G-1 are used. This is not absolutely essential, but their use eliminates the necessity for an additional switch.

Two tubes connected for transmitting consume about the same current from the "B" batteries as one tube. This is due largely to the fact that only one tube is oscillating. Although the radiation is no greater with two tubes than with one, the results obtained by using two tubes as evidenced at the receiving station, are at least 50 per cent. better on account of more nearly perfect modulation. It is also much easier to "raise" a desired station. With this circuit and less than 200 volts on the plates, a radiation of a little better than .6 amperes was obtained.

The receiving circuit is practically the same as that given in the January issue of THE WIRELESS AGE with two exceptions. An additional step of amplification has been added, and for the antenna coupling M. is substituted a coarse-wire variocoupler the secondary of which is untapped. This was found to be a considerable improvement over the coupler previously described.

A cabinet or panel 15 by 24 inches is ample for the complete receiver while a separate panel 10 by 15 inches may be used for the transmitter. Mica grid condensers are perfectly suited for the grids of the amplifying tubes while the amplifying transformers may be of any standard make.

In designing circuits such as the above for maximum efficiency, use is made of the theory that high frequency currents tend to travel on the surface of conductors. Ordinary copper wire, no matter what the size has but one surface. By actual test the increased efficiency was at least 25 per cent. when the transmitting and receiving instruments, and the terminals both inside and outside the cabinets, were connected with 1/8, No. 20 gauge copper tubing.

With this three-stage amplifying circuit and a Baldwin receiver at the end of a phonograph horn, the head phones may be entirely disposed of and phonographic music and speech be clearly heard across the room.

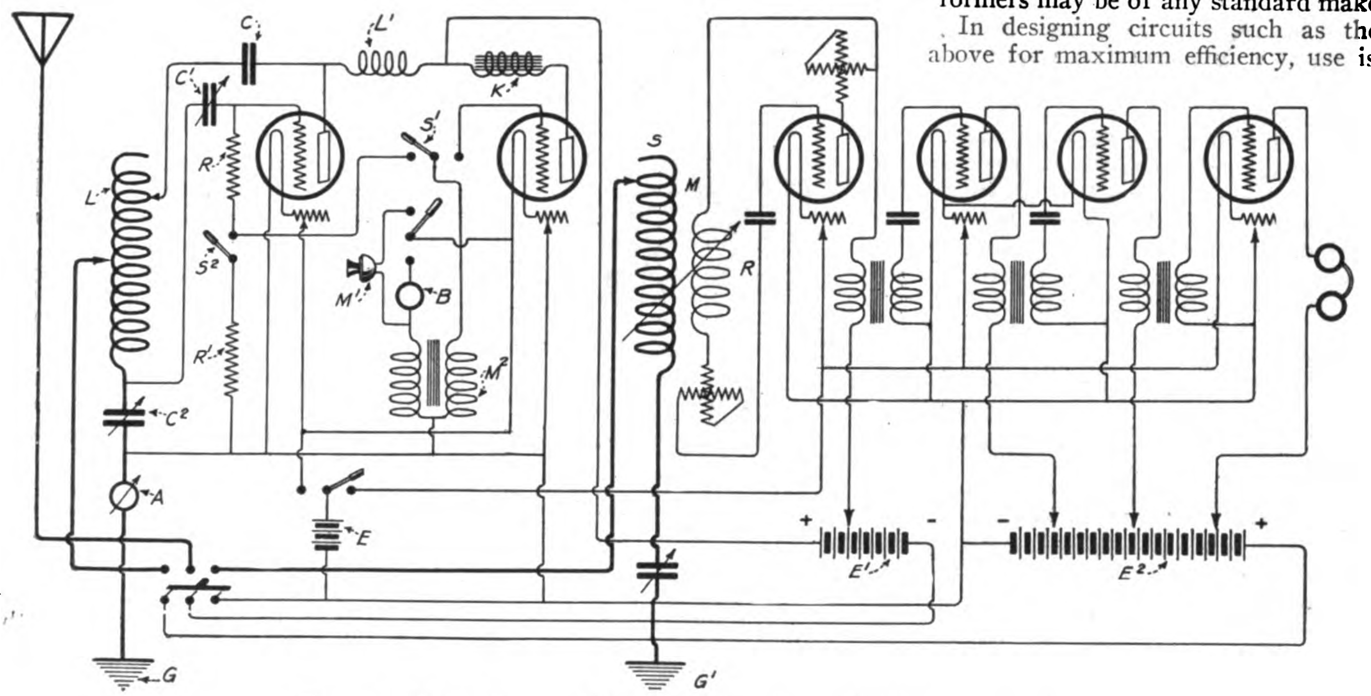


Figure 1—Wiring diagram of the combined receiver and radiophone transmitter

Distribution of Market News by Radiophone

(Continued from page 20)

Sufficient interest has already been expressed in the project to warrant the belief that farmers, bankers, county agents, newspapers, rural telephone exchanges, dealers in farm products, merchants and others, will liberally subscribe to the purchase and maintenance of one of these radiophone outfits in their respective communities, the cost of which would be only trivial when apportioned between the leading citizens of a given community. In fact, the cost for maintaining such a service by individuals is not expected to be prohibitive and the State Marketing Bureau of Missouri is looking forward to encouraging the installation of inexpensive radiophone equipment in thousands of farm homes throughout Missouri.

If this ambitious program is worked out to a success, there will be a new version in Missouri of the old poem entitled "Why Boys Leave the Farm." In addition to receiving valuable market information on wheat, live stock, cotton, fruits and vegetables and other farm products, farmer boys and girls in Missouri will be able to sit in their homes and entertain their friends by listening to a concert given by the Minneapolis Symphony Orchestra at Minneapolis, or to Galli-Curci or Caruso in Chicago or New York.

The first Missouri radio exhibit was at the Centennial State Fair.

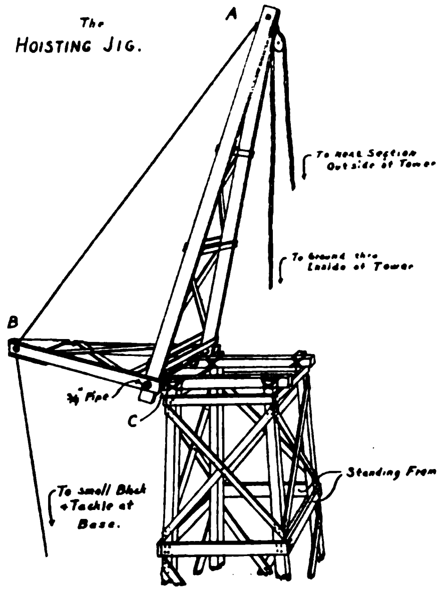
Latticed Wireless Towers for Amateur Stations

A RELATIVELY high wireless pole must be of heavier construction and more rigid than one of average height. Built-up towers of latticed construction fulfill these requirements and are inherently more stable. They cost very little more than a correspondingly rugged pole of the straight type, while their greater service and neater appearance make them more desirable.

The design discussed here was built and erected by the writer for 6ZN in San Fernado, Cal., owned by Messrs. H. B. Denis and C. A. Taylor. It has been in service for several months and has withstood very severe wind strains. The tower is 50 inches square at the base, 10 inches square at the top and 100 feet in height. Detailed dimensions will not be given, but rather an outline of the method of construction and erection involved, as this type presents some new features in both these operations.

Wireless poles should be guyed at shorter intervals progressing toward the top and the sections should be of corresponding lengths; that is, joints should occur at the point where guys are attached. The lowest or base section will be the longest and the others may be shorter by 2 feet intervals, successively.

The exact size of the section at each end should next be determined. This is readily given by the formula:



Design of the hoisting jig and first section of the tower

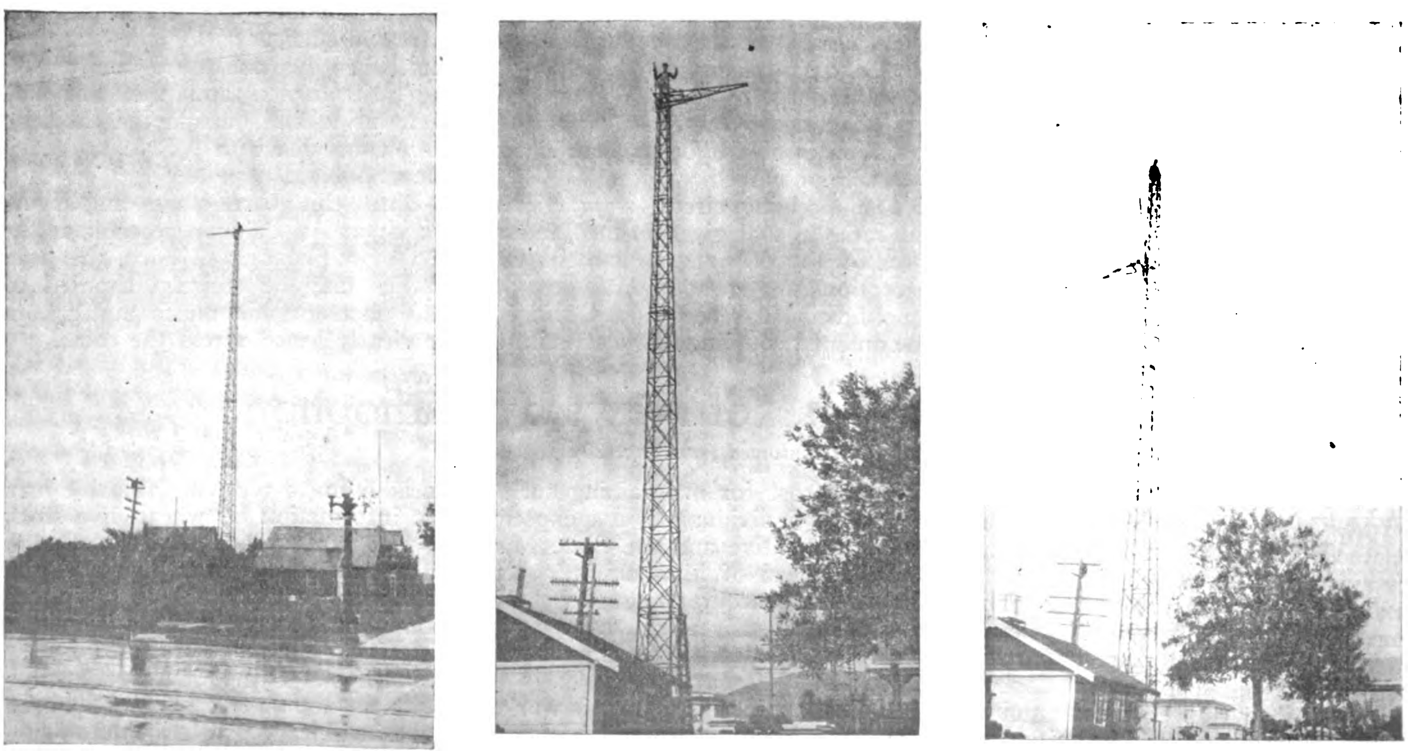
$$S_n = \frac{L\,(S_b - S_t)}{H} + S_t$$

Where

S_n=Width in inches at any point
S_b=Width in inches at base
S_t=Width in inches at top
L=Distance in feet from top
H=Height in feet of tower

Both ends of every section should be framed with 1 inch by 3 inches, 5 inches back from the ends in order to give support while handling and—as will be noted later — to support the hoisting jig. A similar frame of 1 inch by 3 inches should be placed at the upper end of every section except the first two, at the point where the horizontal lath members would normally be placed (see sketch) to serve as "standing room."

The cross members should be placed so that the diagonals intersect at an angle of slightly less than 45 degrees. The vertical side members are 2 x 2 inches in section and should be as straight and clear as possible. Two opposite sides of a given section may be built up separately and these two then combined with similar latticing to form the completed section. The latticing is made from 8-foot lath. These are slightly heavier than the ordinary lath, being ⅜ x 1¼ inches section. A box nail about 1¼ inches in length was used and not less than three were driven at each end. Two nails were driven through the intersection of the diagonal members and clinched. The four struts of any one section should be of exactly the same length and their ends flat and square. Time will be saved by painting or staining the pieces before assembling, but they should be allowed to become thoroughly dry. The legs may be set two feet into the ground in concrete or they may be placed on a smooth concrete base. In the former case the concrete should not be placed until the section



The latticed wireless tower in two stages of construction and in completed form, 100 feet high has been placed in a truly vertical position.

The joints are made by nailing and wiring 2-foot pieces of 1 x 2 inches along the inside of the struts. The two lowest sections joined in this manner may be erected as one piece. The guys should be attached and may be used to pull with from the other side. Heavy pike poles and several strong assistants can easily raise thirty or forty feet high enough so that the pull on the opposite guy will swing it into position. Steps should be firmly nailed to each section at about 2-foot intervals.

The succeeding sections were raised by means of the jig shown in the sketches. The jig should be as light as possible, as it has to be managed by one or perhaps two persons in a rather small space. The side members may be 1 x 3 inches and are latticed much like the tower. The long leg must be two-thirds the length of the longest section to be raised. This is important as the section must be lifted from a point above the middle and must be raised to the level of the section beneath. The shorter leg may be two-thirds the length of the long one. The inner ends of both are bored to fit a ¾ inch pipe and are spread to a distance greater than the top of the section in place. A bolt through A supports a heavy pulley through which a ½-inch rope passes from inside the tower to the new section outside. A heavy wire (No. 10 or two of No. 12) is securely attached at A and is held at B in such a way as to prevent the member B-C from hinging. From B this wire extends down to a small block attached to the legs at the base.

A hinged support is constructed at C by wiring notched pieces of 2 x 2 inches to the pipe inside the side struts. These in turn are firmly attached to the struts. The pipe itself, however, may be securely wired to the two struts on that side and rested on the 1 x 3-inch frame mentioned above. The jig may be laid in a folded position across the top of the tower while the hinge is being attached.

The next section with guy wires in place is set up beside the base under A. The rope from A is attached with a yoke to two struts of this section at a point just above the middle. A light rope or wire should be attached to the same point on the opposite side to guide the section up and prevent it from "going-on-over" when the jig is pulled back as will be seen later.

The jig is then hinged back to the position shown in the sketch; the point A being just over the edge of the tower, and the small block securely tied.

One man should be at the jig where he can assist in lifting and be ready to fasten the joints quickly. Another will be needed to pull from the ground and manage the small block while a third should steady on the guide rope. The section is pulled steadily up to its proper level and the supporting rope tied at the base. The small block is then slowly taken up until the section hangs directly over the tower, and it is then retired. The guide rope is pulled up fairly tight during this process in order to prevent the weight and pull of the jig from pulling the section clear over. A slight lowering of the hoisting rope will allow the new section to rest in position. The guys should be attached and the section plumbed, after which the joints should be made.

The jig may now be supported from the new section and the hinge unfastened, after which it is raised to the top of this section, set up as above and the next section placed in a similar manner.

If a cross arm is desired it may be made from two 1 x 3-inch pieces fastened together at the ends, bowed out in the middle, and latticed the same as the tower; or a plain 2 x 3-inch piece may be used. In either case a shorter cross brace should be fastened at the middle and another in the center projecting vertically to the ends of which suitable bracing wires are attached. The aerial rope should pass from the end of the arm through a pulley inside the tower and down through the center of the tower.

Inductance, Capacity and Resistance of Coils

By Jesse Marsten

IT is well known that no inductance coil is a pure inductance, but possesses, to a greater or less degree, the three properties, inductance, capacity and resistance. The true value of each of these properties is not readily determined unless special means of measurement are at hand. There is a certain amount of confusion involved in the ordinary use of these terms. The true values of the above properties are independent of one another, but the apparent values, as ordinarily understood, are interdependent. Just how these apparent values are qualitatively dependent on one another will be shown below.

If a difference of potential exists between the terminals of an inductance coil, or if a current flows through the coil, then each turn of the coil is at a different electric potential. Lines of electric force therefore stretch between the different turns, and the turns may therefore be considered as the plates of very small condensers. The capacities of these small condensers add up to one large capacity, which is the resultant distributed capacity of the coil. For any given coil this self-capacity is a fixed quantity. The effect which this capacity has, however, is not fixed, but depends upon the wave lengths at which the coil is used. As will be shown, it has a maximum effect at the wave length equal to the natural wave length of the coil, and the effect decreases as this wave length increases. The distributed capacity has the effect of apparently increasing the true inductance of the coil and also the resistance of the coil. In this way, unless these facts are taken into account, measurements of the inductance and resistance of coils by wavemeter resonance methods at or near the natural wavelength of the coil, will give results far in excess of the true values. These quantities should therefore be measured at wavelengths very much higher than that of the coil, or, if possible, bridge methods of measurement should be used.

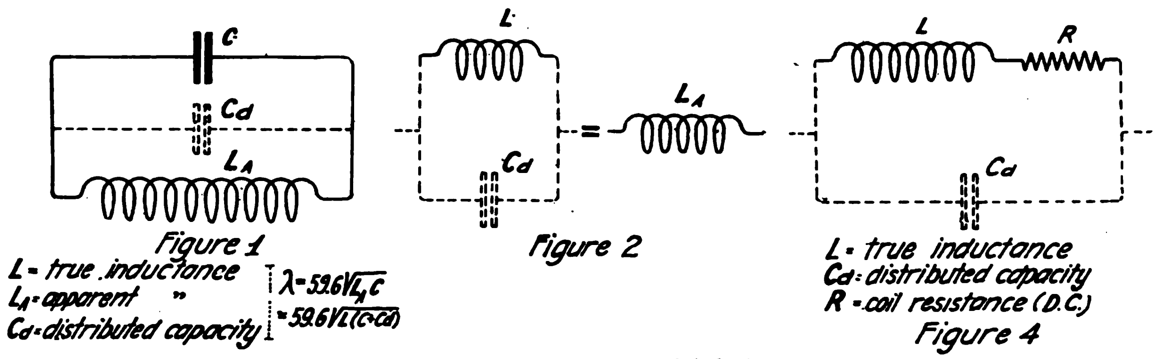
Consider an inductance coil across whose terminals a condenser of known capacity C is connected. This combination, figure 1, will have a definite wave length λ given by the usual formula,

$$\lambda = 59.6\sqrt{L_a C}$$

If this equation is solved for inductance, a value will be derived which is called the inductance of the coil. This value, however, is not the true inductance of the coil, but may be called the apparent inductance L_a. The reason it is the apparent inductance is that the coil has a distributed capacity C_d, which has the effect of increasing the true inductance of the coil. Let L be the true inductance of the coil. Then since the distributed capacity acts as a condenser in parallel with the coil, it is also in parallel with the above condenser C. Consequently the wave length of the coil condenser combination in figure 1 may be written as

$$\lambda = 59.6\sqrt{L(C_d + C)}$$

However, in the ordinary calculations, the effect of the distributed capacity is ignored as in the calculation given above, and the value of inductance derived thus includes the effect of the distributed capacity C_d. Thus the apparent inductance is larger than the true inductance by a certain percentage, and the relationship between



Figures 1, 2, 4—Various types of inductance

apparent and true inductance and distributed capacity is a definite one which can be calculated.

Figure 2 represents a coil of true inductance, L having a distributed capacity C_d, which behaves as a capacity across the coil terminals. This coil is equivalent to a coil having an inductance of L_a, but no capacity, that is, L_a is the apparent inductance of the coil with distributed capacity. Since these coils are equivalent in behavior, their reactances must be equal.

Reactance of coil L_a is ωL_a.

Reactance of coil-condenser is

$$\frac{1}{\dfrac{1}{\omega L} - \dfrac{1}{\dfrac{1}{\omega C_d}}}$$

Setting these two equal to each other, we have

$$\omega L_a = \frac{1}{\dfrac{1}{\omega L} - \dfrac{1}{\dfrac{1}{\omega C_d}}} = \frac{1}{\dfrac{1}{\omega L} - \omega C_d}$$

$$\omega L_a = \frac{\omega L}{1 - \omega^2 L C_d}$$

$$L_a = \frac{L}{1 - \omega^2 L C_d} \quad (A)$$

This result shows that the apparent inductance of a coil is equal to the true inductance times a factor which depends upon the distributed capacity of the coil and the wave length. For any given coil the true inductance and distributed capacity of the coil are fixed. Consequently, if a curve is plotted of apparent inductance against wave length (wave length being varied by placing a variable condenser across the coil terminals and measuring), it will have a shape as shown in figure 3. This figure represents an actual curve taken on a coil, the true inductance of which is 1250 microhenries, distributed capacity 3.9×10^{-6} microfarads.

A consideration of equation A and figure 3 will show the following. If the wave length at which the coil is worked is large compared to the coil fundamental, that is frequency low, then the term $\omega^2 L C_d$ becomes very small compared to unity. Therefore equation (A) becomes

$$L_a = \frac{L}{1 - \omega^2 L C_d} = \frac{L}{1 - 0} \quad [\omega^2 L C_d << 1]$$

$$L_a = L$$

That is, at wave lengths which are high compared to the natural wave length of the coil, the apparent inductance

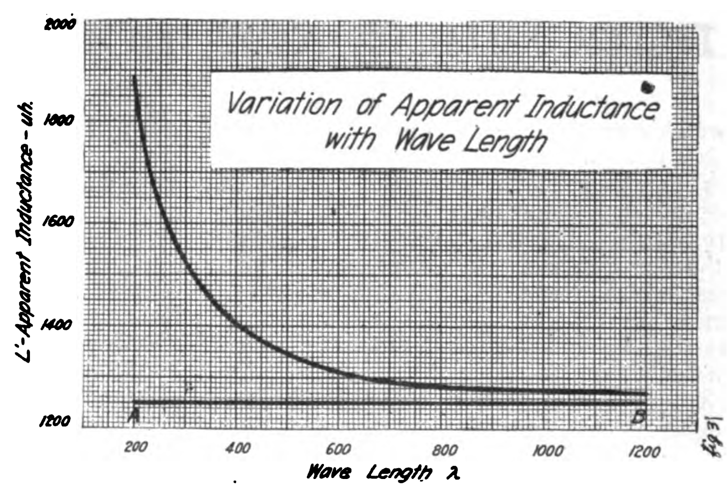


Figure 3—Variation of apparent inductance with wave length

becomes equal to the true inductance. This is shown by the curve in figure 3 becoming horizontal at the higher waves, approaching the horizontal line AB as its limiting lower value, which is that of the true inductance. Thus, at the high waves the effect of the distributed capacity is small and negligible, and it is at these higher waves that the inductance of a coil should be measured—if a resonance method is used—in order to obtain the true value.

From the curve we see that as the wave length becomes smaller and approaches the natural wave length of the coil, the apparent inductance becomes larger and larger. At the natural wave length of the coil (no condenser across the coil terminals), the following relations are true:

$$\omega^2 = \frac{1}{L C_d}$$

$$\omega^2 L C_d = 1$$

$$L_a = \frac{L}{1 - \omega^2 L C_d} = \frac{L}{1 - 1} = \frac{L}{0} = \infty$$

That is, at the natural wave-length of the coil the apparent inductance becomes equal to infinity, which is shown by the curve in figure 3 becoming vertical at the lower wave lengths. Thus at these waves the distributed capacity exerts its maximum influence on the apparent inductance of the coil, and it is therefore evident that if the inductance of a coil is measured near its resonant period, without taking into account its distributed capacity, the value of inductance thus obtained will fall wide of the true value. By measuring the inductance on a bridge this difficulty is avoided.

The value for the apparent inductance derived above is based on the assumption of a negligible coil resistance. If the coil is assumed to have an appreciable resistance, a slightly different result is reached. This will be considered in the discussion of the effect of the distributed capacity on the resistance.

In the same way that the self capacity of the coil influences the apparent inductance, it also influences the apparent resistance of the coil. This can be shown in the following analysis: Figure 4 represents a coil whose true inductance is L, distributed capacity is C_d, and the resistance at zero frequency (direct current) is R. The expression for the impedance of this circuit in terms of complex algebra is

$$Z=\frac{1}{\frac{1}{R+j\omega L}+j\omega C_D}$$

$$=\frac{R+j\omega L}{(1-\omega^2LC_D)+j\omega C_DR}$$

This expression for the impedance can be resolved into two components, one a real component, the other an imaginary component. The real component is the apparent resistance component of the impedance, the imaginary component is the apparent reactance component of the impedance. These are as follows:

Resistance component is

$$\frac{R(1-\omega^2LC_D)+\omega^2LC_DR}{(1-\omega^2LC_D)^2+\omega^2C^2R^2}$$

$$=\frac{R}{(1-\omega^2LC_D)^2+\omega^2C_D^2R^2}=R_A$$

Resistance component is

$$\frac{\omega L(1-\omega^2LC_D)-R^2\omega C_D}{(1-\omega^2LC_D)^2+\omega^2R^2C_D^2}=\omega L_A$$

$$L_A=\frac{L(1-\omega^2LC_D-R^2C_D}{(1-\omega^2LC_D)^2+\omega^2C_D^2R^2} \qquad (B)$$

$$R_A=\frac{R}{(1-\omega^2LC_D)^2+\omega^2C_D^2R^2} \qquad (C)$$

(B) is the apparent inductance, (C) is the apparent resistance. These two equations show how the distributed capacity affects the values of the apparent resistance and inductance of coils. Consider first equation B showing the value of the apparent inductance. At the high wave lengths, where ω is small, the terms containing R become negligible compared to the other terms and we have the same case that was discussed previously, where R was neglected, namely, the apparent inductance approached the true inductance in value. At the lower wave lengths, where ω is large, these terms become of greater importance and can no longer be neglected. Thus when the natural frequency of the coil is approached and

$$\omega^2=\frac{1}{LC_D}$$

the value of the apparent inductance becomes negative. This means that the coil no longer behaves as an inductance, but takes on a property opposed to that of an inductance, namely, the coil behaves as a condenser. Thus the apparent inductance increases, as the wave length decreases, to very high values of inductance until its own natural period is reached, when it becomes negative and acts as a capacity. As the frequency is further increased (wave length decreased) ω becomes larger and larger, and therefore the apparent inductance approaches zero as its limiting value. In practice of course the condition of most interest and importance is that where the frequency is greater than the coil fundamental, and where the apparent inductance is positive and greater than the true inductance.

In the same way it is seen from equation C that the apparent resistance is dependent on the distributed capacity of the coil and the frequency of operation. Since R, L and C_d are fixed for any given coil, a curve can be plotted of wave length against apparent resistance and it will have the appearance of figure 5. Consideration of this curve and equation C show that at the higher waves the apparent resistance approaches the DC resistance of the coil. As the wave length is decreased the resistance becomes larger and larger, reaching its greatest value at the natural frequency of the coil.

It is therefore evident that the distributed capacity influences essentially the circuit constants of a coil, and that it must be taken into account in the design of radio circuits, especially at the low wave lengths. It explains the absorption of energy by dead ends, inaccuracy of measurements at very low waves, and alteration of the frequency of a circuit to which open coils are coupled, and other freak effects which are observed on the very low wave lengths. Distributed capacity in coils is not a readily controllable factor and coils should therefore be designed to have a minimum of capacity and, where possible, used in circuits where an external localized capacity plays the determining part.

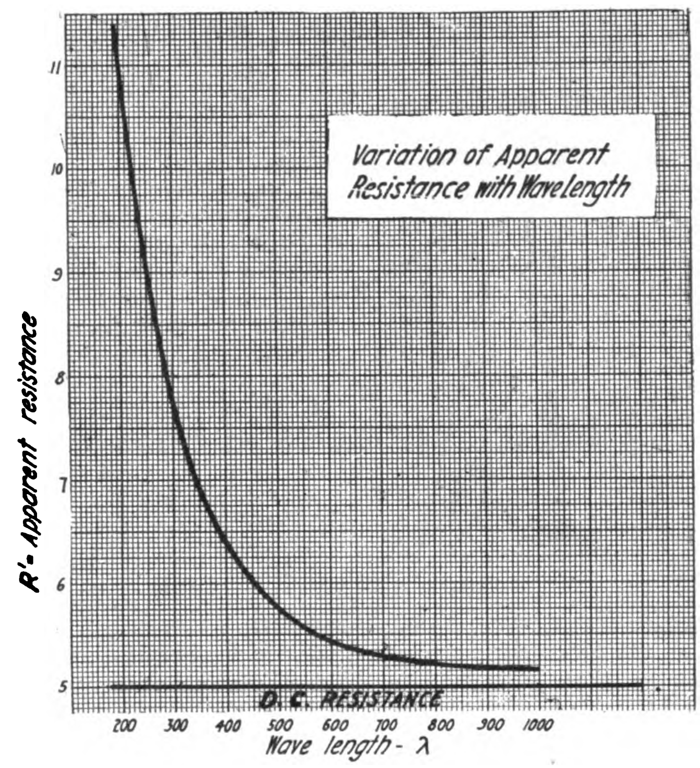


Figure 5—Variation of apparent resistance with wavelength

THE Precision Instrument Company, of Cincinnati, O., of which Harry F. Breckel is Chief Engineer, conducts radiophone concerts every Monday and Wednesday night.

▽ ▽

THE Wireless Association of Atlantic City met on July 7 at its clubrooms, in the Real Estate and Law Building. Election of officers was held. William H. A. Paulus was elected president and William Jordan elected secretary. After the usual business of the club was disposed of a very interesting talk was delivered by Mr. B. Elfman, of Philadelphia.

Among the members present were William Jordan, H. Hemphill, William Haslett, N. M. Davis, W. Bowker, M. McCoy, N. J. Jeffries, B. Elfman.

Mr. N. J. Jeffries gave a very impressive talk on sun spots and their cause and also their effect upon radio communication.

Better Antennas

By D. W. Richardson of 2DH-3XM

I HAVE read with considerable interest many recent articles on antennas, which have appeared in the various magazines, but no one has brought forward all the details that enter into the construction of the most efficient yet least expensive antenna for transmission on short wavelengths. Many of the articles ignore certain factors that result in serious losses by absorption. I shall endeavor in this article to suggest types, which, if approximated in design, will work for the ideal short wave aerial.

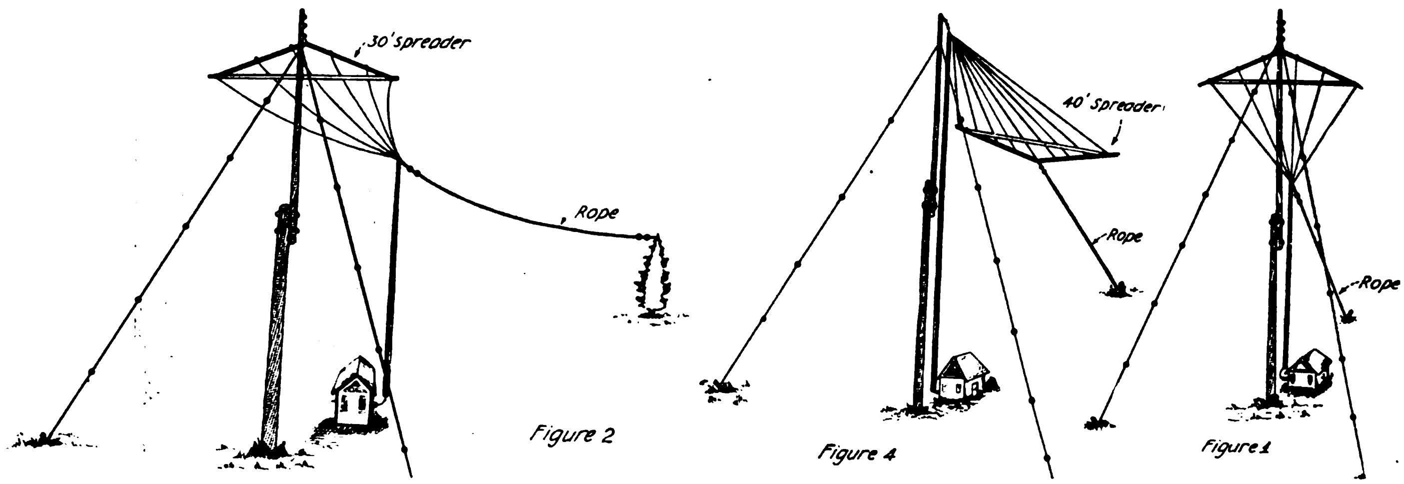
In building his antenna, the experimenter should strive to get the best radiation. The location is an important matter to consider. The antenna should be hung free from trees and other objects, the poles being erected as high as possible on elevated ground. A one-hundred-foot antenna over seventy-foot trees is not as good as a seventy-foot antenna with nothing beneath it. Keep the antenna free, and put it on the top of a hill, using a counterpoise, rather than down in a hollow with trees, although water ground may be available at that point. In the city, the leads and aerial should be kept away from buildings and walls, and if supported by a high building on one end it should be swung at least fifty feet away (see type figure 5).

With the location chosen, we pass to a consideration of the design of the antenna. The designs illustrated are self-explanatory and are only to be followed in principle, as the location permits. If the experimenter is handicapped by lack of space, figure 1 is a very suitable type and becomes practically a vertical fan of the best order, but if the experimenter is in the country, and there is a high tree or building within two or three hundred feet, the fan section may be guyed to such an object, thus raisin the greatest center of capacity in the aerial to a greater height.

The amateur should strive for capacity with a minimum of resistance as high above the ground as possible. The six-wire cage, when four inches in diameter, has the minimum resistance to high frequency currents and the maximum capacity. We need this for our lead-in. The fan has the greatest capacity at the right point, because the nearer the end, the greater the capacity, and the greater will be the paths of return to the earth. These paths of return to the earth being well toward the end of the antenna, the energy in the vertical section will be greater. Thus, unless the experimenter is in a position to put up a one-hundred and sixty-five-foot, four-inch cage, we have nearly approached a perfect antenna for average experimental purposes, where only a seventy, or at most a one-hundred-foot mast, is possible. Remember, it is the vertical section that does the greatest radiating; but, unless there is capacity at the top, the current reading at the top will be O, and the top of the vertical section will not be working.

With this kind of antenna, one pole is nearly as good as two and only half as expensive. Then, too, with one pole there is only the loss by absorption of one mast and two guys, as against twice that much with two masts. If two poles are already up, figure 3 is superior to either of the others and a great improvement on the ordinary "T" type antenna. But it would be better to spend the same time and energy putting up one mast higher than either of the two.

The size of the fan at the top depends on the height of the masts used. For a one-hundred-foot mast, a fan of six thirty-foot wires on a thirty-foot reinforced spreader is the best for practical convenience, although, of course, wires fanning in every direction would be better. If the mast is only seventy feet, the fanning should start at the forty-foot mark and should be eight or ten wires on a forty or forty-five-foot spreader. If it is impossible to construct a pole at least seventy feet high, the type of antenna shown in figure 4 should be used, for that type will have the vertical section as high as possible and yet not make the wavelength run over one hundred and seventy-five meters by having the total length too long. The average wavelength of these antennas will be about one hundred and seventy meters.



Figures 1, 2, 4—Various installations of the fan-type antenna using one mast

The construction of the spreader is optional with the individual. One-piece thirty-foot lengths are rather expensive, so a reinforced spreader made of two-by-twos and two-by-fours is suggested in the models. A thirty-foot gas pipe may even be used; but no matter what kind of a spreader is used, all the wire should be joined at the far end, and any wires holding or bracing the spreader should be made part of the antenna system and soldered. This not only does away with some of the absorption, but also gives more capacity at the end where it is desirable. Do not use a steel cable to hoist the antenna up; use one-inch rope, or three-quarters if the mast is not too high. Do not have any metal or wires in the field of the antenna or use them in the construction, except the two guy wires, which should be broken every twenty feet with insulators. Use rope in guying the antenna.

The mast should be all wood and of the self-supporting flag-pole type. Two sixty-foot poles joined together make a very fine mast and need be guyed only at the top with two guys, the antenna acting as the third guy. These poles may be secured in most localities from the local power or telephone company, or can be purchased from shipyards or dredging companies. With a steel mast the antenna should great effective height, but also the danger of absorption if the building is too near. It is not difficult, with a windlass and one-inch rope, to swing the importance of a good antenna. Height is nearly everything in long distance transmission. It is better to have a half kilowatt set on a one hun-

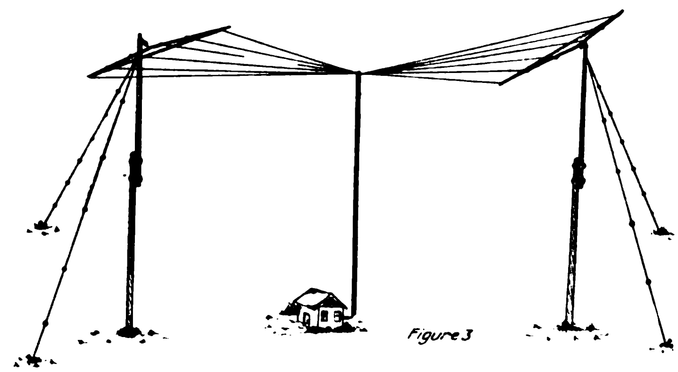


Figure 3—Installation using two masts

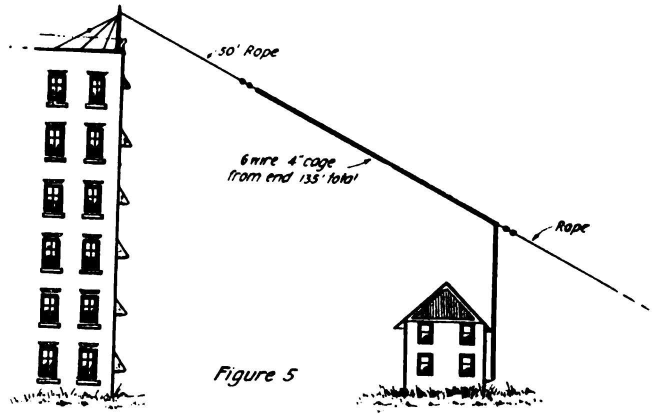


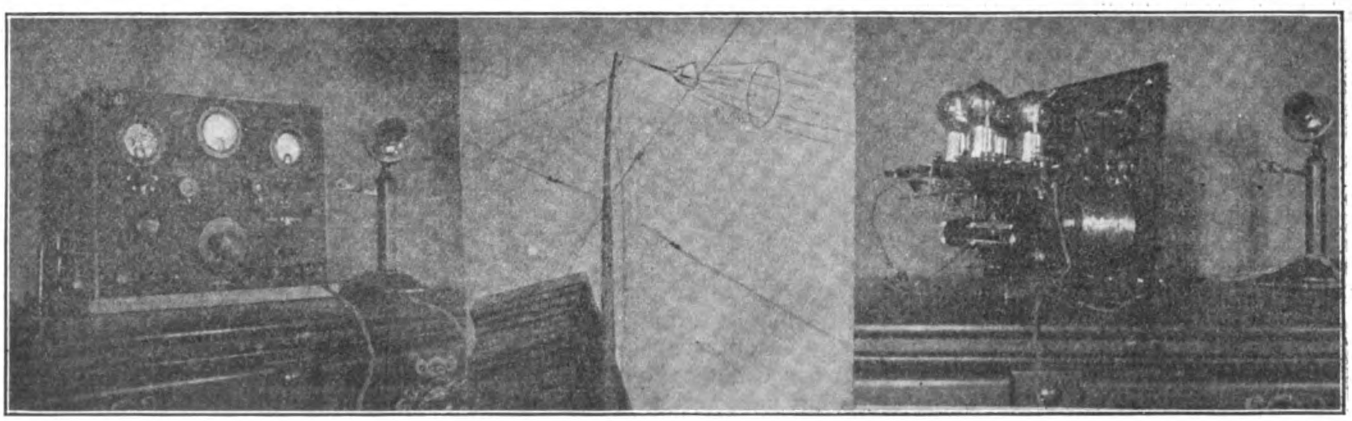
Figure 5—Showing the use of rope guys to prevent absorption

be hung many hundred feet away from it. If a high building is near, put a pole on the high building and hang the aerial just as far away as possible, keeping in mind the desirability of any of the suggested antennas between two trees or supports four hundred feet apart. But be sure the supports are well guyed.

In conclusion, I want to emphasize dred-foot antenna than a one kilowatt set on a fifty-foot antenna. It is also better to build a one-hundred-foot mast than two seventy-five-foot masts.

Construction and Operation of 1AE

THE amateur radio station of Sumner B. Young, 294 Ashmont Street, Dorchester, Mass., is undoubtedly one which contains many novel points of interest to other amateurs. The station employs a 10-watt C.W. transmitter, which is used as a radiophone and a telegraph set. The station has attracted considerable attention among amateurs, especially in the East, by reason of the regularity with which it has been able to work other stations over long distances or over difficult radio territory during the past winter and spring. Signals from 1AE station reported frequently from points in the Middle West, several of them over 600 miles distant, and the station maintained a nightly schedule with 2ZL station, at Valley Stream, L. I., just outside of N. Y. City, for a long time. On the night of March 14 last a story of 1,000 words in connection with the Second District Convention, Boston Traveler, was handled by the two stations, which is remarkably good work considering the difficult conditions for radio which exist between New York and Boston.



The receiving and transmitting set and antenna installation at 1AE

The exceptionally good work done by 1AE station is undoubtedly due to the efficiency of the 10-wire cage antenna as a radiator and seems to establish the fact that the cage antenna will enable an amateur station to get more out of low power and short wave lengths than would be possible with the ordinary flat-top antenna. The 1AE station radiation is parallel to the results obtained by measurement in the case of a 10-wire flat-top antenna, where it was found that 62 per cent. of the antenna current of 30 amperes was flowing in the two outside wires, the other 38 per cent. being divided between the other eight wires.

The station of Mr. Young is located on the third floor of his home at Dorchester, which is situated in an advantageous position at the top of a hill. The far end of the cage antenna is supported by an iron-pipe mast, 45 feet high, mounted on a flat roof 30 feet above the ground. The cage antenna runs on a slight downward angle to the window of the operating room. The ground lead of the set is connected to gas, water, steam and drain pipes, and two tin roofs under the antenna, and also to several large zinc plates buried in the ground.

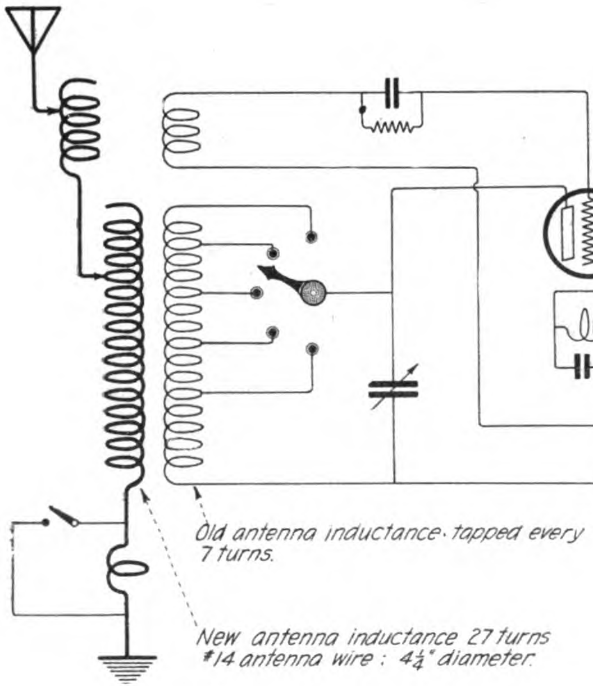


Figure 1—Normal "Radiation," conductive coupling,

240 meters	340 meters
2.4+	1.8 to 2

Normal "Radiation," inductive coupling,

240 meters	340 meters
2.3+	1.6 to 1.8

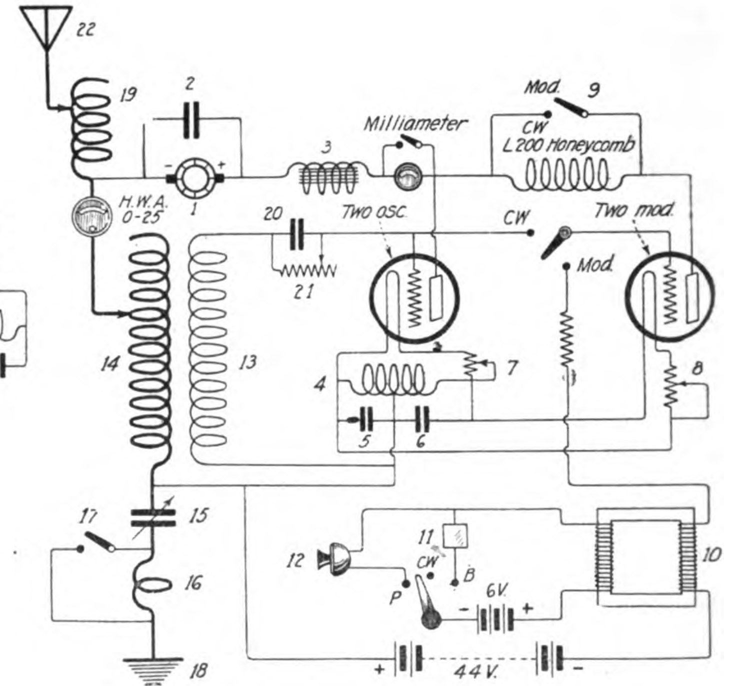


Figure 2—1, 300to 500 volt D.C. generator; 2, 3-mfd. paper condenser; 3, Acme 500-milliamp. choke; 4, Acme 50-watt fil. heating transformer; 5, 6 2-mfd. paper condensers; 7, 8 3-amp. carrying capacity rheostats (now set at zero resis.); 9, air choke, L200 honeycomb; 10, Acme modulation transformer; 11, Century buzzer; 12, W.E. phone; 13, grid tickler coil, 50 turns abt. No. 28, 2" diam.; 14, antenna inductance, 35 turns No. 14 antenna wire, 3" diam.; 15, 43 plate variable; 16, compensating inductance 1½ turns 6" diam.;17, telegraph key; 18, ground made up of pipes, two large tin roofs, buried zinc plates; 19, antenna loading coil (spark set) 15 turns edge-wound copper ribbon 10" diam.; 20, grid condenser .0002 mfd.; 21, variable grid leak 12,500 ohms; 22, 58 foot 10-wire cage 3 ft. diam. sloping 75 ft. to 35 ft.

An Amplifying Transformer for a Dollar

By C. Chandlee Pidgeon

FIRST, get a 2-oz. spool of No. 40 wire. Wire manufacturers list such wire (enameled) at about seventy-five cents for a 2-oz. spool. Next, get a sheet of silicon steel about 1-64 inch thick. This weighs about ½ lb. and costs about 20 cents

Cut forty L shaped pieces according to the dimensions of figure 1. Give these a thin coat of shellac or varnish on each side. Next, roll up a tube of paper—writing or wrapping paper will do—of four or five layers, cementing the layers with shellac or varnish. This tube must be 1¼ inches long and ½ inch in diameter.

The primary is wound on this tube. Solder a flexible lead formed of three or four strands of No. 36 wire to the end of the No. 40 wire and start the winding ⅛ of an inch from one end. Wind twenty layers, each 1 inch long. Insulate each layer with very thin paper. Onion skin writing paper may do, or paper taken from the secondary of an old spark coil. A thin coat of shellac will help hold the paper and wire in place. One layer of paper is sufficient for each layer of wire. After winding twenty layers, cut the wire and solder a flexible lead as at the start. Cover the last layer with paper or tracing linen.

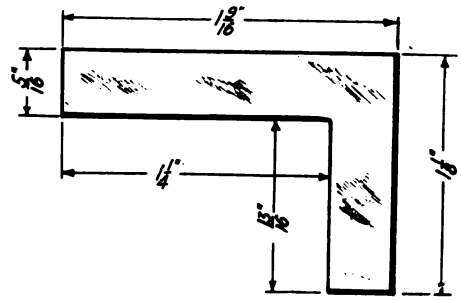


Figure 1—Constructional detail of the transformer

Start the secondary over the insulated covering of the primary after having provided a flexible lead; wind the remainder of the wire in layers 1 inch long, and provide a flexible lead at the end. Wrap the finished coil with a couple of layers of paper, empire cloth or tracing cloth.

The core pieces should now be put in, inserting the long leg of the L alternately into opposite ends of the coil. They may be firmly clamped in the coil by means of a few narrow strips of silicon steel. The portion of the core outside the coil may be clamped between two pieces of angle brass with a piece of bakelite for attaching the binding posts.

A convenient winding device may be made by obtaining a couple of gears having a ratio of three or four to one and putting an arbor in one with an extension ½ inch in diameter and a crank on the other and mounting them on a block of wood or a board. A couple of pulleys and a belt can also be rigged up to do the trick.

From rough calculations, the primary impedance at 1000 cycles should be in the neighborhood of 12,000 ohms and the secondary impedance about 110,000 ohms. The direct current resistance of the primary will be about 1000 ohms and of the secondary about 3000 ohms.

The MONTHLY SERVICE BULLETIN *of the*

NATIONAL AMATEUR WIRELESS ASSOCIATION

Guglielmo Marconi *President* | J. Andrew White *Acting President* | H. L. Welker *Secretary*

Founded to promote the best interest of radio communication among wireless amateurs in America

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HEADQUARTERS: 326 BROADWAY, NEW YORK

THE following ordinance was adopted recently by the City Council, of Salem, Mass.:

"No person shall set up, install or maintain a wireless apparatus connected with or intended to be connected with a current of electricity without first having obtained therefor a permit in writing from the city electrician."

The ordinance, as passed, is of little or no value, in that its provisions cannot be legally enforced. What the ordinance evidently means and what it really says are two entirely different things. As adopted, it covers the installation of receiving instruments, as well as transmitting, for it specifically states that "no person shall set up, install or maintain, a wireless apparatus, connected with, or intended to be connected with, a current of electricity."

This, literally, means that a dealer cannot carry a stock of receiving radio apparatus in a store, because "it is intended to be connected with a current of electricity," namely, a storage battery.

According to the ordinance it would be illegal to do receiving by means of a loop.

The boy scout who might use a bed spring for an antenna and a water pipe for a ground, is outlawed, if he even plans to connect a one-volt dry battery to a crystal detector at some time in the future when his finances will allow it.

The jeweler who uses a receiving set to listen to the time signals from Arlington is also under the ban.

All transmitters are, of course, outlawed, unless a permit has been granted for their operation by the city electrician, who, it is reported, states that he "knows nothing about radio and doesn't want to."

The whole thing seems to be an impossible situation, brought about through lack of co-operation between the parties most concerned. It is, of course, the perogative of the Salem City Council to adopt any regulation it considers essential to the interests of the city, but in adopting any regulation, it should be sure it is right before going ahead. In this case it would seem that it is considerably off the right track. The ordinance as adopted is arbitrary and places autocratic power in the hands of a man "who doesn't know anything about radio and doesn't want to," and does not specify what requirements must be fulfilled in order to obtain authority to operate a radio station, either for transmitting or receiving.

The ordinance will hardly be effective in its present form and should be revised. When this is done two or three practical radio men, who do know something about radio, should be invited in on the revision and their views respected.

▽ ▽

NEW and startling possibilities in radio were demonstrated at a big outing at The Pines on the Harmony route at Pittsburg, Pa., August 6, under the auspices of the Radio Engineering Society of Pittsburgh. The outing was attended by thousands of radio experts and amateurs from Western Pennsylvania, Eastern Ohio and West Virginia, included in the Eight Radio District, of which Pittsburgh is the headquarters city.

Instruments recently invented and as yet unannounced were demonstrated. Amateurs were instructed how to properly erect their stations and install their instruments. Prizes were given for the best performances of amateurs and for new inventions and ideas. A chicken and waffle supper was served at 6 o'clock, and there was dancing till midnight.

Addresses were made by President Coleman of the Radio Engineering Society; Parker Wiggins, vice-president; J. O. Olsen, president of the Radio Electric Company, and other radio experts.

Many retired telegraph operators, electrical workers and others ranging up to 80 years of age attended the outing, sharing their enthusiasm with the boys.

▽ ▽

THE American Radio and Research Corporation, has just announced a reduction of from 20 to 35 per cent. on all its products, bringing the retail price down to the basis on which Amrad products were sold before the war.

▽ ▽

AT a recent meeting of the board of directors of the Radio Club of America it was decided to establish branches, or local sections, of the club, at such places outside of New York as might be desirable. Local sections will be established upon request of ten persons, and a charter will be issued to each local section upon approval of the application by the Board of Direction. The presidents of the local sections will also be automatically elected to membership in the Board of Direction of the club. Communications in connection with organization of local sections should be addressed to Mr. R. H. McMann, Corresponding Secretary, Radio Club of America, 380 Riverside Drive, New York.

▽ ▽

AT the last meeting of the Radio Traffic Association for the season of 1920-1921, held at Browne's Business College, Brooklyn, N. Y., on June 17, the following officers were elected for the coming season:

Ernest K. Seyd, chairman; Ferd. C. W. Thiede, first vice chairman; Uda B. Ross, second vice chairman; Louis J. Wadsworth, corresponding secretary; William E. Garity, recording secretary; Oscar Oehman, financial secretary; John P. Holder, treasurer; Clifford J. Goette, traffic manager; Frank A. Maher, editor "Radio Traffic Bulletin"; Frank M. Squire, associate editor.

The association has grown to a membership of 115 and is one of the strongest amateur radio organizations in the New York district.

For several years the club has issued a semi-monthly paper, the "Radio Traffic Bulletin." Associations publishing similar papers are invited to exchange bulletins, as it is believed an exchange of ideas in this manner may prove of mutual benefit to the members, as well as their respective clubs. Communications of this nature should be addressed to Frank A. Maher, editor, 4903 Sixth Avenue, Brooklyn, N. Y.

Amateurs who may be interested in the activities of the Radio Traffic Association are invited to write to Louis J. Wadsworth, Corresponding Secretary, 174 Alabama Avenue, Brooklyn, N. Y.

▽ ▽

THE newly formed Utica Radio Club, Utica, N. Y., met for the first time at the home of Elmer Smith, 306 Lansing Street, July 8. Elmer Smith was elected president; Edward Weiss, vice president; William Druber, secretary and treasurer; Howard Kohler and Charles Schrader, committee on membership.

A radio concert was given from the station owned and operated by Edward Weiss, vice president and traffic manager of the club and Chief Operator G. L. Gates, for the benefit of the club on July 12. The concert was given for the purpose of interesting licensed amateurs of Utica and vicinity in boosting the membership of the club.

The set used in the concert is owned jointly by Mr. Weiss and Mr. Gates, the installation of which cost approximately $200. The operators stated that there was considerable static, but they managed to entertain over 75 local amateurs, while about 300 out-of-town operators listened in as the music was flashed through the air. It is expected that a concert will be held every week.

▽ ▽

THE Liberty Radio Club of Cumberland, Md., which has its plant in the tower of the Fairview Hotel, Baltimore and Front Streets, is installing a new transmitting set, of the largest power the government will allow amateurs to use. It is expected to transmit 500 miles. Amplifiers are being added to the receiving set. The club has been receiving government time and weather reports, and has been picking up messages from New York and other places. It received the news of the Dempsey-Carpentier fight from the Hoboken station of the Radio Corporation of America. The club has a number of improvements in prospect which will add to its efficiency. Percy C. Clise is president and Melvin Dean, secretary and treasurer.

▽ ▽

AT a recent meeting of the Executive Radio Council of the Second District the following amendment to the constitution was adopted:

The officers of the Council shall be an Honorary Chairman, who shall be the Radio Inspector or his Assistant of this District, Chairman, Vice Chairman, Corresponding Secretary, Recording Secretary, Treasurer, and Traffic Supervisor.

This action made Mr. Edwin A. Beane, Honorary Chairman, and left the office of

Chairman open. At the regular meeting held July 12, 1921, Mr. J. O. Smith was elected chairman to be the active head of the organization. The Council feels that Mr. J. O. Smith, with his experience as Traffic Manager of the A. R. R. L., and his thorough knowledge of amateur radio in general, will prove an excellent leader. The other officers are as follows: John Di Blasi, vice chairman; Ferd. C. W. Thiede, corresponding secretary; Murray Blum, recording secretary; Carl E. Trube, treasurer, and Clifford J. Goette, traffic supervisor.

The Council at the present time represents the following prominent clubs of the Second District: Radio Club of America, Armour Villa Radio Club, Bronxville, N. Y.; Bloomfield Radio Club, Bloomfield, N. J.; Radio Club of the Bronx, New York City; Fordham Radio Club, New York City; Hill City Radio Club, Summit, N. J.; The Radio Club, Irvington, N. J.; Radio Club of Long Island; North Jersey Radio Associaton; Radio Traffic Association, Brooklyn, N. Y.; Ridgewood Radio Club, Ridgewood, N. J.; Rutherford Radio Club, Rutherford, N. J.; Stuyvesant Radio Club, New York City; Technical Association Licensed Operators, New York City; Westfield Radio Association, Westfield, N. J.; Y. M. C. A. Radio Club, New York City; Yonkers Radio Council, Yonkers, N. Y.

The Council has adjourned for the summer and will hold its first fall meeting on September 14. In the meantime the Traffic Committee of which Mr. Clifford J. Goette is chairman, will prepare a set of rules and regulations, to be passed upon at the first meeting, and distributed to all the amateurs of the Second District. The Council feels that perfect co-operation can be obtained from all, which no doubt will result in the speedy improvement of traffic conditions in the New York District.

Association of the Second District that have not yet joined the Council are urged to do so at once. Communications should be addressed to Ferd. C. W. Thiede, Corresponding Secretary, 486 Decatur Street, Brooklyn, N. Y.

▽ ▽

THE first radio club to be formed primarily for the reception of the daily market reports by radio of the Department of Agriculture is now busy in Ocean County, N. J., where forty farm boys and girls of the county are constructing wireless outfits for the purpose of receiving wireless market news from the bureau of markets, and posting the news for the benefit of the farmers of the county. A number of outfits are already in operation and the farm market quotations are posted daily in the local post offices, stores and other central places.

▽ ▽

THE Naval Pigeon Service of the United States Navy Department has been placed under the jurisdiction of the Director of Naval Communications.

▽ ▽

THE Navy Department has begun the installation of a Type CF-4000 radiophone set, with a range of 150 miles, at South San Francisco. This radiophone set is to be connected to the San Francisco telephone exchange and when the installation is completed it will be possible to talk between ships and any telephone connected with the regular land system.

▽ ▽

THE Fordham Radio Club has heretofore been functioning as an institution dealing with radio work in general, while those of the club who specialized in continuous wave work organized a C.W. chapter, and were so chartered by the club. The interest in C.W., however, has grown to such proportions, and the membership has increased so rapidly, that it became necessary to change the system. The club has therefore been reorganized as a C.W. club, with a "spark" chapter for those who are not yet C.W. members.

As a C.W. club, we have adopted a standard transmitter that all C.W. operators use. At a recent meeting a paper was read in which the details of construction and theory of operation were fully described. The adoption of a standard set was found to be of material aid in converting the spark men into C.W. operators, and in solving the problems always encountered in C.W. work.

At the present time plans are being formed for the erection of clubrooms where a C.W. set will be installed, so that the club can take an active part in relay work.

Local traffic is being handled by a number of the phone operators throughout the district, while the greatest part of the DX traffic is handled on several nightly schedules by 2XK.

The club intends to begin the publication of a club periodical in the near future, containing a permanent record of the proceedings of the club, and enough technical and humorous matter to make it interesting to the radio fraternity at large.

Pending the completion of permanent quarters, meetings are being held at the home of Mr. L. M. Cockaday, 2XK, 2674 Bailey Avenue, Bronx, every Monday evening at 8 o'clock. Anyone desiring to join should attend a meeting at that address and make formal application for membership. Communications on general matters should be addressed to the secretary, Mr. William Weller, 2156 Webster Avenue, Bronx, New York City.

▽ ▽

FOR the past year or two the United States Army Air Service forces and those of the United States Forestry Service have been co-operating in the employment of radio in an endeavor to reduce the damage by fire in the great forests of the West and Northwest. Airplanes equipped with radio have been employed to patrol certain sections, but even with their help many fires have started and gained such headway before the fire-fighting forces could be summoned that extensive damage to the forests, and, frequently, loss of life, have resulted.

In an effort to make the protective measures more effective, through a saving of time in relaying reports of fires to the headquarters of the various sections, amateur radio operators are to be asked to volunteer for service during the time of year when the fire hazard is greatest—from June to September, inclusive.

The following letter has been sent to all amateurs of the districts most concerned by Major B. M. Atkinson, commanding officer of Mather Field, Mills, Calif., and gives amateur radio operators another opportunity to demonstrate their ability and great usefulness in an emergency:

"One of the principal duties of the Forestry Service is to prevent, as far as possible, the destruction of valuable timber by fire, and during the dry summer season the time of almost the entire field personnel, as well as of a large number of extra men, is devoted to this work. The forests are very inflammable, so that fires are easily started from such sources as lightning, careless campers, hunters and smokers, and also by sparks from railroad locomotives. The key to the whole situation is to find the fires, and put them out while they are small, for when a forest fire gets beyond control, it does tremendous damage to timber and other property, is costly to extinguish and may even result in the loss of life. At a number of stragetic points forest supervisors are located who are in charge of the national forests and the district rangers, who are located at central points wthin their respective districts. These district rangers are the men on the "fighting line." They are assisted by guards, patrolmen and firemen and by lookouts stationed on high peaks. With all of these they are connected by telephone, and are prepared to take a crew of fire-fighters immediatly to any point where a fire may be reported, but they have no means of receiving reports direct from airplanes of fires discovered in that manner. It is, therefore, planned to employ amateur radio operators, who will be stationed at Forestry Headquarters, to receive messages from airplanes and deliver them to the supervisor's offices, from which they will be telephoned immediately to the district rangers, and in this way it is believed the fire hazard will be greatly reduced.

▽ ▽

CANADIAN Wireless says that an amateur they know of has converted an Ouija board into a panel for a receiving set and everybody is waiting with interest to see what will happen.

▽ ▽

AN amateur of Montreal recently wrote to Canadian Wireless and asked the purpose of an "osculation" transformer.

▽ ▽

THE broadcasting of police information by radio, which has resulted in the recovery of stolen automobiles and the apprehension of criminals by the aid of amateur radio operators at various points throughout the country, has again demonstrated its usefulness at Boston, where a stolen automobile was recovered and restored to its owner through the efforts of two amateur operators. The automobile, a Peerless Roadster, owned by Arthur Vinton of Highland Avenue, Somerville, was stolen near Harvard Square, Boston, last week. A wireless flash announcing the theft was broadcasted, in accordance with arrangements made with the Boston Police Department, and picked up by radio amateurs within a hundred mile radius.

Early Sunday morning Charles Barney, age 18, of 20 Breamore Road, Newton, assistant scout master, was walking near his home on Hunnewell Avenue, Newton, when he discovered a car similar to the description sent out by wireless. The young man hurried home, secured the detailed data, registration, engine, serial and model numbers, which his brother Edwin had received with his wireless outfit, and, finding that his information checked with that of the automobile, which was empty, promptly notified the Cambridge police. Two patrolmen answered the call and the machine was restored to its owner.

The recovery of the machine marks the first important result secured by the Boston Police Department in sending out wireless broadcasts each night in connection with missing automobiles, men wanted for misdemeanors, missing persons, etc.

Reports are telephoned from police headquarters at Pemberton Square at the close of each day to the radio station at the factory of the American Radio and Research Corporation at Medford Hillside. The reports are then flashed by both wireless telephone and telegraph. When sending out by telegraph the messages are sent very slowly at ten words a minute and are repeated three times to insure their reception. Wireless operators within a radius of one hundred miles pick up the reports and then are asked to refer them to the local police.

Returns have shown, according to the police, that the reports are widely distributed. Records are at hand which show that this has ben done as far west as Fitchburg and as far east as Marion. Reports are sent out from headquarters at Pemberton Square at 7:40 P. M. and are broadcasted by wireless at 8 o'clock.

Distance Records

WHEN signals from a radio station are heard at unusual distances it is proof that the station is an efficient radiator of energy. The location, apparatus, construction and operation of an efficient station is therefore, of great interest to all amateurs and THE WIRELESS AGE wants this information.

You are therefore requested to send us a monthly list of distant amateur stations heard, which will be published regularly. Report only stations located 200 miles or more distant from your station. Arrange the calls by districts (each district a paragraph), and the calls in alphabetical order.

In a second group arrange the stations you hear regularly by district, including only two or three stations, to determine consistency of performance.

State whether the stations heard use a spark or C.W. transmitter. THE WIRELESS AGE will follow the records closely and whenever possible will secure and print for your benefit and the benefit of amateurs in general detailed descriptions in illustrated articles on the stations consistently heard over long distances.

If a station is an efficient radiator of energy, it should be given proper credit in the history of amateur progress, and at the same time you will be given credit for efficiency in receiving in having heard it, as your name, address and call letters will be published with all lists submitted by you.—THE EDITOR.

Ravings of a Wireless Fan

Your crystal in good adjustment;
And you hear a station or two,
Then someone hits your table.
Did it ever happen to you?

Then for a half hour or so
You hunt all over the lot,
Your patience is almost exhausted
In search of a sensitive spot.

There! now that is a good one.
Isn't that music just fine!
It stopped! now what is the matter?
Oh heck! it is half past nine.

Oh, well, let's try for Arlington,
She'll come in just a bit before ten.
We can catch the time and weather report,
If the crystal stays right until then.

Now, there! that's Arlington's wave length.
She's coming in fine tonight,
The addition of that new condenser
Makes the set work just about right.

But I'm tired of this crystal business,
And in a few days or so
I'll have a three-bulb outfit.
Then, boys, just watch us go!

—PETER DEETS.

Prize Contest Announcement

The subject for the new prize contest of our year-round series is :

Construction of a Wavemeter for Tuning C.W. Transmitters

CLOSING DATE :: :: OCTOBER 1, 1921

Contestants are requested to submit articles at the earliest practical date.

Prize winning articles will appear in the December issue.

All manuscripts should be addressed to the CONTEST EDITOR of THE WIRELESS AGE.

A C.W. Wavemeter is an absolute necessity to the amateur station of today and with this idea in mind the construction should be made as simple as possible. Wave length range 150 *to* 450 *meters.*

PRIZE CONTEST CONDITIONS—Manuscripts on the subject announced above are judged by the Editors of THE WIRELESS AGE from the viewpoint of the ingeniousness of the idea presented, its practicability and general utility, originality and clearness in description. Literary ability is not needed, but neatness in manuscript and drawing is taken into account. Finished drawings are not required, sketches will do. Contest is open to everybody. The closing date is given in the above announcement. THE WIRELESS AGE will award the following prizes: First Prize $10.00; Second Prize, $5.00; Third Prize, $3.00, *in addition to the regular space rate paid for technical articles.*

FEDERAL prohibition agents at Atlantic City believe liquor smugglers on Jersey coasts are now using seaplanes from ships equipped with radio lying outside the three-mile limit. The rum-running has continued in such measure, despite the large fleet of surface patrol vessels, that the seaplane and radio theory seems the only explanation. In a raid on a palatial houseboat in Great Bay, eight miles from here, two seaplanes were reported to have removed a portion of the liquor cargo before the arrival of revenue and coast guard men. The houseboat, which was deserted, was found to have an elaborate wireless equipment.

AT a meeting of the Rubber City Radio Club, Akron, O., held at the Y. M. C. A., it was necessary to hold an election of officers. R. F. Palmer, 8DE, resigned as traffic manager because he is leaving Akron for the summer, and R. W. French, 8UQ, resigned as secretary, intending to go to college in the fall. Myron Gould, 8GE, the president of the club, was unanimously elected traffic manager, and J. D. Crawford was elected secretary.

Mr. Gould spoke to the club for a short time, and urged all members to be present at the meetings during the remainder of the summer, even if their interest lags because of the bad weather for radio.

Preparation of Technical Mss.

BEFORE starting scientific work find out exactly what has already been published on the subject. Every article should be carefully planned and the sub-divisions made clear. The manuscript should be ready for the printer, preferably typewritten on one side of the paper; bad handwriting and subsequent alterations add considerably to the cost. Keep the article within the narrowest limits, avoid foreign words and choose the most careful English; omit lengthy introductions, developments, and unnecessary calculations. As far as possible replace lengthy descriptions by diagrams. Insert all scales and figures in draughtsman's style. Brief particulars under the diagrams increase their value and replace long descriptions. Diagrams should only contain the essentials; omit secondary details or well-known matter. If already published elsewhere give references. Carefully observe editorial suggestions for shortening the article. Generally speaking, the shorter the article the better its effect. Never offer an article to a second journal until the first one has declined it. Any second publication should contain only short abstracts from the main publication.—The Radio Review.

Queries Answered

ANSWERS will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.

Positively no questions answered by mail.

W. A. M., Avon Lake, Ohio.

Q. 1. What chokes and condensers would you advise for a filter circuit for rectified 25-cycle for phone work?

Ans. 1. Your chokes should be of from 1½ to 2 henries and your condensers should be from 1½ to 2 mfds.

Q. 2. How can I find the inductance of the following choke? Close core, cross-section 1 inch x 1 inch, outside dimensions 4¼ inches x 4¾ inches; winding 3000 turns on each long leg No. 24 D.C.C.

Ans. 2. The formulae with complete directions for their utilization occupies so much space it is impossible for us to publish them here.

Q. 3. Can you give a formula for figuring inductance (of above), or tell me where I can find one?

Ans. 3. At the very best, formulæ for the measurement of inductance are not very accurate as they depend upon too many empirical quantities. We would suggest that you measure the impedance and the resistance and then the inductance can be calculated from the formula

$$Z^2=R^2+X^2$$

where Z=impedance
X=inductance
R=resistance

If, however, you wish to calculate this inductance we would refer you to article 177 of Practical Wireless Telegraphy, by E. E. Bucher. We would also refer you to the June, 1921, issue of THE WIRELESS AGE, pages 18 and 19.

A. G. C., St. Louis, Mo.

Q. 1. Please give me the best hook-up for long wave stations using primary and secondary and tickler.

Ans. 1. For this 3-coil circuit we refer you to the April 1921 issue of THE WIRELESS AGE, page 15.

Q. 2. Please give me the dimensions for an ærial that will have a natural wavelength of about 150 or 200 meters. The aerial is to be elevated by two 40-foot iron pipes. There is a tin roof about 150 feet from the poles, and some high trees, and it will be 45 degrees from electric light wires.

Ans. 2. For a T type antenna 180 meters natural period use 4 wires 190 feet long. For an inverted L type antenna 180 meters natural period use 4 wires 105 feet long. Both antennae to be 40 feet from the ground.

Q. 3. Will this aerial respond to foreign long wave stations without an amplifier?

Ans. 3. This depends entirely upon the care taken in building and adjusting your apparatus. We do not believe it possible in your location.

Q. 4. Will a single coil set get the foreign stations in above conditions without amplifiers using De Forest hook-up?

Ans. 4. The answer to this question is the same as to the question above.

* * *

W. L., Paterson, N. J.

Q. 1. On page 19 of your June issue under numerical example number two you have $\frac{3260}{216 \times 625} = 0.02771$ is this correct?

Ans. 1. It is quite evident this calculation should have read: $\frac{3260}{135,000} = 0.0241$.

Q. 2. I wish to construct electro magnets suitable for 60-cycle and about 500 ohms. What is the formula? How much wire? Size of wire? Size of iron, etc. I constructed such a rectifier using 500-ohm coils, built it does not turn, simply buzzes and demagnetizes the steel bar of the rotor. Where can I buy permanent magnets?

Ans. 2. It would be much more satisfactory for you to secure a pair of 1,000 ohm ringer magnets from an old telephone. You can probably secure them from some dealer in second hand electrical supplies.

Q. 3. In your April issue, pages 22 and 23, on "Construction of a Synchronous Rectifier" by Thomas W. Benson, could you give me Mr. Benson's address?

Ans. 3. We would be glad to forward any correspondence that you may wish to send to Mr. Thomas Benson. Address it care of THE WIRELESS AGE.

Q. 4. I would like to study electrical calculations (I understand practical mathematics.) I would like to know how to calculate A.C. magnets of all kinds. How much wire, etc., to use. Same for a D.C. magnet.

Ans. 4. For a text to study electrical calculations we would refer you to any standard text book on direct current.

Q. 5. I understand inductances from your June issue, but I believe there are other things that you may have to take into consideration. In wiring a coil sometimes it is best to use a large size wire, etc. Also like to calculate A.C. in general, particularly where it pertains to radio. Could you recommend a reasonable book which you think would help me?

Ans. 5. For a good book that will give you all you should need to know about the various electrical quantities which pertain to radio apparatus designs, we would suggest that you procure a copy of the "Wireless Experimenter's Manual," by E. E. Bucher. The price of this book is $2.25 per copy.

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3 R. C. U.R. 542 Porcelain Tube Sockets,	3.00
1 R. C. Grid Leak and Mounting,	1.25
3 Paragon Rheostats, @ $1.75,	5.25
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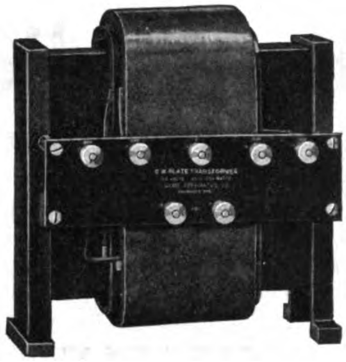

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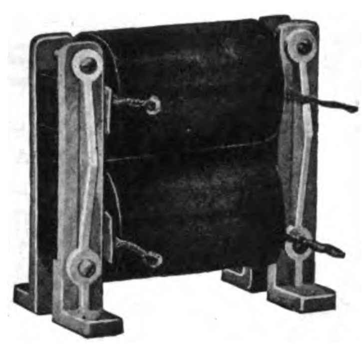

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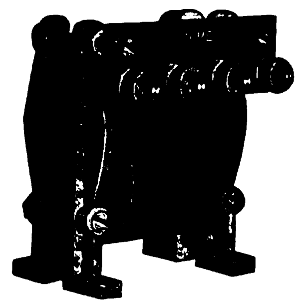

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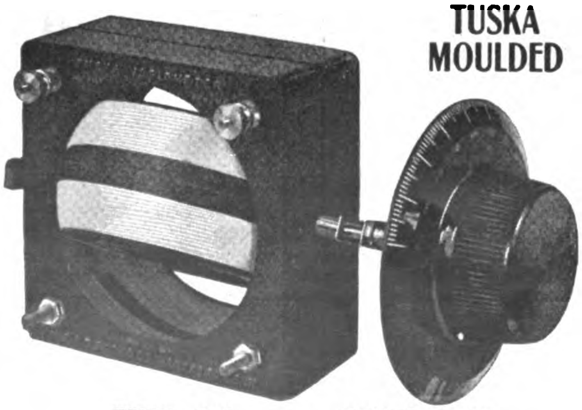

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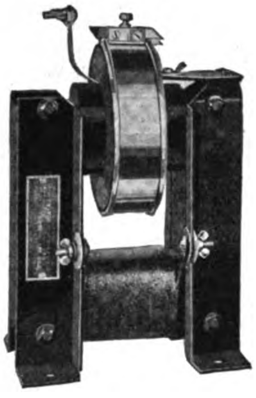

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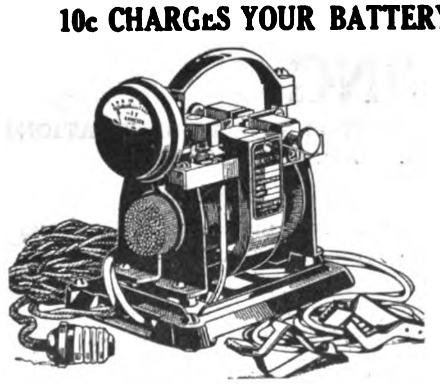

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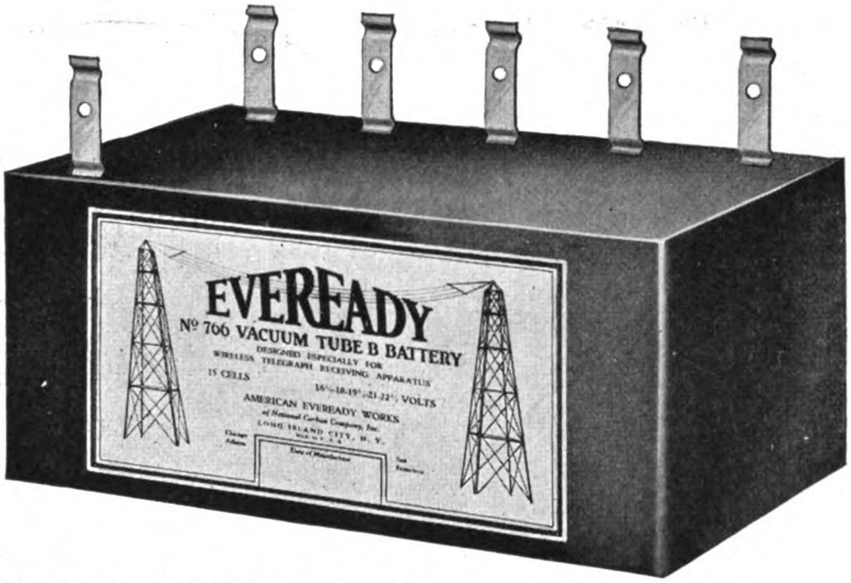

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