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RADIO NEWS

REG. U. S. PAT. OFF.

25 Cents
January
1924
Over 200 Illustrations

Edited by H. GERNSBACK

THE RADIO POLICE CAR

See Page 870

IN THIS ISSUE

THE 100% WIRELESS MAGAZINE

CIRCULATION LARGER THAN ANY OTHER RADIO PUBLICATION

Cunningham

RADIO TUBES

The Heart of your Receiving Set

IN the case of all living things the heart is the most vital organ. Weaken, injure or destroy the heart and life is accordingly weakened, endangered or destroyed.

In a radio receiving set the tube is analogous to the heart. Remove it entirely and the set will cease to function. Use an inferior tube and the results will be inefficient and generally not pleasing to listen to.

In living things a perfect heart does not always insure a healthy body, but on the other hand it is indispensable. The same is true of the radio receiving set. It may be perfect in every detail but unless the best tubes are used the results will not be perfect.

Cunningham Radio Tubes were developed in the great Research Laboratories of the General Electric Co., and are now being made in that company's modern and mammoth factories under the supervision of highly skilled engineers.

Better tubes are not attainable. There is a model specially adapted to every set, every circuit and every socket used today. Every radio dealer can supply you with Cunningham tubes. Buy them for replacements. Insist that they be included when purchasing a new set—and you will know that your receiving set has a perfect heart.

The care and operation of each model of Receiving Tube is fully explained in our new 40-page "Radio Tube Data Book." Copies may be obtained by sending ten cents to our San Francisco office.

Cunningham Radio Tubes	
C-301A—6 Volts ¼ amp. Amplifier	$6.50
C-299—3 Volts .06 amp. Dry Battery Det. & Amp.	6.50
C-300—6 Volts Gas Content Detector	5.00
C-11—1.1 Volts .25 amp. Dry Battery Det. and Amp. Special Base	6.50
C-12—Similar to C-11 with standard base	6.50

E. T. Cunningham Inc.

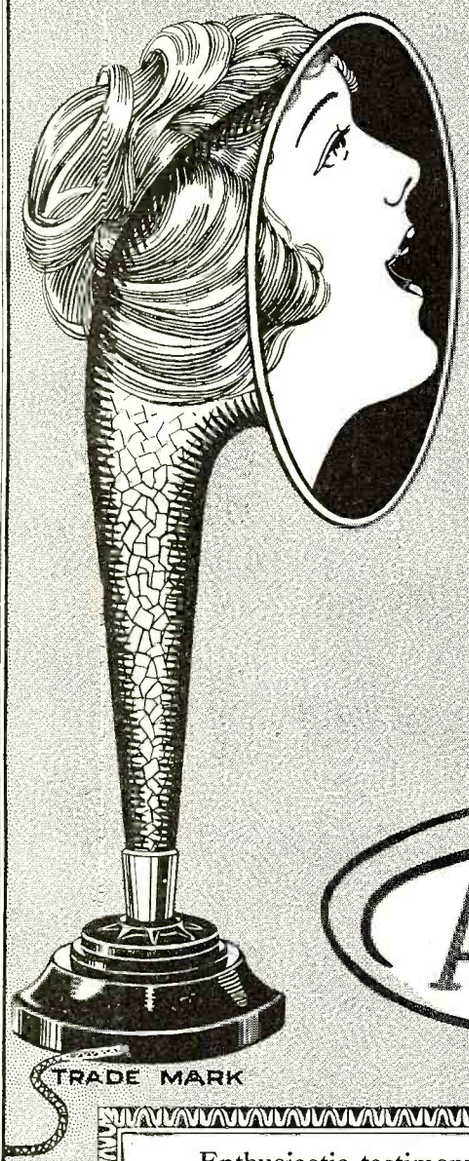
Home Office: 182 Second St. San Francisco, Calif.

154 West Lake Street Chicago, Illinois

30 Church Street New York City, N. Y.

PATENT NOTICE

Cunningham tubes are covered by patents dated 11-7-05, 1-15-07, 2-18-08, and others issued and pending. Licensed for amateur, experimental and entertainment use in radio communication. Any other use will be an infringement.



Atlas LOUD SPEAKER

Natural Re-Production

PARKIN MANUFACTURING CO.
Established in 1914
Radio Manufacturers
Builders of Parkin

SAN RAFAEL, CALIFORNIA October 30, 1923.

Multiple Elec. Products Co. Inc.,
Leo J. Meyberg Co., Representatives,
973 Mission St.,
San Francisco, Calif.

Gentlemen:

It will probably interest you to hear of a record we have obtained with the Atlas Loud Speaker for which you are the agents. We manufacture a set in which we mount the Loud Speaker in the cabinet, and preparatory to giving a radio dance at Solinas, we tested this set out on the bay, could hear every word rowing out about half a mile on the bay, could hear every word of KPO'S concert above the noise of the ocean.

The following day, Mrs. Wm. McKeeman who lives on the opposite shore of the bay, 1½ miles away direct line, informed us that she and her family could hear the program.

We have no doubt that this is a record for any loud speaker of this type. Three stages of Radio-frequency amplification were used with C-301A tubes with 90 volts on the plate.

Yours very truly,

PARKIN MFG. CO.
Per John Parkin

A Record!

Enthusiastic testimony straight from an impartial authority. Re-PRODUCTION is a *fact*. There is no difference between the *Atlas Re-PRODUCTION* and the actual music in the broadcasting studio. The delicate overtones which give music its roundness, resonance and timbre, are faithfully re-born through the modern magic of the patented "double diaphragm." This extremely responsive device is adjustable to the exact requirements of your set and individual receiving conditions.

Write for Illustrated Booklet F
Containing Suggestions for Better Reception
and List of Broadcasting Stations.

Letters from Users Requested.

Make Your Own Loud Speaker with THE ATLAS UNIT, with phonograph attachment **$13.50**
(Unit without attachment $12.50)

Sole Canadian Distributors
The Marconi Wireless Telegraph Company of Canada, Limited, Montreal, Canada.

Hear the Atlas Loud Speaker

Ask your dealer for a demonstration. Submit it to any reasonable test. Get the proof NOW.

LIST PRICE COMPLETE

$25

Multiple Electric Products Co. Inc.

ORANGE ST., RADIO DIVISION NEWARK, N.J.

RADIO NEWS

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ON EXPIRATION of your subscription we enclose a renewal blank in our last number to you; we stop our delivery to you on expiration.

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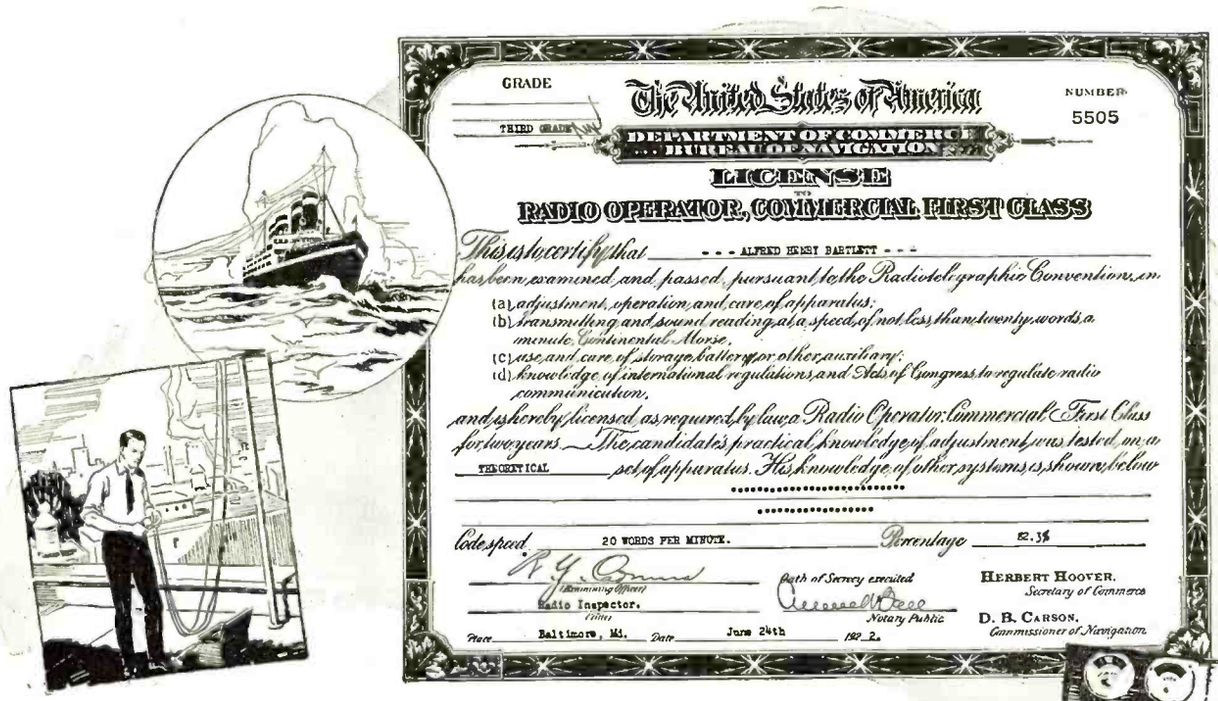
Index to Advertisers



Get This First Class Radio License

You Can Earn Big Money With It

THE best paid positions in Radio go to the men who hold the Government's Commercial License. The radio men on every ship, in every land commercial station, in every broadcasting station, must have one of these licenses. Every radio inspector must pass the first-class license examinations. Engineers, mechanics, installation and maintenance experts must all of them own a Government First-Class Commercial License in order to operate a transmitting station. It is every radio man's ambition to get a license, not only because it is the highest mark of honor he can get but because it also opens to him all the wonderful opportunities in this great profession.

Edward L. Powell, expert radio aide at the Washington Navy Yard gets $2600 a year. George Staffa is making $125 a month with all expenses paid. Read in the panel of the fine salaries paid in all the wonderful positions open to you as soon as you get the Government First-Class License.

Win Your First Class Government License This New Easy Way

The National Radio Institute, America's first and largest Radio School, has devised a remarkable new method that makes it easy for you to win your license. No previous experience in electricity or radio is necessary. Lessons, so fascinating they read like an interesting romance, take you step by step through the whole wonderful science of radio. Spare time study at home prepares you in an amazingly short time to pass the government examinations, so you can get one of the fine jobs waiting in this great field.

Prominent radio experts give you personal instruction and advice. They grade your papers, answer your questions, give you every help you want so you can qualify quickly. The diploma we give you upon completion of the course, counts for 5 to 10 credits on all government license examinations.

The most important requirements for a commercial license is a knowledge of the Radio Code. One of the most extraordinary features of the Institute's comprehensive course is the four patented instruments, invented and owned by the National Radio Institute, give you the practical training in radio operation, installation, maintenance and repair which you *must* have to become an expert.

Four Radio Instruments Free

Among these instruments is the wonderful Natrometer, said by experts to be the most perfect device ever invented to teach the Radio Code. With this amazing machine you quickly learn how to send and receive code with all the speed, the accuracy and precision of a trained expert operator. No extra equipment is necessary. Simply connect a dry cell, adjust the head-phone, wind the motor, and for twenty minutes you can listen to a reproduction of the code-work of two of the most expert trans-Atlantic operators.

Interesting Book on Radio Free

Get into this fascinating profession now. The field is wide open; thousands of positions are open. Find out at once *your* opportunities in radio. Send for the interesting free book, "How to Learn Radio at Home," which gives complete details of the plan by which the National Radio Institute qualifies you quickly in your spare time at home for a Government Commercial License. If you are sincerely ambitious to win success and wealth in radio, send the coupon, or a postcard, now.

National Radio Institute, Dept. 13-A
Washington, D. C.

Send me your free book, "How to Learn Radio at Home," with full particulars about the opportunities in radio, and how you will quickly train me in my spare time at home to win a Government First-Class Commercial License. Also tell me how your free Employment Service will help me to a position.

Name ..... Age .....

Street .....

City ..... State .....

$300 a Month and All Expenses

Your course was worth $5,000 to me, but I wouldn't take ten times that for the value I've gained from it. I signed up with a company for $300 a month and expenses paid. I owe this to your course.

E. W., Peculiar, Mo.

Triples His Salary

Thanks to your course and the help it gave me, I have had another boost in pay. This is the third one in less than a year. Today I am getting three times as much as I got before I began your course.

M. W., Chicago Heights, Ill.

Easy to Get a Good Job

Only a short letter to let you know I am on shipboard waiting to sail. Tell your students that a man with a license has no trouble finding a good position, and believe me a job like this is worth studying for.

L. M.

Prepares for All Radio Jobs

It will interest you to know that since completing your course I was 1st operator on S. S. Lake Giltedge. Last summer I had charge of Broadcasting Station WIAI, and in December connected with the Colin B. Kennedy Radio Corp., as sales correspondent, handling all technical inquiries, which I enjoy immensely. All due to N. R. I.

W. W.
St. Louis, Mo.

Pick Out the Job You Want We Will Help You Get It

This is a brief list of the positions in the Radio field today, and the salaries paid:

Broadcasting Station Operator—$125 to $250 a month.
Commercial Land Station Operator—$150 a month and up.
First-class Ship Operator—$105 a month in addition to all expenses paid.
Radio Engineer—up to $10,000 a year.
Radio Inspector—$1800 to $4500 a year.
Radio Salesman—$2000 to $10,000 a year.
Radio Mechanic—$1500 to $4000 a year.
Radio Instructor—$150 to $250 a month.
Radio Draftsman—$7 to $15 per day.
Radio Executive—up to $15,000 a year.

NATIONAL RADIO INSTITUTE
Dept. 13-A Washington, D. C.

Make Him Smile On Christmas Morn

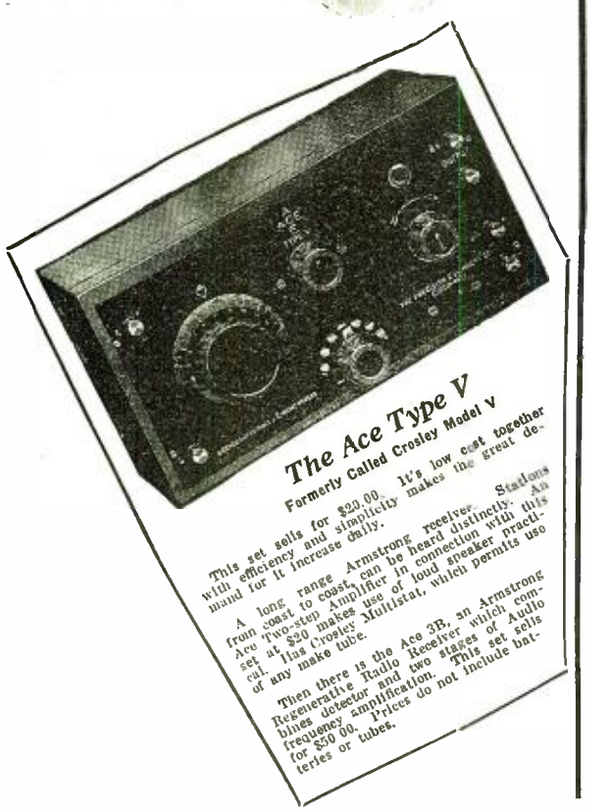
Make him happy—give him a real gift that will be enjoyed by both young and old—give him an Ace Radio Set.

The Ace Type 3C Consolette shown in the lower left corner is a comparatively new addition to the Ace Family. It has beautiful solid mahogany, wax finished cabinet and greatly adds to the appearance of the finest home.

This set consists of a regenerative tuner, detector and two stages of amplification, with built in loud speaker. The tuning circuit is licensed under the Armstrong U. S. Patent No. 1,113,149 and due to the particular method of winding Crosley coils it is exceptionally selective. Has sufficient room inside cabinet for dry batteries, making a complete self-contained long range receiving outfit. Has phone jack for tuning with head phones. Crosley multistat; filament switch; Crosley moulded condenser, beautifully engraved formica panel. Uses all kinds of tubes. Price $125.00, with stand $150.00. Prices do not include batteries or tubes.

Let an Ace Radio Set bring happiness to someone on Christmas morning.

If your dealer cannot supply you order direct, mentioning his name.



The Ace Type V

Formerly Called Crosley Model V

This set sells for $20.00. It's low cost together with efficiency and simplicity makes the great demand for it increase daily.

A long range Armstrong receiver. Stations from coast to coast can be heard distinctly. An Ace Two-step Amplifier in connection with this set at $20 makes use of loud speaker practical. Has Crosley Multistat, which permits use of any make tube.

Then there is the Ace 3B, an Armstrong Regenerative Radio Receiver which combines detector and two stages of Audio frequency amplification. This set sells for $50 00. Prices do not include batteries or tubes.

THE PRECISION EQUIPMENT CO.

POWEL CROSLEY Jr., *Pres.*

122 VANDALIA AVENUE **CINCINNATI, OHIO**

The TOWN CRIER of TODAY

IN the quaint old villages and towns of long ago, when each community was a world unto itself, the Town Crier played an important part in the affairs of the day. With clanging bell and stentorian voice, he broadcast the news, perhaps weeks old, that occasionally drifted in from outside places.

Today news from all parts is immediately available right at your fireside. No matter how isolated your abode, Radio binds you to civilization. By a turn of the dial, the happenings, entertainments and amusements of the world are yours to command.

The Crosley Manufacturing Co. has done much towards bringing this new wonder within the reach of all and has made Radio a living, tangible thing—something to use in daily life, in business or pleasure.

Popularly priced, these famous receivers give perfect performance. Unsolicited letters are received daily from owners telling of satisfaction and new distance records.

Everyday tests prove to us that Crosley instruments are the most simple and efficient Radio receivers ever offered to the public, regardless of cost.

For Sale By Good Dealers Everywhere

Write for complete catalog. This fully describes the Crosley line of Radio parts and receivers which range in price from a 2 tube set at $30 to the new, beautiful Model XL at $140.

CROSLEY

Better-Cost Less Radio Products

The Broadcasting Station WLW is maintained by the Crosley Manufacturing Co.

CROSLEY

Model X-J

$65

Crosley Model X-J $65

A 4 tube radio frequency set combining one stage of Tuned Radio Frequency Amplification, a Detector, and two stages of Audio Frequency Amplification. A jack to plug in on three tubes for head phones, the four tubes being otherwise connected to loud speaker, new Crosley Multistat, universal rheostats for all makes of tubes for dry cells or storage batteries, new condenser with molded plates, filament switch and other refinements add to its performance and beauty.

Nowhere can a better receiver be purchased at any price.

Cost of necessary accessories from $40.00 up.

List prices on our equipment west of the Rockies 10% higher. In Canada add duty.

Crosley Manufacturing Co.

Powel Crosley Jr. President

122 Alfred Street **Cincinnati, O.**

Mail This Coupon Today

Crosley Manufacturing Co.,
122 Alfred St., Cincinnati, Ohio.

Gentlemen: Please mail me free of charge your complete catalog of Crosley instruments and parts together with booklet entitled "The Simplicity of Radio."

Name .....

Address .....

The Proof of the Pudding!

900 MILES

Gentlemen: I have one of your Monodyne Tube Sets Model GT-1. **I think it a wonderful set.** Have heard about 900 miles during the last few days but expect to get much farther when the weather will permit.

I would like to put this set in stock, so I am writing for territory and dealer's discounts. Hoping to hear from you, I beg to remain

Leslie M. Wallace,
Holstein, Iowa.

"ALL VERY CLEAR"

Last night I got WGY, WDAP, WLW, WCX, WJZ and WHAS. On the night previous I got WHAZ of Troy, N. Y., and WOS of Jefferson City, Mo., as well as WDAF, Kansas City Star, **all very clear** although not loud. One evening last week I got WEAF of your city. My longest distance so far is WSB of Atlanta, so am satisfied with the receiving range of the set. And believe that with even one stage of amplification could double the range without trouble.

H. H. Martin,
1815 Denune Avenue
Columbus, O.

UNDER OATH

ATLANTA, GEORGIA, Fulton County.

Personally appeared before me Mr. R. D. LeRoy, who on oath and by original of the above shown, declared this to be an exact copy of an **unsolicited testimonial** presented to the Electric Shop, by Mr. D. H. McCalla.

Sworn to and subscribed to before me this 25th day of September, 1923. (Signed) W. W. Magell,
Notary Public of Georgia.

The list of stations heard by Mr. McCalla include KDKA, Pittsburgh, Pa.; KFKZ, Minneapolis, Minn.; KYW, Chicago, Ill.; WDAF, Kansas City, Mo.; WDAP, Chicago, Ill.; WJAK, Stockdale, Ohio; WLW, Cincinnati, Ohio; WMC, Memphis, Tenn; WOAR, Philadelphia, Pa.; WOC, Davenport, Ia.; WOS, Jefferson City, Mo.; WOR, Newark, N. J.; WOO, Philadelphia, Pa.; WEAF, New York, N. Y.; WJAX, Cleveland, Ohio; WOAW, Cleveland, Ohio; WSAI, Cincinnati, Ohio; WJAZ, Chicago, Ill.; WNAV, Knoxville, Tenn.; WFI, Philadelphia, Pa.; WGR, Buffalo, N. Y.; WGY, Schenectady, N. Y.; WIP, Philadelphia, Pa.

Yours truly, (Signed) D. H. McCalla.

1000 MILES

Gentlemen:— Having purchased your Monodyne set I was more than pleased over the results obtained from it. I think it is one of the best one-tube sets on the market today.

I have heard the following long distance stations—WDAF Kansas City, WDAP Chicago, WSB Atlanta, WOO Philadelphia, WGY Schenectady, WOC Davenport, and a Canadian station whose call letter I could not obtain.

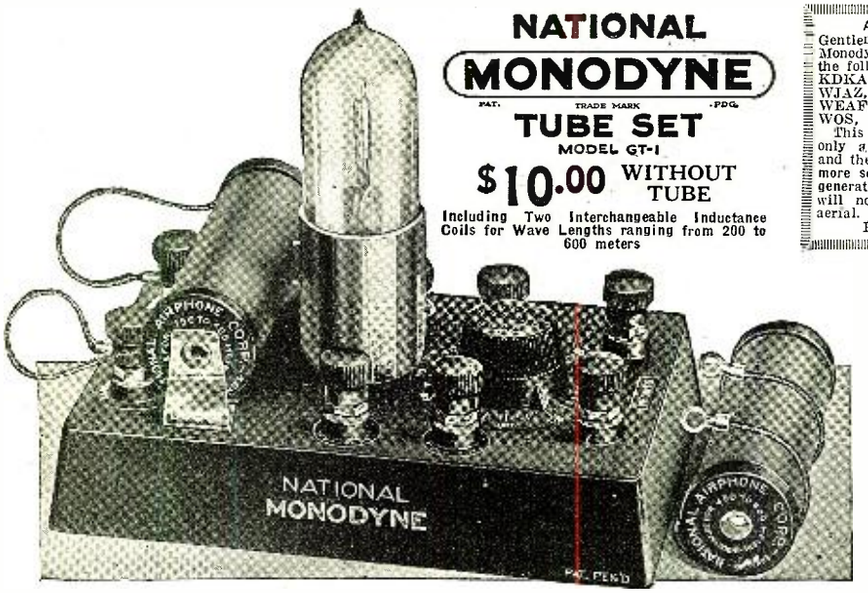
Using hook-up **No. 4** gives very selective tuning and volume. Your set cannot be praised too highly.

William Brown,
65 East 117th St., N. Y. C.

"LOUD AND CLEAR"

Dear Sirs: — The National Monodyne is all which you claim it to be. Up to date I have received the following stations **loud and clear:** WSAR, Fall River; WTAB, Fall River; WMAF, South Dartmouth; WNAC, Boston; WBZ, Springfield; WGY, Schenectady; WJAR, Providence; WEAN, Troy; WEAF, New York; WJZ, New York; WJY, New York; KDKA, E. Pittsburgh; WDAP, Chicago, and another 360-meter whose call letters I couldn't get.

William H. Burns,
19 Buckley St.,
Fall River, Mass.



NATIONAL MONODYNE

PAT. TRADE MARK PEND.

TUBE SET

MODEL GT-1

$10.00 WITHOUT TUBE

Including Two Interchangeable Inductance Coils for Wave Lengths ranging from 200 to 600 meters

A LITTLE WONDER

Gentlemen: Just a word about your Monodyne Tube Set. I have heard the following stations: KDKA, WCAP, WOAW, WWJ, WJAZ, WOC, KYW, WCAT, WEAF, WMC, WGY, WHB, WOS, WDAF.

This makes fourteen stations in only a few nights listening in, and they were **all loud and clear—more so than a single circuit regenerative set** (which by the way will not function at all on my aerial.

Earl S. Kirk,
P.O. Box 336, Marion, Ind.

"A LITTLE WONDER"

Dear Sirs: I have received as a present a National Monodyne Tube Set. The following is a list of stations which I have received with this set so far: WJZ, WRW, WOR, WEAF, KDKA, WBZ, WGY, WHAZ, WOE, WDAP, WOO, WIP, WGI.

These stations were heard in New York, also in a place thirteen miles from Albany. **I think this set is a little wonder.**

Rosario De Bello,
538 West 179th St.,
New York.

"TOO LOUD"

Your National Monodyne arrived Sept. 18, 1923 and in one week's time I have heard the following: Joplin, Mo., Chicago, two stations, Detroit, two, Cincinnati, one, Louisville, one Pittsburgh, two, Cleveland, one, Philadelphia, two, New York City, two, also Troy, N. Y., Canton, N. Y., Providence, R. I., Washington, D. C. and last but not least WGY comes in too loud. I have no trouble to tune out any station.

Clyde G. Swartz,
Bellefonte, Pa.

The MONODYNE Circuit is one of the most radical advances in radio engineering since the advent of the Armstrong Circuit.

Parts heretofore considered essential are omitted and one simple tuning control gives a selectivity equal, if not superior, to that of sets costing hundreds of dollars. A child can operate it.

No more hunting for stations. You know in advance at what point of the scale your favorite station is located—only the highest price sets accomplish this.

"A WONDER"

Gentlemen — Received your Monodyne set in perfect condition, **and I must say that it is a wonder.** Tuned in on KHJ, The Times, Los Angeles. Static was absent in the reception. The program was clear as a bell. I am using a **C-299 tube.**

Louis Jones,
543 First Ave.,
Yuma, Ariz.

"WONDERFUL"

Gentlemen—A friend of mine just purchased one of your Monodynes, and I tell you it is wonderful. He has received WGY, Schenectady, N. Y., — WOC, Davenport, Iowa.

J. O. Noble,
3503½ W. Madison St.,
Louisville, Ky.

"REMARKABLE RESULTS"

Dear Sirs:—Being an amateur of the first order, I was rather surprised with the **remarkable results** obtained last evening on your Monodyne. Local music came in clear and loud and the fight returns were perfect. Later in the evening fairly good results were obtained from Chicago, Schenectady and the Hotel Adelphia in Philadelphia. Undoubtedly after I am more familiar with the set even better results are in view.

R. H. Cherry,
30 Church St., New York City.

TRULY AMAZING

Gentlemen:—

We live in a wooded part of the tidewater section of Virginia. When the Monodyne arrived, with the help of a little plantation darky we erected our aerial, running it from the top of an iron frame wind mill to a corner of the porch.

We confess that we were a little skeptical about it, as it was during an excessively hot spell in the early part of August—a condition which we understood to be very unfavorable to radio reception—that the set arrived. The results, however, **were truly amazing.** We heard Chicago, Atlanta, Schenectady, Cleveland, and other stations—over distances ranging from 500 to 850 miles—and every station came in **loud and clear.**

We think that you will be pleased to know of the really wonderful work your little set is doing down here.

Mrs. Henry Williams,
Sherwood, Gloucester County, Virginia.

1000 MILES

Gentlemen:—The first eve I had the set in operation (Sept. 14) we received the fight returns from WMC, Memphis—about 300 miles also from WWJ, Detroit, about 225 miles. That eve we also heard WOAW, Omaha, 525 miles and WJAZ, Chicago, 200 miles. Our total list follows: WOAW Omaha, 525 miles; WMC, Memphis, 300 miles; KAD, St. Louis, 225 miles; WJAZ, Chicago, 200 miles; WWJ, Detroit, 225 miles; WOC, Davenport, 300 miles; WOS, Jefferson City, 250 miles; KLZ, Denver, 1000 miles; WOO, Philadelphia, 550 miles; WDM, Washington, D. C., 400 miles.

Dealers here in Indianapolis tried to tell me that it is impossible to get a complete set for $10 that will work, but I'm here to tell them they are mistaken.

I wish to call your attention to the editorial in October Radio News, or rather, the last part of it. I think that the National Monodyne is the answer. Another National Booster,

G. Perlee Smith.
847 Eastern Ave., Indianapolis, Ind.

USES NO AERIAL

Dear Sirs:—The other day I bought one of your sets in Chicago. Perhaps you will be interested to know, that I put the set in operation tonight by using a 'Ducon' plugged in a socket in the wall, on the sixth floor and heard the announcers at Davenport, Iowa, and Chicago also singing at latter place very distinctly, but not a speaker at former place clear enough to understand the talk.

Then tried with a seventy-five foot wire thrown out the window and heard Minneapolis, the announcer distinctly but not the singing and talking. Lot of static. Omaha very plainly.

Clarence J. Berlew,
2683 Briggs Ave.,
New York City, Bronx.

Dealers, Jobbers and Distributors—Send for Samples and Prices

SEND NO MONEY

National Airphone Corporation, R. N. 1
18 Hudson Street, New York City, N. Y.

Gentlemen:

Please send me prepaid One (1) NATIONAL MONODYNE tube set, Model GT-1, for which I will pay the postman $10.00.

NAME .....

STREET AND NO. .....

CITY ..... STATE .....

NATIONAL AIRPHONE CORPORATION
18 HUDSON ST. NEW YORK

WITH BARAWIK STANDARD RADIO GOODS

VACUUM TUBES

Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

C105 Detector, UV200 C300 Each $4.38
C112 Amplifier, UV201A C301A. 5.85
C118 5-Watt Transmitter.. 7.70
C107 WD11 C11. Each.... 5.85
C101 WD12 C12. Each.... 5.85
C102 UV199 C299. Each 5.85
C104 UV199 Adapter fits 199 tube to standard socket ..... .42
C108 WD11 Socket, Each ..... .31
C109 WD11 Adapter. Each ..... .45

STANDARD TUBE SOCKET

C140 Each 39c
Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.

METAL TUBE SOCKET

C146 Each 39c
A strong durable socket for panel or table mounting. Metal tube and base. Plainly marked binding post connections well insulated.

TWO AND THREE GANG SOCKETS

These sockets make it easy to build detector and amplifier units and make a neat, compact workmanlike job.
C147 Two-gang socket 95c
C149 Three-gang socket $1.30

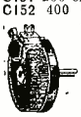
199 SOCKET

C145 Each 49c
Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

FILAMENT CONTROL RHEOSTATS

C132 6 ohm. Each 45c
C129 20 ohm. Each 52c
C131 30 ohm Each....59c
C135 6 ohm Vernier....95c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅜ in. Tapered polished black knob 1¼" diam.
Potentiometers. Match above rheostats. Same high grade construction.
C151 200 ohm. Each 79c
C152 400 ohm. Each.....79c

SUPERIOR RHEOSTATS



C153 6 ohm. Each 69c
C154 20 ohm. Each 76c
C155 30 ohm. Each 83c
The finest rheostat. Smooth, even action. Best design, best workmanship. Supplied with attractive dial and knob. A rheostat for high grade sets.
Potentiometers to match above rheostats with dial and knob.
C156 300 ohm 98c

QUICK ACTING RHEOSTAT

C124 6 ohm. Ea. ..79c
C125 15 ohm. Ea. ..88c
C126 30 ohm. Ea. ..99c
Vernier adjustment at every degree of resistance. Pushing knob in turns off the filament.

THREE INCH DIAL

C923 For 3-16 inch shaft. Each 22c
C924 For ¼ inch shaft. Each 22c
A handsome neat looking dial moulded in one piece of polished black composition. 180° scale marked 0 to 100 finely engraved in contrasting white enamel. Diameter 3 inches.

TWO INCH DIAL

C921 For 3-16 inch shaft. Each 16c
C922 For ¼ inch shaft. Each 16c
A handsome dial moulded in one piece of polished black composition. 270° scale marked 0 to 100 finely engraved in contrasting white enamel. Fine for rheostat or switch control. Diam. 2 in.

VERNIER DIAL ADJUSTER

C941 Each 19c
Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

BAKELITE DIALS

C931—2 in. Diam. for 3-16 in. shaft. Each 35c
C932—2 in. Diam. for ¼ in. shaft. Each....35c
C933—3 in. Diam. for 3-16 in. shaft. Each..39c
C934—3 in. Diam. for ¼ in. shaft. Each...39c
C935—4 in. Diam. for ¼ in. shaft. Ea. 48c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Sizes match perfectly.

WE PAY TRANSPORTATION CHARGES EAST OF THE ROCKIES

PRESERVE THESE PAGES — ORDER FROM THEM AND SAVE MONEY
FAST SERVICE — TRY US AND BE CONVINCED
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

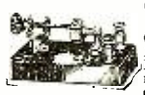
OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.

HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

ENCLOSED DETECTOR

One of the finest crystal detectors on the market, supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.
C730 Each 89c

GALENA DETECTOR



Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequaled value.
C732 Each 59c

GREWOL CRYSTAL DETECTOR

C742 Each $1.69

DETECTOR CRYSTALS

C736 Galena, Arlington tested, piece 19c
C738 Silicon, Arlington tested, piece 19c
C735 Tested, Galena, Mounted, piece 9c
C737 Tested, Silicon, per piece..... 9c
C739 Genuine million point crystal. Ea. 29c

SUPERIOR VARIABLE GRID RESISTANCE

C167 Each 80c
C168 With .00025 Condenser 95c
Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.
C171 Freshman panel mounting variable grid leak with .00025 condenser. Each 69c
C172 Durham variable grid leak with mounting. Each 89c
C173 CRL Variable grid leak. Each $1.19

TUBULAR GRID LEAKS AND CONDENSERS

Very convenient. Permit of quick change of leaks or condensers of varying capacity. Cut shows leak mounted. Leaks and condensers have same appearance. Each part priced separately.
C849 Grid Leak, Each 18c
Resistances—½, 1, 1½, 2, 3, 5, 7, and 10 megohms. Specify which size is wanted.

C831 Grid and Plate Condensers. Ea. 39c
Capacities—.00025, .0001, .00025, .0005 mfd. Specify which size is wanted.

Mountings. Bakelite base.
C840 Single mounting. Each.....28c
C842 Double mounting. Each 47c
C844 Triple mounting. Each 67c

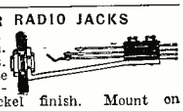
SUPERIOR INDUCTANCE SWITCH

C286 Each 74c
Quickly and securely mounted by drilling one hole. Only knob and pointer show in front of panel. Connections can be soldered before fastening switch, making assembly much easier. Metal parts nickeled. Bakelite knob and supporting base.

STANDARD BRAND LOUD SPEAKERS AND UNITS

C610 Murdock $4.38
C611 Rico 4.85
C613 Barawik with Baldwin unit..11.25
C615 Pathe 19.50
C616 Atlas 21.50
C612 Magnavox R3 .....32.50
C614 Magnavox M1 .....32.50
C617 Music Master 27.00
C755 Genuine Baldwin type C unit 5.35
C619 Murdock Special Unit 2.60
C618 Brandes Table Talker..... 8.75
C620 Baldwin Loud Speaker 22.50

SUPERIOR RADIO JACKS



Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
C390 Open circuit. Each 36c
C391 Closed circuit. Each 45c
C392 Two circuit. Each 54c
C393 Single circuit filament cont....58c
C394 Two circuit filament cont.....74c

COMPETITOR JACKS

C387 Open circuit. Each 27c
C388 Two circuit. Each 35c
Well made, durable, smooth working, nickel finished frame. Well insulated.

SUPERIOR RADIO PLUGS

C395 With set screws for fastening cord. Each ...35c
C397 Two-way — takes two pair any style cords. Each.....59c
Highest grade plugs. Fit any standard jacks. Polished round barrels.

SWITCH CONTACT POINTS

Brass polished nickel finish. All have ⅝ in. long size 6-32 screws and two nuts. All prices the same.
Dozen 15c Hundred $1.00
Order by Article Number.
C360 Head, ¼" diam.; ¼" high
C362 Head, 3-16" diam.; ⅜" high
C363 Head, 3-16" diam.; 1-16" high

Solder Lugs to Fit Contact Points
Also for connecting wires to binding posts, etc.
C365 **Dozen 8c Hundred 30c**

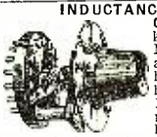
SWITCH LEVER STOP

Brass polished nickel finish.
C386 **Dozen 18c Hundred $1.05**

SWITCH LEVERS

Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch.
C381 1¼" Radius. Each. 15c

INDUCTANCE SWITCH



C285 Price including knob and dial..$1.29
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 15 switch points, any number of which may be used. Smooth wiping contacts. Attractive tapered knob.

CABINETS

Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid.

Panel Size	Inside Dimensions High	Wide	Deep	Art. No.	Price Each
6x 7"	5½"	6½"	7"	C420	$2.15
6x10½"	5½"	10 "	7"	C422	2.65
7x10"	6½"	9½"	7"	C421	2.90
7x12"	6½"	11½"	7"	C424	3.05
7x14"	6½"	13½"	7"	C423	3.20
7x18"	6½"	17½"	7"	C426	3.45
7x21"	6½"	20½"	7"	C425	3.85
7x24"	6½"	23½"	7"	C429	4.65
9x14"	8½"	13½"	10"	C428	3.55
12x14"	11½"	13½"	10"	C430	4.65
12x21"	11½"	20½"	10"	C432	5.45

BARAWIK QUALITY HEADSETS

C770 Per Set. 2000 ohms $3.25
These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from only the best selected materials. The receiver cases are fine polished finish with polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.

STANDARD BRAND HEADSETS

C754 Baldwin Type C with universal jack plug $10.95
C756 Red-Head, 3000 ohm 5.78
C768 Brandes, 2000 ohm 4.90
C769 Brandes, 3000 ohm 6.75
C751 Murdock 56, 2000 ohm $3.59
C752 Murdock 56, 3000 ohm 3.95
C764 Frost, 2000 ohm 3.59
C766 Frost, 3000 ohm 4.15
C758 Western Electric 9.50

PLATE CIRCUIT "B" BATTERIES

You can make real savings on these batteries. Don't pay more. We guarantee them to equal any on the market regardless of price. Absolutely uniform. Extra long life.
C180 Signal Corps type, small size. 15 cells, 22½ volts. Each $1.10
C182 Large size, 5 taps 16½, 18, 19½, 21 and 22 volts. Each $1.59
C184 Variable Large Navy size, 16½x4x3 inches 5 taps, giving range from 16½ to 22½ volts in 1½ volt steps. Each...$1.95
C188 Combination Tapped 45 volts, 30 cell, 13x4x3 battery. Tapped to give 45, 22½, 21, 19½, 18 and 16½ volts. Handles both detector and amplifier tubes. Ea. $3.65

"B" BATTERY METER

C189 Each 98c
Reads 0 to 50 volts. Accurately tells you the exact condition of your B Battery. Convenient watch size. Polished nickel case with wire lead.

STORAGE "A" BATTERY

A very high grade battery made especially for radio service. Guaranteed for three years. Properly cared for will give many more years of service for filament lighting. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.
C194 6 volt, 40 ampere size. Each $10.75
C196 6 volt, 80 ampere size. Each 13.25

HOMECHARGER BATTERY CHARGING RECTIFIER

Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Gives a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.
C201 For 6 volt battery $12.95
C203 For 12 volt battery..... 12.95

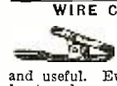
HYDROMETER

C190 Each 48c
Accurately tells you the condition of your storage battery. Helps you keep your battery in better condition.

BATTERY CLIPS

C198 Two for 28c
Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

WIRE CONNECTING CLIPS



C199 Per dozen.....30c
Small connecting clips for quickly fastening leads onto binding posts, etc. Handy and useful. Every radioist should have at least a dozen.

RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. Others ask as much for hard rubber panels which are worth much less. We supply genuine Bakelite, Condensite Celeron or Formica, all of which are materials with practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled.

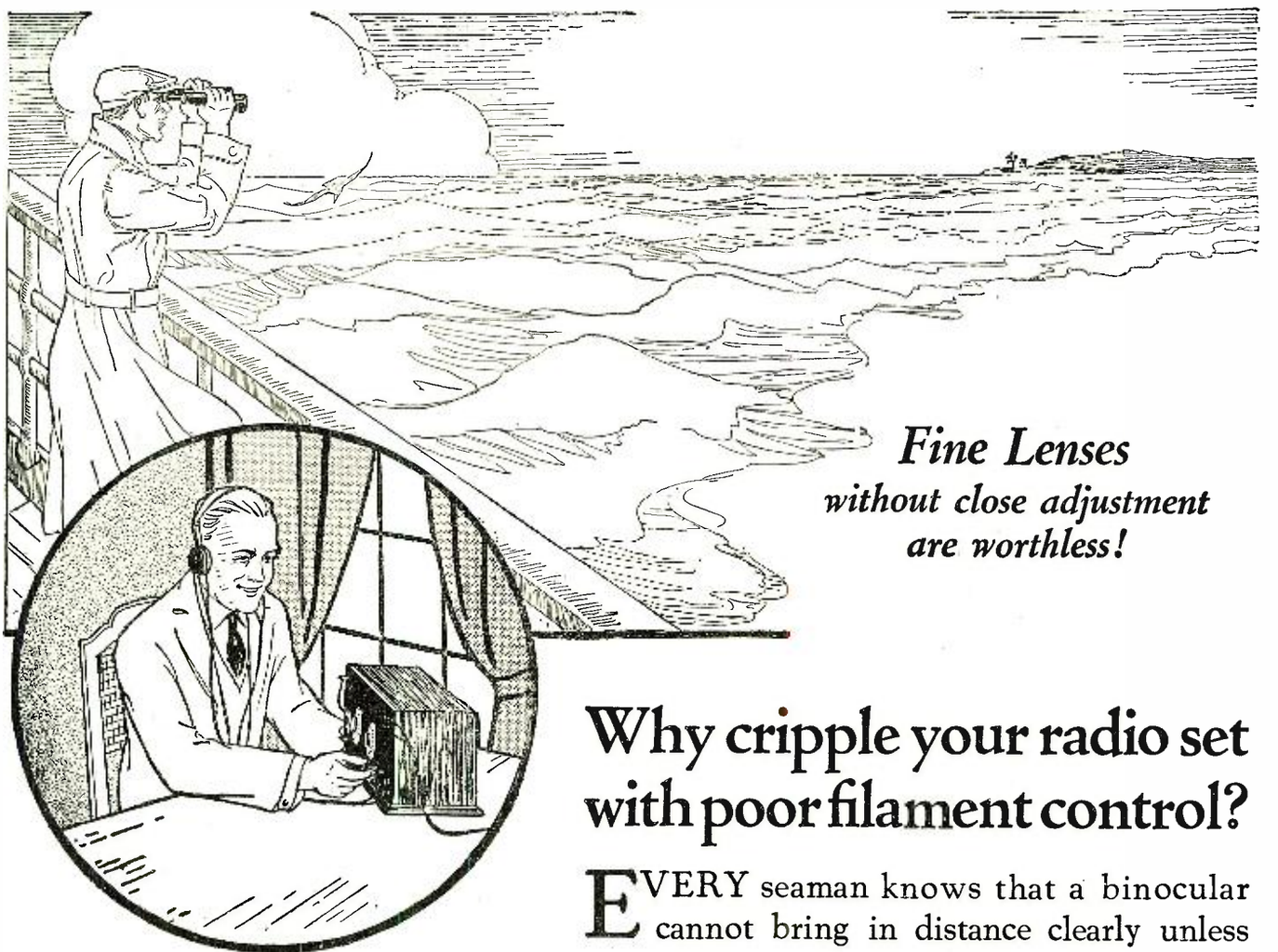
Panel Size Inches	⅛" thick Art. No.	Price	3-16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	C450	$0.57	C460	$0.8[illegible]	C470	$1.15
6x10½	C451	.86	C461	1.27	C471	1.73
7x14	C458	1.38	C468	2.07	C478	2.76
7x18	C453	1.78	C463	2.6[illegible]	C473	3.56
7x21	C457	2.05	C467	3.05	C477	5.10
7x24	C459	2.42	C469	3.56		
9x14	C454	1.85	C464	2.65	C474	3.56
12x14	C455	2.42	C465	3.56	C475	4.78
12x21	C456	3.62	C466	5.35	C476	7.13

RUBBER COMPOUND PANELS

Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch. Size given is in inches.

C481 7x10...$ .88
C482 7x12... 1.05
C483 7x14... 1.22
C484 7x18...$1.60
C485 7x21... 1.85
C486 7x24... 2.10

THE BARAWIK CO. Chicago's Original Radio Supply House Beware of Imitators 102 South Canal St., Chicago, Ill.



Fine Lenses
without close adjustment
are worthless!

Why cripple your radio set with poor filament control?

EVERY seaman knows that a binocular cannot bring in distance clearly unless focused with extreme care. It is the last fractional turn of the adjusting screw, perhaps the width of a hair, that brings the distant object within the range of clear vision. The slightest turn, either way, makes a blurred, distorted image.

The same is true of radio sets. The finest detector tube cannot bring in distance clearly without ultra-fine filament control. The Universal Bradleystat performs this delicate operation with utmost precision. The gradual adjustment of the Bradleystat knob brings in distant stations without noise or distortion. Every fine radio set deserves a Bradleystat. Are you getting the best out of your set, today? Try a Universal Bradleystat.

Bradleystat
REGISTERED U. S. PAT. OFF.
PERFECT FILAMENT CONTROL

Retail Price, $1.85
In Canada, $2.50
Postage 10c

Perfect Control For ALL Tubes

If you want to extend the range of your radio set, improve reception and get louder signals, learn about Bradleystat by mailing the coupon below.

Allen-Bradley Co.,
287 Greenfield Ave., Milwaukee, Wis.

I would like to know more about the Bradleystat and why it improves radio reception.

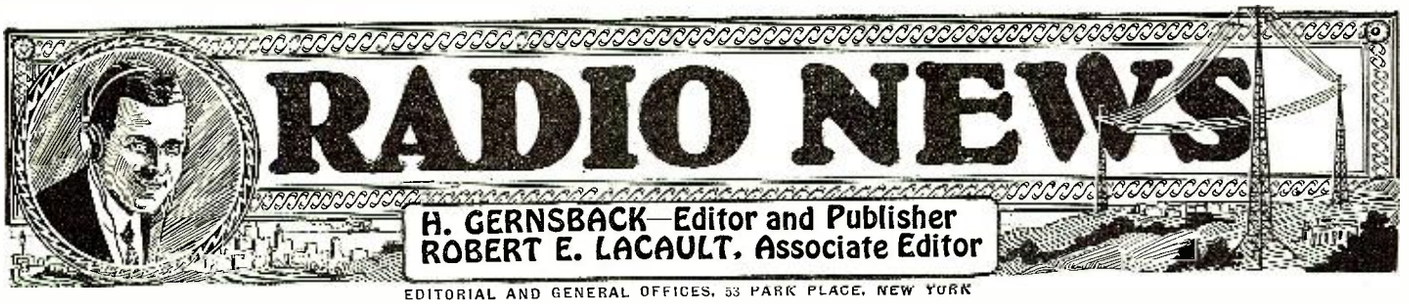
Name _____

Address _____

_____

Allen-Bradley Co.
Electric Controlling Apparatus
287 Greenfield Ave. Milwaukee, Wis.

Manufacturers of graphite disc rheostats for over 20 years.



Vol. 5 JANUARY, 1924 No. 7

What Broadcasting Needs

By H. GERNSBACK

HAVE you taken note lately that the quality of broadcasting has diminished somewhat? It is almost impossible these days to get a first-class artist to broadcast. If you have wondered why this is so, you may stop wondering right now, and take yourself severely to task. *The fault is all your own* for a very simple reason: Recently, Eddie Cantor, an actor of no mean standing, broadcast a very fine selection from a well known station in New York. The next morning he received an avalanche of mail—yes, he did not! As a matter of fact, he did not receive a single, solitary postal card. Imagine how pleased he was. And he is no exception. The public is becoming so used to radio that it takes it for granted, never thinking that the artist, very likely, is not paid for his work. Broadcast listeners should be aware of the fact that artists are not going to continue broadcasting to an unappreciative public. At best, broadcasting is a thankless job. You render a selection into a lifeless microphone transmitter, and at the end of the performance the artist does not even get applause. He might just as well perform in the Sahara Desert for all the personal satisfaction he gets. Then the next morning, if he does not receive even a single letter thanking him for his work he is not likely to broadcast soon again.

It is absolutely essential that broadcast listeners make an effort to show their appreciation of the artist's work in some way. If you are near the station, telephone, and if you find that the line is busy, send a letter or a postal card to the artist and thank him. This is the very least you can do, owing to the fact that **the service costs you nothing in the first place.** Your letter of applause to the broadcasting station will not only please the performer, but it will also inform the broadcasting station that it is doing a worth while service.

During July of this year there were 581 broadcasting stations. At this writing, there are approximately 567; in other words, a net decrease of 14 stations. If broadcasting interests you and if you have the radio industry at heart, telephone or mail your applause as often as you can. A number of concerns are now getting out applause cards, which is a very good idea. It costs only a cent to mail these out and we hope to see them universally adopted in the very near future.

Almost every day we are in receipt of letters from broadcast listeners who complain of commercial ship and shore radio stations which handle traffic on 450 meters. The complaint seems justified because such traffic, it would seem, could be handled just as well on 600 meters. Furthermore, there also seems to be an excessive amount of testing going on at the lower wave-lengths. This, of course, interferes greatly with the reception of radio broadcast programs and many of our readers are wondering if the Department of Commerce could not assist in improving these conditions by ruling that ship and shore stations, particularly those using spark transmitters, should work on the 600-meter wave-length during broadcast hours, and on 450 meters, only when necessary.

One of the greatest nuisances today in radio broadcast reception is the pause when a broadcasting station is on the air, but does not transmit. For instance: You try to get a certain station which you know is on the air. An artist has just finished a selection and the announcer has given the name of the artist and the selection just rendered and concludes his statement with: "Artist so and so will render a new selection in a few minutes." Meanwhile, someone a thousand miles off is trying to get this particular station. He frantically moves his dials too and fro; although he may get the carrier wave he is not sure that this is the station sought, because there is no way of telling whether the station has been finally and definitely located. It seems that such a condition could be overcome without great expense by our broadcasting stations. We know of one station that used to have a metronome which the announcer started the second the station stopped sending. You could hear the ticks plainly and the listener-in knew that this station was still operating. We suggest that broadcast stations in general adopt some sort of mechanical appliance to keep their listeners informed during intermissions. One suggestion is a single stroke bell placed near the microphone, which bell might be sounded once or twice a second. This system would be very simple, because the different stations could use different sounds. There are any number of variations and differences in musical sounds that any clever electrician could rig up in a few hours' time; thus each station could have its own earmarks.

We would also suggest that stations use an automatic transmitter to send their call letters slowly in code. This can easily be accomplished by using an instrument somewhat similar to an omnigraph which would enable distant listeners to read the letters in code. The whole apparatus operating a buzzer might be placed in front of the microphone, or better yet, operate the oscillator tubes on the transmitter as this would increase the range.

While we are about it, why do some broadcasting station announcers fail to designate their station's call letters at the end of each selection? The other night, the writer, with infinite trouble, finally located what proved to be a DX station, but he had to wait through the rendition of at least four selections before the announcer finally thought to state the station's name. This happened to be a Philadelphia station, and such practices are, of course, inexcusable. The advertising that such a particular station gets from long distance listeners is destroyed at once because not every listener-in has the time to wait, and often if he does have the time, atmospheric conditions may make it impossible to understand the infrequent announcements of the station.

Also, some of the announcers are very careless in announcing. Numerous broadcast listeners in Cuba complain that they are unable to determine what broadcasting station they are receiving, since most of the stations they receive from are weak, and it is often very difficult to understand voice transmission. If the suggestion given above, namely, to designate the station between selections with different sounding gongs, is adopted, this will help a great deal, for even if the DX listener does not understand correctly the call letters of the station, he can check himself up by listening for the next intermission.

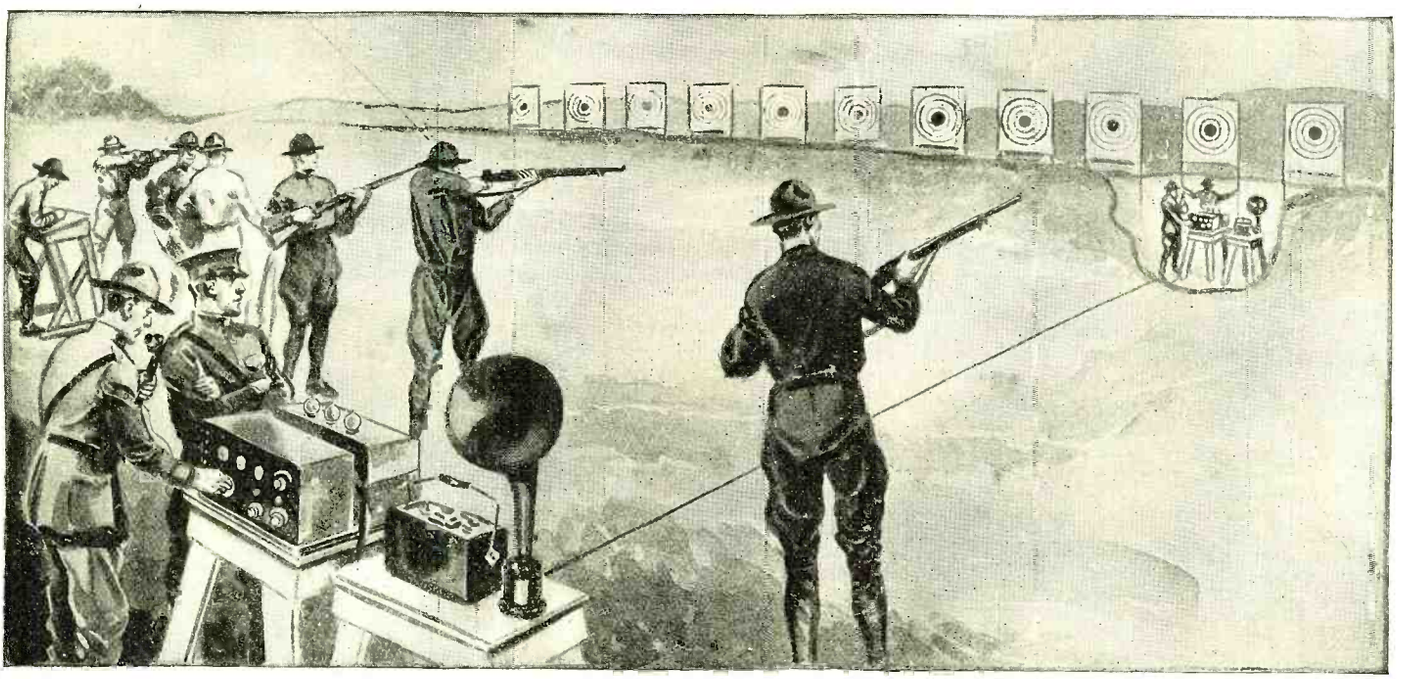
Certain stations are in the habit of reading off a quantity of telegrams and messages received by them, all of which are practically the same in their wording and most of them are of no interest to the listeners. Broadcasting stations should discontinue such practice and merely thank the senders as a body for their kindness. In nearly all instances, the listeners grow tired of hearing these telegrams read and tune in to another station.

Many broadcast listeners would like to receive long distance stations, but due to local interference they never have a good opportunity. It is suggested that the United States be divided into its time sections: Eastern Standard Time (E.S.T.), Central Standard Time (C.S.T.), Mountain Standard Time (M.S.T.) and Western Standard Time (W.S.T.). Then let all broadcasting stations in one zone (E.S.T. for instance) cease transmitting for one night at 10:30. Then the listeners in this zone could listen for the DX stations. The next night all stations in the next zone (C.S.T.) would shut down at 9:30. The following night stations in zone (M.S.T.) should cease broadcasting from 8:30 to 9:30 and in (W.S.T.) from 7:30 to 8:30. This would give the whole country a chance to listen in for DX stations, which is not possible today with simple receiving sets.

Wired Radio Saves the Taxpayer Money

By CAPTAIN H. W. WEBBE, Member A. I. E. E.*

Wired radio is being used daily by some large lighting companies to furnish their subscribers with musical programs and the like. The advantages of the system will be apparent after reading this interesting article by Capt. Webbe.



Employing Wired Radio As Means of Communication Between the Butts and Firing Line in a Recent National Rifle Contest Proved Far Superior to the Usual Line Telephone System. Loud Speakers Enabled All of the Men in the Butts to Hear the Spoken Word from the Firing Line.

A DEMONSTRATION was given at Camp Perry, during the National Rifle Matches, whereby a radio principle, wired wireless, and loud speakers, took the place of telephone operators in handling the targets on the range. The demonstration was given September 27, before Assistant Secretary of War Davis, Senator Brookhart and other officials of the Government. The significance of this demonstration may be judged—when one considers that $11,000 is the cost of labor to operate the communication system for one month during the matches. By the use of wired wireless and loud speakers, over $7,000 of this running expense is eliminated. The writer sees in this a step forward in putting radio telephony to work. The radiophone up to date has acted the part of an entertainer. The public has been so enthralled with the pleasure it has rendered that they have been slow in demanding of it a more utilitarian mission. At Camp Perry it will be made to take the place of 50 men; 50 labor units relieved for other work.

HOW A RIFLE RANGE IS OPERATED

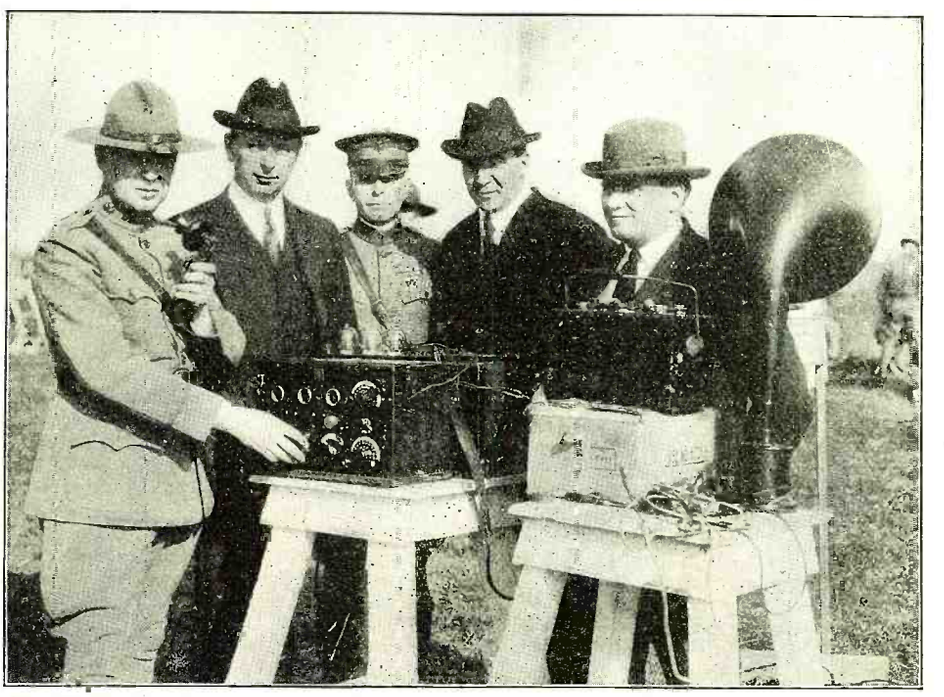
A word or so as to how a large rifle range is operated. Camp Perry, which is the largest range in the country, compares favorably with the great ranges of the world. It has 250 targets. Next year it will have over 300 targets and a firing line a mile in length. Every 10 targets have a telephone line with an operator at the firing point and another at the targets. Their job is to keep down congestion owing to disputes over marking the targets. They repeat the calls and instructions of the range officer between the two points. The telephone is in continual use during the entire day. So important is its mission that an interruption of telephone service holds up the firing.

Fifty thousand feet of wire is used over ground on the range and an underground cable system costing $30,000 is used. The latter continually gives trouble due to moisture. This year in view of the enormous attendance the mere delay in ringing up of the field magneto telephone caused the schedule to run over into the noon hour. It was due to this that the writer, who was in charge of the signal work on the range, began to think of a more adequate means of handling the traffic.

RADIO TO THE FORE

The first idea to afford relief was to try out radio. Having no radio equipment on hand we applied to a Toledo concern for the loan of transmitting apparatus. Not having much faith in the proposition they finally consented to turn over two receiving sets with the sug-

(*Continued on page* 981)



The Officials Who Assisted at the Demonstration of the Wired Radio Communication Scheme. From Left to Right They Are: Captain H. W. Webbe, Asst. Secretary of War Dwight F. Davis, Colonel C. E. Stodter, General Glen H. Phillips and Senator Smith W. Brookhart, of Iowa.

Professor Military Communications, Formerly of Ohio State University.

Shall We Have a Federal Radio Tax?

By RAYMOND FRANCIS YATES

This article contains one of the most practical suggestions we have heard to put broadcasting on a commercial basis. The plan outlined by Mr. Yates seems quite practicable, and we shall be glad to receive from our readers their opinions regarding it.

If All the Broadcast Listeners Were Willing to Pay a Few Cents Monthly, the Best Artists Could Be Engaged to Perform for the Radio Audience. The Money Already Spent for Cards and Letters to Acknowledge the Reception of Programs Represents a Huge Sum Which Might Be Employed for This Purpose, If Uncle Sam Could Take Care of the Distribution.

BROADCASTING is a sort of economic curiosity. It holds out the same interest for the economist that a two-legged calf holds for the biologist.

The radio problem is a federal problem. The very nature of radio makes it so. Any broadcasting station, no matter what its power, is an inter-state proposition. Radio has no respect for boundary lines, national or international, and the program of any station is the property of the nation. A station cannot be a state affair no matter how hard it tries. The pure universalism of radio to say nothing of the more complicated angles of the problems, demands that we have federal control. Radio broadcasting means entertainment and education for the masses and consequently it takes on a national aspect.

Radio broadcasters are drifting they know not where. Broadcasting proved to be a mirage for many of those who jumped into it without thinking of the consequences. Today they have on their hands expensive establishments requiring large sums of money for upkeep.

If we were to buy an automobile, and the manufacturer of that automobile obligated himself to supply us with gasoline and oil for an indefinite period we would have a situation somewhat akin to that of radio broadcasting as it stands today. Now, if our automobile manufacturer would sell cars so fast that his profit would be of great enough volume, he might be able to carry out this program for two or three or possibly ten years, but a time would eventually be reached when the sales would strike the saturation mark and naturally fall off, leaving him in a position where he would have to eat into the huge profits that came during the years of prosperity. He would suddenly find himself faced with a situation that would eventually bring about his financial ruin.

FINANCING BROADCASTING

Today our radio manufacturers are selling enormous quantities of radio equipment and part of the profits resulting from the sale of this equipment are used to support broadcasting programs. In the meantime the country is rapidly becoming filled with receiving instruments. Perhaps in another three or four years there will be as many as 15,000,000 receiving sets in the United States, if the present sales records are maintained, 15,000,000 receiving sets distributed throughout this country would bring it dangerously close to the absolute saturation point. Should broadcasting be able to support itself until that situation is reached —a feat which now seems doubtful—our manufacturers would be absolutely unable to carry on and broadcasting would have to pass into other hands.

It goes without saying that those who are shouldering the responsibility of broadcasting are entitled to some revenue, but under what method are they going to collect it? They have a moral right to charge for their programs, but as yet there is no way in which they can collect. They are not so much in love with the "dear public" that they are giving this entertainment out of the kindness of their hearts.

As the situation appears now, there is only one plan that can give to space broadcasting a permanent place regardless of other developments technical or otherwise. The writer refers to a Federal tax system for the maintenance of space broadcasting. Now the word tax is quite distasteful to the majority. So many taxes have had to be met since the war that any additions are scorned. Perhaps we have misnamed this particular kind of revenue. It would not really be a tax, but rather a fee collected by a responsible party (The Federal Government) and distributed as needed to broadcasting stations operated by the Government located in the various zones throughout the country and supported by small re-broadcasters who would make the program available to everyone with a receiving set, no matter how elaborate or how modest. Every fair-minded person who enjoys radio could not have any objection to the Government acting in their interests and taking upon itself the responsibility of collecting a small fee and placing it in a broadcasting budget for the

(*Continued on page* 976)

Pioneer Pathfinders of Radio

By JESSE MARSTEN

The pioneer experimenters in radio are not well known to the general public. Without their knowledge and their contributions to this science, there would be no broadcasting today.

THE last few years have ushered in a period which may, in the future, be called the "radio era." The radio art had been making steady and consistent progress previous to the present time, but few people were aware of it. The war brought it a little more to the fore, but even that was not sufficient to call the attention of a mass of people to such a tremendous achievement as radio. Suddenly, however, the attention of the public was forcibly brought to its existence. It was like a shock. Radio had progressed to the point where it could entertain. Public interest followed as a matter of course. Two years ago radio was unknown, today it is a household word. Then its advocates numbered in the thousands, today they must be counted in the millions.

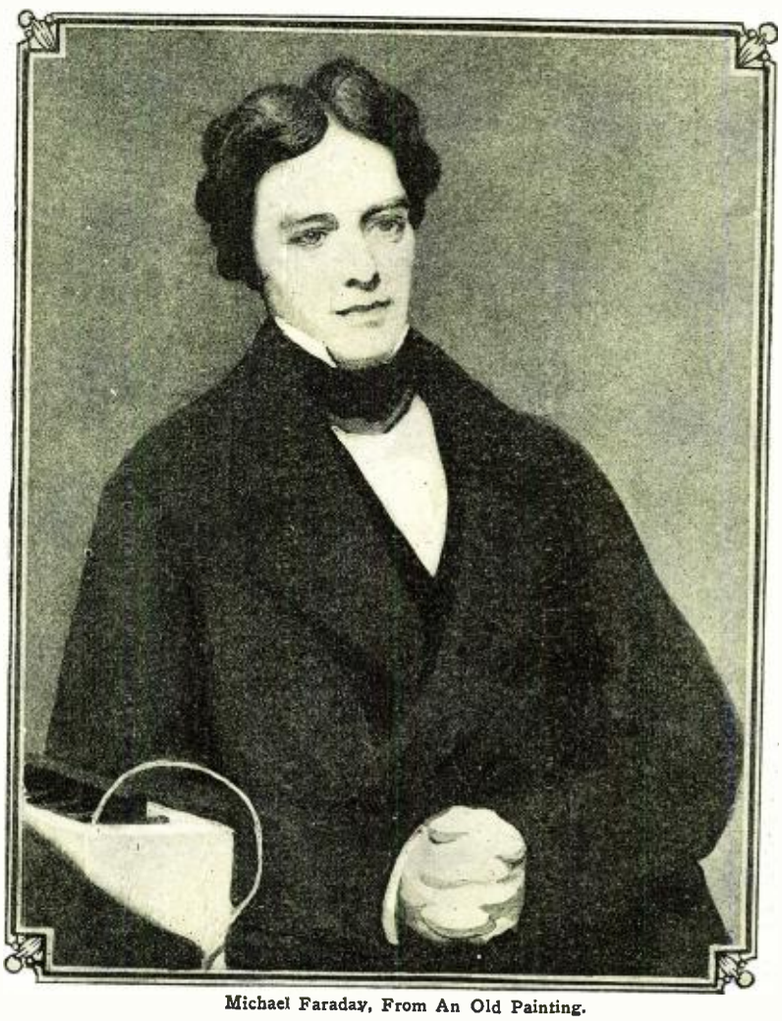
Whatever has a popular appeal is bound to be exploited. In fact popular appeal is often developed or manufactured in order to create a market for exploitation. Radio is no exception in spite of the fact that it is a highly technical and scientific industry. The rise of legions of radio manufacturers is too well known to dwell upon at any great length. What it is desired to emphasize, however, is that the radio following public was confronted by a mass of names of men associated with these various enterprises, men who were supposed to be the guiding lights of radio progress. A few of these are prominently associated with the progress of radio science, a ridiculously small percentage, however. The rest are of secondary and less importance who shine by the light of the present radio conflagration. These latter, self-styled experts. have foisted upon the public "invention" after "invention," "hyper-super-infra" circuits of all descriptions and what not. The public, thrust in the heart of a scientific movement of which it has little or no knowledge, is unable to separate the chaff from the wheat, and regards these radio poseurs as prophets. It has little knowledge of what laborious work is required to bring an art to such an advanced stage as radio has now reached. It does not know that constant research by well trained engineers and scientists is the price of such progress.

Yet. if it be hard for the public to distinguish those who are today instrumental in advancing the art of radio as against those self-advertising imposters, how much more difficult must it be for them to know those who have laid the foundations of this remarkable art. It is disheartening, to say the least, that a man with little or no scientific achievement who is exploited in the newspapers as the inventive genius who developed the "Infra-X circuit," should be widely known and respected by the radio following public, whereas such truly scientific geniuses as Faraday and Maxwell, without whose works radio might not be in its present stage of progress, are practically unknown to most people.

Such a condition may be partially attributed to a peculiar characteristic of human beings, namely, the habit of taking things for granted. They speak very glibly today of radio waves, electro-magnetic theory of light, displacement currents and so on, as though, like instincts this knowledge was born with the individual. They take these ideas as they take everything else—for granted, without giving much consideration to them. Yet these ideas are relatively new and have not been with us forever. Only a short time ago these ideas, which are the very heart of radio, were unknown. They had to be conceived and developed in fertile minds. There is nothing about such a process which should be taken for granted.

The conception and formulation of any fundamental scientific idea or law is a matter requiring the highest order of intellect under any circumstances. When the ground has been cleared and the view is clear and open and the necessary tools are available, the task is considerably easier, but even then it is a task only for the finest minds. How much greater, then, must the achievement be if such fundamental ideas are conceived when the ground has not been cleared away, and the tools are of the very crudest order. The basic idea of radio was conceived at such a time.

Radio is essentially an electrical subject, hence it might be argued that the real radio pioneers are identical with the founders of electrical science. But if we followed this line of reasoning we should have to go back to the early philosophers as the original founders of every science. In considering the question of tracing radio back to the original pioneers who laid the foundation for the modern developments of the art, therefore, it is necessary to make a definite starting point. Such a starting point may well be the beginning of the electro-magnetic theory of light.



Michael Faraday, From An Old Painting.

I
MICHAEL FARADAY
EXPERIMENTER PAR EXCELLENCE

Radio communication is essentially an electric wave phenomenon. The birth of radio may, therefore, be said to date from the time electric phenomena were coupled with wave phenomena. Such a coupling in the early nineteenth century was not a simple matter. At that time light, heat and sound were the chief wave phenomena known. Electricity was a manifestation of energy entirely dissociated from any of these wave types of energy. In fact it was only in 1800 that a source of steady current was obtained, and this was the Voltaic cell. Chemical energy was the one type of energy to which electricity might be referred. Alternating current did not exist for the scientists; the capacity currents were out of the question. How could electricity be compared with wave motion with so little data on hand? Yet such a reference was made. The association of light and electricity, or, better still, of wave motion and electricity, was practically a pure idea, a colossal speculation of a human mind. The identification of light and electricity as similar wave phenomena was made by Michael Faraday in 1845. It was an idea with practically no experimental proof, a "Shadow of speculation" as Faraday himself put it.

It is interesting to obtain some idea of the educational background which Faraday had. He was born in 1791 of very poor parents, his father being a blacksmith. All the schooling which he had was crowded in the few years up to the age of 13, in which time it is obvious that not very much preparation could be obtained for a rigorous scientific life. At 13 he was taken out of school and apprenticed to a bookseller and bookbinder as an errand boy. It was here that

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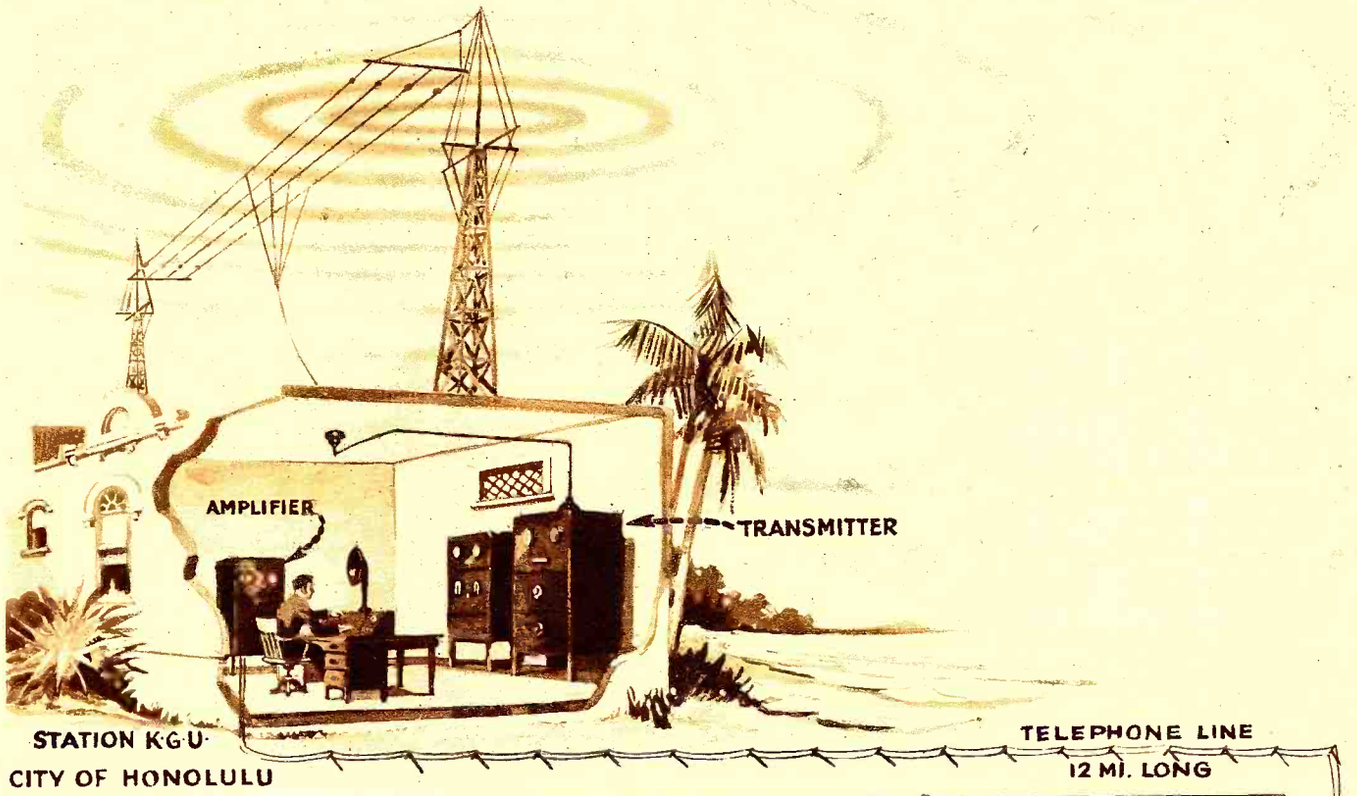
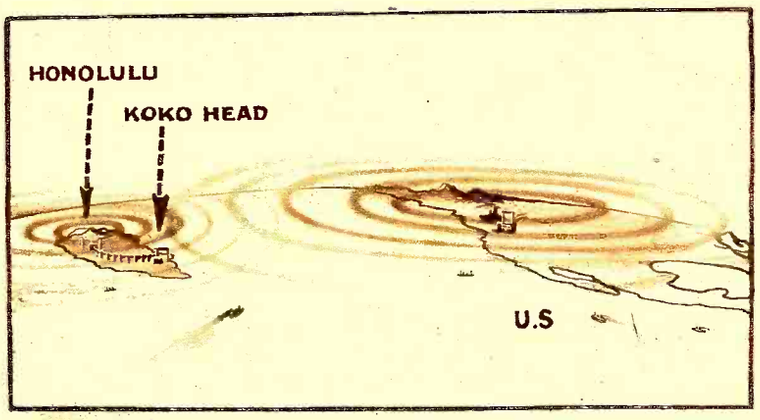
Radio Programs from U. S. Are Re-Broadcast In Hawaii



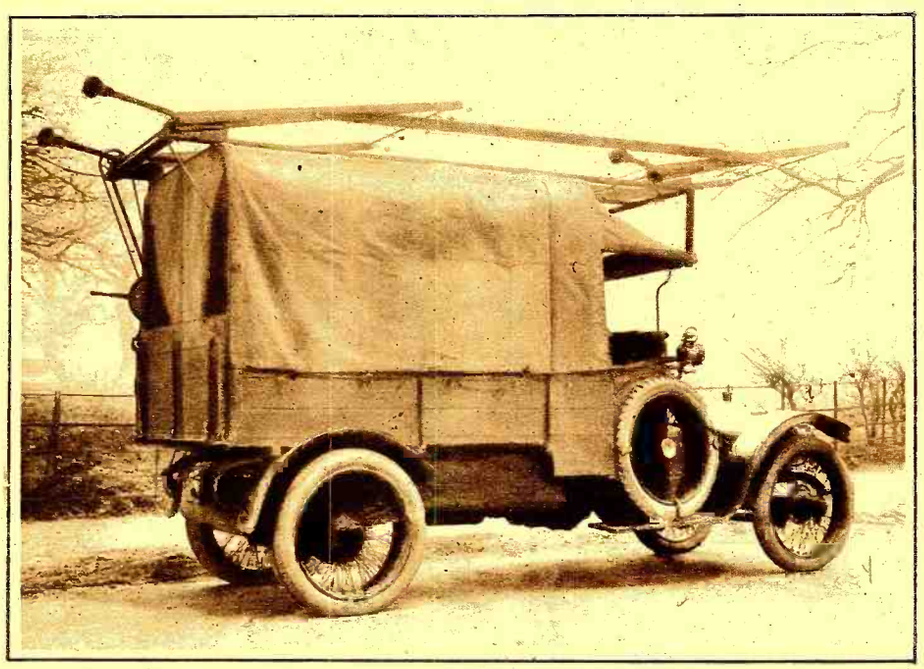
Radio Listeners in the Hawaiian Islands Have for Some Time Had the Pleasure of Listening to Programs From U. S. A.," Re-Broadcast From the Station of the Honolulu "Advertiser." Usually These Programs Come From KHJ and KFI, Both in Los Angeles and Both Equipped With Western Electric 500-Watt Transmitters On the Night of September 2, a New Record Was Made With the Re-Broadcasting of a Late Program from WHB, at Kansas City. The Re-Broadcasting Arrangement is as Follows: At the Koko Head Station, Twelve Miles From Honolulu, is a Receiver Consisting of Three Stages of Radio Frequency and a Standard Short Wave Set, Fed From a Beverage Antenna. The Signal is Then Amplified at Audio Frequency and Passed Through Twelve Miles of Telephone Line to the City of Honolulu, Where it is Put Into the Modulating Circuit of the Honolulu "Advertiser's" Transmitter (KGU). The Distant Signal Thus Actuates the Local Station.



The Radio Police Car

By ARMSTRONG PERRY

During his trip in England, the author visited Scotland Yard, the English police department, and describes in this article the new radio cars employed by the British sleuths in their war against crime.



Two Views of the English Police Automobile, Showing How the Frame Supporting the Aerial May Be Folded to Pass Under Low Bridges, Trees, Etc.

SCOTLAND YARD is the world-famous police headquarters of London, England. Noted for its efficiency, it nevertheless exhibits the conservatism typical of the British, so when Scotland Yard adopted radio as a means of controlling highway traffic it could safely be assumed that radio had "arrived" as an auxiliary in police activities.

The radio man at the Yard is G. A. H. Wootton, A. M. I. E. E., of the Engineering Section. Mr. Wootton has been in charge of the electrical appliances at the Yard for many years and much of the equipment is of his invention. One of his little jobs is to see that batteries for the police lamps are kept in order. They are storage batteries, or "accumulators," as they call them over there. There are 7,000 of them and the whole lot has to be charged every three days. A police lamp must function reliably. It cannot be permitted to die just at the critical moment when a Jack-the-Ripper is to be caught in the act. It was put up to Mr. Wootton several years ago to make sure that no lamp failed at an inopportune time or lit up uninvited when its attached Bobby was sitting with a housemaid in a quiet nook beyond the range of the street lamp. No such unfortunate incident has ever occurred since. The officers may wear the enamel off their black lanterns by using them for buffers between their backs and the stone walls they lean on, and bend them into nondescript masses of tin by sitting on them, but so long as the mechanical elements of the lamp permit of a proper contact between an unbroken bulb and the battery, the "juice" will not be found wanting.

It is a joyous experience to see the little accumulators pass through the charging station. If the visitors ask why dry cells are not used, Mr. Wootton explains patiently that in exhaustive tests the acid battery, without jelly or other thickening to make it spill-proof, has proven itself the only one worthy of implicit trust. The glass cells of the accumulators are fitted with a patented device that keeps the acid where it belongs even when the lamp is standing on its head. The accumulators come down to the charging room on a special elevator, all placed in receptacles that hold just so many. They are quickly transferred from these to the patented charging racks, where they stand on glass shelves that project just far enough so that any acid that may ooze from the cells drips into a trough on the floor. The cells are snapped into place under contact points held firmly by springs. By a slight rocking motion the contacts can be polished bright. All that are on the same circuit are in series, but the removal of one or more does not break the circuit, for the contact points automatically drop to the line and close it. Dimly-glowing incandescent lamps at the ends of the racks serve as resistances and an automatic device keeps the amperage down to the proper value, no matter what else may go wrong.

Since the cells are made of glass, a "sick" positive or negative plate can be seen at a glance. If badly sulphated, the battery is removed to the hospital rack where it is charged and discharged until the coating of the plates disappears. If incurable, a plate can be slipped out and a new one inserted in a moment.

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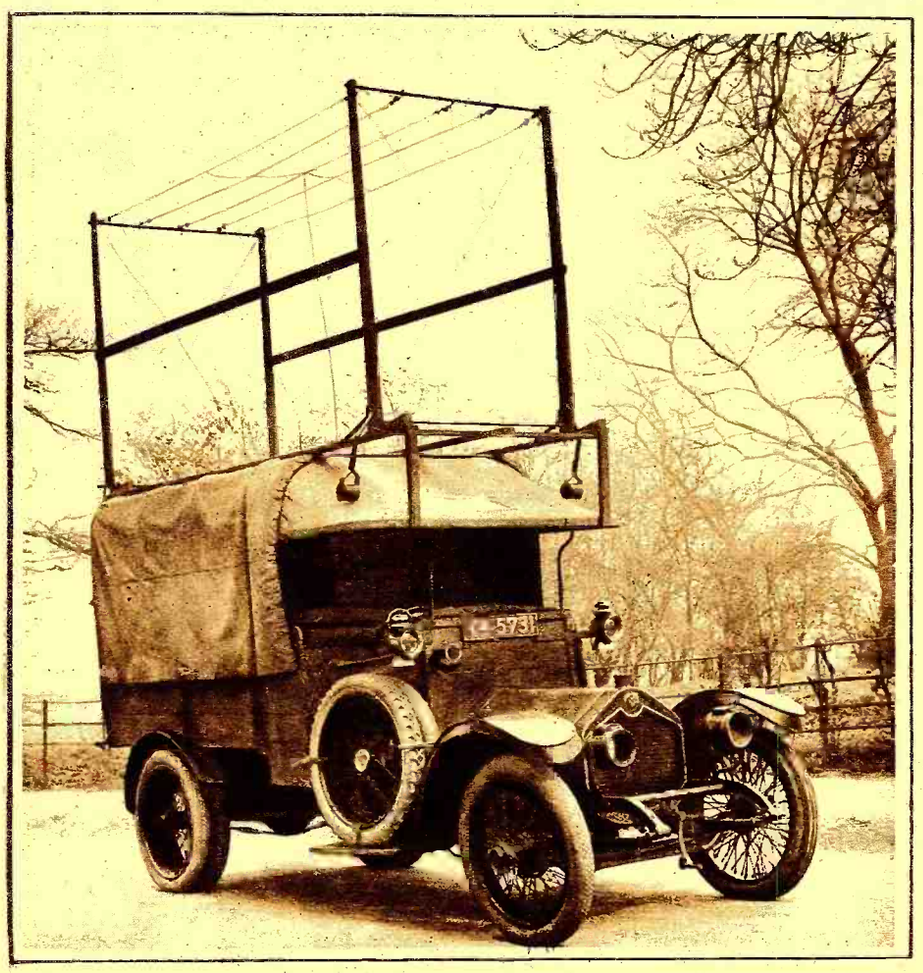
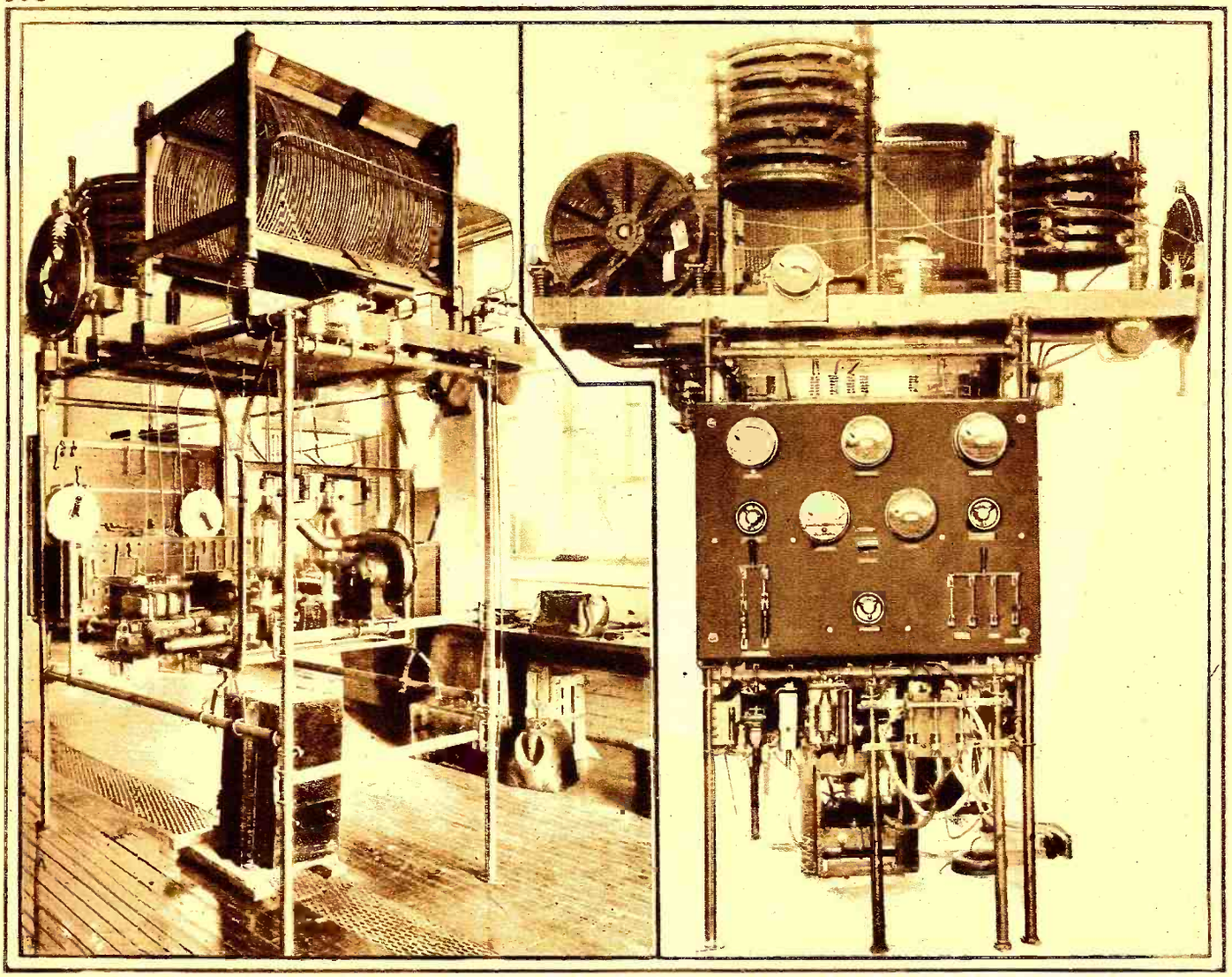
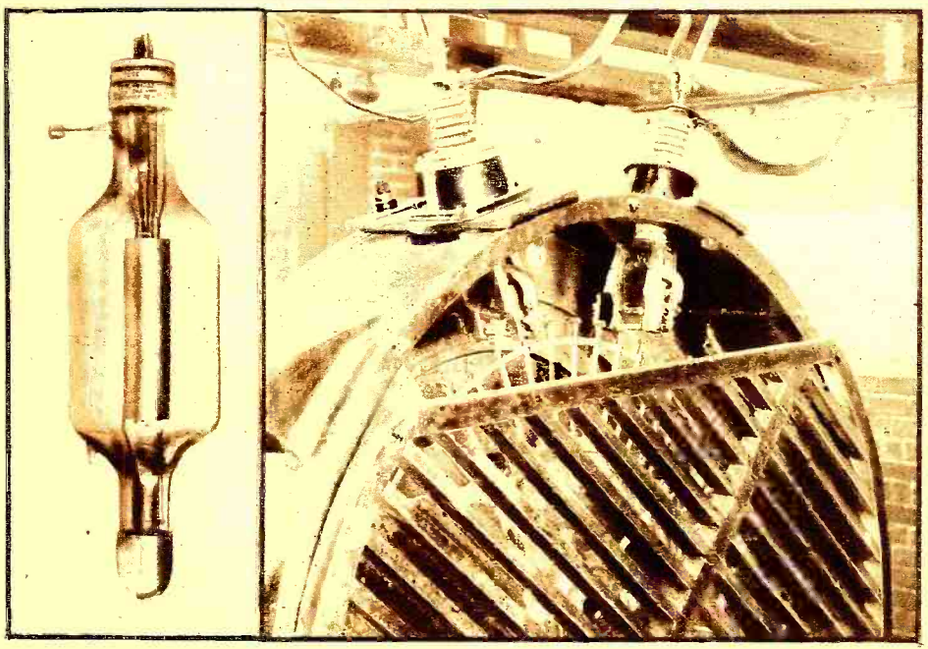


The New Arlington Tube Transmitter*

By CHARLES SPEAKER, R. E. Navy Dept.

The old spark transmitter of NAA has been dismantled, and replaced by a 10-KW. Vacuum tube transmitter. The 500-cycle note of the former set is greatly missed by all the old timers.





To the Left Are Shown the Giant Rotary Spark Gap, a Part of Arlington's Old Spark Transmitter, and One of the Two Vacuum Tubes Used in the New C.W. Transmitter, Front and Rear Views of Which Are Shown Above.

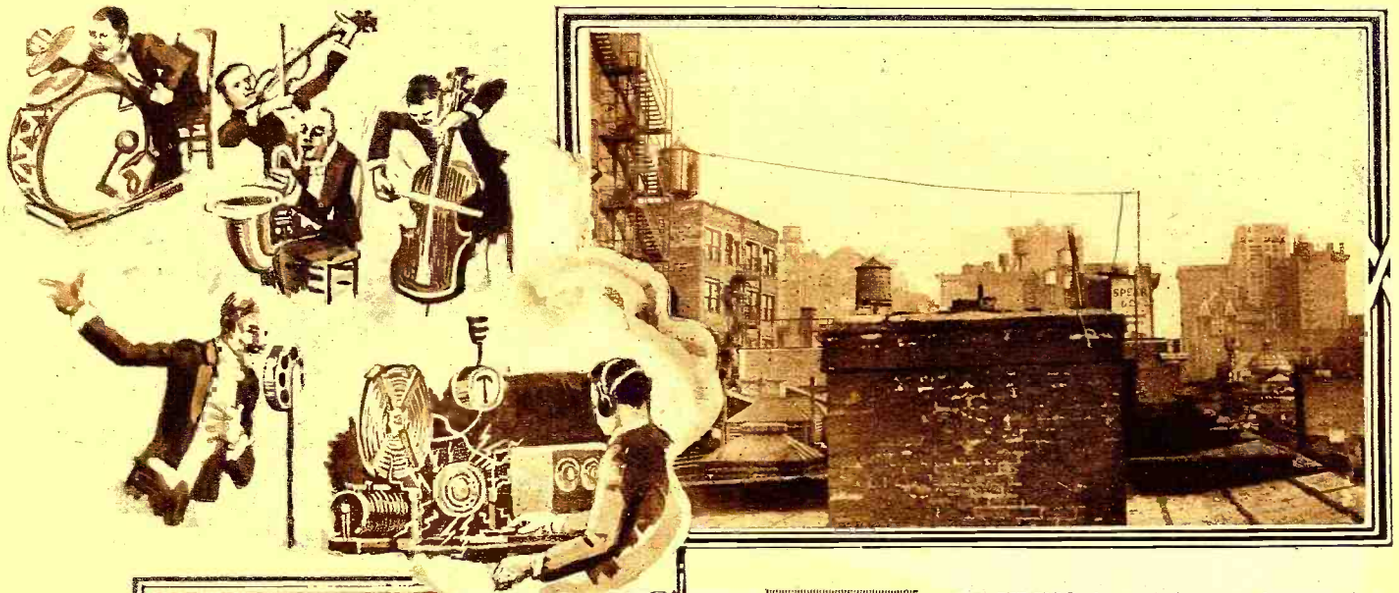
FOR many years the 2650-meter Naval Observatory time signal dashes and press news service from the Naval Radio Station at Arlington, Virginia, have been sent out by the famous old Fessenden spark set known throughout the world as NAA. To many amateurs and radio engineers mention of the Arlington spark brings memories of the old days of wrestling with the code. Recently this first great milestone in high-power radio transmitting progress has been relieved of its duty of guiding the mariner by furnishing chronometer check and has been given the rest that is due old age. The faithful old spark is standing by until plans are completed for its removal from the corner of the Arlington station where it has been for years. Fig. 1 is a photograph of the really wonderful synchronous gap whose terrific roar and crashing blue flame will never be forgotten by those who have been for-

(*Continued on page* 926)

**Released by permission of the Director of Naval Intelligence.*

Some Suggestions for Radio Beginners

By BERNARD STEINMETZ



When a Long Aerial Such as the One Shown Above is Used in a City Where Several Broadcasting Stations are Operating Simultaneously, It Is Difficult to Eliminate the Unwanted Ones, and the Results Are Pictured on the Left.

DURING the past few months a number of acquaintances have installed broadcast receivers in their homes, and like good friends they have called on me for help ever since. Looking after these troubles has proved to be an educational treat to me, for it has given me an insight into some of the beginner's difficulties, and the errors he is apt to make. It is my object, therefore, to describe the particular troubles as I found them in my experience with these novices, point out the symptoms, and explain how they may be easily remedied and why. At the same time some practical advice and pointers in the operation of receivers will be given which should enable broadcast listeners to get the maximum benefit from their receiving sets.

LOCATION IS IMPORTANT FACTOR

One of the greatest difficulties which novices experience is that of separating broadcasting stations. Although broadcasting stations are separated by as much as 40 and 50 meters, yet they interfere with each other so that numerous broadcast listeners are unable to enjoy their reception. "I hear two stations at the same time, how can I eliminate one of them?" is a constant question. There

(Continued on page 984)

The Selectivity of a Receiver May Be Increased By Using a Short Aerial Such as Shown on the Left. It Becomes Easy Then, to Tune in Any Particular Station Without Interferenace.

Energy Values In a Broadcasting System

By JESSE MARSTEN

PEOPLE are invariably awed when enormous magnitudes are brought into play. Thus, tremendous wealth incites more wonder than the most abject poverty, though it is logical to expect abject poverty existing side by side with abnormal wealth to be an equal source of wonder. Again the onrush of a tremendous waterfall amazes people, often not so much because of the natural beauty of the fall as that, as advertisements might put it, "these falls light the homes of five states, furnish the power to run all the railroads within a radius of so many hundreds of miles, furnish the power for all factories and industries in these states, help mine one-third the coal output of the country," and so on. Yet few people pause to marvel, or think that there is at all any cause for marveling, at the minute amount of energy in the light of a little candle which throws its beams so far, or the microscopic amount of energy in a whisper which the ear so readily detects. The explanation of this may perhaps be found in the natural appeal of the spectacular, and large magnitudes are spectacular.

OUR MEANS OF INTELLIGENCE

Yet when it comes to the matter of transmitting or communicating intelligence, which is one of the most important functions of modern life, we have to fall back primarily on almost infinitesimal sources of energy. Thus the chief organs for the transmission and reception of intelligence between human beings are the mouth (vocal organs), the eye, and the ear. Each of these organs gives rise to, or is actuated by minute amounts of energy. The light energy in a small candle may be of the order of hundredths of a watt, yet the eye can detect this light many blocks away, even after the greater part of the light has been frittered away by absorption, refraction and reflection. The mouth in voicing a sound produces a displacement of the air so small that the wave-length of a light wave is enormous in comparison. Yet the microscopic energy contained in the motion of the air is sufficient to actuate the ear, which hears the sound, a splendid illustration, by the way, of the frugal and efficient manner in which Nature operates. The farsightedness of such an arrangement is apparent when you consider the effect of a one-hour talk on a speaker. Fleming states that the sound wave energy generated by a man speaking for one hour in a normal tone is of the order of 20 foot-pounds. This is as much energy as is expanded in moving a weight of one pound through a distance of 20 feet, which is hardly felt by a normal man. Yet after talking for one hour a man is very much exhausted. If the ear were an organ which required considerable amounts of energy to actuate it, people might not be able to talk steadily for more than a few minutes without tiring, assuming a proportional effect on the nervous system—a state of affairs which many people might consider desirable.

WHY CONSIDERABLE ENERGY IS NECESSARY

Although in the communication of intelligence our organs of speech, sight and hearing require only minute amounts of energy, yet in the actual transmission of this intelligence over distances it is necessary to augment this energy. The reason is that in the actual process of transmission the original energy content diminishes, due to a number of causes, and by the time it reaches its destination the energy may be so low that it cannot actuate the organs of sight or hearing. Thus, consider a source of light which sends out its beams in all directions. The entire light energy is distributed over a comparatively small amount of space in the region directly near the light. However, at a distance away, the energy has to distribute itself over a much larger volume of space, as a result of which each unit volume receives less energy than the same volume near the light. In other words the light intensity falls off as the distance from the light source increases. Furthermore, in the course of their travels the light beams meet with many obstacles which absorb or reflect some of them, thus more of the energy is lost in this way. The same things happen to a sound wave as it travels over a distance. Thus it is sometimes necessary to increase the original source's energy in order that it reaches its destination with sufficient intensity to actuate the receiving mechanism, be it eye or ear.

COMMUNICATION BY RADIO

One of the latest and most novel forms of communication is that of radio broadcasting. In this system of communication, which is a one-way system, that is, intelligence is communicated in only one direction, namely from the broadcasting station to innumerable receiving stations, the intelligence, which may be concert, song, lecture, or talk or music of any kind, is transmitted through space from a central point. This energy is sufficient to actuate receiving mechanisms within a radius of several hundred miles and under favorable conditions with sufficient power within a radius of thousands of miles. This energy, which is thus transmitted through space in the form of electric waves, is subject to the same diminution or attenuation, as it is called, through dispersion, absorption and reflection as light and sound waves. The original energy, as for example the energy in the sound waves generated by a speaker is microscopic, the ultimately received energy as received by the listener is likewise minute. By what process is it possible to distribute this original energy, almost infinitesimal to millions of listeners over distances of hundreds of miles? The answer is given in the preceding paragraph: amplification. Thus while at the start and end of our communication system we have dealt with tiny amounts of energy, in between we have

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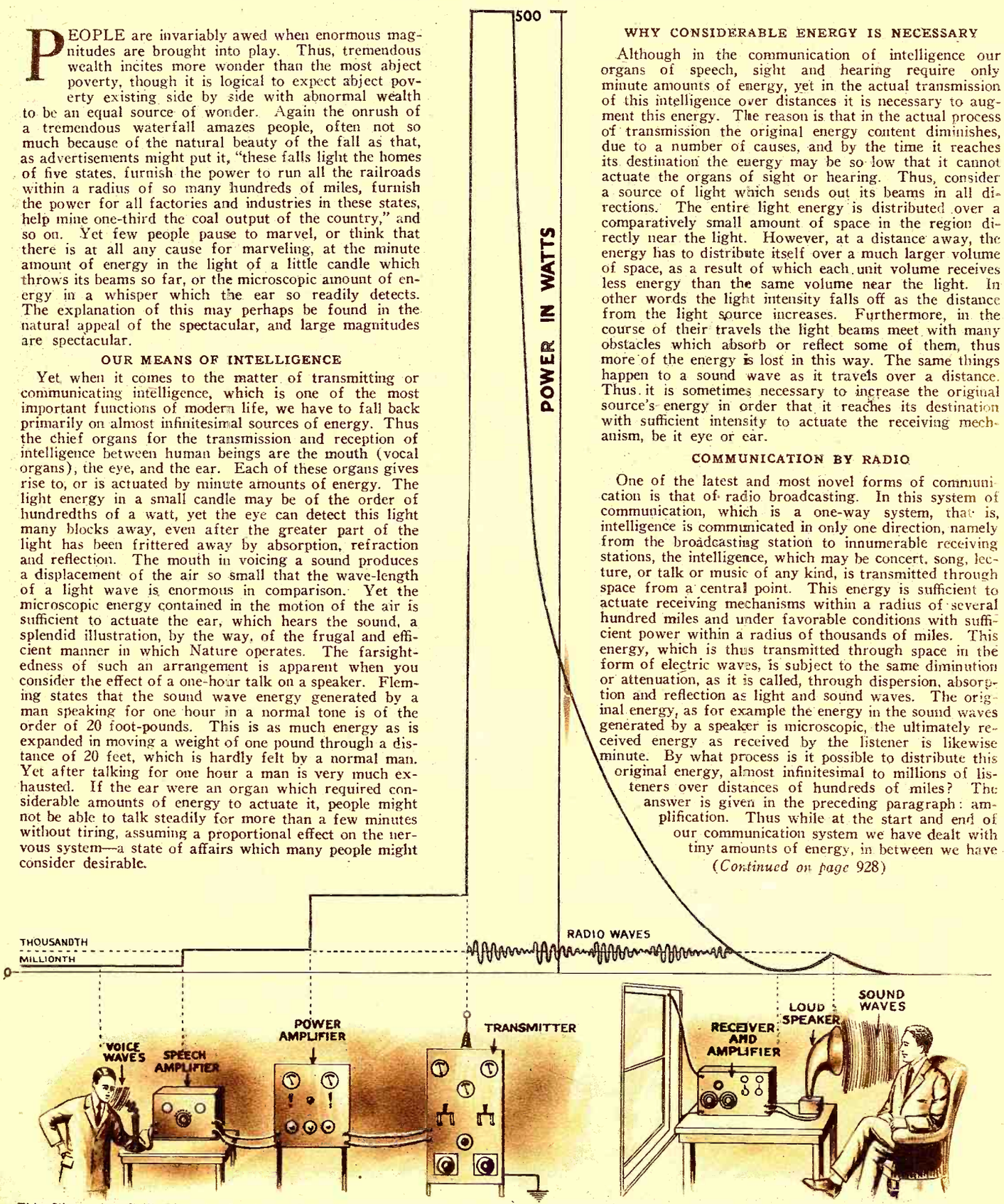
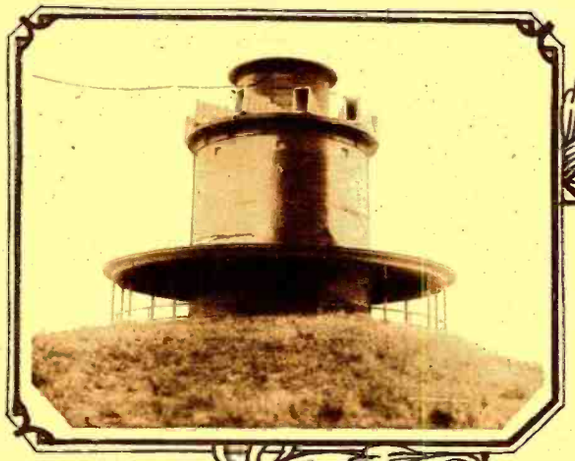


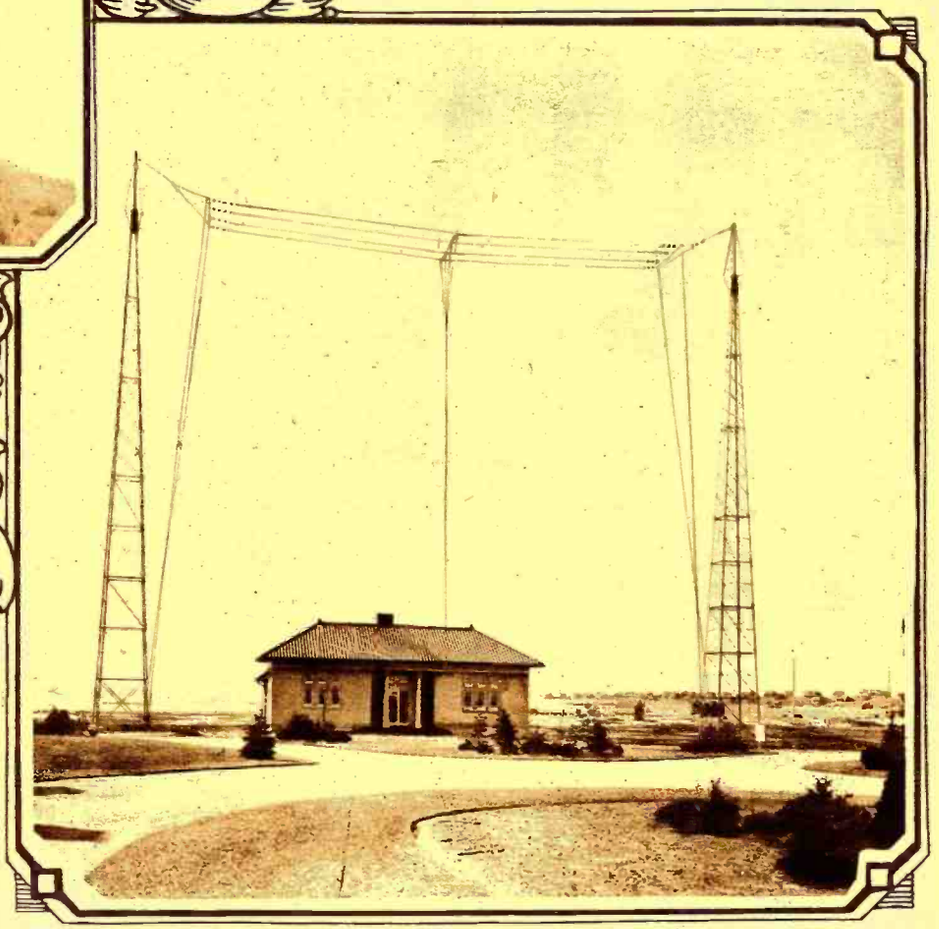
This Illustration Will Give the Reader a Good Idea as to Energy Values in Broadcast Transmission and Reception. The Voice Waves, a Matter of a Millionth of a Watt in Energy, Are Transformed Into Electrical Vibrations of Much Greater Magnitude in the Speech and Power Amplifiers and Increased Finally to 500 Watts in the Transmitter from Which They Are Shot Into Space. An Immense Amount of This Energy of the Radio Waves is Dissipated in Space, But When Picked Up By a Receiver It is Again Increased By Its Passage Through Amplifiers.

A Broadcasting Station De Luxe

By W. A. KIMBALL

A DESCRIPTION OF COL. GREEN'S STATION WMAF



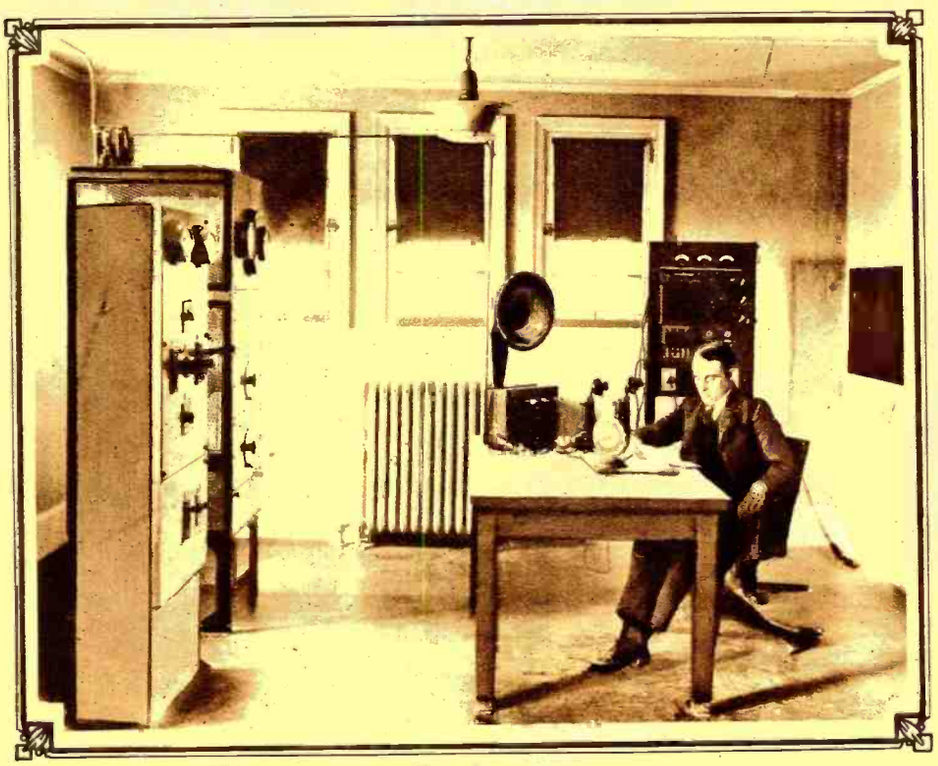


Broadcast Station WMAF Owned by Colonel Green, and on His Estate at Round Hills, Mass., Has Created Considerable Interest. The Accompanying Photos Show the Massive Towers That Support the Antenna, the Station Which Houses the Transmitter and the Interior of the Same Giving a View of the Western Electric 500-Watt Set. The Water Tower Shown Above Has a Multitude of Loud Speakers Mounted on the Roof Which Reproduce With Great Volume the Programs Rendered at This Station.

THE Round Hills Radio Corporation near New Bedford, Mass., is daily giving a broadcasting program, free to all who care to listen, from the wonderful private station of Colonel Green, listed among the many stations as WMAF.

The people of New Bedford and vicinity are particularly fortunate to have such a benefactor in their midst and they hear the very best of talent every evening during the week at no cost. Hundreds of parties are parked around the amplifying horns every evening.

As there is no trolley line to this station, it is necessary to travel by auto out of New Bedford, about 10 miles. To give this program to the people of the city who have no automobiles, the city has installed a smaller station at Buttonwood Park and the public can get the evening program almost from the front porches of homes in this section. For those living farthest away there are trolley cars which are easily accessible to the Park.



The Station at Round Hills is a Western Electric 500-watt affair, with four stages of amplification. The American Telephone and Telegraph Co., of New York City, has arranged to transmit the programs rendered at its station WEAF over its telephone lines to Round Hills, where the speech and music will control the radio output just as if the artists were in the adjoining room. In this circuit there are five stages of amplification at New York, two stages at each of the three points enroute and with the four stages of amplification at Round Hills there is a total of 15 stages before the public gets the program.

When a program is to be rendered at Round Hills, power is thrown on the set and the wave-length and antenna current are checked. The announcer gets a signal that all is ready and makes a final connection with the microphone and then introduces the performer at New York to the audience at Round Hills. A control operator at Round Hills listens to the program through a head-

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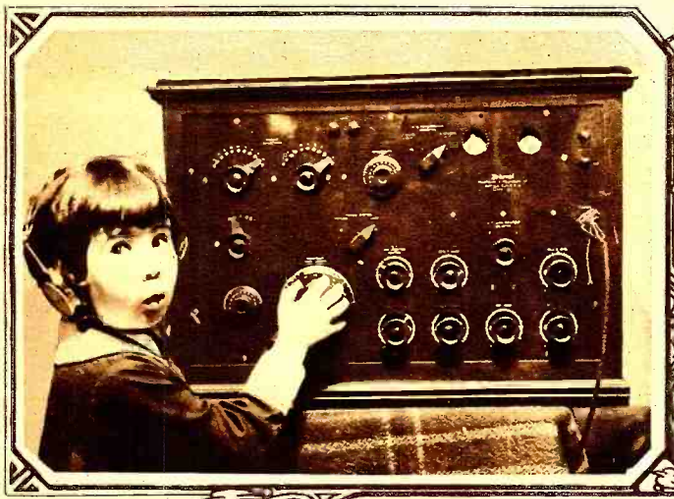
Radio Events In Pictures



Baby Peggy, a Million Dollar Screen Star, and One of the Most Popular Child Actors, Gets Her First Radio Treat. Baby Peggy Didn't Register Much While the Classical Number Was on the Air, But as Soon as WEAF Let Out Jazz Strain She Gave a Distinct "O-O oh" and Then the Cameraman Snapped. © Foto Topics.

The Problem of Interference Caused By the Squeals and Howls That Are Sent Out Through the Air By Neighboring Regenerative Sets Has Become Acute, and People Are Hoping That Legislation Will Soon Be Enacted That Will Prohibit the Use of All Sets That Radiate. The Plan Followed by a Number of Radio Fans in the East is Original, if Nothing Else. The Annoying Party is Warned and if the Person Still Persists in Causing Unnecessary Squeals, His Aerial is Cut Down and a KKK Warning Sign Attached. Several of These Cases Have Been Reported. © K. & H.

P. R. Fortin, of the Radio Department of the General Electric Company, Has Developed a Device Which Will Make the Piano Solo a Real Feature of a Broadcasting program at WGY. The Device, in Brief, Consists of a Magnet Between the Poles of Which is Pivoted a Suitable Coil System. The Magnet is Firmly Fastened to the Frame of the Piano and the Coil is Anchored to the Sound Board. By Means of This Pick-up Device All Tones in the Piano Are Faithfully Converted Into Corresponding Electric Currents Which Control the Radio Transmitter. When Heard on the Loud Speaker the Piano is No Longer a Twinkling Sound. The Listener Gets All the Characteristics of This Percussion Type of Instrument, the blow of the hammer, the singing tone and the Overtones.

The Future Of Radio Broadcasting

By MARTIN P. RICE*

ELECTRICITY as a servant of man was almost unknown 50 years ago and its conspicuous achievements in lighting, traction, power, ship propulsion, and communication are all within recent years. So the word "electric" has almost become a synonym for speed, progress, and accomplishment. Unlike other new developments which are frequently held back by their own limitations, the progress of electric application is limited chiefly by human inertia and conservatism.

Thus while the incandescent lamp was invented by Edison in 1879 and has since been so perfected that it furnishes the best light available and more economically than kerosene or candles, yet it is now used in less than half the houses in the United States. Electric locomotives capable of exerting greater power than any steam locomotive and operating so efficiently as to save enormously in coal consumption have been available for many years, yet only two per cent of our railroad mileage has been electrified. The complete utilization of water power which is practicable through electrification would be a tremendous factor in conserving our country's fuel resources, yet only one-fifth of our available water power has been developed.

In spite of the great strides which electricity has made, we must admit that with one notable exception, we have been relatively slow in realizing its full possibilities. The notable exception is, of course, radio broadcasting. Never in the history of the world has any invention been so eagerly, so rapidly, and so universally adopted. Three years ago it was an almost unknown art. Today there are 600 broadcasting stations, and the receiving sets are numbered in millions. As a method of communication it has taken its place with the telephone, telegraph, and post office, but it is more than a method of communication. With the printing press and the moving picture it is one of the three greatest factors in forming and influencing public opinion.

What of the future of this marvelous invention which makes it possible for a speaker to address an audience of millions, reproducing sound so faithfully that a whisper or the rustle of a sheet of manuscript is projected hundreds of miles and so rapidly that the voice may be heard across the continent before it reaches a hearer at the end of the room.

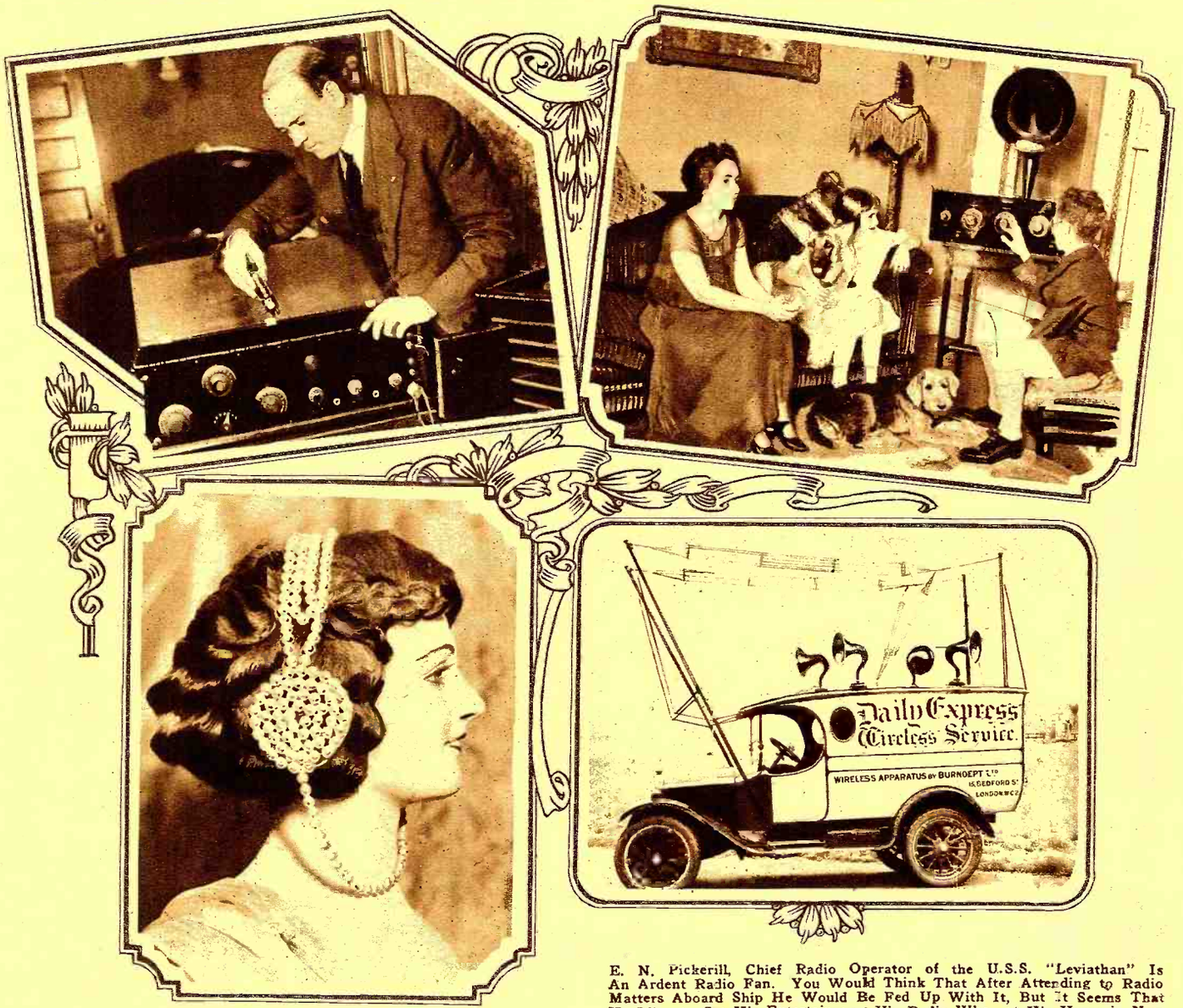
Forecasts may be of two kinds: First, the natural and logical developments of an art according to its known principles and laws; and, second, the imaginary extension of the art beyond these limits, and we may readily, although reluctantly, dispose of the latter by predicting that the most fanciful flights of the imagination are probably inadequate pictures of the future of radio just as the fairy tales of the last century fell short of the actual accomplishments of the present day. In other words, we may consider the future of broadcasting as an economic force rather than try to foretell how invention may add to its further development.

The ability to communicate instantly and simultaneously with millions of people is not a power which will be lightly discarded as a fad or a passing fancy. It suggests, with no strain on the imagination, a universal language and the vehicle for complete mutual understanding among the peoples of all civilized nations. Music is a universal language and fortunately music is the foundation of all

(*Continued on page* 998)

**Director of Broadcasting, General Electric Co.*

Radio Events In Pictures



E. N. Pickerill, Chief Radio Operator of the U.S.S. "Leviathan" Is An Ardent Radio Fan. You Would Think That After Attending to Radio Matters Aboard Ship He Would Be Fed Up With It, But It Seems That He Likes to Get His Entertainment Via Radio When at His Home in New York City. He is Shown in the Above Picture with His Broadcast Receiver. © Keystone View Co.

There Has Been So Much Radio in the Air and So Many Young Ladies Wearing Ear-Phones That Their Beaux Would Not Recognize Them Without Their Ear-Pieces On. The Natural Result of This is the Permanent Wearing of Ornaments That Look a Great Deal Like the Ear-Phones. This Head Dress is Gaining in Popularity, and Who Can Say That it is not Attractive? © Fotograms, N. Y.

The Rothafel Family, Whose Head, Mr. S. L. Rothafel, is Known to Thousands of Radio Fans as "Roxy," and Whose Concerts Have Made Broadcasting from the Capitol Theatre, New York City, Famous, Listen in to Daddy from Their Home. ©Keystone View Co.

In Order to Increase the People's Interest in Radio, the Bundept Co. of London, England, Has Equipped An Automobile With Sensitive Receiving Apparatus, Placed Loud Speakers on the Roof and Gives Open-Air Demonstrations to the Public, of the Advantages of Radio and the Entertainment That They Can Derive From It. An Elaborate Aerial Is Suspended on Masts so as to Insure Consistent Reception of Broadcast Stations.

Course In Radio To Be Given From Station WBZ

STATION WBZ in co-operation with the Massachusetts Division of University Extension will broadcast what is probably the first comprehensive and complete series of courses, as a utilitarian as well as entertaining part of its program.

The first course, which consists of 10 lectures, is on "Radio Reception and Transmission." It is elementary enough in character to appeal to those radio enthusiasts who are interested chiefly in the results that they can get with their own sets, and who do not care to go very deeply into technical details. It will be broad enough, however, to furnish the listeners with a sound foundation for a more advanced and technical study of the subject.

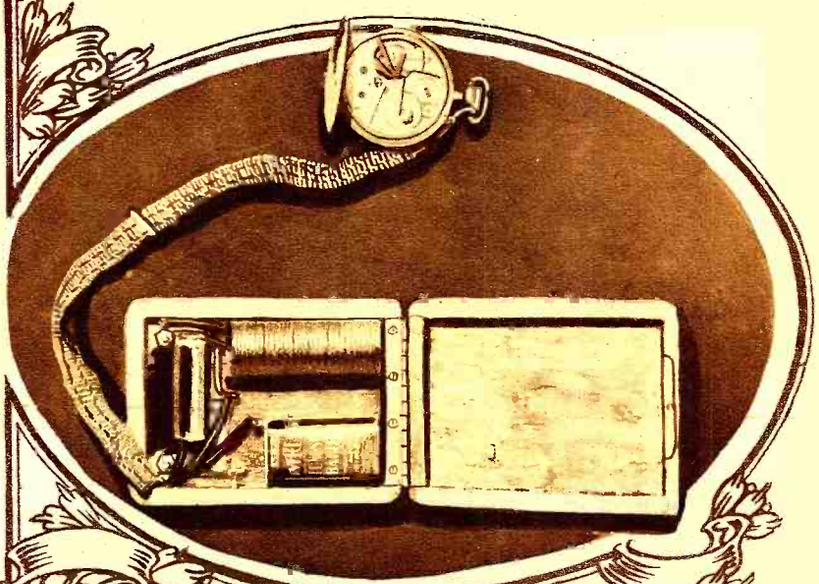
A lecture will be given every Wednesday evening from 7:00 to 7:30 P. M., by Edward H. Goodrich, of Springfield. All radio listeners within range of the station are of course, welcome to become part of the student audience. If, however, they wish to take an active part in the course, they may enroll as university extension students by sending to the Radio Station WBZ, Westinghouse Electric Company, Springfield, Mass., their name, address, age and occupation together with the registration fee of $1.00. This application and payment constitute an enrollment and entitles the student to receive any study material which may be sent out by mail, and to submit lesson papers to a University instructor for correction. For students thus enrolled, topics will be assigned from which a final paper is to be written at the end of the course. If this work is successfully carried out, the student will receive a certificate testifying to his completion of the lesson assignments, and of the course. The best three of the highest grade papers submitted will be broadcast with the names of the students, after the course has been completed. Students who wish to compete must submit their papers not more than a week after the final lecture has been given. It is contemplated that special prizes may be offered for very excellent work.

University Extension in Massachusetts is already serving thousands of men and women. It was established by State Legislature in 1915, and has grown so rapidly that during the past year alone, there were over 35,000 students.

It is hoped that broadcast listeners within receiving range of station WBZ will avail themselves of this opportunity.

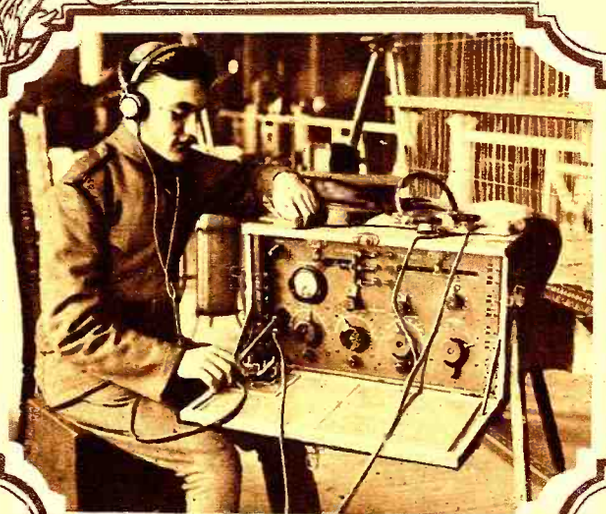
Radio Pictorial

A Watch That Automatically Sets Itself Each Noon Via Radio Is the Invention of Lieut. John W. Iseman, U. S. N. R. F., Which Was Developed in an Attempt to Perfect a Device to Automatically Correct and Regulate Chronometers on Ships at Sea When at Considerable Distances from Radio Stations Transmitting Time Signals. © Keystone View Co.



The Device Consists of a Miniature Radio Receiving Set With a Fixed Wave-Length. On Receipt of Time Signals, the Circuit of a Sensitive Relay is Closed for Each Dash. The Delicate Escape Wheel has 270 Teeth and is Rotated One Tooth for Each Dash, Until the Snap Mechanism for Setting the Hands is Released at the Final Dash of the Time Signals. © Keystone View Co.

John H. Morecroft, Vice President of the Institute of Radio Engineers, Presented Harold H. Beverage, of the Radio Corporation of America with the yearly $500 Award for the Most Noted Improvement in Radio During the Year. Mr. Beverage is the Inventor of the Wave Antenna, the Use of Which Has Considerably Improved Trans-Oceanic Reception and Has Done Much in Helping to Eliminate Static. © Keystone View Co.



This Interesting Combination Radio Transmitter and Receiver Was Exhibited at the U. S. Army Booth at the Electric Show, New York City, and Attracted Considerable Attention. It Is a Portable Outfit Designed to Be Carried in a Mule Pack. The Receiver Consists of a Standard Regenerative Circuit with Two Stages of Audio Frequency Amplification. The Transmitter is of the Vacuum Tube Type and is Capable of Transmitting Signals for Considerable Distances. © Kadel & Herbert.

The New York Radio Show

THE New York Radio Show held in the Grand Central Palace, New York City, and organized by the New York Radio Exposition, admitted the radio public to its confines on October 6. It is generally agreed that it was the most successful radio show that New York has seen, not because of any elaborateness, but because it was on a firmer basis than past expositions. Comparing this exhibit to past ones, there was a noticeable difference; it was more like an automobile show. Quietness reigned throughout the entire floor upon which it was held, and the public did not turn away in disgust upon hearing screeching receivers as they were prone to do in the past. Keen was the wisdom of the men who decreed that there should be no broadcast reception at the show except on the sensitive super-heterodyne receiver in the booth of the Radio Club of America. True, loud speakers were placed at a number of points on the floor so that no matter where situated, the people could listen to the programs from local broadcasting stations, but picked up by a sensitive receiver operated by expert hands. This silence had a tendency to make the show more conservative. It certainly made more of an impression on the people than radio has heretofore ever made.

Practically all the large radio manufacturers were represented. The booths were well decorated and their appearance never failed to attract the eye of those passing by. Experts were on hand to give information to the inquisitive.

From observations covering the display of apparatus, it was evident that the general movement of the manufacturers is towards the standardization of one and two control receivers using a single tube and also the same type with several stages of radio and audio frequency amplification. Any number of loop aerial receivers were exhibited. There were also a series of complete receivers housed in cabinets designed along the same lines as those for phonographs, eliminating the usual scientific appearance and giving a more artistic touch to the whole.

It is hoped that both the public and the manufacturers will profit by the exhibition of apparatus which was nearer to ideal design and workmanship than was evident a year ago.

The Radio trade association held a meeting during the show and we reproduce below Mr. H. Gernsback's speech.

Summarizing the Year In Radio

By H. GERNSBACK

IN reviewing the year just passed, we must admit that no great and radical changes have come about, either in the radio art itself or in the trade. Last year, just about this time, the trade was recovering from a tremendous slump, the aftermath of all booms, be they in radio or in oil. The year just passed has been rather a sober one and it has kept us busy cleaning up the wreckage left over by the radio boom which started off early in 1922 and which created the situation that was unparalled, not only in the radio industry, but in every other industry. The radio boom was responsible for a tremendous expansion of the radio industry, when the manufacturers were only concerned with one thing and that was production. We have not entirely recovered from the radio boom as yet, due to the frenzied rush in order to get out material which was poor and thrown on the market upon thousands of people who still have a grouch against everything and anything connected with radio.

The year just passed has witnessed one very important phase and that is, the price of nearly all classes of radio merchandise has receded from the 1922 artificial high level. Manufacturers have learned a lesson—that it is possible to make more money by selling goods for less than selling merchandise at high cost and get a few sales that are expensive in the end. Speeding up the production brings undreamed of savings.

I am not an advocate of selling goods for nothing, but I do believe that most of the radio material that has been sold during the past year was sold at an artificially high figure. What is the result? Big discounts are given to the trade which immediately invite cut prices by the less reliable section of the trade. A lower list price with a fair discount rather guarantees the upholding of the list price and such a policy is not liable to play havoc with a manufacturer as does the high list price.

The past year has also witnessed some simplification in the construction of radio sets. I believe the biggest single mistake of the radio industry today is that we insist on forcing upon the public outfits that the average man cannot operate. I doubt whether there are five people in a hundred who can operate a modern set that has five controls or more, with the aid of simple printed directions. It simply cannot be done. Radio will not be as popular as the phonograph until we have learned to build our sets with a single control. There are such sets on the market today and they are eminently successful for that reason. Your wife, your sister, and your daughter cannot operate complicated sets. And for what

(Continued on page 996)

Secrecy In Radio

By Dr. ALFRED GRADENWITZ

Berlin Correspondent of Radio News

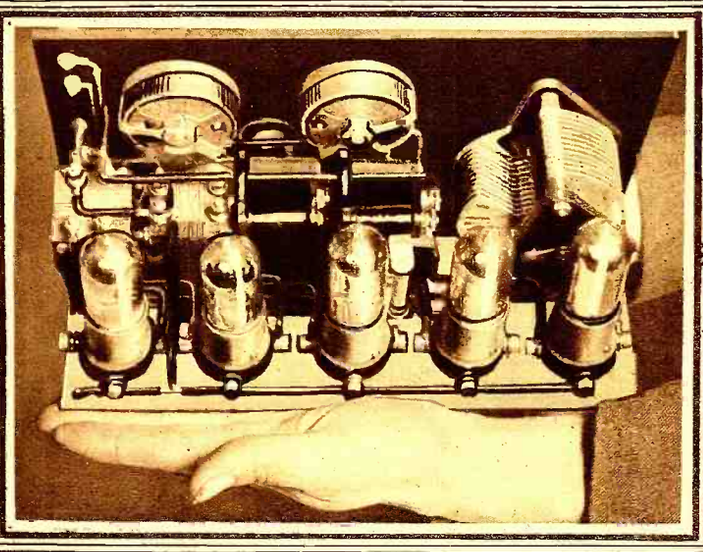
THE enormous and ever-growing popularity of radio makes it practically impossible to warrant the secrecy of radiograms, anybody within range being able to intercept what is only intended for one given person. Nor can a ciphered text prepared according to ordinary methods, i.e., with a maximum of, say, 20 exchange alphabets, be said to constitute anything like an adequate safeguard, the detecting of the "key" being a relatively easy matter. Attempts have also been made to do the ciphering and deciphering mechanically, but even in this case there is no more efficient guarantee to be hoped for.

This is why the new ciphering machine designed by Dr. Scherbius of Berlin and which is being adopted by the German Postal Department is bound to interest our readers. In fact, this machine, in point of efficiency, greatly excels anything so far known, the cipher letters being derived from upwards of 600,000 exchange alphabets, and a new alphabet being automatically switched in

(Continued on page 997)

The Automatic Ciphering and Deciphering Machine Which Undoubtedly Will Play an Important Part in Radio.

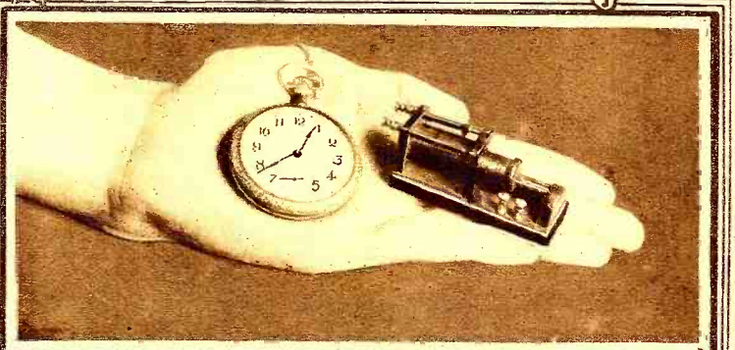
Seen At the Radio Show



This Miniature 5-Tube Radio Set Was Designed by Sydney Kasindorf In a Contest Held at the Radio Show in the Grand Central Palace, New York City. It Consists of Two Stages of Radio Frequency Amplification, a Detector and Two Stages of Audio Frequency Amplification. Using Only a Loop Aerial, Distant Stations Are Easily Received and with Enough Volume to Operate a Loud Speaker. It is So Small That it Can Easily Be Held in the Palm of the Hand. Three Rheostats Are Used, One for Controlling the Two Radio Frequency Tubes, One for the Detector and One for the Two Audio Frequency Tubes. A Potentiometer Stabilizes the Action of the Radio Frequency Circuit. All Tuning is Accomplished by the Variable Condenser Mounted on the Right of the Panel. © Kadel & Herbert.

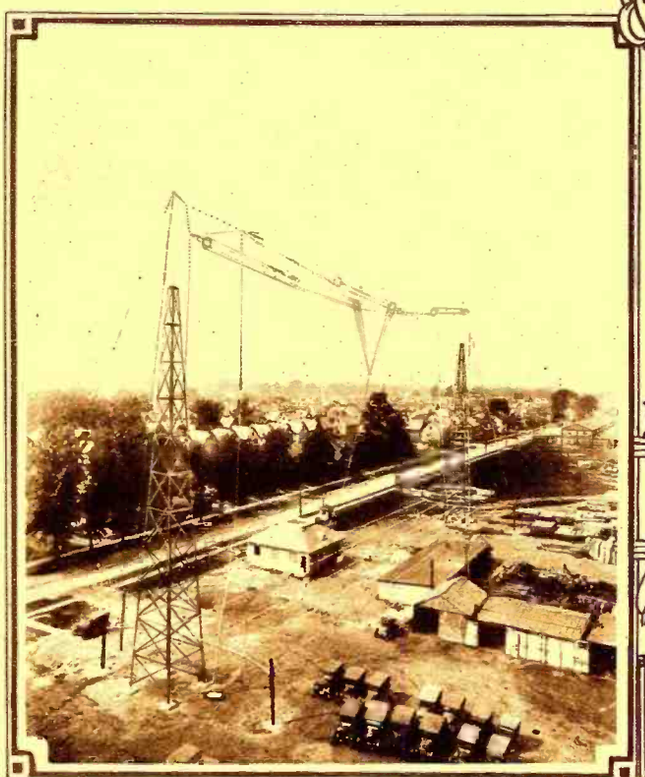
Another View of the 5-Tube Radio Set Designed by Sydney Kasindorf. Although Very Compact With the Transformers Very Close to Each Other, It Is So Well Designed That the Usual Deficiencies Encountered in Portable Sets Are Eliminated. Operation Is Considerably Simplified by the Use of UV-199 Tubes Which Are Not Critical As To Filament Adjustment. © K. & H.

Among the Novelties at the Radio Show Was a Huge Vacuum Tube of the Dry Cell Type. Its Construction Was Similar in Every Respect to the WD-12 Tube Manufactured by the Radio Corporation of America. A Small Red Light Was Placed in the Center of the Tube, Between the Elements, and When Lit, Presented a Very Pretty Sight. © Kadel & Herbert.

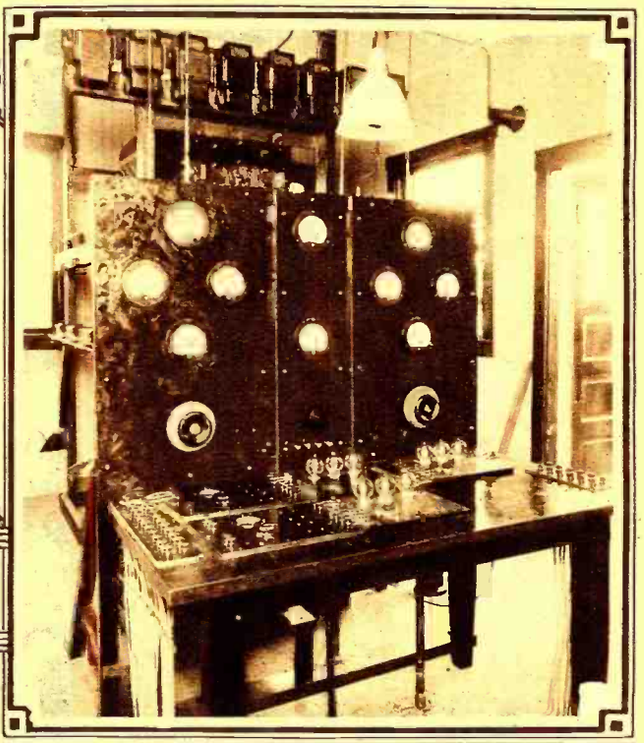


The Builder of This Miniature Loose-Coupler, Mr. M. W. Obermiller, Claims It To Be the Smallest in Existence. It Is Wound with a Very Small Gauge Enamel Wire and Has the Usual Taps on the Secondary for Changing the Wave-Length Adjustment. Note the Two Sliders on the Top, and the Miniature Binding Post. This Loose Coupler Is Capable of Covering the Entire Band of Broadcast Wave-Lengths and It Is Quite Efficient When Used with Either a Crystal Detector or a Vacuum Tube. © Kadel & Herbert

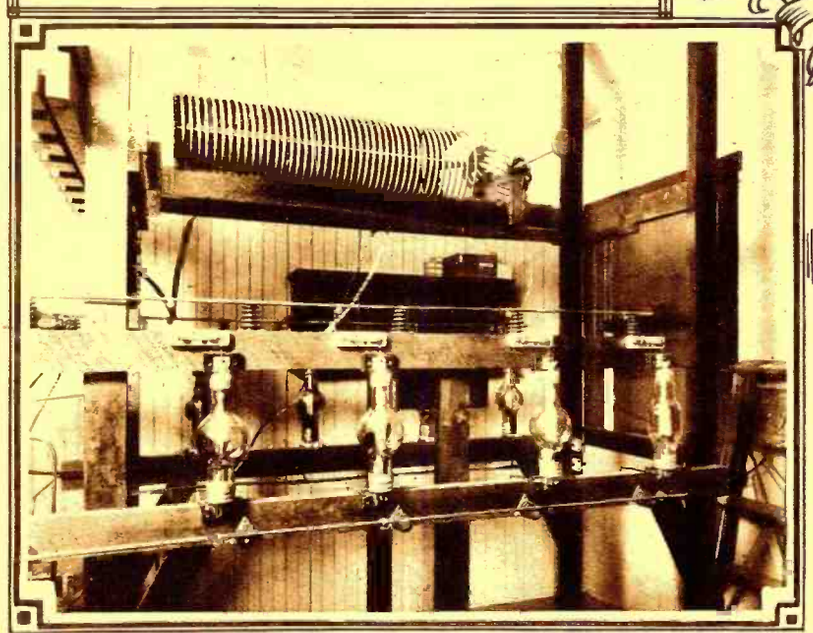
WTAM, A Battery-Operated Broadcasting Station



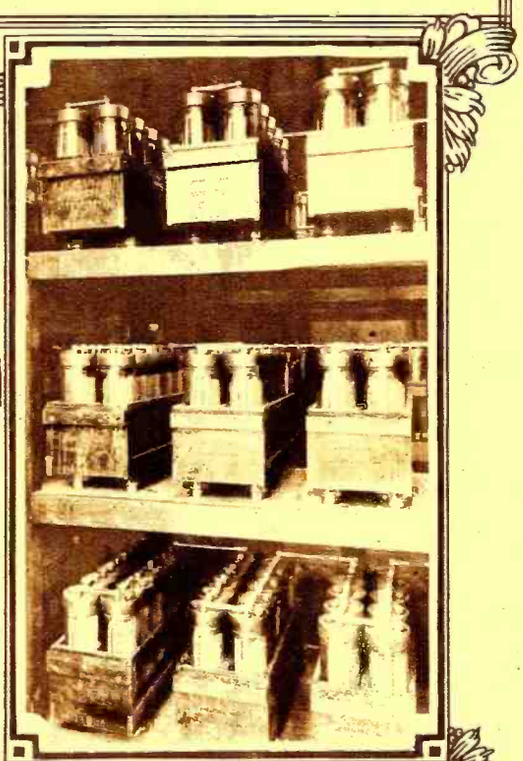
A Very Good View of the Massive Lattice-Work Steel Towers Supporting the Antenna of Station WTAM, Owned and Operated by the Willard Storage Battery Co., Cleveland, Ohio. In Order to Obtain Maximum Radiation of Energy, a Large Counterpoise is Used Instead of a Ground Connection. This is Suspended Directly Underneath the Antenna and About 15 Feet from the Earth.



The Entire Operation of This Station is Controlled from the Switchboard Shown in the Above Photograph. This Includes the Power Amplifiers and the Various Meters That Tell at a Glance the Performance of the Transmitter. This Station is of Unusual Interest, as the Power for Operating is Obtained from Storage Batteries Instead of a Motor-Generator.

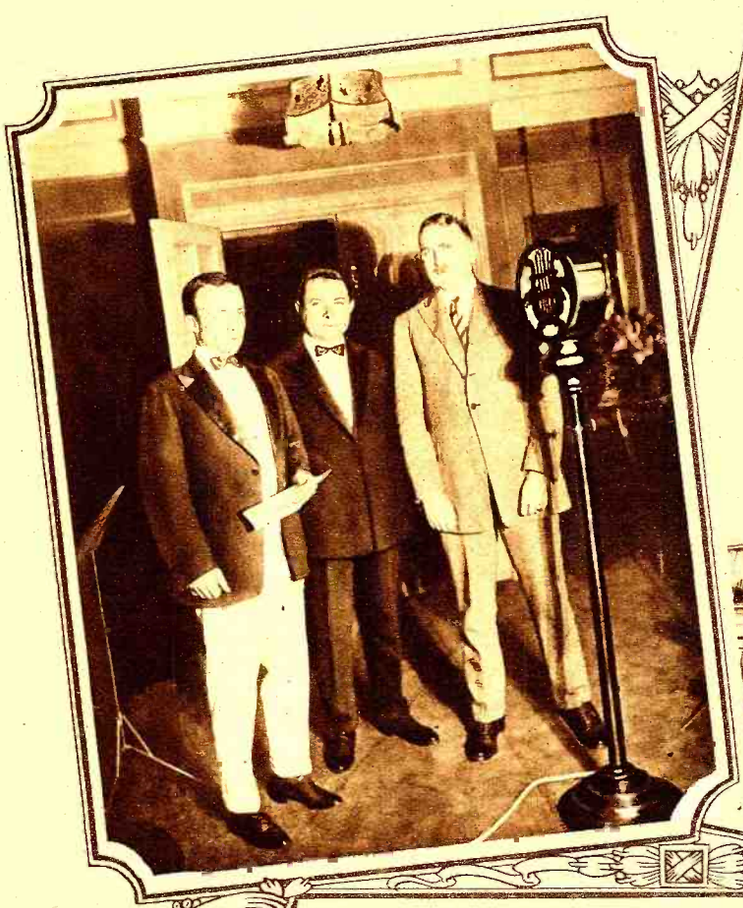


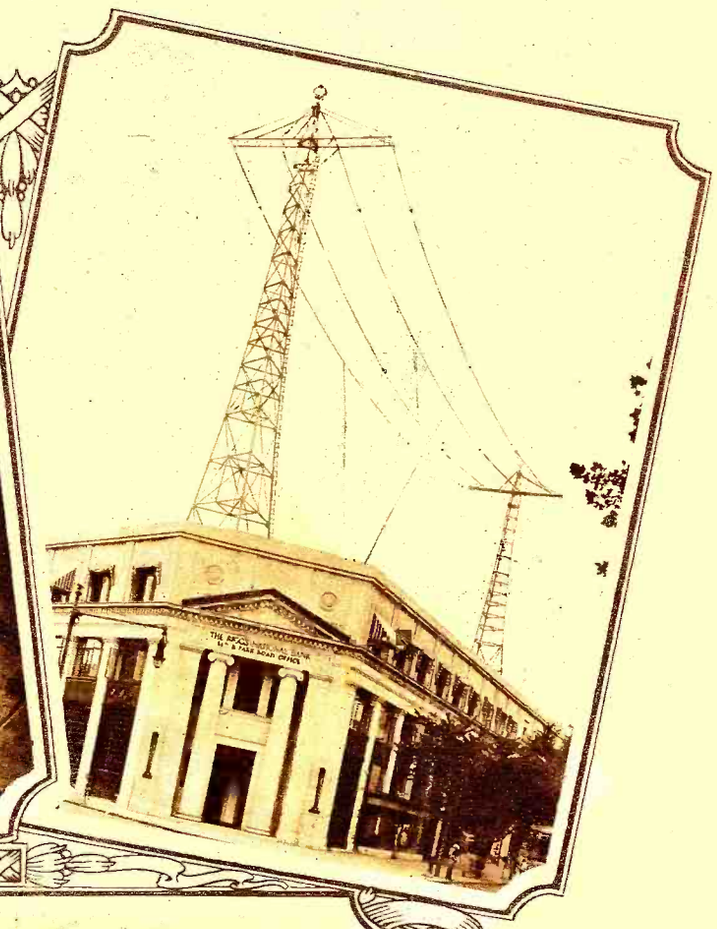
A Rear View of the Transmitting Panel Showing the Large 250-Watt Oscillator Tubes and the Smaller Modulator Tubes. The Antenna Inductance is Seen Directly Above Them. This is Composed of Heavy Copper Tubing. Note the Tickler Coil Coupled To It.



A Section of the Bank of Storage Cells Used at WTAM for Operating the Transmitter. The Advantages of Using a Pure Direct Current Are Shown in the Perfect Modulation of All Material Transmitted from This Station.

Broadcasting Station, WRC, Washington D.C.





An Interior View of Station WRC, Showing the Receiving Set and Control System on the Table and the Transmitter Panels in the Background.

WRC, a New Broadcasting Station of the Radio Corporation of America, Was Opened Recently. It is Practically a Duplicate of Station WJZ at New York City. The Large Steel Towers Are Atop the Riggs Bank Building.

LOCATED in the Mount Pleasant District, one of the highest points in Washington, D. C., where the antenna wires are suspended 150′ above the street level, a giant broadcasting station WRC, located at the New Riggs Bank Building, 14th Street and Park Road, was opened recently by the Radio Corporation of America, the company which owns and will operate the station.

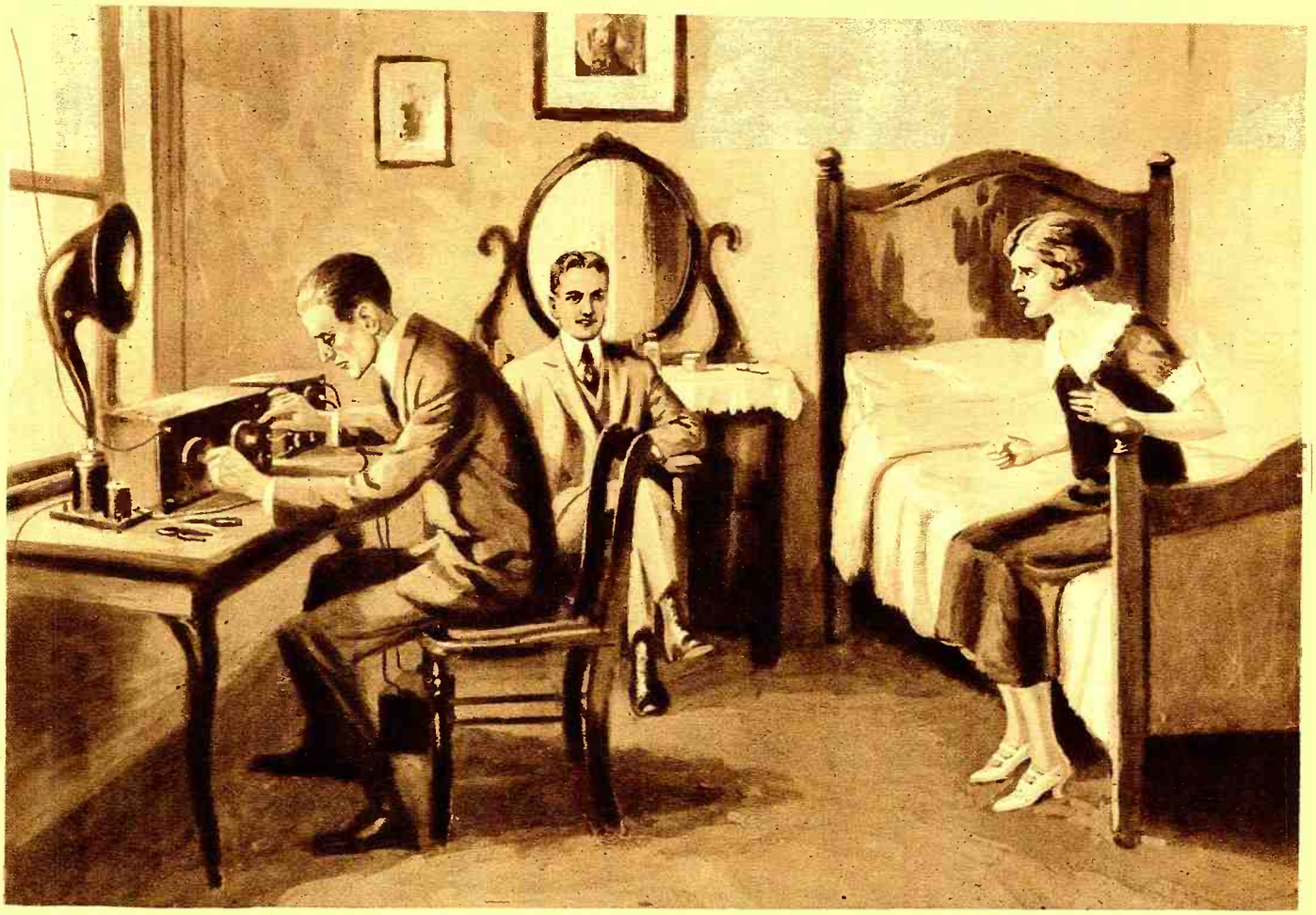
The operating table is in front of the transmitters and on it is a small box through which the operators may throw in either of the powerful transmitters and listen to the outgoing program at various stages of its progress. On this table also, is a microphone that the operator on duty may cut-in and talk to the "unseen audience" himself, should this be necessary at any time. By means of an inter-communicating phone he may talk to office, studio and reception room or may be called by them. Because the law requires that a transmitting station must constantly listen in for distress signals from ships, a highly efficient receiver is provided.

The motor-generators are housed in an adjoining sound-proof room, so their low hum may not disturb either artists or operators. Two machines are provided, one for each transmitter. Each of these powerful units consists of a single motor driving two generators, one of which supplies 2,000 volts for the oscillator and

(*Continued on page* 918)

The Proof

By ALLISON PHELPS



Again the Harsh Laughter of Tom Whitley Coming Out of the Loud Speaker Filled the Room.

A SMILE of gladness spread over the attractive face of Audrian Waite as she heard the sound of Tom Whitley's footsteps in the hallway. Hastily, she rolled her sewing into a compact bundle, dropped it into a work basket and sprang eagerly to the door. She admitted a tall, flashily handsome man who smiled hungrily at her as he laid aside his hat and examined her flushed face critically with bloodshot eyes.

"Tom!" Audrian cried, happily. She held out both hands to him in greeting.

Tom Whitley's too-wide eyes narrowed. He took the girl's hands in his own and pulled her toward him. Audrian caught the odor of whiskey on his breath as he grasped her roughly and forced his hard lips to her soft ones. She was startled by the tempestuousness of the embrace. It was the first time Tom had kissed her and she was not quite pleased with the result. It left her trembling, disgusted. She endeavored to push him away from her, but he held her slight figure tightly and pressed his scarlet face close to hers.

"Tom!" she breathed, "you mustn't!"

"Why not?" he queried loudly, "what's the matter? Can't a fellow kiss his fiancee?"

A calm, annoyingly cool voice, which was not Audrian's answered him. Whitely looked up sharply and frowned at the white face of a frail youth who had entered the room.

"Certainly," said the voice, "a fellow has a perfect right to kiss his fiancee—that is, he has with her permission."

Hostile eyes stared into Tom Whitley's and the older man flushed under the redness, which raw liquor had brought to his face.

Audrian stepped between the two men. "Tom," she said, "I want you to meet Joe, my brother. Joe, this is Mr. Whitley of whom you have heard me speak—the man I am going to marry."

Tom Whitley threw back his shoulders in unfeigned relief. "Glad to know you, Joe," he remarked and advanced with extended hand toward the pale youth who was sizing up his future brother-in-law with eyes in which no sign of friendliness showed.

"I'm glad of having this opportunity of meeting my sister's future husband," Joe said quietly; then, ignoring completely the proffered hand, he turned on his heel and went out of the room.

The flush on Tom Whitley's face deepened.

"I guess your brother doesn't like my looks very well," he said to Audrian when Joe was gone.

"Joe's funny," she answered. "He'll like you as well as I do when he knows you better. But he is inclined to be jealous. You see, he and I have been very close since mother died and Joe's chest was crushed in that terrible automobile accident. Joe hasn't been able to work since, and I have had to take care of him. But he is older than I am and he feels that he must watch out for me."

"Humph!" grunted Whitley, "seems to me you're old enough to take care of yourself."

"I guess I am," laughed Audrian, "but Joe doesn't think so. I suppose I'll always be 'Baby Sister' to him."

"You'll soon be Mrs. Thomas Whitley," he told her. "When that day comes you won't have to worry about Brother Joe any more." Tom led Audrian to a davenport which had seen better days and pulled her down beside him.

Audrian sighed. "It makes me glad to hear you talk that way," she said to him. "I wouldn't think of marrying a man who wouldn't be good to Joe. Joe is sensitive and proud. He used to be big and strong before the accident. It hurts him now to have to be dependent upon me. I don't know what he would do if he didn't have his radio."

"Radio?"

"Yes. Joe is an enthusiast of the new rage. From early morning until late at night he sits in his little back bedroom and works on the new audion detector he is building, or listens on the little crystal receiver he made some months ago. He is anxious to finish this new set, but in order to run it he has to have some batteries and some kind of a light he calls a vacuum tube. Those things cost a lot of money, but I'll get them for him—some way or other."

Tom Whitley was not interested in radio. In fact he was not interested in much of anything except Thomas Whitley and Thomas Whitley's own passions. Tom had

(Continued on page 960)

Toll of the Sea

By HOWARD S. PYLE

SITTING huddled in his chair, firmly lashed to a convenient stanchion, Harry Myers, wireless operator on the lumber carrier, *Sea King*, Bellingham for San Pedro, grimly fought to maintain his equilibrium in the little cabin, rolling wildly with the sturdy little vessel bucking the seas off Tatoosh.

The full fury of the storm had struck them a few hours before, after leaving Neah Bay and rounding the Cape into the open Pacific. The wind shrieked wildly in the rigging and each enormous wave caused the husky little motor-ship to shudder violently, like a huge dog, attempting to shake the water from its back. It was truly a wild night and one not soon forgotten by many a Pacific mariner who uneasily paced a bridge deck incessantly the night through. Official weather bureau reports from Tatoosh placed the wind velocity at one hundred and four miles per hour and the seas ran mountain high, sending a scattering spume entirely over the tiny island guarding the entrance to the straits.

Valiantly the *Sea King* plunged and dived into the great mountains of green sea rising always to meet her. Feverishly did the Chief Engineer stand by his throttle in a vain effort to control his laboring engines to meet the frequent plunges which often brought the propeller many feet clear of the water. But the fight was close—like a huge monster the turbulent waters threatened to engulf the struggling vessel in its enormous maw with each succeeding wave.

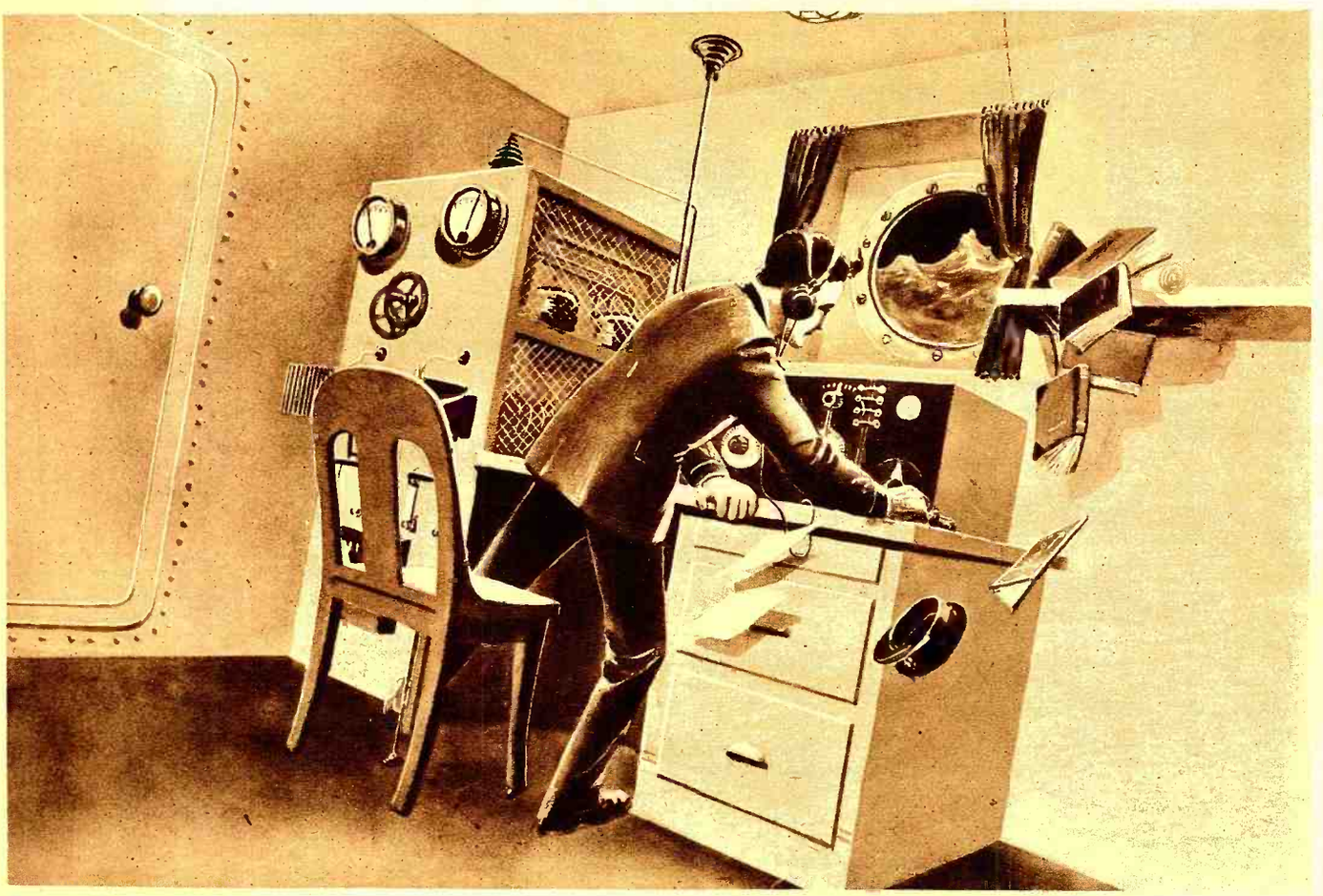
Eight bells struck—the sonorous booming coming but faintly to the small wireless cabin on the boat deck, where with his headphones tightly clasped to his ears, one lone human exercised a ceaseless vigilance over the lives of the sixteen souls braving the terrors of the sea. It was comforting to this lonely watcher to hear the re-assuring signals from the familiar shore stations—the shrill whistle of NVL at Seattle, the deep staccato of VAE, far up the coast and the hoarse boom of KPH guarding the San Francisco district. A few insistent characters made by his hand on the little key before him and instantly would these shore stations take up his appeal and send flashing out over the wide expanse of heaving water, the call for assistance that would cheer the despair of men who were losing in their grim battle.

The door of the little cabin was suddenly flung open and in a blinding swirl of wind and water, the mate staggered into the room. "God, Sparks, what a night! The Old Man of the Sea himself must be on the rampage! All Hell's broke loose below—our steering engine quit cold and how under Heaven I can keep men at a slippery hand-wheel on a submerged deck I don't know! You'd better stick tight to your junk and stand-by for the old man's orders. We're going to try and make the straits again if she'll make the turn. And Sparks, old man, better get into your life belt—Lord knows what's to come!" With that the first officer pulled his cap closer about his ears, bundled his great-coat tight about him and forced himself once more into the elements.

If anything, the wind was increasing. Its howling in the rigging rose from a low moan to a piercing shriek. A heavy rain commenced to fall and curious zig-zag streaks of lightning lit up the scene like daylight. To Harry, venturing a long look from his tiny port-hole, came a strange premonition that they could not last the storm. "What chance," he whispered, "—has a mere man-made vessel against the natural laws of God. We won't weather it—we can't," and so saying he reached for his life-belt in the rack overhead, adjusted it carefully to his slim body and then, starting his motor-generator, put in a short quick call for NPD, the radio station of the United States Navy, just a few miles away at Tatoosh. Shutting down his set, he waited tensely for the shore station to start its big gas engine, for Tatoosh was not blessed with a constant source of power from city lines.

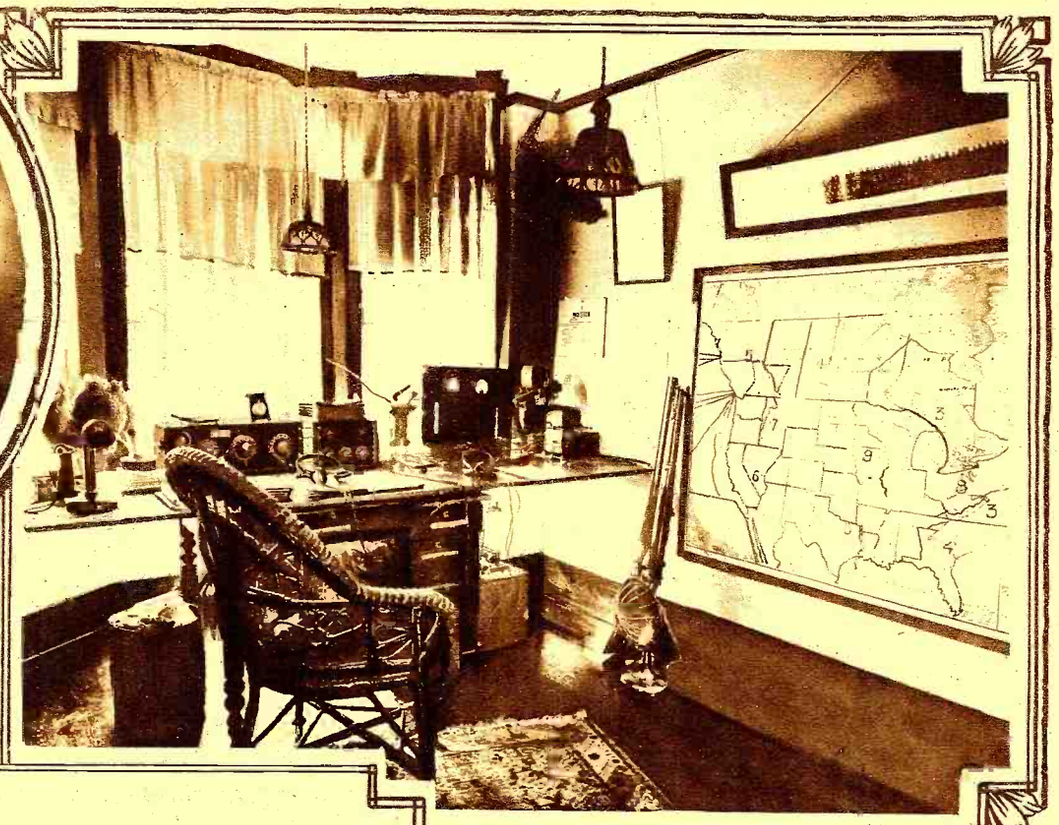
At last it came, the re-assuring spark from NPD, telling him to "go ahead." Again bringing his motor to speed, Harry quickly threw his antenna to the sending position and snapped out, "MS SEA KING, eight miles off NPD, steam steering gear disabled. Hand gear not expected last. Going try for straits. Please keep your engine running and stand by; may need assistance." His spirits brightened at the cheery answer, "All right, old man, we'll watch you. Will call Coast Guard and tell 'em stand-by. Keep us informed. Good luck." Slowing his motor down, but allowing it to continue turning over, Harry settled himself more firmly in his chair and prepared to immediately meet the anticipated orders from the bridge. A smoke, he reflected, was said to sooth the nerves and he accordingly fished out a crumpled package of cigarettes and a lone match, from his coat

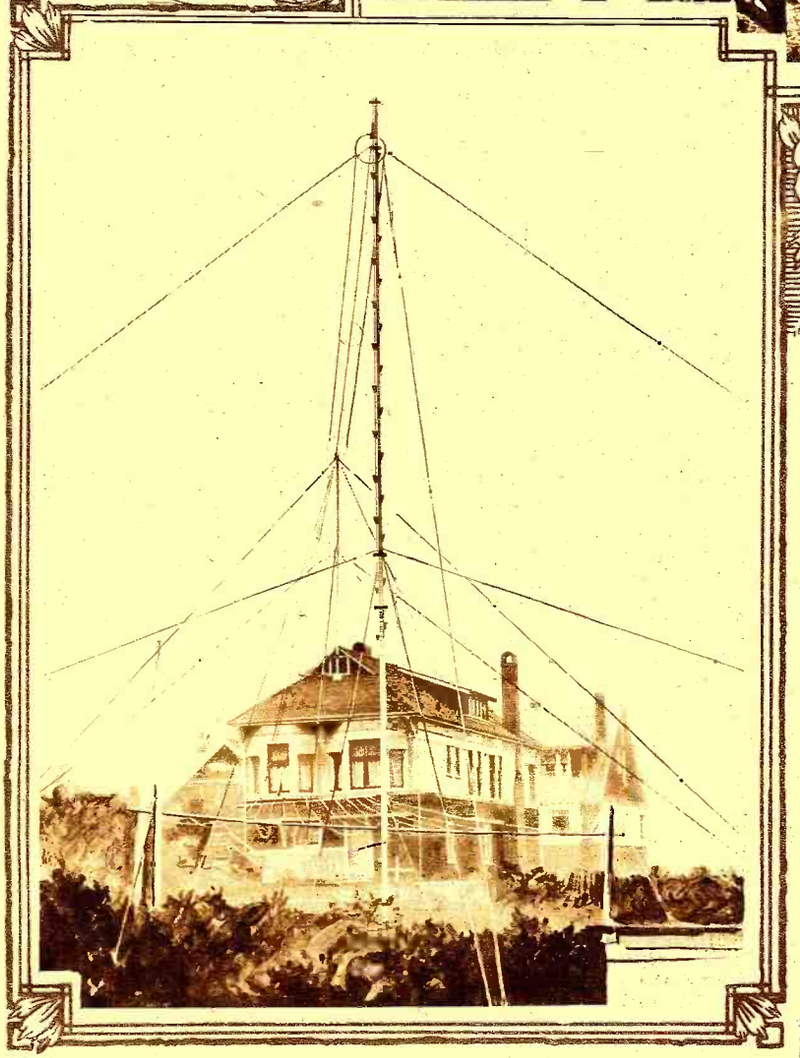
(*Continued on page 975*)



Placing His Phones and Throwing the Antenna Switch, He Grasped the Frame of the Transmitter Panel for Support, and Standing Well Braced, Called NPD In a Quick, Decisive Style, Following With, "It's An SOS Now. Hand Gear Gone Too. Ship Out of Control. Can Only Last Few Minutes. Tell Coast Guard eigh——" and There His Generator Stopped!

The Station That Broke Through To the Arctic





Until Recently, Jack Barnsley, owner and operator of station 9BP, Situated at Prince Rupert, B. C., Has Been the Only Amateur Who Has Been Able to Get Into Direct Communication with Operator Mix on Board the S.S. "Bowdoin," now in the Arctic Regions. The Accompanying Photograph of His Station Shows That Efficiency Has Been the Prime Factor. The Aerial System at This Station is Quite Elaborate, Composed of a Four-Wire Cage Aerial, with a Large Counterpoise Directly Beneath It.

The General Radio Research League

WE have two A. R. R. L.'s, a C. R. R. L. and now we have a G. R. R. L. The G. R. R. L., however, is not related to the others, being a Research League not a Relay League. Still the G. R. R. L. is doing important work, just as the others are, and is bound to flourish.

The General Radio Research League was recently organized, and so far has not spread much. Similar to the other R. R. L.'s it is not centered and it is the fair hope of the League officers that within a short time there will be at least one chapter in each State of the Union, if not more.

The purpose of the organization is to promote research in the radio field and to assist those who are seriously engaged in such work. "United we stand, divided we fall" might be the motto of the G. R. R. L. as its members *are* members to "help each other to help themselves."

The first Bulletin of the League appeared in October. Although quite small at present, it will probably enlarge itself as the number of active chapters increase.

Anyone interested in the General Radio Research League can obtain full information from the Secretary, Mr. Frank Eppley, 1317 E. 10th Street, Davenport, Iowa.

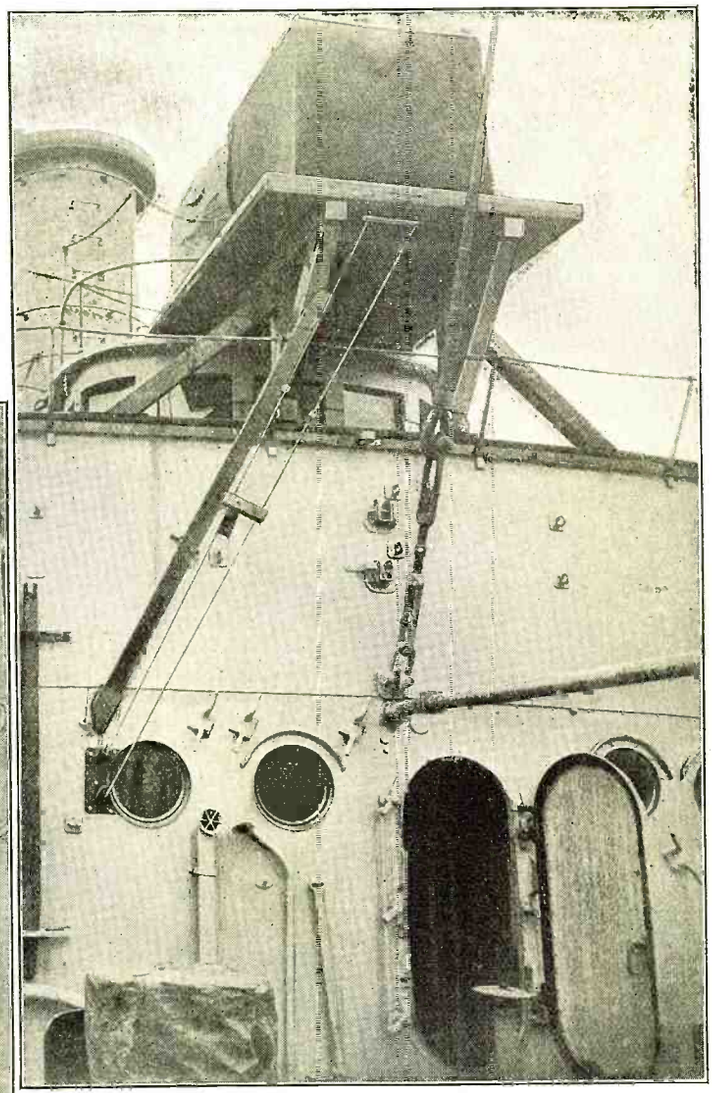
The German Radio Compass for Shipboard

By DR. ALBERT NEUBURGER

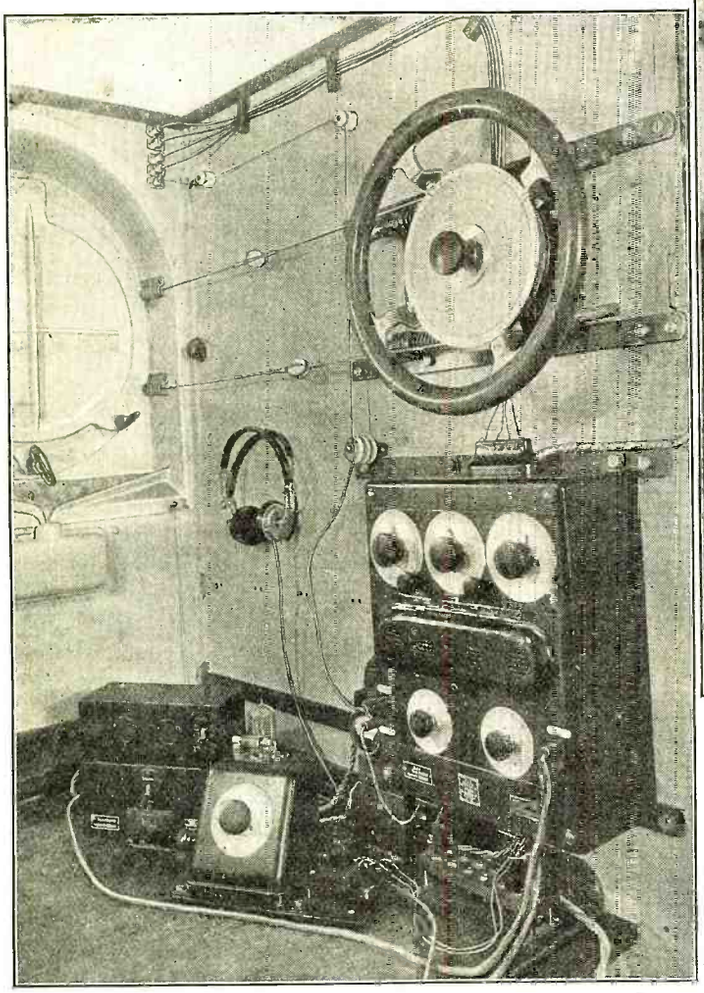
A novel heterodyne receiver which makes possible the obtaining of uni-directional bearings with the use of an ordinary loop aerial.

SOME 20 years ago, during the childhood of wireless telegraphy, it was rightly recognized that the electric waves were a first-rate aid in finding the position of ships by taking the bearings. If a ship came near a coast and wanted to know her whereabouts, two points of the coast were aimed at by help of a special compass, the bearing-compass. Thus two lines were found, which could cut only in one certain point. This point had to be the position of the ship.

The proceeding presumes good weather, moreover it was only then reliable, when there was no possibility of an error concerning the objects aimed at by help of the telescope combined with the compass. To avoid such errors, sketches of the coast are drawn in the sea-maps with all the steeples, towers, rocks, villages, etc. But even then the sphericity of the earth is the cause that the bearing is only possible up to a certain distance. If the ship is situated below the horizon the objects to be aimed at are out of sight.



On the Right May Be Seen the Mounting of the Loop Aerial Which is Housed in the Square Box Atop the Bridge. Note the Control Cables Running from the Wheel in the Radio Room to the Loop.



A View of the Receiving Apparatus Used in Conjunction with the Loop Aerial. The Loop is Turned by the Large Wheel Attached to the Bulkhead Directly Above the Receiver.

Then other ways of bearing have been found out, above all acoustic ones. They consist of signals given from the coast by help of sirens, etc. There are movable receivers on board the ship, which are turned round until the signals are at maximum intensity. Thus the direction is found, from which they come and again the two lines are found, which cut in the position of the ship. Of course, the different stations at the coast must give various signals, which differ from each other and are characteristic for each station. On the water the sound is transmitted four times better than in the air. Therefore the proceeding has been changed recently insofar as it can be executed by help of submarine signals. These signals are received by very sensitive telephones below the surface of the water on the outside of the ship. From there, wires run to the bridge, where the headphones are.

BEARINGS BY RADIO

Compared to all these methods the use of electric waves offers great advantages. Above all, the distance of transmission is not limited in such a degree as with optic or acoustic methods. For this reason wireless telegraphy was used 20 years ago to determine the position of ships. Professor Braun in Strassburg and later Bellini and Tosi designed apparatus for wireless bearings and in the course of time further methods have been devised.

Generally the proceeding is as follows: A ship wanting to know her position begged by the help of her wireless apparatus, for radio signals from coast or land stations. After this, the ship transmitted signals for a space of time. These were received by the stations on land and here the direction from which they came was determined. To ascertain this, a movable loop aerial was used. If such a loop is turned round its vertical axis, the sound in the headphones of the receiver becomes, as is well known, distinct and strongest in that moment when the edge of the winding is directed exactly to the transmitter. If the aerial is turned, the sound gets weaker and weaker. Its strength reaches minimum intensity after turning it 90 degrees, that is, when the axis of the windings is directed towards the transmitter. At this moment the sound stops fully. As the minimum

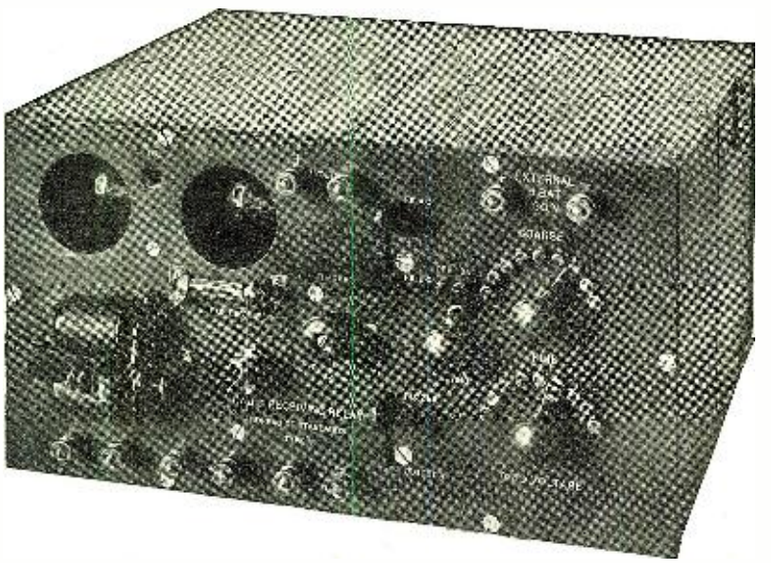
(*Continued on page* 970)

Break-In Radio Relay Communication

By LIEUT. COL. J. O. MAUBORGNE Singal Corps, U. S. Army

IN CHARGE OF SIGNAL CORPS RADIO RESEARCH LABORATORY, BUREAU OF STANDARDS, WASHINGTON, D. C.

In this article, especially written for Radio News, Lieut.Col. J. O. Mauborgne describes an interesting automatic relay system which might be used by amateurs for long distance transmission. It was developed by the author and has been used very successfully in stations of the army radio net.



The Dunmore Relay Used in the Automatic Retransmission of Signals. This Apparatus Was Described in Detail in the July 1922 Issue of RADIO NEWS.

VARIOUS types of radio relays of widely different sensitivities are now in actual operation in various parts of the world, either for the relaying of radio telegraphic messages, or for the control of radio-operated boats, aircraft, or other mechanisms. Of these, the Dunmore Relay, described in detail in the April, 1922, issue of the Journal of the A. I. E. E.,* appealed to the writer as a decidedly practical device of great value in a net of radio stations of moderate power, such as that operated by the Signal Corps of the Army, which covers practically the entire continental area of the United States, as a means for relaying messages through one or more intermediate stations, thereby avoiding manual relaying with consequent loss of time in transit, curtailing message errors which sometimes creep into a manual relay system, and reducing not only the strain on the operators, but the total number of personnel necessary at intermediate stations of such a system.

With the accomplishment of these objects in view, the scheme of break-in relay communication herein described, was proposed by the writer to the Chief Signal Officer of the Army, about a year ago, and given a very successful trial in the Army Net. The results obtained were so satisfactory and promising that the writer is convinced that amateur relay organizations, such as the Amateur Radio Relay League, might well put the scheme in operation in their relay system, thereby speeding up the time of transmission of their trans-continental messages, and boosting their efficiency.

The first scheme proposed was based upon the need for break-in relay operation at only one intermediate station, which would serve two terminal stations.

It was early realized that the successful operation of any relay system must permit either terminal station to "break" the other terminal station, when sending, to ask for corrections or what not, without the interposition of manual operation at the relay point, and also that the relay station should be able instantly to "cut in" on the conversation, and communicate with one or both terminal stations at the same time. Also, that the arrangements at the relay station should be such that the operator at the relay point could be instantly called upon to adjust the relay at any time by either terminal station.

For the circuits of the Dunmore Relay, the reader should refer to the article in the Journal of the A. I. E. E., by Mr. Dunmore, already mentioned.

Essentially this scheme for break-in relay communication depends upon the fact that the relay which controls the transmitter at the relay station may be actuated by any signals from one, two, or more receiving sets tuned to incoming signals of the same or of different wavelengths, provided the output circuits of the receivers, in parallel, feed currents of equal strength into the relay, since it will then function as well on one audio signal as another. Differences in current strengths received at the relay station from the terminal stations due to unequal distances or powers, must be equalized by amplification control.

A further requirement is that each terminal station must listen in for the signals from the relaying transmitter to ascertain if its own signals are properly leaving the relay station. This, of course, requires, in the ordinary case, a separate antenna for each transmitter and receiver at each relay or terminal station.

Fig. 1 shows a diagrammatic arrangement of the apparatus at the relay and terminal stations as actually operated in practice.

The stations represented are called "A," "B," and "C" respectively.

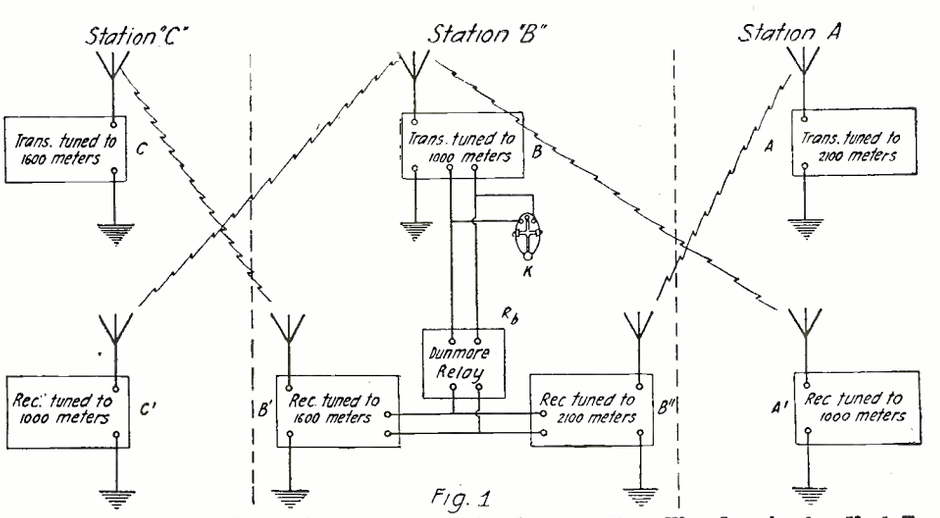
In the case shown, the transmitters are all tuned to different wave-lengths. Transmitters "A" and "C" are manually operated, while "B," at will, may be operated manually or controlled by the relay, Rb, which is actuated by signals either from transmitter "A" or "C."

The operation at station "A," transmitting at 2,100 meters, listens in on his receiver "A'", for his signals returning from transmitter "B" which is sending out a 1,000-meter wave, noting if his transmission from "B" is satisfactory. If not, he calls upon the operator at the relay station to make better adjustment of his relay or receiving apparatus, or of his transmitter, if the fault should lie therein.

The adjustments of the relay and the receivers, "B'" and "B''" should be checked daily or more often, if necessary, by the relay station operator, who calls on both terminal stations to send alternately while he separately adjusts his two separate receiving sets, and the output of his amplifiers, so that the signals from both terminal stations affect the relay equally. The distant stations check the accuracy of the adjustment.

The receivers at "A" and "C" stations are both tuned to the wave-length of relay transmitter "B".

One operator is sufficient for watching



A Radio Circuit With Intermediate Automatic Relay Stations. Three Wave-Lengths Are Used To Prevent Interference.

*"A Relay Recorder for Remote Control by Radio," by F. W. Dunmore, Radio Laboratory, Bureau of Standards, Journal A. I. E. E.

the reception at "B," since he can listen in on both receiving sets simultaneously by having two single-ear telephone receivers on one head-band. He also maintains a watch upon his own transmitter adjustment.

CAUSES OF INTERFERENCE

With one terminal station sending and the relay operating satisfactorily, interference with the operation of the relay may be brought about in several ways: First, by signals from other transmitters working nearby, or on almost the same wave-length. The solution of these difficulties are apparent to all practical radio operators and may involve the use of extremely loose coupling at the receivers, the use of wave traps, and perhaps of other arrangements, although when using the Dunmore relay its audio tuning arrangement assists in eliminating much of this trouble.

A second cause of interference, when the relay has to be adjusted for weak signals, undoubtedly, is strong static, particularly of local variety. Skill in the adjustment of the relay will help remarkably in the elimination of the effects of static, but even with a maximum amount of skill on the part of the operator, static elimination devices of a practical nature are still highly desirable for use with any radio relay now in the field.

A third cause of interference, from the very nature of the arrangements shown, will be that set up by the transmitting apparatus of the station desiring to break, when the signals are not coming through the relay properly, or when for any other reason, it becomes necessary to break the transmission from the distant terminal station. The ease with which this is accomplished was marvelled at by the Signal Corps operators who first worked through the relay station established for test of this scheme. Calls for repetition, O. K.'s, and other signals were made just as though the operators were working over a wire telegraph line, while the man at the relay station, until then swamped with manual relay work, settled back in his chair, put his feet on the desk, lit his pipe and said "Well, I sure can take a good rest now with that system working."

With station "A" sending, should "C" desire to break, he simply starts sending the break signal. Station "A" hears his transmission from "B" interfered with, as the break signals operate the transmitter "B" not only during the time station "A's" transmission closes the relay contacts at "B," but also between letters and words. Thus during the interval when the key is open at "A," "C" can transmit and operate the relay which will be idle at that instant. Thus a break-in signal from "C" will be heard at "A'".

An interesting point in connection with this method is the fact that no interference will be experienced at the receivers "B'" and "B''" from the neighboring transmitter "B," because the break signals function at the time when there is no transmission from "B," that is, between letters and words.

The operator at "B" may break the relay transmission at any time by simply operating his key, "K," which is in parallel with the relay contacts. Terminal stations listening to the transmission from "B," hear the break and stop sending until "B" has finished.

When the operator of a terminal station hears his transmission from "B" being interfered with by static from "B'" or "B''", he instantly repeats his signals and continues to do so until they are correctly transmitted from the relay station.

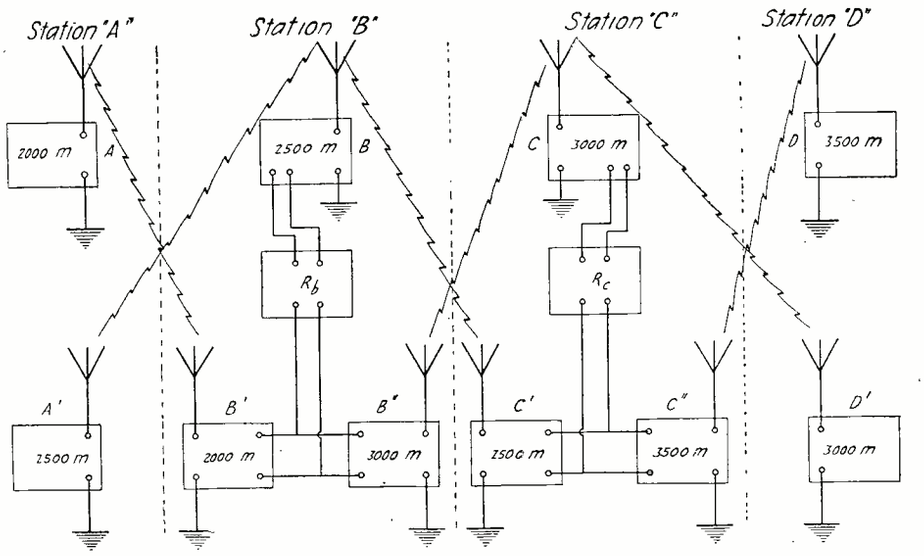


Fig. 2

By Using Two Relay Stations a Greater Range Could Be Covered. This, However, is Only a Suggested Scheme Which Has Not Been Tried Out.

While the scheme just outlined is arranged with two receivers at the relay station, so as to be able to receive two different wave-lengths from "A" and "C" respectively, it is quite practicable to have the two terminal transmitters tuned to the same wave-length, in which case only one receiver need be provided at station "B," that is, if the input currents to the relay can be arranged to be about equal for the two signals received.

Whether this relay scheme can be applied satisfactorily to a system where more than one intermediate relay station is used will depend upon the lag in transmission inherent in the adjustment of the relays themselves. So far as known, the following scheme suggested by the writer and exhibited diagrammatically in Fig. 2, has not been tried, though it offers some promise of success, within certain limits.

Given four stations "A," "B," "C" and "D" in a net, the problem is to make it possible to break-in from "D," "C" or "B," for example, while station "A" is sending.

EACH TRANSMITTER EMPLOYS A DIFFERENT WAVE-LENGTH

In the arrangement shown in the figure each of the four transmitters uses a different wave-length. The two terminal stations each use only one receiver, but the intermediate relay stations each has two receivers either of which controls the transmitter of that station through its relay. Every receiver and transmitter in the entire net has a separate antenna, "remote control" of the transmitters being arranged where necessary.

Station "A" sending is received at station "B" on receiver "B'" which actuates relay Rb, in turn controlling transmitter "B" which sends out a wave of 2,500 meters to both receivers "A'" and "C'". Receiver "C'" in turn actuates relay Rc and operates transmitter "C" which transmits on 3,000 meters to receivers "D'" and "B''". Note that therein lies the difficulty, for unless the signals from "C" and "A" are received on receiver "B'" and "B''" practically simultaneously, the lag between the two signals will cause the relay Rb to chatter or drag the signals, more or less interfering with good transmission from transmitter "B." Not only will the lag due to adjustment of the relays have to be taken into account, but also the actual time of transmission from one relay station to another and back again, has to be considered an important lag factor. With considerable distance between the relay stations, the scheme shown in Fig. 2 is manifestly impracticable.

Whether or not break-in system can be arranged for a multiplicity of relay points along the lines last outlined, remains to be seen, but there is no doubt that the break-in relay system shown in Fig. 1 is entirely feasible, as has been demonstrated by practical test.

HOLLAND AND ITALY HAVE DIRECT RADIO SERVICE TO UNITED STATES FOR FIRST TIME IN HISTORY.

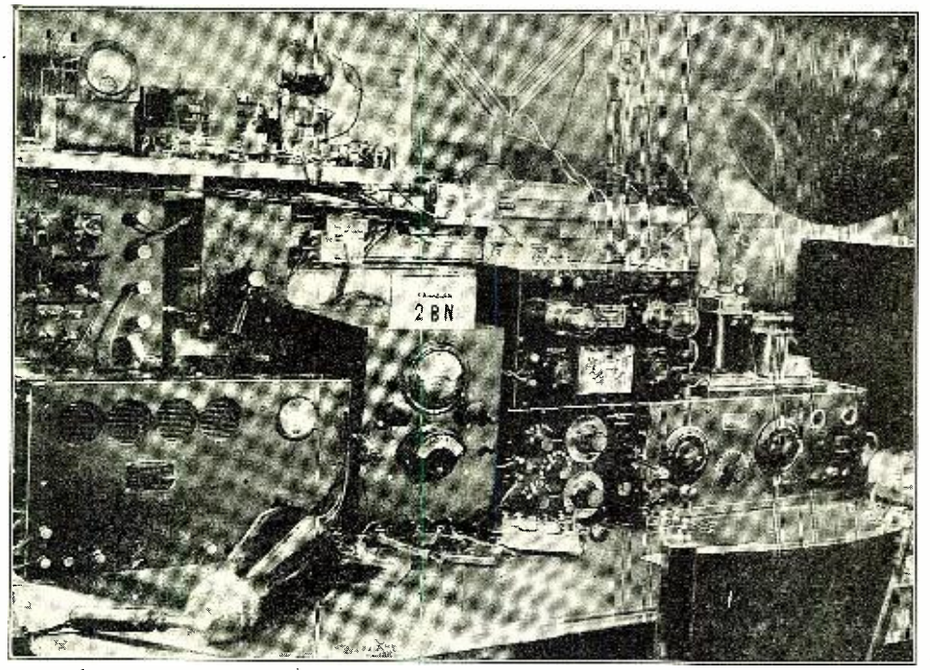
For the first time in the history of international communications, direct radio telegraphic service between the United States and The Hague, Holland, and between the United States and Coltano, Italy, has been established, according to an announcement made by the Radio Corporation of America. The opening of these services raises the total number of direct radio circuits radiating to European countries from New York City from six to eight and affects not only Holland and Italy but provides more direct routes between the adjoining countries and the United States.

The addition of these new circuits to the already existing channels of radio communication to many parts of the world materially advances the status of plans which are now being worked out by the Radio Corporation to make the United States the center of a world-wide radio communication network. Because of the centralized location of the United States, with Europe to the east, South America to the south and the Orient to the west, this country enjoys a natural advantage which helps to make it possible to link the principal nations of the world by radio around New York as the pivotal center. This plan is rapidly nearing completion, there being at present eight connections across the Atlantic and one bridging the Pacific.

The circuit to Italy is one of the longest in existence. The distance which the radio waves travel in connecting the two points in communication is over 4,500 miles or one-sixth of the way around the globe. In bridging this distance, however, the element of time is a negligible

(*Continued on page* 979)

From 150 to 220 Meters



Station 2BN (Can.) Owned by J. L. Miller, Montreal. On the Shelf in Top Left-Hand Corner is a 40-Watter With a French Tube and Hartley Circuit. Directly Below is a Tampered-With (Hi!) Westinghouse Transmitter. Can Be Used for Phone (10 Watts) or C.W. (20 Watts). Power is Obtained From Motor-Generator or Line Voltage Through a Tube or Chemical Rectifier. Antenna is a "T" Type Flat Top With Six Wires, 60′ and 75′ High and 75′ Long. A Seven-Wire Counterpoise is Used. 2BN Has Been Copied in Every District in the U. S. and Canada.

Excelsior

A CERTAIN commercial official recently stated:

"The amateur game of today seems to be a detriment to the person experiencing it. Give me the greenhorn from school and I will make an operator of him—give me some of the hams I have had and they will produce pandemonium for me! There are good amateurs, but they get scarcer and scarcer."

This calls definitely to our attention the fact that there is something wrong with our game. It is something serious and it behooves us who make up the personnel to not merely take notice, but to act and to start acting now. It was not so formerly!

There was a time when amateur radio experience was decidedly valuable to the ham who might wish to carry on and make the fascinating vocation of radio his life pursuit; there was a time when the ham was welcomed into the commercial game as an experienced man. The time has not entirely passed, but it is passing and will be entirely lost unless we make the move to straighten matters in this, our hobby.

The commercial end of the radio game has its drawbacks according to our point of view; but, commercialism does develop personal efficiency, dispatch, and service, all of which should be a big part of our goal as well as transmission efficiency. Make it your goal—the star to which you hitch your wagon—be known as a *good* operator.

Sincerely, from the sound of the air, it seems as if our high aims are gone and the substitute is made of shoddy material—cheap tinsel, gaudy, but threadbare.

As you listen-in, think it over—as you operate, think it over, then, IMPROVE!

Some of us are making a big error. We are aiming at the wrong bull's eye. We make DX our idol and forget the truer gods.

The ham who brags about his DX record of so many miles has, we admit, something to brag about; but can he brag equally honestly about the ease with which he moves and handles traffic, the number of stations he works, the sharpness of his wave, and the efficiency with which his set works? The DX record has not half the value that the other virtues have.

The bird that brags about his DX record usually has nothing else to brag about. He is usually heard on a CQ and doesn't seem to realize that a man might get distance while handling traffic. Handling traffic is considerably more fun anyway.

I, personally, get twice as much kick out of working 20 other fellows in a night and handling a bunch of messages, as I do out of a DX report. And I feel that I have accomplished something too. Yet, I will bet that any one of these fellows who are on regularly and doing something when on, have more of the same DX than the "dumbell" who cannot work, but who is heard now and then and brags about it.

A five-watt set heard only 1000 miles and doing a regular 500 to 800 mile DX communication is twice as good and useful as the 50-watter with a 6000-mile DX record and unable to establish consistent communication.

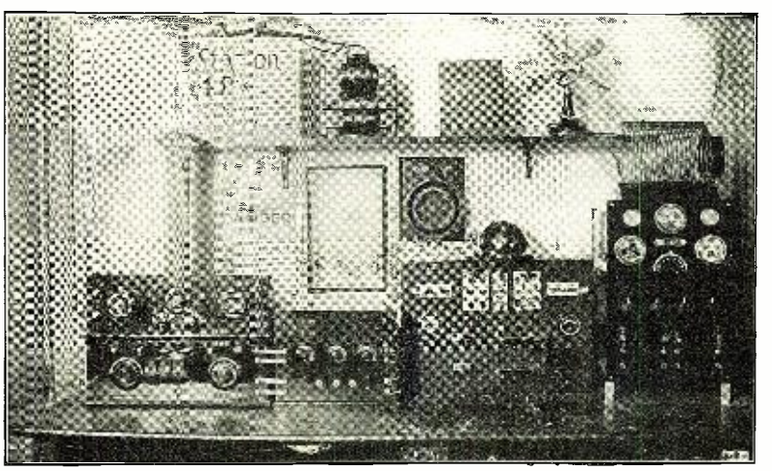
Make it your goal to have a station with which you can communicate and not one with which working is an impossibility. Don't be satisfied with DX reports; go after the kind that say: Fb hr OM QRK gud es stdy hpe to work u oftn. They mean something.

5XV.

[*We have Mr. Hatry to thank for suggesting that we run a "Ham Column" and for the first "Hamitorial." We will run this column every month and place in it every interesting feature we can lay hands on. If your 50-watt tube lays a couple of 5-watters, or if you are QSA in Africa, let us know so we can tell the gang.*—EDITOR.]

NOTICE

Mr. Y. W. P. Evans, secretary of the Manchester Wireless Society, 2 Park Side Road, Princess Road, Manchester, England, would like to hear from a number of American amateurs with a view of making a series of special tests apart from those of the American Radio Relay League. His station, 5MT, will be working every week from October to the beginning of February.



Station 4PK, Owned by J. C. Hearn, Atlanta, Ga. The C.W. Set is a 20-Watter, Delivering 2.9 Amps. To a Six-Wire Cage 45′ High and 60′ Long and Counterpoise 8′ Above Ground. Receivers Are Three-Circuit and Honeycomb With Two Stages of A.F.

8CPY—8DKC

J. A. Wilson's station, 8DKC, located at his summer home at Gordenech Lake, Mich., will be closed from November 1, 1923, to May 1, 1924, but will be QRV for all traffic at his Kalamazoo station, 8CPY, during this time. QSLs will be greatly appreciated.

9BOL

The call 9BOL has been reassigned to Robert A. Prehm, 86 South 13th Street, Minneapolis, Minn., 10-watt C.W. Will QSL all cards.

9LE

QRA—9LE; Leonard Carlson, 820 Prospect Street, Kewanee, Ill.

3BEZ

The call 3BEZ has been issued to Raymond L. Luckett, 1212 Orren Street N. E., Washington, D. C. All cards answered.

7AIX

The call 7AIX has been assigned to S. E. Spittle, Astoria, Oregon, five-watt, A.C.C W. Would appreciate any QSLs and will answer all cards.

3CHG

The call 3CHG has been assigned to Elmer Gabel, 412 Meredith St., Kenneth Sq., Pa. 50 watts C.W. All crds answd.

CANADIAN 3PA

Canadian 3PA has been reissued to Leonard C. Meyer, Box 65, Weston, Ontario, 50-watts C.W. Please QSL.

A NEW STATE IN THE UNION

Statistics shows that there are more receivers in a certain state than in any other. Perhaps it is the state of Oscillation.

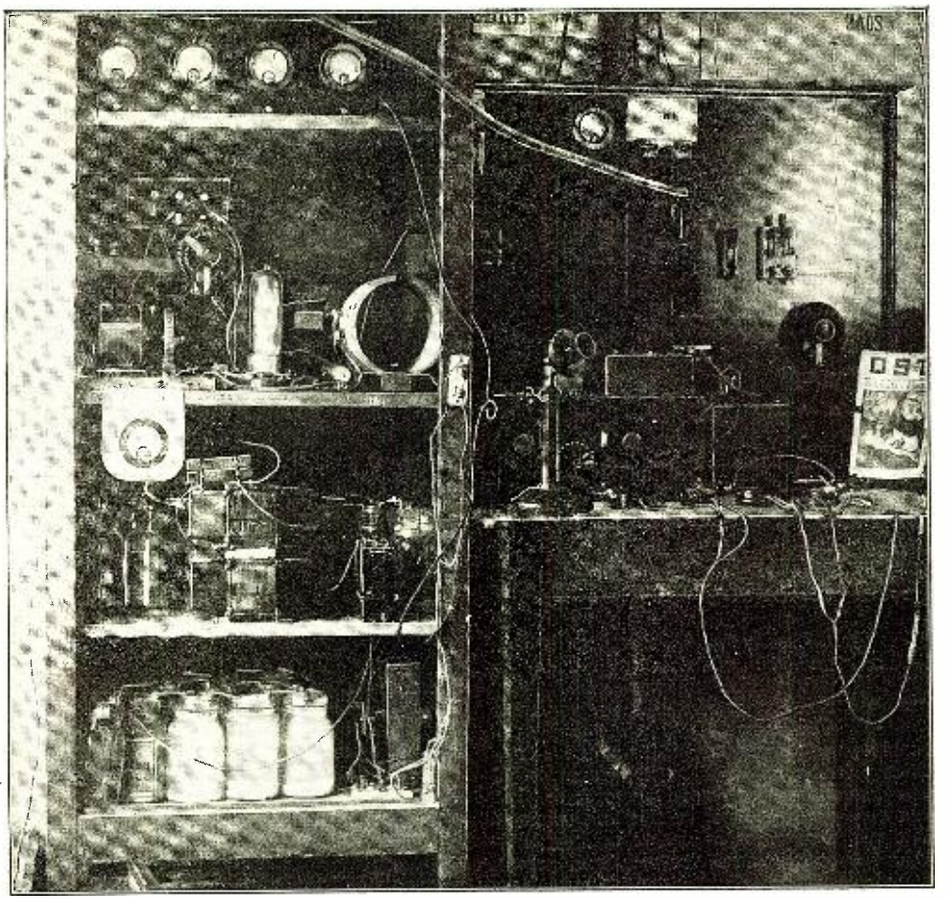
Contributed by Henry Kaufmann.

OPEN CIRCUIT

RADIO DEALER: "Here, let me sell you a good plug."

AMATEUR: "Nope, haven't got the jack."

Contributed by Ernest Erlandson, 9DER.



Station 1CRW Located at Jeffrey Nichols Co., 971 Commonwealth Ave., Boston, Mass., is Owned by Mr. C. E. Jeffrey, Jr., and Mr. S. S. Frizzell (1SF). The Transmitter is a 100-Watt Set Using Two 50-Watt UV-203 Tubes in the Hartley Circuit With 1,200 Volts of Rectified A.C. on the Plates. The Rectifier is a Chemical Type Using 28 Quart Jars With 6 M.F. of Condenser and Two R.C.A. Filter Reactors. Filaments Are Heated by Acme Filament Heating Transformer. Grid Chopper is Used for I.C.W. and an Absorption Loop for Modulation on Phone. The Radiation on C.W. is 5 Amps. On I.C.W. 3.5 Amps. and 2 Amps. on Phone. A Low Power Set Using Two 5-Watt UV-202 Tubes With a 500-Volt Motor Generator is Used for Local Work. The Receiver is a Grebe CR-5 and an Acme One-Step of A.F. With W. E. Phones. The Antenna is a 50′ Four-Wire Flat Top, 40′ Above the Roof of the Building With a Cage Lead-in. The Ground is on the Frame of the Building and Water Mains. 1CRW Has Received Cards From Every District in the U. S. and Canada Also English 2SZ and Has Worked Every District But the U. S. 6th and 7th. On Phone He Has Worked 500 Miles.

Pickled Ham:—'Nother (sniff) Tube Gone (hic!). Guesh I (hic!) Besher Get a Fils—Filshament Volshmeter.

Please Be Quiet During the Tests

This is a request from the American Radio Relay League to the American and Canadian transmitting amateurs and we hope that all will heed it.

The A. R. R. L., in cooperation with the leading radio societies of Europe, is conducting the fourth Trans-Atlantic Tests from December 22, 1923, to January 10, 1924. They are appealing to the transmitting amateur, asking him to please keep his transmitter silent during the period of the tests. Let us have an absolutely quiet air every night during the tests.

The American and Canadian amateurs are not scheduled to transmit at any time during the tests as it is desired to lend the best efforts at receiving European amateurs and to try to establish two-way Trans-Atlantic Amateur Communication. First of all, we American Amateurs must show that we can copy foreign amateur signals.

Hours of transmission by European amateurs (French and British) will be from 0100 to 0600 Greenwich Mean Time; 8:00 P. M. to 1.00 A. M., Eastern Standard Time; 7.00 P. M. to midnight, Central Standard Time; 6.00 P. M. to 11.00 P. M. Mountain Standard Time; 5.00 P. M. to 10.00 P. M., Pacific Standard Time. Wave-length will be from 180 to 220 meters.

These tests are open to the broadcast listener as well as the operating amateur. The European transmission will be slow, probably not more than ten words a minute. This will give everyone a chance.

THE RECEPTION OF U. S. AMATEURS IN FRANCE

By René Burlet

A number of tests have been carried on here since the trans-Atlantic tests of the past year during which time I received 48 amateur stations with a receiver that was but partially finished and the tuning of which I was not at the time acquainted with. Since the early part of August, the static has decreased considerably in these parts, so advantage was taken of this perfect atmospheric condition. On August 27 I picked up the following calls from 3.00 A. M. to 4.45 A. M. GMT.

2WR, 3VO, 8CEI, 1XCQ, 1CCZ, 4GX, 2RB, 1ABS, 1ACU, 2XJ, 1CKG, 2TJ, 8AIO, 3KM.

I noted particularly the good reception of 4GX, this station being heard numerous times. The signals were very readable on two valves, one detector and one low frequency amplifier. On August 27 I listened in from 4:15 A. M. to 4:30 A. M. GMT, but owing to QRM, it was very bad. I heard the signals from 1ACV, 8ZZ and 1ANA calling WNP. He was readable 5″ from the phones. 8CMT and 1ANA were heard again on August 30. The statics and signal strength of 1ANA are noteworthy. The following stations were logged September 2 from 4:10 to 5:05 A. M., G.M.T.

2KR, 1BCF, 1ACU, 3BFU, 1ANA, 1RR.

(*Continued on page* 1012)

A Balanced C. W. Circuit for Quick Wave-Length Changes

By JOHN L. REINARTZ, 1XAM—1QP

Mr. Reinartz has again come forth with some valuable information for the operating amateur. This article deals with a balanced transmitting circuit which allows for a quick change of wave-lengths and also—duplex operation! Read it, by all means!

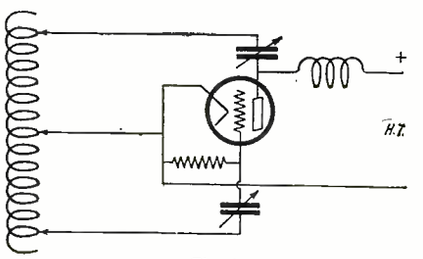
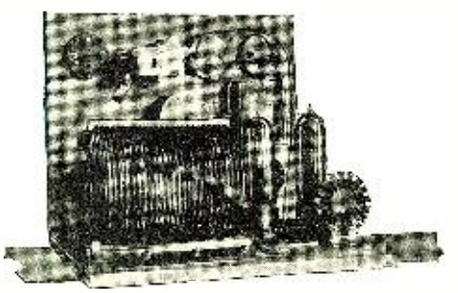


Fig. 1

A Hartley Oscillating Circuit with Pre-Determined Grid and Plate Voltage Connections.



A Rear View of Mr. Reinartz's Balanced Circuit Transmitter, Showing the Disposition of the Instruments.

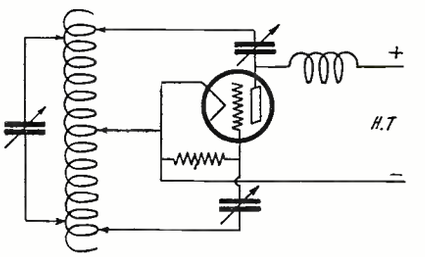


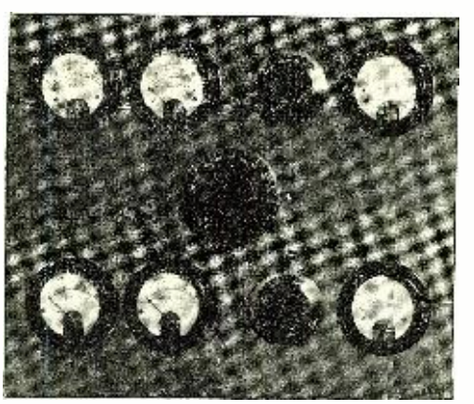
Fig. 2

A Change of the Capacity Across the C.W. Inductance Does Not Necessitate a Change of the Grid and Plate Taps. They Remain Constant.

HOW many transmitting circuits have we which will do all the things you would like to have them do? Namely, increasing your radiation meter reading; allowing any reasonable wave-length change, instantly; that is to say, from 150λ to 200λ, or which allows you to connect your receiver to it so that you may work duplex; receive and transmit over the same antenna, always being able to hear the other station between your transmitted signals; and last but not least, allow you to work your tubes at their greatest efficiency, due to a perfectly balanced circuit.

In Fig. 1 we have shown an oscillating circuit in which the proper grid and plate voltage connections have already been found to be those connections which allow the best operation of the tube. If we now shunt a capacity around the inductance, Fig. 2, with a radio frequency meter in its circuit, we will get a deflection of the meter pointer in a relation from which we can determine the output in watts, and no matter how much we raise the capacity, we will find no need to change the grid and plate connections to the inductance for better operation of the tube. That is, such connections as will raise the efficiency of the oscillating circuit, this only holding good when a pure capacity is shunted across the inductance and connected so that we have the same number of turns each way from the filament tap, and our antenna systems are mostly anything but that.

Now let us see what would happen if we substituted for the pure capacity something that would more nearly simulate our antenna systems. It would have to be both capacity and inductance, not even equal amounts for unit length, because the antenna nearly always has a greater proportion of inductance to capacity in the lead-in or vertical portion of an inverted "L" design, and the earth when used probably has infinite capacity compared to inductance. The counterpoise also has more capacity than inductance in its make-up. It, therefore, is hardly possible to haphazardly connect antenna and counterpoise to the inductance and get results in our transmission, but just the same let us connect some capacity and inductance to the inductance of the set, as shown in Fig. 3. We are now trying to simulate our radiating system as regards capacity and inductance in its make-up. If we now add some meters we can see just how these various elements and their relation effect the input and efficiency of the tube, so we insert a plate milliammeter and two radio frequency meters, shown in Fig. 4.



A Front View of the Transmitter, Showing the Controls and Indicating Meters.

For the time being we will leave C-3 set at 100 per cent dial reading. Now set C-1 at 100 per cent and C-2 at 100 per cent, note the meter readings and change C-1 to 50 per cent—note meter readings again. You will find that the plate meter has gone up—that both R. F. meters have gone down, but the one at C-2 reads highest, showing an unbalancing of the current in the circuit due to unequal capacities in the two halves of the testing system. Setting C-2 to 50 per cent will balance things up again. Both R. F. meters will read alike, although lower, and the pate meter has gone down again, thus proving that in an oscillating circuit greatest efficiency is obtained when there is symmetry in the circuit as regards the distribution of capacity and inductance and functions best when the current antinode is at the filament connection on L-3. When this is not the case, then the grid and plate voltages are changed with relation to each other from what they were and the operating efficiency of the tube is impaired, which must be corrected by a re-arrangement of the taps C-1 and C-2 on L-3 so that the current antinode is again at the filament connection. But we can readily see that if we use that arrangement, we cannot change the wave-length instantly and without this trouble; but if we vary C-1 and C-2 the same amount at the same time, we do not unbalance the system and we can change the wave-length instantly. This, then, is what I am going to show you how to do.

Let us take whatever antenna we have and build it over so that it becomes a 6-wire cage not greater than 18" in diameter using wire not greater than No. 14 and making the antenna not longer than 100' from set to far end. The lead-in is to be of the same construction. Then let us make a counterpoise like the antenna, suspended not nearer the earth than 5' and not longer than the distance horizontally from the set to the far

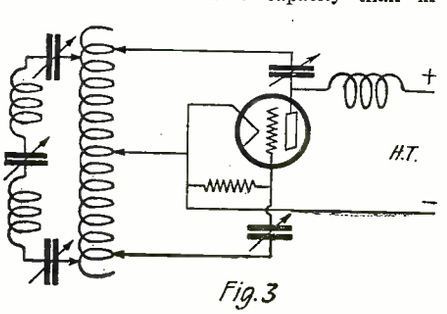


Fig. 3

The Same Circuit Built Up with Inductance and Capacity as a Substitute for the Antenna System.

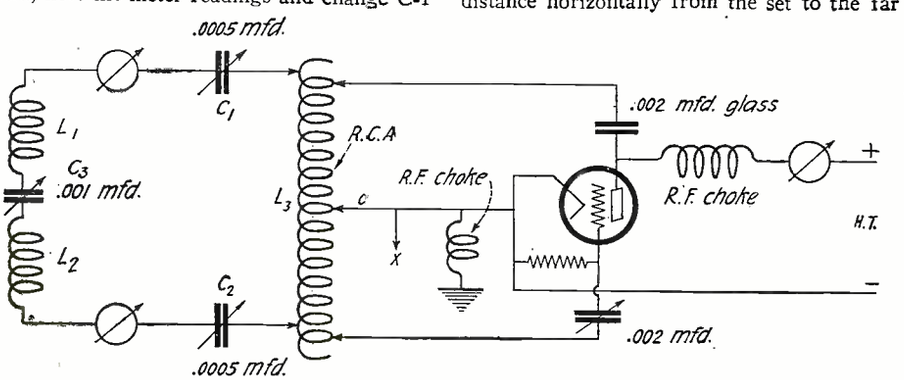


Fig. 4

When the Circuit is Properly Balanced the Current Flow is Equal at Both Ends of the C.W. Inductance. The Nodal Point is at the Filament Center Tap.

end of the antenna. Having done this, let us connect the antenna and counterpoise to C-1 and C-2 of the set, taking care to have the same number of turns from the filament tap to C-1 and C-2. Set the plate and grid tap at the last turn of L-3 in case of an R. C. A. inductance and by trial to any other make, moving the plate tap in to increase plate input. Have both C-1 and C-2 at 50 per cent dial reading and after a last look to make sure all is set, press the key. Note the plate meter and R. F. meter readings and then carefully vary the setting differing from 50 per cent. Then that part of the radiating in which the C reads lowest is too large and must be lessened. If this happens to be the counterpoise, cut it shorter one-half foot at a time and test after each cutting. When C-1 and C-2 finally read alike for the lowest plate input, the two R. F. meters will also read alike and the system is balanced. You can now change the wave-length by simply changing C-1 and C-2 at the same time to the same reading, without any worry as to the action of the tube, because you are not changing the plate and grid voltage relation.

Going back now to Fig. 4, the capacity (C-3 represents the capacity) between the antenna and counterpoise and the greater this is, the greater your R. F. meter reading, but whatever you do, balance your system as instructed.

In Fig. 4 you will find point x at the filament tap, run a wire from this point to the antenna post on your receiver and to your surprise you will hear signals with very little less strength than with the regular antenna connection. You may now press the key and transmit, using no change-over switch, always being able to hear the signal from the other station when you release your key, and regardless of his or your own wave-length.

If your receiver has no series antenna condenser it may be well to insert a Micadon of .002 M. F. capacity to act as an insulator to the receiver and which may avoid current flow from your filament source to earth.

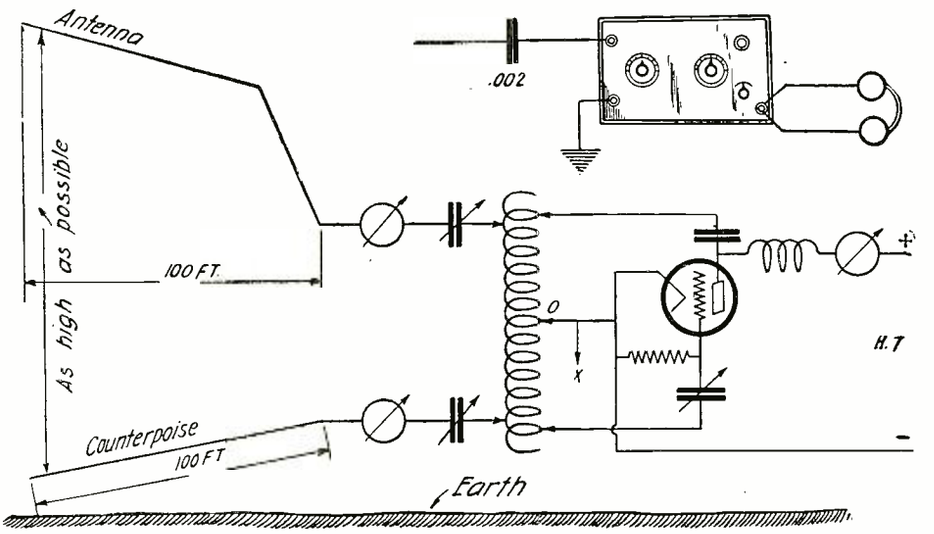


Fig. 5

Circuit Diagram of the Balanced Transmitter Described in This Article. If the Receiver is Used for Duplex Operation a Stopping Condenser is Inserted in Series with the Antenna Lead and Connected to Point X on the Center Filament Tap. In This Case an R. F. Choke Should Be Connected in the Protective Ground Lead as Shown in Fig. 4.

In conclusion, I wish to let you know that I have had this circuit system in operation over six months and have been able to go down to 70 meters with it without trouble. Numerous tests have proven that it is good. If you have any trouble let me know, but don't fail to enclose an addressed and stamped envelope with your questions which should be precise and, if possible, short.

A Remote Control Antenna Transfer-Switch

By THOMAS W. HEINE

A REMOTE control antenna transfer-switch is something which few amateurs possess, and it is surprising that this is the case when it is realized how easy it is to construct one.

The one described in the following article is controlled by means of two push-buttons, one for receiving and the other for sending. As may be readily seen it is actuated by means of two solenoids which draw in the plungers, thus operating the switch. These are connected, through the push-buttons, to the regular Filament Lighting "A" Battery. They consume about two amperes of current, but as this takes place for only an instant, it will not run down the battery to any great extent.

The method which I shall describe is adapted to a Signal Electric Change-Over Switch, but it could probably be applied to other types, with suitable changes in construction.

As may be seen in the figure, the upright is removed from the base and mounted on a larger one in order to have room for the solenoids. These are mounted on pieces of heavy brass at the proper height.

The solenoids each consist of about five pounds of No. 18 D.C.C. wire wound on a thin brass tube, ⅞" inside diameter. Both the amount and the gauge of wire can be varied to suit each individual case. The brass tube should be about 3" long.

The plungers are separate so they will operate more freely and one of each is placed on a side of the upright piece. These are made of pieces of soft iron rod ¾" in diameter and about 3¼" long. They are flattened on one end and holes drilled to pass a suitable machine screw.

The upright piece is made of a length of ⅜" or ¼" brass rod. This is threaded on one end to screw into a hole previously drilled at the top of the knob on the switch. The other end is flattened and drilled like the plungers.

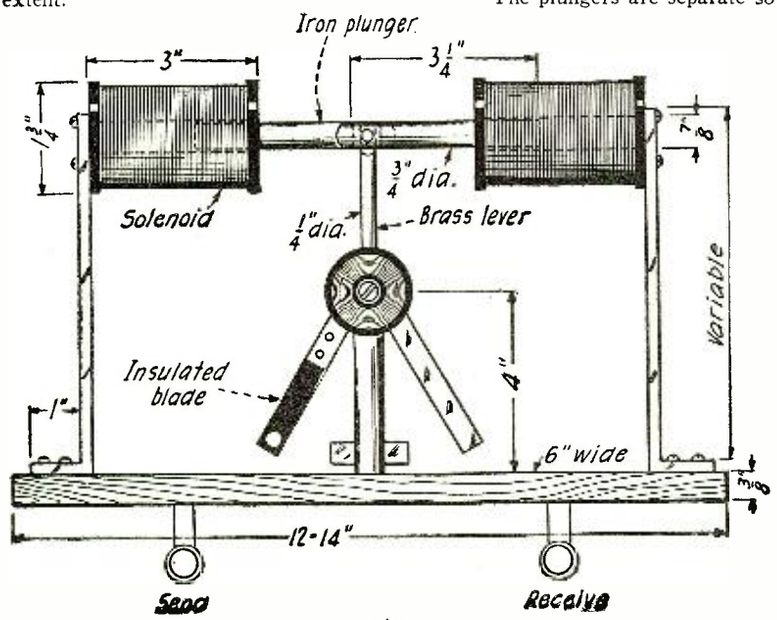
The solenoids can now be mounted on the base, which should preferably be of bakelite, the upright brass rod can be inserted in the knob and the plungers fastened in place. Connections can be brought out from the solenoids to suitable binding posts.

The solenoids are rather bulky as described above and if they are covered by a wrought-iron shell that is closed at the back, the size and amount of wire used can be reduced. This acts as the opposite poles of a magnet, the plunger being pulled to the back of the shell.

It will be well to test the switch before mounting it permanently, in order to make sure that it will operate satisfactorily. If it is too weak to operate the switch, remove the solenoids and wind on more wire, thus increasing the field intensity.

Once put into operation it will prove its worth to any up-to-date transmitting station, and the owner will be able to operate his station much more efficiently than if he used the customary method of throwing the switch by hand.

Should anyone interested desire further information concerning the details of this switch the writer will gladly furnish additional data. Just address me through the publishers of this magazine.

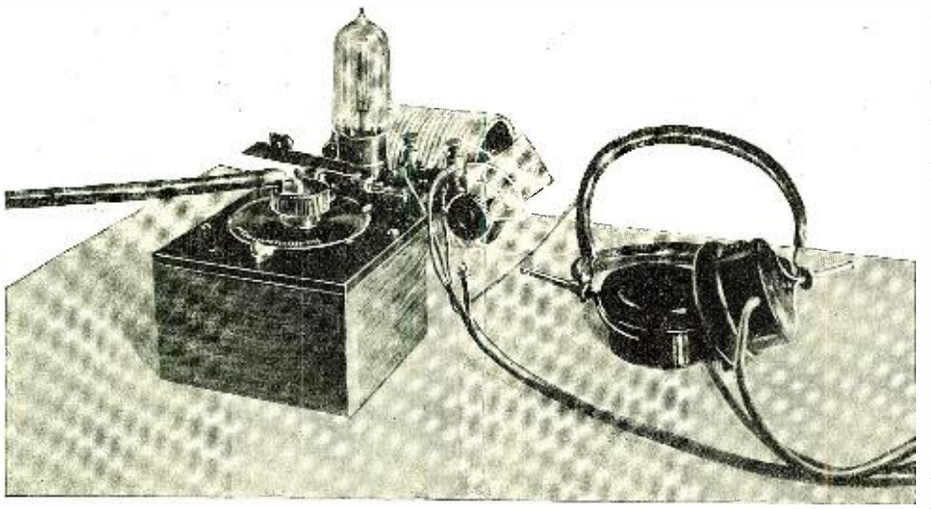


A Well-Designed Remote Control Antenna Switch Operated by Electro Magnets. Details Are Given in the Illustration.

A Well Designed Short-Wave Receiver

By JAMES WOOD, JR.

It is very seldom that a radio magazine has the opportunity of publishing an article on a receiver with efficiency as its criterion. The set described by Mr. Wood was designed with mathematical precision and contains no excess parts. Whether you desire to build a similar set or not, you will find valuable information in this article which pertains to receiving sets in general.

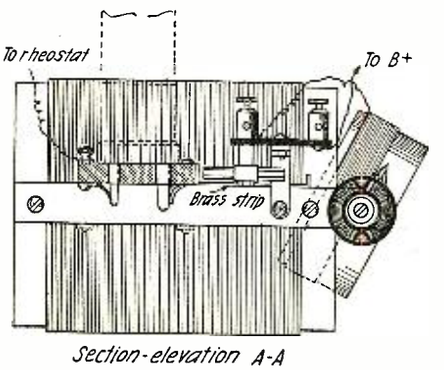


The Receiving Set is Quite Simple, as Shown in the Photograph. The Variable Condenser Acts as a Support for the Inductance Tube, etc. The Long Insulating Arm on the Variable Condenser Provides a Means for Close Tuning.

EFFICIENCY is a term which is numercially represented by the ratio of the output over the input of any system. In the case of a radio receiver it can readily be seen that the results obtained will be greatly improved if the value of this ratio is brought close to unity. The receiver described in this article was designed with this point in view. Inasmuch as it was meant for the reception of continuous waves, we will consider in the following discussion only the electrical condition which exists when C.W. is being received. In other words, the condition in which the high frequency circuit is in a state of oscillation. When no signal is present the electrical state of the oscillating circuit is such that a continuous alternating current is being generated by the circuit comprising the inductance and capacity. This alternating current is kept at a continuous amplitude by the energy which the vacuum tube supplies. When a signal is induced in this oscillatory circuit (assuming straight C.W. for simplicity) and the circuit is tuned to the frequency of this incoming signal, it is evident that no sound will be produced in the head phones. If, however, the circuit is slightly detuned above or below the frequency of the incoming signal, a beat note will be produced which, when rectified, will be audible in the headphones. Now it will be readily agreed that it is the amplitude of this beat note that determines the audibility of the sound produced in the telephones. It will also be readily agreed that the amplitude of the current induced in the high frequency circuit by the incoming signal, is determined to a very large extent by the resistance of the circuit. Furthermore, the amplitude of this current determines for the most part the amplitude of the beat note. Hence the problem resolved itself into one of designing a receiver with the least possible resistance.

Aside from the resistance there are other ways in which energy can be lost in a receiver. The two most important are faulty insulation and capacity coupling between parts of the set that should not be coupled. Faulty insulation is notoriously common in the cheaper grades of instruments especially condensers. Bakelite or a good grade of hard rubber are generally considered to be the best materials for condenser insulation. Capacity coupling between the various parts of the set can be greatly reduced by reducin the length of the leads and by avoiding the use of all unnecessary metal parts.

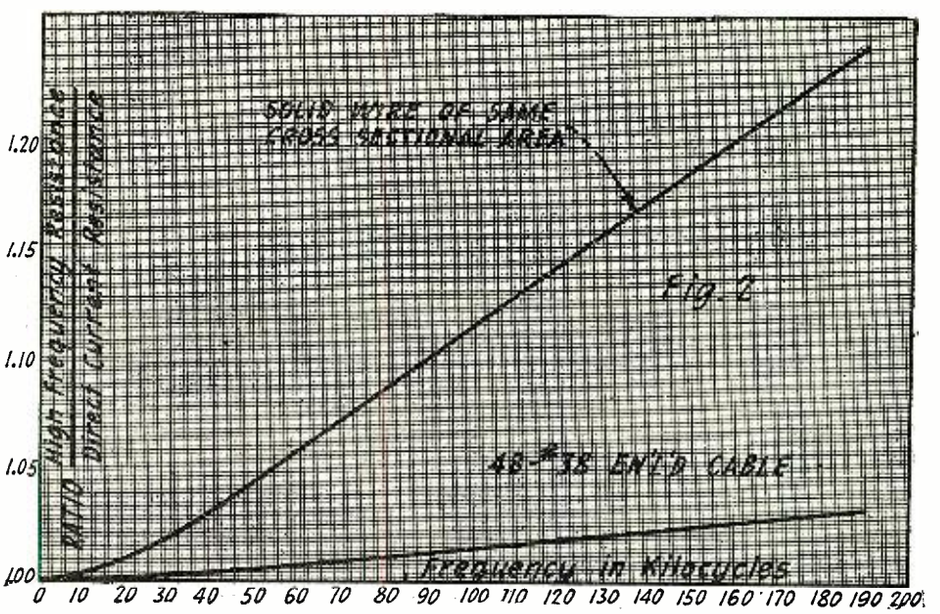
The way the resistance of the receiver was kept at a low value and the way other losses were reduced to a minimum will become apparent as the various parts of the set are described.



Details of the Antenna Inductance and Tickler Coil. For the Reception of C.W. This Coil is Set so That the Tube Oscillates and is Left in That Position.

INDUCTANCE

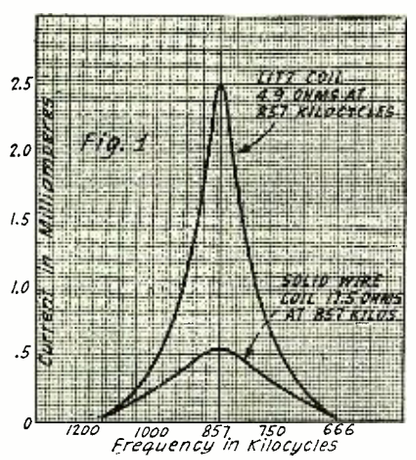
The inductance is of rather original design. It consists of 60 strands of No. 40 single cotton covered wire twisted slightly to form a cable. It is well known that at high frequencies alternating current flows along the surface of a conductor and that the interior of the conductor carries only a small portion of the current. It is evident then that the greater the surface of the conductor the lower will be its high frequency resistance. This explains the use of the Litz. The writer has noticed occasionally in various periodicals the statement that Litz is of no particular advantage below 300 meters. He believes this to be untrue and as evidence offers Figs. 1 and 2. Fig. 1 illustrates the difference in the amplitude of the current which flowed in a circuit to which were connected a Litz and a solid wire coil in turn. The C.W. oscillator or driver used was tuned to the frequency of the circuit (857 kilocycles or 350 meters). Each inductance was connected in turn to a condenser and thermo operated milliammeter and the current curve plotted as shown. As can be clearly seen, about five times as much current flowed in the circuit when the Litz coil was connected as when the solid wire coil was used. In view of this great difference, it seems hardly logical to suppose that the mere reduction of 50 meters would so alter matters as to make the resistance of the solid wire coil less than the resistance of the Litz coil. If this is not convincing consult Fig. 2. In this curve the ordinate distances indicate the number of times the



A Curve Illustrating the High Frequency Resistance of Litz and Solid Wire at Various Wave-Lengths. It is to be Noted That the H.F. Resistance of the Solid Wire Increases Very Rapidly With an Increase of Wave-Length.

high frequency resistance is greater than the direct current resistance; that is, the ratio of the high frequency resistance to the direct current resistance. As can be seen the upper curve, which is for the solid wire, continually departs from the lower curve and it is evident that the higher the frequency the greater will be this departure.

The inductance consists of 24 turns of the Litz on a dry unshellacked cardboard tube 3" in diameter. It is important to remember when winding the coil not to jam the turns together, as this increases the distributed capacity and raises the minimum wave-length range of the receiver. Both these effects are, of course, undesirable. It is aboslutely necessary that the leads from the ends of the inductance be very carefully soldered. Otherwise the resistance of the joints may be of such a value as to entirely counteract the lowering of the resistance gained by using the Litz. The best way to make a good connection is to unwind the cotton insulation from each strand individually. This is a very tedious procedure, but since only two such connections have to be made, it is feasible to use the method. After all the strands have been uninsulated they should be twisted slightly together and dipped in molten solder. While the latter is still in the molten condition, the strands should be twisted tightly. This will insure the reaching of the inner strands by the solder as well as those on the outside. Care must be taken not to break any of the strands, as a few broken ones will cause enough energy loss to entirely counteract the benefit derived from using the Litz.



The Amplitude of Incoming Signal Energy is Considerably Increased if Litz Wire is Used as Shown by This Curve.

CONDENSERS

All the fixed condensers used are Dubilier Micadons No. 601. These condensers have the advantage of remaining fixed in their capacity and in addition are of such small size as to permit the use of very short leads, as can be seen from the illustrations. Two such condensers will be needed, one for the grid circuit (.00025 mfd.) and the other for shunting across the phones and "B" batteries (.001 mfd.). The condenser across the inductance is one of the variable, air dielectric type. The capacity is approximately .0005 mfd. It is very important to see that the end plates of this condenser are made of good insulating material such as bakelite or a good grade of hard rubber. Fibre must not be used under any circumstances as it is often of such poor insulating quality that the strength of the incoming signals is noticeably reduced by its use. It is very desirable also to have a flexible cable lead from the movable plates, as a friction joint is very apt to be noisy in operation.

As will be seen from Fig. 3, the wave-length curve of the receiver is nearly a straight line. This obviates the necessity of giving the movable plates the involute shape.

The figures show the constructional details of the receiver. The dimensions are not given, since these will almost certainly be different in each individual case.

In order to cut the length of the leads down as much as possible, the tube socket was made up especially for the particular arrangement. The springs which make contact with the tube prongs are themselves the connections between the closed oscillatory circuit and the tube. The fixed condensers are so placed as to make the leads to them of minimum length, and it should be noted that there is no pretty square cornered wiring. All connections are made as direct as possible. There are only two leads in the high frequency circuit that are more than 1" long, the flexible cable from the movable condenser plates and one tickler lead. Both of these are about 2" long. A long handle should be provided for the condenser to aid in preventing body capacity effect and to allow close adjustment. None of the metal parts should be of iron, since this metal in the vicinity of the instruments induces losses.

The hook-up is shown in Fig. 4. As can be seen, it is nothing radical. Just the good old standby. A tickler coil is used for feeding the energy from the plate circuit back to the grid circuit. A tuned plate circuit can, of course, be used, but this makes one more variable adjustment and then the receiver can no longer be termed uni-controlled. The tickler is not varied at all through the entire range of the receiver once the circuit is in a state of oscillation. It is well to point out also that the method used for coupling the antenna to the closed circuit is such

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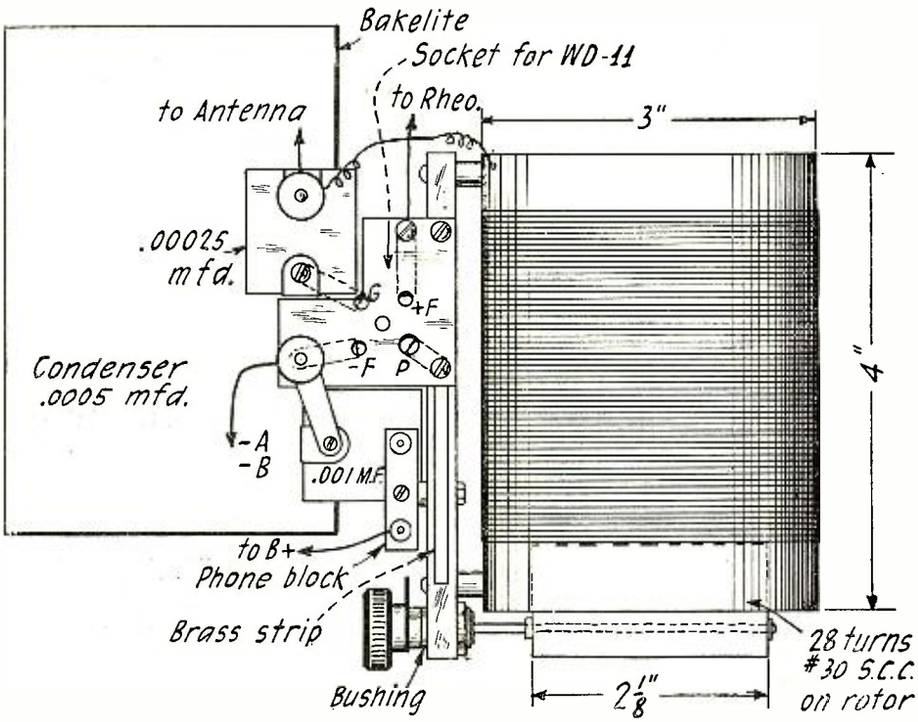
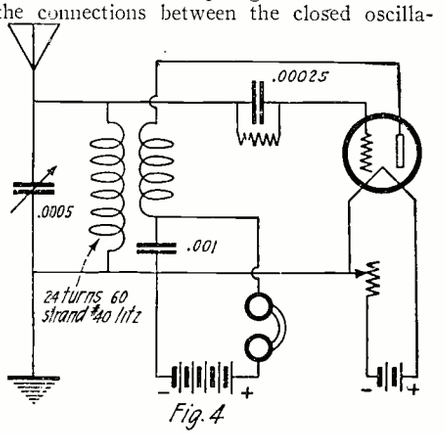
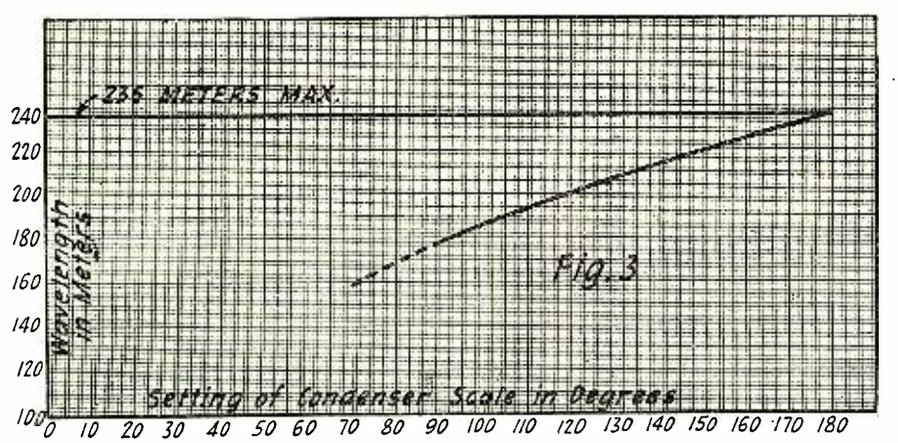


Constructional Details of the Entire Receiver. Note That All of the Apparatus is Supported by the Variable Condenser, the Binding Posts of the Same Being the Supporting Members.



Circuit Diagram of the Receiver. It is Virtually a Single Control Affair as it is Not Necessary to Readjust the Tickler After the Circuit is Once in an Oscillating State.



The Wave-Length Curve of the Receiver Described in This Article. It is to be Noted That the Curve is Nearly a Straight Line, a Condition Not Found in the Average Amateur Receiver.

Some Suggestions on the Design and Construction of Aerials

By L. W. HATRY, 5XU

The difference between a bad and a good aerial is radiation plus carrying power. Mr. Hatry has had practical experience with most every form of transmitting aerial. He gives you his best in this article. His advice is well worth following.

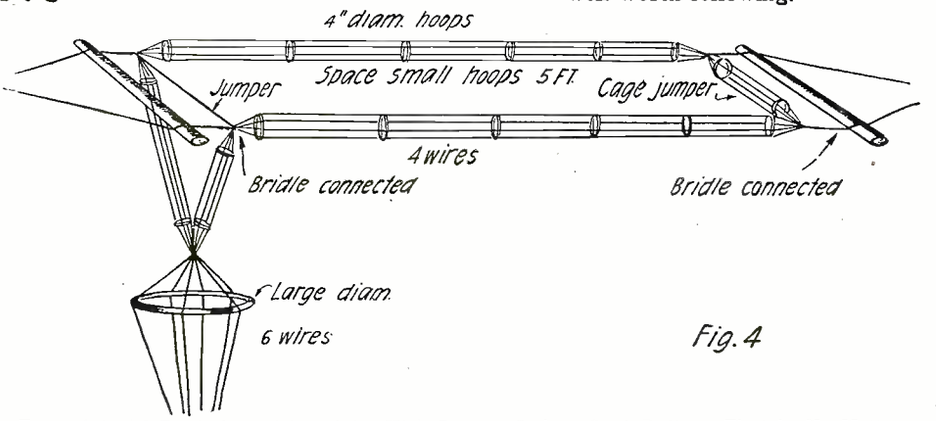


Fig. 4

A Type of Aerial Particularly Adapted for High Power. It is a Good Radiator Though, No Matter What the Power May Be, and Will Conform to the Physical Characteristics of the Usual Location.

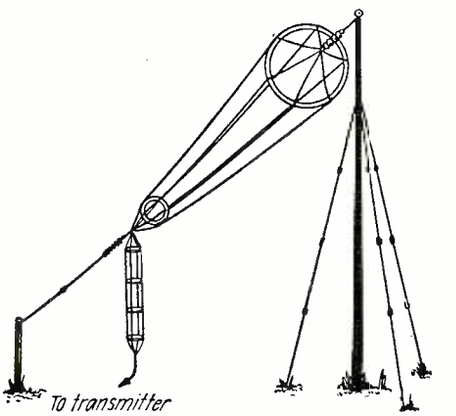


Fig. 7. Where Space is Limited, This Type of Aerial is Ideal.

IT is my purpose to give a number of practical articles that will cover your C. W. transmitter from the aerial to the ground in such a manner that it will leave you in no doubt as to what to do and will clear up, to a certain extent, doubts as to why you do it. Furthermore, theoretical forms will not be discussed because it is the thing that works that counts and on which we desire to expend our time and money.

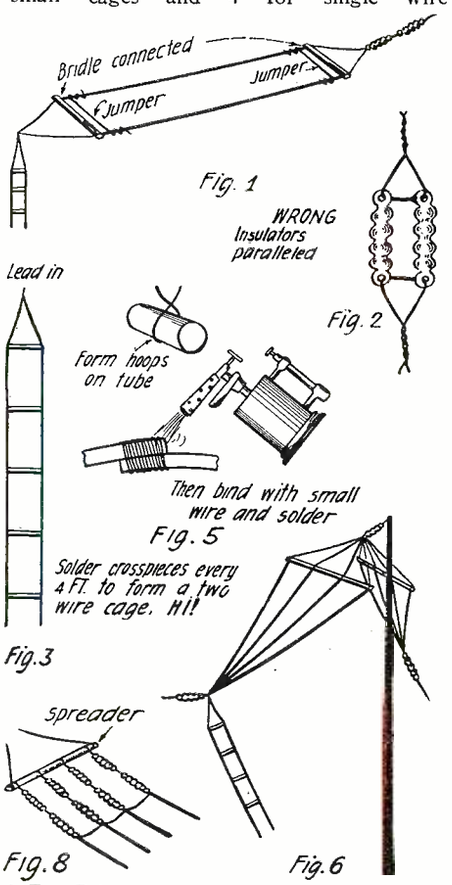
As usual, with a series of this sort, the proper place to start is at the aerial, so we will consider a number of things or rather a number of possible situations and how to overcome them; how to suit each at its best.

Presume at first that you are situated normally with a couple of poles a reasonable distance apart and a five-watt transmitter. The simplest aerial you can make for the purpose would be a two-wire "L" or "T" type, depending on the length you must use, made as in Fig. 1. This should have the jumping wires, as shown, as they are a help. The spreaders should have a width of at least 10′ and the bridles should be connected in the circuit. Insulators should be installed after the bridle as shown at one end, and should be glazed porcelain such as the 10″ Fleron or else Electrose. A very good insulator is formed of an 18″ length of plate glass 1½″ wide with a ¼″ hole, 1″ from either end. Do not place two insulators in parallel as in Fig. 2. It is best to have two of the 10″ insulators in series at the free end of the aerial, as shown at the end in Fig. 1. Make the lead-in as in Fig. 3, which forms an efficient two-wire cage.

WORK ABOVE THE FUNDAMENTAL

Ballantine says the best wave-length on which to work an aerial is the fundamental, but everyone does not agree with him so that just about now we've come to figure on about 10 per cent, or perhaps a little higher above the fundamental, as a suitable wave so as to avoid the use of the series antenna condenser. Personally, I don't believe in working on the fundamental, as it has never been successful with me, whereas I know that good results can be obtained about 10 per cent above the fundamental and feel sure that 20 per cent is not too much. A simple way to worry about the wave and settle the matter is to decide on a maximum of five turns of antenna inductance being necessary and use as much less as will give good antenna current. Of course, your conditions may prevent this.

Perhaps you have no wavemeter and are aiming to make an aerial for a definite wave. The simplest way to get at it is to use the age old formula of multiplying the overall length, plus the length of the lead-in, by the constant 4.5 for a big cage flat top, two cage top, tapered cage top of any size, or multi-wired aerials of conventional type, 4.2 for the small cages and 4 for single wire aerials. If your aerial is large and not very high this constant might go to 5. Divide the results by 3.1, if the length is in feet, and the resultant will be the wave in meters, approximately and close enough for your purpose.



A Few Pointers in Aerial Construction That Are Worth Following if Your Aim is Efficiency.

A SMALL CAGE IS A GOOD RADIATOR

A better aerial for the five-watt set is a single 4″ in diameter cage of four wires. This is more work to build than the two-wire flat-top but is easier to support. It is also more expensive to construct and unless you feel that you want the best above all things, those items might make the two-wire serve the purpose. It must be admitted that the small cage is not much better than the two-wire, except on more power. If you are planning on increasing the size of your set soon then it would be a good idea to construct the cage to start with, for it will serve up to 20 watts, well. This small cage is advisable for aerials from 25′ to 40′ high and at that height will serve well with almost any power.

A TWO-WIRE CAGE FOR HIGH POWER

When your aerial can be 50′ in minimum height and you have 10 watts or more, we come to a slightly different design. Notice Fig. 4 which illustrates an aerial for powers up to 250 watts. The "wires" are formed of two small cages not larger than 6″ in diameter, though I would say use 4″ or smaller, but you might be governed by circumstances. The hoops can easily be made of No. 10 or larger wire and should be formed on a tin can or something round, bound with small wire and soldered as in Fig. 5. The lead-in is formed as shown, and the large cage has a maximum diameter of about 4′ and tapers within 5′, or less, to 4″ in diameter, and continues the small size to the lead-in insulator. The large diameter has six wires to achieve the symmetrical appearance and to get capacity. At the height mentioned a cage of from six to eight wires and one foot or more in diameter will work, but is not quite so good. Its ease of construction might prove advantageous, however. Make the lead-in always of the small cage.

When you build the "T" type aerials the general construction is the same, except that the lead-in comes from the ex-

(Continued on page 990)

C. W. and Radiophone Transmitters

By L. R. FELDER

Part IV

In this article Mr. Felder describes a number of methods of modulating the current in low power C.W. transmitters for radiophone work. They are all simple, and can be used very nicely with five-watt sets.

THE first half of this series of articles on C.W. and radiophone transmission was given over to a consideration of C.W. oscillating circuits. These circuits constitute the generator end of the radiophone system. By means of these circuits radio frequency oscillations are generated. In order that these radio frequency oscillations should be able to carry or transmit intelligence they must be modified in some way which is characteristic of the message to be transmitted. Thus in telegraphy they are modified by "keying." This constitutes the method of C.W. telegraphy. This system obviously requires that the intelligence to be transmitted be first thrown into some codes and after reception this code must be again translated into understandable language. These stages of translating the message into code and from code may naturally lead to errors. To eliminate the possibility of error it is, of course, best to transmit speech directly, as is done over the land wire telephones. This gives rise to radiotelephone communication.

In order to transmit speech via radio it is necessary to again generate radio frequency oscillations, and the circuits described in the first three articles of this series are suitable. It is then necessary to modify these oscillations so that they will carry the speech message. This process is called "modulation." The radio frequency oscillations act as the agent which carries the speech from the transmitter to the receiver.

These radio frequency oscillations are, therefore, called the "carrier wave." The rocess of modulation in radio telephony consists in superimposing the speech signals on the carrier wave in such a manner that the signals will be efficiently transmitted. Also they must be superimposed on the R.F. oscillations in such a way that no distortions occur, and so that they are transmitted in their true and original form, undistorted. For, if the signals are distorted they will not be intelligible at the receiver and no advantage will be gained over the system of telegraphic transmission of dots and dashes. Our present problem, therefore, is a discussion of the various circuits and methods for suitably modulating a radio frequency wave, and thus transmitting speech via radio.

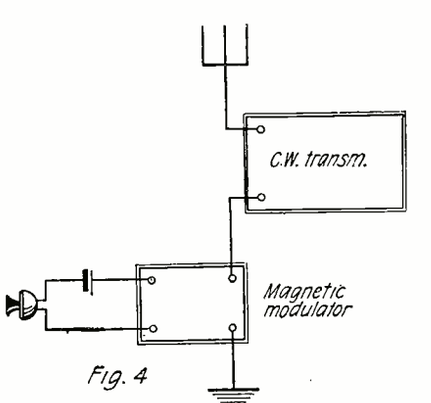


Fig. 4

The Use of a Magnetic Modulator in Connection With Low Power Transmitters is a Very Effective system.

A Transmitting Circuit for Low Power Work Employing Modulation Similar to the Absorption Loop Method.

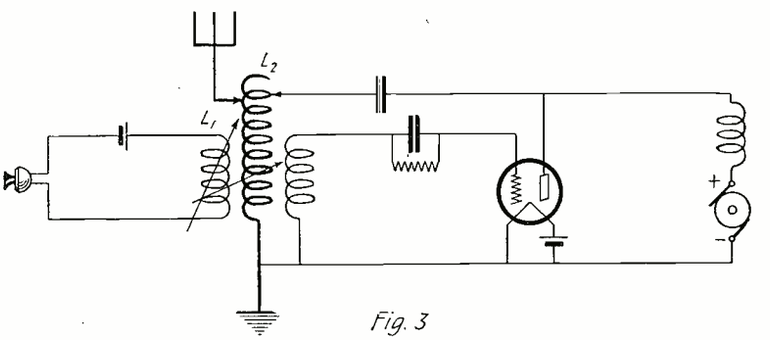


Fig. 3

There are numerous methods and circuits for modulating, but certain methods are applicable only in certain cases. We will begin with the simplest and lead up to the more complex ones. It so happens that the simpler modulation systems are those which

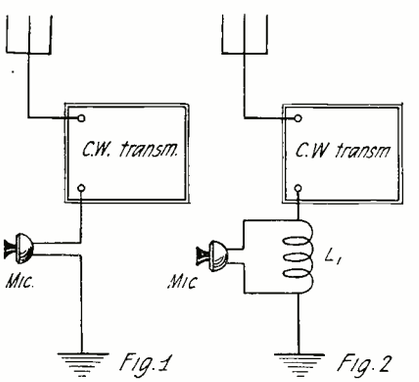


Fig. 1

Fig. 2

Two Simple Methods for Modulating the Current in Low Power Radiophone Transmitters.

are applicable to the low power sets, some of which have been described in Part II of this series, Nov., 1923, issue of RADIO NEWS.

MICROPHONE IN ANTENNA

For very low power sets, up to not more than 5 watts, the simplest radiophone system to employ is that in which the microphone is inserted directly in the antenna, Fig. 1. The simplicity and inexpensiveness of this system make it an admirable beginning for those amateurs just going in for radiophone transmission. The only additional apparatus required—assuming that the C.W. oscillation transmitter is already available—is a microphone, and since the microphone is needed regardless of what radiophone system is employed, the investment is not at all wasted. The manner in which this simple system modulates the radio frequency is as follows: When the microphone is idle, that is, when it is not spoken into, the radio frequency oscillations in the antenna have a certain definite amplitude, determined by the resistance of the antenna and of the microphone. When it is spoken into, the speech waves striking the microphone diaphragm cause the diaphragm to move back and forth, as a result of which the pressure on the carbon granules in the microphone varies. This in turn produces changes in the resistance of the microphone, and hence the antenna current is made to vary by means of speech. If the resistance of the microphone varies exactly in accordance with the speech impressed on the microphone, then the antenna current will likewise vary in accordance with the speech, and the R.F. oscillations will be modulated by the speech. These modulated R.F. oscillations are of course transmitted, and when received are re-converted by the detector into the original speech signals.

It will at once be evident that such a system is not suitable for high or medium powers, for the entire antenna current flows through the microphone, and microphones (good ones) are not built to carry much current. In fact, if they carry considerable current, the carbon granules heat up and "pack." When the microphone packs, the carbon becomes insensitive to change in pressure due to vibration of the diaphragm, and hence does not operate or becomes very insensitive. This is frequently evident when talking over the regular land line telephones. The party at the other end of the wire hears you well at the beginning of the conversation, but after a while the speech intensity begins to fall off. This is due to the carbon granules of the microphone heating up too much and packing. If the microphone is tapped the carbon granules are agitated and regain their original condition, when the speech is again loud. Too much current through the microphone will, therefore, result in poor operation, low modulation and distortion, and hence this system is not used except for very low power sets.

(*Continued on page* 994)

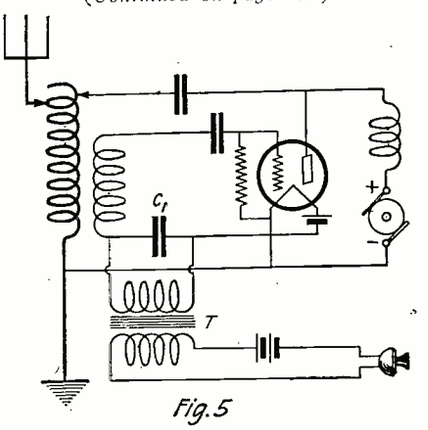


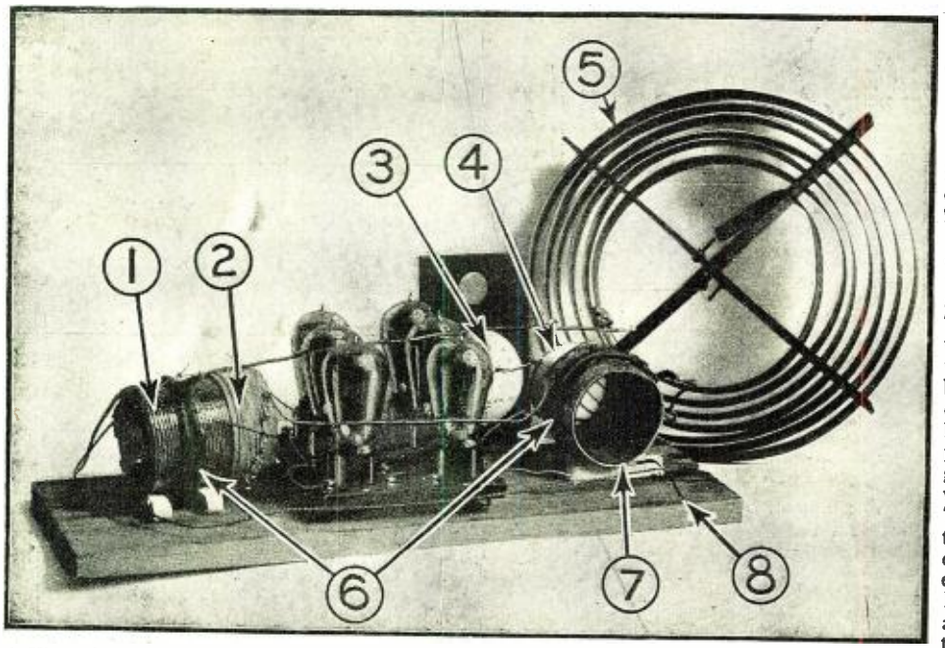
Fig. 5

A Means by Which the Grid Current is Modulated. This is Also a Good System for Low or Medium Power.

A Transmitter That Will Work With Plenty Of Five-Watt Tubes

By L. W. HATRY, 5XU

When a number of five-watt tubes are parallel in a transmitting circuit the elemental capacity increases considerably and it is necessary to decrease the number of turns in the plate circuit to such an extent that the tubes fail to oscillate and it is necessary to increase the working wave. Mr. Hatry explains a method by which this can be overcome.



A View of Mr. Hatry's Transmitter Employing Six Tubes. The Parts Are: (1) Plate Coil, (2) Grid Coil. (3) Grid Tuning Condenser, (4) Second Grid Coil, (5) Antenna Load, (6) Antenna Coupling Coils, (7) and (8) Ground and Filament Center Tap Terminals.

ONE of the many difficulties we hams have had to contend with has been the fact that we have had to use larger powered tubes rather than many small ones to get the higher powers. To use more than four of the well-known five-watt tubes has proved very inefficient because when they were paralleled, the number of turns included in the plate circuit became such a small amount that the increase became a detriment instead of an advantage. This is due to the increased capacity present when the tubes are paralleled which requires a reduction of inductance to retain the working wave. So rather than put out the price of the larger tubes, most of us just simply overloaded the fivers, figuring that an occasional small sum was an easier way to pay than one big sum.

Now from the usual set employing four of the so-called five-watt tubes with about 500 volts D.C. on the plates we generally get an antenna wattage varying from 40 to 70 watts approximately, depending on the efficiency of our set. A single 50-watt tube delivers about 75 watts to the antenna when used at rated plate voltage (1,000 volts) and as the fifties don't, as a general rule, stand the overload as well as do the fivers, we are not gaining much by the use of the larger tube and the use of the small ones avoids having all our eggs in one basket, as Kruse says. The next thing that comes to mind is to overload the tubes some more to get a higher output and this is practical to a certain limit which is safely represented by 850 volts. Try it on up, if you want to, but watch out for sudden decreases. *Keep your filaments at rated voltage!!!* Also, we usually find it difficult to increase the generator so that A.C. is used and A.C. is best used in a self-rectification scheme.

We use the self-rectification for one reason only, and that is to get a decent readable note. This is important and I strongly advise it. There is one thing to remember with self-rectification, which is that the antenna ammeter is no longer the criterion of your antenna power. It can't be compared to a D.C. reading (D.C. plate supply). In other words, 2 amperes furnished by a D.C. C.W. set is lower power in the antenna than two furnished by the ordinary A.C.C.W. set.

At any rate, we want a set that will work with plenty of fivers to get power if we want it, and one to which it is possible to add a little at a time, insofar as the tubes are concerned. This is possible and a set designed to use up to six or eight five-watt tubes is described here. At any rate it will give better efficiency than the familiar methods which make this quantity of tubes a disadvantage rather than an advantage.

Referring to Fig. 1, the plate circuit difficulty was overcome by having a plate coil for each bank of tubes. Self-rectification is shown, but D.C. can be used and can be connected as shown in Fig. 2. (*See page* 978.)

Here's the dope: L1 and L2 are duplicate coils of 20 turns each of No. 12 or larger wire. The wire is spaced for insulation and a form 4" in diameter is a good size. These should be mounted *at right angles* when assembling the set. LL is the grid coil which is in two parts as shown, 15 turns being wound on the same form as the plate coil but in the opposite direction. Follow my system of connection as much as possible. Space the plate winding and the grid winding about ¼". No. 18 D.C.C. wire should be used, or larger if desired. The antenna coupling inductances L"L" are two turns of No. 8 or larger wire around each plate coil and of such diameter to be equidistant ½" from the plate winding. It is possible to use a single turn in each antenna coil and thereby work your antenna, very, very close to its fundamental if you believe in that. L3 is the antenna loading inductance and is made much like the plate coils except that it should be wound with No. 8 wire and needs only about 15 turns. For all these coils except the grid, tap every turn, or fix it so that you can get a single turn variation. The condensers CC are each .002 mfd. and should be able to stand about 3000 volts or more. Condensers cc are .006 mfd. micadons and are necessary. Condenser C^1 is the grid tuning condenser and should be a good one. The capacity is .001 mfd. or 43 plates. Additional tubes are, of course, connected in parallel and it is preferable to add in pairs although the set will work with odd values. The R.F. chokes are made up the way they are shown for efficiency.

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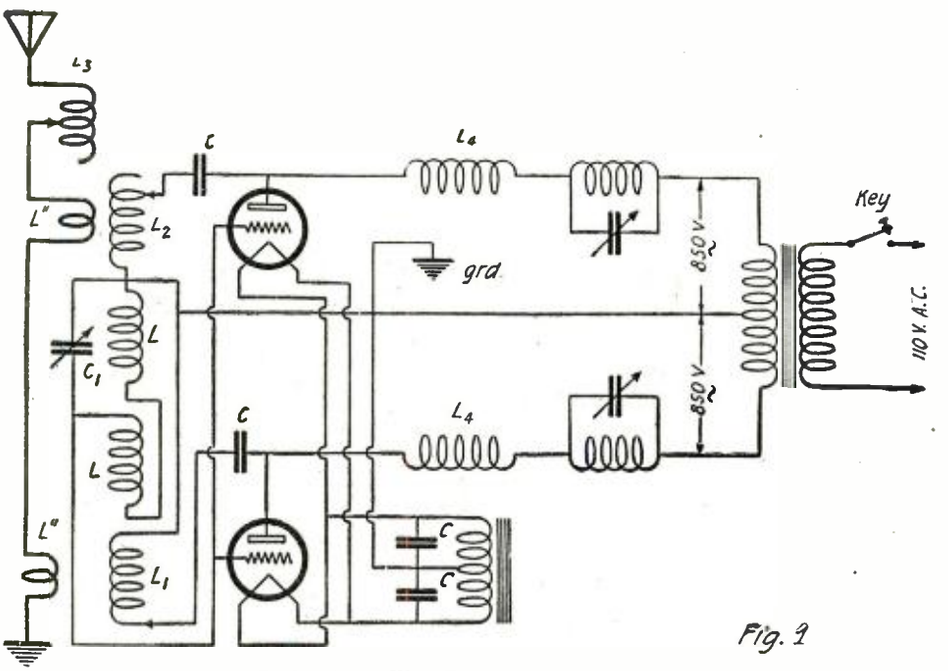


Circuit Diagram for Two Banks of Five-Watt Tubes. Extra Tubes Are Parallel to the Two Shown. The Two Tuned Chokes In the Line Circuit Are Important Factors In the Operation of the Set.

High Power Radio Station Without Antenna Masts

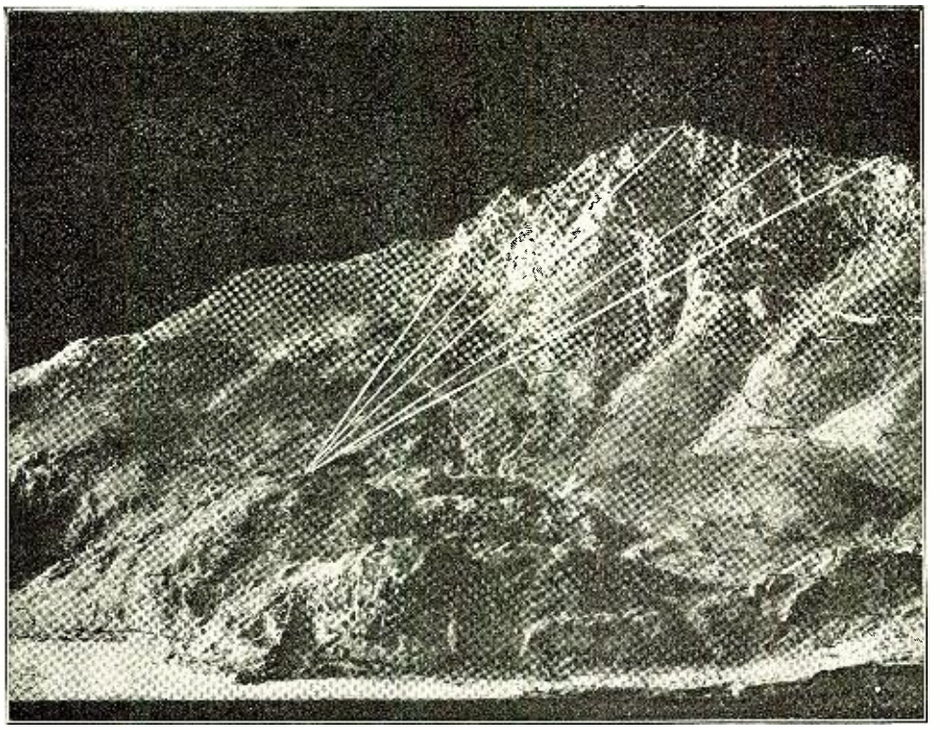
By Dr. ALFRED GRADENWITZ
Berlin Correspondent of Radio News

A REMARKABLE radio station is being installed by Messrs. C. Lorenz, of Berlin, between the Kochel and Walchen Lakes, the last-named of which has recently often been referred to in connection with the mammoth power station now in course of construction, which is to supply electric energy to Upper Bavaria.

Inasmuch as the cost entailed by the installation of antenna masts, of course, constitutes a very considerable portion of the total building expense of a high power radio station, an attempt has been made to do without any antenna masts by installing such stations in high mountain districts, where natural level differences admirably lend themselves to this kind of installation. While endeavors such as this have been made during the late war by the Austrian army fighting in the Alps, the cable stretched out, so far from being used as an antenna, merely served to carry an umbrella antenna 120 meters high. A similar principle was resorted to by the Dutch radio engineer, Dr. de Groot, in designing the antenna system of the Java high power radio station. In the present case, however, the following two problems had to be solved experimentally: First, designing an antenna the useful height of which would be far in excess of the height of masts in the usual type of high power stations; second, comparing the radiation effect of such mountain antennæ with that of a station installed in the lowlands.

The station building, provisionally comprising a laboratory and a dwelling room, was, while work on the antenna was going on, erected in the Jochbach Valley, a rather moist district between two mountains 1730 meters and 940 meters in height respectively; the former overlooks the Walchen and the latter the Kochel Lake. A cable was at first stretched out between the two mountains of different heights, and from the accurate center of which (corresponding to a height of 1,300 meters) a conductor leading to the station building was provided. A special attachment compensating any excessive load on the cable was installed on the lower elevation, thus protecting the cable against breakage, hoar-frost or wind pressure. In fact, after leading the cable, duly insulated, over a pulley, it had been fixed to a car running on rails over an incline. This car is sub-

(*Continued on page* 980)



A Photo Showing How the Antenna of the New High Power Is Suspended From the Mountain Top. It Is 4,333 Feet High at the Far End.

The Overlooked Beverage Antenna

By THOMAS A. MARSHALL, EX-6ZY

AMATEURS with ground space for a Beverage antenna have overlooked its value because they are getting good enough results with a flat top aerial. But a thorough tryout is worth while, as it will surely bring progress in long distance reception, and will eliminate interference.

The height controls the velocity of the current along the flat portion. If too low, the current will lag, resulting in a decrease in signal strength. Vary the height and note results in strength of signals from distant stations. An approximate height of 8' for ordinary soil will give fairly good results.

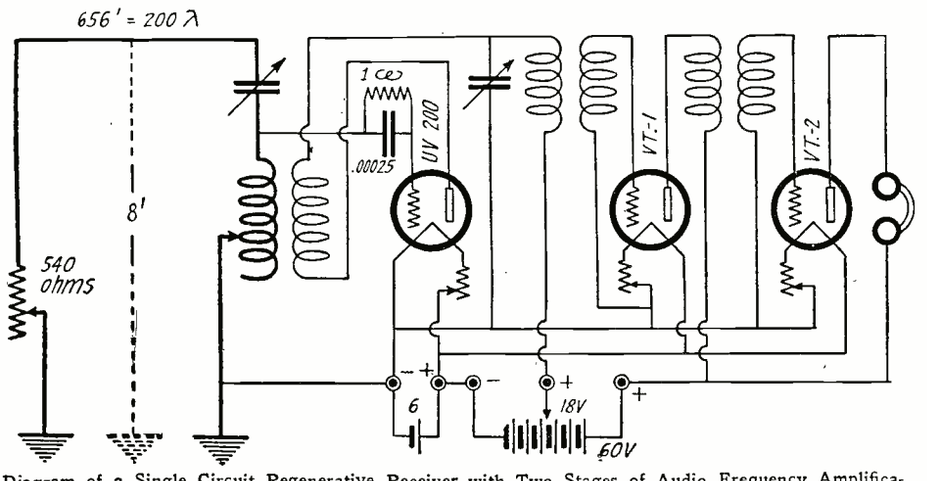


Diagram of a Single Circuit Regenerative Receiver with Two Stages of Audio Frequency Amplification Used in Conjunction with a Beverage Antenna Having a Length of 200 Meters.

The length for 200 meters is 656', and 1,197' for 365 meters. No. 8 cotton covered magnet wire was found to give excellent results. Use a variable resistance of 0 to 540 ohms in the free end, and vary the resistance for best results. Fairly good results may be obtained without the resistance in the free end. The most efficient hook-up is shown in the accompanying diagram.

The free end should extend on the great circle bearing in which maximum signal strength is desired. A great circle bearing is a radio bearing and is not the same as the direction we ordinarily calculate. The method of calculating the great circle bearing is best indicated by an example:

Amateur A, located in latitude 20 degrees and 30 minutes north and longitude 70 degrees and 13 minutes west, wishes to erect a Beverage antenna for receiving amateur B, located in latitude 25 degrees and 20 minutes north and longitude 140 degrees and 20 minutes west. Find the great circle bearing for correct location of a Beverage antenna at amateur A.

Solution:—(a) 20 degrees 30 minutes north, (b) 70 degrees 13 minutes west, location of A; (c) 25 degrees 20 minutes north, and (d) 140 degrees 20 minutes west, location of B.

(*Continued on page* 980)

Eliminating Interference

By J. R. BALSLEY

Radiation from regenerative receiving circuits has caused complications which are becoming serious. All are acquainted with the squeals created by neighboring regenerative receivers. This article describes a method by which radiation can be very much reduced or even eliminated and the selectivity of the receiver considerably increased.

IT has occurred to the writer many times in the last two years that perhaps a lot of printers' ink is being wasted and many conscientious persons are spending much valuable time in condemning or defending the "ham" operator for spoiling concerts when the cause of the trouble may be elsewhere.

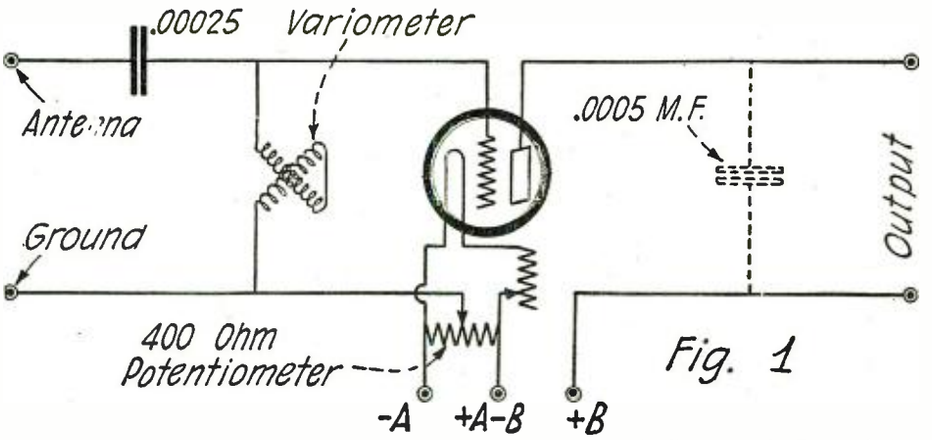
To illustrate: The writer had occasion to spend several months in northern Michigan where the pestilent ham is not much in evidence. Strange to say, on cold or otherwise unpleasant nights when everyone stayed home from the movies to play with the Radio, the several receivers I have listened to were subject to much the same ailments in the way of interference that I get at home in the East.

In some of the towns, such as Ludington, Manistee, East Jordan and a few others where only a comparatively few receivers have been installed, it was possible to arrange for all the others to shut down for several minutes at specified times.

Almost invariably, when this was done, the interference was eliminated.

At Manistee an amateur operates a C.W. set on a little over 200 meters. I listened in one evening on a Westinghouse R.C. located about a mile from the amateur. The interference was very objectionable. The operator of the receiver blamed it entirely on the amateur because he could be heard very distinctly at times when the R.C. was tuned to 400 meters. My idea was that a lot of the trouble was caused by a single circuit receiver across the street, the aerials of the two receivers being close together. To prove it, having learned the chap across the street was using his receiver, I asked him to shut down for a few minutes. When he did so we heard no more C.W. He had been listening to a number of C.W. stations and his antenna oscillations were plainly heard in our receiver.

This condition is prevalent everywhere and MUST be remedied if we are to increase or even preserve public interest in this most fascinating pastime of "listening in."



When It Comes to Interference, One Stage of Tuned Impedance Radio Frequency in Front of the Detector Will Do More Than Anything Else to Eliminate It. This Shows How the R. F. Amplifier Should Be Connected Up.

How many times has each of us been forced to defend our receiver against visitors' complaints that "Oh, I've heard that story a thousand times. They always work when no one is listening."

With the standard American receivers it is entirely possible to make them proof against regeneration in the antenna and still get maximum results from regeneration in the detector circuits. I have done this several times by adding a step of radio frequency amplification ahead of the detector.

At Manistee I made up two radio frequency amplifiers described below and added them to the receivers. Interference was reduced to a negligable quantity and both parties insisted that the amplifiers be installed permanently because of the added range and elimination of interference. On the first night these were used many stations were heard for the first time, notably KHJ and PWX, both well over 2,000 miles distant.

For use on any standard three-circuit tuner, the amplifier, wiring diagram for which is shown in Fig. 1, can be easily and cheaply added.

OSCILLATIONS ISOLATED FROM AERIAL CIRCUIT

With this amplifier added, all oscillations are kept from the antenna circuit because regeneration takes place in the circuits of the detector tube and cannot be transmitted to the antenna circuit because of the one way or rectifier characteristics of the vacuum tube. It is, however, possible to induce oscillations in the antenna circuit if the antenna tuner is too close to the variocoupler, but this is easily remedied by moving the antenna variometer out of inductive relation. Sometimes there is a capacity feed-back into the antenna because of the high capacity between elements in some tubes. This is controlled very easily by means of the potentiometer. The recently developed neutrodyne condenser eliminates this by balancing this capacity externally, but is not necessary in a one-step amplifier.

It will be noted that a fixed condenser is shown in the output circuit. Its use is optional but not recommended. When tuning in, the condenser should be connected to increase the capacity in the output circuit, thus "broadening" the tuning. When the station is tuned in and all circuits adjusted, throw off the switch and tune the station in very

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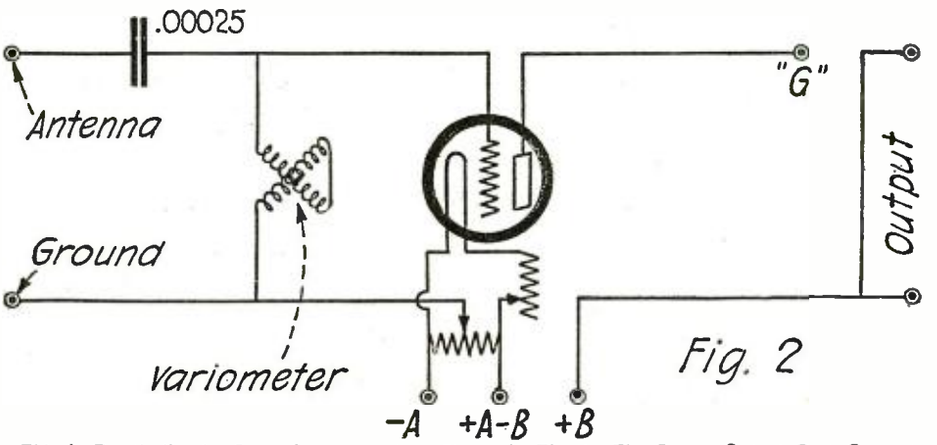
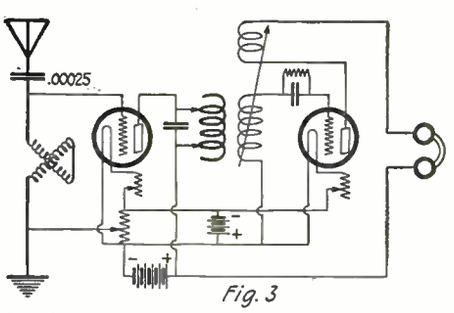


This is Practically the Same Arrangement as Shown in Fig. 1. The Lower Output Post Connects to the Plate of the Detector Tube and the Upper One to the End of the Tuner that Would Otherwise Go to the Ground.



Showing How the Tuned R. F. Amplifier is Connected to a Two Circuit Regenerative Receiver Employing Tickler Feedback.

METHOD OF ELIMINATING INTERFERENCE

To remedy the trouble outlined above it is necessary to devise some means to keep the antenna circuit of receivers from oscillating and at the same time increase the efficiency of the receiver. The British Government has put many restrictions on Radio, some of them we could well copy. It is not permitted to operate a regenerative receiver unless the feed-back is so arranged that with maximum coupling the antenna will not oscillate. This reduces the efficiency of the set very much because a certain factor of

A Practical Neutrodyne Receiver

By ALLAN T. HANSCOM

This article explains the action of the neutrodyne circuit in a manner which can be grasped by the novice. Its formation is described stage by stage, followed by complete constructional details for the building of a receiver of this type.

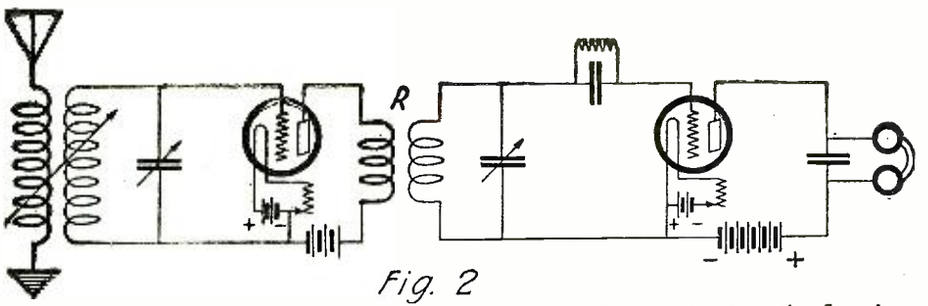


Fig. 2

A One-Stage Radio Frequency Amplifier and a Non-Regenerative Detector, the Respective Secondary Circuits of Which Are Tuned by Means of Variable Condensers.

IT is unfortunate that so many good circuits are labeled with such formidable titles. The name "neutrodyne" is usually enough to scare the average radio fan. A neutrodyne circuit, as commercially developed, is, however, a great deal more simple to understand than the regenerative or reflex circuit.

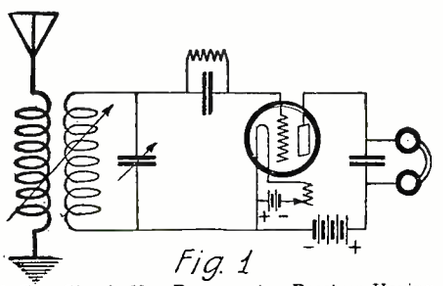


Fig. 1

A Two-Circuit Non-Regenerative Receiver Having a Tuned Secondary Circuit.

The average fan is not interested in the higher mathematics of a circuit but he does like to know the size of the parts so that he can put one together to obtain results.

Fig. 1 represents a simple type of non-regenerative hook-up. By varying the condenser the natural wave-length of the set can be altered. This is exactly the diagram of the first stage of the neutrodyne.

In Fig. 2, another stage exactly like the first has been added. In this case the first tube acts as a radio frequency amplifier and the second tube as a detector.

It will be noticed that the plate circuit of the first tube is not tuned, but that the grid circuit of the second tube, as well as the grid circuit of the first tube, are both tuned and in reality make the two stage filter through which the incoming signal must pass.

Fig. 3 represents three stages exactly as outlined above and this is the scheme of the neutrodyne after we add the neutralizing condensers which will be considered later.

In Fig. 3, there are two stages of radio frequency amplification and the detector, each stage being tuned by a variable condenser in the grid circuit. This circuit would give wonderful results if it were not for the internal capacity coupling between the plate and the grid circuit of each radio frequency tube. This internal capacity is neutralized by the combination of capacity and inductance; the inductance being the windings of the air core radio frequency transformers R. The capacity necessary for the average vacuum tube is very small and is usually about equal to two circular plates 3/8" in diameter separated by 3/32 of an inch. This is only approximate and the proper value may easily be found. Other types of condensers for this purpose are shown in Fig. 4.

The radio frequency transformers can be made by winding 80 turns of wire on 3" tubes with a tap taken off at the 20th turn. It is preferable to use cardboard because it is an advantage to have a close coupling between this coil and the primary, which is inserted inside. The primary consists of 20 turns of wire on a tube which will just clear the tube on which the secondary coil is wound. It is difficult to buy one tube to fit inside another in this manner, but it can be overcome by sawing a piece of tube ½" wide lengthwise from the same tubing. Then when it is wound, the wire will draw it to a smaller diameter whereupon it may be slid into place inside the full sized tube. It is very important that these transformers be mounted at least 6" apart and at such an angle that a line drawn at right angles to the axis at the end of the winding does not intersect the winding of the adjoining transformer. See Fig. 6. Note the relative position of primary and secondary windings.

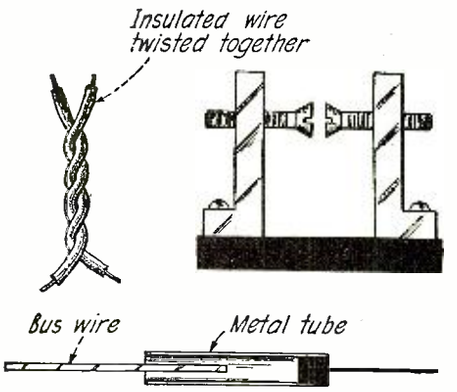


Fig. 4

Several Ways of Making the Neutralizing Capacities.

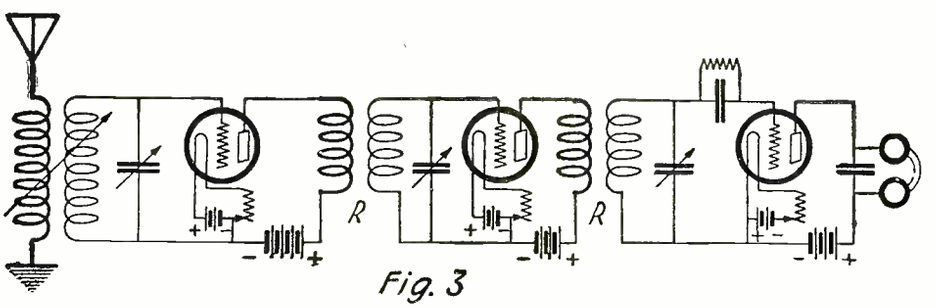


Fig. 3

Two Stages of Tuned Radio Frequency Amplification and Detector. These Circuits Are Free to Oscillate Due to Feed Back Through the Internal Capacity of the Tubes.

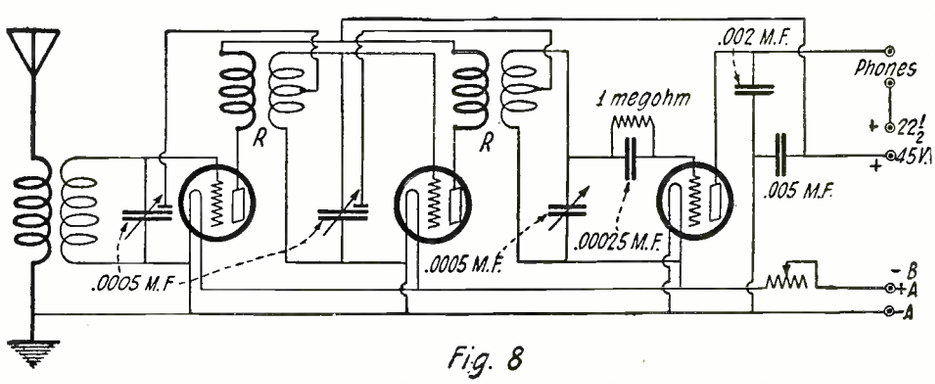


Fig. 8

Complete Circuit Diagram of a Neutrodyne Receiver Having Two Stages of Tuned Radio Frequency Amplification and Detector. The Circuit is Kept from Oscillating by Means of Small Condensers Which Neutralize the Capacity of the Tubes.

NEUTRALIZING CONDENSERS

Since the variable condensers used are connected between the grid and the filament, it is possible to connect the grid to the fixed plates and then mount the other small movable plate on the back insulated portion of the condenser. By this means a very small change of capacity can be made in the neutralizing circuit. See Fig. 7.

After the proper value of this capacity is found, it need never be disturbed unless tubes are changed. It is likewise advantageous to shield the set, although it is absolutely impossible to make this set oscillate if it is properly constructed.

To find the proper value of the neutralizing condensers it is necessary to tune the set to a very powerful signal. The Flewelling "screamer" makes an excellent oscillator for this case. A paper may be inserted in the socket to cover the filament connections but leaving the plate and the grid free. Then the tube is inserted and the signal is still heard.

(*Continued on page* 914)

Notes On the Autoplex Receiver

By M. L. MUHLEMAN, A. M. I. R. E.

This article should help those who have had difficulty with the Autoplex receiver. Directions are given for adding one stage of audio-frequency amplification for those who desire greater volume.

SOME time has elapsed since the introduction of the Autoplex circuit, consequently there are quite a number of people who have constructed sets of this type and have obtained excellent, good or poor results. Of the number who have been successful, the majority are probably more or less acquainted with the action of receiving circuits and vacuum tubes. Of the number who have met with failure, some are not acquainted with radio at all, others have failed to heed directions and no doubt a few have experienced pure hard luck. Although the Autoplex circuit is uncommonly

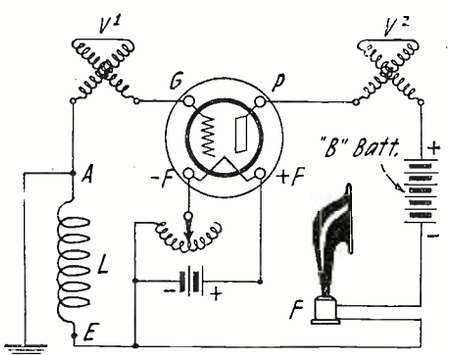


Fig. 1

A Ground Connection is All That is Necessary to Obtain Good Results. It is Connected as Shown.

simple, the action is somewhat complicated and the circuit demands certain conditions before it will operate to the height of its efficiency.

It should be remembered that it is a modified super-regenerator and is, therefore, rather ticklish in its operation. Unlike the usual form of super-regenerative receiver, it is not encumbered with excess controls, but this is no reason to believe that it is the acme of simplicity as to tuning. On the contrary, it requires both skill and patience to operate one correctly and not until a person has spent a bit of time with the circuit will it give forth its best.

The novice should understand that the Autoplex receiver is no "pull a switch and work" arrangement on a silver platter, nor is it the wonder circuit of the 20th Century. It is, however, a very reliable circuit when properly handled and has the advantage, over the usual run, of being cheap to construct and requiring nothing more than a ground connection for satisfactory operation.

The Autoplex receiver was introduced primarily to fill the want of a one-tube set that would operate a loud speaker when using a ground connection or some form of simple aerial, thus avoiding the prohibition placed by landlords on out-door aerials. It is not intended for long-distance reception, although stations 1,000 miles distant can be brought in on a loud speaker when local broadcast stations have subsided. Distant reception, however, depends a good deal upon the adeptness of the operator in handling the set, and the type of collective agency or agencies used. Furthermore, the Autoplex was not designed for use with head-phones. Little noises inherent in most any receiver employing audio frequency amplification are not particularly noticeable when using a loud speaker, but are quite bothersome when employing head-phones. This is also true of the Autoplex. If the head-phones are left on the table, all very well, but the volume in this case is not one-half that obtained if a loud speaker were used, or the phones with some form of horn attached to them.

One of the most common troubles experienced with the Autoplex circuit is the inability on the part of the manipulator to receive broadcast programs free from noise. This may be due to a number of reasons:

First: Local interference caused by sparking generator commutators, X-Ray machines, Arc lights, etc.

Second: Run down "B" batteries.

Third: Poor contact in some portion of the circuit.

Fourth: Variometers having low inductance value and loose coupling between rotor and stator windings.

Fifth: Lack of knowledge on the part of the owner of the correct tuning of the set.

Sixth: Too large or too small a collective agency.

Variometers are the most important part of the circuit and should be as specified. Both rotor and stator coils should have at least 60 turns of wire each, making a total of from 120 to 130 turns for the whole instrument. A variometer with a greater number of turns is still more advantageous, since longer wave-lengths can be reached with them.

As mentioned before, the collective agency used is quite important. In some cases, the use of a bed spring or some other form of capacity antenna connected to point A (see Fig. 1) is more efficient than the regular aerial and ground. Since location has considerable influence on this, it is advised

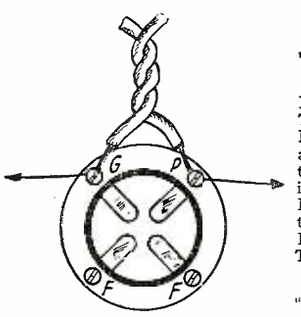


Fig. 3

Low Voltage Tubes Can Be Made to Operate More Effectively by Inserting a Capacity From the Plate to the Grid Posts on the Tube Socket.

that different aerial systems be experimented with. The elimination of the ground, or whatever metallic object which may be connected to point E (see Fig. 1), will help considerably in increasing the selectivity of the set and may be found to be the solution of the noise problem. Since most tubes have different characteristics, no specified "B" voltage can be given; therefore, voltages from 22½ to 90 should be given a trial.

If, after trying these various suggestions to eliminate the rushing noise, no success is had, it is suggested that a rheostat be included in the circuit so that the filament temperature may be adjusted to a fine degree. This will prove of help in the usual case and at the same time allow the tube to work on a lower filament temperature and thus conserve the storage battery current.

Another method by which the circuit can be made more stable is by the use of a 4½ to 9-volt "C" battery. It is connected into the circuit as shown in Fig. 2. With the correct "C" battery voltage, greater amplification will also be obtained.

If the circuit fails to oscillate at audio frequency (denoted by a high whistle), there is either an open or a short circuit in one of the instruments, or the vacuum tube used is poor for this work.

The use of a low voltage tube, such as the WD-11, WD-12, UV-199 or C-299 will not

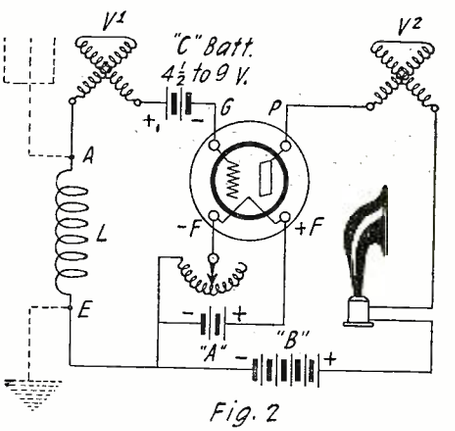


Fig. 2

The Use of a "C" Battery Connected as Shown Will Clarify the Signals and Also Conserve the "B" Battery Current.

prove very satisfactory, since the capacities of these tubes are too low to produce any appreciable amount of volume when used separately. A large capacity tube should be used such as the UV-201, UV-201A, VT-2 or 216-A.

Considerable difficulty may be experienced in making the low voltage tubes (WD-11, WD-12, UV-199, C-299) oscillate at both radio and audio frequency which of course is necessary in the Autoplex circuit. The reason for this is that oscillation depends on the grid to plate capacity (condenser effect) of the tube used, and in the above mentioned it is very small. To increase the capacity, two pieces of well insulated wire, about 3" long each, should be twisted together and the end of one wire connected to the grid post of the tube socket and an end of the other connected to the plate post. This makeshift capacity can be increased or decreased as necessary by twisting more of the wire together or untwisting

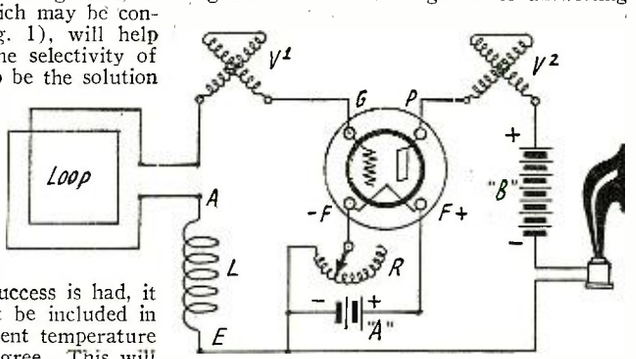


Fig. 4

The Autoplex Operates Well With a Loop Aerial Connected as Shown. If a Ground is Used it Should Be Connected to Point A.

an amount of it until the most desirable capacity is determined. This is illustrated in Fig. 3.

Extreme care should be taken that these two wires do not make contact with each other, for if they do, the "B" battery will be short-circuited and the phones or loud-speaker would, no doubt, burn out.

When wiring the receiver, be sure that the lower connection of the honeycomb coil "L" (see Fig. 1) connects through point E to the negative side of the "A" battery. The negative side of the "B" battery, through the phones F, can be connected to either the negative or the positive side of the "A" battery.

The tuning characteristics of the Autoplex circuit are rather out of the ordinary. A single broadcast station can be tuned in at possibly four different dial settings with a noticeable increase in volume at only one of the four settings. Any number of people have picked up a broadcasting station when tuning and received the signals quite loudly, but with considerable noise present, and took it for granted that it was the best that could be done. If they had attempted to pick up the same station at other dial settings they could have eventually struck a point where the signals came in loudly and clearly and free of circuit noises. At this point the circuit is tuned to the true wavelength of the transmitting station.

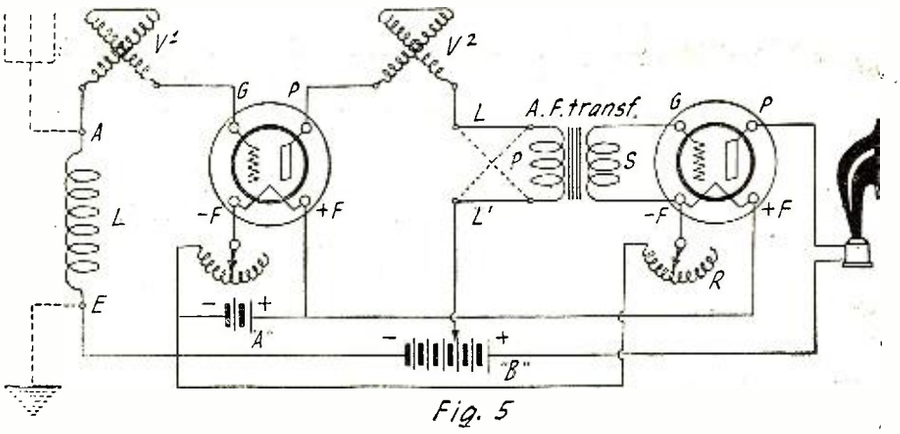


Fig. 5

A One-Stage Audio Frequency Amplifier in Connection With the Autoplex Will Give All the Volume Desired.

If desired, a loop aerial can be used with the Autoplex circuit, if connected as shown in Fig. 4. A ground connection is optional, but if used, should be preferably connected to point A rather than point E.

The use of one stage of audio frequency amplification will naturally increase the volume of received signals considerably, since the output of the first tube is of large proportion in the first place. The circuit for this arrangement is shown in Fig. 5. If failure is encountered in amplifying the signals at the first trial, the two leads "L" and "L-1" running to the primary winding of the audio frequency transformer should be reversed. This is quite important since results are indifferent when the leads are connected one way.

Improved Loud Speaker Horn for Indoor Use

By A. W. SHRAEP

WHENEVER there was occasion to demonstrate a receiving set with a loud speaker, either in a large or small room, to a number of people where a comparatively large volume of sound had to be used, there was always met the annoyance, to those near the speaker, of being disagreeably affected, while listeners at a point half way to the rear of the room would just about be able to judge the good and bad points of the receiving set employed. At the present time, when entertainment is furnished in an auditorium, hotel lobby, etc., it is always necessary to use two loud-speakers placed at different points.

From time to time new loud speakers have been placed on the market. However, the manufacturer of every one makes new claims only for quality of tone, etc., due to the construction of the diaphragm. In principles, they are all alike, throwing the entire volume of sound *in one direction.*

Beginning with the premise that *even distribution* of this volume of sound *over the entire room,* in other words diffusion of the sound, would solve the problem, it logically follows that this must be done from some point at the center.

Placing a loud speaker with the conventional type of horn at this point, directing the sound waves either against the ceiling or the floor, does not help—the problem was one of actual direction of the waves. Taking into consideration the reflecting qualities of the horn itself, as well as those of the ceiling, walls and floors, the solution had to be such that the means sought would function under any indoor conditions, such as in rooms of different sizes, furnished or unfurnished, etc.

From the above, the line of research to be followed, and the solution, will be readily understood by the description and illustrations of the means employed to get the desired effect of diffusing the total volume of sound practically evenly over an entire room. The first step was to place a horn within a horn, with simple means to hold these two horns in their proper relative positions. Horns with straight sides would naturally constitute no improvement, therefore, the principle of the bell (as for instance the opening of a cornet) of the brass musical wind instrument was adopted—and please note—this bell has been used since time immemorial without change.

On the curve of the bell, however, depend to the largest degree the acoustical qualities, and to fulfill its purpose this curve has to be mathematically, as well as acoustically correct, and by colaboration the true curve was designed. After using various materials, the horns were made of No. 16 gauge copper and in order to still minimize internal vibrations, the interior, as far as possible, as well as the exterior of both horns were covered with paper. The illustrations show the dimensions as well as the curves.

It will be noted that the inner horn at the bottom is shorter than the outer one, and the travel of sound waves through this horn is directed and spread against the ceiling, while the flare directs the sound waves from the outer horn sideways and downward.

This combination of bells or duplex horns replaced the horn of the Western Electric loud speaker. No power amplification was needed as the receiving set employed was provided with three stages of audio, using No. 216A tubes. The loud-speaker was placed within an electric light fixture of the reflecting bowl type, and suspended in such manner that the top of the speaker would be within 4½′ of the top of a room 12′ high. In rooms with lower ceilings, approximately the same proportions were maintained.

Considering the fact that the bells in this speaker were by no means perfect, each was made in two pieces, cut out of a flat sheet of copper, shaped by hand, brazed and finished on mandrels which happened to be near the dimensions required—the result was truly surprising. In every part of the room, be it directly underneath the speaker or at a distance of 15′, the results were entirely different from those obtained with the usual type of horn. Good music or the voice received, acquired or were reproduced in a soft mellow tone, though the full volume was used at the input, and without this input being greater than necessary with the old type horn.

The above results were obtained in a room 28′ x 35′, using a single speaker. It is a

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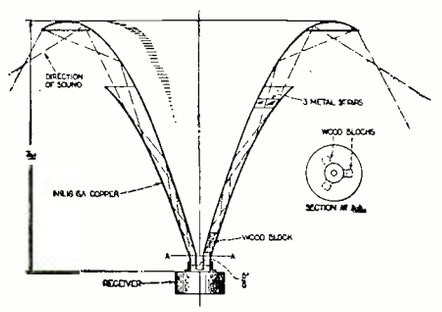
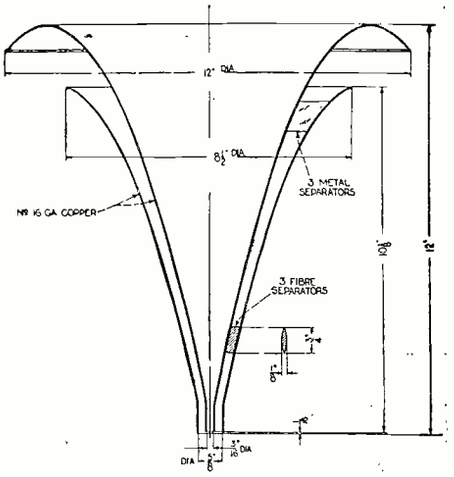


Two Horns Are Used With This Arrangement; the Sound is Projected Upward Through the Inside Horn, and That From the Outside Horn Deflected Downward by the Curved Edges of the Larger One.

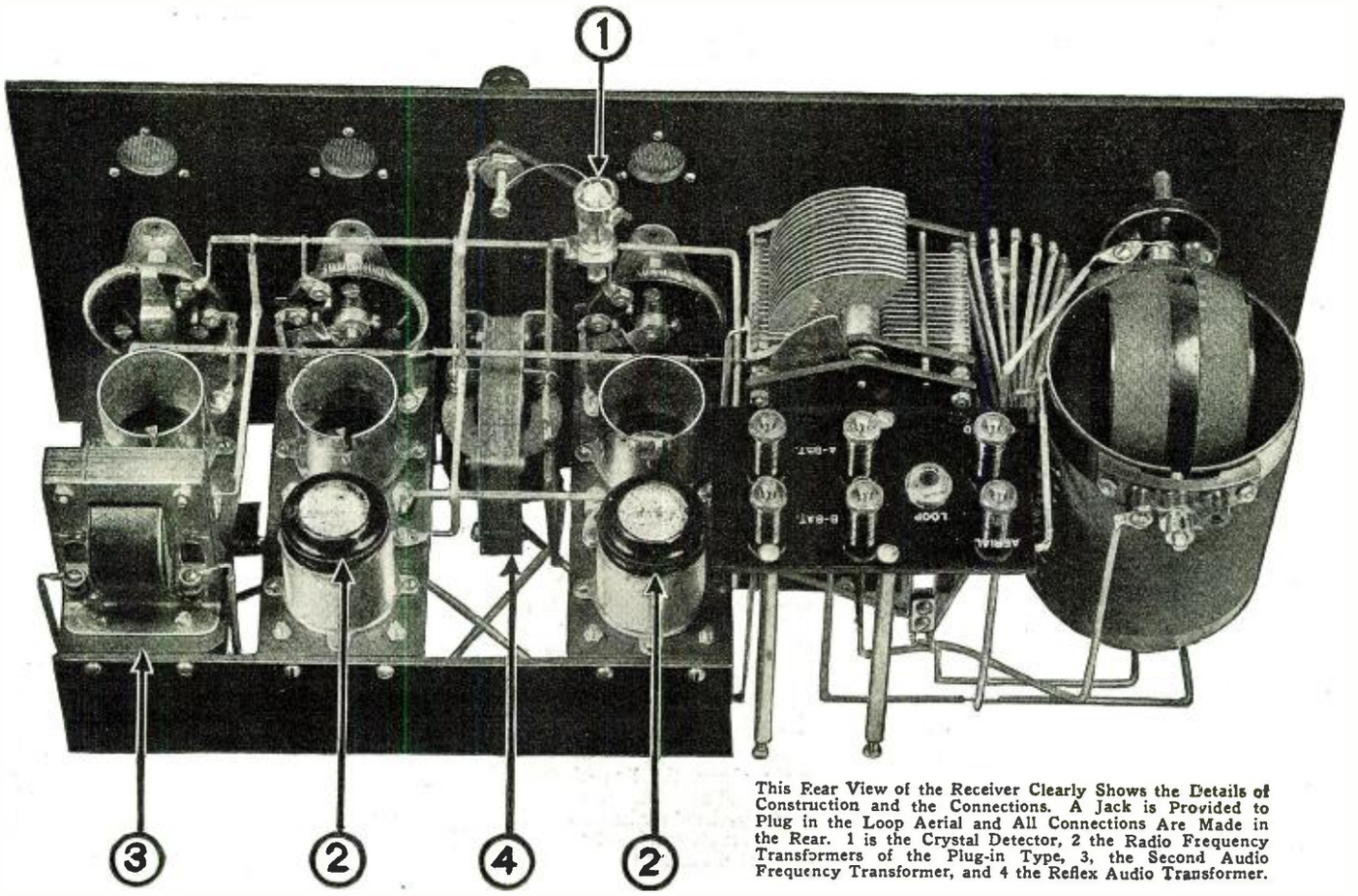


Details and Dimensions of the Loud Speaker Horn Described in This Article. The Larger Horn is Supported by Pieces of Fibre Fastened to the Outer Horn.

An Original Reflex Receiver

By EDWIN S. WATKINS

Remarkable results have been obtained with this well designed reflex receiver in various parts of the country with loop or outdoor aerial. It embodies two stages of radio and two stages of audio frequency amplification, using only three tubes.



This Rear View of the Receiver Clearly Shows the Details of Construction and the Connections. A Jack is Provided to Plug in the Loop Aerial and All Connections Are Made in the Rear. 1 is the Crystal Detector, 2 the Radio Frequency Transformers of the Plug-in Type, 3, the Second Audio Frequency Transformer, and 4 the Reflex Audio Transformer.

THE reason that so many home-made multiple tube reflex circuits have failed is that the description from which they were made did not specify the type of reflex radio and audio transformers to be used nor the arrangement of the apparatus behind the panel. Probably no other amplifying circuit needs to be followed in more detail of instruments and arrangement than the multiple tube reflex circuit.

This article has to do with the construction of a reflex amplifier which has given excellent results, not only to the writer, but to many hundreds of radio fans on the Pacific Coast. For the benefit of our Eastern friends, I might state here that it has been our experience in the Pacific Southwest to find that a set which is good for 2,000 miles east of the Rockies is usually good for about 200 miles when it comes into our neighborhood. We of the West were misled for some time by the distance claims of Eastern manufacturers, so that now when we read an article about a 2,000-mile set we merely cut off the last cipher to adapt it to our location. Conversely, a receiver which is good for 1000 miles out here (they are few and far between) will, as a general rule, receive from every section of the country when taken east of the Rockies.

A very striking example of this occurred during August when a friend of mine, who has a receiver similar to the one shown in this article, had occasion to visit his father in Missouri. He erected an antenna consisting of one wire, 60′ long, 5′ high at one end and 12′ at the other. A ground was obtained by the usual water pipe method. From New York to Pensacola, Florida, on the East coast, across to Texas and up the Pacific coast from Los Angeles to Portland, Oregon, was the limit of his reception. The big surprise came, however, when he discovered that he had been listening to Los Angeles with the aerial wire disconnected and hanging about 5′ from the set. All of the Eastern stations came in with excellent volume. This same receiver, when used here in Los Angeles during the past summer, has not received any stations off the Pacific coast.

This set has shown exceptional ability when used with a loop antenna, having received most of the stations as far as Portland, Oregon, during the summer, with one measuring 18″ on the side. The best record the set has made occurred last April when PWX, Havana, Cuba, was heard with an outside antenna.

Almost any kind of tuning circuits may be employed, depending on the degree of selectivity you must have to eliminate interference. If you use a single circuit tuner, be sure to keep the variable condenser in the antenna or ground circuit at a small value. A 13-plate or smaller will give excellent results. While speaking of condensers, it might be well to know that variable condensers with metal end plates and small bakelite inserts for insulation are decidedly inefficient. If the bakelite insert is an inch or two in diameter, the losses are not so great. Under no consideration should you use a condenser with fibre insulation such as are being sold by the carload by various so-called radio manufacturers.

Where interference is bad, such as in the cities where there is more than one broadcasting station, a double circuit tuner similar to the one shown in the diagram should be employed.

The primary condenser, C1, is of .00075 mfd. capacity. A 31-plate with vernier adjustment will fill the bill. If the set is to be adapted by means of a loop jack for the use of a loop aerial, the secondary condenser, C2, should be of the same kind. A vernier adjustment is absolutely essential in the secondary circuit for long distance operation.

The vario-coupler, L, in the diagram, is shown in a picture accompanying this article. If made properly the tuning will be sharp and the received signals strong, but if not made properly, will ruin the whole set. Metal parts thereon should be kept at a minimum size and as few in number as possible. Note that the supporting brackets and bearings are made of moulded bakelite. The primary

winding consists of 125 turns of No. 24 single silk covered wire wound on a 3½" formica tube. Ten equally spaced taps are brought out to contacts on the panel.

The rotor should be mounted about ¾" above the primary winding and not down inside of it. The so-called 180-degree couplers are not very efficient for radio frequency or reflex circuits. Sixty turns of No. 24 single silk covered wire are required for the secondary winding.

In the rear photograph of the set can be seen the method of mounting the terminal board or loop support. It consists of a piece of formica 3-16" x 2" x 4", supported on the back of the secondary condenser by means of angle brass. To fasten the angle brass to the condenser, the rear end plate is removed. Two holes are drilled therein and countersunk from the inside so that the heads of the 6-32 flat head machine screws will not touch the stationary plate of the vernier adjustment. Six binding posts and a double circuit jack are used for connections to the set. The jack is used as a receptacle for the loop, which is mounted on a standard phone plug with a heavy formica shank.

To the left of the condensers may be seen the reflex amplifier. The arrangement of equipment and types of apparatus for this section of the set should not be changed if you would be sure of success. Wireless Shop Reflex amplifying units were used throughout. The radio transformers may be seen in the rear, mounted in brass tube sockets. As you look at the set from the rear the primary terminals are on your right and the secondary terminals on the left. The reflex audio transformer is mounted on the panel between the two radio amplifier units. Directly above may be seen the internally mounted crystal detector, which is controlled by a knob on the front of the panel. An adjustable detector will invariably be found best for this set. The Gold Grain detector was found to give good results in some cases, but varied considerably. The Grewol detector worked well.

The last audio amplifier may be seen at the extreme left of the photo. It was found in the laboratory that this was acting almost as a power amplifier. In actual practice it gives from eight to ten times volume amplification. This condition is remarkable when one compares it to amplifiers on ordinary sets. The explanation is that the radio frequency gives us almost pure voltage amplification and hence the grid voltage on this tube is extremely high.

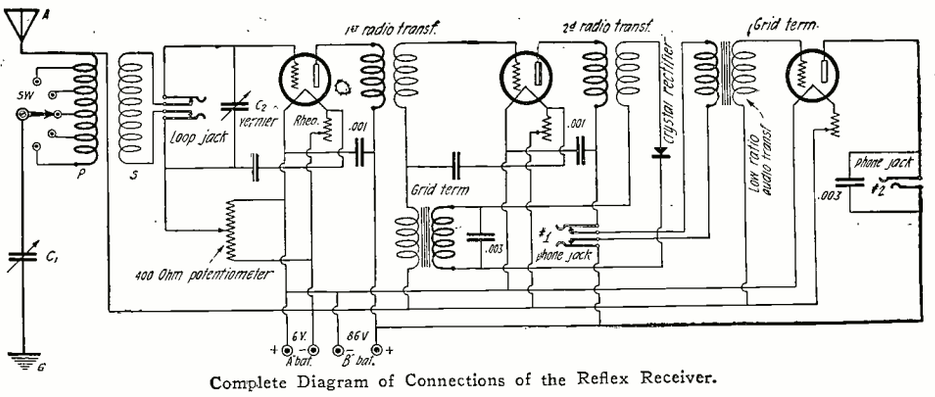
One instrument which does not show in the rear view is the 400-ohm potentiometer which is located directly below the coupling dial. Note that the vario-coupler is set back ¾" from the panel by means of three pieces of 3-16" brass tubing. This gives clearance for the potentiometer.

The back support for the amplifier units is made of a piece of ⅛" formica. It should rest on the bottom of the case when the instrument panel is inserted. The potentiometer should be mounted on the panel first. The variocoupler is then mounted and the contacts wired. The lower, or primary condenser, should then be fastened in place and wired.

The reflex audio transformer should be fastened by four flathead machine screws and its primary by-pass condenser of .003 mfd. connected in place. After the amplifying units and jacks are put in place, wiring should proceed as far as possible. The secondary condenser with the terminal board completes the job, with the exception of the bezels and crystal detector.

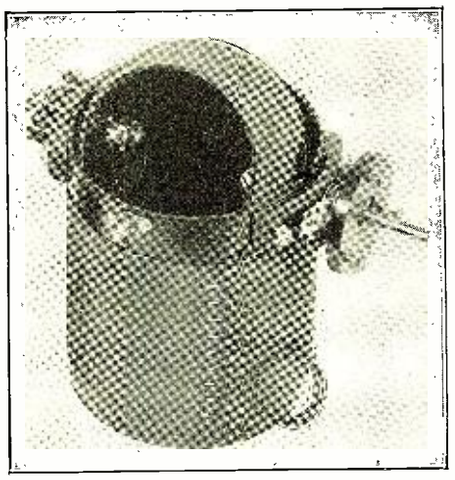
The jacks should be carefully inspected to see that they open and close the circuits properly.

After placing some 201-A or 301-A tubes in the sockets, connect the storage or "A" battery to the proper binding posts and turn on the rheostats. If the filaments light properly the "B" battery should be connected. It will be found that 86 volts gives the best tone quality.



Complete Diagram of Connections of the Reflex Receiver.

When the head phones are plugged into the jacks, a sharp click should be heard. Set the rotor of the vario-coupler near a vertical position and turn the potentiometer dial toward the negative end. Another click should be heard as the set goes into oscillation. This condition indicates that the wiring of the radio frequency circuits is probably correct. The loop should then be inserted and the same procedure followed with the potentiometer, the secondary condenser being set at about half capacity. Results should be similar to the first case.



A Well-Designed Vario-Coupler. Such An Instrument is Used in the Reflex Receiver Described in This Article.

Remove the loop and connect the antenna and ground to the proper binding posts. Set coupling at about 60 degrees from horizontal. Primary inductance switch should be set at about the third contact. With the set in oscillation and with the primary condenser set at different points about 20 degrees apart, rotate the secondary condenser slowly throughout its range until the shrill whistle of the carrier wave of a broadcasting station is heard. Rotate the potentiometer dial slowly toward the positive end until the set just goes out of oscillation. The crystal detector should then be adjusted until signals are heard at their best volume. The vernier of the secondary condenser is rotated to bring the signals in louder. At this point the primary switch and condenser are varied once more, with each variation a compensating change being made on the secondary condenser. After the settings of the various dials are found for a certain station you can always duplicate all of them except the potentiometer to receive a same station at another time. For maximum volume the potentiometer is placed as close to the point where the set goes into oscillation as possible without causing distortion.

It will be found that the crystal detector holds its adjustment especially well, due to the fact that there is power flowing through it at all times from the radio frequency tubes ahead of it.

Some of you will wonder if another stage of radio frequency will not add to the distance possibilities of the set. After making many of these sets with three stages of radio I have come to the conclusion that absolutely nothing is gained by adding a third stage. The perfect tone quality is ruined and the set becomes more difficult to handle. Therefore you will do well to stick to the instructions as given in this article.

In conclusion, I wish to give only one precaution in the construction of the receiver. Do not, under any consideration, try to use high ratio audio transformers, as you will experience more distortion and noises than you ever heard in a radio set. Transformers with a low secondary distributed capacity and a ratio in the neighborhood of one to three or four give best results.

HELPFUL HINTS TO RADIO LISTENERS

There are ten good rules for broadcast listeners:

1. Don't try to hear Australia in midsummer. Be satisfied to enjoy the nearer stations most of the time.

2. Don't be disappointed if an occasional storm interferes with your summer radio evening. There are many fine concerts coming. You can't expect to find a pearl in every oyster nor to receive a record-breaking concert every night.

3. If you want louder signals, use a longer aerial, more tubes, higher plate voltage, more sensitive loud speakers, and more careful tickler and receiver adjustment.

4. A pleasant signal filling a moderate sized room should be enough to give satisfaction. It is not worth while producing signals which deafen the neighbors. It is wasteful to insist on tremendous signals which are generally less pleasant than moderate signals.

If your local station comes in too loudly and drowns others out, a smaller aerial will help in tuning him out, with a smaller condenser connected between aerial and ground. And if all measures to get rid of the local station fail, why not enjoy his concerts? He is working hard for you and it is nobody's fault that you are so close to him that you are bound to hear him. Broadcast stations have to be closer to some people than to others.

6. For the new longer waves above 450 meters, use a condenser connected between the aerial and ground terminals of your set.

7. A little patience in learning to handle your receiver yields rich returns in satisfaction from fine signals. Remember that "Rome wasn't built in a day" and keep on getting more and more familiar with your set and how it works.

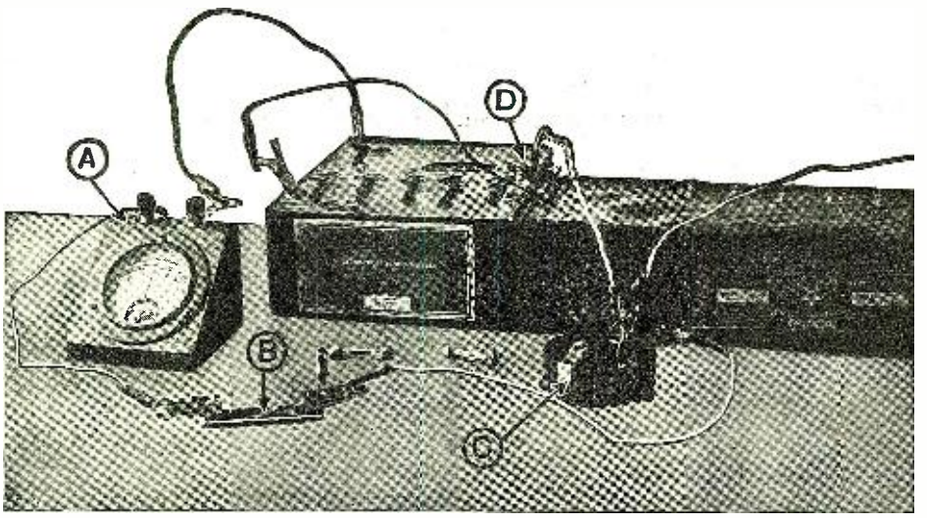
8. It is a good idea to read the radio column of a newspaper or a good radio magazine or two. It helps you to know how your set works and keeps you up-to-date in radio.

(*Continued on page* 1016)

How To Make Your Own Grid Leaks

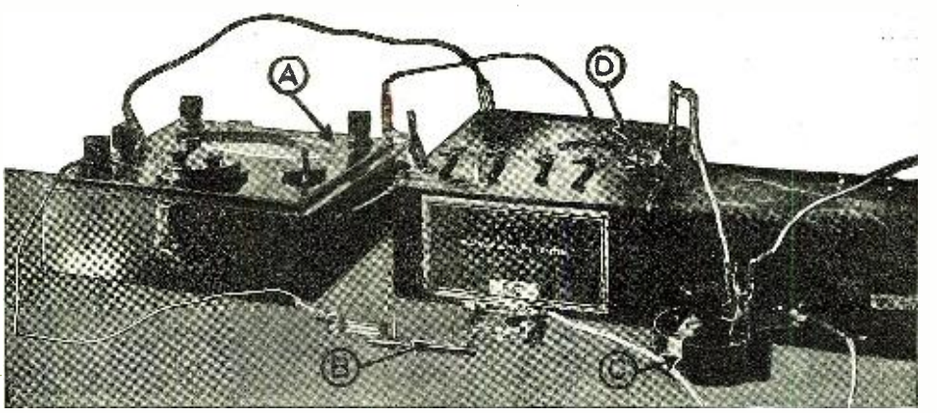
By CARTER FISKE

The grid leak is one of the most important considerations in a receiving set. A poor grid leak, or one of the wrong value defeats efficient operation. Mr. Fiske explains in this article how reliable ones can be made, and a simple method of determining the resistance values.



The Layout of Apparatus Used by Mr. Fiske in His Simple Method of Testing Grid Leaks. A, Galvanometer; B, Leak Mounting; C, Potentiometer; and D, Battery.

MANY radio fans look upon the grid leak as being a very mysterious thing, both in construction and in operation. It is true that it effects a very delicate operation, allowing the negative charge which accumulates upon the grid to leak off at the proper rate. If this charge that accumulates on the grid were allowed to reach too high a point, the efficient operation of the tube would be greatly interfered with. Hence it is important that the resistance of the grid leak be perfectly suited not only to the peculiar characteristics of the tube, but to the circuit in which the tube is used. Too many fans overlook the importance of this particular device. If the grid is allowed to accumulate too great a negative charge, the proper flow of electrons between the filament and the plate will be interfered with. Many radio receivers are unable to operate at their maximum efficiency simply because the grid leak is not of the proper resistance value.



REQUIREMENTS FOR GOOD GRID LEAKS

The resistance of grid leaks is measured in megohms. A megohm is 1,000,000 ohms, and this should not be confused with the microhm, which is 1/1,000,000th of an ohm. Grid leaks are used having a resistance from 200,000 to 5,000,000 ohms.

A pencil mark made on a piece of paper is a poor apology for a grid leak. First and foremost, its resistance will be anything but uniform and will change with the weather. If left exposed it will absorb moisture and its resistance will drop to half its original value. However, it is possible to make good grid leaks and to make them cheaply and quickly with resistances that will be accurate. By the simple process that the writer is going to outline, any radio fan can make up a set of resistances ranging all the way from 1/10th megohm to 5 megohms. With these at hand it is a simple matter to obtain the proper one for any circuit, regardless of its nature.

HOW THEY ARE MADE

The accumulation of the necessary materials is the first step. A bottle of ordinary Higgins India Ink is one requisite. This is used just as it comes, without dilution. Next, some three-ply bristol board should be obtained, together with a few feet of clear glass tubing with a ¼" bore. These materials with a little paraffin and a few little copper clamps of the dimensions shown in the sketch are all that is necessary to make up a batch of leaks. The bristol board should be cut up into strips measuring 1" x ⅛".

The resistance units are made simply by applying the ink to the surface of the Bristol board strips. The amount of ink placed upon the surface determines the resistance. The more ink, the lower the resistance. Before applying the ink, it is well to place the Bristol board strips in a warm oven for a few minutes to drive out all moisture. This done, the strips are taken in hand and the ink is applied by wiping the wet quill from the bottle over the surface. For a 5-megohm leak, one application of the ink is sufficient and the papers are put away to dry where no dust will accumulate on the surfaces. It is advisable to make up five or six strips with the one application and this course should be followed throughout. It is necessary because of the impossibility of applying ink evenly and uniformly. When high resistances of this nature are being dealt with, the most insignificant inaccuracies will greatly affect the final resistance.

Next some papers should be prepared with two applications of ink, and then some with three, four, five, six, etc. This simple procedure allows us to go down

(Continued on page 988)

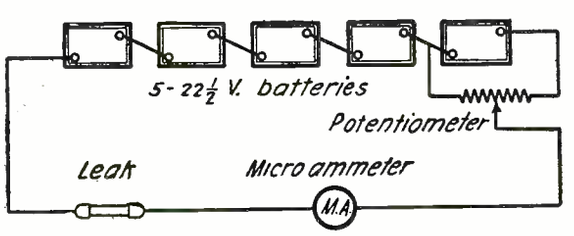


Fig. 1

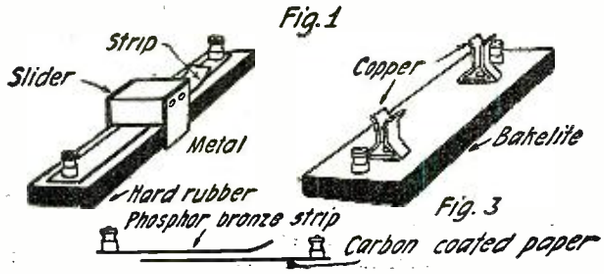
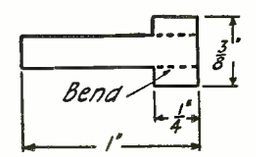


Fig. 3



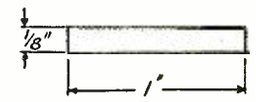
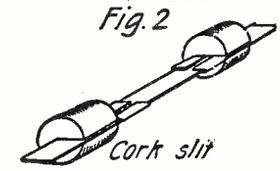


Fig. 2



Details for the Construction and Testing of Fixed and Variable Grid Leaks are Given in the Drawings Above.

Curves As An Aid to Tuning

By H. C. DEFFENBAUGH

Instead of searching all over the scales of your dials for a station that you know is transmitting at the time, calibrate your receiver by the method explained in this article and tune exactly for the station you wish to receive. It is easy.

ONE of the advantages claimed for the Hazeltine Neutrodyne circuit is that the dial settings plotted against wave-length form a curve which, once having been determined, may be used for tuning without recourse to a log of the dial readings for individual stations. That is, if the wave-length at which a station is operating is known, reference to the curve will give the dial settings to pick up this station.

As I am using a set similar to the Aeriola Senior, which brings in Omaha, and points East on an indoor aerial, and a peanut tube, I thought that it might be possible to plot a calibration curve by means of which I could pick up any station I desired to listen to without looking up log readings or without hunting around over the tuning dial till I found the station. The result of my efforts is shown by the set of curves in Fig. 1. The most of the points to determine these curves were obtained one evening when over 30 readings were taken on about 20 stations. Later other readings were taken to fill in sections of the curves which were incomplete, but the general trend of the curves was determined in about three hours. Their use has shown that it was three hours well spent.

SERIES CONDENSER IS USED

In addition to the fixed condenser used in aerial circuit of this type of receiving set, I used in parallel with it a variable condenser having 15 plates. The fixed condenser is connected to a switch point so that it may be cut in or out. The fixed condenser is cut in only when it is desired to listen to stations of over 460 meters. This two-condenser arrangement gives a wide range of tuning so that most of the tuning on the "wave" or tuning inductance can be done between 25 and 75 on the dial. For low wave-lengths I have found that best results were obtained with the series condenser alone set at 25 for high wave-lengths with the series condenser set at 100 and the fixed condenser (.00025 Mfd.) cut in. Accordingly I decided to plot curves with variable condenser settings at 25, 50 and 100 with the fixed condenser cut out and at 100 with the fixed condenser cut in. The entire range of the set could be covered by the first and last curve, but I preferred the four so as to keep the tuner dial readings more nearly the 50 division point. In the case of the three lower curves, the tickler dial was set at 50 as I have found that when stations were tuned in to maximum strength the tickler dial setting has been around 50. In the case of the upper curve (fixed condenser cut in) the tickler dial was set at 60 so as to be able to operate at a lower filament current.

HOW TO MAKE THE CURVES

The procedure in tabulating data for the curves is as follows: The series condenser is set at 25; the tickler dial at 50; the rheostat was turned until the tube began to function and fairly loud whistles could be heard when the tuner dial was rotated. A station around 20 on the tuner dial was selected and the rheostat adjusted slightly till the station came in loud and clear and its name or call letters identified; the setting of the tuner dial was then tabulated. A station around division 30 on the tuner dial was then picked up, identified, and the dial reading tabulated. After getting several readings around the scale of the tuner dial, the series condenser dial was reset to 50 and a series of readings taken, and so on. After the tabulations have been completed, it is then necessary to look up the wave-lengths of the stations tabulated. The curves for different condenser settings are then plotted between wave-length and tuner dial readings. After the curves are plotted, a check test may be made by transferring stations from one curve to another. As an example, a station transmitting at 380 meters will be picked up at a tuner dial setting of 71 on the top curve. This same station will come in at 61.5 and at 43 respectively on the two curves next below it. After the general trend of the curves has been obtained this cross check is of value in obtaining accuracy in the curves.

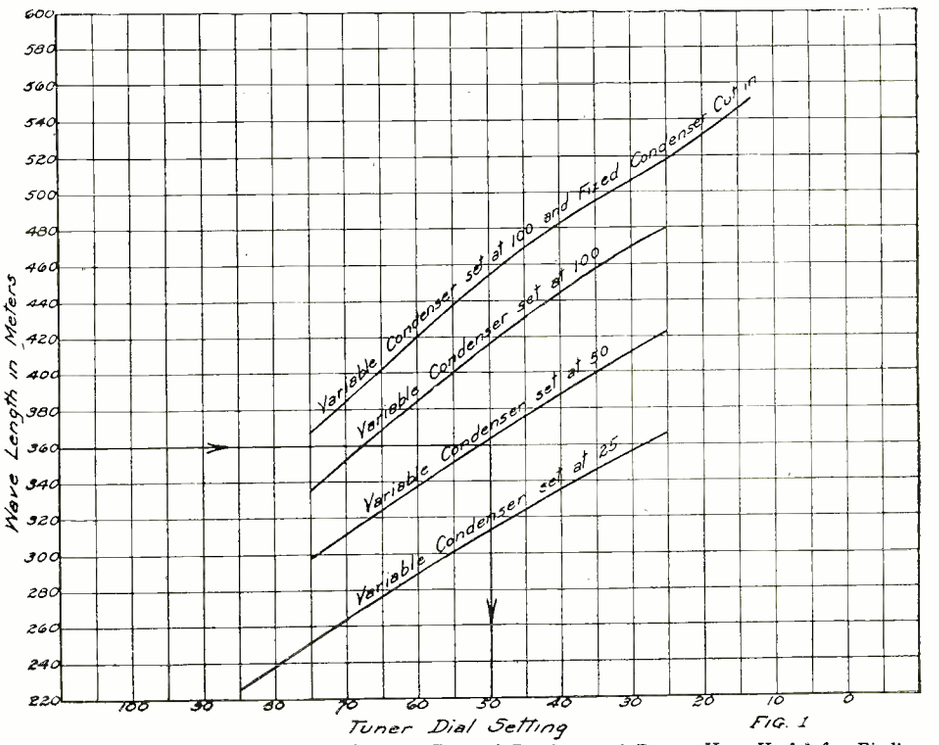


FIG. 1

Such a Chart May Easily Be Made for Any Type of Receiver and Proves Very Useful for Finding Stations of Which the Wave-Length is Known.

The method of operation with the curves is simple. The tickler dial is set at 50 (or 60 in the case of the top curve), the series condenser is set at the dial division corresponding to the curve to be used, the tuning dial is set at the point on the curve corresponding to the wave-length of the station, and the rheostat is then turned till the whistle of the station is heard. A slight readjustment of the tuning dial and rheostat will then bring in the station clear and loud. I might recite several cases where the curves have saved time in locating stations, but one example is indicative of them all. On October 6 I noticed in the papers that WTAM, the new station of the Willard Battery Co., was to give a dance program that evening. As I had no log readings to aid me in picking up this station, it would have been necessary, without the curves, to guess at the approximate point to find them on the tuner dial. As their wave-length was given in the paper, the tuner dial was set at the corresponding reading on the curve. When the rheostat was turned, their whistle was heard, and they tuned in sharp when the tuner dial was adjusted less than half a division.

The method has worked perfectly for me with the single exception of one station which is operating about 12 meters above the wave-length which the dope sheets state is assigned to it. Incidentally the curves offer a ready check on the wave-length of code stations which have strayed from their fold, as for example, on the night I made the original tabulations they were picked up at 286, 330, 414, 430 and 448 meters.

MEASUREMENTS OF FREQUENCIES OF STATIONS

In order to assist the Radio Inspection Service in maintaining stations on their licensed frequencies, the Bureau of Standards makes daily measurements of the emitted waves from various stations. The measurements to date have been mainly on Class B broadcasting stations and on the low-frequency high-power trans-oceanic stations. The measurements show in general a gratifying degree of adherence to the assigned frequencies. In a few cases where the observation showed stations to be seriously off their assigned frequency, the Supervisors of Radio have readjusted the stations so as to bring them within the required tolerance.

In only a few cases are the stations maintaining without exception the assigned frequencies so closely that the wave can be used as a frequency standard.

(*Continued on page* 934)

Awards of the $50 Radio Wrinkle Contest

First Prize

A ROLLING CONTACT FOR VARIABLE RESISTANCES

By B. A. KINSEY

With the continued use of a wire type potentiometer or rheostat the contact arm is very likely to cut through the wire, thus ruining the instrument. Also there are very few rheostats and potentiometers which have smooth sliding contacts. To eliminate these disadvantages I incorporated on the contact arm of a rheostat, a small roller contact. This arrangement has proven highly efficient and has given me so much satisfaction, that I have employed the same system on all variable resistances in my receiving set. Figs. 1, 2 and 3, clearly show how this arrangement can be applied to various types of rheostats and potentiometers. As seen, a small brass wheel or roller about ½" in diameter is fastened to the end of the contact arm and placed so that it will make firm contact with the resistance wire either on the end or on the side of the winding. This small roller is attached to the arm by means of a machine screw and two nuts or an inductance switch

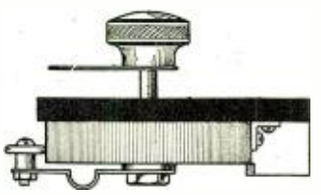


Fig. 1

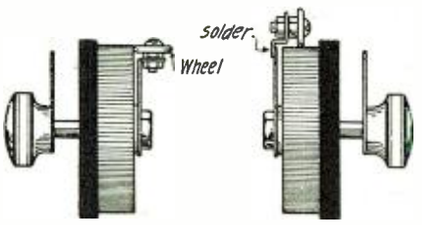


Fig. 2 Fig. 3

Showing Different Ways the Roller Contact Can Be Attached to a Rheostat or Potentiometer. This Provides an Exceptionally Smooth Running Contact.

or binding post bushing. The slider contacts on all these instruments are made of spring brass so that it is an easy matter to bend them so that the rollers can make firm contact with the resistance wire. This arrangement is the most smooth running system that I have as yet laid hands on and I believe that many will find it a worth while addition.

Second Prize

A VARIABLE CONDENSER

By ANDRE DEMORGNY

I present in this article, a new variable condenser. The principal feature of this is the small sum for which it can be made, the small space it takes on a panel and the comparatively steady variation of capacity obtained. The parts required for its construction, are as follows:

2 pieces of hard rubber measuring 1" x 2" and ⅜" x 1½", respectively (when mounted on a panel, only one piece is required).
1 piece of mica,
2 brass plates (see Fig. 2),
2 binding posts,
4 screws,
1 insulating knob.

The knob has a sharp ring into which is

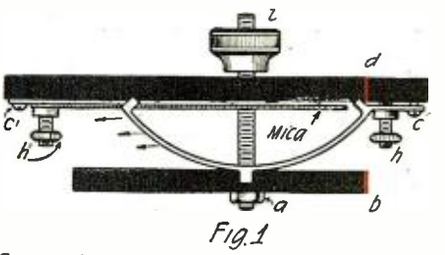


Fig. 1

Constructional Details of the Variable Condenser. The Capacity is Varied by Turning the Knob.

screwed a large threaded rod (i) about 2" long as shown in Fig. 1. This rod extends through the entire instrument and is permanently fastened to insulating block (b) by the nut (a). Cut two plates as shown in Fig. 2, making the variable plate slightly wider than the stationary plate. Secure the

Prize Winners

FIRST PRIZE, $25

Rolling contact for variable resistances

By B. A. KINSEY,
36 Crown Street,
Dalton, Ga.

SECOND PRIZE, $15

A variable condenser

By ANDRE DEMORGNY
9 Rue des Belles Feuilles,
Paris 16, France.

THIRD PRIZE, $10

An efficient inductance coil for short waves

By EDWARD BINNS,
2645 Shaker Road,
Cleveland Heights, Ohio.

rod (i) in the center of the insulating piece (b). The holes in the plates are drilled larger than the diameter of the rod (i) hole in the mica which is large enough to pass it. The movable plate (a) is fastened to the insulating block (d) by means of the two screws (c) (Fig. 1). The stationary plate is fastened to (d) by the two screws (c-1).

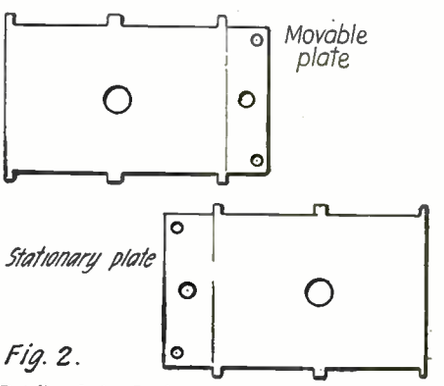


Fig. 2.

Details of the Stationary and Movable Plates of the Variable Condenser.

A piece of mica is placed between the two plates and should be slightly larger than the stationary plate, thus avoiding the possibility of short circuit. Two binding posts (h) and (h-1) complete the construction.

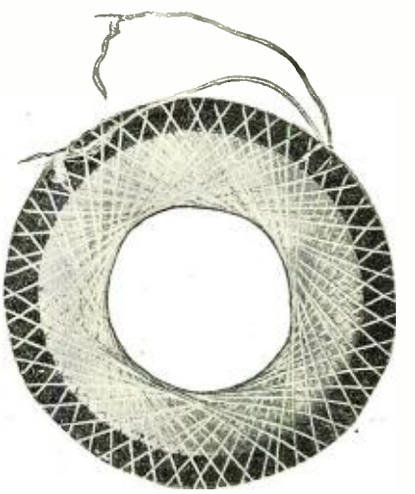
The capacity of the condenser is very close to .001 M.F. at its maximum and has a comparatively low minimum capacity.

Third Prize

AN EFFICIENT INDUCTANCE COIL FOR SHORT WAVES

By EDWARD BINNS

There are several characteristics which an efficient unit inductance coil must possess. Some of the most important of these are: Maximum inductance for a given amount of wire, a minimum distributed capacity, and a minimum resistance caused by losses from imperfect dielectrics in the field of the coil.



Showing the Appearance of a Complete Short Wave Inductance Coil. The Wire is Wound on a Circular Framework of Insulating Material.

The coil which I shall describe possesses all of these features except the first: but, since it is to be used for short waves only, this will not interfere with its efficiency to a great extent. One of its desirable features is the ease with which it can be wound and the simplicity of the form upon which it is wound.

As can be seen from Fig. 1, the coil is wound upon a flat circular ring of suitable insulating material about ¼" thick. The ring is about ⅜" wide, and may be any diameter desired; although I have found that 5" is about right for the broadcasting wavelengths.

The outside circumference of the ring is first divided into 96 parts. This is done by dividing the circumference by the radius. Mark every other one of the points left by the dividers. Next divide each space in half. Do this three more times and cut a notch at each of the 96 points.

No. 24 D.C.C. wire is about right for this coil. Secure the wire around the ring at one of the points which has been marked,

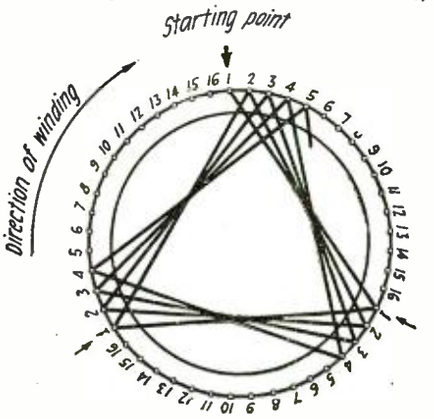


Fig. 1

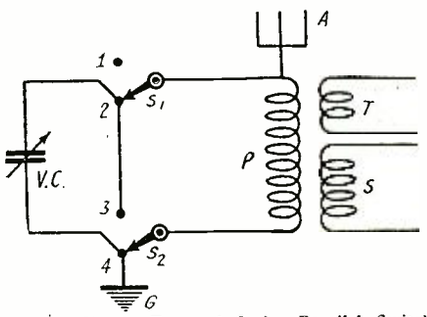
Illustrating How the Short Wave Inductance Coil is Wound.

calling this notch No. 1. Then stretch it across the next marked point. Do the same with the next notch No. 1. Then stretch it across point No. 2, as shown in Fig. 1, stepping each turn around a notch until all the notches are filled. Secure the wire around the ring at the last notch. This completes the coil.

The writer has thoroughly tested this coil for efficiency and has found that results are slightly better than those obtained with a spider-web coil. With it I can receive WWJ (Detroit) on a crystal in almost any kind of weather, although the results are not entirely due to the coil, as the same station is received very faintly with a spider-web coil.

SUBSTITUTE FOR A SERIES-PARALLEL SWITCH

In constructing a honeycomb coil set, the diagram of which called for a series-parallel switch in the primary circuit in order that the primary condenser could be thrown at



A Very Simple Type of Series Parallel Switch That is Easily Mounted Upon a Panel.

will in series, parallel, or cut out entirely, I was confronted with the choice of a delay of several days to procure a regular four-contact switch, plus the extra expense, plus the very particular job of getting the switch points exactly right for this type of switch, or making a substitute with such material as the average fan usually has on hand. I solved the difficulty by using two ordinary switches and four switch points, as per the diagram.

Nos. 1, 2, 3, and 4 are switch points, No. 1 being blank and the rest wired according to the diagram. S^1 and S^2 are ordinary switches. With S^1 on 2 and S^3 on 4, the condenser VC is in parallel. With S^1 on 1 and S^2 on 3, the condenser is in series and with S^1 on 1 and S^2 on 4, the condenser is cut out entirely.

This idea will work equally well with any of the ordinary forms of coils, honeycomb, spider web or variocoupler.

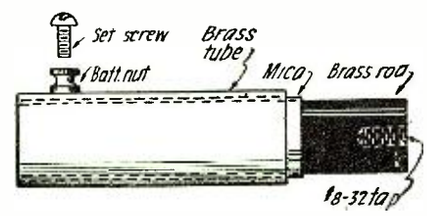
Contributed by Charles E. Wells.

AN EXCELLENT GRID CONDENSER

The ordinary commercial type of paper grid condenser is usually constructed in such a manner that one has to be very careful in tightening a binding post nut down upon it, for the reason that the contact eyelets are so easily torn loose. The average condenser of this type will stand only a very few changes from one hook-up to another. A much more substantial grid condenser may be constructed as follows:

Bore a 3-32" hole into the end of a section of brass rod ¼" in diameter and 2½" long, and tap the hole with an 8-32" thread. Now cut a piece of mica 2" wide and just long enough to wrap around the rod with a narrow lap joint. This piece of mica should be very thin for best results, and when wrapped around the rod it should extend very slightly beyond the unthreaded end of the rod, leaving "pincer room" at the threaded end. Now procure a piece of thin brass tube with an inner bore just large enough to fit snugly about the brass rod and mica and on the side of it solder a common battery nut, which has an 8-32 thread. When assembled, screw the condenser directly on to the grid post of your tube socket; connection to tuning circuit may then be made by means of a set-screw in the battery nut on the outer tube. Any desirable change in the capacity of this condenser may be made by sliding the tube back and forth on the rod.

Contributed by Robert N. Auble.

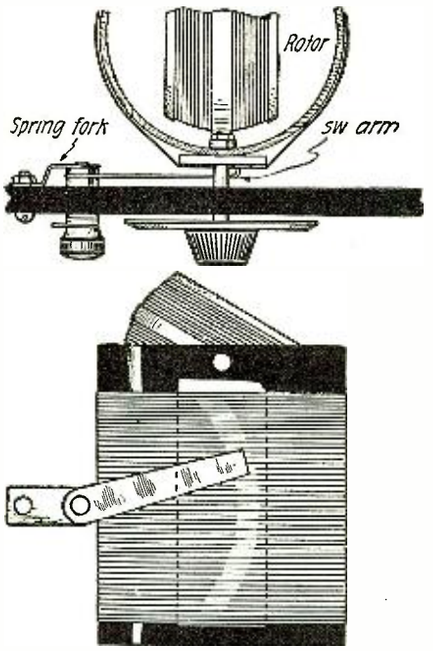


A Very Good Idea in the Way of Variable Grid Condensers. The Brass Rod is Threaded so That the Condenser Can Be Screwed Directly onto the Grid Post on the Tube Socket.

FOR YOUR VARIOCOUPLER

Enclosed is a drawing of a variocoupler, of my design, which departs from the conventional form of changing the number of turns of primary circuit to tune the wavelength desired. By using a long switch arm attached to the back of a switch lever, single tap tuning is afforded.

To construct the variocoupler, simply wind the primary coil around the tubing and also a narrow strip of bakelite the length of the tubing. This gives a flat surface for the switch arm to slide on, and is more compact,



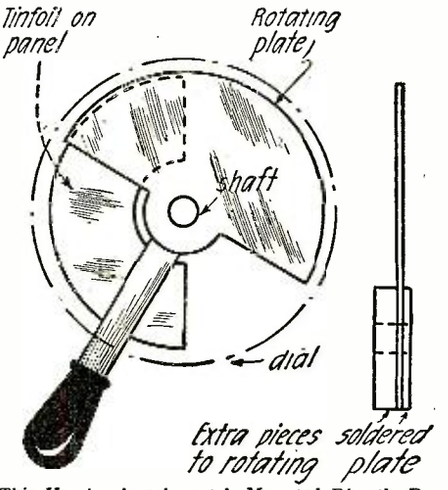
A Very Fine Variation of Inductance Can Be Obtained by Using This System, Which is Less Complicated Than the Usual Method.

as well as being neater in the outside appearance, than the ordinary coupler that requires several switch points, and even two sets of switches if signal tap variation is to be had.

Contributed by H. W. Sutton.

A VERNIER CONDENSER

This Vernier condenser consists of a small semi-circular piece of tinfoil glued to the panel front and connected to the stationary plates of the variable condenser. The rotating plate of the Vernier is a small circular piece of sheet brass with another piece of brass soldered to the center to make the whole ⅛" or a little more in thickness. Through this center is drilled a hole the size of the shaft. It should fit snugly on the shaft and be just tight enough so that it will not jar out of position. A composition handle is fastened to the movable plate and is long enough to extend out past the circumference of the dial. The space between the tinfoil and the movable plate should be about $\frac{1}{32}$", but care must be taken that this arrangement does not short circuit the condenser. To prevent this, a small insulating washer can be placed on the con-



This Vernier Attachment is Mounted Directly Behind the Knob and Dial and is Adjusted by Means of the Insulating Knob.

denser shaft so as to be between the stationary and movable plate on the Vernier.

Contributed by Richard C. Henderson.

A USE FOR WORN-OUT DRY CELLS

Many amateurs are at present using WD-11 tubes and No. 6 dry cells to light the filament.

When these cells run down below 10 to 12 amperes, on test, they are no longer suitable for this purpose and are, therefore, usually thrown away. Where such cells are used to operate three or more WD-11s, they soon accumulate and by saving them it takes but a short time to get together 15 or more of these used cells. But instead of throwing them away, connect them up in series (15 cells for 20 volts or about 1.3 volts per cell) to make an excellent "B" battery to supply the plate current to the tubes.

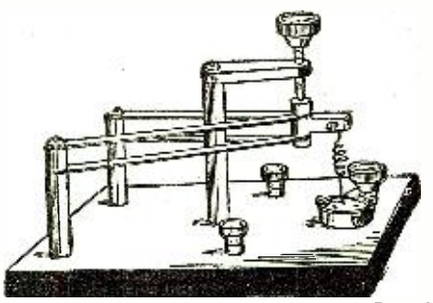
Since "B" batteries cost considerable, it is well worth while saving the dry cells, as these will last a long time, due to the comparatively small amount of current required for the plate supply.

Contributed by Geo. M. Lay.

A GOOD CRYSTAL DETECTOR STAND

The following is a description of a crystal detector that, when set on a sensitive spot, pounding on a table is possible without moving it from that sensitive spot. The ease of having a very light contact on silicon

(*Continued on page* 983)



A Very Stable and Serviceable Type of Crystal Detector Stand. The Arrangement Prevents the Possible Jarring Out of a Sensitive Point.

RADIO NEWS LABORATORIES

RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a write-up such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratories tests, they are returned to the manufacturers with suggestions for improving them. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested must be forwarded prepaid, otherwise they cannot be accepted by the Laboratories.

Apparatus Awarded Certificates

THE MAGNAVOX LOUD SPEAKER

This loud speaker is the result of considerable experimenting and research in the design of radio loud talkers, and is an instrument that does not require any electric current for its field excitation. It is designed primarily for use with radio

sets that employ dry cell tubes. Unlike the famous electro-dynamic type employing an electro-magnet, this instrument employs a powerful permanent magnet for its field. It is called the Semi- Dynamic, type M1, Magnavox, and is manufactured by the Magnavox Co., Oakland, California. This instrument has a D.C. resistance of 400 ohms and an impedance at 1,000 cycles of about 5,000 ohms. It is exceptionally sensitive throughout the wide range of audible frequencies and reproduces powerful signals without rattling. It is noted for its excellent quality and faithfulness of reproduction. The base and horn are of metal, highly finished in gold.

Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 292.

WARREN RADIO LOOP

This loop antenna is entirely enclosed, thus protecting the wires

from mechanical injury. It is provided with three terminals for connections to the grid and filament of a vacuum tube receiving set and also the ground. A wave-length range of from 170 to 525 meters may be covered when shunted by a .0005 mfd. condenser. This loop is manufactured by the V-De-Co Radio Mfg. Co., 814 Cookman Avenue, Asbury Park, N. J.

Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFIATE OF MERIT NO. 283.

GLOBE HEAD-SETS

The Globe Phone Mfg. Co., Reading, Mass., submitted for test two head-sets known as the Super-sensitive Standard and the Balanced Type Perfectone. Each head-set is of excellent mechanical and electrical construction and is very efficient throughout a wide range of audible frequencies. The Standard head-set has a resistance of 2,100 ohms and the Perfectone head-set a resistance of 2,400 ohms. Each has an impedance of approximately 23,000 ohms at 1,000 cycles. The illustration shows the standard head-set which employs a slightly smaller diaphragm than the Perfectone head-set. They are of the standard two-pole construction.

Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 284 AND 285.

"RICO" STRAIGHT CONDENSER

Rico Straight Line Condenser is a book type variable condenser employing a mica sheet as the dielectric. Although this type of condenser is not quite as efficient as the air dielectric types, it is exceptionally simple, much cheaper to manufacture and occupies less space than other types. The capacity range is from .00024 to .000103 mfd. The entire range is covered by one turn of the dial. Although the capacity curve is not exactly straight, it is of such a shape as to make tuning much easier and selective than with the ordinary rotary plate type. The dielectric loss resistance, at 1,000 cycles, is 400 ohms. This condenser is manufactured by the Radio Industries Corporation, 131 Duane Street, New York City.

Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 290.

UNITY CARTRIDGE RHEOSTAT

The Unity non-vernier rheostat or Cartridge rheostat is designed for efficiency and economy. It is manufactured by the Unity Mfg. Co., 224 N. Halsted St., Chicago, Ill.

A phosphor bronze fork type of contact is used. This insures minimum changes and smooth variations in resistance. The positive contact given by the fork makes certain that no distortion or noise is caused in the amplification circuit, where non-vernier rheostats are used.

Resistance cartridges suitable for each tube are sold separately, so that tubes may easily be changed in a set, and the proper resistance inserted, without removing the bracket from the panel, and at very small expense.

Potentiometer cartridges are also made which fit the same brackets.

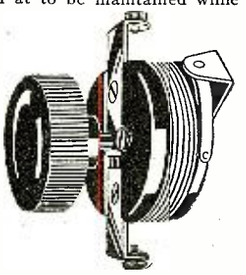
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 282.

UNITY VERNIER RHEOSTAT

The Unity vernier rheostat is the result of years of experience in manufacturing radio rheostats. It is designed to accomplish the highest possible perfection in tuning adjustment.

The design is vernier throughout. The wire is a highly polished special nichrome wire, and is followed throughout its entire length by a contact point of special alloy. The most infinitesimal variation and refinement in tuning can easily be obtained.

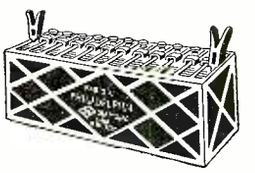
A cut-out switch operates with no change in the tuning adjustment, thus permitting a tuning once arrived at to be maintained while the



tube is turned on or off at will. It is manufactured by the Unity Mfg. Co., 224 N. Halsted St., Chicago, Ill.

Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 281.

PHILADELPHIA STORAGE "B" BATTERY

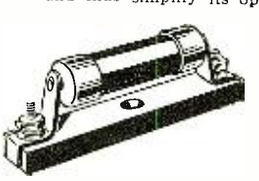


This storage "B" battery which is manufactured by the Philadelphia Storage Battery Co., Ontario and C Sts., Philadelphia, Pa., is especially recommended for radio use. It is shipped dry charged; that is, the battery is shipped fully charged but without electrolyte. The electrolyte is furnished separately in a bottle and when poured into the empty battery, the latter is fully charged and ready for use. When discharged, it may be charged from the 110-volt A.C. line by using the small electrolytic rectifier furnished with it. Complete instructions accompany each battery, of course. It may be put into operation practically as easily as an ordinary dry cell "B" battery, but when once installed, troubles due to dead batteries are practically eliminated. This battery, type 224 RB, is only 2" x 3" x 10½" in size.

Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 279.

AMPERITE

It is desirable to eliminate as many controls on a radio set as possible and thus simplify its oper-



ation. The amperite shown in the illustrations may be effectively used in place of a filament rheostat. It automatically maintains the filament current constant. Amperites are manufactured for practically all makes of receiving tubes now on the market. The amperite will also tend to prevent the burning out of a tube, should excess voltage be applied to its filament. They are manufactured by the Radiall Co., 99 Warren St., New York City.

Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 280.

VICTAPHONE LOUD SPEAKER UNIT

This loud speaker unit is designed for attachment to a phonograph or other horn. It has an adjustable air gap so that it may be adopted for

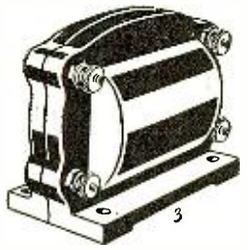
use under practically all conditions. The resistance is approximately 1,600 ohms, and the impedance at 1,000 cycles about 23,000 ohms. Excellent results were obtained throughout the entire range of audible frequencies, and it reproduces speech and music quite well. This loud speaker phone is manufactured by J. Thomas Rhamstine, 2152 E. Larned St., Detroit, Mich.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 274.

SAMPSON AMPLIFYING TRANSFORMER

This amplifying transformer is somewhat different from the usual type in that the coils are spiral wound and arranged on the core



in pie shaped layers. This construction does away with the usual paper insulation employed between layers in the ordinary type and consequently allows for more turns in the same space. The capacity effect between the windings is also reduced. The characteristic curve is very flat and the voltage amplification is high throughout a wide range of audible frequencies. This instrument is manufactured by the Samson Electric Co., Canton, Mass.

Arrived in ecellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 275.

ANTENNA INSULATOR

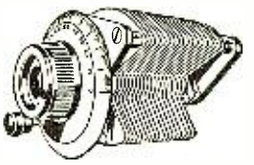
An antenna insulator suitable for receiving signals or low power transmitting aerials is shown in the illustration. This insulator is of glazed porcelain, having holes in each end for attaching the wires. Its small size and shape make it especially adapted for insulating the average sized antenna. It is manufactured by the Square D Co., Detroit, Michigan.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 276.

RADIANT CONDENSER

The Heath Radio & Electric Mfg. Co., 206 First Street, Newark, New Jersey, submitted for test one of its improved 45-plate vernier type variable condensers. This condenser is noted for its exceptionally low dielectric absorption loss, mechanical



accuracy, and durability. The dielectric loss is equivalent to a series resistance of only 46 ohms, measured at a frequency of 1,000 cycles. The capacity range is from .000025 to .000884 mfd. The plates are exceptionally flat and hard, being stamped out of sheet aluminum under high pressure. The condenser is furnished complete with knob and dial and template for drilling.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 291.

VITREOSIL

Vitreosil is a substance of glass-like appearance manufactured in both clear and satin finish. It is noted for its exceptionally low radio frequency phase difference angle, low coefficient of expansion, and high melting point. On account of its brittle glass-like structure. it cannot be used as insulating parts in radio instruments unless the instruments are especially designed for its use. Vitreosil has the highest dielectric strength of any other insulating material known, making it especially adapted for high voltage condensers, etc. On account of its low dielectric losses, it is especially recommended for use in variable condensers. Samples of this material were submitted by the Thermal Syndicate Ltd., 350 Madison Avenue, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 277.

AMERICAN HARD RUBBER PANELS

The radio panels manufactured by the American Hard Rubber Co., 11 Mercer Street, New York City, are noted for their pleasing appearance and exceptionally low radio frequency losses. Two types are made, the Mahoganite and the Resiston Radion. The Mahoganite panel has a grain in it resembling the grain in mahogany. Both types are highly polished on both sides and are very easy to cut and drill. The low radio frequency losses are due of course to the fact that the panels are made of a good grade of hard rubber.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 243.

THE DIAMOND HEAD-SET

This 2,000-ohm head-set which is manufactured by the Diamond Electric Specialty Corporation, Newark, New Jersey, is very sensitive throughout the entire range of audio frequencies. The head band is so designed that the head-set may be

worn with comfort. The caps and shells are of insulating material and of very neat appearance. The phones are of the standard two-pole construction and reproduce music and speech with very little distortion.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 269.

FORMICA

Formica, an insulating material out of which excellent panels are made, is of very tough construction and takes on a highly polished surface. Black formica grade M is manufactured in panels of several thicknesses and is especially recommended for radio use. This material is manufactured by the Formica Insulation Co., 4614-28 Spring Grove Avenue, Cincinnati, Ohio.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 270.

RUB-MIKA

Rub-Mika, an insulating material made especially for radio panels, is manufactured by the Cooper Corporation, Findlay, Ohio. A 12" x 18" x ¼" panel was submitted for test and this panel was found to be very easily cut and drilled and free from warping. The finish is a dull black. The radio frequency phase difference angle is low, insuring high efficiency from the radio instruments, such as condensers, mounted on it.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 249.

KIMLEY STORAGE "B" BATTERY

Many dry-cell "B" batteries have been ruined through accidental short circuits and at best are expensive in the long run, due to a comparatively short life. This storage "B" battery will last for years and requires very little attention. It is not harmed from over charging, discharging or short circuits. It may be charged in a few hours from a 110-volt A.C. line by using the rectifier supplied

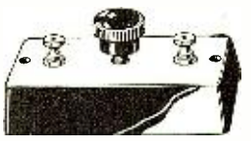
with the battery or from a 110-volt D.C. line, and will give excellent service for several months before requiring another charge. The 100-volt battery shown in the illustration is made up of 78 Edison cells with tap switches for obtaining different voltages for detector and amplifier tubes. It is manufactured by the Kimley Electric Co., Inc., 2665 Main St., Buffalo, N. Y.

Arrived in good packing, with full instructions and accessories.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 265.

AMPLEX GRID CONDENSER

Although a variable grid condenser is not absolutely necessary, it is well known that different tubes work best with different values of grid condenser capacities. For this reason, the Amplex Instrument Laboratories, of 57 Dey Street, New



York City, has designed the unique variable grid condenser shown in the illustration. It is small in size and may be mounted inside the radio cabinet near the detector socket so that when once adjusted to suit the particular tube in use, it may remain so adjusted and requires no further attention. A range of from 113.46 to 477.51 M.M.F., was obtained and a dielectric loss resistance of 2,900 ohms, which, although high, is low compared with many condensers employing a solid dielectric. Metal plates are clamped between mica sheets by the control knob which varies the capacity.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 241.

DELAWARE HARD FIBRE

The Delaware Hard Fibre Co., Wilminton, Delaware, manufactures several forms of hard fibre which may be used in many radio instruments. This material is made in tubes, strips, knobs and forms for rheostats, and may be found useful for many other purposes. Although the surface is not highly polished, in some cases this material may be used for panels.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 268.

Radio Trade News

By L. N. ALLEN*

"ANOTHER Radio Christmas" was one of the slogans used by the Radio Trade Association in the Radio Week Campaign. The slogan started off "Make it Another Radio Christmas," but the public seemed determined to handle the matter themselves, without any assistance from the trade. Radio for holiday gifts certainly has arrived—and that with a vim. Even the most pessimistic in the trade is forced to admit the fact that radio offers a real market for brains and for ability.

Talking of brains and ability in the industry, it is interesting to note the various changes the personnel and even the policies of some of the old line radio firms. Today it is parts, yesterday perhaps it was a single item, tomorrow it may be complete sets, or the manufacturer may turn his efforts to selling accessories by mail or completely divert his business efforts. These changes, while ofttimes smile-provoking point out one of the better features of the radio trade —it is a business with hundreds of live-wire executives, young men, all anxious to learn and willing to change, once they are convinced some other method is better than the one they are following. A well known figure in the electrical trade recently remarked on the progressiveness of the radio industry. "You folks make a lot of mistakes," he said, "but you always do something." The radio business man perhaps is cursed with a desire continually to "do something," but after all most great inventions and even developments in business practice, have come from an unwillingness to be content with things as they are.

With the real radio industry in its third year, sales managers generally are beginning to breath with more freedom, and every visit of the "expert" to the factory does not mean a change in the design of the

(*Continued on page* 1000)

*Associate Editor, *The Radio Dealer.*

Correspondence from Readers

BROADCASTING ADVERTISING

Editor, RADIO NEWS:

Broadcasting is without question either going to become a factor in our lives in every way equal to the printed word or the work of the public schools, or it is going to destroy itself. Which of the two courses it will take will depend entirely on the kind of broadcasting we receive. If the bulk of our broadcasting continues to consist of poorly modulated canned music and the quivering quakes of woud-be artists, radio is doomed. If our broadcasters receive an income sufficient to enabe them to give the best, none of us is able to foretell the big extent to which radio will influence and enrich our lives.

I agree with Mr. Eddy, not in the sense that I am a broadcaster, but in the sense that I am and have for years been a radio fan and an amateur code man. During the recent world baseball series millions of people followed the games via radio. In most cases the interval between innings was filled in with blank spaces, or whistling, or canned music and telling stories, so that distant receiving stations would know that the broadcaster was still in tune.

Would it not have been better to give the broadcaster an income during these intervals so that he could improve his equipment and pay for the best talent by proceeding somewhat as follows:

"End of the second inning; score 1 to 0 in favor of the Yanks. While the players are changing positions, Mr. Sterns of the Staudemaker Automobile Company will speak to you for three minutes." "The 1924 model Staudemaker automobile will not be equipped with four-wheel brakes, because they are dangerous. They add 100 pounds to the weight of the car, increase operating expenses, etc."

"End of the sixth inning. Mr. Smith of the Hat in the Ring car will address you for three minutes." "The Hat in the Ring car is now regularly equipped with four-wheel brakes. Present day traffic conditions make them absolutely essential; they operate efficiently," etc.

Would such a procedure cause you or me any inconvenience? Would it annoy us if we realized that this advertising between acts of a grand opera made it possible for us to sit in our homes and enjoy that grand opera? It would be a very easy matter to so tax the earnings of a broadcasting station that the very best programs and only a reasonable profit would be assured.

As Mr. Eddy says: We do not object to newspaper and magazine advertising, though the fact remains that this advertising is bound to attract our attention. In fact many of us spend more time reading the ads than we do the reading matter. Take for example the November issue of RADIO NEWS with a circulation of over 230,000 copies. It is printed on a very good grade of paper, the cost of which alone would cost you or me the price of the magazine, to say nothing of paying for the big expenses of securing and printing good reading matter, prize awards, experimental laboratories, etc.

Out of a total of 484 columns in the magazine, 276 were advertising. And now, radio fans, be honest with yourselves; don't you get fully as much pleasure and information from these ads as you do from the printed matter? In the Oct. 13 issue of the *Saturday Evening Post,* out of a total of 589 columns, 336 were advertising. The same applies to all other worthwhile publications. Advertising makes it possible for us to get these good magazines for the prices we pay. Why in the name of common sense shouldn't we be able to let advertising pay for real good broadcasting? Do you object to going to an opera house because the program contains advertising to be read before and during the performance? If you don't want to listen to this advertising, get a half-way selective tuner and tune him out, or go to bed and dream the dreams of a dreamer. Sentimental dreams seldom get anything anywhere; a sound business policy does.

I do not in any way wish to belittle the splendid programs broadcast in the past from many of our excellent stations. However, they cannot, AND WILL NOT, go on forever paying their own expenses, and, good as they are, they cannot, AND WILL NOT, give us the best unless we pay for it in some way or other.

It seems to me that we must either let advertising pay for our radio broadcasts, or run them at public expense much as our schools and post offices are being run. The radio situation is such right now that I believe that if all other things were reasonably equal, a strong man, backed by a strong political party, would materially increase his chances of a presidential election, if, among other things in his platform, he were to come out with a sound, definite policy in regard to radio broadcasting. Certainly radio is fast becoming of sufficient importance to warrant such a policy. The day is coming without doubt when all about us will be the voice of well regulated song and music, education and information, all of the highest type; but why should it be necessary to delay this day until you and I are gone?

U. J. BARBELL,
National Educational Service,
3149 Stout St., Denver, Colo.

MR. EDISON AND RADIO

Editor, RADIO NEWS:

The Louisville *Herald* carried an article recently under the caption "KEEP FORD AT HOME—EDISON." It seems that a reporter for the Associated Press interviewed Mr. Edison regarding Henry Ford's possibilities as the Nation's Chief, and during this interview the electrical wizard, it is purported, gave his opinion on the question of "Radio" as follows:

"The Radio, he (Thomas A. Edison) believed, has been the greatest modern factor in causing young people to think. It has widened the range of knowledge, he said, and will continue to do so. Musical and other radio entertainment features, in his opinion, sooner or later will be confined more to speeches and market quotations. He characterized the entertainment programs as fads which would not live, largely because of the difficulties of perfect transmission."

If that will be the future of radio entertainments, I am ready to throw my receiving outfit in the Ohio River tomorrow. I have been a "dyed in the wool" BCL for the past two years. I have heard musical concerts from the coast of the Pacific to the coast of the Atlantic, from distant Canadian points to the Gulf, and after two years I am more interested than when I started, as I am certainly improving my set and reaching out for clearer and better reception of radio concerts. While I will admit, and surely trust, that radio will be used more extensively in the future for commercial enterprises, I cannot see why entertainment over radio should cease, and especially not for the reason as set forth by Mr. Edison, namely, "difficulty of perfect transmission."

Are we going backwards? Have the radio engineers and experts all over the country ceased experimentations? If transmission of radio signals are so very difficult to send out perfectly (which fact I cannot vouch for), is this the time to cease improving and experimenting? I have been a subscriber to RADIO NEWS for some time and I read it from cover to cover, but to date, I have never found anything that would indicate a cessation of radio broadcasting for entertainment purposes. That it is not a fad or passing fancy, is very obvious to me as an individual. Go into any first-class radio store and watch people who are now first becoming radio enthusiasts, then take a trip through any city, town, village or country and count the ever increasing number of aerials.

I sincerely hope Mr. Edison has been misquoted, as it certainly would be too bad if the great electrical wizard, Mr. Thomas A. Edison, honored by all the nations, should be of this opinion; and besides, what can we broadcast listeners expect or hope for in the future if this opinion becomes general?

H. O. PRAETORIUS,
1125 E. Broadway, Louisville, Ky.

(Unfortunately Mr. Edison was not misquoted or misunderstood; it was the Editor of this Journal himself who asked him the technical questions. Mr. Gernsback, who was a guest at Mr. Edison's dinner, asked him a number of technical questions, among them being the one as to the future of radio. Mr. Edison's answer is substantially correct as quoted.

Of course, the Editor, and for that matter many other radio people, do not share Mr. Edison's views. This is simply a personal opinion of Mr. Edison's and should not be taken too seriously by the radio enthusiasts. Mr. Edison, admittedly is not a radio man himself, and has done practically no work along radio lines. As a consequence, the country need not get very much excited about Mr. Edison's views. As a manufacturer of phonograph records Mr. Edison may be pardoned for not being a radio enthusiast. As is well known, the phonograph interests consider radio their greatest menace.

—EDITOR.)

(*Continued on page* 940)

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.

ELECTROLYTIC RECTIFIER SOLUTION

(814) Mr. Theo. Fletcher, Philadelphia, Pa., wants to know:

Q. 1. How is the borax solution for an electrolytic rectifier made?

A. 1. This solution is prepared by dissolving ordinary borax in distilled water. The borax is added to the water until no more can be dissolved. The solution should then be placed aside until all extra borax has settled in the bottom. The clear solution can now be poured off to use in the rectifier.

Q. 2. Please publish a hook-up of two-jar electrolytic rectifier for use in charging a 100-volt storage "B" battery at about two amperes and 112 volts.

A. 2. As you have 110-volt supply, you cannot charge this battery at 112 volts. Also it would be injurious to the battery to charge it at two amperes. A storage "B" battery should not be charged at a higher rate than ½-ampere. The best way to charge this battery would be to divide it into two batteries of 50 volts each, place them in parallel, and connect them in series with a one-jar rectifier and the 110-volt line. A 75-watt lamp should also be placed in the circuit to allow the correct amount of current to pass.

Q. 3. Are tungsten lamps better than carbon lamps when used as a resistance in this rectifier?

A. 3. Both types of lamps will work equally well in this circuit.

R. F. WITH RA-10

(815) Mr. Martin Swanson, Valley City, N. D., resquests:

Q. 1. Please publish a hook-up of a Paragon RA-10 with two stages of radio and two stages of audio frequency amplification.

A. 1. This circuit will be found in these columns. We have shown the regular connection for the plate variometer, but regeneration will be difficult to obtain in this manner and this instrument can be eliminated and the wiring made as shown by the dotted line.

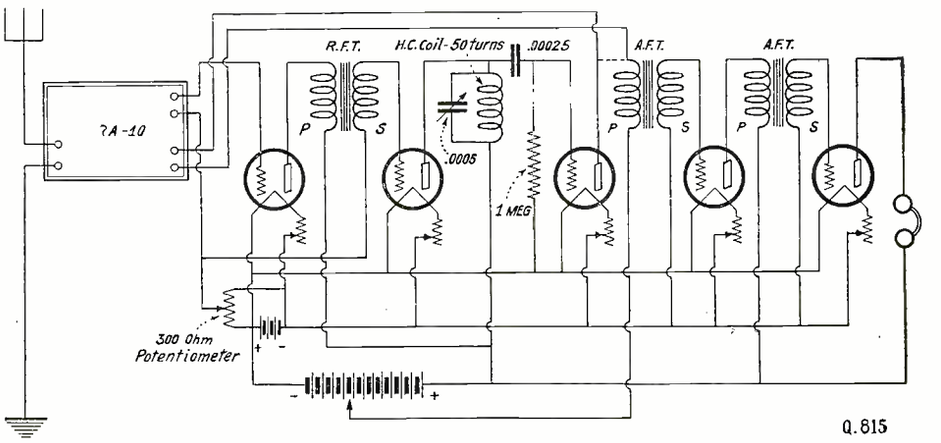
CRYSTAL RECEPTION

(816) Mr. Robert Morrison, Cleveland, Ohio, asks:

Q. 1. Would a person seven miles away be able to hear phone transmission from a station using one 5-watt tube and 100 volts on the plate? The Colpitts system is used with a microphone in the ground circuit.

A. 1. It is not probable that a crystal receiver would be able to receive this station at this distance.

Q. 2. What will be the range of this set under normal conditions?

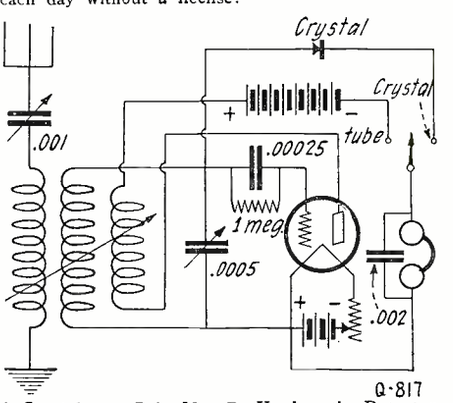


Two Stages of Radio and Two of Audio Frequency Can Be Added to an RA-10 Receiver as Shown Here. Tuned R.F. is Used in the Second Stage for Selective Tuning.

A. 2. With a sensitive receiver at the receiving end, this transmitter might cover a distance of about four or five miles.

Q. 3. Will I be able to broadcast a half hour each day without a license?

A. 3. No. A license is required for any class of transmitting.



A Crystal or a Tube May Be Used as the Detector in This Circuit by Means of the Single Pole, Double Throw Switch.

COMBINATION CRYSTAL AND TUBE SET

(817) Mr. Alan Henry, Edmonton, Canada, requests:

Q. 1. Please publish a circuit using three spider web coils showing how a crystal or a tube may be used as the detector.

A. 1. This diagram appears on these pages. A single pole, double throw switch is used to change from crystal to tube.

Q. 2. Can an old type Bradleystat be used with a UV-201A tube?

A. 2. This instrument can be used with a UV-201A with good results.

Q. 3. Can a safe, home-made electrolytic battery charger be constructed by one who has only a moderate knowledge of such matters?

A. 3. A good rectifier can be safely constructed by anyone, by following the correct plans. A good article on this subject will be found on page 164 of the March issue of RADIO NEWS.

REPAIRED TUBES

(818) Mr. Walter Radcliff, Chicago, Ill., asks:

Q. 1. Is a repaired tube as good as a new one?

A. 1. Sometimes a repaired tube will give as good results as when new, but as a rule we do not believe it will equal a new tube.

Q. 2. Would a WD-11 or a UV-199 give better results?

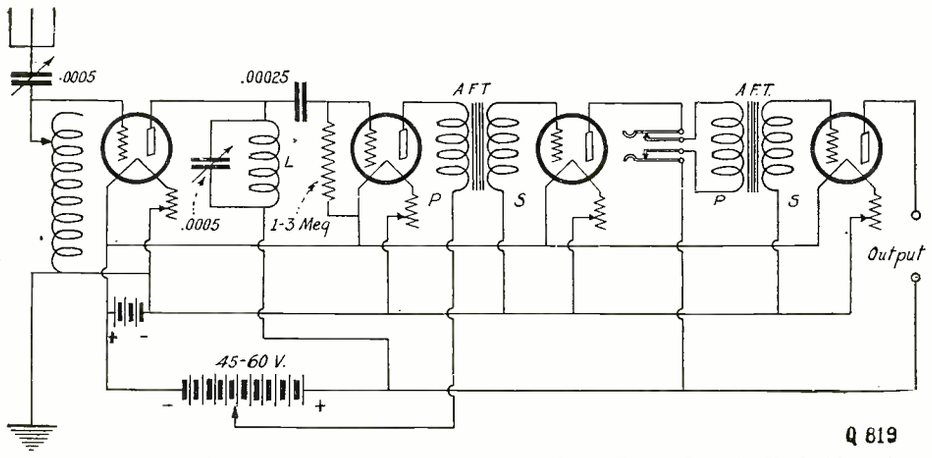
A. 2. These tubes when used as detectors would give about equal results, but when used as amplifiers, the UV-199 would prove superior.

CROSLEY XJ RECEIVER

(819) Mr. E. L. May, Detroit, Mich., requests:

Q. 1. Would you please publish in the "I Want to Know" column, the hook-up of the Crosley XJ receiver?

A. 1. This hook-up will be found in these columns. This circuit is identical with the familiar model X receiver with a jack in the plate circuit of the first A.F. tube for phones.



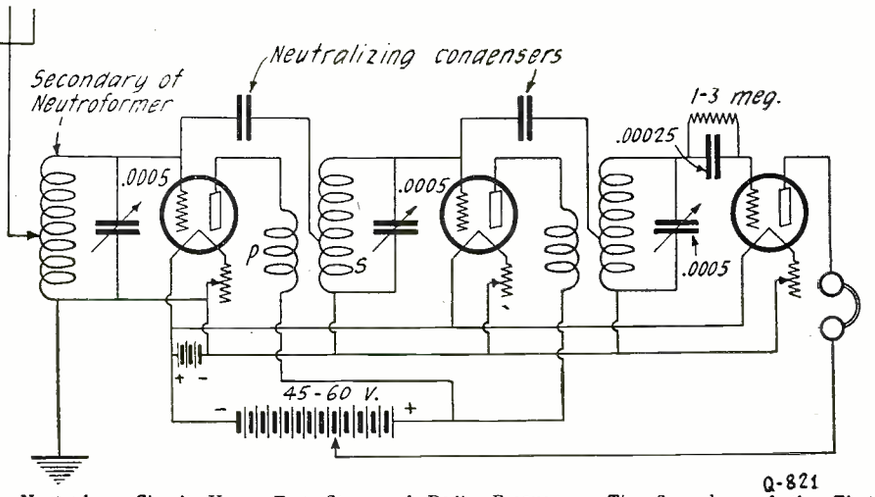
The Crosley Xj Receiver is Similar to the Well-Known Model X. A Jack is Used After the First Stage of A. F. So That Phones May Be Used.

LIGHTNING

(820) Mr. C. R. Crawford, Vancouver, Canada, wants to know:

Q. 1. In the event of lightning hitting an antenna, would there be any danger to the inside of the house?

A. 1. There is always danger during an electrical storm, no matter if the house supports an antenna or not. If lightning should hit an



The Neutrodyne Circuit Using Two Stages of Radio Frequency. The Secondary of the First Neutroformer is Used as the Tuner.

antenna it might follow it to the inside of the house or it might jump from the wire at some point to some other part of the house. There are only a very few cases on record where lightning has hit an antenna as against the hundreds of times where houses without antennae have been struck. A properly grounded antenna is a protection rather than a menace.

NEUTROFORMER DESIGN

(821) Mr. Geo. B. Drako, Jr, Ithaca, N. Y, asks:

Q. 1. Please publish in your columns, data giving the construction of the transformers used in the Neutrodyne receiver.

A. 1. The secondary of a Neutroformer consists of 62 turns of No. 22 S.C.C. wire wound on a tube three inches in diameter. A tap is taken off at the 15th turn. The primary consists of 15 turns of the same size wire wound on a tube small enough to fit snugly inside of the secondary. This winding should be under the lower 15 turns of the secondary.

Q. 2. Kindly show a neutrodyne circuit using these transformers?

A. 2. This circuit appears herewith. The plate of the tube should go to the lower terminal of the primary and the grid of the next tube should go to the upper end of the secondary.

WD-11 HOOK-UP

(822) Mr. Theo. Moore, Yonkers, N. Y., writes:

Q. 1. Is it not permissible to substitute a variometer for the variocoupler in the hook-up shown in "Notes on the WD-11 Tube," in the June issue of Radio News?

A. 1. A variometer may be used in this circuit with equal results.

TUNED R.F. AMPLIFICATION

(823) Mr. Joseph H. Weber, Philadelphia, Pa., requests:

Q. 1. Would you kindly publish how two stages of tuned radio frequency can be added to a standard three-circuit receiver?

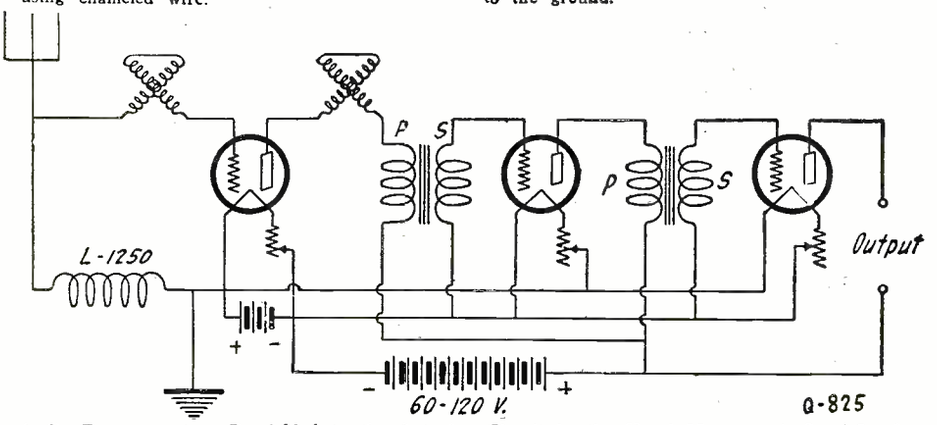
A. 1. This circuit appears on these pages. The radio frequency is placed before the tuner and the variocoupler is used as a tuned radio frequency transformer. Two stages of tuned R.F., will be very difficult to tune, but if correctly handled, will give excellent results.

MAGNET WIRE

(824) Mr. G. R. Thompson, Charleston, S. C., asks:

Q 1 Can enameled wire be used in radio winding instead of double or single cotton covered wire?

A. 1. Enameled wire can be satisfactorily used instead of cotton covered wire. A greater number of turns can be wound in a given space when using enameled wire.



Audio Frequency Can Be Added to the Autoplex Circuit in the Usual Manner. A Loud-Speaker Must Be Used with Two Stages.

Q. 2. Can No. 30 or 32 wire be used where No. 26 wire is mentioned?

A. 2. No. 30 or 32 wire can be substituted for No. 26, but the coil will have more distributed capacity and a higher resistance. Fewer turns will also be used for a given wave-length.

Q. 3. Is there any advantage in using No. 18 wire on a variometer instead of No. 24?

A. 3. The answer to Q. 2 also applies here. Also, when large wire is used on a coil the tuning will be sharper. Fairly large wire should always be used where possible.

A.F. WITH THE AUTOPLEX

(825) Mr. Uriel S. Zook, Millcreek, Pa., requests:

Q. 1. Please publish the Autoplex circuit with two stages of audio frequency amplification.

A. 1. This hook-up will be found in these columns. The primary of the first audio frequency transformer should have at least 1,000 ohms resistance.

Q. 2. Can WD-12 tubes work efficiently in this set?

A. 2. WD-12 tubes will give fair results, but will not give the volume of a good amplifying tube. We would suggest a UV-201A or a Western Electric 216-A tube in this circuit.

Q. 3. Can a loop be used with this set?

A. 3. A loop may be used by placing it in the circuit between the grid variometer and the 1250-turn coil. Better results might be obtained with a ground connected in the usual place when using a loop.

SERIES CONDENSER

(826) Mr. Ralph D. Bleecher, LaGrange, Ill.. wants to know:

Q. 1. Will a .0005-mfd. variable condenser, placed in series in the antenna circuit, greatly improve the tuning qualities of a standard three-circuit receiver?

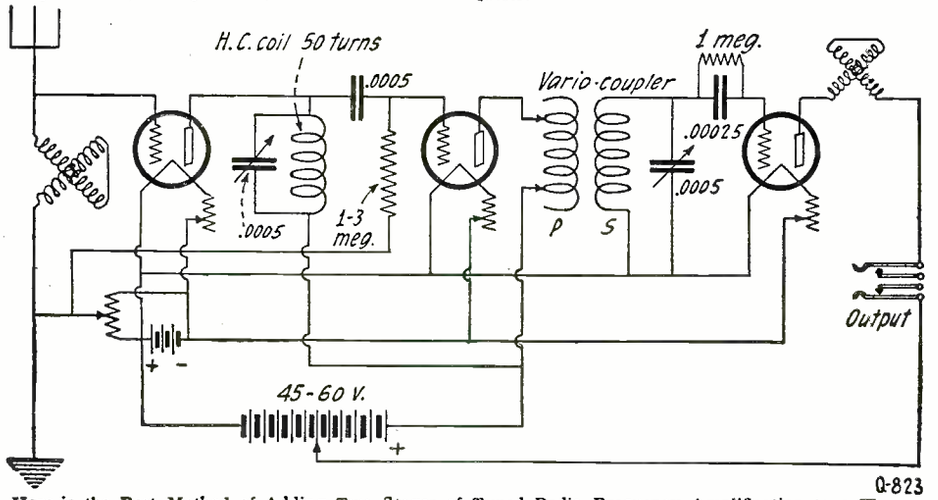
A. 1. If a "units" and a "tens" switch are used to tune the primary, a variable condenser will not be necessary. The primary tuning is, as a rule, not so important; the fine tuning being accomplished in the secondary circuit If the primary tunes too high a condenser may be placed in series to reduce the wave-length.

Q. 2. Should the condenser be placed between the tuner and the antenna, or the ground?

A. 2. Equal results will be had with the condenser in either position.

Q. 3. Should the movable or the stationary plates go to the ground?

A. 3. The movable plates should be connected to the ground.



Here is the Best Method of Adding Two Stages of Tuned Radio Frequency Amplification to a Three-Circuit Regenerative Receiver. The Variocoupler is Used as Tuned R. F. Transformer.

FADING

(827) Mr. A. Leclerc, Quebec, P. Q., writes:

Q. 1. Can you tell me why signals come in loudly and then fade away? Is there something wrong with my receiver?

A. 1. This is commonly known as fading or swinging signals. Most long distance stations swing in this fashion. No satisfactory theory has yet been given to account for this, and it cannot be prevented.

Q. 2. Will a potentiometer of 300 ohms help to keep it steady?

A. 2. A potentiometer will be of no use in this case.

LITZENDRAHT VS. SOLID WIRE

(828) Mr. Jas. A. Robinson, Warrenton, Va., writes:

Q. 1. Would Litzendraht wire be more efficient than silk covered wire in a crystal receiver?

A. 1. According to tests that have been made by Prof. Morecroft on the comparative merits of the two wires, Litzendraht was found more efficient on wave-lengths above 300 meters. Below this wave-length, solid wire proves best. Great care must be used, when employing Litz. wire, so that no strands are broken, as the resistance increases considerably if the cable is not perfect.

Q. 2. What crystal would you advise using?

A. 2. Silicon or Galena would give very good results.

GREBE CR-12

(829) Mr. P. McClelland, Des Moines, Iowa, writes:

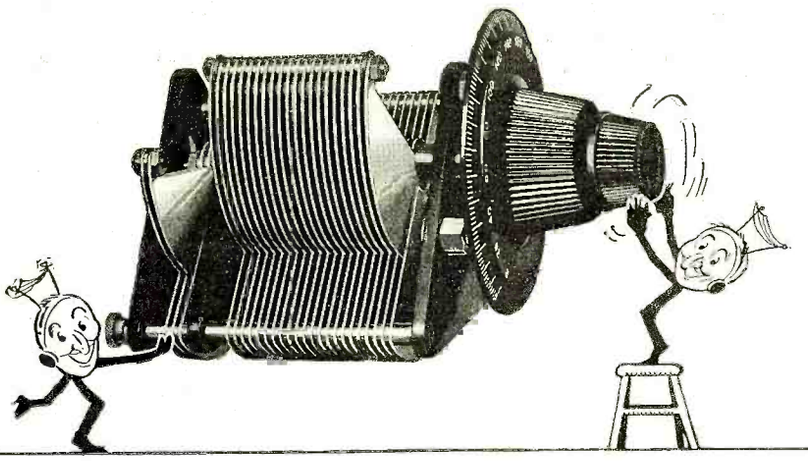
Q. 1. Please publish the circuit of the Grebe CR-12 receiver.

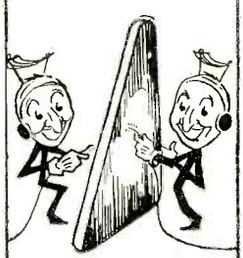
A. 1. A diagram of this circuit will be found in answer to question 788 in the November issue of Radio News.

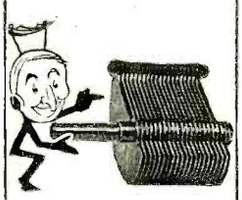
Q. 2. Which is considered better for volume, a five-watt, or UV-201A tube?

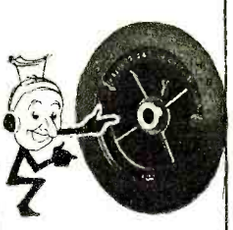
A. 2. If connected in the proper circuit and sufficient voltage is used on the plate, a five-watt tube would give better results.

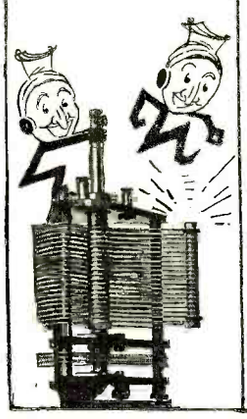
(Continued on page 1012)











"Some Condenser" says the "Radio Bug"

Makes your receiving set respond to every broadcasting station operating.

The size of the Kellogg Condenser and dial gives easy, accurate tuning. The vernier makes unusually sharp tuning a simple matter.

The end plates are of the best radio insulation in use today—Bakelite. The Kellogg accurately built dial is also of Bakelite, which retains its handsome appearance indefinitely. Its heavy reinforced construction and beauty of design add to the appearance of any set.

The rotor plates are properly spaced and bolted together, making it impossible for them to make contact with the stator plates.

Large bearing surfaces assure smooth, even rotation of the rotor plates and reduce wear to a minimum.

The high class workmanship, with the fine materials used in Kellogg Variable Condensers place them in a class by themselves.

The relations of the capacities is such that as great a flexibility as desired in any set may be maintained by the use of the various models.

The resistance to alternating currents at the average wave length is low thus assuring full use of all current intercepted by the antenna.

The Kellogg variable condenser is a precision instrument built in size, proportion and ratio for use as a decremeter or wave meter, as well as for control of capacity in the radio broadcasting and receiving sets. This makes it of far greater value to the amateur as well as the laboratory expert.

Kellogg Variable Condensers are made in the following styles:

Code No.	Zero Cap.	Max. Cap.	Ratio	Price
601-11 plate Vernier	.000120	.000262	2.1:1	
with vernier All Plates	.000120	.000600	5 :1	$6.75
602-11 plate	.000045	.000396	2.8:1	4.50
603-23 plate Vernier	.000071	.000210	3 :1	
with vernier All Plates	.000071	.000990	14 :1	7.75
604-23 plate	.000071	.000885	12.6:1	5.50
605-43 plate Vernier	.000102	.000250	2.4:1	
with vernier All Plates	.000102	.001800	17.6:1	8.75
606-43 plate	.000082	.001690	20.7:1	6.50

Have your dealer furnish you with Kellogg radio equipment and know you have the best.

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COLUMBUS, OHIO KANSAS CITY, MO. SAN FRANCISCO, CAL. PORTLAND, ORE.

Kellogg Apparatus exclusively is used in building the Symphony Receiver

Eliminating Interference

(*Continued from page* 898)

sharply with the single and multiple turn switches of the tuner. This is in effect an air core transformer coupled amplifier and is equally effective over the entire range of the tuner. The resultant complete circuit is shown in Fig. 2.

ADAPTED TO SINGLE CIRCUIT TUNERS

For single circuit tuners the amplifier shown in Fig. 3 has proven very effective. As in the first case the output of the amplifier is connected to the input of the tuner. When a receiver such as an R.C. is used where the tuning elements are in one cabinet and the tubes in another, busses connect the two. The post marked "G" in Fig. 3 connects to the post marked "Grid" on the tuner. When the tuner has no outside connections, such as in an Aeriola Senior, a separate wire is run from the grid lead inside the tuner to "G". On some sets it is necessary to remove the grid leak when it is connected around the grid condenser instead of to the filament.

This arrangement makes a tuned impedance coupling between the first two tubes

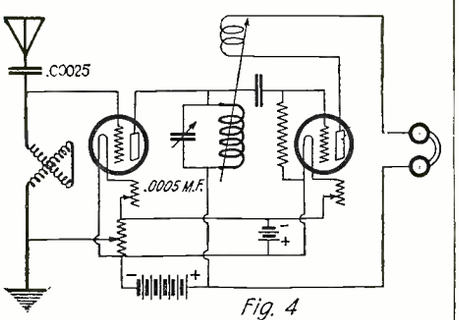


Fig. 4

A Regenerative Circuit Employing One Stage of Tuned Radio Frequency Amplification to Increase Selectivity and Distance and to Prevent Reradiation.

and is shown below with the detector in Fig. 4.

It is not necessary to install this apparatus in a cabinet, as very excellent table mounted instruments are available. The parts used are:

1 Variometer
1 Potentiometer
1 Rheostat
1 Socket
1 .00025 M.F. Fixed Condenser
1 Amplifier Tube.

I feel confident that any reader who will spend the few dollars necessary to install either of the amplifiers will be well paid by the improvement in his set and I know will be blessed by his neighbors.

A Practical Neutrodyne Receiver

(*Continued from page* 899)

This is done for the first stage and second stage separately, adjusting each condenser until the signal is no longer heard. I have found it possible to adjust these condensers without going to this trouble by simply setting them at the greatest capacity which would not cause the set to go into an oscillating condition. The action of these condensers is similar to that of the potentiometer in the original radio frequency circuit with

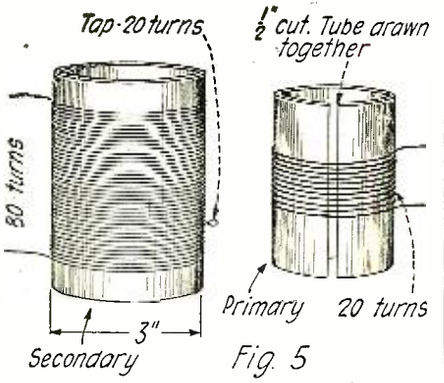


Fig. 5

Constructional Details of the Primary and Secondary Coils of the Neutroformers

the exception of the fact that they need never be changed for different wave-lengths or signal strengths. The complete circuit of the neutrodyne receiver is shown in Fig. 8.

If this set is constructed properly it will give results in clearness and sharpness which are superior to any other type of set which has come to my attention. The volume is not extremely loud but audio frequency can be added in the usual manner.

As seen, there are two stages of radio frequency amplification and a detector. The radio frequency transformers, unlike the iron core type, have untuned primary circuits and tuned secondary circuits. The tuning system likewise has an untuned antenna circuit and a tuned secondary circuit. All adjustments are made by the three variable condensers and maximum volume of any one signal will not be obtained until these three

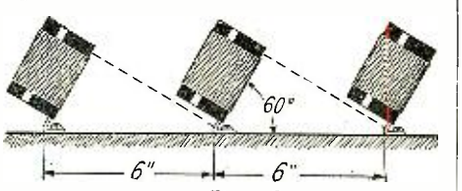


Fig. 6

It Is Important That the Radio Frequency Transformers Be Mounted as Shown in the Above Illustration.

circuits are tuned to the same values. This should be kept in mind when operating a neutrodyne receiver. The simplest way for hunting stations on various wave-lengths is to start at zero on all dials and slowly work towards 180 degrees moving the right hand condenser dial a few degrees first, followed by a corresponding adjustment of the second and first dials. Keep progressing until a station is heard. At this point, a fine adjustment of all three dials will be necessary to obtain maximum volume.

If it is desired to add the regenerative feature to this receiver a variometer should be connected in series with the plate of the detector tube and the head-phones. This variometer will allow as well the placing of the detector circuit in an oscillating condition for the reception of C.W. signals and without a chance of re-radiation.

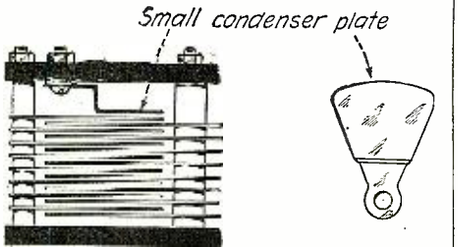
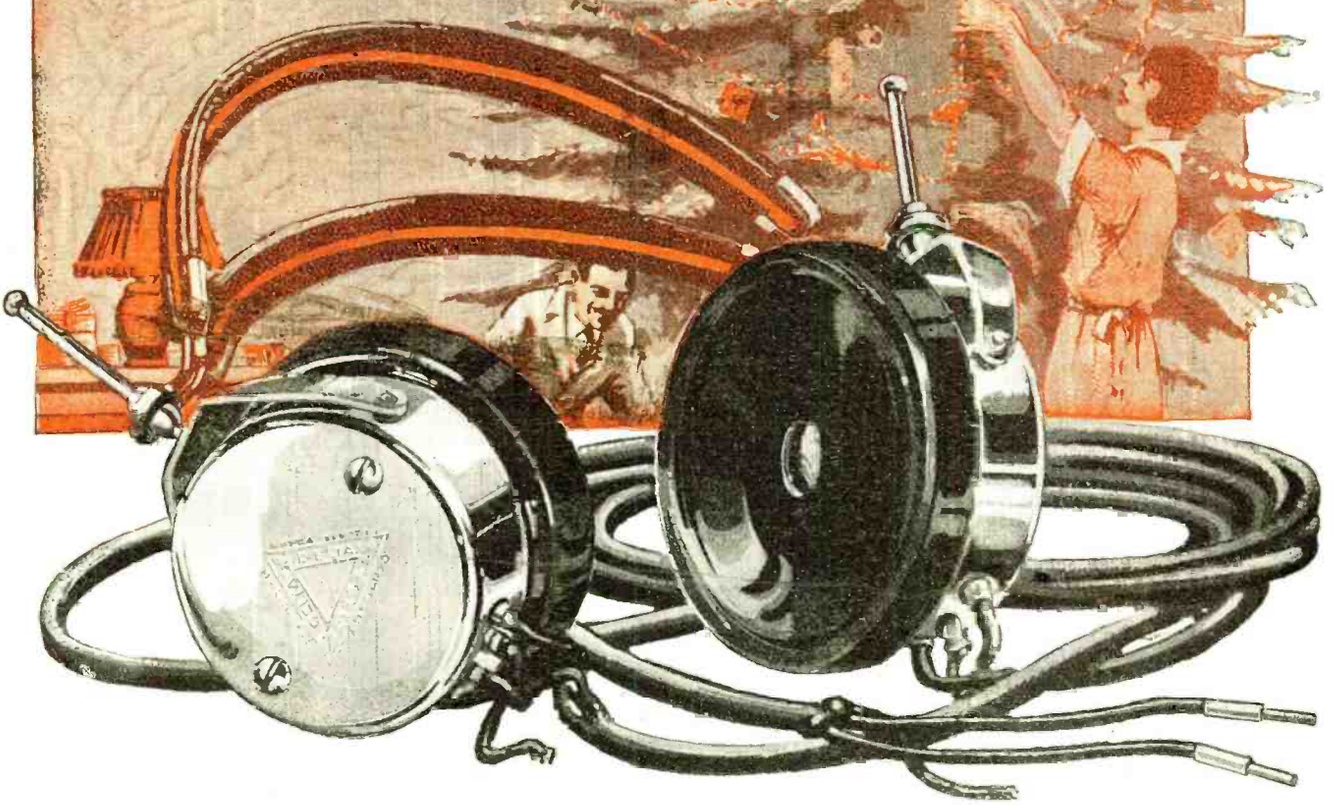


Fig. 7

A Small Metal Plate Mounted as Shown Well Serves the Purpose as the Neutralizing Capacity.

DELTA
GOLD-STRIPE
RADIO HEAD SETS



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Sanford Bros.
311 Minna St.

WINNIPEG
Bissett & Webb, Ltd.
126 Lombard St.

Broadcasting Station, WRC Washington, D. C.

(*Continued from page* 881)

modulator tubes and 1,000 volts for the amplifier tubes, while the other furnishes the 125 volts used to operate the automatic relays and the 88 volts which heat the filaments of the large vacuum tubes.

A unique feature of this station, and one which further assures perfect transmission of programs, is a device known as the oscillograph, by which the operators have before them "a working picture of the voice." The delicate instrument may be switched into any one of the many circuits and shows, by means of an undulating, ever-varying beam of light, exactly how the artist's voice or music is affecting the electrical and radio currents. By watching this little tell-tale beam, as reflected from revolving mirrors, one knows instantly whether the sound waves are too weak, too great in volume or blurred.

Book Review

DER RADIO-AMATEUR "BROADCASTING," By Dr. Eugene Nesper. 6½" x 9½", cloth cover, 368 pages, fully illustrated. Published by Julius Springer, Berlin.

If one but looks at the nine pages of fine type devoted to the contents table of this book, one will see that this very eminent author has covered a large field with wonderful detail and minuteness. There are 15 sections, devoted to all phases of broadcasting, and addressed to the amateur. But of course, the amateur of today, especially in the United States making his own apparatus in many cases, has to be handled with care and precision, and no indifferent work will do for him. This book cannot possibly be reviewed within the limits of our space. It is enough to say that it is liberally illustrated with reproductions of photographs of apparatus and parts thereof of all descriptions and with any number of diagrams of hook-ups. The diagrams, like the text, are of the clearest style and reproduction. Without any exaggeration, we may say that the illustrations and diagrams alone are such as to make it really interesting to one not knowing the language of the text. It is rather interesting to see how the author starts off in his first sentence. He says that the first American amateur movement in radio, so called broadcasting, started in the spring of 1921 and the author seems certainly to have an appreciation of all that America has done. The very first picture in the book is a reproduction which appeared originally in "Judge" and then was reproduced in the September, 1922, issue of RADIO NEWS, entitled "In Tune with the Infinite."

We certainly recommend this book to our readers, for with its many circuits and details and sections of parts and apparatus as well as the photographs already alluded to, it tells a very complete story of the art. Among the illustrations, as we happen to turn over the leaves, we find one of the prints refers to Sleeper, a well known American authority. A very interesting list of radio books and publications in English, Dutch and German literature is given, which, however, might be very much enlarged. The book ends with an adequate index of subjects. The subdivisions of subjects and the sectional index so common in German books Dr. Eugene Nesper has not adopted. The single index is more to the taste of the American and English reader.

THE OUTLINE OF RADIO. By John V. L. Hogan. Published by Little, Brown & Co., Boston, Mass. 5" x 7½", cloth cover, 256 pages, fully illustrated.

It is usually said of the radio engineer, or in fact of anyone whose knowledge of radio runs into the highly technical phases, that he is a poor subject for either writing or attempting to explain even the most simple operations of a radio set, since it is impossible for him to come down to the same plane of conception as the novice. If this be true as a rule, Mr. Hogan is an exception. In his book "The Outline of Radio," he not only completely covers the subject of radio, but shows an extraordinary knack in making his material comprehensive to the mere layman. Further than this, Mr. Hogan has introduced a bit of originality in his writing, so as to make his book of unusual interest. He says "Imagine that you are spending a week-end at my home, that

TUSKA RADIO

PUT a Tuska Radio in your home—and the best in radio will be yours to command. You can select the near-by or distant program you wish to hear, and hear it well. The Tuska is the ideal set for busy people who have no love for tinkering. It is a finished set, built by painstaking New England craftsmen. So sound in design, so lasting in construction, that it will serve you faithfully for many years.

The fame of Tuska instruments for distinct, selective radio receiving is older than broadcasting. For a dozen years, parts and sets bearing the Tuska imprint have been admired for fine workmanship and praised for efficiency. The Tuska trade-mark guarantees advanced design and painstaking construction, under the personal supervision of C. D. Tuska. His skill and experience are strengthened by a staff of experts in research and practical radio building.

Although Tuska prices are moderate, Tuska Radio has no superior in design, materials, construction, selectivity or simplicity of operation. There are models, ranging in price from $35 upward, all built to give many years of satisfactory service, without tinkering or repairs.

Ask any reliable radio dealer to show you a Tuska.

THE C. D. TUSKA COMPANY

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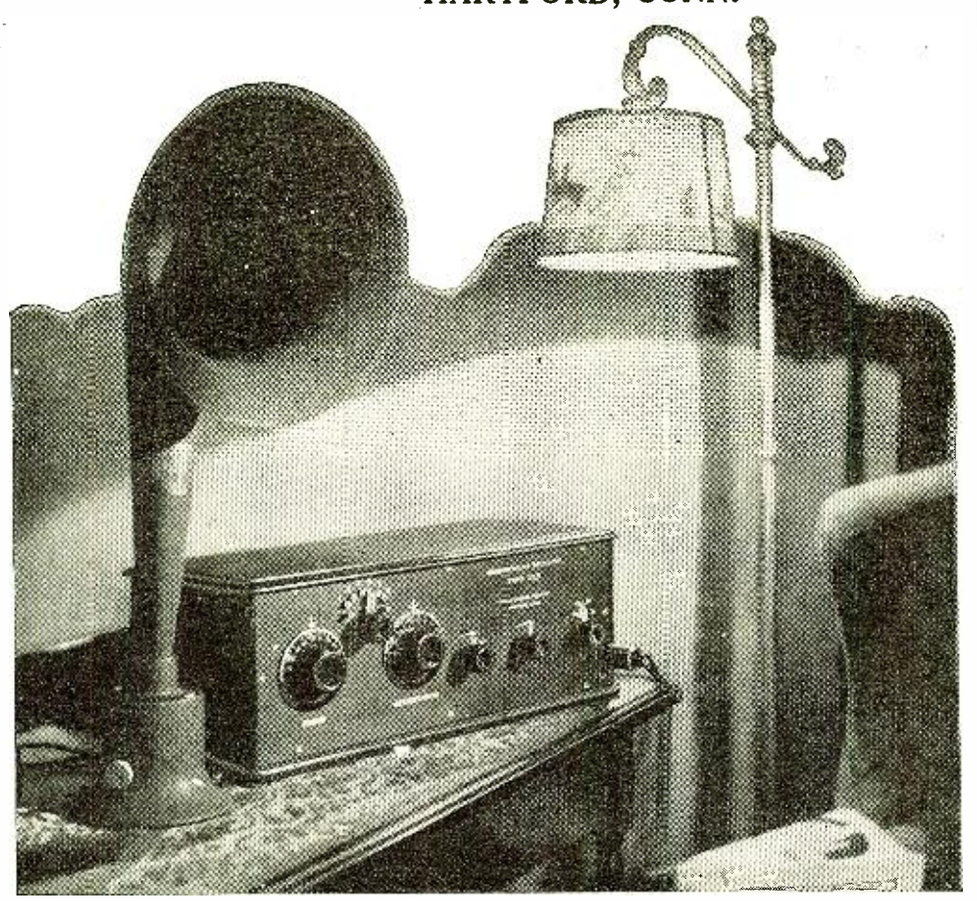


Would you like to hear a hundred critics?

"I have heard to date over one hundred different broadcasting stations. I heard KHJ at Los Angeles, Cal., five different evenings. The signals were remarkably clear. On the evening of December 28th, at 10.40 o'clock, I heard the whole of four selections from KLZ, at Denver, Colo.

"I often hear Fort Worth, Tex., with just the detector alone, without amplification.

"To say that I am greatly pleased with my Tuska outfit is putting it mildly.

Merrill B. Whitney
Randolph, Vermont"

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

Tuska Popular No. 225

Three-bulb Regenerative Receiving Set. Piano finish mahogany cabinet. Amplifier switch. Concealed binding posts. Armstrong circuit, licensed under Patent No. 1,113,149. Price $75, without bulbs, batteries or loud speaker.

Ask for special circular No. 11-G, describing this set.

we have drawn our chairs before the fire and that you have asked me, "Just what is this radio anyway; how did it happen; what makes it work?" and I answered, "Well . . . it is like this"; and he goes on to explain. This personal touch is noticeable throughout the entire book.

It is unnecessary to outline the various chapters of Mr. Hogan's work. As Consulting Radio Engineer, Fellow and past President of the Institute of Radio Engineers and Member of the American Institute of Electrical Engineers, it can be taken for granted that Mr. Hogan is an authority on radio. Nothing included in the book is stale and nothing of importance has been left out. We recommend this book to our readers.

REFLEX AND RADIO FREQUENCY. By M. B. Sleeper. Published by the M. B. Sleeper Corporation, Inc., 88 Park Place, New York City. 6" x 9", paper cover, fully illustrated with working drawings and photographs.

This little book gives a comprehensive description of the construction of various forms of reflex receiving sets that can be built and assembled on the "Kitchen Table Work-shop." The receivers described are the two-tube Grimes inverse duplex set, three-tube radio frequency receiver, a small one-tube reflex set, a one-step radio frequency amplifier and a long range loop receiving set. Nothing is left to the imagination of the reader.

RADIO FREQUENCY AMPLIFICATION. By Kenneth Harkness. 6" x 9", paper cover, 176 pages, illustrated. Published by the Radio Guild, Inc., New York City.

This book covers the elementary laws of electricity and the theory of radio reception in general with chapters on inductance, capacity, resistance coupled circuits, the vacuum tube, regeneration, radio and audio frequency amplifiers and general information on receiving systems. These chapters compose Part I of the book. Part II is concerned with the construction of various types of receivers as well as radio and audio frequency amplifier units. The Neutrodyne system is also taken up in this part of the book. A quantity of helpful information is included in the rear of the book that should help those who are contemplating either the purchase or the construction of a radio receiving set or amplifier.

POWERFUL BROADCASTING STATION TO BE ERECTED AT DENVER, COLORADO.

Denver, Colorado, has been selected as the site of a powerful radio broadcasting station by the General Electric Company, according to an announcement made recently by Martin P. Rice, director of broadcasting for that company. Work on the new station will be started as soon as the General Electric Company station at Oakland, California, is finished, probably in December.

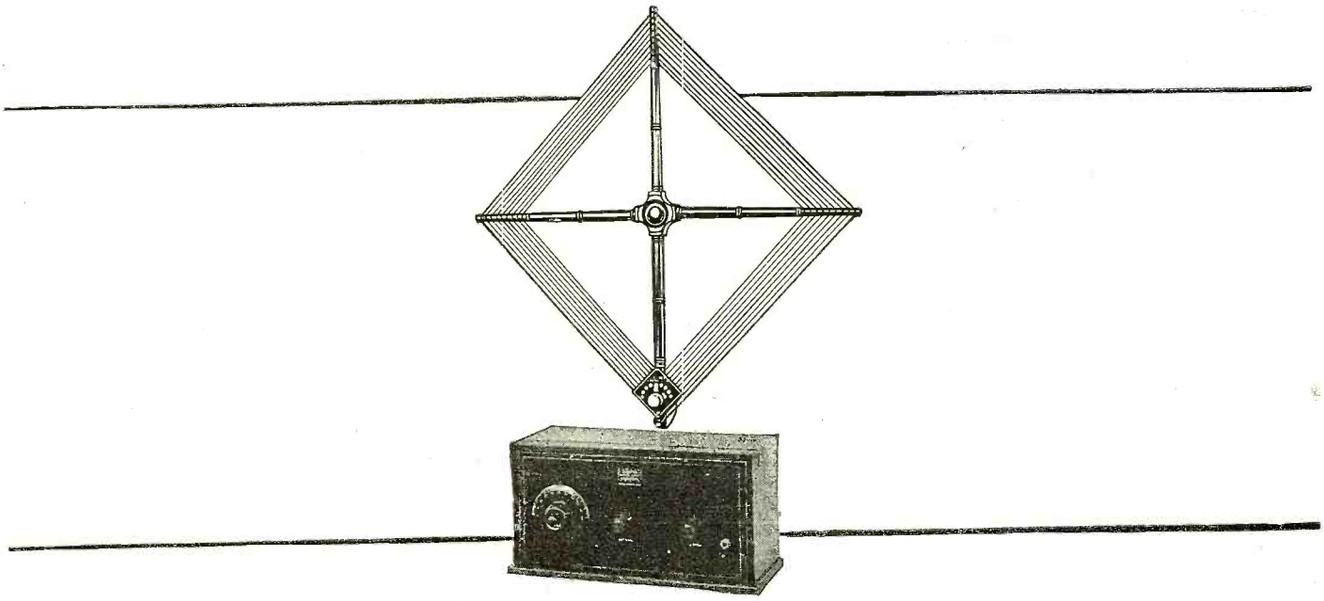
Denver will have the third and last station in the General Electric program of broadcasting stations. The first, WGY, at Schenectady, has been in operation for the past 18 months. Oakland, the second station, is the first to be housed in a structure erected exclusively for broadcasting equipment.

Both the Oakland and Denver stations will be modeled after WGY, so far as equipment is concerned. They will have the same power and sending radius as WGY which, under favorable atmospheric conditions, has been heard on a single transmission in every state in the Union, in England, Hawaii and countries of South America.

RANDOM RADIO REPORTS

Recent reports from the Navy Department indicate a very considerable amount of interference from mush and harmonics at all points within 200 miles of Pearl Harbor. Current transformer circuits will be installed on the Honolulu transmitters of the Navy in the near future, which will eliminate this interference, it is hoped.

Naval experts admit that arc and spark transmitters create a considerable amount of interference in their vicinity, unless special circuits are installed to reduce such interference. Transmitters of these types are being modified as rapidly as funds permit. On arc transmitters current transformers or similar circuits are being installed and spark transmitters are being re-



SLEEPER MONOTROL

Is insulated with Formica

FEW of the new designs in radio sets are attracting more attention than the Sleeper Monotrol. Its fine finish, and the beauty of the Formica Panel, is a matter of comment, as well as the new ideas in control and wiring.

More prominent radio engineers use Formica exclusively in their products than use any other material of the kind. This nation wide preference of the men who make a business of radio, is upheld also by experienced amateurs from Coast to Coast.

When you ask the dealer for a Formica Panel you are sure you are getting the best.

Formica panels of standard sizes are supplied in individual envelopes carrying the Formica trade-mark. Special sizes may be cut from sheet Formica either at the factory, or by the jobber.

Dealers find Formica a quick moving staple for which the demand is certain.

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47 King St., Toronto, Ontario

FORMICA
Made from Anhydrous Redmanol Resins
SHEETS TUBES RODS

placed by tubes. Owing to the large number of transmitters operated by the Navy and the limited funds available, this work is, of necessity, proceeding slowly, but it is expected that the greater part of this interference will be eliminated during the next fiscal year.

ICE-BOUND ARCTIC TRADING POSTS ENJOY AMERICAN RADIO CONCERTS

Though ice-bound, and in darkness through the long winter months of the North Pole, trading posts in the Arctic zone will not be entirely isolated from civilization. According to plans made by the Hudson Bay Company, lonely posts will be provided with radio receiving sets so they may secure entertainment at any time. Two North-bound ships, the S.S. *Bayeskimo* and the S.S. *Nascopie* are carrying Westinghouse radio receiving sets to six of the posts above the Arctic Circle.

In order to determine whether or not these posts will be able to hear the concerts from the United States this winter, the ships are listening in on their way North to the broadcasts. A short time ago, the Westinghouse station WBZ in Springfield, Mass., gave a special concert at 11 p. m. and radiograms received from the steamship *Bayeskimo* state that the music has been heard with great success.

There are hundreds of the company's posts spread throughout Canada and North America, from above the Arctic Circle into James Bay. The ships have left for these trading posts and they will have sets for this winter. Although the reports received from the ships thus far have been very encouraging, complete information on the results obtained will be secured upon their return. The posts are so far removed from civilization that these reports will be the last news from the outposts until spring. The lanes of travel to these posts are entirely blocked on account of the heavy ice which accumulate.

COMMITTEE TO REVISE WAVE-LENGTHS

In an effort to decrease governmental radio interference, a special committee composed of members of the Interdepartmental Advisory Committee on Radio, has made a study of wave frequencies used by the Government and has recommended certain changes to the Department of Commerce. In view of this, Secretary Denby of the Navy has requested that a complete survey of all Government radio activities be now undertaken by this committee, so that complete co-operation and co-ordination may be had.

OAKLAND TO GET G. E. STATION

The new General Electric broadcasting station planned for the Pacific Coast is to be located at Oakland, California, and will be ready within six months.

The transmitting set will be similar to that which is now heard almost nightly from WGY, Schenectady, N. Y., and the many developments which have brought to this station a reputation for exceptional transmission quality will be part of the Pacific coast station equipment. The apparatus is now being manufactured in the Schenectady works of the General Electric Company and tested at WGY.

SCHOOL EXAMINATIONS GIVEN BY RADIO

A new use has been found for radio. Examinations written on the blackboard or sets of mimeographed questions have gone into the discard in California high schools and students are now having their examinations broadcast over the radiophone.

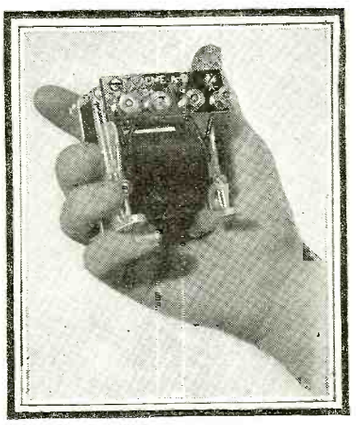
Mr. Will C. Wood, state superintendent of public instruction dictated a spelling lesson from Sacramento to children in all sections

(*Continued on page* 926)

"Now I get distant stations loud and clear!"

" . . . my range at once increased so I get stations that I never got before, and I get them loud and clear, which is exactly what I wanted . . ."

Radio energy from every broadcasting station in the country reaches your receiving set. Wonderful thought! But what does it amount to if you can only hear the nearby stations? It's when you hear distant stations as loud and clear as if they were in the same room with you — that's when you get the thrill! And that's what ACME offers you today.



Type A-2 Acme Amplifying Transformer
Price $5 (East of Rocky Mts.)

The key to radio is amplification without distortion

To insure maximum distance, volume and clarity for your set, two things must be done. First, the incoming radio energy must be built up in strength so that your detector will detect it. This gives distance. Second, the audio energy coming from the detector must be amplified without being distorted.

Acme radio and sound engineers, after long research, have perfected two instruments to accomplish these results. They are the Acme Radio Frequency Transformers, in three types, R-2, R-3, R-4—for distance. And the Acme A-2 Audio Transformer for amplification without distortion. They sell for $5.00 each, and are on sale in most electrical and radio stores. Look for them in the set you buy.

The Acme A-2 Audio Transformer (see illustration below) with a ratio of 4.25 to 1 may be used with any vacuum tube now made, either dry or storage battery type. It positively eliminates resonance, the cause of distortion. When one Acme A-2 Transformer is used, it produces loud, clear sounds in any head set. When two are used, an Acme Kleerspeaker or other loud speaking device may be hooked up so that a roomful of people may listen.

Tens of thousands of experienced radio owners in the United States, Canada and Cuba use the Acme method to secure loud, clear broadcasting from stations five hundred to three thousand miles away. The results have been marvelous. Loud, clear radio concerts are now heard with sets which once seemed capable of producing only weak or distorted, almost unintelligible sounds.

Send for ACME *Booklet*

"Amplification Without Distortion" an instructive and helpful book, explains how to secure best results with Acme Transformers on your own radio set (large or small); gives wiring diagrams of great help in building a set; clearly explains amplification and distortion; describes how to determine causes of poor results with amplification; how to get Audio and Radio Amplification in same vacuum tube—"REFLEX" System. Mail coupon with 10 cents (U. S. stamps or coin) to Acme Apparatus Company, Dept. 23, Cambridge, Mass., U. S. A.

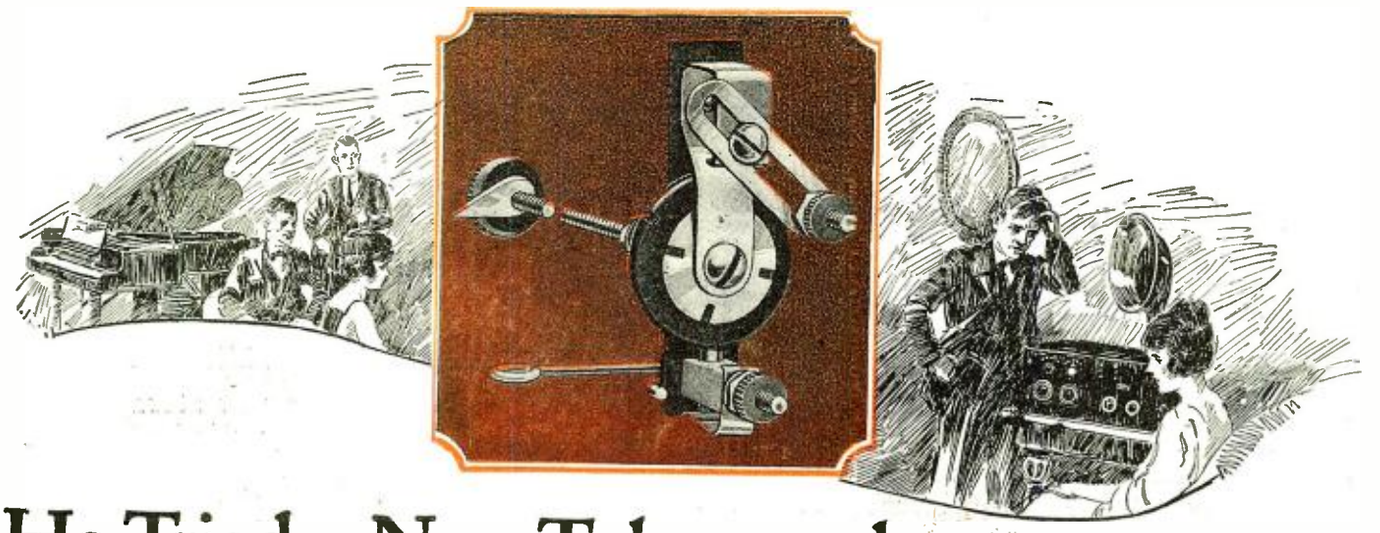
ACME
for amplification

ACME APPARATUS COMPANY
Dept. 23, Cambridge, Mass., U. S. A.
Gentlemen: I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book, "Amplification Without Distortion."

Name .....

Street .....

City .....*State*.....



He Tried a New Tube—and Then Learned the Secret of Grid Control

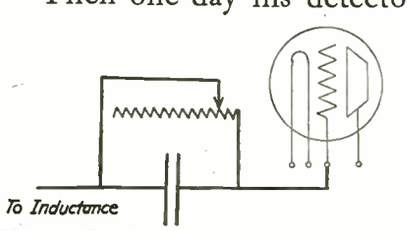
Many Sets Can Have Increased Range and Better Reception Through Proper Control of the Grid Condenser

He was a careful buyer. He knew the folly of using cheap equipment in his set—for precision decides between results and failure in radio. And he built carefully

But when the set was finished he had only fair results. The distant stations that he wanted could not be heard consistently. And when they were tuned in, they *faded*, so that adjustments had to be made continuously. At times the program would die away and be lost. At others, there was a distinct clicking heard, with alternate periods of clear and muffled reception.

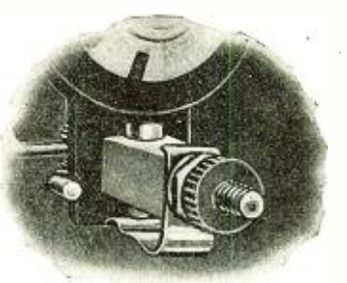
His friends said the set was not *stable*—and there were as many suggestions for corrections as there were friends. But each time the circuit was checked it showed no wrong connections. Every joint was soldered, every binding post tight.

Then one day his detector tube passed into the great beyond from which no tube returns. And it was then that he learned the secret of his poor results.



Unless a "Leak" of the proper resistance is placed across the grid condenser, the tube will either choke or the effect of the condenser be destroyed. The value depends on both the characteristics of the tube and the circuit—it can be obtained only in an accurate variable grid leak of proper design.

With a new tube the set produced perfect concerts—tones clear and natural—fading and clicking were eliminated. Like a flash he realized that the characteristics of this new tube were better suited to the constants of his circuit. To prove it he tried another tube—of exactly the same type. And again his results were better. Stations he had never received before could be heard, and those that he had copied only on perfect nights could be tuned in at will. His lack of control of the grid condenser cost months of unsatisfactory reception.

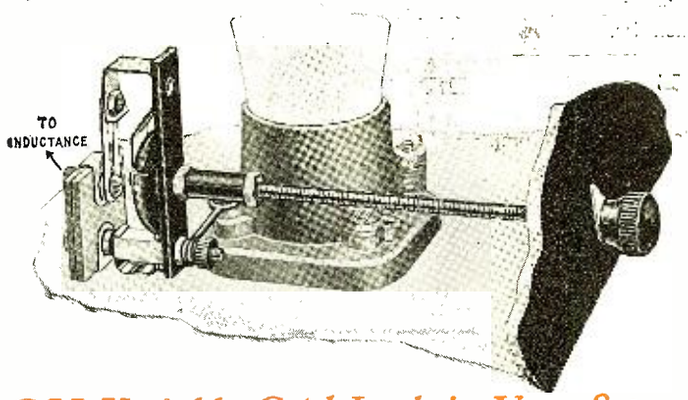


The carefully milled rotor of the C-H Variable Grid Leak constantly accumulates graphite from the specially prepared brush, reducing the resistance of the leak. If this becomes too low for the tube used, merely wiping the rotor with a clean cloth restores it to a high value for readjustment.

Are Your Results Choked Off in the Grid Condenser?

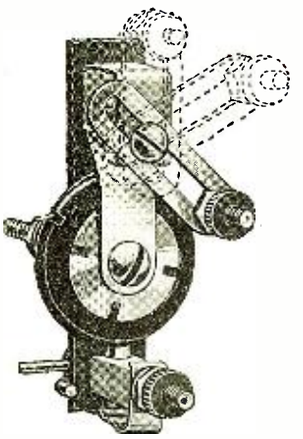
For every tube and for every circuit there is a certain value of resistance that allows the charge which "piles up" on the detector grid to "leak off" at just the proper rate. If this value is too high the charge accumulates, and the tube

chokes—if too low, reception is "mushy," in some cases the grid condenser cannot function at all. Therefore, the *Grid Leak* must be of variable resistance to adapt itself to the characteristics of the circuit in which it is expected to operate. To insert a *fixed* leak is merely a gamble—a chance against large odds of hitting the proper value with all the results of your set at stake.



Put a C-H Variable Grid Leak in Your Set and Be Certain of Maximum Efficiency

The C-H Grid Leak is worthy of the trademark it carries. It was designed by the master builders of all electrical control apparatus, and is produced with watch-like precision to give accurate control. It can be installed in a few minutes in any set. A special flexible mounting link makes it easy to attach directly to the grid terminal of the tube socket or wherever else desired. A long, fully threaded brass control rod (which can be cut to any length required) is furnished with bakelite insulating joint, Thermoplax knob and pointer for panel control. The leak is adjustable, arranged to care for any style of grid condenser.



The C-H Variable Grid Leak is fully adjustable for all styles and sizes of grid condensers.

Install one in your set tonight for better, clearer, more consistent reception. No wiring is required. Attach it to the grid terminal of your tube socket, and attach the wire you removed from that post to the one on the Leak marked "to inductance." Carried by jobbers and dealers everywhere. Sample can be obtained direct from factory at list price, $1.50 plus 10c for wrapping and postage.

THE CUTLER-HAMMER MFG. CO.

Member Radio Section
Associated Manufacturers of Electrical Supplies

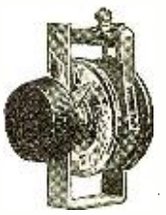
MILWAUKEE, WISCONSIN

C-H

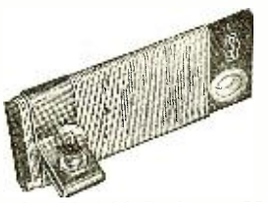
Instruments of Guaranteed Quality Assure Success in Radio

The C-H 4 Ohm Vernier Rheostat
Perfect detector tube control. Also furnished without vernier for amplifier tube control.

The C-H 30 Ohm Radio Rheostat
For control of the ¼ ampere, "UV201A-C301A" type receiving tubes and the "UV199-C299" type.



The C-H 125 Ohm Radio Rheostat
The rheostat that makes it possible to use a 6V storage cell with the UV199 or C299 tubes.



The C-H Variable Resistance Unit
Attach it to your present 4 ohm rheostats to obtain the required 30 ohms for the new tubes.

The C-H Radio Potentiometer
The potentiometer with the resistance unit that does not wear and cannot be displaced under constant usage.

HAMMER

of California. This is the first time in the United States, and probably the first time in the world, that radio has been used for broadcasting a spelling lesson.

NAVAL RATES CHANGED

The Naval Communications Service has doubled its radio commercial rates. After April 1, all Naval stations requested to handle commercial messages will charge at the rate of 12 cents a word. It is hoped that this will relieve the Department from further criticism. Emergency Commercial Service will be continued, however, where there are no other facilities.

WIRELESS PHONE, SHIP TO SHORE

The United Steamship Company of Copenhagen, Denmark, plans to install wireless telephone equipment on all boats plying between Copenhagen and the provincial harbors for the traveling public's convenience. Travelers will be able to secure direct communication, through the land telephone service, with their own homes or offices, similar to the service planned for the U. S. S. *Leviathan.*

The New Arlington Tube Transmitter

(*Continued from page* 871)

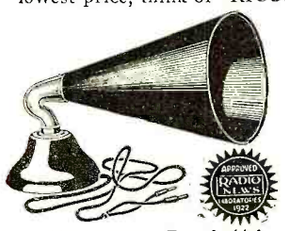
tunate enough to have visited the station during its operation. No doubt there will be in some hearts just a tinge of regret that this friendly old spark note will be heard no more. But interference is interference, even when created by such an Old Faithful And so the old voice of NAA has been silenced and a new non-interfering tube transmitter has been installed at Arlington so that Radio Washington can enjoy broadcasts from friends in other cities.

The new tube transmitter which has taken over the 2650-meter service at noon and at 10 P. M. for time signals, weather reports, and press news is shown in Figs. 2 and 3. Fig. 4 shows the type of tube employed, rated by the General Electric Company at 5-K.W. output. The transmitter is of the alternating current type, that is to say, it employs the "self-rectification" circuit developed by the Navy in which alternating voltage at high potential is applied directly on the plates of two tubes which act simultaneously as rectifiers and oscillators. Many amateurs have used this circuit to operate tubes directly from the house lighting circuits. Those who have been in the habit of setting their watches to the Arlington signals every evening have, no doubt, been impressed with the purity of tone of the new transmitter.

This transmitter is free from the harmonics of most tube transmitters, special precautions having been taken to achieve this end on account of the desire to avoid the possibility of any interference with the ever increasing broadcast public in the city of Washington. These means consist of the use of the so-called tank circuit, that is to say, the radio frequency currents flow in three independent circuits. First, there is the "closed circuit" into which the tubes oscillate; second, there is the "tank" or intermediate circuit; and third, there is the "open" or antenna circuit. These three circuits are inductively coupled to each other with very loose coupling, so that only the true wave gets out into the ether. Whereas broadcast reception during the 2650-meter service was practically impossible in the days of the spark, to-day this service is inaudible on the shorter waves except possibly on receivers using several stages of radio frequency amplification.

RICO GUARANTEED PRODUCTS

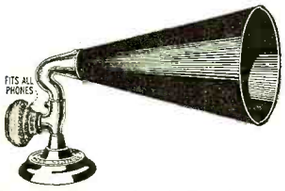
ALL "Rico" goods are guaranteed unqualifiedly by us. "RICO" goods are standard today and are used all over the country. Ask any of your friends about "RICO" goods and "RICO" workmanship. A trial of any of our items will convince you. There is a dealer somewhere near you who stocks "RICO" goods and who will be glad to show and demonstrate to you the latest additions to our line. Whenever you want good goods at the lowest price, think of "RICO."



No. 250 Melotone Tuned (Adjustable) Loud-speaker, complete $6.00

"Rico" Tuned (adjustable) Melotone Loud-Speaker

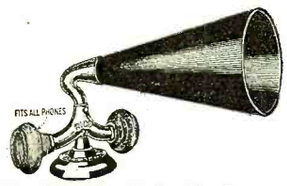
The highest grade, lowest priced and most popular loud-speaker on the market today. This speaker is equipped with "Rico" tuned (adjustable) loud-speaker phone unit. Comes fully equipped with black fibre horn and five foot cord. This low priced speaker compares well with the most expensive ones. Length of horn 11½", total height 9". No. 250 Melotone Loud-Speaker $6.00



No. 700 "Rico" Single Fonehorn, complete (without loud-speaker unit) $2.50

SINGLE FONEHORN

NEW! Here is the appliance you have been waiting for. 11½" fibre horn, mounted on a heavy cast base stand. The stand also has one of our single phonodapters. Will take any loud talking phone unit. At a small expense you can now have a loud-talker. It not only looks good, but gives surprising results due to the fibre horn. All metal work, with the exception of the base, is nickel plated and polished. Not a toy, but a massive piece of apparatus that looks good, works well, and is marked at a very low price. Horn swivels in any direction independent of base and phone. No. 700 Single Fonehorn....$2.50



No. 701 "Rico" Double Fonehorn, complete (without phones) $3.00

DOUBLE FONEHORN

This article is constructed similarly to our No. 700 single Fonehorn. The double Fonehorn is made to take any standard head set and thereby the appliance becomes a real loud-speaker unit. Acoustically worked out to perfection, this appliance will give excellent results. It is equipped with 11½" full fibre horn. All metal parts nickel plated and highly polished. Heavy cast base in dull black finish. This appliance has two of our phonodapters which will take any make head set. An article that looks good with any expensive set. Horn swivels in any direction independent of base and phone. No. 701 Double Fonehorn ...$3.00

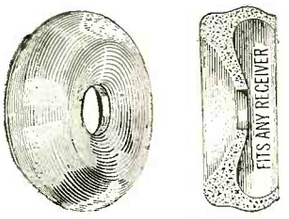
"Rico" Head Sets

These head sets are the original ones using the center pole pull on diaphragm principle. Well known for their sensitivity, loudness and absolutely tuned quality. Now made with superior tungsten steel magnets, better head band, a heavier and better quality cord, sherardized diaphragm, and a number of minor improvements. The highest priced phones are made with tuned (adjustable) diaphragms.

No. 6 2000 ohms (standard non-adjustable $3.50
No. 7 3000 ohms (standard non-adjustable) $4.00
No. 20 "Rico" De Luxe Tuned (adjustable) 2000 ohms....$4.50
No. 30 "Rico" De Luxe Tuned (adjustable) 3000 ohms.....$5.50
No. 40 "Rico" De Luxe Tuned (adjustable) 4000 ohms.....$7.00

FONEKUSHIONS

The latest radio wrinkle. How many times have you had a headache from wearing tight head receivers? How many times when you are listening for DX have you not been able to hear clearly due to outside noises in the room? Fonekushions do away with all this. Made of sponge rubber. They not only make wearing your receivers a pleasure but they positively exclude all noises and make reception a pleasure. Made of black sponge ruber that will last for years. Can be washed with soap and water. Smooth outside surface. Light as a feather. Once worn, always worn.
No. 500 "Rico" Fonekushions, set of two.....$.50



SPONGE RUBBER

No. 500 Fonekushions, set of two ..... $.50

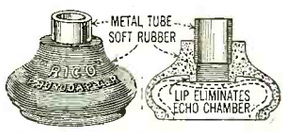
"Rico" Tuned (adjustable) Loud-Speaker Phone

This is our famous (adjustable) loud-speaker phone unit. This phone gives amazing results as a loud-talker on one and two stages of amplification. You must hear this phone to appreciate it. This unit has a rubber gasket underneath diaphragm which makes phone fully adjustable. Can be adjusted for loud or weak sounds simply by slightly loosening or tightening cap.
No. 25 Loud-Speaker Phone with 5 ft. cord $3.50

No. 25 "Rico" Loud-speaker Phone with 5 ft. cord....$3.50

"Rico" Single Phonodapter

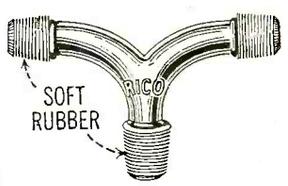
This Phonodapter fits Victrola, Columbia and Sonora phonographs. Entire adapter is made of pure rubber with a brass tube insert. Adapter will stretch over any make of phone. Note construction! No echoes due to special lip. Comes complete with brass tube insert which makes it fit any phonograph.
No. 131 "Rico" Phonodapter .....$.50



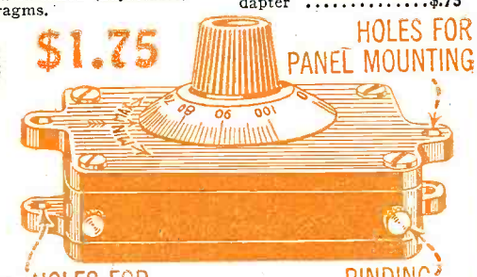
No. 131 "Rico" Single Phonodapter .....$.50

"Rico" Double Phonodapter

This handsome instrument is made of a single casting, nickel plated and highly polished. There are three generous soft rubber bushings. The Phonodapter fits all phonographs and takes any standard double head set, thereby making your phonograph a loud-talker. Made in just the right proportion to fit your head set.
No. 132 Double Phonodapter .....$.75



No. 132 "Rico" Double Phonodapter .....$.75



"RICO" STRAIGHT LINE CONDENSER

A revolution in condenser building. Simplest and most practical type of condenser as yet developed. Takes up one-third less space than mesh plate condenser. Size over all 3½"x3½"x1⅞". Lightest weight condenser made. Particularly useful for portable sets and where little room can be spared. Money refunded if this condenser is not superior to any other. Now made in three sizes to replace 43 plates, 23 plates and 11 plates.
No. 450 "Rico" Condenser .001 mfd. 43 plate cap. ...$1.75
No. 423 "Rico" Condenser .005 mfd. 23 plate cap ... 1.75
No. 411 "Rico" Condenser .00025 mfd. 11 plate cap.. 1.75
All above types without dials 1.50

Dealers and Jobbers Write or Wire for Territory that is Still Open for Proposition

SEND NO MONEY

Radio Industries Corp., R.N. 1
131 Duane St., New York City.

Gentlemen:—Please send me by Parcel Post....
"Rico" ..... for which I will pay
the postman the amount of .....
Name .....
Street .....
City ..... State .....

RADIO INDUSTRIES CORPORATION
131 Duane Street, New York City
Cable Address: Ricotrade, New York

This transmitter radiates from 25 to 30 amperes as compared with 80 amperes previously used by the spark set. However, the range of the new set, even though it uses only one-tenth of the power of the spark is about twice that of the latter transmitter. This fact was determined in a series of transmission tests in which stations on both coasts were asked to listen in. It was desired to make sure that the new set had at least the range of the old one before it took over the traffic. This cautiousness is only one example of the thoroughness of Navy radio and the shutting down of the Arlington spark is testimonial to the fact that the Navy is alive to the problem of interference with broadcast reception. As funds and conditions permit, this interference is being eliminated, always making sure that whatever changes in Navy radio material are necessary will be done with caution so as at no time to disrupt the communication needs of our first line of defense.

In closing, the writer hopes that this new transmitter will make as many friends as that older voice of NAA, the famous Fessenden spark, which has at last fallen behind the march of Progress.

A Broadcasting Station De Luxe

(*Continued from page* 874)

set or loud speaker and adjusts the amplification so that the concert program is clear to the audience at all times.

To make the program available to the public, Colonel Green has had installed a set of loud-speaking sound-projectors on a water tower a short distance from the main station, WMAF, on his estate, and there is plenty of parking space around the tower. When the outfit was first used the program could be heard for some distance outside the grounds of the estate and later the loud-speaker sound-projectors were tipped downward a little so that the sound carried only a short distance away from the tower.

Energy Values in a Broadcasting System

(*Continued from page* 873)

considerably increased energy. It is of interest to trace the various levels of energy through which the intelligence to be transmitted must pass as it proceeds from its source to its final destination.

THE TRANSFORMATION OF ENERGY

We will assume that a talk or lecture is to be transmitted: The speaker talks into a telephone transmitter in a normal tone at a distance of two or three inches from the transmitter. The power of the sound waves generated by such normal talking is of the order of millionths of a watt. How ridiculously small this energy is may be realized when it is said that the power delivered to the ordinary electric lamp is five million times as great as that of the sound waves generated by normal talking. This minute amount of energy in the sound waves is transmitted by the motion of the air to the diaphragm of the telephone transmitter. The actual motion of the air is likewise minute, probably of the order of millionths of an inch,

The Outstanding Value *in* New Kennedy Radio Sets

The new Kennedy Radio Model V is everywhere acknowledged as the one outstanding value in the radio field today.

The receiving unit in Model V is a distinct advance in radio engineering. It is a special development of extensive research in the Kennedy Laboratories and was produced in response to an insistent, popular demand for more simplified apparatus. After initial settings are made, all tuning is controlled by a single dial. Yet, with this extreme simplicity of operation the selectivity of the earlier Kennedy models has been retained. The new unit responds to all broadcast wave-lengths and operates on any ordinary antenna.

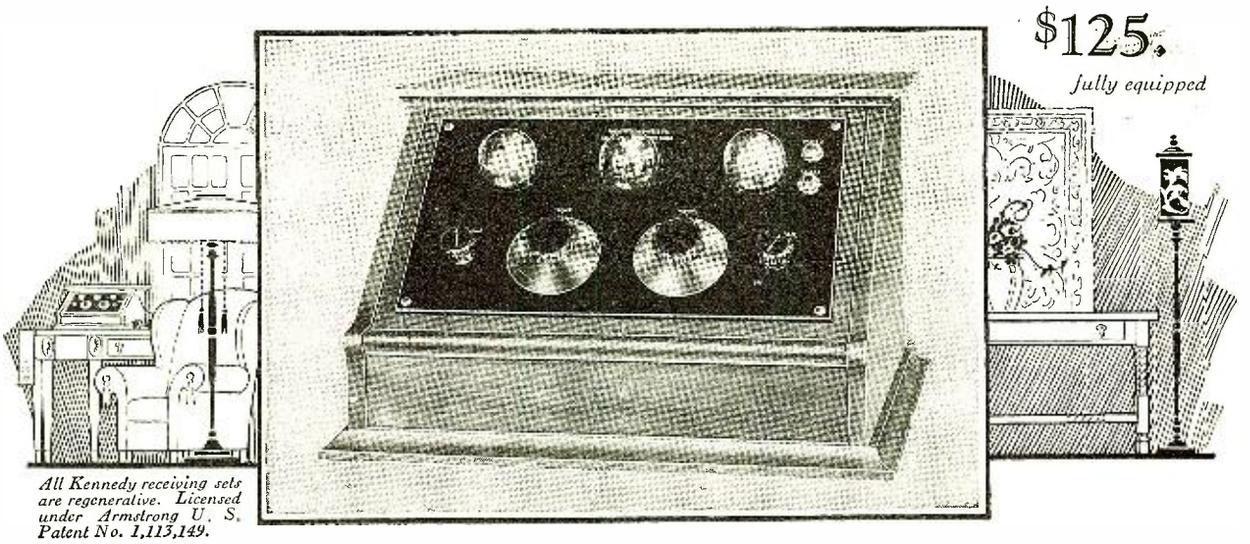
The cabinet is of solid mahogany and follows a pleasing design that adapts itself to home surroundings. Equipment includes all tubes, dry batteries, Kennedy phones and plug—batteries are fully enclosed. Price, complete, $125.00.

More elaborate Kennedy furniture models range from $285.00 to $825.00, completely equipped, including built-in loud speaker.

See the new Kennedy furniture models at your dealer or write us for fully illustrated particulars.

THE COLIN B. KENNEDY COMPANY

SAINT LOUIS SAN FRANCISCO



$125.

fully equipped

All Kennedy receiving sets are regenerative. Licensed under Armstrong U. S. Patent No. 1,113,149.

KENNEDY

The Royalty of Radio

or if we lean towards the optimistic, of the order of hundred thousandths of an inch. This small motion is transmitted to the telephone transmitter diaphragm which then moves in unison with the motion of the air. Due to the construction and mechanism of the telephone transmitter this small power of ten millionths of a watt of sound energy is converted into electrical energy having power of the order of a thousandth of a watt, so that in this instrument only, we have already magnified the originally minute sound wave energy about one hundred to one thousand times.

However, this available power is not sufficient to enable the transmission of intelligence via radio. It is, perhaps, sufficient to transmit intelligible speech over a telephone line for about 20 miles. But in the transmission over a telephone line all the energy is confined to a limited path, namely the two copper wires constituting the telephone line and none of the energy leaks out appreciably. In the case of radio the energy is diffused over enormous space, hence this energy must be still further amplified. For further amplification it is now essential to call into play the vacuum tube which is able to amplify speech energy without appreciably distorting the speech. In order to obtain the total amount of amplification required, it is necessary to divide this process into a number of steps, that is, grade the amplification. The first step consists in amplifying the above small amount of speech energy to the level of about five watts. This may be accomplished by one tube, or by a number of tubes, but the net result is the same, namely energy of the order of about five watts is now obtained. Thus in this step the energy has been amplified from approximately one one-thousandth of a watt to about five watts, giving a total energy amplification of five thousand times approximately.

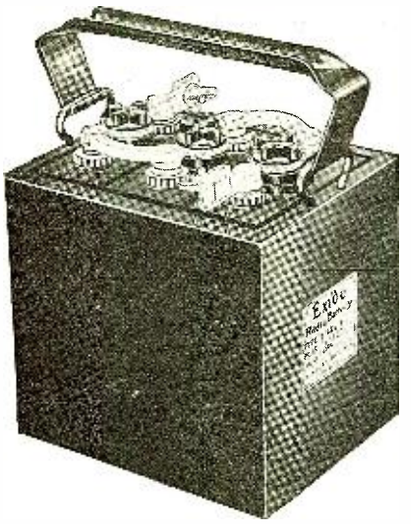
The next stage in the amplification process is that of raising the available energy to the order of 50 watts. This again may be accomplished by one or several tubes, but the end result obtained is the same, namely, the tube amplifies the five watts of speech energy put into it, to about 50 watts. Finally in the last step these 50 watts are amplified to the order of 500 watts, this being the power of the average broadcasting station. Thus, in these last two steps we have amplified the five watts to 500 watts, a total of 100 times, and these 500 watts are launched into the ether by the broadcasting antenna.

A broadcasting station starts out with speech energy in the form of sound waves, of the order of ten millionths of a watt, or about one five-millionth of the power required to light an ordinary lamp, and ends up with about 500 watts, or enough power to light about 10 lamps. The original energy has been amplified by no less than 50 million times! In spite of this enormous amplification the total power launched into space is relatively small, only 500 watts, as compared to power transmitted for lighting houses, or driving motors. This relatively small amount of power is not confined to a narrow channel or definite limited path, but is distributed in all directions, which will explain why the power falls off so rapidly as we move away from the broadcasting station.

LOSS OF ENERGY IN SPACE

Power equal to 500 watts is therefore impressed on the ether in the immediate vicinity of the broadcasting antenna, this power being in the form of electro-magnetic waves, waves similar to light waves in their properties, but tremendously

Will your battery stay for the concert?



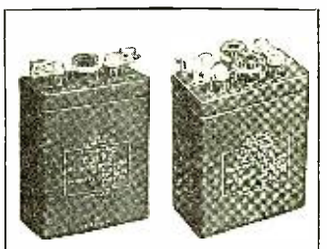
THERE is nothing more exasperating than a battery that "signs off" just when you are enjoying a splendid radio concert.

A good A battery should supply uniform filament current during a long period of discharge. Frequent recharging and replacements take all the fun out of radio receiving.

When you hook up your set to an Exide A Battery you'll appreciate what ungrudging battery service means. You'll be impressed time and again with the value of its ample capacity-rating and the smooth, unvarying flow of current that it delivers to your tubes.

Features you will appreciate

From its heavy, well-made plates to its convenient terminal binding posts, every detail of the Exide's construction is designed to help you get better reception. Vent plugs that may be inserted or removed by a single twist of the wrist make it an easy matter to add water or test the battery. A deep sediment space in the bottom of each cell eliminates danger of internal short circuits or reduced life. Wood separators of the same fine quality that are found in the Exide automobile batteries insulate the plates from one another and also contribute to the battery's long life. A stout detachable handle across the top of the battery makes it extremely easy to carry.



Two- and four-volt A batteries

Two low-voltage A batteries

The Exide line has been extended to include two low-voltage A batteries, consisting of one and two cells. They are designed specifically for WD-11 and UV-199 vacuum tubes, and are right in line with recent developments in radio receiving.

The two-volt Exide A Battery will heat the filament of a quarter-ampere tube for approximately 96 hours. The four-volt Exide A Battery will heat the filament of a 60 milliampere tube for 200 hours.

Exide B Battery

Exide B Battery

Current from the new Exide B Battery is full-powered and noiseless. It is free from fluctuations that cause hissing and crackling sounds in your phones. When you tune in distant stations you know that your satisfaction will not be marred by imitation static that sounds as though a heavy electrical storm were in progress.

You don't have to put up with a battery that discharges quickly. Go to any radio dealer or Exide Service Station and ask for Exide A and B Batteries. If your dealer cannot supply you with free booklets describing the complete Exide line of radio batteries, write to us.

Exide

RADIO BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

Oldest and largest manufacturers in the world of storage batteries for every purpose

Service Stations Everywhere — Branches in Seventeen Cities

larger in length. These waves carrying the transmitted or broadcast intelligence travel away from the antenna in all directions, giving up some of their energy to every antenna in their path. But the energy extracted from the waves by the antenna is but a very small part of the energy lost by the advancing waves. Most of their energy is lost in a natural diminution as they travel farther and farther from their source, the antenna. Just as light becomes dimmer and dimmer as we recede from the source of light, so the electric waves become weaker and weaker as we recede from the source of the waves. Furthermore these electric waves meet with numerous obstacles which extract large portions of the electrical energy uselessly. Thus the steel girders in modern buildings are consistent thieves in this respect, the energy of passing waves being absorbed by such girders and wasted in them. Also electric waves, being similar to light waves in their properties, are reflected and refracted when the properties of the medium through which they pass change appreciably. The net result of all this is that the electric waves lose the greater portion of their energy wastefully, and only a very small percentage of the total wave energy is utilized in actuating receiving sets. As a result the energy actually arriving at a receiving antenna is reduced to practically the same order of magnitude as the energy of the original sound waves, namely, the power of the receiving aerial is of the order of millionths of a watt. The actual power varies, of course, with the distance from the broadcasting station, the nearer the receiving station the greater the power received. But when appreciable distances are under consideration, say 25 to 50 miles or more, this state of affairs exists. Thus our original power of the order of a millionth of a watt was amplified several million times until it was increased to 500 watts, only to be reduced after its travel to the order of the original millionth of a watt again.

This power of a few millionths of a watt is sufficient to actuate the mechanism of the ear if only the ear could respond to the high radio frequencies employed. Since the ear cannot be actuated directly by such high frequencies it is necessary to reconvert this energy back to its original form, namely, to audible speech to which the ear does respond. The detecting device, the vacuum tube again, does this. But before it can do this the detecting tube itself must have sufficient power to actuate it efficiently, and so the receiving energy of the order of a millionth of a watt or less is amplified and then detected. When the energy finally emerges from the detector tube it is in the form of electric currents of audible frequency, and the power of these currents is of the order of thousandths of a watt, an amplification of the order of a thousand times. This electrical power of a thousandth of a watt or so is what moves the diaphragm of the telephone receivers, which moves a distance of the order of millionths of an inch. This motion of the receiver diaphragm is then transmitted finally to the air with a loss of energy. The thousandth of a watt in the telephone receivers is converted to the order of a millionth of a watt of power when transferred to the air, and this is sufficient to actuate the mechanism of the ear which now hears the original sounds as spoken in a broadcasting studio.

The illustration shows graphically how the energy level varies throughout the entire procedure; how we start with unbelievably small amounts of power of the order of a millionth of a watt, magnify it

MAGNAVOX Products

EVERY condition in the art of radio reproduction is most successfully met by Magnavox apparatus.

Reproducers

R2 with 18 inch horn $60.00

R3 with 14 inch horn $35.00

M1 with 14 inch horn; for dry battery sets . $35.00

Combination Sets

A1-R consists of Magnavox Reproducer with 14 inch horn and 1-stage Amplifier $59.00

A2-R same with 2-stage Amplifier . . . $85.00

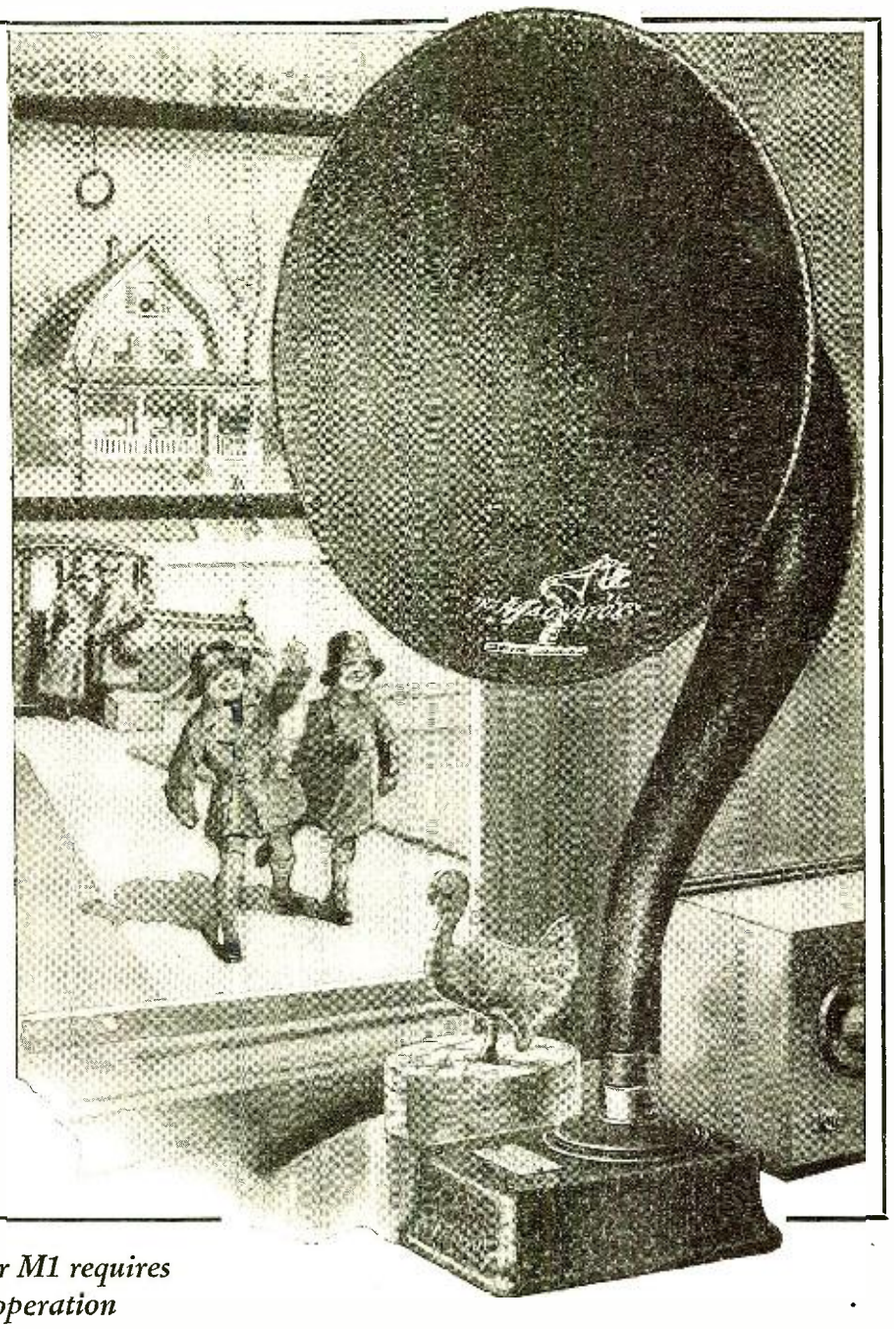
Power Amplifiers

A1-One-stage . . $27.50

AC-2-C-Two-stage 55.00

AC-3-C-Three-stage 75.00

Radio users will be sent new 32-page Magnavox Radio Catalogue on request.



Magnavox Reproducer M1 requires no battery for its operation

NO man can foresee in detail the further wonderful progress that Radio will make during the year 1924.

Among the few radio products that have passed successfully every test of actual usage for years on a large scale, Magnavox Reproducers and Amplifiers stand supreme.

The secret of their marvelous results does not lie in any *one* feature (such as the shape or material of the horn) but in the scientific working out of correct underlying principles in *all* features. To make your receiving set entirely useful and enjoyable, add a *Magnavox*.

THE MAGNAVOX COMPANY
Oakland, Calif.

New York Office—370 Seventh Avenue

Perkins Electric Limited—*Canadian Distributors*
Toronto, Montreal, Winnipeg

MAGNAVOX PRODUCTS

There is a Magnavox for every receiving set

IR

several million times to 500 watts; how it diminishes, as it travels, to its orginal level of millionths of a watt; how it is then amplified again to the order of thousandths of a watt, and then finally diminished again to millionths of a watt, its original microscopic value, but sufficient to actuate the sensitive human ear, even at distances of thousands of miles.

Measurements of Frequencies of Stations

(*Continued from page* 905)

Special attention is being given by the Bureau to the stations which do maintain such standards, and an announcement will be made later stating the degree of constancy that has been observed, so that persons may utilize the transmissions from these stations as a standard for the calibration of apparatus.

The method used by the Bureau in measuring the frequency of distant stations involves the use of a local radio-frequency generator. This is adjusted to the same frequency as the received wave from the transmitting station, this adjustment being determined by receiving both frequencies in a receiving set and varying the local generator until a zero beat note is obtained. The frequency of the local generator is then measured with a wavemeter.

Further details of the method are given in the Bureau of Standards' Letter Circular 92, "Radio Signals of Standard Frequency and their Utilization." A limited number of copies are available at the Bureau and can be obtained by those having actual use for this information.

The Radio Police Car

(*Continued from page* 870)

But radio now interests Mr. Wootton more than the systems that he has perfected. His office has all the ear-marks of an amateur wireless station. By removing the apparatus from a chair and holding it in his lap he is able to make room to sit down. No one should interpret incorrectly the use of the term "amateur" in this connection. It is the designation made sacred by the American Radio Relay League, by whom it is never, never, never applied to listeners-in, folks who copy local stations, or that kind of people. Mr. Wootton is one of those amateurs who apply the term "professional" to the next grade in a descending series. He knows where each little electron is and what it is planning to do next.

"Are the American amateurs having much success with the Armstrong super-regenerative circuits?" he asked, picking up a small suitcase.

It hurt me to do it, but I told him the truth.

"This Armstrong set looks crude, but it works all right up to a radius of 15 miles," he said, opening the bag.

The first part of the statement was correct and I took his word for the rest. No one could doubt anything Mr. Wootton said, even if he wanted to, he is so conservative and careful not to over-state anything. He would make a very poor newspaper man.

Out in the Yard is his wagon, the auto that runs 40 miles an hour while a cop inside chats with headquarters in the city, stations in the field, an airplane overhead

The size you want— the insulation you need

YOU don't need to wait while your panel is cut to order when you get ready to build your radio set. Just go to your dealer and ask for a Celoron Radio Panel. He will give you, without a moment's delay, the exact size you want. And—what is more important—you get the proper insulation for successful results in radio receiving.

Celoron is recognized by radio experts as the best material for insulation purposes. Its high dielectric strength makes it the ideal panel material.

Used by leading manufacturers

Many of the leading manufacturers of radio equipment use Celoron in making their standard parts. It is approved by the U. S. Navy Department Bureau of Engineering and the U. S. Signal Corps.

Celoron Radio Panels come ready-cut in eight standard sizes, selected to meet the needs of the set-builder. Each panel is neatly wrapped in glassine paper to protect the handsome surface.

Celoron panels are readily worked with ordinary tools at home. They are easy to machine, saw, drill, and tap.

Ask a radio dealer for one of the following standard sizes:

1—6 x 7 x 1/8	5—7 x 18 x 3/16
2—7 x 9 x 1/8	6—7 x 21 x 3/16
3—7 x 12 x 1/8	7—7 x 24 x 3/16
4—7 x 14 x 3/16	8—7 x 26 x 3/16
9—12 x 18 x 3/16	

We also furnish Celoron in full-sized sheets, and in tubes, and can cut panels in special sizes when desired. If your dealer hasn't yet stocked Celoron panels, ask him to order for you, or write direct to us, indicating by number the size you want.

Send for free booklet

"Tuning in on a New World" is the title of a booklet we have prepared especially for the radio fan. It contains a list of the leading broadcasting stations in the United States and Canada, an explanation of symbols used in radio diagrams, and several popular radio hook-ups. This booklet will be sent without charge, on request.

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

Diamond State Fibre Company

BRIDGEPORT (near Philadelphia) PENNSYLVANIA

BRANCH FACTORIES AND WAREHOUSES
BOSTON CHICAGO SAN FRANCISCO

Offices in Principal Cities

In Canada: Diamond State Fibre Company of Canada, Limited, 245 Carlaw Ave., Toronto

CONDENSITE CELORON STANDARD RADIO PANEL

or anyone officially interested in what the wagon is doing. Houseboats, canvas camps and summer cottages will go out of fashion among radio amateurs when the design of this buzz wagon becomes known. He dropped the tail board. Instead of putting one's hand on the floor, vaulting to one's knees and falling forward on one's nose, as is the custom in starting to explore the interiors of commercial vehicles, one places one's foot on a small but firmly anchored step and walks right in upright. There are comfortable padded benches to sit on.

The center of interest, of course, is the radio outfit. There is a six-valve receiver, which furnishes radio- and audio-frequency amplification enough to make the incoming voices audible above any disturbance that even a mob riot might create. The transmitter uses electron tubes also and can make itself heard at a distance of 30 miles by anyone except the London County Council, a governing body that is said to be stone deaf to anything invented since the Elizabethan Era. This is as far as any point in London County can get from any other point.

It was on Derby Day last summer that Mr. Wootton's wagon was christened. Anyone who has heard of William the Conqueror knows that on Derby Day London is as empty as a fire station with a dog fight going on outside. Everything in the British Isles except the real estate is either at the Derby or trying to get there. A Harvard-Yale football game, a Dempsey-Somebody prize fight and a Mystic Shrine national convention, if dropped into the Derby crowd anywhere, would be as relatively insignificant as a single star in the Milky Way.

Since only a very small proportion of the population of the British Isles can get within sight of the race track, the fact that it all moves in that direction must be due to habit or tradition. It is said that British subjects in India and other remote possessions get their bearings on the race track with compasses, fall toward it on their faces and pray, as Moslems turn toward Mecca at the hour of worship. There are divergent opinions as to which horse will win and these expressed in words, pounds, shillings and pence on the way to the track often lead to the temporary stoppage of traffic until the police arrive and remove the killed and wounded. The officers place their bets early in the day and leave the rest to providence while they make it the object of their lives to keep the human tide flowing in one direction without eddies or cross rips. There are not enough policemen to provide a personal escort for each costermonger and Billingsgate fish market man, so it is very necessary to locate each argument and stalled flivver quickly in order to save the dynamite that would be needed to loosen the jam if it got a five-minute start.

The Marconi Company interested itself in the problems of road traffic control by radio some time before last year's Derby Receivers tested in moving autobiles, and in airplanes, showed a strong tendency to bring in signals from magnetos, power lines, violet ray beautifiers and tram motors with intensity equal to that of voices from radio stations. The company gives Mr. Wootton credit for having provided a convincing demonstration of the practicability of a system they tried only experimentally.

Mr. Wootton's wagon sallied forth on Derby Day with two motorcycles leading the way and two more following up the rear. A radio-equipped airplane circled overhead, not being able to keep down to the speed of the machine on the road.

FROST-RADIO

Ask Your Neighbor

No. 161
2000 ohm
set $4.00

No. 171—3000
ohm set $5.00

Aluminum Shells
and Caps

He long has used this famous radio apparatus

ASK your neighbor about **FROST-RADIO**. He probably has used it for years—knows the sterling quality of every item in this famous line. Ask him about **FROST-FONES**, **FROST-RADIO** Plugs and Jacks, Jac Boxes, Extension Cords, Tuning Coils, Receiving Transformers, Rheostats, Potentiometers, Sockets, Adapters, Dials, Switches and many other high quality pieces of radio apparatus sold under the well known **FROST-RADIO** name and guarantee.

He will tell you there has never been a question about the high standard of manufacture and superb design, construction and finish of this apparatus, and that **FROST-RADIO** prices are remarkably low—so low, in fact that they are not, and have never been, an index of **FROST-RADIO** quality.

No.172
3200 ohm
set, Maroon
Bakelite Shells
and Caps $6.00

No. 162—2000 ohm set,
composition shells
and caps
$5.00

FROST FONES
(Reg. U.S. Pat. Off.)

For those who wish the economies made possible by the aluminum shell type of construction we recommend our Nos. 161-171 Frost-Fones. Have special headband. The nation's greatest headfone value. Extremely sensitive and light in weight.

No. 172 Frost-Fones, in genuine maroon bakelite, with moulded-in terminal block, have no "lead" wires. Remarkably sensitive. No. 162, Frost Fones in composition shells and caps, are greatly improved. Hundreds of thousands in use.

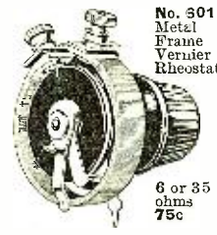
Here Are Just a Few of the New Items in the Line

NEW PLUG
FONE
LIST:
60c

Takes
2 pairs of
fones

No. 611
Bakelite UV-199
Adapter 50c

No. 608
Push-Pull Battery Switch,
Single Hole, 30c



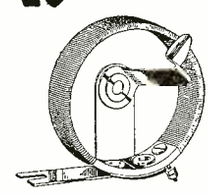
No. 301
Metal
Frame
Vernier
Rheostat

6 or 35
ohms
75c

FROST-RADIO

Your neighborhood dealer handles **FROST-RADIO**. No matter where you live you can secure promptly from him any of the 17 new items of this well known apparatus—as well as **FROST-FONES** and *all* of the 69 different pieces which comprise **FROST-RADIO**. Get in touch with your dealer today.

FROST RADIO



No. 630
35 ohm Resistance
Unit, adjustable
25c

HERBERT H. FROST, Inc.

154 WEST LAKE STREET, CHICAGO, ILLINOIS.

30 Church Street, New York **550 Gates Bldg., Kansas City, Mo.**

Builders of Radio Apparatus that is the Acknowledged Standard of the World

Auto and wagon kept in touch with city and field headquarters and with each other. To prevent interference and to provide a measure of secrecy, the transmitters employed widely different wavelengths. For example, the radio patrol wagon might transmit on 300 meters and listen in on 700. No radio eavesdropper could get both ends of their conversation without two receivers.

Before long, the airplane began reporting blocks in the traffic. The snorting motorcycles plowed furrows through the mass of motor vehicles, hansom cabs, two-wheeled carts, prams and pedestrians. Mr. Wootton's wagon followed, and in nine cases out of ten it was found that there was no block. The situation was quickly analyzed. The airplane observer, traveling at a high rate of speed, would see the traffic halt. Not seeing it move again while he was near enough to have a clear view, he would believe that it was blocked. In this manner every halt to let a chicken cross the road was developed into a case requiring the attention of the patrol wagon. This experience disqualified the airplane as an auxiliary in the handling of road traffic, but the usefulness of the radio wagon with its motorcycle aides was so well proven (two fires being extinguished and other emergencies being promptly met), that four others will be on the job next Derby Day. Of course, all will be used for other purposes also, but Derby Day is the big annual test of police efficiency.

The auto that gave such good service this year carries a specially designed aerial on a frame that is lowered forward or backward by means of a lever. The change in the height of the aerial in passing under bridges or trees did not interfere with the transmission or reception of messages. The four wagons that are being built will each have four telescoping masts, one on each corner, raised and lowered together by geared wheels. These masts, when fully extended, will raise the aerial higher than the frame now in use, giving greater radiation, longer range and increased efficiency in both transmitting and receiving.

The new cars will be full of improvements and new features. The top will be high enough to permit a full-sized London Bobby—and, my eye, but they are tall!—to stand straight. In the rear there will be an observation post, slightly elevated, for the man who manipulates the aerial. At his hand will be one of those handles that a steamship pilot pushes, with a dial showing where to set it for "Full speed ahead," "Half speed ahead," "Half speed astern," and "Stop for tea." This will connect with a similar dial and indicator on the dash, just like the one in the steamer's engine room, so that observer and chauffeur will work in harmony.

To take care of any overhanging branches too low for the aerial to dodge, there will be a long hook-shaped knife. The radio operator will occupy a seat in the front of the enclosed body and through a hinged window, normally closed by a spring, he will be able to communicate with the men on the driver's seat. There will be tables that let down from the sides. Food, water and first-aid materials will be stowed in convenient places. Once in the Derby Day stream of traffic, the police patrol must stay in. It is either a hot and dusty 24-hour day or a wet and muddy one. But those who ride in Mr. Wootton's wagon will be comfortable whatever the weather may do. Judging from the long, clean record of Scotland Yard, it is safe to predict that they will also be courteous and efficient.

SUPER-HETRODYNE

The World's Best Radio Receiver

BY PERFORMANCE

ADVANTAGES NO OTHER RECEIVER CAN EQUAL

1. UNIFORM EFFICIENCY over the entire wavelength range of 160 to 850 meters. This means that all stations, Radiophone Broadcasting, Amateur and Commercial within this wavelength range, will be received with maximum intensity. This very desirable feature is not obtainable by any other practical method using Radio Frequency amplification.

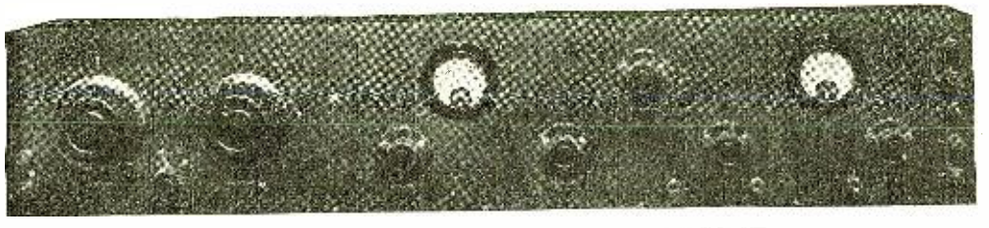
2. SELECTIVITY by this system, greatly exceeds that obtained in all other methods of reception. Using the Model "C" with a loop in the Suburbs of New York, WOR 15 miles distance, operating on 405 meters, can be completely eliminated, and PWX 1300 miles distance operating on 400, can be received on a loud speaker. This holds true on an average cool night. There is no telegraphic interference from 200 meter amateur stations or 600 meter ship stations.

3. SIMPLICITY to change from one station to another, there are only two dials to vary. The two dials can be calibrated for all the various stations, as there is only one best position for each station.

4. AMPLIFICATION is much greater than obtainable in any other standard receiver. Total is as follows: 1st the Heterodyne Amplification in the 1st Detector; 2nd, the Regenerative Amplification in the 1st Detector; 3rd the 3 stages of Tuned Regenerative Radio Frequency Amplification; working at a low advantageous frequency; 4th, the second Detector action, and 5th, the two stages of low ratio distortionless audio frequency amplification.

5. RECEIVING RANGE other factors correct, the receiving range is in proportion to the effective radio frequency amplification applied. As this receiver has much greater effective radio frequency amplification than all others, the range is proportionally greater.

"THE ROLLS-ROYCE OF RECEPTION"



MODEL "C" SUPER-HETERODYNE

Wavelength Range 160 to 850 meters. Tubes. 2 Detectors, Oscillator, 3 Tuned Radio Freq. Amplifiers, 2 Audio Amplifiers.

The Super-Heterodyne is the most efficient method of short wave radio frequency amplification known. It is used extensively by the Commercial radio companies and various governments, when it is necessary to receive over extremely long distances, without interference from near-by stations.

The remarkable results are due to the Super-Heterodyne action, which is briefly as follows: the incoming signal, which may be any wave from 160 to 850, is changed thru the use of a local oscillator, to a wavelength of 10,000 meters. At this wavelength an exact duplicate of the original signal is amplified at radio frequency with the very highest efficiency possible, rectified and amplified at audio frequency.

During this change a very high degree of selectivity is secured, due to the amplifier, which is designed to pass nothing but 10,000 meters. Accordingly while there may be ten or more signals in the loop, only one will be received at a time, the one that the oscillator heterodynes thru the amplifier.

Complete Constructional Blue Prints Consisting of Two Sheets 50x21" and Two Sheets 27x21", Our Numbers 30141-145. $2.00 Postpaid.

Experimenters Information Service

Designers of the Highest Class Radio Apparatus in the World

531 West 46th Street :: :: New York City

Correspondence from Readers

(*Continued from page 910*)

RADIO SOLD MUSIC TO HIM

Editor, RADIO NEWS:

I most heartily agree with you in your stand on broadcasting music, and positively disagree with those who say the broadcasting of their music is detrimental to the sale of that certain selection either in record, sheet music, or roll form. I have bought numerous records that I became acquainted with through radio broadcasting. One in particular was Mr. Gallagher and Mr. Shean; the first time I heard this piece I did not like it. The second and third times I heard it I did not care for it, *but they kept on playing it until I learned to like it and then I bought the record.* Numerous other records, about 15 or 20, were introduced to me in this manner.

I believe that in a period of less than five years music dealers *of all kinds* will be glad to pay high prices to have their music broadcast. I even believe that large music concerns will install powerful broadcasting stations so as to present their music to the public. Radio broadcasting from one small station often brings more results than advertising in a large magazine.

JOHN J. WARMUTH.

TO THE POINT

Editor, RADIO NEWS:

Although I have been a reader of your Magazine for some time, this is my first "explosion", but I couldn't hold in any longer.

In your November issue I read and thoroughly enjoyed an article on "Audio Frequency Transformers," illustrating their comparison with charted curves and also giving different constructions. In all such articles, no matter what the publication, no mention is ever made of the make of instruments on which the tests are made. One can write these different publications for information regarding the best makes of transformers, condensers or whatever instruments are used and they all consider it bad policy to mention or suggest any specific make. It is just this that I am on the warpath about. It seems to me that when such tests are made, if those proving best were mentioned, we would all be enlightened a bit. If the manufacturers involved are afraid of such tests, let them build instruments that they will not be ashamed of. Those whose instruments stand highest should be glad of such tests and it would make the others sit up and take notice. They would either have to improve their goods or go out of business from *lack* of business at some time in the future and that not so far off either. It seems to me that this would bring better quality to the market. If some manufacturer thought the test unfair let him prove the quality claimed for his goods and then we would also learn something in the testing line.

Some make the cry, "get this information from your radio dealer," and what kind, as a rule, of radio dealer have we? In a nearby town the situation is this: In a certain radio store there is a man who is referred to as the official radio man and is consulted both by the store and customers on all subjects pertaining to radio. He considers himself an Electrical Engineer. Now I have had an education in Mechanical and Electrical Engineering but have not followed it, so at the present time, I can't see where I have the right to call myself an Electrical Engineer. The person above mentioned would be lost if he were called upon to solve a problem in trigonometry, much less any of the higher mathematics. His radio education has been obtained from radio publications. I don't mean to "slam" your publication for it is the

IMPORTANT

Any individual part in any of the 6 outfits below may be purchased separately at the special reduced prices listed under column headed "Our Price."

BUILD THOSE SETS NOW!

Now's the best time and here's your best opportunity. Look these six complete outfits over carefully. Did you ever see anything to beat 'em anywhere for both quality and price?

PANELS DRILLED

Specially drilled panels are included with each outfit. No additional charge for drilling.

COMPLETE INSTRUCTIONS

for assembling, and blue-prints for wiring are included with each outfit. Instructions written so everyone can understand them. No special skill or technical knowledge required—a few hours and you're ready to tune-in New York, Los Angeles—any of 'em.

Western Electric

VT-2 TUBES

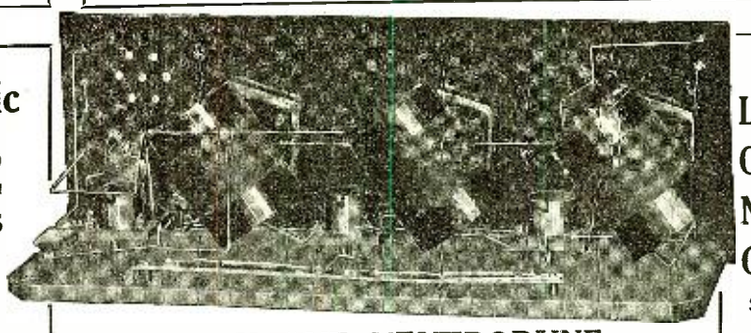
CW 931
5 Watt
"E" Tubes

$7.45

About 1/3 of these 10,000 brand new, genuine Western Electric VT-2 Tubes that we bought from the U. S. Signal Corps have been sold. Radio men know that a genuine VT-2 Tube for $7.45 is an unusual opportunity—a real "find"! These tubes may be used for RF and AF amplification and for CW, and phone transmitting. They have a higher amplification factor than any tube made!

Not Navy rejects—sold only as a surplus.

Characteristics: Filament 6 volts, current consumption 1 amp., plate potential 22.5-350 volts.



HAZELTINE NEUTRODYNE

FREED-EISEMAN OR FADA LICENSED PARTS

1 7x21x3-16 drilled formica panel
1 Howard rheostat
3 4" Radion Dials
3 John Firth Bakelite Sockets
8 Binding Posts
3 23 Plate Variable Condensers
1 Wave Control Neutroformer
2 Radio Frequency Amplifying Neutroformers
2 Grid Neutralizing Condensers
1 .00025 Micon Condenser
1 Marco Variable Grid Leak
1 Base Board for mounting 25 feet tinned copper bus bar wire and complete instructions for assembling and wiring.

$28.60

4 tube set $44.65
5 tube set $46.25

Automatic Electric LONG RANGE

$10.00 Value Headsets

$3.65

These headsets were formerly sold by the Automatic Electric Co., makers of telephone exchanges, at $10 each. We bought their entire stock—40,000 phones—paid spot cash and because of this buying power (unequalled elsewhere in the radio field) we are able to offer you a $10 headset for $3.65.

30 years of experience have produced the Automatic Headset. Coil is wound with about 6500 turns of No. 40 enamel coated copper wire. D.C. resistance 1600 ohms. Impedance at average music and voice frequency (800 cycles) 21,000 ohms. (Effective impedance rather than D.C. resistance is the big factor in a good headset.)

ERLA SINGLE TUBE REFLEX

CONSISTING OF	Our Price
1 Variocoupler	$3.45
23-Plate Variable Condenser	1.45
2 Erla Sockets	1.30
1 Erla Reflex No. 1 Transformer	4.45
1 Erla A. F. Transformer	4.85
1 Erla .002 Mica Condenser	.30
1 Erla .001 Mica Condenser	.30
1 Erla .00025 Mica Condenser	.25
1 Erla Fixed Crystal Detector	1.00
1 Howard Rheostat	1.00
2 Bakelite Dials	.50
8 Binding Posts	.40
1 Dozen Switch Points and 4 Stops	.30
2 Switch Levers	.50
1 6½x14x⅛" Formica Panel	1.37

Our Price **$20.90**

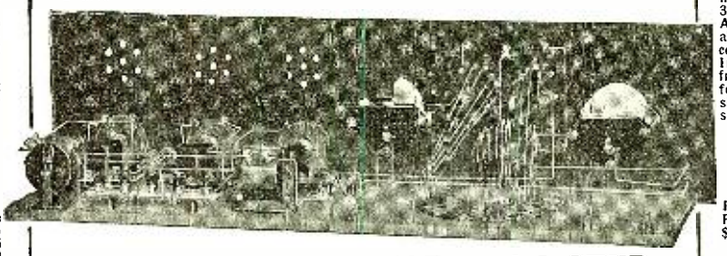
2 STAGE AMPLIFILR

To amplify Ultra-Audion, Reinartz, Flewelling, Knocked Down Short Wave Receiver, Crystal or any receiving set so that loud speaker or phonograph can be used in place of headset.

CONSISTING OF

Reg. Price		Our Price
$1.05	7x9 Formica Panel (Other suitable size)	$ .95
4.75	High Ratio All-American or Thordarson Transformer	3.95
4.50	Low Ratio All American or Thordarson	3.95
2.20	2 Howard Rheostats	2.00
2.00	2 Bakelite Sockets	.90
3.00	3 Double Pacent Jacks	1.50
1.30	13 Binding Posts	.65
.30	Baseboard	.15

$21.00 Our Value Price **$12.95**



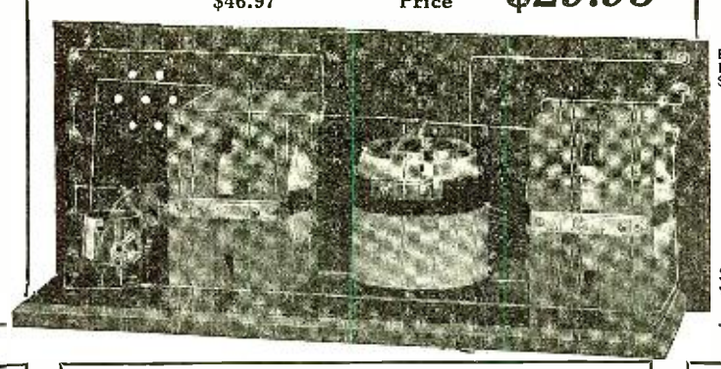
REINARTZ DETECTOR and 2 STEP

Reg. Price Each		Our Price EACH
$6.00	1 Drilled Panel 7x28x 3/16 inch	$3.92
2.50	1 Reinartz Spider Web Coil	1.95
6.00	1 23 Plate Vernier Condenser	3.45
5.00	1 11 Plate Vernier Condenser	2.95
1.50	1 Howard Vernier Rheostat	1.35
1.10	2 Howard Plain Rheostat	1.00
.75	3 Firth Sockets	.35
2.00	1 Variable Grid Leak and Condenser (cartridge type)	1.40

Regular Price $46.97

Reg. Price Each		Our Price EACH
$4.75	2 Transformers (All American 10-1 and 3-1 or new type high and low ratio Thordarson)	3.95
.10	7 Binding posts	.05
.40	2 Dozen Switch Points	.20
.02	6 Switch Stops	.01
.50	3 Switch Levers	.25
1.00	2 Bakelite Dials	.25
1.00	2 Double Circuit Jacks	.50
.65	1 Single Circuit Jack	.35
1.00	1 Baseboard	.50
.75	Blue Print for Assembly	.50
.50	25 Feet Tinsel Wire	.25

Our Special Price **$29.95**



COCKADAY RECEIVER

Regular Price		Our Price EACH
$3.00	1 Cockaday Coil	$1.95
1.00	2 Bakelite Dials	.25
1.00	1 John Firth Socket	.45
1.00	Freshman Grid Leak and Condenser	.65
1.50	1 Howard Vernier Rheostat	1.35
1.00	1 Pacent Double Circuit Jack	.50
.80	8 Binding Posts	.05
.04	7 Switch Points	.02
.50	1 Switch Lever	.25
	1 7x14x⅛" Formica Panel	1.44
	Blue Print and Wire	1.00
	1 Baseboard	.25
3.30	2 23 Plate Condensers	1.45

Our Price **$11.95**

KNOCKED-DOWN SHORT WAVE RECEIVER

Regular Price	(See illustration to left) CONSISTING OF	Our Price
$10.00	2 Variometers	$3.90
5.00	1 Variocoupler	1.75
3.00	3 Bakelite Dials	.75
1.00	John Firth Socket	.45
1.10	Howard Rheostat	1.00
4.50	Mahogany Cabinet	2.95
2.25	Genuine Formica Panel	1.75
.80	8 Binding Posts	.40
.50	Switch Lever	.25
.40	12 Switch Points	.20
1.00	Freshman Grid Leak and Condenser Combined	.65
1.00	Complete Drawing for Assembly and Wiring	.50

$25.85 Our Value Price **$13.45**

Send For Your Copy Today See Coupon—

We Guarantee all our merchandise to be of the BEST QUALITY

CHICAGO SALVAGE STOCK STORE

Mail Orders Given Immediate Attention

509 S. STATE ST. Dept. RN-1 CHICAGO

CATALOG COUPON

Send this coupon and 10c (coin or stamps) for a copy of our big, new 48-page catalog. Contains 10 complete receivers like these listed above—hundreds of bargains in parts that HAVE not and CAN not be equalled elsewhere. Fill out and mail this for your copy today!

Name .....

Address .....

City ..... State.....

best and has helped me, helped him and all the rest who read it, but frankly, is this the fellow who is fitted to advise others? Think it over.

I am just an ordinary BCL and am speaking from that viewpoint as I see it, and it seems to me that the greatest cry from the BCL today is HELP! He is here to stay and you may just as well make the best of this evil; help of the proper kind will advance him. It won't do any good to try setting him back. This right kind of help is helping him to learn to select the best instruments as well as the proper way to use them.

If I am wrong in the way I look at the situation I am only too willing to give in when shown the right way, so let's hear from some of the rest of the fellows on the subject.

Good luck to the "Hams," for they have certainly helped me and will always hold a place of esteem with me.

GLENN O. SLIGH.
San Gabriel, Calif.

[*If you want to know which transformers and other instruments are of high grade, we would suggest that you read carefully the Radio News Laboratories Dept. in each issue of this Magazine. You will find described, and illustrated there all the apparatus which are submitted by manufacturers and are tested by ourselves.*—EDITOR.]

IT CAN BE DONE

Editor, RADIO NEWS:

We handle drugs, but if that were all we depended upon, we would starve to death, drugs being the smallest part of our business.

We sell radio sets and install them, we also sell Edison and Victor phonographs.

Last spring when the Night Hawks at Kansas City played and sang, "Yes! We Have No Bananas", via radio, we had a large audience in the store and that same night we received orders for seven records of that title to be delivered when they were available.

We do not sell sheet music but had a great many inquiries for same. All through radio.

The population of Barrett, Minnesota, according to the latest census, is 278.

C. L. JARENS,
Barrett, Minnesota.

RECEPTION IN ENGLAND

Editor, RADIO NEWS:

The following results may be of interest to the stations concerned. The apparatus used was a single valve regenerative set with dull emitter (oxide coated filament) and only 30 volts on the anode. For indoor aerial work the set is made to super-regenerate by simply switching in the low frequency oscillator coils.

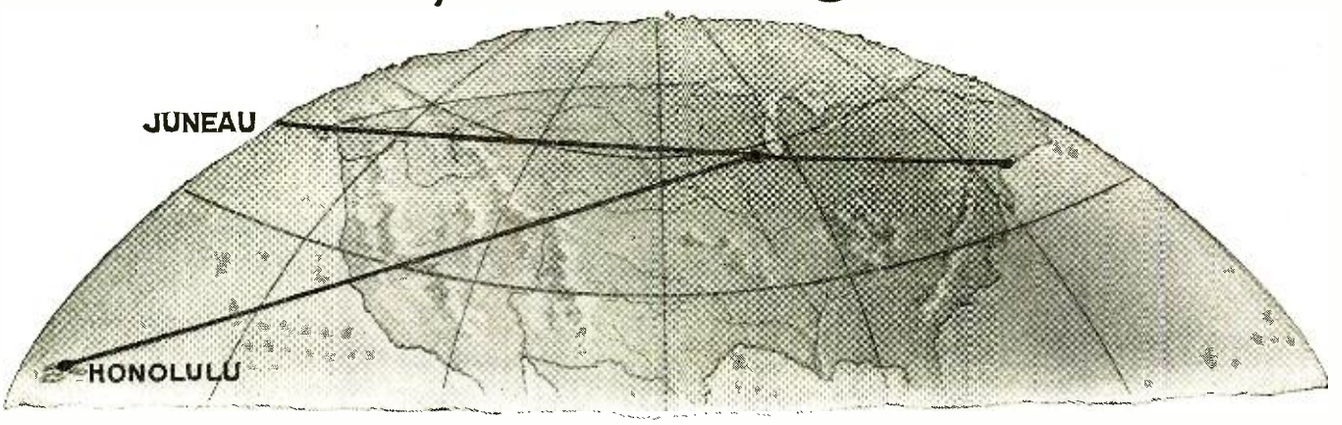
Super-regeneration is never used with the outdoor aerial as it brings in QRN too badly, and in any case results are not much improved.

The outside aerial is a 60′ single wire, with a 20′ lead-in, average height 4′, and very badly screened. I will not give all the stations received on the outside aerial as these are numerous, but will confine my remarks mainly to indoor aerial work.

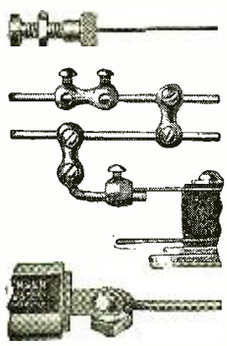
I switched on my set about 4:45 A. M., G.M.T. on Sept. 17, and on the main aerial very soon logged 2RU (who is by far the strongest and most frequent of the American stations I hear) 1RW, 2AGB, 1FB, etc. I then switched over to a steel bed spring aerial which was simply standing in the room, about 5′ from the set. With super-regeneration 2RU was immediately heard, and very soon afterwards 1RW.

To prove that these results were capable of repetition, I tried again on Sept. 18. On main aerial at about 5:20 A. M. the usual stations 2RU, 8ADG, 2AGB, 1FB, etc., were heard. On the steel spring aerial 2AGB and

From New York to Honolulu
With Erla Synchronizing Transformers



Unequaled range and power, over a waveband of 200 to 700 meters, is assured by Erla synchronizing reflex transformers. List, $5 each



Erla solderless connectors eliminate dangerous, difficult soldering, speeding up and simplifying apparatus assembly. List, 3c to 5c each

Solve crystal troubles by installing an Erla fixed crystal rectifier. Once installed, no attention is required. Jolt and jar proof. List price, $1

Erla is the only condenser guaranteed to test to the exact capacity for which it is marked. Made in eleven sizes, 30c to 75c each

"All U. S. Stations on Loud Speaker, Using Only Three Tubes"

Typical of the thousands who have discarded complicated multi-stage receiving units in favor of simple, efficient Erla reflex design, is the experience of J. G. Hamock, 1917 So. Western Avenue, Chicago, who writes:

"During my first week with your three-tube hook-up, tuning through high power Chicago stations, I got Jefferson City, Dallas, Memphis, Atlanta, Omaha, Kansas City, St. Louis, New York, Springfield, Pittsburgh, Harrisburg, Louisville, Cincinnati, Fort Worth and Tampa.

"The Sunday following I added Fresno, Denver, Astoria, Los Angeles; Honolulu, Hawaii Naval Maneuvers; and Juneau, Alaska, the Alaska Electric Light and Power Company.

"The United States Stations all were clear on the loud speaker. Also I re-tuned every station by checking them with my twelve-year old son, who would get them on the re-tune, whereupon I would, when required, sharpen the re-tune myself."

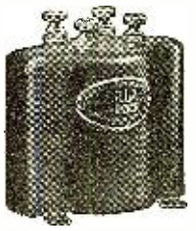
Such power, selectivity and ease of control, with three tubes, are attainable only through Erla reflex design, incorporating Erla synchronizing r. f. and a. f. transformers.

Guaranteeing the perfect synchronization of received and reflexed currents having the same phase characteristics, Erla transformers enable vacuum tubes to do triple duty, as simultaneous amplifiers of received radio frequency, reflexed radio frequency and reflexed audio frequency currents.

For complete details, ask your dealer for Erla Bulletin No. 14, giving Erla one, two and three-tube reflex hook-ups. Or write direct, giving your dealer's name.

Electrical Research Laboratories
Dept. C. 2515 Michigan Avenue, Chicago

ERLA



Unduplicated amplification without distortion enables Erla audio transformers to improve any receiving unit. Ratios: 3½ and 6 to 1. $5

Attractive Erla telescoping bezels, in bright nickel or dull black enamel, fit any ⅛" to ¼" panel. Made in 1" and 1½" diameter. List, 20c

Mechanically and artistically, Erla sockets occupy first place. Heavy, triple nickeled shell on polished Radion base. List price, $1

Erla plugs handle two sets of phones, without cutting or changing the phone tips in any way. Exquisite workmanship throughout. 75c ea.

2RU were heard. Encouraged by these results I determined to try a loop. On the 19th, on the main aerial, a very loud station was heard sending 2WQY "Bishops Rock." Then 1AR, 1CMX (or 1CMK), 2RU, etc. I then switched over to a 3' loop which simply stood on a shelf, no earth connection being used. On starting super-regeneration 1CMK and 2RU were immediately heard. During these tests with indoor aerials it made no difference whether the outside aerial was "earthed" or not. May I claim that to receive American amateurs on such simple apparatus and indoor aerial on three consecutive nights is a record?

I have had great success in the reception of your broadcasting stations, particularly on the mornings of Sept. 21 and 22. The apparatus used was the single valve set mentioned above, without super-regeneration, which I find of no use for this work. Stations WGY and WNAP are the loudest heard as yet. On the 21st I heard almost every word of a lecture from WGY on the batteries used in the home radio set. Also on the 22nd the orchestra playing "Kathleen Mavourneen" and the song "We Ramble All Around" were received here with wonderful clarity. On this occasion I switched over to the loop, leaving the earth wire connected, and succeeded *in hearing faint music from WGY on loop and one valve.* Of course, it was extremely weak and disappeared altogether when earth wire was removed.

I should be interested to hear from 2RU and any of the other stations heard. Also particulars of their radiation, etc.

RICHARD H. MCCUE,
Ass't. Hon. Sec'y Clapham Park Wireless Society,
50 Cloudesdale Rd.,
Balham, London S.W. 17,
England.

FOR THE FOURTH TIME, WHY NOT?

Editor, RADIO NEWS:

It has often occurred to me to wonder why some of the broadcasting stations in the States do not put a key in the circuit to break the continuous wave carrier, and between selections honor us with their call, on C.W.

The prevailing atmospheric conditions of this part of the world make it at best very difficult to tune in concert stations, and after having succeeded in doing so, it is natural to wonder who it is. After the selection is finished, the announcer mumbles something, usually almost inaudible, and very seldom intelligible. On a slight increase of regeneration the carrier wave is very loud, and if the call were sent on it, I am sure it would be appreciated by far off listeners who read the code.

We hear KDKA and PWX almost nightly, and WGY frequently, and many others, which for the reason mentioned we have not been able to identify.

H. I. HALL,
Coco Solo, C.Z.

INFERIOR GOODS

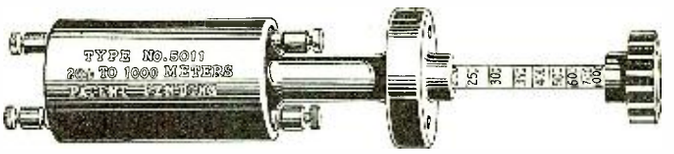
Editor, RADIO NEWS:

It is certainly disgusting to walk into a radio store, ask for a piece of good merchandise, and be shown a 5 and 10-cent article. Yet this has happened to me many times. Many dealers make regular trips to the 5 and 10-cent stores, purchase inferior material and try to sell it in their stores as first-class material.

I am not trying to knock the 5 and 10, but I do not think it fair to the buying public that this should continue.

Another point: I would like to warn "fans" not to buy tubes without carefully

Get Greater Pleasure From Your Radio Set



Coast To Coast Reception

Coast to Coast reception is made possible with DAY-FAN Tuned Radio Frequency Transformers. Instantaneously adjustable to any Public Broadcasting Wave Length. The Wonder Instrument of the year. Model 5011— $6.00

Without Distortion

Music and Voice—Clear and True. DAY-FAN Audio Frequency Transformers faithfully amplify Concerts, Speeches and all broadcasted entertainment.

Model 5002—9 to 1—$5.00
Model 5026—4½ to 1—$5.00

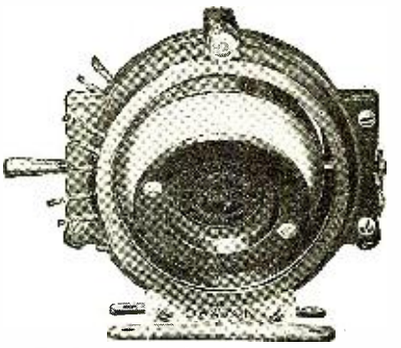
Audio Transformer

For All Wave Lengths

180 to 710 Meters—the tuning range of the DAY-FAN Bank Wound Variocoupler includes all Public Broadcasting Wave Lengths. Don't limit yourself to a narrow band of entertainment. Model 5010—$8.00.

There are many more DAY-FAN Radio Units, all just as necessary and efficient as those mentioned above. Before you complete your set, get our descriptive booklet, free. Use DAY-FAN radio parts, and be assured of getting the utmost in pleasure and satisfaction from your radio reception.

Jobbers—write for our cooperative advertising plan.



Bakelite Variocoupler

THE DAYTON FAN AND MOTOR COMPANY

Established 1889

DAYTON OHIO

looking them over. There are a great many dealers who sell bootleg tubes. I am not going to mention any names, but I overheard a conversation between a general manager of a reliable firm's store and his intimate friend. The friend said:

"Are those tubes bootleg?"

"Yes," was the answer, "all of them handle them, so why shouldn't I"

"Where do you get them?"

"Oh! A fellow comes in every once in a while."

From the rest of the conversation I intimated that he sells these tubes instead of genuine ones supplied him by the firm. He then also sells the genuine tubes and makes a good deal of money for himself. I happened to get a look at the tube and the base bore the inscription: "Federal 1½-volt." It had a silvery coating and was very small, with a standard base.

I would like to hear from other fans regarding these matters.

FRED ALEXANDER,
148 Rogers Ave.,
Brooklyn, N. Y.

SOME LIGHT ON THE SINGLE CIRCUIT RECEIVER

Editor, RADIO NEWS:

Regarding the very interesting fight some of the correspondents to RADIO NEWS are waging I would like to say that, for one who is able to sift the meat from the pure out and out bunk, the expressions are very interesting. Some one speaks a little, very quiet, favorable word for that much abused little single circuit receiver and immediately from all corners of the Nation come a bunch of slaps in the form of letters from folks who go by the name of Hams, Amateurs, Experimenters or John Doe. Once in a while some man who really knows something about the subject he is writing the letter to us folks about, gives us some real information about the single circuit receiver. Such for instance, as Mr. E. Peacox, Yonkers, N. Y., in the October issue of RADIO NEWS.

Now come on everybody and get the clubs and rocks ready. (I am an old confirmed advocate of the single-circuit receiver). Now since I so far have not been killed for that remark and will have a chance to hide by the time you get started I will tell you why I favor that type of receiver, for my own use:

First—If it is constructed properly it is easy to handle.

Second—It gives more volume per unit of signal voltage in the receiving antenna. Therefore distance and volume.

Third—It is extremely sharp if properly constructed.

Fourth—It is stable.

The first reason requires no explanation as I think everyone knows how easily a single circuit receiver tunes.

The second requires a little concise explanation. The signal voltage impressed upon the input circuit of the audion depends directly upon the total resistance of the input circuit, which includes the antenna, tuning inductance, tuning condenser, ground and the input leads to the audion. This resistance is not the ohmic resistance, but is the impedance offered by that circuit to the alternating voltage of the frequency to which you wish to tune the circuit, or in other words the *effective resistance* at that frequency. You cannot, under any circumstances or conditions, reduce the effective resistance of that circuit by the addition of additional circuits which introduce other inductance or capacity into the input leads to the audion. This resistance is the single circuit brings in loud signals.

Third: The only way to increase the sharpness of the resonant peak curve assuming that the circuit is already tuned to resonance is *to decrease the effective resistance.* This can be accomplished by reducing the distributed capacity of the circuit, also by increasing

You'd Smile, Too!

Who wouldn't wear a broad grin if someone gave him for Christmas a set of radio batteries that would put an end to a lot of those frying, crackling noises; would bring in distant stations more clearly, and would make it unnecessary to buy batteries every little while?

Willard Rechargeable Radio B Batteries do all of these things and more—and they last for years.

Sixty-six broadcasting stations, including many of the most powerful, use Willard B Batteries. The improved results they get can be duplicated with your receiving set.

With all of their advantages, Willard B Batteries cost little and greatly reduce battery expense.

Sold by Willard Service Stations and Radio Dealers. The Willard Dealer will be glad to give you a copy of the interesting booklet, "Better Results from Radio", or send direct to Willard Storage Battery Company, Cleveland, O.

Willard
Rechargeable Batteries for Radio

For Peanut Tubes

A leak-proof, noise-free storage battery that costs little, lasts for years and has many advantages over the ordinary peanut tube battery. See your Willard Dealer, or send for descriptive literature.

Willard B Batteries

Willard Rechargeable B Batteries are made in 24 volt or 48 volt units, each type in two capacities, 2,500 and 4,500 m. a. h. Glass jars enable you to see the condition of your battery at all times and help prevent electrical leakage.

Willard A Batteries

Good A Batteries are as important as good B Batteries. There are several types of Willard A Batteries in a range of prices, including the Willard All-Rubber A Battery, with rubber case and Threaded-Rubber Insulation. Five sizes, 20 to 125 a. h.

the surface area of the wire in the tuning inductance without increasing the cross sectional diameter of the wire itself. If Litzendraht wire is used for the tuning inductance coil, and if every one of the strands are in the circuit, you have attained precisely the result you have been aiming at. If you plot a resonance curve for the above circuit you will find it has a very sharp peak when compared to a coil of solid copper cotton covered wire of the same size. The effective resistance for a 200-meter wave is only 50 percent.

Fourth: It is stable because it is the simplest form of resonance circuit and once tuned properly will stay put. Anything causing a variation or fading of signal on a single circuit comes from outside, 99 times out of a hundred.

Last, I would like to ask anyone who is interested enough to enlighten me how in the world you can make a two or three circuit receiver more selective to DX or weak signals when the very principle of the loose coupling is to weaken the incoming signals to the point where the interfering signal is of such diminished strength that it does not operate the input circuit of the tube and, therefore, leaves the stronger signal to function. If some very distant station has a very powerful transmitter and is able to drown out some local transmitter I can see where you increase the selectivity with a double circuit set. I am open to conviction on this subject from anyone, but please give me some facts and forget the usual form of bunk. And, by the way, don't tell me to learn the telegraph code so I will be more interested. That's the way I have earned my bread and butter for the last 16 years and I think I know it pretty well. At least I am getting by with it anyway, and they pay me for it. Now I know I will have brickbats, paving bricks and alley apples coming at me like a hail storm but they won't worry me a bit. If any one tells me some real facts, I can assure you I will absorb them like a sponge and I will thank you for the favor. But you will have to give me the precise instructions to construct a receiving set that will reach out and pick broadcast from the four corners of the North American continent on detector tube only and one that will, with a variation from minimum to maximum of the vernier plate of the tuning condenser, through the terriffic scramble we had last winter on the 400-meter scale, tune in and out with perfect ease, 11 stations scattered over the U. S. and Cuba, from Fort Wayne, or you will have to fix it. My single circuit does that as if there were nothing to it at all. I am open to constructive criticism, but I will enjoy the bunk also, so let it fly.

W. C. Abele,
1016 Putnam St., Fort Wayne, Ind.

MORE ON THE SINGLE CIRCUIT

Editor, Radio News:

Here is another old-timer to stick up for the humble single-circuit receiver. I am not an amateur, but it is solely because too much of my time is occupied in operating some one else's apparatus.

It has been my experience that a properly designed barrel receiver is amply selective even for commercial work. I freely admit that the circuit has a strong tendency to reradiate, if improperly handled, but this tendency is also found in three-circuit receivers. One can spoil the neighbor's evening with a Paragon, or a CR-3, or even with a test buzzer and a rock detector.

I refuse to commit myself as to the relative sensitivity of the two popular circuits, but a single circuit tuner of very ordinary construction actually outheard a standard make of three-circuit receiver, using the same antenna, the same tubes, and the same telephones. Both sets were handled by experienced operators. Signals that were ab-

Brandes

Table-Talker

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

Everybody-listen in!

"Tune" with your *Matched Tone* Headset. Then let the family listen with a Brandes *Table-Talker!* The perfect combination for *real* radio fun!

The new *Table-Talker* does for group-listening what the *Matched Tone* Headset does for the individual.

It provides true tone—mellow and strong. It reproduces the program faithfully — from the deepest speaking voice to the highest instrumental music. And it's a good-looking addition to any set — with its simple lines and neutral brown finish. A *remarkable* loud-speaker!

$10

All Brandes' Products are sold under a money-back guarantee.

C. BRANDES, Inc. NEW YORK

Matched Tone

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

Radio Headsets

solutely unreadable on the three-circuit set were very fair on the "single-barrel," and the selectivity was about the same.

The dealer who says a first-class single circuit set is utterly simple is entirely mistaken. Anyone can hear signals with them, certainly, but it takes as much skill to handle one properly, and get the utmost out of it as it did with the old British Multiple Tuner. The average man can drive a car, why can't he learn to handle a receiver?

G. B. Horne,
1165 Sunset Ave.,
Seattle, Wash.

A WORD ABOUT STATIC

Editor, Radio News:

Being a regular radio fan I always read the dope on what the other fellow has to say in regards to distance, static, hook-ups, etc. After that, I go after the advertisements to see if there is anything else on the market that will eliminate (?) static and improve any set by 100 per cent.

Speaking of the distance, etc., 95 per cent of the fans who write about distance should be here in this country and sit night after night with the phones on till you feel as though the ear pieces would meet in the center of your head and be satisfied with, *just about getting Havana,* mixed in with the ship and high power government code. Just once, and only once, have I been fortunate enough to reach Savannah, and then for just about five minutes.

Static; just the word, written in most of the letters this summer from radio fans, makes me shiver, for he who has never tuned in in the tropics in the neighborhood of the Carribean knows not of what he speaks till he has tried. I really believe that if I ever go back to the States I will be satisfied with reception in the summer and will be inclined to think that my set is not working if I tune in during the winter months.

Perhaps I am not well enough versed in radio, but I have not been very successful in my attempts to build a set that will deliver the goods as I would like it to. If any one, any place, can give me the "dope" on a good hook-up at a moderate price that will work and receive 2,000 miles he will be my friend for life. As it is now, I have enough parts to build a set that would be capable of communicating with Mars, if they did all the manufacturers claimed for them, also if the wire and bus bar that I have cut up and used in trying new hook-ups were joined together, I could telephone there instead.

L. D. Van Valkenburgh,
P. O. Box 58,
Pedro Miguel, C.Z.

INTERFERENCE

Editor, Radio News:

I have read with interest the letters you print in Radio News from readers for and against the amateur sending code and interfering with concerts.

My experience is that it is not so much the amateur who gives us trouble as the Commercial and Naval stations and boats.

I have a Neutrodyne five-tube set, selective and satisfactory, but I find this code on ANY WAVE-LENGTH and ALL THE TIME, day and night. It is annoying to say the least, to be listening to a splendid speech and right at the interesting moment have some one da da da, da dit, da dit da da and keep it up for five minutes, stop and then when you get interested again, start all over.

For the benefit of your readers who are not, perhaps, familiar with what was done or is going to be done in spreading the stations, will you please explain why these code senders are not on the wave-length they are supposed to be, or am I mistaken in sup-

Equal to All Demands

This is Number Four of a Series

Every tube you add to your receiver makes it just that much more important for you to use Eveready "B" Batteries, for each additional tube increases the work the "B" battery has to do. It demands a more capable, long-lived battery.

Here is a table that shows just what each type of receiving tube draws from your "B" battery. The current is measured in milli-amperes, or thousandths of an ampere.

Current (in milli-amperes) Taken From The "B" Battery by Various Tubes

"B" Volts	WD-11 WD-12	UV-199 C-299	UV-201 C-301	UV-201-A C-301-A
22½	0.5	0.5	0.5	0.5
45	1.5	1.4	1.5	1.5
67½	2.5	2.4	2.5	3.5
90	4.5	4.0	3.9	6.0

Above figures are at zero grid bias

The table shows that the "B" battery current drain increases much more rapidly than the increase in voltage. For example, if the voltage doubles from 45 to 90, the current drain increases three-fold in one case and four-fold in another case. This all means that the life of the "B" battery may be materially lengthened by not using a higher voltage than is necessary to obtain the desired results.

The most popular type of receiver today has at least three tubes, operating a loud-speaker. As ordinarily employed, it places a fairly heavy drain on the "B" battery.

Under light and heavy service, Eveready "B" Batteries prove up. More and more fans buy them every day because they are the most economical. According to the work they have to do, so is their life.

You get most energy for your money in Eveready "B" Batteries — **they last longer.**

"the life of your radio"

The Metal Case Eveready "B" Battery, No. 766. The popular 22½-volt Eveready Battery in a *new* handsome, durable, waterproof metal case. At all dealers, $3.00.

Eveready "B" Battery No. 767. Contains 30 large size cells, as used in the popular No. 766. Voltage, 45. Made especially for sets using detector and one or more stage of amplification. The most economical "B" Battery where 45 volts are required. At all dealers, $5.50.

Eveready Radio Battery No. 771. The Eveready "Three." The ideal "C" Battery. Voltage, 4½ — three terminals permitting the use of 1½, 3, or 4½ volts. The correct use of this battery greatly prolongs the life of the "B" Battery. At all dealers, 70 cents.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, Inc.
Long Island City, N. Y.

EVEREADY
Radio Batteries
—they last longer

NOTE: This is Number 4 of a series of informative advertisements, printed to enable users to realize the utmost in battery economy. If you have any battery problem, write to G. C. Furness, Manager, Radio Division, National Carbon Co., Inc., 122 Thompson Ave., Long Island City, N. Y.

Ask for special booklets on "A", "B" and "C" batteries.

posing they are expected to be on any particular wave-length?

Why don't the radio magazines keep suggesting to the 500 broadcasting stations that they get together in a united effort to have this properly regulated? What is the use of giving an excellent program, expensive and troublesome and have it spoiled? I wish some of the broadcasters could just listen to their own programs on my set. I would almost be willing to bet them anything they could not listen all the way through their program without lots of interference.

Perhaps it is my ignorance, or maybe I have not the right set; if so, won't some readers write and tell me their experiences; and won't you print something about this in some future issue for the benefit of those who perhaps don't know as much as they should as to why and wherefore?

A. H. MORRIS,
906 Blackshire Road,
Wilmington, Del.

A DISSERTATION ON SINGLE CIRCUIT TUNERS

Editor, RADIO NEWS:

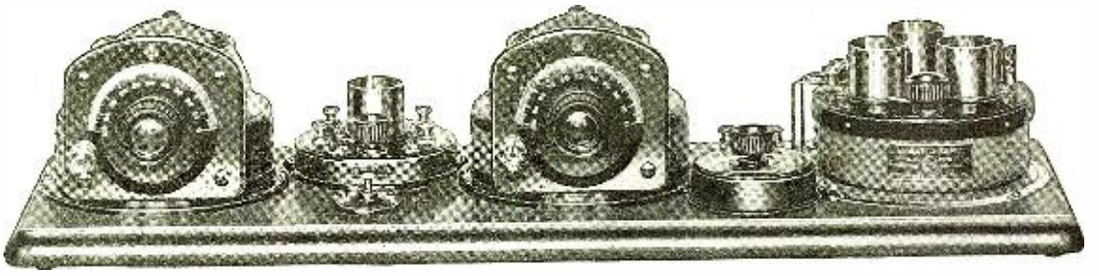
I little realized, when I sent you that letter in July, that I would receive over 200 letters from all over the United States concerning it; nor did I realize that such distinguished amateurs as the gentlemen from Texas, Connecticut, New York, and other points would do me the honor of "knocking the chip off my shoulder," in recent publications. Right here I wish to thank them for their carefully prepared letters, and to ask all those 200 or so, to whom I wrote about the single circuit tuner, to report to the Editor of RADIO NEWS on it, when finished, *especially* if you have used a two or three-circuit tuner previously.

The first part of this letter will be devoted to (apologies to WGY) Mr. Frederick L. Stafford, 1BAG, who had a fine letter for me in a recent issue of RADIO NEWS. It is true that my first letter did touch only the desirable points of the single circuit tuner, and I wish to agree with him in the fact that unless the regenerative tuner is ousted there is little hope for the future of radio, but I disagree with him, or any other person, when he says that a Reinartz or a three-circuit tuner will not radiate energy in the antenna. He is mistaken; true, they do not radiate as strongly as a single circuit type, and while I think of it, will say that when I operated a three-circuit tuner, 18 months ago, I could not hold a station against the squeals and squawks in the air, but the single circuit will *stick* on the station in *spite* of the squawks.

It is quite true that Mr. Godley did not take a single circuit tuner to Scotland, but this is quite natural; being the designer of Paragon instruments, why should he take a single circuit set? Mr. Stafford's letter leaves one under the impression that Mr. Godley used a three-circuit tuner in Scotland. Wasn't it a super-heterodyne? Anyhow his reception is duplicated and exceeded every week by foreign amateurs; and some of them are using one "valve." In fact I think the record for broadcast reception of 10,000 miles on WHAZ was accomplished on a single circuit tuner. Speaking of "Squawk Factories," as Mr. Stafford calls the regenerative tuners, I will admit that they are a nuisance, so, since Mr. Conrad, Mr. C. D. Tuska, Mr. Reinartz, Mr. Pyle and Mr. Flewelling, are your brother relay men, why not prevail upon them to discard the regenerative tuner, since they designed most of the squawk factories in use? Mr. Hazeltine seems to be working on the right track; down with the regenerative tuner.

The second portion of my letter is devoted

ATWATER KENT
RADIO EQUIPMENT



Atwater Kent Model 9 Receiving Set

ATWATER KENT Receiving Sets are a truly remarkable achievement. Their wide range of operation; the volume and clearness of tones obtained from distant points, together with the ease with which desired broadcasting stations can be tuned in are the outstanding features of their unusual performance.

The ATWATER KENT Loud Speaker will give you a new conception of clear reproduction:—the true gift of the broadcasting artist is brought undistorted into your home.

If you are now working with a one-tube set, the ATWATER KENT 2-Stage Amplifier will give you the necessary volume to use a loud speaker.

ATWATER KENT Radio Equipment includes complete sets and every instrument necessary for the assembling of complete sets from tuning unit to loud speaker.

The Atwater Kent Loud Speaker

2-Stage Amplifier

Literature describing the entire line of Atwater Kent Radio Sets and Parts sent on request

ATWATER KENT MANUFACTURING COMPANY, PHILADELPHIA, PA.
4943 STENTON AVENUE

to Mr. Peacox. I wish to thank him for his careful review of his impressions. He says that stations having a harmonic on two points *ought* to be tuned out. If this is the case, why should the radio inspector of the eighth district advise a friend of mine who operates such a C.W. set, to either quit transmitting on 500 meters or else close down his station? It is true he had a wave at 200 meters, but his harmonic at 500 meters was much stronger; he seemed to question the radio inspector's wavemeter. The point is this: Are we expected to tune out this sort of C.W. wave, when the inspector 300 miles off is ordering it stopped? The average amateur C.W. wave is not as sharp as the good broadcast wave; if every amateur who thinks it is would try to transmit voice, he would learn a few points on sharp C.W.

Mr. Peacox questions if any DX reception is done on a single circuit tuner: Refer to January, 1923 RADIO NEWS, page 1289, "Some Real DX Work." Among other statements you will find this one: "After experimenting considerably over a year, with various types of inductances, variometers, inductive and conductive circuits for short wave reception, I have finally settled on a simple regenerative SINGLE CIRCUIT tuner."

Refer to May, 1923, RADIO NEWS, article entitled, "How I Receive American Amateurs in France With a Single-Circuit Tuner."

Refer to RADIO NEWS, February, 1923, article entitled, "New DX Record Set by 6ZY at Honolulu"; done with a single circuit tuner.

Mr. E. W. Rouse, 5IM, July, 1923, RADIO NEWS, says: "Contrary to theory, the single circuit tuner shows a remarkable degree of selectivity." Refer to *Radio Broadcast*, August, 1923. Read article starting on page 114 which deals with recent Navy tests with American amateurs: "Navy Officials Listen in on the Amateurs of This Country From Coast to Coast, and *Then Some*." The point I want to drive home is this: The Naval experts used a *single circuit tuner* in these tests; a diagram of wiring and list of parts are given, and these Naval men were after *results and* they *got them* with a single circuit tuner. I want every three-circuit amateur in America to "*soak up*" this letter.

The American amateur is there with the transmitter, but he is neither here nor there on the receiver. The average amateur in Europe has a better receiving set because he has to have it, and what was heralded as a feat for Paul Godley, seems to be "small potatoes" for the foreign amateurs. And I wish to remark here that they use principally super-heterodyne, radio frequency and reflex circuits. All American experimenters and amateurs should be working on sets incorporating either radio frequency or other combinations to get rid of the RADIATING receiver, which means EVERY regenerative set:

I realize this last statement will get a rise out of lots of readers, but it is either discard the regenerative receivers, or radio will cease to be in a few years. This is from a broadcast listener's viewpoint.

W. W. BRACKENRIDGE,
Harrison, Ohio.

FOR THE AMATEUR

Editor, RADIO NEWS:

Lately I have noticed several letters published in RADIO NEWS regarding the amateur's willingness or unwillingness to help the broadcast listener. With what experience I have had, I should say that they are more than willing to help the novice.

It was two years ago that I first felt the desire for a tube set. Having a slim pocket-

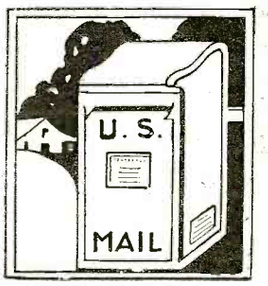
RADIO AT NEW YORK PRICES

Via Daily Parcel Post

The Prices Quoted Below Deliver Goods to Your Door

REFERENCES:
R. G. Duns, Bradstreet, Coal & Iron National Bank, Corn Exchange Bank, N. Y. City.
No salvaged goods handled. Only standard brands in original packing, which bears ours and the manufacturers' guarantee. Due to our tremendous output we can undersell any of our competitors. Send your order in today and insure prompt delivery.

HOW TO ORDER—Write your order plainly; state number, description and price of items wanted. Send Post Office or Express Money Order, personal check or bank draft.

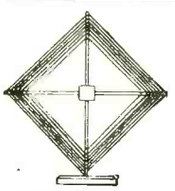


VACUUM TUBES

Standard brand Radio Corp. tubes. Guaranteed brand new.
J50 Detector, U.V.200 ea. $4.25
J51 Amplifier, U.V.201A ea 5.75
J52 1½ volt W.D.11 ea.... 5.75
J53 W.D.12 ea. 5.75
J54 U.V.199 ea. 5.75
J55 U.V.199 Adapter for U.V.199 tube fits any socket ea. ..... .50
J56 W.D.11 Adapter fits W.D.11 tube and any standard socket ea. $0.50

AUDIO FREQUENCY TRANSFORMERS

The following transformers are guaranteed standard makes, and will produce very efficient results
J63 Dietzen 3 to 1 Ratio. $3.95
J64 Dietzen 5 to 1 Ratio 3.95
J65 Dietzen 10 to 1 Ratio 3.95
J66 Acme Audio 4.25
J67 Amertran 5.95
J68 U.V. 712 R.C.A. 5.75
J69 U.V. 714 R.C.A. 5.75



LOOP AERIAL

J76 Can be assembled by anyone in five minutes, all wood parts, wire and binding posts included, complete $1.00

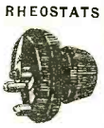
MOULDED BAKELITE VARIOMETER

J79 Ea. $5.75. List...$8.00
A high grade instrument. Takes in the wave lengths from 250 meters to 800 meters. Table or Panel Mounting.

FRESHMAN VARIABLE GRID LEAK AND GRID CONDENSER

Lowest filament current increases battery life; eliminate howling; zero to 5 megohms.
J102 Freshman Variable Grid Leak alone.....$0.65
J103 Freshman Variable Grid Leak and Condenser combined ..... .85

FILAMENT CONTROLLED RHEOSTATS



Highest grade of material used, tapered knob.
J104—6 ohm $0.39
J105—30 ohm ..... .49
J106—200 ohm Potentiometer ..... .79
J107—400 ohm Potentiometer ..... .79

WAVE TRAP

Simplifies tuning. Eliminates interfering stations, thereby improving the selectivity of your set. Selects between conflicting stations. Special while quantity lasts.
J131 Each $4.95

HONEYCOMB COIL MOUNTINGS

J140 2-coil mounting $2.85
J141 3-coil mounting 3.79
J142 Single coil mounting ..... .40
J143 Receptical for single coil mounting ..... .50

MISCELLANEOUS

J163 Spaghetti Tubing per yd.....$0.09
J164 Synthetic Crystal ..... .30
J165 Ground Clamps ..... .17
J166 Black Rubber Binding Posts .. .05
J167 Nickel Plated Binding Posts 2 for .05
J168 No. 18 Annunciated Wire half pound coil ..... .39
J169 6 ft. Phone Cord with tips..... .79
J170 20 ft. Extension Cord with tips 1.95
J171 Wall Insulators, Porcelain..... .05
J172 Tubular Porcelain lead-in Insulators, 6 in. ..... .10
J173 Reinartz Coil 1.45
J174 Cockaday Coil 2.45
J175 2 in. Dial and knob..... .25
J176 3 in. Dial and knob ..... .35
J177 4 in. Dial and knob ..... .49

BUILD YOUR OWN SET

COCKADAY CIRCUIT COMPLETE

Consisting of
1 Cockaday coil and 7 pigtail connections
2 .0005 Variable Condensers
1 Socket
1 Panel 7x18
2 Dials, 3 in.
1 Grid Leak and Condenser
1 Rheostat
1 Switch Lever
1 Base Board
12 Ft. Bus Bar
7 Switch Points
7 Marked Binding Posts
1 Jack
Wiring Diagram and Instructions

J-178 . . Our Price $12.65

FLEWELLING CIRCUIT COMPLETE

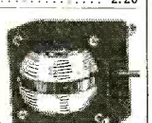
Consisting of
1 .0005 Variable Condenser
3 .006 Mica Condensers
1 7x12 Panel
2 Coil Honeycomb Mount
Variable Grid Leak and Condenser
1 50 turn Honeycomb Coil
1 75 turn Honeycomb Coil
2 Coil Mounts with straps
1 Dial, 3 in.
8 Marked Binding Posts
1 Baseboard
Wiring Diagram and Instructions

J-180 . . Our Price $12.45

HARD RUBBER PANELS

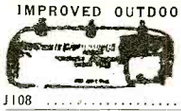
The highest grade panel on the market. Highly polished finish; cut in the following sizes:
J88—7x10 .....$0.95
J89—7x12 ..... 1.15
J90—7x14 ..... 1.25
J91—7x18 ..... 1.65
J92—7x21 ..... 1.95
J93—7x24 ..... 2.20

HIGH GRADE MOULDED VARIOMETERS



J97 Price $2.65
A real high grade job at extremely low price. Takes in all wave lengths.
J98 Wooden Variometer same as above type $2.65

IMPROVED OUTDOOR LIGHTNING ARRESTER



Passed by the Board of Fire Underwriters. Regularly sells for $1.50.
J108 .....$0.95

AMPLITONE LOUD SPEAKERS

This speaker will give efficient results when used with any pair of Head Phones; highly nickel plated; 18 inches high.
J117 .....$3.95

STANDARD BRAND HEAD PHONES

J134 Brandes Superior $5.25
J135 Dictograph . 6.75
J136 Baldwin Type "C" Double .. 9.85
J137 Baldwin Type "C" Single ... 4.95
J138 Western Electric 10.50
J139 Dietzen 3000 ohms extra special 3.95

REINARTZ CIRCUIT COMPLETE

Consisting of
1 Reinartz Coil and 16 pigtail connections
2 3 in. Dials
1 .0005 Variable Condenser
1 11-Plate Condenser
1 Socket
1 Vernier Rheostat
3 Switch Levers
1 7x14 Panel
1 Base Board
8 Marked Binding Posts
12 Ft. Bus Bar
1 Grid Condenser
2 doz. Switch Points and stops
Wiring Diagram and Instructions

J-179 . . Our Price $10.85

ULTRA AUDION CIRCUIT COMPLETE

Consisting of
1 7x12 Panel
1 Variable Condenser .0005
1 Socket
1 Variometer
1 Vernier Rheostat
1 Grid Leak
1 .0002 Mica Condenser
7 Marked Binding Posts
1 Base Board
16 Ft. Bus Wire
Diagrams and Instructions

J-181 . . Our Price $9.65

1½ VOLT DIETZEN TUBE

Two-element Fleming valve effect; operates on one dry cell with or without "B" Battery; wiring diagram free with each tube.
J95 Dietzen Tube $1.00
J96 Socket for Dietzen Tube ..... .40

BAKELITE TUBE SOCKETS

Moulded of brown bakelite; Binding Post Connections.
J99 Standard Type for 201A 301A, W.D.12 .....39c
J100 For U.V.199, U.V.299 Socket 39c
J101 For W.D.11, C11 39c

RADIO SOLDERING IRON

Indispensible for the man who builds his own sets.
J109 .....$2.50
J133 Soldering Paste Tube..... .25

VARIABLE AIR CONDENSERS

These condensers are made of heavy aluminum plates, high grade bakelite ends.
J110—21 Plate .0005 Mfd. ..$1.75
J111—11 Plate .00025 Mfd. .. 1.25
J112—3 Plate .00005 Mfd. $0.95
J113—43 Plate .001 Mfd. 2.25

VERNIER VARIABLE CONDENSERS

Specifications the same as above.
J114—14 Plate Vernier with knob and dial $2.95
J115—26 Plate Vernier with knob and dial 3.45
J116—43 Plate Vernier with knob and dial 3.95

MAGNET WIRE (8 oz.)

Double Cotton Covered Size	Price	Green Silk Size	Price
J144 18.....	$0.43	J145 18.....	$0.73
J146 20.....	.53	J147 20.....	.85
J148 22.....	.68	J149 22.....	1.00
J150 24.....	.78	J151 24.....	1.13
J152 26.....	.88	J153 26.....	1.65
J154 28.....	1.07	J155 28.....	1.95
J156 30.....	1.58	J157 30.....	2.65

WOOD CABINETS

Highest grade Mahogany finish Cabinets hinged top. These cabinets are being sold at less than one-half regular value.
J57 Wood Cabinet; panel size 7"x10" Each $2.50
J58 Wood Cabinet; panel size 7"x12" Each 2.75
J59 Wood Cabinet; panel size 7"x14" Each 3.00
J60 Wood Cabinet; panel size 7"x18" Each 3.50
J61 Wood Cabinet; panel size 7"x21" Each 3.75
J62 Wood Cabinet; panel size 7"x24" Each 4.00

RADIO FREQUENCY TRANSFORMERS

J70 Tri-coil for 201A or 301A tubes $1.95
J71 For 199, 299 or W.D.11 and 12 tubes 1.95
J72 Erla AB1 ..... 3.75
J73 Erla AB2 ..... 3.75
J74 Erla AB3 ..... 3.75
J75 Erla Reflex 4.65

VARIOCOUPLER

J77 High Grade 180 Degree Coupler made of Bakelite tubing wound with green silk wire. Special $2.65
J78 Variometer same specifications $2.65

PLATE CIRCUIT "B" BATTERIES

The highest grade of battery made at prices lower than they ever were sold before.
J80—22½ Volt Small $1.15
J81—22½ Volt Medium 1.45
J82—22½ Volt Large..... 1.95
J83—45 Volt Medium 1.95
J84—45 Volt Large 2.50
J85—45 Volt Extra Large..... 3.50
J86—300 hr. 1½ Volt twin double duty "A" Battery ..... .75

RUSONITE CRYSTAL RECTIFIER MULTIPOINT

J159 The perfect synthetic crystal detector sensitive over entire surface. Loud and clear. Price, mounted 50c
J160 14 K. Gold Supersensitive Rusonite Catwhisker. Permanent. Will not oxidize. Price 25c
J161 Rusonite Reflex Crystal. Manufactured expressly for Reflex Circuits. Guaranteed. Price, mounted $1.00

JACKS AND PLUGS

Jacks are polished nickel constructed with pure silver contacts.
J118 One Spring open circuit.....$0.39
J119 Two spring closed circuit..... .49
J120 Round plug as illustrated..... .49

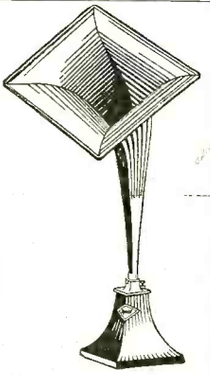
AERIAL WIRE

J121 100 ft. solid copperweld wire coil $.49
J122 7 strand 100 ft. ..... .69

Ground Wire Rubber Covered No. 14
J123 25 ft. coil.....$.49
J124 50 ft. coil ..... .85

INSULATORS

These are very strong strain type insulators.
J158 Moulded insulator shown above ..... Ea. .10 Doz. $1.10



LOUD SPEAKERS

J125 Herald Loud Speaker; no extra battery required. The ideal instrument for the home, school or church. Now ..$30.00
J126 Magnavox new type $29.95
J127 Music Master 28.50
J128 Atlas Speaker 22.50
J129 Pathe Speaker 21.95
J130 Dietzen Speaker 18.95
The above prices delivered to your door.

Modell's 71 Cortlandt St. New York, N. Y.

America's Greatest Radio Mail Order House

ELEVEN NEW YORK STORES

A. R. R. L. Station
Always GLAD to Q. S. R.

Clinton, Iowa
728 Bluff Blvd.
Sept. 29, 1923.

Electric Specialty Co.,
Stamford, Conn.

Gentlemen:-

It has been sometime since I have written you, but want to let you know that the 500 Watt, 1000 volt Motor-Generator Set of your make, I bought one year ago, has given perfect service. Have gotten all districts - Mexico, Cuba and Canada with it. People marvel at the quality of modulation. All say I sound like a Broadcasting Station.

I work New York City often, also Oil City, Louisiana. All report that I sound like I am using battery for plate, instead of Generator.

Thought that I would let you know of the success of this outfit, as I believe in letting the manufacturer know of the fine points as well as the poor ones.

Yours Very Truly
F. E. Phillips
Spr at 9HK.

book and a slimmer knowledge of radio I decided to construct an ordinary non-regenerative set with a single coil. Even in the building of this simple outfit I was forced to seek advice from an amateur.

Being a friend of mine, he offered to construct for me a Reinartz receiver, giving me on credit the apparatus which was needed for the set, also several hours of his time.

Since then, my knowledge of radio has greatly broadened and more than one layman has benefitted by it.

It is unfair to the amateur to write anything to the effect that an amateur will not give his advice or even his time to those with less experience.

GEORGE NIEMI,
Seattle, Wash.

QUITE TRUE

Editor, RADIO NEWS:

I was very much interested in the letter written by Mr. Kamp and see in him the makings of a good Ham.

But regarding this code practice idea; you yourself know of course that the amateur cannot transmit above 200 meters. That is the law and the amateur is expected to obey that law. At the same time the writer feels perfectly safe in stating that most of the broadcast receivers used today are unable to get down to amateur waves. So you can readily see that it is almost impossible to do as Mr. Kamp suggests, at least as far as the amateur is concerned. If the Broadcast Listener can come down, all well and good, but the point I am trying to bring out is this—THE AMATEUR CANNOT GO UP.

Here in Boston, through the courtesy of the Commonwealth Radio Association, Code Practice is to be started within a very short time for those broadcast listeners who want it and can come down to get it.

Commonwealth Radio Association,
H. CRONCHER, Secretary.

[*What Mr. Croncher says concerning the average broadcast receiver is quite true. If there are enough broadcast listeners interested in learning the code it should be possible to persuade a local broadcast station to give over a portion of its time each night to the transmitting of telegraph signals for their benefit.—Editor.*]

ENGLISH RECEPTION OF AMERICAN BROADCASTING

Editor, RADIO NEWS:

I am writing to say how well the American broadcasting is being received here. On the morning of Sept. 22, at 0120 G.M.T. (8:20 P. M., Sept. 21, E.S.T.) I tuned in WGY and heard the full program until they closed down at 2:20 A. M. G.M.T. (9:20 P. M. E.S.T.). The following are the items I recognized, but there are others whose titles I missed:

1:20 A. M., Song—"For He's a Jolly Good Fellow" (as a greeting), Talk on "National Welfare."

Orchestra.

Song—"Asleep In the Deep."

Two songs—(1) Title missed. (2) "My Bonnie Lies Over the Ocean."

Monologue—"Tale of a Down and Outer."

Solo—"Darling, I Am Growing Old," Club (?) Quartette.

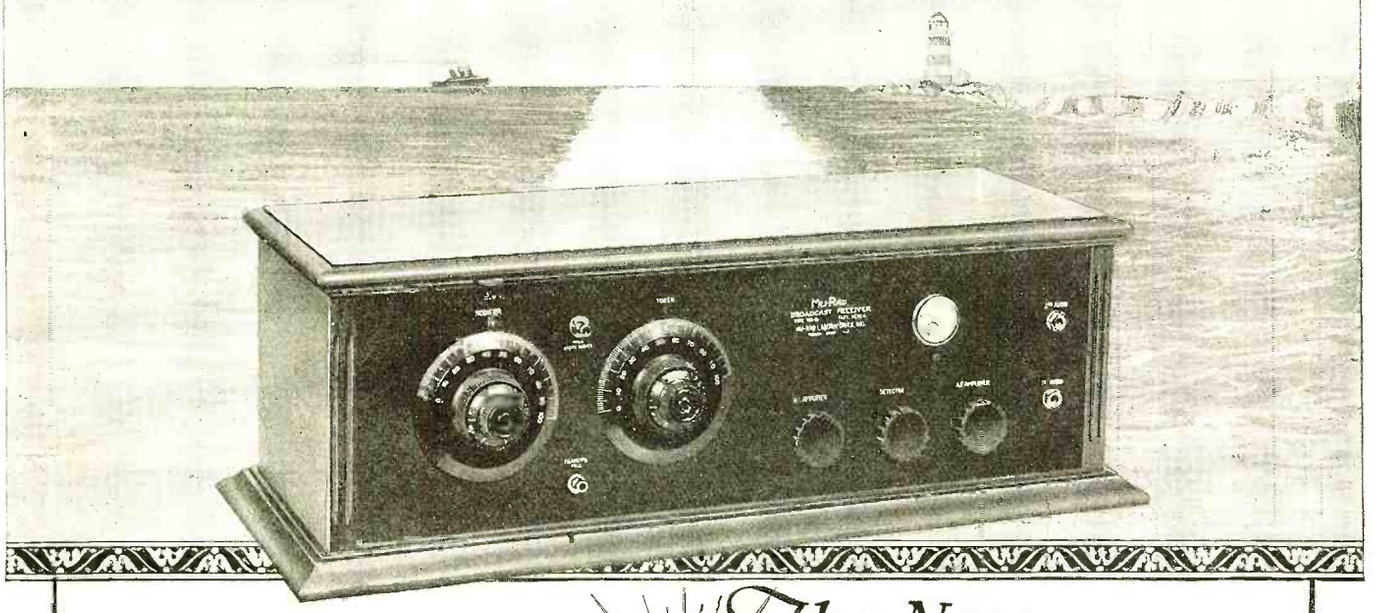
Orchestra.

2:15 A. M., Announcements of future programs also particulars of a prize competition for the best radio drama suitable for broadcasting ("The plot must be clean and morality questions handled with care").

2:20 WGY signed off with the words: "WGY, the station of the General Electric Co., New York, concluding the first evening's program and signing off at 9:20 Eastern Standard time."

Throughout the transmission the an-

Establishing a New Horizon for Radio



The New MU-RAD RECEIVER MA-15

THE HORIZON of the radio art extended and broadened by this new perfection of radio reception —the more versatile, more simply operated receiver, *Mu-Rad MA-15*. Many important refinements—plug-in type radio frequency transformers, so that the MA-15 can be accommodated to any future changes of wave lengths or tubes, volt-meter for instantaneous readings of "A" or "B" batteries, new type vernier dials, operated by cams to eliminate back-lash, no other aerial than a 2-foot loop needed, and a wave length switch for bringing in short wave stations. Solid mahogany cabinet, with an engraved Formica panel. The MA-15 anticipates every possible use and requirement. *Guaranteed range, 1,000 miles using 2-foot loop.*

Another New MU-RAD Receiver MA-17

Three stages of radio and two of audio frequency amplification and detector. *One* tuning dial and two selecting dials, each independent of the other. Plug-in type r. f. transformers to care for changes of tube type or wave lengths. Panel-mounted volt-meter for quick reading of A and B batteries. Solid mahogany, Adam Brown hand-rubbed finish cabinet with loop fitted into top and compartment in base for "B" batteries. Guaranteed for 1,000 miles reception using only a 2-foot loop.

WRITE FOR BOOKLET AND THE NAME OF THE NEAREST DEALER

MU-RAD LABORATORIES, INC.
801 FIFTH AVE. ASBURY PARK, NEW JERSEY

nouncer's voice was very clear, as was also the applause following each number. The humorous references to the man who had come all the way from "Sing Sing to sing" and the "boiler shop" musicians were not lost.

All the above was received on a home constructed 3-valve set (2 R.F., 1 Det) using "plug-in" type transformers with tuned primary winding, Mullard "Ora" valves (not usually recommended for R.F. amplification) and an outdoor aerial of four 30' wires. The "re-action" (tickler) coil was coupled to the first transformer.

As an experiment I used the detector valve alone and found *I was able to get WGY faintly but audibly on this one valve.* (I felt myself justified at this moment of waking my young brother and he was amazed at this achievement). However, I soon reverted to the two R.F. valves in order to increase the volume of sound and enjoy the American music to the full.

During the same period the following morning (1:15 A. M. to 2:25 A. M., G.M.T., Sept. 23, or 8:15 P. M. to 9:25 P. M., Sept. 22, E.S.T.) when, I understood, there was no transmission from WGY, I heard WMAF (Round Hills, Dartmouth, Mass.) very well. On this occasion I could not follow the announcer as well as WGY the previous day, but the program included a National Welfare Talk and numerous orchestral items by Laddener, Gardner (or Wagner) etc., titles of which I missed.

I hope your readers will find the above of interest.

F. EUSTANCE,
92 Briardale Road,
Mossley Hill, Liverpool, England.

COMMERCIAL TELEGRAPH SYMBOLS

Editor, RADIO NEWS:

It was with much interest that I read the article entitled "The Amateur Traffic Problem," by Howard S. Pyle in November issue of RADIO NEWS. I was especially interested in the part of this article covering the forms of service messages.

Being a joint railroad and commercial operator, I thought it would be a good plan to give the telegraphing amateur some idea of how SVC. messages are composed by the commercial telegraph companies and have listed below the symbols we use in various forms.

ADS—Address.
ADSD—Addressed
ANS—Answer.
CFN—Confirmation.
CY—Copy.
DLD—Delivered.
DFS—Disregard Former Service.
GBA—Give Better Address
GSA—Give Some Address.
GQA—Get Quick Answer.
HA—Hurry Answer.
LC—Addressee is Said to Have Left City for—— (if known).
NR.—No Record.
NSA—No Such Address.
NSN—No Such Number.
NSS.—No Such Street.
UNDLD—Undelivered.
UNKN—Unknown.

Of course, it would not be necessary to use all these symbols, but I think they would help out in cutting down the check of SVC. messages.

—RAILROAD OP.

SAKATAH SPRINGS RESORT

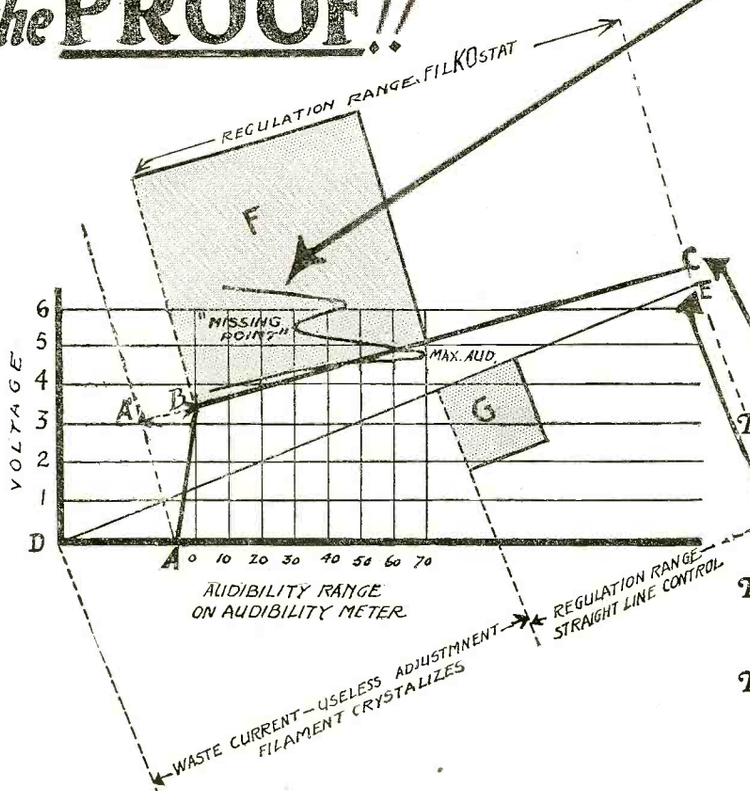
Editor, RADIO NEWS:

As a confirmed Radiophan I have watched the efforts of the Music Combine try out its hand in the affairs of the Radio, and as a Resort owner I have been notified that I would have to get a license to play their

Demand *Rheostats* that have *this performance curve and record*

—it GUARANTEES Longer Tube Life and Scientifically Correct Filament Control

Here's the PROOF!!



LONGER TUBE LIFE

The distance from D to the square G on the line DE ("straight line" control rheostats) indicates the increase of current from zero to the initial operating point of the tube. During nearly all this period the filament remains black and crystalizes; greatly reducing the life of the tube. Compare the distance D to square G, with the distance A1 to B which indicates how little waste current flows through the filament when FIL-KO-STAT is used. The current is thrown on suddenly with FIL-KO-STAT, the filament becomes incandescent and the operating range is reached instantly—*preventing crystallization and prolonging tube life.* After this initial point of current flow, FIL-KO-STAT permits infinite adjustment over the entire operating range of the tube.

The test here presented is one of a series covering all sides of the filament control problem. The entire series, prepared for us by one of America's leading Consulting Radio Engineers, and reprinted by permission.

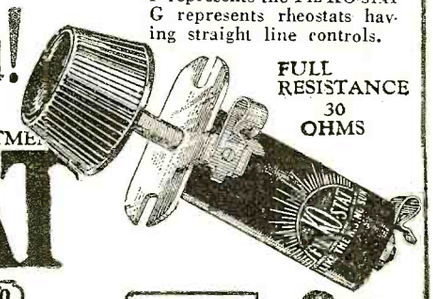
The **CURVE** *represents* audibility in terms of filament voltage: that is, the volume of your 'phone reception as compared with the amount of filament current. It shows clearly that the point of maximum audibility (70) is at approximately 4.8 volts—*just prior to the 'hissing point' of the tube.* Audibility starts at about 3.8 volts. From 3.8 to 4.8 is the most efficient operating range of your detector tube, (tests made on C-300 or UV-200) It is here that your rheostat must give dependable minute regulation—as well as over the entire operating range. *The great tuning possibilities of the vacuum tube can be realized only by the very finest control.*

The **LINE ABC** is the characteristic performance curve of FIL-KO-STAT *which gives equally fine adjustment on all types of tubes.*

The **LINE DE** is characteristic of all rheostats having "straight line" control.

The **SQUARES F AND G** erected on these lines show the proportionate area of *fine adjustment* range of the various types of rheostats—F represents the FIL-KO-STAT G represents rheostats having straight line controls.

Make Your Own Comparison!



FILAMENT CONTROL OF INFINITE ADJUSTMENT

FIL-KO-STAT

Not a carbon powder rheostat—no wires, no discs, no adjustments to puzzle you.

MADE AND GUARANTEED BY DX INSTRUMENT CO. HARRISBURG PA.

Adjusted For All Tubes Including U V 199's and 5 watt Transmitters

$2 AT DEALERS EVERY WHERE

In Canada 2.75

RADIO STORES CORPORATION
Sole International Distributors
Dept. RN 124 . 218-222 West 34th Street, New York
Chicago Minneapolis Kansas City Los Angeles

music on a Victrola for the amusement of guests, and the notice came by registered mail with notice that failure to comply would place our Camp on their inspection list. We are open to inspection.

I firmly believe through my own experience that Radio has been the means of my buying more music, as we had a checkup and found we had bought 14 records of pieces we liked over the Radiophone and the same condition is present with my friends.

In a restaurant here that has a Radio receiving set, I found all the late song hits on the piano and a few questions of the young folks showed good sale of the "hits" even here, and they said "we liked them on the Radio, so we bought them to sing ourselves."

Personally, I believe the time will come when they will be glad to pay for the chance to have their musical hits broadcast that the public may hear and then buy them, and I think the music makers see the time ahead and want to forestall it if possible. Grand Opera has had several attendants from here, and Radio helped to send them, as they heard it at times from Chicago. The shaping of public opinion will have a heavy effect on any such movement and it's well to consider the outcome.

C. W. CHRISTMAN,
Waterville, Minn.

The Proof

(*Continued from page* 882)

inherited a prosperous business from a father who had been too busy attending to his commercial affairs to give much thought to his son. Tom had drifted and like driftwood had spent most of his time floating idly on a sea of froth. His life had been one long mixture of strong drinks, careless women and flippant music.

Audrian Waite was the first good woman in whom Tom had ever been interested. He recognized her purity and desired her the more for it. Audrian knew nothing of his habits. She had come to believe in him. She wanted to marry well, that Joe might have every pleasure possible. She had thought that she loved Kenneth Choate, a struggling young attorney and a great friend of Joe's, but Tom Whitley, with his flowers and candy and classy red roadster had quite swept her off her feet.

Joe Waite was aware that Kenneth Choate was in love with his sister and he was anxious to see the match consummated. When he heard of Tom Whitley he was startled and dismayed. He heard Kenneth mention Whitley in far from complimentary tones. Kenneth knew Los Angeles from "A to Z." He had lived there all his life and was familiar with all of the most prominent families of the city. He had come in contact with Whitley on several different occasions and had passed his impressions to Joe.

When Joe told Audrian that Tom was a rotter she became angry.

"You don't know a thing about Tom Whitley," she said. "He's not what you say he is. He is a gentleman."

"Sure. He's a gentleman of leisure," scoffed Joe. "He spends his time on the borderland of Hollywood and his money on cast-off dancing girls. He isn't fit company for you."

"I don't know where you gained your information," returned Audrian, "but I do know that it is not correct. When you meet him you will then see for yourself that he is a perfect gentleman."

Well, Joe had met Whitley now, had observed that the man had been drinking and had returned to his radio outfit with a certainty in his heart that Audrian was in danger.

SEE OUR GUARANTEE
HOOK-UPS and CATALOG FREE

REDUCED PRICES

SERVICE AND QUALITY BUILT THIS HOUSE

ON STANDARD QUALITY PARTS

WE PAY TRANSPORTATION CHARGES IN THE UNITED STATES ONLY

PHONES THAT HAVE STOOD THE TEST

D161 Frost double set 2000 ohm $3.35
D171 Frost double set 3000 ohm $4.05
D162 Frost double set 2000 ohm $4.05
D163 Frost double set 3000 ohm $4.65
D172 Frost double set 3200 ohm.....$5.19
D166 Brandes Superior double set....$5.19
D167 Brandes Navy type double set..$6.75
D168 Genuine Type C Baldwin Phones double set $10.50
D169 Genuine Type C Baldwin Unit with cord $5.15

BALDWIN LOUD SPEAKER $25.00

SPAGHETTI AND WIRE

D33 Per 4-ft. length 27c
D32 Tinned Copper No. 16 Wire...Ft. 1c
D34 Wire with insulation similar to spaghetti on it. Wire is tinned for soldering. Price 10 feet 29c

ERLA R. F. TRANSFORMER

Specify 1st, 2nd or 3rd stage.
D1500 Erla Transformer $3.40

ERLA REFLEX TRANSFORMER

D1650 Reflex Transformer $4.40

TESTED CRYSTALS

D12 Galena, per pkg $0.10
D13 Silicon, per pkg. ..... .10

JACKS AND PLUGS

Jacks are polished nickel, nickel-silver springs, pure silver contacts. Nickel washers for mounting on any panel ⅛ to ⅜ inch thick. Spread terminals make soldering easy.
D133 One spring (open circuit).....$0.32
D134 Two spring (closed circuit).... .42
D131 Four spring (two closed circuits) .50
D135 Three spring (two open circuits, called "single filament control").... .53
D136 Five spring (two open and two closed circuits, commonly called "two circuit filament control") ..... .69
D139 Plug with threaded barrel instead of set screw. Takes cord tips.. .45

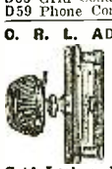
VARIABLE GRID LEAK

Pencil mark type. Removable black enameled cap.
D50 Grid Leak.....13c

GRID AND PHONE CONDENSERS

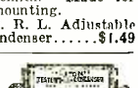
Mounting Holes spaced to fit screws of above Grid Leak. Mica insulation, wrapped with varnished cambric tape. Capacity, .00025 Mfd.
D55 Grid Condensers 6c
D59 Phone Condenser, .001 Mfd.....15c

O. R. L. ADJUSTABLE GRID LEAK AND CONDENSER



A turn of the polished black knob will enable you to get the one and only one potential that provides the maximum signal strength. Made for panel mounting.
D107 C. R. L. Adjustable Grid Leak and Grid Condenser.....$1.49

FRESHMAN MICON TESTED MICA CONDENSERS



D62 .00025 mfd. Condenser $0.27
D63 .0005 mfd. Condenser.....$0.27
D64 .001 mfd. Condenser..... .31
D65 .002 mfd. Condenser..... .31
D66 .0025 mfd. Condenser..... .41
D67 .005 mfd. Condenser..... .65
D68 .006 mfd. Condenser..... .65
D69 .01 mfd. Condenser..... 1.37

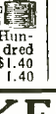
FRESHMAN VARIABLE GRID LEAK AND GRID CONDENSER

For unbroken range—zero to 5 megohms, clarifies signals, lowers filament current, increases battery life, eliminates hissing.
D60 Freshman Variable Grid Leak and Condenser $0.85

AERIAL WIRE

D355 Copper 7 strand 100 ft. coil..$0.77
D356 Single No. 14 Bare Solid Copper Wire 100 ft. Coils ..... .55

SWITCH POINTS AND STOPS



Brass, polished nickel finish. Screw size, 6/32x⅝ ins. long, two nuts with each contact point and one with stops.
D158 Switch point ¼" dia., ⅛" high Each 2c. Dozen 18c. Hundred $1.05
D130 Switch Point diam., ¼ inch; height, Each Doz. Hundred
3-16 inch 2c 20c $1.40
D150 Switch Stops 2c 20c 1.40

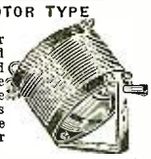
OUR GUARANTEE YOUR PROTECTION

Your satisfaction guaranteed. If for any reason you do not feel satisfied with your purchase, you may return it and we will refund your money. We will pay return transportation charges.

180° VARIOCOUPLER

The primary and secondary windings of this coupler are properly spaced. The center of the secondary is always in the center of the primary field. Black base, brown formica tube and nickeled parts. Panel or table mounting.
D1100 Coupler $2.75

180° MOULDED ROTOR TYPE COUPLER

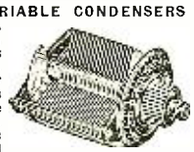


This 180° variocoupler has heavy black tube and moulded rotor. Wound with green silk wire and has 10 taps on the primary. Metal parts are brass nickel. Can be mounted on panel or table.
D1120 Variocoupler $3.45

VARIABLE CONDENSERS

Condensers are made of heavy aluminum plates, evenly spaced with high grade bakelite ends.
D1443 43 plates .001 Mfd. without dial $1.49
D1423 21 plates, .0005 Mfd. without dial 1.29
D1411 11 plates .00025 Mfd. without dial 1.15
D1403 3 plates .00005 Mfd. without dial ..... .98

VERNIER VARIABLE CONDENSERS

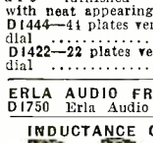


For fine tuning, neat appearance, this condenser is just the thing. Made of heavy aluminum plates and high grade bakelite ends. These condensers are furnished with neat appearing knob and dial.
D1444—44 plates vernier .001 Mfd. with dial $3.05
D1422—22 plates vernier .0005 Mfd. with dial $2.73

ERLA AUDIO FREQ. TRANSFORMER

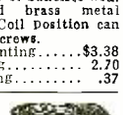
D1750 Erla Audio Transformer.....$4.40

INDUCTANCE COIL MOUNTINGS



For base or panel mounting. Connecting leads furnished, coil settings are adjustable by means of knobs. Made entirely of bakelite with nickeled brass metal parts. Coil position can be locked by knurled set screws.
D1603 Three circuit mounting.....$3.38
D1602 Two coil mounting..... 2.70
D1601 Single coil mounting..... .37

INDUCTANCE COILS



Rigidly wound, nicely finished, low distributed capacity. All coils are equipped with standard mountings. We can supply any of these coils with or without mounting plugs. The wave lengths shown are range limits, based on variable condenser .001 mfd. capacity.

No.	No. of turns	Wave Lengths	Price unmounted	Price mounted
1725	25	125- 250	$0.34	$0.78
1726	35	175- 450	.38	.91
1727	50	240- 720	.44	.97
1728	75	390- 910	.49	1.03
1729	100	500- 1,450	.53	1.08
1730	150	600- 2,000	.58	1.12
1731	200	900- 2,500	.67	1.21
1732	250	1,200- 3,500	.73	1.30
1733	300	1,500- 4,500	.77	1.31
1734	400	2,000- 5,000	.92	1.52
1735	500	2,800- 6,100	1.07	1.58
1736	600	4,000-10,000	1.22	1.73
1737	750	5,000-12,000	1.38	1.88
1738	1,000	7,000-15,000	1.65	2.19
1739	1,250	9,750-19,500	1.87	2.39
1740	1,500	14,500-26,500	2.13	2.53

INSULATORS

These are very strong strain type insulators. Each Doz.
D360 Moulded insulator shown $0.10 $1.10
D365 Porcelain insulators .... .09 .95

VARIOMETERS

For efficiency, perfect inductive ratio, low capacity effect and neatness of design these variometers are unexcelled. Metal parts nickeled. Stator and ball mahogany finish. Completely assembled.
D1200 Variometer $2.65
The above variometers knocked-down stator wires cemented in the stators. Rotors are wound. All metal parts included.
D1205 Knocked-down Variometers ..$1.85

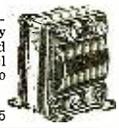
MOULDED VARIOMETERS

D1220 Moulded Variometer.....$3.95

DIALS

Genuine Bakelite Dial as pictured. Sharply engraved divisions and figures filled with a brilliant white. Set screws included.
Bakelite Composition
D502 Dial, 2 inch, 3-16 in. shaft....$0.32
D500 Dial, 3 inch, 3-16 in. shaft.... .35
D501 Dial, 3 inch, ¼ in. shaft ..... .35
D504 Dial, 4 inch, ¼ in. shaft ..... .67
Moulded composition dial as pictured. Has a luster that cannot be told from Bakelite. Set screws included. Each
D563 Dial, 2 inch, 3-16 in. shaft....$.16
D550 Dial, 3-16 in. shaft..... .22
D555 Dial, ¼ in. shaft..... .22
D565 Dial, 3½ in. ¼ in. shaft..... .32

AUDIO FREQUENCY AMPLIFYING TRANSFORMERS



Correctly designed for minimum distributed capacity and low core loss. Shielded beautifully finished in nickel and black enamel. Ratio 5½ to 1.
D1506 Shielded Transformer $2.95

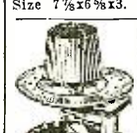
THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

There is probably no better known transformer. Made by a company that specializes in transformers. Entirely encased in sheet aluminum shield. Heavy connecting straps to binding posts.
D1504—Thordarson Transformer, 3½ to 1 .....$3.35
D1505 Thordarson Transformer 6 to 1 3.75

"B" BATTERIES

Standard high grade radio "B" batteries. Never over five days old.
D230 22½ volt Signal Corps type. Size 3⅝x2 x2¼ inches $1.18
D240 22½ volt large variable—5 positive taps. Size 6½x4x3. .....$2.25
D245 45 volt large size binding posts. Size 7⅞x6⅝x3. .....$4.50

INDUCTANCE SWITCH



For neat appearance and time saving, we suggest this inductance switch, as it needs but one hole in the panel to be mounted. Switch Points are mounted on this switch, 15 switch points, in all.
D1095 Inductance Switch $1.22

MAGNET WIRE

Quality magnet wire. We carry three types in stock. Each spool is 8 oz. Double cotton

Size	covered Price	Size	Green silk Price	Size	Enameled Price
D18	$0.40	D20	$0.75	D20	$0.37
D20	.52	D22	.90	D22	.47
D22	.68	D24	1.05	D24	.51
D24	.78	D26	1.18	D26	.56
D26	.88	D30	1.70	D30	.62
D28	1.02	D32	2.00	D32	.66
D30	1.40	D36	2.70	D36	.85

SWITCH LEVERS

A high grade, polished nickel-plated lever with solid moulded black composition knob. Complete with panel bushing. Each
D151 1 -in. Radius 14c
D155 1½-in. Radius 14c

VACUUM TUBES

Genuine Cunningham or Radiotron made by the General Electric Co. Every tube guaranteed new and in original package. We do not sell "bootleg" tubes. Will ship brand in stock unless specified.
D300 UV200 Detector $4.37
D301A UV201A Amplifying 5.83
D11 WD11 1½ volt... 5.83
D12 WD12 1½ volt... 5.83
D299 UV199 3 volt... 5.83

QUALITY SOCKETS

For C200, C301A, C12 or WD12 tubes. Signal socket. Tube made of brass, nickeled. Base is bakelite. Panel or base mount. Belden socket. Made of bakelite. Panel or base mount. Great Lakes nickel socket. Panel or base mount. Great Lakes bakelite socket. Base mount only. All sockets have heavy spring contacts.
D1073 Signal Socket $0.65
D1074 Belden Socket ..... .60
D1075 Great Lakes Nickel..... .37
D1076 Great Lakes Bakelite, base mount only ..... .49
WD11 Bakelite Socket..... .30
WD11 Adapter ..... .43
299 Bakelite Socket ..... .42
299 Adapter. Makes regular socket fit 299 tube ..... .39

GREAT LAKES SUPREME RHEOSTATS AND POTENTIOMETERS

We guarantee these rheostats and potentiometers to be unexcelled. They give perfect satisfaction under constant use. Each turn of the resistance wire is in a groove which makes it impossible to have trouble when the contact slider runs over the resistance wire. Polished taperd knob, base is 2¼ inches and made of heat resisting material. A real value. Priced very low.
D90 G. L. Supreme Rheostats, 6 ohm $0.39
D91 G. L. Supreme Rheostats 25 ohm .42
D92 G. L. Supreme Rheostats 40 ohm .45
D93 G. L. Potentiometer, 200 ohm.. .52
D94 G. L. Potentiometer, 400 ohm.. .56

HOWARD RHEOSTATS

D1064 Howard 6 ohm Plain.....$0.98
D1065 Howard 6 ohm Vernier..... 1.35
D1066 Howard 25 ohm Plain ..... .98
D1056 Howard 25 ohm Vernier..... 1.35
D1069 Howard 40 ohm Plain..... .98
D1059 Howard 40 ohm Vernier 1.35
D1067 Howard 200 ohm Potentiometer 1.35
D1068 Howard 400 ohm Potentiometer 1.85

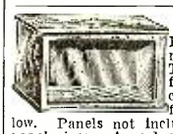
CUTLER-HAMMER RHEOSTATS

D1061 Cutler-Hammer Vernier $1.35
D1062 Cutler-Hammer Plain ..... .90
D1051 Cutler-Hammer 30 ohm 1.35
D1052 Cutler-Hammer 30 ohm Resistance ..... .22
D1063 Cutler-Hammer 200 ohm Potentiometer 1.35

BINDING POSTS

Complete with screw and washer. All brass finished in polished nickel or with black composition top as listed. Order by number. Each Doz.
D110 Large size, all nickeled 7c 75c
D122 Medium size, nickeled, with hole for phone tip or wire..... 3c 30c
D112 Medium size, black composition, top 4c 35c
D120 Large size, composition top.. 4c 40c

CABINETS



Fine finished cabinets sturdily built. These make a wonderful appearance. These cabinets are made to fit panels listed below. Panels not included. See table for panel sizes. A real value.
D217 6x7x7 .....$2.40
D219 7x9x7 ..... 2.70
D213 7x12x7 ..... 3.40
D228 7x18x7 ..... 3.75
D224 9x14x7 ..... 3.55
D221 7x21x7 ..... 3.95
D222 7x24x7 ..... 4.65

PANELS

Genuine Formica panels, to fit our cabinets.
D267 6x7x⅛ $0.56
D269 7x9x⅛ ..... .90
D263 7x12x⅛ 1.25
D268 7x18x3-16 ..... 2.60
D274 9x14x3-16 ..... 2.60
D261 7x21x3-16 ..... 2.95
D262 7x24x3-16 ..... 3.50
⅛ inch Panel cut to size...$.01½ sq. in.
3-16 in. Panel cut to size .....$.02 sq. in.

CRYSTAL DETECTORS

D20 Enclosed crystal detector $1.18
D30 Crystal Detector ..... .59

HOW TO ORDER

Order from this page. Please give number, description and price of the article you order to help us avoid mistakes. Total the amount of your order and send Post Office money order, certified check or draft with your order. Be sure to give your name and street address on both letter and envelope. Do not include money for transportation. We pay it except on storage "A" batteries. See ads of previous months for other items.

GREAT LAKES RADIO CO., 136 W. Lake St., Chicago, Ill.

Joe clamped his headphones to his ears. He frowned angrily as he adjusted the crystal on his receiving set and slid the brass tuner along the mahogany-colored cone of enameled copper wire. Music came floating in to him. Somewhere in the night a voice was singing "I Wish I knew." When the song ended, Joe heard the announcer at the broadcasting station. "This is radio KHJ," the announcer said, "the Times broadcasting station, Los Angeles, California. The next number will be a flute solo entitled 'The Mocking Bird,' played by Donald Brigham. Mr. Brigham will be accompanied on the piano by Miss Rosalind Foster."

Under the influence of the haunting tones of the music, Joe became calm. When the Times' concert was concluded he made another adjustment of the sliding tuner on his receiver, re-arranged the cat-whisker on the crystal and tried to pick up conversations that are broadcast between Catalina Island and the mainland. Now and then he could hear the voice of a central giving numbers to be called or reading telegrams. Once in a while he was able to catch a few words from conversations, but the volume was lacking and he finally hung up the headphones and turned to the new set he was building.

"When this audion set is completed and Sis gets my batteries and vacuum tube, I'll hear those conversations," he murmured.

In the living room of the shabby little apartment in which Joe and his sister lived, Audrian was bidding Tom Whitley goodnight.

"Then you'll call for me next Friday afternoon at three," she was saying. "I'll be ready. Oh! Tom! It will be wonderful to hear you call me 'wife.'"

Audrian's face was turned to his. In her eyes there was a light of trust and admiration. She was a picture of loveliness as she stood before the man to whom she intended to give her all. Her gorgeous hair, piled in heavy rings upon her round, well-formed head, touched here and there by the light in the chandelier above her, formed a halo of glory—the glory of womanhood in full bloom. On her wistful lips a seductive smile of innocence hung.

Tom Whitley leaned toward her. Never before had he seen such a beautiful mass of golden hair; never before had he been privileged to gaze into such gorgeous eyes. He stood before Audrian as a maurauding bear stands and contemplates a lucious cone of honey. His arms went up to encircle Audrian. A harsh light leaped into his black eyes as he swayed toward her. He was interrupted as his hands reached for the shrinking girl by a sudden ra-ta-tat-tat on the door behind him and he whirled about sharply, guiltily.

Audrian heaved a deep sigh of relief as she went to the door and opened it.

"Hello, Kenneth Choate," she greeted the newcomer. "I suppose you've dropped in to help Joe on his new radio outfit. I——I—" For some reason which she could not explain she suddenly felt confused under the steady, questioning gaze of Kenneth Choate. But she went on: "I—I want you to meet Mr. Whitley, Kenneth. Tom, this is Mr. Choate, a good friend of Joe's—and of mine."

Whitley threw back his head and laughed. "I've met your friend before," he said. "Do you remember the case, Choate?"

Kenneth Choate sized Whitley up with piercing, grey eyes. "I can't forget that case," he answered coldly. "In addition to its being the only case I've lost in three years, it was the only one in which I have appeared where the opposition was able to buy the judge and the jury."

Whitley glowered angrily at Choate for a moment, then he again threw back his head and laughed loudly. "Money talks," he said,

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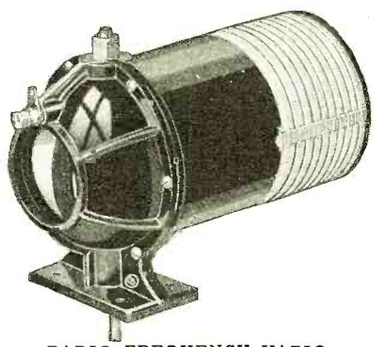
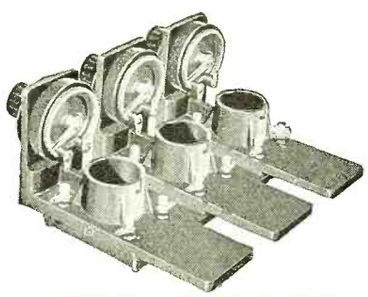


RADIO FREQUENCY VARIO-COUPLER

One of the latest developments in radio construction. The Gilfillan Radio Frequency Vario-coupler, as illustrated above is ideal for REFLEX CIRCUITS, giving absolute selectivity through perfect zero coupling. Wide coupling, sharp tuning and extreme selectivity are made possible by this unit. Highly recommended for radio frequency work. Local broadcasting easily tuned out in favor of more distant stations.



DETECTOR-AMPLIFIER UNIT

Admirably adaptable to radio frequency circuits or audio frequency work. Simplicity of wiring and exceptionally short leads. Jacks can be mounted directly to bottom, and transformers on platforms provided. Filament rheostats, tube sockets, binding posts and solder lugs complete in this unit.

OF COURSE the set you build is to be better than any owned by friends—and it can be. Avoid their mistakes—profit by experience—and build a set to be proud of. The difference in cost between a makeshift assembly and a good one is nominal—but the difference in reception results obtained is tremendous. For best results—

Gilfillan Radio Parts

(Units of Recognized Quality)

offer the most at least cost. Ask your dealer for these *better* parts. If your dealer does not handle *Gilfillan*, write us for name of nearest dealer, descriptive folder and list.

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Varicouplers (2 sizes)	Audio Frequency Transformers	Tube Sockets	Vernier Air Condensers
Variometers (2 sizes)	Primary Inductance Switches	Tube Socket Adapters	Filament Rheostats
Air Condensers (3 sizes)	Panel Switches	Detector Amplifier Units	Vernier Rheostats
Potentiometers		Detector Units	Moulded Knobs, etc.

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"and you want to look out for these corporation attorneys, Choate. They eat young fellows like you alive." He turned his back on the young lawyer and faced Audrian. "Goodnight," he said to her, endeavoring to put a caress in his words, "I must be going, dear. Sorry I'm not interested in radio."

When the door closed behind Whitley, Audrian followed Kenneth into the little back bedroom where Joe was busily engaged constructing his new radio receiver.

"Having a deuce of a time with this condenser, Ken," Joe said. "I can't seem to get the plates lined up properly, but you just wait until I get this set hooked up! Gee! I'll bet everything will come in like a million dollars!"

"You bet I will, Joe," agreed Choate. "I'm anxious to see it in operation. When will you be ready for the batteries and the tube?"

"About Friday morning. My rheostat, variocoupler and socket are finished. When I get this dog-gone condenser to working satisfactorily I'll be ready to put the whole thing together."

"I'll be up Friday with the batteries and the tube," Kenneth promised.

"I—don't believe I'll be able to pay for them just now," Audrian put in regretfully.

"I don't want you to," said Kenneth Choate. "This is going to be my treat." He silenced the protests of Joe and Audrian with a wave of his hand. "Don't I come up here and enjoy the programs?" he asked. "I get as big a kick out of your radio as you do yourself, Joe. I guess you can permit me to have a little financial interest in the proposition. Anyway, I'm going to get a nice healthy fee tomorrow. I won the case of Brawley and secured an injunction against the Whitley Corporation. What's more I'm going to lick Whitley to a standstill this time."

"Hope you do," cheered Joe and he chuckled as he bent one of his aluminum condenser plates with a pair of pliers.

Audrian rose stiffly. "I don't see why you both take such great delight in anticipating unpleasantness for the man I am going to marry," she said with a defiant toss of her fair head.

"God!" gasped Kenneth Choate, and all color seemed to rush from his face at her words, "you—you aren't going to *marry* Whitley, are you Audrian?" he cried.

"Yes," she answered, "I certainly am. Friday afternoon at three he is going to call for me. We are going to motor to Santa Ana and be married there. Then we are going on down to San Diego. We'll spend our honeymoon in Coronado."

She turned to leave the room, then she flung back at them: "I now know where you got your incorrect information about Mr. Whitley, Joe. Well, while I'm away you two old maids can sit here together and have a regular old-fashioned gossiping bee." And with another defiant toss of her golden mass of hair she swept majestically from the room.

"My gosh!" ejaculated Joe.

"Lord!" exclaimed Kenneth Choate.

For a long while the two unhappy men sat staring miserably at the cheap carpet that covered the floor of Joe's little bedroom.

Finally Kenneth broke the silence. "We've got to do something to stop this foolishness," he said.

"Sure," agreed Joe, "but what can we do? You know Audrian. She's as stubborn as they make 'em. I've tried to tell her about Whitley. She won't listen to me. She thinks he's about twenty-four karat. Then—" Joe's voice quivered—"then there's me, Ken. Whitley has money—lots of it. Audrian thinks he'll take good care of me if she marries him." He buried his pale face

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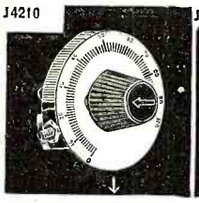
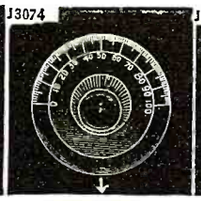
J4210



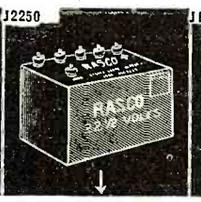
Rheostats and Potentiometers
Come with metal dials and composition knob. Excellent merchandise despite low price.
J4210 6 ohm Rheostat $.27
J4211 30 ohm Rheostat .30
J4212 200 ohm Potentiometer ..... .45

J3074



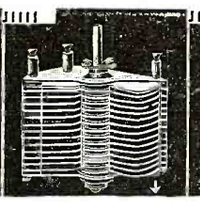
Molded Dials
Only very best grades handled. Bushings absolutely true. Dials cannot wobble. Letters inlaid in fast white enamel. All dials for ¼" shaft.
J3074 Dial 2" .....$.20
J3075 Dial 3" ..... .25
J3076 Dial 4" ..... .40

J2250



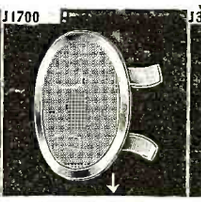
Tapped "B" Batteries
We positively guarantee these batteries to be of long life. We carry only fresh stocks.
J2250 Small 22½ V. $.85
J2251 Medium Navy size, 22½ volt 1.20
J4500 Large size, 45 volt 2.30

J1111



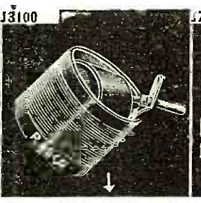
Panel Mounting Condensers
Positively no better condenser on the market. Shafts ¼". Save from 40 to 60% by assembling condenser yourself.
J1111 11 plate, ...$1.10
J2121 21 plate..... 1.22
J4543 43 plate..... 1.33

J1700



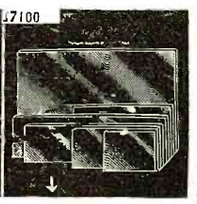
"Rasco" Bezels
Finest Bezel on the market. Bezel comes entirely nickel plated. Can be used on 2½" or 3-16" panel.
J1700 Rasco bezel 1" $.15
J1701 Bezel 1½" diam. ..... .20

J3100

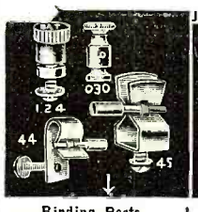


Rasco 180° Variocoupler
Silk wire wound on bakelite tubes. Six taps. Wave length 150 to 600 meters. For panel mounting, ¼" shaft. Your money refunded if it is not all we claim.
J3100 Variocoupler prepaid $1.50

J7100

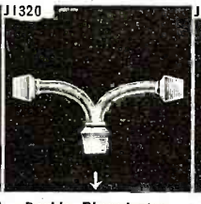


Dilectryte Panels
Highest dielectric strength as per Bureau of Standards.
J7100 7x10x3-16" ..$ .90
J7120 7x12x3-16" .. 1.05
J7140 7x14x3-16" .. 1.20
J7180 7x18x3-16" .. 1.60
J7210 7x21x3-16" .. 1.85
J7240 7x24x3-16" .. 2.10



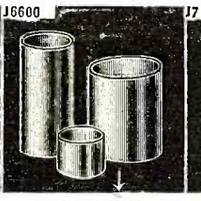
Binding Posts
J030 Small size, ½" high, nickel finish, each ..$.04
J124 Initialed Binding Posts: Antenna; B Bat.—; A Bat. -|-; B Bat. -|-; A Bat. —; Ground; Phone; each ..... .12
J45 Spring Posts, ea. .04
J44 Spring Posts, ea. .07

J1320



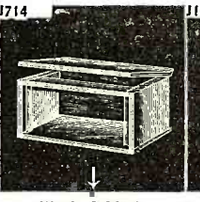
Double Phonodapter
Fits all phonographs and will take any standard double head set, thus making your phonograph a loud talker. Made of cast metal, nickel plated and highly polished.
J1320 Double Phonodapter .....$.65

J6600



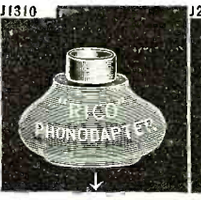
Cardboard Tubing
Only seamless tubing made (I.—Inside Diameter. O.—Outside Diameter. L.—Length), J6600, 3" L, 3½" O., 7" L., $.30 J6601 3½" I., 3¾" O., 7" L., $.35. J6604, 4" I., 4¼" O., 5" L., $.35. J6605, 2¾" I., 3" O., 2⅜" L. $.15

J714



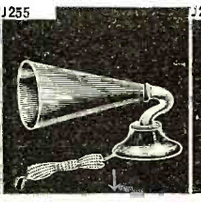
Wood Cabinets
Highest grade mahogany cabinets made. Top is hinged. Made of ½" stock.
J714 Panel, 7x14"...$3.35
J718 Panel, 7x18".. 3.60
J724 Panel, 7x24".. 4.40
J710 Panel, 7x10".. 2.60
J712 Panel, 7x12".. 3.00
J721 Panel, 7x21".. 3.90

J1310



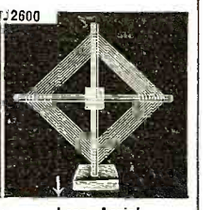
Phonodapter
Will fit any phone. Make your phonograph a loud talker. Fits all phonographs. Made entirely of pure soft rubber with brass tube insert.
J1310 Phonodapter...$.40

J255



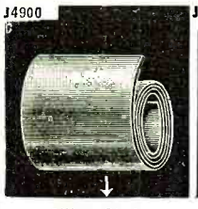
Melotone Loud Speaker
Best popular loud speaker. Fibre horn, heavy metal base, five foot cord. Nickel goose neck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
J255 Melotone Speaker $4.90

J2600



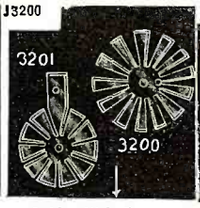
Loop Aerial
Made entirely of well seasoned hard wood. Complete with all parts and base. Total height of loop 36". Can be put together by anyone in less than 5 minutes.
J2600 Two ft. loop aerial, complete $1.15

J4900



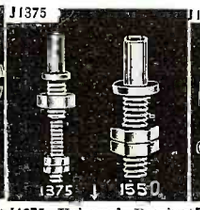
Silicon Steel
Used practically in all audio-frequency transformers. Better than iron. Extremely soft. ⅜" wide and .007" thick.
J4900 Silicon steel per foot .....$.08

J3200



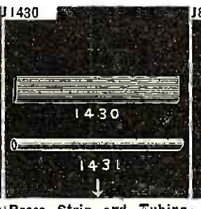
Spider Web Forms
Fine forms to wind your spider webs. Made from hard, well seasoned fibre, 1-16" thick, center and side holes for wiring. Both 5" diameter.
J3200 Spider form, $.25
J3201 Spider form $.25

J1375



Universal Bearing
to hold rotors. Length of bearing 2¾", shaft 1⅛", thread 1" long, thread sleeve ¾" long. each .....$.25
J1550 Sockettes. Four of these take one vacuum tube. Grasp tube firmly. Best by test. Set of 4 $.25

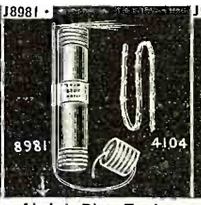
J1430



Brass Strip and Tubing
Brass strip ½" wide; 1-16" thick; 6" long.
J1430 Per length....$.10
J1431 Brass tubing, dia. ¼", 6" long; length.$.15

Threaded Brass Rods
Sold in 6" lengths only.
J8032 8-32" thread $.08
J6032 6-32" thread ..$.06

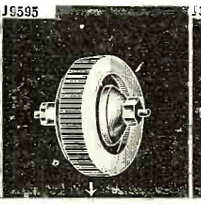
J8981



Alcohol Blow Torches
Best made. Give intense hot flame. Great for fine work.
J8981 5" Torch.....$.85
J8982 3" Torch..... .50

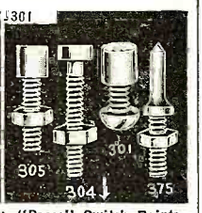
J4104 Rosin Core Solder.
A non-corrosive solder with flux inside.
18" length .....$.10

J9595



Skinderviken Button .
Famous Micro-Phone for Transmitters. Sold all over for $1. This is the genuine article. No imitation. Smallest and most sensitive microphone made.
J9595 Microphone ...$.75

J301



"Rasco" Switch Points
Nickeled and polished.
J301, ¼"x¼", 6/32" doz. .....$.18
J304, ¼" dia., ⅛" thick; 8/32", doz .....$.18
J305, ¼" dia., 3/16" thick, 4/36", doz. ....$.18
J375, ⅞" long, 4/36" with nut, doz ..... .18

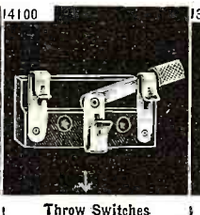
Cat. 10

FREE
The big "Rasco" catalogue. Contains all Armstrong circuits. Every up-to-date vacuum tube hookup. Greatest little book printed. Free upon receipt of postal.

J5353

The Radiogem
The simplest radio outfit made. Includes all parts for tuning: coil, tapped switch, crystal, catwhisker.
J5353 Radiogem, no aerial or phone .....$.75
J5354 Radiogem, with 1000 ohm phone and 3 ft. cord $3.75

J4100

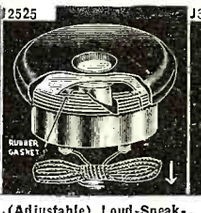


Throw Switches
Mounted on composition block. Small enough for all radio purposes.
J4100 Single pole ...$.25
J4101 Double Throw Single Pole .....$.35

J3150

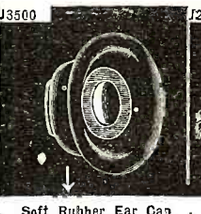
Bakelite 180° Coupler De Luxe Style
Tubes of natural color bakelite, wound with green silk. Aluminum bracket, ¼" shaft. Primary 13 taps. 180 to 550 meters.
J3150 Coupler $2.45

J2525



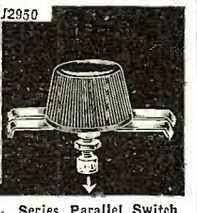
(Adjustable) Loud-Speaker Phone
Has rubber gasket underneath diaphragm, making phone fully adjustable. Gives amazing results as loud-talker on 1 and 2 stages of amplification.
J2525 Speaker with 5 ft. cord $3.70

J3500



Soft Rubber Ear Cap
At last! Ear caps that will relieve headaches, earaches, and undue pressure on the ears. Fit all receivers.
J3500 Ear caps; pair $.50

J2950



Series Parallel Switch
Quick change from one circuit to another. Black composition knob, nickle plated fittings. Blade radius 1¾".
J2950 Series parallel switch .....$.25

Short Wave Regenerative Receiver

1—J710 Mahogany Cabinet 7"x10" $2.60
1—J7100 Dielectryte Panel 7"x10" ..... .90
1—J3150 DeLuxe Variocoupler 2.45
1—J4343 43 Plate Condenser 1.60
2—J3075 3" Dials ..... .50
1—J200 Switch Lever ..... .25
1—Doz. J305 Switch Points.. .18
2—J375 Switch Stops..... .04
1—J6500 Vacuum Tube Socket .35
1—J5060 Grid-Leak Condenser .30
1—J4311 30 ohm Rheostat... .65
1—J1000 Double Circuit Jack .65
8—J201 Binding Posts ..... .80
8—J6000-8 Binding Post Name Plates ..... .24
24 Ft. J6400 Bus Bar Wire .60
Blue Prints and directions for assembling ..... .50

Total $12.61

Our Price $12.00

Reinartz Circuit

1—J710 Mahogany Cabinet 7"x10" $2.60
1—J7100 Dilectryte Panel 7"x10"x3-16" ..... .90
1—J2660 Reinartz Inductance (225 to 600 meters) 1.90
1—J6500 Vacuum Tube Socket .35
1—J4311 30 ohm Rheostat.. .65
2—J2121 21 Plate Variable Condensers 2.50
1—J5059 Grid Leak Condenser ..... .30
8—J201 Rasco Binding Posts .80
2 Doz. J305 Switch Points.. .36
3—J200 Rasco Switch Levers .75
2—J3075 3" Dials ..... .50
2—J1450 Vernier Attachments ..... .60
24 Ft. J6400 Bus Bar Wire .60
1—J1000 Double Circuit Jack .65
1—J1003 Rasco Plug ..... .55
8—J6003 Binding Post Name Plates ..... .24
1—J1430 Brass Strip 6"x½"x1-16" ..... .10
1—Consrad Assembling Pattern ..... .50

Total $14.85

Our Price $14.25

2 Stage Amplifier

1—J710 Mahogany Cabinet ..$2.60
1—J7100 Dilectryte Panel .. .90
2—J1100 A.F. Transformers. 4.00
2—J1000 Double Circuit Jacks 1.30
1—J1003 Rasco Plug ..... .55
2—J6500 Tube Sockets ..... .70
2—J4311 30 ohm Rheostats.. 1.30
10—J6060 Post Name Plates .30
10—J201 Rasco Binding Posts 1.00
30 Ft.—J6400 Bus Bar Wire .75
Blue Prints and directions... .50

Total, $13.90

Our Price $13.50

RADIO SPECIALTY CO., 98 Park Place, New York City

Factories: Brooklyn, N. Y. Elkridge, Md.

in his white hands. "Oh, I wish I had my strength back," he sobbed.

Kenneth Choate gazed pityingly on the bowed head of his friend and placed a hand on Joe's shoulder.

"Never mind, Kid," he said, "your strength's returning all right. And what's more we'll find a way to open Audrian's eyes."

Suddenly Kenneth sprang to his feet. "I have it!" he almost shouted. Then he sat down again beside Joe and began to whisper to him. The faces of the two men brightened as the young attorney unfolded his plan to Audrian's brother.

Presently Kenneth rose and prepared to depart.

"Tomorrow is Thursday," said Joe. "I'll have the condenser completed by noon. If you will bring the batteries and the tube Friday morning I'll be ready to listen in by two o'clock in the afternoon."

"Good!" exclaimed Kenneth. "I'll have to do some tall hustling tonight. But we'll make it. And I want to be here when you try out this new set for the first time."

As he departed from the Waite apartment, Kenneth heard Joe whisting merrily. He began to smile broadly, but there was a serious light of determination in his fine grey eyes.

The young attorney hailed a taxicab in the street, gave the driver a street name and number and was whisked away to an apartment house in the eastern section of Hollywood. He entered the building hurriedly, climbed two flights of stairs and knocked with bare knuckles on the mahogany panel of a broad door. There came the sound of rustling silk from within. The door swung open a few inches. A heavy scent of perfume assailed the nostrils of Kenneth. He gazed politely at the kimona-clad figure of the girl who stood before him.

"Miss Le Clair?" he asked.

"Yes," she answered, in a rather rasping, high-pitched voice, "what is it you want?"

Kenneth gave her his name and some information concerning his mission. He was admitted to the luxuriously furnished apartment. A few moments later he was gazing into the face of a girl who had once been very beautiful, but upon whose lovely features the stamps of time and experience had left ugly marks. The young attorney was talking very earnestly to the girl, pleading.

Friday morning Audrian rose with the sun. Today was to be her wedding day and she sprang from her bed with a queer feeling of uncertainty gripping her heart. She bathed, dressed her hair carefully and donned the best and only traveling suit she possessed. There were circles of weariness beneath her violet eyes. She had not slept well. She was nervous and excited. All night she had been thinking of Joe and of his frank manner of expressing his dislike for Tom Whitley. And she had recalled Kenneth Choate's exclamation following her announcement that she intended to marry Whitley. Somehow, that exclamation had bothered her ever since its utterance.

Joe was dressed and working feverishly on his radio outfit when Audrian went out to prepare breakfast. He looked up at her as she entered the room.

"I suppose I ought to congratulate you, Sis," he said. "Today is your wedding day."

Suddenly Audrian found herself on her knees before Joe with her face buried in his lap. She cried bitterly. Joe caressed her hair with his thin fingers.

After her outburst Audrian rose, washed her eyes with cold water and prepared the morning meal.

The day promised to be beautiful. There was a hint of spring in the air and the illusive odor of orange blossoms. Somewhere in the neighborhood a mocking-bird was

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To Them We Offer Standard High Grade, Well Advertised Merchandise That Will Allow for a Handsome Profit When Sold to Friends in Their Neighborhood. Below is a Partial List of the Many Values We Offer:

	List Price	Agent's Price	Agent's Profit
Tubes, U.V.199, U.V.201A, W.D.11, W.D.12	$ 6.50	$ 5.45	$ 1.05
Tubes, French Detector and U.V.200	5.00	4.20	.80
Tubes, French Amplifier	5.00	4.20	.80
Tubes, DeForest D.V.6	6.00	4.95	1.05
6, 20, 30 and 40 Ohm Plain Howard Rheostats	1.10	.85	.25
6, 20, 30 and 40 Ohm Vernier Howard Rheostats	1.50	1.20	.30
Howard Multiterminal Plug	2.00	1.65	.35
Howard Inductance Switch	.50	.40	.10
Carter Vernier Rhoostats 6 ohm	1.50	1.20	.30
Carter Vernier Rheostats 20 and 30 ohms	1.75	1.40	.35
Walnart Inductance Switch	1.00	.80	.20
Carter Inductance Switch	2.00	1.60	.40
H.K. 15 pt. Inductance Switch	2.00	1.60	.40
Madera Clear Speakers (Diecast Wood) Equipped with Baldwin Units)	15.00	11.75	3.25
Seaman Acoustical Fibre Horn	16.00	12.25	3.75
Waveland Concert Receiver (unassembled)	20.00	17.00	3.00
Waveland Two Stage Amplifier (wired)	20.00	17.50	2.50
Accessories for Concert Receiver	18.00	15.60	2.40
Accessories for Concert Amplifier	29.00	24.90	4.10
Crosley Model XJ Receiver	65.00	55.75	9.25
Crosley Model XJ Complete with accessories	127.00	107.95	19.05
Ace Type V Receiver	20.00	17.00	3.00
Ace Two Step Amplifier	20.00	17.00	3.00
Ace Type 3-B Det. and Two Stage Amp. Combined	50.00	42.50	7.50
Ace 3-C Consolet Model	125.00	106.25	18.75
Grebe CR5	80.00	68.00	12.00
Grebe CR9	130.00	110.50	19.50
Grebe CR12	175.00	150.00	25.00
Waveland Superior "B" Batteries			
Waveland Small Two Tap 22½ V	1.40	1.05	.35
Waveland Medium Six Tap 22½ V	1.70	1.38	.32
Waveland Large Six Tap 22½ V	2.25	1.85	.40
Waveland Large Six Tap 45V	3.85	3.15	.70
Waveland "C" Battery Unit	.60	.48	.12
Eveready Drycell "A" Batteries			
Eveready Single Unit 1½ Volt	.40	.33	.07
Eveready Two Unit 1½ Volt	1.00	.80	.20
Eveready Four Unit 1½ Volt	2.00	1.60	.40
Genuine Baldwin Head Sets	12.00	9.75	2.25
American Elec. Co., Victo Head Sets	6.00	4.80	1.20
Trimm Dependable Head Sets	5.00	4.00	1.00
Trimm Professional Head Sets	6.00	4.80	1.20
Frost No. 161 Head Set	4.00	3.35	.65
Frost No. 162 Head Set	5.00	4.00	1.00
Frost No. 172 Head Set	6.00	4.80	1.20
Genuine Baldwin Loud Speaker Unit	6.00	5.00	1.00
American Elec. Co. (Burns Speaker Unit) (Adjustable Diaphragm)	10.00	7.90	2.10

Walnart Variable Condensers

Mfd. Plate Capacity							
3 .00006	$1.25		1.00				.25
5 .00010	1.50	Plain	1.20	Vernier			.30
13 .00025	2.00	Vernier	$4.00	1.60	$3.25	Plain .40	.75
23 .0005	2.75	4.50	2.25	3.65	P.50	.60	.85
43 .001	3.00	5.50	2.40	4.50			1.00

Bakelite Dial 3-inch Dial, Furnished on all Vernier Type Condensers.

Waveland Bakelite 3-inch Dial (¼ in. Shaft)	.35	.25	.10
Walnart Variable Grid Resistance	1.00	.80	.20
Walnart Variable Grid Resistance with .00025 Mfd. Condenser	1.25	1.00	.25
Walnart Standard Tube Socket Metal	.50	.40	.10
Walnart U.V.199 Tube Socket Metal	.50	.40	.10
Na-ald Bakelite Moulded Sockets			
DeLuxe No. 400 (Standard base)	.75	.60	.15
Small Space No. 401 (Standard base)	.35	.27	.08
W.D.11 No. 411 (W.D.11 base)	.75	.60	.15
Special No. 499 (U.V.199 and C299 base)	.50	.40	.10
Two-in-one No. 450 (Standard & W.D.11 base)	.50	.40	.10
U.V.199 Adapter No. 429	.75	.60	.15

	List Price	Agent's Price	Agent's Profit
Formica Panels			
6"x7"x3-16"	.84	.72	.12
7"x9"x3-16"	1.26	1.06	.20
7"x12"x3-16"	1.68	1.43	.25
6"x14"x3-16"	1.68	1.43	.25
7"x14"x3-16"	1.96	1.66	.30
7"x18"x3-16"	2.52	2.14	.38
6"x21"x3-16"	2.52	2.14	.38
7"x21"x3-16"	2.94	2.50	.44
7"x24"x3-16"	3.36	2.85	.51
12"x14"x3-16"	3.36	2.85	.51
12"x21"x3-16"	5.04	4.29	.75
Cabinet Mahogany Finished			
6"x7"	2.50	2.00	.50
7"x9"	3.15	2.60	.55
7"x12"	3.50	2.90	.60
6"x14"	3.30	2.90	.40
7"x14"	3.60	3.05	.55
7"x18"	4.15	3.20	.95
6"x21"	3.90	3.10	.80
7"x21"	4.20	3.45	.75
7"x24"	5.50	4.45	1.05
12"x14"	5.10	4.15	.95
12"x21"	6.00	5.10	.90
Waveland Loop Antenna	10.00	7.80	2.20
WorkRite Variocoupler 180 degrees	3.50	2.40	1.10
WorkRite Variometer	3.50	2.40	1.10
National Variocoupler 180 degrees	4.25	2.95	1.30
National Variometer	4.50	3.10	1.40
Bremer Tully Vernier Tuning Unit	5.00	3.85	1.15
National Audio Frequency Transformer 6:1 Ratio	4.50	2.70	.80
National Audio Frequency Transformer 3½:1 Ratio	4.00	2.50	1.50
All American Audio Frequency Transformer 10:1 Ratio	4.75	3.85	.90
All American Audio Frequency Transformer 5:1 Ratio	4.75	3.85	.90
All American Audio Frequency Transformer 5:1 Ratio	4.50	3.65	.85
National Radio Frequency Transformer	3.00	2.15	.85
Tri Coil Radio Frequency Transformer	2.00	1.60	.40
Carter Telephone Jacks			
One Spring; Open Circuit No. 101	.70	.55	.15
Two Springs; One Break Contact Closed Circuit No. 102	.80	.65	.15
Three Springs; One Local Make Contact, Single Filament Control No. 103	.90	.75	.15
Four Springs; Double Circuit No. 104	1.00	.80	.20
Carter Plug, Takes Two Pair Phones	1.00	.80	.20
American Plug, Takes Two Pair Phones	.75	.55	.15
LeFax Radio Handbook	5.00	3.75	1.25
Antenna Wire, 7 Strand No. 22, Per 100 Ft.	.90	.70	.20
Ground Wire No. 14 Insulated, Per 100 Ft.	1.50	1.22	.28
Antenna Insulators, Each	.10	.07	.03
Waveland Lightning Arrester	1.50	1.05	.45
Jewell Lightning Arrester	1.10	.90	.20
Little Joe Lightning Arrester	1.25	1.00	.25
Walnart Comp. Engraved Binding Posts	.10	.07	.03
(Ant. Grd. Tel. "B" Bat. — "B" Bat. -|- "A" Bat. — "A" Bat. -|- A -|- B — Plain)			
Rosin Core Solder per 18 in. Length	.10	.06	.04
Spaghetti (Varnished Tubing) 4 ft. Lengths	.25	.20	.05
Tinned Copper Wire No. 14 Per Foot	.01½	.01	.½
Ultra Audion Spiderweb Coils	2.00	1.60	.40
Reinartz Spiderweb Coils	2.50	2.00	.50
Belden Double Cotton Covered Wire No. 18 per ½ lb.	.45	.40	.05
Belden Double Cotton Covered Wire No. 20 per ½ lb.	.55	.48	.07
Belden Double Cotton Covered Wire No. 22 per ½ lb.	.70	.60	.10
Belden Double Cotton Covered Wire No. 24 per ½ lb.	.75	.65	.10
Belden Double Cotton Covered Wire No. 26 per ½ lb.	.90	.80	.10
Belden Double Cotton Covered Wire No. 28 per ½ lb.	1.10	.95	.15
Belden Double Cotton Covered Wire No. 30 per ½ lb.	1.40	1.20	.20
Belden 37 Strand No. 38 Litz Wire, 100 Ft. Coil	2.00	1.50	.50
Tungar Battery Charger, 2 Ampere Outfit	18.00	15.30	2.70
Waveland Battery Charger, 2 Ampere Outfit (Using Tungar Bulb)	16.00	13.60	2.40
R.W. Crystal Detector (Self Adjusting)	1.50	1.20	.30
R.W. Crystal Receiving Set	12.50	9.50	3.00
WorkRite Neutrodyne Kit (Consists of 3 Neutroformers and 2 Neutrodons)	17.50	14.00	3.50

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3rd. Maintain the list price when selling.

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INCORPORATED

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sending out a trilling call to its mate. Audrian began to absorb some of the spirit of the day.

"Won't it be fine when we have a home of our own again, Joe?" she asked. "There'll be a garden and a tennis court and a fine garage. And there'll be a radio room for you, Joe."

"Um!" grunted Joe as he tackled his eggs with a ferocity that belied a sick man. "Ken's building the swellest little bungalow out in the Beverly Hills. It's up high. Wonderful place for an aerial."

Audrian's cup of coffee stopped halfway on the journey to her fair lips.

"Tom is going to build us a fine home in the Wilshire District," she said.

"Um!" grunted Joe again, this time without enthusiasm. "What time are you leaving for Santa Ana, Sis?"

"Tom will call for me at three."

There came a knock on the door.

"Come in!" called Joe.

"Can't," answered Kenneth Choate. "I have my arms full."

Audrian opened the door and in staggered Kenneth with his arms crowded with packages. He set them down on convenient chairs.

"There's the stuff you need, Joe," he said, "two 'B' batteries, a six-volt wet-cell and several tubes. In case one tube burns out you'll always have another on hand."

"You're good to—to Joe," murmured Audrian.

"Sure. Why shouldn't I be? I like him. And his sister! Say, Audrian, I want to wish you all the happiness in the world."

Something seemed to tighten around Audrian's throat like a band of steel as she gazed into Kenneth Choate's eyes and found therein a look of tenderness which seemed to be tinged with utter dismay.

"I'm going out to select a wedding gift now," Kenneth told them, "but I'll be back to listen in on the new radio set at two."

All during the morning hours Audrian was busy packing her suit-cases and doing the thousand and one little things a woman does on her wedding day. The hours passed swiftly. She prepared lunch at noon, but Joe refused to leave his radio set long enough to eat.

At one o'clock Kenneth returned. This time he brought another armful of packages. In one, there was a large black horn which could be connected to Joe's radio set and which would abolish the necessity of listening with the headphones. In another, there was a box which Kenneth exultantly declared was a two-step amplifier.

"You pick up the music with your set," he told Joe, "and this amplifier will bring the sound out through the horn with such volume that it can be heard all over the house."

"It must have cost a lot of money!" Audrian exclaimed.

"It's worth it, if it does the work," Kenneth assured her, earnestly.

And then he pulled forth a small package from a side pocket of his coat and handed it to Audrian.

"Your wedding gift from me," he said.

Audrian opened the box with trembling fingers. When her gaze fell upon the beautiful pendant which lay curled on the soft blue velvet of the container, she turned to Kenneth with sparkling eyes.

"You're a—a dear!" she said softly and again she was overcome by a flood of tears.

Joe put an arm around her. "Come on, Sis," he commanded, "let's tune in and see what we can get with the new radio outfit."

The three of them filed into Joe's little room. Kenneth and Joe sat close to the table on which the radio receiving apparatus stood while Audrian reclined on the bed and

gazed, fascinated, into the bell of the big black horn which faced her.

Presently the sound of music came filtering into the room. As Joe made an adjustment here and another there on the panels of the detector and amplifier, the volume grew greater and greater until the whole room was flooded with a roar of melody.

"Isn't that wonderful!" Audrian cried. She sat erect and stared with new interest at the black mouth of the horn.

Suddenly the music stopped. The sound of a voice came roaring into the room. "This is KFI, the Radio Central Station of Earle C. Anthony, Incorporated, located at Eleventh and Hope Streets, Los Angeles, California. The next number on our program this afternoon will be rendered by the Packard Twin-Six Orchestra. The selection is entitled 'Peggy Dear.'"

In a moment the air was filled with a rush of melody.

Kenneth Choate's eyes were gleaming. He glanced at his watch. It was one minute of two o'clock.

"Tune in on the Catalina wave-length," he told Joe.

Audrian was intereted. "What do you mean by Catalina, is there a broadcasting station there?"

Joe explained: "All telephone communications which take place between Catalina and the mainland are broadcast. For instance: If you desire to converse with some one in Catalina from here, you call Long Distance and are connected with the broadcasting station at Long Beach. The party to whom you are going to talk is connected by wire to the broadcasting station at Avalon. Your voice is picked up over the wire, sent through the broadcasting set, received at Avalon and sent over the wire to your party. The same thing applies to the other end."

"Heavens!" exclaimed Audrian, "isn't that wonderful! Then anyone who has a radio outfit can hear all the conversations that take place between Catalina and the mainland?"

"Sure," said Joe, "they can if their receiver is sensitive and efficient enough."

With a trembling hand, Joe turned a black knob and the sound of the music disappeared instantly. Joe made several adjustments of dials and presently a voice came ringing through the horn.

"Here's your party," said the voice.

"That is the Catalina Central!" Joe cried.

"Sh-h!" warned Kenneth.

"Go ahead," said Central.

"Hello!" came a rather high-pitched feminine voice.

"Hello!" answered a musculine one which sounded strangely familiar to Audrian and which caused her to sit suddenly erect on the bed.

"Is this you, Tom?" queried the feminine voice.

"Yes. Tom Whitley. Who is calling?"

"This is Dorothy, Tom."

"Dorothy—Dorothy—"

"Yes. Dorothy Le Clair."

"Oh!" exclaimed Tom Whitley. Then he laughed and the harsh tones of his voice rang in the ears of his listeners with a distinctness that contrasted the color from Audrian Waite's face. "I thought you were off me for life," he went on.

"No, Tom," the feminine voice answered, "I couldn't be that. I have longed for you, hoped you would look me up. I couldn't stand it another day. I just had to call you up. Don't you care—a little bit?"

There was a moment of silence, then Tom Whitley's voice rang through the radio horn toward which Audrian was straining.

"Sure I care, girlie. But you were beginning to get mean about things. I'm a good sport, but I'm not a—a marrying man. What do you want?"

"I'm calling from Catalina, Tom," replied Dorothy Le Clair. "I'm over here alone. I —I thought perhaps you'd like to join me. I have to get back on the lot next Tuesday. Starting a new picture. Won't you come over on the boat tomorrow? Please, Tom."

Audrian thought it was an eternity before Tom made his answer. In fact, Whitley only hesitated for the fraction of a minute.

"Sure I'll come over, Dot. I'll take a 'plane this afternoon. But it will certainly change my plans some. I was going to be married this evening."

"Married! Really?"

Again the harsh laughter of Tom Whitley filled the room in which three listeners were frowning into the yawning mouth of the radio horn.

"No," answered Tom, "not really. It is to be one of those convenient marriages. You know the kind."

"Yes," replied the girl in a low voice, "I know the kind. Ceremony performed by a friend."

"Sure. That's it. Your a wise little girl. Well, I'll call the other lady on the telephone and postpone the engagement temporarily."

"Good!" cried the voice of Dorothy Le Clair, "you do that little thing. Perhaps it will give the lady a chance a find out what a rotter you are before it's too late."

Once more there came the sound of Tom Whitley's harsh laughter.

Joe turned a dial on the receiving set. He did not look at Audrian. But Kenneth Choate did. And an expression of tenderness and pity swept over his face as he saw the hurt and the agony that were reflected in Audrian Waite's eyes as she rose unsteadily and left the room.

Kenneth followed her. And presently he was holding her tightly in his arms and she was crying softly on his shoulder.

"What a fool I've been," she whispered in Kenneth's coat, "what a big fool."

Pouring into them from the little back bedroom there came a flood of melody.

"This set sure does the work," called Joe, contentedly.

"It sure does," agreed Kenneth Choate.

And then he lifted Audrian's face to his and pressed his lips to the warm, unresisting ones of the girl he loved.

The German Radio Compass for Shipboard

(*Continued from page* 885)

of the sound can be fixed more easily than its maximum, the latter procedure is followed, to find out the direction from which the wireless signals are coming.

In the way just described, the coast-stations ascertain, from where the signals come, which ship is sending. Thus they fix the two lines which cut in the position of the ship. After this they fix the base-line by which they are connected themselves. Thus a triangle is found of which three values are given: the base-line which connects the two coast-stations and the two angles formed by the lines leading to the ship. These three quantities are transmitted to the ship by wireless. As all values of a triangle can be found if three of them are known, they are able on board the ship to find out their exact position.

As can easily be understood, the proceeding is somewhat troublesome. It would simplify the matter a good deal, if the ship itself could receive signals from any two coast-stations. For this purpose the ship must be provided with a revolving loop aerial. The aerial is turned until the sig-

nals of a certain station are not heard any more, then by help of a compass-card attached to the aerial the position of the sending station is fixed. Thereupon the aerial is turned until a second coast station is no longer heard. Also in this case the line of direction is ascertained. Thus the angle is found, in the point of which the ship finds herself or by help of a map and the three lines mentioned above that are easily found on it, the triangle can be constructed, which is the basis of all the necessary calculations.

Though this proceeding is a simple and convenient one, its practical application brings about difficulties. To begin with, the iron mass of the ship sends out disturbing magnetic fields which influence the sensibility of the loop aerial. Corrections must be made with the aid of another ship. This second ship circles around the first one, on which the wireless bearing apparatus is installed. By comparison to a compass, the misleading action of the masses of iron is fixed from degree to degree of the compass card. Thus for each ship and each apparatus a table of deviation is found by which the corrections of the reading have to be taken. Further, the receiving aerial itself offers an electric field that causes disturbances and gives reason for mistakes. The Telefunken-Gesellschaft in Berlin has succeeded in correcting these mistakes by a special method. This method consists in supplying an additional receiving energy, compensating the disturbing influences of the electric field of the aerial. Moreover with the aid of the loop aerial it cannot be determined whether a sending station lies before or behind the ship or to her right or left. If two stations lie at an angle of 180 degrees to each other, the minimum is found always at the same position of the aerial. In order to determine whether the transmitting station is situated before or behind the ship, the aerial is provided with a certain amount of additional energy. By help of this additional energy, given to the aerial by a coupling system, it can be recognized whether the station finds itself before or after, on the port or on the starboard side of the ship.

A reliable bearing can only be found with a loop aerial, the axis of which is hanging strictly perpendicular. After a good deal of trouble there has been found a special type of cardanic suspension which gives excellent results. The arrangement of the wireless bearing-compass is a very practical one. The hand-wheel by which the aerial is turned is connected with a 360-degree scale. If the loop aerial stands in the right position, the direction of the sending station can be read off directly from the scale.

The trial trips with the new bearing apparatus, recently made, were satisfactory in all respects. It has been installed on the surveying ship *Panther* and showed an exactness of measuring up to $\pm$ 0.7 degrees. No mistakes were recorded. The new wireless bearing-compass succeeded not only in fixing the position of the ship during the night, and in foggy weather, but also in finding out easily and with certainty other ships asking for help. Such a ship steamed ahead for 13 miles in the bay of Kiel, which was covered by a heavy fog, and gave wireless signals. The *Panther* searched for the ship. As she had to avoid other ships crossing her way, she had to find the old directions again after each meeting of that kind. The wireless receiver was installed inside the ship from where the necessary commands were given to the man at the helm by telephone. Without any error the ship looked for was found. It will not be necessary to explain how great an advantage this proceeding will be for ships in need.

It is very easy to steer a ship in a certain course by the help of the wireless bearing-compass. The man at the helm was provided

with head-phones and was told to steer in such a manner that he heard no sound. By this simple method he found the aim without difficulty. The accuracy with which it was reached was astonishing.

In this manner radio has added another safety system in navigation to its many former ones, a success of highest importance for the security of ships at sea.

Pioneer Pathfinders of Radio

(*Continued from page* 868)

Faraday's appetite for science was whetted, for numerous scientific works were sent to his master for binding, and while in the process Faraday had a good opportunity to read and absorb them. His interest was aroused sufficiently by these works to make him next attend lectures on science, and it was his custom to take copious notes at these. This habit was to stand him in good stead later. Through the medium of one of the customers of the bookshop Faraday was enabled to attend several lectures on chemistry given by Sir Humphrey Davy, at that time the greatest English scientist. This chance attendance may be considered the turning point in Faraday's life. He took notes of these lectures as usual, and elaborated and rewrote them. Having decided to leave bookbinding and go into some scientific work he wrote Sir Humphrey Davy a letter asking whether he could not employ him in some scientific capacity, at the same time sending along the notes he had written of Sir Davy's lectures as a sign of his scientific interest. This ultimately led to the employment of Faraday by Sir Humphrey Davy, as assistant in the laboratory of the Royal Institution of London. Once Faraday wedged his way into some position connected with science it was a matter of short time before he began to do original research work and became the leading electrical scientist of his time and one of the foremost of all time.

Faraday spent his first years of original research work in the field of chemistry in which branch of science he achieved very high distinction. While engaged in such work Oersted made his famous discovery in 1820, namely the discovery that a magnetic needle is deflected by a current flowing through a wire when the needle is near the wire. This notable discovery threw the entire scientific world in a furor, and everybody of any note in science began either to speculate and theorize or to experiment on the basis of this fact. It was likewise an impetus to Faraday who devoted thereafter as much time as possible to electric and magnetic researches, attempting to discover the real nature and explanation of this phenomenon which was the wonder of the age.

The subject which was always uppermost in Faraday's mind was the real connection between magnetism and electricity. It was well known, but not understood at the time, that a direct current through a coil of wire could magnetize an iron core if placed in the coil. In other words electricity could produce magnetism. Faraday was a great believer in the correlation of forces; he believed that all different types of energy could be converted from one form into another, ultimately all forms of energy being reducible to some common type. Since electricity could pro-

duce magnetism then, why not have magnetism produce electricity? Faraday worked on this problem for a very long time, but experiment after experiment produced negative results. Finally, however, his experiments yielded him the result he was looking for when he was able to produce a current in a coil by the motion of a very powerful magnet near the coil. From this he went to the problem of producing a current in the coil by means of the flow of a current in a neighboring coil. Thus the phenomenon of electro-magnetic induction was discovered, and the intimate relationship between magnetism and electricity finally established. At the same time in developing his theory and explanation of the actions taking place in induction he invented the nomenclature of "magnetic and electric lines of force", which conception is at the basis of a real physical understanding of electric and magnetic phenomena.

Up to the time of Faraday's momentous discovery of electro-magnetic induction, only direct current was available, and this only from voltaic cells. Electric power was, therefore, an impossibility. The discovery of induction ushered in and made possible large scale industry; it is the basis of the gigantic electrical industry which exists today. Without electro-magnetic induction modern industry is not conceivable, since the generation and transmission of power, which is the basis of modern industry, is not possible otherwise. Induction likewise plays a major rôle in radio. Induction is the chief means whereby energy is transferred from one radio circuit to another. There is hardly any radio set or equipment in which induction is not a prominent action of the circuit or set. It is, therefore, obvious that Faraday must be regarded as one of the first pioneers of radio simply on the basis of his discovery of electro-magnetic induction.

Faraday had thus succeeded in converting magnetism into electricity and had thus shown the essential unity of the two forces of electricity and magnetism. In his time the different ways of producing electricity were essentially by means of the voltaic cell, by friction and, as he showed, by induction. But the currents produced by these different methods were regarded as different from one another, even by the most prominent scientists. Such a conception was very odious to Faraday and he devoted some time to proving that all forms of electricity, no matter how produced, were alike. Again in his most remarkable work on electro-chemistry he showed how electricity produced chemical reactions, and vice versa, and thus again demonstrated the essential unity between different forms of energy. Another link added to his chain of reasoning in which he shows how all forms of energy are correlated. Magnetism and electricity were convertable into one another, all forms of electricity are alike, electricity and chemistry were shown to have some common basis. There was one other problem in identifying forces to which he turned his attention, namely the relationship between light and magnetism. There was no evidence pointing to such a relationship, yet his mind conceived the possibility of such an identity. Thus we find in his writings such remarks as "What may be the best means of causing light to evolve electricity and magnetism are thoughts continually pressing upon the mind." (Experimental Researches No. 2242).

Here again he attacked the problem experimentally, as he did all his problems, and for a long time searched eagerly for some manifestation of a connection between light and electricity, but with no success. "Never say die," seems to have been his motto, for in the face of failure after failure to observe such a connection between light and electricity, he still continued to work and perform experiments. Ultimately in a series of brilliant experiments he succeeded in producing some effect on a ray of light in a strong magnetic field. Light when passed through

certain crystals becomes polarized, which means that the vibrations which make light are executed in one plane. By means of a powerful magnetic field Faraday was able to rotate this plane in which the vibrations take place, namely he rotated the plane of polarization. While this showed that a magnetic field could have some effect on a light ray it did not establish the identity of light and electricity. Faraday continued experimenting along these lines and although he searched for certain definite results which would point to such an identification he was not able to find them.

However, what he could not establish experimentally he boldly proclaimed in theory. Faraday was essentially an experimenter. He never would theorize where he could experiment. But he was unable to reach positive results along this line, partly because of the limitation of apparatus, which at best was very crude, and partly because, perhaps, there was so little data on the subject at hand. The theory of electricity was in an elementary state as yet. Although he could not definitely establish this identity between light and electricity experimentally, he felt so sure of his ground that he proclaimed this relationship in a very brief statement, which is one of the most important he ever issued.

In a letter to the Philosophical Magazine in May, 1846, Faraday formally stated his conception of the relationship between light and electricity. He considered that space is filled with lines of force, such as electric or magnetic or gravitational lines of force. Any transferrence of action, as for example the attraction of iron to a magnet, or the falling of an apple, or the motion of a magnet in the vicinity of a current, is due to the lateral or sidewise shaking of these lines of force, or to the vibration of these lines of force. In his own words: "The view which I am so bold to put forth considers, therefore, radiation as a high species of vibration in the lines of force which are known to connect particles and masses of matter together." In other words, light, which is a form of radiation, is due to the vibration of lines of force, possibly magnetic or electric lines of force.

We have here the germ of the electromagnetic theory of light. With absolutely no data to go by, Faraday conceived such a relationship between light and electricity, two manifestations of energy which seemed to be separate and distinct forms of energy. The brilliance of this speculation cannot be exaggerated. To us today it may not seem so great. We have experimental proof of such a relationship, radio communication over thousands of miles is an everyday fact, airplanes travel across continents at hundreds of miles per hour, the entire world is electrified. But in Faraday's time, the only source of electricity was the elementary voltaic cell, motors and generators were unknown, alternating currents were not yet, electric currents produced in different ways were considered different, the basic laws of electricity were not yet established. Yet with all this Faraday was able to proclaim the germ of the theory which is at the very bottom of electrical science and which forms the foundation of the science of radio communication. The enunciation of this great theory by Faraday places him at the very head of all the pathfinders of radio. The development of radio communication may be said to begin from this time on. It remained for his successors to give the theory mathematical form and apply it in practice.

BIG RADIO BROADCASTING STATION IN MEXICO CITY

A powerful radio broadcasting station has been inaugurated in the Mexican Federal Capital, Trade Commissioner McKenzie reports from Mexico City.

Toll of the Sea

(*Continued from page* 883)

pocket. Just as he was about to apply the light, a terrific impact tore his chair loose from the stanchion to which it had been secured and sent him spinning with it into the far corner of his cabin. Dazed, but still in full possession of his faculties, he rose, to hear the frantic ring of his telephone, communicating with the bridge. Quickly reaching the instrument by a series of cautious jumps from one support to another, he answered and received the expected orders, "—Sparks, get on that key with an SOS for all you're worth," came in the Captain's cool, even tones. "We've lost our hand-gear too, in the turn and we're out of control. Eight miles off Tatoosh. Let me know your results." Dropping the receiver, Harry reached his motor field rheostat in a fraction of a second and throwing it hard over, was relieved to hear the steadily increasing whine as the machine gained speed. Placing his phones and throwing the antenna switch he grasped the frame of the transmitter panel for support, and standing well braced, called NPD in a quick, decisive style, following with, "It's an SOS now. Hand gear gone too. Ship out of control. Can only last few minutes. Tell Coast Guard eigh——" and there his generator stopped! A particularly heavy sea stove in the after hatch cover and flooded the gas engine supplying motive power to the ship's dynamo! Quick as a flash he cut over his switch to the auxiliary battery and heaved a relieved sigh as the motor once more picked up its load. "—Eight miles off NPD. Better come quick," he finished. Grabbing the bridge phone he reported to the Captain, who said, "Fine, Sparks, you'd better come up here on the bridge now and be ready to take to the boats—you've done your duty." "May I remain here, sir?" Harry asked, "I'd like to know they've started." "All right boy," acquiesced his skipper in a hoarse voice and hung up, muttering, "Damn fool kid, but sure has the spunk."

A few minutes of tense silence, then KPH called the *Sea King,* requesting position and information. Harry replied, "Right off NPD. He handling. Won't need you. Thanks." Frisco's "OK. Good luck" was followed by Tatoosh with, "Coast Guard under way now. If abandon ship, pull for straits and watch for rocket signals from Coast Guard boat. We'll get you in, old man." In the midst of his acknowledgement, Harry was almost torn from the key by another terrific body blow, dealt the helpless vessel by the merciless seas. Hoarse crys from the bridge to, "Take to the boats; she's sprung a seam" came to his ears, and with a quick, "Good bye, boys. Boats now," he tore off his phones, rushed to the bridge and communicated the Coast Guard instructions to his Captain. "You've done your duty well, boy" murmured the old man, "go to your boat," and at the command, Harry found his way aft, was pulled over the gunwale of number four boat by the Chief Engineer, and letting go the falls, the little lifeboat was soon bounding about like a cork. Willing hands bent manfully to the oars and in spite of the terrific seas, managed to make head-way away from the vessel. Ten minutes later—it seemed an age—Harry, glancing back at the darkened hulk, was just in time to see the *Sea King* slip beneath the triumphant waters which closed over her with a mournful, sucking sound that brought a shudder to the occupants of the small boat.

Hard pulling seemed to gain them little, but to keep them headed into the waves. Two hours of struggle and the survivors of the ill-fated motor-ship despaired of reaching a safe haven, when a quartermaster, acting as look-out, reported joyfully, signal rockets just ahead. The emergency rockets from the life-boat's store were quickly brought

out and with the aid of matches from the mate's water-proof box, sent an answering flare into the heavens. The answering siren of the Coast Guard cutter came faintly to them, after what seemed an interminable wait, telling them that their signal had been seen. Another rocket a few points off their starboard beam disclosed the presence of the other ship's boat which had got safely away.

There could be no resting on the oars. In spite of aching arms and weary bodies, the boat must be held into the waves or swamped. But they had been seen, and help was almost at hand. "Thank God," murmured the mate, "I didn't believe we could do it. I hope the old man made his boat, all right."

"Guess there's no fear of that, Mr. Nelson," ventured Jack, "the boys wouldn't leave without him."

"You don't know some of these old shellback skippers and their fool traditions, my boy," and with that remark, the tossing boat once more was silent.

For all of an hour the little craft was held in place by the heroic efforts of the small crew. And at last their efforts were rewarded, for topping the crest of a monstrous wave, came the Coast Guard's sturdy little motor sailer, the rythmic exhaust of her powerful motor making sweet music to the tortured victims of the sea.

The transfer was difficult, but skilled seamanship and willing hands soon had all on board the larger boat and but one man had suffered a ducking; a quartermaster's numbed limbs answered slowly, but a quick grab and a mighty heave and he was safe. The bobbing life-boat they attempted to tow, but it proved such a menace that they were forced to cut it adrift.

A similar rescue was effected a few minutes later when the crew of the second lifeboat were hauled aboard. But, as the mate had feared, the Captain was not among them. He had elected to remain aboard his vessel and share her fate for his traditions were strong within him. The mate reproved the crew of the second boat for not forcing the Captain to accompany them, but the reply of the first assistant engineer, "He threatened us with a pistol, Nelson, if we didn't leave," convinced him that the old man had been firmly determined.

A rough but safe journey to the Neah Bay Coast Guard station and hot coffee, followed by a warm bed, put all hands in good shape and none the worse for their experience. The incident of the rescue was communicated by wire to NPD and the broadcast of that powerful station, fittingly closes another chapter in the annals of the sea:

"TO ALL SHIPS AND STATIONS:

MS SEAKING, BELLINGHAM SAN PEDRO, DISABLED AND SANK EIGHT MILES WEST TATOOSH 510 AM TWENTY FOURTH. ALL HANDS RESCUED BY COAST GUARD WITH EXCEPTION CAPTAIN. BEWARE FLOATING WRECKAGE.

RADIO TATOOSH."

Shall We Have a Federal Radio Tax?

(*Continued from page* 867)

establishment and maintenance of stations.

There would be nothing to interfere with the immediate adoption of such a plan and should our present 4,000,000 listeners endorse and urge such a scheme in a political way it might be possible to get action and eventually bring about the inauguration of such a plan. The plan would be economically sound and if it were put up to the listeners in proper fashion they could be made to understand that they were not paying a tax but a small fee for a service.

HOW BROADCASTING CAN BE PUT ON A SOUND BASIS

Say we have 4,000,000 listeners in the United States and six dollars a year or fifty cents a month was collected from each one. This would place in the hands of the Government not less than $24,000,000 for the use of broadcasting. To this our radio manufacturers might add a small percentage of their profits which would boost it another four or five million, giving approximately $30,000,000 a year for this purpose. Now, $30,000,000 spent wisely and discreetly would guarantee for the citizens of the United States a wonderful nightly program, and it would only be necessary to use a small percentage of the present broadcasting stations. Some of them might be changed into relay stations, and, of course, it would be necessary to make additions to the system at strategic points. It would seem that the stage is beautifully set for such a plan and no doubt many of our present station owners would heave a sigh of relief if their equipment should be taken over and operated by the Federal Government. Such a plan would also thwart the progress of wired wireless. Indeed, it might discourage the whole scheme.

Some will ask, how would it be possible to collect this broadcasting fee? The answer is, how is it possible to collect any other legal fee? How is the revenue tax collected, the income tax, and all the other various collections that the Government has to make? It is true that there are a certain number of evaders, but they are greatly in the minority. In the case of radio, legislation could be enacted that would make it illegal for a person to own a radio receiving set without being obligated to pay a small yearly fee, and it is certain that the Government would meet with just as much success in collecting this charge as it has met with in the many other tax collections that it has to make.

Tax is a mean-sounding word in these days. It conjures up pictures of fat collectors clothed in authority which they use with reckless abandon. At the very mention of the word, we automatically think of our pocketbooks. Consequently the writer hastens to explain that the term is used here for the want of a more expressive one. We might call it a radio service fee. The automobile tourist does not grumble when he realizes that part of his state tax goes for the maintenance of the roads that his six cylinder bus goes bounding over, bringing his eyes to feast upon the green fields and spacious valleys. The roads are public. Could anything be more public than the ether? True, one must have a radio set to tap the ether, but one must also have an automobile to enjoy the roads and a motor boat to enjoy the waterways.

If broadcasting is to grow and prosper, we need a non-partisan Federal Commission of educators, entertainment and technical experts to govern, regulate and control broadcasting and to arrange for the collection of a small yearly fee from each owner of a receiving set. The fee asked might depend upon the receiving range of an outfit, the greater the range, the greater the service available to the owner. Our manufacturers could very easily be induced to contribute to this fund.

MULTIPLE BROADCASTING WOULD REDUCE EXPENSES

With this scheme it might be possible to place remotely controlled stations in various parts of the country that would be fed from the larger outfits in the greater cities thereby effecting considerable economy. It is now possible to rebroad-

cast, that is, to have one station pick up the broadcasting of another, strengthen it and send it out again. This is done daily with the time signals from Arlington. They are first received and amplified on a very ordinary outfit. This done, they are fed into the transmitter and sent out again on another wave-length. Using this system one man could take care of a remotely controlled station, and one large station in a community where it is easy to obtain the necessary talent could "mother" as many as ten of these radio outposts.

Within the next three years radio will do one of three things. We can have Federal control, a system of subscription through a specially designed receiver for secret transmission, or what has recently become known as wired wireless. These latter problems are entirely technical, but their solution is eminent enough to regard them as possible remedies for the broadcasting tangle. Of course, they would make it possible for the broadcasters to collect for their service, otherwise they could not be regarded as possible solutions.

A practical system of secret transmission would be a delicious solution of the problem. By this we mean the development of an apparatus that will allow the transmission of any broadcasting station to be secret except to those who have rented or leased the special instrument that will respond to the waves. This could be done by scrambling several wave-lengths in such a way as to make them unintelligible except to those who were in possession of the proper kind of a receiver. Such a system is in use today, but not for the purpose of broadcasting and it is doubtful if it could meet the demands for this type of service. With scrambled waves, any one with a receiver of ordinary design would receive nothing but patches of the programs which would sound like the gurglings of an infant.

A Transmitter That Will Work With Plenty of Five-Watt Tubes

(*Continued from page* 896)

L4 L4 are two coils wound with No. 28 D.C.C. wire on a 3" or 4" diameter form with about 200 to 225 turns. Do not mount these so that they will be in inductive relation to anything else. The two tuned chokes have 35 turns each and are wound with heavy wire and shunted by a good .001 mfd. variable. On these choke coils, do not

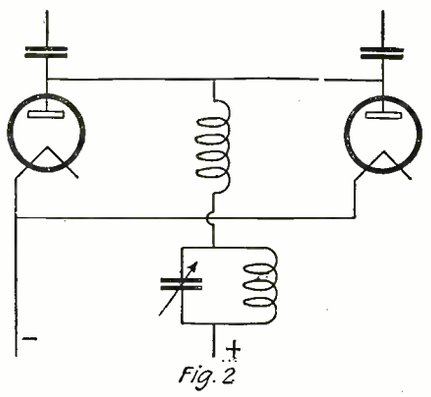


Fig. 2

The Connection of the Circuit When Used With D. C. Plate Supply. Only One Tuned Choke Is Necessary

use any kind of preparation: they work best without any dope of any sort.

Tuning the set is easier than it looks to be. Allow only one set of tubes to be active and adjust the plate coil to maximum. Guess at the antenna load and vary the grid tuning condenser as the key is held down until the maximum antenna current is arrived at. Then adjust the plate coil for best reading. You are then ready to connect in the other plate coil and it need only have the same amount of adjusted turns as the one tuned to. Hold down the key for all the tubes and vary the grid tuning condenser for maximum antenna current again. Then a turn more or less in both plate coils may be necessary and is easily found out. When this is done, tune for your proper operating wave and when found, vary the two tuned chokes in the plate leads for maximum antenna current. They are very sharp. Of course, only one would be necessary for the D.C. plate supply.

Place the key in the primary of the plate supply high-voltage transformer which should have 850 volts on either side of the center tap. You can use higher voltage, but lower voltage will work also.

Tune the counterpoise in, if you use one, on a separate inductance of about 15 turns, connected directly to the ground and not coupled to any other coil in the set. When it is tuned in at its best a readjustment of the plate will be found necessary. (Yep, both of 'em.)

As I said before, this sounds complicated, but you will find it easy in practice. Anyhow it partially solves the problem of using more tubes by one way. Next!

Holland and Italy Have Direct Radio Service to United States

(*Continued from page* 887)

factor, it requiring but one-fortieth of a second for the signal flashed in New York to reach Italy. The distance traveled by radio waves between the United States and Holland is 3,500 miles.

The transmitting station which engages in communication with the two stations abroad are situated at Rocky Point, Long Island, 70 miles from Manhattan. The antenna system of this central station is so large that a plot of 6,400 towers. A system of private telegraph lines joins the control apparatus of this station with the operators at the Broad Street office of the Radio Corporation where the actual telegraphing is performed. The receiving station is located at Riverhead, seven miles east of Rocky Point, and in a similar manner the receiving operator at Broad Street receives the signals intercepted at Riverhead and transcribes the dots and dashes as they are received by him. This system of remote control of high power radio circuits is a strictly American innovation which obviates all the disadvantages of the station located in a city where various atmospheric disturbances seriously interfere with its efficient operation.

A TROUBLED CONSCIENCE

"Father is Scotch and takes the headphones off when the minister announces the offering," wrote eight-year-old Harold Midgley, of Galt, Ontario, Canada, to WGY, the Schenectady, N. Y., broadcasting station.

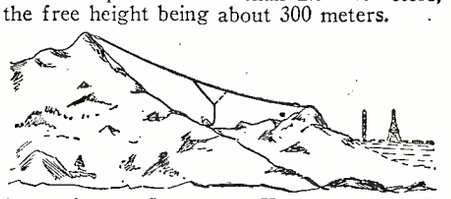
High Power Radio Station Without Antenna Masts

(*Continued from page* 897)

mitted to a load sufficient in the case of a normal tension to tighten the cable. However, the wind or hoar-frost, acting on the cable and putting it to a load which, of course, might become very high, the car would give way, thus allowing the cable to sag.

In the same figure, the heights of the Eiffel Tower and Nauen Station respectively are recorded on the right, thus strikingly illustrating the enormous profit to be derived by the new scheme with a view to the height of antennæ.

One special antenna type, viz., the one known as the L-antenna, was found to give particularly satisfactory results. In fact, when using equal current intensities in the antenna, the new type of mountain station will insure greater ranges of transmission than the usual design of high power station. In the present case, there are used four to five cables rather than a single one, as illustrated in Fig. 1. Fig. 2 shows the arrangement of these. The total antenna system covers a span of more than 2.5 kilometers, the free height being about 300 meters.



Illustrating the Comparative Heights of the Eiffel Tower, Nauen Station and the New Station.

The choice of the proper site for the station building was partly determined by the excellent roads leading to the higher summit and the valley, as well as by the vicinity of the Walchen Lake Power House, which by utilizing a head of 200 meters, is to supply a peak output of 168,000 H.P. and, without interfering with its other duties, will be able readily to feed the radio station at a cost incomparably less than in the event of using coal for generating electrical energy.

The Herzogstand High-Power Radio Station is to be equipped with a large Lorenz-Poulsen generator of about 2,000 K.W. and a Lorenz high frequency dynamo (system Schmidt) of the same output, high frequency energy being either generated direct or through the intermediary of a frequency transformer. In fact, the most diverse systems are to be used side by side in accordance with the various tasks actually to be solved, thus enabling long waves to be chosen for very great distances, while the frequency most in agreement with the general design of existing stations may be adopted in the case of shorter distances.

The Overlooked Beverage Antenna

(*Continued from page* 897)

Hence: B is north and west of A.

(b)—(d) equals 70 degrees 7 minutes Cos. 9.53161 Cot. 9.55831.

(c) equals 25 degrees 20 minutes Cot. 10.32476; 35 degrees 42 minutes equals tang. of .85637 Cosec. .23393.

(a) plus degrees of tang. 35 degrees 42 minutes equals 56 degrees and 12 minutes. Cosecant equals .74531. Cot. .53755.

Cotangent .53755 equals 70 degrees 59 minutes which is the great circle bearing from A to B, and the direction in which amateur A should locate his Beverage antenna for obtaining maximum strength of signals from amateur B. The great circle bearing is, therefore, north 70 degrees and

59 minutes west. The amateur should obtain a table of log. sines, tang., and secants for calculating a great circle bearing.

1BCG and 1BDI, both located in Maine, were copied on the afternoon of December 12, 1922, by using a Beverage antenna. 6KA can be copied in the daytime in Honolulu on the same circuit. Mr. Herbert R. Slocum of the Hawaiian Electric Co. and the writer employed two Beverage antennae connected to separate receiving equipment and were able to copy amateurs without experiencing crossing or heterodyning difficulties. One Beverage antenna employed was 1,312′ in length, while the other was only one wavelength, or 656′.

The detector used may be a UV-200 or a Meyers R.A.C. audion. For the first step of amplification, use a VT-1, and for the second step use a VT-2. Use variable "B" batteries, being sure that they are trouble-free.

Connect 16 volts in the detector circuit. 45 volts should be used on the amplifier. Do not employ inferior material as it will lower the efficiency of the receiver considerably. Use a two-plate variable condenser in the antenna. About five taps of inductance and a small amount of capacity give best results. Too much capacity will stop the receiver from oscillating.

Wired Radio Saves the Taxpayer Money

(*Continued from page* 866)

gestion that we use a microphone in the ground leads for transmitting. The writer wishes to point out to the young experimenter at this point, that success ofttimes lurks in disappointments. The equipment was not what the writer wanted, but he took it rather than give up the idea. There stuck in his mind the possibility that something might be done with this inadequate apparatus to demonstrate a principle. He also needed loud speakers and secured the loan of them after much persuasion and argument with a well known Cleveland, Ohio, house. With two receiving sets and two loud speakers experiments were started. Private Timmerman of the Signal Detachment and a Mr. Lee Slusher of the camp Y. M. C. A. were given the job to devise ways and means. They hooked up sets on antenna using various means of modulation. The transmitters in the ground lead were not satisfactory. They finally took a couple of turns around the tickler coil with a transmitter in series and were able to get fair results. An interesting point here is that with both sets tuned to zero beat on the same wave they were able to transmit and receive using the same tubes for both purposes. Here is a case of using the same tubes for transmitting and receiving without the use of switches or relays to change from one to the other. The best principles of modulation were not used, but the results sustain the writer's previously stated proposition that two-way telephone communications can be carried on with the same tubes, using the first tube as an oscillator and a detector. This should interest the young radio fans for experimenting with radio telephony from block to block, using receiving sets. It is true that on the high frequencies used, the tuning is critical and hard to hold but the principle is demonstrated. The difficulty came in trying to get distance with the small receiving tubes. Necessity is the mother of invention; General Squier's principle of wired wireless occurred to

the writer. It was a simple matter to connect the ground and antenna posts of each set by a pair of wires. This latter was the General's original method I believe.

The voice now came in loudly and clearly. The distance could be indefinitely extended and there was no longer any disturbance from C.W. signals or broadcasters. We placed the equipment on one of the ranges during practice fire and substituted it for one of the telephone lines. The try-out was made to work out the details. If the try-out proved a success we decided to use the equipment during the classic event "The National Matches," where it would be open for inspection before high officials of the Government, and where it could plead for itself in its aspect as a saver of time and money. The first day of the tryout everyone within hearing distance was well aware that radio was being used. There were squeals, and howls and chatters and all the embarrassing accompaniments of an amateur's hard luck, but sandwiched in between the weird noises the human voice sounded loud and clear. The instructions from the firing line rang out at the target pits from a loud speaker and gave encouragement to the experimenters. The same equipment was duplicated at both ends so the pits could speak back. The bugs were finally eliminated and the next day the equipment worked perfectly. The following day was the "National Match" when rifle teams from all parts of the United States and its possessions gathered. There were Porto Ricans, Filipinos, National Guardsmen and civilians, R.O.T.C. teams from colleges and C.M.T.C. teams from summer camps, also representatives from foreign governments

WIRED WIRELESS PROVED SUCCESSFUL

The "National Matches" at Camp Perry to the rifleman is like the "Derby" at Churchill Downs to the racetrack fan. It is the classic event of the marksmen of the country, and this year of the world. We substituted our equipment for a telephone line in the center of the range. In the midst of a distinguished audience we proceeded to handle the traffic with a dispatch that had never been seen before. The instructions were called into the transmitter at the firing line and went directly to the target operator, "Re-mark Target 41." Immediately, to be exact, in six seconds, target 41 was hauled down to be re-marked. Any questions from the target pits came back and sounded out at the loud speaker at the firing line. At the end of the firing at the 200-yard line the targets within hearing distance of the loud speaker were all down at half mast. They had finished 20 minutes before the flank targets, which were operated on the slow manual telephone. Wired wireless had demonstrated its efficiency here.

OTHER POSSIBILITIES

This demonstration was given with crude equipment picked up in the field merely to prove a principle. The writer's plan is to work out in the laboratory a system of carrier frequencies such as is used by the American Telephone & Telegraph Company on its New York-Chicago trunks. By using low kilocyclage, say about 25 kilos and with filter circuits to differentiate these frequencies, one heavy bus wire will do the work of five telephone lines. That is, for every five lines a wired wireless unit will be used, with loud speakers, thus eliminating troublesome cable systems and an enormous amount of field wire, and about 50 tele-

phone operators. Such a system made up into field units with armored duplex wire cable could be used and rolled up when finished, so as to move from one range to another. As a matter of fact, for such short distances, using these low frequencies, it may be possible to do away with wires. The low frequency eliminates critical tuning. Here is work for the experimenter. That which holds good on a rifle range is practicable in pursuits of more general use.

To conclude, my message to the experimenter is, if you have a good idea don't let people dissuade you. They are inclined to laugh until the thing works and then they pat you on the back. That is the way of the inventor. But he who laughs last laughs best. The writer wishes to thank Mr. Lee Slusher for his invaluable help and suggestions, also Mr. Hays of the Bissell Electric Company, Toledo, Ohio, and Mr. Grant of the Cleveland branch of the Western Electric Company.

A Good Crystal Detector Stand

(*Continued from page* 907)

and heavy contact on galena is had in this detector. The bronze springs have a tendency to go upwards and are held in the right position by the knob for adjusting the cat-whisker. A base of dry wood or composition, two knobs, some sheet bronze, brass tubing and a few screws are all that are needed for this remarkable detector. Dimensions are not given, as they may vary with the same efficiency.

Contributed by William W. Smith.

MAKING STORAGE "B" BATTERIES

As is well known, "B" batteries may be constructed from the plates of commercial storage batteries. I recently read an article describing how such a battery might be made by purchasing new plates and sawing them up to fit test tubes. New plates are doubtless excellent, but are expensive enough to be quite an item when used for a 100-volt bank.

The objection to using junked storage battery plates lies in the property of a storage cell. The positive plates in an old battery will crumble at a touch and are thus impossibe to saw. The negative plates being composed of spongy lead are, on the contrary, very long lived and may easily be cut.

It occurred to me that it might be possible to make up a battery using pieces of negative plates only, re-forming one plate in each "B" cell by charging into a positive one.

I cut two pieces from a negative plate about 1¼" by 2½" and placed them in a tumbler of electrolyte for a test. A current of 7 amps was passed through the cell for about 15 minutes. As this is about 20 times the proper charging rate for plates of this area, the cell boiled violently but for the short period was apparently unharmed.

At the end of this short time one plate had taken on the characteristic chocolate color of a positive plate so a 3-volt flash-light lamp was connected across the cell. The lamp was still burning brightly the following morning and the cell showed a voltage of 1.9. It was then given another charge of 15 minutes and, due to other work interposing, was set aside for about 10 days. The lamp was connected to it at the end of that time and burned for 10 hours. Judging by its brightness it would have burned very much longer, but it burned out.

After the loss of this expensive discharging apparatus the positive plate was removed and upon breaking it up was found to be formed throughout, that is, the chocolate

colored lead oxide extended through the whole mass. I consider this surprising owing to the fact that 3½-ampere hours were all the charge received—not a very expensive procedure. It is even possible that the first charge of 1¾ A. H. did the forming.

Mechanically the plate was little weaker than in its original negative form—certainly strong enough to hang indefinitely in a "B" battery where the service is anything but severe. The active material showed no tendency to swell out of the plate grids.

I think the conclusion from this experiment is that a very satisfactory "B" battery may be made in this manner. Since such plates may be had for the asking and test tubes, separators, acid and box be obtained for about $1.50 there is little excuse in paying for dry "B" batteries which die very quickly when power tubes are used. Five "B" cells may be made from each plate so that five plates are required for a hundred volt bank. In cutting up the plates use a fine-toothed hack saw and *GO EASY*. With care few plates will crumble.

Contributed by John R. Haviland.

Some Suggestions for Radio Beginners

(*Continued from page* 872)

are a number of ways in which this state of affairs may be remedied, if it is at all remediable, but at the outset of this discussion it should be pointed out that often this interference of broadcasting stations is not due to the installation of the receiving set or anything under the control of the receiving operator. It is due frequently to the unfortunate location of the receiving station with respect to the interfering broadcasting stations, so that one broadcaster will always jam the other. This unfortunate condition might almost be termed an "act of God." Thus one of the writer's friends lives in Manhattan, on 8th St., between Aves. C and D, a distance of a couple of miles from both WEAF and WJZ; he is north of WEAF and south of WJZ. Both stations come in with reasonable signal strength, though WEAF is considerably louder, and compared to WJZ sounds like a "ton of bricks." It is possible to tune out WJZ and get WEAF alone largely because the signal of WEAF is so much louder than that of WJZ who is therefore drowned out. But it is impossible to tune out WEAF and get WJZ, no matter what expedients are employed, such as wave traps, short antenna and regeneration, etc. This interference is simply unavoidable due to WEAF's excellent directional effect at this point as compared to WJZ. In such a case there is no sense in swearing at the manufacturer of the receiver or at radio. Take the matter philosophically and satisfy yourself with the stations you can get, or else get a very highly selective receiver, such as a superheterodyne or other similar make, or move to another neighborhood.

LENGTH OF ANTENNA

Thus if you happen to be unfortunately located with respect to interfering stations you will be out of luck. However, this is not generally the case and the cause for interference will be found elsewhere. Of these other causes the writer found one very prominent one, namely *the use of too long antennae.* Let us kill at once and for all the heresy that very long antennae are necessary; this is not the tendency of modern development at all. The writer knows a person in Westchester, New York, who put up an an-

tenna about 150′ long, thinking to get as loud a signal as possible with a long and high antenna. He uses a standard Westinghouse R.C. single circuit regenerative tuner with two-stage audio frequency amplifier. He found that while he got sufficient signal strength he could not tune out WOR from WJY, and WJZ from WEAF. The writer's aid was enlisted and after some listening in he suggested cutting down the antenna length to about 75′. This was done and it was an easy matter thereafter to separate the above stations and at the same time signal strength was not reduced.

There was no magic in the above suggestion and it was based on sound radio principles. Why does the short antenna give better tuning and selectivity and equal strength when used with the single circuit regenerative receiver, as compared with the long antenna? The answer to this will solve the difficulty of thousands of radio perplexed novices, and will show the futility of large antennae when used with regenerative receivers. It is true that the larger the antenna the more energy it will extract from the ether. But the larger the antenna the more difficult it is to tune sharply, for it collects so much energy that even waves to which it is not tuned will extract considerable energy and pass it on to the receiver, thus causing interference. In other words a very large antenna collects so much energy on all waves that various signals just force their way into the receiver. Obviously the greater the antenna length is, the higher is the natural wave-length of the antenna and the less inductance or capacity is required to receive the broadcast wave-lengths. Whereas the shorter the antenna the more inductance and capacity is required, which enables you to actually tune your set more sharply. If your antenna is long enough, it is not at all necessary to tune your set, the energy will simply float into the receiver without tuning. Thus a large antenna makes sharp tuning more difficult by virtue of its very largeness and by the fact that it picks up so much energy.

REGENERATION

Another point: A regenerative receiver, when properly regenerating is one of the most selective receivers known. Also it is more selective the more you are able to regenerate. If a very large antenna is used it is difficult to regenerate much, in fact, it may not be possible to regenerate at all; due to the long antenna, the moment you begin regenerating by using the tickler coil or plate variometer the set begins to squeal. Long antennae mean small regeneration, hence little selectivity, for you cannot employ the very feature of the receiver which gives it its selective qualities, namely regeneration. On the other hand, with a short antenna it is possible to use considerable regeneration before the squealing point is reached, hence the set is extremely selective on short antennae, due to the ability to regenerate and bring its selective properties into play. Now, although a shorter antenna is used which collects less energy from the ether than the long antenna, the signal strength is not impaired, in fact it may be better than with a long antenna. Why? For two reasons: In the first place a regenerative receiver is more sensitive to low signal voltages, that is, it will amplify low signal voltages considerably more than it will high signal voltages. Thus although the long antenna brings in a large signal voltage it will not be amplified much, whereas the short antenna's low signal voltage may be amplified many times and thus bring

the utlimate signal intensity above that of the long antenna. In the second place, due to the fact that it is difficult to regenerate much when using a long antenna, the loud signal from the antenna is not amplified much, whereas the weak signal from the short antenna is considerably amplified by the regeneration of the set. The long and short of the whole matter is, therefore, as follows: Use short antennae if yours are regenerative receivers, and regenerate as much as possible. Use the tickler coil or plate variometer as much as possible—that is what it is meant for—and you will not have much trouble with interference and your signals will be satisfactorily loud.

Another cause of frequent disturbance to novices is made by noises heard in the phones, there are high pitched noises, squeals and so on. These noises, in the case of those who have regenerative receivers, are often found to be due to too much use of the regenerative control; that is, too much tickler coupling or too high plate variometer. In their efforts to bring in stations with a deafening sound they jam the tickler all the way in. Bring the tickler up to the point where the set begins to squeal or howl, and then move it backwards a trifle until the noises disappear. This will be the very best operating point. In case it is desired to use more regeneration for reasons given above, it is possible to keep the tickler coupling tight and just decrease the filament current a trifle. This often eliminates the howling without necessitating decreasing regeneration.

Complaints are often had about too small volume of signal in the second stage of an audio frequency amplifier. Signals come in satisfactorily in the detector and first stage, but not in the last. If everything else is found to be all right the chances are that the last tube is a poor amplifier. Novices ought to make it a rule always to change the tubes around. Try the last amplifier tube as a detector, and the detector as an amplifier. It will very often be found that the last amplifier tube is a very good detector but a poor amplifier; a change like this very often means satisfaction.

DISTORTION

The above may also be the cause for distortion which is present in the last step. The tube itself may be a poor amplifier and distort also, so that changes of tubes from detector to first stage and second stage should always be tried. Distortion in the last stage is often due to overloading the last tube. It must be remembered that the tubes generally employed as amplifiers are not power tubes. Thus a WD-11 or 12 is a good amplifier, but if given too much pep will back down and distort as a result. Therefore, if the input into the last tube is regulated a bit when distortion is present it will frequently be found that the distortion disappears. Very often, however, the distortion is due to poor amplifying transformers, the 25c. variety, which eliminate many of the frequencies which are required for faithful reproduction of voice or music. The only remedy in such a case is to get good transformers. Frequently shunting your transformers with condensers will be found to improve matters a trifle. In any event never begin swearing at the broadcasting station for poor quality until you are sure that your set is blameless. Nine chances out of ten something in your set is contributing the distortion.

Difficulties with loud speaker distortion are also frequent. This is a more troublesome matter because loud speakers are not yet perfectly designed. A loud speaker

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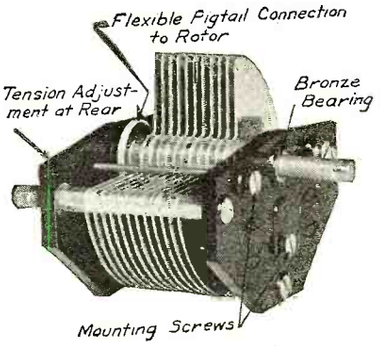

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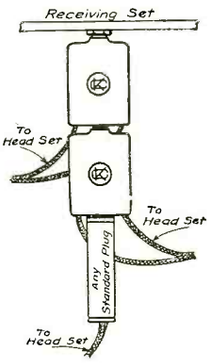

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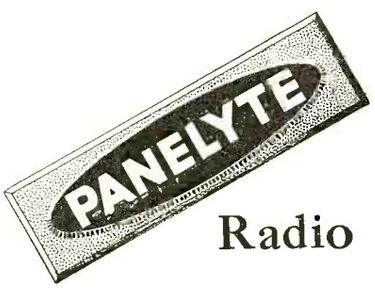
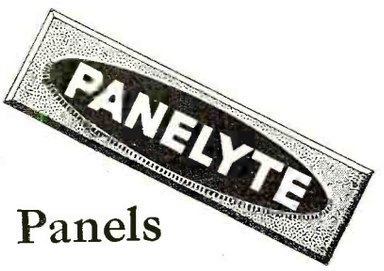


Radio



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will distort much more easily than any other part of your set. It is advisable, therefore, to buy the very best make, if you are buying one. Then, if you have trouble, shunt the loud speaker terminals with a small condenser which frequently takes some of the ragged edges from speech and music. Do not use too high values, as this will result in shunting the audio frequency currents and reducing intensity. Values for the condenser in the neighborhood of .002 or .003 mfd. will be found about right.

It is hoped that some of these random suggestions will enable novices who are meeting some of the above problems to solve their difficulties and get a little more satisfaction out of their receivers.

How To Make Your Own Grid Leaks

(*Continued from page* 904)

the resistance scale until we reach a point where we have 1/10th megohm or less.

After the papers are all thoroughly dried they must be mounted in the little copper strips. Offhand, this would appear to be the most simple part of the whole process. Perhaps it is simple, but it is at the same time the most important part of all. It will be evident that for high resistances of this nature the distance separating the copper strips must be very accurate. By the aid of a machinist's scale, it will be possible to put the clips on with reasonable accuracy. They should be pinched down tightly so that a good contact will be made with the surface of the paper. In doing this, it is well to avoid handling the leaks as much as possible, and a pair of tweezers could be very profitably employed. The delicately coated surface is extremely sensitive and the resistance can be effected appreciably by simply handling it.

After the copper strips are placed on the Bristol board it will be necessary to obtain some very small corks that will fit the glass tubes used. A little knife slit is made in these corks and one of the copper strips is slipped in them. This is then mounted in a tube and molten paraffin is poured in and allowed to cool. This paraffin should not be too hot, but just hot enough to be liquid. After the paraffin is cooled, the opposite end is provided with a cork and from this it will be seen that the tube should not be entirely filled with the paraffin, but space should be left to accommodate the second cork.

DETERMINING THE RESISTANCE VALUES

With this work done we are now ready to test the resistances of the grid leaks and to mark them. For this purpose we can use a calibrated student's galvanometer similar to the Weston No. 375 type. This is an inexpensive little instrument which may be had for approximately $10 and which will be found about many radio fans' laboratories. This is connected up with a circuit, as shown in Fig. 2. The writer fortunately has an expensive microammeter reading to 100 microamperes, and it is a very simple matter to measure these high resistances with this unit. The same circuit is used and 100 volts of "B" battery are employed. For this purpose it is necessary to place a potentiometer around the last "B" battery so that the voltage can be accurately adjusted to 100. If we should place a grid leak in this circuit and obtain a reading of 50 microamperes it is evident that we would be measuring a 2-megohm leak, according to

Ohm's law which states $R = \frac{E}{I}$.

We know that the voltage is 100 and 100 divided by 50 (.000050) microamperes gives us 2,000,000 ohms. If we had a reading of 100 microamperes we would have a resistance of 1 megohm.

In the case of the student's galvanometer, each division on the scale is equivalent to 22 microamperes. With this figure in mind it is a comparatively simple matter to measure the current with a fair degree of accuracy. It almost goes without saying that some care should be taken to prevent a short circuit, since the heavy voltage of the batteries would instantly burn out the galvanometers.

As the resistances are measured it is well to take small stickers and mark the values on them for future reference.

A little practice in this work of making grid leaks gives surprising results and the writer knows of one "ham" who became so proficient, that he made them for all the hams in the neighborhood, selling them at 50 cents apiece. He guaranteed them to have an accuracy of 10 per cent.

A little mounting block, similar to that shown in the sketch (Fig. 3) will be necessary to hold the leaks. With this they can be slipped in and out very rapidly for experimental purposes.

With a few grid leaks it is possible to connect them up in such a way as to arrive at any point within a wide range of resistances. If they are connected in series in holds, according to Ohm's law, $R = R_1 + R_2 + R_3 + R_4$. When resistances are connected in parallel we have the following formula:

$$R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}}$$

In Fig. 4 we see a very simple way of making a variable grid leak. However, the writer has had very poor success with leaks of this nature, probably due to the fact that the resistance element is constantly exposed and therefore suffers changes by causes that could be prevented if the thing were hermetically sealed. The phosphor bronze used in this leak should have enough spring to it so that it will always remain in its original form.

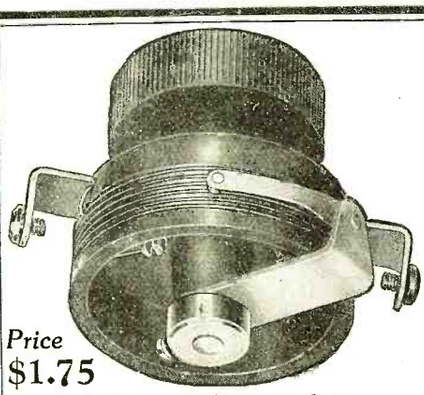
Some Suggestions on the Design and Construction of Aerials

(*Continued from page* 894)

act center and a jumper should be run across if the aerial is of the two-wire type. When you figure for a definite wave you use half the flat top length and after achieving your final length of half of the aerial top, subtract 5′ from the total length of the top to make up for the increased capacity that results, partially. If, however, your aerial, as a "T" type, is over 60′ high, then refiguring for the wave-length is unnecessary, as the change in capacity is not so much with the higher aerials.

THE IMPORTANT CONSIDERATIONS

As a summary of this foregoing, get these points: If your aerial is below 50′ high and long, a single 4″ in diameter cage is as good as you can get, if you also have a counterpoise. Without the counterpoise, use the two-wire flat top for even the powers above five watts. With the counterpoise, use the two-wire if you only use five watts and the small diameter cage on more power. Where your



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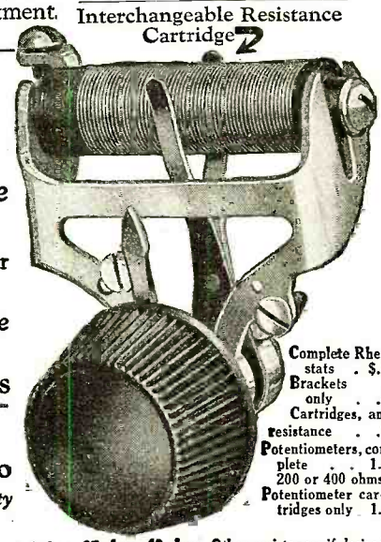

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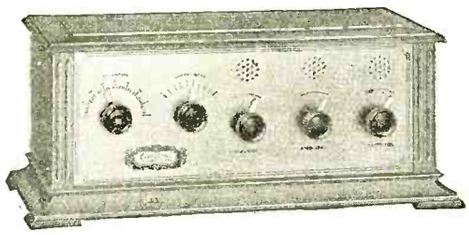

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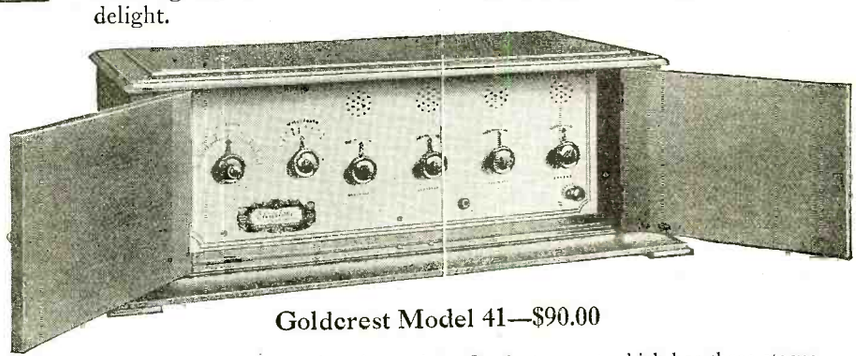

Goldcrest Model 41—$90.00

The GOLDCREST Model 41 is a four tube reflex instrument which has three stages of radio frequency amplification, a detector and two stages of audio frequency amplification.

This beautiful and distinctive solid mahogany cabinet with the engraved gold paneled instrument make a completely self-contained unit when 1½ volt tubes are used.

Model 20 ..... $40.00	Model 32 ..... $115.00	Model 42 ..... $135.00
Model 31 ..... 70.00	Model 40 ..... 75.00	Model 60 ..... 60.00
Model 61 ..... $75.00	Model 62 ..... $120.00	

Write for folder describing complete line

THE CLEARTONE RADIO COMPANY, Cincinnati, Ohio

height goes to 50 and above, use the double cage preferably for powers above five watts and the single small cage for the five-watter.

Now, in building aerials for unusual locations and those different from the normal types, we come to different designs which are best for the height and position. Length here is not considered, as your aerial may be forced to be shorter than necessary. But, where your length is obtainable, it is not so necessary to increase the capacity of the aerial. Take Fig. 6 as an example. It shows an aerial to be built on a single pole about 50′ high with two other supporting points not above 25′ in height. The small fans are advisable so as to get maximum capacity above ground and even if these fans are only 4′ wide, they should have as many wires as possible, 10, 12, or more. Their length can be determined by one factor: the small end should terminate in the small cage lead-in at least 30′ above ground. The additional small fan on the side opposite the lead-in helps to add to the length and can be used, if you have room, to make the full length you need. The insulation at the free end should be at least three of these 10″ porcelains and because there are so many supporting points it will be necessary to use plenty of insulators in series to avoid the multiplication of normal losses. You must be careful to see that the angle between the two fans is kept greater than a right-angle. The same applies to the angle between the lead-in and the fan it connects to. The lead-in of course can go in any necessary direction. If it is possible to use the fan on only one side of the pole and get length enough to work within 30 per cent of the fundamental, then be satisfied, for the additional fan on the other side should be avoided if possible, but where it is needed to get a good fundamental, do not hesitate to use it. Where your height gets in the neighborhood of 60′ and more, so that you have a good height to work from, then the construction is changed to tapered cages as in Fig. 7. The cages on either side of the pole are necessary only to make up for lack of length, as was true with the fans. These large top cages should have their maximum diameter as great as possibly convenient for you to construct, and should have six or more wires, depending on the size, of course.

Where your power on these freak construction aerials is only on the five-watt order, then make the fans with only about four wires and the great width is not necessary as 4′ or 5′ would suffice. But, the wider it is convenient to make them, the better. On five-watts your cages at their maximum can also be comparatively small and of from four to six wires, as that is sufficient.

As a summary, get these points: where your aerial is comparatively low, the idea is to spread out horizontally and not at all vertically (the single small long cage in the first few paragraphs and the fans and flat tops) and not too much horizontally, unless the length is limited so that length must be made up by capacity: where your aerial is higher, do two things, spread out horizontally and cage entirely, as the cage is more efficient than the flat top where it doesn't detract too much from your vertical height due to diameter.

If it is possible to put up the vertical type of antenna, then the best you could use would be the vertical tapered cage with a very great diameter at the top.

WORTHWHILE POINTERS

These final tips in building the aerial should be noted as really valuable and always deserve use. They pay on the cheapest aerial.

1—Solder every joint. Where one wire must cross another especially. Either solder in your supporting bridles or else make them of rope.

2—Use metal hoops in your cages whenever possible and where wood must be used, short it with a jumper wire to each wire it supports.

3—Use solid wire in the aerial always and as large a size as convenient. No. 12 is usually most convenient. No. 14 is good, in cages, but should not be used in the two-wire type if larger wire can be obtained.

4—Acid core solder wire is not good to use, but it is the easiest to work with, so, if you use it, wash off the job with a hose and plenty of water. Non-corrosive soldering pastes are the best.

5—Don't use a soldering copper to do the work on your aerial, as it takes too long and requires too much labor; use the torch direct to a joint covered with plenty of paste and apply the solder when the paste starts boiling. A few joints will soon teach you how. If acid core solder is used, it is only necessary to heat the joint and apply. Finish all acid-solder joints with some plain solder to fill the joint free of acid.

6—Hoops in the small diameter cages should be placed at least every 5', as otherwise twisting will set in. Hoops for the small cages can be made with No. 8 or so wire and for the larger cages, of trolley cable which is usually solid, and some of which can usually be obtained from the local trolley company cheaply from their second-hand scraps. Copper tubing is good too. Always bind well with small wire and solder.

7—Insulation: for five watts, put two 10-inch porcelains at the free end of the aeriel and one at the other supports. More would be better. For higher powers, at least two insulators on all supports and three at the free end. More would be better. Don't use insulators as in Fig. 8 if avoidable, although if necessary you should double the normal value, for each individual wire. In fact, within reason, it is almost impossible to use too much insulation when put in in the proper manner, which is in series with actual supports.

A Well Designed Short-Wave Receiver

(*Continued from page* 893)

that there is no resonance point between the two. In other words, there is no point on the condenser scale at which the circuit stops oscillating, because it is in resonance with the antenna circuit. The Reinartz method of coupling can be used, but this will introduce a resonance point which will interfere with the proper functioning of the receiver and in addition is a good deal broader in tuning. The increase in signal strength which results is not of such a value as to make this method worth while or desirable. This is a matter of actual test since both methods were tried by the writer and the one shown in Fig. 4 was found to be best. The antenna used consisted of two wires 8' apart, 35' long and 30' high. With this antenna, one WD-11 and a 20-volt plate battery, C.W. stations in central Kansas are regularly received. It may also be of interest to our broadcast listeners to learn that KDKA is regularly heard with the condenser scale set at 6 degrees. The sig-

uals are strong and there is, of course, absolutely no QRM. As nearly as the writer can judge, the wave-length is in the neighborhood of 100 meters. Whether this is harmonic or low-wave broadcasting, the writer has been unable to determine. The fact remains, however, that the set described is worthy of a trial and the writer feels that it will pay the amateur fraternity to investigate its merits, for it is a real short-wave receiver and it is of the simplest possible design for an efficient receiver.

C. W. and Radiophone Transmitters

(*Continued from page* 895)

By a simple change this system may be made applicable for currents generally given by 5-watt sets. This change is shown in Fig. 2. Here the microphone is shunted by a small inductance L_1 consisting of about four to five turns of bare copper wire, No. 14 B. & S. gauge is satisfactory, wound on a form about 1½" in diameter. This shunt coil takes part of the antenna current; thus the microphone only takes a small part of the total antenna current, and packing is thereby avoided. By varying the number of turns shunting the microphone the most suitable number of turns will be found. The actual number of turns shunting the microphone which will give best results depends upon the resistance of the microphone and antenna. This is the reason for winding this shunt coil with bare wire, so as to enable a very accurate adjustment of the shunt inductance.

Still another arrangement for this system is that shown in Fig. 3, and this is the best one. For best results in such a modulation system it has been mathematically proved by Seibt that the resistance of the microphone should be equal to the resistance of the antenna in which it is inserted. It is not possible to construct an antenna so that its resistance will exactly equal or nearly equal that of the microphone, nor is it generally the case that the microphone can be obtained whose resistance matches that of the antenna. We must take these as they come. In such a case we must adapt the resistance of the microphone to that of the antenna. It will be recalled in discussing low power oscillators (see Nov., 1923, issue of Radio News) that for maximum power output it was necessary that the antenna resistance be equal to the tube resistance. Such a state of affairs does not exist, and we saw that by adapting the tube resistance to the antenna resistance by means of a step-down transformer, the condition for maximum output could be realized. The same solution can be applied to the present case, and this is shown in Fig. 3. The microphone is coupled to the antenna circuit by means of a coil having a few turns of wire. Thus these two coils L_1 and L_2 constitute a transformer. By varying the number of turns on coil L_1 the ratio of the transformer is varied until best results are secured, in which case the antenna and microphone are adapted to each other. When this system is used it is necessary to use a dry cell in series with the microphone, for otherwise talking into the microphone will produce no effect on its resistance, since there would be no current to vary. The direct current of the battery is altered by speaking into the microphone and this variation is transmitted to the antenna circuit inductively by the transformer L_1 and L_2.

The coils constituting L_1 and L_2 may be ordinary copper wire wound coils wound on dilecto, fibre or cardboard tubes. The microphone is the most important item. If good, clear and undistorted speech is to be secured,

the microphone must repeat faithfully in its resistance changes the sound waves impressed on its diaphragm. The twenty-five cent variety of microphone is not always the best. A standard make of microphone should be secured, such as those made by Kellogg Switchboard & Supply Co., Stromberg-Carlson Co., Western Electric Co., etc., for these people have been making telephone apparatus for years and they know how to make good microphones.

An improvement over the above systems which employ the microphone directly in the antenna is the use of the magnetic modulator, such as that made by the Radio Corporation of America. The advantage of this method is that the magnetic modulator has been designed to produce good and high modulation when employed in low power sets. The connection of microphone and magnetic modulator is shown in Fig. 4. The magnetic modulator is a transformer with a special type of iron as the core of the transformer. When the microphone is spoken into, the variation of the resistance of the microphone produced by the vibrations of the diaphragm alters the current flowing in the primary winding of the magnetic modulator. This in turn alters the magnetic flux or condition of the transformer, which results in a variation of the iron losses in the core, which is equivalent to a variation of the resistance of the antenna circuit, since one winding of the magnetic modulator is in series with the antenna. As a result, the radio frequency current in the antenna circuit is modulated by the speech.

All of the above systems are very simple and applicable to low power sets, and are especially suitable for the beginner in transmission. Not much expense is involved and the circuit arrangements are very simple.

The modulation systems described above fall under the head of "absorption" systems of modulation, because energy is absorbed by the modulator, as, for example, the microphone and magnetic modulator absorb some of the radio frequency energy. Another modulation system which is applicable to low power sets is called the "grid control" method, and the circuit for this system is shown in Fig. 5. Here the microphone is connected to a telephone transformer or inductance coil T, i.e. to the primary winding through a dry cell. The secondary of the telephone transformer is connected in series with the grid of the oscillator tube. The microphone is spoken into and variations in the primary current produce large induced voltages in the secondary of the speech transformer. The voltages being impressed on the grid of the oscillator tube control the amplitude of the R.F. oscillations in accordance with speech, and since these speech variations are repeated in the plate circuit we have a radio frequency output modulated by speech. The transformer T should be one of standard make. It will be found necessary to shunt the secondary of the speech transformer with a by-pass condenser, for otherwise the secondary of the transformer will present a high reactance to the radio frequency voltages. The choice of this condenser C_4 is very important and must fill two conditions. In the first place it must have a low reactance to radio frequency currents, since its function is to by-pass the radio frequency currents around the secondary of the speech transformer. In the second place it must have a very high reactance to audio frequency currents. For it shunts the secondary of the speech transformer, and if its audio frequency reactance is low it will act as a short circuit on the speech voltages, and very poor modulation will result. Large capacities have low reactance at all frequencies, whereas low capacities have large audio reactances and low radio frequency reactances. A good aver-

age value for C_1 will be found to be about .002 microfarads.

The above system is applicable only to low power sets also. If it is used on high power sets broken speech results when the speech voltages reach high values. This is due to the fact that when high speech voltages are impressed on the grid, R.F. oscillations abruptly cease when the speech voltage reaches a certain value. When it drops below this value R.F. oscillations are again introduced, the result being broken speech. This method should, therefore, not be used on sets of over 5-watt power.

For sets employing higher powers we must have recourse to an entirely different kind of modulation system which is, at present, the best system available and which is therefore used in practically all of the best broadcasting stations. This particular system of modulation will be the subject of the next article and at the same time a discussion of degree of modulation and its effect on speech quality will be given.

Summarizing the Year in Radio

(*Continued from page* 878)

good reason should they be deprived of listening in to radio entertainment any time they may wish to do so? Most of the time they have to wait until the male member of the family arrives home in order to operate the set. This, of course, is radically wrong and we should rectify it just as quickly as possible. The single control outfit is coming, as sure as the sun will rise tomorrow. It is simply a matter for the engineer, plus a little courage.

Another thing that is still holding back the full development of radio as it has held it back for the past year, is the loud speaker. I am not on the warpath against the loud speaker for the reason that I own a number of patents myself on various loud speakers and I am, therefore, just as much to blame as the next one. But the trouble with the loud speakers today is that the majority of them chase away sales instead of making them. Time and again, I have seen people standing in front of a store listening to some of these atrocities, otherwise called radio horns, when it was impossible for the bystander to understand a single word. I have actually heard people say, "If this is radio, save me from it." Of course, not all loud speakers are bad, but I should say that 80 per cent of them are, while the other 20 per cent do not reproduce spoken words, for instance, faithfully, and in some of my past editorials, I have made the remark that a horn on a loud speaker is a monstrosity. An expert in acoustics will tell you that the minute you put a horn on anything that produces sound, you will have distortion immediately.

Personally, I do not believe that this stage will ever come about. Radio is the one thing that calls for the use of one's wits and Americans are born thinkers and born inventors. Tens of thousands of people are using radio as a hobby and love to make their own sets. Indeed, I have a banker friend, who has constructed no less than 18 sets, any one of which any manufacturer would be proud to turn out. Today 80 per cent of all the output in radio material consists of parts, and only 20 per cent complete sets. I am quite certain that this condition will prevail for many years to come.

This leads me to another thought that is of importance to the radio dealer; 80 per cent of the radio public today make their own sets. Go into any radio store and see what happens; people are continually coming in and asking the salesman behind the counter thousands upon thousands of ques-

tions. Nine times out of ten, the salesman does not know much about radio himself, or a vague answer is given, or the clerk who does know is so busy that he finds no time to answer the questions intelligently. The radio public buying parts is certainly entitled to some information, otherwise the trade is going to be injured.

There is still one more point upon which I would like to touch and which threatens to become serious as time goes on. At the present time the radio trade in its entirety, has its foundation upon broadcasting. Imagine for a second what would happen to the trade if, with one stroke, the broadcasting stations were wiped out or discontinued. It is all very well for you to say that such a condition is impossible, but is it really? One of the greatest dangers today is the wired wireless situation. Slowly a number of lighting companies are getting their own broadcasting stations and studios and broadcasting over the power line. By means of filters and other devices it is possible for the wired wireless broadcaster—now called wirecasters—to say to the consumer that upon paying a fee of $2, more or less, a month, they will install a radio set, the charge to be added to the lighting bill. In other words, a sort of subscription, the same as you subscribe to the telephone.

This is a great danger that threatens the entire radio industry today and the sooner we face it the beter off we will be. In the first place we should support the broadcasting stations much more than we are doing today. We take the broadcasting stations for granted and do nothing in support of them. The public does not even support the artists who broadcast their programs. We should seriously think of some plan to support broadcasting stations and we should start immediately to support the artists. This can be done best by having all dealers give away, free of charge, applause cards to every customer. These applause cards should be sent out by the public who should be urged tc send them to the broadcasting stations they listen in to, mentioning the name of the artist or artists, and otherwise making them feel that their work is appreciated. While, of course, some people are doing this without these cards, the volume of applause that is reaching the artist is still very small. The public should be urged by the dealers, and the Radio Trade Association should see to it that a "Radio Applause Week" or a similar idea of this kind is started very soon.

Secrecy In Radio

(*Continued from page* 878)

after each letter. While part of these exchange alphabets within one period, i.e., within the time elapsing before the return of the mechanism into its initial position, are used several times, they are never. used in the same sequence again. In fact, the length of *one period* works out at about 1,000,000 *letters,* the same sequence of exchange alphabets only reverting after so enormous a number of letters written according to a given key. Now, as the machine comprises about 22,000 different periods of the. same length, it will be readily understood how hopeless any attempt at decyphering would be, the more so as the extreme variability in the sequence of individual alphabets prevents even the return of combinations showing some mutual similarity.

The fundamental organ of the "Enigma" cyphering machine is a system of cylinders each of which at its circumference carries a set of types by means of which the exchange alphabets are constituted and shifted

continuously as electric contacts are made. These cylinders are turned around by variable angles, according to an irregular sequence, which, however, can be adjusted by means of what is called a "key." A switch enables the machine to be used either for open writing, like an ordinary typewriter, or for cyphering or decyphering. The "key" of the cyphering machine comprises eight letters subdivided into two groups of four each and is adjusted by means of four milled knobs which, in their central position, will shift the corresponding cylinders, according to the first group of four letters, while the second group is adjusted by pushing the knobs into their final positions. The first four letters are read through a window-opening, while the other four appear on the knobs.

The cyphering machine also comprises a counting mechanism, by means of which each letter typed is automatically counted, the actual position of the counter being likewise ascertained through a window opening. A milled knob allows the counter, previous to beginning the operation of the machine, to be set to zero.

When the machine is set to "decyphering," it automatically translates the cyphered text into open writing. As each type corresponding to the cyphered text is pressed down, the cylinders are shifted in the same, though inverted, order as before, so as to reproduce, letter by letter, the original text.

Even apart from its use in wireless telegraphy, the new machine will lend itself to many applications, in common business life, in the diplomatic service and, unfortunately even in war. It would seem for the first time to solve the problem of translating secret messages into a cypher which cannot possibly be detected and of effecting both the cyphering and decyphering automatically and without any loss of time as compared with ordinary typing.

The Future of Radio Broadcasting

(*Continued from page* 875)

broadcasting today. Undoubtedly it will continue to occupy an important part of the programs, but it will be used with more artistic taste. The best in music will always be available so that public appreciation will become more exacting and the inferior and mediocre will be eliminated. To music will be added the radio play, a form of drama introduced by WGY at Schenectady having characteristics as distinctive in the radio field as the screened play in moving pictures, but preserving at the same time the complete realization of literary form.

Religious services will continue to inspire the vast radio audiences and particularly to cheer and comfort those who are incapacitated through age or infirmity. In spirit they will assemble regularly "to meet the Lord in the air", and there will grow up a religion in which shades of creed will be subordinated to belief in great fundamental principles. Then there will be established a unity of religious peoples which has never before existed.

Graded educational courses will be available at times convenient to those who labor in factories or fields so that the world's educational standards may be greatly advanced by providing opportunities even for those isolated from educational centers or otherwise prevented from attending school and college.

The use of radio for broadcasting news, market, stock and weather reports will be greatly extended supplementing these functions of telephone, telegraph, and newspaper.

These are some of the obvious developments of radio broadcasting which may be expected in the immediate future as they do not demand any radical advance in our present technical knowledge. They do, however,

necessitate some consideration of the question, "Who will undertake to broadcast?" because broadcasting today involves a serious responsibility. Whether broadcasting develops along the line of its technical possibilities or remains stationary depends largely on those who undertake the job. The inquiry is particularly pertinent now when a score or more broadcasting stations are relinquishing their licenses every month and about an equal number of new stations are coming "on the air." This condition, which was predicted a year ago, results largely from a lack of understanding as to the cost and responsibility of broadcasting. A modern well equipped high power station costs not less than $150,000 and the annual cost of operation is approximately $100,000. Obviously a department store, newspaper, or other enterprise supported largely by local trade cannot afford to broadcast far outside of the area it serves. Such stations will naturally be short-lived unless they limit themselves to low power and short programs. Even then it is probable that better results for all concerned would be obtained in such cases by renting broadcasting facilities from those established to render such service.

We may, therefore, assume that the number of broadcasting stations will decrease rather than increase, and that the high power stations with daily programs will be operated by interests of national scope. The Radio Corporation of America and the great electrical manufacturing companies will continue to broadcast on a large and expensive scale because the sale of receiving sets is dependent on the continuance of good broadcasting and also because of the friendly relations which broadcasting may establish with the public.

Another development worthy of mention is the distribution of broadcasting over telephone or electric lighting systems. This plan is entirely practicable and may be employed to a considerable extent in metropolitan areas, but will never supercede general broadcasting. The one quality of radio broadcasting which has gripped public interest is its universal freedom. It reaches everywhere and is free for all who supply themselves with receiving sets.

Thus while broadcasting involves an enormous expense without any direct returns, it may be expected to continue on an improved and more comprehensive plan, becoming an established means of disseminating news, music, education, entertainment and religious services. Fortunately most of the important broadcasting stations are quite conscious of the great responsibility they have accepted and they are seriously studying the problems involved with the views of rendering the listening public a real and permanent service.

Improved Loud Speaker Horn for Indoor Use

(*Continued from page* 901)

practical certainty that in a large auditorium with fair acoustical qualities, two or three loud speakers using the described type of horn, will give excellent results. Naturally, tests for placing the horns will have to be made in every case, as the length, width and height of the auditorium will govern the situation.

Only the horn of the size illustrated has been made and used. However, there should be no question from the acoustical standpoint why different sizes of double horns, equipped with different types of microphones should not work satisfactorily.

Radio Trade News

(*Continued from page 909*)

product. Literally hundreds of worthy items have been cast about in the experimental laboratory month after month, when inferior articles were selling with ease—all waiting for the final touch of refinement to be added to the product. Most of this is gone and we can expect fewer developments in the way of betterments of present equipment, while the lines that are now leading the field in their respective lines can be expected to maintain their leadership unless challenged by a superior sales organization combined with a superior product.

Public confidence in radio apparatus has been restored to a considerable extent the past summer by the absence of concerted price cutting on the complete list of products. While some price cutting has been noticed, and some special sales have been complained of, in the main, retail resale prices have been held up stronger the past six months than ever before in the history of the industry's short life. Many factors contribute to this condition; not only has the demand been strong with the manufacturer holding down on the supply, but the retailer has become educated to understand that rent and lights and clerks cost money, while the manufacturer in many instances has shortened his discounts and reduced the list price of the product.

Radio today is just beginning to come into quantity production, and production methods are being applied to radio manufacturing plants with surprising results. Competition is forcing many manufacturers to trim their sails in the matter of factory costs, with the result that many heads of firms find that they can not only meet the competition, but go them one better by stopping up some of the leaks in their organizations.

It has been said that this may lead to price cutting on the part of the manufacturer, which perhaps might be possible, although very doubtful, if the manufacturer did not need all his available capital to buy raw materials and to take care of the expansion of his business. Practically every radio factory of the smaller class is today worth several times the investment, and the absence of long strings of items, credited as "worthy of patents and good will" from statements of radio factories, is indicative of the strength of this, as yet, infant industry.

Wiseacres in the trade are looking for a new star in the radio world—looking for some individual to rise above the common rank of manufacturers with some startling development or some radical change in merchandising methods. This "star gazing," can be understood, as radio has yet to develop a man who can truthfully be said to tower head and shoulders above all others in the trade. Out in the Middle West is a man who bids fair to attain the first rank, while another in a neighboring city also can be claimed as runner up. In the East one or two have risen in the trade to suffer setbacks and to rise again, and the crown of the king of the industry still awaits a claimant.

The radio industry will soon have its captains in the hall of fame, leaders from the art—inventors; and leaders from the financial side—merchandising men who had the vision and ability to capitalize their foresight. The close competition of the coming seasons will rapidly weed out the unfit, and in another year radio apparatus will be sold by better class stores—with many captains of industry that are truly worthy of the title.

Glancing back, as is the custom, over past

histories of some of the newer industries it seems to the impartial observer that the radio industry has come further and made more progress towards a firm foundation than any other industry in the country has ever done in the same length of time. Radio impulses move with the speed of light and the radio industry can develop leaders and near leaders with the same speed.

On every hand the tendency seems to be towards complete sets—if those we hear are to be believed, yet the parts manufacturers seem content—and their cries for raw materials sound as if there were today more demand for parts than has ever been dreamed possible before. The entry of the wiser class phonograph and music dealer into the lists as a retailer of sets has opened up a completely new market for radio sets—and new markets always attract attention, but the steady sale of parts cannot be said to have slackened in the least.

The fact that the new radio-phonograph dealer has not attempted the parts line in the main is one of the leading arguments used to indicate the permanency of these dealers. Undoubtedly the radio boom was utilized by many electrical firms to revive an almost dead business—and doubtless many music and phonograph men will try radio on the same line—any port in a storm. Naturally these dealers will not survive in large numbers as would be the case were only the successful to enter radio, but a sufficient number of them will be found in the ring a year from now to make this outlet for sets an important one.

AMERICA LEADS IN RADIO EXPORTS

Exports of radio apparatus from the United States during the last eight months were valued at $2,200,000, according to the Department of Commerce figures. American manufacturers are leading the world in exports of radio instruments. In August, Argentina led other countries in the purchase of American equipment, the exports to that country totaling $99,059. Uruguay was second with $40,984, while Canada, importing $27,648 worth of apparatus, ranked third. Total exports going to 41 countries in August amounted to $307,127. The peak of American radio exports was reached in July, when a total of $682,885 worth of equipment went to foreign countries, and $443,000 of this went to Sweden. The average value of exports is about $270,000, but this figure is influenced considerably by construction of large transmitting stations in foreign lands. August exports of $307,127 were above the average, although much less than the July figure.

RADIO POPULAR IN HOLLAND

Commercial reports from the Netherlands tell of an unusual demand throughout that country for radio receiving sets. New broadcasting stations will be opened within a short time, and the increased number of concerts in the air is expected to stimulate the radio activity. Dutch manufacturers are able to supply vacuum tubes, having made them for local as well as export trade for a considerable length of time.

BANDIT TURNS OUT TO BE RADIO

Samuel Cohn and his wife have found a new terror for the radio fan. It's the radio bandit.

All was serene in the Cohn household when Mrs. Cohn awoke with a start—she heard mumbling voices from the front of their apartment. She awakened her husband. Taking his revolver, followed by Mrs. Cohn, he crept cautiously toward the front room.

As they entered the dining room they heard a voice say: One moment please!"

Then the voice continued, in a monotone, "Station 9PZ, testing——"

They had forgotten to turn off the radio.

A HANDY AND EFFICIENT RADIO RECEIVER

By DR. ALFRED GRADENWITZ

The most striking feature of the Benaudi radio telephone receiver, represented herewith, is the provision of an air cushion between the ear and the membrane, which by its vibrations results in a 15 to 20 per cent increase of acoustic effects. Moreover, the new receiver is simply hung on the ear, which it encompasses completely, thus eliminating any extraneous noise. It readily fits any size of ear and does away with the troublesome headband. The operator's hands remain free and his head retains full liberty of movement. The handy little apparatus is of excellent workmanship and insures an exceedingly clear rendering of speech as well as of music.

This German Telephone Receiver Fits on the Ear. It is Very Light in Weight and Eliminates the Use of Head Band.

JOSEPH HENRY MEMORIAL SERVICE TO BE BROADCAST

Under the auspices of the New York State Museum, Albany, N. Y., on December 17, the broadcasting stations WGY at Schenectady and WHAZ at Troy will broadcast a program in memory of Professor Joseph Henry who, while a Professor in the Albany Academy in 1831, invented an electro-magnet by which he was able to transmit signals to a distance. This was a basic discovery and one to which radio is much indebted.

It is of interest that the bell which gave forth the first sound ever heard in response to the electro-magnet was kept by Dr. Phil-

The Bell Which Gave Forth the First Sound Ever Heard in Response to the Electro Magnet.

lip Ten Eyck, an assistant of Prof. Henry, and is now the property of the New York State Museum where it is on exhibition.

A unique feature of this program will be that the stations at Troy and Schenectady at different times during the program will broadcast the ringing of this bell.

Probably without parallel in the history of electrical invention is the fact that the same bell which in 1831 gave forth the first sound ever heard at a distance by the use of the electro-magnet should again ring in 1923 and be heard around the world.

The inventions which make it possible for this bell to be heard around the world are largely based on the electro-magnet which rang it in 1831.

Radio In the Far East

By J. H. Maade

Perhaps it might prove of some interest to those not acquainted with the Far East to hear something about radio here in the Orient, and it is with this intention that I write this, having been sailing between Java, China, and Japan ports for nearly four years.

Radio is by far not as up-to-date as it is in the United States or Europe, though has been much improved lately. While some coast stations work splendidly, the handling of traffic by others is poor and regulations of the Radio Convention do not seem to exist in the East. Is there not such a regulation which says that ships must give their messages to the nearest coast station? Well, here it is quite common that a ship calls a shore station one or two thousand miles away, while he is but 50 miles off another coast station. The result is an awful lot of jamming, which, together with the exceptionally bad atmospherics, makes good traffic impossible. And it is but seldom that ships are reported for this violation of the Radio Convention regulation.

Only the early morning hours are free from static, and it is then that some good, long-distance reception might be done. With one valve and a honeycomb receiver, it is always possible to pick up the high power stations in Europe, and messages are often readable. On only a detector tube I check the time signals every morning from Nauen POZ and NPM simultaneously, everywhere in the Orient. NPM which transmits on 11,500 meters arc must be slightly detuned to get the loudest signals from POZ, which works on 12,600 alternator, and both time signals (2356-2400 GMT) may be checked at the same moment. Other European stations, namely, UFT, LY, PCG, GBL, IDO, and many others come in very well during the early morning hours, and especially the first three which are very strong on one tube, and can be heard practically the whole day although the atmospherics become too strong in the afternoon to have the signals still readable.

A few days ago I heard the new station at Monte Grande, Buenos Aires, testing and calling POZ, on a wave-lenth of about 12,000 meters. Signals are strong on but one tube, though the distance is around 10,000 miles. It would be interesting to know which way the waves travel in this case. If they come over the Atlantic Ocean, the distance is 10,000 miles, but there are large masses of land between; while, if the waves come over the Pacific Ocean, the distance is about 14,500 miles, but they travel then over the sea.

Tests with a uni-directional loop would perhaps prove of great value.

American stations may be heard in the late afternoon and evening, when the Pacific Ocean is all dark. Press from NPL, San Diego, is often readable, so that, with the news received in the morning from POZ (trans-ocean press) a nice little newspaper may be published every day. The R. C. A. stations near Honolulu, KGI and KIE, come in loud and clear all day long; also KET,

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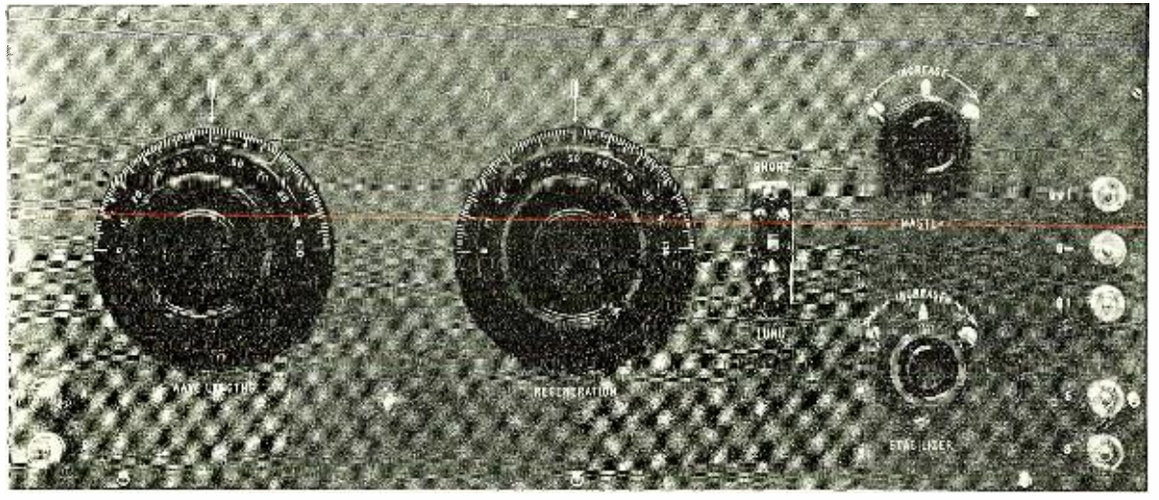

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which seems to be Bolinas, Cal., and which is of good signal strength in the morning, though the Pacific is then in full daylight.

Recently a new high power station seems to have been erected in China. It was testing for some days on a 15,000 meter alternator and was of very great intensity—it gave as call letters XYZ.

Weather reports, which are of the utmost value, owing to the numerous typhoons here, are sent out by nearly all coast stations, but due to the very bad atmospherics, they usually cannot be read over any great distances. A valuable exception is NPO, Cavite, which gives weather warnings every night at 1400 G.M.T. on spark and arc simultaneously, the latter on a wave-length of 5000 meters, may be read all over the Orient and Pacific, even when QRN is very bad. Also the warnings from JJC, Funabashi, Japan, on 4000 spark, are of much value (1200 G.M.T.) and may be copied over long distances.

As with regard to broadcasting, they seem to make a start here; there are already two regular broadcasting stations at Shanghai and Manila, which send out music every night. The music is still of the grammaphone quality, but no doubt this will soon be replaced by actual orchestras and bands.

Where a year ago the whole Orient seemed to be closed for radio amateurism, as there were no shops to buy anything, it is a fortunate fact that in all big places in the Orient radio shops have opened, or electrical dealers have taken radio as a side line. And thus far it has been mostly American import, which has been put on the market; so I was able to procure the new Cunningham C301-A tubes only a few months after they were generally sold in the States. This is the more fortunate, as a year ago one was very happy, when short of tubes, to buy an inferior tube of Japanese make. Now the latest apparatus and parts may be bought here.

It is funny to see how the Japanese are imitating many radio sets and parts, which are of original American make. At the Tokyo Radio Company I saw many instruments, such as the famous Radiola, nicely imitated, and the Japs do not even seem to worry when they put the name R. C. A. on them, though they proudly claim that all is made in Japan. On closer examination it can be easily seen that these apparatus are inferior to the originals and the finish is very poor. If one turns a switch, turns it a second time, and then a third time, it is very probable that it will break off or get loose. Magnavoxes, Paragon detector units, condensers, valves, sockets, variometers, honeycomb coils, all are imitated exactly as the original stuff, and only by close examination the differences may be found. They now make valves of all kinds; American Radiotron types, Auditron types, French types, etc., etc. The newest is that a representative of the Tokyo Radio Co.'s branch office at Kobe comes on board every steamer in port with a suit case full of radio stuff. All instruments and valves are certainly not so good as the original makes, but, in case of an emergency, they may be of some help.

I think it quite probable that radio broadcasting will take a great flight here the coming year. It must not be forgotten that the Orient usually comes a year or two behind the rest of the world. But the general public in the different places have read so much about the broadcasting of music, operas and speeches, in America and Europe, that they won't sit idle, but urge their governments to allow radio reception, which, thus far, is still prohibited in some countries of the Orient. The British, too, are discussing the possibility of broadcasting in India, and if the Dutch East Indian government isn't too slow, we'll also have broadcasting in Java in the near future.

It is a very good thing that firms are opening radio stores everywhere; if the general

public cannot buy sets near at home, and if they want something and must order it either in Europe or America, they won't worry much about radio.

But if they have only to go to a shop in their own town to buy the latest instruments, and are thus able to listen in after having read so much about it in the newspapers, then certainly it won't be long before broadcasting will break its way into the Far East, notwithstanding that lazy Governments will do their best to prevent it because it gives them so much more work to do. Let us hope for the best.

STATION WBZ TO GIVE UNIVERSITY EXTENSION BY RADIO

In order to further extend the use of radio so that it may be put to utilitarian uses, Westinghouse Radio Station WBZ at Springfield, Mass., has arranged with the Massachusetts Division of University Extension for a number of courses in which the successful student will obtain a certificate of perfection at the completion of the course. Two courses have been arranged at the beginning—one intended primarily to interest men and boys, the other intended to interest women. If the original courses are received with enthusiasm, other courses will be offered from time to time.

These are the arrangements which have been made. For the men a course will be given in "Radio Reception and Transmission." It will be sufficiently elementary to appeal to those radio enthusiasts who are interested chiefly in the results that they can get with their own sets, and who do not care to go very deeply into technical details. At the same time, it will be broad enough to furnish a sound foundation for a more advanced and technical study of the subject. If a sufficient number of people show interest in this first course, a second and more advanced one may be given later in the year.

The course will consist of 10 lectures, one to be broadcast from this station by Edward H. Goodrich of Springfield, each Wednesday evening, from 7:00 to 7:20 P.M. The first lecture was given on Wednesday evening, October 3.

For women, the Division will broadcast a course in "Household Management," consisting of eight lessons and given each Tuesday evening from 7:40 to 8:00 P.M., beginning on Tuesday evening, Oct. 16. The instructor will be Miss Agnes H. Craig, teacher of domestic science in the Springfield School Department. The arrangements for this course are similar to those for "Radio Reception and Transmission."

All radio users within range of this station are, of course, welcome to become part of the audience at these lectures. If, however, one wishes to take an active part in the course, he may enroll as a university extension student by sending to the Radio Station, Westinghouse Company, Springfield, Mass., his name, address, age, and occupation, with the registration fee of $1. This application and payment constitute enrollment and entitle the student to receive any study material that may be sent out by mail, and to submit lesson papers to a university instructor for correction. For students thus enrolled, topics will be assigned upon which a final paper is to be written at the end of the course. If this work is successfully carried out, the student will receive a certificate testifying to his completion of the lesson assignments. If the final papers written by students are of a high grade, the best three will be broadcast with the names of the writers after the regular course has been completed. Students who wish to compete for this honor must submit their papers not more than a week after the final lecture has been given. It may even be possible to offer prizes for excellent work.

University Extension in Massachusetts is already serving thousands of men and women. Established by the state legislature in 1915, it has grown so rapidly that during the past year alone the enrollment was over 35,000 students. Several hundred classes have been formed to meet in almost every corner of Massachusetts, and there is scarcely a postoffice within the boundaries of the State through which does not pass mail to and from university extension correspondence students.

With the addition of radio lectures to the regular program of class and correspondence instruction, this work can be made even more valuable and more extensive. Its growth has been due entirely to the fact that a surprisingly large number of people are eager to use their spare time for study. The extent of the university extension program is limited only by demand. If you wish the privilege of taking each year by class or by radio the subjects in which you are most interested, show your interest by becoming a member of the great student body. The two courses which start on October 3 and October 16 are only a beginning: other subjects may be offered by radio if enough people want them. At the present time we suggest as subjects for later courses by radio, Appreciation of Music, Appreciation of English and American Literature, Short-Story Writers, Salesmanship, Civics and Citizenship, Economics, Business Law, and Finance. If you have a preference for one of these courses, write to the Radio Station, Westinghouse Company at Springfield, Massachusetts. In this way you will make it possible for us to give courses which are of greatest interest to radio fans. Meanwhile, don't forget to mail your application letter and the fee of $1.00 for the Radio course or the Household Management course to the Westinghouse Radio Station, Springfield, Massachusetts.

SAN JUAN'S ONLY BROADCASTING STATION IS NOW SILENT

It is estimated that about $50,000 has been spent in radio sets and equipments, during the last few months by radio fans and radio students in and near San Juan, and who are now complaining of not getting any service out of their sets.

It is nearly three months now that the broadcasting station in San Juan has remained silent and the thousands of radio fans over the island have given up hopes of obtaining any service for their costly receiving sets.

There are at present more than one thousand radio sets distributed all over the Island and more than three-fourths were installed during the period when the Radio Dealers Association sent out radio programs from the broadcasting station, located on top of the Telephone Building.

The story goes that the Radio Dealers Association in the town has been unable to come to any reasonable understanding as to how the expense of broadcasting programs is to be distributed among themselves, as well as among other dealers, who refuse to share the expense. Some of the well established dealers desire to pay as much as those who are newcomers in the business, and hence the misunderstandings and present static position of radio broadcasting. In the meantime, those fans who save enough to buy what they believe an over-priced radio set, sit idly at home brooding over their ill fortune when they bought their $15 to $175 sets.

NO MORE HUNTING

A Schenectady woman, wife of a schoolteacher, asked WGY to broadcast a request for a flat. She described and specified the number of rooms she desired and the rent it was possible for her to pay and also mentioned the streets she preferred.

GOVERNMENT MAY CALL ANOTHER RADIO CONFERENCE

By CARL H. BUTMAN

The first two radio conferences in Washington aided the Department of Commerce so materially that it is probable another representative gathering may be called this spring, with a view of making the conferences annual affairs. One thing in particular that the conferences accomplished was the eliminating of interference through wave allocation. Officials of the Department of Commerce believe that broadcasters, amateurs and commercial stations are now keeping on their wave-lengths pretty well. This is essential if we are to have a minimum of interference. Representatives of the Department in every district are listening in all the time and measuring the waves emitted by transmitting stations, warning offenders when they are too far off their waves.

The Bureau of Standards through "WWV" has been sending out standard wave-lengths, so that stations can adjust their sets; the Navy is aiding also. Methods of calibrating sets properly have been announced and it is now up to the transmitting stations to keep within bounds.

BROADCASTING COMPANY ESTABLISHED IN SWEDEN

"Svenska Rundradioaktiebolaget" is the name of a new firm in Sweden for broadcasting. The organizers of the company are Elektriska Aktiebolaget A.E.G. Allmanna Telefonaktiebolaget, L. M. Ericsson and others. The minimum capital of the company has been fixed at 100,000 Kroners and the maximum at 300,000 Kroners. The company has applied to the Government for a concession to transmit information by radio.

GOVERNMENT RADIO HEAD PLANS TRIP

Chief Supervisor of Radio W. D. Terrell, of the Department of Commerce, will take a trip around the country, eventually visiting each of the nine radio districts. Recently he made a trip to Detroit and Chicago, the eighth and ninth district headquarters. Within a month's time, he hopes to start west to visit Seattle and San Francisco and inspect the district headquarters there. Returning via New Orleans, he will stop off there and in Atlanta, where the new fourth district offices were recently established. En route to Washington he hopes to stop at Norfolk. Later in the season, he will go to Baltimore, New York and Boston, thus completing a circuit of all nine district headquarters.

Since the advent of broadcasting, it has become necessary for the Chief Supervisor to keep in closer touch with his district supervisors and their inspectors, and it is for this reason, and in an effort to adjust some local difficulties that Mr. Terrell is making the extensive trip.

Mr. Terrel will also sound out the sentiment of several sections of the country as to broadcasting, amateur activity and other phases of radio communication as part of a general study he is making of operation under the regulations and new wave-lengths laid down last spring.

SHIPPING BOARD NEEDS RADIO OPERATORS

Radio operators seeking employment will find excellent opportunities for real radio work on board ships of the U. S. Shipping Board which sail the "Seven Seas" and call at every port in the world.

The annual turn-over of radio personnel is large, due to several causes, among

them being the fact that many college men spend their summer vacations sailing the "briny deep" as marine radio operators, and then return to their studies at the end of the vacation season.

It is understood that approximately 100 first-class radio operators can be placed on Government vessels alone during the next few months.

On the first of last July, the Government increased the pay of all its commercial operators approximately 15 per cent. The monthly rates of pay now in effect range from $85 per month to $125. A few positions pay a higher salary.

Radio operators aboard Shipping Board ships are classed as officers and, in addition to their regular monthly pay, receive free lodging, meals and such other accommodations as are accorded to ships' officers.

Applicants for berths as radio operators must hold commercial first-class radio operators' licenses, which are issued by the Department of Commerce. Examinations for such licenses may be taken any time at the offices of the Department of Commerce's Radio Supervisors, located at the following places: Custom House, Boston, Mass.; Custom House, Baltimore; Custom House, New Orleans; L. C. Smith Bldg., Seattle, Wash.; Custom House, New York; Federal Bldg., Atlanta, Ga.; Custom House, San Francisco, Cal.; Federal Bldg., Detroit, Mich., and Federal Bldg., Chicago, Ill.

Radio operators who desire employment on board Shipping Board vessels and holding required licenses should communicate with the radio companies which employ operators for the Board. These companies are: Radio Corporation of Amercia, Ship Owners' Radio Service Inc., and Independent Wireless Telegraph Company, all of which have offices in large American ports.

NAVAL STATION TO SEND STANDARD SIGNALS

Standard radio frequency signals will be transmitted from NPG, the Naval Radio Station at San Francisco on the third Monday of each month commencing October 15, at eight A. M., Pacific time. All transmission will be on continuous waves from both a medium and a high-powered arc set, no voice announcements being made. The six frequencies to be transmitted will range from 28.5 to 125 kilocycles, all long wave-lengths.

SOUTH AFRICAN COMPANY ORGANIZED TO SET UP HIGH POWER STATION NEAR CAPETOWN

The Wireless Telegraph Company of South Africa (Ltd.), has been recently organized to provide international telegraphic service for the Dominion. The principal high-power station is to be located at Klipheuvel Station, Cape Province, about 30 miles by rail from Cape Town, according to advices to the Department of Commerce. The site comprises about 1,000 morgen (2,110 acres) of farm land and is so located as to be about 10 miles distant from any mountains. It is estimated that the station will be in operation in about 18 months. The power of the new station will be 750 kilowatts and it is probable that it will operate on a wave-length of about 16,000 meters.

The aerials will be supported by 16 towers 800' in height, arranged in the form of a circle having a diameter of 1½ miles. Beneath this circle an earth screen will be supported on 250 towers 40' in height. The use of the earth screen was determined as the result of experiments carried on at the Marconi station at Carnarvon, Wales.

A UNIT IN THE EMPIRE WIRELESS CHAIN

This South African installation together with the stations planned for Canada, Australia, and India and the existing stations in England and Egypt will form an Empire wireless system, each one being designed to communicate directly with the mother country or with any of the other Dominions.

PROJECTED WIRELESS PLANT AT CONSTANTZA

Business circles in Constantza are much interested in a projected wireless telegraph plant. The present radio station at Constantza is used for little more than the distribution of shipping intelligence. The bankers and shippers generally want not only telegraph and telephone (wireless) connection with Western Europe, but also with Constantinople, the Piraeus, and Odessa. The project for the construction of such a station has secured the approval of the Bulgarian Ministers of Communications, Finance, and Industry and Commerce, and, with a certain supply of German material now on hand, it is expected that the new enterprise will soon take definite form at a cost of approximately Lei 800,000.

RUSSIAN-FRENCH RADIO AGREEMENT RATIFIED

Ratification has been made of the contract between the French Compagnie General de Telegraphie Sans Fil and the Russian Radio Electric Trust, according to cable advices from Trade Commissioner Butler, at Paris. The agreement provides for the installation of wireless stations and manufacture of apparatus in Russia.

G. E. TO INSTALL SIX HIGH POWER TUBE TRANSMITTERS

Six radio transmitters, to be the most powerful on the American Continent, operating from vacuum tubes and first to make use of the General Electric 20-kilowatt radiotron, are being installed by the United Fruit Company and the Tropical Radio Telegraph Company at points in Central America and the United States for the purpose of completing the links of an adequate communication system between the Americas. These transmitters will be located at: New Orleans, La., Miami, Fla., Puerto Barrios, Guatemala, Tegucigalpa, Honduras, Managua, Nicaragua, Almirante, Panama.

The Tropical Radio Company operates the stations at New Orleans, Miami, Tegucigalpa and Managua while the stations at Puerto Barrios and Almirante are operated by the United Fruit Company.

The first of these six sets has just been completed at the Schenectady works of the General Electric Company for the Radio Corporation and sold to the United Fruit Company, and will be shipped within a few days to the Tegucigalpa station. The other five are scheduled to be completed and shipped at the rate of one a month and, as about two months will be required to install each set, it is expected all six will be in operation by the middle of next year.

The United Fruit Company established the first radio stations in Central America and was the first to establish commercial radio communications between Central America and the United States. It was shortly after the International Yacht races off Sandy Hook had been reported by radio that the first radio sending and receiving sets were purchased and installed at Port Limon, Costa Rica, and Bocas, del Toro, Panama. This was in 1904 and service was inaugurated the following year. The operation of these two stations convinced the directors of the United Fruit Company that radio was practical and valuable in a business which handled such a

highly perishable product as the banana. So the year following, or 1906, stations were opened at Bluefields and Rama, Nicaragua. All these stations, because of the lack of land communications, handled in addition to the Company's business a large share of the telegraph business of the general public between these places and the United States and Europe. Other stations have followed since then until now, with the six new tube transmitter stations, there will be a total of 19, comprising what is known as the United Fruit Company's radio system. All stations of the United Fruit Company's system, including all their ships of the "Great White Fleet" are to be equipped with tube transmitters of a similar type.

The United Fruit Company has spent more than $3,000,000 in the development of its radio system and upon the completion of new stations under construction its investment in radio will probably exceed $4,000,000. Since 1911, the radio activities of the Company in all its branches have been under the immediate direction of George S. Davis, who is general manager of their Radio Telegraph Department. He is also president and a director of the Wireless Specialty Apparatus Company, general manager of the Tropical Radio Telegraph Company and a director of the Radio Corporation of America.

In the operation of these transmitters, in some cases where stations are located in remote places, the primary power is generated at the station by gas or oil engine driven alternators supplying 220 volts. In other stations the power is obtained from the distribution system of the local power company. This power first goes to the service panel where complete apparatus for control, protection and metering is installed. Then it goes to the rectifier which consists of a bank of transformers and six 12½ kilowatt kenetrons. Here the voltage is stepped up and rectified, to become 15,000 volts direct current. This high voltage is then used for plate power on the pliotron oscillators.

The frequency is controlled by means of a master oscillator employing one 1-kilowatt pliotron. The master oscillator provides a lower power radio frequency supply which is then amplified to 20 kilowatts of power by means of one of the new water-cooled 20-kilowatt tubes. The amplified power is passed through a tank circuit which eliminates harmonics and is then fed into the multiple tuned antenna.

Keying is accomplished by means of a relay in the master oscillator unit. This relay may be controlled from any desired distance and is adapted to keying speeds of 60 words per minute.

HOW TO MAKE INDUCTANCE COILS

A circular descriptive of how to make a series of single-layer inductance coils suitable for radio-frequency standards has been prepared by J. L. Preston and M. S. Strock of the Bureau of Standards. Owing to the increased interest in radio-frequency measurements, the illustrated circular should be of considerable value to those technically inclined and in laboratories where a fixed conductor of known inductance and having a small radio-frequency is desired. This type of coil in conjunction with a high-grade variable air condenser, such as the Bureau of Standards type, forms a very dependable and accurate wavemeter. The pamphlet is known as Letter Circular LC-103.

WORSE THAN THE DENTIST

We read in a New York paper that Ellis Parker Butler was recently pallophotophoned. Some folks not as up-to-date on radio as they should be immediately wanted to know if the humorist would recover.

I Want to Know

(*Continued from page* 912)

RECTIFIER QUERIES

(830) Mr. Charles Luigs, St. Meinrad, Indianna, wants to know:

Q. 1. Please give dimensions of jars and plates of a four-jar electrolytic rectifier.

A. 1. Jars having a capacity of one quart should be used. Pure lead and aluminum plates 5" long and 1" wide should be employed These plates should be immersed in the solution to a depth of about 3½". The circuit of this rectifier will be found in answer to question 759 in the October issue of Radio News. Instructions for making the solution for this rectifier are given in answer to question 814 of this issue.

Q. 2. Where may the lead and the aluminum necessary for this rectifier be obtained?

A. 2. Pure lead and aluminum sheeting may be obtained from Patterson Bros., 27 Park Row, New York City.

Q. 3. Could a five-watt transmitting tube be used in place of the amplifying tube in the combination transmitting and receiving set described in the May issue of Radio News?

A. 3. A five-watt tube will give very good results in this circuit.

R.F. IN THE COLPITTS CIRCUIT

(831) Mr. T. J. Tronson, Lake Villa, Ill., writes:

Q. 1. I am using a receiver employing the Colpitts oscillator circuit. Will you kindly publish a diagram showing how one stage of radio frequency amplification may be added?

A. 1. Radio frequency amplification cannot be adapted to a receiver using the Colpitts oscillator circuit.

VERNIER CONDENSER

(832) Mr. Thomas J. Rozum, Humboldt, S. D., asks:

Q. 1. I would like to know if a 23-plate condenser with a vernier dial is as good as a 23-plate vernier condenser.

A. 1. A variable condenser using a vernier dial will give just as good results as a standard vernier condenser.

VARIOCOUPLER DATA

(833) Mr. William J. Scott, Toronto, Canada, wants to know:

Q. 1. Using a 4" tube for the primary of a variocoupler, what diameter should the tube for the rotor be?

A. 1. This would depend upon whether a ball rotor or an ordinary tube is to be used for the secondary. If a ball rotor is used, it may be just large enough to fit inside of the primary. If a tube is used, it should be about 3" in diameter.

Q. 2. The primary is wound with 60 turns of No. 20 S.S.C. wire; how many turns should be on the secondary and what size wire?

A. 2. The secondary should consist of 40 turns of No. 22 or 24 S.C.C. wire.

Q. 3. Would No 22 give better results on the primary?

A. 3. No. 22 wire would not be quite as efficient as No. 20 for the primary of your coupler.

With the Amateurs

(*Continued from page* 889)

WNP was also heard, answering 1ANA at approximately 220 meters. The following were heard on September 5.

1BCG, 3CKM, 2KW, 1ABS, 1ANA, 2BY, 5HL (very good), 1ACU, 1BQH, 1AR and 2FP (spark).

I am the owner and operator of radio station 8CS which has been heard about 400 miles with a power of 15-watt input and a radiation of only 0.35 ampere. I can now get in touch regularly with English, Dutch and French amateurs with a one-half ampere radiation. On phone my speech has been reported good up to a distance of 350 miles. I hope to increase my power in the near future so as to try to send across the Atlantic and be heard in America. I should be very glad to give full information about my reception here, to anyone who will ask me by a letter or card.

Calls Heard

9DRS, DECATUR, IND.

1AR, 1AX, 1BES, 1BOQ, 1KC, 1FD, 1VHR, 3AA, 3AAY, 3BD, 3BDO, 3BVN, 3BVR, 3ES, 3MB, 3SS, 3TB, 3ZS, 4CR, 4DV, 4DX, 4IA,

4KC, 4KU, 4LG, 4MB, 4MV, 4RV, 5AA, 5AFO 5AIU, 5AMA, 5EK, 5LR, 5LRH, 5MU, 5UP, 5SZ, 8AAR, 8AGF, 8AGP, 8AM, 8AMR, 8ASM, 8ATH, 8 AVN, 8AWF, 8BDA, 8BIQ, 8BNH. 8BMU, 8CDZ, 8CP, 8CQS, 8CR, 8CTE, 8CTN. 8CVG, 8CWG, 8CZ, 8DCG, 8DKM, 8FU, 8KGF, 8KJ, 8PD, 8PL, 8PR 8VP. 8VQ, 8WA, 8WG, 8ZZ, 9AAR, 9AAU, 9AAW, 9ABB. 9ACI, 9AED, 9AFI, 9AHZ, 9AIM, 9ARC, 9AUN, 9AUY, 9AXX, 9BA, 9BAK, 9BEL, 9BEZ, 9BSP, 9BW, 9BWF, 9BQQ, 9BZI, 9CCK, 9CFK, 9CFO, 9CHD, 9CTE, 9DBJ, 9DCG, 9DGW, 9DHG. 9DIS, 9DLW, 9DLG, 9DMJ, 9DRI, 9DRO, 9DWM, 9EBT, 9EKF, 9EL, 9EMF, 9IG, 9QR, 9RC, 9ZT, 9ZV.

"CALLS HEARD" AT 9BTL—1 TUBE

1AW, (1ALJ), 1BCG, 1BES. 1BDI, 1BMJ. 1BWJ, 1CBG, 1ER, 1SN, (2AGB), 2BRB, 2CFB, 3AAO. 3ACY, 3AJG, 3BVA, (3BVL), 3GE, 3IW, 3SU, (3TJ), 3ZO, (4AF), 4CS, 4DX, 4FA, 4FT, 4GX, 4MB—6ALV, 6ARB, 6AWT—Hum audible 3 ft. from phones on Det. only—(6BGY), 6BHU, 6BM, 6BPZ, 6BVG, 6CBU, 6CHL, 6PE, 6PL, 6RM, 6ZAH, 7AGV, (7AJQ), 7IT, (7LY), 7WN, 7WP, 7WV, 7ZD, 7ZF, Can. (3BP), (3OH), (3NI), 4DY, 4ER.

Using 10 watts—Reports over 1,000 miles appreciated.

9AER, WILMETTE, ILL., (One Tube.)

C.W.—1ACU, 1BBO, 1BWJ, 2CAL, 2CCX, 3CDK, 4DB, 4KU, 5AIC, 5AIU, 5EK, 5MN, 5NJ, 8GPB, 8HZO, 8BCI, 8BNH, 8DHA, 8YV 8ZZ, 9AAR, 9AAU, 9AAV, 9AAW, 9ABB, 9ACK, 9ACR, 9ACW, 9AEM, 9AEN, 9AGQ, 9AIM, (9AJH), (9ALY), (9ANB), (9AOY). 9APJ, 9AQM, (9ASA), 9AUA, 9AUN, 9AUY, 9AVP, (9AWK), 9AWF, 9AWM, 9AZN, 9AZO, 9AZP, (9BBR), 9BCX, 9BED, 9BF, 9BFF, (9BGA), 9BHL, 9BMO, (9BNA), 9BQA, 9BQQ, 9BRE, (9BRX), 9BRS, 9BTT, 9BTD, 9BWP, 9BYA, 9BZI, 9BZD, 9CCK, 9CDV, 9CHR, 9CLV, 9CLX, 9CVS, 9CXH, 9CYQ, 9DFO, 9DGW, (9DHQ), 9DHG, (9DHU), 9DIW, (9DKK), (9DQ), 9DQA, (9DRN), 9DVM, 9DVL, (9DXP), 9DYZ, 9DYH, (9EBA), (9ECB), (9ED), 9EIN, 9EKF, 9EKY, 9ES, 9GL, (9LZ), 9MO, 9OX, (9PO), (9QRG) (hi), (9RC), 9US, 9WP, 9ZY, 9ZT.

Spark—9AOZ, (9BAM), (9BEF), (9BIQ), (9BWS), (9DFV), (9DIL), (9DMY), (9DVK), (9EDG), (9EDH), (9GT), 9JO, (9OF), (9WM).

HEARD BY JOE SOMERS, 1804 VERMONT AVE., CONNERSVILLE, IND, (One Tube)

C.W.—1BOQ, 1BOM, 1MU, 1WB, 1YB, 2AAY, 2CCD, 2CCX, 2KK, 2WB, 3AAO, 3ADN, 3AGC, 3AJD, 3BOG, 3BDO, 3BMN, 3CBM, 3GN, 3IW, 3JJ, 3NI, 3ZNA, 4AI, 4BA, 4BY, 4DB, 4ED, 4FS, 4FT, 4GF, 4GW, 4GX, 4HR, 4KA. 4KC, 4KV, 4LJ, 4MB, 4ME, 4MR, 4NA, 4NV, 4OR, 4QF, 5ABY, 5AGJ, 5AGO, 5AHJ, 5AIR. 5ALV, 5AJW, 5AM, 5APJ, 5APS, 5BDR, 5BM. 5CV, 5DAU, 5ED, 5EK, 5FA, 5FR, 5FX, 5GA, 5GI, 5GJ, 5GN, 5II, 5JJ, 5LX, 5MI, 5MO, 5MU. 5NJ, 5OA, 5PH, 5RH, 5TJ, 5TP, 5VA, 5UP, 5WO, 5WX. 5ZB, 6ZBA, 6AIW, 8ALH, 8ANB, 8AUE, 8BGG, 8BLQ, 8BJU, 8BMB, 8BNH. 8BSY, 8BYR, 8BXH, 8BZD, 8CAB, 8CAO, 8CEI, 8CGT, 8CHB, 8CHX, 8CNW, 8CP, 8CQA. 8CRW, 8CSB, 8CVG, 8DAL, 8DAR, 8DAT, 8DCB, 8DCG, 8DCJ, 8DHA, 8DHQ, 8DIQ. 8DIV, 8DIL, 8DRD, 8EKN, 8ES, 8FI, 8GZ. 8JJ, 8JU, 8KK, 8PD, 8PL, 8QE, 8QN, 8WA, 8VE, 8VK 8VQ, 8VY, 9AAL, 9AAU, 9AAW. 9ACI. 9AEM, 9AIM, 9AIV, 9AJV, 9AKT, 9AIM, 9ANB, 9APD, 9APS, 9APN, 9AQD, 9ASR, 9ASV, 9ATM, 9AUC, 9AUS, 9AWF, 9AWG. 9AWK, 9BAK, 9BAN, 9BAV, 9BBR, 9BCV, 9BDA, 9BDE, 9BDS, 9BDV, 9BDU, 9BEH. 9BEZ, 9BFB, 9BFZ, 9BIK, 9BKO, 9BKU, 9BKY, 9BMU, 9BRI, 9BSY, 9BUJ, 9BWA. 9BWR, 9BYG, 9BYX, 9BZI, 9CA, 9CAA, 9CAH, 9CAO, 9CBA, 9CBV, 9CCS, 9CCY, 9CEE, 9CEN, 9CGY, 9CHE, 9CHF, 9CJA, 9CNO, 9CQH. 9CR. 9CRA, 9CTB, 9CTE, 9CTK, 9CTR, 9CTT, 9CVD, 9CVG, 9CAH, 9CYF, 9CYG, 9CZS, 9DEY. 9DDU, 9DHM, 9DHS, 9DII, 9DIN, 9DIM. 9DNN, 9DKG, 9DOF, 9DPC, 9DPQ, 9DRO, 9DSL, 9DTJ, 9DTT, 9DWA, 9DX, 9DYK. 9DXN, 9DZS, 9DZX, 9DZY, 9EAK, 9EFY, 9EIF, 9EIR, 9EKF, 9EKY, 9ELA, 9ELB, 9ELO, 9EKF, 9EO, 9EQ, 9ES, 9FP, 9IH, 9KD, 9MA. 9MC, 9MU, 9OR, 9OX, 9RL, 9TA, 9UC, 9UR, 9UZ, 9VL, 9VM, 9ZV, 9ZY, 9ZZ.

Phones—4FB. 5AMF, 5HL, 8ALW, 8BIL, 8HG. 9ASV, 9AHJ, 9PV.

5KC, PLAQUEMINE, LA.

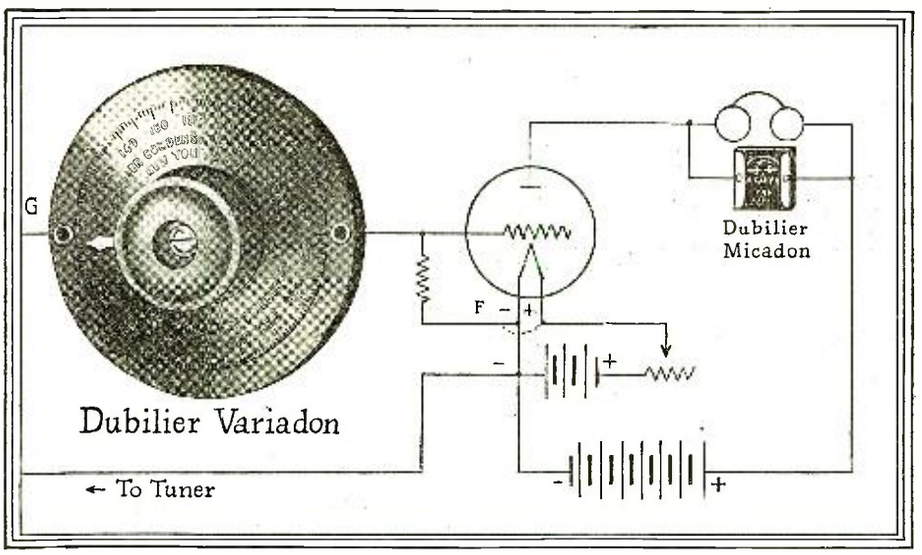
Can.—(3CO), 3JL (3JT), 3QT, 3SS, 3SX, 3TB—daylite, (3UJ), 3WS, 3XN, 3ZN, 3ZT.

Mexican—(BX).

U. S.—1FB 2FP, 2PF, (2WA), 2BQD, (2BUE), 2CCX, 2JS, 3BBD (3BDO), 3BRM, 3CBM, 4HJ, (4ME), 4QF, 5 too numerous, 6CF, 6KA. 6PL, 6VD, 6VF, 6ALV, 6AVV, 6AWT, 6BBC, 6BIC, 6BIH, 6BKX, 6BPE, 6BPZ, 6BQC. 6BRF, 6BUT, 6BVF, 6BWP, 6CAH, 6CAJ, 6CBI, 6CDC, 6CDG, 6GGW, 7AGV, 7BCF, 7YL, 7ZU, 8, 9 too numerous.

9ARB. KEWANEE, ILL.

C.W.—1FD, 1BWJ, 2BG, 3BI, 3EV, 3HK,



At F, the filament terminal of the grid leak is shown connected to the negative side of the tube. Occasionally better results are obtained by connecting grid leak terminal to positive side of the tube.

WANTED—Back numbers of Radio News, Dec., 1921, Jan. and Feb., 1922. Experimenter Publishing Co., 53 Park Place, New York City.

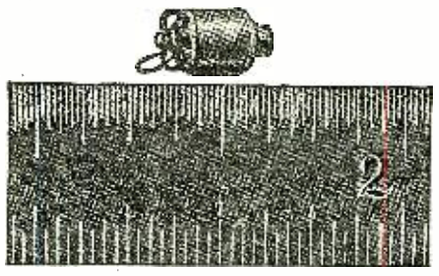
$200 Miniature Electric Prize Contest

THIS prize contest conducted by PRACTICAL ELECTRICS magazine, promises to be one of the most interesting that has been staged in recent years.

Here at last is something worth while. Not only can you win an attractive prize, but you will derive a tremendous amount of personal satisfaction from this contest. The illustration on this page shows the smallest electrical motor that has been built. Its dimensions are as follows: 11/64" high; 19/64" long. It weighs 5.5 grains.

This little motor is along the lines of our new contest except that we will not be quite so hard on the participants. *We require miniature electric models, the largest dimensions of which must not be more than ¾".* Any electrical appliance, any electrical apparatus, any radio instrument that will be reproduced *in a working condition* in miniature, is eligible for entry in this contest.

World's Smallest Electric Motor



Total weight slightly above 5 grains. The tiny armature, .09" in diameter, has 4 pole pieces and is wound with No. 40 silk copper wire. Silver brushes are used. The over-all dimensions of the motor measure 19-64" long and 11-64" high. When connected to a small flash light battery, the motor runs at a very high speed.

$200 IN GOLD

First Prize	$75
Second Prize	50
Third Prize	20
Fourth Prize	20
Fifth Prize	10
Sixth Prize	10
Seventh Prize	5
Eighth Prize	5
Ninth Prize	5

The judges will welcome miniature models of the following: Electric bells, switches, all kinds of electric heating appliances, electric generators, telephones, microphones, telephone desk stands, telegraph instruments, any and all radio apparatus, static machines, electric lamps, batteries, rheostats, measuring instruments, fans, transformers, in fact any electrical apparatus or electrical appliance. *One of the rules of the contest is that the miniature models must work.* Dummies cannot be entered in this contest. The builders of these miniature models will come in for a goodly share of publicity as many newspapers and periodicals will feature these models.

Full particulars, for entering the miniature models in this contest, closing date, rules and restrictions, etc., will be found in full in the January issue of PRACTICAL ELECTRICS.

3TA, 3TR, 3UU, 3AFS, 3BDO, 3CBM, 4AS, 4BX, 4JK, 4QF, 4SU, 5BI, 5BM, 5DW, 5EK, 5ER, 5FC, 5GA, 5GM, 5HT, 5HP, 5KG, 5LR, 5LJ, 5NJ, 5QL, 5QW, 5WO, 5WX, 5XB, 5ZA, 5ZB, 5ZK, 5ABY, 5ACQ, 5AFQ, 5AHJ, 5AIU, 6KM, 6MH, 6PL, 6AWB, 6BAA, 6BBD, 6BIC, 6BQE, 6CBU, 6ZAH, 7BO, 8AB, 8BU, 8GG, 8JJ, 8KJ, 8PL, 8UF, 8YN, 8ZZ, 8AAF, 8ADA, 8AMR, 8ARN, 8BDA, 8BDH, 9BNH, 8BQM, 8BZC, 8CES, 8CJD, 8CNW, 8CRA, 8CVA, 8DDC, 8DHQ, 8DIG, 8DKI.

Printed card to all who QSL for same. QRK my 10 watt D.C.C.W.?

KENNETH ROWE, MINNEAPOLIS, MINN.

1AIN, 1AJT, 1AQI, 1AR, 1ARY, 1AWL, 1BOQ, 1BQR, 1BWJ, 1BYD, 1ER, 1FB, 1FD, 1LF, 1MY, 1OW, 1PA, 1RR, 2AAY, 2AFP, 2BQB, 2BQH, 2BQU, 2BSC, 2CBL, 2CEI, 2CJR, 2CJU, 2CKN, 2COA, 2CUA, 2CZR, 2WR, 3AAO, 3ACY, 3AHP, 3AJB, 3AUO, 3BG, 3BML, 3BMN, 3BOF, 3BUC, 3BUV, 3BUY, 3BVL, 3CBZ, 3CCU, 3CDV, 3HK, 3IW, 3JJ, 3JY, 3LK, 3MB, 3NO, 3OH, 3OY, 3PZ, 3TR, 3UO, 3UU, 3WS, 4AI, 4AY, 4BX, 4OB, 4EL, 4EQ, 4FT, 4GW, 4GX, 4JK, 4JL, 4KC, 4MB, 4ME, 4MY, 4OA, 4QF, 4ZA, 5AAU, 5ABY, 5ACM, 5ADO, 5AFH, 5AFQ, 5AGO, 5AHD, 5AIU, 5AJB, 5AKN, 5ALI, 5AMH, 5ANC, 5BE, 5BM, 5DR, 5DW, 5EK, 5FC, 5GA, 5GI, 5GJ, 5GM, 5HL, 5HT, 5IF, 5JE, 5LG, 5LR, 5MO, 5NJ, 5NT, 5NW, 5NY, 5OV, 5PH, 5PV, 5QQ, 5QW, 5SK, 5SR, 5SY, 5UK, 5UR, 5VF, 5XV, 5ZA, 5ZAS, 6ALV, 6ANB, 6OAC, 6ASX, 6AUY, 6AWT, 6BKX, 6BRF, 6BTT, 6CBD, 6CFZ, 6KM, 6NX, 6YF, 6ZAR, 6ZZ, 7AFE, 7BB, 7DU, 7IT, 7LN, 7LU, 7LY, 7YA, 7ZO.

Can.—2BE, 2CG, 2BN, 3AA, 3AD, 3ADK, 3ADN, 3BA, 3DH, 3GK, 3HE, 3HT, 3JJ, 3MO, 3TB, 3XI, 3ZS, 4DY, 9 BW.

2CQI, BAYONNE, N. J.

1BIY, 1XP, 1AJP, 1BCU, 1BIN, 1BCK, 1MQ, 1II, 1CRE 1YB, 1EA, 1CMP, 1FD, 1ARY, 1PA, (1AJA), 1ER, 1AQM, 1AUR, 1AQI, 1CPN, 1UJ, 3HH, 3GC, 3ZS, 3KQ, 3WF, 3AUV, 3BDO, 3OH, 3CDV, 3JY, 3BEZ, 3FS, 3SH, 3AKL, 3VO, 3WG, 3TR, 3HK, (3BCJ), 3BRF, 3CEL, 3CEJ, 3HD, 3CGM, 3CBZ, 3ACY, 3ME.

Spark—3BTL, 4EQ, 4OA, 4SU, 4QF, 4GW, 4KC, 4DB, 4GX, 4CS, 4AS, 4FT, 5EK, 5UP, 5GA, 5AGJ, 5AFS, 5ZAS, 5ZAV, 5HT, 5UK, 5FC, 5AMH, 5HL, 5QL, 5NN, 5ABY, 5KG, 6HU, 6ZZ, 7HR, 8BSI, 8CJD, 8DGJ, 8ABS, 8BRL, 8YN, 8BOB, 8AIF, 8PL, 8AGP, 8KR, 8TH, 8CQH, 8RJ, 8AVL, 8BRM, 8BXH, 8GZ, 8ARD, 8BQI, 8DBL, 8CVE, 8JJ, 8FU, 8CUB, 8CBP, 8AVB, 8AWL, 8BAU, 8CTN, 8DAD, 8CSE, 8ACH, 8IB, 8CCR, 8BOA, (8CUV), 8DBR, 8DIL, 8CYX, 8BNH, 8DJ, 8CJP, 8ZZ, 8ADG, 8AVU, (8AJE), 8CWU, 8DAT, 8COB, 9VZ, 9ASV, 9AEN, 9BCH, 9CTE, 9BBG, 9ZT, 9BRK, 9MC, 9CCS, 9US, 9BSH, 9AAU, 9AZX, 9QR, 9CVV, 9BZI, 9CTB, 9BOY, 9UZ, 9QX, 9VM, 9NU, 9CVS, 9DGI, 9CHK, 9DDK, 9DKY, 9CNO, 9BRS, 9DNN, 9EFQ, 9ZY, 9DGW, 9AOU, 9CTT, 9AIM, 9DLG, 9AHY, 9BMU, 9CWC, 9EG, 9DMJ, 9DTT, 9EKF, 9EQD, 9BAK, 9EKY, 9DDY.

Canadian—1AR, 1DD, 2BE, 2BN, 2BG, 2CG, 2HV, 2BY, 2AU, 2PG, 3PG, 3OH, 3BA, 3AA, 3KO, 3NI, 3XI.

Mexican—FK, HB.

6CBA—NAVAL RADIO, FARALLONS, CALIFORNIA (One Tube Home Brew Receiver)

2TS, 5ZAV, 9EKY, 5ADB, 9AUW, 9CTR, 9BDS, 8TJ, 9AON, 9BED, 9CO, 8BCU, 8GT, 8APT, 9AEM, 9RC, 9CAJ, 8COI, 9CH, 9DMJ.

WOW!

The following is an abstract from a daily paper.

Looking for the Disturber

Radio fans in the city and suburban districts have been subjected to considerable annoyance during the last few weeks due to the persistency of some amateur to transmit wave lengths. There is a severe penalty for doing this and local authorities are at work endeavoring to locate the source of trouble. A. L. Atkinson, local inspector of radio, said that the noises heard locally indicated that someone was trying to learn the transmitting code. There are 125 licensed sets in St. John, N. B.

(*You fellas will just have to quit transmitting wave-lengths. Under the new ruling you are allowed to transmit kilocycles only. Another thing, this business of learning the transmitting code is not so hard, but to learn the receiving code! Ah, that's the job.*—EDITOR.)

Helpful Hints for Radio Listeners

(*Continued from page 903*)

Information of this sort is an aid in getting the concerts loud and clear.

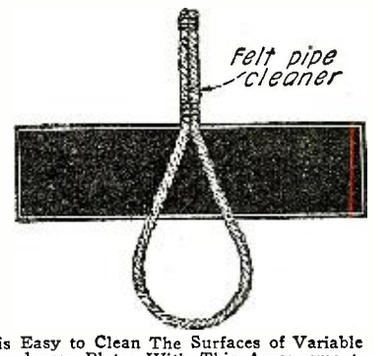
9. Ask your radio dealer for advice; he can probably tell you what you want to know and will be glad to do so. The manufacturer of your set is also willing to help you get the desired results from its use.

10. Do not throw away the direction sheets or booklet that came with your set and with the tubes. Read all such material carefully now and then. If you have lost the direction sheets, write to the dealer or manufacturer for others. The direction sheets must answer most of the questions which have been puzzling you and preventing you from getting the best out of your set.

A HANDY CLEANER FOR VARIABLE CONDENSERS.

It appears that dust and oil often accumulate on the plates of variable condensers. Any foreign material that may stick to their surface is apt to short circuit the entire condenser, thereby making it inoperative. Since the space between the plates is so small it is a difficult matter to clean the surfaces. However with the cleaner to be described, it becomes an easy matter. All are acquainted with the type of pipe cleaner that is composed of two wires twisted together with a quantity of fibrous material. By bending one of these so as to form a loop, and twisting the two ends that are so brought parallel to each other, both a handle and a cleaning surface are afforded. This can be better understood from the accompanying illustration. These cleaners are also handy for wiping away accumulated dust and grit in corners of the receiving set.

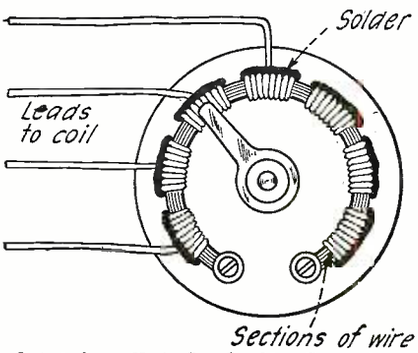
—*Contributed by Joseph Burroughs.*



It is Easy to Clean The Surfaces of Variable Condenser Plates With This Arrangement.

AN EASILY CONSTRUCTED BACK PANEL SWITCH

The usual back panel switch on the market is quite expensive and beyond the pocketbook of the average radio fan. It is quite



A Switch for a Vario-Coupler May Be Made from an Old Rheostat.

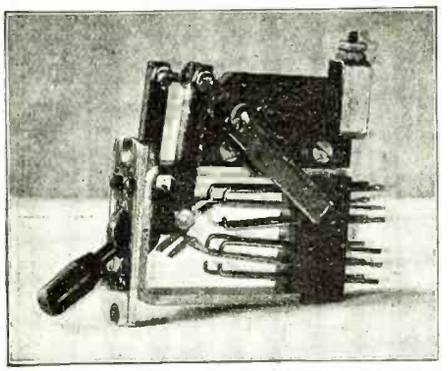
a simple matter to construct one of these, if the directions given below are followed.

From an old rheostat remove the insulating section upon which the rheostat wire is wound. Mark off on this as many sections as you require taps, making each section of an equal width. Wind each of these sections with bare copper wire, then after replacing the element, with a hot iron quickly run solder over the turns to bond them. The rheostat is then mounted on the back of the panel, the leads from the tuner or variocoupler are soldered to the sections of the wire and the switch is complete. This makes a very smooth running switch and is excellent for the purpose intended.

Contributed by M. R. McCabe.

A CHANGE-OVER SWITCH OF NOVEL DESIGN

It is desirable, particularly in C. W. and phone work, to have some system whereby



The Compact Switch Designed by the Author.

switching from the sending to the receiving position can be accomplished in quick order. Recently I found a necessity for such an instrument and feel that the one constructed will be of interest to other amateurs. This was made from a Federal anti-capacity four-pole, double-throw switch. To this switch was made an attachment which is clearly shown in the photograph and illustration. This accomplishes a number of things at one time. In the receiving position, the phones and "B" batteries are connected. When thrown to the transmitting side, the phones and the negative lead of the "B" battery are disconnected, and the microphone and the plate circuit of the transmitter tube are closed. I have the switch in use with my 10-watt phone set and 2-watt C. W. set and it is holding out with absolutely no trouble whatever. The filaments of both sets are always left burning while I am operating, hence there is no necessity of finding the critical rheostat adjustment whenever changing from one to the other.

Contributed by Louis J. Gallow.

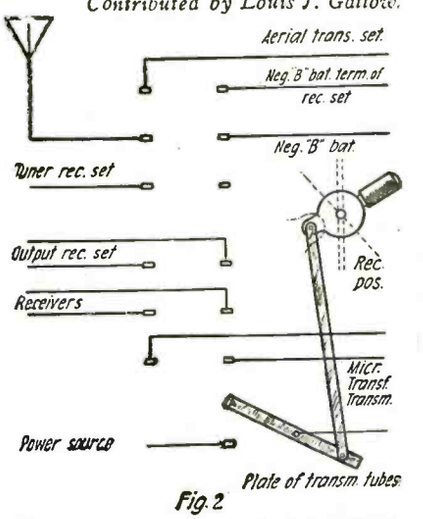


Fig. 2

Diagram of Connections to the Switch Blades.

DID IT EVER OCCUR TO YOU?

By EDWARD T. JONES, A.M.I.R.E.

DID it ever occur to you that when you turn on your receiver with all the filaments "set on edge for best effort," and you hear a perfect conglomeration of noises which sound like a bunch of clog dancers on a tin roof—that you have overstepped the "gas" a little and have throttled over the rheostats about a quarter of an inch further than they should go;

That when you begin cussin' out the broadcasting studio for "scraping a violin with rosin" and repeating the fact that Mr. Bloudinski just played "Souvenier" with his best effort—that you were guilty of trying to "get the last farthing" out of your detector tube and thereby produced all the distortion "with the set that Jack built";

That there is more good static generated by loose connections—in the receiver lead wires and mainly in the contact arm of the detector rheostat than is produced by accumulation of clouds;

That—even though a home-made low-powered broadcast station is not capable of turning out the best that is to be listened to—you can, by properly tuning the receiving set, eliminate much of the disagreeable accompaniments which are common with such types of broadcasters;

That you can get more enjoyment from a near-by CLASS B Station than from 40 stations located thousands of miles away;

That—once working well—if you will leave it alone—a radio receiver will continue to give excellent results;

That there is nothing to be gained in shifting from one station to another—and thereby annoying those listening with you; That they will be more pleased with a real program from one station of the Class B type;

That a home-made receiving set, if not constructed by someone who knows enough about radio to insure perfect contact and proper arrangement of the parts, will not give service, and that it will prove to be more bothersome than beneficial;

That "A" and "B" batteries require renewal once in a while—and that perfect performance depends mainly on the "A" and "B" battery supply.

That when a station "fades out" after it has been tuned in there is no use trying to find it by shifting the tuning dials; by waiting a few seconds, that the station will again come in with maximum intensity.

That you, not knowing anything about radio, should have purchased a complete receiving set in the first place instead of spending just as much for a lot of junk and worry;

That telephone receivers are not intended for loud speakers and when forced to work as such distort badly;

That you can get more out of radio by being satisfied with just a little less than the outfit will give?

THE RADIO SENTINELS OF THE CAPITAL

By CARL H. BUTMAN

Broadcast fans within "hearing" of the two aerial spokesmen at the Capital City,—this certainly includes those living within 1,500 miles of Washington—will be informed immediately of any important events affecting the country.

Two Class B transmitting stations are on guard here constantly. Like sentinels, they are watching that all is well, ready to call out the guard, so to speak, in any emergency. Throughout the twenty-four hour watch, one or the other sends out items of national interest, news, music, entertainment and many unique features.

Popular NOF, the old Naval station at Anacostia, later succeeded by NAA at Arlington, has been relieved of most of its

unofficial broadcasting, including the transmission of the Army, Naval and Marine Band Concerts, by two limited commercial stations, WCAP of the Chesapeake & Potomac Telephone Co., and WRC of the Radio Corporation. Working alternately, these stations will keep the country in close touch with all phases of the Government's activities, bringing from time to time the voices of the White House and Capitol to the listeners' ears.

By way of current examples of what is going on: WCAP broadcast Lloyd George's address recently, and transmitted ex-President Wilson's speech, given November 10 last. WRC is transmitting music from military and naval orchestras and bands and has just inaugurated a series of talks by Government officials and heads of national organizations. These stations are handling matter never before available to those living outside of Washington.

The Washington station of the Radio Corporation, initialed in monogram-style WCR, went on the air last August. Reports from listeners-in have come from as far north as Maine and Canada; Miami, Florida, in the south; San Antonio, Texas, in the southwest; Lexington, Nebraska, in the west, and Lake City, Minnesota in the north. The whole plant was overhauled recently by engineers from the New York office of the corporation and transmission now ranks "A-1."

Among the new features introduced by WRC are: Instruction in radio, including code practice three times a week and a weekly mid-night show carrying the entertaining features. The mid-night entertainment will be new in the East, since all Eastern stations, most Central and some of the Mid-Western stations are closed by 12 P. M., Eastern Standard time. One of the most popular forms of entertainment by WRC is the daily children's hour. Other items include lectures from representatives of the National Geographic Association and the Smithsonian Institution on travel, exploration and scientific events, talks on automobiling by experts from the A. A. A., and Navy nights, when officers hold forth with tales of the sea and air. Fashion, fact, finance and fiction are all included in the daily schedules, besides the regular instrumental and vocal musical numbers.

UNIQUE METHODS

WCAP, of the Chesapeake & Potomac Telephone Co., while without a studio for transmitting, is unique since by means of its land lines and a field radio truck, it can broadcast practically anything which happens in the Capital. Already the open air concerts of the Marine Band have been made available to the country. So with other meetings and functions, if there is anything to hear, WCAP plans to send it, whether it is in the White House, State Department or Capitol building.

The President could, on a moment's notice and within a very few minutes, talk to the whole country with the aid of the Telephone Company's engineers and WCAP.

In fact, an ex-President's voice is soon to be broadcast by both WCAP and WEAF, from his own house telephone. Other events scheduled include the broadcasting of speeches by important national guests visiting the Capital.

WCAP has been heard in Lancaster, England, on the Pacific Coast, in San Salvador, Central America, and in every state, according to messages received.

A more extensive program is planned with local talent when the studio now being built is finished. This station is materially increasing the fame of the American Telephone and Telegraph Company's station WEAF, through the simultaneous broadcasting of the New York program carried to Washington on a land line. Talent not available in the Capital is thus

broadcast farther south and with better results than WEAF can alone achieve.

In return WCAP picks up concerts and, besides broadcasting them, wires them to New York for further distribution. An interesting piece of portable apparatus, known as the pick-up truck, is used in the transmission of music and important speeches. This apparatus gathers in and boosts the sounds, relaying them by wire to the station for radio transmission. It is expected that this motor truck and other apparatus will be used in sending speeches from the Capitol this winter.

To illustrate rural interest in the station's work, one letter from a little town in Virginia across the Potomac River says:

"We wish to thank you for a wonderful evening's entertainment which we received last night on a dinky little crystal set which cost about $1.35 and was set up by my son. He is 15 years old.

"We live two miles from Falls Church on a little farm and very seldom go to the city. We have no moving pictures and few neighbors, so any pleasure we have with your concerts and other things, such as speeches, believe me, is most appreciated."

SIMPLE, FOOL-PROOF SETS SOON

The near future will see small, compact and portable radio receivers, practically self-operating, in every home, according to Major General George O. Squier, Chief Signal Officer of the U. S. Army. There will be no outside antennae, no complicated wiring, and no batteries in the ideal "fool-proof" set soon to be sought by up-to-date householders who will demand radio "service," just as they do telephone service today.

General Squier believes that what he terms the second stage of radio development has arrived. When an invention first becomes popular there are always a lot of energetic mechanics or electricians, both professional and amateur, who delight to tinker with the new apparatus. Some of these constructors have aided in the perfection of radio receiving sets," the General points out. But today the chief demand is for efficient sets which will be practically self-operating and will approach the ordinary telephone receiver in simplicity, taking their power and broadcasts from a single source or at least a central distributing point.

It would be impossible for every tenant in a thousand or even a five hundred, apartment building or hotel to have an individual antenna. The roof of the hotel would be literally covered with aerials. The elimination of lead-in wires and batteries is also desirable, so that sets can be taken from room to room and plugged in. Naturally some local company, probably the power company, must furnish either the broadcasting by wired-wireless and at the same time the power for operating the tubes of subscribers, or erect its own main antenna on the outskirts of a city and distribute the broadcasts by wire locally. This scheme would involve combining Squire's wired-wireless system and regular radio transmission.

That broadcasting would not operate so successfully over a telephone system was quickly shown by General Squier when he pointed out how the system of phone wires was constantly being broken down and rebuilt between different points, whereas the light wires remain a stable net work running to each and every hotel, home, hall and store.

General Squier anticipates the development of local broadcast distributors who will collect radio entertainment and news for redistribution or who will establish wired broadcasting for local subscribers.

Coincident with the establishment of this system, will come the standard receiving set capbale of being moved about the house and plugged in like a vacuum cleaner or electric fan, he believes. Some listeners-in are now using the electric companies' lines instead of aerials. Many possessing tube sets are utilizing inside loops, and dry batteries are slowly replacing storage batteries where the available space is small. Practice is tending toward simplification and reliability in service, the General insists. There will always be a few real fans who want to build and re-build their sets, but most of us aren't mechanics and prefer ease in operation, reliability and compactness, to continual experiments.

"Hideous skylines covered with wire spider-webs and rooms criss-crossed with wires will soon disappear," General Squier said, calling attention to some of the larger hotels and steamships which have already undertaken to serve their patrons with continuous radio broadcasts from a central system. "The indispensibility of broadcasting will make consolidation and simplification a necessity," the General concluded.

TO THE RADIO EDITOR, BINGLEVILLE BLAST, IDAHO:

By JOHN D. FORREST

Q. 8769. Can an ordinary meat chopper be used to break up sustained oscillations?

Yes, in fact the whole set may be broken up this way. Try it.

Q. 8770. What size pipe should connect the gas mains to a soft detector tube? I am twelve years old and can speak Chinese.

No. The negative lead must be disconnected.

Q. 8771. How is the grid, sir, cut?

We would suggest a filament.

Q. 8772. Please give me a diagram of hook-up to receive 4.00078 meters. I have two hatracks, three red pool balls, and a Canadian dime with a hole in it.

Use your head along with the other ivory.

Q. 8773. My antenna is 137 feet long and connected to a 16,000-volt A. C. line at both ends. Why do I get a spark on the grid commutator when the phones are hung on the bathtub faucet?

Your phone cords are open-circuited. There is also probably induction from the A. C. primaries due to carelessness of the power company in running their lines near your aerial. Sue them for abduction.

Q. 8774. Will the proximity of a neighbor's still make my transmission damped or undamped?

Damped.

Q. 8775. Can I hook up a curling iron and a hair mattress so as to get undamped waves?

Suit yourself.

Q. 8776. Which would be better as a variometer, a small coat-hanger wound with galvanized zinc or three spider-web coils and a rheostat?

Yes.

Q. 8777. Why is a cabinet?

Yes. It may be placed in shunt or in parallel. Forty turns is enough.

Q. 8778. How long does it take a radio wave to reach Mars?

About as long as getting ten miles on the N. Y., N. H. & H. Express.

Q. 8779. I am coming to New York to go to school. Can you tell me who runs the hotel in New York now?

We never get downtown much so we cannot say. We were under the impression that there were two hotels in the city. Ask Mr. Foster.

Q. 8780. I hear the church services every Sunday over the radio. Do you go to church, Mr. Editor?

No, I sleep home now.

Q. 8781. Can I get board near the radio schools in New York?

There are several lumb—just a minute.

Q. 8782. My radio ammeter pointer went around three times. I wonder if there is something wrong with it.

We would suggest placing it under a pile driver, which will loosen the screws. The inside may then be examined at will. Use care in reassembling.

Q. 8783. Why is a panel to drill?

We refer you to the heat treatment department.

Q. 8784. Why is a loading coil?

As far as we know it is not.

Q. 8785. Is there anything about radio you don't know?

There is nothing that we don't. No.

So endeth the first day.

NEWS VIA RADIO FOR ARMY POSTS

For several years the ships of the Navy and outlying Naval stations have been able to get the news daily from what is known as the Navy Press which goes out by radio from NAA, at Arlington, each night. A similar scheme is now under consideration by the War Department for sending news to Army forces stationed at foreign ports and posts out of the regular news channels.

If the present plan goes through, Army posts at Hawaii and the Philippines will receive news bulletins at least once a week from a high-powered Pacific coast station. These radio bulletins would also be sent to Army forces stationed in Alaska, Panama, Porto Rico and Cuba, and would be picked up by some of the isolated posts in this country, where little if any Army news percolates.

QUIT COMPLAINING AND HELP CLEAR THE AIR

Some listeners-in keep complaining that amateurs interfere with broadcasting. In truth, they do not actually know who is interfering, but simply that someone transmitting code is interfering with their reception. Half the time it is a ship which is sending or a shore station handling regular commercial work. What these "knocking" listeners-in should do, Department of Commerce officials say, is to learn to read code so they can identify the senders and report the offending stations if violations are found.

Here is a real service those who own receiving sets can render by simply learning the code and reporting infractions of regulations to the District Radio Supervisor or the Department proper. Present regulations make the air free to amateurs on 150 to 200 meter waves, except between 8 and 10:30 p. m. Amateurs have the right to use spark or tube sets; those owning tube sets can communicate by either code or voice. Broadcasting as such is forbidden amateurs; that is, music and entertainment cannot be sent out, but two station owners may converse,

except in the evening broadcasting period. Special amateurs have the privilege of using wave-lengths as high as 220 meters.

International Morse is the code used by amateurs, and its rudiments should be mastered within a few months.

CHANGES IN BROADCASTING STATIONS

Three new Class A stations:

Call	Station	Frequency Keys	Wave-Length Meters	Power Watts
KFLQ	Bizzell Radio Shop, Little Rock, Ark.	1150	261	20
WWAB	Hoenig, Swern & Co., Trenton, N. J.	1330	226	10
KFLR	University of New Mexico, Albuquerque, N. M.	1180	254	100

TWO TRANSFERRED FROM CLASS C TO CLASS A

WKAV	Laconia Radio Club, Laconia, N. H.	1180	254	50
KFAY	W. J. Virgin, Medford, Ore.	1060	283	50

BROADCASTERS WHICH HAVE STOPPED

A list of 14 limited commercial stations deleted during October, 1923, follows:

WMAM	Beaumont Radio Equipt. Co., Beaumont, Texas.
WSAU	Camp Marienfeld, Chesham, N. H.
KFHI	Dixon, Charles V., Wichita, Kan.
KFGY	Gjelhaug's Radio Shop, Baudette, Minn.
WHAO	Hill, F. A., Savannah, Ga.
WOAR	Landskow, Henry P., Kenosha, Wis.
KFHY	McEwan, R. S., Trinidad, Col.
WBAF	Middleton, Fred M., Moorestown, N. J.
WRAS	Radio Supply Co., McLeansboro, Ill.
WGF	Register & Tribune, Des Moines, Iowa.
WAAP	United Elect. Co., Wichita, Kan.
WOAB	Valley Radio, Grand Forks, N. D.
KFJQ	Valley Radio Div. of Elect. Construction Co., Grand Forks, N. D.
WIAY	Woodward & Lothrop, Washington, D. C.

KFKX TO BE RELAYING STATION FOR KDKA PROGRAMS

Hastings, Neb., has been selected by the Westinghouse Electric and Manufacturing Company for the location of its first radio relaying station, to serve as the connecting link of the pioneer station KDKA at East Pittsburgh, Pa., with the Western States.

The installation of the Hastings station, KFKX, means that the programs broadcast from Pittsburgh will be picked up as easily and with the same receiving apparatus in the West as KDKA's broadcasts are now received by people living in the vicinity of Pittsburgh.

The Hastings station will receive the Pittsburgh programs on the 94-meter wave-length and relay the same broadcasts on 107 meters to another transmitting station located on the Pacific Coast. These wave-lengths are much lower than those used in regular broadcasting, so they will not interfere with any other concerts nor with amateur traffic. After the Pittsburgh programs reach the relay stations over the short wave route the signals can be amplified and rebroadcast on the regular wave-lengths assigned to broadcasting stations ranging from 222 to 545 meters.

"Make Your Own" with CONSRAD PATTERNS

How to Make a Short Wave Regenerative Receiver

This set was designed by a foremost radio engineer to fulfil the wants of an all-round broadcast receiver. It covers wave-lengths up to 800 meters..... **50c.**

How to Make Detector and Amplifier Units

This pattern was designed for detector and amplifying units especially adapted for use with our regenerative receiver. It is strongly recommended when the attachment of a loud speaker to that set is desired. **50c.**

How to Make a Cockaday Receiver

The Cockaday four-circuit tuner is one of the latest advancements in radio. Its main advantage lies in the fact that the set can be adjusted to the highest point of regeneration, and tuning accomplished over a wide band of wave-lengths without the necessity for readjusting the regeneration control. All dimensions, size of wire, number of turns, etc., are given leaving nothing to the imagination. ..... **50c.**

How to Make the S. T. 100

This is a two tube and crystal dual amplifier brought out by an Englishman, John Scott-Taggart. This is a very stable circuit and above all, very easy for the amateur to construct. Complete blue prints for drilling and wiring ..... **50c.**

14 Radio Formulae and Diagrams

With this packet you need never worry about schematic wiring diagrams, measurements and radio tables. All formulas and diagrams are printed on heavy paper. **50c.**

20 Radiophone Diagrams and Hook-Ups

These diagrams show how to get the best possible efficiency from the instruments you make or purchase. They cover hook-ups from the simplest to the most complicated, in a way that any amateur can understand and follow without difficulty. Printed on heavy paper, 8½x11½ inches, and together with KEY CHART OF SYMBOLS and pamphlet "How to Read Diagrams", are contained in a heavy two-color envelope..... **50c.**

How to Make a Reinartz Receiver

The original Reinartz Receiver is the most popular type of set in existence today due to its simplicity of operation and capability of long-distance reception. Full directions for building this receiver are given in this folder. Two blue prints and instruction pamphlet in two-color manilla envelope. The connections of the set are shown plainly. ..... **50c.**

All About Aerials and their Construction

These blue prints were made after practical erection of each aerial, and point out how simple it is to erect not only the proper aerial for your particular need, but how to erect this aerial in the most practical manner and at the least expense. Consists of 12 blue prints 8½x11 inches and one four-page instruction pamphlet 8½x11 inches. ..... **50c.**

How to Make A Radiophone Crystal Set

Designed for those without technical knowledge. This set has a range of 30 miles. Packet consists of 4 page illustrated direction pamphlet and full size blue print for drilling and wiring. ..... **50c.**

How to Make an Autoplex Receiver

The long expected one-tube set that will work a loud speaker. Will operate wherever placed and requires but a ground connection. Every station within its range is amplified sufficiently for a loud speaker. Tuning is very simple, there being but two controls. Any tubes from the "peanuts" up to the "big ones" can be used. This receiver knows no such thing as "critical filament adjustment." The complete plans consist of full sized blue print for wiring and drilling and also a four-page instruction pamphlet giving complete details even as to tuning. ..... **50c.**

How to Make a Neutrodyne Receiver

This pattern gives the complete assembly, wiring, adjusting and tuning of a five-tube Neutrodyne receiver. This type of receiving outfit was brought out after extensive experimenting and is noted for its very efficient radio frequency amplification. All the disadvantages of ordinary radio receivers, such as distortion and re-radiation are eliminated. The circuit is also noted for keeping the tubes from oscillating. Put up in packet, with full size blue prints for drilling and wiring and four-page instruction pamphlet. ..... **50c.**

How to Make a Reflex Receiver

The plans for the reflex receiver were gotten out only after considerable research work by our engineers. Most people have trouble with reflex receivers. It takes an expert to build one that will work satisfactorily. The trouble lies in the values of condensers, etc., in the circuits. If they are incorrect, the set is a dismal failure. The construction details of a reflex receiver, contained in this folder, are the results of their successful efforts. ..... **50c.**

Order Direct From These Dealers—Or If Your Dealer

Abilene, Kans.
Union Elec. Co.
Albany, Ga.
Lonsbergs Book House
Akron, O.
Radioart Supply Co.
Albany, N. Y.
Havens Elec. Co.
Ignition Service Supply Co.
Cooper & Hotchkiss
Kimball Bros.
Peoples Radio Store
Standard Elec. Co.
Wanger Bros.
Amsterdam, N. Y.
Anderson Elec. Co.
Allentown, Pa.
Hess Bros.
Buchman Book Store
Altoona, Pa.
Altoona Elec. Supply Co.
Anthony, Kans.
LeRoy Hughbanks Rad. Co.
Astoria, L. I.
Astoria Radio Shop
Atchison, Kans.
Low & Blythe Elec. Co.
Atlanta, Ga.
Capital Elec. Co.
Millers Book Store
Atlantic City, N. J.
Paramount Radio Co.
Eastern Hdwe. & Sup. Co.
Sport Shop
Just Elec. Co.
Sea Coast Radio Co.
Auburn, Me.
G. L. Foss
Baltimore, Md.
Jos. A. Becker
Jos. M. Zamoiski
Wilbur Elec Co.
Bacharach Rasin Co.
W. W. Hentzchel
S. B. Berkowich
Joel Gutman
Herdas Elec.
Little Joes Dept. Store
C. D. Kellert
J. Meyer
Murdock Co.
E. I. Rosenfeld & Co.
Batavia, N. Y.
H. F. Smith
Bethlehem, Pa.
Lehigh Radio Co.
Billings, Mont.
Torgerson Bros.
Birmingham, Ala.
Interstate Elec. Co.
Bluefield, W. Va.
Burgess Elec. Co.
Boston, Mass.
Atlantic Radio Co.
Cutter & Wood Supply Co.
Seth Fuller Co.
International Radio Corp.
Lewis Elec. Supply
F. D. Pitts Co.
New Eng. Elec. Spec. Co.
Williams Book Stores
J. B. Hunter & Co.
Samuel J. Beckwith
Chandler & Farquhar Co.
A. P. Merchant Co.
Eugene Proctor Co., Inc.
Radio Sales & Service Co.
Farrington & Clark
Berman Radio
Bridgeport, Conn.
Morison Radiophone Parts
Flynn & Power
Conn. Radio Supply Co.
Brooklyn, N. Y.
Arthora
Brooklyn Radio Serv. Co.
O. Olsen
Tollner Elec. Co.
Bklyn. Radio Center
Bobs Radio Service
Bklyn Elec. Lamp & Nov.
Boro Hall Radio
Globe Radio & Bat. Shop
Haag & Vince Co.
G. Kleinteich
C. G. Rosewall
J. Streiff
Denmarks
American Phon. Exch.
Arlington Radio Service
Barneys Radio Shop
Bengo Elec. Co.
J. D. Cunningham
Delta Elec. Co.
H. A. Dietz
Duckmans Music Store
Kelley & Feist
Halpern Elec. Co.
Kensington Radio
E. C. & H. B. Lagerholm
G. Moskowitz
G. Scharff Sons
H. Schur & Son
Victor Radio Sport Shop
Walker Elec. Co.
Breuer Bros.
20th Century Radio Co.
Morch Radio
M. Ulrich
B. Haupt
David M. Isaac
Starr Radio
Buffalo, N. Y.
McCarthy Bros. & Ford
Robertson Cataract
O. Ulbrich Co.
Burlington, N. J.
Burlington Elec. Co.
Butte, Montana
Montana Elec. Co.
Cambridge, Mass.
Clapp-Eastham Co.
University Book Store
Canton, Ill.
Frank White & Bros.
Camden, N. J.
Neisner Bros.
Carrollton, Mo.
Carrollton Radio Shop
Centerville, Ia.
H. E. Luther
Champagne, Ill.
H. C. Swanell & Son
Charleston, W. Va.
John R. Koch
Charlestown, S. Car.
S. C. Radio Shop
Charlotte, N. C.
Smith Novotoy Elec. Co.
Caroline Radio Co.
Chester, Pa.
Neisner Bros.
Chicago, Ill.
Harry Alter & Co.
Barawik Co.
Beckley-Ralston Co.
Chicago Radio App. Co.
Elec. Appliance Co.
Inland Elec. Co.
Marshall-Field & Co.
A. C. McClurg & Co.
Montgomery Ward & Co.
Newark Elec. Co.
Henry Paulson & Co.
Sears-Roebuck & Co.
Chicago Cut Rate Book
Community Book Store
Izenstark Radio Co.
Follett Book Co.
McArthur Elec. Co.
P. O. News Co.
Max Stein
E. J. Stringos
Fireside Radio Co.
Cincinnati, O.
Midwest Radio Co.
Milnor Elec. Co.
Reuter Elec. Co.
Cleveland, O.
Radio Electric Shop
Radio Eng. & Sales Co.
H. Lesser & Co.
Oliver C. Schroeder
Radio Sales & Rep. Co.
Columbus, O.
Hall Elec. Co.
Coraopolis, Pa.
T. C. O'Donovan
Cumberland, Md.
J. A. Fulton & Co.
Dallas, Texas
Huey & Philp Hdwe. Co.
Southwest Radio Sup. Co.
Radio Equip. Co.
Denton, Tex.
Evers Hdwe. Co.
Denver, Colo.
Electrical Auto App. Co.
Pratt Book Store
Reynolds Radio Co.
Des Moines, Ia.
H. W. King
Iowa Radio Co.
Detroit, Mich.
Federal Elec. Supply Co.
Twentieth Century Radio Co.
Crowley Milner Co.
McCaulay Bros.
Detroit Elec. Co.
Wolverine Radio Co.
Northwestern Radio Co.
Duluth, Minn.
Kelley Duluth Co.
Easton, Pa.
F. & W. Grand Stores
E. Orange, N. J.
Essex Radio Shop
United Radio & Sport Shop
Elizabeth, N. J.
H. Richmond & Son
Elizabeth Elec. Sup. Co.
Eureka, Ill.
Klaus Radio Co.
Fergus Falls, Minn.
Grande & Sether
Far Rockaway, L. I.
Dunlap Sptg. Goods Co.
Scientific Radio Co., Inc.
Flushing, L. I.
The Electric Shop
Ft. Worth, Tex.
H. C. Meacham Co.
Galveston, Tex.
Galveston Wireless Sup. Co.
Gardner, Mass.
Gardner Hdwe. Co.
Gloucester, N. J.
Lenny's Variety Store
Granite City, Ill.
Rosenberg Dept. Store
Great Bend, Kans.
Great Bend Radio Co.
Greensburg, Pa.
H. Hamilton
Hamilton, O.
Radio Co.
Hartford, Conn.
Elec. Sup. & Equip. Co.
F. & W. Grand Stores
G. Fox & Co.
Havana, Cuba
Diamond News Co.
Liberia de Jose Albele
Helena, Mont.
Van Blaricom Co.
Hoboken, N. J.
International Book Store
Eagans Radio
Holyoke, Mass.
Haskell Elec. Co.
Independence, Mo.
The Melodian Co.
Hackensack, N. J.
Wurtz & Fuchs
Jacksonville, Fla.
Southern Elec. Co.
Holt Elec. Co.
Jamestown, N. Y.
Willis Switch & Inst. Co.
Jamaica Plain, Mass.
Conrad Radio Co.
Jamaica, L. I.
Scientific Radio Co., Inc.
Merrick Elec. Co.
Jersey City, N. J.
Arrow Elec. Co.
M. Schlein
Guarantee Elec. Co.
Johnson City, Tenn.
Bishop Elec. Co.
Johnstown, Pa.
W. T. Grant Co.
Joliet, Ill.
Joliet Book & Sta. Co.
Kansas City, Mo.
Vulcanizers Supply Co.
Donaldson Radio Co.
Lancaster, Pa.
Radio Outfit. & Sup. Co.
Lawrence, Mass.
Schwarzenberg, W.
Los Angeles, Cal.
Leo J. Meyberg
S. California Elec. Co.
West Radio Elec. Co.
Radio Concert & Equip.
Natick Book Store
Prode Elec. Co.
Lewiston, Montana
Chas. Williams
Lock Haven, Pa.
Burkett Bros.
Louisville, Ky.
Sutcliffe Co.
Lowell, Mass.
G. A. Hill Co.
Lyons, Kans.
R. I. Case
Macon, Ga.
J. W. Burke Co.
Memphis, Tenn.
Street Elec. Co.
McKeesport, Pa.
F. C. Wampler & Son
Milwaukee, Wis.
Julius Andrae & Co.
Dewey Sport Goods Co.
Badger Radio Co.
Minneapolis, Minn.
Jacob Andressen Co.
Findley Elec. Sup. Co.
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Reinhard Bros. Co., Inc.
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Loud Talkers

How to Build Them

Gives complete data for building two distinct types of loud talkers. One chapter deals with improvised loud talkers, and gives complete instructions on how to build suitable horns for use in loud speakers of the Baldwin and other types. With this book anyone can build a successful loud talker, equivalent to the commercial types, costing $40.00 or more. 48 pages, profusely illustrated. Prepaid ..... **25c.**

Radio Questions Answered

This book is proving as welcome to the radio public as our "100 Radio Hook-ups", which is now the fastest selling radio publication on the market. "Radio Questions Answered" was gotten up after a thorough canvass of dealers to find out which topics troubled most of the amateurs. Almost 100 questions are answered very fully and in language so simple that even the most inexperienced layman can easily understand. Put up in the style which has made the E. I. books famous all over the world. 52 pages, 2 color cover, 25 illustrations. ..... **25c.**

How to Tune Your Radio Set

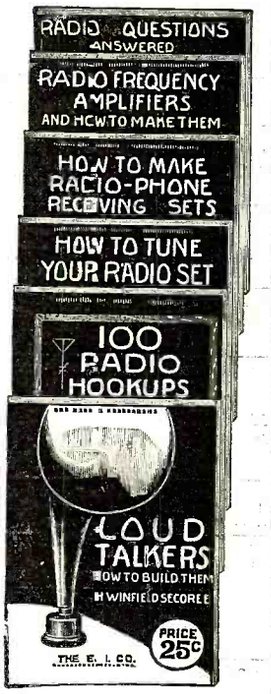
Covers in comprehensive form, the fundamental principles of tuning. The characteristics of radio waves are fully described and illustrated. Several chapters are devoted to the use and functions of all radio apparata. The book describes how to tune such sets as the Reinartz, Flewelling, Neutrodyne, radio frequency amplifier receivers and others. 52 pages, 25 illustrations, Prepaid. ..... **25c.**

100 Radio Hook-Ups

Contains a varied selection of hook-ups from the simple crystal to the more elaborate circuits, with a circuit for every requirement. Crystal hook-ups, combined crystal with radio and audio frequency amplifiers, non-regenerative, and regenerative vacuum tube circuits with and without radio and audio amplifiers. Amplifier units, with straight jacks, filament and switching arrangements, power amplifiers, choke coil, resistance coupled and transformer coupled radio frequency amplifiers. Includes all the latest types of Reflex, super-regenerative, super-Heterodyne, Neutrodyne, Reinartz, Flewelling, and Bishop. 52 pages, two-color cover **25c.**

Radio Frequency Amplifiers

Shows the construction of the Radio Frequency Amplifying Transformer and gives complete constructional data. It shows the application of Radio Frequency to amplifying units that the amateur may already possess and gives 15 hook-ups showing practically every use Radio Frequency Amplifying Transformers can be put to. 32 pages, 15 illustrations. Bound in beautiful two-color cover. Size, 5½x7½ in. Prepaid.. **25c.**



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All the technical details and a thorough explanation of radio reception, written in easily understood, non-technical language by a foremost radio engineer and inventor. The five Lecture Books with over 100 graphic drawings give you the knowledge to intelligently buy, design, build, operate and maintain radio receiving apparatus. Tells you how to locate and correct troubles, how to make your apparatus more efficient and gives you a **thorough knowledge** of radio science. This set of five handsome Lecture Books are a complete radio library. To own them is like having a trained engineer or instructor at your side, answering questions, pointing the way. No matter what your interest in radio, take advantage of this attractive special offer and be the owner of this fine set of books.

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Cannot Supply You Send Us His Name and Address

Mt. Vernon, N. Y.
Stephens Shop
Nashville, Tenn.
Zibart Bros.
Newark, N. J.
Bamberger & Co.
Bassett Radio Sup. Co.
Davis Elec. Co.
Eddies Wireless Ex.
Bannister & Pollard
Essex Mfg. Co.
W. T. Grant Co.
United Elec. Sup. Co.
Friedmans Music Shop
New Brunswick, N. J.
Schneider Bros.
The Elec. Shop
Newburgh, N. Y.
Rouss & Davis
New Orleans, La.
Interstate Elec. Co.
Nola Radio
Newport, R. I.
Geo. H. Chase
New Haven, Conn.
W. W. Gale & Co.
New York City
Penno & Co.
Frank Radio Co.
J. J. Kelleher
David Killoch & Co.
Liberty Radio Co.
R. H. Macy & Co.
Manhattan Elec. Sup.
Overland Radio & Equip Co.
Peerless Light Co.
Radio Specialty Co.
Stanley & Patterson
Viking Radio Co.
The Winchester Store
Army & Navy Dist. Co.
Chamberlain Elec. Co.
Economy Radio
Elec. Service Eng. Co.
Goldfinger Bros.
Gimbel Bros.
R. G. Haslinger
Herbert & Huesgen
Allied Radio Co.
J. Belmuth
J. H. Bunnell & Co.
Butler Bros.
Carnahan & Dalzell, Inc.
Bway. Radio Corp.
P. M. Dreyfuss Co., Inc.
Delta Elec. Co.
Fordham Radio Spec. Co.
F. & W. Grand Stores
J. L. Lewis & Co.
Lowe Motor Sup. Co.
Rova Radio Stores
Live Wire Elec. Co.
Marks Radio
Models—8 Stores
Phillips Sport Shop
Wehman Bros.
A. & A. Elec. Co.
Acme Radio Co.
Am. Elec. Tech. App.
Atlas Elec. Supply Co.
Atlas Radio Co.
Bergmaier Bros.
Franklin Radio Shop
J. Gabler
Globe Radio Shop
Hygrade Elec. Co.
International Radio Store
J. Kelleher
Marlen Hdwe. Co.
Nassau Radio Co.
Times Sq. Auto Sup. Co.
Triggers
Ace Elec. Co.
Baker & Taylor Co.
Borough Elec. Co.
Coruhia Elec. Co.
J. Edelson
Keystone Battery Service
S. S. Kresge & Co.
Langers Radio Store
A. Marcus
G. H. Masten & Co.
Mentz Store
Milbro Radio & Elec. Co.
Radio & Mech. Trad. Corp.
Radio Parlor
Radiophone Equip. Co.
Rialto Elec. Shop
St. Marks Radio Co.
K. R. Schullstrom
F. E. Silverman
Woelfer
M. Worksman
Perfection Radio
Cortlandt Radio
James Gear
A. J. Goldman
T. Eaton & Co.
Progressive Book Store
S. Astor
M. & T. Elec. Co.
Borough Elec. Co.
Marvel Elec. Sup. Co.
O. R R.
A. E. Zimmerman
Davidson Radio Co.
Mogul Elec. Co.
Brunswick Supply Co.
Stuyvesant Radio Co.
Oscars Radio
Fordham Sup. Co.
M. H. Elec. Co.
The Heights Radio Sup. Co.
Eclipse Elec. Co.
Fordham Radio Co.
Crescent Radio Co.
Terminal Rad. & Mus. Shop
United Anchor Tire Co.
Inter City Radio Co.
Josephson
Redifon Corp.
Greenwich Radio Co.
H. Goldstein
Isador Fajans, Inc.
Grand Radio
M. Rubin
Hannes & Co.
Madison Hdwe. Store
American Radio Co.
Electrical Eng. & Con. Co.
Niagara Falls, N. Y.
H. Messersmith & Sons
Norristown, Pa.
E. M. Law
Oakland, Cal.
Warner Bros.
E. M. Sargent Co.
Omaha, Nebr.
Wolfe Elec. Co.
Onset, Mass.
W. C. Spring
Passaic, N. J.
J. L. David
Simon Bros.
Passaic Radio Shop
Perth Amboy, N. J.
Smerling, J.
Amboy Lighting Co.
Amboy Radio
Paterson, N. J.
Federal Radio & Elec. Co.
Pawtucket, R. I.
Delancey Felch & Co.
Peoria, Ill.
Peoria News Stand
Philadelphia, Pa.
Gimbel Bros.
H. C. Roberts El. Sup. Co.
Sayre Level Radio Co.
Goetz Music Stores
F. & W. Grand Stores
E. P. Noll & Co.
Trilling & Montague
Neisner Bros.
Schimmel Elec. Co.
Radio Sales Co.
John Wanamaker
Phoenix, Ariz.
Nielson Radio Sup. Co.
Poughkeepsie, N. Y.
C. P. Raymond
Pittsburgh, Pa.
Goldsmith & Son Co.
Ludwig Hommel & Co.
Gain-a-Day Elec. Co.
Liberty Incan. Sup. Co.
Pitts Radio & App. Co.
U. S. Radio Co. of Pa.
Doubleday Hill Co.
Pittsfield, Mass.
W. T. Grant Co.
Plainfield, N. J.
H. E. Gayle Hdwe. Co.
Plattsburgh, N. Y.
H. E. Atwater
Portland, Me
Chisholm Bros.
Portland, Oreg.
E. L. Knight Co.
Hynson Elec. Co.
Hylands Old Book Store
Pottstown, Pa.
T. S. Reidenhour & Son
Pottstown Radio Sup. Co.
Princeton, N. J.
Princeton Cycle Shop
Providence, R. I.
B. & H. Supply Co.
R. I. Elec. Equip.
The Shepard Co.
The Outlet Co.
Boston Store
Reading, Pa.
F. & W. Grand Stores
Rochester, N. Y.
Hickson Elec. Co.
Rochester Elec. Sup. Co.
Wheeler Green El. Sup. Co.
Eastman Radio Co.
R. Schmidt & Co.
E. C. Sykes & Co.
Neisner Bros.
Miller Drug & Elec. Co.
Ridgewood, L. I.
Ridgewood Radio Shop
Rock Island, Ill.
H. E. Gelhart & Co.
Beardsley Specialty Co.
Valle Co.
St. Joseph, Mo.
Empire Elec. Co.
Mannschrecks Book Stores
St. Louis, Mo.
The Benwood Co.
Linze Elec. Supply Co.
Foster Book & Cigar Co.
St. Paul, Minn.
North-West Elec. Eq. Co.
Premier Radio Mfg. Co.
Pioneer Elec. Co.
St. Paul Book & Sta. Co.
Crist Book Shop
San Francisco, Cal.
Richter, Conrad
Schenectady, N. Y.
Albany St. Radio Store
J. Tigar
Seattle, Wash.
F. B. Wilson
Stamford, Conn.
Arthora
Stillwater, Okla.
Stillwater Elec. Shop
Syracuse, N. Y.
Grant's Alexander Sons
Hughes Radio Corp.
M. H. Salmon Elec. Co.
Toledo, O.
Kuebler Radio Co.
W. J. Nagel Elec. Co.
Aitken Radio
Toronto, Ont., Can.
H. M. Kipp
T. Eaton & Co.
Trenton, N. J.
Fleron & Son, Inc.
Radio Chain Stores
Troy, N. Y.
L. H. Cooper & Son
Tyler, Tex.
R. E. Bryan
Union Hill, N. J.
N. W. Friedman
Uniontown, Pa.
Frederick Piano Co., W. F.
Utica, N. Y.
Dent, Co., M. F.
Olds Book Store
Utica Elec. App. Co.
Utica Elec. Sup. Co., Inc.
Waco, Tex.
Jackson's Radio Eng. Lab.
Washington, D. C.
Continental Elec. & Sup. Co.
Radio Auto Sup. Co.
Watertown, Wis.
D. & F. Kusel Co.
Watertown, N. Y.
F. A. Emosall & Co.
W. Hoboken, N. J.
The Heraco Exchange
W. New York, N. J.
W. N. Y. Heraco
Wheeling, W. Va.
Gee Electric Co.
Wapakoneta, Ohio
Heine & Nagel Elec. Co.
Waupaca, Wis.
Waupaca Radio Sales Co.
Wausau, Wis.
Janke, Kurth Co.
Wilkes-Barre, Pa.
Foster Radio & Elec. Co.
Wilmington, Del.
I. X. L. Radio
L. P. Moore
Wilmington Elec. Spec. Co.
Worcester, Mass.
Neisner Bros.
Williamsport, Pa.
Wilhelm Book Store
Yonkers, N. Y.
Knepfer, F.
Westchester Elec. Eq. Co.
York, Nebr.
Bullocks
Youngstown, Ohio
Robert F. Phillips

New York City

and Sales Agents for E. I. Co. Books

Radio Call Book Company, Inc.

The Conrad Co INC.

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer their most attractive specials in these columns.

Classified advertising rate fifteen cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisments not accepted. Advertisements for the March issue must not reach us later than January 1st.

THE *Net Paid* CIRCULATION OF RADIO NEWS IS OVER 200,000

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Agents Wanted

Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested, write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 912 Orange St., Wilmington, Delaware.

General Agents—Service Men! Genuine Gold Letters for store windows easily applied. 20 percent cash commission on all orders from local agents appointed by you anywhere. 50 percent discount on your own orders. Free samples. Metallic Letter Co., 422 N. Clark St., Chicago.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton Street, New York City.

Salesmen & Agents to sell our low price highpower three tube receiving sets. Big commission, write for particulars. Luxem & Davis Co., 6229 Broadway, Chicago.

Agents Wanted on a commission basis, for a well established radio accessory. American Solder & Flux Co., 16th St. below Indiana Ave., Phila., Pa.

Start your own business as our sole agent, selling 100 famous home products. All or spare time. Dr. Blair Laboratories, Dept. 541, Lynchburg, Va.

You can make $75.00 to $100.00 a week selling our big line of 150 articles, used constantly in every home. Write us, we will send you our handsome $15.00 Sample Case Outfit on trust. Federal Pure Food Co., Dept. T, Chicago.

Rug Salesmen—Get next to the biggest seller of the year Loomrite Felt Rugs. Sell at sight at $2.50, cost $15 dozen. Big, complete Rug Catalog, Free. Maisley-Payne Mfg. Co., 104-N Hanover St., Boston, Mass.

Radios on consignment. Pay me when you sell. 800 Agents wanted—Make Big Money—Write! Gilbert Swanson, Cambridge, Ill.

American Made Toys

Manufacturers on Large Scale, also homeworkers, **wanted to manufacture Metal Toys and Novelties. Millions needed of Barking Dogs, Wag Tail Pups, Wild Animals, Automobiles, Indians, Cowboys, Baseball Players, Cannons, Toy Soldiers, Crowing Roosters, Statues of Liberty, Miniature castings of Capitol, Bathing Girl Souvenirs and others. Unlimited possibilities. Guaranteed Casting forms furnished manufacturers at cost price from $5.00 up, with complete outfit. No experience or tools necessary. Thousands made complete per hour. We buy goods all year and pay high prices for finished goods. Cash on delivery. Contract orders placed with manufacturers. Catalog and information free. Correspondence invited only if you mean business. Metal Cast Products Co., 1696 Boston Road, New York.**

Automobiles

Automobile owners, garagemen, mechanics, send for free copy of America's popular motor magazine. Contains helpful, money-saving articles on repairing, overhauling, ignition, carburetors, batteries, etc. Automobile Digest, 528 Butler Bldg., Cincinnati.

Books

Radio Books Latest and Best. Catalog free. **Ray Dobbins,** 146 West 27th St., Indianapolis, Ind.

"Lights, Colors, Tones and Nature's Finer Forces", including Vibrations, colors; Electromagnetones; Odic-auras; Radio; Coldlights; Inventions; Marvelous Opportunities. Illustrated; 270 pages, $2.00. Table contents free. Stevens Publishers, 242 Powell, San Francisco, Calif.

Hypnotism Astounds Controls others. Wants gratified. Ten easy Methods, Mind Reading (any distance). Wonderful Fascinating, Illustrated 205 pages $1.00 postpaid. R. N. Collins Co., 197 Fulton Street, Brooklyn, N. Y.

The How and Why of Radio Apparatus, by H. W. Secor, E.E. This newest book on radio matters fulfills a distinct gap in wireless literature in that, while the treatment is made as understandable and as free from mathematics as possible, it at the same time incorporates a wealth of technique and instruction for the Radio Amateur—the Radio Operator—the Installation and Designing Expert—as well as teachers and students of the subject in general. A glance at the following list of chapters gives but a very scant idea of the extensive and useful radio knowledge provided in its text: The Induction Coil; the Alternating Current Transformer; Radio Transmitting Condensers; The Spark Gaps; Radio-Transmitting Inductances; Radio Receiving Tuners; Radio Receiving Condensers; Detectors; Telephone Receivers; Radio Amplifiers; Construction of a Direct Reading Wavemeter and Measurement of Inductances; Appendix containing very useful tables, covering all subjects treated in this very unusual book. This newest of Radio Works, cloth bound in Vellum de Luxe, Gold Stamped and Hand Sewed, has 160 pages. Size of book 6x9 inches. The How and Why of Radio Apparatus. Postpaid, $1.75. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

Business Opportunities

Wanted County Distributors for World Fastest Selling Auto Accessory. Write G. Benross Co., 384 E. 144th St., New York.

Salesmen Make $120 weekly. Free Radio instrument. Ozarka is the longest distance receiver. Introduce it to your friends and secure your own free. No canvassing. 2 sales weekly nets you $120. Sharpe of Colorado made $955 one month. Our plan sweeping country. Write today giving name your county. Ozarka, Incorporated, 813 Washington Blvd., Chicago, Ill.

Free Book. Operate little Mail Order business home evenings. Pier, 515 Cortland St., N. Y.

Sell us your spare time. You can earn Fifteen to Fifty dollars weekly writing showcards at home. No canvassing, pleasant, profitable profession easily, quickly learned by our simple graphic block system, artistic ability unnecessary, we instruct you and supply work. Wilson Methods, Limited, Dept. 51-L, Toronto, Canada.

Chemistry

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 967 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

Correspondence Courses

Used correspondence courses of all schools sold, rented and exchanged. New 1924 catalogue free. (Courses bought). Lee Mountain, Pisgah, Alabama.

Exchange

200—20,000 Meter Receiver including Radiotron $35.00. Two step Amplifier $22.00. Smith, 4416 Market, Philadelphia.

1500 mile Vacuum tube receiver $24.50. Radio, 4416 Market, Philadelphia.

Broadcasting Station complete equipment for Sale: Station known as WIL, located in Washington, D. C. This station needs no introduction. Its performances for the last two years speak for the set. This station will be in operation until it is sold. For particulars write to the Continental Electric Supply Co., 808 Ninth St., N.W., Washington, D. C.

Help Wanted

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton Street, New York City.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665, St. Louis, Mo.

Detectives Needed Everywhere. Work home or travel. Experience unnecessary. Write, American Detective System, 1968 Broadway, N. Y.

South America Needs skilled help. Write Employers Direct. 388 Addresses $1. South America Information Bureau, Portland, Oregon.

All Men, Women, Boys, Girls, 17 to 65 willing to accept Government Positions $117-$250 traveling or stationary, write Mr. Ozment, 251, St. Louis, Mo., immediately.

Improved Made Toys

Wanted—Manufacturers and Houseworkers to manufacture Metal Toys and Novelties. Wonderful opportunity. Millions needed. In Whistling Birds, Wild Animals, Wag Tail Pups, Crowing Roosters, Automobiles, Baseball Players, Statue of Liberty, Indians, Toy Soldiers, Barking Dogs, and 50 others. No experience or tools necessary. Guaranteed casting forms with complete outfit, at cost. From $3.50 up. We buy goods all year. Cash on delivery. Higher price for finished goods. Contract orders placed. Send for catalog and information free. The Improved Metal Casting Co., 342 East 145 St., New York.

Instruction

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 967 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

Languages

World-Romic System. Masterkey to All Languages. Primers, 23 languages, $1.94 each language: English, French, German, Italian, Portuguese, Spanish. Pronunciation-Tables, 102 languages, 30c each language. Languages Publishing Company, 8 West 40th Street, New York.

Miscellaneous

Wood Turning. Expert Hand Turners Solicit your special work. Our floor and table lamps are beauties. The price is low. Send your inquiries. Wood Specialty Company, Collins, Ohio.

Free. Complete price list. Aitken Radio Co., 504 Superior St., Toledo, Ohio.

Radio Call Cards printed to order. Red call, black printing. 100, $1.75; 200, $2.75, prepaid. Color changes 35c extra. Government postals, 1c extra each card. Letterheads 8½x5½ and envelopes, 100 each $2.25; 200 each $3.50. ARRL emblem used on cards or stationery if requested. Send Today. Department 29C, Radio Printers, Mendota, Illinois.

"How to hit the Ball." Latest patented wrist-device automatically teaches basic principles quickly. Particulars Free. Golf Pronator Company, 301 Montreal Trust Bldg., Montreal, Canada.

Motorcycles—Bicycles

Build It Yourself—A real Automobile that any handy man or boy can build. A low-slung, speedy cycle car. Power supplied by famous 2½ H.P. Shaw Motor. Send stamp today for Descriptive Circulars or send 25c for Complete Book of Easy-to-Follow Plans. Shaw Mfg. Co., Dept. R.N.1, Galesburg, Kansas.

News Correspondents

Earn $25 Weekly Spare Time writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Novelties

Magic goods, cards, books, novelties, catalogue free. J. Fenner, 2401 Jefferson, Louisville, Ky.

Patent Attorneys

Patents, Trademarks, Copyrights procured; all countries; very reasonable; 20 years' experience; booklet free. H. Sanders, Registered Patent Attorney, 13 Rand McNally Building, Chicago.

Patents. Send drawing or model for examination and report as to patentability. Advice and booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 624 F Street, Washington, D. C.

Patents Procured. Send sketch or model today for examination; prompt report and advice. No charge for preliminary advice. Write for free booklet and blank form on which to disclose your idea. Highest references. Promptness assured. **Clarence A. O'Brien,** Registered Patent Lawyer, 313 Security Bank Bldg. Directly across the street from Patent Office, Washington, D. C.

H. F. Lowenstein, Registered Patent Attorney, Radio Expert. 825 McLachlen Building, Washington, D. C.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster & Allwine, 269 Ouray Bldg., Washington, D. C.

Patents—Inventors should write for Free Guide Books and Record of Invention Blank before disclosing invention. Send model or sketch of your invention for our Free opinion of its patentable nature. Radio, Electrical, Chemical, Mechanical and Trade-Mark experts. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

M. P. Laughlin, Patents, Engineer-Attorney, 48 East 41 Street, New York.

Representative Wanted

Manufacturers' Representative Wanted. By a well known and nationally advertised Radio Corporation. Manufacturing high quality, moulded bakelite variocouplers and variometers. Territory open: All Southeastern States. Upstate New York. Write immediately to Box 32, 222 Fulton St., New York City, N. Y.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 278, St. Louis, Mo.

Personal

150 Funny Jazzy Parodies on Latest Songs 25c. The Collins Co., 32 Liberty Street, Hastings, Brooklyn, N. Y.

Correspondence Club—Many wealthy members everywhere. Fascinating particulars free. Smith, Box 1167Y, Denver, Colo.

Exchange interesting letters with new friends. Dolly Gray Club, Box 186G, Denver, Colo.

Lonesome—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 58, Kansas City, Mo.

Lonely Hearts—Exchange letters; make interesting new friends in our jolly club. Eva Moore, Box 908, Jacksonville, Florida. Enclose stamp.

Exchange Cheery Letters with new friends. Write Betty Lee Inc., 4254 Broadway, New York City. Stamp appreciated.

Your Horoscope. Business changes, social, matrimonial prospects. Send birthdate and 10 cents (stamps) for remarkable test reading. Zanya, 202-J West 105th Street, New York.

Postcards and Pictures

Send any photo or film and $2.00 for fifty genuine photo postals. Barbeau's, Oswego, N. Y.

Radio Equipment

Genuine Edison Elements (new) for making "B" Batteries, obtained from U. S. Government. A positive and negative element—6c; glass tube—3c; all other parts at reasonable prices. Postage, etc. 50c extra per order. Free instructions. Todd Electric Company, 109 West 25rd St., New York.

Sales Accounts Wanted

To Radio Manufacturers: Our Radio sales for one factory in October were 20,000 dollars. Are you satisfactorily represented in the East? Manufacturers Agent. Box 145, Radio News.

Salesmen Wanted

Lightning Strange Battery Compound. Charges discharged batteries instantly. Eliminates old method entirely. Gallon free to agents. Lightning Co., St. Paul, Minn.

Scenery to Rent

Settings for Opera, Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

Song Poems Wanted

Poems Wanted—Sell your song-verses for cash. Submit Mss. at once, or write New Era Music Co., 152, St. Louis, Mo.

Song Writers

A $500.00 Cash Prize is offered for the best second verse written for the song "Remember." Those wishing to compete may receive a free copy with rules by addressing Equitable Music Corporation, 450 State Theatre, N. Y.

Stamps and Coins

Price list of packets, sets, single stamps free upon request. Premium to approval applicants. Yonkers Exchange, Yonkers, N. Y.

Stamps—50 varieties, Brazil, Peru, Cuba, etc., 10c. 50 different U. S. 25c. 1.000 hinges, 10c. 1.000 mixed, 40c. List free. C. Stegman, 5956 Cote Brilliante, St. Louis, Missouri.

Stamps Free—Variety Packet foreign stamps with catalogue—2c postage. Gray Stamp Company, Station E4, Toronto, Canada.

California gold. Quarter size 27c; half-dollar size 53c; Half-dime and Catalogue 10c. Normal Shultz, Colorado Springs, Colo.

Telegraphy

Learn either code in one hour. Radio Code chart and Code Cards teach Wireless and Morse Codes. $1 complete. Particulars free. John Percival, 2115 York, DesMoines, Iowa.

Telegraphy—Both Morse and Wireless taught thoroughly and quickly. Tremendous demand. Big salaries. Wonderful opportunities. Expenses low; chance to earn part. School established fifty years. Catalog free. Dodge's Institute, Cour St., Valparaiso, Ind.

Wanted to Buy

Full Value Paid for Old Gold Jewelry, Watches, Diamonds, crowns, bridges, dental gold, silver, platium, gold or silver ore, magneto points, old false teeth. Packages returned if our offer is not satisfactory. United States Smelting Works (The Old Reliable), 120 So. State St., Dept. 16, Chicago, Ill.

Stammering

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 121 Potomac Bank Bldg., Washington, D. C.

Wireless

Cabinets—Catalog on request. Special cabinets made to order at low cost. Manufacturers' and jobbers' inquiries invited. Panels—plywood; natural, ½c sq. in.; dull black finish, 1½c sq. in., postpaid. Miami Cabinet Co., Yellow Springs, Ohio.

Radio Panels. Cut exactly to size and a guaranteed 12 hour shipment. ¼" thick .01½c per square inch, 3-16" thick .01¼c. Made of the highest grade black fibre. This material possesses electrical strength of 200 volts per mil, is inexpensive, unbreakable, easy to work and takes a fine finish. We pay postage. Radio Instrument & Panel Co., 564 W. Monroe St., Chicago, Illinois

Build your own electrolytic storage battery charger. Plates and complete Instructions, $1.00. Descriptive circular free. Peerless Electrical Parts Co., 105 Harris, Rochester, N. Y.

Immediate delivery. Tubes, Magnavox, Phones, Battery Chargers, storage and "B" Batteries, Couplers, Variometers, Condensers and all parts with Radio Corporation, DeForest and "Neutrodyne" Receiving Sets. R. B. Electric Co., Distributors, Galva, Ill.

Boys! Don't Overlook This. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalog. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal, 75c prepaid. Send for yours today. Radio Specialty Company, 96-98 Park Place, New York City.

Attention! — 50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalog, which contains raw materials and parts in a greater profusion than any other catalog. 15c in stamps, or coin, will bring the catalog to you. Radio Specialty Co., 96-98 Park Place, N. Y.

Build your sets with quality parts and get sure results. Radio Parts Co., Box 56, Dunellen, N. J.

Build Yourself a Rechargeable Storage "B" Battery from Edison Elements that will Last You a Lifetime! Complete units for making 120 volts, 1500 Milliamperes battery consisting of cabinet, switch, elements, glass tubes, separators, wire, electrolyte and blueprints for assembling, $12.50. Battery assembled and charged $17.50. Drilled elements, 6c per pair; glass tubes 2c, separators 1c, nickel wire 1c per length; rubber covered switch wire, 2c per foot. Mail Orders Filled. N. Roberts Storage "B" Bat. Co., 41 Jefferson Street, Brooklyn, N. Y. Near Broadway and Myrtle Avenue, Tel. Pulaski 2023.

Reflex Sets—Latest most economical hookup. Coast to coast. Only half the tubes. We specialize in parts and complete assemblies for ERLA one, two and three tube reflex sets. Information on request. Other specialties and standard apparatus. Western Wireless Supply Company, 2162 North California Avenue, Chicago, Illinois.

Edison Storage "B" Battery elements. Large size, full capacity. 3c per pair, in lots of 100. Kindly send postage for 5½ lbs. per 100 pair. Gilman's Battery Shop, 57 Washington Ave., Chelsea, Mass.

LOOK—New Crosley X $42.50. New Crosley VI $21.00. New Crosley V $10.00. Paramount Regenerative $20.00. Rectigon Charger $13.50. Write, Box 103, Jackson, Mo.

Special Only for this month, Paragon RD-5 and A-2 combined $110.00. Grebe CR-9 $115.00. Tubes 15 percent off. Loud Speakers $5.00. Join our mailing list, dealers wanted. C. H. Anderson, Lewistown, Mont.

Clapp Eastham Bargain. Type RZ tuner, detector and two stages, Radiotron tubes, Allen headset, $100. R. Carlock, West Salem, Wis.

Radio Dealers: Get our prices before you buy. Large stock of Nationally advertised goods. 4 percent cash discount small orders. Federal Radio Co., 19th & Harney, Omaha, Nebraska.

Fifty assorted flathead solid brass machine screws, nuts, washers, copper lugs—50c. Eight initialed binding posts, set 60c. Twelve nickeled binding posts—50c. All three items—$1.50. Radio List for stamp. All prepaid. Stamps accepted. Kladag Radio Laboratories, Kent, Ohio.

Radio Sets—Repaired, Built to order—any circuit. K. H. Laboratory, 5011 California St., Omaha, Nebraska.

Do It Now—Rebuild that old set. Ten latest Radio Circuits—Looseleaf cover—One dollar. Radio Engineering Works, 359 Lincoln Ave., Council Bluffs, Iowa.

Radio Agents: Write for quotations on fast sellers. Radio Central, Abilene, Kansas.

Magnavox R3 or M1. Latest nationally advertised reproducers. List $35. Introductory $25. The factory sealed carton is your guarantee. Radio Central, Dept. R, Abilene, Kansas.

7x18 Panels $1.20. 3 Plate Vernier Condensers 65c. 30 Ohm Rheostats 50c. Catalogue Free. Stewart Radio Supply Co., 3124 Cherokee, St. Louis, Mo.

Radio-Applause Post Cards. Encourage broadcasting by such acknowledgement. 2 dozen, 25c postpaid. D. J. Spangler, Elkhart, Ind.

Special for this month: Atwater-Kent Two Stage Amplifiers $9.95. Electric Soldering Irons $1.98. Many other Bargains. Send for Radio Bargain Bulletin. The Electric Shop, Secor, Ill.

Wholesale House selling out special lines of Radio Receiving sets and parts at less than cost, 50 percent to 75 Dercent reduction from list price. Prices in effect for short time only. Write today for list of exceptional money saving values. Address P.O. Box 93, Station C, Los Angeles.

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Only Two Days From New York

Sailings Twice Weekly
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Landing passengers directly at Hamilton Dock, avoiding delay and inconvenience of transfer by tender. Tickets good on either Steamer, insuring unequalled express service safety and via Palatial new Twin-Screw Oil-burning Steamers.

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Modern Hotels—No Passports—All Sports

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GUARANTEE

WRITTEN GUARANTEE
12 Months—At Half Price

These are Goodrich, Goodyear, Firestone, Fisk and other best known standard make tires. All slightly used, but readily give our customers thousands of miles of splendid service.

Lowest Tire Prices in America

	Tires	New Tubes		Tires	New Tubes
30x3	$1.65	$ .90	32x4½	$3.25	$1.65
30x3½	1.75	.90	33x4½	3.60	1.65
32x3½	2.25	.90	34x4½	3.75	1.65
31x4	2.50	.90	35x4½	4.00	1.65
32x4	2.75	1.40	36x4½	4.00	1.65
33x4	3.00	1.40	35x5	4.00	1.95
34x4	3.25	1.40	37x5	4.00	1.95

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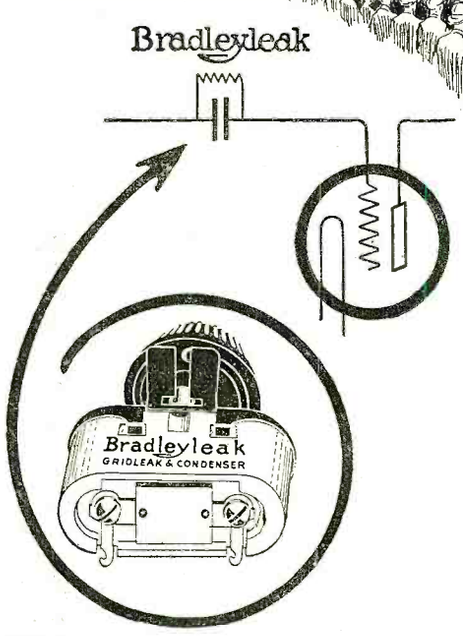

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C-200	2 Megohms
C-299	2 to 5 Megohms
C-301-A	2 Megohms
UV-199	2 to 5 Megohms
UV-200	2 Megohms
UV-201-A	2 Megohms
WD-11	3 Megohms, or more
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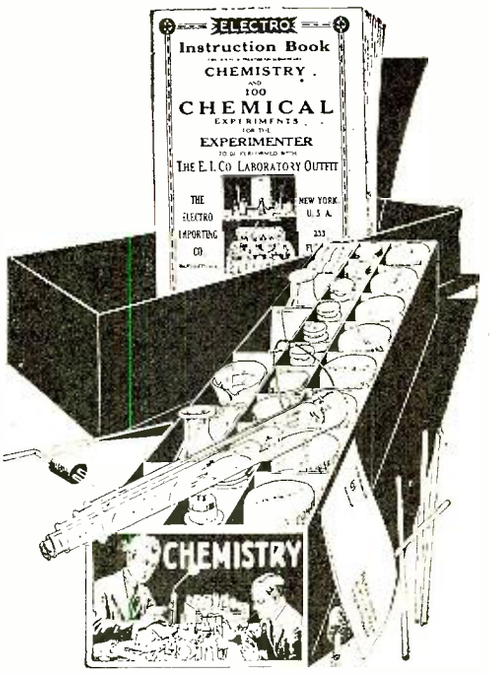

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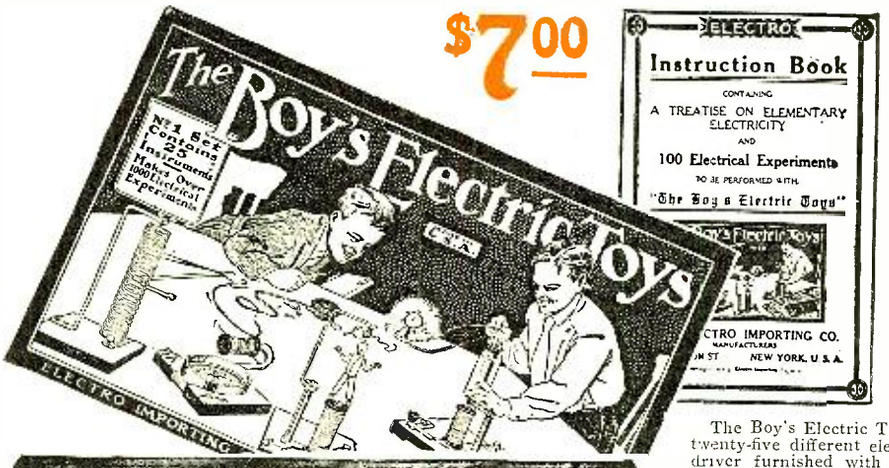

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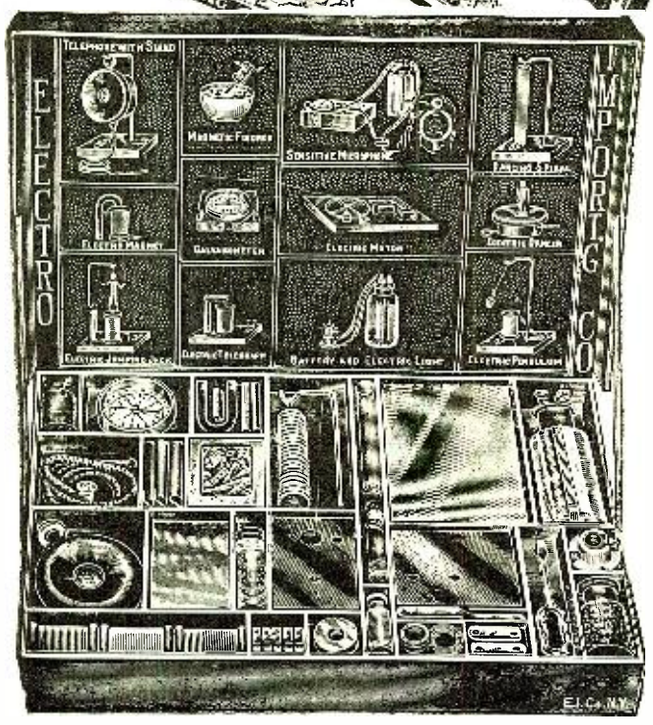

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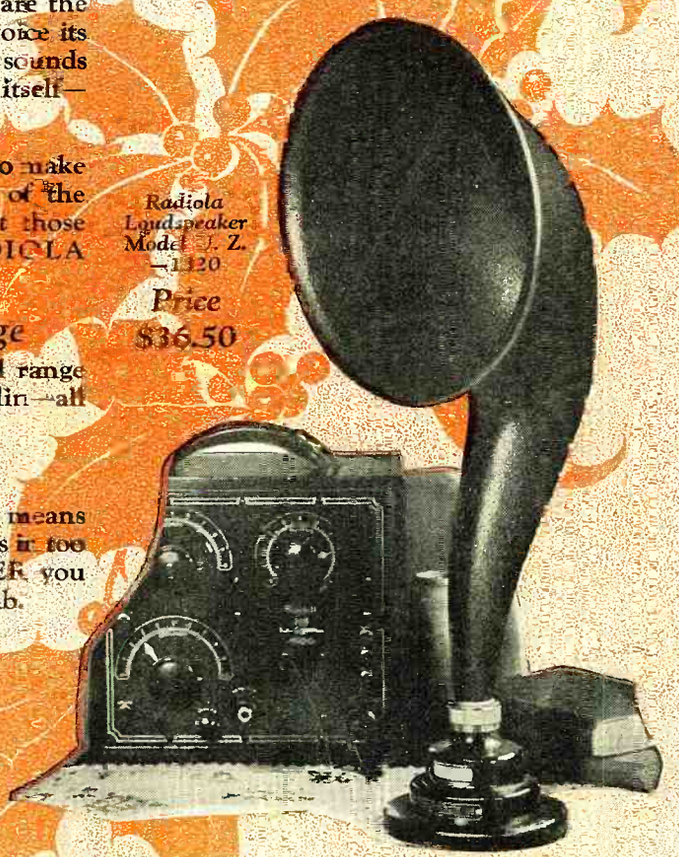

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