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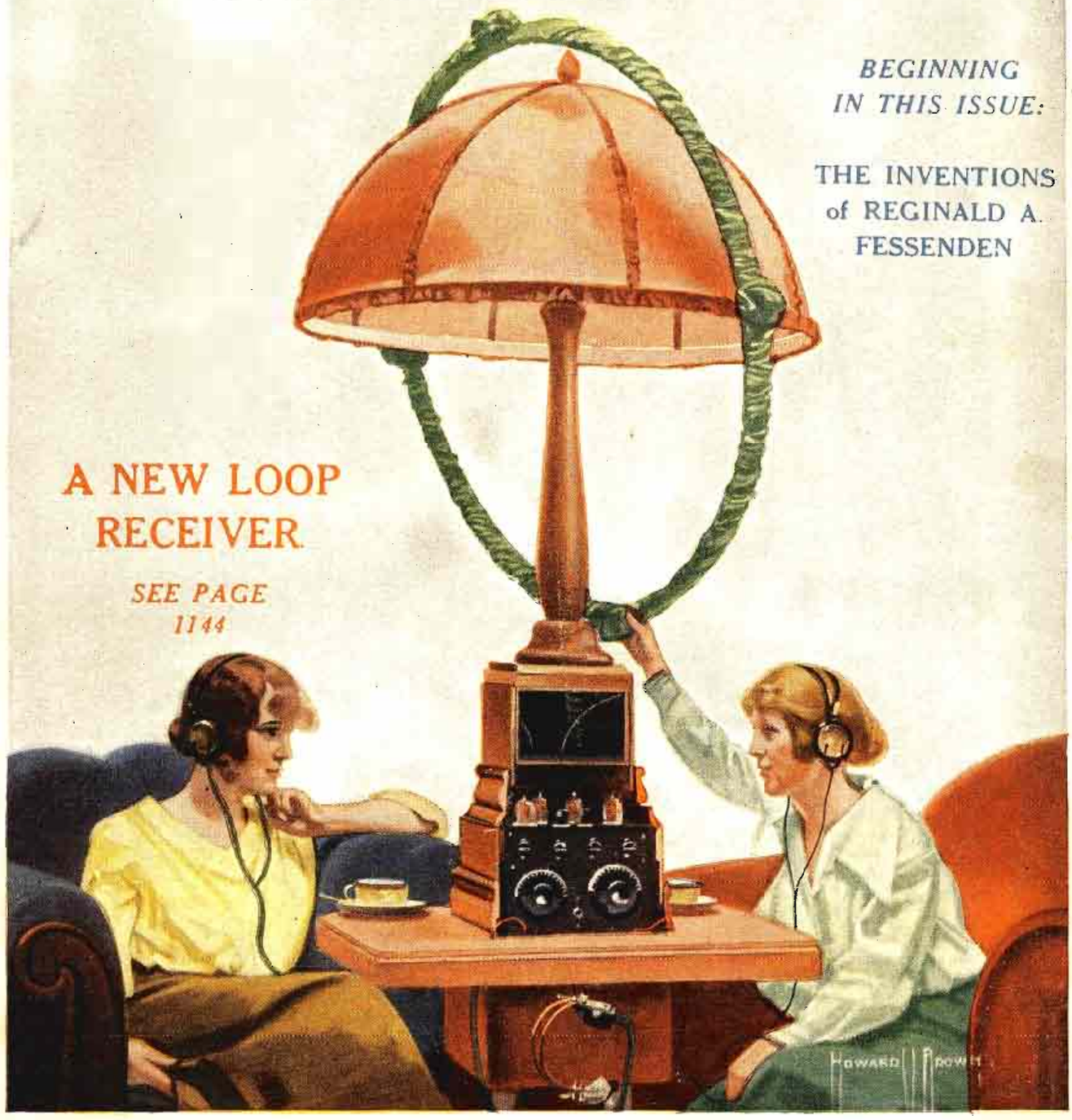
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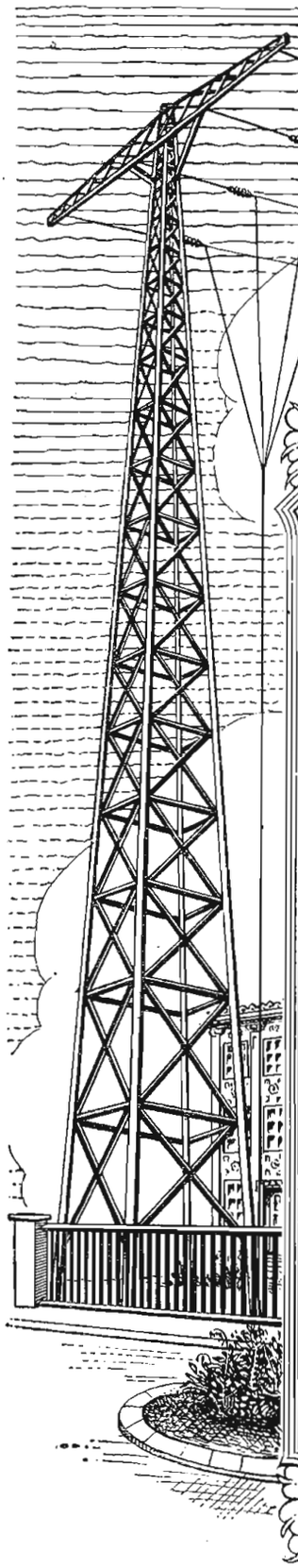
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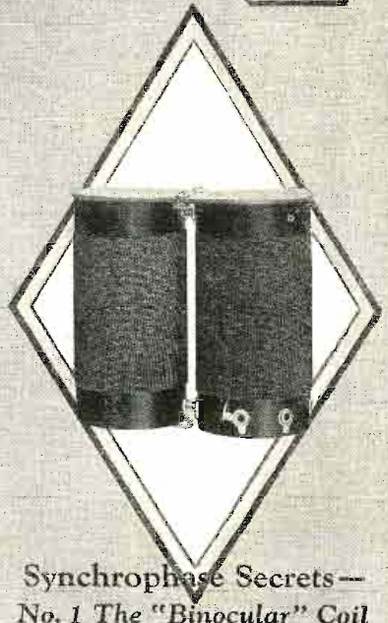
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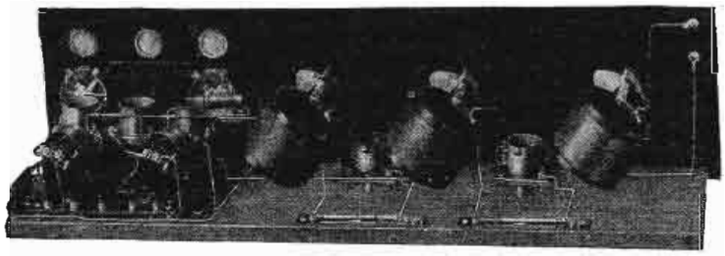
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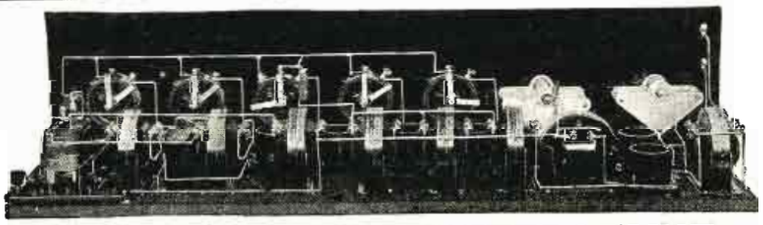
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2 Bezels
$33.75

COMPLETE PARTS FOR
2-Tube Harkness Set
including **Licensed Harkness Coils,** Drilled Panel and wiring diagram. Easy to build. Wonderful results. **$17.95**

OUR GUARANTEE
Every article exactly as represented. Every article is tested before shipping. Complete satisfaction guaranteed or money will be cheerfully refunded.



COMPLETE PARTS FOR 8-TUBE SUPER-HETERODYNE

2 23-Plate Bremer-Tully or Duplex Low Loss Condensers.
3 Remler or Columbia Intermediate Frequency Transformers.
1 Remler or Columbia Tuned Circuit Transformer
1 Special Oscillator Coupler
1 Midget Condenser
8 Bakelite Sockets
2 Thordarson or Columbia A.F. Transformers
1 Connecticut Filament Switch
2 Bakelite 6-ohm Rheostats
2 Bakelite 30-ohm
1 Bakelite Potentiometer, 400 ohms
1 Carter Double Circuit Jack
1 Dubilier 1 mfd. Condenser
1 .006 Mica Condenser
1 .0005 Mica Condenser and 2 megohm Grid Leak
3 .0025 Mica Condensers
10 Binding Posts
1 .00025 Mica Condenser
1 Bakelite Terminal Strip for Binding Posts
1 Multicord cable for connecting batteries
1 7x30x¼ Drilled Bakelite Panel
1 Baseboard
35 ft. Hook-up Wire
2 4-in. Bakelite Dials
2 4½ volt C Batteries
$59.75
Complete wiring diagrams, base board layout, blue-prints and instructions.

COMPLETE PARTS FOR
Two Stage Amplifier
with Thordarson or Columbia Transformers; with drilled panel & wiring diagram **$10.90**

COMPLETE PARTS FOR
Ultra Audion
1000 Mile 1-Tube Set... $8.95
with drilled panel and wiring diagram.

COMPLETE PARTS FOR
Reinartz
1-Tube Reinartz Set.... $10.45
3-Tube Reinartz Set.... 17.55

Randolph Special Headphones
2200 Ohm $2.45
3000 Ohm 2.95

Easy to Build Your Own Radio Set

All complete parts for sets on this page consist of **standard advertised guaranteed parts** and include **drilled bakelite panels** and **wiring diagrams** for easy set construction.

Everything guaranteed on money-back basis. All transportation charges paid. **Don't forget!** Only genuine guaranteed parts used. Lack of space does not permit us to itemize individual parts, but you are fully protected by our money-back guarantee. **Our Service Division is behind you.**

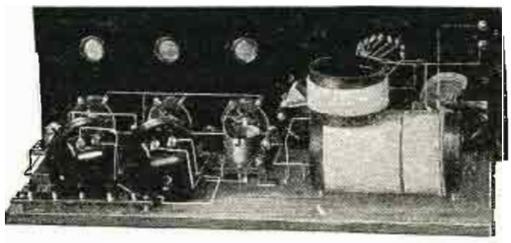
FREE BIG MONEY SAVING RADIO CATALOG

containing a thousand bargains of everything on radio—parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable, up-to-the-minute radio data. Send your name and address on a card or letter. We will send catalog free.

Free Service Department

Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is **free** to our customers.

COMPLETE PARTS FOR
5-Tube Improved Cockaday Receiving Set
With Resistance Coupled Amplification
As designed by L. M. Cockaday.
Including drilled panel and wiring diagram complete, ready to wire.
$39.65



COMPLETE PARTS FOR 3-TUBE
Cockaday Receiving Set

1 Cockaday Coil
2 23-Plate Hy-Grade Cond.
1 Bakelite Rheostat, 6 ohm.
2 Bakelite Rheostat, 30 ohm.
3 Bakelite Sockets
1 high ratio Columbia or Thordarson Transformer
1 Single Circuit Jack
1 low ratio Columbia or Thordarson Transformer
2 Double Circuit Jacks
2 3 in. Bakelite Dials.
1 Grid Leak and Mica Cond.
7 Switch Points. 2 stops.
1 Bakelite Binding Post Strip
7 Binding Posts
1 7x21x¼ in. Drilled Bakelite Panel
3 Bezels
1 Baseboard
1 switch lever
24 ft. Hook-up Wire
$19.95
Complete blue-prints and wiring diagrams.

1-Tube Set..... $10.45

RANDOLPH RADIO CORPORATION
159 N. Union Ave. Dept. 275 Chicago, Illinois

RADIO NEWS READERS' BUREAU

Time and Postage Saver

IN every issue of RADIO NEWS you undoubtedly see numerous articles advertised about which you would like to have further information. To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in RADIO NEWS.

If there is any Manufacturer not advertising in this month's issue of RADIO NEWS, from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

TEAR ALONG THIS LINE

READERS' SERVICE BUREAU, RN-1-25
Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of RADIO NEWS.

☞ DO NOT USE THIS COUPON FOR TECHNICAL QUESTIONS

NAME	ADDRESS (Street — City — State)	List here specific article on which you wish literature.	If Catalogue of complete line is wanted, check in this column

☞ DO NOT USE THIS COUPON FOR TECHNICAL QUESTIONS

Use this space if you desire information from a manufacturer whose advertisement does not appear in this month's issue.

NAME	ADDRESS (Street — City — State)	

Your own name here .....

☐ If you are dealer check here.

Address .....

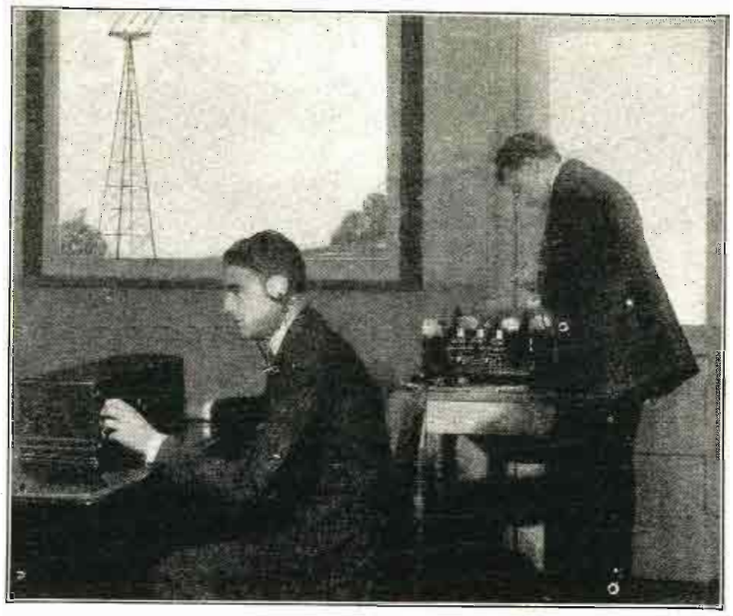
City ..... State .....



I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10,000 too much for the course.
(signed) A. N. Long,
120 N. Main St.,
Greensburg, Pa.



"No sooner had I received my discharge (as a buck private) than I opened a radio shop of my own. I earned over $3500 in 1 year. I wouldn't have missed the N. R. I. course for a million dollars."
John P. Zinno,
Corona, L. I.





Before I enrolled with you I was making $15 a week on a farm. Now I earn from $2,080 to $4,420 a year. And the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost $4,000 and I believe the course will be worth at least $100,000 to me.
(signed) Geo. A. Adams,
Route 1, Box 10, Tamaqua, Pa.



I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately $3,000 over and above what I would have earned had I not taken it.
T. Winder,
731 Bedford Av. Grand Junction, Col.

Prepare Yourself For Radio —*the New Profession*

Many N.R.I. Graduates Now Earning From $50.00 to $200.00 a Week

THE biggest, best-paying field open to ambitious men today. Thousands needed at once for pleasant, interesting jobs. High Pay—Short Hours. No experience required. Learn in your spare time.

Here is work that is fascinating, new and easy—an industry which is growing more rapidly than any other in the world today—an industry that offers you the chance of a lifetime to "get in on the ground floor" and make big money. Right now, thousands of trained men are needed in all branches of the business. Radio operators, radio engineers, salesmen, mechanics and Radio executives are scarce and receive wonderful pay. Are you going to shut your eyes to this golden opportunity when there is a quick, easy way to get one of these splendid positions?

You can train for this "big money" field right in your own home—in your spare time. No matter how little you know about electricity or Radio, the National Radio Institute—the biggest and best school of its kind in the world—will guarantee to give you a thorough Radio training in a few short months.

Salaries Doubled and Tripled

Since the National Radio Institute was founded in 1914 over 15,000 men and young men have taken this short-cut to Success in Radio. They are enthusiastic about this wonderful Course.

E. W. Barnes, Norfolk, Va., writes: "During my spare time, I make about as much repairing radio sets and building them as my regular salary."

In a letter from Arthur Ruse of Toronto we read that he has doubled his income since mastering Radio and that he earns from $50 to $100 a month in his spare time.

This page contains only a few of the thousands of letters we receive from successful graduates. Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer."

"We want men with executive ability in addition to radio knowledge to become our local managers." "We require the services of several resident demonstrators" — these are just a few small indications of the great variety of opportunities open to our graduates.

This is the absolutely complete Radio Course now being offered which qualifies you for a Government First Class Commercial License and really gets you the bigger paying jobs in Radio.

Study In Your Spare Time

This is the time to go into radio. Big opportunities are now open in every branch of the work, and salaries were never so high. The thing to do is to begin studying at once, in whatever time you can spare, so that you will be able to qualify for the position you want when the time comes. Only an hour or so every evening will quickly prepare you for radio—a profession you cannot fail to find fascinating and pleasant. Don't handicap yourself; start at once and advance with the others.

Send Today for Free Book and Special Short-time Offer

Don't rely on this announcement for a true picture of the opportunities in Radio Simply mail the coupon and we will send you a big *free book* "Rich Rewards in Radio," which will show you *actual praaf* of the big money being made by our graduates today. It will describe the course in full detail, it will tell you just how much you can earn in this fascinating profession. Best of all, you will get the details of our Special Reduced rate which is being offered for a short time. So, mail the coupon now! Make this your lucky day!

The National Radio Institute
Dept. 13CB, Washington, D.C.

The National Radio Institute,
Dept. 13CB, Washington, D. C.

I am interested in radio as a profession. You may send me, free and without obligation, your interesting book, "Rich Rewards in Radio," all information about your spare time, home-study plan and about your free employment service. Also, the details of your Special Offer.

Name ..... Age....

Street .....

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

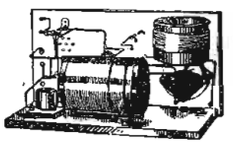
BARAWIK

60,000 Barawik Sets Prove Our Reliability

VALUE

We have many thousands of customers all over the world. You take no risk in dealing with us. We are one of the oldest and most reliable radio supply houses. "RADIO NEWS" guarantees our reliability. Let us serve you and save money for you. All orders shipped same day received.

COCKADAY CIRCUIT

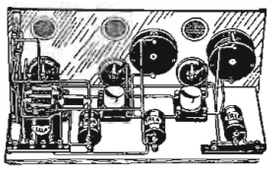


J873 Complete parts, 1 tube set..$10.25
J874 Complete parts, 3 tube set.. 18.75
A very selective set that will tune out even nearby stations. A favorite circuit with many builders. One tube set has 7x14 panel, 3 tube 7x21. Panels are drilled for easy assembly. Instructions furnished for assembly.

IMPROVED COCKADAY CIRCUIT

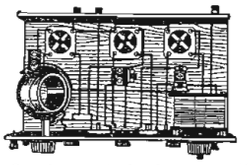
J875 Complete parts for 5 tube set..$48.65
This is the latest model Cockaday circuit with resistance coupled amplifier. Green silk coil wound on bakelite tubing, highest grade ground rotor loss condenser and best grade parts throughout. 7x24 panel drilled ready to mount parts. Complete with instructions for assembling.

ERLA REFLEX CIRCUITS



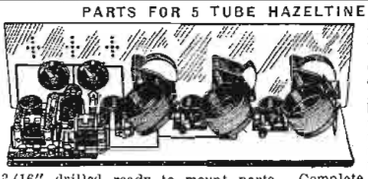
J876 Complete parts, 1 tube set..$21.50
J877 Complete parts, 2 tube set.. 31.95
J878 Complete parts, 3 tube set.. 38.90
These circuits have opened a new field in radio. One tube does the work of three in an ordinary set, two equal to four, three equal five. Crystal detector improves quality of reproduction, preserving the full mellow tones of the original. Easily handled, will bring in distance well. All parts are genuine Erla exactly as specified in Erla circuits. Panels are drilled for easy assembly. One tube set has 6x7 panel, two tube 7x14, three tube 7x18.

AMBASSADOR CIRCUIT



J881 Complete parts for 3 tube set $20.95
A three circuit set that is very selective and sensitive and brings in distant stations with excellent volume. Genuine Ambassador tuning coil wound throughout with Litz wire permits sharp tuning. Simple to build and operate. Genuine bakelite panel, size 7x18, drilled ready to mount parts. Complete with instructions for assembling.

PARTS FOR 5 TUBE HAZELTINE NEUTRODYNE CIRCUIT



J858 Complete set parts, including mahogany finished cabinet $33.50
All the parts needed to build this circuit which is the leader of all circuits today. Tunes thru interference. Easy to find stations once they have been located. Brings in distant stations on the loud speaker in clear pure tones with wonderful volume. Essential parts licensed under Hazeltine patents. Genuine bakelite panel 7x24x 3/16" drilled ready to mount parts. Complete instructions furnished for assembling and wiring. With these parts you can easily build a high grade set at low cost. Note that all our prices are prepaid.

LICENSED NEUTRODYNE PARTS



J852 Licensed Neutrodyne Kit $14.95
Includes three licensed Neutroformers, 2 neutrodons, panel layout, template and book of instructions for building up neutrodyne set. By adding other parts a neutrodyne set can be built at low cost.

TUNED RADIO FREQUENCY UNIT



J853 Each.....$2.75
Three for 7.85
Consists of radio frequency transformer wound on bakelite tubing and high grade variable condenser. For use in tuned radio frequency circuits. Usually used in sets of three. Condenser shaft ¼" diam.

BALANCING CONDENSERS

J854 Pair.....70c
Sold in pairs for neutralizing the capacity in two-stage radio-frequency circuits.



$42.50

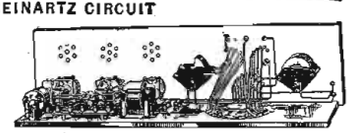
5 Tube Bargain

The greatest radio value ever offered

A five-tube radio frequency set that brings in the distant stations on the loud speaker. All the volume you could want with the finest tone quality, clear and sweet. Careful designing with big quantity production make our low price possible. Only the finest quality materials used throughout. New style efficient low loss condensers and transformers. Bakelite panel size 7x18 in. Handsome mahogany finish cabinet. Neat convenient dials. We can recommend this set for either city or country use. Will not reradiate and will bring in stations from coast to coast. No set aproaches this for value. Equals many sets selling at double and triple our price. Try it for ten days. If you are not satisfied return it and we will refund your money.

J867 Set, only $42.50
J868 Set complete with five 201A tubes, 90 volts B battery, 100 ampere storage battery, one J613 Special Speaker, and complete antenna equipment. Nothing extra to buy. Price $82.00

PARTS FOR REINARTZ CIRCUIT



J862 Complete set of parts for one tube set $10.75
J863 Complete set of parts for three tube set $17.95
One of the best circuits for bringing in distant stations. Can be built at very low cost yet produces fine results. Easy to handle. The three tube provides loud speaker volume on distant stations. One tube set has 7x14 panel, 3 tube set 7x21 panel. Panels are drilled for easy assembly. Complete with instructions for assembling.

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. Panel fits flush in front recess. Panels not included. Inside depth 7 inches except 9x14 12x14, 12x21, which are 10 in. deep. Prices quoted are prepaid and are the lowest ever offered on quality cabinets.

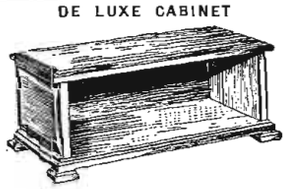
Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
6x7"	J420	$1.95	7x21"	J425	$3.20
6x10½'	J422	2.45	7x24"	J429	3.40
7x10"	J421	2.60	7x26"	J431	3.50
7x12"	J424	2.85	9x14"	J428	3.55
7x14"	J423	2.95	12x14"	J430	4.00
7x18"	J426	3.95	12x21"	J432	5.05

BASE BOARDS FOR CABINETS

Fasten to bottom of panel and fit inside cabinets. ⅜ inch thick, 6½ inches wide.

Art. No.	Length Inches	Price Each	Art. No.	Length Inches	Price Each
J435	6½	19c	J439	17½	29c
J436	9½	23c	J440	20½	31c
			J441	23½	33c
J437	11½	25c	J442	25½	39c
J438	13½	27c			

DE LUXE CABINET



The finest quality cabinet. A piece of furniture worthy of the best set. Made of genuine solid walnut in elegant hand rubbed natural walnut or brown mahogany finish. State which is wanted. Top has piano hinge and lid support. Feet at base add to striking appearance. Inside depth 9 inches.

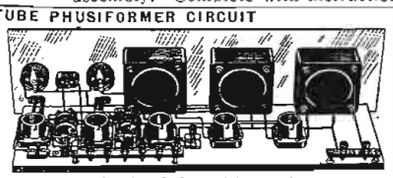
Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
7x18	J444	$7.65	7x26	J447	$10.50
7x21	J445	8.25	7x28	J449	11.50
7x24	J446	8.95	7x36	J448	13.75

CONSOLE RADIO CABINET



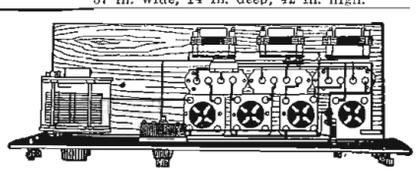
J902 Prepaid price, each $37.50
A high grade piece of furniture. Neat appearance. Elegant finish. Looks well among finest furnishings. Top compartment takes any set or panel size 9 in. high, 10 in. deep, 33 in. long or smaller. Lower compartments hold batteries, chargers and all accessories. Can be entirely closed and locked. Strong durable construction. Paneled doors. Fine mahogany or walnut finish. Size over all, 37 in. wide, 14 in. deep, 42 in. high.

PARTS FOR 5 TUBE PHUSIFORMER CIRCUIT



J880 Complete set of parts, including high grade cabinet..$35.95
One of the easiest sets to build. Best results assured. Two stages tuned radio frequency amplification detector and two stages audio amplification. Brings in the distant stations with great volume and purest tones. Best grade parts furnished throughout. Genuine bakelite panel 7x26x3/16" drilled ready to mount parts. Complete instructions furnished for wiring and assembling. Note that all our prices are transportation prepaid.

ACME REFLEX CIRCUIT



J883 Complete parts for 4 tube set $44.50
One of the most efficient circuits known. Combines three stages of radio frequency and audio frequency using only four tubes. Crystal detector gives unusual clarity. Genuine Acme condenser. Pot Rheo, radio and audio frequency transformers supplied. Genuine bakelite panel, size 7x21, drilled ready to mount parts. Complete with instructions for assembling.

SPIDER WEB COIL FOR REINARTZ CIRCUIT



J296 Each $1.05
A very unusual value. Made of green silk covered wire, spiderweb wound. 21 taps so arranged that crossing avoided. Mounting bracket permits various styles of mounting. Directions included.

COCKADAY PARTS

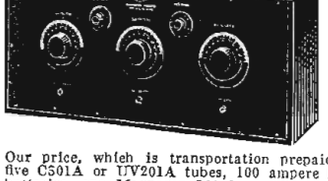


J298 Per set....$1.65
Complete set coils for Cockaday circuit. Properly calculated and made to give best results in this new wonder circuit.
J276 Amplex grid-denser for Cockaday Improved 5 tube circuit.....$1.10

LARGE CAPACITY FIXED CONDENSERS

Tested for use in the new radio circuits. Metal cases. Soldering lugs for connections. Best materials. Carefully made.
J358 .25 mfd...55c J359 .5 mfd...$.65
J360 .1 mfd...85c J361 .2 mfd...1.35

MURDOCK FIVE TUBE NEUTRODYNE SET



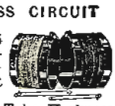
J870 Complete with tubes, bateries and accessories as listed below.....$159.50
A high grade, genuine five tube Neutrodyne set at an unusually attractive price. Manufactured under the Hazeltine patents. Engraved panel and finely finished solid mahogany cabinet lend richness and dignity to its appearance. Easy to tune. When station has been heard once and record made of dial setting you need only set dials at same point and if station is broadcasting it will be heard. Brings in distant stations loud and clear on loud speaker. Our price, which is transportation prepaid, includes the following: Set in cabinet, five C501A or UV201A tubes, 100 ampere hour storage "A" battery, two 45 volt "B" batteries, one Magnavox M4 loud speaker and complete antenna equipment consisting of wire, insulators, lightning arresters, etc.

PHUSIFORMER



J546 Each.....$6.65
A new device especially designed for tuned radio frequency circuits. Consists of primary and secondary inductively coupled coils connected with variable condenser, all enclosed in moulded case with binding posts. Dial on shaft of condenser. Size 4½ in. square, 2 in. thick. Three units occupy small space and can be used to make up a very efficient 5 tube set at low cost.

COILS FOR HARKNESS CIRCUIT



J295 Per set of two..$1.95
Green silk windings on genuine bakelite tubes. Properly calculated to give best results.
J879 Complete parts for 2 Tube Harkness Reflex Set with panel drilled for mounting parts and instructions for assembling $15.85

The Barawik Co.
102 So. Canal St. Chicago, Ill.

BARAWIK

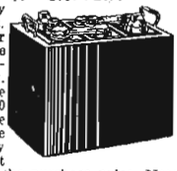
Prices Now are Lower than Ever Before

QUALITY

WE PAY TRANSPORTATION CHARGES IN U. S. EAST OF THE ROCKIES
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
ALL ORDERS SHIPPED SAME DAY RECEIVED

THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid

STORAGE "A" BATTERY



The best battery buy on the market. Guaranteed for three years. Made of best new materials. Full capacity. Try one of these batteries for 10 days. If at the end of that time you are not fully satisfied return it and we will refund the purchase price. Note our prices are prepaid. Transportation cost considered these are the lowest prices obtainable. We deliver this high quality battery to you for less than the cost of inferior batteries.

J194 6 volt, 60 amp. size. Each..$9 99
J196 6 volt, 100 amp. size. Each..13.25

BATTERY CHARGER



Connect charger to 110 volt 60 cycle light socket and your battery charges automatically over night at a cost of only a few cents. Cord and clips for connections included.

J201 For 6 volt battery.....$12.95
J203 For 12 volt battery..... 12.95

Noiseless Rectifier Bulb Charger—King, Tungar or Rectigon.

J255 2 amp..$15.95 J256 5 amp..$24.95

Extra Bulbs.

J257 2 amp...$3.80 J258 5 amp...$7.60

HYDROMETER

J190 Each 48c
Helps keep battery in better shape by showing exact condition.

BATTERY CLIPS



J198 Two for 28c
Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

"A" BATTERY CORDS



J191 Per pair 69c
Two heavy insulated stranded copper wires 5 feet long. Battery clip on one end and binding post terminal on other end. Eliminate shorting of "A" battery. Provide positive connections.

CONNECTING CORD SET

J192 Each 52c
Five connecting cords with braid over all. Each cord has distinctive colored covering. Terminals for connections. Makes connecting of both A and B batteries to set easy with no mistakes in polarity or voltage. Will reach from table to floor or for use in any type cabinet. Does away with unsightly wires. This is a $1.00 retail value.

PLATE CIRCUIT "B" BATTERIES



Reduced prices. A leading standard brand advertised to sell at much higher prices. No better battery made. Longest service.

J180 Small size 2 by 2½ by 3⅝ inches 22½ volts. Each 95c
Ten for $8.60
J184 Large size, 5 taps. Size 3x4x6½", 22½ volts. Each..$1.65 Ten for..$14.70
J188 Large size, 6 taps. Size 3x8x6½", 45 volts. Each...$2.90 Ten for..$27.90



J181 22½ volt. New upright size 3x2½x5½ in. Takes less space in set. Each.....$1.50
J183 45 volt upright size 3x7x 8 in. Each $2.90. Ten for $27.90

"C" BATTERY

J186 4½ volt C battery size 4x 1⅝x3". Ea.42c Ten for ...$3.95

STORAGE "B" BATTERIES



J202 12 cells, 24 volts. Each $3.95
More economical than dry cell "B" batteries on sets using 3 or more tubes. Can be recharged when run down. Capacity 2500 milliamperes. A high grade battery. Glass jars with rubber caps. Strong moulded tray. Shipped dry so as to be mailable. No Electrolyte included.

"B" BATTERY CHARGER



J205 Each.....$8.95
Recharges 24 or 48 volt B batteries from 110 volt 60 cycle light socket rapidly and at practically no cost. Keeps batteries in good condition.

BATTERY METERS



J189 Each 82c
Reads 0 to 50 volts. Accurately tells you condition of "B" Battery. Convenient watch size. Tests 22½ and 45 volt batteries.
J193 Combination meter $1.30
Reads 0-50 volts; 0 to 35 amperes. Tests "B" and "A" dry cells.

PHONOGRAPH ADAPTERS



J771 Fits single unit to tone arm. Each 39c
J773 Fits any double headset to tone arm. Each...65c
Convert your phonograph into a loud speaker. Take off the reproducer and replace with adapter and unit or headset. Such a combination will equal or surpass in tone and volume many high priced speakers.

SUPERIOR RADIO PLUGS



Both styles take two sets of cord tips. Polished round barrels.
J397 With turned fibre barrel. Highest grade obtainable. Each.....44c
J395 With black moulded composition barrel. Wonderful value. Each.....25c

NEW STYLE PLUG



J401 Each 59c
Cords are held firmly in place but can be detached instantly without taking plug apart. No screws to loosen. Bakelite body. Fits all standard jacks. Best plug made.

LOUD SPEAKER UNITS WITH PHONOGRAPH ATTACHMENTS



Make a loud speaker of your phonograph. These attachments consist of a high grade speaker unit arranged to attach to tone arm of phonograph in place of a reproducer. Fit Victor, Sonora, Silvertone and other phonographs having same size tone arm.

J602 Baldwin $7.45
J607 Western Electric 8 55

EXTENSION CORDS



J403 30 ft. $1.95
Place loud speaker wherever desired without moving set. Consists of high grade receiver cord of length specified with plug on one end and jack on other to take plug on loud speaker cord.

PHONE CUSHIONS



J774 Pair 43c
Made of soft sponge rubber. Light as a feather. Fit any phones. Exclude all noises and make wearing phones a pleasure.



J613 Special Sale Price $5.95

This speaker is a marvel for volume and quality of tone. It is actually superior to most of the higher priced speakers and at our price is the biggest value on the market. Guaranteed to please you. Beautiful mottled black finished fiber horn. Bell diameter 10 inches. Height 21 inches. Complete with cord.

BARAWIK QUALITY HEADSET

J770 Spec. Price per Set...$2 28
These headsets are the very best for one quality and volume. Finest quality. Designed to sell for much higher prices than we ask and at our price are a wonderful bargain. Receiver cases are fine polished black finish. Comfortable fabric covered head band. Complete with 5 foot cord.

CABINET TYPE LOUD SPEAKER



J605 Prepaid price, each $12.50
A fine loud-speaker with a full rich tone and unusual volume. Amplifying chamber and unit enclosed in fine mahogany finished cabinet with silk backed grille front. Very convenient and better looking than most other types of sneakers. A wonderful value at our price, in our opinion equal to other sneakers sold at double our price.

STANDARD BRAND LOUD SPEAKERS AND UNITS

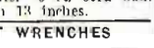
J618 Brandes Table Talker.....$7.95
J616 Atlas Loudspeaker 21.95
J620 Baldwin Loud Speaker.....22.50
J603 Magnavox M4 Loudspeaker....21 00
J612 Magnavox R8 Loudspeaker....29.50
J614 Magnavox M1 Loudspeaker....26.50
J757 Morrison Adjustable Unit..... 4.45
J755 Genuine Baldwin Type C unit 4.75
J608 Atlas Unit. Each.....10 75

RADIO SOLDERING IRON



J540 98c
This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches.

HEXAGON NUT WRENCHES



J950 Set of 3...60c
Handiest tool made for tightening hexagon nuts. Fit nuts for 4/36, 6/32, and 8/32 screws, the three most popular radio sizes.

STANDARD BRAND HEADSETS

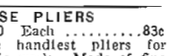
J754 Baldwin Type C.....$8.95
J764 Frost, 2000 ohm 3.30
J766 Frost, 3000 ohm 3.95
J751 Murdock 56, 2000 ohm..... 3.25
J752 Murdock 56, 3000 ohm..... 3.90
J768 Brandes Superior, 2000 ohm... 4 85
J769 Brandes Navy, 3000 ohm..... 6.85

MULTIPLE PLUG



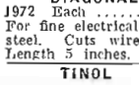
J402 Each 89c
Attach any number of headsets up to four. Cords attached or detached instantly without taking plug apart.

LONG BLADE SCREWDRIVERS



J947 6 inch 20
J948 8 inch 25c
J949 10 inch 30c
Long narrow blade makes it easier to get in difficult places. Wood handle. Length given is over all.

LONG NOSE PLIERS

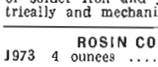


J970 Each 83c
The handiest pliers for radio work. Made of fine hardened steel. Length 5".

DIAGONAL JAW NIPPERS

J972 Each 75c
For fine electrical work, made of hardened steel. Cuts wire clean in tight places. Length 5 inches.

TINOL



J969 Per tube...19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

ROSIN CORE SOLDER

J973 4 ounces 23c

All Orders Shipped Same Day Received

LIGHT SOCKET ANTENNA



J978 Each 97c
Screws into any light socket. Replaces the regular out door antenna. Very satisfactory for nearby stations and under favorable conditions will bring in distant stations. Easy to install. No danger. Gives clear reception with little static interferenee. Ideal for people in apartment buildings.

FAHNESTOCK CONNECTORS



J366 Single Connector. Dozen 16c
J367 Double Connector. Dozen 38c
J368 Antenna Connector. Each ...8c

ANTENNA MAST FITTINGS



J952 For ½ inch pipe. Per set $1.00
J953 For 1 inch pipe. Per set $2 95
Set includes adjustable base to fit roof peak or flat surface, center guy wire fastening ring and top cap with pulley for rope to raise and lower antenna. No pipe included. Makes the installation of a first class antenna simple and inexpensive.

ANTENNA OUTFIT

J272 Each $2.70
Consists of 150 feet stranded copper antenna cable, lightning arrester, four wall insulators, two antenna insulators, antenna lead-in, 25 feet insulated ground wire, ground clamp and 25 feet connecting wire.

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
J248 100 ft. coil 48c J249 500 ft. coil $2.30

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments. Size 14.
J240 100 ft. coil 42c J242 500 ft. coil $2.05

GROUND CLAMP

J273 Made of soft copper ⅝" wide with Fahnestock connector. Fits any pipe ⅜ to 1 inch wide. Each 8c

ANTENNA INSULATORS



J263 Ribbed Porcelain insulator, 2½ in. long. Ea. 6c Dozen 55c
J265 Ribbed Porcelain insulator—5 inches long. Each 15c

ANTENNA LEAD-IN



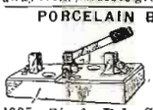
J259 .....15c
Antenna wire is brought in without drilling a hole. Place on window sill and window can be closed down tight and locked as before. Well insulated. Can be bent into any shape. Made of copper strip properly insulated.

WALL MOUNTING INSULATOR



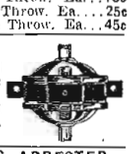
J262 Each ..7c Dozen 65c
Galvanized screw mounting Lead-in wire passes through center of porcelain insulator and is kept away from possible grounds. Easily installed.

PORCELAIN BASE SWITCHES



Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.
J385 Single Pole Single Throw. Ea...18c
J383 Single Pole Double Throw. Ea....25c
J384 Double Pole Double Throw. Ea...45c

OUTDOOR ARRESTER



J980 .....$1.24
Protect your instruments with this lightning arrester. Weatherproof Bakelite case. Underwriters approved.

JEWELL LIGHTNING ARRESTER



J981 Each 68c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved.

SUPERIOR LIGHTNING ARRESTER

J982 Each 39c
Porcelain block with brass binding posts. Dependable and effective.



COLLAPSIBLE LOOP ANTENNA



J976 Each $3.80
A full size loop antenna 31 in. high 28 in. wide into compact case 18 in. long, 3 in. diam. Well made. Fine looking. Insulated wire, extra flexible. Suitable for use with any loop set. Case included. Quickly set up or taken down.

The Barawik Co.
102 So. Canal St. Chicago, Ill.

BARAWIK

It is Easy to Build Your Own Radio Set

QUALITY

WE PAY TRANSPORTATION CHARGES IN U. S. EAST OF THE ROCKIES
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
ALL ORDERS SHIPPED SAME DAY RECEIVED

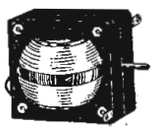
HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

OUR SPECIAL VARIOCOUPLER



J418 Each $1.80
The most efficient type of coupler. Primary and secondary wound on bakelite tubes. Primary tapped for fine tuning. 3/16 inch shaft. Range 180 to 650 meters.

MOULDED VARIOMETER



J412 Each $2.30
Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade instrument that will get the best results. Wave length 180 to 600 meters.

EXCEL 180° VARIOCOUPLER



J521 Each 90c
A wonderful value. Produces excellent results. Green silk windings. Rigid mounting support. Primary tapped for fine tuning. ¼ inch shaft. Range 200-600 Meters.
J522 Variometer—same style. Each 90c

SUPERIOR BAKELITE VARIOMETER



J525 Each $3.35
Forms moulded of red bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ¼ inch shaft. Noiseless pigtail connections. Produces superior results in any type circuit 180 to 650 meters.
J527 Variocoupler. Same style. Primary tapped for fine tuning. Each.....$3.68

SUPERIOR VARIOCOUPLER



J523 Each $3.35
Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest effieiency. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.
J526 Special type for single circuit Regenerative Hook up. Each.....$3 75

SPLIT STATOR VARIOMETER



J524 Each $3.65
A wonderful value at our price. Polished black bakelite rotor and stator forms. Large size green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Split stator winding.

PFANSTIEHL SPIDER WEB VARIOMETER AND VARIOCOUPLER



J406 Variometer, Each.$3.95
J407 Variocoupler. Ea.. 4.15
Sharp tuning, high efficiency and responsiveness to distant signals are features of these instruments due to absence of any insulating material in the magnetic field. Low energy loss. Secondary adjustment provides sharp tuning. Panel or table mounting. Complete with dial.

COTO COMPACT VARIOMETER AND VARIOCOUPLER



J408 Variometer. Ea. $4.10
J409 Variocoupler. Ea.... 4.35
Small in size. Highly efficient. Unequaled for portable sets. Variometer measures 2⅞x1⅞x3¾ inches. Variocoupler 2⅞x3x3¾. Moulded bakelite forms. Silk covered windings. Table or panel mounting. ¼ inch shafts. Range 200 to 600 meters.

SWITCH LEVERS



Very neat polished composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch. 1¼ inch radius.
J381 With black knob. Ea.14c
J382 With mahogany knob. Each.....18c

INDUCTANCE SWITCH

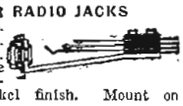


J285 Price including knob and dial $1.18
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 12 switch points, any number of which may be used.

SPIDER WEB COILS

J290— 25 turn 39c J292—50 turn 47c
J291— 35 turn 42c J293—75 turn 54c
J294—100 turn. Each 68c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with mounting strips.

SUPERIOR RADIO JACKS



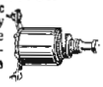
Finest grade jacks.
Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
J390 Open circuit. Each 32c
J391 Closed circuit. Each 39c
J392 Two circuit. Each 49c
J393 Single circuit filament control...46c
J394 Two circuit filament control....59c

RADIO SWITCH



J287 Each 25c
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

SUPERIOR RADIO SWITCH



J283 Each 25c
A switch fully equal to any on the market at a price about half what is usually asked for a switch of anywhere near equal quality.

NEW STYLE JACKS



J379 Single circuit. Each...24c
J380 Double circuit. Each...49c
Occupy less space than other jacks. Binding posts, soldering unnecessary. Well made, durable smooth working. Well insulated.

CORO TIP JACKS



J389 Pair 20c
Eliminates expensive jacks and plugs. Mount on panel and insert headset or loud speaker cord tips. Nickel finish.

JACK SWITCHES



J280 Two springs. Usually used as "A" battery switch. Each 47c
J281 Three springs. For switching from long to short wave, from one battery to another, etc. Each 55c



INDUCTANCE COILS (Honeycomb)



Carefully made—fine looking coils. Low resistance—high self inductance. Very firm impregnation. Mounted coils have standard plug mountings. Specify when ordering whether mounted or unmounted type is wanted.

Tns	Art No.	Not Mtd	Mtd	Tns	Art No.	Not Mtd	Mtd
25	J301	$.28	$.75	200	J307	$.66	$1.20
35	J302	.30	.90	500	J311	1.06	1.57
50	J303	.32	.96	1000	J314	1.64	2.18
75	J304	.37	1.02	1250	J315	1.86	2.35
100	J305	.52	1.07	1500	J316	2.10	2.50

INDUCTANCE COIL MOUNTINGS

J340 3 Coil..$2.75 J341 2 Coil..$2.35
Made of polished black bakelite. Mount on front of panel.
J342 Mounts back of panel, with knobs or dials on front of panel. Takes 3 coils of any size. Each $3.25

MAGNET WIRE

Prices quoted are for 8 oz. spools unless otherwise stated. Prices are prepaid.

Double Cotton White	Enameled	Wire Size	Single Silk Green	Double Silk Green
J990	J992		J991	J993
30c	31c	18	54c	75c
43c	35c	20	60c	82c
49c	39c	22	70c	95c
57c	45c	24	85c	$1.05
70c	50c	26	95c	1.30
95c	55c	28	$1.15	1.60
$1.15	60c	30	4oz. .80	4oz. 1.10
1.49	65c	32	4oz. .95	4oz. 1.30
	85c	36	4oz. 1.95	4oz. 2.60

BAKELITE TUBING

Genuine bakelite tubing. Pieces 3 inches long only.
J985 Inside dia. 2½ in..29c
J986 Inside dia. 3 in....35c
J987 Inside dia. 3½ in.....38c
J988 Inside dia. 4 in. 43c

GALENA DETECTOR



Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish.
J732 Each 59c

FRESHMAN DETECTOR



J760 Each $1.10
A double adjustable crystal detector especially suitable for reflex and other sets requiring a high grade detector. For front or back of panel mounting.

DETECTOR CRYSTALS

J736 Galena, Arlington tested, piece 19c
J738 Silicon, Arlington tested, piece 19c
J735 Tested Galena, Mounted, piece 9c
J737 Tested Silicon, per piece..... 9c
J746 Dutec Crystal. Each 27c

STANDARD BRAND FIXED CRYSTAL DETECTORS

The latest developments in Crystal Detectors. Used in Reflex circuits.
J742 Grewol Detector. Each $1.10
J747 RW Detector 1.15
J749 Brownlie Detector 1.79
J750 Brownlie Renewal ..... .69

DUBILIER MICADON TYPE 601

J502 .0001...28c J507 .0025..32c
J503 .00025..28c J508 .003...40c
J504 .0005...28c J509 .001...40c
J505 .001....32c J510 .005...48c
J506 .002....32c J511 .006...57c

DUBILIER MICADON 601G

Same style condenser as above with mounting for tubular grid leak. No grid leak included.
J581 .00025. Ea. 36c
J582 .0005. Ea. 36c

DUBILIER MICADON 601T

Consists of a Type 601 condenser with brackets designed to fit over terminals on audio frequency transformers, binding posts, etc.
J583 .001 mfd..40c
J584 .002 mfd..40c J585 .0025 mfd..40c

PANEL MOUNTING VARIABLE CONDENSERS



These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Dial and knob on vernier type. No dial on plain type. Our low prices save you money.

No. Plates	Max. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
3		J815	$.58		
5		J816	.97		
11	.00025	J814	1.13	J825	$1.95
17	.00035	J817	1.20		
23	.0005	J813	1.27	J824	2.30
43	.001	J812	1.40	J826	2.45

LOW LOSS VARIABLE CONDENSERS

The latest type condensers. Reduce current losses increasing efficiency of set. Heavy aluminum plates. Vernier type has single vernier plate controlled by lever. ¼ inch shaft. 3 inch dial required for vernier type.



No. Plates	Max. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
11	.00025	J836	$1.90	J833	$2.18
23	.0005	J837	2.12	J834	2.90
43	.001	J838	2.90	J835	3.85

GROUNDED ROTOR LOW LOSS VARIABLE CONDENSERS



J797 .0003 .....$2.74
J798 .0005 ..... 3.30
J799 .001 ..... 3.90
The most efficient type condenser made. Low losses, grounded rotor, straight wave line. Made of the best grade materials throughout. Heavy aluminum plates. Well insulated.

STANDARD BRANO VARIABLE CONDENSERS

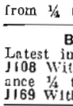
J810 Acme .0005 Vernier $5.65
J784 Coto .00025 Vernier 3.90
J785 Coto .0005 Vernier 4.18
J786 Coto .001 Vernier 4.98
J820 Remler .00035 ..... 4.45
J821 Remler .0005 ..... 4.45
J787 Cardwell .00025 ..... 3.95
J788 Cardwell .00035 ..... 4.35
J789 Cardwell .0005 ..... 4.60
J790 Cardwell .001 ..... 5.55
J791 Marco .00025 ..... 3.95
J792 Marco .00035 ..... 4.45
J793 Marco .0005 ..... 4.95
J794 Marco .001 ..... 5.85
J795 Flewelling .00025 Vernier 5.40
J796 Flewelling .0005 Vernier 6.30

FRESHMAN VARIABLE GRID LEAKS



J177 Back of panel style 47c
J178 Back of panel style with .00025 Condenser....69c
J171 Base mounting type with .00025 Condenser....69c

C R L VARIABLE GRID LEAK



J173 Without condenser but arranged to take any standard grid condenser $1.05
J175 With .00025 condenser 1.35
Turning knob varies resistance from ¼ to 8 megohms.

BRADLEYLEAK



Latest improved type.
J108 Without condenser, Resistance ¼ to 10 megohms ..$1.74
J169 With .00025 condenser 1.95

TUBULAR GRID LEAKS AND CONDENSERS



Cut shows leak or condenser mounted, but all parts are priced separately.
J849 Grid leaks (can be used with Dubilier 601G condensers) 10c
Resistances ½, 1, 1½, 2, 3, 5, 7 and 10 megohms. Specify resistance.
J831 Grid and Plate Condensers. Ea...29c
Capacities .000025, .0001, .00025, .0005. Specify capacity.
Mountings—Bakelite Base
J840 Single. Each 15c
J842 Double. Each 27c
J844 Triple. Each 39c

TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.
J957 Round. Ten feet for.....10c
J958 Square. Ten feet for.....11c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.
J955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for.....14c
J956 Best quality braid and covered with black insulating compound. 3 feet for..8c

The Barawik Co.

102 So. Canal St. Chicago, Ill.

With Barawik Standard Radio Goods

BARAWIK — SERVICE

We have many thousands of customers all over the world. You take no risk in dealing with us. We are one of the oldest and most reliable radio supply houses. "Radio News" guarantees our reliability. Let us serve you and save money for you. All orders shipped same day received.

VACUUM TUBES

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

J105 Detector, UV200, C300. Each $3.59
J112 Amplifier, UV201A, C301A. Each 3.59
J118 5-Watt Transmitter. 7.70
J107 WD11, C11. Each.. 3.59
J101 WD12, C12. Each.. 3.59
J102 UV199, C299. Each. 3.59

ADAPTERS

To use dry cell tubes in standard base sockets simply insert one of these adapters in the socket.

J104 For 199 or 299 tubes....35c
J109 For WD11 or C11 tubes 35c

BAKELITE SOCKET

J140 Standard base...27c
J141 UV199 base.....27c
J136 C11 .....27c

Moulded of genuine red brown bakelite. Binding post connections. Strong contacts. Real values.

EXTRA STRONG SOCKET

J142 Standard base 38c
J138 C299 Base 38c

Extra heavy. Square base. Double reinforced contact springs. For standard base tubes. A wonderful value.

PANEL MOUNT SOCKET

J143 Single Gang .....$.42
J144 Three Gang 1.39

The best socket value obtainable anywhere. Extra heavy, moulded, genuine brown bakelite. Double reinforced contact springs. Will mount on panel behind rheostat. Standard base.

METAL TUBE SOCKET

J134 Each 25c

Nickel plated brass tube set in best grade composition base. Plainly marked binding posts. An excellent value.

STANDARD TUBE SOCKET

J150 Single Gang...$.76
J153 Three Gang ...2.25

Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

CUSHION BASE SOCKET

J145 199 Base 59c
J146 Standard Base 75c

Moulded of high insulating material. Spongo rubber base. Non microphonic. Plainly marked binding post connections. Neat and compact.

BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.

J370 Large size — barrel and knob ¾ in. long. Dozen ...70c
J372 Smaller size barrel and knob 9-16" long. Dz. 50c
J376 Large size with hole for phone tip or wire. Dozen ...80c
J378 Small size with hole for phone tip or wire Dozen 35c

LETTERED BINDING POSTS

J375 Set of eight ...39c

Nickel plated washers. Composition tops lettered as shown in illustration. Eliminate engraving. Improve appearance. Sold in sets of eight only.

COMPOSITION TOP BINDING POSTS

J374 Dozen 45c Hundred $3.00

Composition top, nickel plated body. 5/32 screw with washer.

SWITCH CONTACT POINTS

Brass polished nickel finish. Have ⅝ in. long size 6/32 screws and two nuts.

J363 Dozen....10c Hundred....75c Thousand $6 75

Solder Lugs to Fit Contact Points Also for connecting wires to binding posts, etc.

J365 Dozen...8c Hundred...30c

SWITCH LEVER STOP

Brass polished nickel finish.

J386 Dozen...15c Hundred...$1.05

BRASS ROD

J961 Threaded 6-32, per 8 in. length..6c
J963 Threaded 8-32, per 8 in. length..8c
J965 Solid 3-16 in., per 8 in. length..6c
J967 Solid ¼ in., per 8 in. length....9c

COPPER FOIL

J968 Per piece 25c

Thin copper foil for shielding panels. 6 inches wide, 2 feet long, .005 in. thick.

SUPERIOR RHEOSTATS

J147 6 ohm. Each.....60c
J148 20 ohm. Each.....65c
J149 30 ohm. Each.....70c

One of the finest rheostats we have ever seen at a price that makes it the best value obtainable anywhere. Genuine bakelite base. Beautifully shaped black bakelite knob with white arrow. Single hole mounting. A rheostat you will be proud to have in your set.

J156 400 ohm Potentiometer. Matches above rheostats. Each 89c

FILAMENT CONTROL RHEOSTATS

J132 6 ohm. Each....32c
J129 20 ohm. Each....35c
J131 30 ohm. Each....38c
J135 6 ohm Vernier ..78c

Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛ in. Tapered polished black knob 1¼" diam. Potentiometers. Match above rheostats. Same high grade construction.

J151 200 ohm. Ea.50c J152 400 ohm. Ea.58c

OUR SPECIAL A. F. TRANSFORMER

J549 3 to 1 ratio..$2.25
J550 5 to 1 ratio.. 2.45

In quality of tone and volume of sound, these things a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

TRICOIL R. F. TRANSFORMER

J560 For 201A or 301A Tubes $1.58

J561 For 199 or 11 or 12 Tubes 1.58

This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters.

Super-fine Radio Parts

ALL-AMERICAN

All-American products are known the world over for their high quality. Every item is fully guaranteed to give satisfactory service.

AUDIO FREQUENCY TYPE

J626 Super Het. Oscillator Coupler $5.00

J627 Input transformer $5.40

J628 Universal Coupler. For use in reflex and other circuits $3.60

J625 Intermediate frequency transferoer for super heterodyne circuits $5.40

J531 10 to 1. Each $4.25
J532 5 to 1. Each $4.25
J533 3 to 1. Each $4.05
J534 Push Pull. Pair $10.80

Rauland Lyric. A transformer designed to reproduce music and voice with all its original purity of tone. J535 Ea....$8.10

J629 Short wave R. F. transformer, range 250 to 550 meters. For 201A tubes $4.50 J630 For 199 tubes only $4.50

HOWARD RHEOSTATS

A well known line of rheostats and potentiometers that is giving very satisfactory service to its users. Complete with knob and pointer.

J211 Plain 85c 6 ohm
J213 Plain 85c 25 ohm
J215 Plain 85c 40 ohm
J218 400 ohm Potentiometer 1.69
J212 Vernier $1.25
J214 Vernier 1.25
J216 Vernier 1.25

Single Hole Mounting Type with Dial

J350 Plain 85c 6 ohm
J352 Plain 85c 25 ohm
J354 Plain 85c 40 ohm
J357 400 ohm Potentiometer 1.69
J351 Vernier $1.25
J353 Vernier 1.25
J355 Vernier 1.25

BRADLEYSTAT and BRADLEYOMETER

J208 Bradleystat. Each $1.74

Latest improved type. Can be used with all types of tubes.

Bradleyometer

J209 200 ohm. Each.....$1.89
J210 400 ohm. Each..... 2.89

ACME POT-RHEO.

A rheostat and potentiometer combined in one unit. Does the work of two separate instruments. 300 ohm potentiometer.

J237 With 6 ohm rheostat.....$2.69
J238 With 30 ohm rheostat..... 2.69

AMPERITES

Eliminates rheostats on amplifier tubes where adjustment is not critical. Automatically adjust resistance according to flow of current, keeping tubes at proper point for maximum efficiency. Complete with mounting.

J221 For UV201A or 301A tubes.....95c
J222 For UV200 or C300 tubes.....95c
J223 For UV199 or C299 tubes.....95c
J224 For WD11 or C11 tubes.....95c
J599 Erla Selectoformer $3 95
J740 Erla Crystal Detector ..... .89

OTHER STANDARD BRAND AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers.

J587 Thordarson Ratio 3½ to 1....$3.30
J588 Thordarson Ratio 6 to 1..... 3.70
J589 Thordarson Ratio 2 to 1..... 3.95
J590 Thordarson Push Pull. Pair..11.20
J553 Acme 3.95
J597 Erla 6 to 1..... 4.45
J598 Erla 3½ to 1..... 4.45
J591 Modern 10 to 1. Each..... 4.50
J592 Modern Push Pull. Pair..... 9.90
J555 Federal No. 226. Each..... 4.45
J556 Federal No. 65. Each..... 6.35
J712 Radio Corp. Each 5.70

STANDARD BRAND RADIO FREQUENCY TRANSFORMERS

J562 Dubilier Duratran $3.45
J565 Acme R2 ..... 3.95
J566 Acme R3 ..... 3.95
J567 Acme R4 ..... 3.95
J568 Erla Reflex No. 1..... 4.45
J579 Erla Reflex No. 2..... 4.45

RESISTANCE COUPLED AMPLIFICATION

J570 1st Stage Unit $2.30
J571 2nd Stage Unit 2.30
J572 3rd Stage Unit 2.30

Amplifies without distortion. Replaces audio frequency transformers using same circuit. Each unit consists of a mounting with condenser, grid leak and resistance of proper value for best results.

INSULATED BUS BAR WIRE

J959 Package of 5 30-inch pieces....49c

Tinned copper bus wire insulated with highest grade varnished covering. 5 pieces, one each color—yellow, brown, black, green and red. Using different colors makes tracing of circuits easy and sure, neater and lower cost.

SCREW ASSORTMENT

J960 100 pieces screws and nuts.....39c

Contains screws and nuts of size and style needed for assembling any radio set.

RADIO "BAKELITE" PANELS

We supply genuine Bakelite, Condensite Celeron or Formica, all of which have practically identical properties. Machines well without chipping. Won't warp. Waterproof. One side has attractive natural polished black finish which can be sanded and oiled. Other side mahogany finish. Either side may be used as front.

Panel Size Inches	⅛" thick Art. No.	Price	3/16"thick Art. No.	Price	¼"thick Art. No.	Price
6x 7	J450	$.55	J460	$.89	J470	$1.15
6x10½	J451	.86	J461	1.10	J471	1.60
7x10	J455	1.28				
7x12	J456	1.64				
7x14	J458	1.38	J468	1.73	J478	2.35
7x18	J453	1.78	J463	2.27	J473	3.15
7x21	J457	2.05	J467	2.65	J477	4.10
7x24	J459	2.42	J469	2.97		
7x26			J462	3.25		
9x14			J464	2 35	J474	3.15
12x14			J465	2.97	J475	3.98
12x21			J466	4.25	J476	5.70

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 Inches	Black Art. No.	Price	Mahogany Art. No.	Price
7x10	J481	$ .60	J493	$ .75
7x12	J482	.77	J494	.92
7x14	J483	.89	J495	1.09
7x18	J484	1.19	J496	1.34
7x21	J485	1.32	J497	1.55
7x24	J486	1.50	J498	1.75

COMPOSITION DIALS

Handsome dials moulded in one piece of polished composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 4 inch size have 180° scale marked 0 to 100.

No.	Black Price	Diam	Shaft Size	Mahogany No.	Price
J921	16c	2"	3/16	J926	19c
J922	16c	2"	1/4	J927	19c
J923	22c	3"	3/16	J928	26c
J924	22c	3"	1/4	J929	26c
J925	27c	4"	1/4	J930	32c

GENUINE BAKELITE DIALS

J931 2 in. Diam. for 3-16 in. shaft..35c
J932 2 in. Diam. for ¼ in. shaft. 35c
J933 3 in. Diam. for 3-16 in. shaft..38c
J934 3 in. Diam. for ¼ in. shaft....39c
J935 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. Match perfectly.

VERNIER DIAL ADJUSTER

J941 Each 14c

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

SUPERIOR VERNIER ADJUSTER

J942 Each 26c

Polished black knob. "Vernier" engraved in white. Spring adjustment. Need not be disassembled for mounting. Easily installed.

UNIVERNIER CONTROL DIAL

J918 For 3/16 in. shaft, silver dial, black knob $1.10
J919 For ¼ in. shaft, silver dial, black knob $1.10
J916 Gold dial, mahogany knob for ¼ in. shaft. Each.....$1.29

Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neutrodyne sets.

ACCURATUNE CONTROL DIAL

J914 Clockwise ..$3.20
J915 Counterclockwise 3.20

Has four inch silver finished dial with black knob. 80 to 1 ratio give finest tuning adjustment.

BEZELS

Finest quality. Fit any thickness panel.

Size In.	Nickel No.	Price	Black No.	Price	Gold No.	Price
¾	J904	15c	J907	16c	J910	28c
1	J905	15c	J908	16c	J911	28c
1½	J906	15c	J909	16c	J912	28c

PANEL ENGRAVINGS

J937 Per set 19c

A complete set of transfers in neat white lettering for marking connections, dials, etc. Easily applied in a few seconds. Look like real machine engravings, contrasts neatly on black or mahogany panels. Plenty of titles for the largest set.

The Barawik Co.
102 So. Canal St. Chicago, Ill.

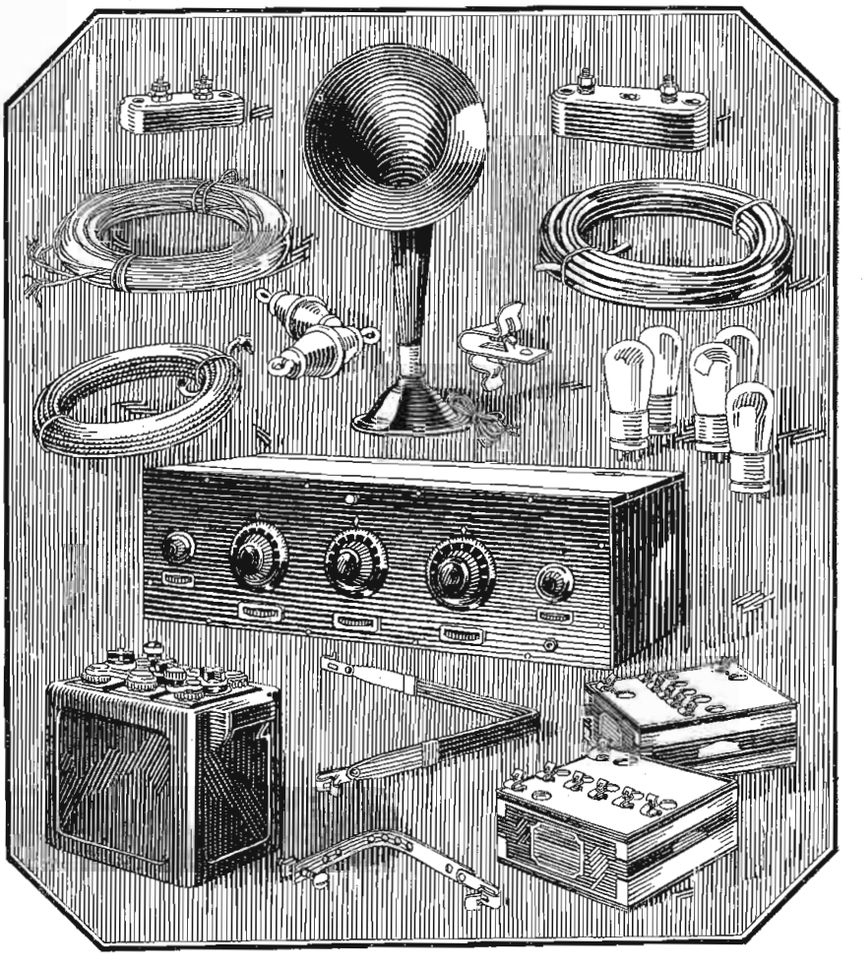
Which would

This →

"WITHOUT ACCESSORIES"

Radio instrument	*Loud speaker*	*Ground clamp*
Antenna wire	*Window lead in*	*Antenna spring*
Connection wires	*Mechanic's labor*	*Hammer*
Clips	*Storage battery*	*Nails*
Lightning arrester	*"B" batteries*	*Screws*
Insulators	*Tubes*	*Staples*
	Your time	

Separate price for each of these items.



What "complete self-contained"

IT is the best of fun, we admit, to hook up a radio set, to string your antenna from tree to house, to connect your ground wire—at least it is fun if you are mechanically minded.

If, however, you want principally to *use* a radio set there are two things of primary importance—*first*, that its tone quality shall be absolutely pure, non-metallic and accurate; *secondly*, that it shall be as little fuss and bother to you as is humanly possible. This means De Forest D-12 Radiophone—the leader in the field—bearing the imprint of Dr. Lee De Forest, the man whose great invention paved the way to radio broadcasting.

As to tone—it is impossible to describe the clean and natural tone quality which this instrument gives. You simply must hear it and judge

DE FOREST RADIOPHONE

REG. U.S. PAT. OFF. REG. U.S. PAT. OFF.

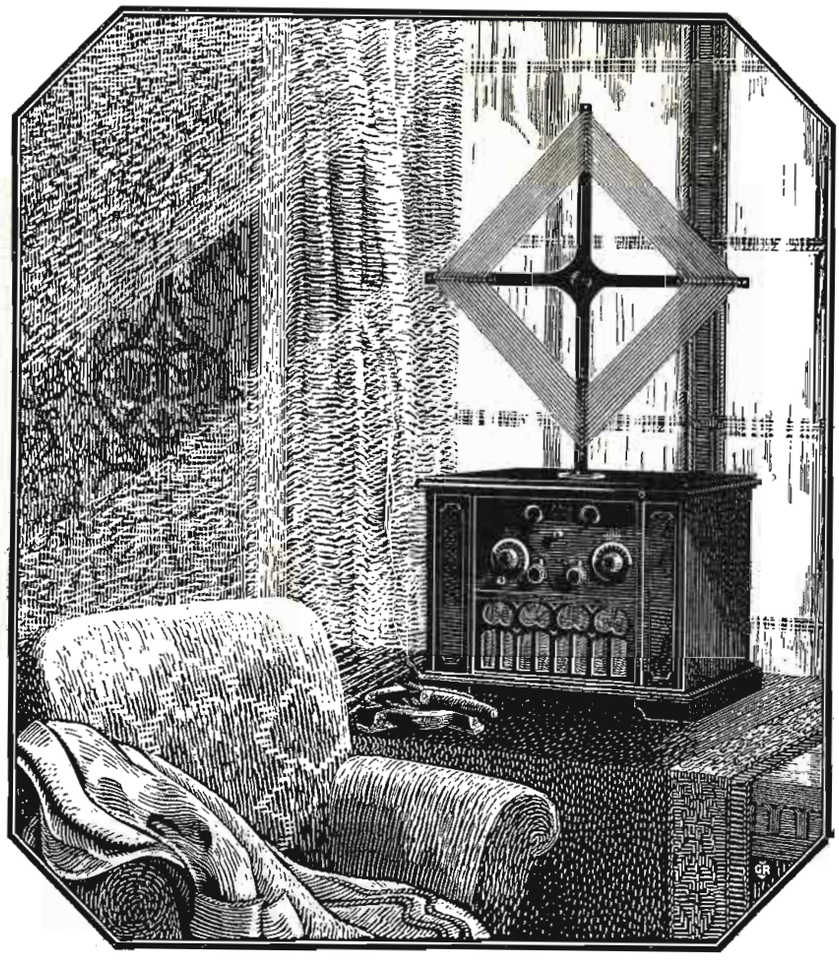
you choose?

DE FOREST D-12 RADIOPHONE
Complete in one unit, with everything necessary to use it immediately — all at the one initial cost.
Prices according to cabinet finish and batteries.

With dry batteries
In Fabrikoid cabinet $161.20
In Mahogany cabinet 176.20

With storage batteries
In Fabrikoid cabinet $180.00
In Mahogany cabinet 195.00

← *or this*



means as in De Forest

for yourself. And as for convenience, remember these important things: it is self-contained and complete in one unit—usable within five minutes after it enters your home—easily movable from room to room because it does not need to be attached to either antenna or ground.

When you find the De Forest agent in your vicinity you find a man who knows radio—a man who has given us his word that he will see that every instrument he sells is thoroughly inspected and properly serviced after the sale.

Avail yourself of his help. He desires, as we do, that you should get the fullest enjoyment and satisfaction from your instrument.

DE FOREST RADIO COMPANY, JERSEY CITY, N. J.

Also makers of De Forest Tubes, The "Magic Lamp" of Radio

DE FOREST RADIOPHONE

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Build the Neutro-Reflex

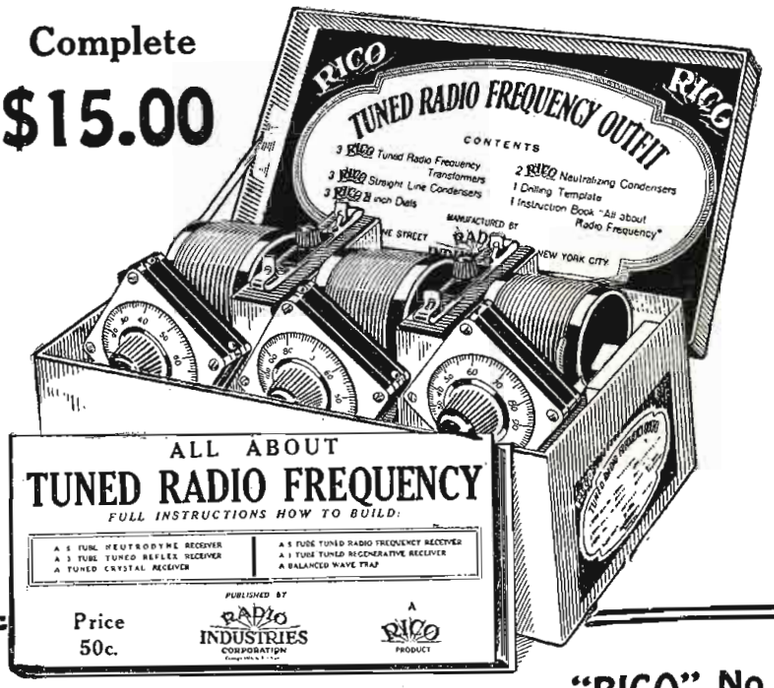
The Wonder Circuit

The new Neutro-Reflex circuit makes three tubes do the work of five. Why build a neutrodyne when the Neutro-Reflex does the same work on practically half the number of tubes?

A complete kit for building the Neutro-Reflex is shown here. With this kit comes a complete instruction booklet. It describes every step in the construction of this marvelous circuit. You can't go wrong if you follow this instruction book.

Complete

$15.00



This circuit gets the results on local stations, brings in distance that is surprising, and gives the same volume as the neutrodyne. It is a distinct advance in radio receiving set construction.

By means of this Tuned Radio Frequency outfit you can also build the following: A five tube Neutrodyne receiver; a tuned crystal receiver; a five tube Radio Frequency receiver; a one tube Regenerative receiver; a balanced wave trap.

FREE We will send you the booklet "All About Tuned Radio Frequency" free of charge on receipt of a post-card from you.
If your dealer cannot supply you use the coupon below

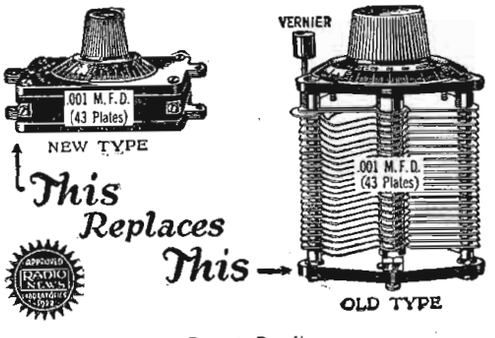
Styles with Capacities

No. 450 Rico Condenser .001 m f d. (43 Plate Capacity)
$1.75

No. 423 Rico Condenser .0005 m f d. (23 Plate Capacity)
$1.75

No. 411 Rico Condenser .00025 mfd. (11 Plate Capacity)
$1.75

All above without dial
$1.50



Patents Pending

This condenser marks a revolution in condenser building. It is the simplest and most practical type of condenser as yet developed for broadcast and amateur work. This condenser has been developed by our engineers after considerable research work and has been pronounced perfect by experts.

"RICO" No. 6 Head Set



$2.95

Patents Pending

Money Can't Buy Better

IF YOUR DEALER CANNOT SUPPLY YOU USE THE COUPON BELOW

Radio Industries Corp., RN1
133 Duane Street, N. Y. City.

Gentlemen:

As my dealer cannot supply me, kindly ship me the following material for which I will pay postman on delivery.

.....

Name .....

Address .....City.....State.....

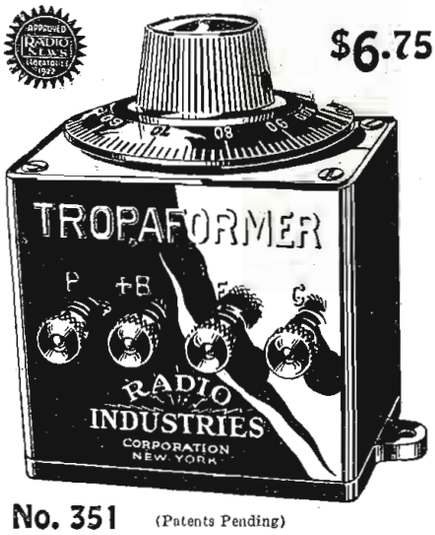
RADIO INDUSTRIES CORPORATION

133 Duane Street New York City

TROPAFORMER

Build Your Own Super with the Only Transformer You Can Tune Yourself

It Stays Tuned



No. 351 (Patents Pending)

The TROPAFORMER here illustrated is the only scientific balanced intermediate Super-Heterodyne transformer. It combines transformer and condenser, and enables the transformer to be tuned to the very finest degree. Once tuned it need not be touched again. Built entirely of hard rubber.

This TROPAFORMER does away with exchanging tubes in order to balance the circuit. Each TROPAFORMER is tuned to its tube and vice-versa.

Entirely New Principle

In the August, 1924, issue the Editor of RADIO NEWS has this to say about the TROPADYNE circuit:—

"Here is a remarkable Super-Heterodyne receiver which we warmly recommend to our readers. It has several new and unusual features. In the first place only six tubes are used giving as much volume as the average 8 tube Super-Heterodyne. The selectivity of this set is unusual. Unequalities of the intermediate transformers have now been done away with by tuning each transformer. After the transformer has been tuned it can be left this way, no further tuning being necessary. This system makes for maximum sharpness and maximum volume. Another outstanding point of superiority of the Tropadyne circuit is that it practically does not radiate, thereby not interfering with other nearby receiving stations. Most Super-Heterodyne circuits, as is well known, are powerful radiators."

The inventor, Clyde M. Fitch, has this to say about TROPAFORMERS:—

You can now build a real Super-Heterodyne that not only exceeds them all, but is the only Super-Heterodyne that is *scientifically balanced*. Heretofore when building a Super-Heterodyne you either made or bought the intermediate transformers. These *never* matched as it is impossible to make two windings exactly electrically alike.

While some firms are advertising matched or balanced transformers this is a misleading statement because even though they are initially balanced ever so well, when placed in the circuit they become unbalanced automatically due to inductive effects between transformers, lead wires, etc.

TROPAFORMERS can be scientifically balanced by anyone. Each transformer is equipped with a condenser across its secondary. Once the TROPAFORMERS are tuned they need not be touched again.

The only intermediate transformer for SUPER-HETERODYNE CIRCUITS that you can match yourself

Enables you to match the transformers in your Super Circuit by tuning—and do so to the finest possible point

BUILD THE LATEST TROPADYNE CIRCUIT

No. 350 Kit containing four TROPAFORMERS with shunt condensers, tuner and one oscillator coil. Price complete with booklet giving full directions	$28.75
No. 351 Tropaformer, each	6.75
No. 352 Tropadyne Bakelite Tuner, each	1.25
No. 353 Tropadyne Bakelite Oscillator Coil, each	1.50

ADDITIONAL TECHNICAL INFORMATION GLADLY FURNISHED

IF YOUR DEALER CANNOT SUPPLY YOU USE THE COUPON BELOW

RADIO INDUSTRIES CORPORATION

133 Duane Street New York City

RN1

Radio Industries Corp.,
133 Duane Street, N. Y. City.

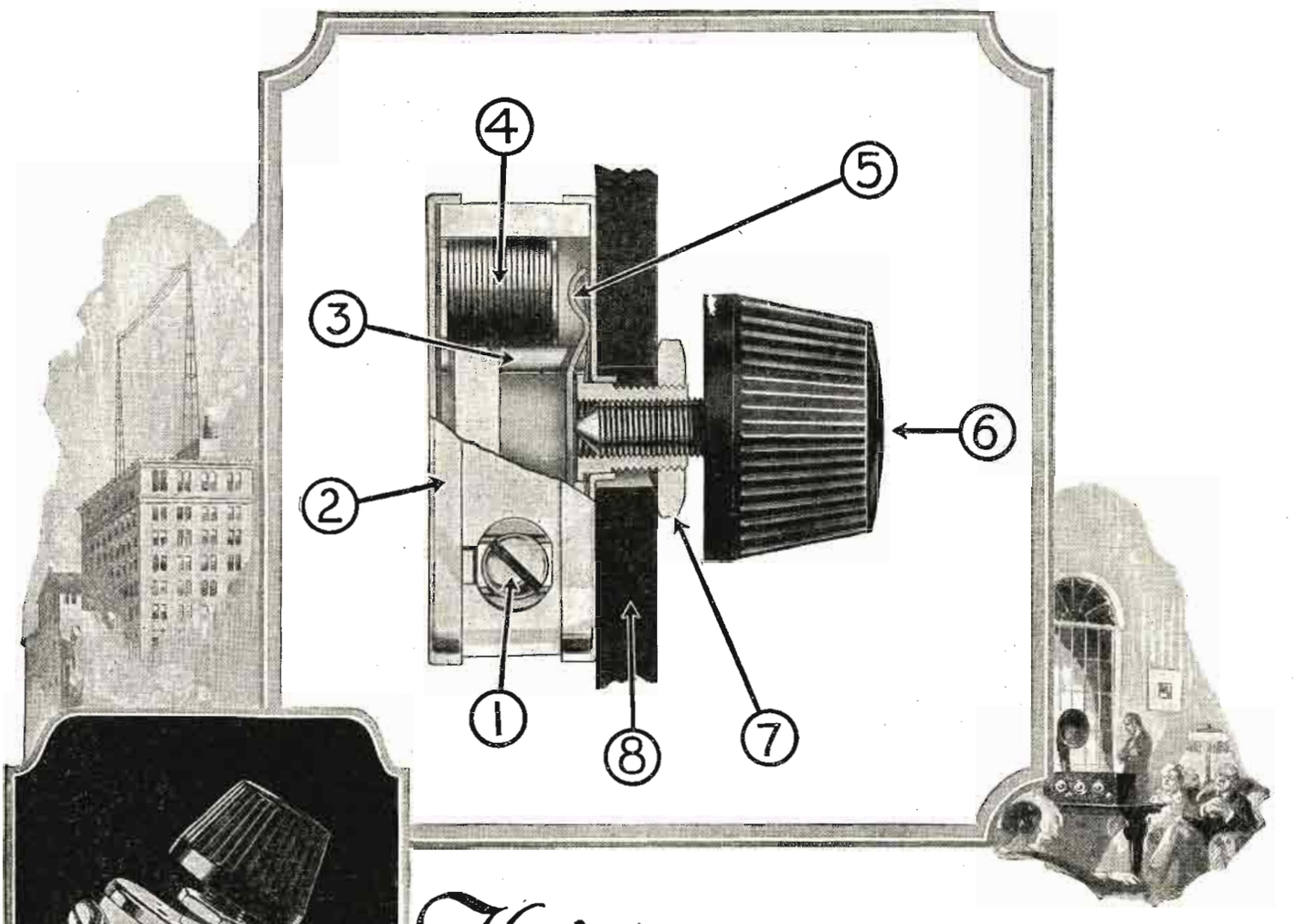
Gentlemen:

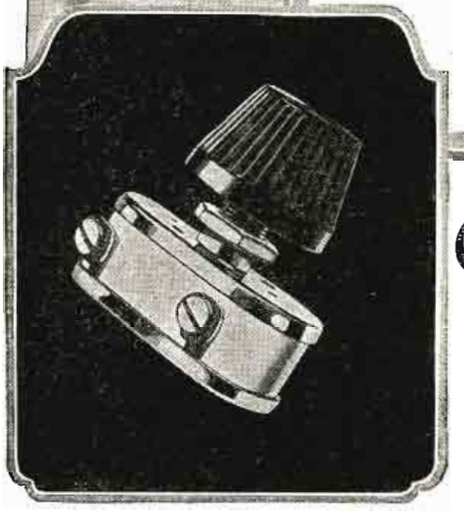
As my dealer cannot supply me, kindly ship me the following material for which I will pay postman on delivery.

.....

Name .....

Address .....City.....State.....





The New Bradleystat

Supreme in design and performance

ASIDE from the novel "one-hole mounting" that characterizes the Allen-Bradley line of radio devices, the most striking new feature is the extreme compactness of the graphite disc container. When mounted on panel, the new Bradleystat extends less than three-quarters of an inch behind the panel. The same is true of the Bradleyleak and the Bradleyohm. And the Bradleyometer extends only seven-eighths of an inch.

You can improve your radio set immensely by substituting a Bradleystat for your present wire rheostat or a Bradleyleak for your old grid leak. There's plenty of room. Try it!

Important Features

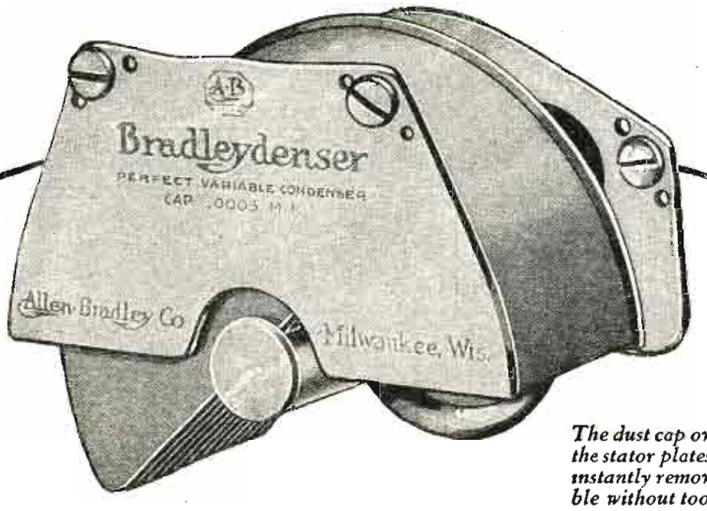
1. Two terminals suffice for ALL Tubes.
2. Back-panel extension is 11/16 inch.
3. Holes for table mounting are provided.
4. Graphite discs give stepless, noiseless control.
5. Internal switch opens battery circuit.
6. One knob provides control from 1/4 to 100 ohms.
7. One locknut holds Bradleystat securely in position.
8. Drill only one hole in panel.

Allen-Bradley Co.

Electric Controlling Apparatus

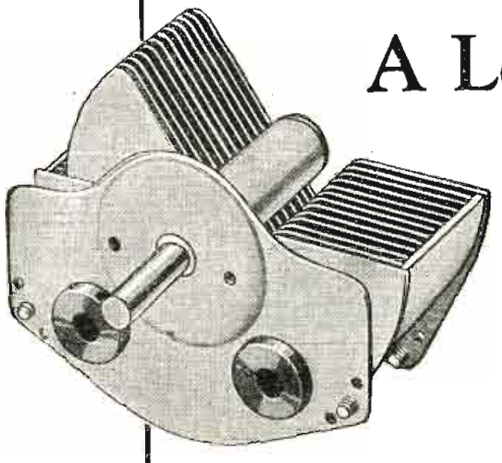
287 Greenfield Ave. Milwaukee, Wis.

Baltimore	Buffalo	Cleveland	Knoxville	Philadelphia	Saint Paul
Birmingham	Chicago	Denver	Los Angeles	Pittsburgh	San Francisco
Boston	Cincinnati	Detroit	New York	Saint Louis	Seattle



The dust cap over the stator plates is instantly removable without tools.

A Low-Loss Condenser for Selective Receivers



All plates are solid brass, carefully soldered at all joints. The Bradleydenser resistance does not increase, even after long use.

THE New Bradleydenser embodies many new and important features that contribute to its high efficiency and low loss. One of the most significant innovations is the omission of the outer end-plate and the substitution of a unique bearing that maintains rigid alignment of the rotor plates without the use of unnecessary insulating or di-electric end-plates. There is almost no di-electric material in the Bradleydenser to absorb energy from the antenna oscillations.

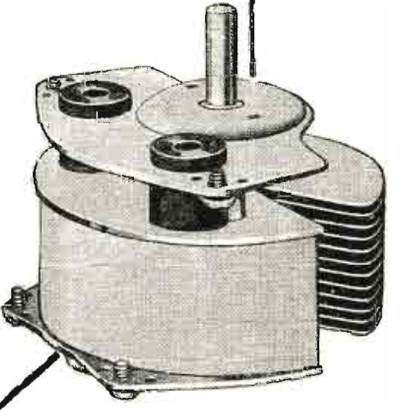
The minimum capacity also is low, affording a wide range of control. This is an important advantage in sets to be operated from loops.

We shall be glad to send you complete information about the Bradleydenser. Drop us a line, to-day!

Standard Ratings and Prices

0.00025 M-F.	$4.50
0.0005 M-F.	5.00
0.001 M-F.	6.00

The Bradleydenser has no vernier plates. The shaft is ¼-in. to fit any standard dial.



Notice the amazing reduction of insulating material to two small spacers. The di-electric loss is, therefore, very low

Allen-Bradley Co.
Electric Controlling Apparatus
287 Greenfield Avenue
Milwaukee, Wisconsin

Sales Offices

Baltimore	Knoxville
Birmingham	Los Angeles
Boston	New York
Buffalo	Philadelphia
Chicago	Pittsburgh
Cincinnati	Saint Louis
Cleveland	Saint Paul
Denver	San Francisco
Detroit	Seattle

Another Allen-Bradley Radio Device of the same perfection and quality as the Universal Bradleystat

"BUILD YOUR OWN" WITH "RASCO" PARTS!

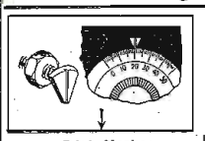
Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. ALL GOODS SENT PREPAID IN 24 HOURS

Order direct from this page.

SPECIAL PRICES FOR THIS MONTH

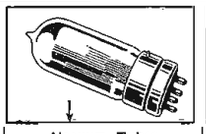
Money refunded if goods do not satisfy



Dial Marker

The big little thing you have been waiting for. Just drill a hole in the panel and mount the marker above the dial. Nickel plated and nolished.

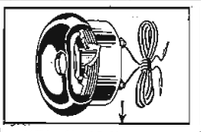
J7788 Dial Marker, each .....$.05



Vacuum Tubes

Only best make tubes carried in stock. Any tube replaced if defective, providing filament lights.

J201A 5 v., .25 amp. $2.50
J199 3 v., .06 amp. 2.50
J12 1½ v., .25 amp. 2.50



"Rico" (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.

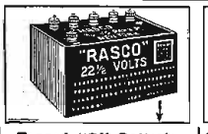
J2525 Speaker with 5 ft. cord $2.65



Cockaday Coil

Guaranteed best make. Three windings of No. 18 Magnet wire. Has brass brackets for panel or base mounting. Satisfaction guaranteed or money back.

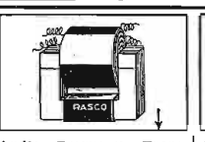
J2750 Cockaday coil $1.50



Tapped "B" Batteries

We positively guarantee these batteries to be of long life. We carry only fresh stocks. All with taps.

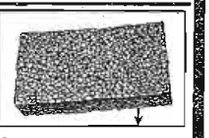
J2250 Sm. 22½ v....$.85
J2251 Medium Navy size, 22½ volt.....1.20
J4500 Medium size, 45 volt 2.30



Audio Frequency Transformer

No better Transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.

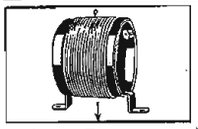
J1100 Ratio 4½-1...$2.00
J1150 Ratio 6½-1... 2.00



Sponge-Rubber Cushions

Get rid of tube noises due to vibration. Softest sponge rubber made. Size 2½"x3", ⅜" thick.

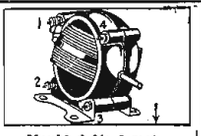
J8989 Sponge-rubber cushions, each .....$.12
Six for 60



Neutro-Transformer

Can be used for all tuned radio frequency circuits. Made for usual broadcast waves. Secondary has one center tap. Two genuine bakelite tubes. Silk wire. Furnished with 2 brackets.

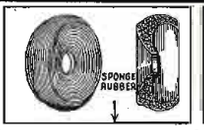
J1159 Transformer, ar $1.65



Moulded Variometer

Highly substantial instrument. Silk windings. ¼" shaft. Bottom flange when placed into 4, 3 direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.

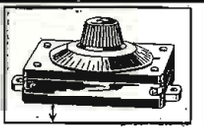
J5350 Variometer...$3.00



FONEKUSHIONS

Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather.

J3550 Fonekushions, set of two .....$.42



Straight Line Condenser

Simplest and most practical type of condenser.

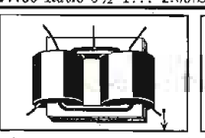
J4430 "Rico" Condenser .001 mfd. 43 plate capacity $1.75
J4230 .0005 mfd. 23 plate capacity $1.75
J4110 .00025 mfd. 11 plate capacity $1.75
All types no dials $1.50



Radio Frequency Transformers

Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type. 200-600 meters.

J2800 Transformer, size 1⅞"x2½" $1.50



NEW!! NEW!!

Push Pull Transformer for many new circuits. See any radio magazine. Made of best materials. Coils impregnated. Silicon steel laminations. Save 50 per cent by assembling yourself. Simple instructions furnished.

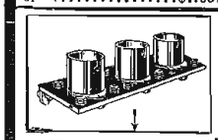
J1159 Push-Pull Transformer, ratio 6½ to 1 $4.00



Dilectryte Panels

Highest dielectric strength as per Bureau of Standards. Beautiful high finish.

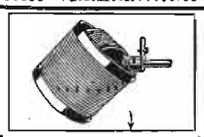
J7100 7x10x3-16"...$.70
J7120 7x12x3-16"... .85
J7140 7x14x3-16"... .95
J7180 7x18x3-16"...1.25
J7210 7x21x3-16"...1.45
J7240 7x24x3-16"...1.65



Three-Gang Socket

Aluminum shells, genuine heavy bakelite base, 3 brackets for mounting, 12 nickel binding posts. Length 7¼".

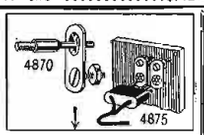
J5995 3 gang socket $1.50



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.

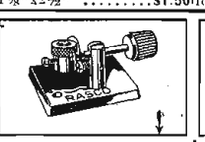
J3100 Variocoupler prepaid $1.50



Jiffy Jacks and Plugs

J4870 shows the best and cheapest cord tip. Mounted behind panel. Positive contact. J4875 shows new Jiffy Cord Plug and two Jiffy Jacks. J4870 Jiffy Jack, nut and screw, ea...$0.05
J4875 Two Jiffy Jacks and One Jiffy Cord Plug .20

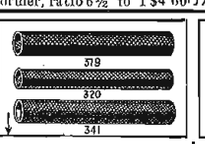
BE SURE TO SEE PAGE 1279 OF "RADIO NEWS" FOR NEW "RASCO" GOODS



Radiocite Detector

Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal. 200,000 in use.

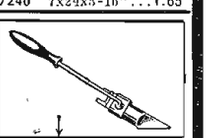
J1899 Detector $0.60
J1898 Galena detector .....$.50



Spaghetti

Varnished flexible cambric tubing. 319 takes No. 22 wire; 320 takes 18 to 20 wire; 321 takes 16 to 18 wire; 341 takes 22 to 28 wire.

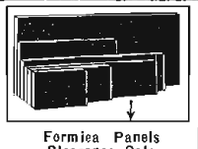
J319-320-321 Per ft. $.06
J341 Flexible soft rubber tubing; 10 feet for..$.20



Soldering Iron

Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.

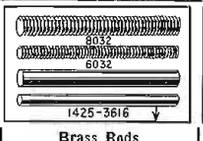
J2200 Soldering Iron $1.45



Formica Panels Clearance Sale

As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.

J352 9x12" each ...$1.75
J354 6½x19½" ea. 1.90
J356 6x14" each.... 1.60
J357 6x4" each..... .65



Brass Rods

Sold in 6" lengths only.

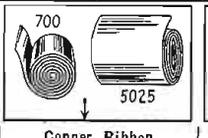
J8032 Rod, 8-32" thread length .....$.08
J6032 Rod, 6-32" thread length .....$.06
J1425 Rod, plain ¼" round, length .....$.10
J3616 Rod, plain 3-16" round, length .....$.06



Litz Wire

Prices are per foot. E= equals.

J823 E No. 25 B&S $.02
J890 E No. 28 B&S .01
J891 E No. 21 B&S .03
J892 E No. 20 B&S .04
10 per cent discount in 100 foot lots.



Copper Ribbon

.005" thick.
J700 ⅜" wide; J701 ¼" wide; J702 3-16" wide. All sizes per foot...$.01

Copper Foil

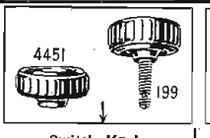
.001" thick. 4" wide.
J5025 Copper Foil, per foot .....$.10
10-foot length ..... .80



Tin Foil

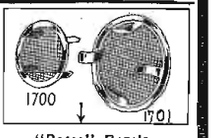
All our tin foils come 4" wide. Uniform product throughout.

Best grade only J850 has 1500 sq. inches per lb.
J851 700 sq. inches to lb.
J850 Tin foil .....lb. $.48
J851 Tin foil ...lb. .48



Switch Knob

J199 Knob, 1⅛" dia., height ⅝"; 8-32" screw.
J4451 Has 8-32" or 10-32" bushing, no screw.
J199 Knob .....$.10
J4451 Knob ..... .06



"Rasco" Bezels

Finest Bezel on the market. Bezel comes entirely nickel plated. Can be used on ⅛ or 3-16" panel.

J1700 Rasco Bezel, 1 inch .....$.15
J1701 Bezel, 1½" diam. ..... .20



Mounted Crystal-Cup

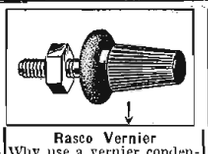
Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.

J318 Nickel Cup ...$.20

Radiocite

Best most sensitive mounted crystal. U. S. Navy using it. Each tested.

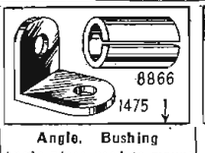
J317 Radiocite Crystal .....$.25



Rasco Vernier

Why use a vernier condenser when a vernier attachment will do anything and everything a vernier condenser accomplishes? Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Nothing to come apart.

J1450 Vernier .....$.18



Angle Bushing

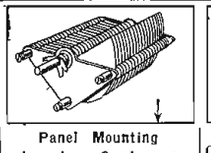
Angle piece used to mount panels, etc. 1,000 uses. 5-16" wide, height 7-16".

J1475 Angle piece, Each .....$.03

Adapter Bushing

Makes ¼" dial fit 3-16" shaft. ½" long.

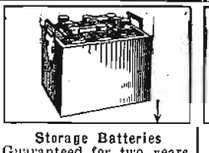
J8866 Bushing .....$.01



Panel Mounting Low Loss Condensers

Positively no better condenser on the market. Shafts ¼". Save from 40 to 60 percent by assembling condenser yourself.

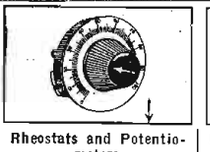
J1111 11 Plate $1.10
J2121 21 Plate ... 1.22
J4343 43 Plate ... 1.33



Storage Batteries

Guaranteed for two years. Only NEW material used. Acid proof terminals. Patent vents.

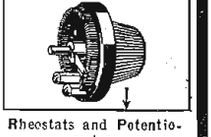
J2400 Two volt, 40 amp. hours $3.90
J640 Six volt, 40 amp. hours 7.25
J666 Six volt, 60 amp. hours 9.50
Shipped express collect.



Rheostats and Potentiometers

Come with metal dials and composition knob. Excellent merchandise despite low price.

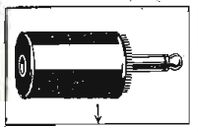
J4210 6 ohm Rheo...$.27
J4211 30 ohm Rheo... .30
J4212 200 ohm Potentiometer ..... .45



Rheostats and Potentiometers

High heat dielectric base. Come with tapered, knurled knob, 2½" dia. Compleo with pointer.

J4310 6 ohm .....$.38
J4311 30 ohm ..... .44
J4312 Potentiometer, 200 ohms ..... .65



Phone Plugs

Sold from 75c to $1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship throughout.

J1030 Rasco Telephone Plug. Each .....$.35



Bakelite Socket

Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.

J6510 Bakelite socket $.40
J6500 Tube Socket. Made entirely of composition. Best made. Each ....$.35



Condensers

Best made, paper-impregnated condensers. Capacity guaranteed.

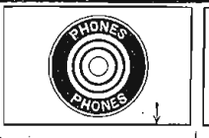
J5050 Phone Condenser, .001 .....$.20
J5056 Grid Condenser, .00025 .....$.20
J5059 Grid Leak Condenser, .00025.....$.30



Name Plates

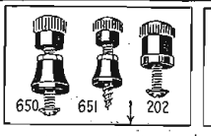
All name plates brass with silver letters.

J8389 (Right or left) $.10
J809 Comes in 35 styles. Any denomination, each style .....$.04
Panel Scale. 2½". 90° metal, silver background, black lettering.
J715 Scale. Each.....$.15
J6000 Name Plates, all styles, each .....$.03



Binding Post Name Plates

Dia. ¾". These styles: Phones, Ground, —, Output, "A" Bat. —, "B" Bat. —, Loud Speaker, "C" Bat. —, Aerial, +, Input, "A" Bat. +; "B" Bat. +, Loop "C" Bat. +, New! "A" Bat. +, "B" Bat. —



"Rasco" Posts

Made of black composition.

J650-51 Each .....$.08
J202 Has nickel-plated bottom, each .....$.08
Dozen, each style....$.90
J122 Initialed Binding Posts. Six popular styles. Each .....$.06

Cord Tips

Standard phone cord tips, nickeled.

J315 Each.....$.03

Separable Cord Tips

No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.

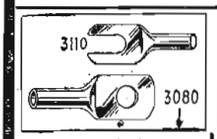
J2900 Each.....$.06

RADIO SPECIALTY COMPANY, 98 Park Place, New York City

Factories: Brooklyn, N. Y. Elkridge, Md.

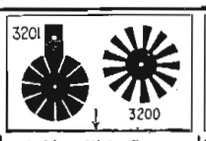
"BUILD YOUR OWN" WITH "RASCO" PARTS!

Lowest Prices in America



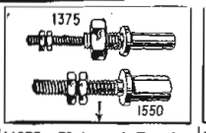
"Perfect" Lugs

These new and improved lugs are brass, nickel plated, flattened on top as shown. Made of a single piece of metal. Lead wire goes into tube. J3110, J3080 "Perfect" Lugs. Each $0.02
Dozen lots ..... .20

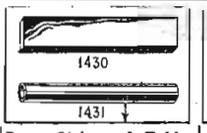


Spider Web Forms

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 1¼" thread 1" long threaded sleeve ¾" long, each .....$.25
J1550 Sockettes. Four of these take one vacuum tube. Grasp tube firmly. Best by test. Set of 4 $.25

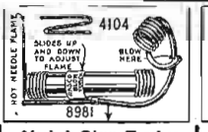


Brass Strip and Tubing

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



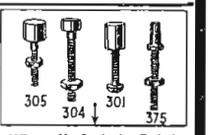
Alcohol Blow Torches

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



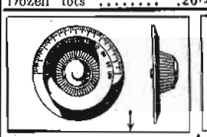
Tropaformer

The only scientific intermediate Super-Heterodyne transformer. It combines transformer and condenser and enables the transformer to be tuned to the finest degree. 3" dial included in price. J3510 Tropaformer, each $6.75



"Rasco" Switch Points

Nickeled and polished.
J301 ¼"x¼", 6-32", doz. .....$.18
J304 ½" dia., ⅛" thick, 6-32", doz.... .18
J305 ½" dia., 3-16" thick, 4-36", doz.... .18
J375 Switch stop ⅞" long, with nut, doz... .18



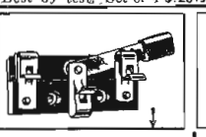
Moulded Dials

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



Tuned Radio Freq. Kit

Build your own Neutrodyne or Neutro-Reflex with this kit. Contains 3 R.F. Neutro-Transformers with .0005 condenser attached two Neutralizing Condensers. Also illus. book.
J8778 Radio Frequency Kit $13.85



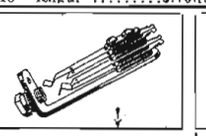
Throw Switches

Mounted on composition block. Small enough for all radio purposes.
J4100 Single pole...$.25
J4101 Double Throw Single Pole .....$.35



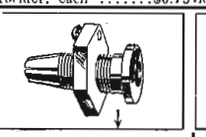
Bakelite 180° Coupler De Luxe Style

Tubes of natural color bakelite, wound with green silk. Cast aluminum bracket, ¼" shaft. Primary 13 taps. 180 to 550 meters.
J3150 Coupler $2.35



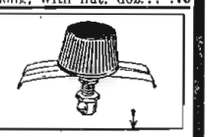
Jacks and Plugs

Best materials. Silver contacts. Factory making Postal Telegraph jacks, makes these.
J1000 Jack 4 springs $.65
J1001 Jack 3 springs .75
J1002 Jack 5 springs .80
J1003 Plug ..... .35



Cord Tip Jack

Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.
J1500 Cord tip jack. Each .....$.15



Series Parallel Switch

Quick change from one circuit to another. Black composition knob, nickel plated fittings. Blade radius 1¼".
J2950 Series parallel switch .....$.25



Meletone Loud Speaker

Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel gooseneck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
J255 Meletono Speaker $4.00



Tinned Nickel Lugs

All our lugs are tinned.
J310 Brass Lugs for No. 8 screw, doz. .....$.10
J311 Copper Lugs for Nos. 6 and 8 screws, doz..$.10
J309 Copper Lugs for Nos. 4, 6 and 8 screws, doz .10
J308 Copper Lug for 6-32 screw, doz. ..... .10



Wood Cabinets

Highest grade mahogany cabinets made. Top is hinged. Made of ½" stock.
J710 Panel, 7x10" $2.60
J712 Panel, 7x12" 3.00
J714 Panel, 7x14" 3.15
J718 Panel, 7x18" 3.40
J721 Panel, 7x21" 3.75
J724 Panel, 7x24" 4.20



Collapsible Loop Aerial

32" high, 28" wide. Has heavy cast base upon which loop turns easily. Winding consists of special multiple stranded wire. Loop readily folds to fit into 4" tube. Hard rubber insulation. J2610 Collapsible loop $3.75



"T" Wire Connectors

This big little article solves all troubles when making "T" wire connections. Made to take 1/16" square or round bus-bar wire. Can be attached with a pair of pliers.
J2975 "T" Wire Connectors, 12 for.....$0.05



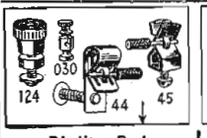
Nickel Screws

Made of brass, nickel plated. Flat and round head style. Any thread up to 10/32".
Price, ¼", ⅝", ½" long, dozen .....$.15
Price, sizes ¾" and 1" long, dozen .....$.30



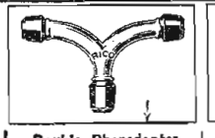
Duo-Spider Coil

For Roinartz circuit, 200-600 meters. 19 taps. Size 4¼" diam.; 1⅞" center opening. Coil is firm and will not fall apart.
J2650 Spider Coil..$1.15
J2660 Coil for panel mounting. 225-600 meters $1.90



Binding Posts

J030 Sm. size, ½" high, nickel finish, each...$.04
J124 Initialed Binding Posts; Antenna: B. Bat. —; A. Bat. +; B. Bat. +; A. Bat. —; Ground; Phone; each .....$.06
J45 Spring Posts, ea. .04
J44 Spring Posts, ea. .07



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. 3 soft rubber bushings.
J1320 Double Phonodapter .....$.65



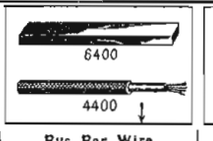
Cardboard Tubing

Only seamless tubing made (I.—Inside Diameter. O. —Outside Diameter. L. —Length). J6600, 3" I., 3¼" O., 7" L....$.30
J6601, 3½" I., 3¾" O., 7" L.., $.35; J6604 4" I., 4¼" O., 5" L., $.35; J6605, 2¾" I., 3" O., 2¾" L.....$.15



Radio Cement

Weather resisting. Used particularly for cementing covered wires. Coils covered with this cement require no form. Wires hold together solely with this cement.
J1750 Cement, 2-oz. bottle .....$.50

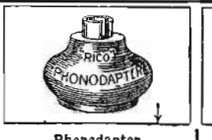


Bus Bar Wire

Square wire, 1/16" x 1/16", already tinned, making soldering easy. Sold in 2-foot lengths only.
J6400 Bus Bar, length .....$.05

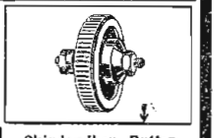
Green Silk Cord

Rubber Insulation.
J4400 Per foot .....$.02



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..$.38



Skindervlken Button

Famous Microphono for Transmitters. Sold all over for $1. This is the genuine article. No imitation. Smallest and most sensitive microphone made. Diameter ¾".
J9895 Microphone ...$.85

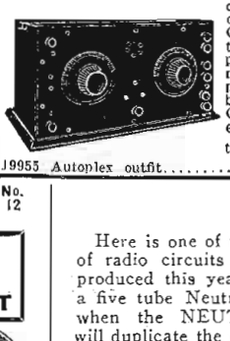
COMPLETE SET SALE AT REDUCED PRICES

Reinartz Receiver



Exactly as shown with mahogany cabinet, panel, all necessary instruments, binding posts and pattern for assembling. This set can be put together by anyone in a few hours. You can cover 1000-1500 miles easily with this set.
J9988 Reinartz Receiver $13.50

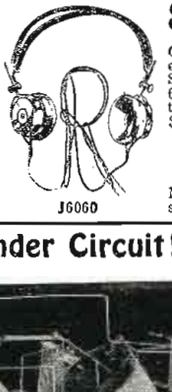
Autoplex Circuit



Will bring broadcast on loud speaker on single tube. Complete as pictured here. All parts, including mahogany cabinet, panel, instruments, binding posts, etc. Can be put together in a few hours time.
J9955 Autoplex outfit..... **$15.00**

Wanted

This Company is always in the market for new ideas. Any small specialties in demand by the radio fan will be highly welcomed by us. Some of the articles shown on this page originated with our customers, whom we paid well for the ideas. Send your sketch or model addressed to Research Department, c/o this Company.



J6060

SPECIAL

Genuine RICO 2000 ohm double head set. Standard phone with 6-foot cord. Tripole type. Regular price, $4.00. Our special price. J6060.

$2.50

Money back if not satisfactory.

New 1925 "Rasco" Catalog No. 12

CONTAINS 75 VACUUM TUBE HOOK-UPS, 300 ILLUSTRATIONS, 500 ARTICLES, 92 PAGES

All Armstrong Circuits: These important circuits are explained clearly, all values having been given, leaving out nothing that could puzzle you.

Just to name a few of the Vacuum Tube circuits: The V.T. as a detector and one-step amplifier; all Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio frequency amplifier; short wave regenerative circuits; 4-stage radio frequency amplifiers; radio and audio frequency amplifier; inductively coupled amplifier; all Reflex Circuits.

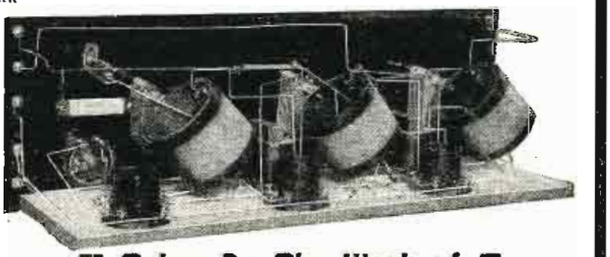
FREE. A POSTAL BRINGS IT



NEUTRO-REFLEX—The Wonder Circuit!

(Trade-Mark)

Here is one of the most talked of radio circuits that has been produced this year. Why build a five tube Neutrodyne receiver when the NEUTRO-REFLEX will duplicate the results on three tubes? This famous circuit was developed by Clyde Fitch, and was fully described in RADIO NEWS for August, 1924, pages 188-189. Practically the same outfit is now made by one of the largest Neutrodyne manufacturers. This circuit does the work, brings in the distance AND has the same volume as a five tube Neutrodyne set. NO NEUTRALIZING CONDENSERS ARE NEEDED WITH THE NEUTRO-REFLEX. Uses three 201A tubes.



3 Tubes Do The Work of 5

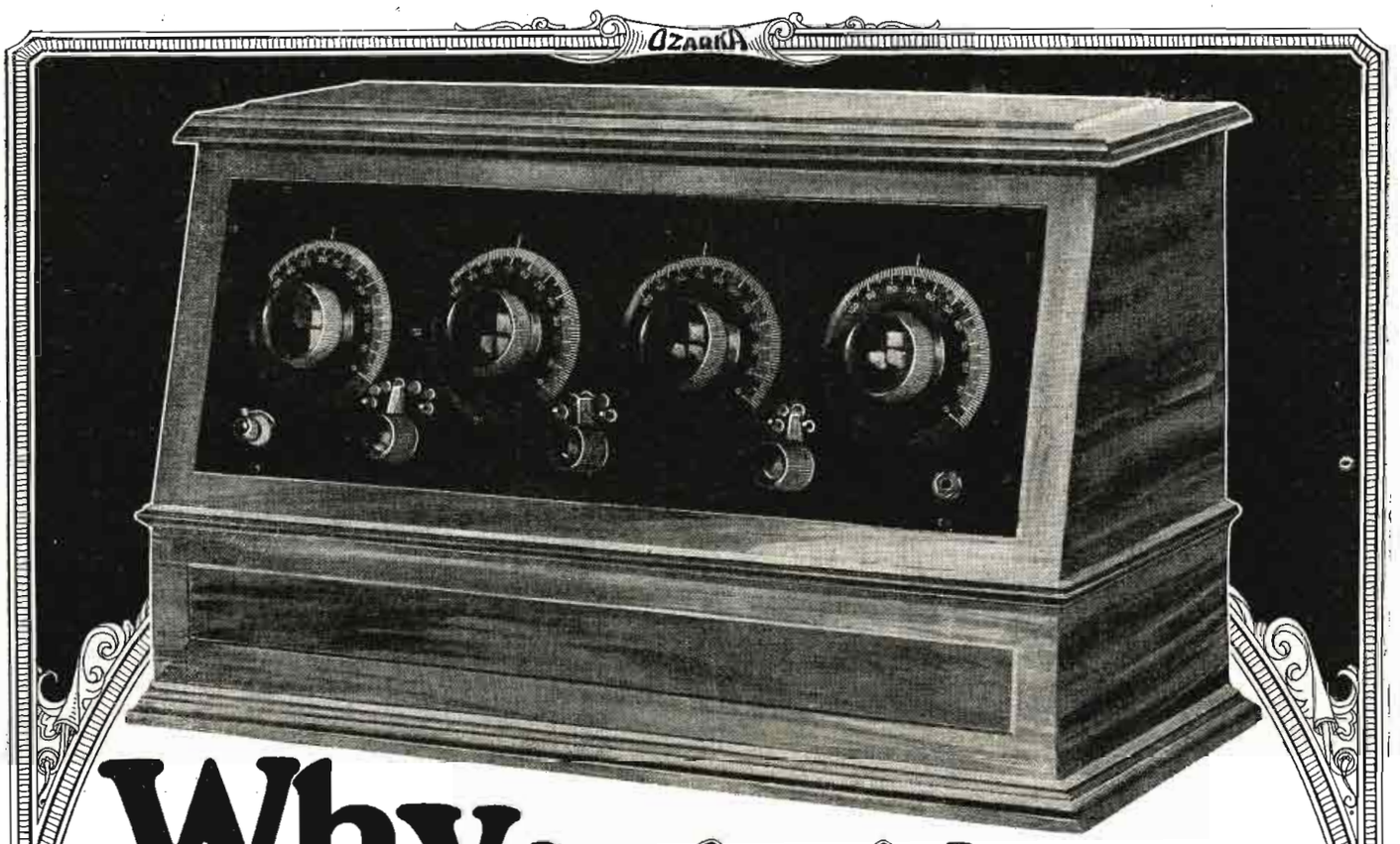
500 MILES ON LOUD SPEAKER

Our outfit comprises all necessary parts to build this set as follows: 3 "Rico" NEUTRO-TRANSFORMERS; 3 "Pilot low-loss 21 Plate Condensers; 2 "Rasco" standard Audio Transformers; One "Rasco" Jack; One "Rasco" Grid-Leak Condenser; One "Rasco" .001 Fixed Condenser; 3 Bakelite Sockets; 3 "Rasco" 30-ohm Rheostats; One 7x21 Mahogany Cabinet; 7 Binding Posts; One 7x21 Dilectryte Panel; 1 Grid Leak; 3 Dial Markers; 3 3" Dials; 3 .001 Condensers; 1 .00025 Grid Leak Condenser; 2 Grid Mountings; 1 Foot Rubber Tubing; 1 Doz: "T" Connectors; Fibre Washers, Screws, Brackets, etc.; 30 feet Bus Bar Wire; One Base-Board; 7 Binding Post Nameplates; One set of directions, Blue Prints, etc.

TOTAL PRICE OF THE GOODS LISTED $27.18

OUR SPECIAL PRICE FOR THIS MONTH ONLY J5599..... **$26.25**

RADIO SPECIALTY COMPANY, 98 PARK PLACE, NEW YORK CITY



Why Can OZARKA Inc., Sell 4-Tube Radio Instruments for $39.50

IF OZARKA Radio Instruments were sold through regular channels—distributor to jobber—jobber to dealer—dealer to you—the Ozarka $39.50 four tube instrument would cost you exactly $65. No wonder people are amazed at Ozarka values.

Selling as we do through our own direct factory representatives, the Ozarka selling expense is the very lowest possible, considering the fact that the instrument is demonstrated in your home.

The price you pay not only includes the sales expense but also the service expense. The success of any radio instrument, like the automobile, depends upon service. Ozarka representatives have been trained directly under Ozarka engineers—the men who designed and perfected the Ozarka circuit. They are, therefore, capable to deliver expert service to you ***in your own home without expense.*** Compare this with the customary method of having to send and instrument back to the factory to be serviced. Somebody has to pay for this expense.



No matter how perfect any radio instrument may be when it leaves the factory, little things sometimes will go wrong. The ordinary handy man is not the one to properly service your automobile, and it is also true of radio—only factory trained representatives can properly service any radio instrument. The saving in selling expense, plus the saving to us of the service expense on Ozarka instruments, makes it thoroughly possible for this company to sell a 4-tube instrument which will satisfactorily operate a loud speaker for a retail price of only $39.50. If you pay more, you are paying someone for sales and service expense.

The Ozarka factory representative who is perfectly capable of delivering Ozarka service wears the Ozarka gold button, which is the symbol that he has completed a service instruction under Ozarka engineers. He is perfectly capable of completely assembling any Ozarka instrument and locating and correcting any little trouble that may ever happen. He will gladly set up an Ozarka in your home without any expense, and let you operate it yourself. You must prove to your own satisfaction that it delivers for you exactly what you expect a radio instrument to deliver.

Would you be interested in reading a few wonderful, interesting stories of real long distance reception—letters from people who have actually heard London and Manchester, England; Cardiff, Wales; Glasgow, Scotland; Buenos Aires, South America; and last but not least, a number of people have heard Honolulu, Hawaiian Islands, on the Ozarka instrument. Ask for book No. 200. It will be sent free if you give the name of your county.

We Have An Opening for a Few More Ozarka Factory Representatives

At the present time there are over twenty-two hundred trained Ozarka representatives who are successfully delivering Ozarka instruments and Ozarka service. There is still some territory not covered, and to the right man we can offer a permanent and satisfactory business of his own.

The type of man we want must be clean cut, have a good reputation behind him, be in a position to furnish the best of references, and above all be willing to learn what we are willing to teach him without cost. Technical knowledge is not essential; in fact, we prefer a man who knows very little about radio because we can then teach him according to our method. The man we are looking for has lived in his vicinity for a considerable length of time. He is well known—well thought of, and would hesitate to sell any article unless he is thoroughly convinced of its merit. He may not be able to put in all of his time to start with, but if he will give it his spare time—radio is sold principally in the evening—he will build up a permanent and profitable business of his own.

This is not a proposition for a man out of a job merely looking for something to tide himself over. The investment required is small, but is absolutely necessary. Experience in salesmanship is profitable but not essential, because the Ozarka in the hands of a man who knows how to operate it will do its own talking—it will sell itself if given a chance.



If you are willing to learn every detail of our instructions regarding the servicing of Ozarka instruments, and realize that such knowledge is necessary to lay a foundation for a permanent radio business, write us for more information.

We can only consider men who are really sincere and want to improve their financial condition—men who are willing to do their best, and above all men who are frank enough to tell us about themselves. Let us have this information today, and be *absolutely sure to give us the name of your county.* If your county is now taken you will be notified immediately; otherwise, we will gladly give you full details. Send for Book No. 100.

OZARKA, Inc., 804 Washington Boulevard, CHICAGO, ILLINOIS



RADIO NEWS

H. GERNSBACK, Editor and Publisher
ROBERT E. LACAULT, Associate Editor

EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 6 JANUARY, 1925 No. 7

The Radio Experimenter

By HUGO GERNSBACK

THE radio experimenter is the outcome of a most unique situation which probably has no parallel in all science. Briefly the situation is as follows: All about us, at almost every hour of the day, there is floating through space music, information, news and every other form of entertainment. But in order to take advantage of this absolutely free entertainment we must first have a key to unlock this invisible universe. There are two ways of accomplishing it. The first is to step in at the nearest radio store and buy a complete radio outfit. The second is to make the outfit yourself.

The first method is simplicity itself, and one need know nothing about radio to receive all the free entertainment. The other method is not so simple but is vastly more interesting and exciting. As a matter of fact, to build a radio set yourself for the first time is a vast adventure with unending thrills and excitement. Moreover, no parallel can be found anywhere in our modern civilization for these reasons: Have you ever heard of anyone making his own phonograph? There may be a dozen such individuals scattered over the world, but we have never met one, unless he was in the phonograph business or an inventor.

Or, have any of your acquaintances ever built an automobile? There may perhaps be a few individuals who have done it, but we have never met such an individual. There are, however, good reasons why it is not done. You cannot step into a phonograph store and buy every article necessary to build a complete phonograph. They will sell you spare parts of certain items, but no one would ever think of trying to assemble a complete phonograph in this manner. The same with an automobile. You cannot step into the next automobile accessory store and buy all the parts for a complete machine.

With radio, however, this situation is vastly different. There is hardly a radio store that does not invite the radio experimenter to step in and buy parts—or, as our English friends call them, components—with which to build his latest pet hook-up. There is not a single item from a loose coupler down to a screw, from a finished cabinet down to the smallest lug that the radio experimenter cannot readily secure. And he gets them now at prices, thanks to competition, that are extraordinarily low.

The dyed-in-the-wool radio experimenter usually starts in with a crystal set or a one tube affair. He reads every available scrap of radio information, radio magazines, Saturday Radio Supplements, books, and what not, and soon becomes perfect in distinguishing a good circuit from a bad one.

And right here we may let the uninitiated in on a deep and dark secret. In spite of thousands of radio hook-ups printed every month, there are only about a dozen fundamental circuits. Just as you can get thousands of different colors and shades from the seven original colors, just so can you derive thousands of radio hook-ups from the few fundamental circuits. Of course each new hook-up is supposed to have special points of superiority above all others, and it is this point that the radio experimenter investigates carefully. He rarely builds what would be known as a "classy" set. It is true that he may build a few for his friends and maybe one or two for himself, but as a rule he just uses a "hook-up board" on which he scatters his various radio components which he hooks and unhooks with various wires, etc., every time he sees a new circuit.

Every experimenter has his own pet hook-up which, for one reason or another, gives "the most wonderful results imaginable" and every radio experimenter will gladly show you how, by means of this particular hook-up, he can bring in stations further away than will any factory built set in existence. Strange to say, however, he actually accomplishes this every once in a while; this, by the way, does not necessarily frighten the set manufacturers out of their wits. Despite such handicaps they manage to get along!

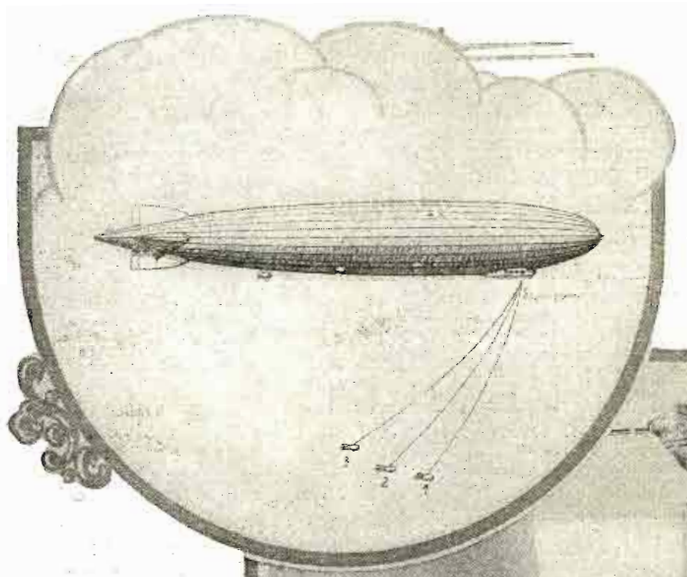
Then again if the experimenter wishes to build a really good set for himself, it is not a matter of great cost nowadays. He can build a good set cheaply himself, in fact, for much less than a manufacturer can sell the same set, for obvious reasons. The radio experimenter has no labor or advertising costing huge amounts. The manufacturer uses expensive labor and many other like items which the experimenter does not have to consider. And let it be said to the everlasting credit of the radio industry, that the radio set manufacturers actually encourage the experimenters. Many manufacturers sell complete "kits" all ready for wiring, so that anyone, with only the aid of a screwdriver and pliers may build his own. In other words, the radio industry recognizes the fact that the radio experimenter is a powerful force in the community.

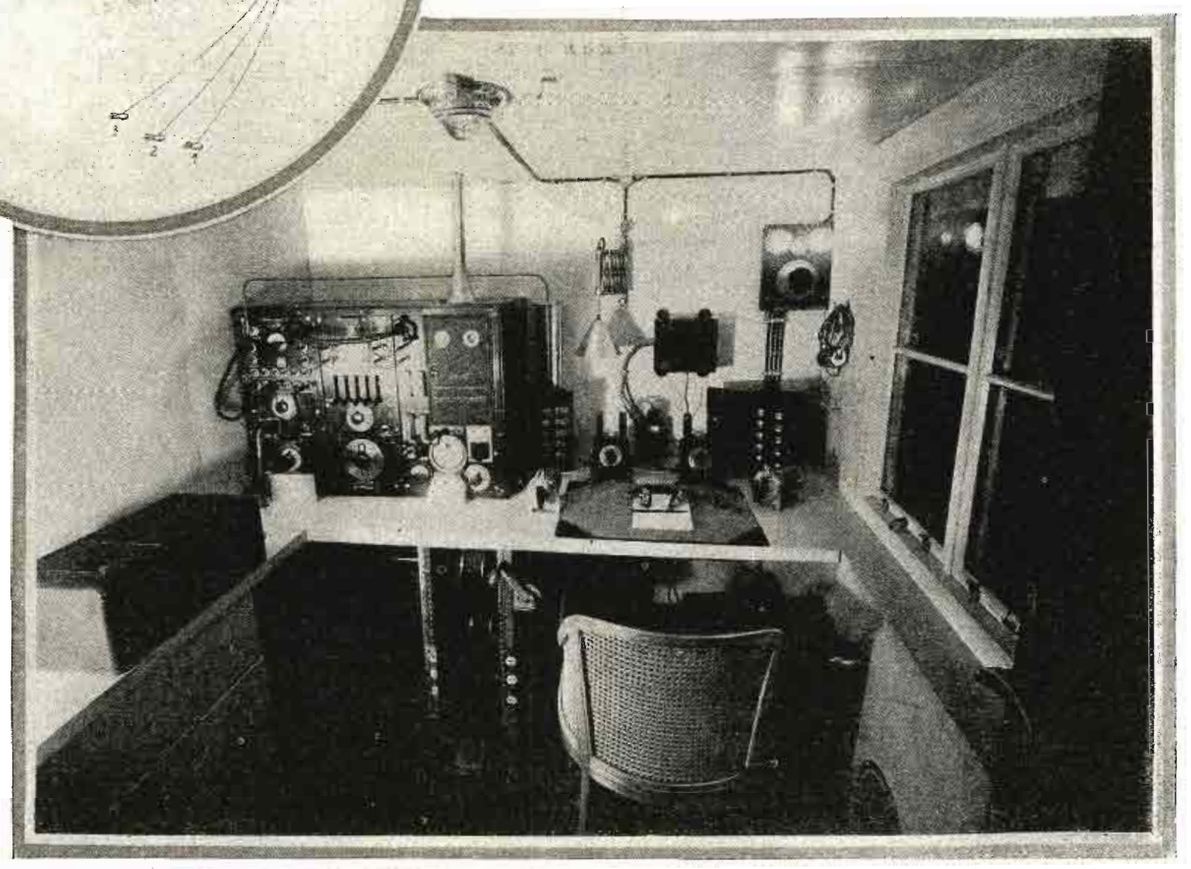
In one point the radio experimenter has it all over the man who buys the ready-made article. No $500 set can ever thrill its owner as a $20 self-assembled set thrills the experimenter. It is characteristic of the American genius that more and more individuals are beginning to build their own outfits. There really is nothing more fascinating in existence. And then there is the great fun of adding new inventions and new developments to your set as time goes on, for a radio set today is as much alive as a tree. It grows slowly but surely, and seemingly never grows old. Small wonder then that a very large number of people who bought ready-made sets have been converted into radio experimenters.

Many people have an idea that radio experimenting will soon stop. The argument is that everybody will own a factory-made set and then there will be no reason for experimenting. The writer emphatically disagrees with these good people; radio experimenting will increase rather than decrease. There will always be the lure of new things to be tried out. During the next three years radio television will come to the front. Just think what a new radio paradise this new art will open up to all radio experimenters. Many people even though they own expensive radio sets will certainly wish to attach a television apparatus to their sets; we are much nearer to this phase of radio than most people think.

How the ZR-3 Was Piloted by Radio

By CAPTAIN H. C. FLEMMING
Chief Radio Operator of the ZR-3





Above is shown the manner in which the three wire aerial of the ZR-3 is suspended in midair. 1, 2 and 3 are each of a different weight. Thus, when the ship is in motion, the wires tend to spread fan-shape.

Right: The radio room aboard the ZR-3 showing the transmitting and receiving apparatus.

THE safe conclusion of the trans-Atlantic voyage of the ZR-3 would never have been possible without complete and efficient radio telegraph and telephone equipment. There are so many factors entering into the proper navigation of such a huge aerial transport device that safe navigatoin of it over such extreme distances would not be possible if the navigating officers were not in touch with various sources of information at all times during the voyage.

The weather conditions alone were of such extreme importance, that even the direction of the course of such a ship is dependent upon minute and voluminous weather information which must be obtained from authentic sources.

An entirely different situation confronts the captain of a dirigible than confronts the skipper of a steamship in the point of navigation. The salt water officer has always his sextant, his log and sometimes land marks. The aerial skipper is not so blessed with means of finding his way about. Consequently, his every position and even his course is checked by the use of the radio compass. Without this highly sensitive piece of apparatus, there would be no end to his difficulties in knowing his place in correspondence with the rest of the world at any given time.

So, considering these few factors alone, it is easily understood why such sensitive radio equipment was included in the cabin of the ZR-3.

The apparatus consisted of five distinct units. There was the regular transmitter of 400-watt capacity capable of working on wave-lengths between 300 and 3,000 meters.

THE epoch-making flight of the ZR-3 from Germany to the United States last October was made possible to a great extent by the important rôle played by radio.

Captain H. C. Flemming, Chief Radio Operator of the ZR-3 describes here exclusively for RADIO NEWS' readers his exciting radio experiences. Our readers will be much interested in this non-technical talk of Captain Flemming, who gives us a remarkable insight into the workings of the giant airship during its successful flight to Lakehurst, N. J.

—EDITOR.

This set is of the standard vacuum tube transmitter type so arranged that it could be operated upon C.W. or I.C.W. This was the transmitter which was relied upon during the greater part of the journey to furnish connection with the outside world. It has a proven range of about 1,400 miles for dependable communication.

Power was furnished by a 1½ killowatt, wind driven generator. This instrument was arranged to swing out from the side of the cabin. A novel method of adjusting the speed of the generator to the speed of the dirigible was obtained through this system of raising and lowering the generator unit in regard to the side of the cabin. By changing the angle, proportionate changes in speed could be obtained, thus enabling the operators to obtain the proper voltage from the generator at all times. The air currents created by the speed of the dirigible, of course, furnished the power for turning the propeller which was directly connected to the shaft of the armature. The voltage from the generator was stepped up to 3,000 volts through a transformer and then rectified through the usual vacuum tube process. After passing through a series of filters it is impressed on the plates of the transmitter tubes. Power for lighting the filaments of these tubes is also obtained from the wind driven generator through the agency of a step down transformer.

THE RECEIVERS

The bulk of the receiving on the trans-Atlantic voyage was accomplished on a detector and two step audio frequency set of a standard German make. Two of these sets were used jointly. The hook-up was of the ordinary regenerative type. For the general run of work, this equipment was found capable and sturdy.

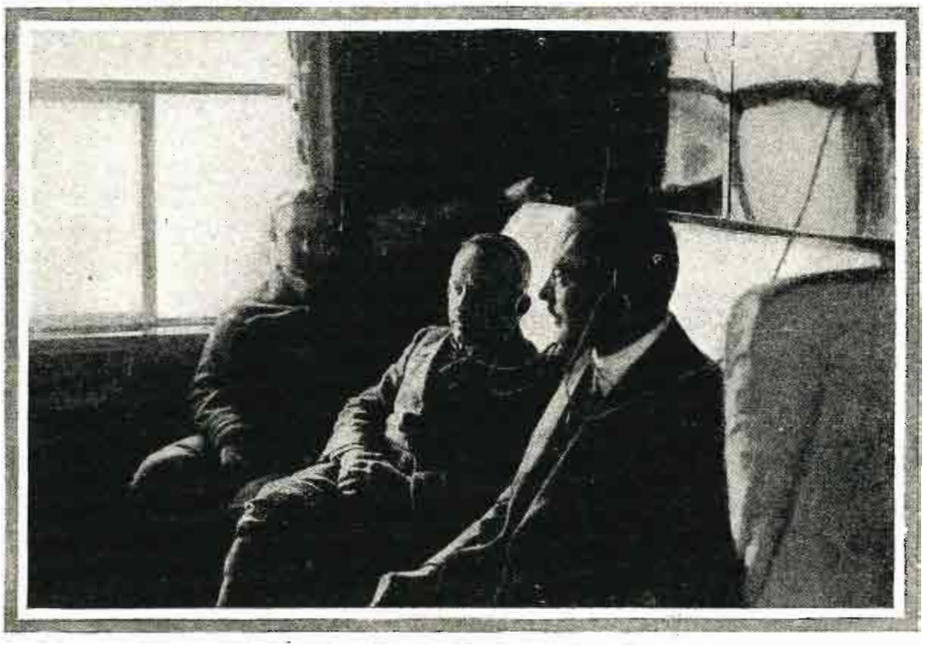
The most novel bit of apparatus is the radio compass which contains, aside from the detector and two stages of audio frequency amplification, *six stages of radio frequency amplification*. Obviously, this set is extremely sensitive, and purposely so, since several times, enroute, the Captain took recourse to it in order to check his position and bearing. As a matter of fact, he used it upon every occasion, for the radio compass is the one arrangement which may be absolutely relied upon for accuracy. Through the use of a unit directional loop, it was possible, with this compass, to obtain a course by taking observations on one known point alone. This is an extreme improvement over previous installations which required that two points be located and then the position or course of the ship designated by the use of triangulation.

The radio telephone installation is comparatively small, being of about a 50-watt capacity, since its use is intended primarily for making landings. As has been fully described in RADIO NEWS before, the only efficient way by which the captain of such a ship may direct his ground crew in making a landing, is through the use of radio telephone; other means of signaling, such as the semaphore or wig-wag codes, might conceivably be used, but the radiophone is the only practical method. Our phone equipment is of the standard vacuum tube type and consists of a standard unit, manufactured by the Telefunken Company of Germany. Small as it is, we found it exceptionally efficient and succeeded in many cases in working distances around 300 miles. As a matter of fact, it is given a range of 280 miles for which it may be depended upon under ordinary conditions.

SPARK SET FOR EMERGENCY

A reserve set which was installed for use in case of an emergency is a standard Telefunken quenched-spark set capable of working over waves between 300 and 800 meters. All during the voyage this set was kept in working condition so that it could be brought into operation at a moment's notice, contemplating a major damage to the regular vacuum tube transmitter. Of course, spare parts were carried to replace practically any breakdown.

The filament current for the receiving tubes, as well as the plate supply, is obtained from storage batteries. These units are housed just outside the operating room. A point well worth noting in connection here is the fact that the batteries are on charge practically all the time the generator is running and that the receivers can be operated with perfect ease while the batteries are on charge. As with the transmitter, the batteries receive their supply from the wind driven generator which also furnishes power for the 27 electric lights in the various cabins throughout the ship.



Three of the navigation officers aboard the ZR-3 listening to a program from an American broadcast station while over the Atlantic Ocean.

THE OPERATING ROOM

The operating room itself, as was said, is in the aft cabin. A peculiar method of construction was employed so that the room is both sound and shock proof. The terrific roar of the engines is deadened by a wax compound lining which covers the entire interior. Several precautions were necessary in installing the apparatus so that all danger from sparks would be eliminated; even the transmitting key was surrounded by a wire gauze which would protect any spark originating at the contact points from igniting stray gases which might have been evident. Similar precautions were taken at every point in the apparatus where there was a possibility of an open discharge. On every occasion when the ship was taken to a higher altitude, the operators were notified to cease transmitting, since each such raise in altitude is accompanied by a slight escape of gas, and the gas being hydrogen was of course, highly explosive. At the conclusion of the rise, when the captain thought it safe, he would signal the operators again to resume their work.

The antenna system consists of three stranded cables of the Litz type. Each wire is attached to its individual wench and may be lowered or raised independently of the others. Through a switching arrangement the operators were able to use any wires separately or any combination of them together. Their total length was 360 feet. A torpedo shaped weight hung from the bottom of each one and was of sufficient size to keep them taut and separate.



A view of the lower part of the ZR-3, run from the radio room, as the huge ship was leaving the coast of France. Note the shadow cast on the beach below.

THE DEPARTURE OF THE ZR-3

At 6:35 GMT, on the morning of October 12, the ZR-3 departed from Friedrichshafen on Bodensee for its voyage to the U. S. Naval Air Station at Lakehurst, N. J. Aside from the crew of 27 men there were aboard the ship three naval officers, and a representative of the U. S. Army. No passengers were carried on the ship, since every extra ounce of lifting capacity was given over to carrying the 30 tons of benzine, two tons of oil and a ton of food.

In the morning before our departure, a heavy fog descended down on Friedrichshafen so that the thousands of people who had gathered to see us take off, were unable to watch the ship more than leave the ground.

The take-off was accomplished without event. The early part of the voyage was made through the clouds and fog. Soon, however, the ship was piloted to a height of 2,200 feet, and immediately we passed above the clouds. The Swiss Alps appeared in the morning sun. Almost immediately the antenna was lowered and the apparatus started. Before we left, complete weather reports had been received daily for more than two weeks, covering the course over which we intended sailing. It was of the utmost importance to keep in close touch with any changes which might take place in the weather along the route, or that we be immediately notified of any unknown circumstances. It was, therefore, with great interest that the first operator took his place and began tuning the receiver.

FIRST USE OF THE TRANSMITTER

This first attempt was unsuccessful, since one of the three aerial wires snapped before we were able to raise the home station at Friedrichshafen, which we were calling. What repairs were possible were made on the broken wire and later, as we were passing over Basel, Switzerland, we succeeded in getting into communication with Friedrichshafen, working at 1,510 meters. Of

(*Continued on page* 1291)

Super-Power in Radio Broadcasting

By LOUIS FRANK

There has been talk of opening super-power broadcast stations. The idea has not been accepted with open arms by all. But to judge sanely one must know the advantages and disadvantages which would accrue from such a scheme. Mr. Frank has covered all the salient points of the subject in this article.

THE most important question that confronts the radio public of the present day is the use of super power in broadcasting. Within the next few years we shall have a chain of powerful stations across the country with a minimum range of 1,000 miles, or there will be innumerable moderately powered stations with an average range of 50 miles. The former supposition seems to be the more logical one, as the tendency is to increase power in every station that goes on the air and in Government Radio Regulations, recently issued, provision was made for this very thing, but only as an experimental measure.

In order to get the proper angle on this question, it is desirable to review some of the considerations involved. In the early days of radio broadcasting, it was purely a local matter. A broadcast station was satisfied to feed its own locality with programs, and stations, therefore, were built with low power capacity, just sufficient for local work. Another reason was that radio equipment was likewise in its first stage of development, both as to power and quality. During this period of development, the type of program broadcast was also more or less of a local character and generally of an inferior grade. However, the public took to broadcasting very rapidly, and progress in the technique of broadcasting was made rapidly. Artists, public performers of all descriptions, people of national and international prominence, noted this rapid development in the art and gradually began using broadcasting either for their own advantage, through its publicity value, or because they had something to say to the public. As a result, the very best entertainment in the country is available to the radio broadcast listeners. In other words, the art of radio broadcasting has developed to the point where it is no longer a local affair, but is a national one and is rapidly becoming international.

Broadcasting having reached this importance, it seems reasonable to say that it should be reorganized on a basis commensurate with its national importance. Present broadcast stations have a maximum power of about one kilowatt, although there are a number of stations doing work on higher power under special experimental licenses. A station with a power output of 1,000 watts is not very powerful, and in spite of numerous so-called DX reports, cannot be relied upon to reach out for any considerable distance. However, this does not mean that these stations are not heard over long distances. It does mean, however, that these stations cannot give good broadcasting service consistently over long distances. A 1,000 watt station cannot be relied on to give good broadcasting service, that is, loud speaker reception on an average good receiver, over a territory having a radius of over 50 miles. This may sound ultra-conservative, but the reader should bear in mind that we are talking of continued reliable service in the entire territory. It is possible that such a station gives very excellent service at a certain point 100 miles out. However, if there is another point 100 miles out where signals are very weak, then the station is not reliable for service 100 miles away. From the point of view of reliability, even a 50-mile estimate is probably high, but assuming that the existing types of stations have this range of 50 miles for reliable communication, it is seen without argument that transmission is only good for local work. If radio broadcasting is to be utilized on a national scale, it becomes apparent that the business of broadcasting will have to be reorganized on a basis commensurate with its national importance.



DAVID SARNOFF
Vice-President and General Manager of the Radio Corporation of America

The fear has been expressed by some that a super-power broadcasting system would interfere with the effectiveness and destroy the function of the local station. This is as groundless as would be the belief that a national highway would obviate the need of local roads. The local station will remain the voice of the community which it serves, just as the local newspaper is the expression of its interests.

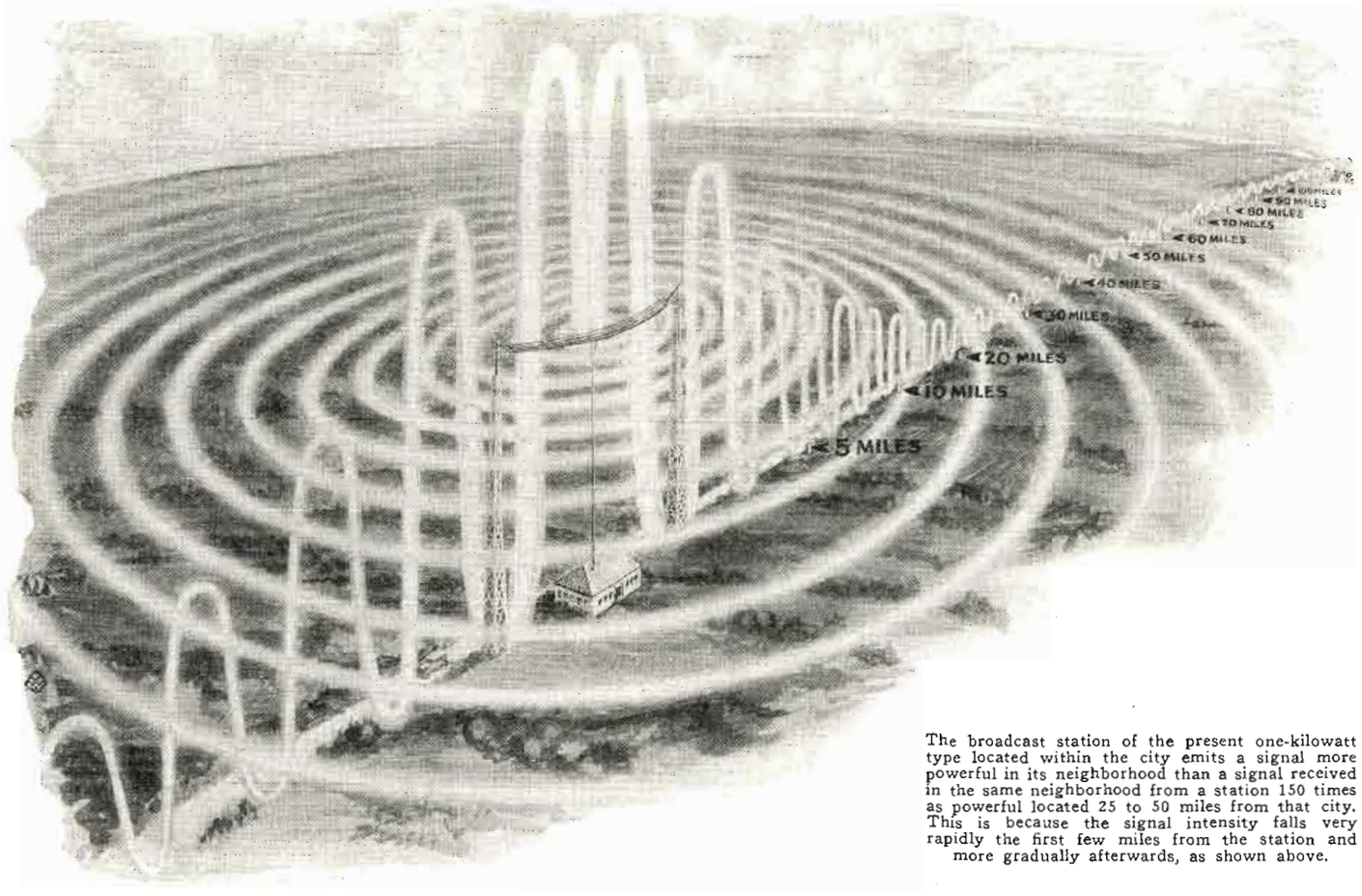
Moreover, the problem of super power is no longer an academic question. Super-power broadcasting is here. Already stations in Canada are employing between five and ten kilowatts. A station has been erected in England in the vicinity of London employing 25 kilowatts. A 20-kilowatt station has been established in France, and a number of other countries contemplate the early addition to their broadcasting systems of stations having powers into tens of kilowatts. It has been thoroughly demonstrated that those American stations which have utiiized the full one kilowatt permitted by the present regulations have afforded a higher degree of all year around satisfaction to the radio listener than those employing lower powers.

The question now is whether the United States shall lead or follow in the development of super-power broadcasting.

Up to the present time, two methods have been employed for bringing radio broadcasting up to a level of national importance. The first of these is that of short wave transmission and re-broadcasting. Here use is made of the fact that short wave transmission has some advantages over that of the longer wave, it being less subject to fading, seeming to travel as well by day as by night and to cover remarkable distances. Therefore, what has been done is this: A short wave transmitter has put a program on the air, this program being received on special short wave receivers at different broadcast stations in the country, and the amplified signals of the short wave receiver re-broadcast by the local receiving station. In this way, a program sent out from one part of the country may be re-broadcast simultaneously, by many stations over the entire country, thus securing broadcasting on a national range. Despite optimistic reports of the proponents of this plan of broadcasting, the records do not show it to be successful as yet. There still remains considerable work to be done in this field, before it can be practically utilized for national broadcasting, as it is altogether too uncertain in performance for reliable communication on a large scale.

The second plan, which has been quite successful, is that of linking the various broadcast stations of the country by long distance telephone lines. This is done as follows: If an important address by a government official in Washington were to be broadcast over the entire country, the address would be picked up in Washington and sent over a telephone line to the exchange in Washington. There the address would be transmitted, as though it were a telephone converstaion over the long distance telephone lines to the various broadcast stations, which would be linked up with the Washington exchange. Each broadcast station would then broadcast locally. This has been done on a number of occasions, proving quite satisfactory. It is not purely a radio plan, as it involves to a considerable extent, telephone co-operation.

If it were possible to reduce the number of links in a national broadcasting chain to a reasonable minimum, of four or five, we should have a national organization of considerable merit. A plan providing for this has been proposed at the recent Radio Conference. This plan involves the erection of high-powered stations at strategic points in the country. It is similar to the one followed in the erection of trans-Atlantic radio telegraph stations. Here it was found necessary to increase the power to very high values in order to insure good service through various kinds of interference. It is proposed to increase the power of a broadcast station to the point where it will be able to serve reliably an area within a radius of 500 or 1,000 miles, thereby reduc-



The broadcast station of the present one-kilowatt type located within the city emits a signal more powerful in its neighborhood than a signal received in the same neighborhood from a station 150 times as powerful located 25 to 50 miles from that city. This is because the signal intensity falls very rapidly the first few miles from the station and more gradually afterwards, as shown above.

ing the number of units necessary to serve the nation to a few high-nowered stations strategically located. Each of these high-powered stations would be linked by telephone lines, so that the same program could be broadcast simultaneously from all of them. It would be possible to build such high-powered stations to give the same good quality as is delivered by the present low-powered stations.

This plan seems to be in line with the logical development of broadcasting. However, a number of arguments against the proposal have been advanced, which it might be well to consider. Such a plan of super-power broadcasting has already been caricatured as a great giant swinging a club over other broadcasters and producing tremendous interference. It has been cited that when station WEAF increased its power a short time ago to more than one kilowatt, tremendous interference was produced and that if 50 kilowatt stations are erected, interference will make any kind of reception impossible. The uninitiated reader most certainly will be impressed by such an argument, but I believe it falls flat if certain factors are included. That is, if a station with increased power were directly in the heart of the city in which the interference was caused, there is no question that great interference would be created. However, if such a powerful station is placed somewhere in the country, even 25 or 30 miles outside the city, there would be no such interference. This is because the signal intensity falls very rapidly the first few miles from the station and more gradually afterwards. The reason for this is that the signal intensity varies inversely as the square of the distance from the transmitter. That is, two miles from the station the signal intensity is one-fourth what it is at one mile, and three miles out, it is one-ninth what it is at one mile. Fig. 1 shows how the signal intensity drops as the distance from the station increases. The greatest drop occurs at the start and by the time it has reached the city limits, the signal strength has dropped sufficiently to avoid interference.

It has also been said that the small broadcast stations would thereby be eliminated. If a small broadcast station becomes useless, there is no reason for its existence. Should the art of broadcasting develop to a point where some small stations become useless, is that any reason why the progress of the art should be stayed? Surely, the public would not contend that motor vehicle development should cease because it puts the horse and wagon out of existence, or that subways should not be built because the small trolley cars would then have to go out of business. The same logic applies in both cases. But as a matter of fact, if a small broadcast station really serves some useful purpose to a community, it most certainly would not be put out of business by large super-powered stations. These would only give to large areas that which cannot be secured in every part of the country. Needless to say a small station in some out of the way town cannot serve its community such fare as the Philharmonic Orchestra's concerts, nor can they serve a speech by President Coolidge. It requires pick-up in central points like New York and Washington, which the small stations cannot have, but which a chain of super-powered stations can accomplish. In other words, there is a sphere of usefulness for both low- and high-powered stations and there is no reason why a small station would have to go out of business if high-powered stations were erected.

The trend of development seems to point to some kind of a national change in broadcasting. It has become so wide in scope and so important that bigger things must be looked forward to than 500 to 1,000 watt stations, which cover a few miles only. Matter is being broadcast which is of vital importance to the country at large, and, therefore, means should be employed by which this matter can surely reach all the people interested. Some available means have been here outlined, and it will be of interest to have further discussion on the subject.

VOTING BLANK

ARE YOU FOR OR AGAINST HIGH POWER BROADCASTING?

In order to ascertain the popularity of the scheme to open Super Power Broadcast Stations it is desirous on the part of the Editor of RADIO NEWS that you cast your vote on this blank and mail it to Radio News, 53 Park Place, New York City, before December 31.

The results of the vote will be published in the forthcoming issue.

☐ For — Mark cross in one or the other box. — ☐ Against

BROADCASTERS AUTHORIZED TO INCREASE POWER

The Department of Commerce has announced that licenses will be immediately issued for increasing power of broadcast stations under a plan permitting the addition of 500 watts at a time. Such increases, however, are emphasized as being wholly experimental and entirely at the risk of the station, and at all times under the control and regulation of the District Supervisor of the Department. The announcement specifies a maximum of 5.000 watts and cautions that the announcement does not deal with so-called super-power stations of 25,000 or 50,000 watts.

(*Continued on page* 1297)

A New College of the Air

With the WJZ-New York University Combination, another college enters the air to benefit those who are desirous of not only listening to music, but of improving their minds. It is possible that some day our children will be educated in this manner.



Mrs. Clara E. Breakey, lecturer on home economics at New York University, who will also lecture for the "Air College." © Gilliams Service.

COMPLETE endorsement of the practical value of radio broadcasting as an aid to education is demonstrated in the co-operative action between New York University and the Radio Corporation of America in opening the Fall Term of the recently instituted "Air College" at station WJZ on Monday evening, October 6. Addresses by members of the N. Y. University Faculty and General J. G. Harbord, President of the Radio Corporation, broadcast direct from the college playhouse on that date officially inaugurated an extensive schedule of educational broadcasting, having no parallel in broadcasting history.

The fall term of the "Air College" will consist of twenty-minute lectures covering eight subjects, broadcast from WJZ every weekday evening from October 7 to December 23.

The "Air College" has as its primary object the dissemination of educational information of the non-technical or popular type. It is presenting through the medium of radio broadcasting, attractive lectures on subjects of general interest. New York University recognizes the growing power of radio as a stimulant of public interest in the arts and sciences, and has established a Radio Educational Committee headed by Professor Marshal S. Brown, Dean of the Faculties. Assisting him in this work are Professor James E. Lough, Dean of the Extension Division, and Professor H. C. Hathaway, Director of Public Occasions.

After more than a year of exhaustive investigation by both university and WJZ officials as to the possibilities of this new field, the eight courses comprising the fall term were determined upon. Although the work is in line with that presented in the classrooms it is simplified to such a degree as to be undertandable to the most casual listener.

Each of the courses were especially selected and prepared with the realization that the mind of the radio audience is composite in the extreme. Fullest results can be obtained only by considering the varied reactions of that audience to unattractive presentation of even the most valuable material. Human interest and non-academic treatment, two prime requisites of successful radio addresses, have been stressed in the choice of subjects and professors for the radio lectures.



L. Reid McClung, Professor of Economics at New York University, whose lectures on the economic problems of the day are one of the features of the newest "air college." © Gilliams Service.

NAVY DOING ITS BIT TO CUT INTERFERENCE

Officers of the Navy afloat and ashore are doing all they can to eliminate interference in the interest of efficiency and in aiding the broadcast listeners. During the past year over five per cent. of the old ship spark sets have been replaced with tubes, practically all new ships are equipped with tube transmitters, and Naval operators have been ordered to tune loose-coupled receiving sets correctly. Another effort on the part of the Naval radio personnel has been to eliminate mush and harmonics from high powered shore stations.

Commandants of all naval districts have been ordered to conduct reception tests in their districts to determine if naval arcs and sparks are causing interference attributed to the Navy. In Honolulu, it was recently demonstrated that interference charged to Naval Stations continued when they were off the air, and eventually it was traced to a violet ray machine.

Why the Navy is so generally charged with causing practically all the interference is not understood by Naval officers, who point out that the Navy actually operates only about one-half of one per cent. of the shore radio stations in this country; actually only 88 in Continental United States out of a total of 17,142 government-owned land stations. At sea, in the neighborhood

(*Continued on page* 1270)

Broadcasting in Great Britain

By S. R. WINTERS

We are confident that our readers will find this article, the result of an interview with Captain Eckersley of the British Broadcasting Co., exceedingly interesting. One is given an insight into the manner in which broadcasting is handled in Great Britain.

"IN my opinion, the next great advance must come in the development of apparatus for the reception of radio signals, the transmitter being far ahead of the receiver in perfection," stated Captain P. P. Eckersley, Chief Engineer of the British Broadcasting Co., Ltd., in a recent interview. "The receiver is distortionless within practical limits up to the output of the last tube, but the methods used to convert electrical waves into sound waves are very far from perfect. We must develop a loud speaker or telephone receiver that will give proper amplitude for the whole gamut of audible sounds."

BROADCASTING IN ENGLAND

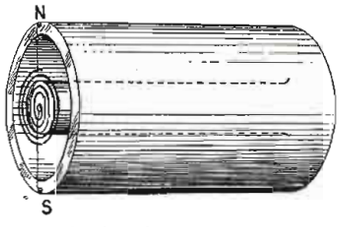
The broadcasting conditions in Great Britain are at variance, radically, with those in the United States in several respects. For instance, persons availing themselves of broadcast services are required to purchase receiving sets under a licensing system—that is, pay $2.50 a year for the privilege of operating a receiver. The broadcasting of programs is different from that in this country. There is a central transmitting station—located in London—and speeches and concerts originating there are dispersed by land lines to 11 relay stations. The Englishman, contrary to the obsession which has seized the American, is not possessed with the "itch for distance."

These divergences in conditions in America and the British Isles prompted Captain Eckersley, who is inspecting broadcast stations in this country, to explain the English system. As a prelude to these explanatory details, it is well to set forth certain general facts: It is estimated that at present there are 7,000,000 broadcast listeners out of a total population of 42,000,000; about 1,000,000 licenses to operate receiving sets have been granted and licenses are being issued at a rate of about 50,000 a month; there are 21 broadcast stations in operation on the continent, and 11 of these constitute a chain of relay stations; and the income of the British Broadcasting Co. is approximately $2,000,000 a year.

THE ORGANIZATION

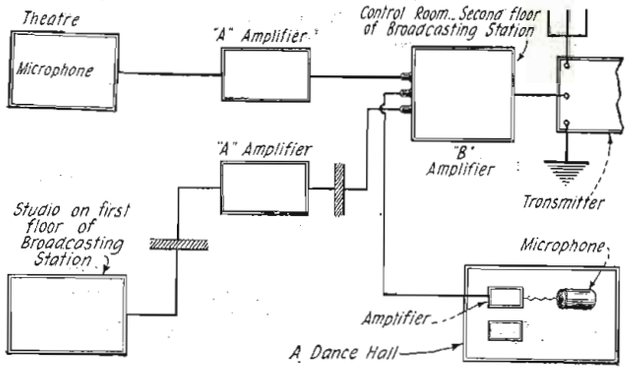
"You must bear in mind," indicated Captain Eckersley at the outset, "that this is a non-profit making organization. The directors of the concern are composed of one managing director, who is independent of commercial attachment, and six other directors who are manufacturers of radio apparatus. These six directors, however, are engaged in the competitive sale of instruments. The company is a private concern with Government supervision. If we care to make a departure in principle of operation, we have to consult the Government, but its consent is ordinarily given. The British Broadcasting Co. receives about $2 of the $2.50 required of each operator of a receiving set, the remainder reverting to the Government.

"The main transmitting stations, having a rating of 1½ kilowatts each, are located in Aberdeen and Glasgow, Scotland; New Castle, Manchester, Birmingham, London and Bournemouth, England; Cardiff, Wales, and Belfast, Ireland. These stations, with the exception of the one at Belfast, were completed in October, 1923. The plan of establishing 11 other stations in a relay system for broadcasting was advanced and adopted as a practical solution to serving the great number of owners of crystal receiving sets. In London, therefore, is concentrated the land wires by which these relay stations are connected. These wires, used for telephone purposes during the day, are put at the disposal of the British Broadcasting Co. at 5 o'clock each afternoon.



The type of microphone used in the British broadcast studios is composed of a strong magnet in the field of which is a small, light coil acting in the diaphragm.

"Even with a chain of relay stations," explained Captain Eckersley, "we found that our broadcast programs were not completely covering the country. Therefore, permission was asked of the Government to erect a high-powered transmitting station so that with one fell swoop, as it were, we might blanket all the areas. This request was granted, and a 25-kilowatt station was built at Chelmsford, about 30 miles from London. This location, however, was only temporary, since, owing to the interference created by this powerful station, it had to be removed to a point 70 miles from London. It is connected by land line with the city.



The arrangement of the pick-up microphones and amplifiers used by the B. B. C. for simultaneous broadcasting.



CAPTAIN P. P. ECKERSLEY,
Chief Engineer of the British Broadcasting Co., Ltd.

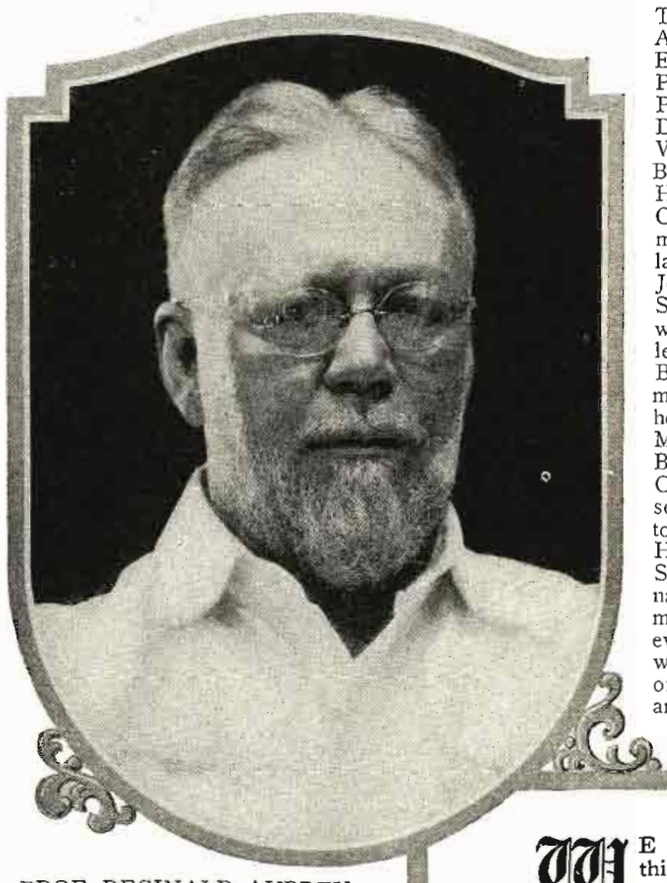
STATION DESIGN

"We have a typical broadcast station in many respects. There are two studios—one for speeches and the other for music. However, we have a novel pick-up device. It is a coil suspended in a magnetic field. The wire composing this coil is wound flat in a ring-like shape on flimsy paper, in order to make it as light as possible. The current picked up by this coil is very feeble (not sufficient to operate a telephone receiver) and the energy induced in that coil is taken through it by means of a cable, which goes directly to an amplifier. The output then goes to the control room, which is two stories higher than the studio. The cable, previously referred to, takes the current from the first amplifier to a second one, which is located in the control room. The second amplifier is variable, that is, the amount of output may be varied at the will of the operator.

"The so-called 'Blind System of Control' is in operation, having dispensed with the usual method of having a person looking through a window in order to control the actions of performers or artists in the studio. The program is scheduled to start at 7 o'clock, at which time a plug is inserted in the jack which causes 'Big Ben' to chime out 7 o'clock. Then the engineer on duty moves a switch to and fro several times, which flashes a red light in the studio. Following this signal the announcer presses a button which signifies to the engineer that the former wants to begin the program. After this particular performer concludes, the announcer states that the next number

(*Continued on page* 1272)

The Inventions of Reginald A. Fessenden



PROF. REGINALD AUBREY FESSENDEN

WE are happy to present to our readers this month the first installment of the autobiography of Professor Reginald A. Fessenden. Dr. Fessenden is, without question, one of the greatest American radio inventors. He is the actual inventor of the very first wireless telephone. He is also the inventor and patentee of the Heterodyne prineiple, now used in all Super-Heterodyne receivers. He is also the inventor of the submarine telephone and over 300 other important inventions. Dr. Fessenden's radio achievements have been tremendous, and without him the radio art would not be where it is today.

This autobiography is probably one of the most important in radio literature, for not only does it disclose the work of a great and famous inventor, but Dr. Fessenden has the knack of writing interestingly, constructively and in a language that even a child can grasp.

"The Inventions of Reginald A. Fessenden" will run in serial form for over a year in RADIO NEWS and the work will subsequently be published for the first time in book form.

—Editor.

THE OBJECTIVE

THIS is to be, first of all, an autobiography, for that is what I have been asked to write. But I would like to make it rather more than that. This is an extremely interesting age, one which will be famous for many things. It is an age of great art. Our sculpture has been finely influenced by detailed and scientific knowledge of anatomy, for lack of which the older masterpieces are always reminiscent of lard. Scientific knowledge of color has raised painting to a new level. There has never been any architecture to compare with the dreams of steel and concrete which we build. We shall be remembered for a hundred things, our literature, our surgery, our medicine, our chemistry, our wars.

THE AGE

But most of all we shall be remembered for our inventions. Now, of the details of the other great ages we know very little. We do not know how Shakespeare wrote his plays nor how the Elizabethan sailors made their plans. Cellini's autobiography tells us much of his travels, but little of the methods he used, or how his contemporaries worked. A man, therefore, who has had the good fortune to know personally many inventors and men of constructive mind and of vision, such as Edison, the Wrights, Maxim, Weston, Westinghouse, Thomson, Brush, DeForest, Sprague, Campbell, Steinmetz, Gray, Bell, Fiske, Corey, Thornycroft, Siemens, Arco, Lodge, Fitzgerald, Ewing, Ferranti, Ayrton, Perry, Hewitt, Mordey, Preece, J. J. Thomson, the Darwin brothers, Langley, Wadsworth, Keeler, Hale, Brashear, Carnegie, Phipps, Heintz, Stanley, Kelly, Chesney, Dushman, Langmuir, Alexanderson, Rowland, Newcome, Arnold, Jewett, Rice, Schwab, Stone, Michelson, Woodward, Webster, Goss, Dudley, Muirhead, Kennelly, Birkhoff; to have met many others, Kelvin, Helmholtz, Duddell, Pickard, Marconi, Tesla, Abraham, Balfour, Parsons, Rayleigh, Coffin, Dean Stanley, Nansen, Roosevelt, Jusserand; to have corresponded with Heaviside, Wien, Righi, Shaw; to mention those names that occur at the moment.—ought to attempt, even if in an unambitious way, to hand on something of the color of the time, and to tell, at least a little, of how the things were done which were done.

METHODS OF INVENTION

Invention is an art; just as much so as painting, or doing fine machine work. Would it not be useful to tell of the methods which the experience gained in making some hundreds of inventions and observations have shown to be apparently the best? And of the best tools to use, i. e., the books which have been most useful, those branches of knowledge found most nearly indispensible. And of the best way of approaching problems.

LAWS OF INVENTION

People think of invention as something beyond all law. But it has its laws; here is one of them:

"No organization engaged in any specific field of work ever invents any important development in that field, or adopts any important development in that field until forced to do so by outside competition."

E.g.

1. The telegraph companies did not invent the cable, and after the first cable had been laid continued their efforts to build lines in Alaska and Russia to communicate by that route.
2. Neither the telegraph nor the cable companies invented the telephone. It was offered to them for $300,000 and they declined it.
3. The telegraph, cable and telephone companies did not invent the wireless telegraph, and declined it when offered.
4. The telegraph, cable, telephone and wireless telegraph companies did not invent the wireless telephone, and turned it down when it was offered to them for $250,000.
5. The gas companies did not invent the electric light.
6. The horse-car street railways did not invent the electric railway.
7. The steam engine companies did not invent the steam turbine. Nor did they invent the internal combustion engine.
8. The steam engine companies, turbine companies, gas engine companies, did not invent the Diesel engine.
9. Neither the various types of engine companies nor the electric companies nor the shipbuilding companies invented the turbo-electric or the Diesel-electric drive, and the chief engineer of one of the largest electric companies put on record his opinion that "electricity could never be used except as an auxiliary on ship-board."
10. The electric companies did not invent the high frequency alternator, and when persuaded to make one up at the inventor's expense, the electric company returned it with a letter stating that in the opinion of its engineers it "could never be made to operate above 10,000 cycles."
11. Neither the electric nor the electric communication companies invented the hot cathode rectifier nor the audion. These great inventions were due to Edison and DeForest.
12. Neither the shipbuilding companies nor the ship instrument companies invented the gyroscopic compass, the inductor compass or the wireless compass.

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12. The silk producers and manufacturers did not invent viscose or artficial silk.
14. The collar manufacturers did not invent the soft collar, and turned it down when it was offered to them. Etc. Etc.

This is a law to which, so far as is known, there are no exceptions. Is it not, therefore, worth while for an inventor of an important improvement in methods of making tea or of storing power to know that he should *not* take his invention to those engaged in selling tea or in generating power, because there is less prospect of their adopting it than substantially any other class or organization; that it would be merely wasting his time; that he should adopt other means?

And is it not important that the student of economics should know such a law, in order that he may investigate it and find the cause? All our civilization is based on inventions; before inventions, men lived on roots and nuts and pine cones and slept in caves. And invention must still go on, for it is necessary that we should completely control our circumstances. It is not sufficient that there should be organization capable of producing food and shelter for all and organization to effect its proper distribution. Nature has tried this again and again, as with the ants and the bees, and it was substantially effected by the Chinese at certain stages of their history. But the ant-hill civilization has always proved a failure and insufficient; we must work for still more complete control.

Even if it were physically sufficient, it would not be so mentally. One of the most interesting things in ancient history is the difficulty the Hyperboreans had with their messengers. They lived in a country which was considered ideal by those who lived elsewhere, for everything grew there without cultivation; there was little or no rain, but a heavy dew each night (see Strabo, 12; 13; 15) and a cool sea breeze blew all day, and while it was never hot, there was but little frost in winter. Yet when they sent envoys and messengers to other countries, as they did at first from time to time (see Herodotus, 4, 33) the messengers and envoys never returned to Hyperborea and they were finally reduced to sending their offerings to other temple shrines packed in wheat straw and handed on from tribe to tribe until they reached their destination.

STUDY OF THE SCIENCE OF INVENTION

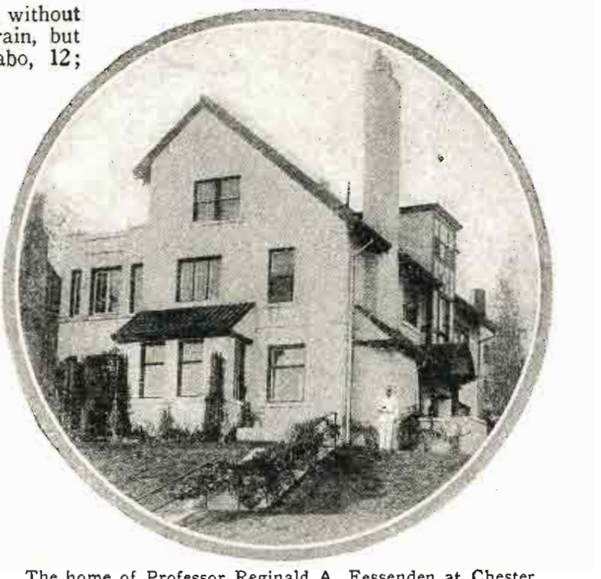
The first thing to do in investigating any subject is to get sufficient data to form a foundation. And in assembling the facts a few definitions are useful, for defined facts are, one may say, already roughly machined.

New and important improvements may originate in a number of ways:

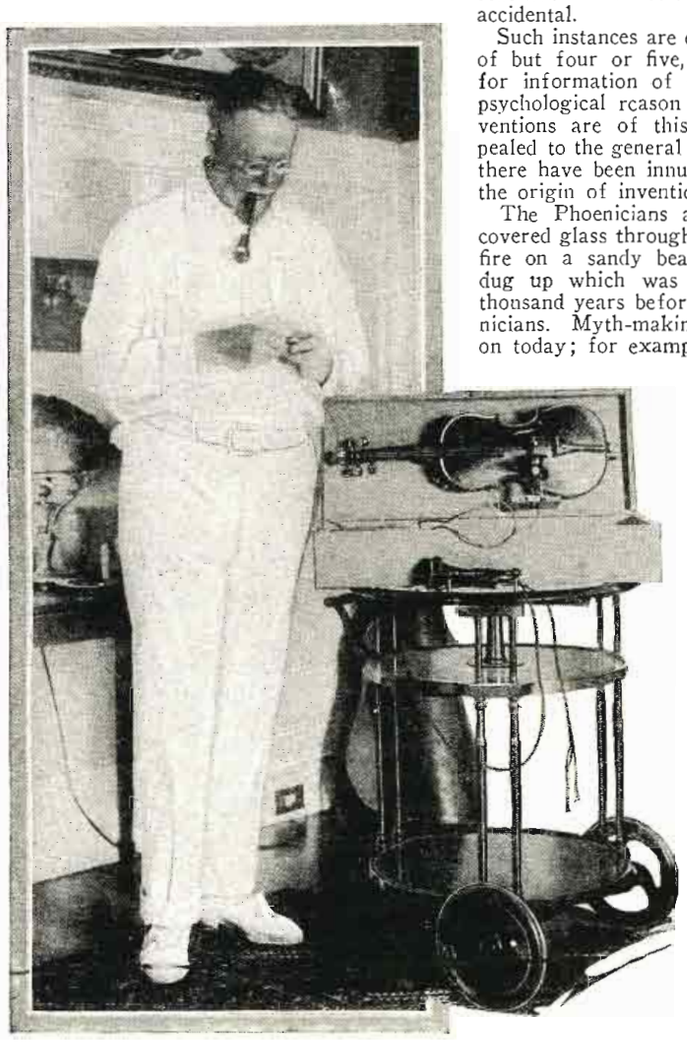
1. *Discovery.* A man working in one field may observe a phenomenon which is immediately and obviously applicable, as an important development, in another field. For example, Röentgen, working in a field which had been opened up by Leonard, but with different apparatus, noticed that when an object of non-uniform density, such as the hand, was interposed between the cathode and the screen or photographic plate the image produced varied as the interposed density, and that he could observe and photograph the bones of his hand. This was a magnificent discovery and has had far-reaching results. The discovery of the light sensitiveness of selenium by Sale was also accidental.

Such instances are extremely rare. I know of but four or five, and would be obliged for information of others. But for some psychological reason the theory that all inventions are of this class has always appealed to the general public and consequently there have been innumerable fake stories of the origin of inventions.

The Phoenicians are stated to have discovered glass through the accident of a wood fire on a sandy beach, but glass has been dug up which was made more than four thousand years before the time of the Phoenicians. Myth-making of this kind is going on today; for example, in the radio supplement of a well-known New York newspaper there appeared, a few weeks ago, a very interesting and circumstantially detailed account of the accidental discovery, at the Brant Rock station, in the presence of a very competent radio engineer, obviously speaking in good faith, of the heterodyne. Though the records of the Patent Office show that the heterodyne patents were filed five or six years before the Brant Rock station was erected, and three or four years before the apparatus described as being used was built, the story told fits in better with the general idea of how inventions are made, probably becoming the standard version.



The home of Professor Reginald A. Fessenden at Chester Hill, Boston, Mass.



Reginald A. Fessenden in his study. The instrument on the table is a radio talking violin, one of Professor Fessenden's latest inventions. An electromagnet is placed near the strings of the violin, which reproduces sounds when audio frequency vibrations flow through the electromagnet winding.

But it is important that the student of economics and of the science of invention should note that it is very rarely indeed that an important improvement arises in this way.

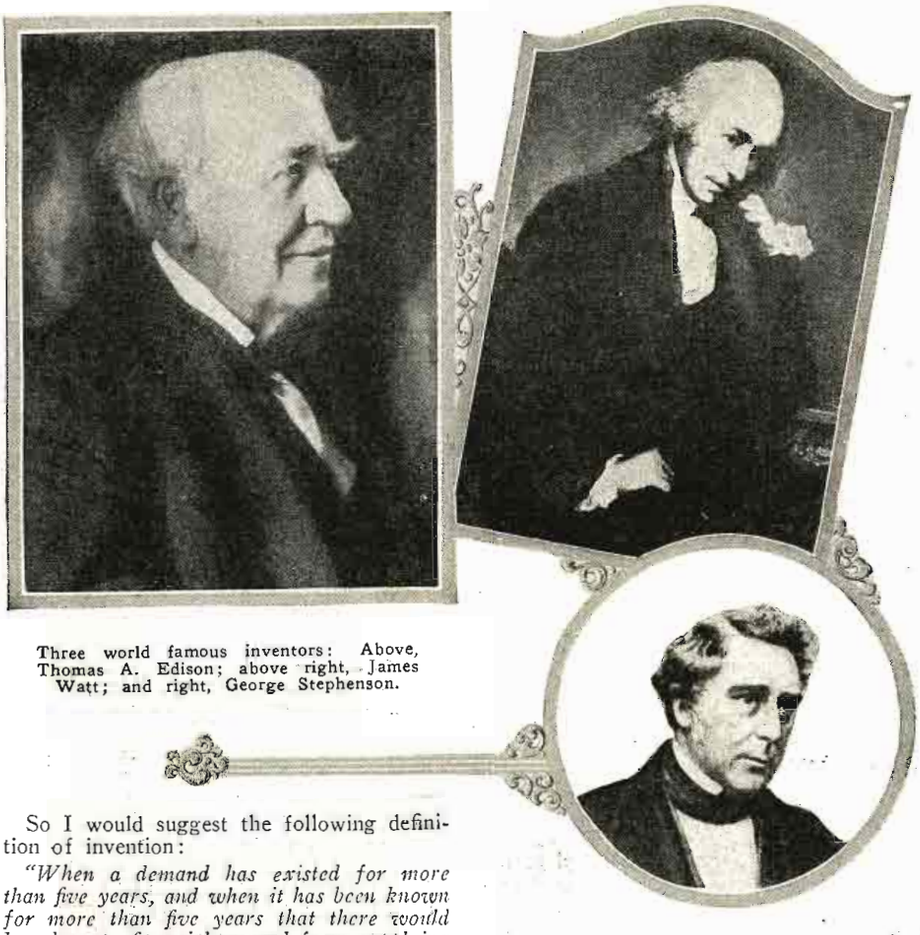
2. *Substitution.* Commercial conditions or engineering methods may change so as to make a well known but previously unused method preferable. Aluminum is known to be a conductor; if the copper mines became exhausted aluminum would be used. A method of signaling for a few miles might be well known but not used; if a demand for apparatus capable of signaling a few miles arose, it might become important.

3. *Design.* A new and definite problem may be presented which can be solved by well known means in suitable combination. For example, at one time lamp black was caused to deposit quickly on copper plates by electrostatically charging the plates and passing the smoke from burning oil between them. The method was found too expensive, but if occasion should ever arise for precipitating other finely divided material, it would be a matter of design to ascertain the proper non-corrosive depositing sheets, the proper means of producing the electrostatic potential, etc.

4. *Invention.* Here a definite problem is set, but the means is not well known, and invention is required.

WHAT IS AN INVENTION?

It will be seen that Substitution, Design and Invention shade imperceptibly into one another. How then shall we determine which is which? I think it determines itself, in this way: If the demand is new or the means for supplying it is new, then it is probably not an invention; and most certainly not when the use of the means to supply the demand is suggested by several individuals. On the other hand, if the demand has existed for a long time, and the means for supplying it have also existed for a long time then the suggestion of applying the means to the demand does involve invention.



Three world famous inventors: Above, Thomas A. Edison; above right, James Watt; and right, George Stephenson.

So I would suggest the following definition of invention:

"When a demand has existed for more than five years, and when it has been known for more than five years that there would be adequate financial reward from supplying the demand, and when all of the means for supplying the demand have been in known existence for more than five years, then the application of the means to the demand will be presumed to involve invention."

Note: About ten years ago, I went over several hundred cases in the Patent Office and found that the application of this rule would reduce the work of the Patent Office between 60 and 70 per cent. It would also do away with patent parasites. By this I mean that when, for example, a man brings out a very important invention, like DeForest's audion, or the new no-hysteresis iron-nickel alloy, the Patent Office is deluged with claims for obvious applications of the new device or material, which are often allowed, incorrectly. This does not, of course, apply to improvements of the new device or materials, requiring real invention.

It may be asked, why set the term of five years? The answer is that this is merely a basis to work from. It may be held as quite definitely settled that when a strong pecuniary incentive has been known in existence for more than five years, and every element of the means to supply the demand, has also been in known existence for more than five years, that invention has been necessary to see that the demand could be supplied by the means, but if either demand or means had been in known existence for less than five years, it does not imply that there has not been invention, but merely that invention is not clearly established and that the claim for invention must be supported by other evidence.

Having cleared this portion of the ground, we can next see if there are any characteristics which define the inventor himself.

WHAT IS AN INVENTOR?

Now we see the advantage of getting out our definition of invention. We can go ahead at once and say:

"An inventor is one who can see the applicability of means to supplying demand five years before it is obvious to those skilled in the art."

DR. FESSENDEN has made over 300 inventions which are in use. Of great interest is the fact that already in 1907 he had a radio broadcast station, while he hurled the human voice across the Atlantic as early as 1908. A list of his more important inventions follows:

1. Wireless telephone.
2. Heterodyne principle.
3. High frequency alternator.
4. Relay wireless, i.e., sending from one station to another which automatically retransmits it. Now used by a former assistant, Kintner, with Westinghouse Co.
5. Wave chute. The first broadcasting from Brant Rock, 1907. The first trans-Atlantic telephoning, 1908.
6. Wireless compass, or Fessenden Pelorus, or direction finder.
7. Loop antenna.
8. Induction telephone. The one where the diaphragm is copper and actuated by induction from adjacent coils.
9. Compressed air condenser, and spark gap.
10. Suspension insulator.
11. Variable transformer.
12. Continuously receptive receiver.
13. Silicon iron for transformers.
14. Flexible insulating cloth (commonly known as Empire Cloth).
15. Turbo-electric and Diesel electric drives for battleships.
16. Submarine telephone.
17. Submarine oscillator.
18. Depth sounding by echo (now on market as Fathometer).
19. Iceberg and submarine locators.
20. Subterranean power storage system.
21. Use of high carbonic acid content air for growing crops.
22. Tracer bullet.
23. Artillery sound ranging.
24. Smoke cloud attachment for tanks.
25. Original geophone.
26. Ultra-audible sound signaling, etc.

WHAT CHARACTERIZES AN INVENTOR'S MIND?

Obviously, that he sees relationship between things to a greater extent than the average individual does. This may come about in two ways:

1. By extensive knowledge, gained by experience or by study.

This explains the reasons for Edison's tests, which have been so much ridiculed, but which are so sound fundamentally. Those tests showed whether the man was one who existed in a mental rut or was one who spread his thoughts.

2. By naturally thinking in that way.

When I first began to invent, I held the opinion that there was no natural aptitude for invention, and that any one could be technically trained to be an inventor. This came from the fact that I have always been extremely fortunate in obtaining good men for my assistants of whom I have always been very proud, and who have placed me under obligations which I can never adequately acknowledge. But in going over the history of all the inventions with which data could be obtained, it became more and more clear that in addition to training and in addition to extensive knowledge, a natural quality of mind was also necessary.

For one thing, this was indicated by the fact that an inventor makes not one, but many inventions, depending on the length of time he lives after he starts inventing, and on his opportunities. Take for example Stevenson, Watt, Edison, Weston, DeForest, Parsons, Henry, the Wrights, Rowland, Michelson, and you will see that they made not one, but many inventions. This is apt to be overlooked, for many inventors are best known by their most prominent invention. How many men know that Watt invented the copying press, the parallel link motion, the condenser, the pantograph method of copying sculpture; that Stephenson invented the safety lamp; that Edison invented the mimeograph and the modern methods of making cement?

In regard to these mental processes, we have not sufficient information and must proceed to collect data. So as furnishing the data for one individual case we come to the autobiography which I promised the Editor of RADIO NEWS that I would write: *"The Inventions of Reginald A. Fessenden."*

(The second article of the series will appear in the next issue of RADIO NEWS)

NATIONAL SIGNAL ASSOCIATION FORMED.

The formation of a national body of signal officers and those interested in radio, telegraph and telephone communications has been undertaken in several cities, according to Maj. Louis M. Evans, of the Signal Officers' Reserve Corps.

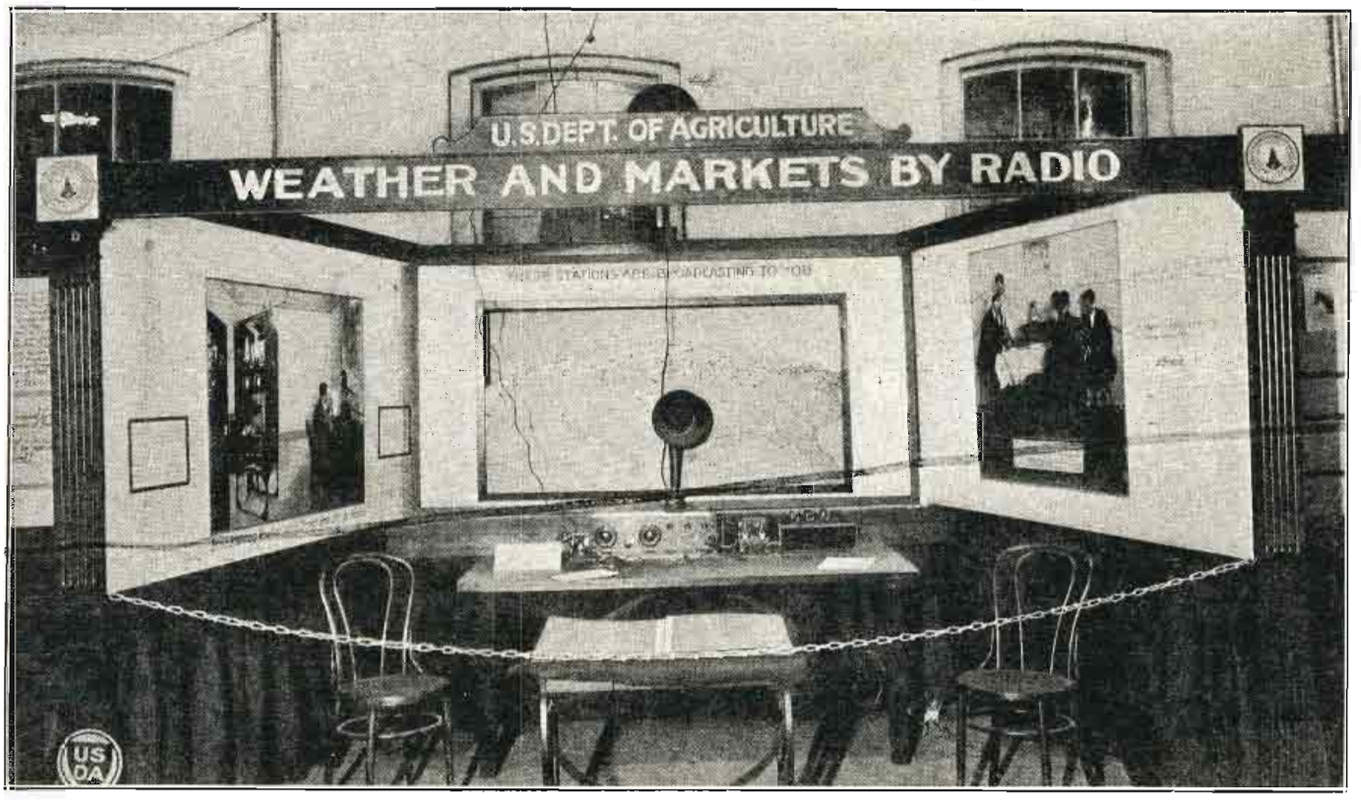
The organization is known as The American Signal Association. It is planned to have branches in every corps area and city, if possible. Maj. Gen. Chas. McK. Saltzman, Chief Signal Officer of the Army, is back of the project, which it is understood will have headquarters in Washington with posts in important centers. The object of this association is to bring reserve officers and others interested in radio communication and signal work into closer touch with the activities of the regular army.

Local posts have been formed in Chicago, Washington, Detroit and Boston, while others are in process of organization. Annual meetings at different centers are planned, and a publication devoted to communications is contemplated. The organization will be similar to those of other military arms, such as the Air Service, Infantry and Ordnance Corps. Area Commanders are aiding in organization work.

Farm Radio Making Rapid Progress

By J. FARRELL

A point has been reached where the farmer cannot well do without a radio set. The information broadcast daily by the U. S. Department of Agriculture, through numerous broadcast stations is invaluable to the modern farmer. Mr. Farrell proves it, in a pleasing manner.



One of the radio exhibits of the U. S. Department of Agriculture that is attracting wide attention throughout the country. It leaves nothing to the imagination of the farmer. It tells everything he has wanted to know about radio and what it can do for him.

THE hold that radio has taken on the rural population of the United States is strikingly brought out in the latest survey made by the United States Department of Agriculture. This survey, made through more than 800 county agricultural agents,—Government representatives who come in daily contact with farm people,—developed the fact that the number of radio sets on farms is now twice the number in use a year ago.

The survey showed that on the average there are now in use 130 radio receiving sets in each agricultural county, which figure projected to the 2,850 agricultural counties in the United States rolls up a grand total of 370,000 sets, as compared with a similar estimate of 145,000 sets a year ago. In some counties more than 90 per cent. of the farms are reported to have radio equipment. Over 50 per cent. of the county agricultural agents themselves have radio sets in their offices for the dissemination of agricultural news.

The writer, in previous issues of RADIO NEWS has described fully the nation-wide agricultural news broadcast service of the Department of Agriculture from upwards of 80 broadcast stations throughout the country. There is practically no farm community in the United States where crop and market advices are not now available, and the big job now, as the Department officials see it, is to encourage greater use of radio in the reception of these advices. Through the county agricultural agents, whose work it is to encourage the use of modern marketing methods, it is hoped to increase the use of radio until practically every farmer in the country may have the benefit of this comparatively new medium for keeping informed of current market conditions.

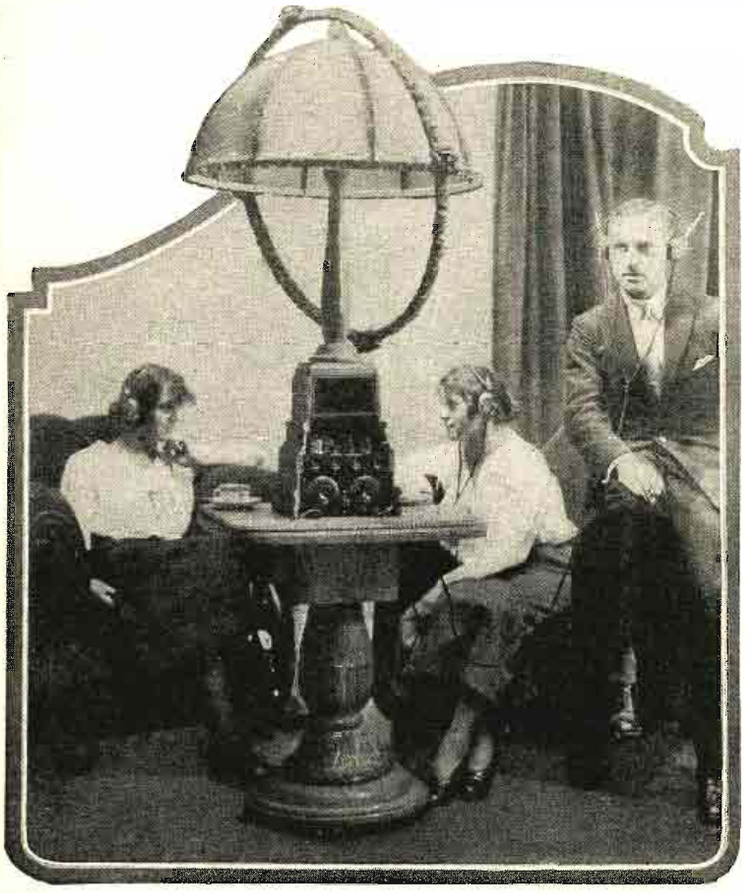
The drive for greater farm use of radio will be made by giving individual demonstrations of radio on farms, and through

(*Continued on page* 1294)



A group of country agents receiving the U. S. Department of Agriculture market reports being transmitted from a local broadcast station.

International Radio



This table lamp radio receiver, of German manufacture, is unique in a number of respects. The receiving set and amplifier are mounted in the base of the lamp. The loud speaker is also in the base and directly above the set. The main feature is the circular loop aerial. It is pivoted at the border of the shade and is swung down when it is to be used for reception purposes. The lamp shade is also pivoted in order that the loop aerial may be turned in a horizontal plane. When the loop aerial is not in use it is swung up, and places itself parallel with the border of the lamp shade. Either headphones or the loud speaker can be used; a multiple jack is provided for the insertion of the former.

GERMANY

Radio Balloon

A test made recently in Germany with a free balloon proved of great interest to the aeronauts of that country, when a radio set was placed in the basket with eight wires for an antenna running to the "equator" of the gas bag. The reception of several large stations was excellent; even the station at the Eiffel Tower in Paris was heard clearly through fogs and clouds.

Radio Lamp

A German manufacturer recently brought out a novel radio set which is built into the base of a table lamp. The set proper is at the base of the lamp and directly above it is the loud speaker. A circular loop aerial which is a part of the lamp shade can be swung down and rotated at will. The shade turns with it. A view of this novel "radio lamp" is shown in the photo at the top of this page.

ENGLAND

English DX

The summer days in England cause no mutterings of discontent from the DX hounds. There are reports at hand that show amateurs in Argentina and Mexico were heard and that the first British-Australian telephony tests were successfully carried out in the "off season."

The short wave tests which were performed by the U. S. Naval Research Laboratory in Washington were received with a Super-Heterodyne receiver in England and were described as "very strong and absolutely steady." An interesting feature of this reception was that Washington was in daylight at the time that the signals were heard in England.

An example of the unimportance of lightning from the radio point of view was illustrated during a thunder storm, when the antenna of the Leeds-Bradford radio relaying station was actually struck. The only damage done was to the antenna ammeter and the program being broadcast at the time was interrupted only for a few minutes. It is perfectly obvious that with the ordinary common-sense precaution no danger whatever need be apprehended because of lightning.

An interesting experiment was recently carried out in London, when it was demonstrated that a heavy machine could be controlled by radio. A 500 k.w. rotary converter was installed in the Palace of Engineering at the Wembly Exposition and was started and stopped by means of tube relays from an experimental station at Trafford Park, Manchester.

All complicated hand-switching operations were eliminated, the starting control being made automatic, and connected with a radio receiving set. The transmission station sent out a signal, and the machine started up; and a few minutes later another signal was sent, stopping the machine. While the mechanism is far from being perfected and there is a slight danger of its starting accidentally from an outside signal, this is considered a great step forward in electrical engineering.

DENMARK

New Station

A new broadcast station was recently opened in Copenhagen, making the third one in Denmark. Tests were made on 300 and 900 meters.

Radio Society

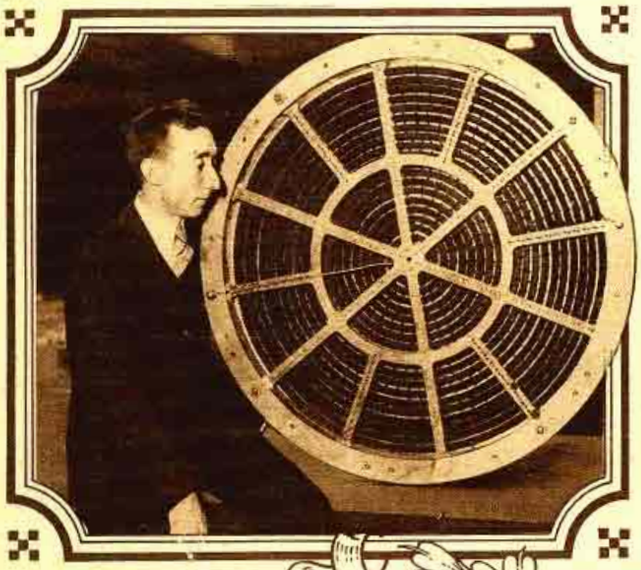
A small number of amateurs worked secretly and in silence with coils, condensers and tubes, until the beginning of last year, when they suddenly came into the daylight and formed their organization, "The Danish Radio Society," which has now a membership of about 15,000. The radio society in Denmark is built up on the same principle as in England, with affiliated clubs all over the country, so that it is the chief organization. Unfortunately the development has created a separation among the amateurs, as a number of them in different parts of the country have formed a new society, "The

(*Continued on page* 1298)

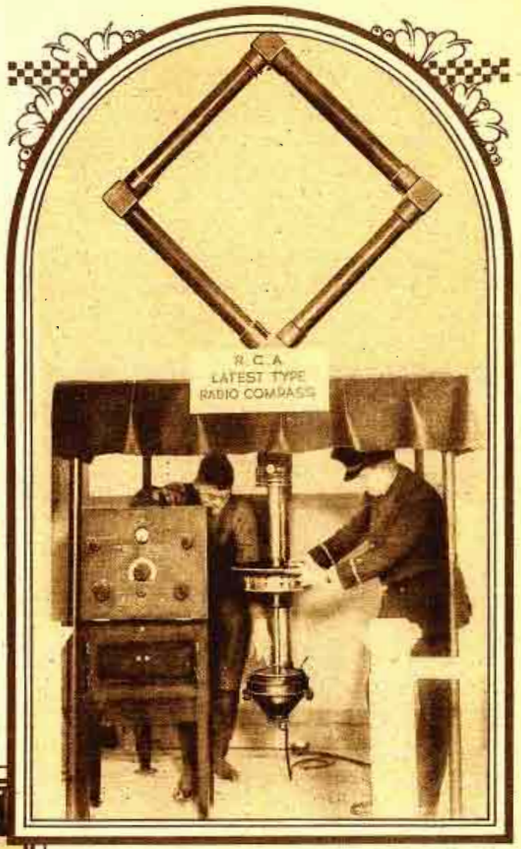


A few late models of radio receiving sets of German manufacture recently exhibited. The set in the lower left hand corner shows ear marks of American design. Note the binding posts employed on the sets: they are combination posts and jacks.

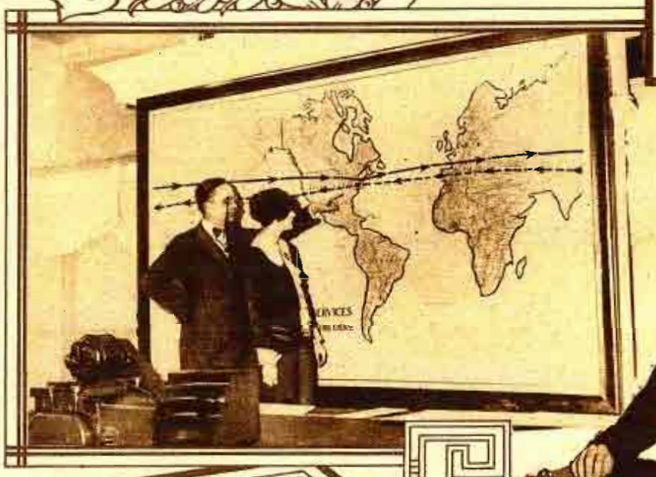
At the National Radio Show



A NEW LOUD SPEAKER, the invention of C. W. Hewlett, is the latest in radio. It can be heard eight miles audibly and consumes 1½ kilowatts in operation and for that reason is hardly a speaker for the home radio. © Kadel & Herbert



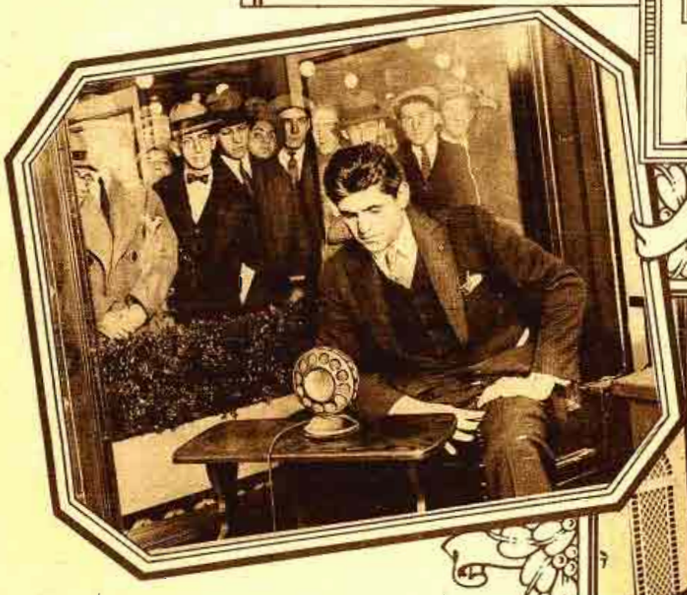
A RADIO COMPASS loop aerial of latest design is shown in the right photo. © Kadel & Herbert.



MAJOR J. ANDREW WHITE, the famous sports announcer of "WJZ" showing Miss Dorothy Nestell the routes on the map, that the two "race" messages followed. © Kadel & Herbert.

A RADIO RACE around the world was one of the features of the National Radio Show, New York. One of these men flashed a message east, the other west. The elapsed time required by each message to make the circuit was the basis on which the contest was decided. © Kadel & Herbert

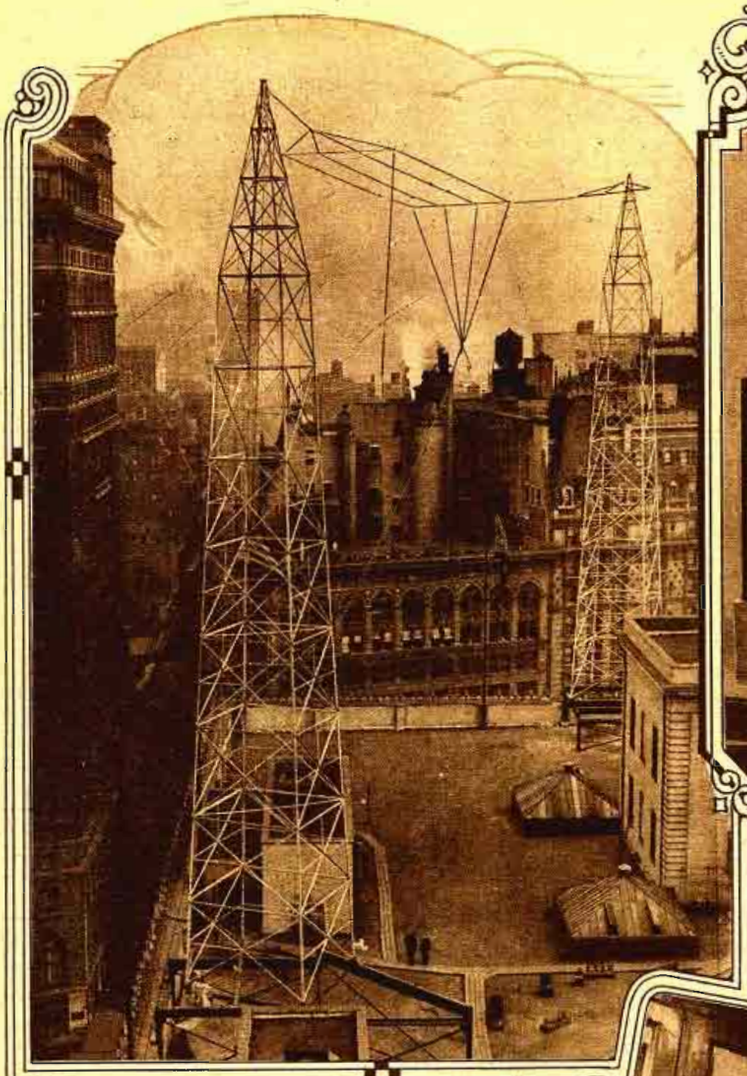


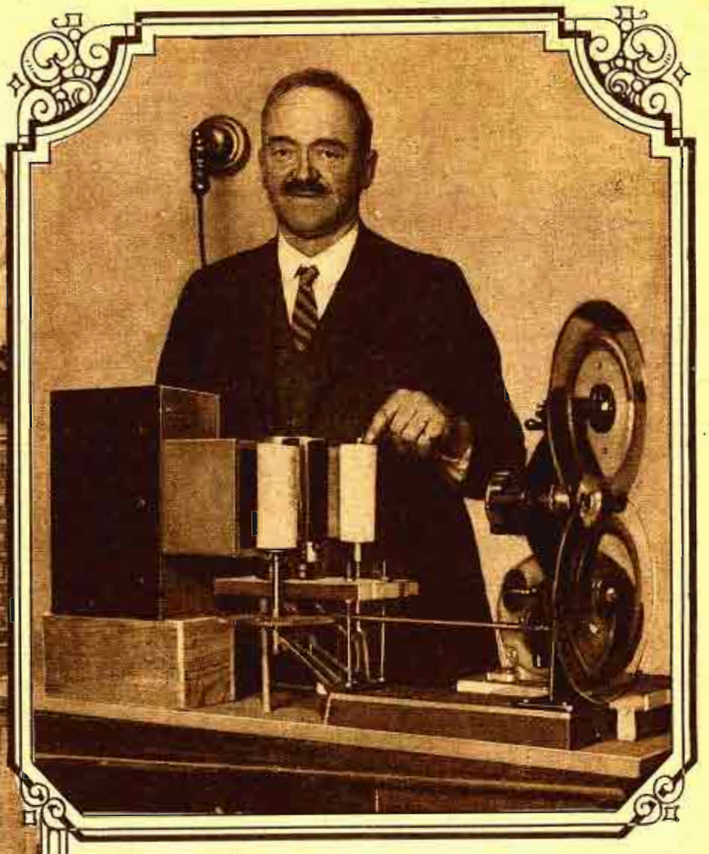


A GENERAL VIEW of the National Radio Show at the Grand Central Palace, New York City, where many new and interesting radio devices were put on exhibition for the first time. © Kadel & Herbert.



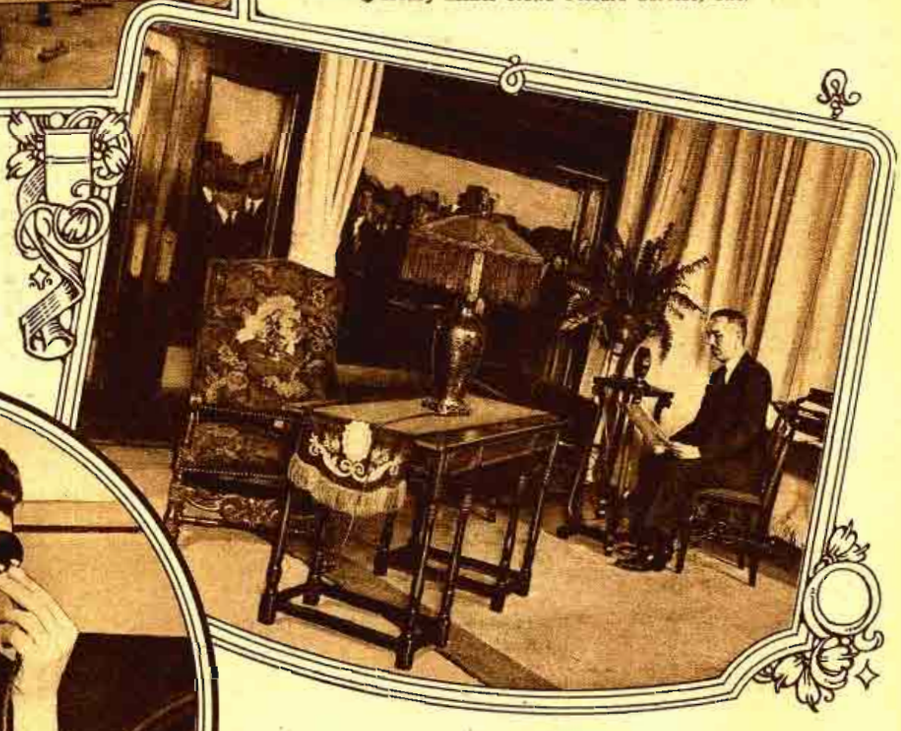
THE WILD BULL OF THE PAMPAS, Luis Angel Firpo, as he delivered a short sport talk into the microphone at the newly erected station WGBS of Gimble Brothers', Store, New York. © Kadel & Herbert.





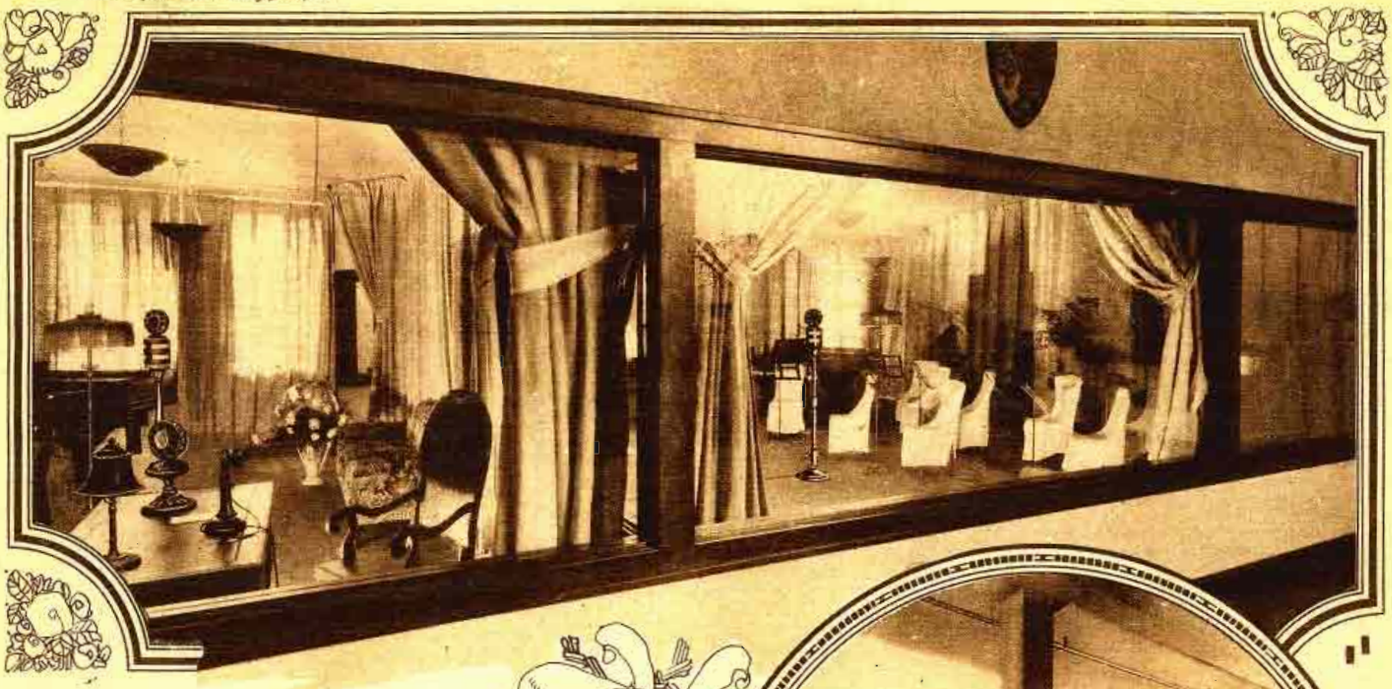
PROJECTION OF PHOTOS BY RADIO is made possible by the use of the illustrated apparatus, the invention of C. Francis Jenkins of Washington, D. C. The device has been put to the novel use of transmitting business forms, letters and general correspondence. It can transmit news copy at the rate of 100 words per minute. © Henry Miller News Picture Service, Inc.

GIMBEL BROTHERS' NEW STATION, WGBS, the towers of which are shown in the upper photo, and the novel glass partitioned studio to the right. Visitors to Gimbel Brothers' store in New York City have the opportunity of "looking-in" on the studio and viewing every phase of the operation of the station. WGBS transmits on the wave-length of 316 meters. © Kadel & Herbert.



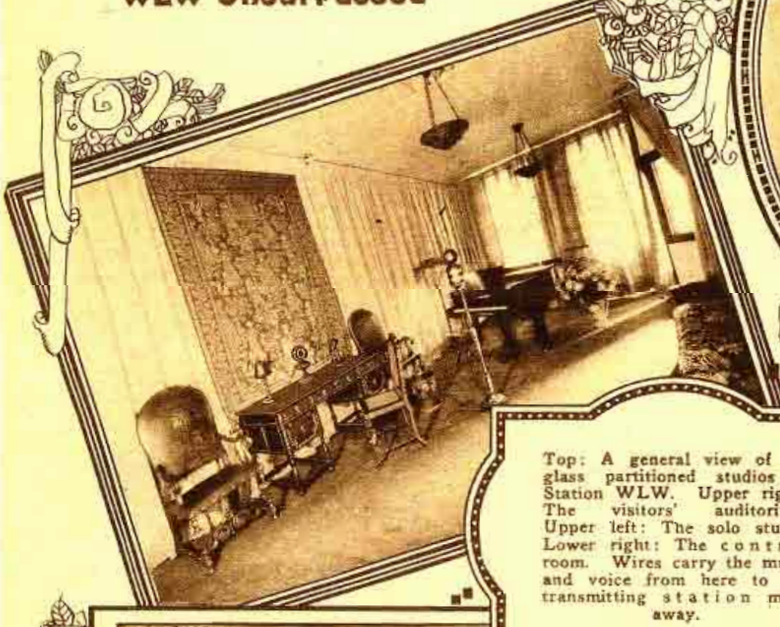


RADIO FOR THE DEAF has been made possible by this new device shown at the recent Medical Exhibition at Westminster, in England. The set is of ordinary type, employing two vacuum tubes. The contact device, which takes the place of the usual headphones, when placed against the elbow, knee or forehead, faithfully imparts the vibrations to the bones of the listener, which in turn affect the auditory nerves. It has been stated that a lady visitor to the Exhibition, who had not heard for 40 years, was able to hear music through the medium of this instrument.



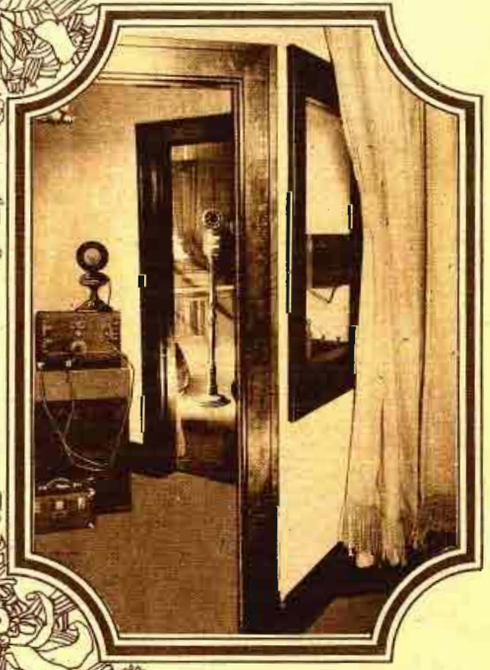
Studios of Station WLW Unsurpassed





Top: A general view of the glass partitioned studios of Station WLW. Upper right: The visitors' auditorium. Upper left: The solo studio. Lower right: The control room. Wires carry the music and voice from here to the transmitting station miles away.





Pictorial Radio News



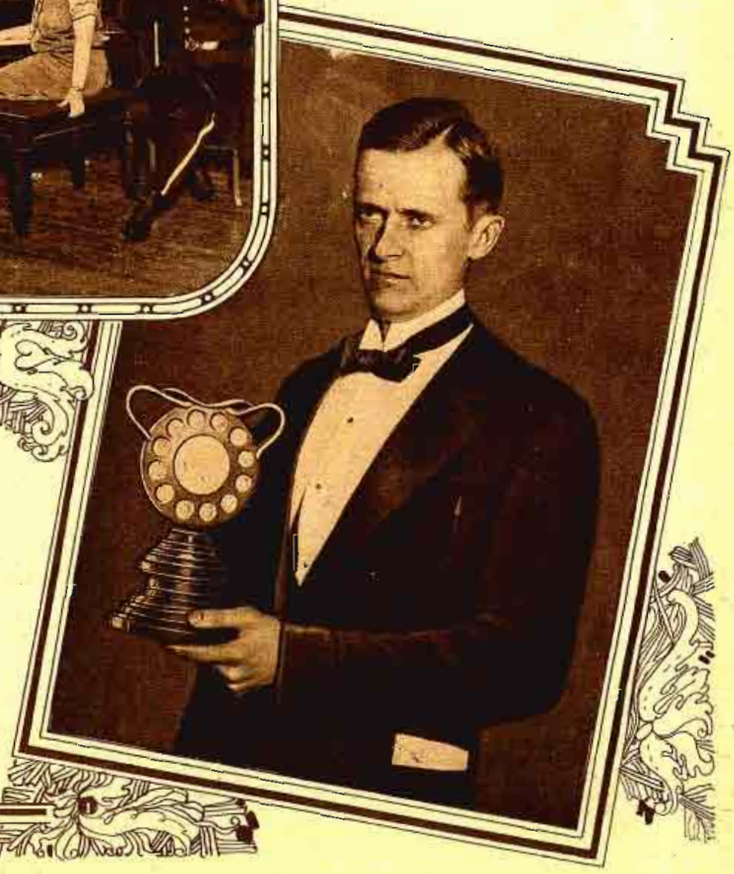
"PREPARE-BROADCAST" says this microphone to the artist and is perfectly silent. Beneath the regulation microphone is an electric sign that does the informing. It is controlled by the studio announcer. © United.



A WANDERING MINSTREL OF THE AIR. "Nate" Coldwell, known throughout the country as the "Joy Digger." He keeps moving and the radio audiences are getting used to his popping up in different stations. He came east three years ago from Chicago to Dartmouth College. A year before graduating, the doctors told him he had developed tuberculosis and would have to quit college and get out into the air. "Nate" went the doctors one better; he not only got out into the air, but got out onto the air. © United.



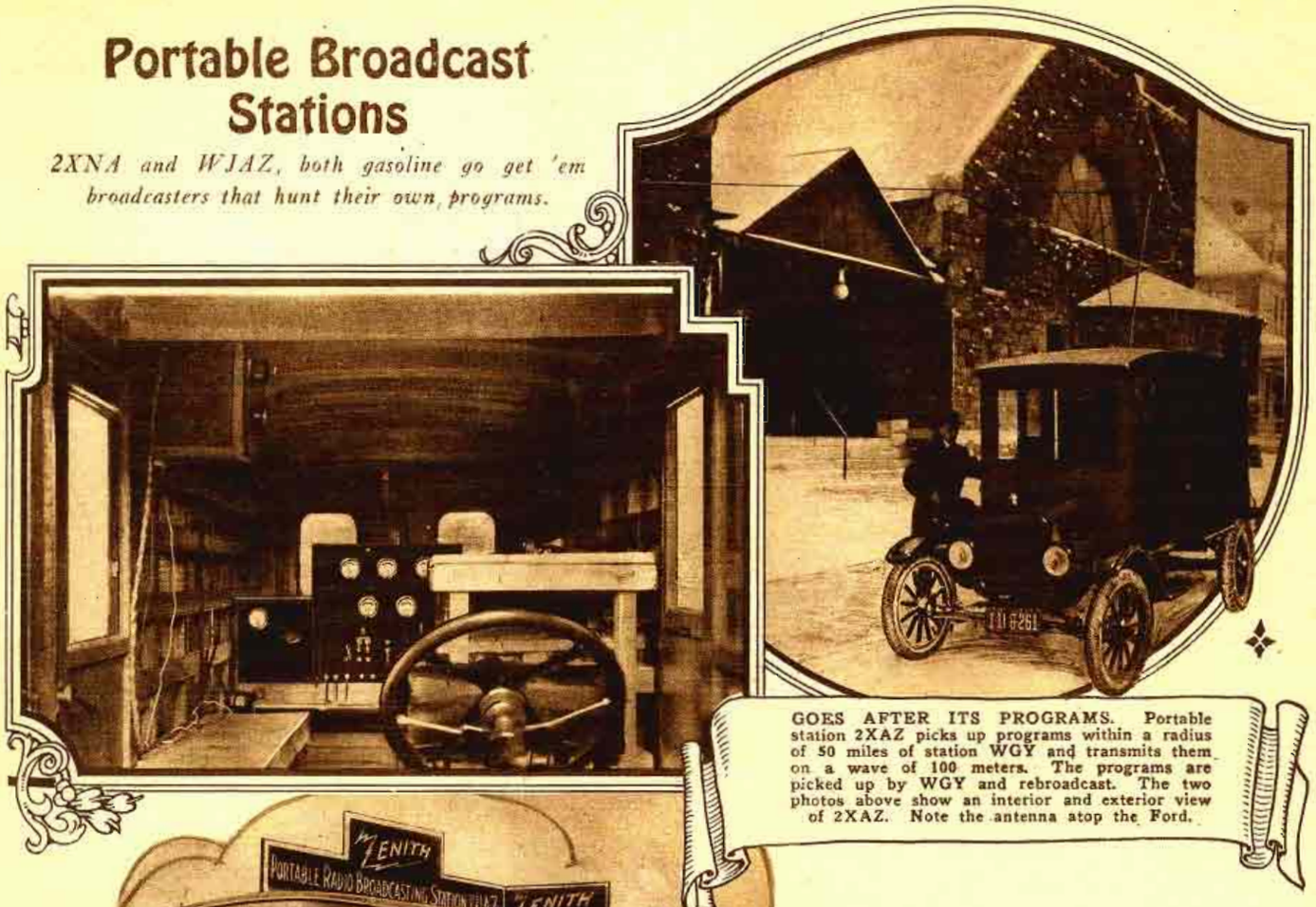
THE FRISCO POLICE JAZZ BAND is making a big hit. Although organized only a few months, the jazz orchestra of the San Francisco Police Department has already become famous. The members are shown in the broadcast studio of station KPO, making the microphone shimmy with syncopation. © Kadel & Herbert.



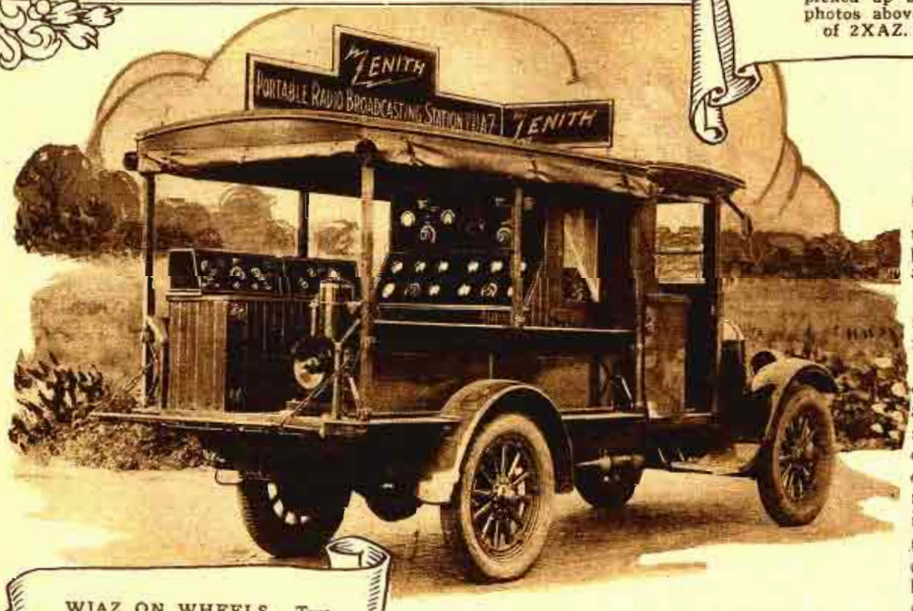
THE MOST POPULAR RADIO ANNOUNCER. George Dewey Hay and the silver loving cup made in the form of a microphone presented to him at the termination of a recent contest in connection with the New York Radio Show. Mr. Hay is now stationed at WAHG, the new Grebe broadcast station at Richmond Hill, N. Y. © P. & A. Photos.

Portable Broadcast Stations

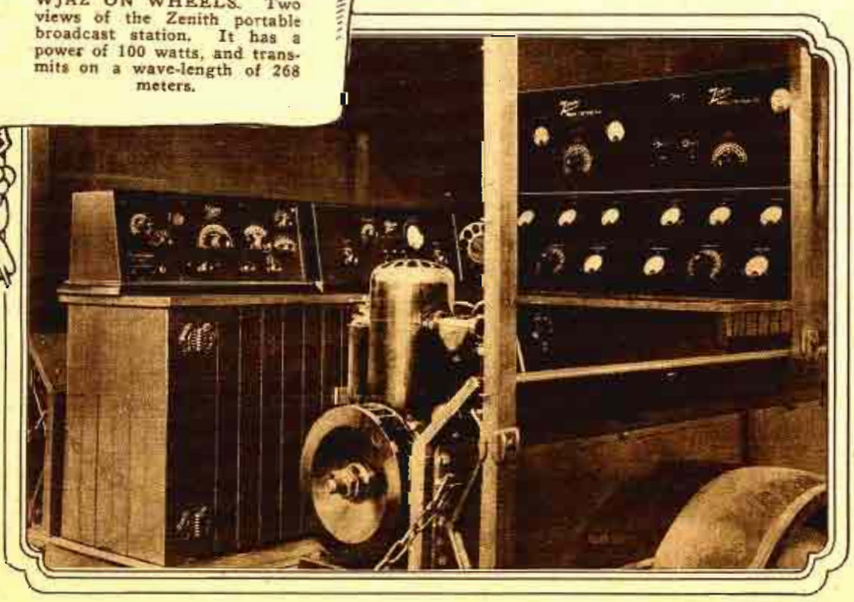
2XNA and WJAZ, both gasoline go get 'em broadcasters that hunt their own programs.



GOES AFTER ITS PROGRAMS. Portable station 2XAZ picks up programs within a radius of 50 miles of station WGY and transmits them on a wave of 100 meters. The programs are picked up by WGY and rebroadcast. The two photos above show an interior and exterior view of 2XAZ. Note the antenna atop the Ford.



WJAZ ON WHEELS. Two views of the Zenith portable broadcast station. It has a power of 100 watts, and transmits on a wave-length of 268 meters.



SOMETHING novel in broadcast stations is shown in the accompanying illustrations. WGY has its new pick-up stations mounted on a truck which can be driven to wherever an interesting event is to take place. The portable station transmits on a short wave-length to the main station in Schenectady where the program is rebroadcast on 380 meters.

The other portable station, WJAZ, is self contained in respect to antenna equipment, amplifiers, batteries, etc. The station can be set up in the middle of a field without any other power supply than its own and without any supports other than its own antenna mast. It operates indefinitely, especially since it is equipped with a complete gas engine generator charging outfit, which is able to charge the batteries while the outfit is in broadcasting operation. This feature is of special interest, as otherwise the period of operation possible would be rather short.

The set is of 100 watts power and uses four 50-watt tubes, two as oscillators and two as modulators. All the apparatus is completely panel mounted.

TRUCK AND MAST

The entire truck is electric lighted with spot lights on the panels, as well as a number of spotlights designed to illuminate the antenna mast which is of sectional type such as was used by the army during the war. It is 53 feet high.

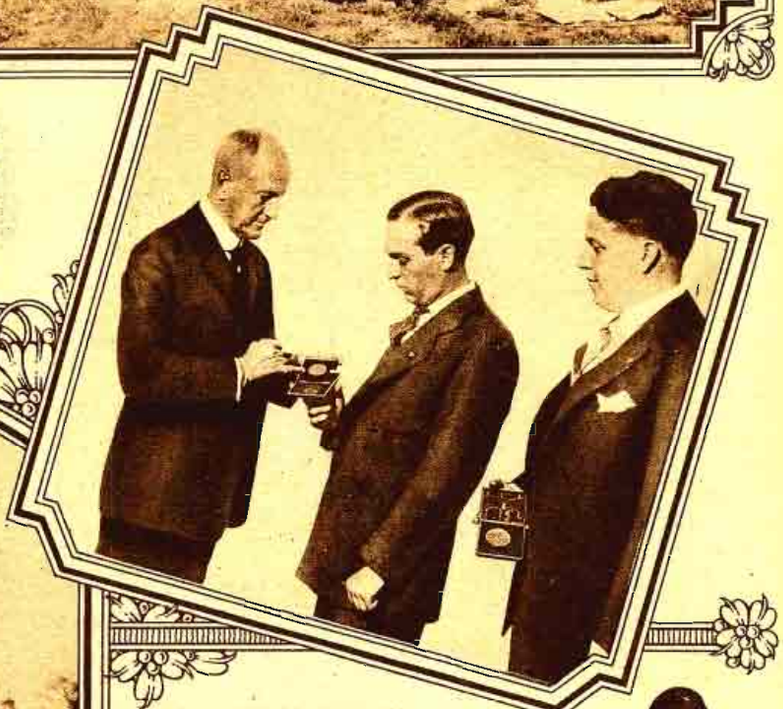
The antenna is extremely novel, consisting of four heavily braided copper cables with extremely fine wire making them extraordinarily flexible. These wires are provided at each end with snap hooks which are attached to rings which fasten to two spreaders. Clips are provided on each spreader for connection purposes.

The battery supply is 24 volts with a total of 320 ampere-hours. This battery arrangement operates a 24 volt to 1,500 volt direct current generator which is equipped with the necessary filter system to eliminate hum. A

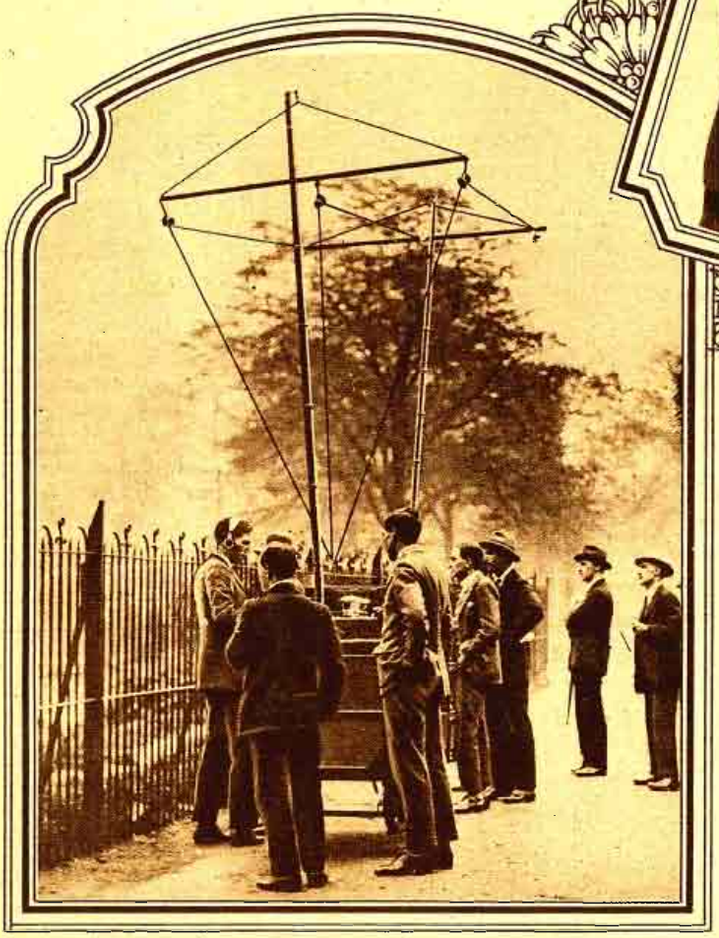
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UNCLE SAM AND RADIO. The communication platoon of the 26th Infantry, commanded by Capt. H. B. Crowell and Lieut. W. W. Jenna, using the full equipment of radio and telephone apparatus which the army employs for field work. Note the self supporting loop aerial on the receiving set on the ground. © Kadel & Herbert.



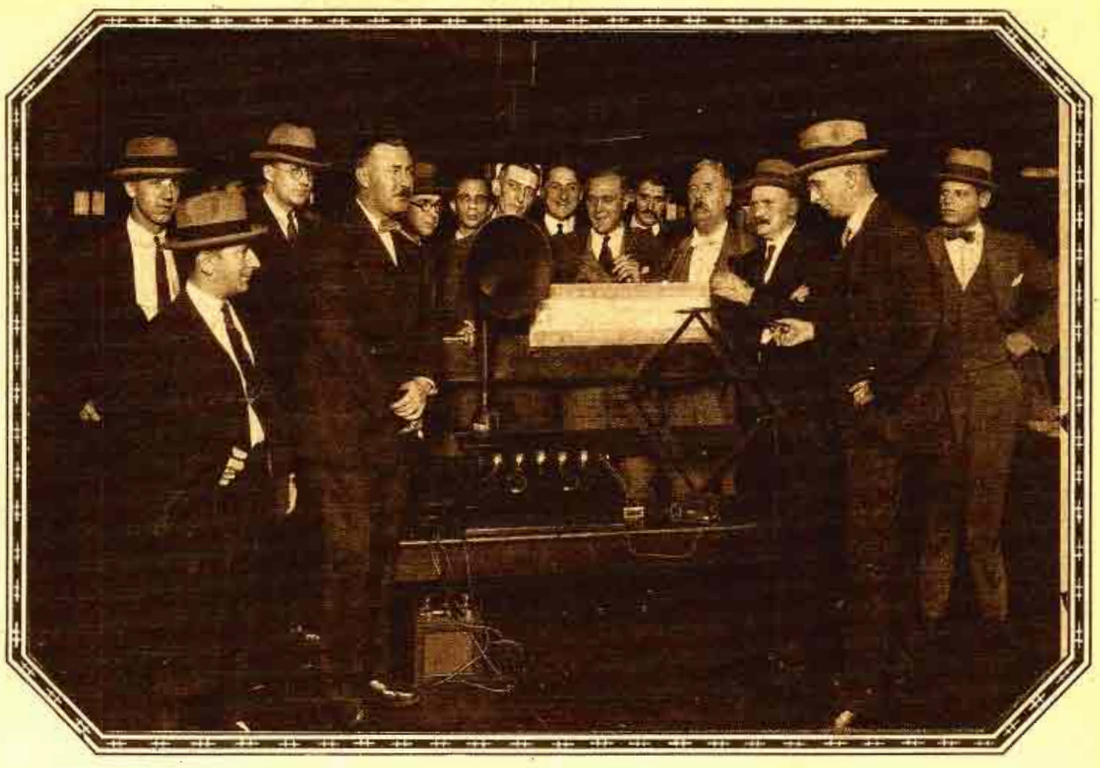
TWO RADIO HEROES. General Harbord, president of the Radio Corporation of America, presenting meritorious service medals to the radio operators of the S.S. Boston, Elmer Walter (center) and Charles Sullivan. © Kadel & Herbert.



BROADCASTING THE ZOO. A view in the zoo in London during the broadcasting of the cries of animals. The photograph illustrates principally the novel remote broadcast station employed at the time. © Kadel & Herbert.



A RADIO CONTROL TABLE, designed by F. R. McGinniss of Albany, New York, which includes everything from battery chargers to power amplifiers, to suit the convenience of his Super-Heterodyne set. (Photo courtesy Experimenters Information Service.)

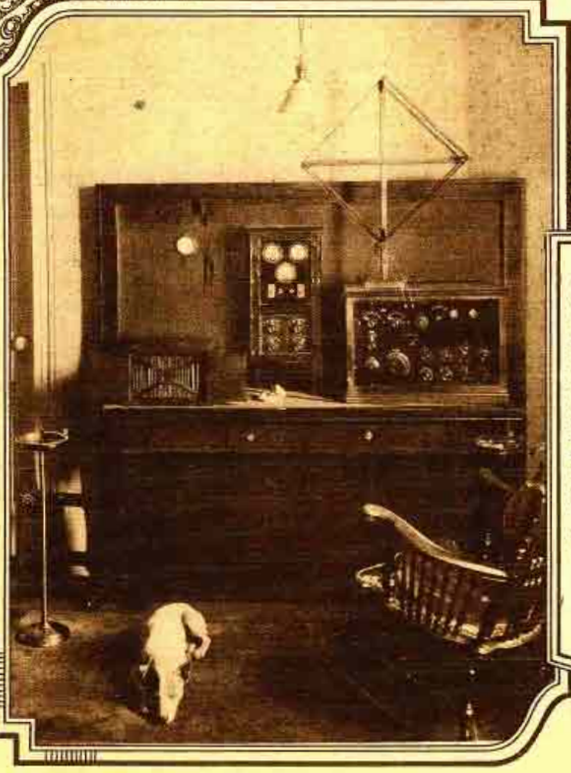


THIRD DOWN, TWO TO GO and these members of the New York Consolidated Stock Exchange should worry about the price of Amalgamated Preferred or Union Common. Not when they can listen to the roar of the crowd at the football game, over the radio. Not when they can get the up-to-the-minute reports on the plays. You betcha not!

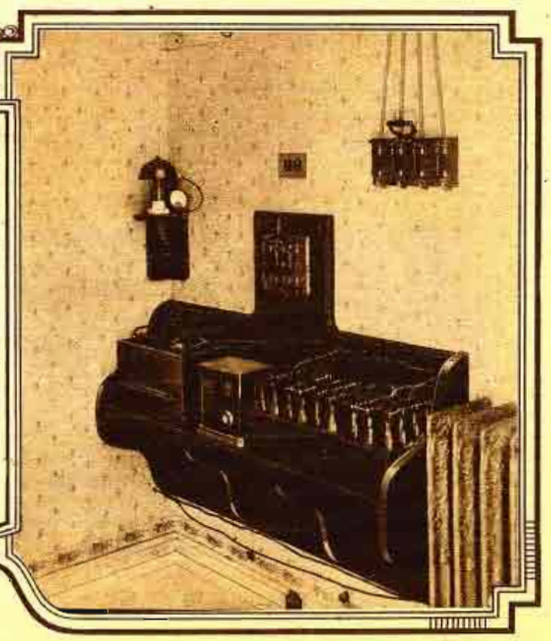


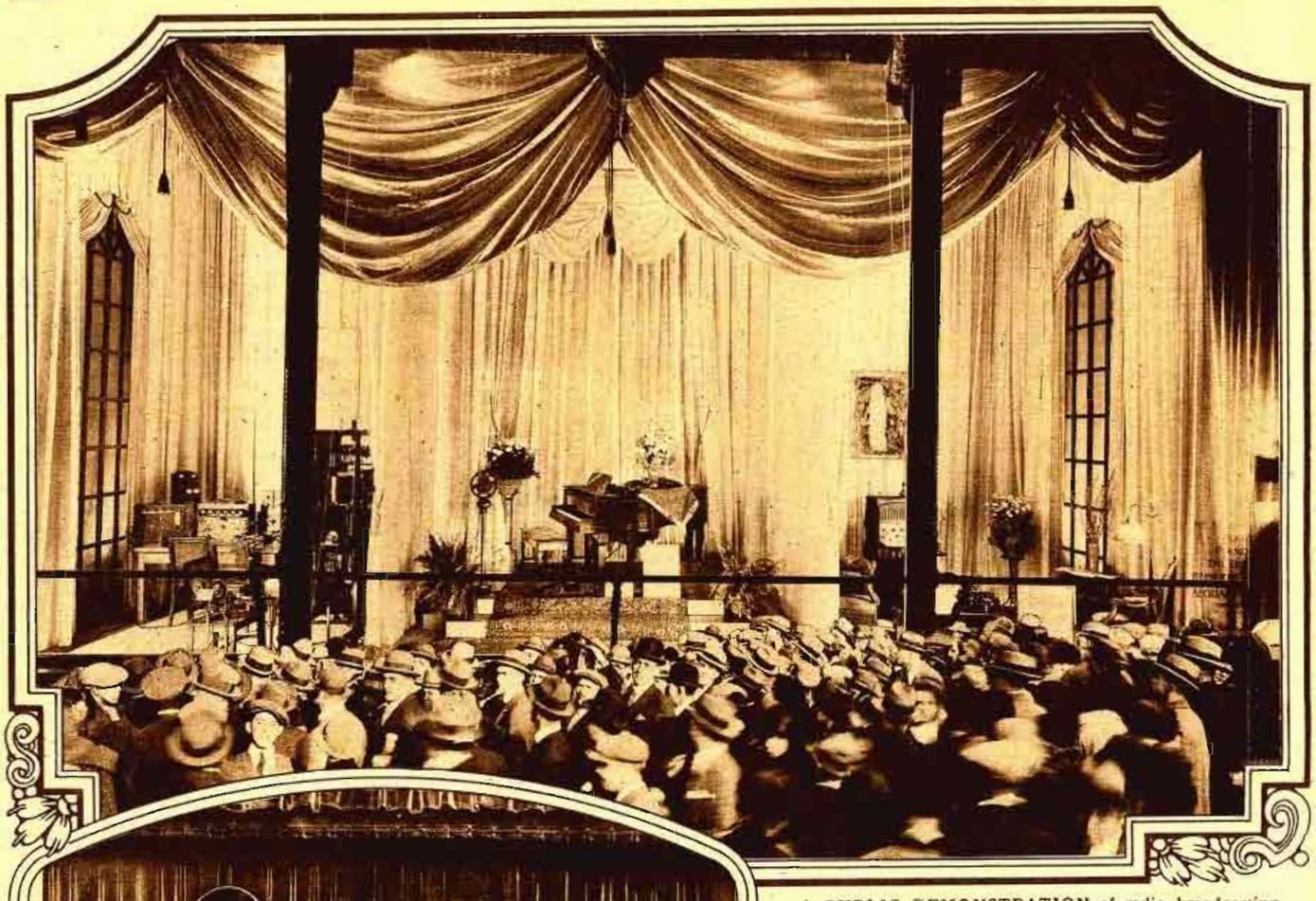


AN ACCOMPLISHED WOMAN is Miss F. V. Wallace, the only one of her sex holding an engineering degree in Australia. She is a qualified electrical engineer, as the reproduction of her diploma asserts, and a radio fan to boot. And she is the only woman member of the Wireless Institute of Australia. She is on the Committee of the Electrical Engineers Association and Treasurer of the Metropolitan Radio Club.

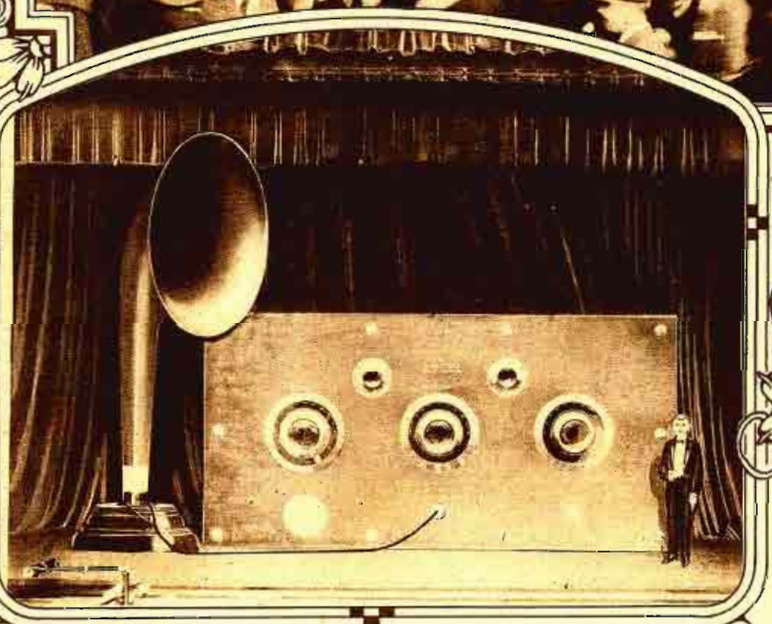


RADIO IN THE HOME of Charles S. Hunter of Staunton, Va., is no small issue. It has taken an important position in the life of himself and his family and being a part of their lives, Mr. Hunter logically asked himself why shouldn't it be done up right and in accordance with the surroundings? And to the left and to the right are the results; an excellent set with a loop aerial and an artistic loud speaker; storage "A" battery and "B" batteries and a charger on a specially constructed shelf. Every thing is complete.

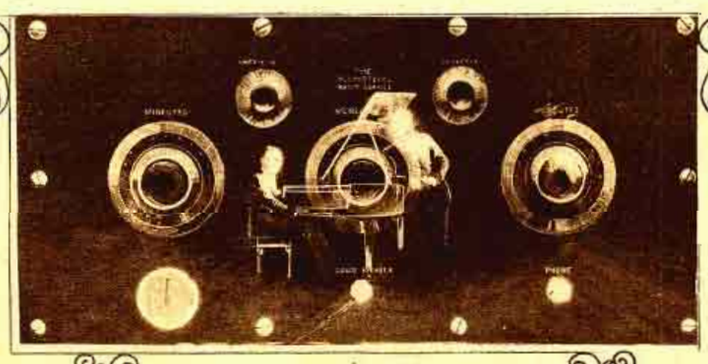




A PUBLIC DEMONSTRATION of radio broadcasting was given recently when WJZ had a complete broadcast station, studio and all, installed in the window of Aeolian Hall, New York City. The passing crowds were able to witness for the first time, the interior workings and the mysterious mechanisms that make their radio sets come to life with voice and music. These programs were broadcast from WJZ, the towers of which are atop the Aeolian Building.



A NOVEL STAGE SET for the Radio Franks (Messrs. Wright and Bessenger) employed for their first public appearance on Broadway at the Mark Strand Theatre, singing songs that made them famous on the radio in the east. Through the use of transparencies and spot-lights off stage, the Radio Franks are shown inside the radio set. The two effects are shown above and below.

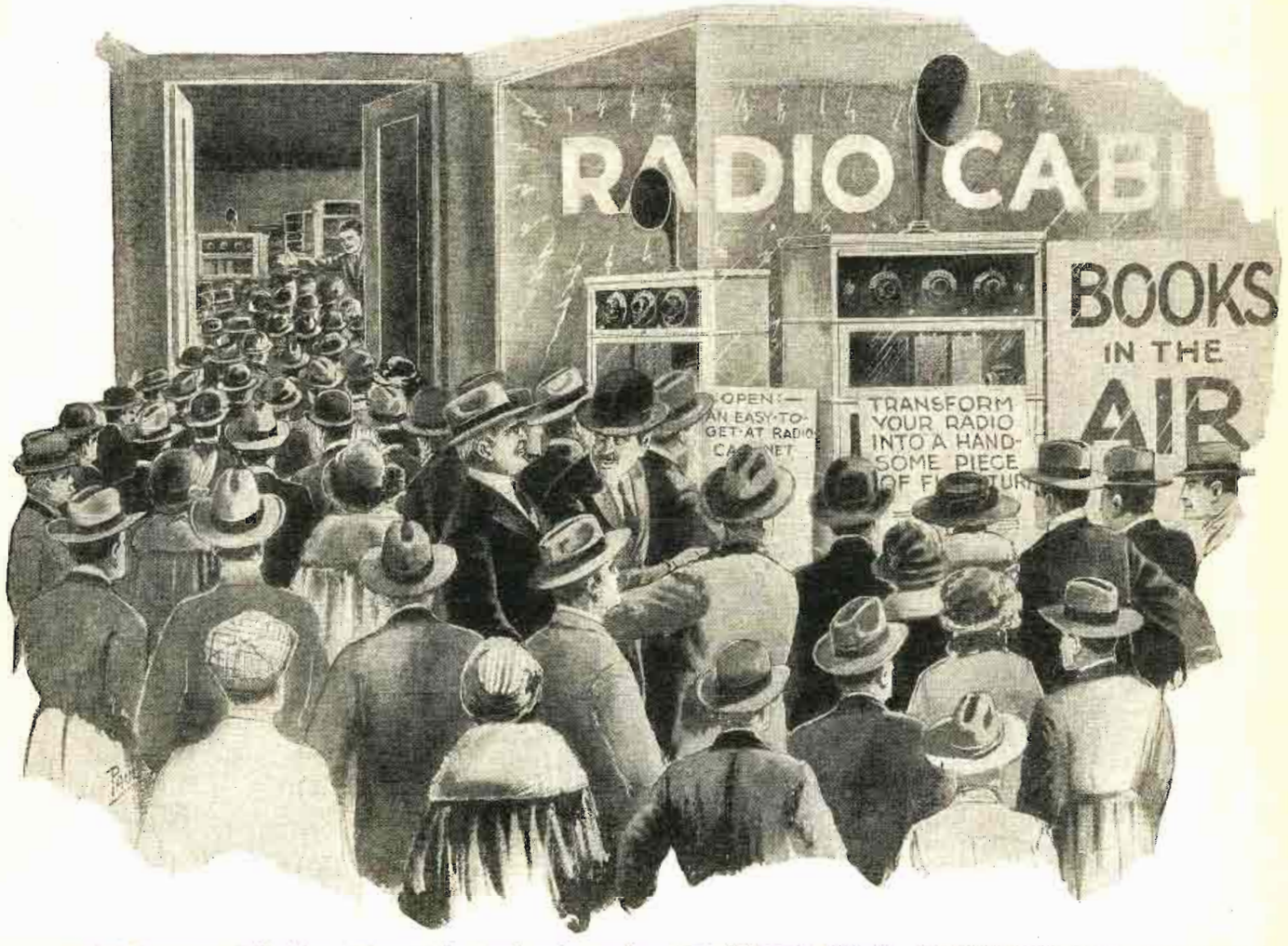




AN ARTISTIC SETTING of radio in the home of Mr. and Mrs. J. D. Wiest of Indianapolis, Ind.

Books in the Air

By WARREN ORDWAY



"But look!" interrupted Mr. Kent. "Darned if he hasn't made a radio set out of that old bookcase! See the loud speaker on top, the Neutrodyne set in the upper section and the batteries in the lower. "By George, look at those signs!" Mr. Watson exclaimed. "Transform your radio into a handsome piece of furniture," he read. "Open: An easy-to-get-at radio cabinet for your favorite set. Closed: A bookcase your wife will be proud to have.

WHEN the crystal germ entered Phil Hayden's system, it resulted in a most rapid and malignant case of radio fever. It broke out in one tube regenerative, then spread in a single season through the various reflex systems and the whole dyne family, till now, he had a bread board covered with tubes, wires and amplifiers, besides a loop and loud speaker. He had forsaken the Saturday Freedom for radio papers, and seldom perused books except those filled with hook-ups and diagrams.

His loud speaker, on the center table, was playing jazz from a local hotel broadcast, while he stretched a long brass coil spring across the living room from one window casing to another. Then picking up a handful of wires with little nickel clips on the ends, he connected a variocoupler in circuit with the coil spring and the radiator. Putting his head almost into the black opening of the horn, he listened intently to the wailing saxophones, while he slowly turned the dial of the coupler.

"Oh, Marge!" he called.

Marjorie came in from the kitchen, wiping her suds-covered hands on her apron. "What is it?" she asked in a bored tone.

"Listen, Marge, and see if you can hear any difference when I turn this variocoupler. I'm trying to cut out interference and boost volume by a tuned inductance in the same room with the loop."

Marjorie listened, she darted an annoyed look around the room, festooned with wires like Christmas decorations. She frowned when she saw the maze of apparatus on top of the two-section bookcase Phil's employers had given them for a wedding present. That was where the bronze lion and the two blue glass candlesticks should be standing.

"See any difference?" Phil asked, looking up.

"No, but does the coiled wire make all that whistling in the music?"

"Oh no, that's just heterodyning—the waves interfering, you know. Gee, but I'd like a Heterodyne set, though," Phil sighed. "That uses the same interference of waves that makes this set whistle to give big volume and sharp tun——"

"Now, Phil, don't say a word about a new set. While our car looks as it does now I'm ashamed to be seen in it, and we have no rug in the dining room, and the kitchen plumbing needs fixing. I think it's terrible the way you spend all your money on—on *this!*" Marjorie's intonation and gesture were scorn personified.

"But Marge——"

"And another thing, Phil. Do get this terrible lot of wires and stuff out of the living room before the Parkers come over this evening. I wouldn't have Jenny Parker see my room like this for anything!"

"But I thought you always liked the music while we play Mah Jong," Phil said in an injured tone.

"Oh yes, if we don't have to see that awful mess around. Put it in the dining room. . . . No, that won't do either. We'll have a little supper in there. Put it—oh, anywhere where we won't see it."

Marjorie stood gazing at Phil while he ruefully unfastened one end of his coil spring aerial. "I do wish you'd read with me again, some evenings, Phil. You used to like Pickwick Papers tremendously."

"Books? Old stuff!" Phil exclaimed. "Why read, when you can get a thousand books in the air? Music, stories, educational stuff, politics, sport, finance—what books will give you what you can get in three minutes on the radio?"

"It isn't only that, Phil. I miss those cozy evenings we used to have. You almost never talk to me now, but spend every evening messing around with your set. And still, it never seems to be finished."

"You wait, Marge! As soon as I can lay my hands on a couple of hundred dollars, I'll have a set that needs no tinkering. A Super-Het.; and what I can't get on it won't be worth getting. Los Angeles'll come in like——"

But with a sigh, Marjorie had returned to her dishes.

When Phil went down town, next morning, he found the office in confusion, for Mr. Kent was starting for the annual home office conference of branch managers in Cleveland. They would discuss how to boost sales of

(*Continued on page* 1284)



The Life and Work of Lee DeForest



PART IV

THE train seemed stuffy. Barbour had drawn almost completely into himself; he hadn't spoken a word for the last fifty miles. On and on the engine pulled its long tail of cars over the unvarying New England landscape. The weather was extremely warm for June, as those who still have an accurate memory of the year 1899 will remember, and the close day coach did nothing to make the day any more enjoyable.

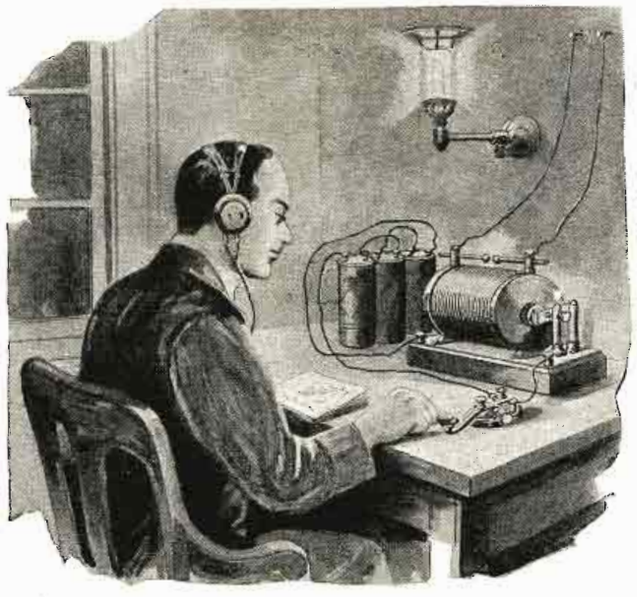
It is doubtful if anything would have made it better, for the inevitable reaction had set in. Barbour and his seat mate, Dr. Lee DeForest, Ph.D., were leaving the aura of graduation and the memories of six of the best years of their lives behind. It had been glorious. For a moment they had been kings. And now——

Well, they were just two ordinary men going to a new town in the west looking for jobs.

But it had been wonderful; the graduation, the Prom, the pretty girls, the center of the stage. Then there were the party banquets and dinners, the long evenings of hilarity, the oaths of eternal friendship, the thousand common heritages which belong only to men who have worked hard and long and have taken their college education seriously. And it had been at Yale.

The work had made it more glorious. As the train moved on DeForest called up visions of those last gruelling months in the laboratory. Certainly it had been interesting but it had also required a lot of labor. He worked like the devil, but he had finished, finished well and slighted nothing. That thesis was a terror. Why did he take such a subject as the resonance of Hertzian waves? And above all, why monkey with the question as to their reflection from the end of resonant wires? It was good and it might stand him in good stead some day. Would lead up to a study of wireless and that was the biggest thing in connection with the new developments of the "wavy" electricity. Wireless would be up and coming. Not many years until it would be in the forefront of the communication field. Then the work on that beastly thesis would be well paid for. First come first served. He knew about as much about waves in electricity as anybody else in America, at least, about the theoretical end and it wouldn't be long until someone would need just such knowledge. No use to worry while waiting. It had to come. And why not be happy now? Five weeks of pure vacation ahead before the necessity of going to work. There were friends, old acquaintances and real home life for a while. Gee, he would enjoy himself.

"Buffalo", said the conductor, as he bobbed his head in the front of the car and as quickly withdrew it.



DeForest noted the change in brilliancy in a Welsback gas burner when his spark coil was in operation giving him the idea for the Audion.

"Your bags, George, the boat awaits", said DeForest, dropping a small Boston bag into the lap of his friend.

"I'm gon'na write a second *Il Penserosi* and make brown reveries respected," replied Barbour, as he heaved the bag back at De Forest and followed it with a small bundle for good measure. "Why can't you respect a man's privacy, you and the railroad, at least when he is mourning the loss of his youth? Callous fellow, thou knowest not the cruel world that is lying in wait at the end of this seeming pleasant boat ride. The gargoyle is almost upon me. I must pay for my sins of omission in mathematics, for I go to a counting house."

"All right, but don't miss the boat; if your mathematics is too skimpy to understand the time table, I'll help you."

The boat ride from Buffalo to Chicago revived their spirits somewhat. They could move around a bit and there were other interesting passengers aboard. And they had a chance to get their minds off themselves.

TO IOWA

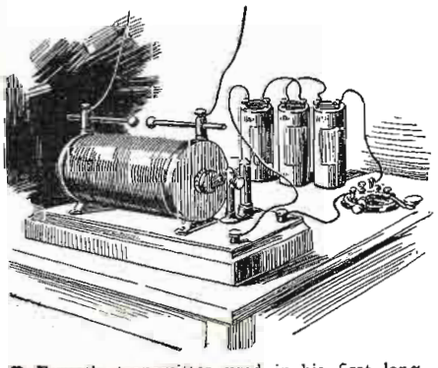
At Chicago Barbour went off to his counting house and DeForest took train for Council Bluffs. There he met his old friends and was entertained royally. He met a kindred soul, a girl interested in music and high ideals. Only a few hours were necessary for DeForest to fall madly in love with her. They were together constantly, woods and stream saw them tramping every day. It was a time of enjoyment with nothing to mar its beauty. Five long weeks he stayed with his friends, enjoying his first real vacation since his entry at Sheffield. For once there was no spectre of duty waiting, no knowledge that each moment stolen from work was money filched from necessity. He was nearly "broke," as usual, but what matter? He had enough to tide him over vacation and possibly a few weeks in Chicago, searching for a job. It was beautiful.

THE FIRST JOB

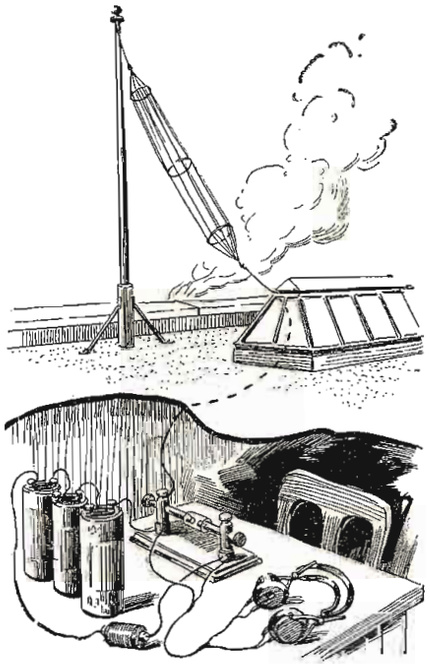
But as with everything, vacation closed. Back in Chicago, he dismounted from the train, checked his bags at the station, wiped away the dust of travel, and started after a job. It was morning, the day was before him. The electrical industry, of course, received his first overtures. Two small companies refused his services with an almost indecent lack of regret. However, his third call was made upon the personnel director of the Chicago plant of the Western Electric Company. He had, thought the director, a use for the young Doctor of Philosophy. The salary was to be eight dollars per week and DeForest should report to the foreman, Mr. DeKrow, of the dynamo assembly department tomorrow morning at seven. He would have three-quarters of an hour for lunch and would be allowed to go home at five fifteen. Yes, he continued, there was a good chance for a future. Only yesterday a man had been taken into the laboratory from the motors department. But evcrybody began in the plant and worked up, that was the policy of the company. Was Mr. DeForest satisfied? Did he want the job?

Yes, Dr. DeForest would take it, for a while, anyway. He must have something and this would serve as well as most anything else as a beginning. Sort of small for a Ph.D., but eight dollars would buy shelter and a bowl of soup.

So he went back to the station, got his baggage, and started in search of a room.



DeForest's transmitter used in his first long distance tests—covering one-half mile—used a Rhumkorf spark coil.



The receiver, the large antenna and the faithful Sponder with battery and telephones used in his first public test.

Biography recorded by W. B. Ayrin of Radio News, *under the personal direction of Dr. DeForest. Copyright 1924 by E. P. Co.*

There were many of them, but they were all pretty steep as to price. Finally, one presented itself. It was a hall bedroom—and it was worthy of the name—heated by a stove and presenting a beautiful view of the wash on the back of the buildings which faced on the next street. But the rent was only eight dollars per month. Some close mathematics followed. DeForest figured that if he could find a good restaurant retailing soup for a nickel a bowl and a steak for fifteen cents (this was in 1899 and such places *did* exist) in which the kitchen was fairly clean and the food flavored a little bit, he could save at least eight dollars a month. The quotient of eight divided into the price of an engagement ring to be given the Council Bluffs girl was astonishing. It was also disheartening. As a matter of fact, it was so large, that should she continue her musical education she would probably have been a star with the Metropolitan before the ring was purchased.

THE FIRST DAY'S WORK

It was a murky morning, that August 14, 1899, when DeForest caught a trolley car at a quarter of seven, to take him to the works. In the dynamo department, he told the foreman who he was and that he had been hired.

"That's all right, just wait here; I'll have something for you to do after a while; just wait here." And with that he went off in the other direction. After almost an hour of waiting, the foreman returned. DeForest, was to be flunkey. There was grease on the floor under the machines. DeForest was to wipe it up. He was also to clean up parts and supply the men on the assembly bench in case of a rush. In fact, all the roustabout jobs in the department were his.

At the close of his first week he wrote: "I work like a nigger from seven until five fifteen. I am learning a little but not much, too much chasing lost parts and mopping up grease—and all for eight dollars a week."

Within a few days he was settled again into a routine. The work was hard and irksome. The associations were very bad. Worse than DeForest had ever known. The workmen were a class of common labor with which he had never before come in contact. Their swearing particularly got on his nerves. Constant use of it filled the conversation and he did not therefore take part. Again he suffered from his purity of ideals, for the other men in the shop, of course, did not like him. And holding such opinions they took no trouble to make his way easier.

He continued his outside experiments as before. He would get to his room at about seven o'clock in the evening. As soon as his purse permitted, he began to collect bits of apparatus and start investigations.

For recreation he discovered the Crehar library. In comparison with his room, this



Leading to the first electrolytic detector was a glass tube with two metal electrodes with a paste or glycerine and water between them.

institution was a castle. He found quiet and solitude, which he so loved. It was an atmosphere in which he could reach his best; it gave him a home-like feeling. The habit of study had fixed itself firmly upon him through the past six years and so he found the keenest enjoyment, now, as he had in the university, in books. Three or four nights a week he would spend pouring over some French or German technical work dealing with his pet subject.

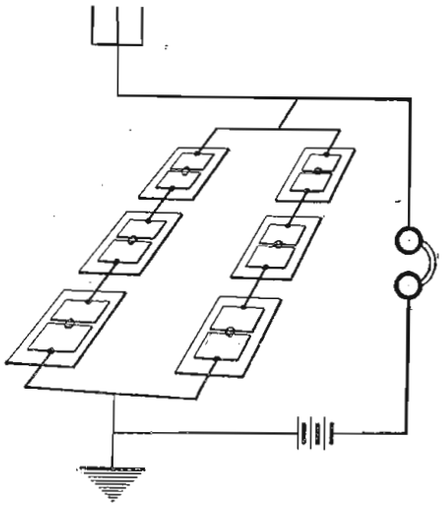
The library carried a complete file of foreign technical journals and DeForest went through them religiously. It was in one of these that he found notes on experiment, made by a German professor in which a new detector of Hertzian waves was described. The device consisted of a piece of tinfoil pasted on a glass plate with a razor-slit through the center of the metal. Across the slit a drop of water was poured and the two foil ends were taken as terminals. In operation, it was exactly opposed to the Branley coherer. It broke the circuit upon the passage of Hertzian waves.

DeForest immediately took voluminous notes on the device and decided to do a little work of his own upon it. He had long since decided that some other method would have to be substituted for the coherer.

The coherer was bulky and required tapping to break its conductivity after the passage of each signal. DeForest saw that such a system was extremely inefficient and had had constantly in the back of his mind an idea for detecting the waves by another method for some time. Accordingly, he immediately jumped upon the German idea.

ADVANCEMENT

He continued in the dynamo department of the Western Electric Company until the beginning of October when he was given a place wiring switchboards. This position



The original hook-up with the electrolytic detector used several of the devices hooked in series as shown above.

lasted only a couple of weeks, however, after which he was promoted to the laboratory in the experimental division. The advancement was well taken.

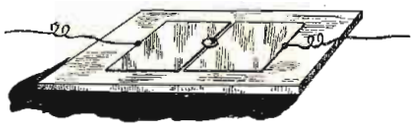
Of this he said: "Oh, the luxury of geting to work at 8:30! I can learn here also and I am with refined gentlemen. I miss the swear words and filth of talk. Here, if ever, can I invent and have the ideas count for something. I study blueprints and apparatus during spare moments and at night read on telephony. And now, at last, can I be fascinated by my work.

"McBerty and Dean are my bosses."

He was first placed in the laboratory to take the place of another worker then on vacation. The position was a precarious one for a few days. DeForest visioned going back into some other department with the return of the regular man, but such was not the case. Dean liked his style of work and the interest he took in the experiments, so he was kept on the force permanently.

For a period he gave his whole time to experiments directly connected with the telephone work.

It was only a short time, however, until he began to use the laboratory and his spare moments for his wireless experiments. McBerty and Dean seemed interested in his work and he told them about it, giving them several accounts of his other inventions and experiments. Work on the decoherer, the tinfoil on glass with some alteration and improvements from the original were making progress. DeForest showed it to Dean. An old spark coil and condenser was rigged up in one corner of the laboratory and the decoherer in the other. DeForest would rush out to lunch, grab a sandwich and rush back in ten minutes in order to spend the remainder of his lunch hour on the new wireless apparatus.

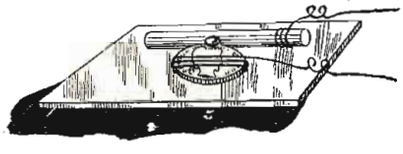


The first step in the Sponder experiments was a drop of water across a razor cut in a piece of tinfoil pasted on a glass plate.

When he went into the laboratory he was continuing at his original salary of eight dollars per week. After a few months, however, at the beginning of the new year, to be exact, he was given a magnificent raise—two dollars per week.

As time went on he grew to give more and more of his time to the wireless end of his work and less and less to the routine experiments of the telephone laboratory. Dean looked upon this change with a friendly eye; it was only when McBerty was about that DeForest had quickly to drop it and rush back to the telephone work. But one day, a couple of months after he had received the raise, he was not quick enough with the shift and Dean caught him. As a matter of fact, Dean had known of the work all along. When he found DeForest so engrossed in the work that he did not even see him, Dean was rather disappointed by the fact that the illusion was not being continued. He did not care about DeForest's working with his own ideas in truth, to the contrary, he had an idea as to their value and figured that DeForest would do just as valuable work for the company in his chosen line as he would working for the improvement of the telephone. He was a bit angry at the loss of the illusion, however, and called DeForest down only to end the reprimand with a command to go on with his own work conclusively. "You can go to Hell and do what you please," were his parting words.

Following this episode, DeForest plunged completely into his experimental work. The spark coil was working constantly. Following the idea found in the German magazine he continued his investigations of detection of the electromagnetic waves. The original idea had some possibilities, but was out of the question so far as practical working was concerned. It would function properly for only 20 seconds at a time. The trouble was



One of the later Sponders consisting of a quarter and a tin bar with water bridging the gap between them.

that the water would pass into a state of semi-decomposition with the passage of the small currents. After discovering this fact, DeForest began searching for other electrodes and cohering substances. He tried everything.

ANOTHER POSITION

One day while he was in the midst of an experiment, one of the office boys came to his desk and handed him a card with the inscription, "Prof. Johnson, Milwaukee,"

(*Continued on page* 1307)



Installing a Radio Set

By A. P. PECK



Fig. 10. Operating a two control regenerative vacuum tube receiving set. The left knob and dial is employed to tune with, while the right knob and dial controls regeneration.

IN all of the former articles appearing in this section, for the beginner, the greatest consideration was given to the person who, more or less mechanically inclined, desired to build his own set and needed simple, explicit directions for doing so. The man buying a complete set has, to date, been somewhat neglected. Bearing this in mind, the author will, in this and future articles, take this division of the radio fans more into consideration. The present article and the illustrations accompanying it will be of interest to all; the builder and the buyer as well. Here will be found directions for putting a radio set into efficient operation, regardless of its type. The directions will hold for any set, although a one tube outfit will be considered in detail.

The first consideration is, of course, the antenna or aerial. This is the collection of outside wires with which we are all familiar since they may be seen on many housetops in every city, town and village. The one thing to bear in mind in connection with this part of the set is that the aerial should be as high as possible and its length between 75 and 100 feet. The wire to be used can be bought from any radio, electrical or hardware store. It should be copper, either one solid strand or several strands twisted together. The latter is the stronger and should be used in locations where high winds are likely to be encountered. The size should be what is known as No. 14 B. & S. gauge. It may be strung between any two convenient points, usually between a tree or a specially erected pole, and the house.

At each end of the wire, what is known as an insulator should be fastened. The purpose of this is to prevent the weak currents collected by the antenna from leaking off to the ground. These insulators serve the same purpose as those placed on telephone poles and are similar in material. They are made of porcelain or some kind of insulating compound and are provided with a ring at each end. These insulators may be bought in any radio store. The hole is placed in the insulators so that the wires can be fastened thereto. The procedure is as follows: Push about six inches of the end of the aerial wire through one of the holes, bend it back on itself and twist the end of the wire tightly around the long portion. Do the same at the other end of the aerial. Now, attach the wire or ropes that are to support the aerial to the other holes in the two insulators.

THE LEAD-IN

It is necessary that the aerial be connected to the radio set in such a way that the currents collected by it can go to the set

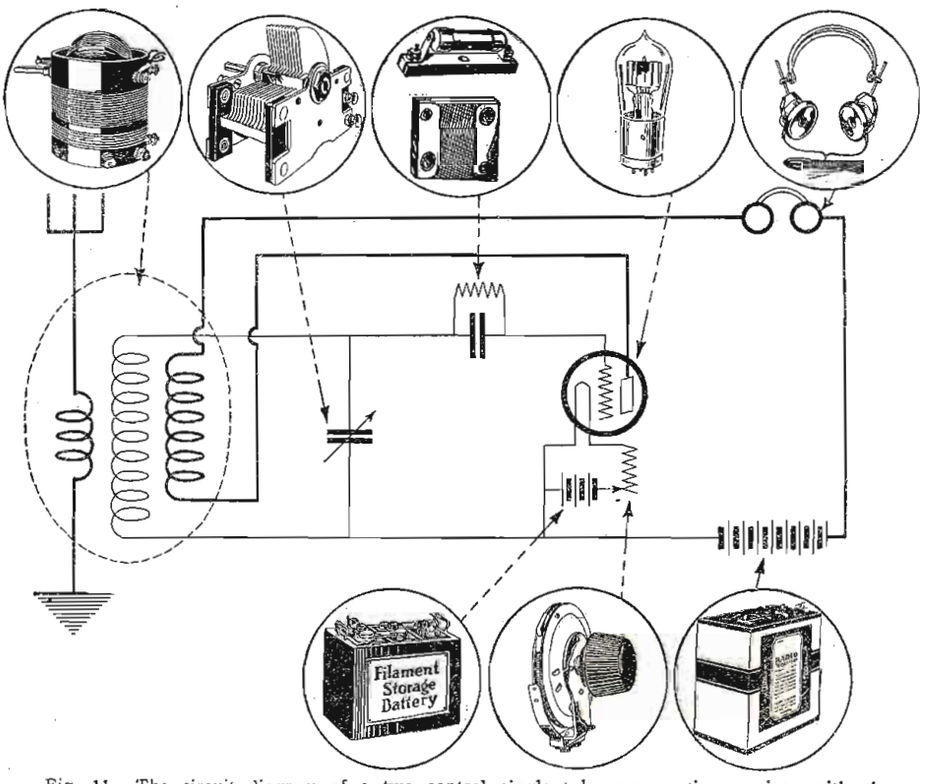


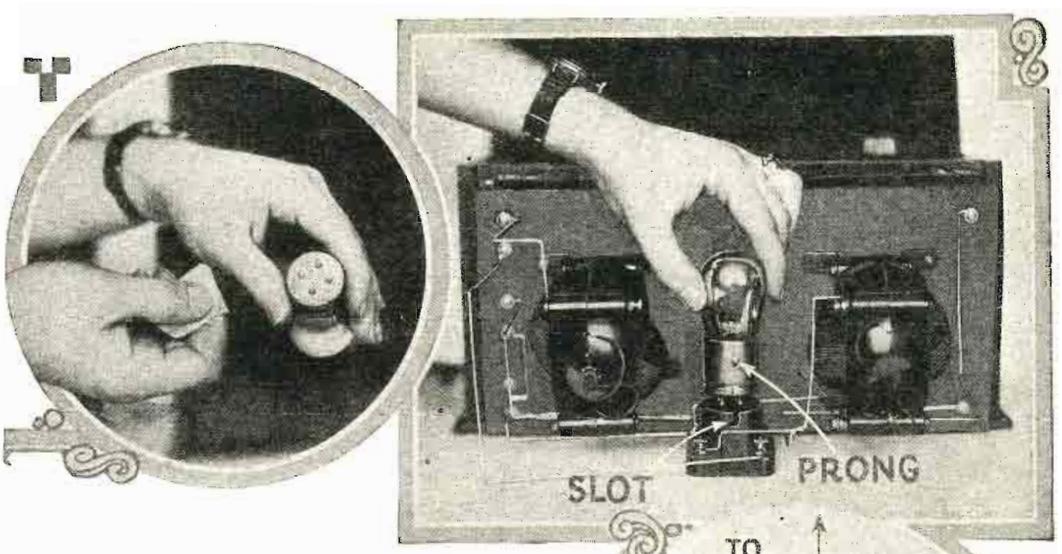
Fig. 11. The circuit diagram of a two control single tube regenerative receiver with the instruments shown in both symbolic and picture form.

The coupler shown in the top left hand circle has two windings on the outside tube. The primary which is in the lower one, is connected between the antenna and the ground and the upper one, which is the secondary is connected to the grid condenser and positive filament of the tube. The tickler coil, which is mounted so that it may be rotated, is connected between the plate of the tube and the phones. In the next circle is a variable condenser, which is connected across the secondary of the coupler. The lower binding post of the condenser is connected to the filament side of the secondary coil and the upper binding post or stationary plates go to the grid condenser end of the secondary. In the next circle there are the grid condenser and leak which are connected together and then one side run to the variable condenser and the other to the grid of the tube. The tube socket used to make connections with the elements of the tube is not shown. The phones shown next are connected to the plus side of the "B" battery, which is in the lower right hand circle. The minus side of this battery is connected to the plus side of the storage battery, the current supplied by this being varied by the rheostat in the middle circle.

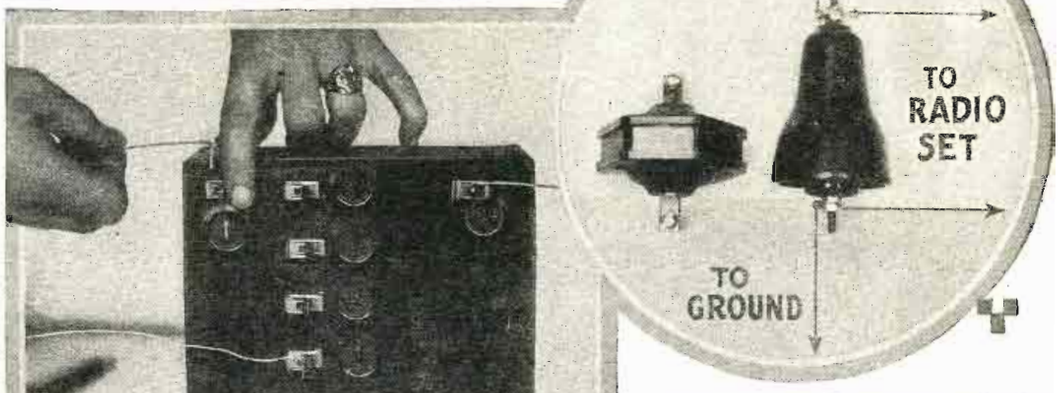
in the shortest manner so that the signals or music and voices will reproduce best. For this it is necsary that a wire known as the lead-in be provided. It is attached at one end to the aerial and to the radio set at the other end. The aerial connection is made at a point just a few inches from the insulator on the end of the aerial nearest the house. Here the aerial and the lead-in wires are scraped carefully until they are bright and clean and the lead-in wire wrapped tightly around the aerial. If you are proficient at soldering, solder this joint. If not, wrap two or three layers of tinfoil tightly around the joint, extending the wrapping an inch on either side of the twisted wires. Then cover the tinfoil with a layer of friction tape and paint the tape with shellac. This will give a tight joint that will resist the weather and will not corrode.

Another very good way to fasten the aerial to the insulator and at the same time have a good lead-in is to use one single length of wire for both the aerial and the lead-in. In this method an insulator is fastened to one end of the wire. Measure off the length of the aerial on the wire and mark that point. Slip the other end of the wire through one of the ends of the remaining insulator until the ring comes to the point marked on the wire. Bend the wire back and twist it three or four times around the portion of the wire leading to the insulator. The loose end then forms the lead-in and no joint is necessary. When a long length of wire is available, this is the preferred method of fastening the lead-in.

After the insulators are fastened in place and the lead-in attached, you are ready to pull up the aerial. It is desirable to use ropes for supporting the aerial and to place pulleys where the aerial is to be fastened. The ropes can then be run through the pulleys and the aerial raised or lowered when repairs or changes are to be made.

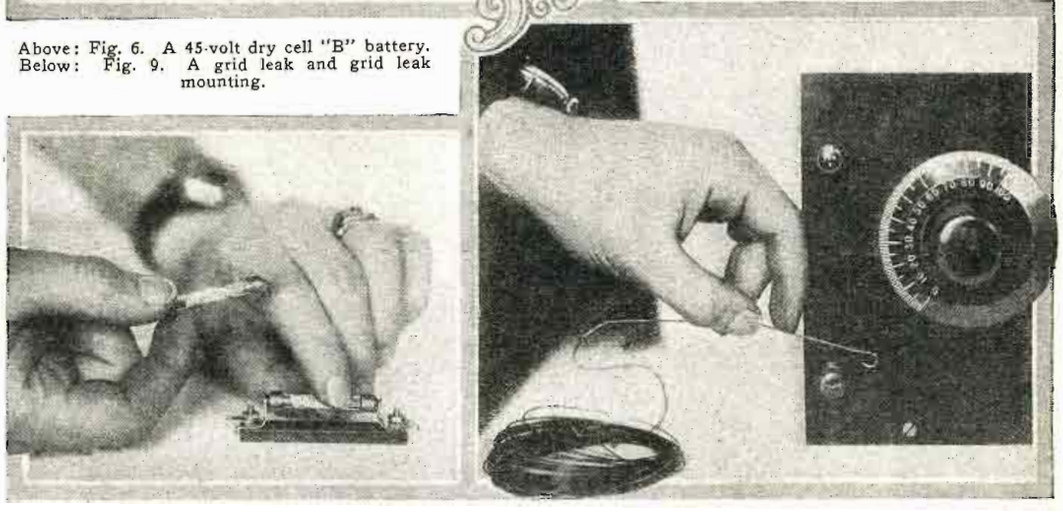


Above: Fig. 7. Cleaning the prongs of the vacuum tube with a piece of sandpaper. Above right: Fig. 8. Correct method of inserting the tube into the socket.



Above: Fig. 1. Two types of lightning arresters and how an arrester is connected up. Below: Fig. 3. Correct method of looping a wire for a binding post connection.

Above: Fig. 6. A 45-volt dry cell "B" battery. Below: Fig. 9. A grid leak and grid leak mounting.



THE LIGHTNING ARRESTER

If you have selected the place for the aerial properly, the lead-in will hang near the window of the room where the radio set is to be located. Here is the spot to place the lightning arrester. Several types are available, some to be attached to the wall of the house and others to the window frame. Both types are illustrated in Fig. 1. Any arrester stamped as having been approved by the Board of Fire Underwriters is good and can be bought with perfect confidence. The type will depend on the particular place in which you wish to put it. It will be found convenient also to purchase what is known as a lead-in strip. More of this later.

PROTECTION

You will undoubtedly want to know if a lightning arrester will really arrest lightning. No, it will not, nor is it intended to do so, even if the name does imply that it should. The usual types of arresters consist of two metal points, placed close together in a glass tube from which all of the air has been removed. It is an established fact that a current of electricity will jump between two points very easily when there is no air present. This fact is made use of in a lightning arrester. The arrester works as follows: During a thunder storm, the air is full of electricity. If the aerial is not connected directly to the ground or to the ground through an arrester, this electricity will collect on the aerial and build up until it is strong enough to work damage to the set. It is out of the question to have the aerial connected to the ground at all times, as we would not be able to receive radio messages. At one time we used a switch to connect the aerial to the ground, but too often, the switch was forgotten. So now we use the arresters described above. The electricity collecting on the aerial jumps across the gap in the arrester and goes to the ground before it gets a chance to build up to a dangerous point. The radio currents, being very weak, cannot cross the gap; therefore, they go to the radio set and give us the messages.

DIRECTIONS

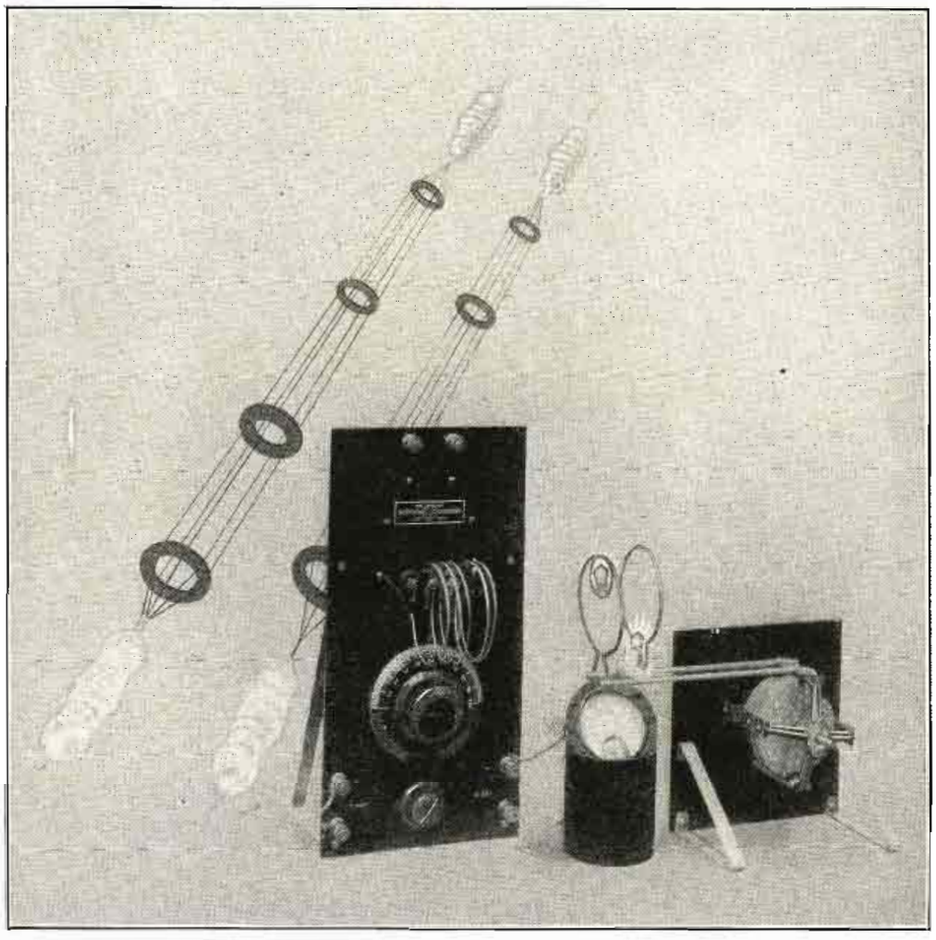
The lightning arrester should be mounted outside the window. Directions accompany each arrester and show where to connect the lead-in, the wire that is connected to a water pipe or other metal object running to the ground and the wire that is to be connected to the set. After making these connections, place the lead-in strip that was mentioned above, over the window sill and close the window on it. The strip will con-

(*Continued on page* 1303)

Experimenting with Five Meters

By WILLIAM A. BRUNO, A. I. E. E.

This is the first of a series of articles by Mr. W. A. Bruno on experimenting with five meters. A new field for experimental work is now open to the radio experimenter and by perusing this article it will be seen that many sensational experiments can be performed by means of the instruments described. Not the least noteworthy is "Radio Power Transmission on a Small Scale."



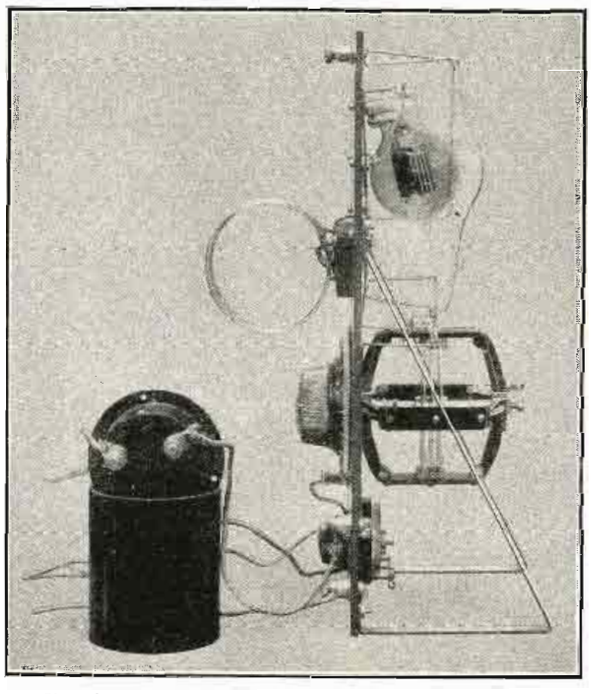
Apparatus for experimenting on the short wave-length of five meters, the oscillator panel, the milliammeter and the wavemeter.

WE have been told time and time again that history repeats itself, but have never stopped to think that after radio was considered an accomplished fact, we would attempt to go back to the early experiments of Hertz, when he first called to our attention the rudimental principles of radiated electrical energy. We all believed that the success of radio was proportional to the length of its wave and we have witnessed a coil winding contest that has led us to believe that the name "wireless" was decidedly misleading. Now that we have made the copper wire industry one of the leaders of the world and given "Litz" a chance to become famous, we turn back to our first love, as Prof. Pupin said when Marconi came here to tell us that he was sorry to have caused us to spend so much money on 44 plate condensers. We stumble over the miles of pretty green silk wire thrown carelessly over the carpet coming from a coil that had to stand on its head in order to be allowed by the "family" to be sheltered under the same roof.

The short wave experiments conducted by some of the leading electric companies and S. Kruse, now so keenly interested in radio, are creating the impression that very soon wave-length bands will be assigned with the micrometer. With the set described here the writer has endeavored to shorten wave-lengths, and having reached 5 meters, now lies back in the easy chair and is going to tell you how it is done and wishes you the same luck.

Last year, while conducting some experiments on high speed printing radio telegraphy for one of the large newspaper syndicates, the writer, co-operating with their engineers, made use of a wave-length of 40 to 60 meters and noted the remarkable possibilities of the short waves. Of course we lost many hours of sleep trying to make four 50-watt tubes oscillate at those frequencies, but after all difficulties were overcome we were astonished by their penetrating power and their selectivity. In fact, in the heart of New York, when all broadcasting stations were on the air, it was possible to receive 90 words per minute on a special machine without an error caused by interference.

The 5-meter transmitter described in this article, is a further development of the above experiment and was exhibited at the recent Radio Exposition at the Grand Central Palace in New York, where it attracted much attention. The writer feels



Side view of panel with milliammeter supported by a fibre tube for insulation. Note manner of connecting in the vacuum tube.

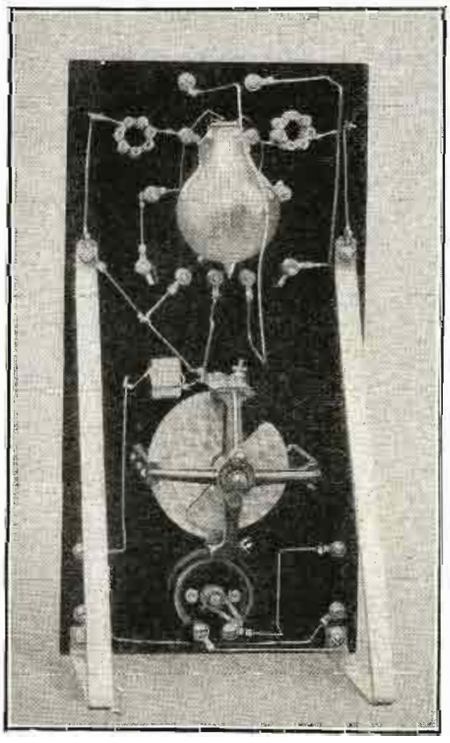


Fig. 3. Rear view of panel showing position of apparatus. Note the small low-loss choke coils.

that the interest in short waves is so great that very soon some obscure experimenter will discover the method of easily handling this old, yet new, form of energy.

Fig. 1 shows the schematic diagram of the oscillating circuit. L1, L2 and L3 are the antenna, grid and plate inductances. L1 consists of one turn of No. 12 bare copper wire preferably polished. L2 and L3 consist of two turns each of the same wire and like L1 should be 3 inches in diameter. R1, R2 and R3 are the radio frequency chokes and consist of 30 turns of No. 26 D.C.C. wire wound in basket-weave fashion on a form of ¾ inch diameter, on seven pins about ⅛ inch in diameter, as shown on Fig. 2. It is necessary to make these chokes self supporting without using any adhesive compound and, therefore, they should be sewed up with silk. C is the transmitter condenser and consists of three plates spaced ¼ inch apart. This condenser is quite important and should be of the best grade. The writer used an 11 plate Ultra-Vario condenser and patiently removed every other

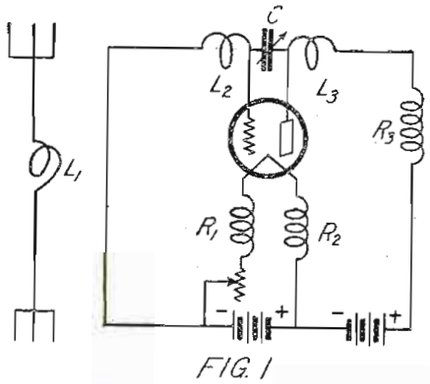
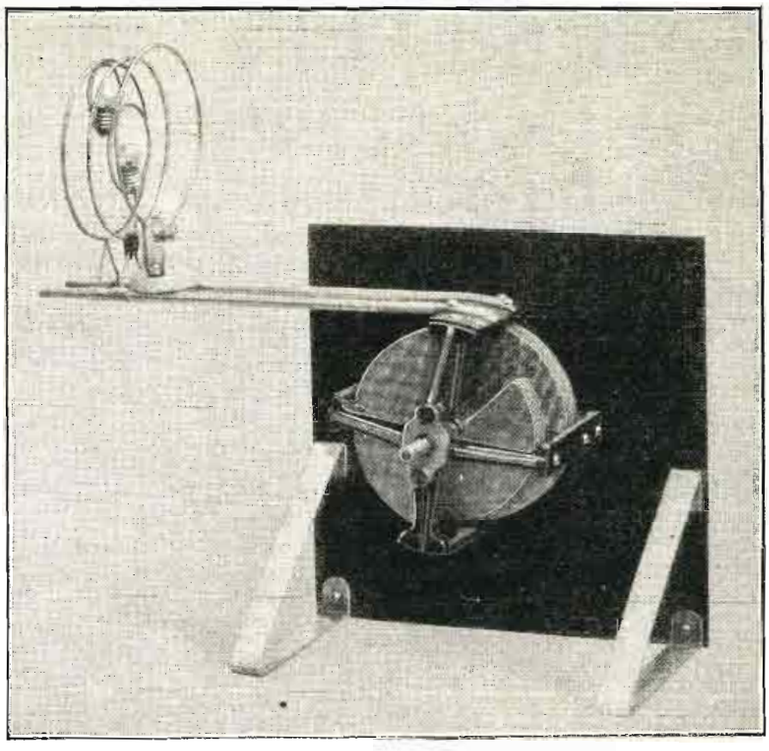


FIG. 1

Circuit diagram of the high frequency oscillator. Note the high frequency choke coils in the filament and plate circuits.

plate from both the rotor and the stator. A very efficient condenser was the result. If this operation discourages you from going any further with short wave experimenting, take two metal plates about .025 inch thick and 3 inches square, as shown on Fig. 2a. Mount them with screws in back of the panel and vary the capacity by simply moving the plates, as shown by the arrows.

The tube used may be a UV-199, a UV-201A or a 5-watt tube. The one shown in the illustration is a VT-2. They are all good for the experiments described in this article, their choice depending upon the pocketbook because of the cost of the "B" battery supply. For the 199, a 90-volt supply was used, for the 201A, 120 volts and for the VT-2 as much as 325 was used; although the plate was hot and a pretty blue glow could be plainly noticed, it continued to oscillate.



A rear view of the wavemeter designed for use with the five meter oscillator. Note the manner in which the coils and lamps are connected to the variable condenser. The details of the coils are shown in the sketch of Fig. 4.

At such high frequencies it is impossible to use a socket for the tubes and it is advisable to remove the base. This operation is very simple, provided you take a little care. If you believe you are going to blow the tube up, reassure yourself, because there is practically no air inside to expand. Also, the glass is of special composition and when exposed gradually to the heat will not crack. Hold the glass part of the tube wrapped with a piece of cloth and expose the base to a gas flame, revolving the tube slowly. When the gas flame starts to give a green glow, with another cloth give a slight turn to the base to feel if the sealing compound inside of the socket has softened. Place on the flame again and when hot shake the tube sharply, as if shaking down the mercury of a thermometer and the base will fly out. You, being an experimenter, should have a few burned out tubes, and it would be advisable to remove the base of one of these

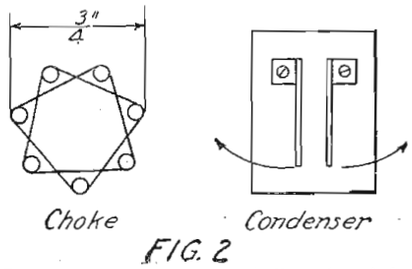


FIG. 2

Position of supports for winding the choke coils, and a condenser that may be used instead of the variable rotary plate condenser referred to.

before attempting the operation on a good one.

Assembling the transmitter is a very simple thing. Bear in mind, however, that *every inch of wire means lower frequency* and you should not expect to build a 5-meter transmitter that has a natural period of, say, 10 meters. Make all connections as short as possible, sacrificing appearances, if necessary.

The panel consists of a piece of the best hard rubber 7 x 18 x ¼ inch. The general layout is shown on Fig. 3. Anything you can do to shorten the leads will help materially in the proper operation of the transmitter.

In this article we will not go into the construction of the antenna, as this will be taken up when the receiver is described. We will describe the wavemeter and a few very interesting experiments, not requiring the radiating part of the circuit, but simply the oscillating field set up by the coils. The wavemeter consists mainly of a condenser and a coil. In order to render the resonating point visible, make a coil of one turn of No. 12 bare copper wire and mount it on a miniature porcelain socket. The lamp used is a 1½ volt flashlight bulb, sold for about 10 cents.

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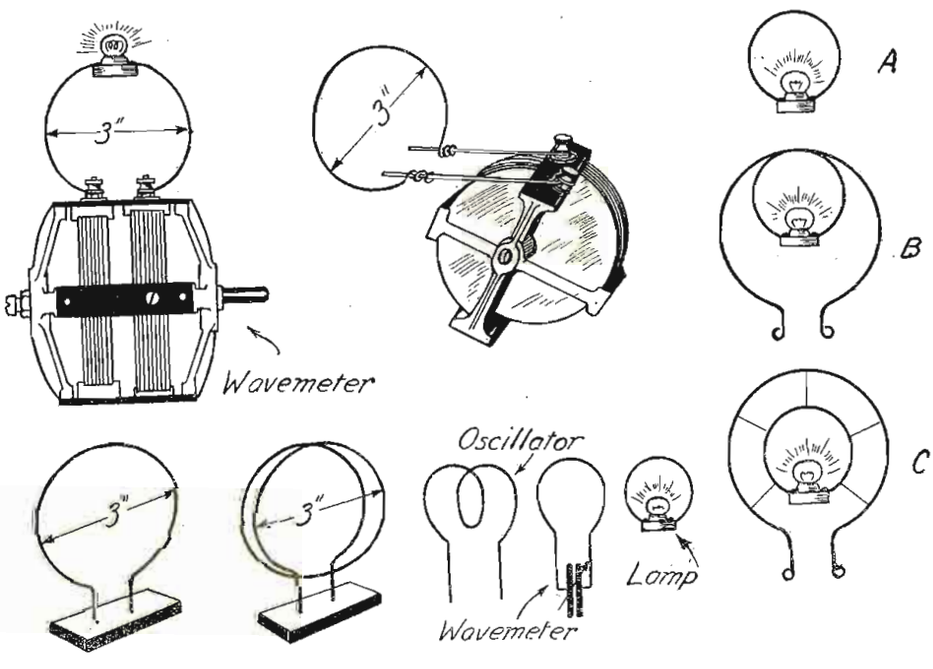


FIG. 4

Details of the wavemeter, oscillator and resonance coils and convenient methods whereby they can be mounted. B and C show two ways of coupling the wavemeter and resonator coils.

Better Radio Transmission by Zero Carrier Waves

By G. H. DACY

The description of a broadcast station employing a system of transmission in which no carrier wave is radiated during the periods the microphone is idle.



A view of the operating room of the broadcast station at the University of Illinois where the zero carrier wave system described in this article is employed with considerable success.

RECENT experiments at the University of Illinois, station WRM, demonstrate that it is not necessary to transmit a carrier wave continuously as under the method practiced successfully at that institution, an electromagnetic wave is sent out only when a sound occurs.

This research features the suppression of the carrier wave in long distance telephony over wires. As a result of the scientific research of the Illinois experts, it is not even necessary to supply the carrier wave at the receiving end of the transmission.

This improves the system of practice with which most radio enthusiasts are familiar in which the so-called carrier wave in radio broadcast transmission is sent out continuously from the transmitter. When a sound occurs near the microphone, this carrier wave is merely changed in amount in accordance with the sound frequency fluctuations.

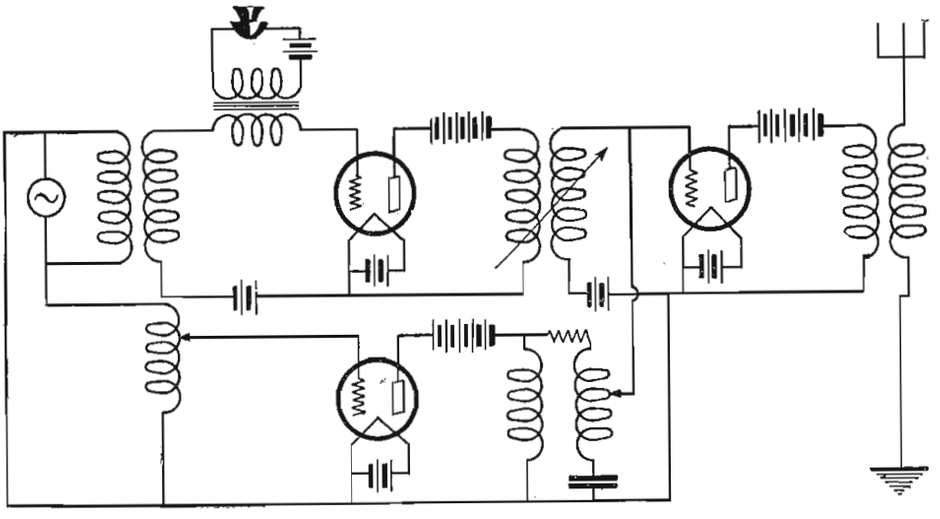
When using zero carrier wave transmission, the effect is approximately the same as when listening with a receiver to a spark transmitting station. No waves are sent out between the periods of "dots and dashes." Under such condition the receiver is affected and sounds are heard only when the key is closed by the operator.

Under the system formerly in use, the plate current of the detector tube suffered a large decrease as soon as the carrier wave came in and as soon as speech occurred, this latter value of plate current fluctuated a very slight amount.

The Illinois engineers have increased the efficiency of transmission marked by eliminating the carrier wave when no sound occurs so that the detector plate current suffers this initial large change with every change of sound which occurs at the microphone. The tests made with the Illinois transmitter showed that this was true.

During the experimental tests, transmission frequently was changed from the constant current carrier wave system to the zero wave system so that intelligent comparison as to the quality and sharpness of tuning could be made. The early results were extremely satisfactory. The tests will be continued until the scientific investigators are completely assured of the permanent success of their new method.

In the circuit diagram shown on this page is illustrated one method by which the carrier wave may be effectively suppressed. A generator of continuous waves is coupled to the grid of the modulator tube shown in the upper part of the circuit. This arrangement is comparatively simple and follows the regular modulator principle. The plate output of this tube is inductively coupled to the grid of the second tube in the upper circuit which acts as the power amplifier and feeds its output directly to the antenna. The carrier frequency generator is also coupled to a second circuit shown at the lower part of the diagram. This tube acts as a power amplifier and generates a frequency exactly the same as that given off by the original carrier generator. But its output, however, is coupled to an oscillatory circuit containing a resistance and a frequency trap. Now, by varying the adjustments in the plate oscillatory circuit of this second tube, the phase difference angle between the amplified carrier wave as generated by the tube shown in the lower circuit and the wave passing through the modulator tube may be placed at a difference of exactly 180 degrees. Through this method it is possible to absolutely neutralize any trace of the carrier wave, when the current in the upper circuit is not being modulated. The thing acts as a bridge so that immediately sound waves impinge on the microphone a differentiation is caused in the frequency of the modulator circuit, thus changing the current output and also destroying the phase relation between the two circuits, allowing the modulated carrier to find its way to the antenna. This circuit is the development of Englund. It is one of several such circuits all of which are still more or less experimental in nature. The Englund adaptation, however, probably shows the most efficient as well as the most simple method of eliminating the carrier, while it is not being modulated. As the field of radio broadcasting constantly enlarges, the necessity for removing every possible source of interference is obvious, so it is hoped that the experiments carried on at the University will find a successful conclusion in the near future.



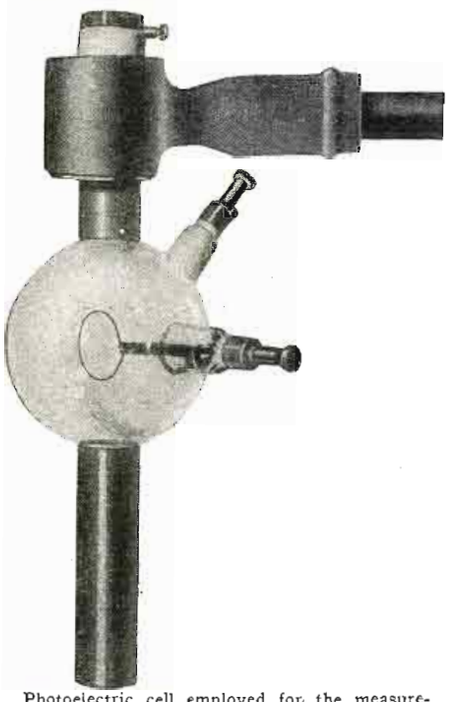
The circuit diagram of a zero carrier wave system developed by Englund wherein the carrier wave is suppressed during the period the microphone is idle.

The Significance of Rays in Physics

By PROF. DR. HEINRICH RAUSCH Von Traubenberg
PHYSICAL INSTITUTE OF THE PRAGUE UNIVERSITY

PART II

The second of a series of articles dealing with that part of physics closely related to radio.



Photoelectric cell employed for the measurement of weak light rays.

IN the first article of this series we dealt with the sensitivity of various natural and artificial detectors of electromagnetic and acoustic rays. In the present continuation of this discussion we hope to take up some of the extremely important phenomena of these rays and show how their study has led the physicist away from the classical theories and into an entirely new field. In many cases, indeed, the close observation of wave phenomenona has led him to change the old laws.

For knowledge as to the range of oscillations which may be created by a single oscillating device, we must thank the great German Physicist, Heinrich Hertz. The phenomena of long waves, discovered by him is, of course, the foundation of radio telephony and telegraphy.

As was stated in the first article, the purpose of this paper is to bring out the importance of rays to the physicist. In his work, he deals principally with the analysis of radiations and the results gained through the superposition of several radiations from oscillators capable of producing extremely short waves. This combination of several oscillations makes the problem a particularly difficult one. As an example, let us take the radiations of a heated body.

If we heat a body, it sends out electromagnetic rays. With a suitable detector we may measure the energy thus radiated. The most efficient instrument to use in this connection is the Langley bolometer. Of course, it is a simple matter to bring a thermometer into the field of a heated body. In such case, the fact that the energy absorbed by the mercury, making it rise, is electromagnetic in nature, may easily be proven by the fact that the thermometer will act as well in a vacuum as in air. With heat rays, one of the best known forms of electromagnetic radiation, we can do many things; they may be concentrated with mirrors, reflectors and lenses; absorbed in other bodies by placing the body in the field of the waves; they may be refracted with prisms and polarized with reflection, or there may be observed interference phenomena by passing them through gratings. In short, we can carry out all the classical school experiments with them. But we can never see the rays.

If we substitute for the thermometer, the more sensitive, Ziess thermo-couple, we see at once the extreme magnitude of these radiations. For instance, we find that the human body is constantly radiating them as long as life is in it. If the couple is placed in the focus of a concave mirror, and the experimenter stands at a distance of several yards, with open mouth, a decided effect will be noted on the galvanometer needle.

The complicated nature of heat radiations may be understood if we use a reinterference screen to determine the wave-lengths at which the energy is radiated. Upon the use of such screen we find that the energy is not transmitted at one certain frequency, but rather carries its energy on all possible waves within a certain given band. We find, also, that the field of radiation is not only selective, but is continuous, giving us an unbroken spectrum, that is, from the smallest radiations, they continue by steps through a whole range to the highest. Such a spectrum as the solar is peculiar in that the maximum of its radiated energy at a specific temperature is always radiated in a very definite range of wave-lengths. A simple experiment with the common incandescent lamp will convince us of a queer relationship here. When very little current is passed through the lamp and the filament is heated only slightly, the light given off is reddish. As the current is increased and the filament heated to a higher point, the light becomes yellow and finally blue, showing that as the heat of a body increases, the tendency is to radiate the energy at shorter and shorter wave-lengths. In other words, the maximum of radiated energy produced by rising temperature always tends toward shorter wave-lengths. This is shown at Fig. 2. At the same time, the total energy radiated by the heated body tends to increase. There is a very definite relationship between the temperature, the radiated energy and the distribution through the spectrum.

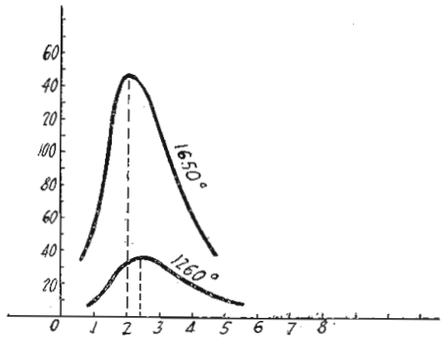


Fig. 2

Showing how the energy radiations of the heated body rise with increase of temperature and simultaneously the maximum tends toward shorter wave-lengths.



PROF. MAX PLANCK

To show this more understandably, let us consider the following experiment. Let us imagine a receiving apparatus of universal scope, taken into the vicinity of a heated body. Here we will find that the receiver

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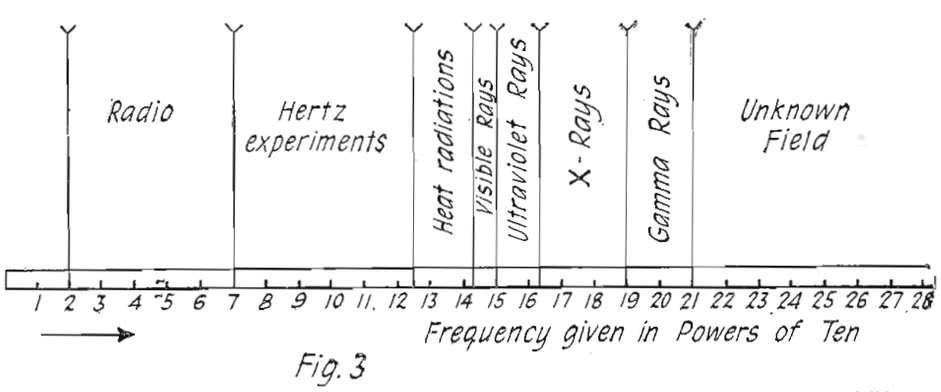


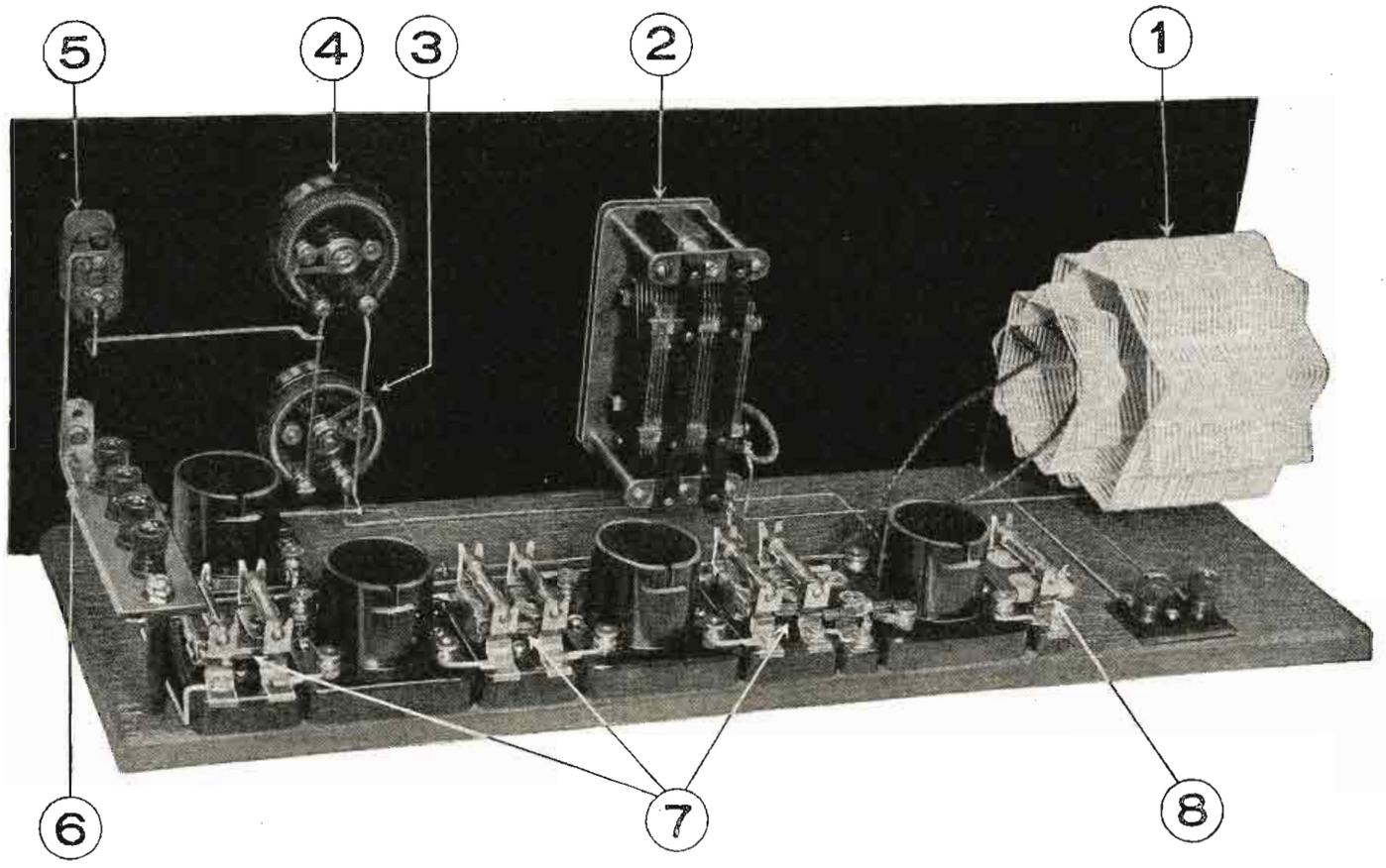
Fig. 3

A chart showing the frequency bands of electromagnetic oscillations in relation to the visible vibrations or light rays.

An Ideal Low-loss Broadcast Receiver

By CLYDE J. FITCH

The description of an excellent low-loss regenerative receiver employing a three stage resistance coupled audio frequency amplifier. The combination of low-loss instruments and resistance coupled amplifiers into one unit makes a splendid set for broadcast reception.



A rear view of the Ideal Broadcast Receiver. The parts are: 1—low-loss coupler; 2—low-loss variable condenser; 3—30-ohm rheostat; 4—6-ohm rheostat; 5—filament switch; 6—phone jack; 7—resistance coupling units; 8—grid leak and condenser.

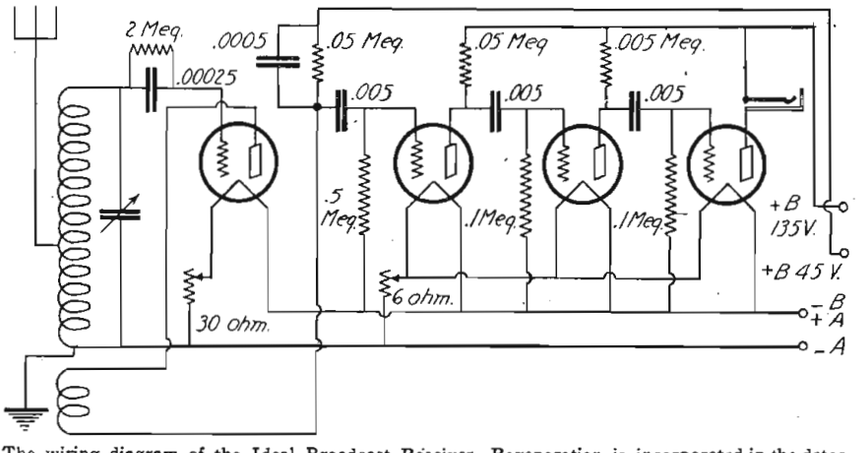
MANY who contemplate building a receiving set are puzzled as to what type to choose. Of course this depends largely upon the amount of money involved. But assuming a moderately priced outfit of three or four tubes that works on an outdoor aerial of 50 to 75 feet in length and gives loud speaker volume on distant stations is desired, it certainly is difficult to select the circuit and apparatus that will give the most enjoyment from the set. Books and magazines on the subject are full of all kinds of trick circuits, each one of which is supposed to be better than the others; but if the various circuits were carefully analyzed they would all be found to operate on the same basic principle, and one circuit would be as good as another. And as a regenerative circuit is the most economical and sensitive of them all, the problem resolves itself into obtaining the most satisfactory regenerative circuit.

THE REGENERATIVE CIRCUIT

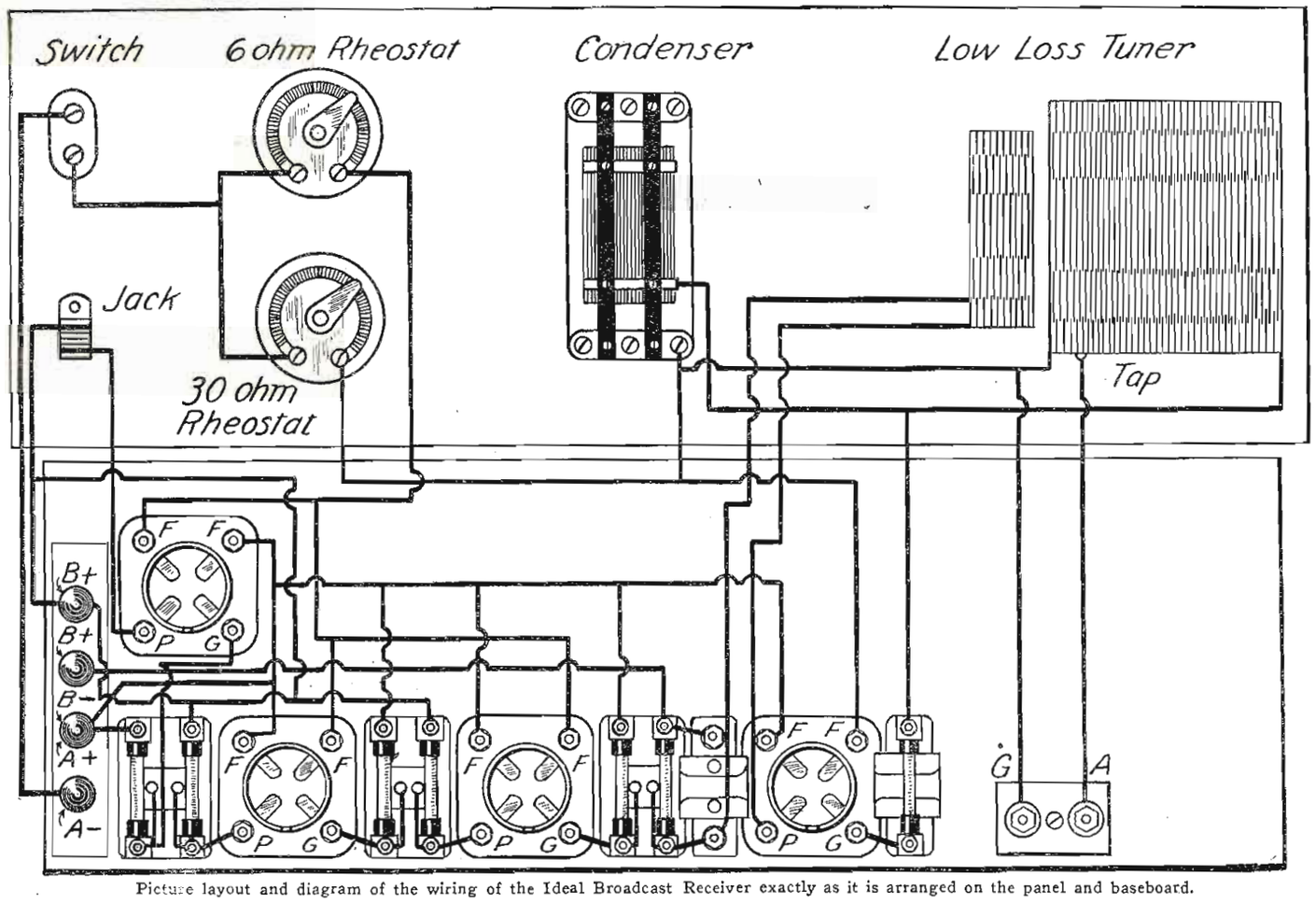
In any regenerative circuit the amount of regeneration can be increased up to a point where the tube begins to oscillate, and no greater sensitivity or amplification can be had. Therefore, of the many single, double, triple and four circuit tuners in use today, selectivity only can be gained, as neither of these circuits can increase regeneration beyond the oscillation point and consequently cannot be any more sensitive than the standard basic circuit. By proper design of the tuning instruments, the basic circuit can be made just as selective as any of the more complicated ones, and the sensitivity will be greater because the less circuits used the fewer losses occur. Therefore we shall select the standard regenerative circuit with a well designed low loss tuner and low loss condenser as the most desirable for broadcast reception.

RESISTANCE COUPLED AMPLIFIER

Sufficient amplification should be used to make the weakest stations loud enough to operate a loud speaker. Audio frequency amplification, of course, is the most economical, but distortion always results when iron core audio transformers are used. But resistance coupling gives perfect results on all the notes of the musical scale, and the quality of the music as it comes from the loud speaker is virtually perfect. Therefore, where quality is desired, resistance coupling should be used. Three stages of resistance coupled amplification will give enormous volume. Our finished set will have four tubes, one as a regenerative detector with low loss tuner and condenser, and three as



The wiring diagram of the Ideal Broadcast Receiver. Regeneration is incorporated in the detector circuit. The last three tubes compose the resistance coupled audio frequency amplifier.



Picture layout and diagram of the wiring of the Ideal Broadcast Receiver exactly as it is arranged on the panel and baseboard.

resistance coupled amplifiers. Such a set is ideal for sensitivity, selectivity, and quality, the three desirable features of a broadcast receiver. The simplicity of building and wiring such a set is apparent from the accompanying illustration, which shows the rear view of the receiver removed from the cabinet.

LOW LOSS INSTRUMENTS

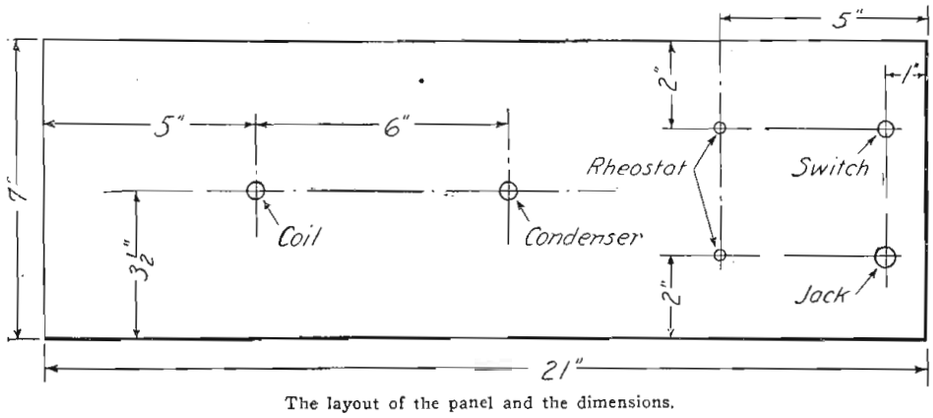
The most important instruments in the entire set are the low loss tuner and low loss condenser. There are many low loss tuners on the market. The type used in the set shown in the illustration may be constructed by hand, if desired. The large coil is wound with 55 turns of No. 16 D.C.C. wire stagger fashion to a mean diameter of 4 inches. A tap is taken at the 10th turn from the end near the tickler coil. This tap serves as the antenna connection. The tickler coil consists of 18 turns of No. 16 wire stagger wound to a mean diameter of 2¾ inches. It is coupled to the main coil, as shown. Only one strip of insulating material supports the whole unit. Note that the tickler is coupled to the filament side of the grid coil, leaving the grid end of the coil free and reducing capacity coupling between grid and plate.

The condenser used is of the square law low loss type with grounded frame to eliminate body capacity. These features make the process of tuning very simple. The condenser is connected directly across the coil, with no binding posts or insulation between to cause losses. One side connects to the grid condenser and leak and the other to the filament.

It may be well to mention that the object of using low loss instruments is to increase selectivity as well as sensitivity. Losses caused by solid insulation material have the same effect as a resistance in the circuit, and losses are usually represented as being equivalent to a series resistance of a certain value, meaning of course that a perfect circuit connected in series with a resistnce of a certain value will have the same losses as the circuit with solid insulating material in its field. And the more resistance in the circuit the weaker the signals and the broader the tuning. Therefore, as little insulating material as possible should be used for supporting the instruments in the radio frequency circuits.

List of Parts Required

1—Panel, 7 by 21 inches, with cabinet and baseboard.
1—Low loss tuner.
1—.0005 mfd. low loss variable condenser with vernier dial.
4—Vacuum tube sockets.
1—.00025 mfd. fixed grid condenser.
3—.005 mfd. fixed condensers.
1—.0005. mfd. fixed condenser.
1—2 megohm grid leak.
1—.5 megohm grid leak.
2—.1 megohm grid leaks.
2—.05 megohm resistances.
1—.005 megohm resistance.
Mountings for above condensers and resistances.
1—30 ohm rheostat.
1—6 ohm rehostat.
1—Filament switch.
1—Single circuit jack.
6—Binding posts.



The layout of the panel and the dimensions.

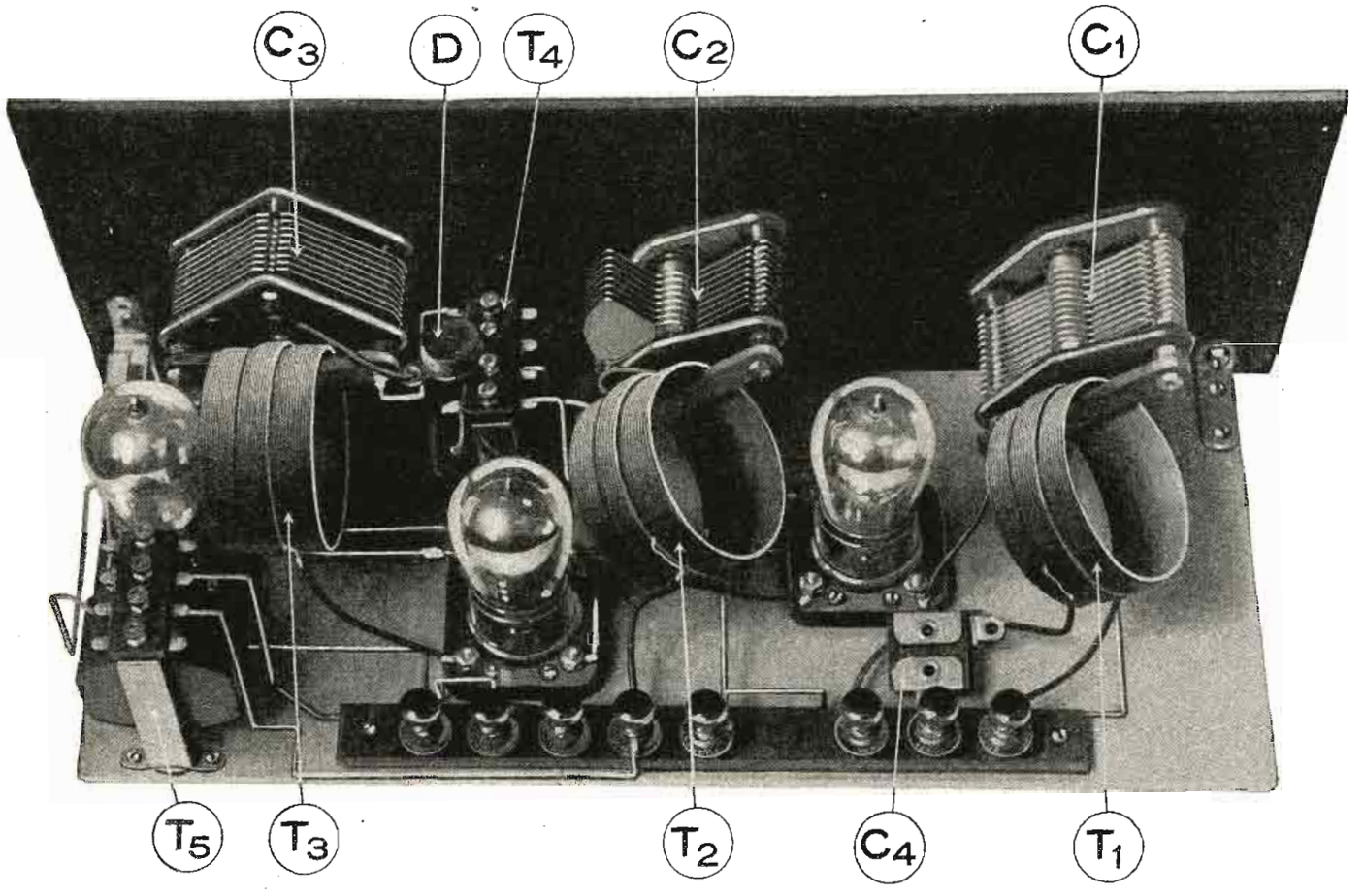
DETAILS

Little need be said about the actual construction of the set. The panel layout shows the location of the center holes of the various instruments. The diagram shows all the connections, and the location of the various resistances used in the amplifier are also given. On account of the compact arrangement of the parts, the wiring is very simple. Type UV-201A tubes are recommended for this circuit. A "B" battery of three 45-volt units connected in series is recommended, with a 45-volt tap for the detector tube. A resistance coupled amplifier requires a high "B" battery voltage for best operation, but the batteries will last a long time, as very little current is used on account of the high resistances in the circuit.

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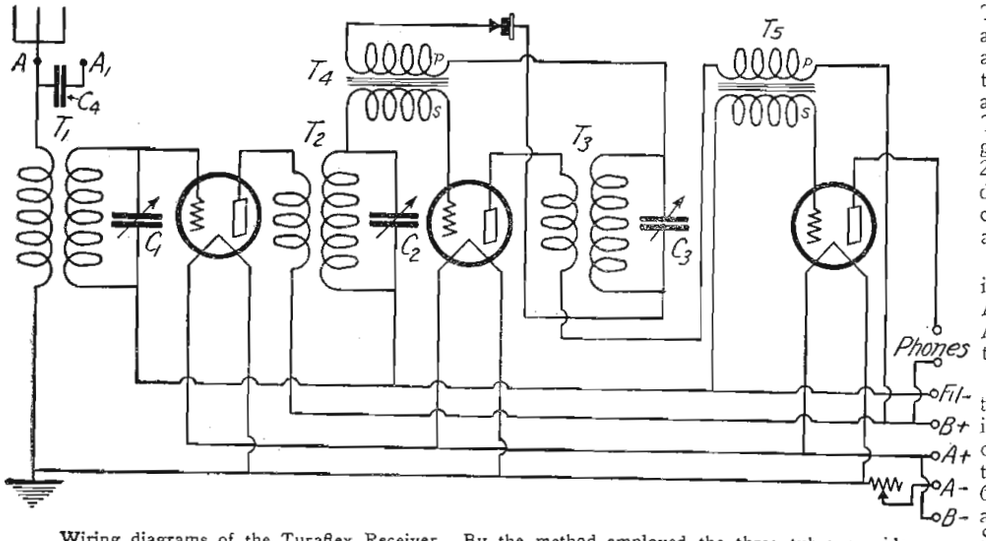
The Tu-Ra-Flex Radio Receiver

A tuned radio frequency reflexed receiver of exceptional merit is the Turaflex. Three tubes are made to do the work of four in a very efficient manner.



A rear view of a completed Turaflex Receiver. The components are: C1, C2, C3—variable condensers; C4—series antenna fixed condenser; T1—antenna coupler; T2, T3—radio frequency transformers; T4, T5—audio frequency transformers and D—crystal detector.
Photo courtesy National Airphone Corp.

A GREAT advance in radio receiver design is incorporated in this new circuit, in which three tubes do the work of four. There are two stages of tuned radio frequency amplification, a crystal detector and two stages of audio frequency amplification. The losses due to a potentiometer or other devices to keep the tubes from oscillating are eliminated by using special low loss coils. There are added advantages, namely: This receiver will not re-radiate; it is as stable in operation as the best neutralized circuit; it is simple in operation, as stations once logged are always received ou the same dial settings; and its selectivity is excellent.

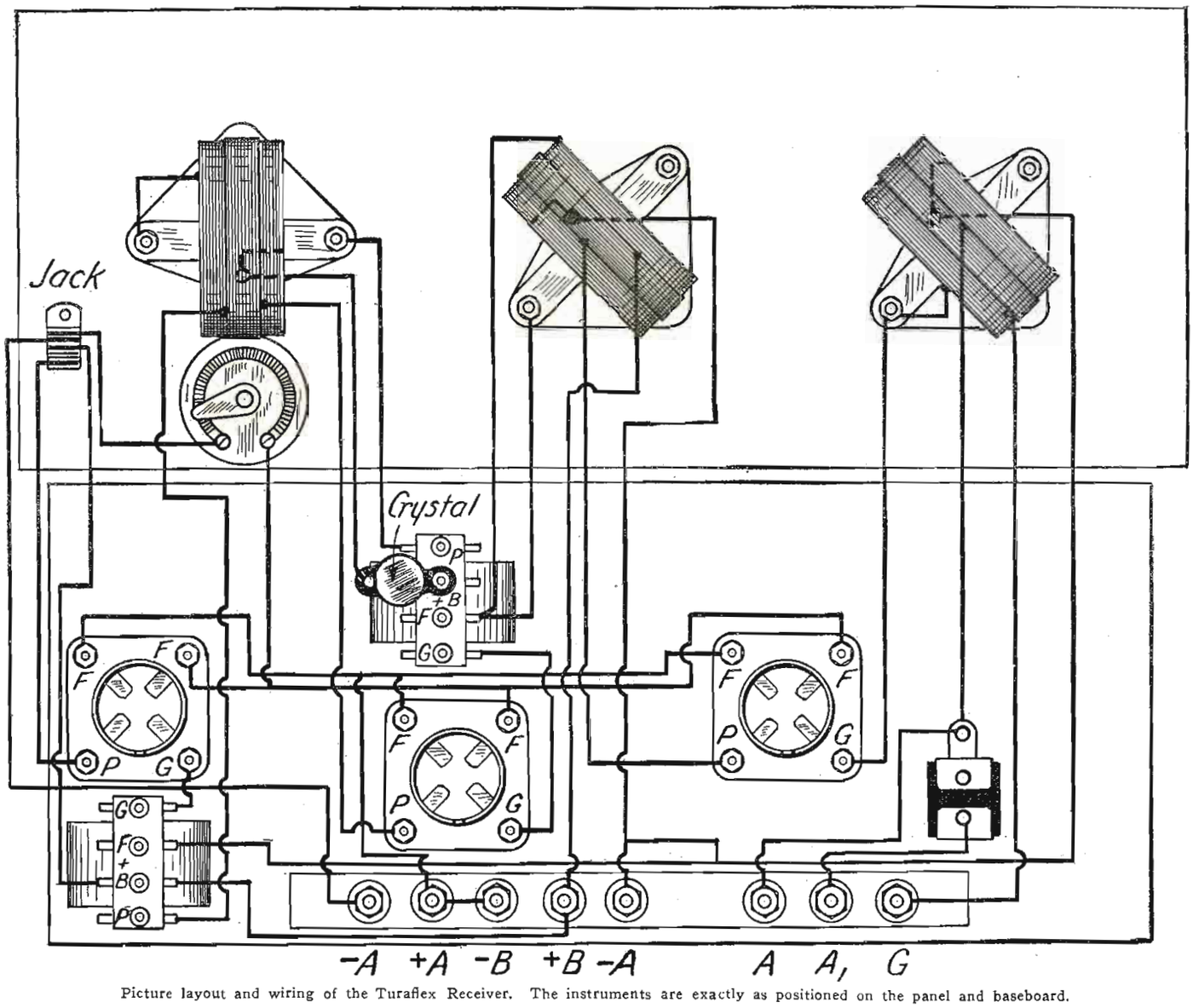


Wiring diagrams of the Turaflex Receiver. By the method employed the three tubes provide two stages of radio frequency amplification and two stages of audio frequency amplification.

The circuit diagram of this remarkable hook-up is shown in Fig. 1. The action of the circuit is: The incoming signal is amplified at radio frequency in the first two tubes, is then rectified by the crystal detector; then reflexed through the second radio frequency tube at audio frequency, and then amplified through the third tube. The fixed coupler T_1, and the radio frequency transformers T_2 and T_3 are mounted on the rear of the variable condensers C_1, C_2, and C_3, as shown in the photograph D is a crystal detector and T_4 and T_5 are the audio frequency transformers. T_1 and T_2 are mounted at an angle of 45 degrees and T_3 is mounted vertically. C_1 is a 23-plate condenser and the other two condensers have 17 plates each. The tubes are controlled by one rheostat, which should be a heavy duty type to carry the current.

It will be noted that two antenna binding posts are indicated, the one marked A being used for a short antenna and A_1 for a long antenna, the latter having the .00025 mf. condenser C_4 in series.

The fixed coupler T_1, which is shunted by the 23-plate condenser, has a primary winding of 15 turns wound directly on the secondary of 50 turns. The radio frequency transformers have 14 turns wound over the 60 turns of the secondary, and are shunted across the 17-plate condensers. No. 26 B. & S. gauge S.C. wire is used for winding the coils.



Picture layout and wiring of the Turaflex Receiver. The instruments are exactly as positioned on the panel and baseboard.

The coils may be wound on a bakelite tube 2¾ inches in diameter by putting on the secondary and then the primary over and in the center of it. If the constructor wishes to wind the coils without using a bakelite tube and make them self supporting, they may be built as follows: On a cardboard tube 2⅝ inches in diameter, wind on sufficient small string. Over the string place a strip of adhesive tape with the sticky side up, so that the wire will be held in position. In the center of the winding, place another strip of adhesive tape about ¾ of an inch wide with the sticky side out for the secondary. A drop of sealing wax or a strip of tape may be used to keep the leads in place, after the string is pulled out and the coil slipped off the winding tube. It is best to have the ends of the primary winding diametrically opposite to the ends of the secondary, as the leads to the condensers and tubes will be shorter.

In tuning, condensers 1 and 3 are moved simultaneously, the center condenser being moved a small amount at a time. After a station has been picked up, condenser 2 is readjusted to maximum volume. UV-201A or C-301A tubes give the best results, although UV-199 tubes may be used. As with all circuits, one tube may function better in one position than in another, so shifting the tubes around should be tried. This set will give excellent results on any type antenna, but best reception is usually obtained on an outside antenna about 100 feet in length.

PARTS REQUIRED FOR THE CONSTRUCTION OF A TURAFLEX RECEIVER

2—17 plate condensers.
1—23 plate condenser.
1—fixed coupler.
2—radio frequency transformers.
2—audio frequency transformers.
1—6 ohm rheostat.
3—tube sockets.
1—crystal detector.
3—dials.
1—jack.
1—.00025 mfd. fixed condenser
8—binding posts.
7" x 18" panel.

Radio vs. Wireless

By EDWARD C. HUBERT

"I SEE that you have installed a wireless set," I said to a well educated neighbor of mine.

"No," he answered, "it's a radio." I concealed the utter disgust I felt for this man and his stupidity, and hurried home to write about the "difference" between radio and wireless. There ain't none such, that's all. Wireless or radio, whichever you wish to call it, has put more people in the bughouse and living room than any other mechanical cussing-machine.

But radio and wireless—there must be a big difference; they're spelled a little different. I hate to disappoint and disillusion some of you who have counted so much on a "big difference." But just brace yourselves and prepare for the shock: THERE IS NO DIFFERENCE BETWEEN RADIO AND WIRELESS EXCEPT THE SPELLING.

Wireless does not mean sparks, noise, lots of switches and neighborhood feuds. Wireless means communication without the use of wires other than the aerial; the ether and ground taking the place of wires. Radio means exactly the same thing: it is the same process. Now communication by wireless waves may consist of an SOS message from a ship at sea or the communication may be simply the reception of a wheezing soprano. It does not become something different in either spelling or meaning just because you can understand one and can't the other. When broadcasting was being ex-

(*Continued on page* 1297)

The Discovery of the Oscillating Crystal

By DR. GREENLEAF W. PICKARD*

Inventor of the Crystal Detector

The Oscillating Crystal is by no means new, as Dr. Pickard ably points out in this interesting history of the principle, recently given wide publicity.

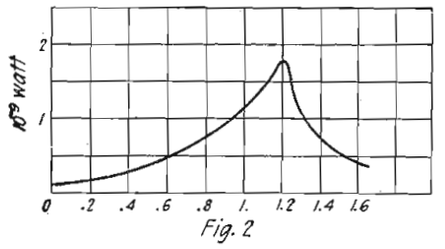


Fig. 2

Characteristic curve of Dr. Eccles' crystal detector.

THE publication, some months ago, in RADIO NEWS, of the experiments of Lossev with the oscillating crystal, calls to mind some facts regarding the first demonstration of this peculiar quality in certain crystalline substances used as detectors of oscillations in radio circuits.

All credit for the discovery and publication of the oscillating crystal must be given to Dr. W. H. Eccles, who in May, 1910, demonstrated before the Physical Society, a galena crystal combination capable for generating oscillations. The circuit used is practically the same, in its fundamentals, as that used by Lossev in his work with the crystal. All of my latter work with this type oscillator, as well as that done by Lossev, is implicit in the original discovery made by Dr. Eccles.

In the summer of 1910, while working with a microphonic telephone and telegraph amplifier—the invention of S. C. Brown, shown at Fig. 1—consisting of a minute spark gap formed between osmium and iridium electrodes, (A) I found that this gap constituted a fairly sensitive though erratic detector of oscillations. Shortly after reading of Dr. Eccles' experiences with the galena crystal combination, I shunted the Brown gap with a capacity-inductance circuit and at once was successful in producing radio frequency oscillations.

After this preliminary success, I repeated the Eccles experiments with the galena detector (working the crystal on the portion of the curve shown in Fig. 2 which drops, or has the character of acting as a negative resistance similar to the electric arc) and then I used silicon, zincite fused zinc oxide and pyrite. In each case I was more or less successful in producing sustained oscillations. In all cases, of course, a condition of oscillation was obtained only after careful adjustment of the contact point on the detector and experimentation with the voltage applied across the crystal in order that it could be worked on the proper portion of the characteristic curve. As Eccles pointed out, the conditions under which the crystal produced sustained oscillation were practically the same as those necessary for the operation of the Poulsen arc.

Acting upon the correctness of this assumption, I placed a strong magnetic field around the detector. In the case of the Poulsen oscillating arc, this condition is extremely important if the arc is to remain stable in operation. However, I found that with the crystal, the magnetic field made not the slightest difference.

After hearing Nauen signals on a regenerative tube set in 1915, I attempted to duplicate that feat with the use of a separate crystal oscillator used to heterodyne the signals, and a second crystal to act as a detector. After several hours' work I was rewarded by faint, though readable signals. Following up this experiment, a few days later I succeeded in receiving this station on an autodyne crystal circuit, that is, by using the same crystal as oscillator and detector. The circuit used in this experiment is shown in Fig. 3. It will be noted that this circuit is the same, in its essential characteristics, as that used by Eccles and later by Lossev.

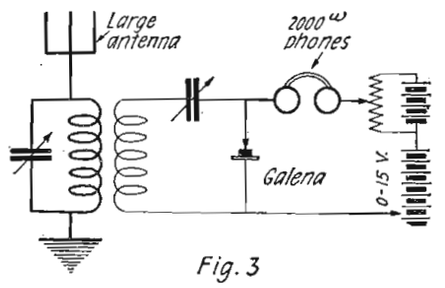


Fig. 3

The circuit employed by Dr. Pickard in his successful experiment to receive the undamped wave signals from POZ by the use of a crystal.

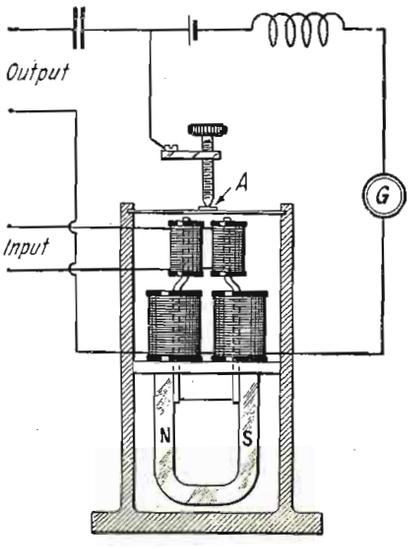


Fig. 1. The patent drawing of S. G. Brown's microphone amplifier, the instrument Dr. Pickard found to be a fairly sensitive detector of oscillations.

In the course of these experiments I noted that the oscillations generated by the crystal were not constant in amplitude, or else were generated in separate groups. This gave rise to a slight hiss in the phones when the crystal was generating radio frequency currents, which would obscure weak signals. It is needless to tell those who have experimented with such an oscillator that the adjustment required by the crystal is extremely fussy as compared with that necessary when it is to be used for detection.

My experience serves well to illustrate how easy it is for one to miss something that is literally under one's nose. For years prior to Dr. Eccles' experiments, I had been experimenting with crystals shunted by a capacity inductance circuit; I was very familiar with their voltage-current characteristics and I had found a marked increase in their sensitivity when a properly adjusted and poled E. M. F. was placed in circuit, but I had not looked for oscillations nor found them.

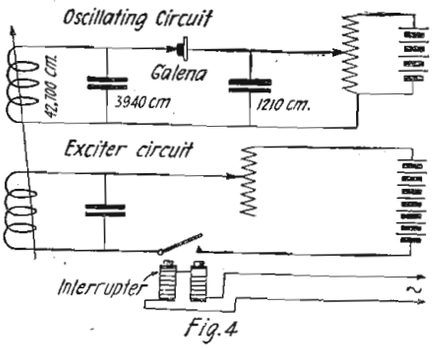
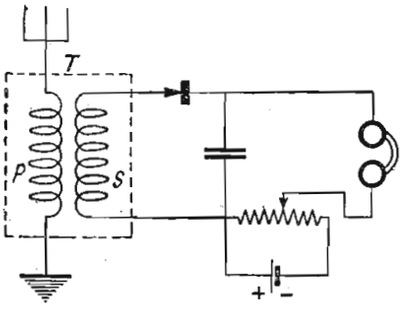


Fig. 4

Simplified arrangement of the basic circuit developed by Dr. Eccles in 1910.

The circuit shown in Fig. 4 is a simplified arrangement of that used by Dr. Eccles in his demonstration before the Physical Society of London in May, 1910. It will be noted that the circuit has a striking similarity to that used in conjunction with the oscillating arc. The discovery of the oscillation characteristic was quite by accident. The experiments were originally directed toward investigating the thermal characteristics of detectors, Dr. Eccles holding that the radio frequency currents through a detector slightly heated up the contact surface and that, when the crystal was shunted by an outside E. M. F., the heating effect materially changed the resistance of the circuit so that an audible effect was produced in telephone receivers incorporated in the circuit. It was in plotting the curve of a crystal, showing the relation of current and voltage that he found the negative resistance characteristic. One of the curves, showing this plainly, is given in Fig. 2. Up to approximately 1.2 volts the detector behaved properly. Passing that point, however, the drop in the curve showed plainly that under certain conditions the crystal had the property of negative resistance. Of this characteristic Dr. Eccles said: "As the current increases the curve bends toward the

(*Continued on page* 1270)



A copy of the circuit contained in the patent issued to Dr. Pickard on Oscillating Crystal Circuits.

* *Consulting engineer of the Wireless Specialty Apparatus Co.*

Oscillating Crystals

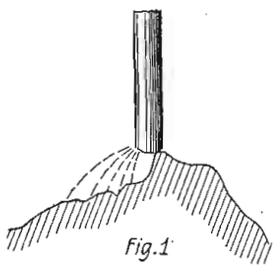
By O. V. LOSSEV

Engineer of the Russian Government Radio Laboratories

A theoretical study of the characteristics of crystals capable of producing oscillations and the circuits employed for determining the actions.

THERE are doubtless many experimenters who are interested in the Crystodyne principle, which was described in the September and October issues of RADIO NEWS. In the following article, there is more technical and experimental data concerning this application. This additional data should prove to be of great value to the fan who is experimenting with the oscillating crystal.

In a crystal detector there is generally contact between the metallic point or a sharp



Enlarged view of crystal and contact point, dotted lines indicating microscopic arc.

Fig. 1

edge of one crystal, with a surface of another crystal. If the surface of the contact is very small, the value of the corresponding resistance may become relatively high and the voltage drop across the contact increase accordingly. Microscopic voltaic arcs or discharges of similar natures take place between the metallic point and the surrounding sharp edges of the crystal. These arcs are in parallel with the contact resistance. See Fig. 1.

The detector then represents a non-inductive resistance obeying Ohm's law, the resistance of the contact shunted by an arc, both being in series with another resistance, which is that of the crystal itself. In Fig. 2, Rc is the contact resistance, Rm is the resistance of the metallic crystal, and Ra the voltage drop across the arc.

A typical characteristic curve of a generating crystal is shown in Fig. 3, and the circuit used to obtain this curve is illustrated in Fig. 5, which will give the IR drop across the detector when the current is varied by the potentiometer P.

Referring to Fig. 3, when a current is less than a certain value, i_a, the potential drop is proportional to it, *i. e.*, the total resistance of the circuit is constant. Here we assume that the total current flows through

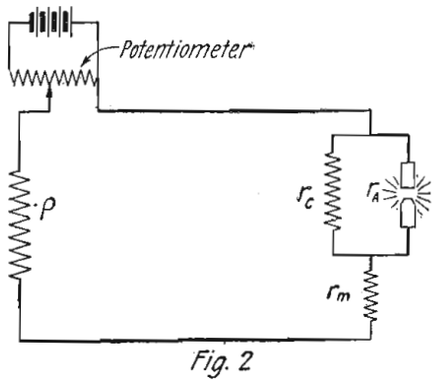


Fig. 2

Diagram illustrating external circuit and Theoretical resistances at point of contact.

the contact and as the contact obeys Ohm's law, we obtain a straight line Oi_a. When the current reaches i_a, a certain change takes place across the contact and the IR drop is no longer proportional to the current. Nevertheless, a further increase of current will mean still an *increase* of the IR drop, showing that the resistance is still positive, although the curve undergoes a change. However, when the current reaches i_o, the IR drop is so great that a microscopic arc is established across the contact. Now if the current is increased, there is a *decrease* of the IR drop, and we may say that the resistance of the detector has become negative.

The term "negative resistance" is a misleading one, because the general conception of resistance is that it is the constant property of the body that impedes or tends to stop the passage of current through it. Such a constant property is generally considered to be positive, regardless of the values of the voltage and current (at least until the body becomes heated).

However, in the case of an arc, the result

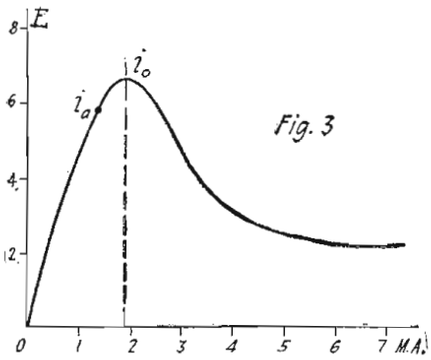


Fig. 3

Characteristic curve of oscillating crystal.

of the voltage divided by the current is far from being constant. For high voltages the resistance of the arc is relatively great, very little current passing through it. For moderate voltages, as the resistance of the arc is also smaller, the current is moderate. For low voltages, the arc resistance becomes extremely small and the current of the arc tends to increase indefinitely this means that the arc is unstable and tends to become a short circuit. The arc, however, has a negative resistance characteristic only for increasing current acting as an open circuit for decreasing current. The conclusion reached is that a small increase in the voltage across the terminals of the arc causes a small decrease in the current; so we sometimes think of the negative resistance of an arc as distinguished from the positive and current limiting resistance of metallic conductors.

I admit that though the microscopic arc differs in certain points from the ordinary arc, its resistance obeys the same laws and can be expressed by

$$iR = \frac{a}{i} + \frac{b}{i^2}$$

where a and b are constants and i the current through the arc.

In taking the characteristic curve, the ballast resistance ρ plays an important role. In

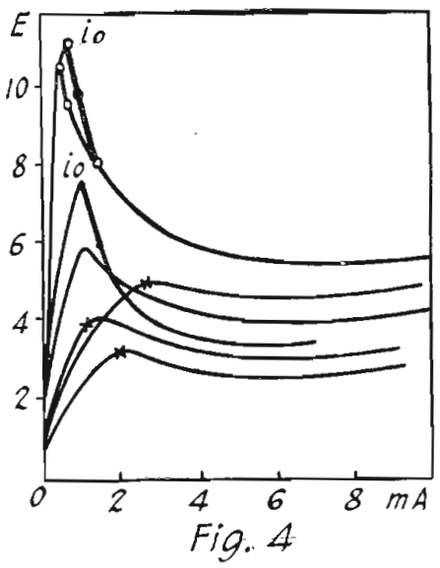


Fig. 4

Characteristic curves of oscillating crystals with "good" and "bad" contact points.

order to have any point in the curve with "negative resistance," it is necessary that the ballast resistance shall be greater than the absolute value of the corresponding negative resistance. The current through the whole circuit (ballast and detector) is equal to the potential difference of the potentiometer divided by the total resistance, which is equal to the algebraic sum of the resistance of the ballast and the detector. If the ballast resistance is not greater than the absolute resistance of the detector, the algebraic sum of them will be a negative quantity and we will not be able to obtain the corresponding current, as it will be infinitely great. Therefore, when it is desired to obtain points with negative resistance on a steep part of the curve it is necessary to increase ρ, if it is desired to approach the point i_o.

Fig. 5 shows how the curves of Fig. 4 were obtained, the reading on the voltmeter being corrected to give the true voltage. The switch A permits the direction of the current to be reversed.

"Good" contacts are those which give a steep falling part of the characteristic curve corresponding to the negative resistance. It seems that a "good" point is one where the leakage is very small, up to the time of the formation of the microscopic arc, which appears suddenly. By a "bad" point is meant,

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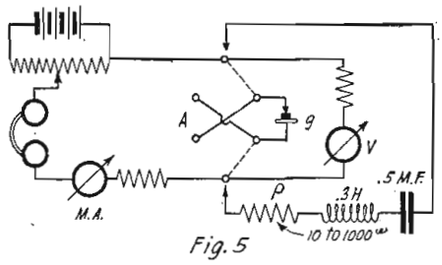


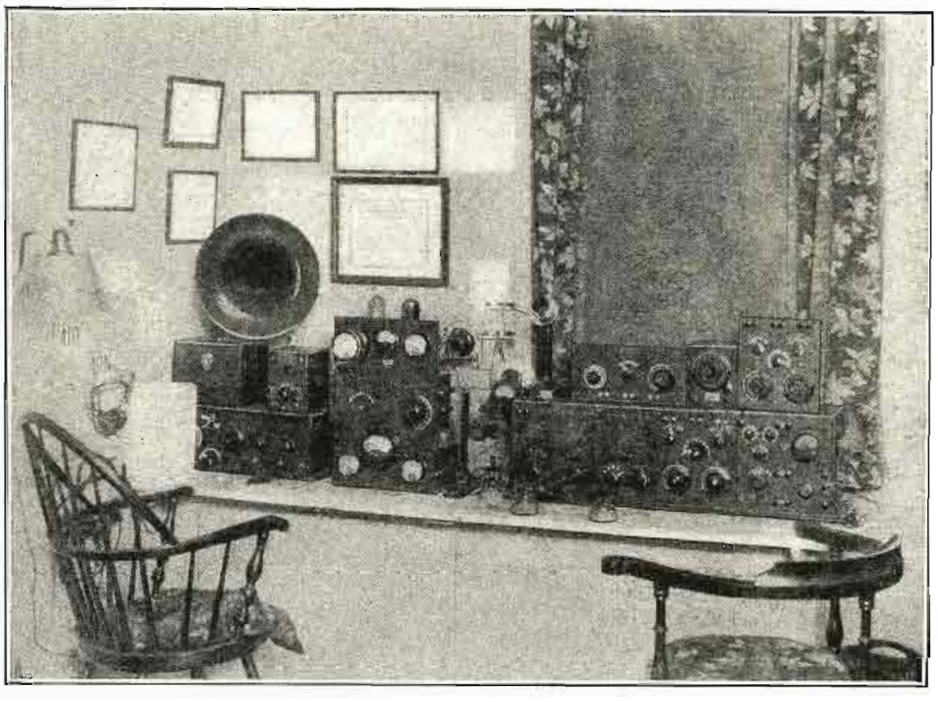
Fig. 5

Circuit diagram for obtaining the characteristic curves of oscillating crystals.



Hamitorial

The Future Does Look Attractive



Experimenter Station 4XE located at Jacksonville, Florida, owned and operated by Messrs. Cooper and Lee. This station has maintained two way communication with Holland and France and been reported heard 15 times in England, Denmark, Holland and France, and holds the distance record for the fourth district of the United States for two way communication, 5,300 miles. Two 50-watt tubes are used in the transmitting apparatus and the receiving equipment consists of four different circuits.

I CAN visualize someone seeing the above title and grunting cynically to himself about "'nother of those Pollyanna prophets." Maybe so.

It has been said that the average age of the radio-telegraphing amateur—the Ham—has risen, which is a damaging fact. We need the youngsters and their bright minds just as business needs apprentices. I think, to consider all factors and then decide that we lose by the lack of the younger Hams, is rather an alarmist viewpoint.

This must be made clear: the average age of the Ham is on the upgrade in this manner. It is ceasing to be lowered by the short-pants brigade.

It is inevitable that this should happen since we have simplified radio and the convenient concerts which eliminate the drudgery of the code. Most kids went into radio for pastime, anyhow in the time gone by, and disturbed a great many people with spark coils and other modes of interference. Now they go into it for pastime, just the same, and don't bother the more experienced amateurs, because they are busy listening to jazz. The technically inclined, in the past, stuck and forged ahead, eventually making good Hams, and the non-technically inclined were either unattracted to begin with, or else were lost by the wayside. The same holds true now, except that many non-technically inclined, who otherwise would not have been lured, fall for the simplified construction articles. So do the technically inclined, but they grow in knowledge and experience and eventually the transmitting game gets them anyhow, without having to suffer from their first agonies.

Thus we get the final fruition of the years without the attendant troubles of developing our own; and we not only get a higher age average, but a higher experience average, too. As experience is parallel to efficiency, to a certain extent, you can see what conclusion would be reached.

This tendency to an older average age means a number of things, the effects of which we are just beginning to realize. It means a greater stress on knowledge because the older you get the more value you find in training. It means a better average of operating efficiency because the older mind requires an aim, not merely purposeless play. It means a faster advancement of the art, for the partially trained minds we obtain will be better equipped to handle the problems which arise from time to time for solution. It means finally, a keener and more stimulating competition because of a higher mental average that will finally and forever eliminate any sneering reference to the telegraphing game as kids' sport. This last will be especially gratifying to us, who have always taken our hobby seriously, and have resented these gratuitous and ignorant slights.

The fact that all this improvement in the personnel will, of itself, demand a higher grade of apparatus must not be ignored. In fact, we are already beginning to feel this effect. It means customers capable of buying good stuff and paying the price that justifies its manufacture. It means prosperity

(*Continued on page* 1236)



This is station 6TI owned and operated by Mr. Horace Greer at 414 Fairmount Ave., Oakland, Calif. 6TI has worked with every district in the United States and has communicated with New Zealand. He has been heard off the Chinese coast, in Alaska, Canal Zone, Hawaii and Australia. On 50 watts input there is used 1,000 volts A.C. on the plate, 10 volts A.C. on the filament and draws about 110 milliamperes.

Suggestions that Improved One 5-Watter

By KEN ROYALE (KR), 5 0C

Mr. Royale has managed to point out here the importance of trifles in connection with transmitters. He has employed an actual case as an example, particularly to point out the usual details that are overlooked by the average beginner.

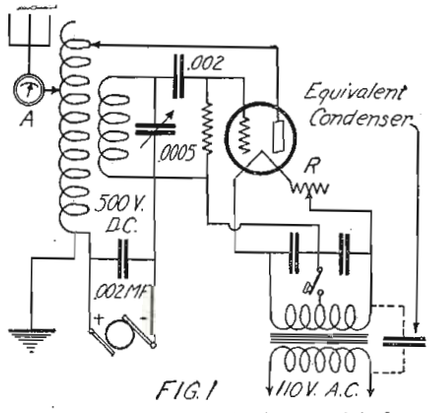
IN building the amateur station of the ordinary type, not a great deal of technical knowledge is used. In fact, quite often none at all is employed. This leads to a number of errors, the importance of which is sometimes of such an order that the station is actually failing in its purpose because of them. Suppose we take a case which recently came under my observation. The young fellow who built the set had followed directions written by several amateurs based on their own stations, and he had no reason to suppose that they were wrong. Undoubtedly they were right, as far as they went. Results do not depend entirely on the transmitter, for a transmitter which has an excellent working range, at one station, may fail to "get out of town" at another. The surroundings of the station, the location of the apparatus, and the dielectric in the proximity of the antenna that are objectionable, must all be taken into consideration.

Inspection showed the antenna proper was O. K., five wire six inch twin cages separated 10 feet, and supported at a good height. Ground was also a good one. Lead-ins? Oh yes, well insulated, the leads going through three inch porcelain tubes, to the set. As the tubes were large and well glazed, it was immediately evident that their insulating qualities were very good, in fact superfluous, considering power. But, these two lead-in tubes were separated by only six inches, and this formed, therefore, quite a condenser. This "condenser," for it was really nothing more nor less than exactly that, technically, introduced an enormous loss, and therefore was greatly reducing the range of the transmitter. This was easily rectified by separating the two lead-in tubes by the height of the room, eight feet. This, theoretically, did not entirely eliminate the trouble, however, it did reduce it to a minimum, and for all practical and financial purposes sufficiently. The latter, by the way, was the most important, as usual.

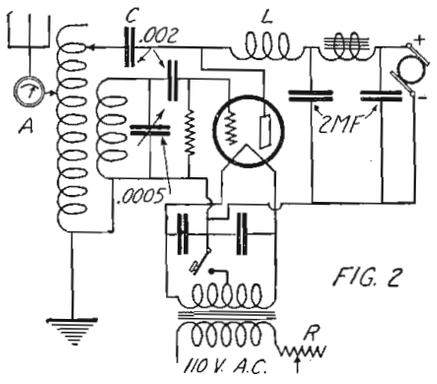
His actual transmitter used the circuit of Fig. 1. Of course such a set will work and under some conditions actually produce the most satisfactory results, but it is, nevertheless, not technically correct. The results were now fairly good, but not as good as are actually obtainable. What, then, was there left for him to do?

A CIRCUIT CHANGE

I advised changing his circuit to that of Fig. 2, because he had too long a ground lead, that put an excess potential difference across C, to ground, which was impressed on the condenser formed by the two windings, through the core of the filament supply transformer, resulting in a loss of energy. Then I told him to increase the number of turns in the antenna coil, as he only had 15, and needed about 25 turns, or a little less, to include the space between the plate tap and the ground. Then, I tried varying the resistance of the grid leak. He had been using one 5,000 ohm leak, simply because that was what had proved O. K. at some other station. The test revealed that 15,000 ohms was the correct resistance. This was obtained by connecting three of the standard units in series. These four changes in his transmitter and lead-ins resulted in an immediate improvement of results. He was fortunate, at that, for it is not so very often that an immediate improvement is noticeable. Often enough, bad conditions set in when a new system is tried, and fair conclusions are not obtainable until after a reasonable period of time. The actual additions to the transmitter, after all, consisted only in the grid leaks, and one choke coil L, which was simply built on any diameter form handy by winding 275 turns of No. 28 D.C.C. wire, on, preferably, a cardboard tube with a little thin shellac or varnish on the last few turns at each end of the coil to act as a binder. The plate blocking condenser C did not have to be changed, as it was already of the proper kind; mica, .002 mfd., 4,000 volts test. The circuit shows the addition of a filter, consisting of an iron core choke coil, of about three henries, with condensers shunted across the line at either end. These were suggested, but not all installed. The addition of an efficient filter will give a better note and bring in more DX report cards.



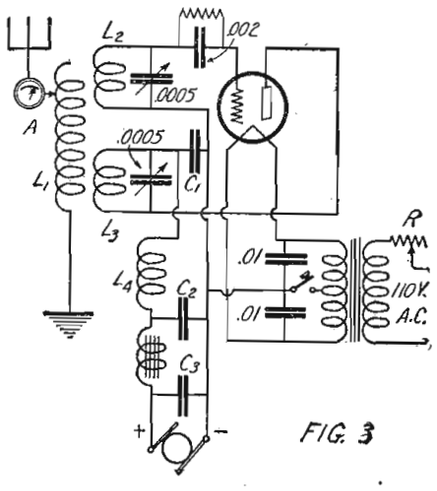
The reversed feed-back circuit, the original arrangement employed by Mr. Royale's protegé.



The circuit of Fig. 1 was improved considerably by a few minor changes, as shown.

He had become interested in the Meissener circuit, which is now fast becoming our most popular hook-up, due to its many advantages. He asked that I look over his experimental Meissener set; I saw immediately that his arrangement could not work efficiently. It consisted of three coils wound on a single form. The middle coil of the three, the antenna coil, was of 10 turns, with the other two coils wound as close as conveniently possible.

This arrangement, with two variable condensers across the grid and plate coils respectively, resulted in his having parasitic oscillations in the plate and grid circuits, causing harmonics to be radiated. In these harmonics, small amounts of energy were being radiated, and of course the energy radiated on any wave other than on the main one is a loss. Remember this, although it may seem queer, the vacuum tube itself, in the Meissener circuit, does not oscillate. The only oscillating current present is in the antenna circuit. With the set as he had it, the tube oscillated feverishly off the wave he intended the set to work on, therefore, the divided energies of the tube did poor work.



The Meisner circuit, the arrangement now employed in preference to the reversed feed-back circuit.

THE PROPER METHOD

The proper way for him to have constructed the set would have been to wind the plate and grid coils, which may be wound on any form having a diameter of about four inches, or that will go inside the end of the antenna inductance. Or, better still, make the coils "low loss" by winding them with No. 16 D.C.C. wire on pegs set in a four inch circle. If a condenser is used across the coils, each should have about 15 turns; however, if condensers are not used for tuning, and they are not absolutely necessary, the coil should have 25 turns. These coils should be separated at least four inches. The best method is to put one at each end of the antenna inductance, which is any conventional inductance, and tapped so as to obtain proper adjustment of wavelength. Different numbers of turns in the plate coil should be tried to find the most efficient point; the grid coil needed changing, for the 150 to 200 meter range. The grid leak values were much the same as in the reversed feed-back circuit, and the Meissener circuit to be used is shown in Fig. 3. He could have, if he so desired, eliminated the plate coil variable condenser, as this is an optional feature.

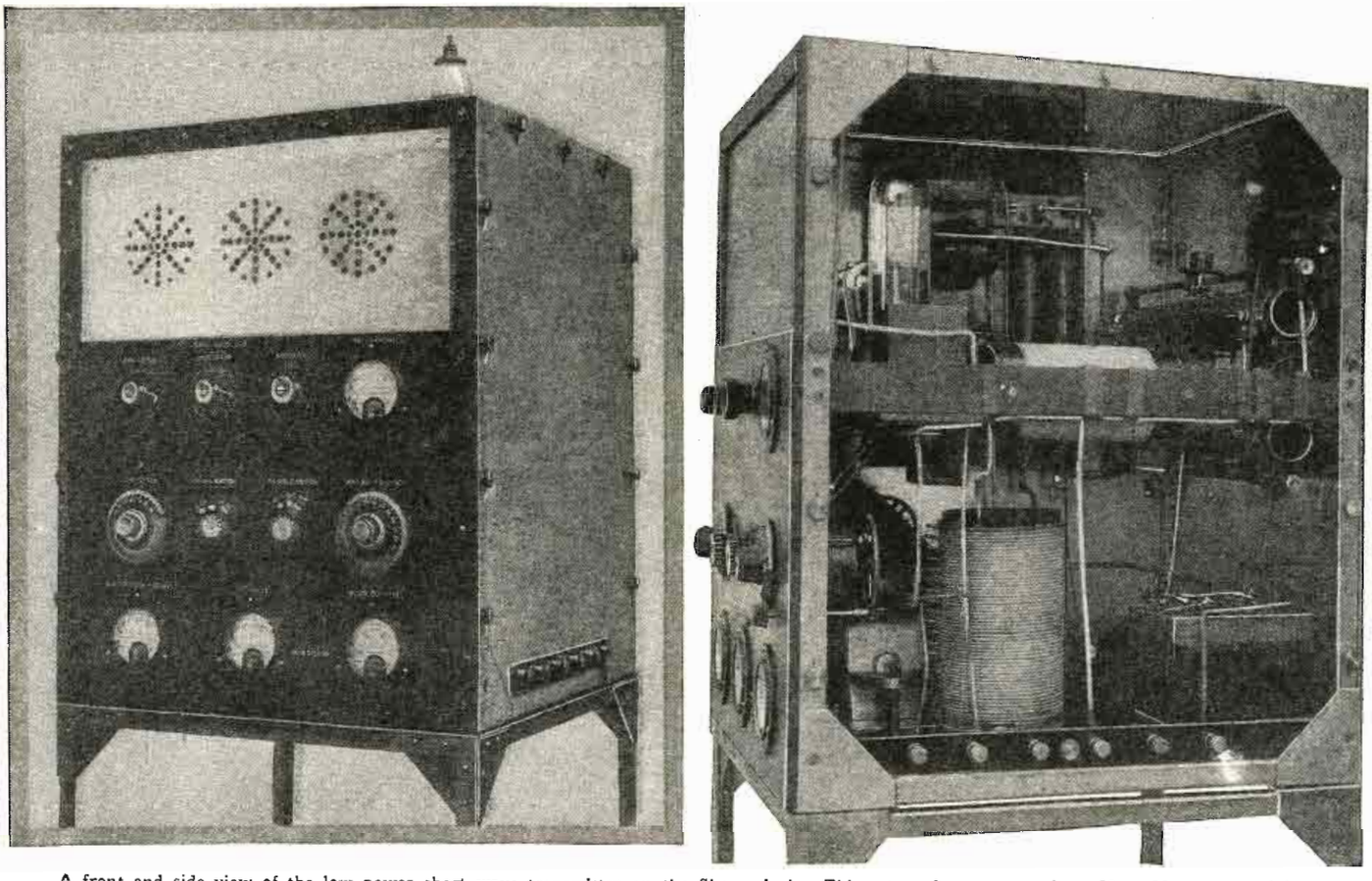
I advised the use of an inductive coupled transmitter, as a permanent installation, such as the Meissener circuit, for two good reasons: First, because the coupled transmitter emits, according to my observations, a steadier and stronger signal, and, second, the

(*Continued on page* 1236)

The Shenandoah Short Wave Transmitter

By S. R. WINTERS

An unusually interesting description of the short wave transmitter on the Shenandoah. This set, though employing exceedingly low power, operated efficiently and with consistency during the entire flight of the ship from coast to coast. It proved more satisfactory than the high power long wave set.



A front and side view of the low power short wave transmitter on the Shenandoah. This set works on waves from 80 to 90 meters and has an output of 50 watts. There are three tubes: A 7½-watt master oscillator, a 50-watt power amplifier and a 7½-watt modulator.

THE use of short waves for maintaining radio communication between aircraft in flight and ground stations is an accomplished fact. The results of a remarkable communication test conducted between the Bellevue Naval Research Laboratory and the *Shenandoah*, master dirigible of the United States Navy, have established this conclusion.

The *Shenandoah*, in its flight across the continent—from Lakehurst, N. J., to San Diego, Calif.—maintained constant two-way communication with Bellevue. This accomplishment, in itself, is not uncommon, because experiments preceding and during the World War established the certainty of maintaining radio communication between aircraft and ground radio stations as well as between two airplanes. However, when we are told that these recent tests made use of short wave-lengths, on the order of 80 to 90 meters, it is not difficult to realize that the achievement is remarkable.

WORK WITH PHONE

Furthermore, radio telephone communication was negotiated between the *Shenandoah* and the Laboratory while the former was in flight over Washington, D. C. Voice communication was maintained over a range of approximately 30 miles, the telephone attachment being installed for the purpose of enabling the pilot of this immense dirigible to direct the operator at the landing field during the operations of bringing the *Shenandoah* to its mooring mast. The voice communication between the operator and Bellevue was satisfactory up to a distance of 30 miles, but this is hardly an accurate measure of the range of the phone installation.

Continuous wave telegraphy, however, was the primary means of exchanging intelligence between naval officials in Washington and the *Shenandoah* as it journeyed across the continent. During the trans-continental flight, four-hour traffic schedules were in effect between the Laboratory and the dirigible. Daylight (two-way) communication was possible until the *Shenandoah* had passed Birmingham, Alabama. Then telegraphic signals were exchanged between the ship and the Government laboratory, each night, the schedules operative at 12 and 4 o'clock, Eastern Standard Time, until the *Shenandoah* was safely anchored at the mast in San Diego.

Lieutenant-Commander H. P. Leclair, whose conservative scientific mind is not given to extravagant claims, regards the results of this communication test as a record achievement in the transmission and reception of signals between aircraft and ground stations. On behalf of the Radio Division of the Bureau of Engineering, he is grateful to amateurs for their co-operation in enabling the Laboratory to develop high frequency apparatus for use on aircraft. It marks a departure and makes possible the use of more or less idle wave bands for aircraft and similar services. The amateurs also co-operated with the Navy Department in listening for the dirigible's signals emanating on its trans-continental flight. Although reports have not been received in Washington, it is likely that many amateurs throughout the United States intercepted the signals without difficulty.

THE APPARATUS

The short-wave transmitter was designed to operate on 90 meters with an output of 50 watts. Strangely enough, this outfit is designated as the auxiliary or stand-by transmitter on the *Shenandoah*, although its trial performance would seem to indicate that it is entitled to better than a secondary classification. However, the main transmitter, which has not been installed, will probably be the most powerful system ever placed on aircraft. This is a four-kilowatt tube transmitter which will operate over a band of wave-lengths ranging from 500 to 2,000 meters.

The auxiliary transmitter is of the master oscillator, power amplifier type. The master oscillator is a 7½-watt tube, while the power amplifier is a 50-watt tube. In addition to the oscillator and amplifier tubes, there is provided a 7½-watt modulator tube. The output is about 50 watts, governed by the 50-watt power tube. The equipment is capable of transmitting on continuous-wave telegraphy or telephony, operating at 89 and 98 meters, respectively.

Contrary to ordinary practice on aircraft,

(*Continued on page* 1272)

Multi-Stage Radio Frequency Amplification

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

Part III.

A continuation of the series of articles on a subject of vital interest to every experimenter desirous of increasing the range of his receiver.

LOOKING at Fig. 31 it will be seen that a middle tap is taken from S to the filament of the tube. Under these conditions the end E_1 will always be at opposite potential to the end E_2 with respect to the filament. The oscillating potentials across L_2 C_3 will be communicated through the grid to plate capacity of the tube to the end E_1, but the same potentials are fed into the grid oscillatory circuit at the opposite end E_2, and these two coupling effects will consequently cancel each other out in their effect on the grid circuit.

Fig. 32 shows an arrangement which A. D. Cowper has proposed for neutralizing the

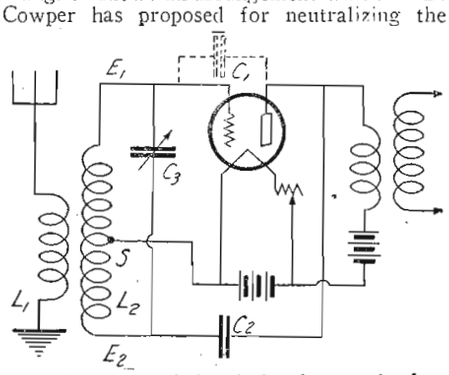


Fig. 31. A circuit in which tube capacity is neutralized by taking a tap on the grid circuit inductance.

capacity inside the tube. The ordinary tuned plate arrangement L_2 C_2 is employed, and the potentials across this coil are used for communicating to the grid of the next tube. To the coil L_2, however, is coupled another inductance coil L_3, and this coupling effects a reversal of phase which enables us to apply, through the condenser C_2 to the grid, potentials of opposite sign to those which are being communicated to the grid through the grid to plate capacity of the tube.

Instead of using tuned plate coupling, as in Fig. 32, the secondary of the transformer which effects a reversal of phase may be connected to the grid of the following plate. Such a circuit is shown in Fig. 33, where a tap is taken on the inductance L_3 and connection made through the small condenser C_2 to the grid of the tube. The arrow heads on the right show the connections to the grid and filament of the next tube. The high frequency transformer L_2 L_3 serves as a coupling between the plate circuit of the tube shown and the succeeding tube, but at the same time by the transformer arrangement it is possible to obtain a reversal of phase so that potentials will be passed through C_2 to the grid, of opposite sign to those which are passed to the grid through the various undesirable capacities.

The dotted line in Fig. 33 indicates that the bottom of the coil L_3 is really connected

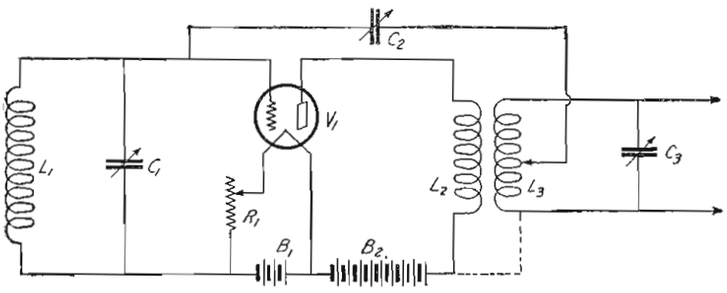


Fig. 33. A circuit in which the tap is taken from the grid circuit of the second tube.

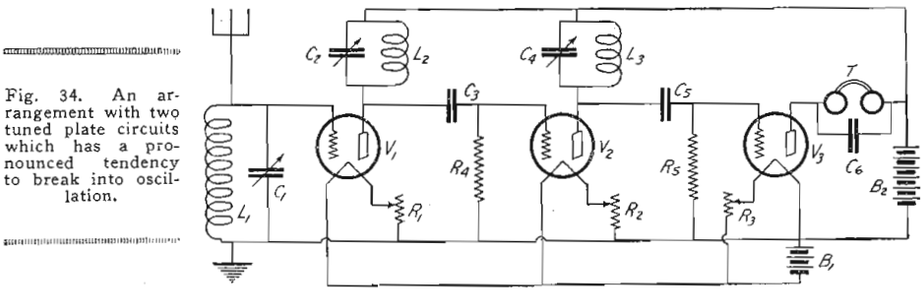


Fig. 34. An arrangement with two tuned plate circuits which has a pronounced tendency to break into oscillation.

to the filament of the first tube, because in a multi-tube set working with a single battery, the lower arrow head on the right-hand side of Fig. 33 would go to the common filament battery.

ACTUAL CIRCUITS EMBODYING THE METHODS DESCRIBED

It is now proposed to give typical examples of multi-stage amplifiers in which the principles already outlined are carried into effect.

The first of the circuits shown is that illustrated in Fig. 34, and here we have two tuned plate circuits. In this arrangement self-oscillation is very prevalent, although only two stages of radio frequency amplification are shown. It will be seen that the most stable form of aerial coupling is illustrated, and that the ground side of the aerial circuit is connected to the positive terminal of the filament battery, thereby introducing a large amount of damping into the grid circuit of the first tube. This will help greatly to stabilize the first tube, but the second tube is more likely to give trouble. This second tube has for its grid circuit the tuned plate circuit of the first tube, and its plate circuit, of course, is tuned, as shown. The plate current flowing in the plate circuit of the first tube will help to introduce damping into the circuit L_2 C_2, and it is therefore undesirable that the filament of the first tube should be turned too low. This may help to stabilize the first tube, but it will help to create instability in the second tube. The grid of the second tube is connected through the gridleak R_4 to the positive terminal of the battery for the purpose of introducing damping into the circuit L_2 C_2, but this will cause the second tube to rectify, although this is no very serious disadvantage.

The last tube, of course, is intended to rectify, and the bottom of R_5 is connected to the positive side of the battery B_1. This will help to introduce damping into the circuit L_3 C_4.

All the coils should be spaced well apart with a view to eliminating any inductive coupling between the coils, and also to reduce the capacity coupling between the coils.

If there is instability when the circuit is connected up, self-oscillation may usually be prevented by having larger condensers across the tuned plate circuits and using smaller inductances. Another precaution is to make the resistances R_4 and R_5 of lower value than usual, the experiment first being tried with the resistance R_4, which may be reduced to about 200,000 ohms, or even 100,000 ohms.

USE OF PARALLEL DAMPING RESISTANCES

In Fig. 35 is shown a method which has been specially favored by myself in experiments in tuned plate coupling. It will be seen that there is a variable 100,000 ohm resistance across the grid circuit of the first tube, the plate circuit of the first tube, and the plate circuit of the second tube. These resistances should be capable of adjustment to infinity so that it can be seen which, if any, of the resistances are required to stabilize the circuit. It may be that only the resistance R_7 is required, in which case R_4 and R_8 may be adjusted to zero. It will, of course, be appreciated that a certain amount of feed-back effect is desirable in radio frequency amplification, provided it does not produce self-oscillation. A fine adjustment of the feed-back effect may be ob-

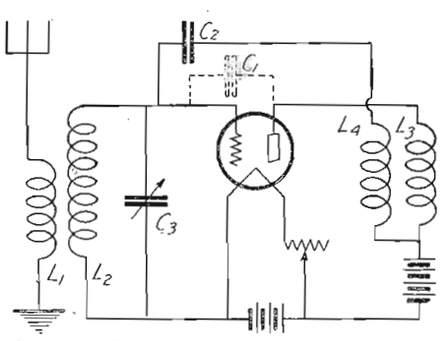


Fig. 32. The Neutrodyne arrangement suggested by Mr. A. D. Cowper.

tained with the Fig. 35 circuit by suitably adjusting the various resistances R_4 R_7 and R_8.

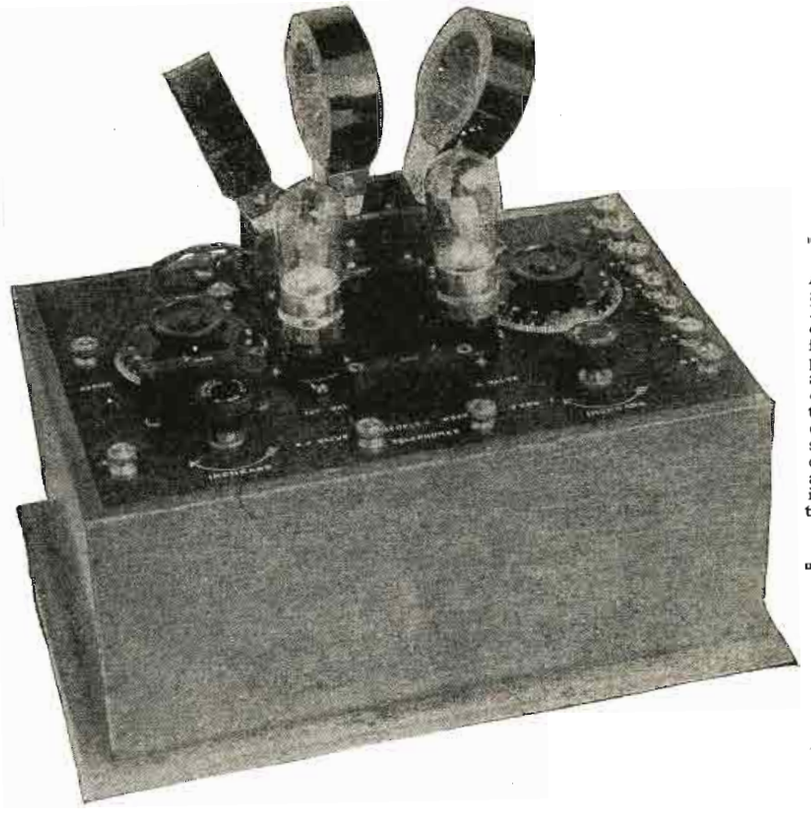
In Fig. 36 we have an example of the use of resistances R_6 and R_7, included in the tuned plate circuit for the purpose of introducing damping. These resistances are of the order of 30 to 50 ohms, but individual experiment is necessary to find what value is best suitable for stabilizing the circuit. This method of stabilizing tuned plate circuits is one which appeals to the writer as most likely to give general satisfaction, and

(*Continued on page* 1325)

The Resistoflex Circuit

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

A new and successful method of reflex amplification of considerable merit is disclosed in this article. Many of the disadvantages common to reflex circuits of the usual type have been eliminated.



A top view of a completed Resistoflex receiver made from English parts. There are four main controls, the two variable condenser knobs and dials and the adjusting knobs on the two honeycomb coils.

REFLEX circuits have undoubtedly captured the imagination of experimenters and constructors in spite of the fact that there are still certain factors which have prevented as consistent and efficient results being obtained as in the case of the ordinary straight circuit.

The reflex circuit is undoubtedly ideal, from many points of view, for the constructor who is limited to one or two tubes. The experimenter with three tubes is not so much concerned with the saving of the additional tube, for this is the one and only merit of a reflex circuit. On multi-tube sets I am very much in doubt whether the saving of an extra tube is worth bothering about, and the added complication is an important factor to be considered.

As Captain Round has pointed out, the really fundamental difficulty with regard to reflex circuits is the audio frequency buzzing due to the audio frequency currents modulating radio frequency oscillation, a peculiar chain of audio frequency reaction being set up. This, as has been pointed out in detail in these pages, is due to distortion in the reflex tube due to a defective characteristic of grid potential plate voltage and filament current. Irregularities in these respects will cause the audio frequency currents which are fed back into the grid circuit of the reflex tube to modulate oscillations set up, for example, by the reflex tube itself when using regeneration. This form of buzzing is merely one of the many which it is possible to obtain in a reflex set, and it is the most difficult to eliminate. A suitable adjustment of plate voltage, filament current, and grid bias will do a lot to prevent this form of buzzing, as also will the choice of a suitable tube. It is a good plan, in all reflex circuits, to try different tubes, if they are available, in the place of the one acting as the reflex amplifier.

Having investigated very closely all the different methods of eradicating the causes of buzzing, I came to the conclusion that the outstanding trouble was the fundamental one just described, and that the best way towards the solution of the problem was to cut out audio frequency resonating circuits in connection with the reflex tube. The cutting out of any audio frequency transformer or telephones should make a very great difference indeed to buzzing tendencies. Most forms of buzzing are due to audio frequency oscillations being set up, these being dependent, in pitch, upon the constants of the iron-core transformers used to feed-back the audio frequency currents. This may be tested out by connecting different sizes of condensers across the secondary of the transformer, a varying pitch of note usually being produced.

Several months ago a patent was filed for arrangements which overcame many of the disadvantages of reflex circuits. I desire to make it quite clear that cutting out the audio frequency transformer is not novel in itself. Mr. P. G. A. H. Voigt is prominently associated with the type of crystal reflex circuit in which the rectified currents from the crystal detector are used to charge a condenser in the grid circuit of the reflex tube without the intermediary of an iron core transformer.

In May of this year I appreciated the importance of trying to cut out audio frequency resonating circuits in connection with the reflex tube, and directed my attentions particularly to that biggest of all problems, the application of the reflex principle to a tube receiver using a detector tube. I do not suggest that it is impracticable to use a transformer in, say, a two-tube reflex circuit in which the second tube acts as a detector, but I do say that the difficulties are very much greater than in the case of a crystal reflex set. The impedance of the crystal has an undoubted influence on the stability of reflex circuits. The raising of the cat whisker on the S.T.-100 is usually accompanied by a violent howl, ample indication of the damping effect of a crystal detector. On the other hand, there is undoubtedly a demand for a reflex circuit not using a crystal detector, and during the last two years I have been trying to evolve an arrangement which could easily be built at home. Readers are, no doubt, aware that there are several sets on the market manufactured by commercial companies using the reflex principle with a detector tube, but many stabilizing devices are usually required to do this, and I very much doubt whether the arrangements are suitable for home construction.

An example of a circuit of this kind is the three-tube reflex, which has given remarkable results where the original specification was closely adhered to. Unfortunately, it appeared to suffer from the disadvantage that even small modifications may result in disappointing results.

The present circuit is the result of much experimental work in the direction of producing a reflex circuit using a tube as a

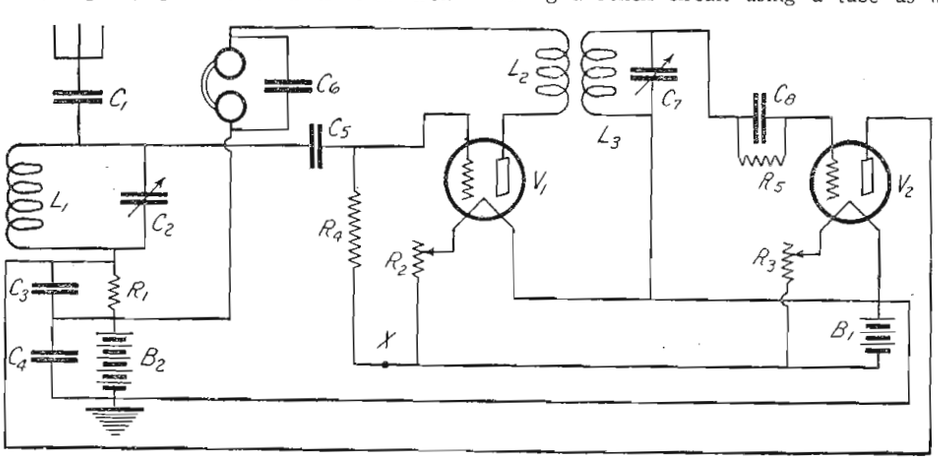
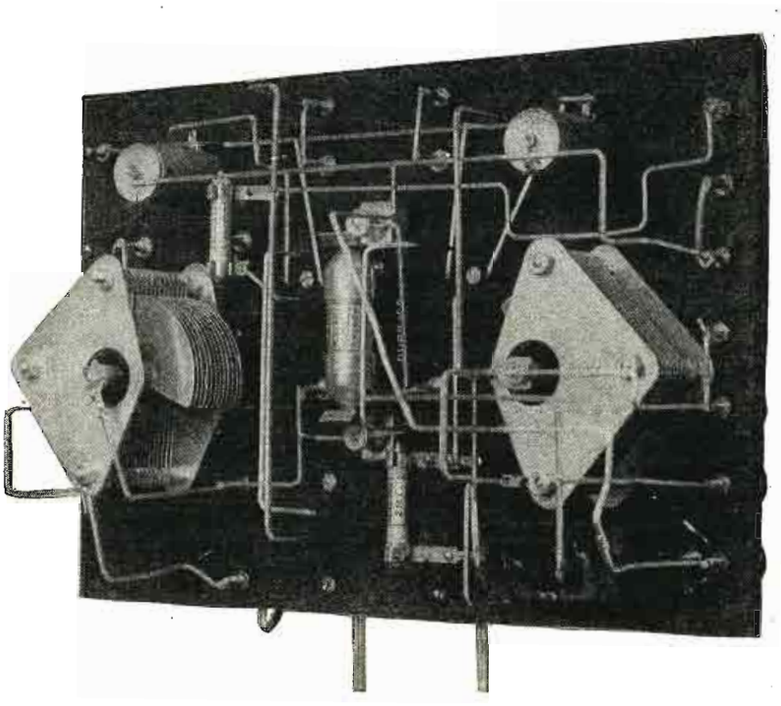


Fig. 1. A simple Resistoflex circuit. A "C" battery may be placed at point X to prevent rectification in the grid circuit of the first tube.

detector and eliminating an audio frequency resonant circuit. Although disapproving in principle to extending the radio vocabulary by unnecessary names for circuits, yet in certain cases it is extremely convenient for those of us connected with the press to evolve an easily remembered name which may be used in correspondence and articles as a convenient method of identifying a certain circuit or principle. The word "Resistoflex" has, for the sake of convenience, been given to the class of circuit about to be described.

The general principle is, like many other useful principles, simple, and consists in feeding back the audio frequency currents from the rectifying tube through a high resistance of the order of 50,000 ohms, the varying audio frequency potentials across this resistance being communicated to the grid of the radio frequency amplifying tube which will now become a reflexed tube. The high resistance is connected in the plate circuit of the detector tube and is also preferably connected in the aerial circuit.

A simple resistoflex is shown in Fig. 1. It will be seen that the first tube V_1 acts as a radio frequency amplifier, the aerial circuit containing the constant aerial tuning condenser C_1, the main oscillation circuit L_1C_2, a condenser C_3, another condenser C_4, and the earth. The battery B_2 and the resistance R_3, which has a value of from 20,000 to 100,000 ohms, do not form part of the aerial circuit proper. The radio frequency oscillations produced by incoming signals are communicated through the grid condenser C_5, to the grid of the tube V_1. The usual grid leak R_4 is used to prevent an accumulation of electrons on the grid of the tube V_1, and a grid bias battery may be included at the position X to prevent rectification in the grid circuit. The condenser C_5 and the leak R_4 have no connection whatever with the first tube acting as a rectifier. On the other hand, this tube should act purely as an amplifier. The condenser C_5 is simply for the purpose of insulating the grid of V_1 from the positive terminal of B_2, which is the "B" battery.



An interior view of the Resistoflex receiver showing the two variable condensers and the resistances. Note the manner in which the set is wired.

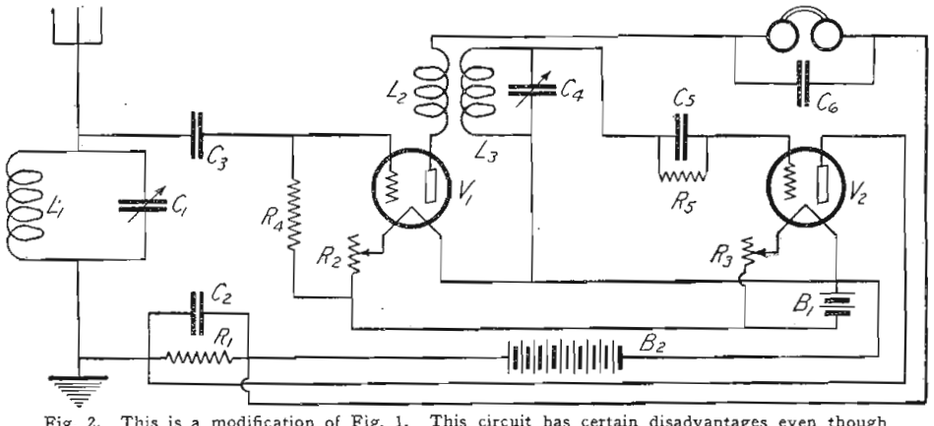


Fig. 2. This is a modification of Fig. 1. This circuit has certain disadvantages even though the antenna circuit is simpler.

The tube V_1 now acts as a radio frequency amplifier, the amplified oscillations passing through the primary L_2 of a radio frequency transformer L_2L_3. They pass through the by-pass condenser C_6 across the telephones and through the condenser C_4 which may have a capacity of 1 mfd. The amplified oscillations are passed from L_2 into the circuit L_3C_1 which is tuned to the incoming frequency. The second tube V_2 acts as a detector in the ordinary way, and the rectified audio frequency currents in the plate circuit pass through the high resistance R_1, through the "B" battery B_2 and so back to the filament of the second tube. In passing through R_1, audio frequency potential variations are produced across this resistance, and these are communicated to the grid of the first tube, through the inductance L_1 and through the condenser C_3, the resistance R_1 being not only in the plate circuit of the second tube, but also in the grid circuit of the first. The grid of V_1 will have its normal potential varied at audio frequency by the rectified currents, and these are now amplified by V_1, which is now acting in its reflex capacity. The audio frequency currents pass through L_2 and so through the telephones, around the battery B_2 back to the filament of V_1. In doing so they actuate the telephones or the loud speaker.

We therefore have here a stage of radio frequency amplification, rectifying action by the second tube, and a stage of resistance audio frequency amplification.

Great purity of reception is obtained, and one of the causes of buzzing is eliminated. On the other hand, we do not completely eliminate the presence of an audio frequency resonant circuit, because the telephones shunted by C_6 form such a circuit. When the three-tube development of Fig. 1 is used (described later), the audio frequency resonant circuit disappears altogether.

Fig. 3 is a modification of Fig. 1 in that the plate resistance is between the ground and the filament battery. This arrangement has certain disadvantages. The aerial circuit, of course, becomes simpler. The disadvantages are the same as those existing when a transformer secondary is connected in the position of the plate resistance. Full reasons for this were given in a recent issue of RADIO NEWS in the article on "Reflex Receivers in Theory and Practice."

Fig. 4 is a circuit similar to Fig. 1 with regeneration from the plate circuit of the second tube applied to the grid circuit of the first. It will be seen that the regeneration coil L_4 is included in the plate circuit of the second tube, and that by suitably coupling L_4 to L_1 a regeneration effect will be obtained in the aerial, and also into the tuned inter-tube radio frequency circuit. Separate tappings off the "B" battery are shown, and a grid bias battery might be included in the position X in such a position as to make the grid of the first tube negative.

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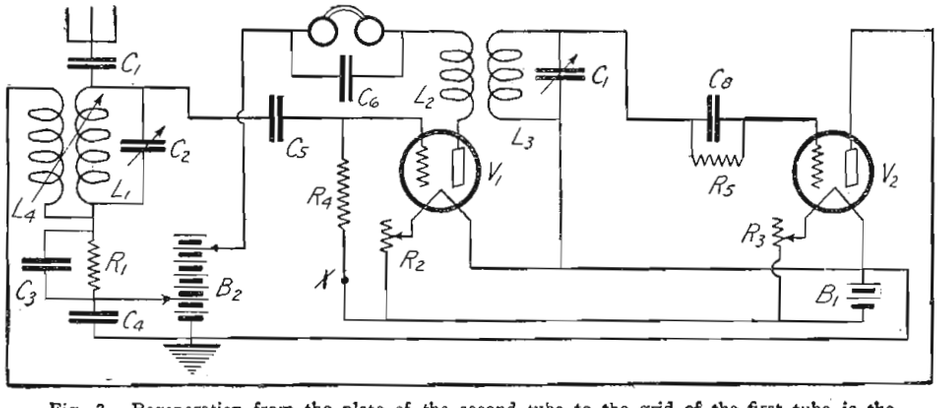


Fig. 3. Regeneration from the plate of the second tube to the grid of the first tube is the feature of this circuit.

Analyzing High Frequency Resistance of Single-Layer Coils

By SYLVAN HARRIS, Consulting Engineer

It is with pleasure that we publish this comprehensive article by Mr. Harris, dealing with single layer coils and coils approaching them in characteristics, such as the present low loss type. We believe that this treatise will fill a long felt want.

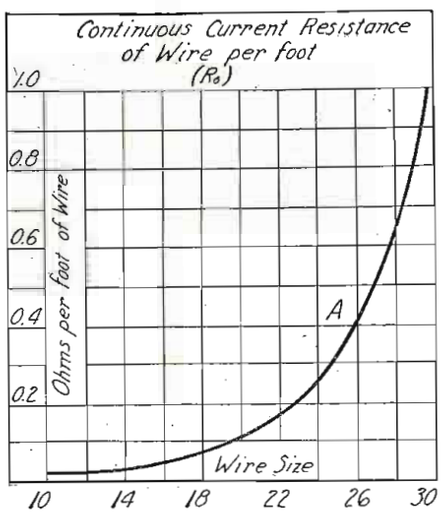


Fig. 1.

THERE are a great many variable factors entering into the resistance of coils, and although much has been written about them, it is not probable that many of the radio fans have a clear idea of the subject. This state of affairs is true, not only of the fans, but of many designers of radio apparatus.

We have reached the "Low-loss" era in radio. It has almost become a fad, a craze, to use low loss apparatus in the receivers and transmitters. It is a good fad, one that is productive of good results, for when we consider the very minute quantity of electrical energy that comes into the receivers from the ether, the necessity of being very economical with it is obvious.

ANALYZE RESULTS

It is interesting to note that although there has been much speculation about ways and means of reducing losses, when we consider the matter carefully, it is apparent that there has not actually been a great deal accomplished. This has been probably due to the fact that many designers have looked at the thing from the viewpoint of the theoretical physicist or teacher. As an example, we may remember that when we were studying physics we were always impressed with the fact that no matter what

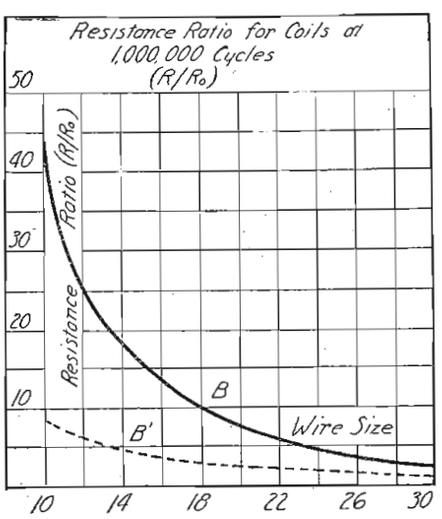


Fig. 1-A.

readings our instruments give, we should mark these down and take them as the results of our experiment. This practice is good, but it is necessary to go several steps further.

The next step is to learn the engineering point of view; that is, *not* to take things as we *apparently* see them in the results of our work, but to *analyze* the results in such a way as to prove of benefit to us. The engineering point of view gives to each thing its proper value. It attempts to deal with the more serious things first, assuming, of course, that they are known to exist. Much has been done in the way of reducing the distributed capacities of coils. Distributed capacity, however, is only a negligible item in single-layer coils, and in all coils is small compared with the skin-effect in the wires. Dielectric losses in coils are also serious, and great advances are being made in reducing them. Little has been done, however, in attempting to reduce the actual resistance of the wire in the turns of the coil. Many of the coils (single-layer as well as multi-layer) on the market are made with

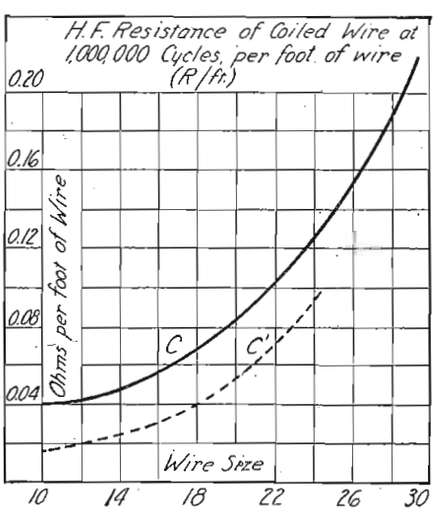


Fig. 1-B.

exceedingly fine wire, with the result that the resistances of these may run as high as 60 or 80 ohms. This is a serious matter when it is considered that power losses are proportional to the resistance in the circuit.

As a means of illustrating the point the writer has spent the last couple of months computing the curves shown in this article. It is acknowledged that it is impossible to calculate, with any degree of precision, the high frequency resistance of coils. The writer maintains, however, that although great inaccuracy results from attempting to apply the available formulae, the various tendencies contributing to the resistance of coils may be easily studied from them. To tell the truth, the agreement between the conclusions drawn from this study and actual experimental evidence is surprisingly good, not as regards actual values of resistance, but as to the best wire size to use, the best diameter, etc. These will be pointed out as we proceed.

The factors contributing the high frequency resistance of coils are as follows:

(1) The D.C. resistance of the wire (ohms per foot of wire). (Ro)
(2) The skin effect in the coil. (R/Ro)

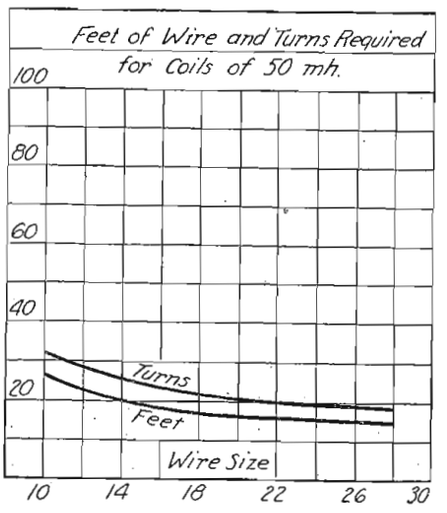


Fig. 2.

(3) The distributed capacity of the coil. Ra/R)
(4) Losses due to dielectric effects in insulation and in the forms supporting the coil.
(5) Losses due to eddy currents set up in objects in proximity with the coil.

There may be other causes of coil resistance, but these are the most important. The nature of skin effect is generally understood; how the presence of the magnetic lines of force inside a wire carrying high frequency current causes the current to travel at the "skin" of the wire; how this asymmetrical distribution of the current causes the wire to act as if its resistance were raised to many times its ordinary value for direct currents; as to how this effect is spoken of in terms of the ratio of the high frequency resistance to the direct current resistance, and so on. The effect is further accentuated in coils, for the presence of a strong magnetic field within the coils themselves causes the current in the wire to not only travel on the surface of the wire, but to also limit the amount of "skin" used to that portion on the outside of the coil. The skin effect, therefore, in coils, is many times that in straight wires.

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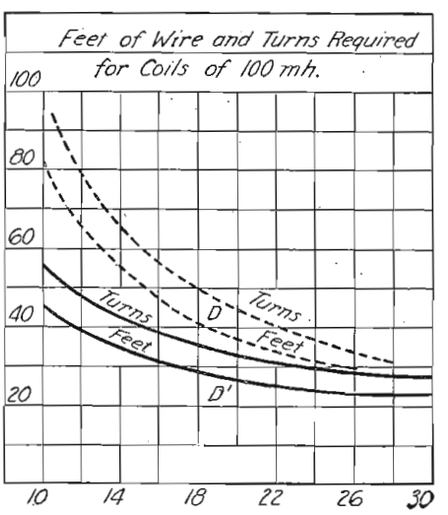


Fig. 2-A.

Modern Radio Storage Batteries

By JAMES M. SKINNER*

A treatise on storage "A" and "B" batteries; their care, maintenance and operation. An article full of valuable information for the set owner.

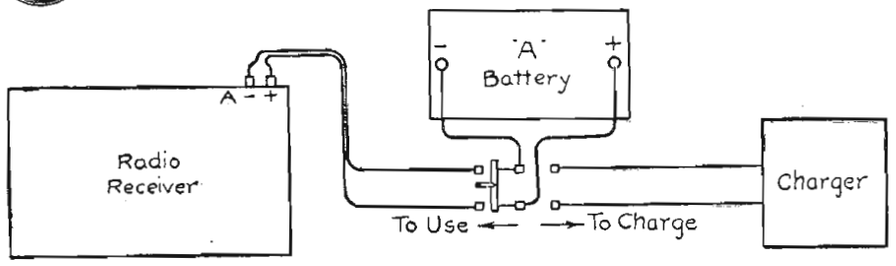


Fig. 3. By the use of the D.P.D.T. switch this "A" battery can be placed either on charge or connected to the set.

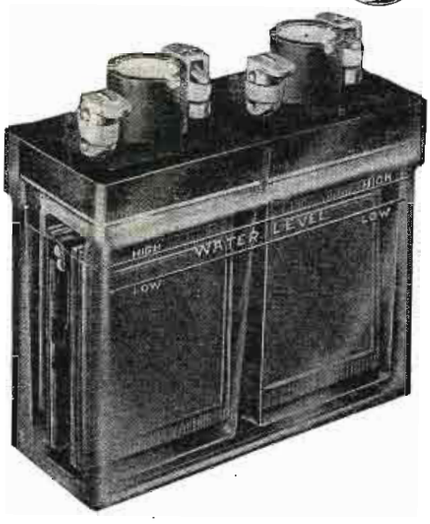


Fig. 2. Glass container dry cell replacement "A" battery with visible charge indicator in end.

BECAUSE of the relatively low current demand, radio storage battery operation is inherently rather simple. An automobile battery must often deliver current up to 300 or 400 amperes for starting. Naturally it must be charged at comparatively high current rates (10 to 15 amperes).

Even large radio receivers rarely consume over two amperes, and the popular five tube radio frequency set usually consumes only 1¼ amperes. Radio charging rates are therefore low (1 to 5 amperes).

It is fairly difficult and also unnecessary to prevent the escape of a small amount of spray through the vent caps of an automobile battery charging at 10 to 15 amperes. It is fairly easy and very necessary to eliminate all spray in radio batteries charged in the living room. Radio "A" storage batteries of good design, Glass container "dry cell replacement" storage batteries, which are often used inside radio cabinets, may be kept perfectly clean and dry on the outside by charging at ½ ampere. (See Fig. 2.)

With modern well-built radio batteries, the spilling of acid should never occur. However, if such an emergency should arise, the remedy is simple. The acid should be neutralized by the free addition of ordinary houschold ammonia (baking or washing soda will serve if ammonia is not at hand), followed by washing up with warm water.

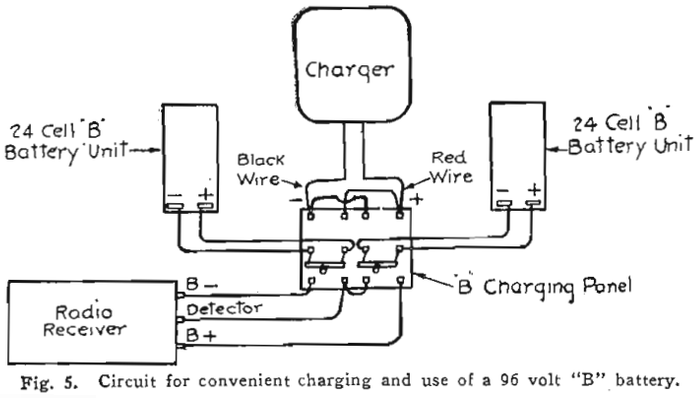


Fig. 5. Circuit for convenient charging and use of a 96 volt "B" battery.

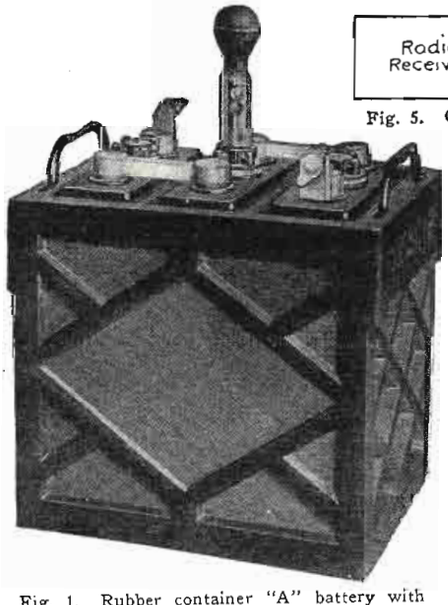


Fig. 1. Rubber container "A" battery with permanent filler cap charge tester.

may be kept dry for living room operation by the very simple precaution of selecting the proper size of charger for each size of battery:

30 to 60 ampere hour battery not over 1 ampere charger.

90 to 120 ampere hour battery not over 2 ampere charger.

150 to 180 ampere hour battery not over 5 ampere charger.

Most radio fans buy larger and, therefore, more expensive "A" storage batteries than they need. A large size is needed where the battery must be disconnected from the set and taken to a service station for recharging, but where current for recharging is available in the home, a rather small battery will give the same excellent reception and is cheaper. Beside being less bulky and more easy to move from one place to another it requires less time for charging which is a feature that every fan should bear in mind.

BATTERY CHARGING CONNECTIONS

A five tube set (UV-201A tubes) requires 1¼ amperes. Using it three hours a night consumes less than four ampere hours. A 30-ampere hour battery will operate the set for a week, and a 60-ampere hour battery for two weeks. Recharging presents no problem. Connect the battery, the receiver and the charger together once for all by means of a double-pole throw-over switch or by means of the plugs and sockets with which some chargers are equipped. (See Figs. 3 and 4.) Thereafter the operation of recharging consists merely of throwing over the switch or of shifting the battery plug from the receiver receptacle to the charger receptacle. It is unnecessary to disconnect any wires and after once wiring up, you can forget all about positive and negative. With charging as easy as this, the fact that a small battery requires more frequent recharging is unimportant compared to its saving in cost and space.

"B" BATTERY CHARGING

"B" battery charging can be made as simple as "A" battery charging. Practically all

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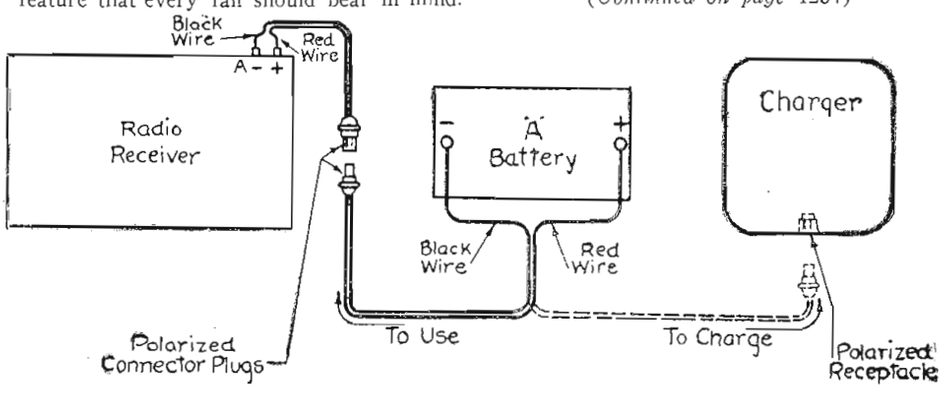


Fig. 4. Permanent "A" battery charging equipment with plugs and receptacles. The "A" battery can be connected to the receiver or to the charger at will.

*Vice-President, Philadelphia Storage Battery Co.

Reflex Radio Receivers in Theory and Practice

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

Part III.

This is the third article of an important series dealing exhaustively with reflex amplification in all its forms. A number of excellent single tube reflex circuits are presented.

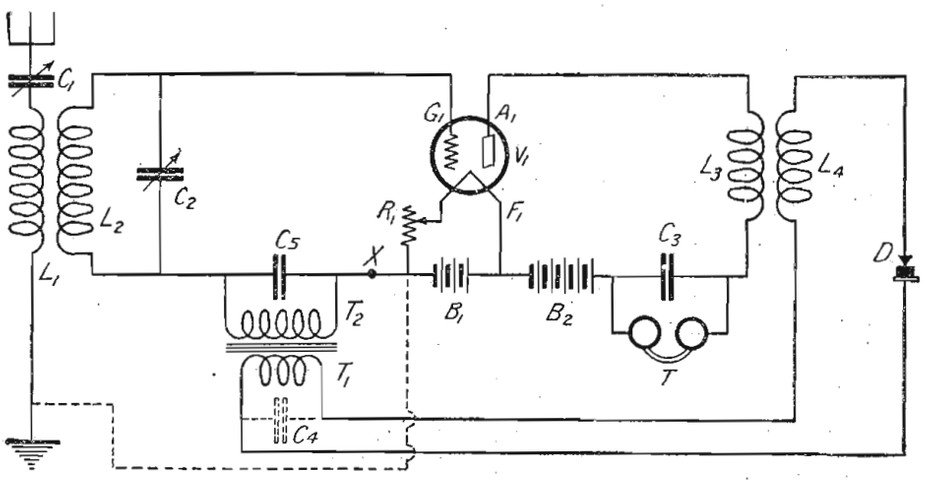


Fig. 10. A simple single tube reflex amplifier employing a crystal detector for rectification.

FIG. 10 shows a simple single-tube dual amplification circuit. This circuit has been chosen because of its simple nature. A loose coupled circuit is employed for introducing the high frequency oscillations from the aerial to the grid circuit of the tube V_1. A variable inductance L_1 is shown in series with a variable condenser C_1, while L_2 is loosely coupled to L_1 and is also shunted by a variable condenser C_2. Both the aerial and closed circuits are, of course, tuned to the incoming wavelength. The high frequency oscillations are applied to the grid and filament of the tube, the connection to the filament being made through the condenser C_5, which has a value of, say, .001 mfd. In the plate circuit of the tube we have the inductance L_3, and the telephones T and the high voltage battery B_2. The inductance L_3 of the primary of a fixed transformer L_3 L_4 is designed to suit the wave-length to be received. The telephones T are shunted by the fixed condenser C_3 of, say, .002 mfd. capacity for the purpose of by-passing the high frequency currents from the plate circuit. Across the secondary L_4 are connected the crystal detector D and the primary T_1 of the step-up transformer T_1 T_2, which is of a type generally known as step-up intertube transformers. The primary T_1 may be shunted by a condenser C, of .002 mfd. capacity, and this is often done when a crystal detector is being used. The secondary T_4 is connected in the grid circuit of the tube V_1, the condenser C_5 acting as a short circuit of T_2 insofar as high frequency currents are concerned.

HIGH FREQUENCY POTENTIALS

The high frequency potentials communicated to the grid G_1 of a tube V_1 are amplified by the tube, the amplified currents passing through L_3 and being passed on by inductive coupling to L_4; the oscillations in L_4 are detected by the crystal detector D and pulses pass through the primary T_1 of the step-up transformer T_1 T_2. Currents of an alternating nature are produced in the secondary T_2, and as the right-hand side of T_2 is connected to the filament, and the left-hand side is connected through the inductance L_2 to the grid, the low frequency currents are applied to the grid. The low frequency potentials applied to the grid now cause large low frequency variations in the plate current of the tube, and these pass through the telephones T and operate them. As L_3 L_4 is an air core transformer and the coupling, as regards audio frequency currents, is extremely weak, no audio frequency currents will be passed into the detector circuit. It is also hardly necessary to point out that the radio frequency currents passing in the plate circuit of the tube will in no way affect the telephones T, which will only respond to the amplified audio frequency currents produced after rectification.

There are several points of design which have been observed even in the simple circuit of Fig. 10. It may be useful to point these out. In the first place, it will be noticed that the filament rheostat R_1 is connected in the negative lead to the filament—*i.e.*, the rheostat is connected between the negative terminal of the battery and one side of the filament. The effect of this is that when the rheostat is in circuit the current through the filament and through the rheostat will produce a drop of potential across the latter which may amount to one volt. The effect of this is that the negative terminal of the filament battery B_1 is at minus one volt potential with respect to the negative end of the filament F_1. It will be noticed that the right-hand side of T_2 is connected to the negative terminal of B_1. The result is that the grid G_1 is given a normal operating potential of about minus one volt. This is highly desirable, because the tube acts purely as an amplifier in the Fig. 10 circuit; it amplifies both high and low frequency currents, but in both cases it is highly desirable to avoid the establishment of grid current due to the grid becoming positive with respect to the negative end of the filament. By keeping the grid at a negative potential, grid currents will only be set up when the signals are very strong. By this little device distortion due to damping of the positive half-cycles of current, and consequent rectification, are avoided. If a larger negative potential is required, a small "grid battery" is connected at the point X in the circuit so that some such operating point as B in Fig. 8 is in use.

It will also be noticed that the high voltage battery, B_2, and the telephones, T, are connected together at what may be termed the bottom of the plate circuit of a tube. The high voltage battery B_2 has its negative terminal connected to the positive terminal of a filament battery. By doing this we get the additional voltage of the battery B_1 communicated to the plate A_1 of the tube, whereas if we had connected the negative terminal of the high voltage battery to the negative terminal of the filament battery we should have lost this extra voltage. Some definite convention is highly desirable, and the practice of connecting the negative terminal of the high voltage battery to the positive terminal of the filament battery is one always to be recommended, except perhaps in very special cases which need not be discussed here.

POSITION OF HIGH VOLTAGE BATTERY

The question of whether the high voltage battery should be in the position shown, or should change places with the telephones T, is a doubtful point in a single tube circuit.

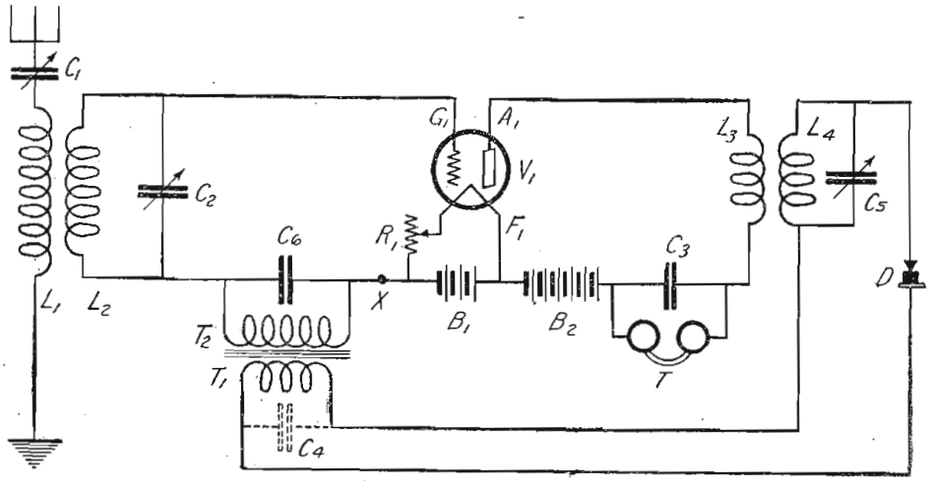


Fig. 11. A loose coupled reflex circuit with a tuned radio frequency transformer.

When two or more tubes are used the high voltage battery should be connected next to the filament battery, but when a single tube is used there are arguments which may be advanced in favor of the idea of having the telephones next to the filament battery. The most cogent argument is that when the high voltage battery is next to the filament battery, as shown in Fig. 10, if there is any leakage between the telephones T and the operator wearing the telephones, a shock may be received. This is not likely to happen in the case of Fig 10 because the battery B_1 is ordinarily insulated unless definitely grounded. If, however, an actual connection were taken from the negative terminal of B_1 to the ground, as shown by the dotted line in Fig. 10, the argument might apply. In any case, the author does not consider that this is an important point, because telephone receivers are generally well insulated and the chance of shock, or of injury to the telephones, is very small.

SPECIAL GROUND CONNECTION

It may be pointed out here that a connection between the negative of the battery and the ground, as shown by a dotted line in Fig. 10, is generally desirable in the case of a loose-coupled circuit of this kind and helps towards stability.

It might be asked, "Why should not the telephones T be connected next to the plate of the tube?" Here we have an example of the principle that no piece of apparatus which is likely to have a capacity to ground or a leakage to ground should be connected near a point at high frequency potential to ground. This question of capacity to ground is a very important one, and it might be as well to explain the meaning of the term. Anything which is connected by a short wire to the ground is considered as being at ground potential. If a large condenser is connected in between the ground and the object, the latter, to all intents and purposes, may be said to be at ground potential. Even a medium-sized condenser inserted in the lead between the ground and the object will not alter the fact that the object is substantially at ground potential when high frequency currents are flowing through the leads to the ground. When, however, low frequency currents are involved, a medium sized condenser would not have the equivalent effect of an ordinary wire connection. If the condenser in the lead is of relatively small capacity, say .0005 mfd., high frequency currents flowing through this condenser will set up potentials across it and the object previously mentioned will certainly not be at ground potential.

EFFECT OF THE BODY

Now there are many objects of substantial size in a wireless receiving station, and the principal object is the operator himself. He is, to a certain extent, a conductor, and since he stands on the floor he acts as one plate of a condenser, the earth acting as the other plate. The human body, therefore, has a capacity to ground. If, then, we were to touch the aerial terminal of the receiver, it would be equivalent to connecting a large condenser across aerial and ground. Incidentally, it would also be more or less equivalent to connecting a leak across aerial and ground, because the operator is not usually perfectly insulated from the ground. The "capacity to ground" effect of the human body is particularly noticeable when the hand is placed near a condenser or other part of a sensitively adjusted receiver working on short wave-lengths. The higher the frequency of the currents in a wireless receiver, the more susceptible will they be to interference by the capacity effect of the human body. In the case of low frequency currents the capacity of the human body is not sufficiently great to interfere quite as much with these currents. The result is that on an ordinary receiver we can touch either of the telephone terminals of the receiver without making a difference to the signals received. In the case of badly designed reflex circuits, or reflex circuits in which one or other of the telephone terminals is in such a position that by touching it one is altering the high frequency conditions in the circuit, the signal strength may be greatly varied and perhaps low frequency oscillations or buzzing produced. If, however, the low frequency circuit is quite separate and unconnected, as regards mutual effects, to the high frequency circuits, touching either terminal will not make much difference. This should be the case in the Fig. 10 circuit.

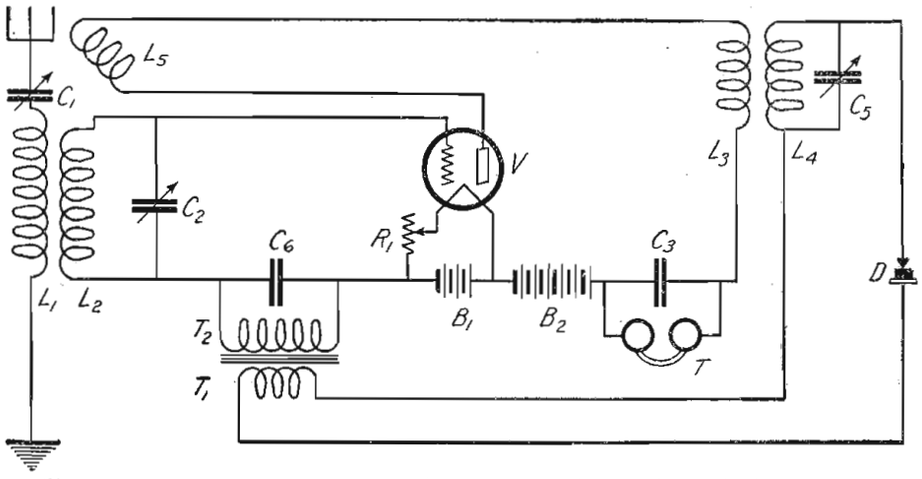


Fig. 12. A single tube reflex circuit similar to that of Fig. 11, but with the addition of regeneration.

The Experimenter

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Be sure to reserve a copy from your newsdealer before the issue is sold out.

THE EXPERIMENTER will be on sale at all newsstands December 20, 1924.

If, however, we had the telephones T connected next to the plate of a tube, the circuit would continue to operate, yet the results might easily not be so good, the reason being that a substantial capacity and a possible source of leakage is connected across the inductance L_3.

CAPACITIES TO GROUND

Any large body, such as a filament battery or high voltage battery, or even telephone receivers, have a capacity to ground. This capacity is the condenser effect between the battery, say, and the ground lead, and between the battery and the walls of a room and the floor, etc. Small objects, such as connecting wires, grid condensers, and similar objects, have no appreciable capacity to ground, and any undesirable effect which might arise with a larger object is absent when the object is small. In the case of the high voltage battery and filament battery, these have a substantial capacity to ground, and the telephones also, especially when worn on the head, have a capacity to ground. A little thought will show that the effect of connecting the telephones T next to the plate in Fig. 10 would be equivalent to a condenser being connected across L_3. Quite apart from the capacity of the different components to ground, they have a very important self-capacity effect towards each other, so that even if there were no capacity to ground it would still be undesirable to connect the telephones T next to the plate. For example, when standing near the receiver, the human body and high voltage and filament batteries would form a condenser, and since the telephones are being worn on the head, there is a condenser effect between the telephones and the human body. Here again we should have a capacity effect across the inductance L_3. Even if the telephones were lying on the table, they and their leads would form a condenser with the batteries. Not only is there a capacity effect in these cases, but there is usually a certain amount of leakage. This may easily happen when telephones are being used, but it is far less likely when a loud speaker is being employed. For this reason, and also because a loud speaker has no very large capacity to ground when kept away from the batteries, it is far less injurious to have a loud speaker connected next to the plate of the tube in the circuit of the Fig. 10 type than telephone receivers. This point must be borne in mind, as, indeed, must all the points dealt with here, because it is sometimes necessary to connect the telephones or loud speaker in a position which is not the most satisfactory from the point of view of general principles. Special cases may necessitate the inclusion of telephones or loud speaker next to the plate of a tube and in between the plate and an inductance carrying high frequency currents. The dangers which are likely to arise by doing this should be noted.

AN ADDITIONAL POINT

An additional point which should be borne in mind is that when telephones are used, the capacity they have in respect to ground and other pieces of apparatus is continually varying owing to different adjustments of the telephones on the head and to the fact that the operator is not absolutely stationary, and his hands are being used to make various alterations in tuning, etc. While a capacity effect of this nature is bad, a varying capacity effect is very much worse, particularly when receiving on short wavelengths and when the apparatus is adjusted in a very sensitive manner to a weak signal,

(*Continued on page* 1192)

Awards of the $50 Radio Wrinkle Contest

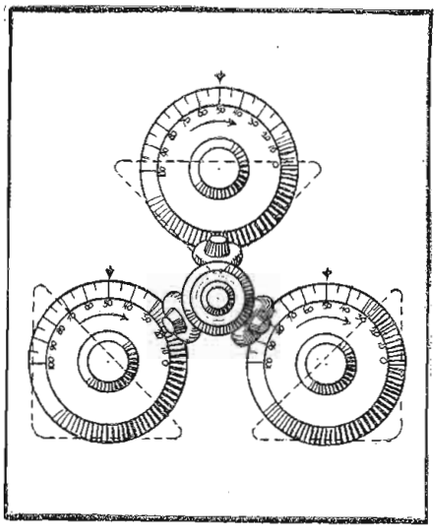
First Prize

UNI-CONTROL FOR TUNED RADIO FREQUENCY SETS

By ROBERT VAN BUSKIRK

The problem of operating three dials at once on the Neutrodyne and various other tuned radio frequency sets can be easily overcome by arranging the three tuning condensers in a triangular position on the panel, as shown in Fig. 1, and by placing the three brackets with soft rubber vernier rollers attached and central operating knob exactly in the center.

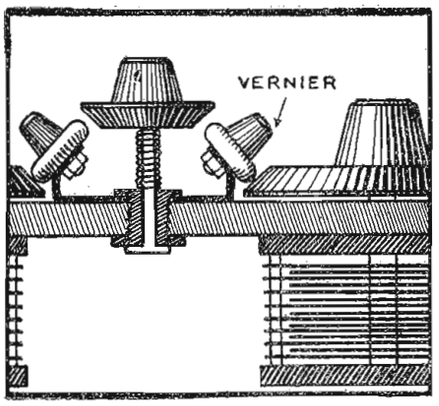
By grasping the center knob and pushing in, it will operate all three condensers simultaneously and in the same direction. For final adjustment the center knob is released and each condenser is tuned separately with the vernier knobs.



An ingenious idea for the control of a tuned radio frequency or Neutrodyne set. The three condenser knobs and dials are clustered in the manner shown and worked upon by separate verniers. By turning the center knob all three condensers are manipulated.

Below is shown a cross section view of the Uni-Control. The central operating knob is mounted on a shaft having a collar soldered on the inside, and should be free to slide in and out of the panel bushing. The spring tends to keep the knob free from the verniers for separate adjustment of the condensers.

The air-core transformers do not have to be mounted on the condensers, but can be placed in a straight line at the customary six inch spacing and at the customary angle of approximately sixty degrees.



By pressing down on the central knob it is brought in contact with the three verniers. Turning the central knob rotates the vernier and consequently moves the condenser dials.

Prize Winners

First Prize $25

UNI-CONTROL FOR TUNED RADIO FREQUENCY SETS

By ROBERT VAN BUSKIRK,
3687 Field Ave.,
Detroit, Mich.

Second Prize $15

A COMPACT DUST-PROOF CRYSTAL DETECTOR

By PHILIPPE A. JUDD,
1525 Tenth Street,
Portsmouth, Ohio.

Third Prize $10

SELF SUPPORTING LOW-LOSS COILS

By HARRY VAN DER STAAL
120 Liberty Street,
New York City.

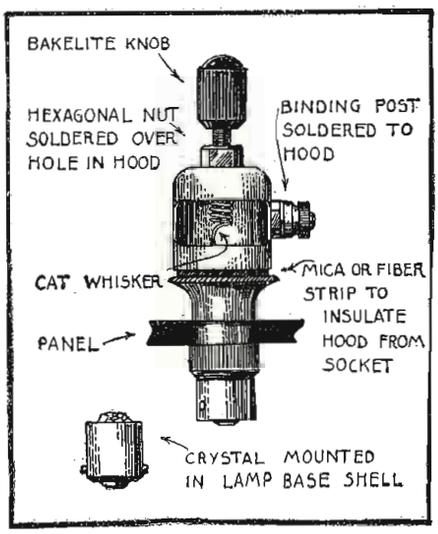
Second Prize

A COMPACT, DUST-PROOF CRYSTAL DETECTOR

By PHILIPPE A. JUDD

A hooded dashboard lamp of the type shown in the illustration may readily be converted into a crystal detector stand of compact proportions requiring only one ⅝-inch hole for mounting. It takes up very little space on the panel and its highly nickeled finish harmonizes well with the other fittings.

The hood is insulated from the socket proper by means of a thin strip of mica, ¼ inch wide, and long enough to encircle the socket flange over which the hood fits. A ¼-inch hole is drilled in the center of the hood. A 6/32, hexagonal, brass nut is centered and soldered over the hole to accommodate the threaded shank of the adjusting knob, which is provided with a coiled catwhisker of phosphor bronze wire at its free end. The small binding post, shown soldered to the side of the hood, serves as one terminal of the detector, while the other lead may be fastened to any part of the socket.



An excellent dust proof crystal detector made from the parts of a cowl lamp.

Crystals to be used are mounted in the shells of old lamp bases, as shown. These are taken from burned-out lamps and thoroughly cleaned, after which the crystals are inserted and the remaining space filled with Wood's metal or some similar alloy. Thus the crystals may be changed as quickly and easily as are vacuum tubes.

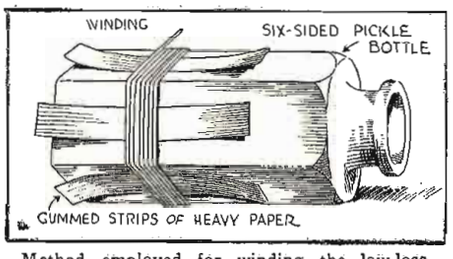
Third Prize

SELF SUPPORTING LOW-LOSS COILS

By HARRY VAN DER STAAL

Besides the spider-web and basket-weave low-loss coils, there has come into wide use the type illustrated herewith. For want of a better name, and because they are wound on pickle bottles, they have been named "Pickle Bottle Coils."

Not only does this coil possess all of the desirable features of the low loss coils, but they are a little easier to wind. Secure a bottle that has six or eight sides, as shown in the drawing. Secure strips of gummed paper, and run them with the gummed side up along each side.



Method employed for winding the low-loss coil. The coil is secured by the gummed tape.

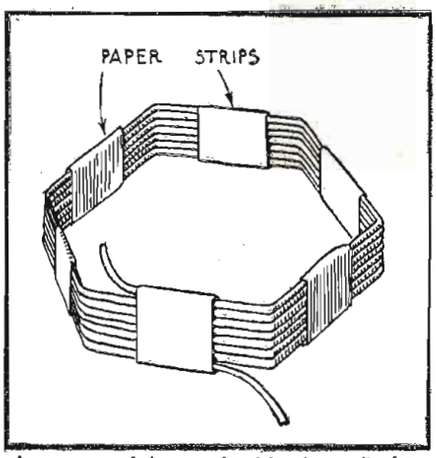
Then start the winding. Number 20 wire will do. When the required number of turns have been wound, bend over the gummed strips, and secure them solidly. Then remove the whole coil from the bottle, by sliding it off. If you have wound the wire too tightly, it may be necessary for you to break the bottle. This can be done without danger with a small hammer.

The finished coil will be found to be self-supporting, easily mountable, and to possess minimum losses.

ROTOR CONNECTION FOR VARIO-COUPLER

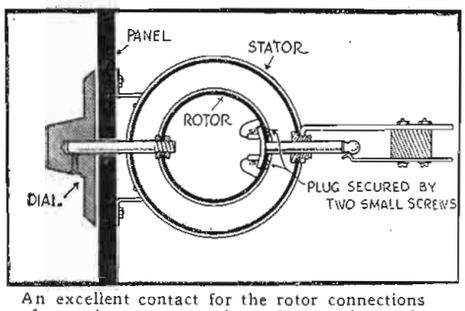
In the construction of the rotor connection illustrated in the accompanying diagram, the parts needed are to be found in most any fan's junk box. All that is needed is a telephone plug and single circuit jack.

Two holes are drilled diametrically opposite in the tube carrying the rotor winding. The phone plug may be inserted in one and a brass rod, ¼ of an inch in diameter, secured by two nuts in the other. The



Appearance of the completed low-loss coil after having been taken off the bottle and secured by wrapping the strips of tape around it.

wires from the two ends of the rotor winding are secured in the binding posts of the phone plug, just as phone tips would be. The single circuit jack is placed on a suitable hole in the tube carrying the primary or stator winding. Connections may be soldered to the lugs of the jack in the usual manner and the result is a connection to the rotor, which is quiet and which furnishes a solid bearing. This arrangement allows the rotor to be turned as many times as desired without the necessity of stops to prevent the pulling loose of flexible leads. The jack also maintains an even tension counteracting any unbalanced condition of the rotor, which makes for accurate tuning.



An excellent contact for the rotor connections of a variometer or variocoupler can be made from a plug and jack as shown.

The same scheme will find its application in many places, where variable leads will cause awkwardness. With the cheapness of present day apparatus, it solves a troublesome difficulty inexpensively.

—Contributed by Malcolm F. Jameson.

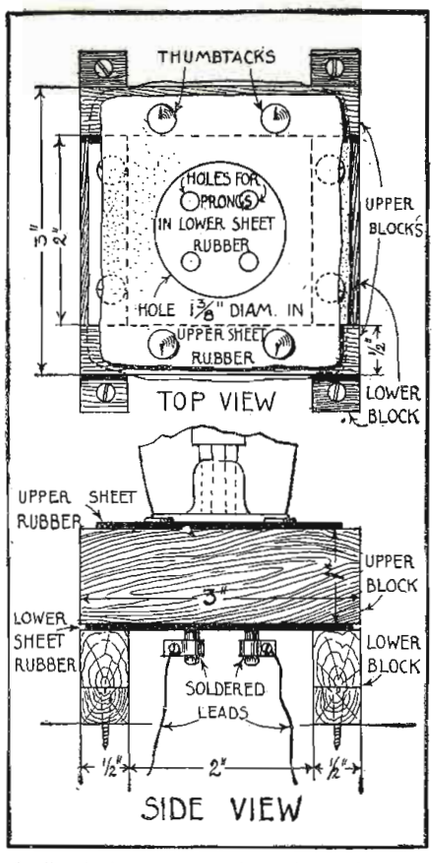
AN EFFICIENT, CHEAP SOCKET

Although a reader of RADIO NEWS and other radio periodicals for almost two years, I have not come across a simple explanation as to how to make a socket that is really shock-absorbing, has not loose contacts and most of all is cheap and easily constructed by the ordinary radio fan. Most sockets, supposed to be free from shocks, lose their ability to absorb them when they are connected to the rest of the set by stiff wires.

To remedy these defects, I constructed the following from parts easily obtainable. This socket being of rubber, compares favorably with bought ones in almost all respects. The average socket has about 12 loose, unsoldered contacts or connections which are reduced to eight soldered ones in this socket.

Two blocks of wood 3½ x 1 x ½ inch are placed parallel, 2 inches apart. A piece of sheet rubber 3 x 3 inches is mounted on these blocks with thumb tacks. The rubber sheet is taken from a discarded automobile inner tube and provided with four holes to contain the four prongs of the tube to be used. On top of this are fastened two other blocks 3 x 1 x ½ inch, as shown. Another sheet of rubber the same size, with a hole 1⅜ inches in diameter at its center, is nailed with enough thumb tacks to hold the sheet securely. In case a WD-11 tube is used, the hole should be 1¼ inches in diameter instead of 1⅜ inches.

Flexible wires of sufficient length are soldered to the prongs of the tube and serve as leads to the rest of the set. The tube is then inserted into the socket and all the leads soldered to their respective places, being careful to clean the joints after soldering. The socket can then be screwed on the baseboard.

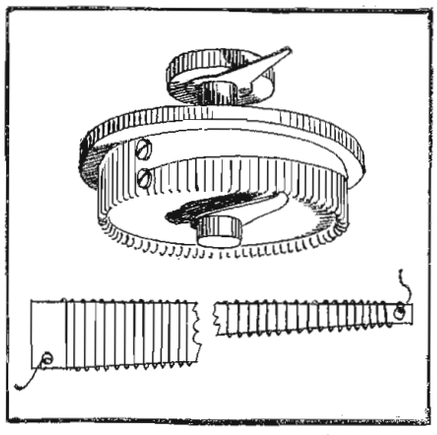


A vibrationless vacuum tube socket made from spare parts. To avoid losses, the connections are soldered directly to the tube prongs.

—Contributed by Poblo Unson.

A VERNIER RHEOSTAT FROM A STANDARD INSTRUMENTS

It seems rather far fetched to claim that a vernier rheostat can be made from a standard rheostat. Not only is this true,



A standard rheostat can be made into a vernier rheostat in the manner shown.

but it can be accomplished by using all of the components in such a rheostat, and without any additions whatever.

A regular 6-ohm rheostat is secured, and the resistance unit, usually supported upon a fibre form, is removed, and the resistance wire unwound. This wire should be carefully preserved. The fibre form is cut, as shown in the illustration. The wire is wound again on the form. A small hole drilled in the fibre will provide an anchoring place for the beginning and ending of this winding. Then, the resistance unit is replaced, the part cut off being used to stabilize the new winding.

A vernier effect will be obtained with this rheostat toward the thin end of the resistance unit, because each turn of the resistance wire introduces a smaller change in current drop than on the high end.

As it will not require all of the wire originally wound on the fibre form, the resistance of this new rheostat may be less than the original. The extra wire may be wound on a form, and connected externally, so as to still have the required ohmage. The operation of this vernier rheostat is no different than that of a standard type.

—Contributed by Harvey Longstone.

Esperanto and Ido

By JAMES DENSON SAYERS

IN considering any matter of a controversial nature, if the proponents of the different angles of the discussion descend from an academic or impersonal presentation of the question and intrude the dragon, acrimony, upon the scene, or resort to inuendo, to personalities and insinuations, the real merits of the subject are apt to become lost in the fog insofar as the audience is concerned. There is scarcely any question before the world today that deserves more careful, impersonal, unprejudiced presentation to the public than that of an international language. But to clear up the very palpable and unjust inaccuracies and ambiguous insinuations strewn through the article, "Esperanto or Ilo—Which?" published in the October issue of RADIO NEWS in the Editor's laudable effort to be fair, I must, to some extent, descend to a similar vein in order that those influenced by that article may know the truth and not withhold themselves from learning Esperanto, especially since the latter is so universally accepted by such organizations as the A. R. R. L.

I need only touch briefly upon the feature of the article, the coinparison of the Ido translation of my radio talk with the original Esperanto. The Idists sooner or later will learn that such comparison brings their plagiarism no credit with real students and linguists, for the reason that such comparisons bring out the greater strength of Esperanto in its pronunciation. The distorted sense of euphony in the auricular orifices of the three men who strained and brought forth the mongrel infant, Ido, led them to eliminate the sounds that make for greater strength and audibility in Esperanto. Such action resulted in making Ido much more difficult to understand when spoken than Esperanto, as innumerable students, including myself, have proven. Quite frequently people ask, when hearing Esperanto spoken in public, if it is Italian. Recognizing musical euphony of the language and having learned that Italian is the most musical of known languages, they naturally assume that it is Italian they hear. The Idists like to search out tongue twisters in Esperanto composed of many words in sequence containing the elements "sh" and "zh," giving such as a "fair" (?) example of the euphony of the language. Where is the native to English who would not resent a statement by a hater of English that "she sells sea shells by the sea shore," or "long slim slick pine sapling," are fair samples of English euphony? I will leave the decision with the reader as to the morality of such methods. A little further on I wish to point to the use of such method by the writer of the above mentioned article.

AN ACCUSATION

What could be more unjustly insinuating in its studied ambiguity than the fourth

(*Continued on page* 1274)

Radiotics

BY AUTHORITY OF THE POST OFFICE DEPARTMENT



Evidently Lee has done it again. Witness, *Springfield Sunday Republican,* Sept. 28, "Priority of DeForest Patents Settled,—Has new features. Uses audion as regenerator of UNSTAMPED oscillations." Will someone inform us whether or not these new oscillations should be turned over to the post office department for cancellation, provided we capture any?

Contributed by Grant W. Crotto.

CHEAP AT HALF THE PRICE



We learn from the program of Radio Station WEAF in the *Bridgeport Evening Post* of Oct. 10, something fetching in the way of novelties. Program reads: "9:00-10:00 Dance Orchestra. Flat; all improvements. Rent $18. Inquire." There you are! If you have the eighteen bucks they broadcast. If you're as flat as they, they will stay off the air. "All improvements" probably means the orchestra is self starting and motor driven.

Contributed by Louis R. Atwater.

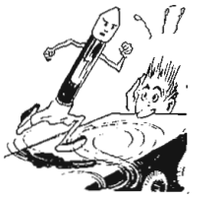
VERY MUCH ATTACHED TO HER RADIO



Hark to this. In the question and answer department of the *Boston Globe,* Oct. 20, Mrs. E. of Boston, informs the readers of said paper that "My antenna is about 150 feet in length AND I AM GROUNDED TO THE WATER PIPE." Furthermore, she says, "I have never been troubled with interference until recently. Now it is very bad. How can this trouble be remedied?" We would suggest that she ground her husband to the water pipe and go to the corner movie.

Contributed by Everet Coffin.

OUT FOR THE MORNING CONSTITUTIONAL



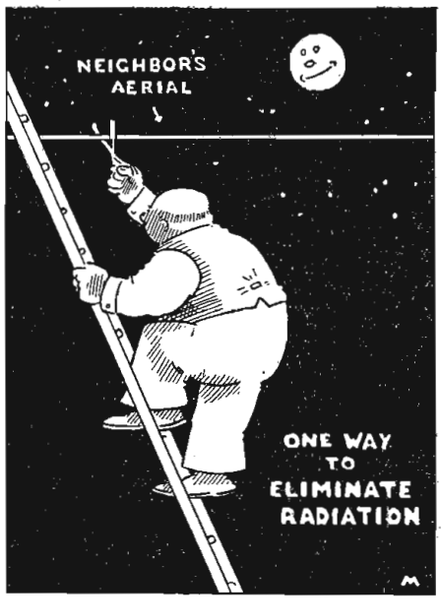
In an article on a radio frequency receiver in the October, 1924, issue of *The Wireless Age* mention is made of cutting grid leaks short and says to boot: "It is exceedingly more efficient than running your highly important GRID LEAKS all over the set, before they reach their destination." Now in our time we have seen a lot of flexible grid leaks, but this one that stretches all over the place is a new one. Maybe this boy was using a garter snake for his leak.

Contributed by W. H. Sellars.

SUN'S EFFECT, NO DOUBT



In the radio section of the *Philadelphia Inquirer* of Oct. 5, was the following Hot Dawg add: "A five-bulb Neutrodyne, FADED PARTS, cost $225. Will sell $125." All of which proves that owners of five-tube Neutrodynes should put shades on the tubes,



or the parts will fade away with the effect of the lamps.

Contributed by Harry L. Cardon.

If you happen to see any humorous misprints in the press, we will be glad to have you clip them out and send to us. No RADIOTIC will be accepted unless the printed original giving the name of the newspaper or magazine is submitted. We will pay $2.00 for each RADIOTIC accepted and printed here. A few humorous lines from each correspondent should accompany each RADIOTIC. The most humorous ones will be printed. Address all RADIOTICS to

Editor RADIOTIC DEPARTMENT,
c/o Radio News

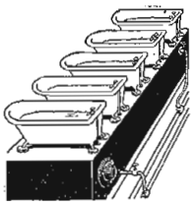
ANOTHER FAIRY TALE



This from a radio story in the *Argosy All Story Weekly* for Sept. 20, 1924, and it's a hot one. We quote: "Snatching the RADIO TUBES FROM HIS EARS, he swayed unsteadily to his feet," and if that doesn't sound as though he pushed his head into the radio set we'll reflex the phones. But no—further on the author states that "With fumbling fingers the old man thrust THE TUBES BACK IN HIS EARS," all of which goes to prove that the old sock was stark mad. On second thought maybe he was a prestidigitator.

Contributed by Milton L. Baker.

FOR THE RADIO BATH ROOM



New ideas in Radio are constantly being introduced. Nattans, in the *Baltimore News,* Oct. 10, advertise "Magnavox FIVE TUB tuned R. F. set operated by one dial only." The tubs are connected in series parallel with the water system and grounded through the tile floor, mounted on red rubber sponges, consume 12 quarts each per washing-hour, and the loud speaker is connected to the hot water line. Truly a set for the large family.

Contributed by Milton Shaffer.

SOME OF GOMPERS' WORK



Hooray or curses—as your opinion may be—it is announced in the Oct. 11 issue of the *Telegram and Evening Mail* (New York) that the Ever-ready Radio Company of Brooklyn has put out a new tuning unit called the Ever-ready TUNING UNION. There will be fear in the hearts of many tonight lest the walking delegate will stop all tuning unless the operator has a union card. Laugh and be merry, for tomorrow we unionize!

Contributed by Albert Greenbaum.

THE CANDID ADVERTISER



The Radio Shack hits another home run! In their ad in *Radio Digest* for Sept. 6, they offer for sale a radio kit concerning which they make the following statement: "You can take these parts and make up a set that is good for distance and WONDERFUL FOR INTERFERENCE." From the way the air sounds nowadays the Radio Shack stock should be almost as valuable as Ford or Anaconda. Interference?—Nothin' else but.

Contributed by Edgar A. Patts.

PREPARE THE SKILLETS



In the radio section of the *Evening World* (New York) for Oct. 4, we find the announcement: "To broadcast gold fish." We hope they do this on Friday. It is also stated: "Though it is not generally known, fish, and particularly gold fish, are most susceptible to music. They can even be made to repeat minor chords, if trained at any early age. To this end I am devoting my time and study so that a more familiar relationship may be fostered between the public and the little understood gold fish."

Contributed by David Lader.

RADIO'S COOK BOOK



Here is a hot ad from the classified section of the Nov., 1923, issue of *Popular Science Monthly.* "Tested Radio Receipts. One Skinderviken transmitter button mixed with radio set gives amplification and loud speaking. The K Electric Co., N. Y." Use wooden bowl, tin spoon, pour slowly, mix rapidly, allow to harden, remove from bowl with chisel, grab result and hurl it out the window.

Contributed by Trygve Norhougen.

ST. PETER'S SET



Thorola has a theological staff. They state in their ad, November issue of RADIO NEWS: "In using the Thorola Loud Speaker, no ETERNAL battery is needed." Our idea of Heaven is a place where no batteries at all are needed. This is the first real step to the higher plane. Now let someone design a perpetual vacuum tube.

Contributed by William A. Zander.

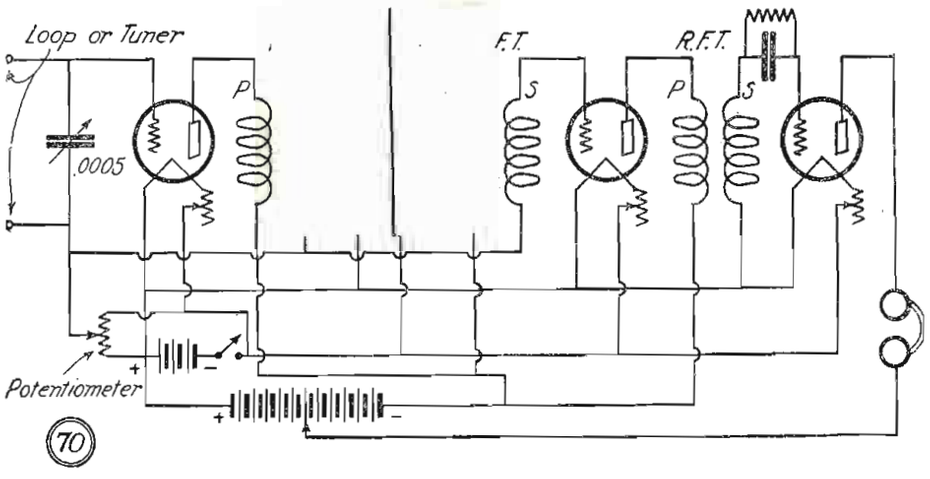
STANDARD HOOK-UPS

EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c to pay for mailing charges.

RADIO NEWS has also prepared a handsome heavy cardboard binder into which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

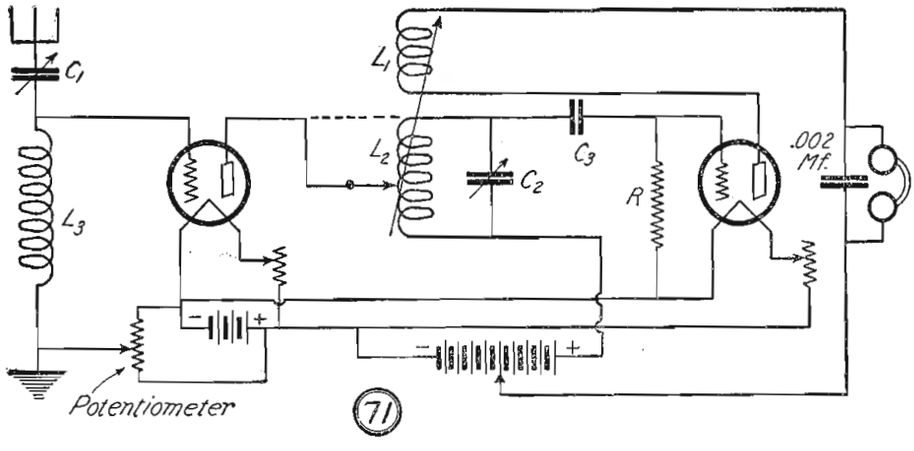
Handy Reference Data for the Experimenter

Circuit No. 70. A long distance receiver employing three stages of radio frequency amplification is shown in diagram No. 70. This type of circuit may be used with a loop with excellent results, but if desired, a tuner may be employed with an antenna and ground. A variable condenser of .0005 mfd. capacity is employed for tuning and may be used to tune a standard coupler or a loop. A potentiometer of 400 ohms is connected across the "A" battery leads to control the oscillations of the tubes. Where a potentiometer is used, a filament switch should always be employed so that this part of the circuit is always disconnected when the receiver is not in use. It will be noticed that the grid returns of all the radio frequency tubes are connected to the movable arm of the potentiometer, but the grid return of the detector tube goes directly to the positive of the "A" battery. In a receiver of this kind, the radio frequency tubes should, if possible, be selected so that they will all have the same oscillation point. If these tubes oscillate at different points they will not be operating at maximum efficiency. A "B" battery voltage of about 90 volts is recommended for the amplifiers. The detector voltage will naturally be at its best working point.



A DX receiver employing three stages of untuned radio frequency amplification.

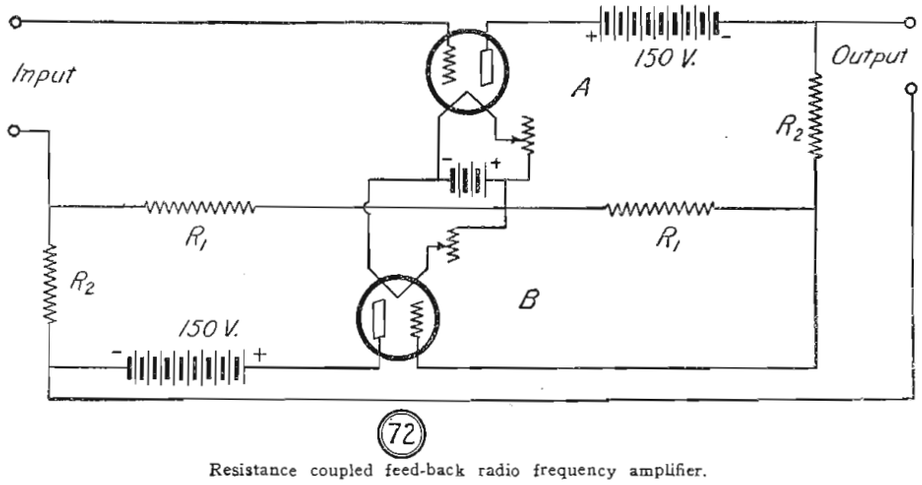
CIRCUIT NO. 71. The above diagram shows a simple single circuit regenerative receiver, having a stage of tuned impedance coupled radio frequency amplification. A variable condenser, C_1 of .001 mfd. capacity, and a honeycomb coil, L_3, having 35, 50, or 75 turns, form the antenna tuning circuit. Coils L_1 and L_2 may be those of a variocoupler, across the primary of which is shunted a variable condenser, having a capacity of .0005 mfd. L_1 acts as a tickler coil, and supplies regeneration in the detector circuit. A potentiometer is required to supply the proper grid bias to the radio frequency tube, and should have a resistance of between 200 and 400 ohms. Two 35-turn honeycomb coils may be used instead of the variocoupler, in which case the lead from the plate of the first tube is connected as indicated by the dotted line in the diagram. The grid leak R of 1 megohm is connected between the grid and the negative filament binding post of the detector tube. A precaution to be observed is, if honeycomb coils are used, to have the coil in the antenna circuit at right angles and separated as far as possible from L_1 and L_2.



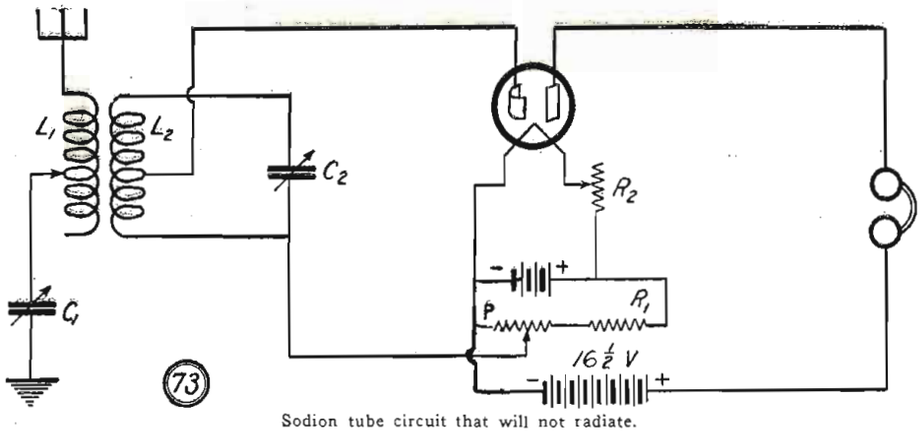
Single circuit regenerative receiver with one stage tuner R.F. amplification.

CIRCUIT NO. 72. This circuit is a radio frequency feed-back amplifying unit that uses two tubes and is resistance coupled. Resistances R_1 are 10,000 ohms and R_2 are 50,000 ohms. The terminals marked "input" are connected to the tuning unit and those marked "output" go directly to the detector tube. The output from the tube A is fed into the tube B, which in turn is fed into tube A again through the tuner. As this action is continuous, the resulting input to the detector tube is larger than with the usual type of resistance coupled amplifier.

It is best to use either the UV-201A type tube with this radio frequency amplifier, or the Western Electric "E" tubes, as with these it is possible to use high plate voltages. It is necessary to have separate "B" batteries having a voltage between 100 and 150 volts, as the voltage drop across the resistances is very high. The resistances R_1 and R_2 may be of the Lavite type. This unit may be more expensive to maintain than the ordinary type.



Resistance coupled feed-back radio frequency amplifier.

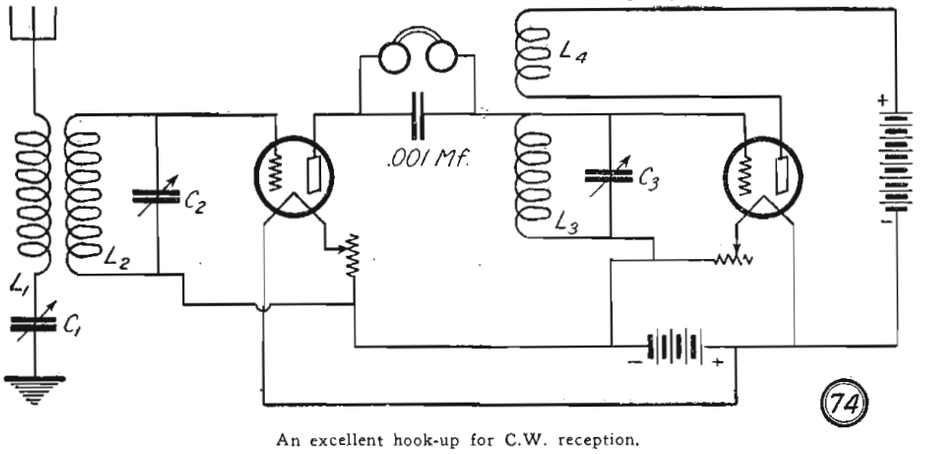


Sodion tube circuit that will not radiate.

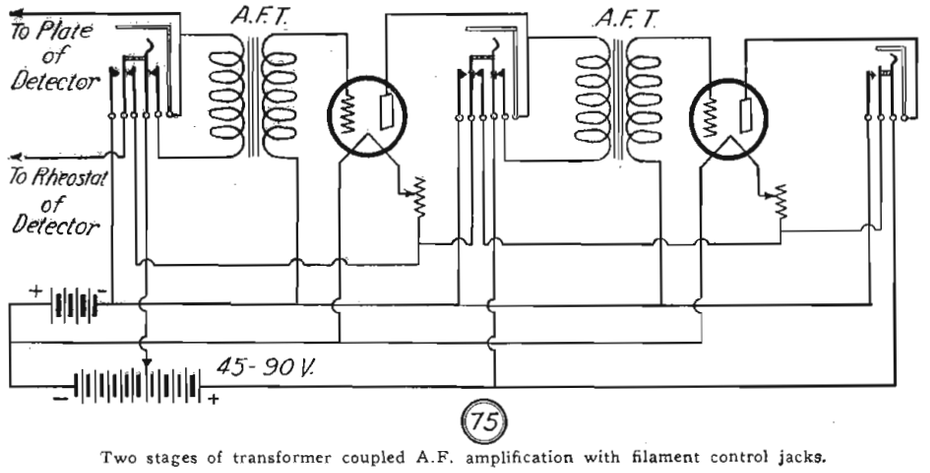
CIRCUIT NO. 73. This circuit has as its detector the Sodion tube introduced last winter by Mr. H. P. Donle. The condenser C_1 of .001 mfd. capacity, is in series with the primary of the variocoupler, L_1. The secondary of the coupler, L_2, is tapped about 10 turns from the bottom and connected to the collector terminal of the tube. L_2 is shunted by the variable condenser, C_2, of .0005 mfd. capacity. P is a 200-ohm potentiometer and the resistance, R_1, has a value of 100 ohms. The rheostat, R_2, used with the tube, is of 30 ohms. The Sodion tube can be used only as a detector and is an excellent one to use in crowded city sections, as it will not oscillate and, therefore, the set can not radiate and create interference. The tube has many advantages over the crystal detector and the diode tube and avoids some of the disadvantages of these devices for detection. This circuit with the two-stage audio frequency amplifier (diagram No. 75) will give excellent results.

CIRCUIT NO. 75. In this circuit are shown two stages of audio frequency amplification, having filament control jacks. The use of these jacks will mean in the long run a saving to the builder, as only the filaments of the tube that are being used are lit. This amplifying unit can be built as an integral part of a set, or can be built in a separate cabinet for the experimenter's work bench. If built as a separate unit, binding posts are used to connect it with the tuner. Four binding posts are needed for the "A" and "B" battery terminals and two for the input. A precaution to be observed is to place the transformers at right angles to each other to reduce, as far as possible, any losses that may occur.

CIRCUIT NO. 76. In this diagram is shown the Superdyne receiver, with two



An excellent hook-up for C.W. reception.

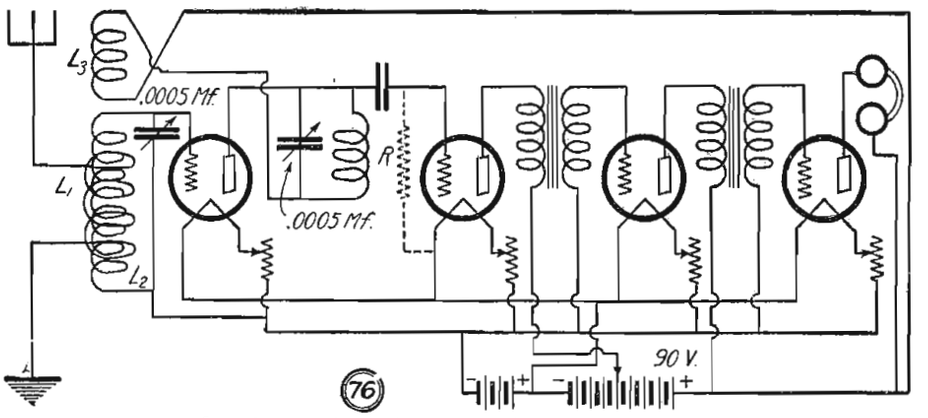


Two stages of transformer coupled A.F. amplification with filament control jacks.

CIRCUIT NO. 74. This circuit is an excellent one for the reception of C.W. signals. The four inductances shown are honeycomb coils, their size depending on the wave-length band to be covered. The variable condensers C_1 and C_2 have a capacity of .0005 mfd. and C_3 is .001 mfd. The plate voltage on the oscillator tube is not critical and may be 45 volts. The first tube, called the modulator, is connected across the oscillating circuit of the oscillator tube. The space between the filament and the plate acts as a resistance, the value of which is varied by the incoming signals impressed upon the grid. No "B" battery is necessary for the modulator tube, as its plate is supplied by high frequency current from the oscillating circuit.

This circuit may also be employed for the reception of broadcast programs by the use of the proper size inductances. Coils L_1 and L_2 may be a variocoupler and inductances L_3 and L_4 may be 50 and 25 turn duo-lateral coils respectively. This rather unique circuit should prove of great interest to the experimenters, because heretofore it has not been used very extensively.

stages of audio frequency amplification. L_1 is four turns of No. 22 D.S.C. wire wound directly over the 42 turns of L_2. These windings are on a tube four inches in diameter. L_3 is 36 turns of the same wire on a rotor, which is 3⅝ inches in diameter. This rotor is inserted half way into one end of the four inch tube and is arranged with bearings for rotation. The plate inductance coil is 45 turns of the same wire, wound on a four-inch tube. The variable condensers, which should be of the vernier type, have a capacity of .0005 mfd. When constructing the set, it is important that the plate coil be at right angles to the coupler to prevent any inductive effects. This set will give excellent results also with a short indoor antenna connected to the grid side of L_2, the negative side of the "A" battery being grounded. This eliminates L_1, which is used for an outdoor antenna. A grid leak is sometimes necessary, depending upon the type of detector tube used and is placed in the position shown by the dotted resistance R. The negative feed-back, which is controlled by L_3 prevents the set from oscillating and in this way enormous amplification is obtained.



Superdyne receiver using the negative feed-back principle.

Correspondence from Readers

WHAT THE RURALS LIKE

Editor, RADIO NEWS:

I have just returned from a trip through the following states: Maine, Massachusetts, Connecticut, New York, Pennsylvania, Ohio, New Jersey, Maryland, West Virginia and Indiana. I have interviewed several hundred owners of receiving sets, both urban and rural, as to kind of programs liked best and what was the most pleasing on such programs; also, what they did not like. For brevity's sake, will make the results in short paragraphs:

The greatest favorite of all was Hawaiian music, because it seems to come in perfectly.

The next was band music, especially when the band played in the open. The following stations were the most favored in this line: KDKA, WLW, WOC, KFI, WTAY and WCAP. WOS and WCBD were also praised.

The high grade music from the orchestras at WEAF, KDKA and WEBH was given much praise.

Organ music was generally liked, though not always.

Baritone solos and choruses, as well as mixed voices were generally commended.

The barn dances by WLS were liked very well, although their orchestra music was criticized and was not liked.

As all farmers go to bed early, all lectures to farmers were not heard. Once in a while someone would hear one and his criticism was likely to be: "The gol darn fool don't know what he is talking about."

Travel talks are fairly well liked.

Could get no comment regarding church services.

The two things most condemned were soprano solos and technical lectures. The first would nearly always cause a listener to tune it out.

Political speeches were never listened to, but when the President talked, he was always listened to. The Democratic Convention was listened to with great interest everywhere.

Jazz music was almost universally condemned. Old songs were the favorites, although some of the new ones were also liked.

By far the greatest majority of listeners were past 21 years of age. Usually very intelligent people.

News over the radio is always gladly listened to, no matter where from.

While most of the receiving sets were small, the owners were quite familiar with all matters concerning radio.

Many farmers with one-tube sets reported hearing Pacific coast stations last winter.

The piano playing of Harry Snodgrass at WOS was frequently praised.

ELWOOD WASHINGTON,
294 Towle St.,
Hammond, Ind.

COMMENTS FROM SCOTLAND

Editor, RADIO NEWS:

Having read Mr. F. M. Howe's letter in your September issue, I must say a few words in defense of British radio products, and of the British broadcast stations.

I should be the last to defend the standard of public demonstrations over here. It is very seldom that you can go into a store and hear a decent demonstration, a state of affairs which one of our English magazines has commented upon more than once. But Mr. Howe should not take a store demonstration as his basis for comment. I venture to assert that practically all the sets in this country containing two or more tubes, one stage being radio frequency, are capable of receiving all British stations. The statements in the Harmsworth Wireless Encyclopedia are obviously absurd, unless they refer to receivers in which regeneration has been completely eliminated.

It may also interest Mr. Howe to know that I receive the Bournmouth station reguarly, some 430 miles distant, on a loud speaker, with a three tube set, detector and one stage each of R.F. and A.F. I do not claim anything special for this; it is only ordinary reception.

With regard to apparatus, we do see American goods over here, and, if Mr. Howe is prepared to accept the Western Electric headphone as typical of American style and quality, I'll say that the Brown phone has it beaten all along the line. Not only is signal strength better with Brown's, but, in my opinion, they are much more comfortable to wear.

Mr. Howe refers to our .06 ampere tubes and to others which sell at 21 shillings. Among the others at 21 shillings he will find the Dextraudion, with a current consumption of one-tenth of a watt (1 volt, .1 ampere), which is, I believe, the lowest in the world.

40 Non-Technical Radio Articles

every month for the beginner, the layman and those who like radio from the non-technical side.

SCIENCE & INVENTION, which can be bought at any newsstand, contains the largest and most interesting section of radio articles of any non-radio magazine in existence.

Plenty of "How To Make It" radio articles and plenty of simplified hook-ups for the layman and experimenter. The radio section of SCIENCE & INVENTION is so good that many RADIO NEWS readers buy it solely for this feature.

List of Radio Articles Appearing in the January Issue of "Science and Invention"

A Special Eleven Tube Super-Heterodyne
Remarkable Six Tube Receiver
By Grandon Lyons
A New Distortionless Amplifier
A Miniature Crystal Set
By W. J. Rittall
Nauen Radio Station
Tuned Intermediate Transformers for Super-Heterodynes
Radio Signals Race Around the Earth
By Leon Adelman
Latest Radio News in Photos
Radio Oracle—Questions and Answers
Radio Wrinkles
Gimbel Bros. New Broadcast Station

The D. F. A. at 30 to 35 shillings are special purpose tubes, capable of handling large speech currents.

The well known Mullard and Osram tubes sell at 12 shillings and 6 pence (say, $3 normal exchange rate). Yet we have quite a number of tubes selling at 10 shillings, which at the present rate of exchange is about $2, so that Mr. Bayes was more or less correct.

In conclusion, I should like to know how Mr. Howe is able to tell that radio apparatus is of inferior quality simply by reading the advertisements. If he would share the information, it would save many of us from being badly bitten.

J. J. KENNEDY,
7 Comphill Road,
Braughty Ferry,
Scotland.

RE CORRESPONDENCE RELATING TO 5XZ

Editor, RADIO NEWS:

I have followed closely the correspondence under the above heading, and feel inclined to add a few words thereto, with your kind permission.

From the tone of 5XZ's letter in the June issue, one surmises two facts, namely: That he is peeved with Americans and also that he has never been to the States, as every one of his statements are erroneous, with the exception of that relative to the Autoplex, Albright and Colpitt's circuits, which, as far as my knowledge goes, I will grant, is right.

As an operator of some standing, and with over three years' experience with American broadcasting, I quite agree with Mr. Mayer when he says Mr. Bayes is "talking through his hat."

As regards "mediocre" programs, let Mr. Bayes pay a visit to America and listen to some of your broadcasting from WGY, WBZ, KDKA and a host of other stations, as apparently only his receiver gets, quoting 2LZ's letter, "harmonics from the high power stations and the 'boiler repairers'."

I might inform Mr. Bayes that the power of the B. B. C. stations is 1½ k.w. output, and not 1 k.w. input as he states; also that this station would be received in America with the greatest of ease if its modulation were improved.

To his statement regarding prices, I am bound to answer quality for quality and price for price, the gain is all on the American side, as I have bought practically every radio component in both Great Britain and the United States.

Referring to Mr. Howe's letter, I might state that I have received 2LO at Algiers (a distance, I believe, of over 200 miles) with every word and note quite clear, on a two tube set, one radio and one detector. The same night I also got Cardiff, Manchester and Newcastle, which were good for the distance, but not as good as 2LO.

The latest authentic information he quotes regarding ranges is published, I agree, but I am inclined to state that those ranges are very conservative, as I have often, with careful tuning, got treble the distance, but even then those ranges are not as high as the quoted American ranges.

I heartily agree with Mr. Howe in his reference to the receivers installed in British land stations, but would like to know what transmitter he refers to, as the "latest marine radio installation." If he refers to the 1½ k.w. quenched gap set, I might remind him that he has only seen one, and efficiency and ranges of sets cannot be judged from external appearances, but only by actual working, as some of our "Western Ocean" vessels will prove.

Yes, Mr. Bayes, take Mr. Howe's advice and study the American methods; I have done so, and it has helped me considerably.

WM. WOOD,
Box 279,
Halifax, N. S., Canada.

ELIMINATING DELCO ENGINE INTERFERENCE

Editor, RADIO NEWS:

Delco engine spark interference may be reduced almost to the vanishing point by properly grounding the small bulb protruding through the spring retaining cap on one end of the ignition coil.

Contributed by D. I. Cue.

CONCERNING A PRIZE WRINKLE

Editor, RADIO NEWS:

I have read in your October issue, on page 497, the article written by Jesse J. Hipple, entitled "A Real Loud Speaker for the Man Who Builds His Own," which I think may convey a wrong impression.

The instrument described by Mr. Hipple is known as the Davis Tone Amplifier and is the invention of John E. Davis, and patents are now pending.

Mr. Hipple bought one of these tone amplifiers some time ago, and it is from this he gets his description, although he overlooks the one most vital point, which he fails to mention. One gathers the impres-

(*Continued on page* 1202)



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, it will be returned to the manufacturers with suggestions for improvements. 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 be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

Apparatus Awarded Certificates

FIXED CRYSTAL DETECTOR

The Radio Craft, 1216 Polk Strect, at Sutter, San Francisco, Calif., submitted one of their fixed crystal detectors. This detector is small in size and is enclosed in a metal box. The cover may be re-



moved and the detector adjusted in case it becomes knocked out of adjustment. A very sensitive crystal is furnished with this detector. It may be used in reflex sets or in ordinary crystal receivers.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 570.

GOODRICH EAR CUSHIONS

The Goodrich radiophone ear cushions are of comparatively soft rubber shaped so as to fit over the average telephone receiver cap. The larger opening covers the entire ear of the person wearing the head set and exeludes all foreign noises. In addition to this, the wearing of a head set is made more comfortable. Those who are in the habit of wearing a head set for any length of time will find these ear cushions very convenient. Manufactured by the Goodrich Rubber Co., Akron, Ohio.

Arrived in excellent paeking.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 578.

STA-PUT JR. PLUG

The salient features of this plug are its small size and the method of making contact with the phone cord tips. No tools are required for connecting the plug; the tips are simply held in position by the spring eontaets and they cannot be pulled out



of place without unscrewing the insulating case. Manufactured by the Martin Copeland Co., Providence, Rhode Island.

Arrived in excellent paeking.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 594.

HAMMARLUND CONDENSERS

The new Hammarlund model C condensers embody both electrical and mechanical improvements over the older types. The metal end plates are ruggedly fixed together by four metal bars. The stationary set of plates is securely held and insulated by two short strips of hard rubber. The losses of the instruments are too low to be accurately measured on our capacity bridge at 1,600 cycles. The capacities of the various eondensers are as follows:

11—plate 12.72 to 235.24 MMF.
17—plate 16.16 to 373.62 MMF.
23—plate 18.20 to 511.36 MMF.
43—plate 25.86 to 962.20 MMF.



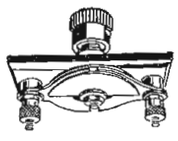
Manufactured by the Hammarlund Mfg. Co., 424 W. 33rd. St., New York.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 605, 606, 607 and 608.

NEUTRALIZING CONDENSER

The illustration shows a neutralizing condenser having very good electrical and mechaniea1 features. The rotor plate is eleetrostatically coupled to the two sets of stationary



plates. A capacity variation of 1.28 to 10 MMF is obtained. Manufactured by the Martin Copeland Co., Providence, Rhode Island.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 593.

MAR-CO WD-11 SOCKET

The Mar-Co WD-11 Socket consists of an insulating block with four nickel plated side contacts that



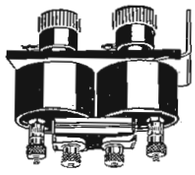
carry the binding posts for connections. A hole through the eenter serves for mounting purposes, only one screw being used. Although compact in size excellent contact to the vacuum tube terminals is obtained. Manufactured by the Martin Copeland Co., Providence, Rhode Island.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 591.

RESISTOR COUPLER

The No. 178 Resistor Coupler manufactured by the Martin Copeland Co., consists of the variable grid leak, a variable coupling resistance, and a .006 mfd. fixed condenser, connected and mounted so as to form a single unit. Its main use of course is for resistance coupled audio amplifiers. The variable grid leak has a range of 10,000 ohms to 3 megohms. The coupling resistance has a range of 7,000 to 125,000 ohms.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 595.

SWITCH PLUG

This instrument will be found useful when it is desired to operate either a head-set or a loud speaker from the one set. Both instruments may he conneeted to the binding posts of the plug. A small push button switch, also attached to the plug, is used to conneet either the head set or loud speaker in the circuit. Manufaetured by the Martin Copeland Co., Providence, Rhode Island.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 596.

VERNIER DIAL

The 2¾ inch type 302 brass dial has a gear directly attached to it that meshes into a small pinion





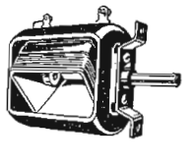
attached to the vernier knob. A very fine control is thus obtained. A spring keeps the two gears engaged. The metal dial has a satin silver finish and is of pleasing appearance. It is manufactured hy the General Radio Co., Cambridge, Mass.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 585.

GENERAL RADIO VARIOMETER

This variometer, type 269, is much smaller than the standard instrument as it measures only 2¾



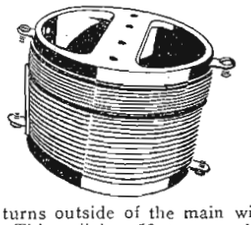
by 2¼ by 3½ inches long. When connected in the plate circuit of a detector tube it oscillates throughout the entire broadcast range. The instrument runs very smoothly and is recommended for use in a circuit where regeneration is required. Manufactured by the General Radio Co., Cambridge, Mass.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 584.

GENERAL RADIO TYPE 277D COIL

This coil is of similar construction to the type 277C coil except that it has a small primary winding of a



few turns outside of the main winding. This coil has 59 turns and an inductance of .220 millihenries. It may be used as an antenna coupler. Manufactured hy the General Radio Co., Cambridge, Mass.

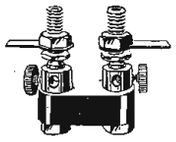
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 582.

GENERAL RADIO MULTI-PLUG

Any number of these units may be placed one in the other so that a number of head-sets can be connected in the circuit. The plug fits the standard telephone jack. It has two sockets in which is placed the small connector carrying two binding posts for the head-set terminals and two spring tips that fit the plug. Mechanical accuracy in construction insures perfect electri-

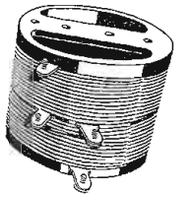
cal contact. Manufactured by the General Radio Co., Cambridge, Mass.



Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 586.

GENERAL RADIO TYPE 277C COIL

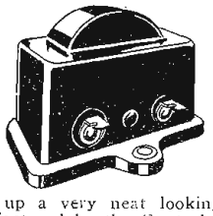
The type 277C inductance coil manufactured by the General Radio Co., Cambridge, Mass., covers the broadeast wave-length range when shunted by a .0005 mfd. variable condenser. It consists of 60 turns on a 2¼ inch diameter tube, and is provided with a center tap, adapting it for oscillator circuits. It has an inductance of .217 millihenries. A special terminal board with bind-



ing posts and spring plug connections is provided with this coil.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 581

MEDIUM FREQUENCY TRANSFORMER

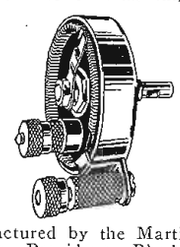
This transformer, type 271D, is somewhat broad in tuning and operates with maximum efficiency at a wave-length in the neighborhood of 10,000 meters. It may be used very conveniently in receivers of the Super-Heterodyne class and on account of its small size it will



make up a very neat looking set. Manufactured by the General Radio Co., Cambridge, Mass.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 583

MAR-CO RHEOSTAT

The main feature of this 30 ohm rheostat is a small size. It is enclosed in a metal case 1⅝ inches in diameter. The electrical contact between the spring lever and the resistance wire is exeellent. The instrument type 100B will be found very useful in portable reeeivers where size is of vital importance.



Manufactured by the Martin Copeland Co., Providence, Rhode Island.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 592

RUB MICA PANELS

These panels have a very good finish and are easily cut and drilled. The phase difference angle at 1,000 cycles is 4 degrees 40 minutes, indicating that the material is excellent for the insulation of radio frequency circuits. Manufactured by the Cooper Corporation, 8th and Main Streets, Cincinnati, Ohio.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 598.

GLOBE HEAD SET

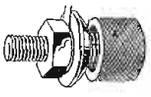
The Globe head set is of the standard two pole construction with nickel plated shells and insulated ear caps. It has a resistance of



2200 ohms and responds very well on all the audio frequeney notes in the musical scale. The quality is excellent, with practically no resonant points. A leather covered headband is used so that the phones may be worn with comfort. Manufactured by the Globe Phone Mfg. Co., Reading, Mass.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 606

GLOBE JACK BINDING POST

The Globe combination jack binding post is designed to fit the standard telephone cord tip. It is constructed similar to a drill chuck;



the thumb screw clamps the cord tip securely in place. It has a highly nickel plated finish and will be found very convenient for use in place of a jack as a loud speaker or telephone head set connector. Manufactured by the Globe Phone Mfg. Co., Reading, Mass.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 607

POLYPLUG

A very convenient telephone plug that is easily attached to a telephone cord is shown in the illustration. It is not necessary to take the plug apart in order to connect the cord tips. The tips are merely



pushed into the sockets and excellent contact is assured. By crossing the cords through the slot it may be pulled and jarred without interfering with the connections. Manufaetured by the Polymet Mfg. Corp., 70-74 Lafayette St., New York City.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 600.

NEWMAN-STERN CRYSTALS

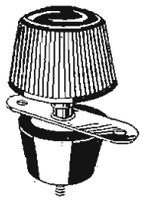
The galena crystals manufactured by the Newman-Stern Co., Cleveland, Ohio, are furnished in a two part brass holder. The parts screw together and clamp the crystal. The complete unit is ½ inch in diameter and fits the standard de-



tector cup. The galena furnished in the unit is very sensitive.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 599

VERNIER CONDENSER

The Vernier condenser manufactured by the Altekamp-Wheeler Co., 104 Hanover Street, Boston, Mass.,



is small in size and of simple construction. It consists of two brass discs enclosed in a moulded case insulated by a piece of mica. Three complete turns of the knoh varies the capacity from minimum to maximum. The minimum capacity is 4.27 mmf. and the maximum capacity is 28.06 mmf.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 597

WALBERT PLUG SWITCH

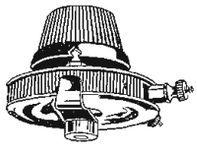
The Walbert plug switch is used for the filament circuits of receiving sets. The plug is the same in shape as the tip of a standard



telephone plug. It may be entirely removed from the rest of the switch and consequently no one will be able to operate the set without having the plug. The case of the switch is of metal, nickel plated. Two lugs extend from the back for soldering the connections. Manufactured by the Walbert Manufacturing Co., 941 Wrightwood Ave., Chicago, Illinois.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 604

CENTRALAB FILAMENT RHEOSTATS

The Centralab filament rheostats are well protected by nickel plated metal cases and insulated with mica.



The No. 230 30-ohm rheostat has a resistance of about 26 ohms. The number 206 6-ohm rheostat has a resistance of 5.7 ohms. These results were obtained from the samples submitted. The instruments are very smooth running and the contact springs make excellent contact with the resistance unit. They carry the load required of them without heating, but should they be overloaded the rise in temperature will not harm the mica insulation.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 601 AND 602

GOODRICH HARD RUBBER TUBING

The B. F. Goodrich Rubber Co., Akron, Ohio, has recently placed on the market hard rubber tubing of very good quality. As hard rubber is one of the best insulating materials for radio frequency circuits, it is ideal for the construction of low loss coils. The material is 1/16 inch thick and furnished in various diameters and lengths. The phase difference angle at 1,000 cycles is 2 degrees 31 minutes.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 579.

EASY-SEAT

This device is simply a piece of sponge rubber two inches in diameter by ⅝ inch thick. It is used to prevent vibration noises in radio receivers. By placing the set on four of these rubber cushions vibration is reduced. Sometimes it is well to place the loud speaker on



cushions also. Submitted by the Easy-Seat Sales Agency, Jefferson Building, Philadelphia, Pa.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 580

TURAFLEX RECEIVER

The Turaflex receiver is put out in kit shape by the National Airphone Corp., 16 Hudson St., New York. It is a tuned radio frequency reflex set comprising three



tubes with two stages of radio frequency amplification, crystal detector and two stages of audio amplification, with the first audio stage reflexed into the second stage of radio. The set gives practically as good results as the majority of five tube sets, with perhaps better quality on aceount of the crystal detector. The radio frequency coils are of a new low loss self supporting type. The National Airphone "Calibrated" audio transformers are used.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 605

CENTRALAB BATTERY SWITCH

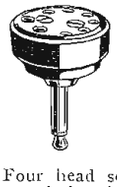
The No. 300 battery switch manufactured by the Central Radio Laboratories, 303 16th Street, Milwau-



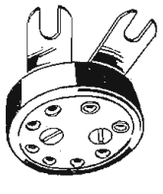
kee, Wis., is of the pusb-pull type and small in size. A fibre case encloses the switch elements. The spring contacts make good connections to the metal plug.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 603

SERIES FOUR PHONE PLUGS

The No. 616 and 618, 624 and 628 plugs are of very simple con-



struction. Four head sets may be connected to each by simply inserting the cord tips into the holes provided for them in the plugs. One of these plugs is for use in the standard telephone jacks. The others may be fitted to binding posts on the panel, or attached



directly to the panel. Manufactured by the Barklew Electric Mfg. Co., Middletown, Ohio.
Arrived in excellent packing.
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 587, 588, 589 AND 590



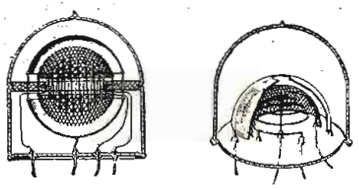
Digest of Latest Canadian Radio Patents

Compiled by G. F. SELLECK, Jr.

VACUUM TUBE

(Canadian Patent No. 239,543, The International Western Electric Co., Inc., assignee of Robert I. Hulsizer. Filed Sept. 27, 1922; issued April 22, 1924.)

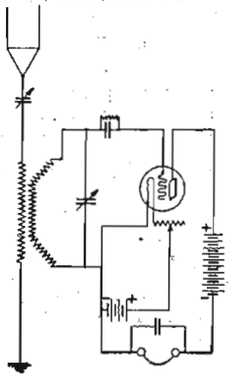
This invention relates to electron discharge devices and more especially to vacuum tubes of the audion type. The object of the invention is to provide the structural arrangement and support of the electrodes. The invention provides electrodes of spherical or semi-spherical configuration which are supported substantially concentrically from a plate by means of widely separated wires carried by the plate. This arrangement avoids the mount-



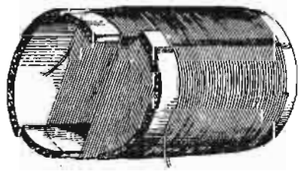
ing of the electrodes on a slender press and arranges the center of mass thereof at a relatively short distance from the points of support. The structural arrangement is thus very compact and sturdy.

COUPLING TRANSFORMER FOR RADIO SYSTEMS

(Canadian Patent No. 237,379, Ralph S. Piper. Filed April 28, 1923; issued Jan. 29, 1924.)



Coupling transformer for radio systems which provides an inductive coupling between the antenna circuit and the secondary circuit which



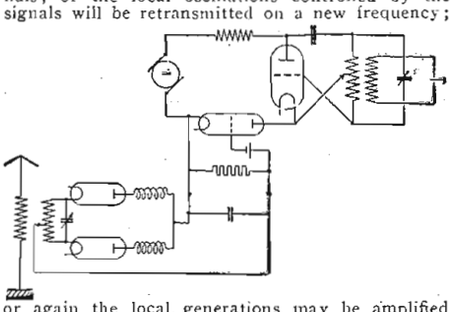
secures the increased signal strength afforded by a tight or close coupling and at the same time gives the increased selectivity and improved tuning qualities of the loose coupling.

RECEPTION AND AMPLIFICATION OF RADIO TELEGRAPHIC SIGNALS

(Canadian Patent No. 239,512, Walter Schaffer. Filed Sept. 2, 1923; issued April 22, 1924.)

According to this invention incoming signals are caused to initiate the generation of oscillations in a circuit tuned to a frequency differing from and independent of that of the signals by a three electrode valve which is so arranged that it will only oscillate when the incoming signals are applied to it.

The invention may be employed in various ways. For instance, the locally generated oscillations may have a frequency so low that they can be heard directly in a telephone while the incoming signals are of high frequency; or the local oscillations may be of higher frequency than the signals; or the local oscillations controlled by the signals will be retransmitted on a new frequency;

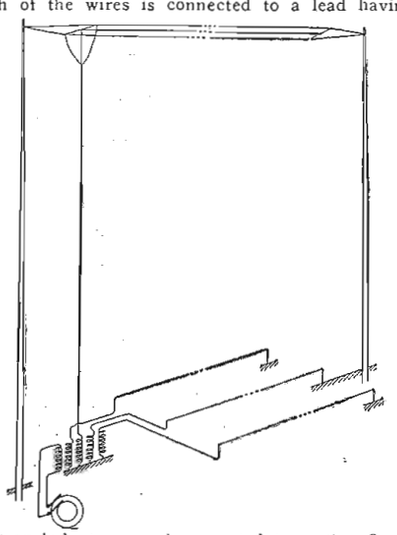


or again the local generations may be amplified so that the number of stages of amplification may be indefinitely increased to any desired strength.

RADIO ANTENNA SYSTEM

(Canadian Patent No. 237,006, Emil Mayer. Filed April 12, 1922; issued January 15, 1924.)

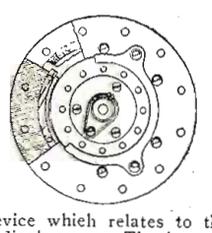
Radio antenna system which consists of a horizontal antenna composed of three wires connected to spreaders supported by masts. One end of each of the wires is connected to a lead having



in it an inductance and connected to earth. Oscillations are generated in the antenna by means of an alternator having in its circuit an inductance G, coupled to an inductance E. Earth screens are laid on or slightly above the ground. Each of these wires is connected to an inductance, each of these inductances being so coupled to the inductance E that the currents in the inductance E induce in the wires currents which balance the currents induced in the wires by inductance from the antenna.

ACOUSTIC DEVICE

(Canadian Patent No. 238,566, The International Western Electric Co., Inc., assignee of George R. Lum. Filed Sept. 12, 1922; issued March 11, 1924.)

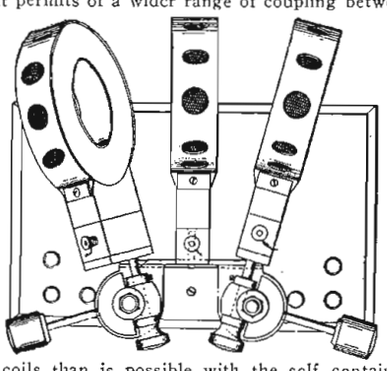


Acoustic device which relates to those employing stretched diaphragms. The invention provides an efficient and economical means for securing and uniformly tensioning diaphragms of acoustic devices. The invention comprises a structure having two clamping members with non-alignable corrugated surfaces between which the diaphragm is clamped and means for stretching the diaphragm to produce a predetermined natural periodicity.

INDUCTANCE COIL MOUNTING

(Canadian Patent No. 237,803, The Pacent Electric Co., Inc., assignee of Louis G. Pacent. Filed April 21, 1923; issued Feb. 12, 1924.)

Inductance coil mounting which provides a mounting whereby the movable coil or coils may be adjusted in a plurality of planes. This arrangement permits of a wider range of coupling between

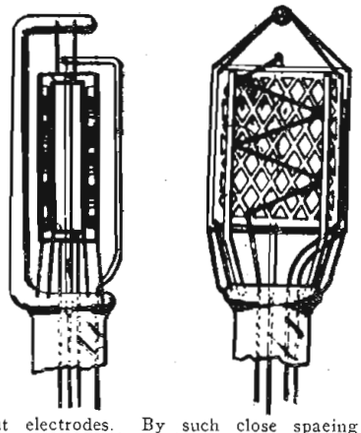


the coils than is possible with the self contained inductance mounting. The invention comprises a bearing member arranged to rotate about a vertical spindle, a horizontal shaft journaled in the bearing member, and means carried by the shaft for securing an inductance coil thereto. Another feature consists in the provision of an operating handle which serves to effect the adjustments of the movable coil in two planes and in which is incorporated a set screw whereby the movable coil may be secured in any horizontal position.

THERMIONIC DEVICE

(Canadian Patent No. 237,341, George L. Geisey. Filed March 22, 1923; issued Jan. 29, 1924.)

Thermionic device which seeks to increase output by disposing the working surfaces of the output electrodes closer than heretofore to the filamentary cathode while retaining the input electrodes of the tube between the cathode and the



output electrodes. By such close spacing the electrons leaving the cathode will not, due to the short flight thereof, be permitted to scatter appreciably before striking the output electrodes, with the result that mechanical noise otherwise caused by such scattering will be minimized.

OSCILLATION GENERATOR

(Canadian Patent No. 239,744, The International Western Electric Company, Inc., assignee of Edwin H. Colpitts. Filed Sept. 20, 1922; issued April 29, 1924.)

Oscillation generator which consists of a method of, and means for, generating electrical oscillations by means of an arrangement which includes

(*Continued on page* 1210)



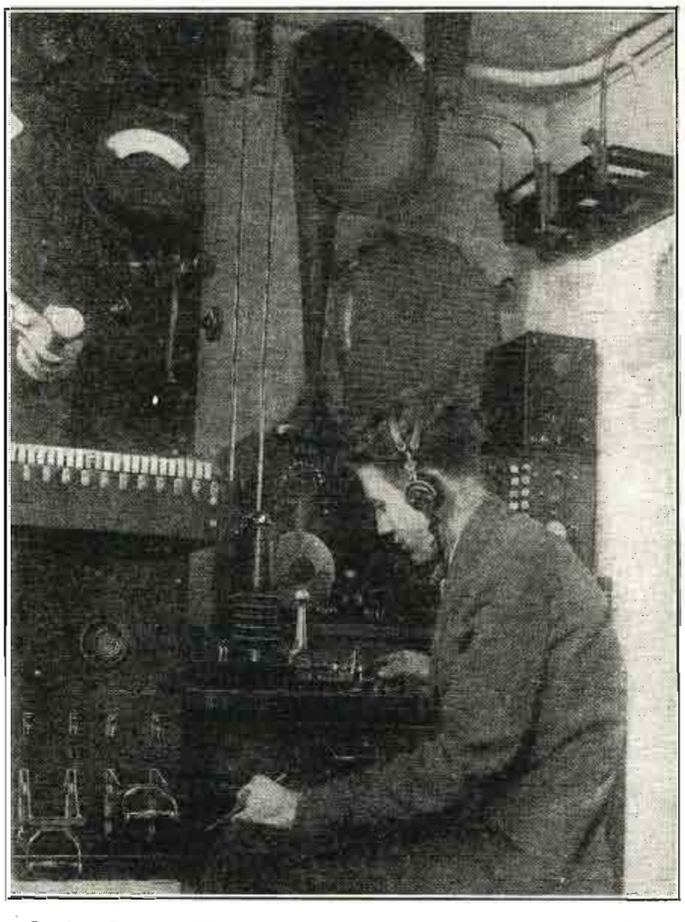
The Old Chief Speaks

The views of a veteran coastal marine operator as told to the author.

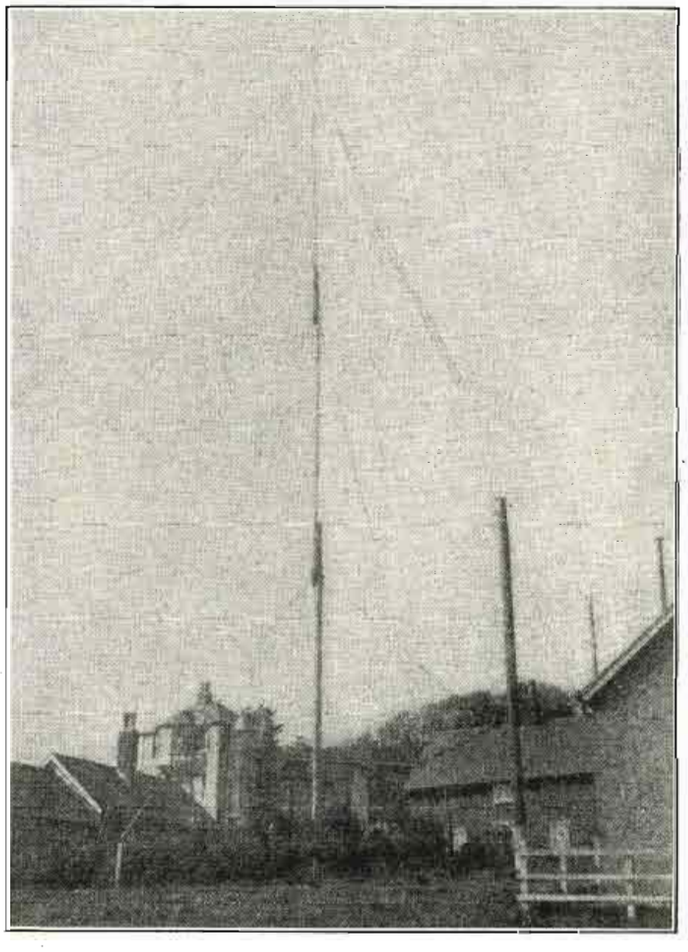
By HOWARD S. PYLE
Former Assistant U. S. Radio Supervisor

I stepped from out the storm into the station building of one of our modern, high powered coastal marine stations and stamped the clinging snow from my feet. It was several minutes before I could clear my vision sufficiently from the effects of the damp, heavy flakes to shake hands with the operator in charge and accept his cordial invitation to remove my overcoat and draw a chair up to the cheery wood-burner, glowing with a welcome ruddiness.

I glanced cautiously around the two small rooms open to my view. One, the manager's office, contained the conventional office fittings, plus a buzzer and sounder outfit with keys, but the other held my gaze, for within its small confines was seemingly everything known to marine communication. The powerful vacuum tube transmitter at one end—the spark emergency set at the other and in between, a table heavily loaded with shining receivers, keys, control boards and telegraph instruments. Directly in the center of this awe-inspiring collection of equipment sat the operator, at the time busily engaged in copying a radiogram from a vessel far out at sea, while both sounders frantically chattered and the telephone insistently clamored for attention. I expressed my surprise to the Chief, that one man could handle such a myriad of communication systems at the same time and laughingly he replied, "Oh yes. It is not infrequent that our men must copy from a ship; tell each wire to 'wait a minute' and take the telephone receiver from the hook, calling a quick 'Just a moment' into the mouthpiece, all at about the same instant. But it is all in the day's work for them—just a matter of experience."



Stanley Rodman Shumway, operator aboard the lightship "Five Fathom," stationed off Cape May. "Five Fathom" is the newest Radio Beacon of the Lighthouse Service. © United.



View of the new radio compass station at Niton on the Isle of Wight which works in conjunction with the coast guards and lighthouses along the Channel.

After a short exchange of pleasantries, I came to the subject of my visit. "Chief," I said, "there is considerable controversy going on among the marine operators, as you doubtless know, as to just what is wrong with the commercial game. Many of them have expressed their opinions through the columns of RADIO NEWS, and we'd now like to hear the views of the coastal service men. Surely the shore stations must exert a definite influence on the marine situation."

His face sobered, and for a moment I was afraid I had touched a subject distasteful to this grizzled veteran of the key, but taking a few slow pulls at his stubby corncob, he slowly turned to me and said, "Pyle, I'm going to tell you a bit of our troubles with the sea-going boys; perhaps you can find a possible reason why there *IS* something wrong with the commercial game today." And taking a hitch closer to the fire, and refilling his pipe, he began:

"I've been in this game about 16 years now. I started way back in the old United days, when the proper wave was the one with which you could raise your man and the call letters a matter of company choice. I broke in aboard ship—a South American passenger vessel, and at that time, we were accepted as steady, sensible ships' officers. Our duties were strictly wireless—beyond that we were required to do nothing. Our place was

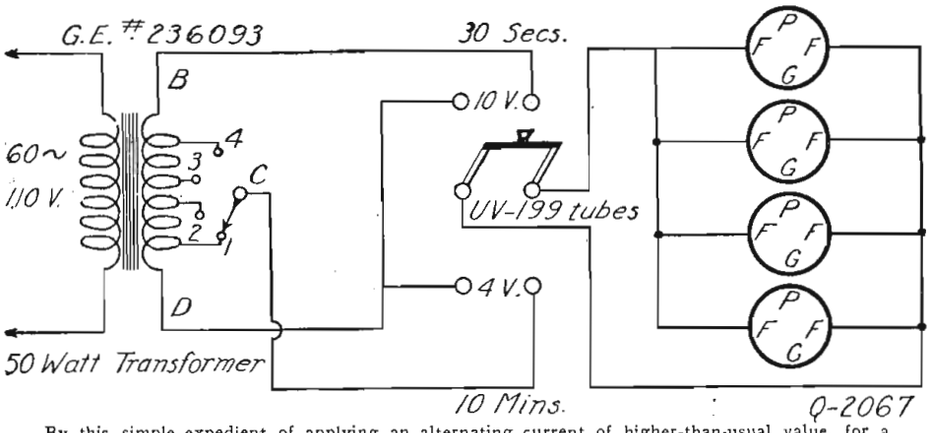
(*Continued on page* 1216)



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.



By this simple expedient of applying an alternating current of higher-than-usual value, for a short time, to coated filaments, tubes using this filament construction may be made to function perfectly. This system is only for tubes that light but operate poorly.

REACTIVATION OF TUBES

(2067) Mr. Henry Smith, Plainfield, N. J., asks:

Q. 1. Is there any method for rehabilitating UV-199 and UV-201A tubes which light but do not function satisfactorily?

A. 1. We are showing the correct circuit for the reconditioning of the tubes you mention. This equipment is in regular use at several places where these tubes are reconditioned. Any transformer having the output indicated will be satisfactory. The catalog number shown is that of the General Electric transformer particularly adaptable to the requirements. While it is possible to recondition only one or two tubes at a time, it is better practice to operate the circuit with four tubes in the sockets at one time, using the time-voltage formula shown.

For UV-201A tubes, the G. E. No. 236095, 100-watt step-down transformer will be satisfactory. Two transformers, two double pole double throw switches and four UV-199 sockets and four UV-201A sockets may be mounted on one board, making a complete reconditioning unit. Note that the 100-watt transformer will have the switch arm on point three, not on point one, as is necessary for the 50-watt transformer. However, these voltages should be checked with a voltmeter, as it may be necessary to move the switch arm one way or the other, depending upon the current supply voltage. Only connections B, C and D on both transformers are used, the A connection remaining open.

The 100-watt transformer, when connected in the manner of the 50-watt transformer, with the switch arm exception mentioned above, will deliver (closely) the voltages of eight and 16 volts. Putting the double-pole double-throw switch on one side should deliver 16 volts to the filaments of the UV-201A tubes for a period of only 30 seconds. Finish off with the switch in the opposite position, delivering eight volts for 10 minutes. For the UV-199 tubes, start with 10 volts for only 30 seconds and then immediately change over to four volts for a period of 10 minutes. Many tubes thus treated test as considerably better than when first purchased.

EXCELLENT TRANSMITTER

(2068) Mr. E. B. Moore, Stuart, Patrick County, Va., asks:

Q. 1. Is there any simple rule for adding a "C" battery to any audio frequency amplifier?

A. 1. The wire (or wires) connecting to the audio frequency transformer (or transformers), and thence to the filament, should be connected to the negative post of the "C" battery, instead of to the filament. The positive post of the "C" battery connects to the point on the filament circuit to which the transformer wires were previously connected.

Q. 2. Please show a diagram of connection for an exceptionally efficient transmitting set of about 50-watts power. It is desired to use this transmitter for phone transmission on a wave-length of about 200 meters. The current should remain constant, regardless of aerial wave-length variation.

A. 2. We are herewith showing the constant current (Heising's) master oscillator transmitter. Modulation is nearly complete, as practically 80 per cent. to 90 per cent. of the output is modulated.

The 5-henry choke coil, L-1, may comprise 15,000 turns of No. 28 single cotton silk covered, or enameled wire. A soft iron core five inches long and three-fourths inch square is used. The choke C-2 may consist of about 6,000 turns of the same wire, wound on the same size core. Inductance L-1 may be 200 turns of No. 30 D.C.C. wire wound on a three-inch tube. This design is the same for L-3. L-2 should consist of 40 turns of No. 22 C.C. wire, wound on a half-inch tube. L-4 is the same size as L-2. L-5 consists of 300 turns of No. 20 D.C.C. wire wound on a three-inch tube. Inductance L-6 consists of about 30 turns of No. 22 C.C. wire, wound on a three-inch tube, tapped every turn. The condensers marked A, B, C and D may function better if of slightly different capacity from that indicated in the diagram.

These constants are for transmission on a wave-length of 200 meters with an antenna of .0006 mfd. capacity and with a natural wave-length of 300 meters. Individual conditions may necessitate slight changes in the constants. The resistance of a particular aerial with which this circuit was developed to maximum efficiency, had a resistance of 15 ohms. Western Electric 5-watt tubes were used with 350 volts on the plates; 50-watt tubes, 750 volts on the plate.

Q. 3. The diagram in Q. 2055 of December issue shows no ground.

A. 3. "A" plus should be grounded.

VARIABLE CONDENSERS

(2069) Mr. Fred Klug, Jr., Boonville, Mo., asks:

Q. 1. Why does the tuning sharpen considerably when a 43-plate condenser is substituted for the 23-plate condenser in my set?

A. 1. This is because a change of one degree in the position of the rotor plates moves twice the number of plates as before. Having twice the surface, it will cover twice as wide a wave-length band as previously. In other words, you will be able to tune to any station previously heard, as well as those in an additional wave-length band nearly equal to the original band. We wish to mention that there is a possibility of your not being able to receive all the stations at the very lowest setting of the 43-plate condenser. This is explained by the fact that the minimum capacity has been increased by the greater number of plates in relation at the lowest capacity setting. If desired, a very small fixed condenser may be inserted in series with the variable condenser. It will reduce both the minimum and maximum capacities obtainable from the 43-plate condenser.

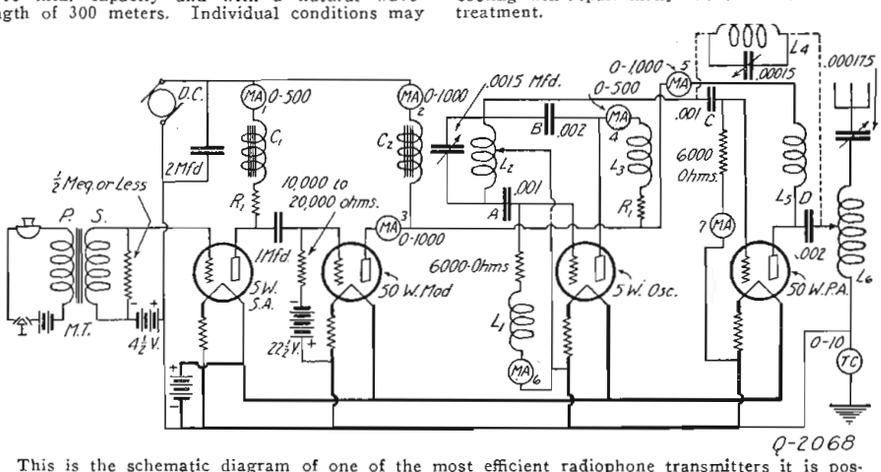
Q. 2. What plate voltage is required for the oscillator of Super-Heterodynes?

A. 2. It is seldom that more than 45 volts are required. Often 20 to 25 volts are sufficient.

Q. 3. What are the "boiling" and "baking" methods for tube reactivation?

A. 3. In the boiling method of a voltage of approximately 10 per cent. in excess of the terminal voltage of the tube is applied to the tube filament for a period of from two to 15 hours, without the plate potential being applied. It is no longer necessary to continue the process if after a period of a few hours the tube is found to function satisfactorily when the plate potential is applied, with the tube placed in the regular receiving set. A safe and satisfactory method for speeding up the tube repair is described in answer to question No. 2067.

In the "baking" method the tubes are placed on their sides in a granite-ware dish in an oven hot enough for baking bread. After 30 minutes they are taken out and allowed to cool off, then placed in the set and the filaments lighted for 15 minutes with the "B" battery disconnected. At the end of this time the filament current should be suddenly cut off. This heating and cooling will repair many tubes. This is the oven treatment.



This is the schematic diagram of one of the most efficient radiophone transmitters it is possible to construct. Constant wave-length and nearly complete modulation are outstanding features of this exceptionally efficient transmitter.

TROPADYNE

(2070) Mr. Clarence L. Alger, Rochester, N. Y., asks:

Q. 1. So far I have been unable to hear any sounds from my Tropadyne, using New York Coil Company intermediate frequency transformers.

A. 1. For best results, the equipment designed for this receiver and now available on the market should be used. Properly constructed, this set will prove to be sensitive, selective, clear and loud.

A 23-plate variable condenser is required across the secondary of each one of the transformers. The size condenser required for the primary of the input transformer would probably in the neighborhood of .001 mfd.

Test all tubes in an oscillating receiver, to determine whether they are uniform in their characteristics. Test your potentiometer for open circuit. It is also possible that you have connected it across the tube filaments instead of across the "A" battery direct. Some of the wires may be making poor contact. The condenser across your radio frequency transformer may be shorted. If you are using a phone condenser in the detector plate circuit, that also may be short circuited.

Test your transformers for open circuit. This may be done by connecting a single dry cell in series with a pair of receivers. When one side of the receivers is touched to the free binding post of the battery, a loud click should be heard. This click should also be heard if the free end of the battery and the free end of the headphones are touched to the primary or secondary terminals of the transformers. It will be noticed, when testing audio frequency transformers, that the click is much less pronounced at the secondary side as compared to the primary side. This is due to the greater resistance of the secondary and is not to be considered a fault.

Examine the tube sockets carefully; it is possible that the tubes are making poor connection to the socket springs.

Test all batteries to be sure they are at the rated voltage. This should be the first operation whenever testing defective sets.

Check the wiring very carefully to be sure that a primary is not connected where a secondary should be, or vice versa; also to be sure that battery polarities are correct.

Q. 2. Is the arc transmitter more likely to produce harmonics than other types of transmitters?

A. 2. The arc is a prolific producer of harmonics. It has been stated that the Eiffel Tower station has been heard on 13 different harmonics between 650 and 162 meters. The great objection to the arc system is apparent. Fortunately there have been new developments enabling a nearly entire control of the harmonics ordinarily produced and radiated by arc transmitters.

Q. 3. What is the object of the piece of string at the end of headphone cords?

A. 3. This is a "tie-cord." It is fastened to the receiver in some convenient manner and serves to take the strain which would otherwise develop at the point where the phone cord is soldered to the phone tip. There is usually a knob or a loop made on the receiver for this purpose.

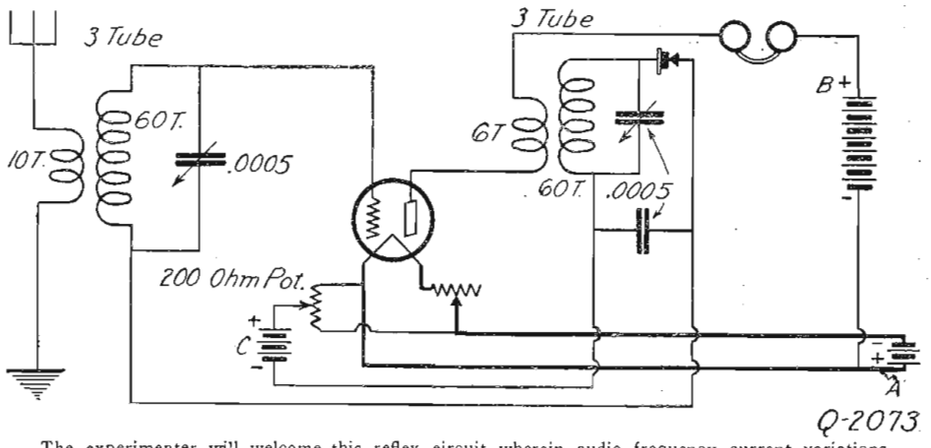
TUBE ACTION

(2071) Mr. Charels C. Taylor, Richford, Vermont, asks:

Q. 1. In what way does a detector tube function differently than a radio frequency tube; and why doesn't a radio frequency tube detect?

A. 1. With a certain grid and plate voltage conditions are usually satisfactory for the radio frequency amplification, detection and audio frequency amplification of radio signals. It is understood that the grid, plate and filament voltages are maintained within certain prescribed limits, each limit depending upon whether the tube is to amplify, oscillate or detect.

With a certain grid voltage and a certain plate voltage (usually about 22 1-2 plate volts and zero grid volts) the grid has been found to cause the greatest amount of change in the plate current, when a very silght voltage (the incoming signal) is applied to the grid. Under these conditions the tube is found to function particularly well as a detector. The rectification is most perfect with the above values. Incoming signals are not amplified to nearly as great an extent as they would be with different grid and plate voltages.



The experimenter will welcome this reflex circuit wherein audio frequency current variations in the .0005 mfd. fixed condenser, due to the rectifying action of the crystal, are impressed upon the grid of the tube, resulting in dual amplification.

YOUR CAR!

Are you interested in motoring, touring or camping? If you are, do not fail to read the January issue of

MOTOR CAMPER AND TOURIST

Here is a magazine that tells you things in connection with your car—things that you never even suspected.

Are you just running around the country or are you getting the full benefit of your car? MOTOR CAMPER & TOURIST shows you the way. On all newsstands.

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By Lee Tibbals

The Etiquette of Motoring
By R. H. Kasper

My Essentials of Autocamping for Pleasure and Recreation
By Ned Huff

Ten Ways My Car Saves Money
By Emma Gary Wallace

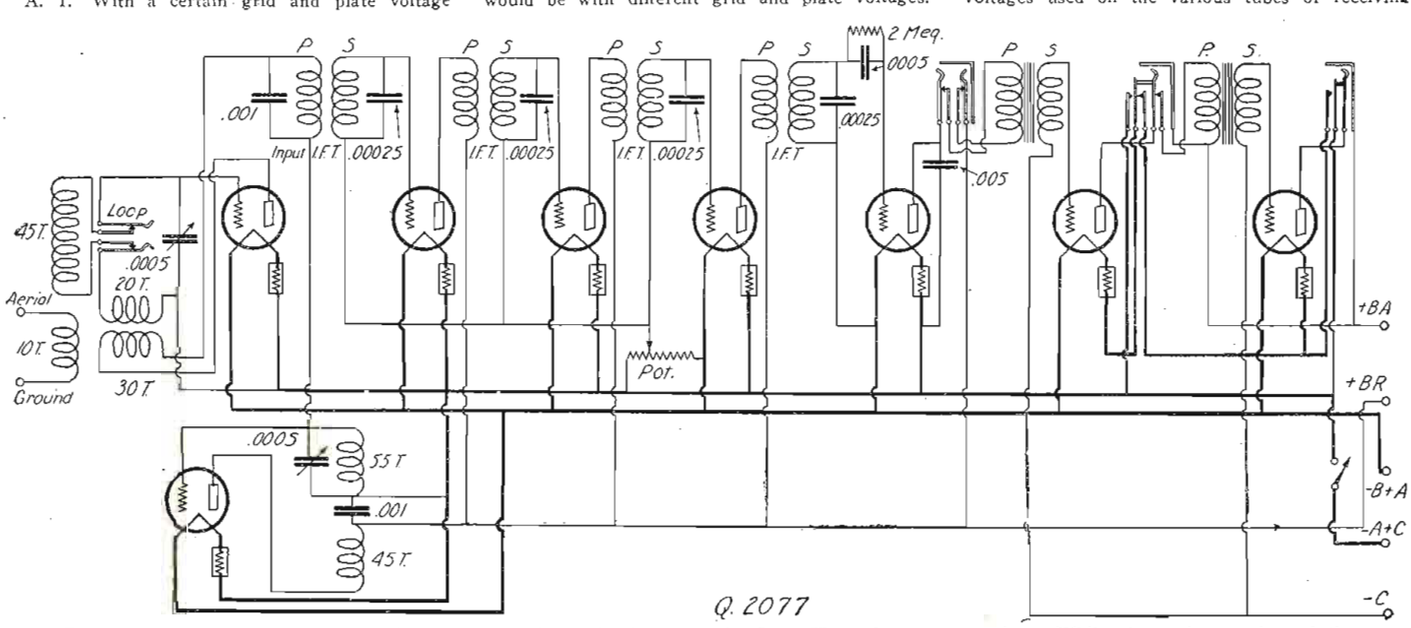
Since a tube is capable of functioning as an oscillator, amplifier, or deteetor, it is only natural to believe that there are different eonditions necessary for the best operation of a tube for any one of these three actions.

The best condition for amplification depends upon whether the amplification is to be at audio frequency or radio frequency. If at audio, high plate voltages are best, plus a high negative grid voltage. Under these conditions the tube could be made to oscillate strongly, if placed in a radio frequency circuit, which would cause great distortion, however; as a detector, under the same conditions, results would be relatively unsatisfactory, as a small, incoming signal would have very little effect upon the highly negative grid.

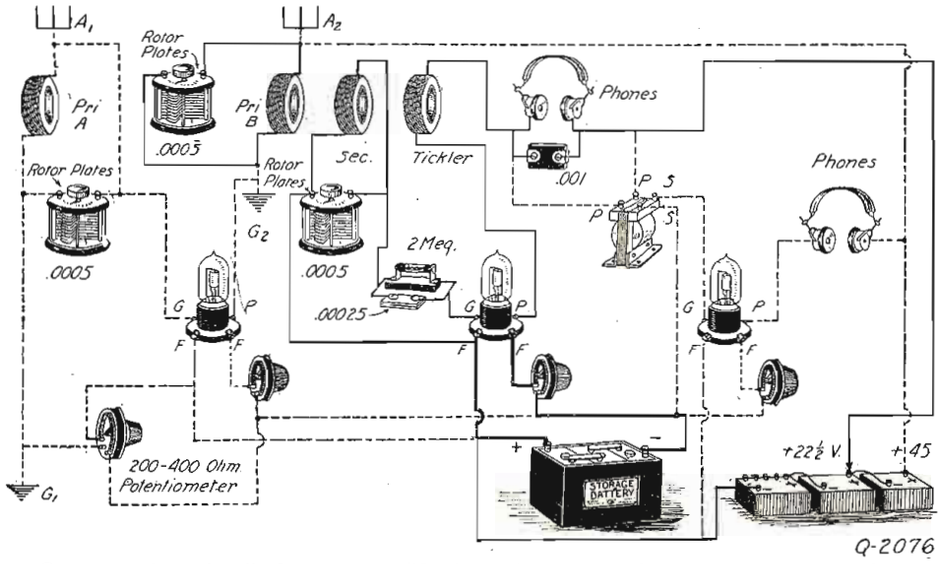
Under the conditions for best radio frequency amplification, the radio frequency transformer secondary connects directly to the grid. The other side of the transformer connects to a potentionmeter. Often, the grid voltage may be zero, but the plate voltage is preferably between 45 and 90 volts. For best results as a detector, a grid condenser is usually employed. In the radio frequency amplifier no grid condenser is used. If a very low plate voltage is used on the radio frequency amplifier, detection will be had, to a certain extent on the radio frequency tubes, but amplification will not be high. This detection is rather slight as compared to the amount of detection which will take place in the properly arranged detector tube circuit. The grid condenser, when used, is a determining factor in the best rectification of radio frequency currents.

It is thus seen that associated tube apparatus must be of a design that will work in harmony with the desired function of the tube. Various charts and other data have appeared in past issues of RADIO NEWS explaining the above. See the third answer to question No. 2076 below.

The information just given must be taken as general, since a complete exposition of vacuum tube actions cannot be made in the amount of space available in these columns. The facts pointed out should explain, in only a general way, the reasons for the various grid and plate voltages used on the various tubes of receiving



The Model L-2 Ultradyne is seen to incorporate the latest developments in Super-Heterodyne construction. While the major portion of the amplification at radio frequency is dependent upon a properly designed and constructed intermediate frequency amplifier, considerable additional selectivity and sensitivity are had by the incorporation of regeneration in the first tube, as shown.



One stage of tuned radio frequency amplification and one stage of transformer coupled audio frequency amplification may be easily added to the three-honeycomb type of regenerative receiver, as shown in this picture diagram.

sets. See last paragraph of answer No. 3 to Q. 2076, in this issue.

RADIO COMMUNICATION DISTRICTS

(2072) Mr. Steve Tellep, Monessen, Pa., asks:

Q. 1. Please publish the circuit for a two-tube portable receiver.

A. 1. Two-tube circuits have appeared in these columns for a long time. Practically any set may be made portable. It is mostly a question of design. Small instruments carefully placed, will help to make the set compact. WD-11, WD-12 or UV-199 type tubes are best for small sets, since small batteries may be used as a current supply. Aerials ranging from a single wire reaching to the lower limb of a tree, to loop aerials two or three inches in diameter, are used for such sets. Loop aerials are not usually used with regenerative receivers, for the range is usually small.

Under good conditions, however, surprising distances may be covered with a loop aerial and a regenerative receiver. The loop aerial takes the place of the grid tuning coil. There must be some arrangement whereby the plate current can be transferred to the grid circuit, causing regeneration. One method is to build a small plate circuit loop into the regular grid circuit loop, making it variable in inductive relation. Another method is to insert about 15 turns of wire (wound on a small tube) in series with the loop and about 30 turns more in the plate circuit. When these two coils are coupled, variations in the plate circuit are reproduced in the grid circuit (regeneration).

Q. 2. Kindly advise me as to whom application should be made for station license information.

A. 2. We have had so many inquiries from all parts of the country for this information, that we are herewith printing the list of the nine radio communication districts, and the territory covered by each. Communications should be addressed to the Radio Supervisor at the Custom House in the principal city of the district.

(1) BOSTON, MASS.: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

(2) NEW YORK, N. Y.: New York (county of New York, Staten Island, Long Island, and counties on the Hudson River to and including Schenectady, Albany and Rensselaer) and New Jersey (counties of Bergen, Passaic, Essex, Union, Middlesex, Monmouth, Hudson and Ocean).

(3) BALTIMORE, MD.: New Jersey (all counties not included in second district), Pennsylvania (counties of Philadelphia, Delaware, all counties south of the Blue Mountains, and Franklin county), Delaware, Maryland, Virginia, District of Columbia.

(4) SAVANNAH, GA.: North Carolina, South Carolina, Georgia, Florida, Porto Rico.

(5) NEW ORLENAS, LA.: Alabama, Mississippi, Louisiana, Texas, Tennessee, Arkansas, Oklahoma, New Mexico.

(6) SAN FRANCISCO, CAL.: California, Hawaii, Nevada, Utah, Arizona.

(7) SEATTLE, WASH.: Oregon, Washington, Alaska, Idaho, Montana, Wyoming.

(8) CLEVELAND, OHIO: New York (all counties not included in second district), Pennsylvania (all counties not included in third district), West Virginia, Ohio, Michigan (Lower Peninsula).

(9) CHICAGO, ILL.: Indiana, Illinois, Wisconsin, Michigan (Upper Peninsula), Minnesota, Kentucky, Missouri, Kansas, Colorado, Iowa, Nebraska, North Dakota, South Dakota.

EXPERIMENTAL REFLEX

(2073) Mr. Charles Van Larsel, Philadelphia, Pa., asks:

Q. 1. Is radio frequency or audio frequency amplification used in the Westinghouse R. C. set?

A. 1. This is a regenerative receiver and does not employ radio frequency amplifier tubes. There is a certain amount of amplification (regeneration) at radio frequency, in the detector tube.

Q. 2. Is it best to wind a variocoupler with "Litz" or regular wire?

A. 2. We do not believe that there would be any advantage in using Litzendraht wire in place of D.S.C. wire, D.C.C. wire, silk covered enameled wire or cotton covered enameled wire. We believe that there would be an advantage to the use of this wire in preference to plain enameled, S.C.C., or S.S.C. wire. Even at best, it is very important that *every* single strand be connected; a poorly connected or broken strand so increases the resistance at high frequencies that it becomes less efficient than ordinary wire, otherwise not nearly as good.

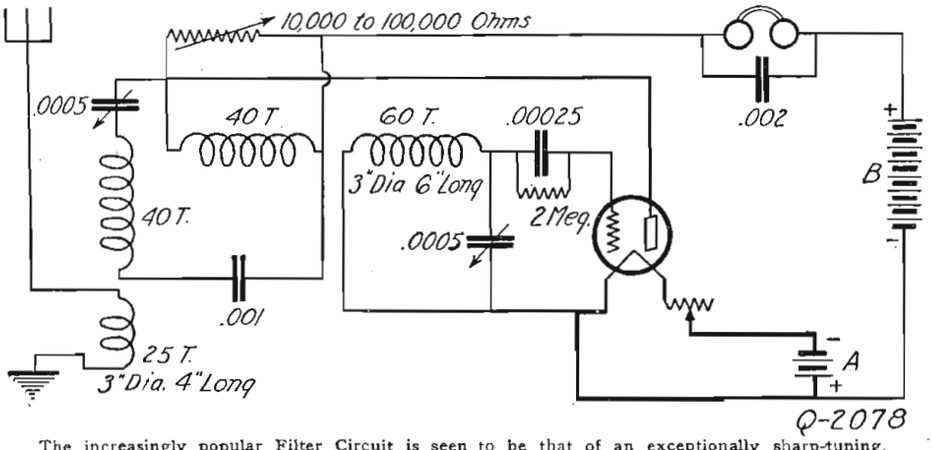
Q. 3. Is there any method of reflex amplification not requiring an audio frequency transformer?

A. 3. We are showing herewith an experimental circuit which has proven very interesting. Results would be somewhat better if an audio frequency transformer were used.

CATHODOPHONE

(2074) Mr. Lester Bebb, Spokane, Wash., asks:

Q. 1. Using a six tube set, the sounds caused by passing trolley cars are objectionable; telephone conversation and bell ringing are also quite audible, what is the remedy?



The increasingly popular Filter Circuit is seen to be that of an exceptionally sharp-tuning, complete receiver. Careful instrument layout, careful construction and good apparatus will be required for best results.

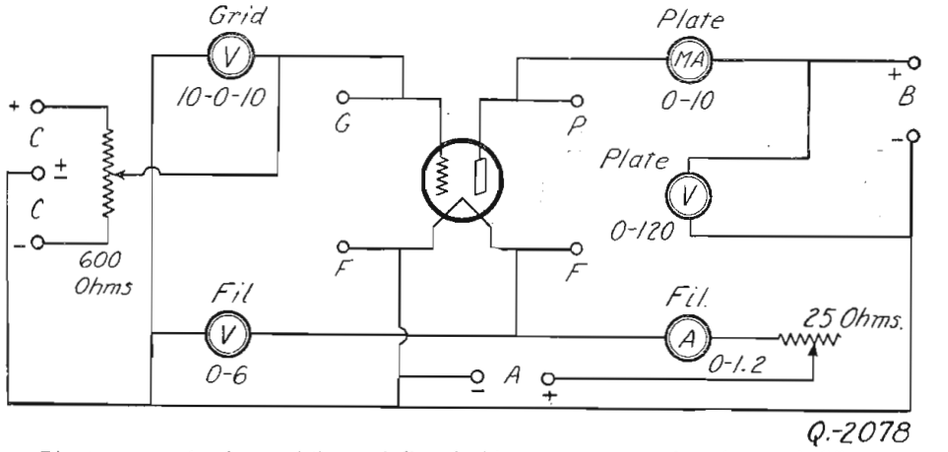
A. 1. It is almost impossible to eliminate trolley induction if one is very near the trolley lines. It is probable that your aerial, the aerial lead-in, or ground lead, are in strong inductive relation to telephone lines. It is possible that your lead-in, after entering the house, runs parallel to telephone wires between the walls of the house. It is often found that changing the ground connection to a different ground eliminates the trouble. Placing your aerial at right angles to the trolley lines should eliminate or greatly reduce the trolley induction. We wish also to call attention to the induction hum reducing method shown on page 57 of the July, 1924, issue of RADIO NEWS.

Q. 2. What is the cathodophone?

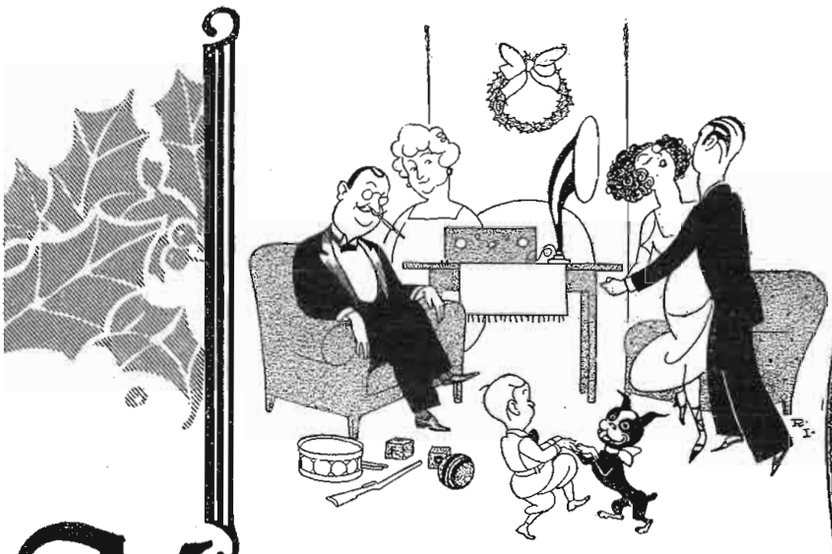
A. 2. It is a "glow" microphone. It is not the same as glow microphones using an arc. The invention is based upon the findings of Wehnelt, that the surface of glowing wires coated with an oxide (such as barium, calcium and strontium), will give off free negative electrons in rarefied gas. This property has been discovered to hold in air at normal pressures also. The high speed of the electron is missing, however, as the free electrons collide with air molecules or atoms, thus forming ions. The glowing oxide body being made the cathode (hence the name of the transmitter), the ions will drift slowly to the anode and thus become carriers for the electric current.

This "ion current" or "emission current" is subject to various pressure modifications in much the same way (but to a higher degree) as the atmosphere. When a sort of "box" of refractory material coated with an oxide is made to glow by a resistance heating, a bluish glow is set up between it and a perforated diaphragm slightly

(*Continued on page* 1226)



Direct current tube characteristics are indicated with test sets connected as shown. A different circuit arrangement is required for determining the exact characteristics under alternating current conditions.



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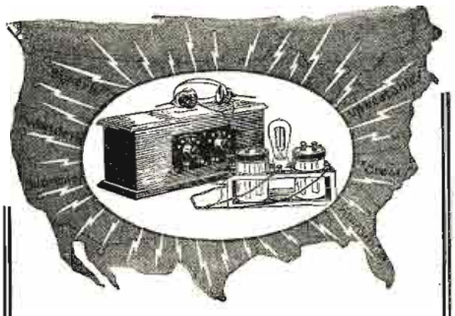
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CZ	"	100	24.50
PZ	"	70	21.50
CZ	"	70	18.50
PZ	"	45	16.00
CZ	"	45	14.50
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Reflex Radio Receivers in Theory and Practice

(*Continued from page* 1177)

e.g., when using regeneration. When a loud speaker is being used, we can say that there is no leakage, but only a capacity effect, and although this capacity effect is not desirable, yet it is not very harmful in many cases because the loud speaker is stationary and the capacity effects remain constant.

As regards the condenser C_3 of Fig. 10, this is a by-pass condenser intended to allow the ready passage of high frequency currents in the plate circuit. The windings of the telephones have a high impedance which would tend to choke back the high frequency currents. In actual practice the condenser C_3 may sometimes be omitted without any disadvantage. In this case the high frequency currents pass through the condenser formed by the parallel leads to the telephones and the self capacity of the windings.

The condenser C_2 is, like other condensers, used in reflex circuits, sometimes desirable, while sometimes it is best omitted. It is in most circuits a matter for individual experiment, and its value is also a matter for trial. There are really three capacities for fixed condensers in reflex circuits, although the ordinary self capacity of the telephones or transformer windings is sometimes sufficient without being supplemented by any extra condenser. Condensers of .0003 mfd., .001 mfd. and .002 mfd. capacity are useful to try across different points in a reflex circuit. It is owing to the fact that different telephones and different transformers have different self capacities and different impedances, and these two properties have a very important bearing on the tendency of the reflex circuit to oscillate at low frequency.

THE CONDENSER C_4

The condenser C_4 in Fig. 10 may, in practically all cases, be omitted, because the primary T_1 of the step-up transformer T_1 T_2, usually has sufficient self capacity. Here, again, it is a matter for experiment, but the author has found that as a general rule the condenser may, in the case of most transformers, be omitted. It will usually be found in most reflex circuits that if a condenser is really of any use, its capacity should be about .0002 mfd.

The condenser C_5 is of greater importance, and here it may be stated as a rule that some additional capacity will be required. A fixed condenser C_5 is employed to shunt the secondary T_2, and the value of this capacity may be .0003 mfd., .001 mfd. or .002 mfd., according to the type of transformer used and the actual type of circuit employed. In the case of the Fig. 10 circuit the condenser C_5 may have a capacity of .001 mfd., and this will probably always be satisfactory. It is to be noted that if too large a condenser is employed here, it will, without affecting the high frequency circuit, act as a partial short-circuit for the low frequency currents supplied by T_2. A very small condenser in place of C_5 would have no material effect on the potentials supplied by T_2, but a condenser of very large capacity, say 1 mfd., would render the arrangement extremely insensitive. The author has found that it is quite possible to detect the difference in signal strength between the .001 mfd. condenser and the .002 mfd. condenser, but there is really not very much difference. In any case, a condenser of larger capacity than .002 mfd. should not be employed. The value, or even need, of these fixed condensers constitutes the great unknown factor in the problem of effective reflex amplification, and anyone who is experimenting with reflex amplification circuits should bear this in mind.

POSITION OF THE CRYSTAL

Another point is in connection with the position of the crystal detector. This detector should be connected at the high frequency end of the coil L_1. It will usually be found that even in the case of a transformer there is a "high potential" end and a "low potential" end, the latter being connected or tightly coupled to a portion of a circuit connected to ground, or to the batteries associated with a tube, these being taken to be at ground potential. Telephone receivers, or the primary of a transformer, should never be connected next to the high potential end of a coil. Nevertheless, if this is done and the crystal detector is connected at the low potential end, signals will still be received, but they will not be as strong as if the crystal, or grid in the case of a tube detector, is connected directly to the high potential end of the coil, and the transformer, or telephone receivers, connected to the low potential end. When radio frequency transformers are used, as in Fig. 10, a reversal of leads to L_4 should be tried. In some cases, the above remarks will not apply, and no appreciable difference in signal strength will be noted, but in others, and especially in those cases where the detector is connected across a single coil in the plate circuit (the high potential end of the coil in that case being the one nearest the plate), it is most important to connect one side of the detector directly to the high potential end of the inductance.

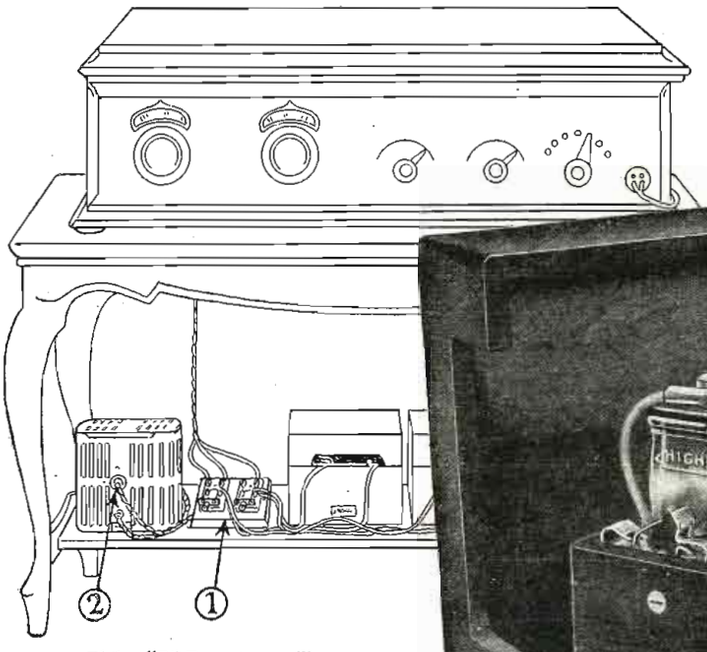
It is proposed now to discuss the more common forms of reflex circuits.

A description has been given of a circuit in which a reflex effect was obtained and in which loose coupling was used between the aerial and the grid circuit to the tube, and a transformer to feed the amplified radio frequency currents into a detector circuit. This transformer was shown aperiodic in Fig. 10, but more usually such a transformer is tuned. Sometimes the primary is tuned and sometimes the secondary, and sometimes both windings are tuned.

As regards which arrangement gives best results, the following remarks may prove of interest.

The transformer itself may consist of two inductances variably coupled, but more usually ready made transformers are supplied which will cover a given range with, say, a .0003 mfd. variable condenser. If of the variable type, greater selectivity will be obtained by tuning both the primary and secondary. When using a fixed transformer, however, there is no special point in tuning both windings; only one winding may be tuned, and as regards sensitiveness and selectivity, there is, generally speaking, no difference which of the two windings is the one to be shunted by variable condenser. The question of stability, however, is one which arises, although the matter is not one which has received proper consideration in the past. If the plate coil, *i.e.*, the primary of the transformer, is tuned by means of a variable condenser, the tendency of the tube to oscillate at radio frequency is much more pronounced. The coupling between the tuned plate circuit and the tuned grid circuit is accomplished through the inter-electrode capacity, the grid and plate forming what is substantially a small condenser. If the secondary winding is tuned and the primary is left aperiodic, the tendency to oscillate will not be so great.

In the case of Fig. 11, this is partly due to the fact that the distance between the coils L_3 and L_4 makes L_3 act more like an aperiodic coil, and partly because the oscilla-



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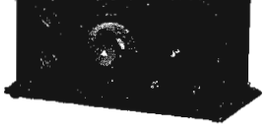


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tory circuit has now got the heavy damping effect of the crystal detector and the primary T_1 T_2 of the step-up transformer T_1 T_2. It is known, for example, that a tube without any intentional regeneration tends to oscillate quite readily when both the grid and plate circuits are tuned, but when the plate circuit contains an inductance which is not tuned, or approximately tuned to the same wave-length as the grid circuit, the tendency to oscillate is no longer present. If you add to this fact the presence of a crystal detector which may have a resistance as low as 2,000 ohms, or in many cases, very much less, the tendency to oscillate is still further reduced.

The connections to the primary L_3 in Fig. 11 are rather important from the point of view of a tendency of the tube to oscillate. When the coil L_3 is fairly closely coupled to L_4, as it is when transformers of fixed coupling are used, it will be found that making the connections to L_3 in a certain direction will result in the tube V_1 having a much greater tendency to oscillate if the connections to L_3 are reversed. When a fixed or tight coupling of this kind is employed, the coil L_3 does not act as an aperiodic coil, but partakes of the properties of the tuned circuit L_4 C_5, and capacity regeneration takes place through the inter-electrode capacities. If, now, we reverse the connections to the coil L_3, the tendency for regeneration to take place will be greatly lessened and the circuit will be much more stable. It is, therefore, advantageous, when using a circuit of the Fig. 11 type, to be able to reverse the connections to the coil L_3. Sometimes it will be found that louder results are obtained with the coil connected a certain way around because of the unintentional capacity feed-back strengthening the signals; but on the other hand, this unintentional feed-back effect may be sufficiently strong to produce self-oscillation, in which case the coil L_3 should have its connections reversed. As a matter of fact, the chances of self-oscillation are remote when using a crystal detector shunted across L_4 C_5.

It is important to note here that adjusting the crystal detector will vary the damping of the circuit L_4 C_5, and so vary the degree of unintentional feed-back introduced into the circuits L_2 C_2 and L_4 C_5. It may thus happen that a light contact on the crystal detector, although unsuitable from the point of view of actual rectification, will result in less damping on the circuit L_4 C_5 and so cause an increase in signal strength.

Another point to notice is that, the detector having a different impedance at different adjustments will alter the tuning of the circuit L_4 C_5, principally by altering the unintentional feed-back introduced into the circuit L_4 C_5. Any variation of feed-back, whether intentional or otherwise, should always be accompanied by retuning of associated circuits, and, consequently, it is desirable, when operating the Fig. 11 circuit, to retune the condensers C_1 C_3 and C_5 after adjusting the crystal detector.

It will be noticed that a condenser C_4 is shown in dotted lines across the primary of the step-up audio frequency transformer T_1 T_2. The writer's experience indicates that this condenser may always be left out without any loss in signal strength, owing to the self-capacity of the primary T_1. If a condenser is used, its value should not exceed .002 mfd.

As regards the connections to the primary and secondary, it is desirable that the left-hand side of T_2 should be the outside secondary terminal, and the right-hand side the inside secondary terminal. As regards the primary, the connections are not so important as the experimenter will usually care to try reversing the connections. If a rule is desired, it might be suggested that the right-hand side of T_1 should be the outside primary terminal, while the left-hand side, which is connected to one side of the crystal detector D, is the inside primary.

As regards the fixed condenser C_6 across the secondary T_2, the value of this condenser may be quite low, say .0003 mfd., and in any case should not be greater than .002 mfd. Even when a .002 mfd. condenser is used, there is a certain reduction in the low frequency potentials established across the secondary winding T_2, and for general purposes the writer would recommend a condenser of .001 mfd. A grid battery could be inserted in the point X in the Fig. 11 circuit for the purpose of giving the grid a negative bias.

A few additional connections may be tried by the experimenter. It is usually desirable, in all cases, where a loose coupled input radio frequency transformer is used, such as L_1 L_2, to connect the negative terminal of the battery to the ground.

Another arrangement worth trying when a transformer L_3 L_4 is used in the output circuit of the tube, is to connect one side of the primary T_1 to the negative terminal of the filament battery; adhering to the note regarding the inside and outside terminals of primary and secondary, the right-hand side of T_1 may be connected to the negative terminal of the battery B_1.

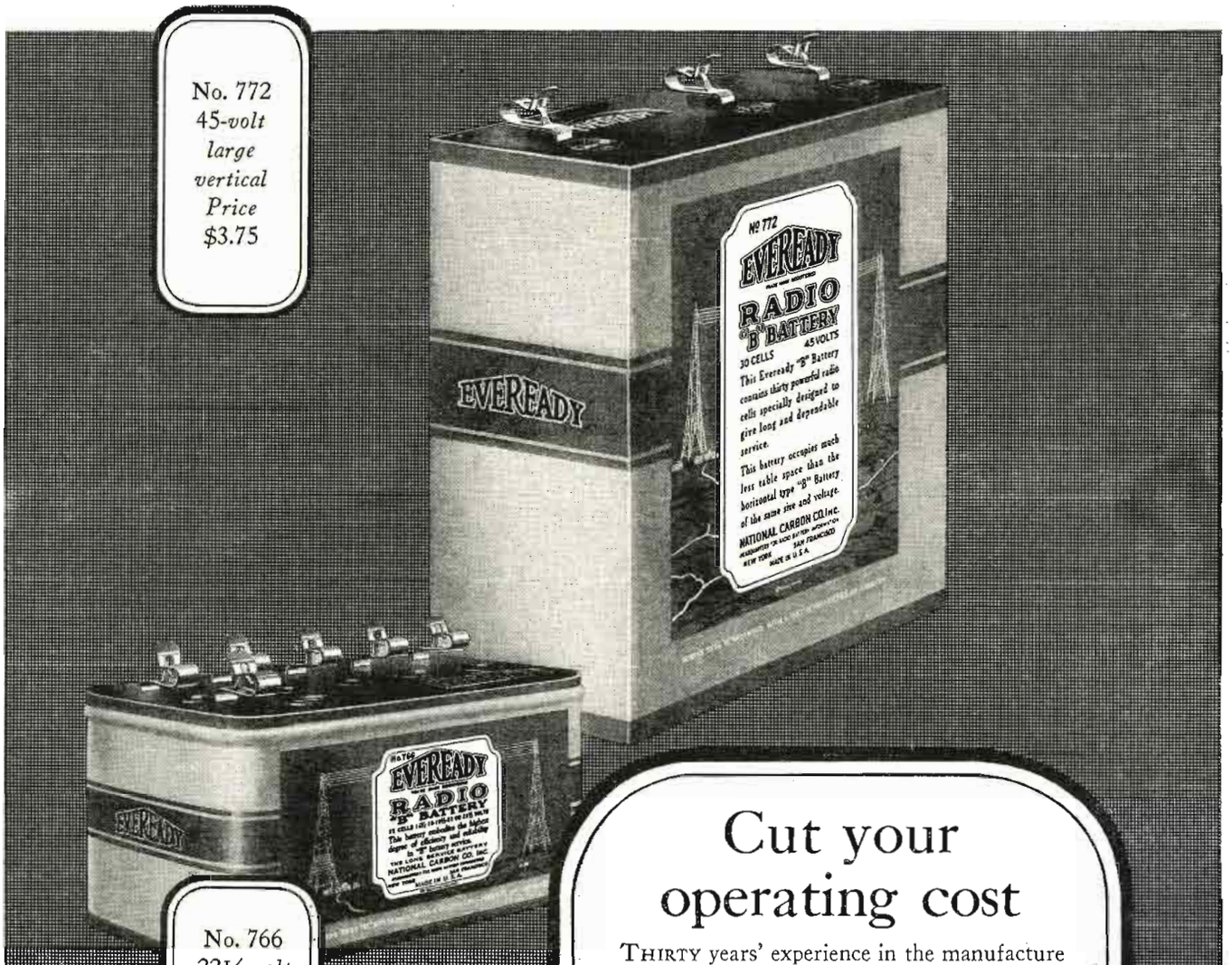
SIGNALS WITH THE CRYSTAL OFF

Many experimenters will have found that when the catswhisker, or upper crystal, is removed from the lower crystal, signals very frequently come in quite well, and this may prompt some to imagine that reflex amplification is not effective. What really is happening, of course, is that the tube is acting purely and simply as a detector. It is, in fact, almost impossible to prevent a tube acting as a detector, whatever the conditions may be under which it is operating.

In Fig. 11 the telephones T are included directly in the plate circuit of the tube, and consequently, if there is any rectification, signals will be heard in the telephones. There will, however, be no reflex amplification effect whatsoever, the secondary T_2 in the grid circuit having no effect on the operation of the circuit. As a matter of fact, it is rather a good test to see whether signals may be heard with the crystal off in order to ensure that the tube is functioning properly as an audio frequency amplifier. If good signals are heard in the telephones it is an indication that the tube V_1 is acting as a detector, and will consequently probably distort the audio frequency currents which are fed into its grid circuit by means of the transformer T_1 T_2. The rectification effect may be eliminated, or practically eliminated, by giving the plate a suitably high plate voltage and giving the grid a negative potential to bring the operating point about the half-way point along the characteristic curve. Under these conditions signals will not be received in the telephones T when the crystal D is raised, or if there are signals, they will be very weak. If, however, no grid battery is connected in the grid circuits, signals will usually be stronger, indicating that distortion will occur on the audio frequency side.

Sometimes the signals obtained by raising the contact from the crystal in reflex circuits are as loud, or sometimes even louder, than when the crystal is employed, and this is a sure indication that something is wrong with the circuit. One of the probabilities is that an inferior crystal detector is employed.

In the Fig. 11 circuit, the raising of the crystal by relieving the circuit L_4 C_5 of a considerable amount of damping, may result in more capacity feed-back in the tube, and this feed-back will strengthen the oscillations in the circuit L_2 C_2. The result is that the tube V_1 is now acting as a detector with feed-back, and the results may be quite good



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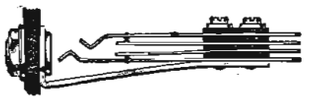
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compared to the normal arrangement of Fig. 11 with the contact on the crystal, the feed-back effect being probably very small. This brings us to the question of how we may improve the signal strength of a circuit of the Fig. 11 type by means of feed-back.

ADDING REGENERATION TO A REFLEX RECEIVER

The desire for obtaining the maximum output from a minimum number of tubes will prompt every experimenter to try to obtain better results by the application of feed-back to his reflex receiver. The application of feed-back to a reflex receiver introduces innumerable problems which require solution and the application of feed-back is usually accompanied by the setting up of loud buzzing noises of audible frequency which are extremely unpleasant to the operator of the set. Ordinary feed-back may cause self-oscillation of an ordinary receiver, but this generally troubles the receiving operator very little; on the other hand, those who have sets in the neighborhood have very good cause to complain owing to the heterodyning of the radiated oscillations with the incoming signals. The average user of a reflex circuit, however, finds that on tightening the reaction, his own set produces an extremely unpleasant noise, and he consequently has to make an immediate adjustment to prevent it. He is, therefore, generally far less troublesome to his neighbors than he who employs an ordinary straight circuit.

Fig. 12 shows a regenerative reflex circuit which only differs from Fig. 11 in that a tickler coil L_6 is coupled to the inductance L_2. The coil L_6 is connected in series with the primary L_3 of the transformer L_3 L_4. The warning that should be given here is that if the tickler coil L_6 is made of a certain size, the natural wave-length of the plate circuit, due to the inductances L_5 and L_3 in series and the capacity between filament and plate and the self capacity of the two coils, is near to the wave-length being received, and the valve will oscillate too readily. It is, therefore, desirable that the coil L_6 should be kept as small as possible, and since a separate aerial circuit is employed, a small tickler coil is all that should be necessary owing to the natural damping of the circuit L_2 C_2. The tickler coil L_6 should, of course, be connected the right way.

The circuit is not recommended as a particularly good one to start with, but most of the troubles experienced with reflex circuits are absent in a simple arrangement such as shown in Fig. 11 and Fig. 12.

Fig. 11, particularly, is calculated to avoid any tendency towards the audio frequency buzzing which is so prevalent in reflex circuits generally. In Fig. 11 we are more likely to get the buzzing because regeneration is employed, and it will usually be found that as the regeneration is increased, a certain point is reached when buzzing takes place. This buzzing is due to audio frequency regeneration, amplified audio frequency currents produced in the output circuit of the tube being conveyed back to the input side, the degree of audio frequency regeneration being sufficiently great to cause audio frequency oscillation. If the audio frequency reaction is not sufficiently great to produce audio frequency oscillation, a big build up of signal strength is often obtained, but nearly always at the sacrifice of purity of reproduction.

All reflex circuits tend to oscillate, whatever precautions may be taken. The reason is that although no audio frequency regeneration is produced through the audio frequency output currents of the tube being directly coupled to the input circuit of the tube, there is, in between, a stage of radio frequency amplification, the radio frequency oscillations being modulated by the audio frequency input currents.



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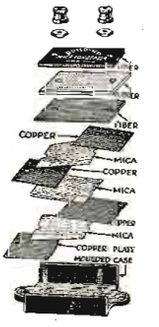
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Modulation *plus* Regeneration

Gazette RADIO SECTION

VOL. XIV - NO. 132 - 16 PAGES ★★

MODULATION PLUS REGENERATION IN NEW MODEL L-2 ULTRADYNE

20 DX Stations logged on August 25th on Loud Speaker using loop aerial at Covington, Ky.

Modulation plus regeneration is the keynote of the new Model L-2 Ultradyne Receiver. Regeneration as applied to this new method of radio reception produces greater rectification than ordinary methods of detection—a vital step in radio engineering. This combination produces tremendous amplification when receiving weak signals. Allows the Ultradyne to respond to a very small amount of energy. Signals are amplified thousands of times before they are detected and made audible.

Mr. R. H. Thomas, 509 Coppin Building, Covington, Ky., writes:

"The Ultradyne far surpasses any idea that I previously had as to what a radio receiver could be. On the night of August 25th, 1924, I tuned in on my Ultradyne, the following stations:

WBZ	Springfield, Mass.
WOR	Newark, N. J.
WGY	Schenectady, N. Y.
WHN	New York, N. Y.
WCAP	Washington, D. C.
WEAF	New York, N. Y.
WOO	Philadelphia, Pa.
KDKA	Pittsburgh, Pa.
WCBD	Zion, Ill.
WJAR	Providence, R. I.
WGR	Buffalo, N. Y.
WTAS	Elgin, Ill.
WAAM	Newark, N. J.
WABM	Saginaw, Mich.
WNAC	Boston, Mass.
WEAN	Providence, R. I.
WLW	Cincinnati, O.
KSD	St. Louis, Mo.
WWJ	Detroit, Mich.
WHO	Des Moines, Ia.
WTAM	Cleveland, O.
WHAZ	Troy, N. Y.
WOS	Jefferson City, Mo.
WSB	Atlanta, Ga.
WMC	Memphis, Tenn.
WOC	Davenport, Ia.
WBAP	Ft. Worth, Tex.
WNYC	New York, N. Y.
WOAW	Omaha, Nebr.
WFAA	Dallas, Tex.
WSAI	Cincinnati, O.
KFKX	Hastings, Nebr.
WCK	St. Louis, Mo.
WBT	Charlotte, N. C.
KFKB	Milford, Kan.
WGAQ	Shreveport, La.
KGO	Oakland, Calif.
KFIM	Grand Forks, N. D.
KFI	Los Angeles, Calif.
WDAF	Kansas City, Mo.

"I consider the above reception remarkable as it stands, but considering it was all accomplished on a *24-inch loop*, and all but WGAQ, KFJM and KFI, were heard on the loud speaker, it far surpasses anything that I have heretofore experienced.

"As regards selectivity, will say that I am only four or five miles from the powerful WLW station at Cincinnati, operating on 423 meters, and his wave is so powerful that I can receive him on the loud speaker, with one stage of audio, loud enough to be heard a block away, *without using antenna, ground or loop.* When WLW is on the air, I can tune him out completely, and receive WSB on 429 meters, WHB and WDAF on 411 meters, and PWX, nominally on 400 meters, but usually somewhat above that wave.

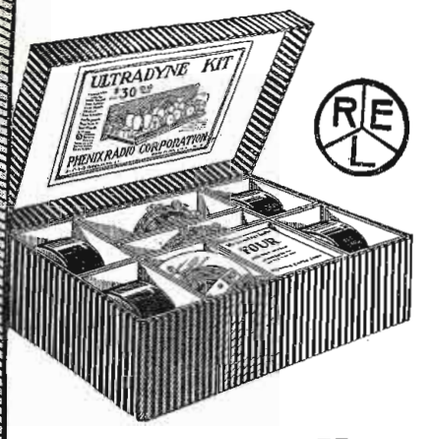
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ULTRADYNE MODEL L-2

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This Model L-2 Ultradyne, without a doubt, represents the peak of present day super-radio engineering skill.



Ultradyne Kit

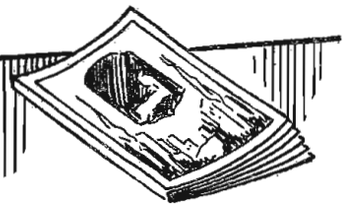
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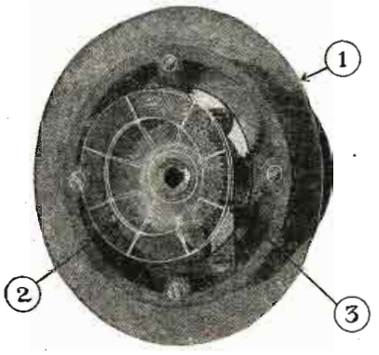
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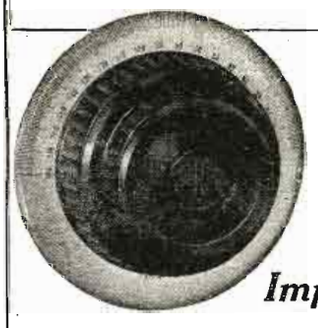
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We may consider this matter best by considering that the tube in Fig. 12 was oscillating and producing radio frequency oscillations of a frequency determined by the values in the circuit L_2 C_2. If, when the tube is oscillating we feed audio frequency currents into the grid circuit by means of the transformer T_1 T_2, we will vary the grid potential at audio frequency, and these variations of grid potential are liable to vary the amplitude of the radio frequency oscillations generated by the tube. This, in fact, is a common method of modulating the radio frequency oscillations of a tube for telephony transmission; but certain conditions are necessary. The modulation effect is not present if the characteristic curve of the tube is absolutely straight, and only a small portion of its straight part is used. In this case the radio frequency currents are amplified by the tube without any distortion or rectification, assuming, of course, that a negative potential is applied to the grid to prevent the establishment of grid current. If, however, the representative point on the characteristic curve, *i.e.*, the point representing general conditions at any given moment, moves along a curved portion of the characteristic curve, modulation will occur. For example, if the whole of the characteristic curve is being traversed up and down due to the oscillating of a tube, and we apply a positive potential to the grid, it will be fairly obvious that the tops of the high frequency current half-cycles will be clipped and distorted. Owing to the tube becoming saturated, the positive half-cycles will not be fully developed because the base line potential for the radio frequency oscillations has been raised by the application of a positive potential to the grid. If a negative potential is applied a similar effect may be obtained at the bottom bend of the plate current characteristic curve.

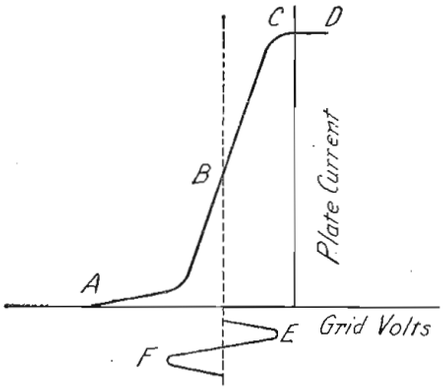


Fig. 13. Characteristic curve of a tube adjusted for reflex amplification.

Fig. 13 shows a characteristic curve of a tube adjusted correctly for reflex amplification. It will be seen that the plate current curve, A B C D, lies to the left of the ordinate passing through zero grid volts; this means that no grid currents will be established. A complete cycle of oscillating current is shown varying the grid potential above and below an average value which results in the middle point of the plate current curve being employed. If an audio frequency potential is now applied to the grid, either in a positive or negative direc-

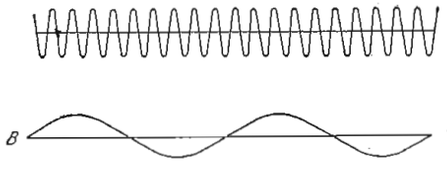
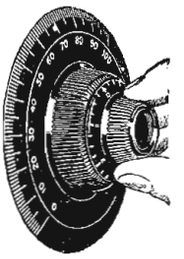


Fig. 14. Graphic representation of the separated radio and audio (B) frequency currents generated by the tube and transformer respectively.

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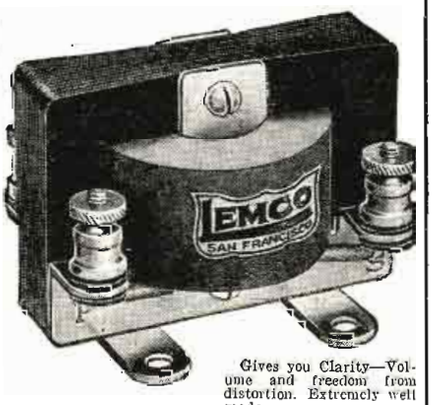
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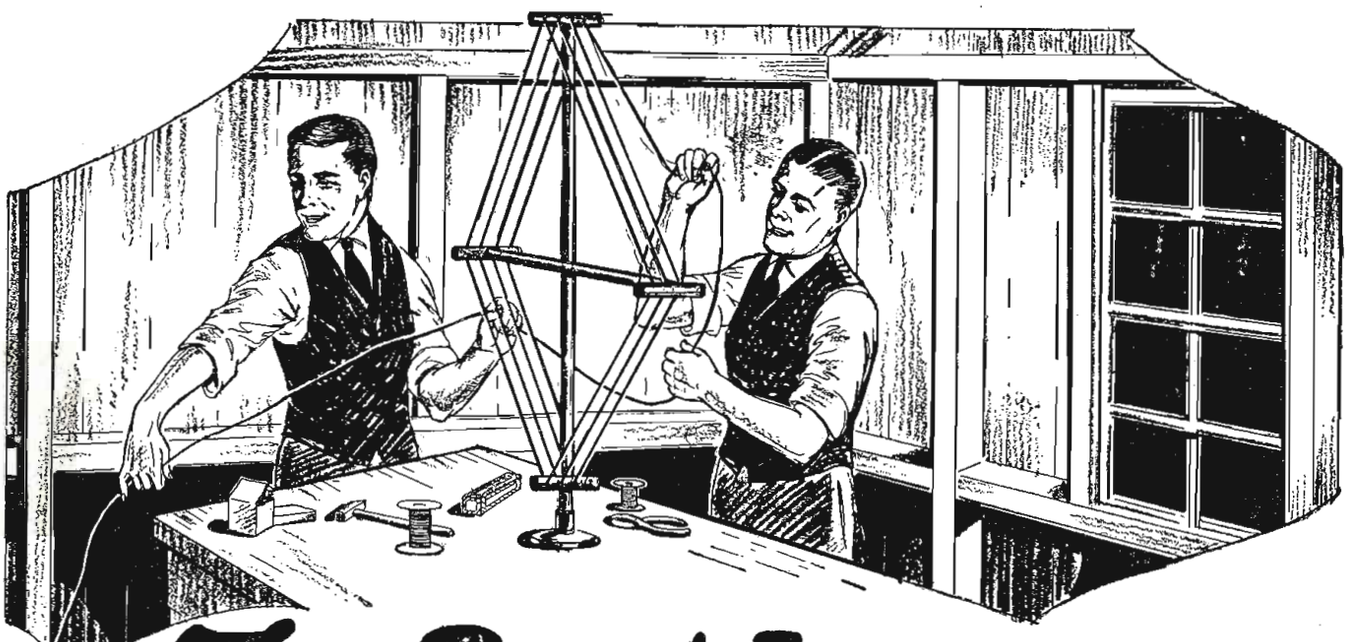


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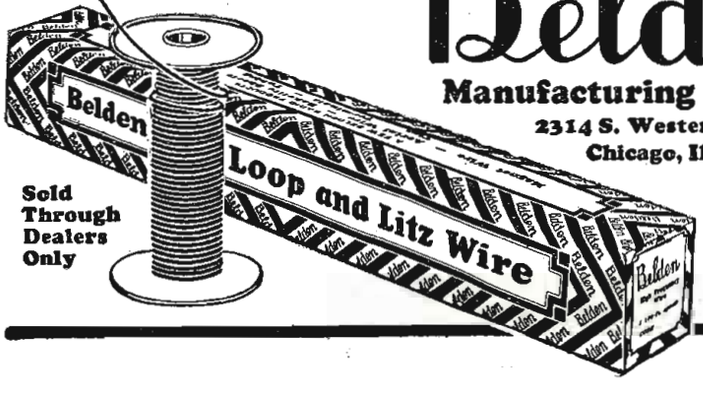
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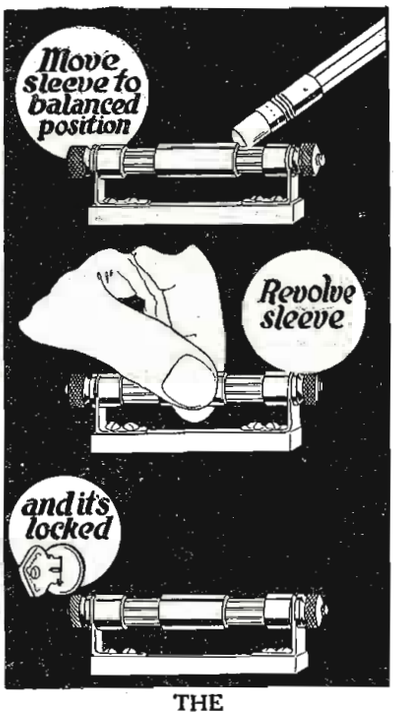
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tion, radio frequency currents will travel beyond the bends, and the radio frequency currents will consequently be modulated.

This is probably best explained by Fig. 14. The top line A shows the radio frequency currents generated by the tube, and the line B shows an audio frequency alternating current which is applied to the grid.

Fig. 15 shows, on the top line C, the sort of modulated radio frequency currents produced by the tube as a result of the alternating potentials on the grid. These radio frequency currents generated by the tube are rectified by the crystal detector in Fig. 12, or by any other detector used in a reflex amplification circuit, because the remarks made here apply equally to all reflex amplification receivers. The radio frequency currents shown in line C of Fig. 15

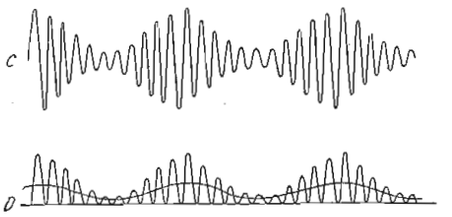


Fig. 15. Radio frequency, rectified and uni-directional currents shown graphically.

are rectified and produce uni-directional currents as shown in line D, and these produce an average current in the form of uni-directional pulses which pass through the primary of the transformer T_1 T_2 in Fig. 12. The transformer converts these uni-directional impulses to alternating currents of the kind illustrated in line E, Fig. 16. These currents are now fed into the grid circuit and reinforce those which we have already assumed are already being introduced into the grid circuit by T_2.

We thus have a chain of audio frequency feed-back which, while quite different from the ordinary kind of chain of audio frequency feed-back, yet possesses the same properties of enabling audio frequency oscillation to take place. The audio frequency currents are, in fact, carried by the radio frequency currents generated by the tube, and only appear again after rectification by the crystal detector D.

When considering the generating action of an oscillating tube, we always presume that something has set up a momentary oscillation which is rapidly built up and maintained by the tube. So, in the same way, we

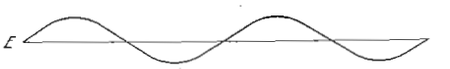


Fig. 16. Graphic representation of the alternating currents produced by the transformer.

may assume, in a circuit of the Fig. 12 kind, that there is some momentary audio frequency potential applied to the grid of the oscillating tube. This will modulate the radio frequency currents generated by the tube; these radio frequency currents are rectified by the crystal detector, and the original impulse is reproduced again on a larger scale which reinforces it and a process of audio frequency oscillation is set up.

This presumes that the tube V has oscillated, and it will always be found that the effect of audio frequency buzzing is always more likely to occur when the tube is on the verge, or is actually oscillating, due to using too tight a feed-back coupling. The same effect, however, may be started even, though the feed-back is not sufficiently tight to produce self-oscillation. In this case the incoming currents of the carrier wave are modulated by the audio frequency currents in the grid circuit. When the carrier wave is very strong this effect may be obtained.

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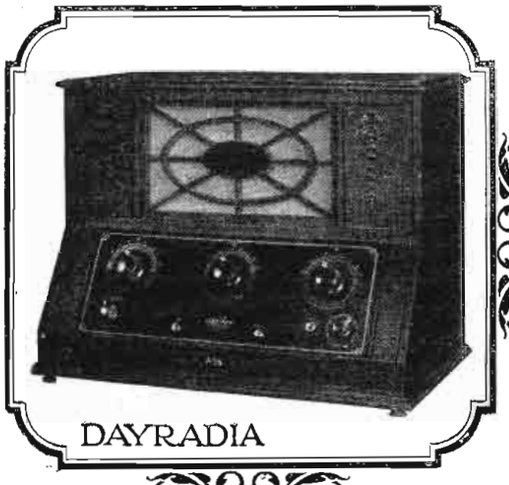
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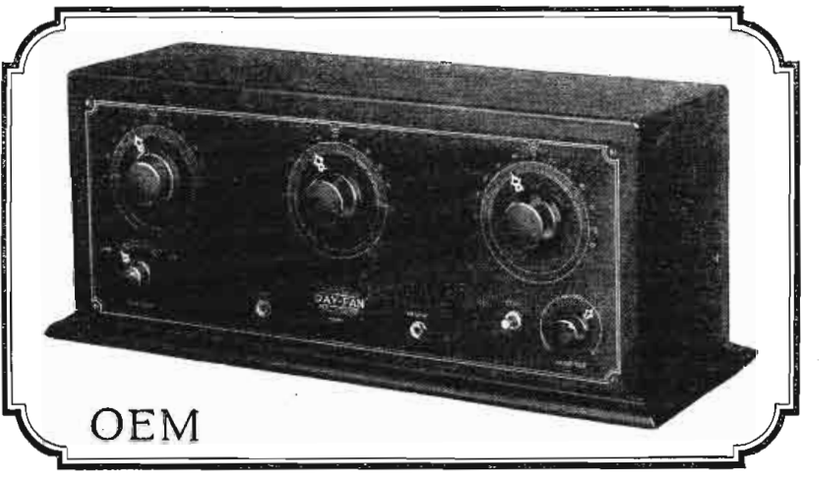
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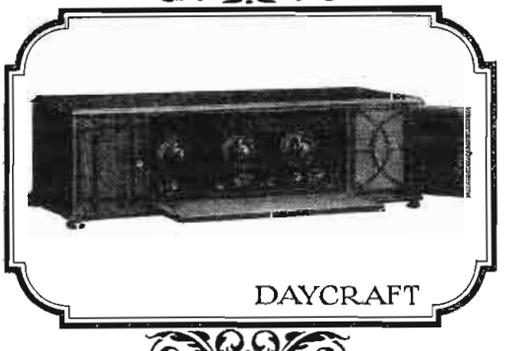
The OEM-11
three tubes $90.00



DAYOLA

The DAYRADIA complete (except tubes) with A & B batteries and special silent, built-in recharging equipment . . $225.00

The DAYOLA with B battery compartment . . $125.00



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The DAYCRAFT with built-in phonograph loud speaker and B battery compartment . . $160.00



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EVERY set, regardless of price, has that important and distinctive DAY-FAN achievement.

ALL DIAL SETTINGS THE SAME FOR EVERY SET, EVERYWHERE, ON EVERY ANTENNA

You don't have to log DAY-FAN sets. A complete list of all stations with corresponding dial settings for the wave length is given with each set. Simply turn the pointers to desired station—and listen in.

There is a model for every taste and purse, and each one embodies the same remarkable qualities of tone, volume, selectivity, simplicity of operation and beauty which distinguish the DAY-FAN OEM Receivers.

Write for literature.

The DAYTON FAN & MOTOR CO.
Manufacturers of High-Grade Electrical Apparatus for more than 35 Years
DAYTON, OHIO.

Dear Mr. Martin:

" . . . I am anxious for you to have a good loud speaker so that the reproduction of the music will be at its best for you, so that you, as a music critic, will not be disgusted with radio music. Last week I got a Thorola from the Reichmann Company of Chicago and I am so struck with this speaker that I am writing this, my first letter of endorsement of a radio part."

(*Signed*) L. A. NIXON
General Manager, THE RADIO DEALER

MR. MARTIN of the New York World is not the first music critic Thorola loud speaker has challenged in radio's behalf. Thorola raises radio beyond comparison with mere reproduced music. Thorola renders *music itself*, just as surely as instruments before the microphone. Artists pronounce Thorola "the pipe organ of loud speakers" for its matchless combination of purest tone and greatest volume, made possible only by exclusive betterments.

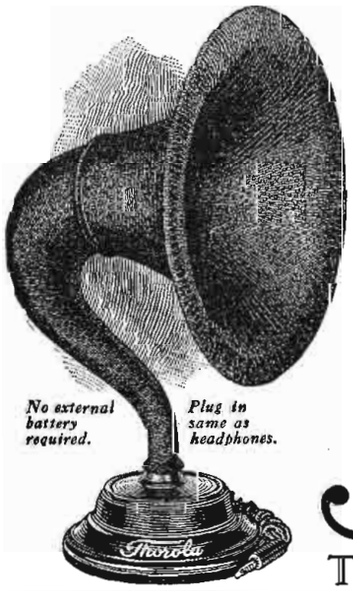
The Thorola Controlled Mica Diaphragm embodies the most advanced acoustic principles ever applied to a radio reproducer. The Thorola Separix literally assorts vibrations, preserving the tonal blends and shades vital to real music. Thorite horn compound, itself a supreme achievement, ends "sound interference" by the horn. And the Thorola Synchronizer perfectly balances Thorola in your set, just as every other circuit factor must be balanced for perfect reception.

Expect new stations pure and strong, from superior Thorola amplifying efficiency. Bring in only the original music, speech or entertainment with Thorola acoustic improvements. Thorola is guaranteed to fulfill every claim, by America's pioneer loud speaker manufacturer.

REICHMANN CO., 1729-35 W. 74th St., Chicago

Thorola demand outpaces distribution. If your dealer is not stocked, we ship any model direct upon receipt of price listed.

THOROLA 4 . . . $25
THOROLA 6
Phonograph Attachment $15
THOROLA 9
Cabinet Loud Speaker $40
THOROPHONE
Powerplus Speaker . $45

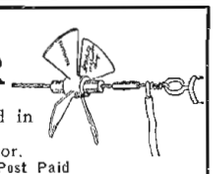


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Experimenter Publishing Co., 53 Park Place, N. Y. C.

and the introduction of feed-back, of course, increases the strength of the carrier wave.

Another thing which starts the circuit buzzing is the actual incoming signal when receiving telephony. The modulated incoming signals are rectified by the detector and produce an audio frequency current which modulates the carrier wave and so perpetuates the audio frequency oscillation.

Very often a tube may have the reaction so tight that an incoming strong signal will set the tube oscillating, and once the tube oscillates at radio frequency it is very liable to start oscillating at audio frequency, due to the effect which has just been described.

(*To be continued*)

Correspondence From Readers

(*Continued from page* 1183)

sion from reading Mr. Hipple's article that the invention is free as air. On the contrary, I aim to protect my interests. Kindly publish this.

JOHN E. DAVIS,
105 Reade Street,
New York, N. Y.

THANK YOU

Editor, RADIO NEWS:

Just a word of commendation and congratulation on your magazine. Without doubt, RADIO NEWS has earned the first place among the numerous radio magazines.

It is not only really worth while to the amateur, but invaluable to the dealer, on account of its up to the minute policy in radio and radio advertisements.

FRANK MCDONALD,
64 Caledonia Street,
Stratford, Ontario, Canada.

WOW!

Editor, RADIO NEWS:

I see by the papers that Radio has supplied the English language with several hundred new words.

Can you give me the ones that are used when your neighbor's oscillating receiver chimes in on the concert you are enjoying? Also I'm sure there are a great many new ones to be used when accidentially burning out a set of tubes and just where should the emphasis be placed on these words?

This information it seems is very much needed by the radio fans, especially by me.

Sincerely yours,
DR. GEO. E. HORNE,
Stanton, Mich.

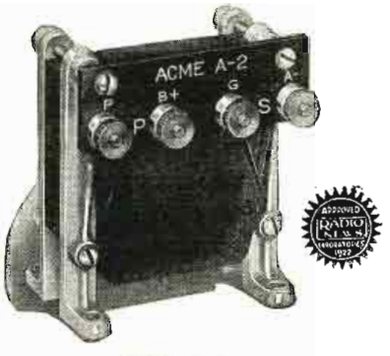
WE SHOULD DISCHARGER

Editor, RADIO NEWS:

In discussing the following question: "If the tube went out, would the lightning arrester?" on the bottom of page 794 of the November issue of RADIO NEWS, kindly permit me to call your attention to some phases of the case which you no doubt have overlooked.

No doubt the tube went out on short notice, soon after the grid leak, and as long as Radio set back and remained silent, when ordinarily a loud speaker, why shouldn't the lightning arrester? Possibly the tube knew filament to charger about being soft and blew out before she could switch on bakelite. Of course, all we can do now is have Volt and Ammeter down at the Battery, and let Galena detector, but in the meantime she may phone Jack, or let Microphone, then wouldn't Grid condenser? Then again, how are we to know if Coupler rotor, which would lead to further interference? There is ground to suspect this.

Low losses and Amplification go *hand in hand*



ACME A-2
Audio Frequency Transformer



ACME R-2, 3, 4
Radio Frequency Transformer



ACME .0005 M.F.
Low Loss Condenser

THE energy that your antenna or loop receives is at best only a little. Every bit of this energy you can save is the same as amplification. No matter what the circuit, you must have both low losses and amplification so that your loud-speaker can reproduce the distant stations loud and clear.

Acme Apparatus insures low losses, and amplification without distortion, for any circuit.

To get low losses, just replace your present condenser with a new Acme "lowest loss" condenser, and to get amplification without distortion, use Acme Transformers. Then you will get ten times the fun tuning in distant stations. You will get everything on a loud-speaker so that a whole roomful of people can hear and you will be able to enjoy all year 'round radio.

Send 10 cents for 36-page book, "Amplification without Distortion," containing many diagrams and helpful hints on how to get the most out of Radio.

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ACME ~for amplification



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Trimm "Professional" Headsets are the unanimous choice of those to whom radio means more than mere entertainment. Dr. Donald B. MacMillan tested headphones for clearness, distinctness and sensitivity before leaving for the Arctic Regions. That he used, and recommends, the Trimm "Professional" Headset is sufficient proof that it is the best available.

Highest quality construction throughout. Bi-polar type. Magnets forged from tungsten steel. Coils wound to full 3000 Ohms. Lifetime guarantee of perfect satisfaction goes with all Trimm Reproducers. Have your dealer demonstrate them to you.

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The Whittlesey System of Aerial Support consists of Self-Supporting Fabricated Steel Masts Shipped in Sections, Mast-Head Pulley, Cable and Hoisting Reel—the painter's "elevator." No Guys, Ladders or Platforms. These masts are solid, stiff, rigid and beautiful. 50-75-100-125 feet. Self-Supporting Broadcasting Masts erected anywhere, any height, any strain required. The Whittlesey Engineering Co., Cleveland, Ohio.

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One of the first and still in the lead.
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Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

To sum it all up, it would look as though we had better let a copper conductor ohm, and leave Neut and Heterodyne in peace. Believe Antenna would receiver and be able to control and transformer without much resistance. The case is now as clear as crystal.

As a subscriber to RADIO NEWS and a radio nut, would like to know watt you think about it.

K. V. PROCTOR,
2821 Wayne St.,
Erie, Pa.

RADIO IN THE PHILIPPINES

Editor, RADIO NEWS:

Just a word about radio in the Philippines. We have quite a few amateurs and three broadcast stations. Radio is getting more popular every day and it is a common sight to see wires strung over a nipa shack. The government is planning several 500 watt stations so that the provinces may have news of the world without having to depend upon the poor telegraph service. Of course, there are some 20 radio telegraph stations at the present time all over the islands. The static is always bad and most of the time it's worse. It will be a long time before radio is as popular here as it is in the States because the average Filipino's income is not large enough to permit him to buy a set. Let me add that RADIO NEWS is by far the most popular magazine on the market here. I hope that this letter will change a few people's opinion of the Philippines.

J. C. MACDONNELL,
Qrs. 36, Ft. McKinly,
Rizal, P. I.

P. S.—The Reinartz circuit takes the cake.

MORE ARCOVERS

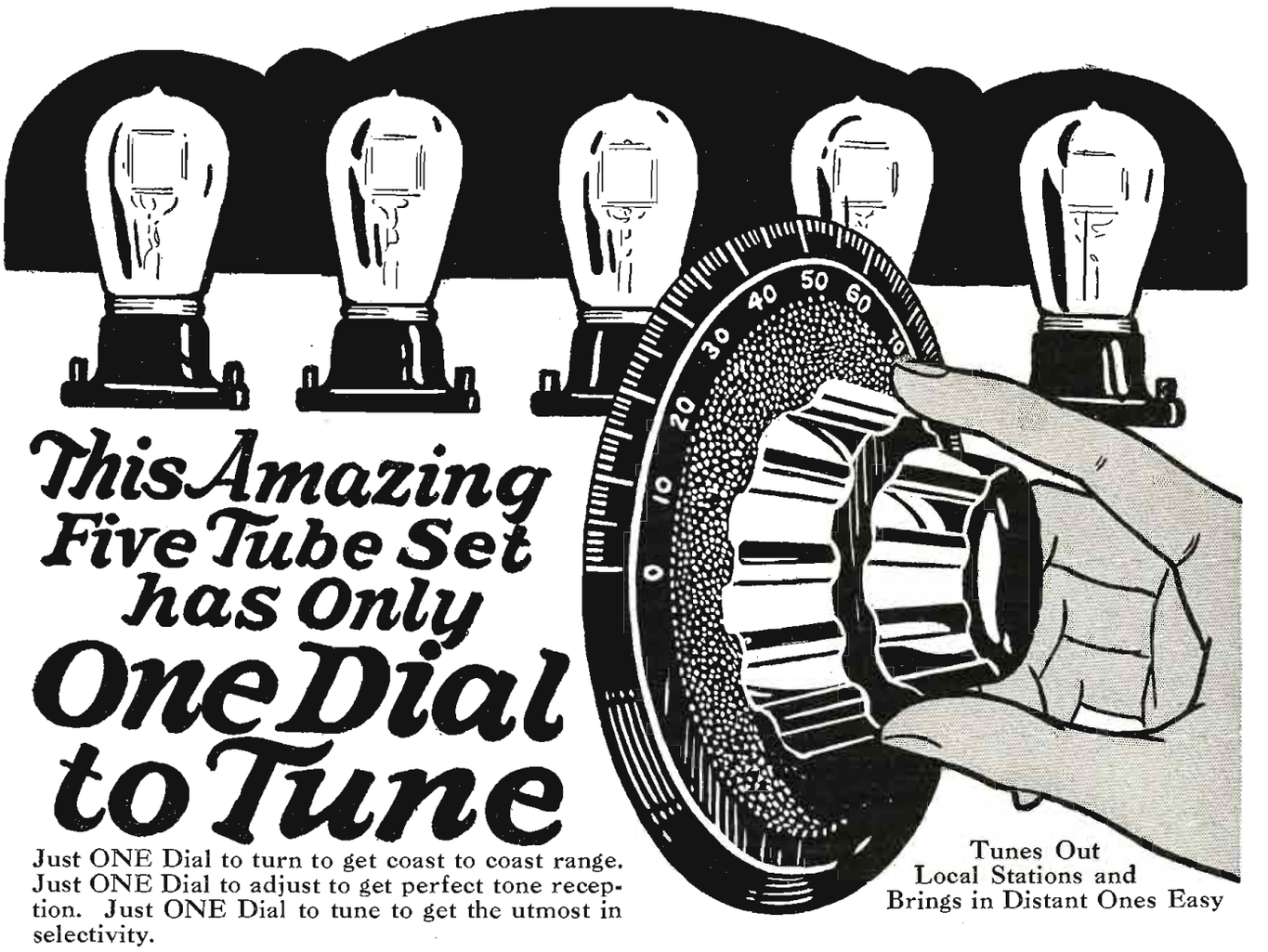
Editor, RADIO NEWS:

After reading Mr. Bront's comment on the workings of the arc stations KDWH and WBN, I would like to inform him of what other arcs are doing. I really cannot see where the communications of the KDXE were exceptional enough to warrant writing about them.

The S.S. *Southern Cross,* plying between New York, Rio de Janeiro and Buenos Aires, is equipped with a 5-kw. Federal Arc, which also *works.* There isn't much use having an arc which cannot work with KFS from the Gulf. Everyone does it without much trouble. For instance, the KDKK, S.S. *Minnekahda,* has worked with KFS from mid-Atlantic, 5-KW I.W.T. arc.

We have an arc which does its stuff regularly enough also. We have worked with KFS more than once off the Brazilian coast, and some nights have worked with BYW, Gibraltar, right afterwards. This is no mean distance, but the KFS is a very good C.W. station. We have worked with WSH, Independent Wireless Co. station, 2,300 miles, in mid-afternoon, and up to 3,900 miles at night. With WCC, at Chatham, Mass., R.C.A., we did 3,300 miles after the sun was up. GKU, the English station at Devizes, has been worked from down here a few times also. And NBD at Bar Harbor, Me., used to have a good arc; he was picked up many times at 3,500 miles and held, northbound. He has a tube now and we can't even hear him half this distance. You must consider that it is very seldom we have a decent C.W. night, what with the QRN steady and QRM from the Amazon high power spark stations up to 70 k.w., which they need to push through the static.

There are four U.S.S.B. Munson liners on this run, all arc equipped. With the S.S. *Pan America* (2 k.w. arc), we invariably communicate up to 2,500 miles. We usually raise them at this distance in the middle of the day. They have a 2 k.w. arc which works too. Remember, this is the east coast;



This Amazing Five Tube Set has Only One Dial to Tune

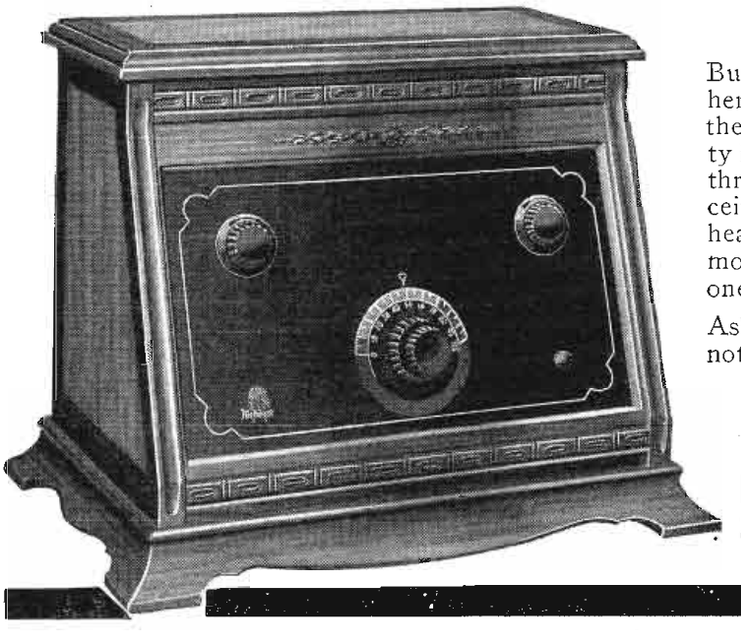
Just ONE Dial to turn to get coast to coast range. Just ONE Dial to adjust to get perfect tone reception. Just ONE Dial to tune to get the utmost in selectivity.

Tunes Out Local Stations and Brings in Distant Ones Easy

HERE—at last—is a five tube tuned radio frequency Receiver with a decidedly different and distinctive simplicity of design. It is a beautiful set—beautifully made—and with its simple one Dial Control it will do anything any other five tube set will do—and do it easier, quicker and better.

Just one Dial to turn on the MOHAWK, and as you turn it you tune in station after station covering the complete range of radio broadcasting wave lengths. It cuts out the nearby stations with ease and brings in the distant ones clear and distinct. You can operate it with an aerial of any length—inside or outside—without making adjustments and it will give satisfactory results under varying conditions.

The Mohawk 5-Tube Receiver



Built in a distinctive period type walnut cabinet, here is a Radio set which will instantly appeal to the artistic taste of the most critical. Yet its beauty is not "only skin deep." The quality goes clear through. If you want the last word in Radio Receiving Sets, don't fail to see the MOHAWK—hear it, and try it before you buy. You might pay more for a Radio set—but you cannot buy a better one than the MOHAWK.

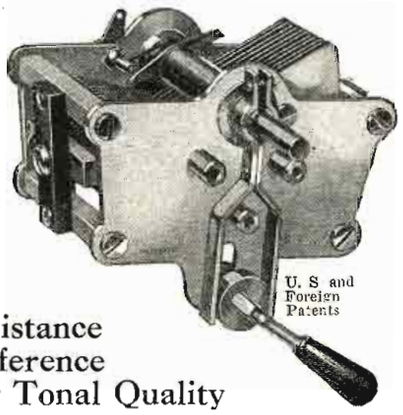
Ask your dealer about the MOHAWK. If he does not have it—accept no substitute. Write us.

FREE We will gladly send you, on request, our FREE descriptive folder giving complete information and prices on the New MOHAWK and its amazing ONE Dial Control.

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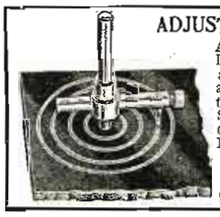
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Experimenter Publishing Co., 53 Park Place, N. Y. C.

receiving conditions are not very favorable. We have held the S.S. *George Washington*, KDCL, until she reached the English Channel, while we were bound north from Rio. KDCL has a 20 k.w. arc aboard. KDTZ gave SPY, Rio tube station, his daylight record, at about 1,800 miles.

Our chopper has never been used for anything except compass bearings; we get an accurate bearing with it. But speaking of chopper records and distances, we may refer KDXE to what WHL and WHM, the *Sonoma* and *Ventura*, do out on the Australian run with theirs. They generally work up to 4,000 miles, which is chopping pretty well, we think. Yes, the only way to work an arc is the right way, as Mr. Bront said. We hear a lot of these record breaking arcs who like to buzz along, but what they need is a receiver, as we find that not much time is utilized for receiving.

We might add that, one night down here, we got hold of IDR, near Rome, Italy; just had him started when he broke and never finished. Have always thought that when he realized where we were, his "fingers went speechless" and he couldn't finish.

J. A. STASSI, Chief Operator, KDTZ,
D. STURGELL, 1st Asst.,
G. BERMAN, 2nd Asst.

A LESSON IN HOW TO BEHAVE

Editor, RADIO NEWS:

I have been reading with great interest the letters and articles published in RADIO NEWS during the past year or so, written by operators and Mr. Howard S. Pyle and at one time a letter by a captain regarding the fall in dignity of the profession of commercial operators and, according to one captain, their uselessness and conceit.

Being an operator myself, I wish to say a few things which I believe may be of help to many young men who are just entering the game or contemplating such a step in the near future.

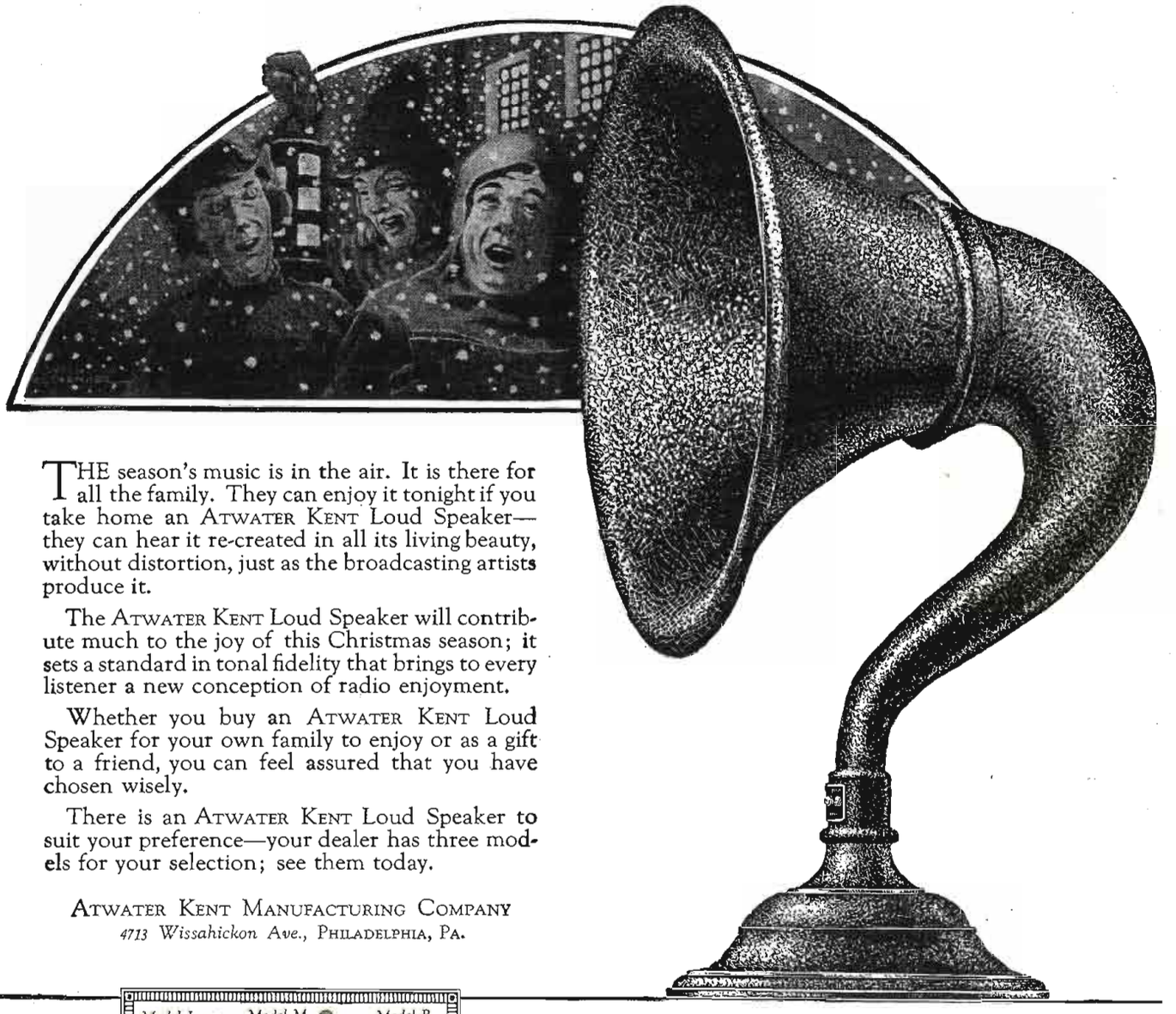
There is no doubt whatsoever but that every operator, sooner or later, comes in contact with a captain who is unbearable. There are some who believe that they are "high and mighty supreme rulers." "I am the MASTER!" This, to them, models whatever deed or desire they may have as perfect. They are ever in the right. Infallible! A captain has, and should have, the undeniable word of authority. No one wants to take this right away from him. It is his just due. But this is no reason why a captain should exercise this privilege to make himself an atrocious tyrant. Some of them do, but "thank whatever gods may be," these are a very small minority of the whole. Life on shipboard with this type of captain is unpleasant for all concerned, and the operator generally comes in for most of his spleen. There is but one solution to this problem when working on a ship so captained, and that is to sign off, bag and baggage, as soon as the ship returns to the home port. Life is too short to waste part of it in such an environment.

There are other captains who cannot see how an operator can earn his pay by sitting down all the time. They want you to practice with a chipping hammer, "play around" with a paint brush, fix all the run down fans, lights, etc., aboard the ship. A general utility man, one to do the small tedious jobs which the mates and engineers dislike. One captain whom I know expects the operator to make all the store lists, of all departments, crew list in every port, write all his letters . . . in fact, all work that can be done on the typewriter. When in port, the operator is supposed to go to the Hydrographic office for the necessary charts and marine data, exchange the library books, buy him some socks and collars, procure money orders required by him, and so on.

A new operator in the game is likely to soon find himself the general messenger boy

ATWATER KENT

LOUD SPEAKERS



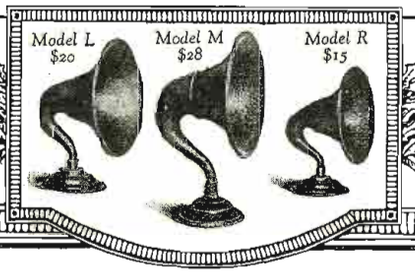
THE season's music is in the air. It is there for all the family. They can enjoy it tonight if you take home an ATWATER KENT Loud Speaker—they can hear it re-created in all its living beauty, without distortion, just as the broadcasting artists produce it.

The ATWATER KENT Loud Speaker will contribute much to the joy of this Christmas season; it sets a standard in tonal fidelity that brings to every listener a new conception of radio enjoyment.

Whether you buy an ATWATER KENT Loud Speaker for your own family to enjoy or as a gift to a friend, you can feel assured that you have chosen wisely.

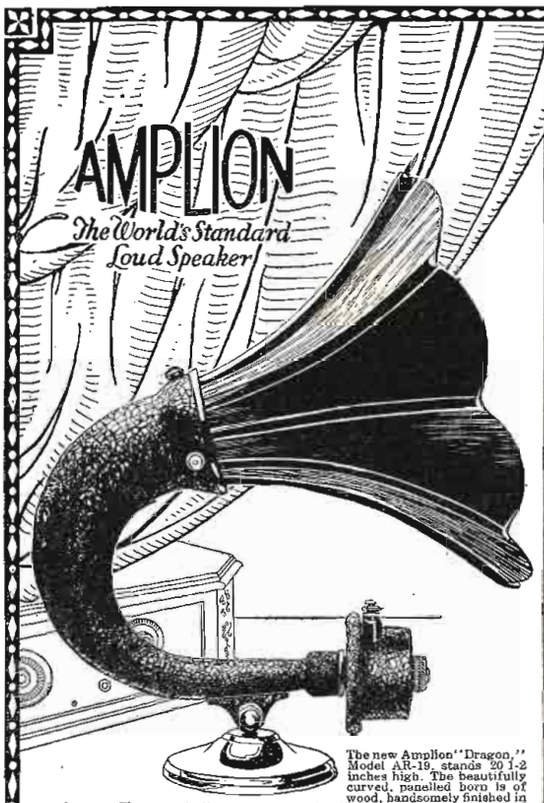
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In 1893—Graham Loud Speakers commercially produced.

In 1894—Graham Loud Speakers first used in the British Navy. Graham transmitters applied to phonographs for loud speaking reproduction.

In 1896—Graham loud speaking naval telephones adopted by the British Admiralty.

In 1898—Graham Watertight Loud Speakers patented. Placed on many warships and mercantile vessels throughout world.

In 1902—Complete Graham Loud Speaker installations, on central battery plan, erected on warships as the sole means of communication aboard ship.

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In 1920—(Long before other loud speakers were thought of!) "AMPLION" Loud Speakers produced for wireless by Alfred Graham & Co. "AMPLION" trade mark registered.

In 1922—AMPLIONS adopted as standard equipment by leading makers of radio sets abroad.

In 1923—AMPLIONS introduced into the United States, Canada and remaining portions of the world.

In 1924—Impossibility of importing AMPLIONS fast enough to supply demand made it necessary to form The Amplion Corporation of America to market and manufacture AMPLIONS on this side.

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Amplion "Dragonfly," AR-102, $13.50

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The Amplion is their development.* You have only to see it, *to hear it in comparison,* to understand why it has become the largest selling loud speaker—the favorite of music lovers in all quarters of the globe

For sensitivity, clarity and natural tone throughout the entire musical range—for volume without distortion—the Amplion is supreme. As your ears will testify. You will never know the true merit of your set until you hear it over an Amplion. A treat awaits you. Visit your dealer's store for a comparison. Literature on request.

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for all the officers on the ship, if he does not draw the line very quickly. There is no reason why an operator should not be accommodating to a certain extent. When asked to help, and he can render aid and service to someone, he should use common sense in complying with the request. There are occasions when a little manual labor will not only raise him in the esteem of others, but he may gain a friend who will be pleased to help him when he needs it. I worked one afternoon with the chief engineer and mate, looking for a ground in one of the lighting circuits. It was a diabolical case and caused much trouble. Knowing that I knew a little of electricity, the mate asked me to help them locate the trouble. It happened to be my luck to find the short circuit. About two months after this incident, I faced an utter failure in attempting to make my generator produce the necessary voltage. Everything tested out O. K., but still the voltage was far below its required force. The chief engineer spent five hours with me to fix this trouble, and he worked, too. I do not believe I would ever have been able to fix the generator without his help.

Thus, one good turn was reciprocated by another. The golden rule holds fair in the radio field as well as in any other walk of life. There should be a sense of proportion, a balanced relationship between all departments on board a ship. One fellow can often assist another.

There is one point, however, which is beyond remedy; namely, the shadow of contempt held by those who work with their hands for those who work "sitting down." The man who does manual labor, very often looks down upon the man who only uses his head, the man who holds what is commonly known as the "white collar job." When you search into the depths of this contempt, you find that it springs from jealousy. Therefore, why bear any ill feeling? The poor devil who harbors such a complex is to be pitied—it shows a weakness in his character.

Now is the time for all operators sailing on the seas, in the service of the merchant marine, to bring the radio profession up to a state of dignity. Let every operator do his best to render the maximum degree of service possible. Let him stand up for his rights and command respect as an officer, but avoid being conceited and overbearing in doing so. He will then be treated as an officer. He should attend to his duties in an irreproachable manner, never interfere in the duties of others, nor allow others to interfere with his. Be congenial but respective with the other officers and refuse to fraternize with the members of the crew, without being snobbish, and he can come and go from ship to ship without being made a fool of, or being a fool. The day has dawned in which we must all endeavor to raise the radio game to the standard of a decent profession, trade, or occupation, as you will. It must be diverted from the possible fall of making the radio man a "general utility man." On the other side, we must not cultivate an air of aloofness. As a man is and acts, so he is upheld and treated. The main factor lies in the hands of the operators themselves to make the radio operator the "Radio Officer" or to see the radio operator fall to the stage of the "ordinary seaman who operates the radio." Which shall it be? All right, the first you say? Well, let's go!

PAUL E. MILLER. Opr.,
SS. Edward L. Doheny Junior,
Cristobal, C. Z.

A TRIVIAL MISTAKE

"Does your wife know anything about your radio?"

"No; I told her I needed a new head-set and she thought I meant a set of teeth."

—Contributed by Les. Van Every.



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"Wish to congratulate you on the one-tube Crosley 50. Have listened to Havana, Cuba, and as far west as Oakland, Los Angeles and San Francisco. This is what I call a wonderful set."

Rockville, Maryland. October 1, 1924.
"I thought it would interest you to know that on September 15th, I received Oakland, California, on my two-tube Crosley 51. That station is 2434 miles from here. I had a hard time making my friends believe it until I wrote to California and had them verify what I heard. As soon as I can afford it, I expect to get a Trirdyn."

Olney, Illinois. October 15, 1924.
"I'm getting stations from New York to Seattle, Wash., on my Trirdyn. Monday night, October 13th, I received clearly and plainly the announcer and music from Honolulu, Hawaiian Islands, 7,000 miles away. My machine is not for sale."

(Names upon request)

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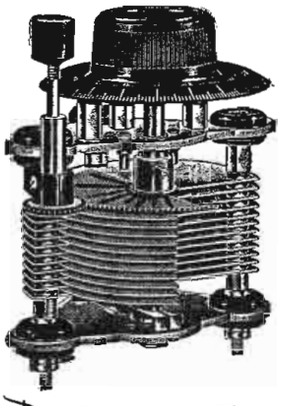
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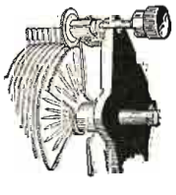
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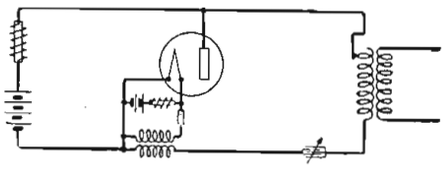
Ordinary adjustments reduced by separate geared adjustment to hairbreadth distinction. We guarantee the Heath Vernier Condenser to be more highly selective than any condenser employing a vernier which actuates ALL of the plates.



New Radio Patents

(*Continued from page* 1186)

an electric discharge device having two electrodes. This invention may be briefly described as comprising an electron discharge device having a cathode comprising a heated filament or other electron emitter, an anode or plate, a heating circuit for the filament or emitter and an oscil-



lating circuit connected between the electrodes and coupled to the filament heating circuit. An oscillating heating current will, therefore, be supplied to the filament and its electron emission rate will vary with the current.

The Significance of Rays in Physics

(*Continued from page* 1161)

is not equally sensitive to all waves. For instance, at a temperature of 1,260 degrees centigrade, we will receive a very small amount of energy. While at intermediate wave-lengths from two to three one-thousandths of a centimeter, it would respond strongly.

If we increase the heat of the body to about 1,650 degrees centigrade, the energy received increases, and obtains its maximum.

This experiment having given us some idea as to the limits of the field of radiation, we will try to express in a single formula how the radiated energy at various temperatures is divided among the different wave-lengths. To this end, it is simply necessary to picture the operation and peculiarities of the oscillator producing the radiated waves.

The attempt has often been made to show the relation between the heat of a body and the frequency of the emitted waves. Such attempts date back to Lord Rayleigh and Jeans, but the laws formulated by them dealing with radiation do not give the relation shown in Fig. 2, which was arrived at experimentally.

First of all, the celebrated Max Planck succeeded in finding the correct solution based on an extremely ingenious idea, which has become the corner stone of all modern physics.

It is known that the energy of an oscillating receiver is given by the formula $\frac{CV^2}{2}$ where C is the capacity and V is the voltage impressed upon it originally. These various energies are radiated by the oscillator by the damping of the waves in the form of a definite frequency. Following out the formula, it will be found possible to restrict the radiated energy to as small amount as desired if the oscillator and the potential are kept low enough. At least, such must be the usual procedure as long as we accept a definite division of the energy.

A very interesting comparison may be made between the ordinary radio antenna and the small heat "antenna." It is a more or less well known law that the radio aerial sends out waves in the neighborhood of four times their own length. If this same law is applied to the oscillators sending out the heat waves we find that, since the heat waves liberated at 1,650 Centigrade have a wave-length of approximately two-millionths of a meter, the small oscillator generating such a heat wave must have a dimension on the order of a millionth meter. The powerful field surrounding a heated body is set up by billions of such small

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When B's start to run down their current gets jumpy, and there's a crash or a sizzle in every jump.

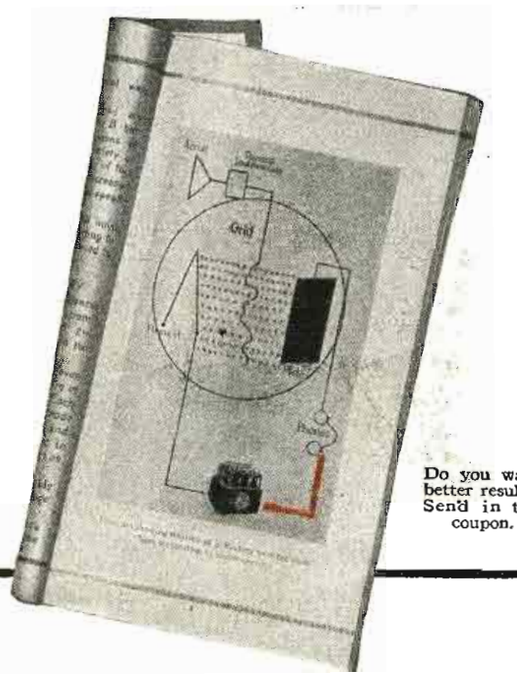
I used to think that Old Man Static made these noises until I got my Willards and listened to the difference.

Take my advice, Jim—get Willards. You can depend upon *them* to give steady current for a long, long time. Willards require very little recharging, and you can do that right at home with an inexpensive little rectifier in circuit with an ordinary light bulb.

Why keep buying batteries when Willards *last for years*, and give better results?

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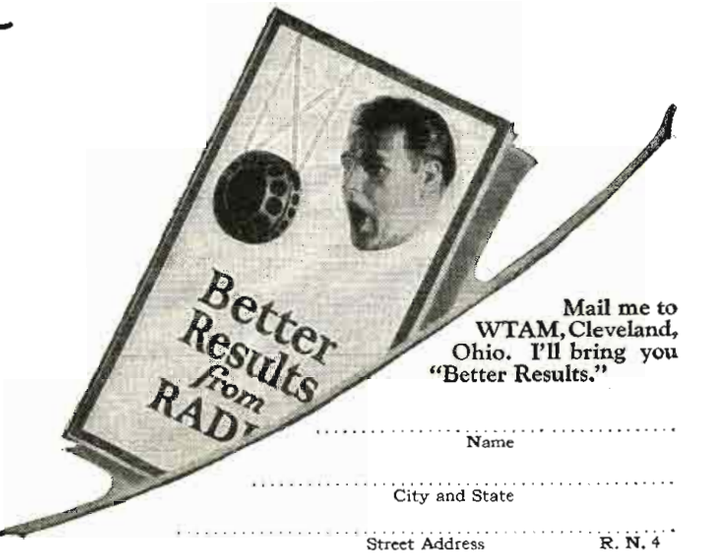
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oscillators, all of which derive their energy from the heat added to the body.

As will be shown later, it is known that every body is made up of single atoms and molecules which consist of positive and negative charges or electrons. The temperature increase of the body causes these small bodies to increase their rate of vibration causing them to come in contact with each other, this giving rise to electromagnetic waves. The energy content of each oscillator is not always the same, many will have an abundance of energy, while another one will have only a small amount. It is evident from this conclusion that we may come to an erroneous law concerning oscillations. If their energy content is unequal they will not generate equal oscillations. Actual experimentation proves that an entirely different set of circumstances arise than those which we would be led to postulate from the above statements.

And here is where Planck comes in: He made the all important step forward by the ingenious hypothesis which states that the oscillators can emit energy not in any given quantity but only in exactly regulated amounts.

This law of his is in exact agreement with the results obtained from experimentation. Planck holds that energy, like everything else has somewhat of an atomic structure, that there exists the smallest possible quantum of energy which may be divided no further, that all energy is composed of exact multiples of this small quanta. So it follows that the small oscillators may send out only this quanta of energy, or an exact multiple of it.

Modern physicists have long accepted the atomic theory of matter, but when Planck first published his theory of quanta, many of the physicists of the old school looked upon it as too revolutionary. As time passed, however, the hypothesis proved itself so wonderful that all the latter day investigators have taken it as a part of and, indeed, one of the foundation stones, of the new physics.

Simply stated, the law, as laid down by Planck, is: The energy, which an oscillator of the frequency v may radiate be only of the dimension nhv, where n is any whole number, and h is the known constant or so-called working quanta. Planck calculated this constant during the course of his experiments and found it to be: $h = (6.55)10^{-27}$ erg. per second.

It will now be of interest to calculate the value of the energy quanta for some rays of known wave-lengths.

For wave-lengths of
100 meters hv equals 2.10^{-20} erg. (Radio.)
1 meter hv equals 2.10^{-12} (Heated bodies).
0.5 M hv equals 4.10^{-12} (Visible light).
1. A hv equals 2.10^{-8} (X-rays).
0.01 A hv equals 2.10^{-0} (Gamma rays).

From these figures we must understand the following: If a radio station with a wave-length of 100 meters sends out, say, 200 watts, it will radiate 10^{20} quanta of energy each second in the form of electromagnetic rays. This is an inconceivably large number.

In the first article we saw that the eye, in good condition, is able to respond to energy of the order of 10^{-16} watts. By mathematical investigation and experiment it has been shown that at least 250 quanta must reach the eye per second to give a perception of light. If we take the quanta as a unit, obviously, the eye is a rather inefficient receiver at best.

If we have conceived the relationship between radiant energy and the frequency of the oscillator it will be of interest to picture to ourselves the distribution of the energy field of the oscillator. Heinrich

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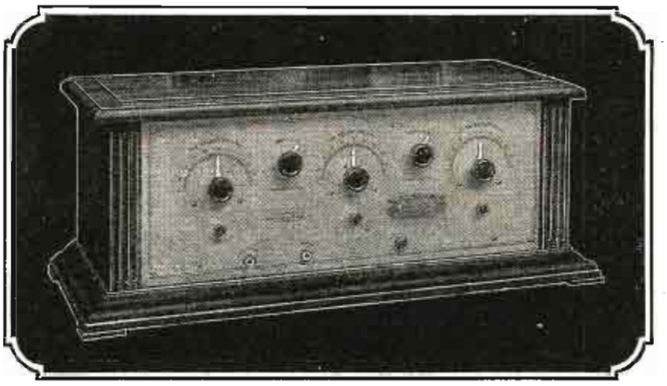
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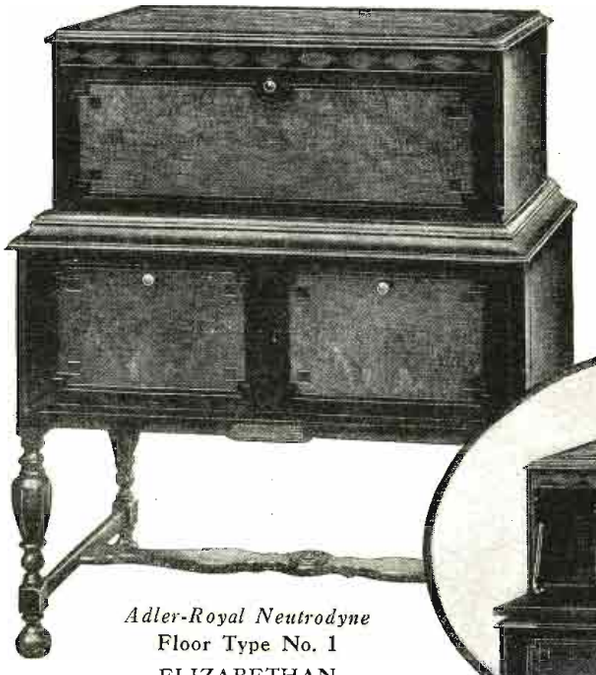
Although this view was held pretty solidly by all the leaders in the field, experiment has lately led to some belief in a deviation from this rule. We have already learned the action of light in setting free electrons. If we take gamma rays of some radio active material such as the source of our light, we know that the action of the shortest rays known will set electrons from any sort of matter with almost the velocity of light. It is very remarkable that the kinetic energy of such an electron is almost equal to the accumulated energy which is present in the entire radiant field of the gamma ray. According to classical theory, the electron would only take up a very minute fraction of the homogeneous divided energy of the field, expressing the fraction of the flux energy in the range of the electron.

To clear up the huge clash with the classical theory, it will be necessary to go to the exceedingly ingenious hypothesis that the radiant field of an atomic oscillator is not homogeneous, but has a structure far different from the spherical one. The energy, according to this hypothesis, is limited to the exceedingly thin radii or needles. Such a radiation, opposed to beam radiation, is called needle radiation.

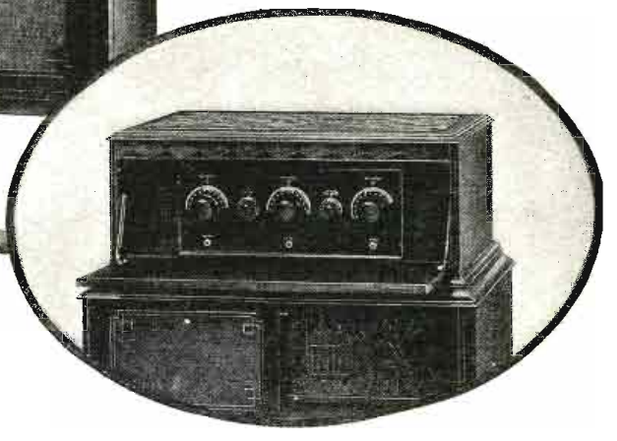
According to this presentation, a radiating atom would send out its radiant energy of one moment only in a definite direction in the form of a beam full of radiating oscillating energy, and if this falls upon an electron, all the radiant energy contained in the beam will be converted into kinetic energy of the electron; if we have, however, to deal with the combined operation of an extraordinarily large number of radiating atoms (as in our everyday source of light) as a result even in the emanations of single atomic oscillators giving out needle rays, an apparently homogeneous radiant field will result, which can account for a diminution of energy with the square of the distance from the center, but cannot account for the interference phenomenon.

We see old firmly founded experiments of interference pleading for a homogeneous radiant field, while new and no less carefully carried out experiments plead for the needle rays, and both conceptions taken by themselves are not consistent with each other. A curious condition which brings clearly to our knowledge that just as the study of electromagnetic rays has left the firmest foundations of classic physics, yet by new experimentation has given weapons to our hands to throw down and undermine these old and firm foundations. This will always be the condition of a philosophy, and does not content itself with past achievements, but sees a hopeful evolution of its structural knowledge in the future.

(To be continued)



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Adler-Royal is on exhibit only at the higher class stores whose reputation is an additional guarantee of the quality of the Royal line.

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General Sales Office: 881 Broadway, New York City
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Adler-Royal
NEUTRODYNE

Licensed by Independent Radio Manufacturers, Inc. NEUTRODYNE Reg. U.S. Pat. Off. Trade Mark 1st March 27 1923 and April 1, 1924 Hazeltine Pats. Nos. 1,450,080 and 1,489,228 Other Patents Pending.

The Adler-Royal Neutrodyne is licensed under the Hazeltine Neutrodyne Patents and manufactured for us by King-Hinners Radio Co.

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Only 5 inches high

Tonal Perfection in a midget Loud Speaker

Reflectone is pleasing on the smallest table, or a smoking stand. Yet, whether for concert restraint, jazz abandon, or speaking voice modulation, the big volume of this five-inch-high loud speaker is as astounding as its improved clarity and purity of tone.

Because sound is scientifically reflected from one tonal chamber to another, a unique construction which also eliminates distortion and amplifies the sound—*big*.

Reflectone is as beautiful as it is small and efficient, therefore at ease in any room of tasteful appointments.

Made of beautiful, highly polished material simulating tortoise-shell.

$8.00

At your dealers, otherwise send purchase price and you will be supplied postpaid.

Write for descriptive circular

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Reflectone

THE MIDGET LOUD SPEAKER WITH THE GIANT VOICE

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As large Wholesalers only and carrying stock in eight largest Cities in Australasia, we can give standard Lines exclusive representation. Send us your catalogue; and samples by Parcel Post, which we will pay for or return.

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Other types carried in stock.
No. 9037 Legless Key, Polished Brass Body.....$6.00
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The Old Chief Speaks

(*Continued from page* 1187)

the wireless cabin, our quarters and the mess hall. We were permitted the same liberties as the other officers—a discreet mingling with the passengers in off time, but upholding the dignity of the ship at all times.

"There were no youngsters among us then—that is, we were all between 22 or 23 and 30, with a few older men. Those of the younger men were carefully chosen and were boys who were capable of conducting themselves in a dignified, manly fashion. They were easier to find at that age then, than among our present day modern 'sheik' class.

"Well, I stayed with the old ship for two years, and never once did I overstep the bounds of ship discipline—had I done so, I would probably be selling boots and shoes today. At the end of that period, I was assigned to a berth at one of the few shore stations then existing.

"It was not long after this that shore stations began to sprout up at numerous points along the coasts. The Navy became very active in this way, and numerous naval vessels were rapidly being equipped. The commercial interests were slower, but soon afterward came the *Republic-Florida* disaster, which opened the eyes of the steamship men to the possibilities of wireless and it was not long before a mad scramble commenced for equipment and operators. Apparatus could be turned out readily enough by merely increasing production at the factories, but operators were far from plentiful. The operator situation became acute directly afterward, when the radio communication laws went into effect, introducing Continental code and requiring a license. Many of the older men dropped out—they did not propose to go through a course of study to prepare them for jobs that they had already held satisfactorily for several years. Then the influx began. Young fellows diligently devoted themselves to code practice, hung around the coastal stations and in devious ways managed to gain a sufficient knowledge to pass the Government examination. Armed with an impressive appearing certificate and full of confidence, they applied for employment and were immediately assigned—a number to large first class liners. Until then, we older men had maintained our reputation for conscientious and industrious application to our business, but the younger element, typically 'Young America,' were determined to miss nothing, and immediately took over rights that were not theirs. Craving company, the radio cabin, formerly maintained as a telegraph office for the transaction of bona fide commercial communication business, became a gathering place for the socially inclined young people and their more curious elders. Frequently the Captain would come to the cabin to hand in a message, and was annoyed to find frivolity the rule and his message accepted with an airy nonchalance that seemed to say, 'Yes, yes. This will receive attention at some later time. I am occupied now.'

"It was only natural that such a condition should embitter the Captains, for years accustomed to the strict discipline of the sea, and a dignified conduct of all the departments of the vessel under their control. Captains grumbled among themselves and to the owners. Operators on shore leave painted highly colored pictures of the wondrous life they were leading aboard ship; how the Captain was 'working for them' so to speak, and in general inflaming the youth of the country with a desire to be wireless opera-



Anti-capacity **JACKS**



Anti-capacity **SWITCHES**



Lower-Loss Vernier **VARIABLE CONDENSERS**



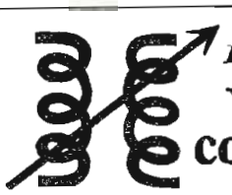
Lower-Loss **PHONE PLUGS**



Lower-Loss **RHEOSTATS**



Lower-Loss **SOCKETS**



Lower-Loss **VARIO-COUPLERS**



Lower-Loss **GRID LEAKS**



Lower-Loss **INDUCTANCE SWITCHES**

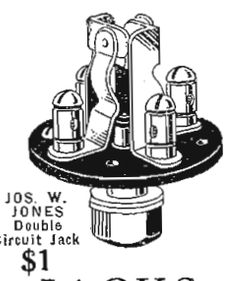


Lower-Loss **POTENTIOMETERS**

NO SOLDERING—LESS DRILLING—SCIENTIFICALLY BUILT

—and then hear the difference!

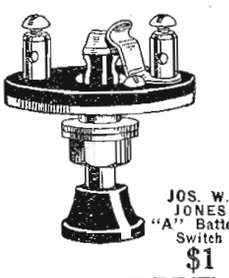
You know what you want from that better set you are going to build—longer DX, clearer tone, and no interference. The sure way to get what you want is to build with Jos. W. Jones parts. Aside from better results, it is twice as easy to work with Jos. W. Jones parts.



JOS. W. JONES Double Circuit Jack $1

JACKS
5 Types

JOS. W. JONES
Anti-Capacity



JOS. W. JONES "A" Battery Switch $1

SWITCHES
5 Types

Jos. W. Jones Jacks and Switches kill capacity effects. The old-style Jack and Switch, because of long parallel leads, act as condensers. Jos. W. Jones Jacks and Switches pass the "juice" through without the smallest loss. Always ask for the switches with the little red button.

Low loss is a feature of all other Jones parts. That, along with less drilling and no soldering.

For Better Results Build With JOS. W. JONES

Jacks Switches Variable Condensers Phone Plugs
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JOS. W. JONES RADIO

TRADE MARK.

"IMPROVED"

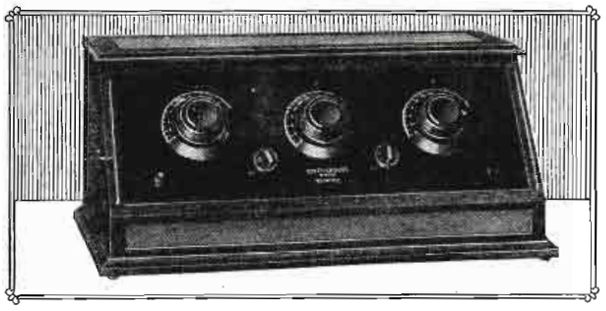
radio parts

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This wide experience, now available in the Thompson apparatus, means Receiving sets and Speakers that embody the latest and best practice in Radio Engineering.

A critical investigation of each model will disclose outstanding features of genuine effect, in artistic appearance, naturalness of tone, simplicity of operation.

Radio in the home broadens the scope of human happiness. Every day the broadcast program carries something for every member of the family.

Licensed by Radio Manufacturers, Inc. Radio Speaker NEUTRODYNE Pat. March 27, 1923 and April 1, 1924. Interference Pats. 1450,080 and 1469,318 Other Patents Pending

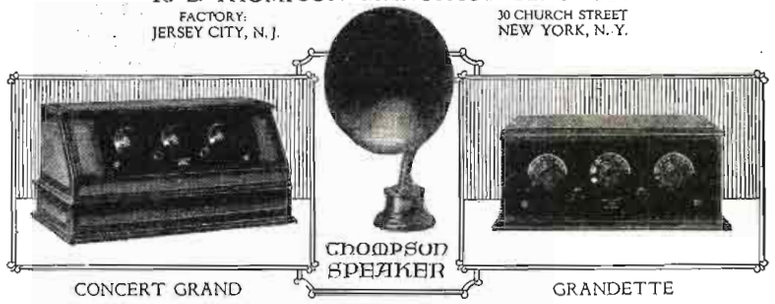
The 5-tube GRANDETTE is $125. The 5-tube PARLOR GRAND, (shown above) is $145. The 6-tube CONCERT GRAND is $180. Prices are without tubes or batteries. The Thompson Speaker, with conical diphragm and other special features, is now $28.

Write for attractive literature and name of Thompson dealer near you.

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Greater Distance. Less Noise

TURN-IT ADJUSTABLE GRID LEAK



Only $1 *at Your Dealers, or Direct From Us.*

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tors. The natural result was that hordes of young fellows got into the game, and soon each employing company had long waiting lists. There was another effect that was even more damaging than the over-riding of discipline by the operators. With such a number to choose from, and the majority craving an assignment for the 'glory' of the job—pay was secondary; it was only natural that the wages, after a short upward rise, should naturally decline. This received a feeble protest, but in view of the eager desire of the numerous applicants for ships, the action was not of sufficient strength to have an appreciable effect, and it was not long before the real old-timers quit in disgust, leaving the field to the newer element.

"Then came the World War. Thousands of the boys enlisted in one branch of the service or another; hundreds of new ships were built and again a serious shortage of operators was found to exist. The wage scale rose in leaps and bounds until finally a goodly number of the old hands returned to the game. Meanwhile numerous commercial and government schools were turning radio operators out by the thousands, but so hurriedly were they put through their courses that they were barely able to handle a light trick. The bars were down and the slightest knowledge of the code secured a man an excellent berth. Many of the operators then employed had not yet reached the shaving age, and a goodly number were in knickerbockers!

"At the close of hostilities, we were left with a large merchant fleet and thousands of operators—some good, more bad, and the great majority just mediocre. It was essential that the radio cabins be manned at once, for with the close of the war, many of the older operators returned to other lines of endeavor. But this only served to leave an enormous number of new operators—boys who had left school to enter the fighting forces and consequently had picked up wireless as their first job. They had no other to return to, and, therefore, our post-war supply of operators was largely drawn from the ranks of these boys.

"Many had rubbed elbows with some of the newer pre-war men, and had listened to their glowing tales of life aboard a passenger vessel. The word passed, and as these boys were assigned, they immediately attempted to take possession of the social activities of the ship. For several years thereafter, and even at the present time, the turn-over in operators has been terrific. Where, in the old days, we often remained on one vessel for a year or more, the modern Romeo of the sea makes one trip, resigns either on his own volition or by request of a greatly harassed skipper, and goes blithely on his way to conquer new fields.

"Just how this affects us of the coastal stations, may be a bit hazy to you. Let me explain: A coastal marine station is dependent upon the traffic tolls accruing from the messages handled for its existence. At best, it is a gambling game, as we never know just how much the traffic tolls will total each 24 hours. Consequently, we must keep expenses at a minimum to justify our existence. This means, that where we might possibly need two men on watch at a time—one on the radio circuit and one on the land wires—we must endeavor to reduce the number by picking good men who can handle the whole job. Again, to make a paying proposition of a station, they must work fast and accurately. This means that when a vessel has a message for us we want it snappy, with no 'dilly-dallying' around, useless signals, much testing, etc. We want the message and want to be through with that ship so that we can turn and get rid of the business to the land line as expeditiously as possible. Similarly, when we have business for the ship, we expect our calls to be answered within a reasonable length



Tune in Christmas with a KODEL

Model P-12 Two-tube Portable. *(Model P-11 with amplifying tube added, which increases distance and votume many times.)*



$22.50

Model S-1 KODEL Crystal Set. *Sensitive, selective, low-priced.*



$5.00

Model C-12 Two-tube Receiver. *A great distance getter; puts local stations on the horn; single dial tuning.*



$18.00

THIS Christmas anyone can give the best that radio offers, for KODEL radio receivers are priced so low that anybody can afford them. And they are so simple to use! Just one dial to turn, and in the stations come, near and far. Only two dials in the 3 and 4 tube sets. Santa can even bring radio to the apartment house where antennas are prohibited, for KODEL will work on ground alone—hook it to the nearest radiator!

All KODEL sets contain a unique circuit, discovered by an independent experimenter. When radio conditions are right, 1000 miles on one tube! Add tubes until the four-tube set gives you the possibility of transcontinental reception.

See the KODEL line at your dealer's. If he does not carry these marvelous sets, send us his name and address and we will send you the interesting KODEL catalog, from which you can order direct. Money returned if any KODEL set does not more than satisfy you.

DEALERS: The KODEL is a sensation wherever introduced. Write for terms.

KODEL MANUFACTURING CO.
Under the same management that made the HOMCHARGER *famous*
121 West Third Street, Cincinnati, Ohio

FREE! Write for instructive KODEL catalog, entitled "Radio for Every Purpose and Any Purse." FREE!

Model C-13 Three-tube Receiver. *Gives five-tube volume with only three tubes, due to reflex amplification.*



$28.00

KODEL Model C-14 Four-tube Receiver, illustrated above, is priced at **$32.50** *(without battery cabinet, loud speaker or accessories). Battery cabinet can be furnished with any* KODEL *set at slight additional cost.*

$32.50

With Battery Compartment
$37.00

Model C-11 One-tube Receiver. *The biggest value in a one-tube radio set today.*



$10.00

Model P-11 One-tube Portable—the Camera of Radio — Price **$16.00** without accessories. *Tube, batteries, headphones, antenna and ground wire all self-contained. Weight 4¾ lbs. complete.*



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RADIO FOR EVERY PURPOSE AND ANY PURSE—$5 TO $32.50

The New Somerset

Beginning a NEW



Somerset Stratford $65

STRATFORD MODEL 4-A

4 tubes—2 dials—space for "B" batteries in hand-rubbed, mahogany cabinet

List $65

The Day Has Come

TRUTH in radio, from now on, will be the firm foundation on which the public will build its confidence.

Confused and disappointed by extravagant and misleading claims, by high sounding names and mysterious terms, the radio buyer has eagerly sought for an assurance of full value for his money and a definite idea of what he can expect for a definite expenditure.

The Somerset line has been developed to meet this unfilled want. It has been planned on the basis of providing a full dollar's worth of radio for the consumer's dollar, of highest quality for the least money, of conscientious workmanship and best materials, backed by the finest engineering skill that money can command.

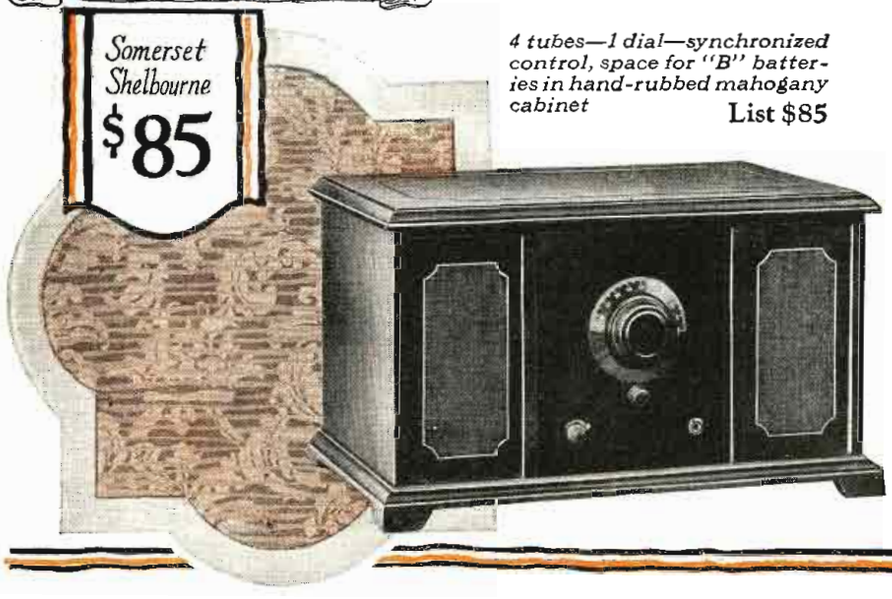
Each Somerset receiver represents the best that can be offered at its price—the utmost in results and permanent satisfaction to the buyer.

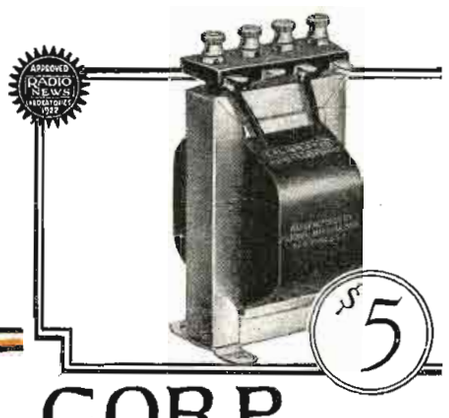
SHELBOURNE MODEL 4-B

Somerset Shelbourne $85

4 tubes—1 dial—synchronized control, space for "B" batteries in hand-rubbed mahogany cabinet

List $85





$5

NATIONAL AIRPHONE CORP.


C-H
FOUR OHM RHEOSTAT
With Vernier
THIRTY OHM RHEOSTAT
VARIABLE
GRID LEAK
THE ORIGINAL
RADIO SWITCH
FOUR OHM
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POTENTIOMETER
THE PERFECT
SOCKET
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125 OHM
RHEOSTAT
A set is only as good
as its parts.
CUTLER-HAMMER

Unsurpassed selectivity, sensitivity, range, volume and tone combined

Looks like—and performs like—a $200 radio set



BUILT TO GIVE LOUD SPEAKER ENTERTAINMENT FROM STATIONS THOUSANDS OF MILES DISTANT WHILE LOCAL STATIONS ARE BROADCASTING

MAY BE USED AS A 2-TUBE, 3-TUBE, 4-TUBE OR 5-TUBE SET!

The Marvelous MIRACO Ultra 5 — costs only $75

[FIVE TUBE OUTFIT IN BEAUTIFUL SOLID MAHOGANY CASE]

Send coupon for SPECIAL OFFER!

Completely built, thoroughly tested and factory guaranteed by one of America's oldest and most reliable manufacturers of quality sets! Years of experience and quantity production explain its almost incredible price. Users, who have deluged us with commendations, say that friends who see and hear it are amazed that it sells for less than $150 or $200. Radio experts, who know good construction and quality parts, are equally astonished. You, too, will be delighted, thrilled, amazed with your big five-tube Miraco "Ultra 5" in its beautiful hand-rubbed solid mahogany cabinet! You'll be envied by radio friends who paid big prices for their outfits. Imagine getting all this for $75—a beautiful sweet toned "coast to coast loud speaker" set, composed of finest parts, housed in solid mahogany, equipped with the latest improvements, refinements and features found on costliest sets—and factory guaranteed! An instrument approved by radio's highest authorities! A set anyone can connect and operate. Even beginners learn quickly to cut through the "locals," get distant stations loud and clear, log stations and return to them at will. (Full directions with each set.) It is non-radiating, non-distorting, non-howling. Has cut-out switch—and a first stage phone jack for tuning—on Bakelite panel. All wiring concealed under Bakelite sub-base. Works on storage battery or dry cells. Literature describes other newest features.

"Coast to Coast" reception verified by Miraco Users

NOTE! Do not judge Miraco sets by their prices. Enormous production makes them cost less. They are built—by pioneer set makers—of highest grade parts. They embody improvements, refinement and features used in the most costly sets. Every Miracouser is an enthusiastic booster—these letters are typical of the many we receive.

Miraco "Shows" Missouri

I bought one of your radios last summer and like it fine. Have picked up stations from Coast to Coast and from Canada to Cuba. My Motto with the Miraco is: "What's the use to pay more when the Miraco will reach as far as you can understand the language!" —George V. Scott, Moberly, Mo.

Wisconsin Gets 'Em All Over U. S.

Am well pleased with my Miraco. Have listened to stations from the extreme eastern and western parts of the United States and as far south as Beaumont, Texas. It has come up to my expectations in every way.—J. H. Halbert, Augusta, Wisc.

New York Hears England And Brazil

Am very glad I bought a Miraco as it works the best of any I have heard. All the people who come to listen say that when they buy a set it will be a Miraco. Have heard London, England and Rio de Janerio, Brazil, with my Miraco. It sure works fine. It is the best set on the market for the price.—Leo Link, Marcy, N. Y.

Pennsylvania Hears California

The Miraco is a real "Coast to Coast" set. Last night I tuned in on KGO, Oakland, Cal., WFAA, Dallas, Texas, KFKX, Hastings, Neb., besides 15 other stations. Have received 56 in all. It is a wonderful set for the price.—Earl C. Way, Coleman, Pa.

Iowa Hears N. Y. to Cal.

Have heard from New York to California on my Miraco. All who have heard it think it fine.—Chauncey Bailey, Stockport, Iowa.

Beats Some $300 Sets

The Miraco that I bought last Fall is giving better satisfaction than some $300 sets others have here.—Otis Morris, Warren, Idaho.

Indiana Gets Coast To Coast

Have received stations as faraway as Oakland, Cal. and New York. I can get any station and am very pleased with my Miraco. —Eddie Smith, Mellott, Ind.

Nebraska Hears Cuba

Miraco sure is a go-getter. I get better reception than anyone in this neighborhood. Had WSAI, Cincinnati, on loud speaker in July—pretty good for warm weather. I tuned in KGO, Oakland, Cal. and WBZ, Springfield, Mass., and have heard PWX, Havana, Cuba, a number of times.—Verne J. Gustason, Blair, Neb.

"Hears The Scotch"

I am proud of my Miraco. Have had Cuba, Canada, Glasgow, Scotland—of which any one should be proud—with nearly every station in the U. S.—Parke A. Neet, Catlin, Ind.

Other Miraco Long Distance Sets $14.35 up



Users tell us that Miraco Model R justly deserves its title, "Radio's finest low priced quality receiver." One tube acts as a tuned radio frequency amplifier and detector combined. A great distance getter. Easy to operate and log. Covers all wave lengths 150 to 625 meters. Like all Miraco sets, it operates on a storage battery or dry cells. Never such value before at only $14.35

MIRACO RADIO GETS 'EM COAST TO COAST

This wonderful new Miraco Model R-3 is the three-tube, long distance, loud speaker set that has created such a sensation. Easy to tune and log. Covers wave lengths 150 to 625 meters. Detector acts also as a tuned radio frequency amplifier. 2 stages audio frequency amplification. Has no equal for simplicity, volume, range or clearness at anywhere near its price



Miraco R-3 only $29.50

These Miraco sets are as easy as a phonograph to operate. Built throughout of highest grade parts. Full directions for connecting and operating supplied with each set. No experience necessary. The three and four tube sets have cut-out switch and first stage phone jack. Each set completely built, thoroughly tested and factory guaranteed.

The famous Miraco Model MW four tube "coast to coast loud speaker" outfit which users all over the country report outperforms and outdistances much costlier sets. Comes in a solid mahogany cabinet. The improved 1925 model is equipped with cut-out switch, first stage phone jack for tuning (removing plug automatically switches program to loud speaker) and other latest features. Employs one stage of radio frequency amplification, detector and two stages of audio frequency amplification. Another unmatched Miraco value, $54.50.



All the Proof you want is waiting for You!

Reports from the many users in every state prove Miraco Tuned Radio Frequency Receivers—at rock bottom prices—have efficiency of sets costing up to three times as much. Remember that Miraco Sets are the product of a long established, reputable manufacturer—pioneer builders of sets. Send for further evidence that they are Radio's finest moderately priced receivers. All Miraco sets bear the endorsement of radio's highest authorities. Mail coupon now for latest bulletins and plenty of additional testimony from users leaving no doubt that "Miraco Radio Gets 'em Coast to Coast."

DEALERS! JOBBERS!
Write for the new Miraco proposition. Nation-wide use and popularity of Miraco Sets, their amazingly low prices and our extensive advertising, makes them wanted everywhere. Send coupon.

AGENTS!
The wonderful tone, volume and distance-getting ability of Miraco Sets makes them easy to sell. Send coupon for proposition; good territory open.

Send coupon for free bulletins [or order direct from this ad]

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets
Cincinnati, Ohio
404-K East Eighth Street

Send free literature, your SPECIAL OFFER and all particulars regarding Miraco Sets. ( ) Jobber. ( ) Dealer. ( ) Agent. ( ) User.

Name .....

Address .....

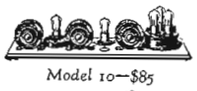
ATWATER KENT RADIO



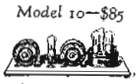
Radio Enjoyment for Every Occasion



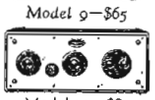
Model 12—$105



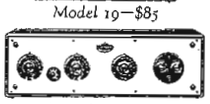
Model 10—$85



Model 9—$65



Model 19—$85



Model 20—$100



De Luxe Model—$120
Pacific Coast prices slightly higher

FOR the owner of Radio there is more and better broadcasting than ever before. Concerts, operas, lectures, sermons, educational courses, market, weather and special reports, and always the thrill of unexpected announcements of important happenings.

ATWATER KENT Radio in your home will assure you countless evenings filled with joy.

You will find ATWATER KENT Receiving Sets and Loud Speakers well within your means. To fully appreciate their many advantages, see the new Models at any radio dealer's.

Note the materials used in their construction; the best that money can buy. Feel how smoothly the dials turn; that's but one example of their master workmanship. And then listen to the remarkable reception. Note the ease with which you can bring in stations with ample volume, even from a distance.

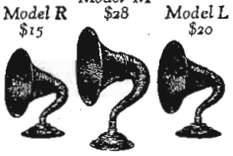
For selectivity, distance, volume, clear reception, simplicity of operation and beauty of design, ATWATER KENT Radio is unexcelled.

These qualities your radio must have to give you perfect satisfaction. Be sure of getting them all by buying ATWATER KENT.

Instructive literature on request

ATWATER KENT MANUFACTURING COMPANY
4713 Wissahickon Ave., PHILADELPHIA, PA.

Model R $15 | Model M $28 | Model L $20



Bring out the best from any set

AN ATWATER KENT Loud Speaker will add to the enjoyment of your radio. Its faithful reproduction of sound, clear and full in volume, enhances the value of any set and completes radio satisfaction.

Its quality is as fine as the best materials and master workmen can make it. Its design, correct in every detail, is a triumph in loud speaker production.

You need an ATWATER KENT Loud Speaker to bring out the best from your set.

THINK OF WHAT IS BACK OF IT

FORMICA
A Laminated Phenolic Condensation Product
SHEETS TUBES RODS

RADIO PANELS

CUT PERFECTLY SQUARE WITH SMOOTH EDGES TO ANY SIZE

1/8" THICK 1½¢ PER SQ. INCH
3/16" THICK 2¢ PER SQ. INCH
¼" THICK 2½¢ PER SQ. INCH

IN POLISHED BLACK, MAHOGANY OR WALNUT FINISH

ORDER SHIPPED SAME DAY RECEIVED

LET US DRILL and ENGRAVE YOUR PANEL

SEND US A DRAWING OF YOUR PANEL AND WE WILL GLADLY FURNISH ESTIMATE

163 SIZES AND KINDS OF FORMICA SHEETS, TUBES AND RODS CARRIED IN STOCK

Send For Price List

MANUFACTURERS JOBBERS and DEALERS

GET OUR PRICES ON MATERIAL AND CUTTING, DRILLING AND ENGRAVING PANELS IN LOTS OF 25 OR MORE

Small Pieces of Formica Sheet, Tube and Rod Cut to Size at Specially Low Prices

STARRETT MFG. CO.
521 SOUTH GREEN ST. CHICAGO, ILL.

Poly Plug



is the only phone plug equipped with the wonderful "tension slot" which permits you to pull and tug the cords all you want and still

Positive contact always maintained

It's Genuine Bakelite, too

At your dealers or by mail on receipt of purchase price

Polymet Mfg. Corp.
70-74 Lafayette St., N. Y.

75¢ "WORTH IT"

DEALERS WRITE FOR QUICK SELLING KITS RADIO PARTS

WHOLESALE ONLY

HAROLD M. SCHWAB, INC.
55 VESEY ST., DEPT. RN-D
NEW YORK CITY, N. Y.

Radio (Continued)

Ivory Radio Panel: Grained white "Ivorylite" makes most beautiful set of all. Guaranteed satisfactory. Any size 3-16" thick sent prepaid 3c per square inch. Sample free. E. P. Haltom, Dept. N, 614 Main St., Fort Worth, Texas.

Radio Books, Catalog free. R. Dobbins, 146 W. 27th St., Indianapolis, Ind.

Radio Fans and B C L's qualify one week—150 students now licensed—Their learning records on request. Complete method $2.50. Dodge Radio Shortkut, Dept. N, Mamaroneck, N. Y.

Send me your burned out or broken Power tubes—50 watts or over. Will pay liberally. W. Baker, 36 W. 20th St., New York City.

Have your broken and burned out Power tubes repaired, 50 watts or over. Send them to us for Repair. Charges reasonable. Wm. Baker, 36 W. 20th St., New York City.

Inquiries solicited for manufacturing Radio Cabinets. We have dry kiln and complete machinery including spraying facilities. Reliable responses only considered. XYZ.

Solid Mahogany Cabinets—7x10—$2.45; 7x12—$2.75; 7x14—$3.00; 7x18—$3.40; 7x21—$3.70; 7x24—$4.10; 7x26—$4.55. Postage extra. Variocouplers—Bakelite, green silk windings, $4.50 value, for $2.35 postpaid. Miami Cabinet Company, Yellow Springs, Ohio.

A reliable and thoroughly experienced radio manufacturing and merchandising organization wants live-wire representative in your community. Complete line of highest quality receiving sets and accessories, exclusive territory, and liberal discounts without annoying quantity regulations. Write or wire Radio Development Co., 25 S., 13th St., Harisburg, Pa.

Genuine "Radiotron" Tubes $5.40 postpaid. MacClaren, Dept. RN-I, Onset, Muss.

100 Volt Edison Type "B" Battery, knocked down. Parts and plans complete. $12.50. Lane Mfg., 2938 W. Lake, Chicago.

Low Loss Inductance Forms, Linen impregnated Bakelite. 50c each. The Kehler Radio Laboratories, Abilene, Kansas.

Bargains Transmitting Sets cost $250.00. $25.00 Storage Batteries Six Volts 80 amperes $4.00 worth $10.00. Navy Tubes $2.50. 824 North Fifth, Philadelphia, Pa.

Salesmen Wanted

Were You Ever Offered a Grocery Store? Our proposition is better. You can handle flour, canned goods, dried fruit, coffee and entire line of groceries as well as radio sets, paints, roofing and automobile oils and tires with no rent to pay; no money invested; take large orders from samples. Goods are guaranteed and proven quality. Selling experience not necessary. Steady, profitable work for "workers." Address Hitchcock-Hill Co., Dept. 204 Chicago, Ill. Reference: Any bank or Express Company.

Salesmen—Sell Four Square Suits $12.50 guaranteed two years. All wool overcoats $19.50, five different patterns. $3.00 to $5.50 each sale. Profits in advance. Complete line, coat, vest, pants, riding pants, overcoats slip-ons caps. One day delivery. District territories open. Stone-Field Corporation W2556 So. Wabash, Chicago.

Salesmen—Sell guaranteed shoes for men, women and children below store prices. $70.00 weekly easy. We deliver, collect. K-W Shoe Company 4048 Harrison, Dept. 22, Chicago.

Wanted: Able specialty salesmen, something different, easily sold, all retailers; liberal commissions, drawing accounts. Salesmen making from $25 to $75 daily. Permanent income from repeat business. Address National Electric Company, Desk 8, Cedar Rapids, Iowa.

Beats a Gold Mine—Electric Sign, sells $15.00. Commission $5.00. Easy to sell 100 to 1000 at once to Manufacturers of Autos, Ice Cream, etc., for distribution to their Dealers or Agencies, or, several an Hour from Store to Store. Write while its new. Flashtric, 2128 Hudson, Chicago.

Scenery to Rent

Settings for Opera, Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

Stamps and Coins

158 Genuine Foreign Stamps. Mexico War Issues. Venezuela, Salvador and India Service. Guatemala, China, etc., only 5c. Finest approval sheets 50 to 60%. Agents wanted. Big 72-p. Lists Free. We buy stamps. Estab. 20 years. Hussman Stamp Co., Dept. 146, St. Louis, Mo.

Telegraphy

Telegraphy—Both Morse and Wireless taught thoroughly. 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, platinum, 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.

Ventriloquism

Ventriloquism taught almost anyone at home. Small cost. Send 2c stamp today for particulars and proof. Geo. W. Smith, Room M-924, 124 N. Jefferson Ave., Peoria, Ill.

You Can't "Blow" Out Your Tubes

Not a Fuse



Lasts a Lifetime

Tested and Approved by Radio News Laboratories. . .

Absolutely Guaranteed ONLY $1.35

One Protect-O-Tube on each B + Battery lead protects all the tubes in your set. It lasts a lifetime and cannot burn out. Your first cost is the last. High voltage absolutely will not blow out your tubes. Fully guaranteed. Nothing else like it on the market. If your dealer cannot supply you, order by coupon today.

Dealers—Jobbers

Write for special proposition and our "quick profit" sales plan.

DON MAC CO.
29 S. Desplaines Street
CHICAGO ILL.

If your dealer cannot supply you, ORDER BY COUPON—MAIL TODAY!

Name..... Address..... City..... State..... No. Wanted

RADIO DEALERS

If you are already established or contemplate going into the **RADIO** business, you should send for our new large illustrated

RADIO CATALOG No. 26-R



All standard quality lines listed. Dealers' discounts very liberal.

WRITE TODAY!

"Exclusively Wholesale"

OHIO RUBBER
228 W. 7th St, Cincinnati

FREE Big Radio CATALOG

Just send your name and we will mail you without cost or obligation our new 100-page bargain radio catalog, which is crammed full of bargains in sets, parts and accessories of all kinds, and interesting information about radio. Quick Service and Satisfaction Guaranteed.

Write to-day. And will you be so obliging as to add the names of several others whom you believe will soon want radio goods? Thank you.

LIBERTY MAIL ORDER HOUSE
Dept. A711, 106 Liberty St., N.Y.C.

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 twenty-two 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 advertisements not accepted. Advertisements for the March issue must not reach us later than Jan. 1st.

CIRCULATION LARGER THAN THAT OF ANY OTHER RADIO PUBLICATION

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Addressing and Mailing

Radio Fans: Don't neglect sending applause cards to stations listened in. For 6c stamps, we furnish cards, fill in your name and address, etc., and mail postpaid to any ten stations you designate, any additional two, 1c. Radio Addressing & Mailing Co., 794 Newball St., Milwaukee, Wis.

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., 405 Delaware Ave., Wilmington, Delaware.

Agents—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn $100 weekly and bonus. Madison Mills, 564 Broadway, New York.

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.

District Managers Wanted. Appoint Local Agents for us in your locality. No canvassing or delivering. $100.00 weekly easily made. Commissions advanced. Bob Russell, Y 2307 Archer, Chicago, Ill.

Write and learn how to start profitable business without capital or experience. Silvering mirrors, refinishing auto headlights, tableware plating. Outfit furnished. International Laboratories, Dept. 25, 809 Fifth Ave., New York.

Big Money selling new Household cleaner. Washes and dries windows. Sweeps, scrubs, mops. Complete outfit less than brooms. Over 100 percent profit. Harper Brush Works, 160 3rd St., Fairfield, Iowa.

Guaranteed Genuine Gold Leaf Letters anyone can put on store windows. Large profits, enormous demand. Free samples. Metallic Letter Co., 422 N. Clark, Chicago.

Young men who want to make their spare time pay from $20 to $50 a week are offered an opportunity to sell an article which every man buys on sight, made by Ingersoll the dollar watch man; retails for $1; you don't need to be a salesman; merely to show is to sell; big profits, quick sales and constant repeat business; write today. Robert H. Ingersoll, 476 Broadway, Dept. 208, New York.

Men wanted for this territory to sell wonderful value mens, womens, childrens shoes direct, saving consumer over 40 per cent. Experience unnecessary. Samples supplied. Big weekly permanent income. Write today. Tanners Mfg. Co., 1335 C St., Boston, Mass.

Agents: Something new—Wonderful Invention. Ford Owners wild over it. Distributors profit 300 per cent—thirty day trial offer. Write Y. Super, 1304 Fondulac, Milwaukee, Wis.

Easy, pleasant work for Mechanics, Shop Men, Clerks, during spare hours; will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Co., 476 Bar St., Canton, Ohio.

Start in a Permanent Business of your own selling guaranteed hosiery, underwear and sweaters. We deliver and collect if you prefer it. No capital or experience needed. Sworn proof of profits $12 daily up, furnished. Become our District Manager. Get others working for you. Write for details to The Mac-O-Chee Textile Company, Station 4741, Cincinnati, Ohio.

At Last! Diamond Rival Discovered! Amazing blue white Rajah Gem astounds jewelry world and deceives experts! Beautiful Sample Case Free! $100 weekly! Write quick! Rajah Diamond Co., Dept. F42, Salisbury, N. C.

$300.00 a month to distribute everyday household necessity in rural and small town districts. No money needed. Million dollar firm behind it. Write for particulars and state territory desired. B. P. Johnson, 611 W. Lake, Chicago.

Darn E-Z big money now. Sells faster than ever. Hard times improve sales. This universal hosiery and fabric cement finds eager buyers in every home, office, store and factory after two minute demonstration. New uses command instant attention. Special selling system assures generous income. Darn E-Z Laboratories, Dept. 31, Dayton, Ohio.

Earn $10 daily silvering mirrors, plating, refinishing metalware, headlights, chandeliers, bedsteads. Outfits furnished. Bolanger-Decie Laboratories, 1133 Broadway, New York.

Radio Salesmen and distributors—exceptional opportunity selling $12.50 loud speaker; big value; sells itself; experience unnecessary; Address Butytone Radio Co., B70 E. 22nd, Chicago.

Agents—Quick sales, big profits—outfit free. Cash or credit. Sales in every home for our high-class line of Pure Food Products, Soaps Perfumes, Toilet Articles, etc. Write today for money-making plans. American Products Co., 2137 American Bldg., Cincinnati, Ohio.

Radio Set Builders—We want a representative who knows radio to handle standard, well advertised sets and parts in your locality. Liberal offer to right party. Write for plan and Free outfit. Waveland Radio Company, Inc. Div. 28, 1027 N. State St., Chicago, Ill.

Agents Wanted (Continued)

Radio Salesmen wanted—Make $50.00 weekly selling standard, well advertised radio sets and parts. No investment necessary. Write for plans and Free Outfit. Waveland Radio Corporation 1027 N. State St., Chicago, Ill.

Business Opportunities

Make $100 Weekly in Spare Time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, 813 Washington Blvd., Chicago.

Advertise, hundred magazines, three issues, 10c word. Pennell Company, Covington, Kentucky.

Cash in on Radio! Build and sell sets for us. No trouble to earn $5 an hour in spare time at home. Auburn Radio Co., Dept. M, Cincinnati, O.

Special Free Offer—100,000,000,000 German Marks 5,000 Polish Marks, and 10 Russian Czar Pre-War Roubles Absolutely Free with every 25c order for 100 Kronen Hungarian Government 5½ per cent Bonds interest coupons attached. Send 25c order today and receive latest quotations. Public State Bank, Dept. 612, Chicago.

Free Book. Operate little mail order business home evenings. Book free. Pier, 859 Cortland St., N. Y.

Educational

Used Correspondence School Courses save over half. Bargain catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d St., New York.

Exchange

200-20,000 meter Receiver including Radiotron $25.00. Two step Amplifier $18.00. Smith, 4418 Market, Philadelphia.

For Sale

For Sale or exchange, I. C. S. course, Interior wiring, unused, value $25. Details free; your offer? Albert Chadwick, East Greenwich, R. I.

Meyers Tubas New $3.25. Trimp, 925 Courtland St., North Borgen, N. J.

For Advertisers

24 Words—355 Rural Weeklies $14.20. Admeyer, 4112-R Hartford, St. Louis.

For Inventors

Inventors' Educator: 900 Mechanical Movements. 50 Perpetual Motions. How to procure and sell patents. Mechanical Movements greatly assist Inventors, suggest new ideas. Explains how to select an attorney and avoid Patent Sharks. Price $1.50. Postage Free. Albert E. Dieterich, 690 Ouray Building, Washington, D. C.

Health

Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Box M, Omaha, Neb.

Help Wanted

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.

Detectives Needed Everywhere. Travel. Experience unnecessary. Write George Wagner, former Government Detective, 1968 Broadway, N. Y.

Become a Landscape Architect. Uncrowded profession of wonderful opportunity for money-making. Easily mastered by mail. Earn while you learn. Write for book. American Landscape School, 11-E, Newark, New York.

Earn $25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 972, St. Louis, Mo.

Man wanted (city or country) old established company will supply capital and start you in your own permanent business selling necessities people must buy every day. Experience unnecessary. Write McConnon & Co., Factory M63, Winona, Minn.

Machinery and Tools

Distributors—Screw-holding Screw Driver. Handiest tool ever invented. Unlimited Market. Tremendous demand! Big repeat earnings! Write Coburn Tool, 738C Boylston, Boston, Mass.

Miscellaneous

Beautiful registered bull pups cheap. Bulldogs. 501 Rockwood, Dallas, Texas.

Violins—I make 'em; sweet, soulful, melotoned; finest tonal quality instruments since Stradivarius' days. Get details now. John Lehto, 935—14th St., W., San Pedro, Cal.

Dealers—Write for our illustrated catalog of reliable radio Merchandise. Rossiter-Manning Corporation, Dept. F. 1830 Wilson Ave., Chicago, Ill.

Motorcycles, Bicycles

Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

News Correspondence

Earn $25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 973, St. Louis, Mo.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 278, St. Louis, Mo.

Patent Attorneys

Inventors—Should write for our Free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Free Examination and Instructions. Radio, Electrical, Chemical, Mechanical and Trademark experts. Terms reasonable. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 269 Ouray Bldg., Washington, D. C.

Patents for Inventions. Long experience, highest grade work, rates reasonable, best references. Advice as to patentability. Wm. Ashley Kelly, 41 Park Row, New York

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, 644 G Street, N. W., Washington, D. C.

Inventors—who derive largest profits know and heed certain simple but vital facts before applying for patents. Our book Patent-Sense gives those facts; free. Write Lacey & Lacey, 631 F St., Washington, D. C. Established 1869.

Patent-Sense—As one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for results, evidenced by many well-known Patents of extraordinary value. Book, Patent-Sense, free. Lacey & Lacey, 631 F St., Washington, D. C. Established 1869.

Personal

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.

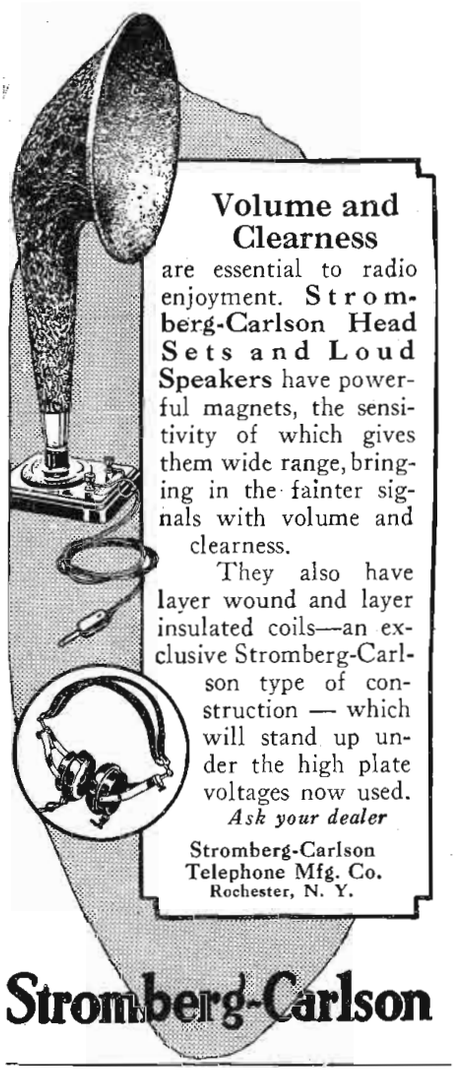
Exchange cheery letters with new friends. Write Betty Lee, Inc., Box 820 City Hall Station, New York City. Stamp appreciated.

Free to Men or Women—Information of a scientific nature that has brought physical vigor and happiness to thousands. No charge; no obligation. Write Fair Sales Co., Dept. 246A, Colorado Springs, Colo.

Lonely Hearts—Exchange letters; make interesting new friends in our jolly club. Eva Moore, Box 908, Jacksonville, Florida. Enclose stamp.

Radio

Make Your Next Reach Out—Same panel, same layout, fewer parts. Our $5.00 Kit includes the one different part, 22 feet real gold sheathed wire, lithographed print of Kladag Coast to Coast Circuit, and complete, simple instructions. Nothing else to buy. Gives selectivity with deep, resonant volume. Not obtainable elsewhere. We originated this and can name scores of buyers it has delighted. Satisfaction Guaranteed. Details—10c. Kit prepaid anywhere, $5.00. New 48-page catalog, thousands of items, many exclusive for stamp. We accept postage stamps same as cash. Kladag Radio Laboratories, Kent, Ohio.



Volume and Clearness

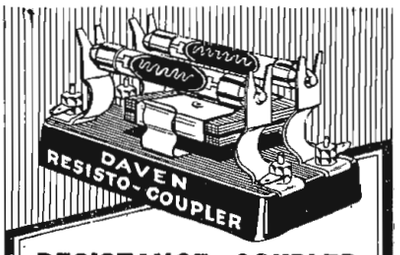
are essential to radio enjoyment. **Stromberg-Carlson Head Sets and Loud Speakers** have powerful magnets, the sensitivity of which gives them wide range, bringing in the fainter signals with volume and clearness.

They also have layer wound and layer insulated coils—an exclusive Stromberg-Carlson type of construction — which will stand up under the high plate voltages now used.

Ask your dealer

Stromberg-Carlson Telephone Mfg. Co.
Rochester, N. Y.

Stromberg-Carlson



RESISTANCE COUPLED AMPLIFICATION

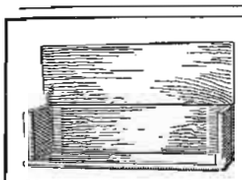
The Resisto-Coupler illustrated above is inserted in the place of the ordinary transformer. It is less expensive to install and operate, gives auditively perfect amplification and wonderful volume. We recommend three stages of Resistance Coupling for most satisfactory service.

Sold everywhere - - - $1.25

Ask your dealer for the Daven "RESISTOR MANUAL" by Zeh Bouck. A practical handbook on Resistance Coupled Amplification.

Price 25c

DAVEN RADIO CORP.
"Resistor Specialists"
Newark New Jersey



NATURAL WOOD

Finish it yourself to match any wood. 11 stock sizes all 7 inches deep, from 7"x9" .....$1.80 to 7"x36" 4.75
Send for free catalog of cabinets for every radio set.

EXPRESS BODY CORP.
42 Lake St.
Crystal Lake, Ill.

NEAT FIT CABINETS

OH MOTHER!

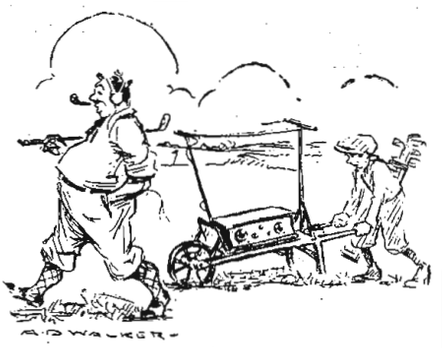
RADIO FAN: "I picked up WGY last night."

AUTO FAN: "Huh, wouldn't she give you her full name?"

A TRUE TALE

BILL: "Did the magazine really accept that technical article you wrote?"

FOLD: "Uh-huh, it's right there in the comic section."



SUNDAY SERVICE WHILE YOU PLAY

Jones is a man of his word. He promised his wife faithfully that never again would he allow his golf to keep him from Sunday service.

Yes, but why the ear phones, particularly if they are not connected to the set?

Editor RADIO NEWS.

PEACE AT LAST

Radio stops some people from talking long enough to listen.

ZOWIE!

SALLY: "I just had my hair 'radioed.'"
IRENE: "How's that?"
SALLY: "Done up in short waves."

OH NO?

No, Ernestine, a wave trap is not a breakwater.

ALAS—'TIS SO

There's no use broadcasting on Monday—that's wash day and so many aerials have other duties.

AND THERE IS NO STOPPING IT

A radio fan is an air circulating device that runs without wires.

TOO MUCH "B" BATTERY

QUERY: I hear such dizzy noises on my radio, what can the answer be?

ANSWER: Probably your tubes are "lit."

FAST WORK

"My goodness man! You're all winded!"

"I know it. I've been listening to Bill's radio, and he kept dashing from one station to another."

'TWAS ALWAYS THUS

Radio, like the baby, does the cutest things after the company has gone.

EDUCATIONAL FEATURES

One feature of radio: A lot of people have learned to pronounce Schenectady.

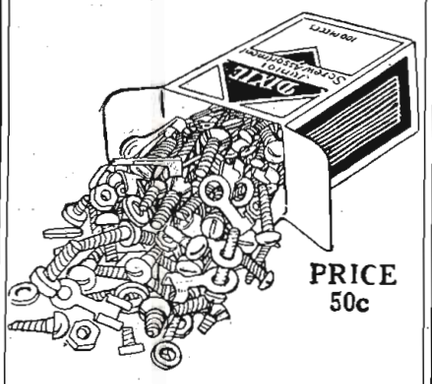
QUITE TRUE

HCL has the most expensive broadcast station.

INDOOR SPORTS

With Radio, Mah Jong and Cross Word Puzzles, no one goes out any more.

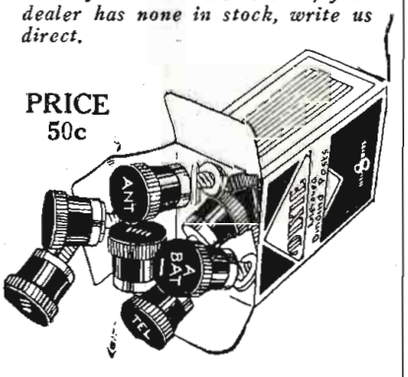
DIXIE PRODUCTS



DIXIE JUNIOR
Screw Assortment

100 pieces all in the one box, ready to use, all handy, useful standard sizes. The little box that saves time, trouble and money, and keeps your worries about losing tiny screws at a minimum. Buy a box or two today. They're worth the price just because they're handy and convenient.

Sold by all Radio Dealers. If your dealer has none in stock, write us direct.



DIXIE ENGRAVED
Binding Posts

CONVENIENCE, takes half the work from the building of a Receiving Set. That's why the DIXIE Binding Posts have always been so popular. Eight handsome, engraved posts to the box. All are clearly marked for you by superior engravers. You'll need a box or two around your work bench; you can always use them.

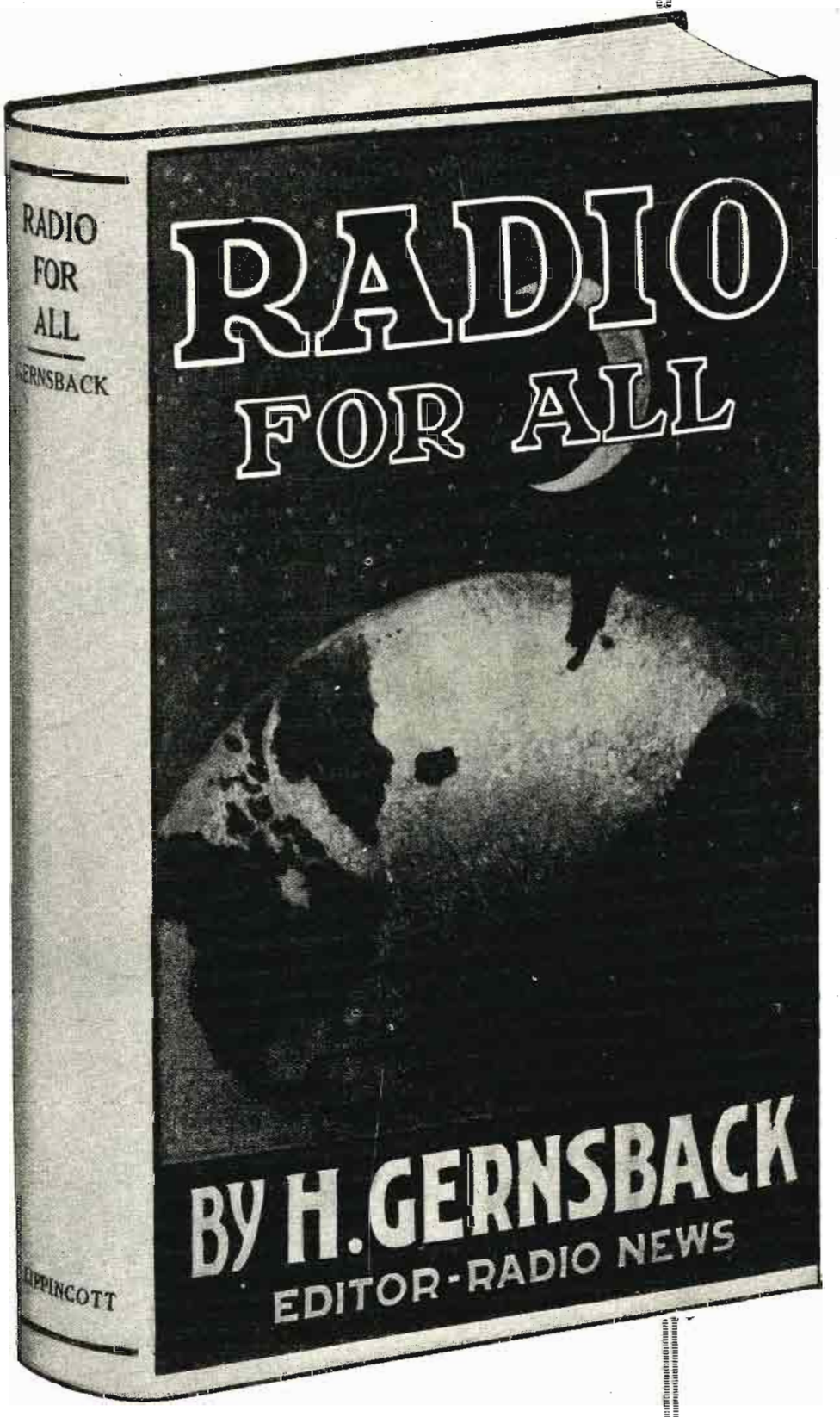
Sold by all Radio Dealers. If your dealer has none in stock, write us direct.

Dealers

There are few, if any, faster selling counter displays than these DIXIE Products. The boxes and display cartons are unusually attractive. Write for our special dealer discounts.

DIXIE SUPPLY COMPANY
91 Seventh Avenue New York, N.Y.

FRED L. TOMLINSON CO.
443 So. San Pedro St. Los Angeles
THE BARSOOK CO.
53 West Jackson Blvd. Chicago, Ill.



RADIO'S

Most Complete Book of Information

By
HUGO GERNSBACK

Editor of RADIO NEWS, SCIENCE & INVENTION, THE EXPERIMENTER, and MOTOR CAMPER & TOURIST

What the novice in radio needs is a book in which he can get all the information necessary for him to understand radio telephony and telegraphy, to make or buy a receiving set suitable to his means, to know how to operate his set, and, after he has an understanding of the radio art, information that will enable him to advance and get the most out of his outfit. All this must ordinarily be dug out of text-books, pamphlets and government publications, but the aim of this book is to have all the data and information that the beginner will need from the time that he takes up radio. It is a permanent, comprehensive reference book for the dyed-in-the-wool dabbler in Radio.

WHAT THE BOOK IS.

A combination of a radio course for the novice in radio telegraphy and telephony with a reference book for the more experienced amateur. Half a dozen books in one.

FOR THE BEGINNER.

The theory of radio carefully explained with drawings.

Description of and instruction for operating instruments of receiving and sending sets, with all picture diagrams of the wiring of the apparatus.

How to make your own receiving set, costing from $3.00 to $50.00.

How to read diagrams; for every picture diagram there is a corresponding technical diagram using the symbols instead of drawings.

How to tune sharply and eliminate interference from other stations.

How to protect your set from lightning, and the laws regarding installation.

Explanation of time and weather signals.

FOR THE MORE EXPERIENCED AMATEUR.

How to make a practical vacuum tube detector, two stage amplifier set costing less than $50.00, that will work.
How the radio compass works.

All about underground aerials, loop aerials and directional aerials.

Formulae for finding wave length; miscellaneous formulae for finding capacity of condenser and other instruments. Tables of wire resistances, wave lengths and their corresponding frequencies, approximate wave lengths for different aerials, tuning coil data, and much more invaluable information.

SPECIAL FEATURES.

Lists of all the broadcasting stations in the United States and Canada for concerts, time signals, weather reports, press, stock market reports, etc., with their call, wave length and time of sending.

Detailed description of Washington weather signals and their translation.

Description of a modern broadcasting station and its operation.

Large map showing location of all U. S. radio telephone broadcasting stations suitable for hanging up in radio room.

Collection of miscellaneous radio information for the amateur.

IN OTHER WORDS.

The information that you ordinarily have to dig out of government publications, text-books, pamphlets, etc., is handily combined in this one book.

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48 VOLTS

Our direct-to-user selling policy, eliminating all costly trade discounts, enables you to buy a Star 48 volt storage "B" battery at a saving of $10 to $15. This battery creates a new standard of battery economy and performance—it is the greatest battery value ever offered. Your purchase protected. Money back if not satisfactory.

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BUTTON FOR LOUD SPEAKERS

AMPLIFICATION AND EXPERIMENTS

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With instructions

K. ELECTRIC CO.
15 PARK ROW NEW YORK

To listen on his radio.
He can't play checkers, nor a thing,
He's got to hear somebody sing.
Us kids, are we too young to know?
What use to us is radio?

And mother, too, has got the fad,
Which makes the matter doubly bad.
No longer does she calmly sew
But listens on the radio.
To hear how to reduce her weight,
To please our Daddy when she's late,
A thousand things she wouldn't know,
If we now had no radio.

When I grow up to be a man,
And have a home, and kids and all
I'll play with them most every night
And see that they are brought up right.
I don't care if I don't know much
Of politicians and the such,
My kids ain't ever goin' to know
A gol' darn thing 'bout radio!

Radio Humor

FROM THE MARCH, 3082, ISSUE OF "RADIOVISION"

News item:

Scientists at the Tampa, Florida, ski grounds have unearthed another of those queer specimens of the Genus Homo. The skull has the usual indentations or depressions which are so common in specimens that are believed to have lived about the year 1925.



ABOUT 1924 A.D.
THE PROBABLE CAUSE



YEAR 3082 A.D.
RADIOPHRENOLYSIS IN HOMO SAPIENS.

The theory is prevalent that the deformity resulted from the habitual use of the old head-phones which seem to have been used in the reception of messages, the constant pressure causing the tissue to waste away.

The malady has been termed *Radiophrenolysis.* The sketches give the scientist's conceptions of the appearance of this primitive race which one time roamed the earth.

—Contributed by Clyde E. Volkers.

ASK DAD—HE KNOWS

"Pa, which is worse—an automobile maniac or a radio nut?"

"A radio nut is the worst thing on earth, my boy—an automobile maniac kills you quickly with his gas buggy and it's soon all over, but a nut with a loud talker drives you crazy and keeps you that way the balance of your life."

—Contributed by H. C. Newton.

IT'S THE BUNK

When people say they receive radio messages through iron beds—it's the "bunk."

THE CAUSE

1st Radio Bug: I stayed up till 3 o'clock in the morning and nearly got Los Angeles.

2d Radio Bug: Why didn't you get Los Angeles?

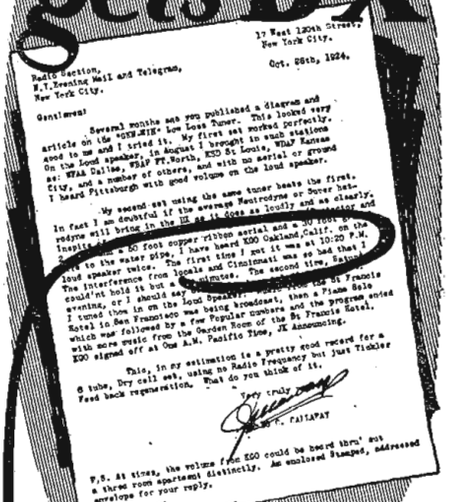
1st Radio Bug: On account of the squeals from my neighbor, next door.

2nd Radio Bug: Has he got a single circuit set?

1st Radio Bug: No, triplets.

—Contributed by P. Zegallo.

GEN-WIN gets DX



Oct. 28th, 1924.

Radio Section,
N.Y. Evening Mail and Telegram,
New York City.

Gentlemen:

Several months ago you published a diagram and article on the "GEN-WIN" Low Loss Tuner. This looked very good to me and I tried it. My first set worked perfectly. On the loud speaker, in August I brought in such stations as: WHA Dallas, WBAP Ft.Worth, KSD St Louis, WHAP Kansas City, and a number of others, and with no aerial or ground I heard Pittsburgh with good volume on the loud speaker.

My second set using the same tuner beats the first. In fact I am doubtful if the average Neutrodyne or Super het. receiver will bring in the DX as it does as loudly and as clearly.

Inspite of a 50 foot copper ribbon aerial and a 30 foot [illegible] to the water pipe, I have heard KGO Oakland, Calif. on the loud speaker twice. The first time I got it was at 10:20 P.M. The interference from locals and Cincinnati was so bad that I couldn't hold it but a few minutes. The second time, Eastern, or I should say Pacific Coast reception was perfect. The old St Francis Hotel in San Francisco was being broadcast, then a Piano Solo which was followed by a few Popular numbers and the program ended with more music from the Garden Room of the St Francis Hotel, KGO signed off at One A.M. Pacific Time, JK Announcing.

This, in my estimation is a pretty good record for a 6 tube, Dry cell set, using no Radio Frequency but just Tickler Feed back regeneration. What do you think of it.

Very truly yours,
P. ZAZAPAY

P.S. At times, the volume from KGO could be heard thru' out a three room apartment distinctly. An enclosed Stamped, addressed envelope for your reply.

~with the Silver Plated Primary

U. S. Bureau of Standards Bulletin proves that silver has lower series resistance than any other metal. Another known fact is that radio frequency currents travel on the surface of wire. Therefore, if surface conductivity is increased, the set employing the wire will be made more efficient.

GEN-WIN Low Loss Tuner

employs an aperiodic primary of special silver plated copper wire. Condenser tuned secondary and self supporting spiderweb tickler are also of latest low loss design. A GEN-WIN Low Loss Tuner will enable you to build the most efficient regenerative set ever designed, both for DX and local reception. They are unconditionally guaranteed.

With each tuner you get a complete set of detailed blue prints (full size panel pattern, instrument layout and picture wiring diagram) for latest Gen-Win Low Loss Set. Separately 50c. Write for descriptive circular, Dept. RN 125.



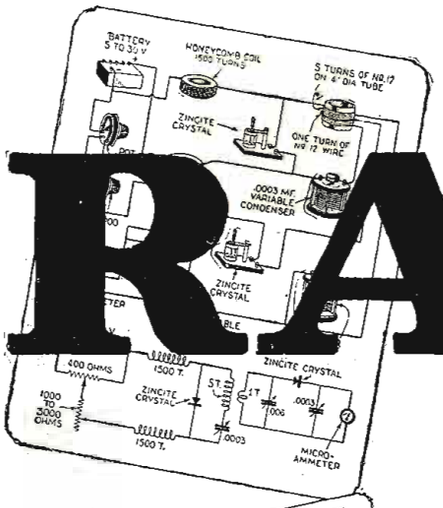
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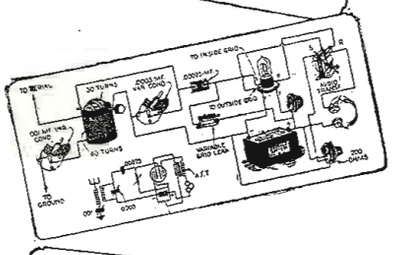
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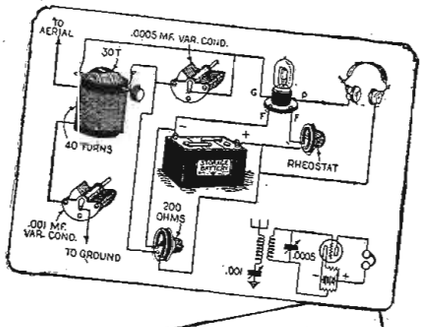
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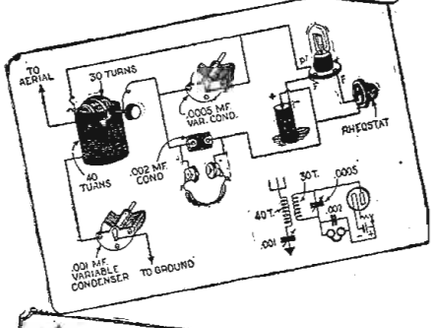
"——using 3UV-199 tubes (detector and 2 step)——, I have heard KGO, Oakland, Calif., on the loud speaker twice. At times—KGO could be heard throughout a three-room apartment distinctly."

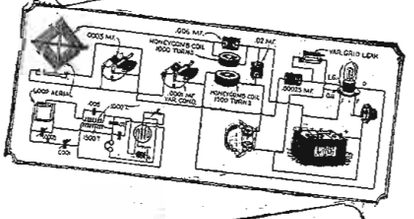
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214 Fulton St New York

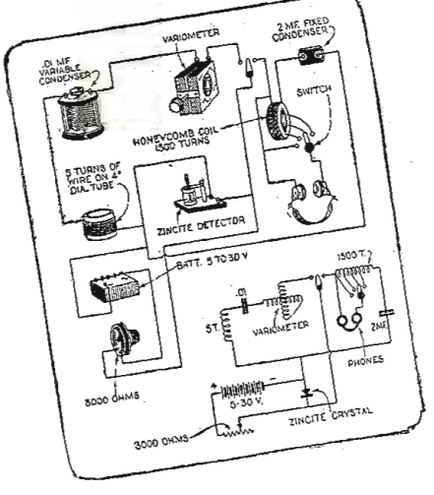












RADIO—

Simplified and Explained For the Beginner

A BEGINNER in radio will find SCIENCE & INVENTION an ideal magazine for his study. Every radio circuit shown in SCIENCE & INVENTION is pictured *twice*. The first drawing showing the picture diagram with actual illustrations of the instruments used. The second, showing the usual radio diagram hook-up. A glance at the illustrations shown here, show you how it is done.

SCIENCE AND INVENTION covers not only radio but every modern scientific achievement. There are correspondents in every corner of the world gathering data and information on new scientific inventions and developments. Every article in SCIENCE AND INVENTION is pictorially illustrated so that every reader can easily grasp the most intricate inventions. Every page in SCIENCE AND INVENTION is not only interesting but fascinating.
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SCIENCE AND INVENTION has reporters in every corner of the world who are constantly seeking news of everything new and interesting for the readers whether it be Scientific, Inventive or about Radio. It is a fascinating Magazine crammed full of interesting news.

25c The Copy
ON ALL NEWSSTANDS

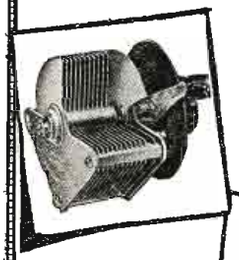
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53 PARK PLACE Dept. R N 1 **NEW YORK CITY**

DUPLEX CONDENSERS

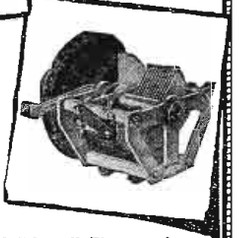
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For all around efficiency and the micrometer adjustment permitted when unusually accurate tuning is required, DUPLEX CONDENSERS lead the field. Made of only the finest materials obtainable under the guidance of foremost radio engineers, they certainly are precision instruments.



"DR" Series

A low loss precision condenser of High value and unusually low price. Great for set builders who want excellent value at low price.



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The highest quality low loss condenser made. Used by foremost set manufacturers. Condenser tests at Yale University in May, 1924, definitely determined its remarkable efficiency.

Write for "Cons" and "Facts." They are free.

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Mail to our nearest office, your burned out or broken tube, any type, and we will send you a guaranteed R-S-K repaired Cunningham or Radiotron, any type you wish, C. O. D., $2.50 each. No extra charge for changing type.

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Every R-S-K Repair is carefully tested and guaranteed to give performance equal to a new tube. Try yours for 30 days. If not delighted, mail it back, and we will replace or refund, provided only that you have not burned out the filament.

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since it is possible to standardize instruction. By using the records according to directions and giving daily tests, the student is assured of exactly the same instruction as is given in the Signal School. This obviously is an extremely desirable feature as it permits of the establishment of standardized code schools throughout the Army, without any particular need for a skilled instructor. The course should appeal particularly to the Infantry, Cavalry and Artillery, as it is a complete solution of their problem of developing radio operators in their own organizations.

Special code practice equipment for radio classes has been designed in the Signal School, which makes the installation of the necessary apparatus very simple. This consists of a modified monocord switchboard with a buzzerphone howler and a four-volt battery to supply the tone.

HAVE YOU HEARD AT9?

Most fans know NAA, or its foster brother NAL, which broadcast when the big Governmental broadcaster at Arlington is not operating, but how many know the Army broadcaster AT9? This is the only other broadcast station of the Government, but, unlike the premier broadcaster NAA, it carries few market and stock reports, being devoted to entertainment.

AT9 is the call of the special Army station at Fort Bragg, N. C., which operates like NAA on 435 meters every afternoon or evening of the week. It carries programs made up and broadcast by Fifth Field Artillery Band or orchestra, vocal selections by men of the regiment, ringside reports of Army boxing bouts, political and other talks and music furnished by neighborhood talent from several cities of the South.

As a publicity medium, it is said to be excellent; and by publicity is meant community interests and army recruiting. In fact, it has put Fort Bragg on the broadcasting map. With its 750 watts power it should reach fans within a great radius, if they tune in on 435 meters Tuesday, Thursday, Saturday and Sunday evenings or alternate afternoons. Signal Corps equipment is used, and Army personnel operate the station.

SINCE DADDY'S GOT HIS RADIO

(What a Child Thinks)

By MINNIE MILLER

Since Daddy's got his radio,
The evenings go so very slow.
We have to sit as still can be,
Billy, Betty, Tom and me,
While Pop, he twirls the dials 'round
He's dreamy—don't know where he's bound.
Gosh—but the evenings do go slow,
Since Daddy's got his radio.

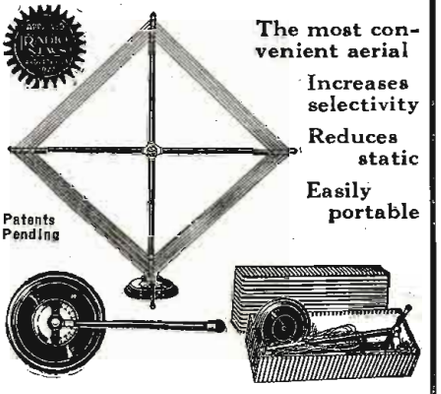
I like the programs well, sometimes.
The joke man and his funny rhymes,
Dream Daddy—and the "sign off" gongs,
The coon man and his darky songs.
But most the time it's very slow,
Since Daddy's got his radio.

But Daddy says, "You'll learn a lot
Of politics and art and what;
The Masters old and new you'll know."
But I'd rather see a movie show;
Gee—ain't our evenings awfully slow,
Since Daddy's got his radio?

I'd rather hear when Dinah sings.
Her "Meetin'" songs, and other things,
Or Ebby picks his banjo strings,
Than all the many other things
That make the evenings go so slow,
Since Daddy's got his radio.

Daddy has no time to play,
A single game of dominoes
Because he always has to go,

Duo-Spiral *Folding Loop*



The most convenient aerial
Increases selectivity
Reduces static
Easily portable

Patents Pending

The favorite loop aerial because of its great convenience, handsome appearance and superior performance. Compact and self contained. The best loop for permanent installations or portable sets.

Rotates on base which has silvered dial graduated for calibration. Handle permits adjustment without body capacity effect. Direct connection prevents losses. Handsomely finished in silver and mahogany. Price $8.50

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Book No. 3



Distance lends enchantment — and its the Radio Frequency Amplification that brings in the distance on your Radio Receiver. If you contemplate adding any Radio Frequency to your set you will want this book at your side.

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Book No. 4



Don't struggle in the dark, looking for stations—here is an inexpensive book that gives you detailed instructions on just how to handle your Radio set. You will be surprised at the increased results that can be obtained through proper tuning.

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No better book for your work bench. Gives diagrams, hookups and details on Radio Hookups galore. One of the most complete hookup books published. Authentic and up-to-date in every respect. Third edition now ready.

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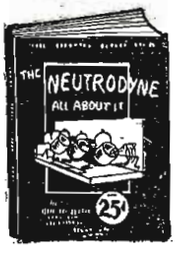
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RADIO'S FOREMOST PUBLISHERS—Everything in Books, Patterns and Diagrams



Old Man Ohm Says:
"Here is the Ideal Rheostat for all Tubes"



—and he ought to know. He is the fellow who measures resistance. He finds that the Marshall-stat varies resistance not step by step, but smoothly, continuously and uninterruptedly from zero to maximum.

He also finds—and you will too—that the Marshall-stat:

Is compact (see exact size cut at left).

Requires only one hole in panel.

Is vernier all the way but requires only one adjustment.

Can be used with any tube or combination of tubes.

Has only two terminals and cannot be connected incorrectly.

Exact size cut of the Marshall-stat

$1.75

MARSHALL ELECTRIC COMPANY
3235 Locust Bl.
St. Louis, Mo.

Marshall-stat

Old Man Ohm has an interesting folder on the Marshall-stat. Send for it.

$4 List 2400 Ohms
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$5 List 3000 Ohms



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Guarantees
Matchless Reproduction

From all parts of critical America, from wireless workers, amateurs, and from those who just insist upon the best, comes enthusiastic indorsement for Repeater Phones. Distance is annihilated, obstacles vanquished by Repeater.

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All the power of the air unleashed flows evenly, smoothly through Repeater's "Single Pole"—you are certain of exact, faithful reproduction.

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DEALERS
In Repeaters you will find a popular appeal. Our discounts will interest you. Write for Merchandising Plan.

MOSS-SCHURY MFG. CO., Inc.
Radio Division
2017 Franklin St. Detroit, U. S. A.
The New Improved "Repeater".

tions, known as Class B, would continue under that name, while remaining stations will be classed as A stations. The suggested designations as Classes No. 1, 2, and 3 will not be practical since existing legislation provides that Class 1 stations are public service stations; Class 4, technical and training, and Classes 5, 6 and 7, amateur stations.

Furthermore, the Department is said not to favor grouping all the lower-powered present A stations, numbering nearly half the present stations, into Class 3, and trying to satisfy them all with only five operating channels. The band for these stations assigned by the conference was between 202 and 207 meters; all very low wave-lengths, and not capable of being picked up on many types of sets. All Class A stations, therefore, it is understood, will be assigned wavelengths between 200 and 280 meters, the more powerful having the higher wavelengths between 233 and 278 meters. Supervisors are also testing the broadcast stations and marking their transmitters for future adjustments on the new waves, thus preparing for the final transfer, when all details are worked out.

RECEIVERS FOR THE BLIND

The American Radio Association, headquarters in New York City, has started a campaign to raise funds for equipping all homes where blind persons dwell with radio. To this end all radio fans are asked to contribute toward the fund through local newspapers or directly to the American Federation for the Blind, 41 Union Square, New York City. Old sets and spare parts are not desired, as it is believed best to purchase new equipment, which will be done with the approval of an advisory committee on which government radio experts will be represented.

RADIO TAUGHT BY A MACHINE

A mechanical device is to take the place of human instructors in Morse and Continental code at the Army Signal Corps School at Camp Alfred Vail, New Jersey, following the successful experiments with the new adaptation of phonographic or dictaphone instruction.

As a result of a report of a board of officers, appointed to make a comparative study of the merits of manual and mechanical instruction in radio and telegraph code work, the Signal School has adopted the Ediphone system. These machines, such as are used in many business offices today, will be employed this year for recording and transmitting code practice in both the Morse and radio departments, and will actually replace the operator instructors, according to Capt. John P. Ferriter, of the Signal Corps.

Briefly, the system requires a Signal Corps Special Ediphone, a shaving machine, 19 hard receiving records and 12 wax records, all of which costs about $263.00.

The records for receiving practice are made of a hard material which makes them practically indestructible. By means of a special reproducer on the Ediphone, the signals on the record are caused to operate a relay. The local contacts of this relay may be caused to interrupt a tone passing through the telephone head sets of the students in the radio classes, or it may operate sounders in the Morse classes. For sending practice, blank wax records are provided. The student records his sending on a wax cylinder. This record is then re-run and he is required to copy it.

Several changes in the commercial Ediphone were necessary to adapt it to this use, the principal ones being a special reproducer and recorder, developed at the Signal School.

The Ediphone method has many advantages over the manual method of teaching,

10 Days FREE TRIAL



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The Last word in Radio Re-Creation

Embodies all proved principles of reproduction. Delicate shading, inflection and modulation of voice—this and the musical instrument re-created with remarkable volume and clarity of tone, with astounding purity and faithfulness, even when sending is weak. **Floods room with best that's in your set.** Horn acoustically perfect. No battery needed—simply plug in like headphones. Handsome crystalline finish fibre horn approx. 22" high; heavy base prevents tipping. Polar indicating connecting cord included.

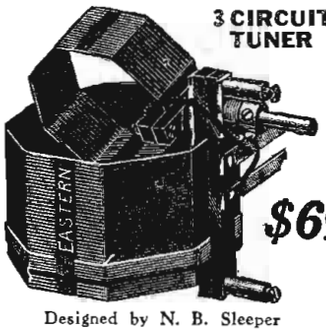
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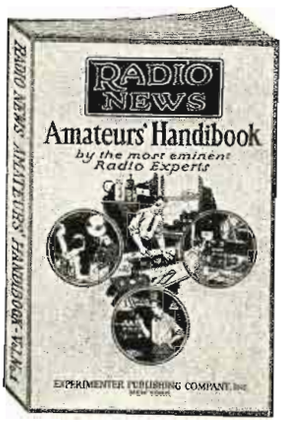
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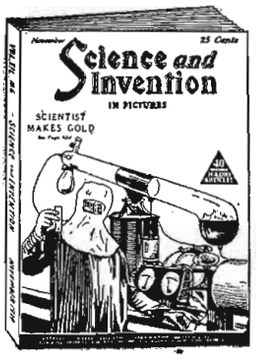


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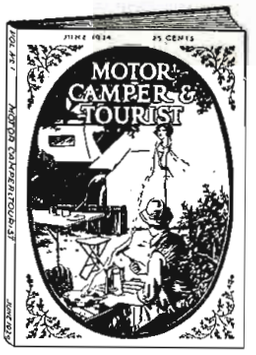
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ing would be issued forthwith, but Secretary Hoover's radio aides have had a terrible time working out the practical details of an equable distribution of the 53 wave-lengths among the 62 class B stations now in existence.

After trying out several plans of allocating wave-lengths by zones and cities where the larger and more powerful broadcasters are located, a tentative system based on distance between the broadcast stations has been sent to all radio supervisors with instructions to confer with local operators and secure their approval. Out of nine national districts, only one supervisor has reported a general agreement to the changes in wave-lengths suggested. Supervisor R. Y. Cadmus of the Third District, having headquarters at Baltimore, reports that all major station owners agree to the wave-lengths assigned. Under this district plan, Washington will get a wave-length of 491.5 meters, time on which will have to be divided by Stations WRC and WCAP. Philadelphia, which has four stations, will have two wave-lengths, 394.5 and 535.4 meters; while Atlantic City will have a single wave of 288.3 meters.

The general plan of subdividing the wave band between 280 and 545 meters among the class B stations provides for a separation of from 10 to 50 kilocycles. Stations in the same city will be approximately 50 kilocycles or about 34 meters apart, which should prevent serious interference when both are on the air. A recent test in Washington, however, when WRC broadcast on 469 and WCAP on 435 meters, brought a number of complaints of bad interference, chiefly from crystal set owners. In reports tabulated by the Department of Commerce, 25 per cent. of the fans claimed it was impossible to separate the two programs. In many other cities, such as in New York, Philadelphia and Chicago, it is understood fans have little difficulty in selecting the station desired during simultaneous broadcasting.

Stations distant from each other 50 to 200 miles will use wave-lengths separated by 30 kilocycles; those from 200 to 500 miles apart will have a 20-kilocycle separation, and those over 500 miles apart will operate on wave-lengths differing by 10 kilocycles.

Before the allocation of the Class B wave-lengths is put into effect, it will be necessary to reassign wave-lengths to the present Class A stations in the new band between 200 and 278 meters, as provided in the general conference plan, and also to get the 89 active Class C stations to transfer to Class A or B, or quit so as to release the 360 meter wave-length. No Class C station licenses will be renewed after November 15. The new allocations will probably not be finally checked and assigned until about January 1, but all supervisors are completing their local surveys as fast as possible. In some cities where there are but two channels for three or more broadcast stations difficulties are being met, as each station wants a separate wave-length. The fact that 26 new Class B stations are anticipated—12 planning to transfer from their present status, and 14 being new stations under construction—hinders progress. All told, this makes it necessary for the Commerce Department to divide 53 wave-lengths among 88 stations, and although 10 of the wave-lengths used on the east coast may be repeated on the west coast, a satisfactory assignment is found difficult.

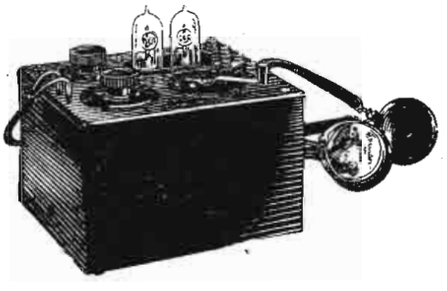
While Secretary Hoover has made no statement as to the Department's acceptance of the conference resolutions, practical applications indicate that some of the plans cannot be carried out. For example, the renaming of broadcast stations by numerical designations, which, of course, makes little difference to the fans anyhow, is impossible. It looks as if the higher powered sta-

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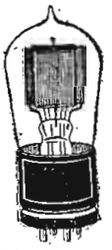
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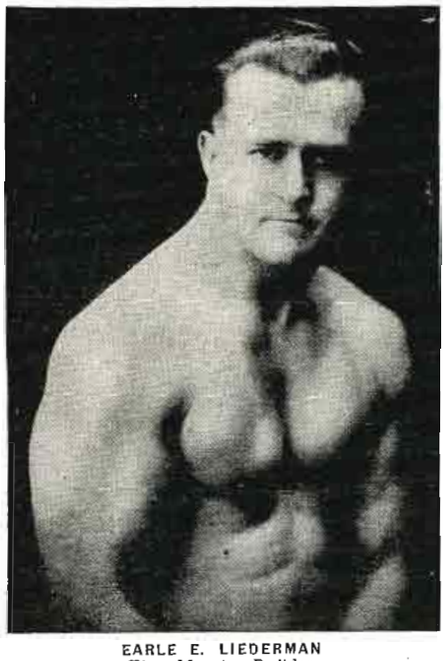


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is the most gruesome commandment handed down to mankind. A man may lie, steal or break any other law and the public will eventually forgive and forget. But let him commit murder and the cry of everybody is to give him the full penalty—Death! And what is the common excuse of the murderer? INSANITY! Sure, he's crazy. Any man must be crazy to commit murder.

But how about the fellow who slowly but surely kills his own body by neglect? He's the craziest one of all.

Stop! Think this over! What are you doing with your own body? Surely you don't want to be put in this class. But if you are not doing everything possible to prolong your life and keep your body just as clean and healthy as your Maker intended, you are inviting death. You are slowly but surely killing yourself.

A New Life

Have you ever enjoyed the pleasures of perfect health? Have you ever felt the thrills which accompany a strong robust body? If not, you have nature's biggest gift awaiting you. That is what I have to offer you. I don't promise to feed this to you in pill form. No, you have to work for it. You can't get anything in this life without effort. Don't let anyone fool you by telling you different. I'm going to make you work, but oh boy! how you'll like it. After a few days you will feel the old pep shooting through your veins and you will crave your exercise like a kid wants his bread and sugar.

Today Is Your Day

This is your birthday. Today you start a new life. I'm going to make a real live, "rip-snortin," go-getter out of you. I'm going to expand that chest so it will give your lungs a treat with life-giving oxygen. This will put real vim into your blood and shoot it throughout your entire system. I'm going to broaden your shoulders and strengthen your back. I'm going to put a ripple of muscle up and down your body that will make a big powerful he-man out of you. You will have the arms and legs of a modern Hercules. I'll clear your brain and pep up your entire system. You will be just bubbling over with vitality. You will stretch out your powerful body and shout for bigger and greater things to accomplish. Nothing will be too difficult for you to tackle.

Sounds good, doesn't it? You can bet your Sunday hat it's good. It's wonderful. And it's no idle prattle either. I'm not promising these things. I guarantee them. Do you doubt me? Make me prove it. Come on. Atta boy. Let's go.

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Dear Sir:—I enclose herewith 10 cents, for which you are to send me, without any obligation on my part whatever, a copy of your latest book, "Muscular Development." (Please write or print plainly.)

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speeches broadcast for a change, rather than all American programs broadcast from the stations across the line, yet when these Canadian programs are broadcast for them, neither the broadcast station nor the artists who supply the talent know whether or not their efforts are pleasing to Canadian listeners-in.

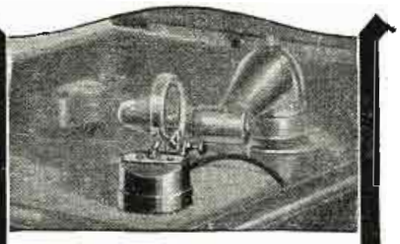
"Children of Winnipeg and district, who have been following the bed-time travel tale broadcast weekly, have, however, been consistent correspondents of the radio man ever since the travel tale started, several hundred of them having written for copies of the Kiddies' Menu, used on Canadian National dining cars and featured in one of the instalments of the travel story. From the number of kiddies' letters received it has been possible to form a rough estimate of the number of Manitobans 'listening-in' to the weekly broadcasts, and a very conservative estimate of the applause letters received from this province weekly would indicate that not more than one person of each thousand listening to the broadcast writes afterwards to commend the artists or the station or to comment on the program. If the same percentage applied in the United States, an idea of the publicity value to Winnipeg and Western Canada of these broadcasts may be gained from the estimate that this would give at least 150,000 listeners to each of the programs of music and speeches broadcast.

"Another feature of the applause cards is that of reaching the artist who has assisted on the program. In the case of one appearing for the first time, to sing or speak into a microphone, not knowing whether or not one is being heard outside of the studio, except for the fact that he or she knows that other artists have been heard through this wonderful invention, there is sufficient awe connected with a first appearance to give one that 'sinking' sensation in the region of the 'tummy,' but when, a few days later, a letter or postcard is received, expressing the appreciation of someone in the city, or perhaps as far away as the state of Texas or some point in New Mexico, there is a willingness to repeat within a short time which can be encouraged in no other way. The applause cards are passed along to the artists interested, of course, and many of them keep clipping books in which they enter the remarks of appreciation, valuing these very highly. So that apart from every other consideration, if the listener-in is pleased with the work of an artist on the radio broadcast program, there is a more likelihood of that artist being secured for a later broadcast if a letter is written, mentioning the fact that his or her efforts on an earlier occasion have given listeners pleasure.

"In some cases, Boards of Trade are furnishing radio fans with applause cards, which they send off to stations they have heard, and thus combine their applause with a little boost for the home town. This, in itself, is of value to the community in which the radio enthusiast lives, for it is a valuable means of advertising the community at outside points. But the applause cards received in Winnipeg would bear out the statements of American announcers, that while the average United States listener is quick to send an applause card to the station he has 'tuned in,' his Canadian cousin for one reason or another hesitates to do so and in the end makes his own radio stations wonder whether or not their programs are really giving the satisfaction that they are expected to do."

NEW BROADCAST BAND BEING SUBDIVIDED

Delegates to the Radio Conference left with the idea that everything was settled and that new wave-lengths for broadcast-



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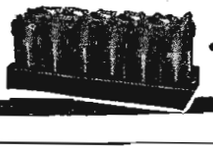
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ufacturers was brought to the fore. The manufacturers, Micawber-like, had waited for over a year for "something to turn up." It was a lightning-like procedure from first to last, and a very strenuous week for all concerned.

Willis H. Taylor, Inc., one of the country's foremost patent attorneys, claims that this grant of license by the Navy Department to the independent radio manufacturers will completely change the complexion of patent litigation.

One of the chief obstacles to the greatest development of the industry is thus removed. The complexities of the radio patent situation are now much minimized. The difficulties incident to the government sharing the use of these patents with only one American manufacturer are permanently obviated. In fact, the monopolization effected by one exclusive license amounted to unwarranted discrimination, and manifestly did injury to the radio industry.

ARE CANADIAN RADIO FANS "COLD"?

Applause cards and letters received by Canadian National radio stations in Western Canada indicate that very small percentage of Canadian listeners will acknowledge receipt of broadcasts while U. S. cards pour in.

Canadian radio enthusiasts are either "cold," as Canadian audiences are sometimes accused of being, or else their enthusiasm for broadcasts does not carry them to the extent of sitting down to write and mail applause cards and letters, as their American cousins do, some of them with pleasing regularity. This is the opinion of Canadian broadcast stations in Western Canada after going through their weekly hundreds of applause letters and cards, which are pouring in by the hundred.

"Take one week of applause cards addressed to CNRW, the Winnipeg station of the Canadian National system alone," declared one of the radio department staff in Western Canada. "Here, in the four days which have passed since the last broadcast from the Fort Garry Hotel, we have over one hundred and fifty applause letters and cards addressed to the department. These come from as far south as New Mexico, with representation from every intervening state clear up to the Canadian border. Looking for a Canadian applause card among the collection is a little easier than finding the needle in the proverbial haystack, but it is rather surprising to find that less than 15 per cent. of the total letters and cards every week are from Canadians, while the balance of 85 per cent. come from people who, in a great many cases, have never seen Canada but are glad to welcome a Canadian station 'on the air.'

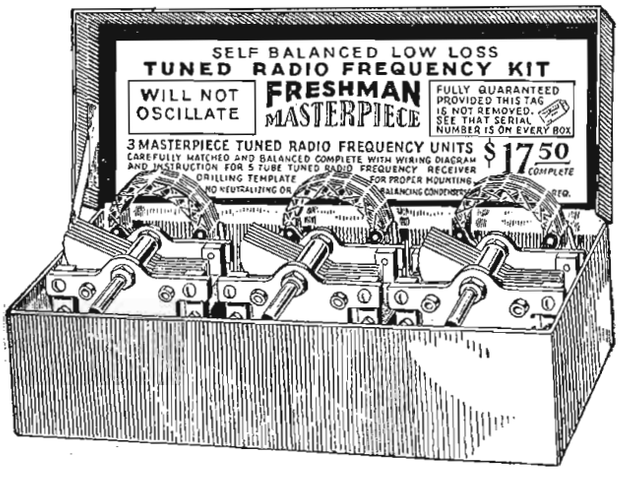
"While we know that thousands of people in Winnipeg and in Manitoba are 'listening in' to our concerts every Thursday night, it is a surprise to find that of one week's applause letters and cards, for instance, six are received from points in Manitoba while seven have come from citizens of the state of Texas.

"Taking the same week's applause, it is a further surprise to find the state of Illinois sending in more cards than all the Canadian provinces together, and also to find the province of Ontario sending in just one less letter of appreciation than does the province of Manitoba, where the station is located and every corner of which we know is reached by the broadcasts. In the meantime there is a continued demand for good programs to be broadcast by Canadian stations, which demand the Canadian National Railways are endeavoring to meet through their broadcast policy. This demand comes, as a rule, from Canadians who say that they prefer to hear Canadian songs and

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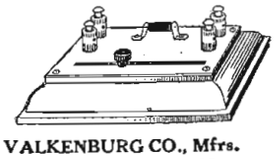
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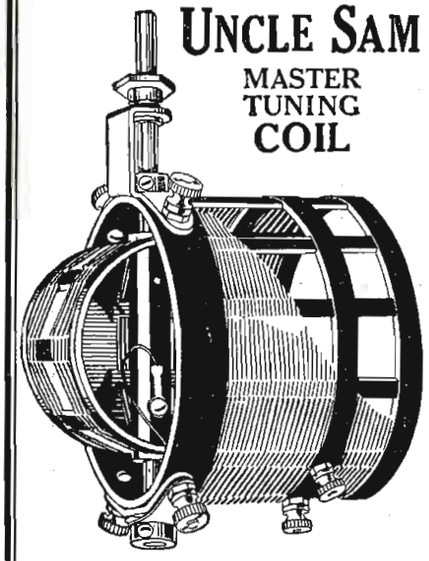
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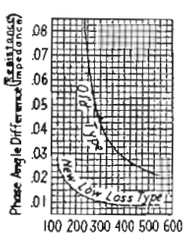
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took over the Atlantic Communication Company.

PURCHASE OF PATENTS BY SECRETARY OF THE NAVY

Under the provisions of the Trading with the Enemy Act, as amended, the Alien Property Custodian on February 5, 1919, sold to the Secretary of the Navy, representing the United States, all right, title and interest in and to the said patents, which had been vested in the Atlantic Communication Company and acquired by him from it. Next day the Custodian also sold to the Secretary of the Navy all right, title and interest in and to the patents and applications which had remained in the Telefunken Company, after the assignment to the Atlantic Communication Company, and which have been acquired by the Custodian.

These sales were outright, without any limitations whatsoever, and covered all the rights acquired by the Government. The sale expressly includes "The sole and exclusive right, license and authority to manufacture or cause to be manufactured within the United States, its territories and dependencies, and within the Republic of Cuba—; and the right to sell and install, to use and to grant the right to use——."

LEGALITY OF PURCHASE BY GOVERNMENT

There is no question about the legality of sales of this nature. Title to property so acquired vests in the United States. The Attorney General has so decided.

It is also established that the grant of a revocable, non-exclusive license to use patents valuable to the manufacture of radio apparatus, is well within the discretion of the Secretary of the Navy.

On August 5, 1920, the Secretary of the Navy granted to The International Radio Telegraph Company a non-exclusive, irrevocable license, without royalty, to make, use and sell for the purposes, and to the extent which the Department has a right to do, the inventions covered by the patents.

ATTITUDE OF THE INDEPENDENT MANUFACTURERS

The theory on which the independent manufacturers requested grant of license was that such grant would tend to advance the welfare of the people of the United States, and would promote a healthy competition in the manufacture and sale of radio apparatus; that to withhold such license would tend to injure the public welfare by tending to promote monopoly contrary to the policy declared by the Sherman Act; that the denial of the license to the applicants would make the International Radio Telegraph Company, the only licensee, which would be inconsistent with Governmental policy as to monopoly, or the principle of equality of opportunity on which this nation is founded.

SPECIAL CONSIDERATION FOR THE GRANT

As a part consideration for granting the said license, the independent radio manufacturers agreed to grant to the United States of America, represented by the Secretary of the Navy, a non-transferable, non-exclusive license under United States letters patent which they now own or may hereafter own during the term of the agreement, to make or have made for it and use for governmental purposes, apparatus utilizing or embodying the inventions of their patents, but not for sale.

SUMMARY ACTION AFTER LONG DELAY

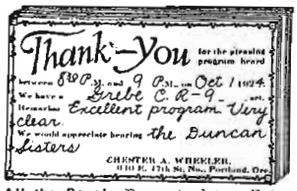
One week ago, with the assistance of Congressman Fred Britten of Chicago, an ardent radio enthusiast, as well as an out-and-out opponent of monopolies, and with President Coolidge and the Attorney-General kindly co-operating, the cause of the approximately sixty independent radio manu-

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50 tons. In it will be the equivalent of 125 stringed instruments of an orchestra—the greatest combination of stringed instruments contained in any organ. The organ would require a symphonic orchestra of 325 men if each were playing one of its instruments. Even a concert grand piano will be included, playable from the organ console as well as from its own keyboard.

Motors of 75 horsepower will pump the wind. When it is known that the average large organ requires motors of from one to two horsepower, the magnitude of the pumping system can be realized. The wind pressure will range from one inch to 25 inches. The keyboard will have 307 stops to bring out the resources of the instrument.

The organ has been designed by Frank Taft and is being built by the Aeolian Company at its great plant in Garwood, New Jersey. When finished and ready to ship it will require 12 large freight cars to convey it from the factory to Davenport. It will take 14 months to build and about four months to install after it arrived. The total length of all pipes in the organ if laid end to end would exceed 25,000 feet, or about five miles.

The music from the new organ will swell to a volume sufficient to rock the very theatre to its foundations, and diminish to an almost inaudible whisper. Any great artist can express any temperament or mood. The playing of the master organists who record their playing for the Duo-Art Aeolian organ will be reproduced by it to absolute perfection.

The whole project illustrates the movement that is on foot to make the radio programs of the country the finest and most enjoyable entertainment that it is possible to procure. Heretofore, the great organs of the world have been heard only by those chosen few who could actually go to them. The new Davenport organ will be heard by millions daily, playing the very cream of music.

RADIO PATENT REVOLUTION

By E. F. McDonald, Jr.

One of the outstanding, downright important historical events in the radio patent field took place October 30, when the Navy Department decided to issue licenses to approximately 60 independent radio manufacturers under 129 German patents seized by the Alien Property Custodian during the World War.

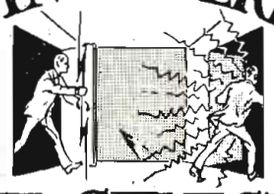
Early in 1923, application for the patents had been filed, but no decisive action was taken by the Washington authorities. Recently the co-operation of Congressman Fred Britten of Chicago, the National Association of Broadcasters, and the Radio Manufacturers Association was enlisted. Through the joint efforts of these, what had grown to be considered a hopeless cause was quickly matured into a successful issue of wide-reaching importance.

HISTORY OF THE TITLE TO PATENTS

The majority of the patents and applications involved were originally owned by the Telefunken Company, a German corporation. Among them is the controlling patent covering tuned radio frequency—the well known Wilhelm Schloemilch and Otto Van Bronk patent. Under a series of contracts, the first dated February 21, 1913, substantial rights in these patents and applications were assigned by the Telefunken Company to the Atlantic Communication Company, a German corporation organized under the laws of the State of New York.

Under the provision of the Trading with the Enemy Act, as amended, the Alien Property Custodian seized all right, title and interest in and to these letters patent and applications, which remained in the Telefunken Company, and simultaneously

EXIT INTERFERENCE



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Guaranteed to tune out any interfering station. The Ferbend Wave Trap is designed and manufactured complete by us after years of careful experimenting. It is not to be confused with imitations, hastily assembled from ordinary parts. The price is $8.50. Shipment is made Parcel Post C.O.D., plus a few cents postage. If you prefer, you can send cash in full with order, and we will ship postage prepaid. Clip and mail the COUPON today!

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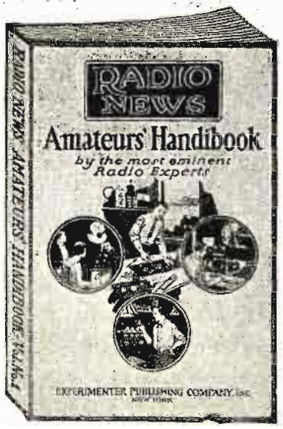
Read the evidence

Dunbar, West Va.
Ferbend Electric Co.
Gentlemen: I bought your Wave Trap to see if I could not cut out the awful noise of telegraph stations which ruined most of our programs. Since we installed it in our five-tube Fada Neutrodyne set we have not heard any more telegraphers—*we let 'em in sometimes to show our friends how easy it is to kick 'em out with the Wave Trap.* I would not have a set without a Ferbend Wave Trap.
(Signed) H. E Atherton.

Farragut, Iowa.
Ferbend Electric Co.
Dear Sirs: I set my radio where Havana, Cuba, should come in but received only a jumble of K. F. N. F., W.O.R. and W.L.A.G. I then tuned in with the Trap and had Havana for two hours. I have several times taken a jumble like this and separated five and six stations. I find it a great help in cleaning up stations that can not be brought in distinct. I am using a Crosley X.J.
(Signed) W. T. Cox.

Townsend, Md.
Ferbend Electric Co.
Gentlemen: Well to say I am pleased with the Trap is putting it mildly. It is simply a wonderful instrument. I have had more or less trouble in getting K.D.K.A., W.B.Z., W.D.R. and W.L.W. with my Freed-Eisemann Set as they are only a few degrees apart on my dials. Your Trap lets me through with the clearest possible reception. In my candid opinion there is no Radio Receiving Set complete without the addition of the Ferbend Wave Trap.
(Signed) E. W. Stevenson.

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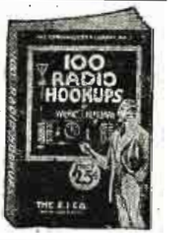
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BIGGEST ORGAN TO BE BROADCAST

WOC Station, Davenport, Iowa, to Be Equipped with Gigantic Wind Instrument

Radio fans will be thrilled by the news that plans are completed for the erection in Davenport, Iowa, of one of the world's largest pipe organs, the music of which will be broadcast over station WOC. The station itself is to be one of the 10 great superstations of the country. The organ will be housed in a building to be known as the Kindt Concertorium Theatre, a structure nearly half again as big as the Mormon Temple at Salt Lake City, and so the largest building in the great section east of the Rockies.

The organ will be built by the Aeolian Company of New York, and according to its present specifications will be the most tremendous feat of organ construction yet attempted. It will be one of the famous Duo-Art Aeolian organs, instruments that reproduce the playing of the world's leading organists. This will mean that radio fans within tuning distance of Davenport will be assured a wonderful musical treat —the playing of the greatest masters of the organ on the world's greatest instrument.

The cost of the organ will be $180,000, a hitherto unhead of sum to be paid for a musical instrument. Many new features will be embodied in its construction, to give it added resources, and the greatest possible shading of tone values and orchestration. Included are a concert grand piano which will be electrically connected with the organ console; orchestral brass organ with trumpets, tubas, saxophones and trombones; bells, chimes, two harps, and percussion instruments.

There will be 13 combinations of pedal stops and nine expression combinations. The blowing plant with five or six large motors and 12-foot blowers will be placed in the basement of the theatre.

The console of the organ will contain six manuals, or keyboards. This is unusual in itself, for the maximum heretofore in organbuilding has been five manuals. Two of these keyboards will have a double touch system. There will be hundreds of devices and appliances to bring its enormous resources under the control of a single performer.

The specifications call for an instrument that will combine 11 large separate and complete organs into one grand organ. These are the great, swell, choir, orchestral string, orchestral brass, vibrato, vox humana, echo, percussion, piano and pedal. The instrument will have a complete saxophone choir, vox humana choir, string choir, and orchestrelle brass choir, and there will be seven vox humanas in the entire organ.

One of the interesting features is the huge 64-foot grand diapason in the pedal organ. The longest pipe in this group of 32 has an actual length of 67 feet and is four feet square. It contains enough wood to lay a floor one inch thick over a room with an area of 87 by 140 feet—all in a single pipe. Its note will be so low that it will be felt by the auditor, rather than heard, and the effect will be like the mighty rumble of thunder.

From the standpoint of placing, the 11 organs will have three divisions, one to be on both sides and over the proscenium arch of the stage. The antiphonal organ will be in the rear over the balcony and the echo organ high in the dome of the ceiling. The echo organ will be located over one hundred feet from the console from which it will be actually played. A marvelous electrical system of cables and wires makes this possible.

The famous pipe organ at the Mormon Tabernacle in Salt Lake City has 2,648 pipes. The Davenport organ will have 9,737, three times as many. The total weight will be

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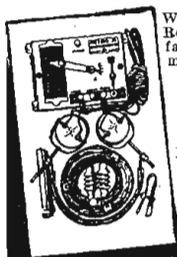
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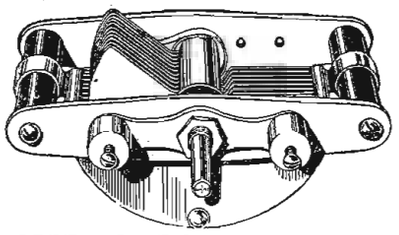
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elsewhere indicate that a full description of a successful set will be shortly described. Buzzing in a circuit of this kind, if it ever occurs, may be due to one or two reasons; either a grid leak howl is obtained, due to the charging and discharging of the grid condenser in the first tube due to the piling up of electrons on the grid through oscillation of the first tube, or it may be due to a complex effect independent of oscillation circuits. This form of audio frequency buzzing is only obtained in certain resistoflex circuits, and is due to an effect similar to that obtained in the multivibrator circuits. It is, however, possible to overcome this latter effect, if present, and also the former, by suitable adjustment of the grid leaks and condensers.

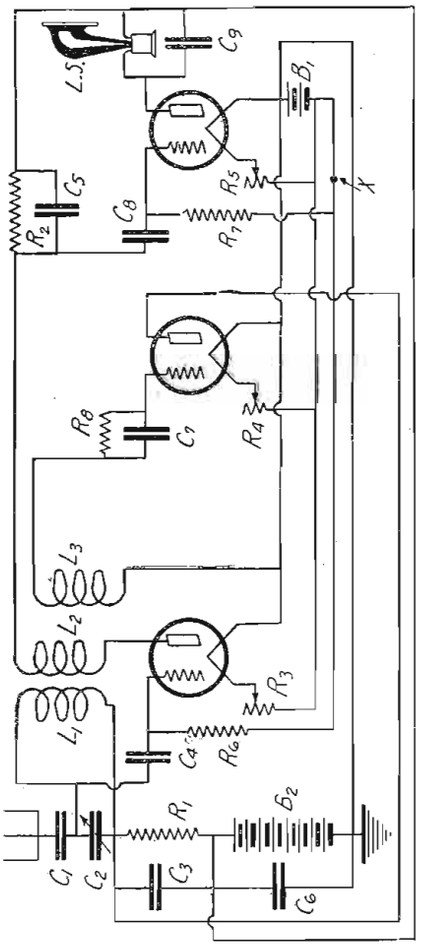


Fig. 7 is like Fig. 4, with the audio frequency stage of amplification being resistance, instead of transformer coupled.

Reports from readers will be very welcome as the introduction of new circuits depends for its success upon the ability of thousands of experimenters to fix up the arrangement and obtain the desired results.

Fig. 5 is certainly the one to try first:

C_2 = .005 mfd.
C_3 = .0003 mfd.
C_4 = 1 or 2 mfd.
C_5 = .0005 mfd.
C_6 = .0003 mfd.
C_7 = .0003 mfd.
C_8 = .0003 mfd.
grid leaks = 2 megohms.
B_3 = 3 volts.
R_1 = 100,000 ohms.

A reversal of leads to the grid coil should always be tried.

BUT HE ONLY CAUGHT MALARIA

"Is Jones a radio fan?"

"Is he! Why man, he named his summer camp 'Listen Inn.'"

—*Contributed by Sam Y. Caldwell.*



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Fig. 6 is a pictorial representation of the Fig. 5 arrangement.

THREE-TUBE RESISTOFLEX CIRCUITS

Fig. 7 is a resistoflex circuit in which the amplified audio frequency currents in the plate circuit of the first tube, which is acting as a reflex amplifier, are passed, not through telephones or a loud speaker, but through another plate resistance R_2 having a value of from 40,000 to 100,000 ohms. A suitable value is 50,000 ohms or 100,000 ohms; the difference in signal strength between the two does not seem to be appreciable. The resistance R_2 is shunted by a fixed condenser C_5 having a value of from .0001 to .002 mfd. Any intermediate value will do. It will be seen that the right-hand end of R_2 is connected to the grid of the third tube through the condenser C_3, which has a value of from .002 mfd. to .25 mfd. The grid leak and condenser of the second tube V_2 have the usual values, namely, .003

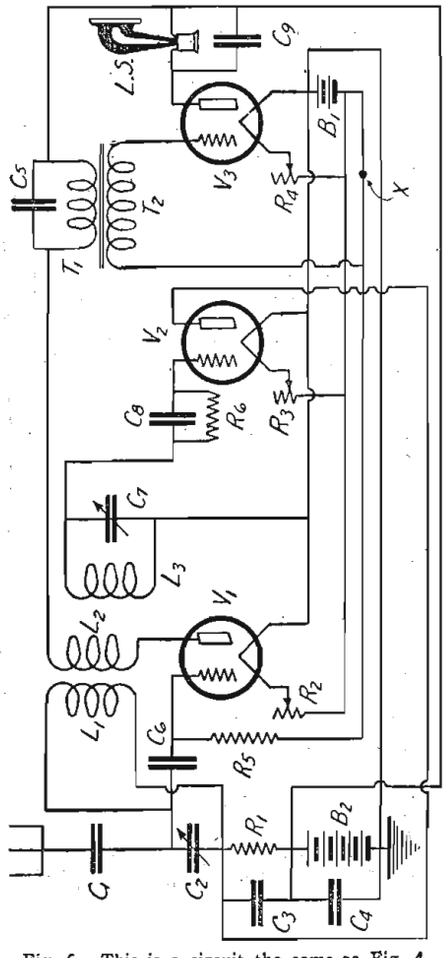


Fig. 6. This is a circuit the same as Fig. 4, except for an extra stage of audio frequency amplification.

mfd. and 2 megohms. It will be noticed that the bottoms of the two grid leaks R_6 and R_7 are connected to the negative terminal of the filament battery B_1; a grid bias battery may be included in the position Y in such a way as to make the two grids negative.

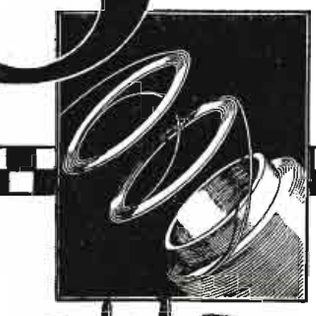
Fig. 8 is a circuit like Fig. 5 with an additional stage of audio frequency amplification, a step-up transformer T_1T_2 being connected in the position shown. The primary T_1 is shunted by a condenser C_5 of .002 mfd. capacity.

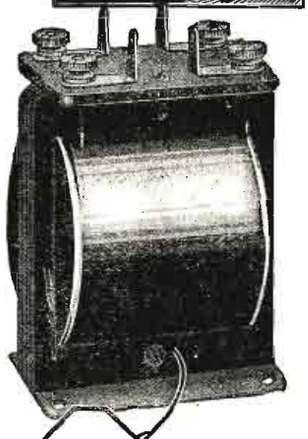
In Fig. 9 we have a circuit like Fig. 5 followed by a stage of resistance amplification. The values of C_4, C_5, C_8, R_2, R_6 and R_7 are the same as those in connection with Fig. 7.

CONCLUSION

Excellent results have been obtained with this class of circuit, and announcements

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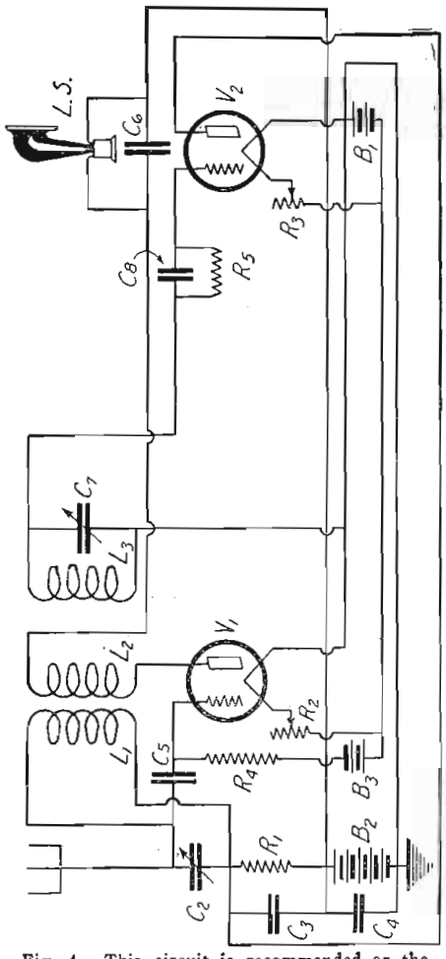


Fig. 4. This circuit is recommended as the best one to use for experimenting with the Resistoflex.

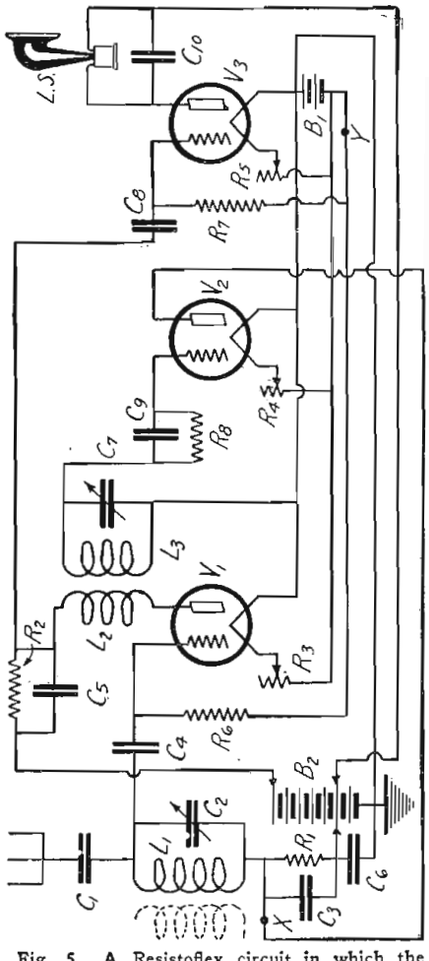


Fig. 5. A Resistoflex circuit in which the amplified audio frequency currents in the plate circuit of the first tube are passed through a resistance R2.

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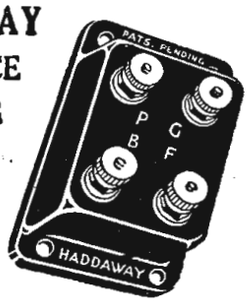
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It is important to connect the coil L_3 the right way round, and reversing leads are desirable in a set made up in accordance with this circuit. The adjustment of the condenser C_3 is very important, and it will be found that there is a certain value which will give freedom from self-oscillation. If this value is either too high or two low the first tube will be prone to oscillate.

ADDING REGENERATION

If it is desired to add regeneration to the Fig. 43 circuit, a feed-back coil may be connected in the plate circuit of the second tube and coupled to the grid circuit of the first.

OVERCOMING MAGNETIC COUPLING

It is to be understood that in addition to using the balance capacity method, any of the methods described in these articles for overcoming magnetic coupling may be used. In Fig. 25 it was shown that by arranging coils in a "raked" manner, similar to the funnels of a ship, it is possible to overcome a great deal of the inductive coupling which is also a bugbear in multi-stage radio frequency amplification. In all the arrangements described, the use of transformers or plate coils may profitably involve arranging the coils in a raked manner.

CONCLUDING REMARKS

This series of articles will conclude in the next issue with a description of a new method of radio frequency amplification which I have developed and which takes advantage of a fact which has hitherto apparently not been fully realized. It had been proposed to include a description in this issue, but, owing to space considerations, it has been found necessary to hold the description for the next issue.

(*To be continued*)

FOUR NEW BROADCAST STATIONS FOR ENGLAND

The British Broadcasting Co. has decided to erect four more broadcast stations in England, which will bring their number up to 19. The locations for all of these stations have not been determined upon. However, one will be in Dundee, 2DE, and another in Swansea, Wales, 5SX. It is reported that they will be transmitting by Christmas. The other two will probably be in Scotland.

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The Resistoflex Circuit

(*Continued from page* 1173)

Fig. 5 is a particularly useful embodiment of the resistoflex circuit, tri-coil coupling being applied to this circuit. The grid coil L_1 should be kept well away from the coils L_2 and L_2 when first tuning in, and L_2 and L_3 will usually be kept close. If, however, there is a tendency towards self-oscillation with L_2 and L_3 too close together, L_3 may be moved to an appropriate distance from L_2. A complete control of regeneration is obtained in this way, and this circuit is probably the best one to try out the resistoflex principle.

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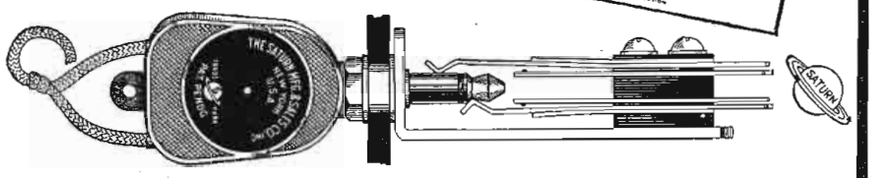
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possesses very marked advantages. A phase reversal is obtained by means of the coil L_3 which is coupled to the tuned coil L_2. One end of L_3 is connected to the filament, and the other end through the very small condenser C_3 to the grid of the first tube. I have carried out very interesting tests with

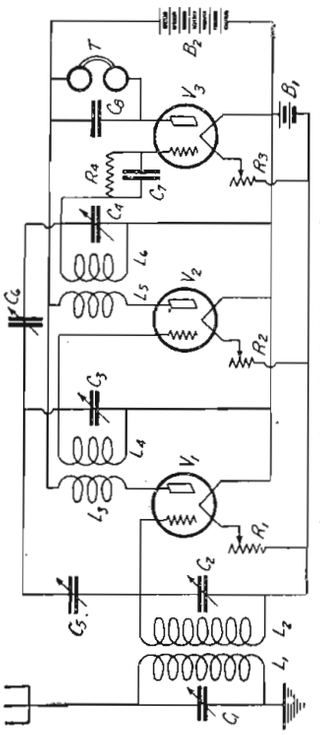


Fig. 42. The standard Neutrodyne circuit in which neutralizing condensers are employed to offset the capacity of the radio frequency amplifier tubes.

this class of circuit myself and it is remarkably effective. All the advantages of tuned plate coupling are present without the disadvantages of a tendency towards self-oscillation. The maximum values of L_3 and L_2 may be employed with minimum values of the condensers C_2 and C_3, thus producing high efficiency. The coil L_3 may be a honeycomb coil of the same size as L_2, while the condenser C_3 for ordinary broadcast wavelengths may be a very small condenser of two or three plates or so.

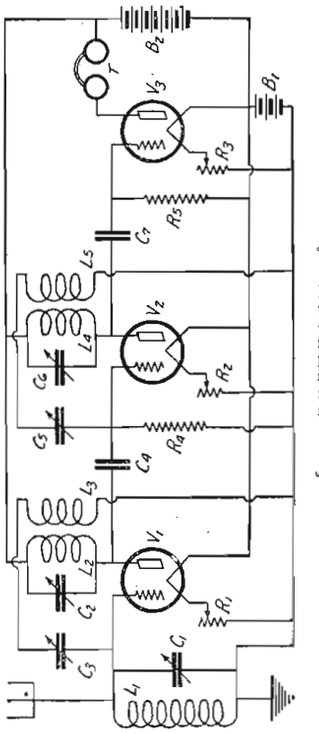
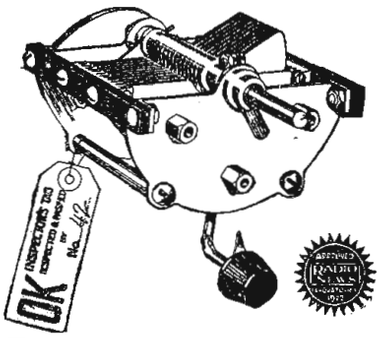


Fig. 43. A tuned plate circuit radio frequency amplifier employing negative feed-back as a means for stabilization.



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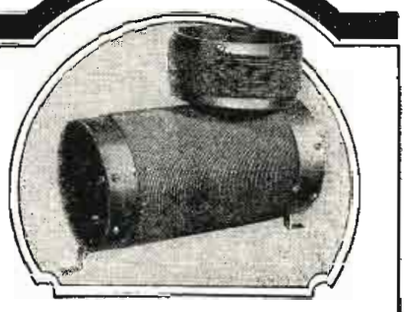
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condenser C_8 of small dimensions being used to prevent the first tube oscillating and the condenser C_6 to prevent the second doing the same. With these arrangements loose coupling to the aerial is a much more simple matter, because the self-oscillation tendency is prevented by the condenser C_5, and the stabilizing effect of a direct coupled aerial is not necessary.

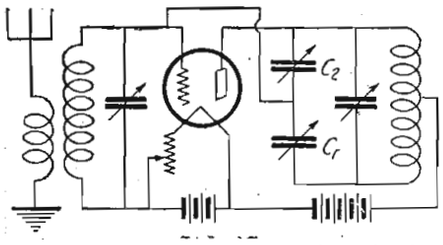


Fig. 40. A circuit suggested by the author in which stabilizing adjustments are less critical than in the Fig. 39 circuit.

OBTAINING A FEED-BACK EFFECT WITH STABILIZED CIRCUITS

When using stabilized circuits of the balance capacity type, it seems probable that the best arrangement is, not to modify the stabilizing, but to stabilize the circuit thoroughly and then to introduce deliberate regeneration. For example, in the Fig. 42 circuit regeneration could be introduced from the plate circuit of the third tube of the grid circuit of the first by connecting a small feed-back coil in series with the telephones.

MR. COWPER'S WORK

Mr. A. D. Cowper, M.Sc., has done some valuable work on balance capacity stabilizing methods, and a circuit which he has introduced is illustrated in Fig. 43. It will be seen that the Fig. 43 circuit is a type which he has introduced and which

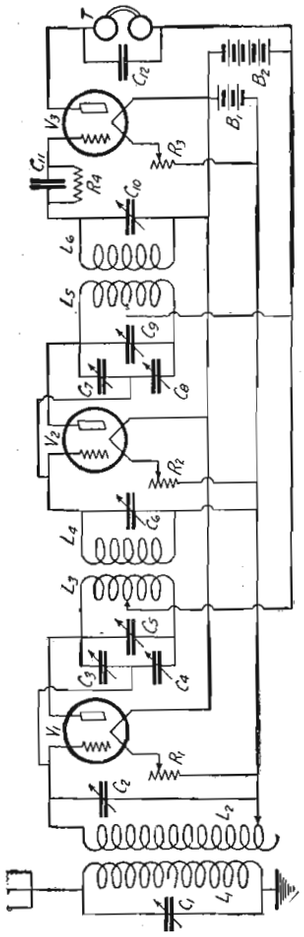


Fig. 41. A circuit arrangement in which the capacity of the tubes are neutralized by a formation of condensers and inductances, previously described by the author.

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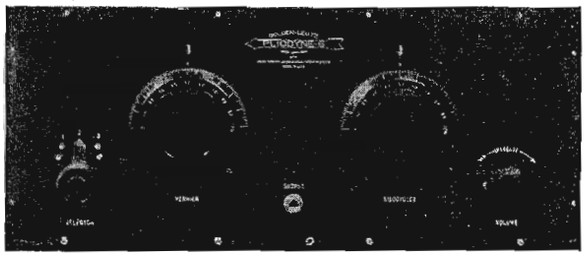
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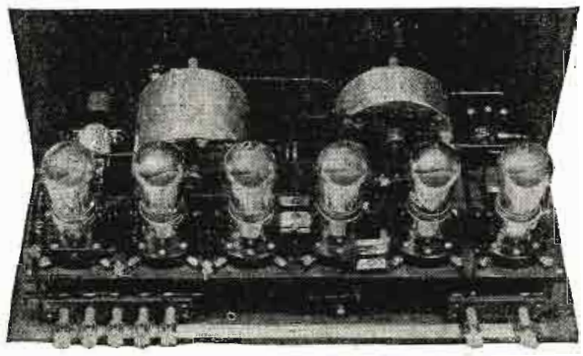
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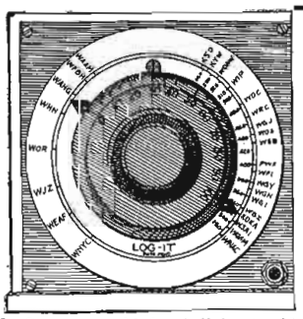
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coils L_2 and L_3, but from points intermediate between their ends. In each case the end of the coil remote from the plate is connected through a small variable condenser to the grid of the tube, the condenser C_2 being for this purpose. The middle tap on the plate coil results in the two ends of the coil L_2 having opposite potential signs with respect to the filament of the tube; in other words a phase reversal is obtained by the device and by using a small variable condenser C_2 it is possible to prevent the first tube from oscillating. The same thing is done in subsequent tubes, and this method of applying the balance capacity method, or neutrodyne-like principle, to tuned plate circuits may be duplicated.

I have spoken about middle taps on the

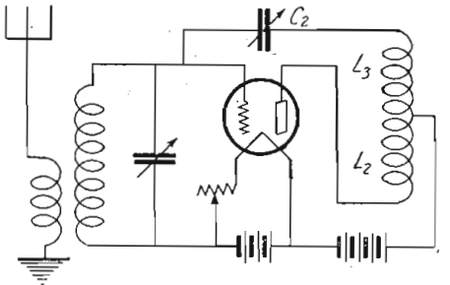


Fig. 39. Individual stabilization of radio frequency tube in which delicate adjustment is required.

coil L_2, but the actual position is not very material from the point of view of self-oscillation and its prevention, because the position of the contact is compensated for by a suitable adjustment of the neutralizing condenser. The further the tap is away from the plate, the larger must be the neutralizing condenser.

The values of these various condensers in balance capacity circuits is small, and two plates the size of pennies may be made to move in relation to each other and act as a suitable condenser under most conditions.

I have further suggested the use of small condensers for supplementing the inherent capacity of the tube, and by doing this it is an easier matter to effect a balance; obviously, if the capacities to be balanced are very small, the slightest movement of the hand in an adjustment may make a big difference.

Before leaving Fig. 39, it would be as well to point out that varying the tap on the plate coil affects the amount of transfer of energy to the next tube. It will usually be desirable to keep the proportion of the plate circuit included in the grid circuit of the second subsequent tube as large as possible. In other words, to have the plate tap as near to the end of the plate coil furthest from the plate as possible.

ADDING TO TUBE CAPACITY

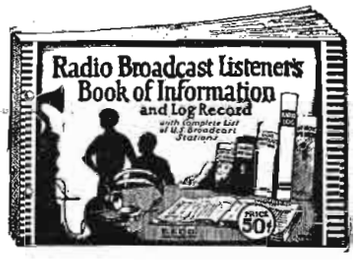
An example of the circuit in which the tube capacity is added to by means of a variable condenser C_2 is illustrated in Fig. 40. The condenser C_2 is for the purpose of adding to the grid to plate capacity of the tube, while the condenser C_1 is for the purpose of obtaining a reverse reaction effect.

Fig. 41 shows an arrangement which is rather complicated to handle but which involves a middle tap from the coil L_3 and the balancing of two condensers C_3 and C_4. (A long description of the circuit was given in *Wireless Weekly*, Vol. 1, No. 12 of June 27, 1923.)

THE "NEUTRODYNE" CIRCUIT

The so-called neutrodyne circuit, if it is possible to use this name in connection with the broad class of circuits of the balance capacity type, is illustrated in Fig. 42. It will be seen that phase reversal is obtained by using transformers L_2 L_4 and L_5, L_6, the

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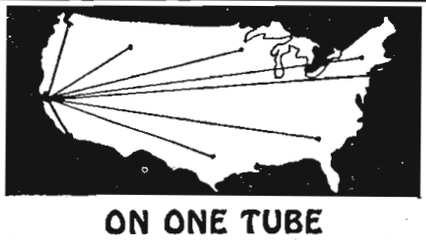
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NORTH—Received coils OK today. If I have same results with these that I had with last will be wanting more. I am 1,500 miles from nearest station and have picked 56 to date. Chicago, Havana, Mobile, New Orleans and TWO IN ENGLAND.——Lunenburg, Canada.

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balanced out by intentional capacities. L. A. Hazeltine produced a highly effective multi-stage amplifier using small capacities for neutralizing inherent capacities in the circuit which produces self-oscillation. Long before any announcement of Hazeltine's work was made in America or this country, I was working on similar lines and evolved cir-

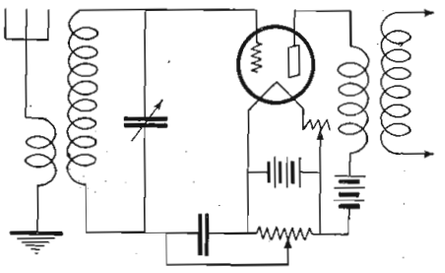


Fig. 37. A circuit employing a poteniometer as a means for stabilization.

cuits of a similar general type, and my British patent 217,971, dated January 2, 1923, covers all so-called neutrodyne circuits in this country. The first claim read as follows:

"A radio frequency amplifier in which the currents are amplified by a plurality of stages of amplification involving a plurality

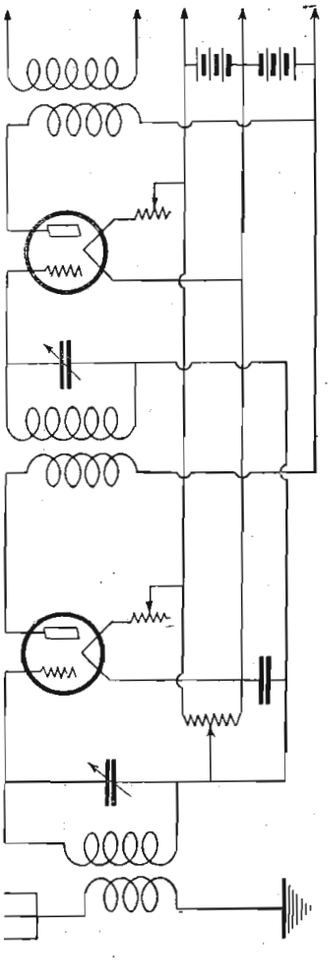


Fig. 38. A collective method of stabilization which, though effective, is decidedly difficult to handle and consequently not very practical.

of tuned circuits, a condenser, or condensers, being connected so as to produce a reverse reaction effect to counteract the tendency of the amplifier to generate oscillations."

Further claims deal with developments and more detailed arrangements.

It must be noted, however, that much attention had been given, curiously enough, to methods of overcoming the trouble of self-oscillation in single tube receivers, where the fault is less troublesome.

In Fig. 39 a distinctly interesting method is shown in which the connection to the plate battery is made, not from the end of the

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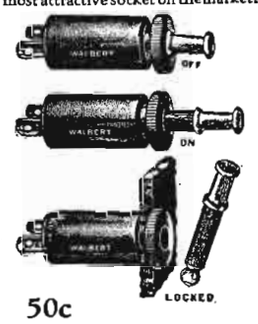
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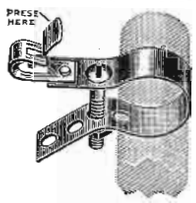
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An example of this kind of circuit is illustrated in Fig. 38, and it will be seen that a reverse feed-back condenser C_7 of very small capacity is connected between the plate of the second tube and the grid of

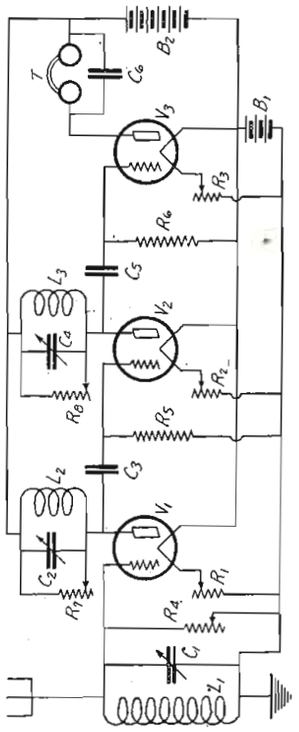


Fig. 35. The introduction of resistances in parallel with the tuned plate circuits provides stability.

the first. I am not at all happy regarding the operation of circuits of this description, and they are, in general, difficult to handle and frequently, if incorrect values are chosen, the condenser which is to eliminate oscillation makes matters worse. I am strongly inclined to believe in stabilizing tubes individually rather than from end to end of a series of tubes.

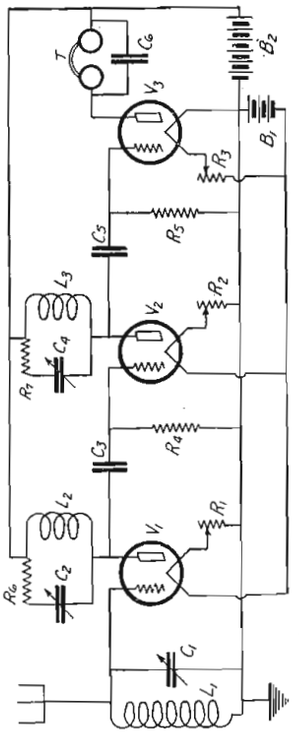


Fig. 36. A circuit employing series stability resistances favored by the author.

An example of this latter method is illustrated in Fig. 39.

A FORM OF NEUTRODYNE COUPLING

The word "neutrodyne" is only used in its generic sense. The word is used, although a proprietary name, in a loose sense to convey circuits in which the capacity of a tube, and other attendant capacities, are

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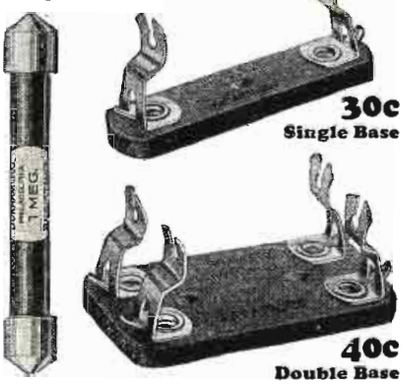
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department is planning to use radio in place of some 1,500 kilometers of wires and cables to insure more efficient public service. U. S. Trade Commissioner Zwickel reports that for the past six months experiments with radio transmitting apparatus installed at the main Vienna fire station and receivers on six fire-fighting vehicles, have shown excellent results and that further installations are planned.

WHAT DO YOU THINK OF THIS?

In an article entitled "American and British Radio," Mr. Percy W. Harris, in *Wireless Weekly*, an English publication, writes that the atmospheric conditions in this country are excellent for broadcast reception, comparing them with conditions as he found them while an operator in Australian waters. He says in part: "American broadcast stations are, on the whole, not so well equipped as ours, save in a few exceptions, such as in the case of large broadcast stations put up by one or two big corporations with the vast resources of the industry behind them. The more experienced British amateur transmitters would be ashamed to own many of the broadcast stations listed in American publications. I have no doubt whatever, if you were to take 2LO, 5IT, or any of the other broadcast stations known to us here, and operate it somewhere in the United States, for both quality and range covered, it would put nine-tenths of the American stations in the shade. Cynical people have said that the American broadcast stations do not trouble greatly about their modulation, as a slight amount of distortion improves the American accent. Be that as it may, the British experimenter can take it as certain that the huge ranges common in America are due, not so much to the efficiency of the broadcast stations as to the peculiarly favorable conditions."

Multi-Stage Radio Frequency Amplification

(*Continued from page* 1171)

the arrangement may therefore be classified with Fig. 35 as suitable for general use.

USE OF POSITIVE GRID BIAS IN RADIO FREQUENCY AMPLIFIERS

We have already explained the use of a potentiometer for the purpose of introducing a positive potential on the grid, thereby setting up a grid current which will introduce damping into the grid circuit, and so secure stability.

This method has achieved great popularity, and is the one which is most usually employed for stabilizing a radio frequency amplifier.

Fig. 37 shows a typical example, and here we see the grids of the first and second tubes given a varying potential by means of a potentiometer connected across the filament battery. A fixed condenser C_4 of .002 mfd. capacity is provided in order to cut out any effect which the potentiometer might have on the radio frequency currents directly. In this circuit, the grid circuits have been tuned, but the same arrangement may be used when the plate circuits are tuned. I am inclined to favor, however, the tuning of grid circuits for the reasons set forth earlier in this article.

CAPACITY COUPLING FROM ONE TUBE TO A PRECEDING ONE

Reverse feed-back may be conveniently obtained, sometimes, by means of a very small variable condenser connected from one of the oscillatory circuits towards the end of the circuit to one of the preceding grid circuits, care being taken that a correct opposing of the grid potentials is obtained.



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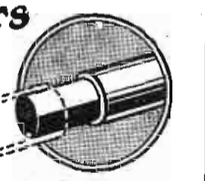
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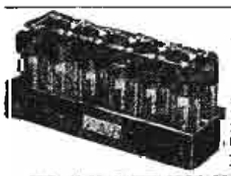
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ful. The Radio Inspection Service of the Department of Commerce is co-operating with the other Federal agencies to that end.

Reports from several of the Radio Supervision Districts indicate that, in one way or another, illicit liquor operators are receiving or seeking aid from commercial and amateur radio stations and operators. In some instances the radio police of the Government cannot take action. But in others, where actual evidence of law breaking is at hand, the radio supervisors and inspectors can and have taken a hand in bringing to justice licensed operators, who have broken radio or other Federal laws.

If an amateur is known to have co-operated with rum-runners off the coast, he loses his license. The license of a coastal station found guilty may be recalled, and it is doubtful if its owner or operator would dare draw the fire of the Inspectors after the ban was removed. He would be watched if he tried to communicate again with rum-vessels off shore.

Probably the most unique case is that of a broadcast station near the Great Lakes, which is said to be owned and controlled by a bootlegger. This astute operator, however, does not go on the air with anything out of the way in radio telephone or telegraph messages to his kin-folk in the trade. He does nothing for which he can be investigated or even called down. He simply broadcasts the regular programs of radio entertainment as do 500 other broadcast stations. But it is believed that some of his acts or parts of his programs are actually code messages to his agents regarding incoming and outgoing "wet" goods. The simple rendition of a Scotch song by a sweet voiced soprano may indicate to his fellows that the market is good for Scotch, while the harmless refrain "Coming Thru the Rye" may be an actual order for rye. Another song may indicate that the coast is clear.

Of course, all his cargo carriers, probably small lake craft, and probably his motor trucks, are equipped with radio apparatus. Mobile radio sets are, of course, not against the law, and in quite common use today.

Speaking of radio codes available in connection with the liquor traffic, a good one was heard recently. An expert operator, who was also an artist at the piano, sent a regulation code message by playing a well-known piece on the piano. The selection was "Coming Thru the Rye" and the message was "Do you want a drink?" To be sure the timing of the measures was a bit erratic, but both the music and the code message were readily recognized. By accentuating or holding certain notes for dashes, and cutting others short for dots, with due regard for spaces, this expert made his query clear. This shows that a code communication could be used very easily by a radio broadcaster, provided his representatives were trained operators and practiced up a bit on piano transmitting and reception.

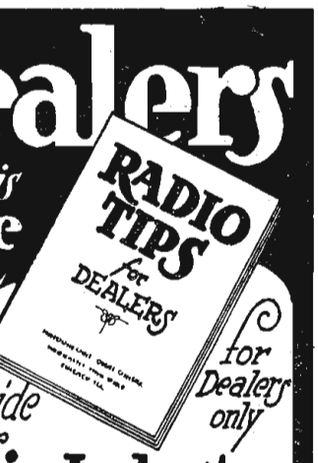
RADIO FOR FIRE DEPARTMENTS

Another way in which radio may serve the public is by installing transmitters at fire headquarters and receivers on fire engines, trucks and other apparatus, so that the fire chief may keep in constant communication with his company commanders.

Formerly firemen and mobile fire units were obliged to leave their stations with meager information as to the fire reported, but now it is possible for headquarters to keep in touch by radio with apparatus en route to, or at a fire. Such a system provides the transmission of detailed orders and also for recalling apparatus or redirecting it to other places if necessary.

A practical example of what can be done in this line of development, is seen in a recent dispatch from Austria where the fire

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32 So. Clinton St. Chicago, Ill.



The Halldorson Audio Frequency Transformer
Gives clear mellow tone, large volume and undistorted reception over the whole range of audio frequencies. It is neat and compact, the product of the highest technical skill—guaranteed to give satisfaction. Write for literature.
Price { Ratio 4:1 $4.00 / Ratio 2:1 4.75 / Ratio 6:1 4.50
THE HALLDORSON COMPANY
1772 Wilson Avenue, Chicago



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DON'T LOSE YOUR RIGHTS
Before disclosing your invention to anyone send for free blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed.
LANCASTER & ALLWINE
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Originators of the form "Evidence of Conception"

kan, the communication center of Alaska, and then goes on to Seward, the southern railway terminus. Radio and land lines take up the service to Juneau, the Capital, and then on to Fairbanks, the northern railway terminus, but radio penetrates to the very center of Alaska, so that few towns are isolated these days.

In talking of the far north service, Colonel Seaone, of the Signal Corps, said the signal men and operators enjoy a unique life in the far north. Two or three are assigned to each inland radio station, where they become almost the center of interest. It is through them that the villages keep in touch with the States and the rest of the world. Where no other communications exist, these men become very popular as they listen in to the nightly Naval Press dispatches, copying the news and posting it on a bulletin board. Baseball scores and stock market reports are read with considerable interest in Alaska. Of course the more important centers have newspapers, which get their press copy through the signal stations at the very low rate of from one-half to one cent a word. Visitors are often surprised, Colonel Seaone says, to find how well Alaska keeps posted through the Signal Corps communication system; in no sense is it isolated today.

Usually as many as 80 new men are required each year in the Signal Corps system. The tour of duty in this fascinating country is two years. Radio, telegraph and cable operators are nearly always in demand, and for this reason the Army maintains a school at its Seattle office, where applicants are tested and rated.

Cable opcration is somewhat different from wire and radio transmission; two keys, one for dots and the other for dashes, are used. Practice in manipulating by the dual key method is required. The transmission, and consequently the reading, is somewhat slower than either wire or wireless work. Continental Morse is the code system followed in the cable work, the reception being through the operation of a syphon recorder, which makes a waving ink line on a tape. Down strokes are dashes and up strokes dots. Practice insures reading with facility.

NEW COMMERCIAL SHORT WAVE STATION LICENSED

The first commercial short wave, low-powered, trans-oceanic radio station has been licensed, showing the recognition of this means of communication by the commercial radio interest.

Station WGH at Tuckerton, N. J., has been licensed to operate on 90, 93, 97, 100 and 103 meters by the Department of Commerce. With this new transmitter rated at 20 k.w., the engineers expect to establish long-distance commercial auxiliary circuits to Buenos Aires, Berlin and Paris.

When WGH is compared with the power and wave-lengths of the main transmitter WGG at Tuckerton, which are respectively 200 k.w., and 15,900 meters, the radical step is obvious; only one tenth the power is to be used. The range of WGG is approximately 4,500 miles, and if WGH is to establish such a circuit it must also function over great distances, at least at night, when the peak of the traffic of the central radio station in New York is reached.

Many experiments on these short wavelengths have been very successful and abroad much progress has been made. The whole radio industry is watching with interest the practical operation of this station.

RUM RUNNERS TRY RADIO

The unlawful, although perhaps somewhat abetted, rum-running and bootlegging industry is striving to secure the aid of radio as an ally so they may more easily evade the alert prohibition officers. It is believed, however, these efforts will prove unsuccess-

Be A Master OF THE Air



Pleasant Home Study

During the next few months you can, by devoting a few hours each week in pleasant home study, qualify yourself to get into the biggest paying field of all time. My practical, understandable course of instruction enables you to be a Master of the Air. Every problem in radio becomes an open book to you. *Be a Master of the Air and you will be a master of your future.*

$3,000 to $10,000 a Year as Radio Expert

15,000 ships, hundreds and hundreds of Radio stations, with new ones springing up every day, are all keenly competing for the services of the radio-trained man. So enormous is the call for the radio expert that the man who knows his business in this field is in a position to command the size of his salary. On land or sea, in Government or private service, there are boundless fine paying opportunities for the man who understands radio problems and how to solve them.

RADIO *where* Knowledge is Power —and Power is Cash

I show you how to construct, install, operate, repair and sell radio equipment. Instead of being a spectator in this big game with big stakes, you become an active player. I qualify you to handle every branch of radio. There is nothing theoretical or practical that is not presented to you in complete, concise form. You are standing face to face with the greatest money-making chance ever presented to you. Will you turn your back on it or will you decide now, once for all, that you will get your share of the millions being divided among radio-trained men? Right in your own neighborhood you can make easy profits. Neighbors and friends will gladly give orders for sets and pay for advice on radio problems.



A. G. MOHAUPT, B.A., M.S. Head of the Radio Association of America. Graduate Electrical Engineer, University of Wisconsin. Former Radio Instructor for U. S. Government. Author of "Practice and Theory of Modern Radio."

I give my personal attention to every student taking my course. Your individual problems and questions are answered by myself. I work with you at every stage of the course, guiding you, directing you to your goal to be a Radio Engineer in the big pay class. My course prepares you to successfully pass Gov't examination for Operator's License.



FREE 1000 Mile Radio Outfit

This set, when completed, has a range of over a thousand miles. I give it free with my course. I give you practical training by having you work on this set. The knowledge you gain is not mere book knowledge, but is usable, practical experience. When you have finished my course, you can sell this set at a price that will more than pay the cost of the course.

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Everything in my course is clearly and simply stated so that you can easily understand every point I bring out. No previous experience or education is required. I give you fundamental and practical training in every angle of radio. There is no time to lose. Now is the best time to pass the other fellow by. Mail coupon today and get full information on my course, also details of the thousand mile set that I give free.

A. G. MOHAUPT, Radio Engineer

RADIO ASSOCIATION OF AMERICA
4513 Ravenswood Ave., Dept. 151, Chicago, Ill.

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A. G. MOHAUPT, Radio Engineer,
Radio Association of America,
4513 Ravenswood Ave., Dept. 151, Chicago

Please send me details of your Home Study Course—also your Free "Radio Facts" and information on how I can get a FREE 1,000 mile Radio Set.

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Back and Front Panel Mountings
Plain or Geared
Genuine Bakelite

The Universal all-wave inductance—accepted as standard in regard to superior construction and electrical units of measurement. Ask your "Old Timer" radio friend why sets using honeycomb coils are better; they give closer tuning, greater selectivity and range. No dead end losses, easy to operate. 16 sizes, mounted and unmounted. Interchangeable with all mountings. Be sure the set you buy or build has them.

Send 25c for Super Heterodyne, Radio Frequency and Honeycomb Coil Circuits and Complete Catalog

CHAS. A. BRANSTON, INC.
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In Canada—Chas. A. Branston, Ltd., Toronto

Don't turn your rheostat on full just to see how fast you can tune in "on high"

There wouldn't be any rheostats in Radio, if a cheap on-and-off switch would do as well. The tube filament is delicate. When cold it has low resistance. The rheostat cuts down the current so that the tube will not burn out in a flash before it has had time to warm up. 1% more current than the tube is rated at cuts down its life 25%; a little more, 50%.

So you see that a rheostat is not an unimportant little switch, that can be made to sell for a few cents. And "any old rheostat" is a luxury few can afford. Reputable manufacturers and experienced amateurs buy only the best small parts.

KLOSNER RHEOSTATS ARE THE BEST MONEY WILL BUY

Not cheap—but reasonable.
Easiest to assemble. Sturdiest in construction.
Smoothest in operation, *with* good contact, because the winding is accurate.
Definite on and off. Bakelite base.
Most beautiful in appearance.
The most for the money.

Used by the most careful manufacturers to make the best sets. Recommended by amateurs and by jobbers and dealers everywhere. If you are about to use a rheostat for two tubes that you formerly used for one, to change your tubes, or to switch from dry cells to a storage battery, ask us how many ohms resistance you require.

Always use Klosner Rheostats and your tubes will give you volume, distance, clarity and long life.

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Young Men—Turn Your Spare Time Into Money!

Earn big profits, prizes, and awards selling RADIO NEWS, SCIENCE & INVENTION, THE EXPERIMENTER, and MOTOR CAMPER & TOURIST in your neighborhood. We train you as our salesman and pay you liberally for your time. Write at once and we will help you to get started.

M. BRIDWELL.

THE EXPERIMENTER PUBLISHING CO.
53 Park Place New York, N. Y.

then we find that over one-third of the population of the country is reached by radio advertising.

"It seems a safe statement to make, that the circulation of radio publications and newspaper radio sections will steadily increase in the coming year, while the increase in the number of radio listeners cannot be estimated at any time.

"Radio stands today on the threshold of its greatest year. At this time in 1925, we may be able to say the same thing, but every indication today points to the belief that the number of radio listeners will double in the coming 12 months. This will bring the total number of radio sets in active use within striking distance of the number of automobiles in the country."

STATUS OF RADIO IN BRAZIL

With reference to the radio industry in Brazil, Dr. Jose Carlos de Macedo Soares, President of the Associacao Commercial of Sao Paulo said that the local Radio Society, known as the "Sociedade Radio-Cultura," has for some time been endeavoring to raise sufficient funds for the construction of a broadcast station in the capital, but so far their efforts have not been very productive. The municipalities in the interior have been asked for subscriptions, but only one has contributed and this a very small amount. Fifty contos ($50,000) has been given by the Municipality of Sao Paulo, and the State Government has authorized the use of the Government Palace of Industries to house the broadcast station. So much money is required, however, for the equipment, that the establishment of a good station is still quite far off. It was suggested that possibly a group of large concerns in Brazil could combine in the establishment of a station to be recognized by the advertising benefits derived therefrom, though this idea was not discussed to any extent.

GROWTH OF RADIO IN UNITED STATES

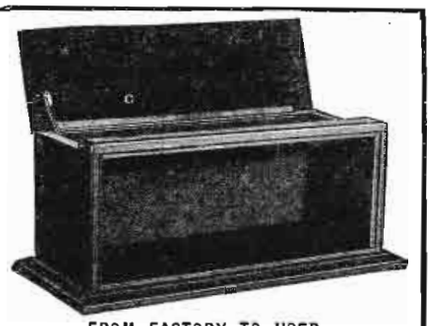
Here are a few figures that give some idea of how radio is growing in this country. At the beginning of 1924 there were approximately 3,000,000 receiving sets, 10,000,000 listeners, 543 licensed broadcast stations, 250,000 persons connected with the industry, 3,000 manufacturers of apparatus, 1,000 wholesale dealers in sets, 20,000 retail dealers of all sorts who sold equipment, 1,000 newspapers that published programs and radio news features, 2,500 weekly papers that had radio departments, 50 radio periodicals, 50 magazines that had radio sections, 250 popular and technical books about radio, and seven trade papers devoted to the radio industry.

Commerical Radio

RADIO, WIRES AND CABLES KEEP ALASKA IN TOUCH WITH THE WORLD

Radio, telegraph and cables are linked into a communication net in Alaska by the Army Signal Corps, which maintains continuous traffic throughout the year in our far-north possession. Although not well known, this system is quite extensive; it includes 18 radio stations, 41 telegraph offices and cable stations at Seattle, Wash., Ketchikan and Seward, Alaska. This net, which handles about 10,000,000 words of traffic a year, is maintained and operated by five officers and 250 men of the Army Signal Corps. It includes 2,700 miles of submarine cables and 840 miles of land telegraph lines.

The cable itself is as long as the ordinary trans-Atlantic cable. The radio stations reach every important point and one of them lies north of the Arctic Circle. Leaving Seattle the cable jumps 865 miles to Ketchi-



FROM FACTORY TO USER

High Grade Radio Cabinets sturdy built and fine looking. Built from select genuine black walnut or birch. Elegantly finished. Tops on all cabinets hinged. Fronts of cabinets are rabbeted to take panel. Walnut cabinets have continuous piano hinges and lid holders. Birch cabinets have regular hinges. (No lid holders). Walnut cabinets finished in French walnut. Birch cabinets finished in Adam brown mahogany. (Panel not included). Money back if not satisfied.

For Panel	Deep	Birch No Base	DeLuxe Black Walnut	Monarch Black Walnut
6x 7	7"	$1.75	$3.75	$4.40
6x10½	7"	2.25	4.65	5.35
6x14	7"	2.75	5.45	6.20
6x21	7"	3.25	5.90	6.80
7x12	7"	2.80	5.50	6.50
7x14	7"	3.00	5.80	6.70
7x18	7"	3.25	6.00	6.80
7x21	7"	3.60	6.50	7.40
7x24	7"	4.10	7.25	8.00
7x26	7"	4.75	7.80	8.50
7x27	7"	5.00	8.50	9.00
7x28	7"	5.25	9.50	10.00
7x30	7"	6.00	10.00	11.00
7x24	10"	5.60	9.25	10.00
7x26	10"	6.25	9.80	10.50
7x27	10"	6.50	10.75	11.50
7x28	10"	6.75	11.50	12.00
7x30	10"	7.00	12.00	12.50
6x40	8"	6.00	11.50	12.50
9x14	10"	3.95	6.40	7.00
9x21	10"	5.00	7.70	9.25
9x24	10"	6.00	9.50	10.50
12x14	10"	4.25	7.00	8.00
12x21	10"	4.75	9.50	10.50

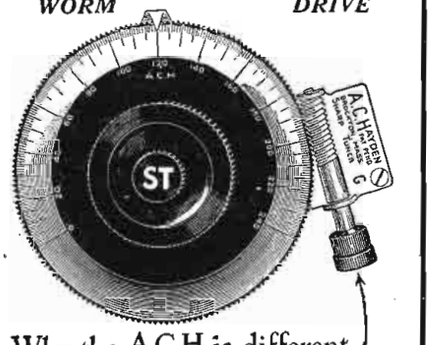
Mounting Boards all sizes in stock.
F.O.B. Milwaukee, Wis.

Circular showing our complete line sent on request. Our Utility Beauty Cabinets are really beautiful. Our Monarch cabinets are the best obtainable.

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439—27th Street Milwaukee, Wis.

A Pleasant Surprise Awaits the User of the A.C.H. Sharp Tuner Dials

WORM ***DRIVE***



Why the A.C.H. is different
3 in. DIAL ACH 150-to-1
4 in. DIAL ACH 215-to-1

Money Back Guarantee

Price 3-inch size....$2.50 Price 4-inch size....$5.00
Regular fitting 5/10 shaft ¼ and 3/16, 5¢ each extra

EXTRA ADVANTAGE OF THE A.C.H.

1. Can be attached or removed from any instrument.
2. Rough tuning same as any dial.
3. Movement so fine that the eye cannot detect but the ear can.
4. Automatically locks instrument so no jar can disturb it.
5. Dial grounded reducing the body capacity to a minimum.
6. Special dial 2 graduations where ordinarily one.

Mail Orders Sent Prepaid In U. S. A.

A. C. HAYDEN RADIO & RESEARCH CO.
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Kraco Radio Masts

All Steel—Neat—Attractive—Permanent
FITS ALL TYPES OF BUILDINGS
Complete with brace rods, pulley, bolts and screws

6 Ft. Size $5.00 PAIR 9 Ft. Size $6.00 PAIR
F. O. B. CHICAGO

Kedmont Mfg. Co., 1355 Cornelia Ave., Chicago
Jobbers and Dealers—Write for Discounts

Insure your copy reaching you each month. Subscribe to RADIO NEWS—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

compete with foreign trade on a quality basis. It is well known that many foreign countries restrict the import of apparatus. Of course, this is a serious handicap, but in several cases these market restrictions are being lifted. Australia has opened her doors to imports, as has Poland and South Africa. Another difficulty has been that some of the foreign governments have placed a tax on receiving sets, which materially reduces the number of listeners. In South Africa this "listening-in" tax is about $10 a year, and in Australia the same amount is charged.

In spite of all these difficulties radio exports are increasing monthly over the same periods last year. There was one exception to this: In July, 1923, we exported to Sweden $443,000 in radio goods, bringing exports up to $682,885, while the figure for the same month of 1924 was 43 per cent. of it.

UNDEVELOPED FIELD FOR RADIO

A possible field exists for the sale of high grade radio receiving sets to communities that have irregular mail service in more or less remote regions. The interest that is shown by people living in the interior of India, Ceylon, Central and South America, Australia and portions of the East Indies is sufficient to indicate that the interest is there. While the potentialities of these markets cannot be fully developed until better broadcasting is provided within a range that can be regularly covered by a good modern set, even at the present time in northern South America, Central America, and many of the South Sea Islands the high grade American set will receive some of the more powerful American stations for the isolated planter or mine operator.

Manufacturers and exporters are reported to have become so accustomed to having the merits and possibilities of radio so well understood by the buying public, as a result of the great publicity given radio, that they lose sight of the fact that the people in these remote regions can not fully appreciate what a receiving set in the house would mean. To develop the use of radio in outlying regions some method of demonstration must be resorted to, which should not be very difficult to arrange. Surely such demonstrations would amply repay in the returns that would be received.

THE TREND OF RADIO DEVELOPMENTS

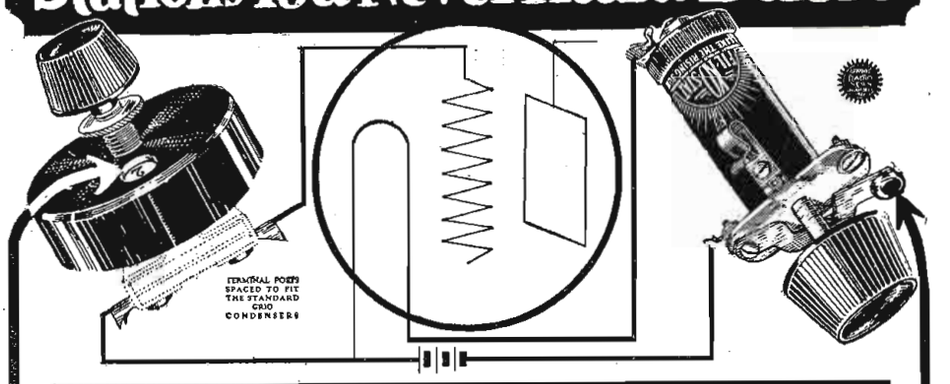
A year ago it was predicted that demand for radio receiving sets would slacken, since it was believed that the market was becoming saturated, but a review of developments in the past year has convinced the Department of Commerce that the reverse is true. A notable increase in the sale of radio receivers was shown, in that time, retail sales approximating $150,000,000. During the last holiday season receiving sets were purchased on a far greater scale than at any time since such apparatus became available to the public. A feature of the development indicates that the purchaser of a cheap or simple radio set will sooner or later buy a more expensive one.

RADIO TRADE INCREASING

The steady development of the radio industry was forecast by President H. M. Shaw of the National Radio Trade Association at a meeting held recently in New York.

"More than half the people in the United States will enjoy the benefits of radio reception in the coming 12 months," Mr. Shaw said. "Today the paid circulation of newspapers and magaziens with radio sections and pages is more than sixty million. Allowing for duplication of circulation, even

Stations You Never Heard Before



-thru scientific tube tuning

The most important (and most neglected) tuning unit on your set is the tube. It is the one thing you can adjust to bring weak stations to audibility—to eliminate distortion on local programs. Coils and condensers are easily tuned to incoming waves, but wave-length isn't everything. The antenna gets distant broadcasters but their signals never reach the phones unless you tune the tube to the different characteristics of the weak, distant stations. Here are two instruments distinctly designed to improve reception through their ability to control tube action—FIL-KO-LEAK to tune the grid by securing correct grid bias—FIL-KO-STAT to tune the plate-filament circuit by its control of electronic flow. Together they assure you maximum audibility, clearer signals and freedom from oscillations and other tube noises. *They bring in stations you never heard before.*

FIL-KO-LEAK $2
SCIENTIFICALLY CORRECT VARIABLE GRID LEAK
Individually Calibrated
In Canada $2.75

You will get stations you never heard before with Fil-KO-Leak. Clear up distortion and increase volume. You can "log" your Fil-KO-Leak as you do your other tuning units. Each Fil-KO-Leak is individually hand calibrated over the operating range of all tubes ¼ to 5 megohms. Set it for specified resistance and adjust it for best results. Resistance read in megohms through panel peep-hole. (Base-board mounting furnished.) Resistance element constant, accurate, not affected by atmospheric conditions, wear or jarring. Assures smooth, gradual control of resistance and correct grid bias. *Unconditionally guaranteed.*

FIL-KO-STAT $2
SCIENTIFICALLY CORRECT RADIO RHEOSTAT
with Battery Switch
In Canada $2.75

Tune your tube filament with Fil-KO-Stat and receive stations you never heard before, get greater distance, louder signals, sharper tuning, freedom from tube noises. Fil-KO-Stat is the only rheostat that permits adjustment over the entire operating range of all tubes and enables you to get maximum audibility in phones or loud speaker. And now the *improved* model is fitted with battery switch that attaches to the regular mounting screws. Distinctly signals "on" and "off" and enables you to break circuit without changing Fil-KO-Stat adjustment. Fil-KO-Stat fits any type tube in any hook up. *Unconditionally guaranteed.*

FIL-KO-SWITCH
SCIENTIFICALLY CORRECT "A" BATTERY SWITCH
Simple Sturdy Sure
50¢
In Canada 70¢

PRICE $1.50
In Canada, $2.05

FIL-KO VARIABLE RESISTOR
SCIENTIFICALLY CORRECT
INDIVIDUALLY CALIBRATED IN OHMS
5000 to 250,000 ohms
For use in resistance coupled amplification or across secondary of transformer

FIL-KO-LIGHTNING ARRESTER
SCIENTIFICALLY CORRECT RADIO LIGHTNING ARRESTER
with the $100 *Guarantee*
$1.50
In Canada $2.05

The "DX Booklet" on "Improved Reception Through Scientific Tube Tuning" sent on receipt of 2c postage.

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DISTRICT SALES OFFICES
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RADIO FANS

Frank D. Pearne, RADIO AUTHORITY, Says:

"The only reliable way to determine if "B" Batteries are still capable of service is by testing with a Voltmeter."

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Indian Head **POCKET VOLTMETER** $1.50 POSTAGE PREPAID

Tests B Batteries 0 to 50 Volts. Guaranteed accurate. Indian Head Ammeter at same price. If your dealer can't supply you send money order to us. Also name of your favorite radio dealer.

Dealers and Jobbers. Send for attractive proposition, also list of other fast sellers with attractive discounts.

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DEALERS' SERVICE

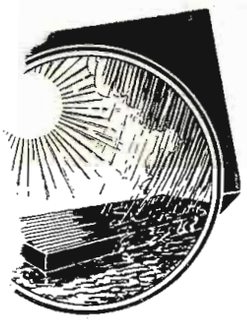
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Heat won't warp a *red stripe* Bakelite-Dilecto panel and water won't make it swell. No weather element can change its form or sleek finish.

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(*Distinguished by its Red Stripe*)

Makers of finest radio sets use Bakelite-Dilecto for panels. Amateurs who make their own outfits know it to be the most satisfactory material known. Identify genuine Bakelite-Dilecto by its *red stripe.*

The Continental Fibre Company

Factory: **Newark, Delaware**

Service from:

NEW YORK, Woolworth Bldg. — SAN FRANCISCO, 75 Fremont St.

CHICAGO, Wrigley Bldg. — LOS ANGELES, 307 S. Hill St.

PITTSBURGH, 301 Fifth Ave. — SEATTLE, 1041 6th Ave. So.

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Dealers send name TODAY !

For DEALERS Only

Send name TODAY for our big, new 84-page catalog. FREE to dealers only. Fully illustrated, with descriptions and special prices on high grade standard sets and supplies.

Unusually attractive discounts to dependable dealers. Orders filled same day received.

Write NOW for big, free catalog.

FEDERAL RADIO COMPANY

Distributors of High Grade Radio Sets and Supplies

WALNART

"TROUBLE-PROOF"

RADIO PRODUCTS

played under authorization of members of the Society by the orchestra at a hotel in Albany. The point of the decision is whether or not radio broadcasting of musical compositions can, under any circumstances, be a public performance for profit. It is not an infringement if according to Judge Knox the playing of the musical composition which is being broadcast is authorized by the owner of the copyright. In other words, it is no infringement for a broadcast station to transmit performances of musical compositions by orchestras in hotels or elsewhere, when the playing of the piece by the orchestra is itself authorized. On this subject Judge Knox says in part: "By means of the radio art, the broadcasters simply make a performance available to a number of persons who, but for his efforts would not hear it. So far as practical results are concerned the broadcaster of the authorized performance of a copyrighted musical selection does little more than a mechanic, who rigs an amplifier or a loud speaker in a large auditorium, so that persons in remote sections of the hall may hear what transpires upon the stage. Such broadcasting merely gives the authorized performer a larger audience and is not to be regarded as a separate or distinct performance. The performance is one and the same, whether the listener-in be at the elbow of the leader of the orchestra playing the selection, or at a distance of a thousand miles."

The importance of this decision is readily perceived. It overrules the claim constantly made by the Society that broadcasting was a performance in itself.

CALIFORNIA AND NEW YORK CITY LEAD BROADCASTERS

California leads the states in numbers of broadcast stations in operation, and New York is first among the cities, a study of Department of Commerce lists discloses. The sunny state has again retained the premier position with a total of 44 stations on the air. Pennsylvania being second with 36, Ohio third with 32, and Texas fourth, having 30 active broadcasters. Other states trail along as follows: New York and Illinois, 29 each; Washington and Missouri, 23; Iowa, 21; Nebraska, 17 and Michigan, 16.

Among the most active cities, New York boasts of 12, Philadelphia follows with 11, Chicago 10, Los Angeles and Seattle 9 each, Minneapolis and New Orleans 8, St. Louis and Omaha 7, and Denver, Washington, D. C., Portland, Ore., and Pittsburgh, 6 each.

Radio Trade News

GROWTH OF RADIO EXPORTS

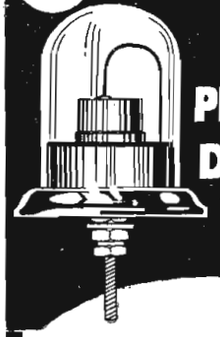
Not only has the growth of the radio industry in all phases been rapid and great in the United States, but exports are growing as well. This country is the leader in export of radio apparatus at present and from all indications, will continue to hold that position.

Three years ago there were about a dozen manufacturers of radio apparatus in America; the only demand then was for commercial telegraph equipment. A conservative estimate today is that 325 firms are sending apparatus out of the country.

Some idea of the volume of business done in the export trade this year may be gained from the fact that for a period of seven months ending Aug. 1, radio exports totaled $2,123.832, compared with $1,894,823, during the same period last year, showing an increase of over $250,000. Since the first of this year the average monthly value of radio exports has been well over $300.000, comparing favorably with $270,000 for the same period last year.

Government statisticians have made the statement that our manufacturers can always

GREWOL The PERMANENT DETECTOR $1.50



REFLEX CRYSTAL

Insures greater distance, selectivity, sensitiveness. Replace your present crystal with the Grewol Fixed Detector. *All you need to improve your set.*

If your dealer does not carry the Grewol detector, mail your order direct (mentioning your dealer's name).

Patented May 15, 1923. Serial No. 1454997.

Infringement subject to prosecution.

GREWOL 2 in 1 CRYSTAL

Two surfaces instead of one; double life; double value.



50c. Each

Jobbers! Write For Exclusive Territory Proposition

GUARANTEED BY

GREWOL MFG. CO.

NEWARK, N.J.

HERE IT IS!



The Terlee Acme Reflex Receiving Set

This is the set we announced last month embodying the famous Acme Reflex circuit. One step of tuned radio frequency is applied to the standard Acme Reflex circuit (rights fully protected). Three stages of untuned radio frequency amplification and three stages of audio frequency amplification give you eight-tube efficiency in performance with a five-tube set. Crystal detector insures purest tone and eliminates detector tube adjustment.

The Terlee-Acme Reflex Receiving Set is easy to set up and operate. Works beautifully with any reliable loop aerial and loud speaker. Two dials simplify tuning and permit definite logging of stations. Potentiometer and rheostat are combined in one non-critical adjustment.

If you want a set with selectivity and range, but easy to tune and free from distortion, get the facts on the Terlee-Acme Reflex Receiving Set. Ask your dealer. If he cannot give you complete information, write us sending us his name.

JOBBERS—Write us for the details and prices.

Eastern Sales Agent—L. C. Price & Company, Hartford, Conn.

Western Sales Agent—Detsch & Company, San Francisco, Los Angeles, Portland, Denver

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443 S. Dearborn St., Chicago, Ill.

"Makers of Radio's Best for Better Radio Results"

MICHIGAN RADIO CORP.

Detector and Amplifier Units

Grand Rapids, Mic.

at Santiago, Chile, the experimental short wave transmission of the Westinghouse station penetrated the Far North to within approximately 11 degrees of the North Pole.

The signals broadcast from the East Pittsburgh station were picked up by the Canadian Government *S.S. Arctic* at Cape Sabine many miles north of Etah, the winter headquarters of Donald MacMillan, the noted Arctic explorer, in the continuous daylight zone and in spite of the very heavy summer static.

Some months ago the *Arctic* left Quebec on a voyage to Etah, Greenland, equipped with a full quota of specially designed radio apparatus, and since her departure the polar ship has been in almost continuous communication with station KDKA.

The course of the *Arctic* took her to Blockhead Island at the mouth of Cumberland Gulf and across Davis Strait to Godhavn on Disko Island off the Greenland Coast. The vessel then crossed to Ponde Inlet and north to Dundas Harbor on Devon Island, north to Craig Harbor on Ellesmere Island and from there to Etah. From Etah the expedition sailed to Refuge Harbor, the winter headquarters of MacMillan. Arriving there, and finding navigation conditions good for a venture north, the *Arctic* proceeded northwest from there to Cape Sabine, which point is considerably farther north than where either Peary or MacMillan wintered.

FLORIDA TO HAVE A POWERFUL BROADCAST STATION

Miami is soon to have the largest radio station in the South, and one of the three largest in the United States. It will be located at Hialeah, a suburb of Miami, and will be constructed by the Tropical Radio Company. Work on it will commence the first of the year.

George S. Davis, general manager of the company, announces that work on the plant will be rushed to completion with a view to having it ready for broadcasting by March 30.

Both the Western Union and Postal Telegraph Companies have announced that they will establish wire connections with the new plant, and it is said there is a strong possibility that direct wires will be installed between the station and the New York offices of the two companies to give quick wirelcss connections with South American stations.

The Western Union Company, it is said, will install first class wire connections between Miami and Hialeah, by way of Lemon City, at a cost of about $10,000. A similar amount probably will be spent by the Postal Telegraph Co.

The Tropical Radio Company is owned by the United Fruit Co., which now controls the Miami Beach wireless station. As soon as the Hialeah plant is completed, the other will be surrendered by the owners. The new plant will be similar in operation to that of the Tropical station at New Orleans, which receives wireless messages from all stations in South and Central America, and re-distributes them to American recipients by telegraph.

BROADCAST OF COPYRIGHT MUSIC NO INFRINGEMENT, COURT RULES

A decision of great interest to broadcasters was recently rendered by United States District Judge Knox, in the Federal Court for the Southern District of New York. The case of the "American Society of Composers, Authors and Publishers," made in the name of Jerome H. Remick and Company vs. The General Electric Company, a member of the National Association of Broadcasters, was to enjoin the defendant from broadcasting music of the Society

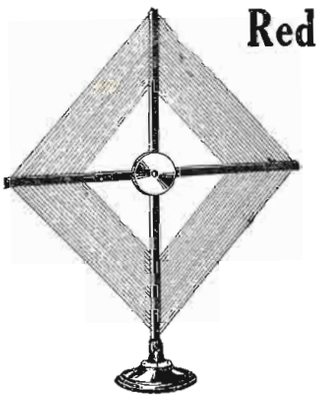


The Super Loop for Your "Super"

The Red Seal Map-Loop Aerial is needed to complete the attractive appearance of any set designed for loop reception. It replaces the usual spider's web of wire with a handsome broadcasting map—an ornament in perfect keeping with your good looking radio cabinet and the other tasteful furnishings of your home.

In the Map-Loop the wires are concealed between two maps of the United States on which the broadcasting stations are listed and located. The frame and base are solid mahogany. Further interest and decorative quality has been given the maps through faithfully employing the odd technique of the old map masters of the 17th Century.

PRICE—$20.00



Red Seal Collapsible Loop Aerial

This indoor loop may be collapsed for use with portable sets. Thumb screws lock its arms rigidly into place when exteuded, preventing collapse should the loop be accidentally struck.

The base carries a circular scale on which may be marked the call letters and position for best reception from any particular station. A special plug connects the loop to the base in a manner which allows free rotation without tangling the connection wires to the set. This plug also allows the loop to be fixed on top of your cabinet by means of a standard telephone jack. These same structural features are used in the Map-Loop Aerial above.

PRICE—$7.50

MANHATTAN ELECTRICAL SUPPLY CO., Inc.

NEW YORK CHICAGO ST. LOUIS SAN FRANCISCO

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Manhattan RADIO PRODUCTS

MADE BY THE MAKERS OF THE FAMOUS RED SEAL BATTERIES

fits any Grid Leak mounting

FRESHMAN PLUNGER TYPE VARIABLE GRID LEAK

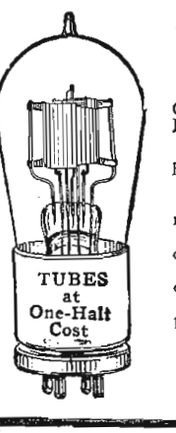
was designed especially for the non-technical set owner who can replace in an instant the fixed grid leak with this new, efficient cartridge type Variable Grid Leak; without requiring the change of a single wire.

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We try to maintain 24-hour service.

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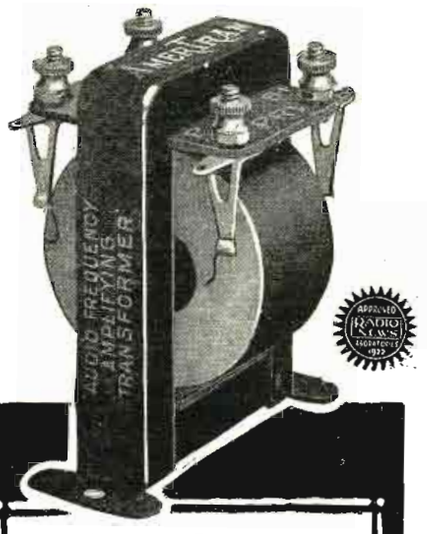
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AmerTran is recommended to you as the "best" audio frequency transformers because:

AmerTran has the *most* uniform amplification. All tones are amplified nearly alike.

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TRADE MARK REG. U.S. PAT. OFF.

confidently expected that the use of short-waves will immeasurably and in a practical way advance the art of radio communication in the field of wireless telegraphy as well as wireless telephony.

"To my mind, one of the greatest advantages which will result from experiments now being conducted with short-waves, is the increased knowledge we shall gain of the behavior of different wave-lengths in the conducting medium between the sending and receiving stations. Much has already been accomplished in perfecting the radio sending and receiving instruments; but much more still remains to be learned about what actually occurs to the electro-magnetic waves in the space which separates the receiver from the transmitter. As we learn more about Nature's secrets, now hiding in the great outdoors, we shall come nearer our goal of completely eliminating static, interference, fading and other scientific problems still requiring solution.

U. S. BROADCASTING FAR SUPERIOR TO EUROPEAN

"I investigated the broadcasting system of England, France and Germany, and met the principal persons both in Governmental and private circles, responsible for the development of radio in Europe. My conclusions are, that broadcasting, which was initiated in our own country, has advanced in the United States, both as a Public Service, and as an industry, to so great an extent as to make comparisons, with European Countries almost impossible. In France it is just beginning, and in Germany it has hardly begun. In England greater progress has been made than in other European countries. About 800,000 Government licenses have been issued permitting British listeners to receive programs from the air. But even in England, broadcasting cannot be said to compare favorably with the United States, either as to quality or variety of programs, or as to effectiveness, simplicity, or small cost of receiving apparatus, manufactured and sold for home use.

BROADCASTING ABROAD LACKS FREEDOM

"Nor is there to be found abroad the same freedom from censorship and restriction which exists here. For example, in England, where freedom of speech has been such a heralded tradition, political broadcasting is forbidden over the radio stations, which are all controlled by the British Post Office. In other Enropean Countries, Governmental regulations and restrictions are even more severe, and these, in a large measure, restrict and retard the growth of the broadcasting art in Europe, and at the same time deprive their listening public of the freedom, enjoyment, and instructive information available to all in the United States.

"I endeavored to interest the British, French and German broadcasters in the idea of increasing the power of their sending stations, so that the programs of London, Paris and Berlin might be easily heard by the American listening public. At the same time I suggested the possibility of American stations sending over their programs, which could be regularly heard abroad. Much interest was shown in these proposals, and I believe that an era of trans-oceanic broadcasting is near at hand. Realization of such a plan, would greatly enhance the value of broadcasting to the public on this side as well as on the other side of the Atlantic Ocean, and help to bring the old and the new world a little closer together."

KDKA SIGNALS HEARD NEAR THE NORTH POLE

Eclipsing the recent achievement of invading the southern and western part of South America, when the signals from KDKA were received on successive nights

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"FORT ST. GEORGE"

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ceiving sets results, its use may be continued. All applicants for such licenses must agree in advance that they will reduce the power used during the course of the experimentation whenever the Department or the supervisor of radio deems such a course to be in the public interest and so directs.

3. If as a result of the experimentation above specified, the use of the additional power is found to be in the public interest and the station desires to make a further increase, such increase will be allowed in successive steps of 500 watts, and experiments may be carried on at each of such increased stages, under the same conditions and restrictions as are above specified for the first increase.

4. The Department anticipates difficulty in laying down any general rule which will be of universal application to all such stations. It will, therefore, consider each station as a separate entity and deal with it according to the local conditions involved.

5. It is anticipated that the location of the station will be a factor of great importance and that the amount of power that may be safely used will be in direct proportion to the distance of the station from congested receiving centers.

6. All such experimentation will be absolutely at the risk of the station conducting it, both as to location and power used, and notice is given in advance that these licenses will carry with them no permanent rights or privileges of any character, are entirely temporary and experimental in their nature, and are subject to withdrawal or revocation by the Department at any time in its absolute discretion.

The prime consideration of the Department is directed to the listening public. The operators of stations must necessarily take the same attitude, for broadcasting is finally dependent upon them for its support.

—Department of Commerce Statement.

SARNOFF INTRODUCES SUPER POWER BROADCASTING IDEA IN ENGLAND, FRANCE AND GERMANY

Having returned from Europe where he remained seven weeks visiting the leading radio engineers and scientists in governmental and private radio circles abroad, David Sarnoff, Vice-President and General Manager of the Radio Corporation of America, is still a champion of long wave-length for trans-oceanic radio communication after making a thorough analysis of the developments which have gone forward in short waves in Europe, under Governmental and private supervision and initiative.

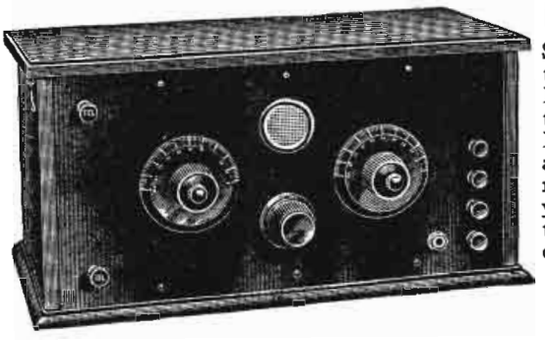
"I have seen nothing, as yet, in this new field of short waves either in Europe or at home," said Mr. Sarnoff, "which justifies the claim that the present high-power long wave stations employed for commercial trans-oceanic communiation will be supplemented by the low power stations. Reliable radio transmission over long distances during the daylight and business hours, must still be conducted with high-power and long waves, such, for example, as we are now using at Radio Central, on Long Island, N. Y. The possibilities of radio development in all branches of the art, however, are too great and promising to permit any negative views that its advance will stop here or there.

STUDIES MARCONI'S SHORT WAVE EXPERIMENTS

"While in England, I saw a good deal of Mr. Marconi and his experiments with short waves. These experiments have given fresh impetus to the work of research men and radio engineers in the United States, where the short-wave field has been under scientific investigation for several years. It may be

Sherma-Flex Set NOTHING MORE TO BUY **$53.78** Delivered

ON APPROVAL—SEND NO MONEY!



Invest in a 2c stamp

Say you are willing to look at the set in your express office. If you like it, give the agent the price, and take it away. If after testing and using it a reasonable time, you are not absolutely sure you got your money's worth, we will take it back and refund every cent you paid.

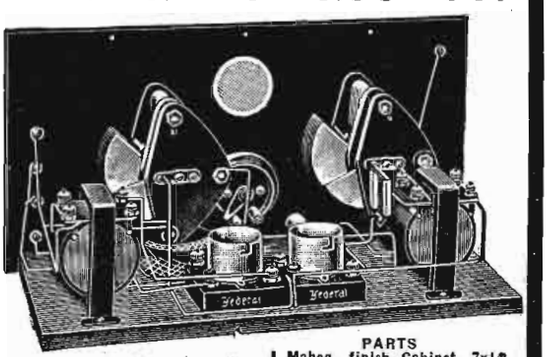
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You have been wanting a real good set Here it is!

This Quality Reflex "Sherma-Flex" set produces most unusual results. It is highly selective. It brings in local and distant stations with a fine clearness and so strong that

Many Users Say the Volume Equals that of a Five-Tube Set

It has been subjected to numerous severe tests under different trying conditions and in many locations, and in every case it has proved extremely satisfactory alike to novice and expert.



We know it will please you, or we could not afford to make such a wide-open Approval offer.

THE SET COMPLETE, with all parts of the Receiver assembled, in a nice piano-polished, dark mahogany finish cabinet, and with all accessories, ready to use—nothing more to buy—for only **$53.78**

IF YOU WANT TO SAVE THE COST OF ASSEMBLING, we will sell you the parts unassembled, including the cabinet, for only **$27.72**

You—anyone—can put the parts together in a few hours. Easily followed charts and instructions go with every set.

As the price of all the accessories is only..... **$16.06**

THE WHOLE OUTFIT, WITH RECEIVER unassembled, then will cost you only..... **$43.78**

If you require long range and this set does not receive over 500 miles from where you live, we will take it back and refund your money.

PARTS
1 Mahog. finish Cabinet, 7x14.
1 Baseboard.
1 Panel, 7x14.
2 Sherma-Tran Transformers.
2 26-plate Sherman Kant-Short Vernier Condensers.
2 Honeycomb Coils.
1 Rheostat.
2 Sockets.
2 Micadons.
1 Fixed Crystal Detector.
1 Single Circuit Jack.
6 Binding Posts.
12 ft. Bus Bar.
¼ lb. No. 20 DCC Wire.
1 Bezel.

ACCESSORIES
2 UV-201A Tubes
1 Pair Guaranteed Phones.
1 Phone Plug.
2 B Batteries, 45 volts each.
1 A Battery, 4 Dry Cells.
1 Coil of Aerial Wire.
1 Coil Lead-in Wire.
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1 Insulator Tube.
2 Insulators.

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From N. Y. this set brings in Hastings, Neb., using Ducon plug. Also Miami, Fla., on loud speaker, using aerial. Chicago comes in with great volume on loud speaker, using bare wire aerial, WITHOUT INSULATION, IN POURING RAIN! *Greater distance on phones!*

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Clear, rich, mellow tone. Attaches instantly, without screws, to any standard phonograph. $7.50 at leading radio stores. Write for folder.

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Saw your bakelite panels, and build beautiful cabinets at very low cost with a

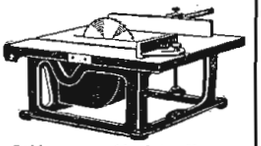
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is exceptionally low for this high quality outfit.

This kit consists of all parts necessary to build a five tube Neutrodyne set, including drilled and engraved panel. Coils are wound on finest grade bakelite with silk wire. There is nothing omitted that is necessary to build this set in best working condition.

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HAS PROVEN BEST and Rules Supreme FROM COAST TO COAST

All parts for the STANDARD NEUTRODYNE $32.50

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variometer consisting of a few turns of heavy wire, by means of which the antenna circuit is tuned. Fixed series condensers are used to provide for the transmitter being worked close to the fundamental wavelength of the antenna, in order that it may radiate efficiently.

The antenna is a four wire flat top supported by steel masts 137 feet above the roof of the store, which with the height of the building included, means that the antenna is 307 feet above the ground. A lead is brought directly to the transmitter on the eighth floor of the store. Brackets are used to keep the lead-in free from the building, the steel frame of which is used as a ground.

Storage batteries furnish the power supply for the transmitter, in order to insure freedom from hum or ripple. A 900 cell battery, with a current capacity of 20 ampere-hours, furnishes 1,600 volts for the main plate supply. Another group furnishes 14 volts to the filaments of the transmitting tubes and has a capacity of 500 ampere hours. This furnishes to the filaments 30 amperes continuously.

The station is separated from the remainder of the store by double glass partitions, thus insuring perfect elimination of outside noises in the studio. Particular attention has been given to the design of the studio, so that hard noises may be softened. Yet the most delicate tones do not lose their quality, which often happens when the deadening effect is carried to excess.

A walk outside the broadcast rooms enables one to see the artists enter the reception room, go into the studio for their performance; then passing into the operating room, watch the effect of the music upon transmitter and amplifier meters— the public can see all this, because of the glass partitions.

Thus, while the vast radio public heretofore could only listen to the various stations, those who live in and near New York, or visit the city, may visualize it as well. No pains have been spared in making WGBS complete in every detail.

INCREASED RADIO POWER

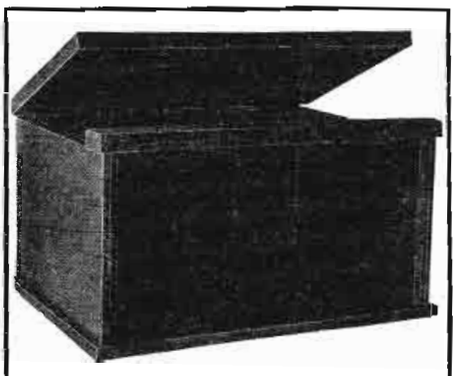
The National Radio Conference, which recently adjourned at the Department of Commerce, recommended that a general increase in power over 1,000 watts was desirable in all stations in order to overcome static and give better service to the listeners. This is a question entirely apart from so-called super-power stations, of 25,000 or 50,000 watts, which are not here dealt with.

In order to include increases up to a maximum of 5,000 watts, the Department feels that it should be proceeded upon an experimental basis under strict limitations which will insure that this development may be without interference with the service of other stations or with the reception now enjoyed by listeners. The Department is receiving many inquiries as to the granting of licenses authorizing this use of increased power.

Licenses for the use, in broadcasting, of power up to 5,000 watts on a purely experimental basis will be issued under the following conditions:

1. Experiments may be carried on only after due notice to the supervisor of radio of the district and must be at all times under the control and regulation of the supervisor and the Department.

2. Stations operating under experimental licenses may at the outset use a power input to the antenna not exceeding 1,500 watts. Whenever the radio supervisor of the district and the Department are satisfied that the public interest is served by the use of such increased power and that no undue interference with other stations or with re-



Radio Cabinets Strong and Rigid. Remember That We Pay Mail and Express Charges. It Makes Quite a Difference When Comparing Prices.

Specifications

Hardwood, rubbed mahogany finish. Top hinged, ends of top spleined to prevent warping.

Panel size	Depth	Price
7 x 14	10	$3.00
7 x 18	10	3.25
7 x 21	10	3.50
7 x 24	10	3.75
7 x 26	10	4.50
7 x 27	9	5.00
7 x 28	10	6.00

Mail and express prepaid east of Mississippi River.

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The Southern Toy Company, Inc.

Dept. N. HICKORY, N. C.

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MODEL 21—A Loud Speaker for thousands of Radio Fans who are looking for a moderate-priced speaker with quality.

Special (non-vibrating) metal horn, 21 inches high, bell 11 inches in diameter, complete with special loud speaking unit and 5 foot cord.

Made in four finishes: Plain Black or Brown Satin; also special Alligator grain in Black and Green or Black Crystalline.

Price Complete ready for immediate use—$9.50



Model 21



Model "A"

Non-Adjustable Phonograph Unit

$4.00

No extra batteries required with either of above; merely connect to receiving set in place of headphones.

At your dealer's or sent prepaid on receipt of price.

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nal of KDKA and repeated on their respective wave-lengths the entire Heinz program.

In Great Britain the pick-up was located in the offices of the Heinz Company in London. Here special receiving equipment had been installed, which permitted the reception of the short waves. From London, special telephone connections carried the signals to the other headquarters of the company in Great Britain, located at Liverpool, Hull and Bristol. Canadian cities had the same receiving equipment as that installed in the cities of the United States.

R.C.A. ADDS SHORT WAVE TRANSMITTER TO ITS SEVEN KEYS IN NEW YORK

The first commercial short wave, low powered trans-oceanic radio station has been licensed, indicating the recognition of this means of communication by the commercial radio interests, following the successful long-distance experiments of engineers and amateurs.

Station WGH of the Radio Corporation of America at Tuckerton, N. J., has been licensed provisionally to operate on 90, 93, 97, 100 and 103 meters by the Department of Commerce. With this new transmitter rated at 20 k.w., the Corporation expects to establish auxiliary long-distance commercial circuits to Buenos Aires, Berlin and Paris, in addition to their seven high-powered, long wave circuits operated from New York City.

When compared with the power and wave-length of the main transmitter WGG, at Tuckerton, which are respectively 200 k.w. and 15,900 meters, the radical step is obvious; only one-tenth the power is to be used. It is possible, if this circuit operates successfully, that short wave low power stations may eventually supercede the expensive high powered stations previously believed essential in long transmission circuits.

The range of WGG is approximately 4,500 miles, carrying to Buenos Aires, and, if WGH is to establish such a circuit it must also function over great distances, at least at night, when the peak of the traffic to the Corporation's radio central station New York is reached.

Radio experts believe this commercial step is especially significant and that, with the development of short wave transmitters and receivers, sufficient short wave channels will be found for additional circuits of this type. Within the band, 90 to 103 meters, the assigned wave-lengths may be placed much closer together than within longer wave bands. Whether the Corporation will also receive on short waves is not known, but it is pointed out that it will probably have no trouble in spanning the Atlantic or reaching South America, receiving on the longer wave-lengths until foreign short wave stations are established. Dr. Taylor of the Naval Radio Research Laboratory stated recently that with his 1½ k.w. short wave transmitter at Bellevue, D. C. he has been heard in Argentine, Chile and Brazil. Westinghouse experiments have been quite successful in short wave transmission, and abroad considerable progress has been made.

GIMBEL BROTHERS OPEN NEW BROADCAST STATION IN NEW YORK

After their particularly successful experience with station WIP in Philadelphia, Gimbel Bros. have installed a second station. It is at their store in New York City and broadcasts on 316 meters.

The transmitter is the 1B type Western Electric unit consisting of two 250-watt oscillator tubes and two modulator tubes of the same rating. The oscillators are arranged in a Meissner circuit, slightly altered to provide a separate circuit for the suppression of harmonics. The plate and grid coils are mounted in inductive relation to a



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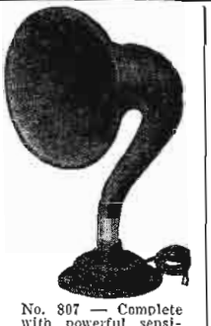
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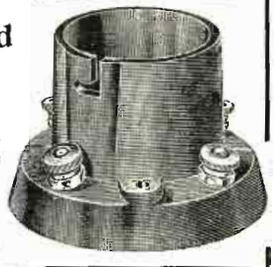


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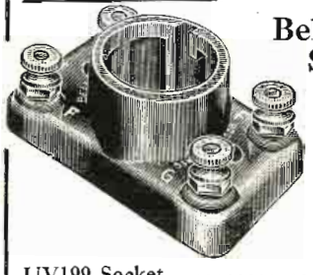
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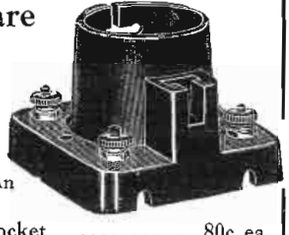
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continents, so widely separated, were enabled "to be present" at an international sporting event, in which both were intensely interested.

"The presence" of the fight fans in the United States and South American countries at the fistic contest was made possible through the operation of the two radio broadcasting sets, both situated at station KDKA, 450 miles from the actual scene. The fight returns were broadcast to the fans of the United States on the long wave, and to South American countries on the short wave.

The event was broadcast from the ringside, and every action of the fighters was minutely described. The equipment used permitted the picking up of all sounds at the ringside, such as the applause and the cheering of the immense throng, the sound of the gong, the conversation of those close to the ringside, the issuing of instructions to the fighters by the referee and the advice of the seconds of the boxers.

This broadcast was arranged for and clearly picked up in South American countries, particularly Buenos Aires, Argentine, where arrangements had been made by "La Nacion," the leading South American newspaper, to re-transmit in Spanish to throngs of interested countrymen of Firpo.

The antenna of the short wave station is a copper tube, erected vertically and supported from a pole 50 feet high. The antenna has a ball on one end and is made rigid to prevent swaying.

10,000 DINERS IN 62 CITIES HEAR SAME SPEAKERS BY RADIO

In 62 cities of the United States, Canada and Great Britain, 10,000 diners met simultaneously October 11 at the world's first international radio banquet to celebrate Founder's Day by the H. J. Heinz Company, radio being used as the medium to tie into a unit these scattered banquets.

With the banquet in Pittsburgh acting as the key, the entire program at the Heinz plant was broadcast from the short and long wave station of KDKA and picked up on receiving equipment which had been previously installed in the various banquet halls and with loud speakers, so that every banqueter enjoyed the same program as it was given in Pittsburgh.

Speakers at the banquet included President Calvin Coolidge, who spoke from the White House, Charles M. Schwab, the Secretary of Labor and Senator George Wharton Pepper. The three latter speakers were in Pittsburgh. Special direct telephone line connections were set up between the White House and Pittsburgh. It carried the President's message to Pittsburgh where it was impressed simultaneously on a public address system installed in the banquet hall and also on the long and short wave transmitting stations of KDKA. Arrangements were made in the White House for the President to hear all the details of the banquet on a radio receiver. Through this arrangement the President was aware of the progress of the banquet and was prepared to start his address at the proper moment.

All other speakers were at the banquet table, where a most complete system of microphone pick-ups had been installed. The voices impressed on this pick-up installation were carried to the transmitting station at East Pittsburgh and from there broadcast on the long and short waves. Station KFKX located at Hastings, Nebraska, picked up the short waves and there rebroadcast the banquet proceedings over the Rocky Mountains to the Pacific Coast. To insure the greatest possible blanket of radio signals being thrown over the largest possible territory, KYW at Chicago, and WBZ at Springfield, Mass., also picked up the short wave relaying sig-

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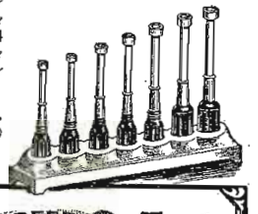
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If he does not handle our table send check or money order. Also please mention name of your dealer. Mention finish.

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Built as a rule for the wave band provided for broadcasting in this country, American radio sets and certain parts, have been handicapped to some extent in certain foreign markets. On the whole, however, it may be expected that the situation as regards wave-lengths will tend to improve and that there will be less and less handicap from this quarter.

The interest shown by plantation owners, mine operators, ranchers and the like in the interior of India, Ceylon, Central America, South America, Australia and parts of the East Indies is sufficient to indicate that the field is there. In part, of course, the potentialities of these fields cannot be developed until better broadcasting is provided at points within a distance that can be regularly and reliably covered by a good modern set. However, in the case of sections, such as Central America, Northern South America, the West Indies and even many of the Island groups of the South Seas, the high class American set will today enable the isolated planter or mine operator to reach some of the more powerful American stations.

Manufacturers and exporters, however, have become so accustomed to having the merits and possibilities of radio well understood by the potential buying public, as a result of the immense publicity given radio by the press of this country, that they lose sight of the fact that men in outlying regions, in little touch with the newspaper press and having little contact with anyone who knows radio at all, do not themselves appreciate fully its possibilities. To develop the use of radio, therefore, in these outlying sections some method must be developed whereby effective demonstrations can be given. It should not be difficult to arrange for such demonstrations and it is believed that they will be amply justified by the returns that will be received.

R.C.A. HAS PORTABLE BROADCAST STATION

The Radio Corporation's traveling show will start broadcasting under the call WEBL, using a new portable station. The license for this traveling broadcast station is one of a few issued by the Department of Commerce for mobile stations. It permits temporary broadcasting from the R.C.A. standard amateur transmitter used for short distances. Along with the radio exhibits it will be directed by George Clark of the Corporation.

BROADCASTING IN CEYLON APPROVED

It is now announced that the Secretary of State has approved the introduction of radio broadcasting in Ceylon, the broadcasting to be under State control, though not necessarily operated by the State. The Ceylon Government has decided to issue an unlimited number of licenses for receiving sets, and the broadcasting will be undertaken by the radio station at Colombo.

SPECIAL BROADCAST RECEIVED AT GREAT DISTANCE

Broadcasting in excess of 5,000 miles was the remarkable achievement of radio engineers of the Westinghouse Company recently in connection with the heavyweight fight between Luis Angel Firpo, "Wild Bull of the Pampas," and Harry Wills, United States contender for the heavyweight boxing championship of the world.

For the first time in the history of the world, fight returns were broadcast direct from the ringside by station KDKA and re-broadcast by the relay station of East Pittsburgh to broadcast stations in Buenos Aires, Argentine, South America, and Hastings, Nebraska, and the peoples of the two

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well; and in my dreams the castles shadowing yet far, seemed nearer to the morning hour."

The International Yacht Races were to be held in New York the following autumn and they had planned to charter a tug boat and cover the race for the newspapers by means of wireless telegraphy. It would make them famous, establish a company of firm foundations, put an end to DeForest's long, hard pull for success and recognition.

Life was good, the way was to success!

(To be continued.)

Radio Broadcast News

RADIO INTEREST IS WORLD WIDE

While the activity in amateur radio work and in broadcasting is still greater in the United States than in any other nation, the past year has brought about marked changes in the situation in many foreign countries, according to the Electrical Division of the Department of Commerce. Today, few are the nations which have not recognized the popular and growing interest in radio by the enactment or revision of regulations of one sort or another.

Naturally, the development abroad has had its greatest growth in Europe. In the British Isles, France, Germany, Sweden, Switzerland, Holland, Belgium, Denmark and Czechoslovakia, the broadcasting of programs of entertainment and news is on a rather regular basis while in Italy, Finland, Spain and Austria, programs are sent out at irregular periods with a decided likelihood of regular schedules being adopted in the no great distant future. In other countries of Europe there has been some sale of long range sets to pick up British and French stations.

In South America, Argentina stands out as having made the greatest progress in the dissemination of music and other entertainment by radio telephony, with Chile also maintaining regular broadcast service. For a time, regular services were also maintained in Brazil and will, undoubtedly, be re-established in the course of time. Uruguay as a result of broadcasting from Buenos Aires, has shown a considerable interest in radio, and in Peru arrangements are going forward looking toward the establishment of regular service.

Australia and New Zealand have each displayed much interest in the new art and in view of the recent lifting of hampering regulations in Australia a marked expansion in radio interest in that country may be looked for. In the Orient, little has as yet taken place, though India and Ceylon are opening up, and intermittent broadcasting is being provided. In Japan, adequate legislation has been enacted, making provision for the establishment of broadcast stations, but little progress has taken place. In China, radio is technically barred under an embargo forbidding the entry of anything usable as war material, though in the British port of Hong Kong and in the international settlement of Shanghai, some broadcasting has been done.

In no foreign country is the use of radio receiving sets as free and unrestricted as in the United States. Even in Canada users of receiving sets must pay a nominal license fee therefor, while in some countries the restrictions imposed and the license fees assessed are onerous.

While most of the countries, which have enacted legislations on radio telephony during the past year or two, have established certain wave bands, not varying widely from that in this country, which must be used for private broadcasting, not a little of the European broadcasting is at wave-lengths greater than those in use in the United States and for which American sets are designed.



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4 in. polished bakelite two piece (for group and vernier readings) dial $1.00
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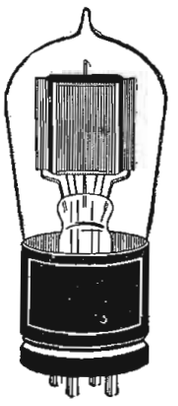
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atic investigation of the new discovery. They analyzed the mantle, noted its shape and heat, in a word took down notes on every possible contingency. Later, they continued their investigations. It was some days before they discovered the true cause of the change in brilliancy.

As soon as the spark coil was removed to another room and the door closed so the sound of the spark could not reach the mantle, the light fluctuations disappeared. It then became obvious that the sound waves from the spark gap caused a change in the gas and air currents within the mantle, forcing the gas from the hotter regions down to the less dense spots which were not quite so brilliantly lighted, thus causing the distribution of the gases to be more even throughout the burner. However, the seed had been sown in DeForest's mind, a mental note had been taken which was held in abeyance for a few years, only to emerge, later, in the form of the three electrode vacuum tube which makes possible the present development in the radio science.

This little episode was passed over in the lives of the experimenters with little portent to the great changes it was to make later. By the spring of the following year, 1901, they had a system fairly well worked out, one that was stable and somewhat dependable. The Sponder, in its final form, consisted of two electrodes, with removable ends tin plated, separated a short distance. In this gap between them there was placed a compound of glycerine, tin filings and lycopodium powder in a glass tube.

At the beginning, an arrangement had been made for changing the polarity of the terminals of the Sponder every 100 seconds or so to counteract the effect of the currents on the compound between the terminals. Much work had been done along this line, such as the mechanical design of an automatic slow break switch to change the leads. With the final development and the compound used in the commercial tests, the problem was simply solved by the use of two Sponders used at intervals, the changeover giving each time to restore itself for further service.

From the beginning of the experiments, a small spark coil had been used for the transmitting end of the apparatus. With the completion of the Sponder and its practical adaptation, it was necessary to give a little attention to the transmitting end. It was this point that brought Freeman—Prof. Freeman of the Armour Institute—on the stage.

At the completion of the first set of test apparatus, he immediately horned his way into the DeForest-Smyth combination with the design of a new transmitter. They held him off as long as possible but he finally won his way into the firm. Not, however, until after the first "long distance" tests had been made in Chicago in which intelligible signals were transmitted from the experimental sending station to a temporary receiver installed atop the Latoka hotel, one half-mile away.

After the successful conclusion of the experiment he wrote in his diary: "I have heard glorious symphonies of Beethoven, the thrilling measures of Wagnerian music ringing through my soul, with joy and inspiration, yet to my waiting ear did that faint 'whir-whir' ticking the h's of the agreed signal seem the sweetest music—the most enthralling sound ever heard by man!

"It spoke of a difficult goal now reached; it sang of great success; it seemed the whir of spirit wings, perhaps bearing laurel! In the mystery of its transmission through that dark void, silence, invisible, timeless, I felt the presence of another world than I had known, the ether realm, to thought boundless, to the soul inspiring, to life infinitude.

"'Thus did I sleep that night, wearily but

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Ever of a highly emotional nature, the music seemed to fill a vacant spot in his character left so void by his latest vain love. He literally soaked himself in the sweet melodies of the old masters. For two weeks, sometimes, after he heard a particularly good concert, he would continue to write about it. Many times he would attempt to put the beauty of the composition on paper, although he said that music was superior in its position, since it seeks to express the feelings and emotions which are unspeakable.

Saturday night after Saturday night during the winter season would find him climbing tier on tier of stairs to reach the highest gallery, the cheapest seat in the hall, to listen to Beethoven or Wagner.

This latter writer spoke more plainly to him than the rest. His first meeting with the incomparable music of Lohengrin left a mark upon his taste and character which remained with him ever after.

Music was his only respite from the continual grind of work all during the winter and spring he spent in Chicago after his return from Milwaukee.

THE work on the Sponder continued and gave promising results. DeForest was always strong in his belief that the coherer and relay method was entirely too complicated and clumsy for wireless and that the logical method of reproducing the signals at the receiving station was through the agency of a telephone receiver. To this end he continued his work on the Sponder in spite of several promising ideas in other directions. Along toward the last of the year 1900 the experiments reached such a state of development that DeForest couldn't see the use of continuing work with the *Electrician* with such good prospects in view in the wireless field.

He laid the possibilities before Smyth and called a sort of consultation as to ways and means. The result of the negotiations was that Smyth agreed to give DeForest five dollars per week and otherwise finance the experiments for a share of the dividends to be reaped from the work. Immediately De Forest began to give his whole time to the work in hand. Things progressed rapidly for a time. Very rapidly; Smyth had had a great deal of experience in the electrical field and he gave much of his spare time to helping with the experiments. A good part of the notes in the now famous note book kept by DeForest during those years are the collaboration of the two men.

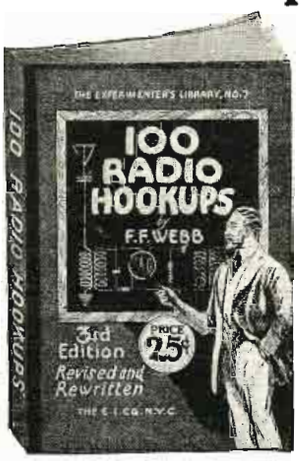
THE INCIDENT OF THE GAS MANTLE

It was during the course of one of these experiments that DeForest noted the change in brilliancy in a gas mantle while the transmitter was working. This was the revelation that later led to the epoch making conception of the vacuum tube detector. This was in September, 1909, before DeForest had been moved down to Armour Flats.

While working over the Sponder, one night, the gas light by which he was working was not lighted to full brilliancy. De Forest was seated at the Sponder operating the transmitting key by means of a string. His eye caught the reflected response of the light to the sparking of the coil. He ran across the street to Smyth and called his attention to the phenomenon. Together they pondered the question.

Immediately the possibilities of the discovery loomed. A new method of detection, more sensitive than anything yet discovered, something entirely stable which needed no attention and changing of polarity during operation as did their Sponder. DeForest was in a seventh heaven of happiness. But exultation required only a few minutes and experimentation and practicality required days and sometimes years, so they rushed back to the transmitter and began a system-

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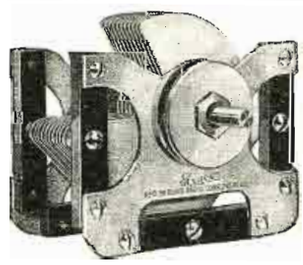
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Forest showed him the note books and told him of various tests made during the Milwaukee stay. Immediately they began their work together.

The first steps were the trials of different electrolytes in place of the water which had proven so undependable. They tried glycerine, kerosene, olive oil—in a word, everything they could procure. Then they began experimenting with the best form and metals of which to make the two electrodes.

One particular note on this subject is of interest. Most everything but silver had been tried, all giving about the same results. DeForest began on a Monday morning experimenting with silver, a dollar forming one electrode. For two days it served and the entry for Thursday noted the fact that a silver half-dollar was used as one electrode and tin as the other (the first experiments proved that tin served well in combination with silver). Then the following day, a dime took the place of the quarter. Saturday, the notation states that experiments were temporarily suspended, since the experimenter had to eat over the Sabbath!

Shortly after that episode he resolved firmly "to go bare footed while working in his room or the laboratory when no one was about and stand up at all possible times in order that his trousers, well on the way to the old clothes man (if he could be persuaded to take them) might last the remainder of the winter and so that his shoos might be retained also. By following such a course he could continue his experiments and go to an occasional opera and symphony concert.

The sudden interest in music had manifested itself when a cousin living in Chicago had taken him to his first concert. He had, as usual, few friends and acquaintances; since his income was hardly inducive to elaborate hospitality his Sundays were almost barren and his evenings given over to work.

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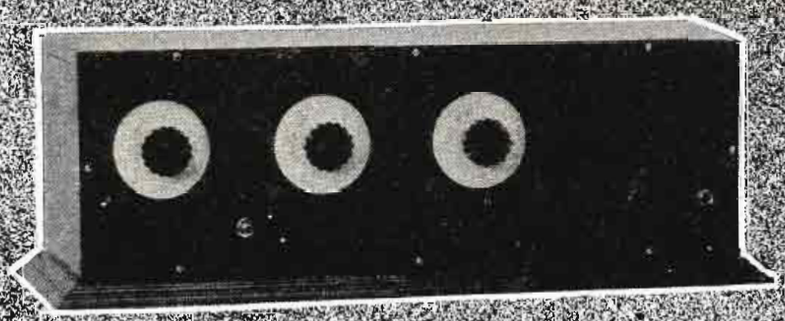
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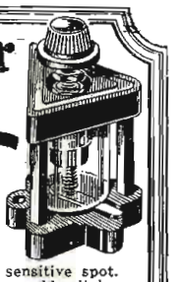
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professor had made no progress with his work, no single improvement had been made over the original Marconi works and he had spent a great deal of money.

Matters came to a climax through a young German who was working as DeForest's helper. All the time the professor's experiments had been going on, DeForest had been continuing work on his Sponder in hours after work. The young German saw the end of his job and said something to De Forest about it. In return, DeForests replied that there was nothing that could be done, since the professor was working on an entirely incorrect idea. The German suggested that DeForest give the professor the Sponder and start work on that line for the company. He had seen and helped DeForest in some of his work, giving him knowledge of the existence of the thing. DeForest replied that he had conceived it long before his entry into the service of the professor and so considered it his own property.

DIFFICULTIES

The German did what seemed logical; he told Johnson of the Sponder and its success in preliminary tests. The following day De Forest was called to the office. The interview was comparatively short and inversely proportional to its length in results. The professor asked DeForest if he had any suggestions to make as to improvements in the apparatus. Lee replied with a few details in the mechanical design of the apparatus they were using. The professor said that he thought some other line of investigation would pay better in the end. DeForest, however, maintained that he had no other tack to offer upon which to start. The professor became furious and told him what the young German had said.

DeForest left the office and likewise the employ of the professor, for he refused stoutly to let his precious Sponder go into the company's hands.

A few days later he was back in Chicago with his Sponder safely in his possession, but without a job or prospects of one. A few days around the electrical trade, however, brought him a position with the *Western Electrician,* a journal of some note. The World's Exposition was being held that summer in Paris and there were voluminous French accounts of it to be translated. The editor gave DeForest a temporary position translating them. The salary was ten dollars per week.

He returned to his old hall bed room and his experiments. Little progress could be made, however, since he had little laboratory equipment and less money with which to buy it. A few days later he obtained an introduction to one of the staff at Armour Institute. An idea immediately crossed his mind. Why not swap a bit of teaching time for the use of one of the laboratories? The next day he made the arrangements. For teaching three hours per week he was to have free run of the electrical laboratory in which to continue his experiments.

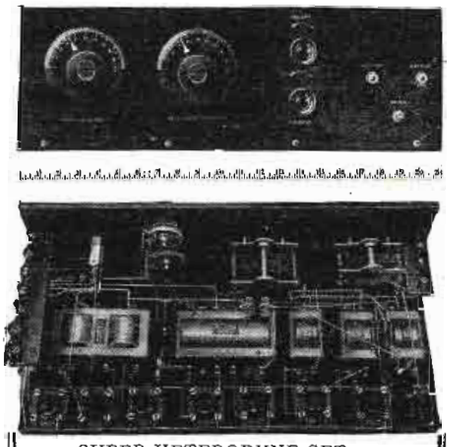
As time went on, the Sponder became better and better in its workings. DeForest began to gall under the necessity of splitting his time between experiments and work at the *Electrician.*

During the course of his work at the Western Electric Company, he had made the acquaintance of one of the younger telephone engineers, W. W. Smyth.

He and DeForest had been great friends during the previous work at the Western Electric and Smyth had become extremely interested in wireless. He had drawn up DeForest's first patent application covering the electrolytic design of detector or Sponder.

So it was only a few days after DeForest's return and settlement at the *Electrician* that Smyth dropped around to inquire after the advances made in the past months. De-

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the various instruments shown in symbolic form, as well as by photograph. In this circuit, the action, much simplified, is as follows:

The antenna or aerial collects energy sent out by the transmitting station which passes through the primary coil and thence to the ground. However, as it passes through the coil, it causes another current to flow in the secondary coil. The variable condenser "tunes" this coil and by means of that condenser, you are enabled to select the station desired, rejecting others that may be transmitting at the same time: The current flowing in the secondary would not, if passed through a pair of phones, make any sounds. It must be changed first and the vacuum tube is employed to do this. Actuated by the "A" and "B" batteries, the tube changes the current and passes it, reinforced by the "B" battery, on to the phones. The latter are similar in construction to the receiver used on telephones and when the current passes through them, sounds are produced that are the counterparts of those being made at the transmitting station. That, in essence, is the action in a radio receiving set. Some of the details have been explained by the writer in past issues of this magazine and others by other writers. More details in simplified language will follow in the future.

The Life and Work of Lee DeForest

(*Continued from page* 1155)

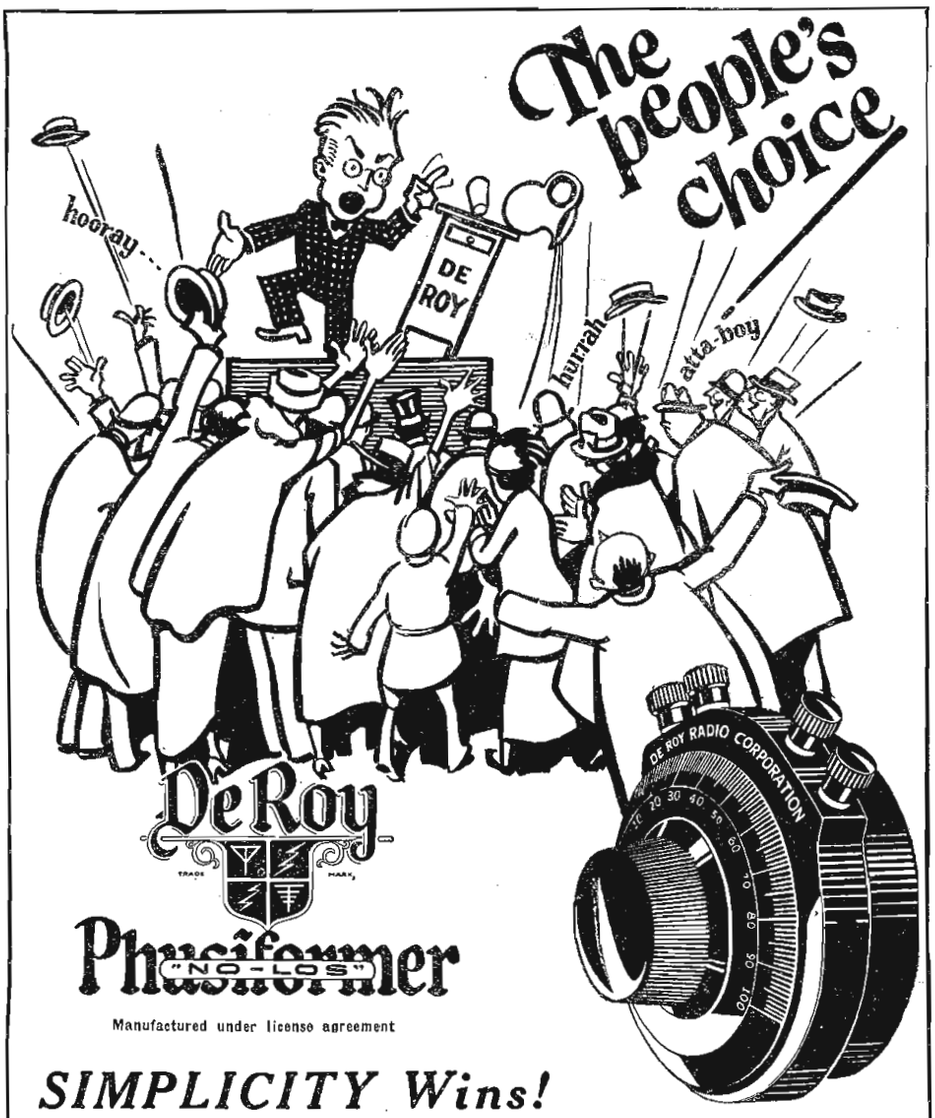
upon it. He, the boy said, was a big lookin' guy and was waiting in the office to see DeForest. DeForest went down. The man greeted him with warmth.

Prof. Johnson was an inventor of some note, having designed a system of vacuum thermostatic control for steam boilers and radiators. He had read considerably of wireless experiments and the coherer and thought that he had a possible improvement for the coherer. The principle involved was the use of a small puff of air to decohere the particles after the passage of a signal. He had learned of DeForest's experiments and wished his services in developing his own system of radio. After a few preliminaries, the Professor offered DeForest a position as "Chief Engineer" and asked what would be demanded as a salary. Lee screwed up his courage and asked for the magnificent sum of fifteen dollars per week. He got it.

Two weeks later, DeForest with his hand baggage and his own private wireless apparatus, including the electrolytic detector which he called the Sponder—short for responder—started for the professor's Milwaukee office.

At Milwaukee, he plunged into the work of making a success of the professor's idea. A transmitting station was installed in the town and DeForest was stationed in a small shack on the shore of Lake Michigan with the Johnson-Fornier pneumatic receiving set to attempt to pick up the signals. Of course, the idea behind the new coherer was all wrong. Marconi and other experimenters had found that an extreme advantage was gained by placing the filings in a vacuum in order to get away from the effects of corrosion caused by moisture always present in the atmosphere. The professor deliberately turned the idea around and blew air into the filings. However, De Forest was living much better than he had in some time and he was pleased. Too, once again he was close to nature, the lake shore, trees and grass. He had felt the separation from it in the city keenly.

While the experimenting lasted he enjoyed himself. But at the end of half a year, the



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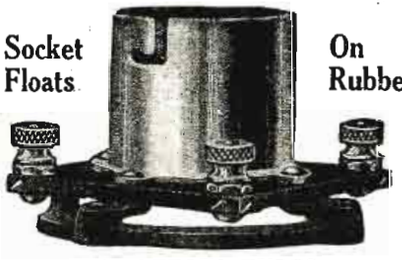
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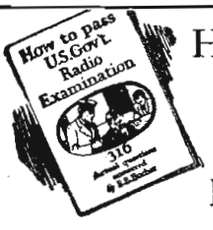


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By E. E. Bucher

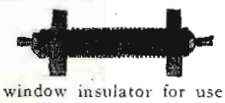
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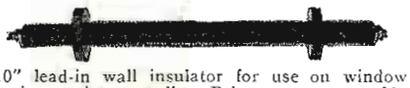
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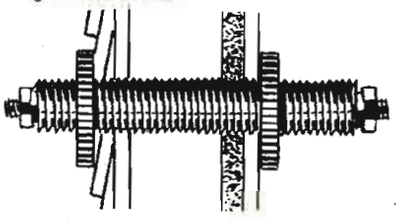
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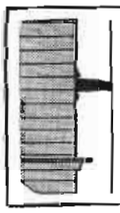
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After the batteries are all connected and you have gone over all the wires and made sure that they are in the right places, be sure that the rheostat is turned all the way off. This instrument is controlled by a small knob on the panel, usually marked with the name. Then remove the tube or tubes from their packing and with a small piece of sandpaper, brighten up the ends of the four small prongs found on the base. This insures good contact with the socket springs. The method is illustrated in Fig. 7.

Holding the tube by the glass bulb, insert it in the socket as shown in Fig. 8. Be sure that the little pin on the side of the base of the tube goes in the slot provided for it in the side of the socket. Then press firmly down and when the prong gets to the bottom of the slot, twist the tube to the right. The prong will then lock firmly in the socket and hold the tube in the proper place. If the tube does not fit smoothly in the socket, do not try to force it in. Rather, remove the tube and examine both it and the socket for defects. Cheap sockets are not always of the right shape and you should exchange any of that kind for good ones. Otherwise, in trying to force a tube into place, you might break it or ruin the socket.

With everything done as described above, you are ready to operate your set. Turn on the rheostat about three-quarters of the way. Considering that you have a two control set, similar to the one shown in Fig. 10, proceed as follows: Set the dial marked tuning at a point midway on the scale. Turn the dial marked regeneration until you hear a click or squeal in the phones. Set this dial at a point just before the click or squeal. Never let the set squeal any more than you can possibly help, as this causes similar squeals in your neighbor's set. With regeneration dial set as noted, slowly rotate the tuning dial, first one way and then the other until a station is heard. Turn until the station is loudest and then adjust the regeneration dial towards the squealing point until the station comes in still louder. Here again be careful not to let the set squeal. Once you learn to tune the set, you will be able always to get a desired station by setting the dials approximately on the points at which it previously was found.

Sometimes sets are sold without what is known as a grid leak, because of existing patents. In other cases, the one supplied may not be of correct value. The latter may be the case if you find that no matter where you set the regeneration dial, the set will not squeal. This is an incorrect condition and you should change the grid leak until the set will squeal when the regeneration dial is advanced. A typical grid leak and holder is shown in Fig. 9. Sometimes clips similar to the ones shown on the holder are placed on the grid condenser. This can be readily located in the set. Try several different values of leaks until the proper one is found. Leaks are high resistances, valued in megohms or fractions thereof. A megohm is the term for a million ohms, an ohm being the unit of electrical resistance.

In Fig. 11 is shown the circuit of a simple one tube, two control receiver, with

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Kant-Blo
SWITCH SIGNAL BINDING POST
"Lights on any Short Circuit"

The KANT-BLO is not an extra accessory on your set. It is designed as a B battery Binding Post or as an A battery filament switch. Post style and Switch Style—are at all the best radio stores. If your dealer is out of stock send us $2 for a KANT-BLO Binding Post Style, or $3 for a Switch Style, and we will ship any number of KANT-BLOS direct to you, charges prepaid.

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a moist spot. If the latter is not available, drive the pipe in the handiest spot and throw a pail or two of water around the pipe every day.

THE GROUND CONNECTION

The ground connection may rightly be considered the place where the ground lead or wire from the ground binding post on the set, is connected to the steam, water or driven pipe. This is an important place, as rust or corrosion here may make a good set give poor results. Get a ground clamp from your radio dealer. They come in different styles, but all serve the same purpose; that is, to make a good electrical connection between the pipe and the wire. Scrape and sandpaper the pipe clean at the point where the clamp is to be applied, and

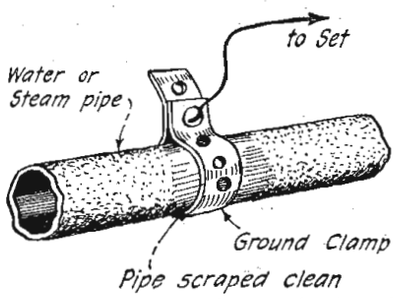


Fig. 5. How the ground connection is made to the steam or water pipe. The pipe should be scraped clean before the clamp is put on.

install the clamp according to directions. Tighten the clamp as much as possible, both on the wire and the pipe. Then attach the other end of the wire to the binding post on the set marked "ground." A typical clamp is shown in Fig. 5.

THE SET PROPER

After the aerial and ground are installed, the first step is to connect the batteries. When you bought your set or made it, you undoubtedly were told what tubes should be used with it. Therefore, you already know what batteries to use and undoubtedly have them at hand. However, for the benefit of those who do not have batteries, we will review the situation. Every tube set (we will consider only that type) has to have two separate and distinct batteries. (The only exceptions to this rule are the Solodyne circuits recently described in this magazine.) The batteries are known as the "A" and "B" batteries. The first is a low voltage battery such as one or more dry cells or a storage battery and the other a high voltage battery, usually a collection of small dry cells sealed in units of 15 or more, but in some cases, a collection of small storage cells.

The following tubes or their equivalent are listed with the voltage battery required for the "A." All of them operate well with one 22½ volt "B" battery when used as detectors:

UV-201A—6 volt storage battery.
UV-200—6 volt storage battery.
WD-11—One dry cell.
WD-12—One dry cell.
UV-199—Three dry cells.

The first thing to do is to connect the "A" battery. Be sure that the polarity is correct. That is, connect the post on the battery that is marked negative (—) to the post on the set marked the same way. Do the same with the other post of the battery, (+) and the other "A" battery binding post on the set. Then connect the "B" battery in the same way to the posts provided for it. Be very sure that you do not get the two batteries mixed, as you are liable to burn out a tube by doing so. The top of a typical "B" battery with the terminals plainly marked is shown in Fig. 6.

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machine screw that is to be passed through the panel, and two nuts, one to hold the screw or bolt as it is sometimes called, to the panel or base, and the other to clamp a connecting wire to the first one. Connections from instruments are fastened to the rear of binding posts and external connections fastened to the fronts. Thus we see that binding posts are placed for convenience. Of course, they take other forms than that described above, some of them being very ornate in appearance. Others are made of strips of spring brass that are so cut that the wire may be clamped in them without the use of nuts. All styles, however, are properly called binding posts.

From the above, you will see we take for granted you have already purchased a radio set, but are not quite sure as to just how to install it. You may wonder why we are not telling you what kind of a set to buy, and here is the reason. Every person has different tastes and requirements and all cannot afford the more expensive sets. Then too, every locality is different and the requirements of a set for any particular place will vary. For instance, if you do not have any local broadcast stations, you need not have a set that will carefully select one station from several others. In other words and in the terms of the confirmed radio bug, you do not need a *selective* set. If, on the other hand, you are in a large city, you will need a set which will separate the local stations and enable you to listen to one of them while the others are sending. So, you see, we cannot advise just what set to buy. If you will write to the author, in care of this magazine, and tell him just how you stand on the above points, he will advise you as to about what type of set will best meet your requirements. Do not forget a stamped envelope.

But to get back to the actual installation of the set, considering for the time being that you have your set, either manufactured or home-made. In the few paragraphs above, we got as far as connecting the aerial lead-in to the set. There is one more

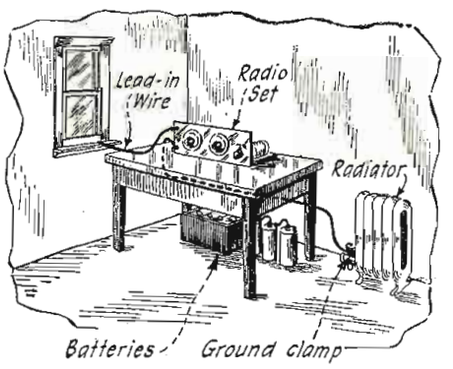
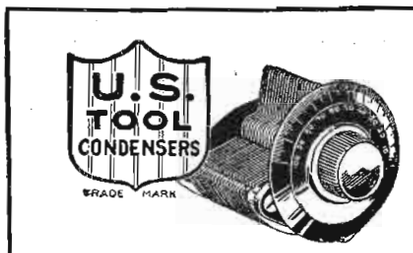


Fig. 4. How the aerial, ground and batteries are connected to the receiving set.

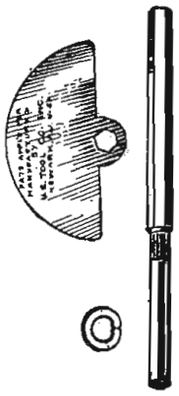
point, aside from the set, to be considered. That is, what is technically known as the ground. The usual method of obtaining a ground is to connect a wire firmly to a water or steam pipe. Gas pipes are taboo, as they often have insulated joints between the house lines and the street connection. A good ground connection is made by soldering or clamping a wire to any metallic object which enters the earth or ground and extends under the ground for some distance; at least five feet. Where water or steam pipes are not available near the instruments, a driven ground may somtimes be the best solution to the problem. This may consist of at least a six foot length of one-inch iron pipe driven in the ground, preferably in



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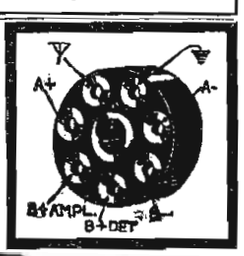
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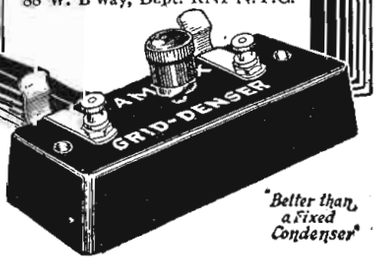
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from the oscillator, but the tuning is extremely critical.

Once the set is in oscillation, very interesting experiments can be carried out. In Fig. 4 are shown a few suggestions for mounting the flashlight bulb. The larger loop is 3 inches in diameter and the small one can be anything from 2¾ inches to ¾ inch in diameter. No object interposed in the field of the coils will affect the lamp to any great extent, but as soon as a closed loop of approximately 3 inches is placed near either the oscillator or the wavemeter coil, the lamp will die out. If the loop is placed about half way between the two coils, the light will hardlly be affected.

Other experiments will present themselves to the mind of the experimenter. In fact everything attempted produced results so unexpected that the writer felt confident that should many experimenters build this transmitter, it would greatly affect the nightly radio golfing. Just a word of warning: Be careful about touching the oscillating parts, as these high frequencies cause some painful burns. Nothing dangerous, and of no consequence, but in your haste to take your hands away, you are liable to ruin something. Remember that to operate this outfit you do not need a license.

Installing a Radio Set

(*Continued from page* 1157)

form to the shape of the sill, as shown in Fig. 2. To the outside end of the strip, fasten the wire connecting to the arrester, indicated as being the one to connect to the radio set. To the inside end of the strip connect a piece of copper wire which is covered with either cotton, rubber or some other insulating material and lead that wire to the table where the radio set is placed.

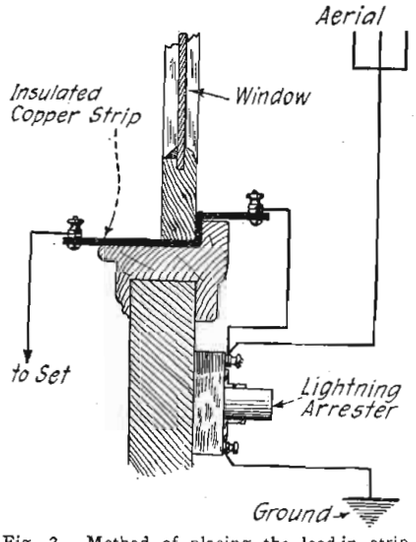
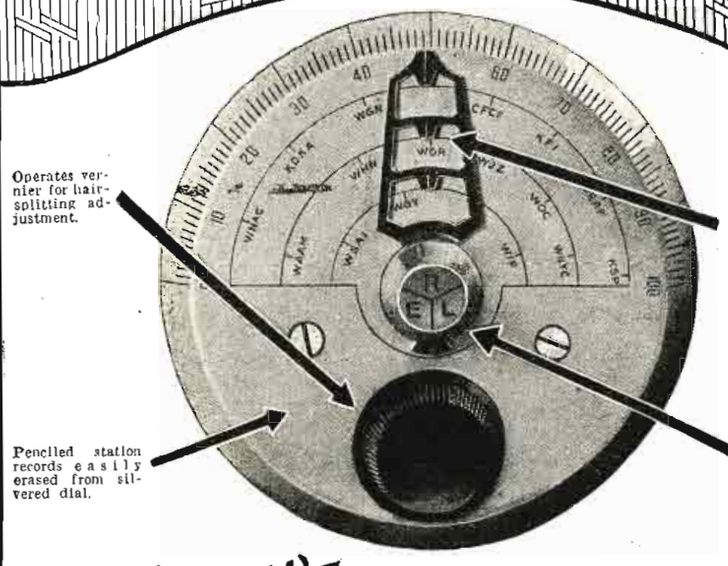


Fig. 2. Method of placing the lead-in strip under the window, and the manner in which the lightning arrester is connected up.

Scrape the insulation from the end of the wire, (this must always be done in making a connection with insulated wire), and fasten it to the aerial binding post on the set, after having bent it to the shape shown in the photo of Fig. 3. Be sure that the curve is bent to the right as shown. This is done so that when the cap of the binding post is tigbtened, it will tend to bend the wire closer to the post instead of pushing it out, as would be the effect if the wire were bent to the left. Remember this little wiring kink, as it may save many irritating moments when connecting wires to binding posts which are not provided with holes in which to clamp the wire.

A binding post is in its simplest form, a



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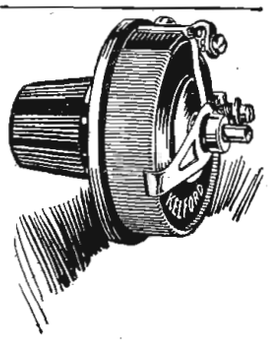
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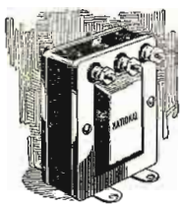
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antenna masts, at the same moment that the station was transmitting messages. It was observed that the birds, through the influence of the electric waves, lost their sense of direction, turning round and round in confusion. These tests were repeated many times, invariably with the same results. (Other similar cases have been reported.)

Barcelona to Have Broadcast Station

Another city is to have a broadcast station, Barcelona. An English company is erecting a high-powered station on the Hotel Colon. The wave-length probably will be 325 meters and the call letters that have already been assigned are EAJ-1.



RUSSIA

Call Letters Assigned Soviet Stations

The Soviet stations are to be assigned call letters starting with R, according to recent advices; some of those already assigned are RAN, Odborsk; RAP, Saratof; RAT, Simferopol; and RAZ, Kharkof.

Experimenting with Five Meters

(*Continued from page* 1159)

The condenser is very important and should have the lowest possible loss. As there are no condensers on the market having a capacity of about .000125 mfd., you must get one of .00025 and remove some of the plates. The writer having ruined a sufficient number of condensers in this fashion, obtained a 22-plate Ultra-Vario condenser. These condensers are built so that three different capacities may be obtained without removing plates.

Make a loop 3 inches in diameter and mount it on the two binding posts connected to the stator sections disregarding the binding post on the rotor. This will cause the two sections of the condenser to be in series, reducing the capacity on one section (.00025) in one-half (.000125 mfd.). Now mount the loop with the flashlight bulb about 2 inches from the wavemeter coil if you are using a VT-2, or closer, if you use a tube of less power.

We are now ready for the fireworks. Connect the "A" and "B" batteries and turn the current on. If you have a D.C. milliammeter with a scale of 0-100 (for VT-2), or 0-50 for the other tubes, place it in the plate circuit by all means, as at the beginning it will be very hard to find the resonating point on the wavemeter. Assuming that you have placed the meter in the circuit, turn the filament current on, and watch the plate of the tube. If it gets too red, reduce either the "A" or "B" battery voltage. The meter will tell you when you have a good combination. The cooler the plate and the higher the reading of the meter, the more efficient the operation. If the set does not oscillate, reverse either the grid or plate coil.

Now take the wavemeter with its little lamp and place it about 4 inches from the oscillating coil. Watch the meter closely and forget the lamp while slowly turning the dial of the condenser. When the resonating point is near, the reading on the milliammeter will be reduced and when passed, it will suddenly return to its original value.

When you note the "kick" in the milliammeter, slow up and by turning the dial very gently you will find a point where the little lamp will light up very brilliantly.

With the 5-watt tube the writer has been able to take the wavemeter 12 inches away

$25,000 TO 1,000 MEN
BIG PROFITS TO LIVE RADIO FANS



We have developed a World Beater. A five-tube set that has no equal in simplicity of operation, clarity of tone, range or volume, all of which is attained without critical adjustments or complicated parts.

To enable our agents to make the greatest possible profit, we are selling these sets fully assembled but not wired.

The efficiency of a Radio Set, no matter how good the parts or wiring system, is entirely dependent on the correct placement of the parts and arrangement of wires. These details have been carefully worked out in our laboratory, and if you follow our diagrams and blueprints, you cannot go wrong, and our simple but complete instructions make this easy for anyone.

We will train 1,000 Radio Fans in wiring and adjusting our sets to fit them to act as our agents and representatives, and handle the rush of business that is bound to come from the quality of our product and the volume and character of our advertising.

The Retail Price of the Blue Seal set as above described with engraved panel, and a beautiful cabinet, is $90.00.

To those able to devote all or part of their time to the sale of Blue Seal sets we offer a liberal agent's discount.

In addition to this, an excellent income may be derived from the wiring of these sets for our customers.

We want real HUSTLERS, and while our regular margin of profit and the income derived from wiring the sets sold is very attractive, in order to select and finally make permanent arrangements with the best of our agents we are offering

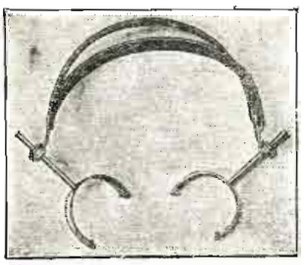
$25,000.00 IN PREMIUMS AND BONUSES
Based on Volume of Sales

WRITE TODAY for illustrated circular and full details which may be the means of putting you in a permanent and profitable business.

If you are not in a position to become our representative, but want the best radio set in your community, we will supply you direct until such time as a local agent is appointed.

BLUE SEAL MANUFACTURING CO.
Dept. 2, 1406-08 South Michigan Ave. Chicago, Ill.

You Know These
HEADBANDS



Simple friction slide adjustment.
Most satisfactory on the market.
No thumb screws to bother with or to catch in the hair.
Two yoke sizes fit any 'phones.
Bands covered in Black or Khaki webbing.
Prompt deliveries on any quantity.

$500,000.00 worth of special and automatic machinery assures quantity output and guaranteed delivery for manufacturers and dealers on any radio equipment.

Submit sample of product. Write for prices.

THE AUTOYRE CO.
OAKVILLE, CONN.

KEYSTONE
VACUUM TUBES



POPULAR PRICE
$4.00

By sending in this ad with your dealer's name and address, you can obtain a Keystone tube at $1.00 less than regular price.

KEYSTONE Tubes are built on the very latest and finest methods of vacuum tube construction. The amplification factor of the KEYSTONE Tube is extraordinarily high, which means for you finer, clearer and louder signals from your set.

FULLY GUARANTEED

Each and every KEYSTONE Tube is fully guaranteed to give you satisfactory service. It is the fact that KEYSTONE tubes are so reliable that gives them the unusual prestige that they have always enjoyed.

KEYSTONE ELECTRIC & RADIO Co.
110 Nassau St., New York City



CANADA

Radio and the Settlers

What radio means to the settlers along the eastern shore of Hudson Bay may easily be seen, when it is mentioned that mail is received there only two or three times a year. The case is cited of a trader at Rupert House, a Hudson Bay post, whose wife left last fall to undergo treatment in a United States hospital. Naturally, the trader was anxious to learn of his wife's condition. In January of this year, he was listening in and heard a minister in Pittsburgh state that he had been asked to mention that the trader's wife was recovering from a serious operation.



AFRICA

Cape Town Broadcast Station

A broadcast station was opened in Cape Town in the middle of September. The call letters assigned are VAMG and the wave-length is 375 meters. The next item about this station will be much more interesting, if some one in this country reports tuning them in.

5,000 Receivers in 100 Miles

There are between 4,000 and 5,000 receiving sets used in the 100 mile area covered by the Johannesburg broadcast station. A conservative estimate would put the average cost of these at $25 each, so that not less than $100,000 worth of radio apparatus has been sold in this district. Firms of all varieties are establishing radio departments, so competition in prices is keen and already costs are comparing very favorably with those prevailing in other countries.



FINLAND

Broadcasting for Finland

Finland has had for some time several radio stations for commercial purposes at Sandham, one Poulson arc working on 5,700 meters, a Marconi set on 2,000 meters, and a Telefunken spark set at 1,500 meters. There are also stations at Wiborg and Hango, and plans are now being made to build a broadcast station at Helsingfors, under the direction of the government.



SWEDEN

Five New Broadcasters

In Sweden the establishment of five new broadcast stations is planned. These are to be erected in Stockholm, Gothenburg, Malmoe, Osters and Boden. The Swedish public, ably seconded by the leading newspapers, express a desire that the energy of the stations is to be 5 k.w. instead of 1½ k.w., as designed, to insure satisfactory receiving at a distance of 200 kilometers at all seasons of the year. At the sending station in Stockholm, it is contemplated to re-transmit English broadcast programs.

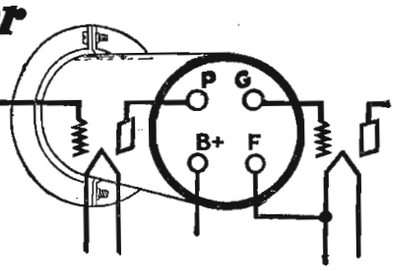


SPAIN

Pigeons Affected by Radio

A curious experiment was recently performed with some carrier pigeons at the radio telegraph station near Valencia. Several of these birds were released near the

No extra condenser for this tuned r.f. instrument





Transformer only for panel or base $9.60
At dealers or postpaid

A Boonton Guaranteed Product



Complete radio frequency amplifier unit inch socket and rheostat $15.00

BALLANTINE VARIOTRANSFORMER UNITS

Pure inductance tuning gives maximum amplification

SIMPLICITY and efficiency are usually found together. That's one reason why your tubes pass on 2 breater proportion of their energy—when coupled through BALLANTINE Variotransformers.

Self-contained; takes less space

Entirely shielded by its metal case (only 1¾" diameter), this instrument may be placed close to other parts of the circuit. The sketch shows how simple is the link between the plate of one tube and the grid of the next. No extra condenser to cut voltage; and no condenser dielectric to absorb energy. Only with the *continuously* variable *inductance* tuning of the BALLANTINE can you cover the broadcast range—and get highest amplification in every tube with fine tone quality assured.

This booklet yours on request

"Radio Frequency Amplification with the Ballantine Variotransformer" tells how to get better results with fewer parts. Your copy is ready to mail.

BOONTON RADIO CORPORATION
624 Fanny Road, Boonton, New Jersey

Use "RAGEMCO" Tools to Build Better Radio Sets



RADIO DRILL SET

Composed of 10 straight shank twist drills, fitting all hand and breast drills. The selection of these drills has been especially made for Radio Constructors and consists of the following sizes: 1-16, 5-64, 3-32, 7-64, ⅛, 9-64, 5-32, 11-64, 3-16, 17-64. Drills are mounted on white Holland Linen with sizes clearly marked.

GR-305—Price $1.25



ELECTRIC SOLDERING IRON

A perfect tool for Radio Work. Operates either on 110-volt A.C. or D.C. The heat element is of Nichrome, which prevents overheating and assures the desired even temperature. Size of iron, 10½ in. long. A 4-foot cord and plug is furnished.

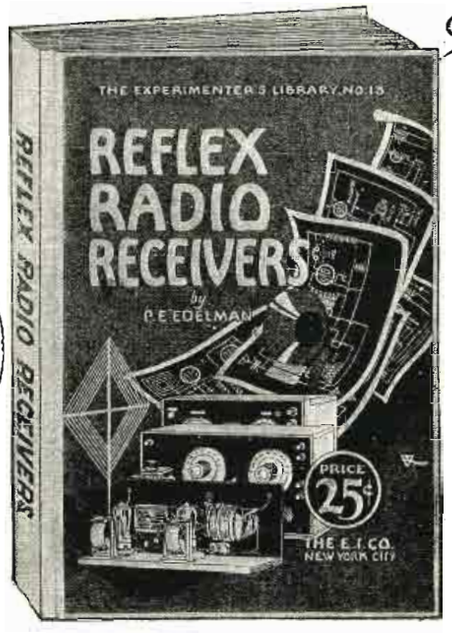
GR-800—Price $2.00

Order by order numbers. Remit by check, money order, stamps or cash. All goods are shipped free of transportation charges to all parts of U. S. and possessions same day as order is received. If not satisfied, money will be refunded upon return of goods.

We carry a complete list of Radio Tools. No matter what you want we have it in stock. Write for our complete tool list

THE RADIOGEM CORP., - - 66-R-W. Broadway, New York City

25¢



Book No. 13

Reflex Radio Receivers

This is the reflex book of the E. I. Co. library. Contains 64 pages. Size 5 x 8 Inches. Handsomely bound with a stiff cardboard cover printed in two colors. Tells all about the Reflex circuits of all makes and kinds and gives all important details of each individual circuit with data of how to construct same.

REFLEX
The Economy Circuit

The Reflex is the startling circuit. The results from the Reflex are sometimes more than startling. Every amateur radio set builder will want this handy book that tells you everything about the various reflex circuits and how they are constructed.

Book No. 11

How Radio Is Received

By R. S. OULD of the Bureau of Standards of the U. S. Government.

This is one of the handiest of the E. I. Co. books for the amature radio listener. It explains in a very clear way how Radio is transmitted and received. It contains 64 pages, size is 5 x 8 inches and is bound with a stiff cardboard cover and printed in two colors. Price 25c.



How Radio Is Received

This new book of the E. I. Co. tells thoroughly and completely just how radio is received. How the radio waves originate, are sent out into space and finally received on the antenna and telephones. It enables you to understand the principles of the reception of the voices and music you receive daily out of the air.

On Sale at All Radio and News Dealers

The E. I. Company
SOLE DISTRIBUTORS
The Consrad Co., 233 Fulton St.
New York City

Consrad
"RADIO'S FOREMOST PUBLISHERS"

It is also of interest to note that one American firm has transacted considerably more than half of the American business in radio articles in this market since the beginning of the year, the total importation from the United States during the first seven months amounting to 83,000 guilders or approximately 13 per cent. of the total imports from all countries. During the same period of the previous year the total importation from the United States was valued at only 45,000 guilders or about 10 per cent. of the total imports, which thus shows that a fair increase has been made.

One of the novelties of the show was an automatic code receiver, capable of registering 200 words per minute on a paper ribbon. There was also demonstrated in connection with this a new invention. In order to economize the necessary paper ribbon, a specially prepared one was used, and upon this the signals were registered with a liquid, which, after a few minutes, disappeared, thus making it possible to use the ribbon continuously.

MANILA

Proposed Broadcast Station

At a recent meeting of the American Chamber of Commerce at Manila, the establishment of a large radio station by the Radio Communication Company of Hongkong was discussed. This company has already obtained grants from the Portuguese Government for the establishment of a station in Macao, and has plans under way for the erection of a station in Hongkong and one in Shanghai. It is expected that if such a station is erected in Manila regular programs of music will be broadcast several times a week. Such a project was contemplated by an American firm about a year ago, but that company decided that the time was not yet ripe and the plans fell through. If the present project is carried out it should result in a considerable increase in the sale of radio apparatus throughout the Islands.



SWITZERLAND

League Broadcast

An event that may some day be marked as an epoch in the annals of European affairs of state occurred at the plenary session of the League of Nations in Geneva. This was the broadcasting of the speeches made by the premiers from the Paris station PTT. The opening speech of Premier MacDonald of England was transmitted by land wire, via the French circuit Paris-Annemasse, to the broadcast station PTT, from which it was heard over all Europe.



FRANCE

Eiffel Tower Harmonics

The School of Posts in Paris is carrying on signal strength tests by transmitting special Morse signals on 450 meters every Saturday night at 11 p.m. One of the main objects of these tests is to collect data on fading.

"L'Antenne," a French radio weekly, announces that between 162 meters and 650 meters can be counted 13 different harmonics from Eiffel Tower arc transmission. It may be seen from this why so much fuss about these arcs has been made in Paris and why their final elimination has been hailed with so much joy.



BURIED TREASURE can still be found in CHEMISTRY



Good Chemists Command High Salaries

and you can make yourself independent for life by unearthing one of chemistry's yet undiscovered secrets.



T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.
Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

Do you remember how the tales of pirate gold used to fire your imagination and make you want to sail the uncharted seas in search of treasure and adventure? And then you would regret that such things were no longer done. But that is a mistake. They *are* done—today and everyday—not on desert islands, but in the chemical laboratories throughout your own country. Quietly, systematically, the chemist works. His work is difficult, but more adventurous than the blood-curdling deeds of the Spanish Main. Instead of meeting an early and violent death on some forgotten shore, he gathers wealth and honor through his invaluable contributions to humanity. Alfred Nobel, the Swedish chemist who invented dynamite, made so many millions that the income alone from his bequests provides five $40,000 prizes every year for the advancement of science and peace. C. M. Hall, the chemist who discovered how to manufacture aluminum made millions through this discovery. F. G. Cottrell, who devised a valuable process for recovering the waste from flue gases, James Gayley, who showed how to save enormous losses in steel manufacture, L. H. Baekeland, who invented Bakelite—these are only a few of the men to whom fortunes have come through their chemical achievements.

What Some of Our Students Say of This Course:

I have not written since I received the big set. I can still say that it far exceeded my anticipations. Since I have been studying with your school I have been appointed chemist for the Scranton Coal Co. testing all the coal and ash by proximate analysis. The lessons are helping me wonderfully, and the interesting way in which they are written makes me wait patiently for each lesson.—MORLAIS COUZENS.

I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

So far I've been more than pleased with your course and am still doing nicely. I hope to be your honor graduate this year.—J. M. NORKUS, JR.

I find your course excellent and your instruction, truthfully, the clearest and best assembled I have ever taken, and yours is the fifth one I've studied.—JAMES J. KELLY.

From the time I was having Chemistry it has never been thus explained to me as it is now. I am recommending you highly to my friends, and urging them to become members of such an organization.—CHARLES BENJAMIN.

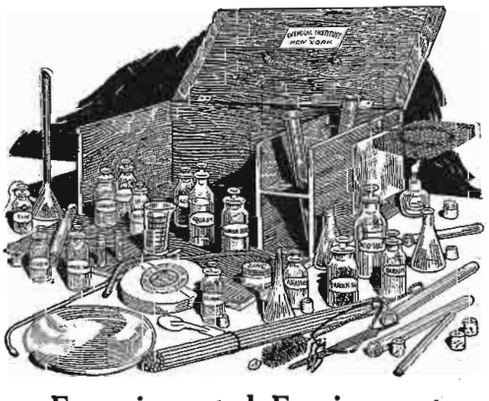
I shall always recommend your school to my friends and let them know how simple your lessons are.—C. J. AMDAHL.

I am more than pleased. You dig right in from the start. I am going to get somewhere with this course. I am so glad that I found you.—A. A. CAMERON.

I use your lessons constantly as I find it more thorough than most text books I can secure.—WM. H. TIBBS.

Thanking you for your lessons, which I find not only clear and concise, but wonderfully interesting. I am—ROBT. H. TRAYLOR.

I received employment in the Consolidated Gas. Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.



Now Is the Time to Study Chemistry

Not only are there boundless opportunities for amassing wealth in Chemistry, but the profession affords congenial employment at good salaries to hundreds of thousands who merely follow out its present applications. These applications are innumerable, touching intimately every business and every product in the world. The work of the chemist can hardly be called work at all. It is the keenest and most enjoyable kind of pleasure. The days in a chemical laboratory are filled with thrilling and delightful experimentation, with the alluring prospect of a discovery that may spell Fortune always at hand to spur your enthusiasm.

You Can Learn at Home

To qualify for this remarkable calling requires elaborate specialized training. Formerly it was necessary to attend a university for several years to acquire that training, but thanks to our highly perfected and thorough system of instruction, you can now stay at home, keep your position, and let us educate you in Chemistry during your spare time. Even with only common schooling you can take our course and equip yourself for immediate practical work in a chemical laboratory. Dr. Sloane gives every one of his students the same careful, personal supervision that made him celebrated throughout his long career as a college professor. Your instruction from the very beginning is made interesting and practical, and we supply you with apparatus and chemicals for performing the fascinating analyses and experimental work that plays such a large part in our method of teaching, and you are awarded the Institute's official diploma after you have satisfactorily completed the course.

Experimental Equipment Furnished to Every Student

We give to every student without additional charge this chemical equipment, including forty-nine pieces of laboratory apparatus and supplies, and forty different chemicals and reagents. These comprise the apparatus and chemicals used for the experimental work of the course. The fitted heavy wooden box serves not only as a case for the outfit but also as a useful laboratory accessory for performing countless experiments.

Easy Monthly Payments

You don't have to have even the small price of the course to start. You can pay for it in small monthly amounts—so small that you won't feel them. The cost of our course is very low, and includes everything, even the chemistry outfit—there are no extras to buy with our course. Our plan of monthly payments places a chemical education within the reach of everyone. Write us and let us explain our plan in full—give us the opportunity of showing you how you can qualify for a highly trained technical position without even giving up your present employment.

Special 30 Day Offer

Besides furnishing the student with his Experimental Equipment, we are making an additional special offer for a short while only. You owe it to yourself to find out about it. Write today for full information and free book "Opportunities for Chemists." Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail it to us. But whatever you do, act today before this offer is withdrawn.

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Murdock Phones

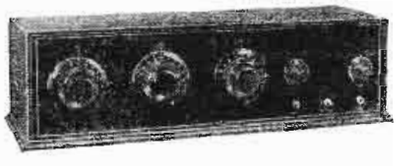
are backed by 20 years of successful experience. There are over 1,000,000 in use today. Murdocks are famous for distinct reproduction and for their light weight. With the Murdock Multiple Plug you can use from one to four phones at the same time.

WM. J. MURDOCK CO.
201 Washington Ave., Chelsea, Mass.

Free Booklet
Write for our free booklet "The Ears of Radio" It contains important data on headphones.

MURDOCK RADIO PHONES
Standard since 1904

Will You Get London?



This licensed 5 tube Hetro Receiver only $75.00

HETRO-MAGNETIC
Receivers broke all distance records—

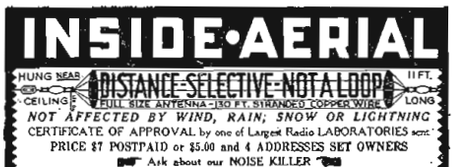
DEMAND a thousand mile daylight test from your dealer or send at once for descriptive literature, describing three types of five tube hetro-magnetic receivers ranging from $55 up to $150.

Works in any location on loop or outside aerial

SIDBENEL RADIO EQUIPMENT MFG. CO.
29 W. Mt. Eden Ave. New York City

Manufactured under special license granted Aug. 13, 1924.

INSIDE-AERIAL



NOT AFFECTED BY WIND, RAIN, SNOW OR LIGHTNING
CERTIFICATE OF APPROVAL by one of Largest Radio LABORATORIES sent
PRICE $7 POSTPAID or $5.00 and 4 ADDRESSES SET OWNERS
Ask about our NOISE KILLER
INTER-STATE SIGNAL CO., Dept. 3 COLUMBUS, OHIO

music. If this is the radio age let us learn the correct classification of the various branches, instead of making one or two words put on various disguises for the many parts they are forced to play.

International Radio

(*Continued from page* 1144)

Danish Radiounion," organized in much the same way as the Danish Radio Society. Each of these two organizations broadcasts its own programs.

It is permitted now by the authorities to have a radio receiver without any restrictions concerning the type of apparatus. The person who wants a receiver has only to walk to the nearest police station and get a form, giving the details of the apparatus. The form is then sent to the post-office radio department. The Danish radio amateur is quite at liberty to use any receiving apparatus, but transmitting apparatus is prohibited and it is not probable that the authorities will alter this restriction. Up to the present time about 6,000 registered receivers have been set up, but the number of amateurs is at least 15,000.

In the first year this society for broadcasting used the government wireless station, Lyngby Radio, which is equipped with a wireless telephone station. This station was built by the German wireless firm, "Lorentz," in Berlin, and has a power of about 10 kilowatts, using the Poulsen arc system. This station was built for the purpose of establishing a wireless telephone connection between Copenhagen and the Danish island Bornholm. In the evening it is used for broadcasting for the radio society and the big Danish newspaper, the "Berlingske Tidende." Every Sunday evening the radio society transmits a concert from 7 to 8 o'clock (g. m. t.) on a wavelength of 2,400 meters.

Two Danish firms have now placed at the disposal of the Danish Radio Society a broadcast station. This station was built last summer and demonstrated for members of the press and a number of people interested in radio.

The station is installed in the middle of Copenhagen in the same way as 2LO, in one of the post-office buildings. The aerial consists of two masts, 21 meters high, placed on the roof of the building. There has been some difficulty in establishing a good earth-connection, for which reason it has been necessary to build a counterpoise. The four-tube transmitter can develop a power of one kilowatt in the aerial. The station has now started transmissions for trial, and these have given very good results, so that the station can be heard all over the country. Transmissions will take place from the royal opera and from the most prominent music halls.



HOLLAND

Dutch Radio Fair

The first exhibition of foreign and domestic radio equipment in the Netherlands was held at the International Radio Fair in Amsterdam for a week in the early part of September. Besides numerous German, French, English and Dutch firms which were represented, there were a number of dealers displaying American equipment.

Although various American manufacturers were well represented at the Fair, special mention should be made of the active part taken by one of the representatives of an American manufacturer of radio articles. As a result of his active participation and acquaintance in the trade, this dealer has become very prominent in radio circles.

FREE
Greatest Catalog of Radio Bargains



SEND FOR IT TODAY

It contains a thousand bargains of everything in radio parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations and other valuable data. Send your name and address and we'll send FREE CATALOG.

BUILD YOUR OWN RADIO SET

All complete parts for the following sets consist of **standard advertised guaranteed parts** and include **drilled bakelite panels** and **wiring diagrams** for easy set construction.

Ultra Audion Circuit	$ 8.95
Five Tube Licensed Neutrodyne	33.75
One Tube Cockaday	10.45
Three Tube Cockaday	19.95
Eight Tube Superheterodyne	59.75
One Tube Reflex	15.85
Two Tube Reflex	20.55
Three Tube Reflex	27.85
Four Tube Acme Reflex	39.85
Five Tube Improved Cockaday	39.65
One Tube Reinhartz	10.45
Three Tube Reinhartz	17.55
Two Stage Amplifier	10.90

Order from this ad and send for catalog. We pay all transportation charges. Everything guaranteed. Money back if you are not fully satisfied.

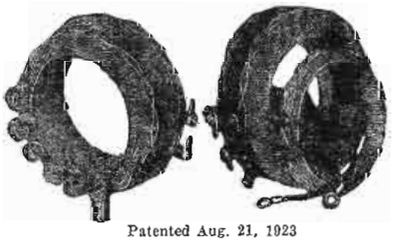
FREE SERVICE DEPARTMENT

Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is **free** to our customers.



HEADPHONES
"Randolph Special"
2200 Ohm moulded headset

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 284 CHICAGO, ILL.



Patented Aug. 21, 1923
PRICE $8.00 A SET

for the Roberts Circuit

Two units of remarkable efficiency, built specifically for the immensely popular Roberts Circuit. Primary and secondary coils in unit No. 1 are mounted on an insulating sleeve, with the primary coil left free to allow for adjustment in coupling.

Unit No. 2 contains primary, secondary, neutralizing coil, and tickler. The tickler is provided with 180 degree dial control. The tickler is also provided with an additional adjustment of coupling to conform to different characteristics of tubes or variations in plate voltage.

Among other popular Sickles products are the Tuned Radio Frequency Coil for self-neutralizing Tuned Radio Frequency Circuits, and the Knockout Reflex Coils. We manufacture coils for all popular Circuits and for special requirements.

Send for Descriptive Catalog

THE F. W. SICKLES CO.
340 Worthington St., Springfield, Mass.

SICKLES DIAMOND-WEAVE COILS

HUDSON-ROSS

Largest exclusive Radio Jobbers in middle West.
Write for discounts.
123 W. Madison St. Chicago

Broadcasters Authorized to Increase Power

(*Continued from page* 1137)

It is expected that it may be some time before the general reallocation of wave-lengths can be made. First of all, the class 1 band must be cleared of old class A and C stations. Whenever practical, the present wave-length of a station will not be changed. The general plan that will be followed in granting wave-lengths to class 1 stations will be to separate stations in the same zone by 50 kilocycles, stations in adjoining zones by 20 kilocycles and stations in removed zones by 10 kilocycles. Under the tentative plan, there will be adequate wave-length for the 20 or 30 expected new class 1 stations.

An Ideal Broadcast Receiver

(*Continued from page* 1163)

One advantage of this receiver is that the amplifier will not howl or cause trouble and when correctly connected it works immediately without any critical adjustments.

When a receiver is to be operated in the vicinity of broadcast stations, selectivity is of the utmost importance; otherwise the local stations will be heard all over the dials and distant stations cannot be tuned in until the local stations sign off. But a selective receiver, such as the one just described, will tune right through the local stations and pick up distant ones without any trouble. The selectivity of this receiver is remarkable. A turn of two or three degrees on the dial will tune in and out a local station with loud enough volume to shake the loud speaker, making a vernier type condenser or dial essential for proper tuning.

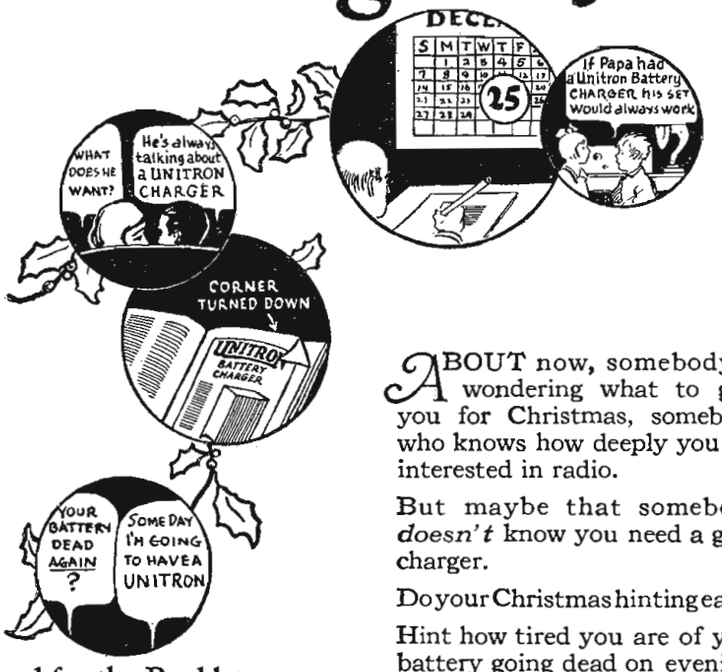
Radio vs. Wireless

(*Continued from page* 1165)

perimented with, back in 1915, they called these experiments "wireless telephone." But today the same thing is being done only on a wholesale basis, and for no reason at all the name has been changed to "radio." But radio is not a new word and its real meaning isn't broadcasting of music or speeches. Radio is simply the process of communication by either voice or telegraphic code by using the ether and ground in place of direct wires. Thus, don't say you "have a radio" in your house. What you mean is that you have a radio receiver or a wireless receiver in your home. If you think that there's any difference between a radio receiver and a wireless receiver then how do you explain hearing code signals on your so-called "radio"? No, there's no difference; the same circuits that the ships and amateurs use for reception of radio telegraph or wireless telegraph signals will be found in a so-called "radio." The famous "Reinartz Circuit" was originally made for the reception of code signals, not soprano broadcasts.

So get it straight now, that the thing you have in the living room that makes noises like the victrola is not "a radio," but a "radio receiver" or "wireless receiver"; the two terms are synonymous. The code signals which sometimes justly drown out a political speech should not be called "wireless," for that is too broad a term. Call it "wireless telegraph" or "radio telegraph." The jazz band music you hear is NOT "radio." It is "radio telephone" or "wireless telephone"

Do Your Christmas Hinting Early



ABOUT now, somebody is wondering what to give you for Christmas, somebody who knows how deeply you are interested in radio.

But maybe that somebody *doesn't* know you need a good charger.

Do your Christmas hinting early.

Hint how tired you are of your battery going dead on evenings when the family wants its service most.

Hint what a good battery charger does for batteries, uninterrupted reception and the increased radio joy of the entire family.

Hint that it saves you trouble and money. Hint that it saves rugs, furniture and clothes.

Hint that you've got to get one *some* day. And hint for a good one—a Unitron.

Hint—but do your *Christmas* hinting early.

Send for the Booklet
"A Little Less Noise....Please"



Model 00 $18
Charges any type of A battery

Model 0 $30
Charges A and B batteries and automobile batteries

[No adjusting, watering, oiling, tinkering. Nothing to wear out. No noise. Fireproof and trouble-proof. Being a low-loss charger the Unitron is *economical*.]

FOREST ELECTRIC COMPANY
Pioneer Manufacturers of Industrial Current Rectifiers
New and Wilsey Streets Newark, New Jersey

Advertising by PICARD-SOHN, INC. N.Y.

CARTER

New Vernier Control



RHEOSTAT
6-20-30 Ohms

Price—$1.75

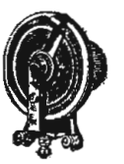
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Carter originality of design has produced vernier control with but one Knob, throughout the entire range of the rheostat.
Smooth— Silent— Efficient.
Complete with combination knob and pointer.
Insist on the original
In Canada—Carter Radio Co., Ltd., Toronto.

A Potentiometer that gives you that fine control so desirable.
Pigtail connection. Positive contact. Silent—Smooth.

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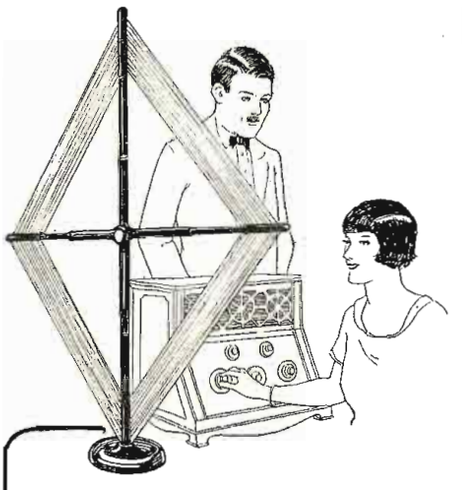
New Vernier Control



POTENTIOMETER
200-400 Ohms

Price—$2.00

Write us for Catalog



"It's the LOOP!—Not Skillful Tuning That Makes All The Difference"

"You see that you can now tune in just as well as I can. The Bodine Low-Loss Loop makes all the difference.

"That new basket-weave bank-wound method of putting on the stranded wire is one of the reasons. It was a wonderful discovery, which makes a loop more sensitive and selective. It also lowered resistance and almost eliminated distributed capacity. Another feature is the 24-inch sides—larger than most loops. Yet it *folds* into a small space, making our set portable. Isn't it a beauty, too, with that silk-covered wire, and graceful, handsomely finished frame?"

A Special Loop for Your Set

The Bodine "Standard" meets the needs of every circuit except super-heterodyne. There is the "Super-Het Special" with center tap suits all super-heterodyne circuits. Both sell for only $8.50. A Tapped Loop is supplied for Inverse-Duplex at $10. Dealers are always ready to advise the buyer which one to get for his set.

BODINE
BASKET-WEAVE
LOOP AERIAL

Where to Buy the Bodine

Most progressive radio dealers have the Bodine Loop or will order a suitable model. If you cannot get it from your favorite radio dealer, send $8.50 to us ($10 for Tapped Loop), stating make or type of set, *and name and address of your dealer*. Loop will be shipped postpaid, at once.

Dealers—Write at Once

Radio fans are discovering the advantages of the right kind of loop aerial. Write for details of this superior loop and be ready to please your customers.

BODINE ELECTRIC CO.
2256 W. Ohio St. CHICAGO, ILL.
Quality Electrical Products for 18 Years

should be particularly stressed in these campaigns, say the county agents, inasmuch as in many cases of dissatisfaction with radio the difficulty has been found due to faulty aerials and connections rather than to the sets themselves. Several of the county agents are themselves radio technicians and have won many farmers back to radio by demonstrating the simple principles of tight connections, unbroken circuits, etc.

"GIVE RADIO DEMONSTRATIONS!"

often written in capital letters, is the common plea in the reports. "Farmers have been buncoed so often," says one agent, "that they are skeptical of everything. I have found that the easiest way of interesting farmers is to carry around a demonstration set; rig up a utility antenna in his front yard, tune in, and there it is—so quickly done and so simple that it fairly takes him off his feet." As a result of this suggestion, several of the State agricultural colleges which jointly with the Federal Department of Agriculture employ the county agents, have arranged to equip all their agents with demonstration radio sets.

The State agricultural colleges are keenly interested in increasing the use of radio among farmers, because they feel that radio offers farmers a real opportunity to employ modern distribution methods in their business. The county agent office, farm bureau headquarters, or co-operative marketing organization which does not use radio to keep in touch with current agricultural conditions is now considered behind the times, but it is felt that the greatest benefits will come only when every farmer has his own set in his home.

The survey showed that of the radio sets in use, about 50 per cent. are home-made, particularly where there are farm chlidren of school age. Some of these home-made sets are costly affairs running as high as $350 each. The technical phases of radio are more fully understood in these instances and an important movement has developed in the organization of groups of the farm boys and girls into radio clubs that give radio demonstrations and service to farmers over a wide territory. This service combined with that of the county agricultural agents, and the relaying of agricultural reports by telephone companies over rural lines, bring the practical benefits of radio to upwards of 1,000,000 farmers.

One novel suggestion offered in the survey is the establishment of so-called "service stations" by manufacturers, so that purchasers of manufactured sets may receive expert advice at some local point on the operation of the equipment, erection of antennae, and other technical phases. This service, it is suggested, should be given free for a limited period until the buyers become familiar with the working principles of radio. There is need in any event, it is said, for simple technical descriptions with each set, a kind of "what makes it work" explanation. In conjunction with the service stations it is proposed to give written courses in radio technique.

Government agricultural officials are greatly pleased with the extent to which farmers are using radio, as revcaled in the survey just made, and feel that the coming year will show even greater progress. Farmers generally are now in the best financial condition in four years, and the factor of cost of radio sets is less of a hold-back to purchases than at any time since the establishment of radio broadcasting. They have the price, and with radio being regarded as a necessary farm implement, it will not be long, it is felt, before radio sets on farms will be as common as milk pails.

YOU BET!

Some radio concerts should be outcast instead of broadcast.

42 DX STATIONS
IN ONE NIGHT ON A
THURMAN COIL
Writes One Fan



17 STATIONS on
24 NOTCHES OF THE DIAL
Writes Another

A three circuit tuner built on the principle of a neutroformer.

Send 2c stamp for free hook-up or send $5.00 and your dealer's name for coil and hook-up. Money refunded if it isn't the best you've ever used.

Jobbers — Dealers:—Some territory still open.

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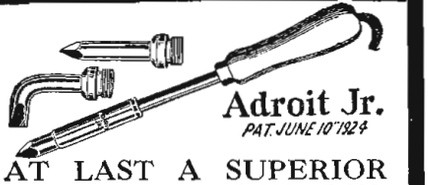
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With the Keystone Radio Lightning Arrester there's no loss in signal strength because your lead-in can be continuous from aerial to set. With many arresters it is necessary to break the lead-in wire at the arrester. And the Keystone is the only Arrester with approved binding posts, and genuine Bakelite insulative. Install a Keystone Arrester. Get reliable protection the year round. Listed as standard by the National Board of Fire Underwriters.

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Complete With Instructions **$1.50**
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GUARANTEED FOR ONE YEAR
The most efficient Soldering Iron made

$2.25 with standard tip: with interchangeable pencil or elbow tip, $2.50. With complete set tips, $3.25.

Nickel plated—Lava and nichrome element. Insulated with mica and special porcelain cement.

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The Greater BEL-CANTO Loud Speaker

Is head and shoulder over them all

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PRICE

$10.00 Plus
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CHARMIO-TONE $25	N & K $27.50
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The Horn

Is the outcome of three years of experimentation and research to attain perfection for the amplification of Radio Signals without distortion. You can only obtain this advantage when you purchase a Bel-Canto—no other speaker will be equipped with this horn.

The Unit

Next to the Horn in importance is the Unit. Great care has been taken in the manufacture of our own exclusive adjustable Unit.

The Volume

The generous size assures an amplitude of volume in any size room. It is graceful in design and not too large.

The Guarantee

Every Bel-Canto is fully guaranteed for one year from the date of purchase against mechanical, material, or electrical defects of any kind and will be replaced free of charge with a new one if found defective in any way within that period of time. Money back any time within ten days if dissatisfied. We further guarantee to the publication carrying this advertisement that each and every speaker will be sold on the above terms and the instrument will be exactly as offered in this issue.

BEL-CANTO MFG. CO.

BENSEL-BONIS, INC., General Office and Factory, DEPT. R. N.
872 BROADWAY, New York City. Tel. Stuyvesant 1921

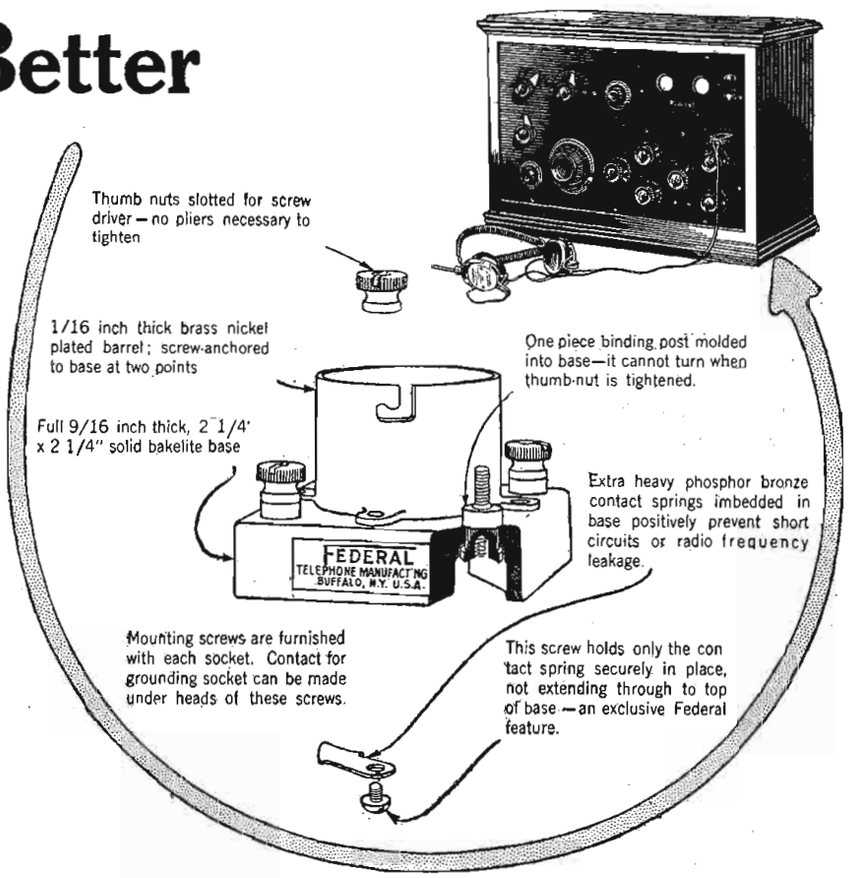
Why it is Better

THE picture tells the story — seven practical, sensible reasons why Federal sockets should be in your "pet" hook-up.

Federal sockets are but another evidence of the care and engineering skill used in designing and making Federal Standard Radio Parts. There are over 130 standard parts bearing the Federal iron-clad performance guarantee — their use means — "Balanced Circuits" with better performance.

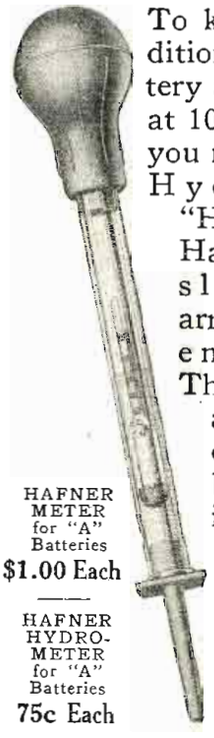
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Boston New York Philadelphia Pittsburgh
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Federal
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Your Set Is No Better Than Your Battery

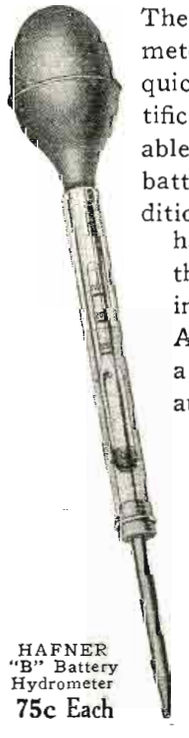


To know the condition of your battery and to keep it at 100% efficiency, you need a Hafner Hydrometer. "Have a Hafner Handy" is the slogan of an army of radio enthusiasts. They know that an unbalanced or run down battery means inefficient receiving and that the guidance of a Hafner is necessary.

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If your local dealer cannot supply you, send us his name with remittance and we will see that you are supplied.

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HAFNER HYDROMETER
"First Aid To Your Battery"

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tional signal, QRM, which means "you are interfering, please use less power or cease transmitting," which had not the slightest effect. Conditions finally became so bad that it was impossible to continue with the work. It was decided that the working wave should be changed. To no avail, however, since we found as much interference at the increased wave as previously. There were a number of ships carrying spark equipment which were quite bad in this quarter. They created constant QRM at all wave-lengths. It was principally through the kindness of WSO and WCC that we were able to get out our quota of traffic.

As we passed on nearer the American shore, matters righted themselves and by the time we were passing over New York, our business was cleared up and the radio staff was quite ready to make landing. Of course, the radio telephone equipment was gone over and placed, ready to stand-by for the landing operations. However, this preparation was not necessary, since the crew at the field handled the situation with perfect ease.

Not the least enjoyable features of the journey was the reception of programs from various broadcast stations. One of the officers of the ship produced a loud speaker which worked with the conventional horn and without additional power of any kind This was attached to the output of the receiver and the results were very pleasing.

During the trip, a little more than 12,000 words were handled in code. This record was made in spite of the great number of repeats, and the extremely bad atmospheric conditions which followed us a large part of the time.

As for the range of our transmitter, WSO heard us while we were flying over Basel, Switzerland. The New York *Times* station picked up our signals while we were cruising over the Spanish seashore. A peculiar thing in connection with this station's performance was the fact that the *Times* station reported hearing us just as well while we were in Europe as it did while we were passing over New York City.

In spite of the difficulties encountered on the journey, the station worked very satisfactorily. Really very well. We wish here to thank most heartily the American Operators for their great co-operation and help, which was constantly forthcoming during the course of the journey and which added so much to the pleasure of the radio men aboard the ZR-3.

Farm Radio Making Rapid Progress

(*Continued from page* 1143)

novel exhibits that have been devised for showing at country fairs, national agricultural conventions, and at other affairs that bring together large groups of farmers. The survey brought out the information that the greatest farm use of radio is in places where the local county agents and agricultural college officials have established radio on a daily practical basis and visually demonstrated to farmers the simple operation of the sets.

Many county agents reported in the Federal Survey that one of the chief reasons why more farmers do not own radio sets is because they feel that operation of the instruments calls for great technical skill. They are confused by such terms as Neutrodyne, Heterodyne and other radio nomenclature. To overcome this situation, the launching of nation-wide campaigns in country newspapers, farm journals and other publications that reach farmers, which will explain in simple language the theory and practice of radio, is proposed.

Proper methods of erecting antennae



Clean Your Set "Behind the Ears"

How can you expect to get the most out of a set filled with dust and dirt? Every radio fan needs a NODUST to keep his outfit *clean* and *efficient!* A bright, shiny panel and a highly polished cabinet won't make your radio work any better; your set must be clean *inside*.
Each powerful blast of a NODUST shoots compressed air into every nook and corner of your set and removes all particles of dirt. You need a NODUST handy to keep your set working at its best.

NODUST

Strongly constructed of best materials, 12 inches long. Wood mounting to prevent short circuiting. Easy to operate, yet very effective. If your dealer has not received his supply yet, send us a dollar bill and we will ship your NODUST by return mail!

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V-60
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Volume—Distance—Selectivity—So simple.
We lay particular emphasis on the tone qualities. Sublimity of perfect tone entirely free from distractive noises and distortions.
Gives a new meaning to the word radio.
There is prestige in owning a Bestone V-60.
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A piece of furniture worthy of the machine it contains.

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Aristocrat Model

The cabinet of beautiful design, a decided departure from the ordinary straight line type, is artistically finished in subdued antique polychrome, that harmonizes with the furnishings in the finest home. A loudspeaker of superior quality is self-contained, together with compartments for all batteries.

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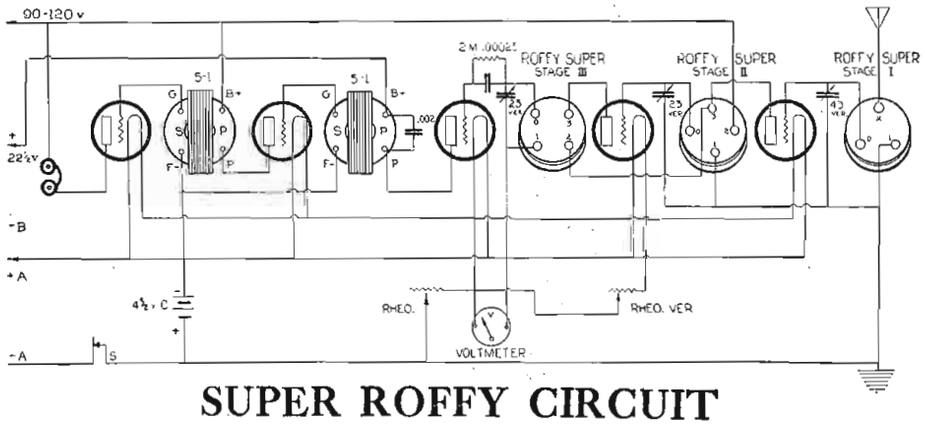
To amplify a long distance signal to loud speaker volume it is necessary to have two stages of Audio Frequency amplification. To receive any signal without distortion it is essential to have a plain detector without burdening this tube with regeneration. To detect a distant station Radio Frequency amplification with at least one tube on the borderline of self sustained oscillation is necessary. To avoid radiation and insure selectivity a stage of blocking Radio Frequency is required; these requirements are the irreduceable minimum required for sharpness, distance and volume. The Roffy Super circuit with its specially constructed transformers fulfills these requirements with the greatest simplicity.

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Absolutely Guaranteed

DEALERS and JOBBERS are requested to write for attractive proposition.



SUPER ROFFY CIRCUIT

The circuit when built according to this diagram, and using only the genuine Roffy transformers, has the proven advantages:—

Super selectivity; long distance and voluminous reception; simplicity as compared to other super circuits; constancy in dialing; the ability to locate instantly unlogged stations; non-regenerative detector giving undistorted reception; non-radiating; low assembling and operating cost; recommended with -99 tubes; portable.

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Super-Heterodyne Receiver May Be Built for $45.00

Approved by Leading Dealers, Jobbers and Manufacturers Everywhere

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(45,000 cycle)

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A remarkable value, made possible through huge quantity production. Rebuild or convert your old set to a modern and advanced type Super-Heterodyne. All other parts required are standard. Hook-up print with complete and simple instructions packed with each "Pacific Quintet" kit.

Foresight and Advanced Engineering Efficiency now bring the latest and most popular developments within a price range to suit the average pocket-book.



Satisfaction Guaranteed
Finely finished merchandise built for real work.

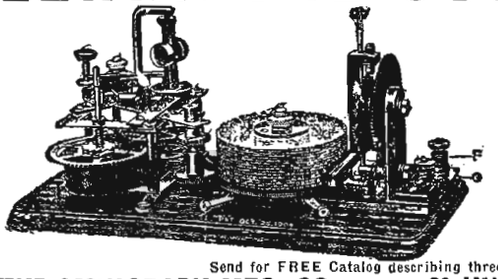
"Pacific Quintet" Super-Het Kit
Consisting of 1 Pacific "Ranger" No. 30 Oscillator Coupler, 3 Pacific "Ranger" No. 25 Intermediate Frequency Transformers and 1 Pacific No. 20 "Ranger" Filter Transformer.

Send us your dealer's name and we will ship TO ANY ADDRESS upon receipt of $15.00 or C.O.D.

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WITH THE **OMNIGRAPH**

THE **OMNIGRAPH** Automatic Transmitter will teach you both the Wireless and Morse Codes—right in your own home—quickly, easily and inexpensively. Connected with Buzzer, Buzzer and Phone or to Sounder, it will send you unlimited messages, at any speed, from 5 to 50 words a minute.

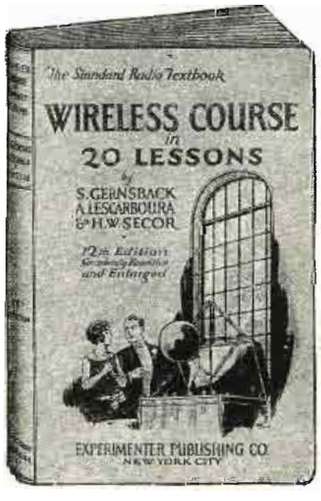
THE **OMNIGRAPH** is not an experiment. For more than 15 years, it has been sold all over the world with a money back guarantee. The **OMNIGRAPH** is used by several Depts. of the U.S. Govt.—in fact, the Dept. of Commerce uses the **OMNIGRAPH** to test all applicants applying for a Radio license. The **OMNIGRAPH** has been successfully adopted by the leading Universities, Colleges and Radio Schools.

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If you own a Radio Phone set and don't know the code—you are missing most of the fun

A complete instruction in Radio, beginning with the very foundation, the principles of electricity, and then on through the principles of radio, the transmitting sets, the receiving sets including all parts of the outfits with various types of standard hook-ups that every radio enthusiast, amateur or professional, should know about.



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12th EDITION

of the

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EXPERIMENTER PUBLISHING COMPANY, Inc.
53 PARK PLACE, NEW YORK CITY

Previous schedules of transmission had been arranged before the departure of the ship. That is to say, a number of stations were to be listening for our call at certain hours of the day, so that we would be able to get off our radio correspondence with the greatest ease and despatch. The hours between 1 and 2 a. m., 7 and 8 a. m., 1 and 2 p. m., and 6 and 7 p. m., were to work with Norddeich, KAV, Germany, and from 2 to 3 and 8 to 9 a. m. and 7 to 8 p. m. we made connection with Bar Harbor, NBD, in the United States.

Some idea of the huge amount of weather information which had to be handled may be gained from the fact that the transmitter was comparatively quiet all during our passage over France, for all during this time the operators were busily engaged in assembling the reports.

INTERFERENCE FROM BROADCASTERS

Immediately we left the French mainland and started for the point off Spain, heavy radio traffic began. In fact, all three operators, Specht, Freud and Ludwig, were kept busy at the apparatus. Matters were not helped any by the fact that many liners along the route of the voyage across the Atlantic took occasion to call us, wishing us good luck. While passing over Spain, all radio work became extremely difficult on account of the programs being sent out by the British broadcasters. Their wave interfered extremely with our receptions.

The following morning, shortly after midnight, a very bad period of radio weather set in, during which we worked the stations at Eilvese and Norddeich with extreme difficulty. Even when we pushed the radio compass into service with its six stages of radio frequency amplification, we could not obtain satisfactory results. This condition existed for several hours. At 8 a. m., however, the air cleared and for 50 minutes we enjoyed what might be termed perfect working conditions for radio. During this time we obtained an answer from Norddeich and succeeded in working off most of the constantly mounting pile of messages.

During this period we passed the steamer *City of Boston*. She signed herself GFRG, and was so kind as to give us her position—39 degrees 18 minutes N. Lat. and 49 degrees 16 minutes W. Long.—by which the Captain checked his observation of our own course.

And it might be remarked here that during the entire trip, steamers and craft of all sorts, equipped with radio were always willing and ready to co-operate in giving us bearings, weather reports, locations, many even offering to relay our traffic for us.

On approaching the Azores, reports came in from Ferinca and at 2:30 a. m., we left the islands aft and started directly for Lakehurst. At this time the wind was in the west and was growing constantly stronger. It was only a matter of minutes until we were called by the *Detroit* and told that a low point of barometric pressure was locating itself just off the point of Newfoundland; with this information, the course was changed accordingly, in order to avoid it.

MORE INTERFERENCE

It was about this time that our difficulties in the radio room became really large. First, we were proceeding at about 90 miles per hour. After the change in course it was only a short time until the clear sky under which we had been sailing for the past 10 hours gave way to dense clouds. Previously, we had been in constant communication with the *Detroit* through the aid of the radio compass. As we proceeded, reception became constantly more difficult on account of atmospherics. But this was not the worst. All the ships along our course were working, and created no end of interference. NERM—the call assigned the ZR-3—called many of them time after time, giving the interna-

Table II shows the stability and easy production of oscillations by generating crystals of different materials. The values given are merely relative and the signs indicate the direction of the current with respect to the individual crystal.

Contacts		
+ Zincite	— Carbon	7
— Zincite	+ Carbon	5
+ Zincite	— Copper	5
— Zincite	+ Copper	4
+ Zincite	— Zinc	3
— Zincite	+ Zinc	2
+ Zincite	— Aluminum	1
— Zincite	+ Aluminum	2
+ Galena	— Copper	1
— Galena	+ Copper	0
+ Galena	— Zinc	1
— Galena	+ Zinc	2
+ Pyrite	— Carbon	4
— Pyrite	+ Carbon	2
+ Pyrite	— Zinc	1
— Pyrite	+ Zinc	2
+ Chalcopyrite	— Carbon	0
— Chalcopyrite	+ Carbon	0
+ Chalcopyrite	+ Aluminum	0
— Chalcopyrite	— Aluminum	1
+ Zincite	+ Chalcopyrite	0
— Zincite	— Chalcopyrite	0
+ Carborundum	+ Steel	0
— Carborundum	— Steel	0

How the ZR-3 Was Piloted by Radio

(*Continued from page* 1135)

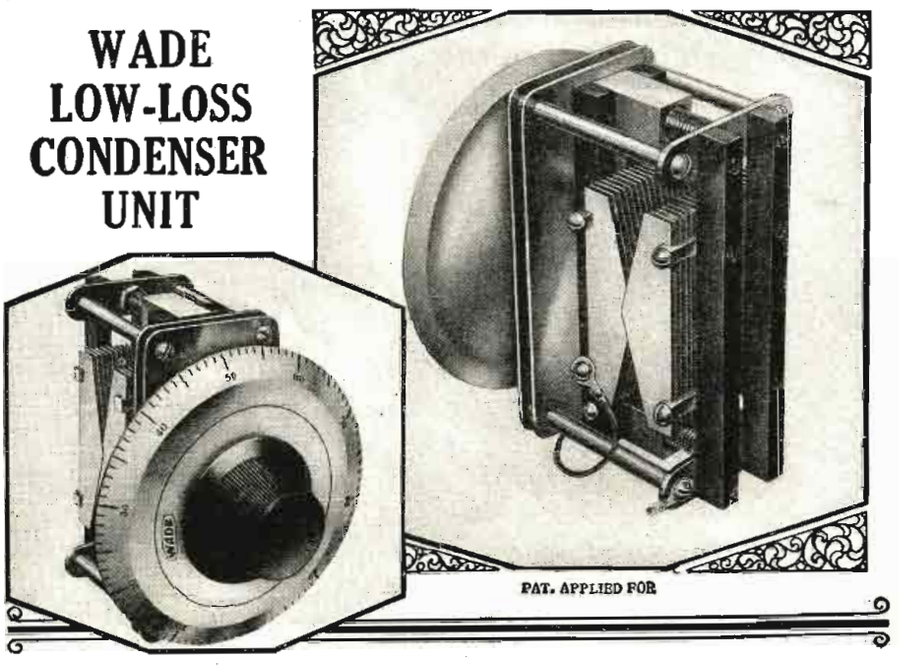
course, the first messages were for the press. Following these there was a large number of weather reports detailing the atmospheric conditions along the first leg of our proposed route. It must be noted here, that these first reports caused us to change our course. At first we had intended to fly south to the Gulf of Lyons and then cross over the Spanish peninsula. However, after the reception of this first bunch of messages we changed directions and headed for the mouth of the river Gironde in France and thence across the headland of the Spanish Peninsula.

Among the stations furnishing us this very necessary information was Deutche Seewarte, Hamburg Marine Information Bureau. Messages from this source came by way of Nauen, call OUI, and were transmitted on a wave of 1,460 meters. These reports, which were sent four times a day (at 5 a. m., 11:05 a. m., 5 p. m. and 10 p. m.) were supplemented by others from Eiffel Tower station in Paris, call FL, and the United States Naval Station at Arlington, Va., call NAA. The United States station at Annapolis also furnished us with a further report of conditions on the American side of the Atlantic.

The transmission of the reports was by no means the largest part of the job. The conditions had to be observed. For this purpose the United States Navy furnished three ships which were placed at points along the course that we were to take, and weather officials on these craft made observations, which were sent by radio direct to us, or at times when the stations aboard the observing vessels were unable to make connections with us, relayed their reports to the Annapolis or Arlington station. The ships assigned to this work were the *Patoka,* NUGN, located at 55 N. Lat., 45 W. Long.; the *Detroit,* NISP, stationed at 45 N. Lat. and 45 W. Long.; and the *Milwaukee,* NISN, 45 N. Lat. and 57 W. Long.

Aside from the weather reports, the time signals sent out from Nauen and Eiffel Tower were of great importance. With the aid of these, the chronometers of the ship were checked, thus enabling a closer watch to be kept on the position and course.

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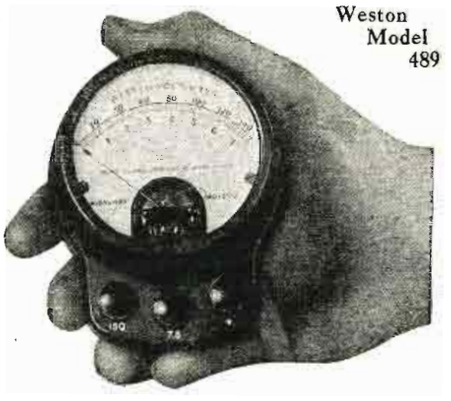
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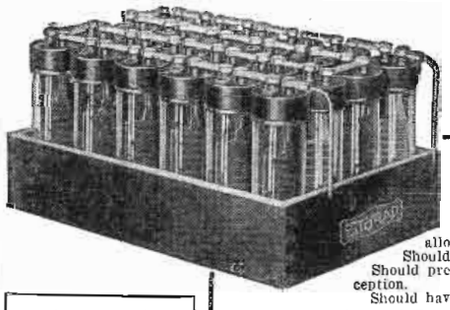
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crystal, the current i_0 has approximately the same value corresponding to the beginning of the negative IR drop. It was observed that the end of the characteristic curve of a generating point is very often unstable, which means that the strength of the current depends upon the time, which increases slowly. If after the current was increased to approximately 6 milliamperes through a detector of zincite, and then gradually decreased, the new curve will not conform with the first one, the peak of the curve becoming much flatter and even disappearing completely. See Fig. 9, Curve II. After having reduced the current to zero, and having waited a certain time, the crystal on the same point will give an identical curve, or follow Curve I. Also if the crystal is cooled by another means, the effect is exactly the same. The explanation of this is that the relatively strong curve at the end of the curve was caused by the increase of the temperature of the contact.

If the current is increased to 8 or 10 milliamperes, the resulting voltage will be smaller. After such a jump shown in Fig 9 (B), it will be impossible to obtain the same curve with corresponding peak even if the crystal is cooled. There is perhaps a change in the crystal, due to either a decomposition of the crystal at the point of contact or a destruction of the sharp point where the contact with the metallic point was made. This same phenomenon was observed on the negative curve.

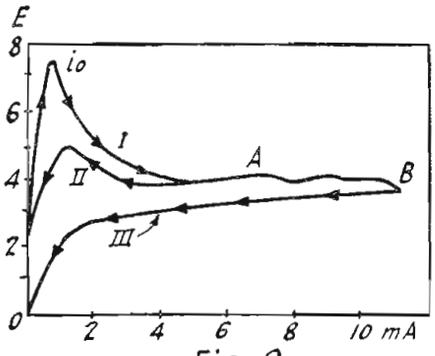


Fig. 9

Variations in charactertistic curve of oscillating crystal of zincite.

The influence of the thermoelectromotive force is small. This was shown on Figs. 7 and 8 by reversing the direction of the current, the corresponding values of the potential drop being the same. In order to find the value of these thermoelectromotive forces, the detector was heated and connected to a sensitive galvanometer. In Table No. 2 it is shown that the thermo effect increases with the heating of the crystal, but the value of this effect is very small. The thermo effect has no influence on the generation of oscillations, because waves of 68 meters in length have been generated.

The difference between a generating and a rectifying crystal is that in the former the discharge obeys the law $e = a + \frac{b}{i}$. The effect of the arc is affected by the resistance of the thickness of the crystal. That is, the thinner the crystal, the better the generating quality.

Results of the measurement of the thermoelectromotive force generated by the detector warmed by an exterior source are shown in Table I.

TABLE I

Crystal	Current sign	Galvanometer readings Micrampères		IR drop across galvanometer terminals Volts
		Bright red heat	Dark red heat	
Zincite No. 1.....	70	20		.012
Zincite No. 2.....	30	5		.005
Galena No. 1.....100		25		.017
Galena No. 2.....250		50		.042

ally by the positive and negative branch of the curve, the results are not due to the thermoelectromotive force. The oscillations of a point operating at a normal temperature stopped when the heating body is cooler than a dark red heat. It was observed that the higher the temperature the more difficult it was to find a generating point. Fig. 7 shows the changes in characteristic curves of a generating crystal of zincite.

I—Corresponds to the normal temperature.

II—Corresponds to a dark red temperature.

III—Corresponds to a red temperature.

Fig. 8 shows the same effects as Fig. 7, for a zincite and galena crystal.

I and 1 correspond to a normal temperature.

II corresponds to a temperature below dark red.

III and 2 correspond to a dark red temperature.

IV and 3 correspond to a red temperature.

These curves show that the increase of the temperature increases the current through the contact and decreases the corresponding potential drop. This phenomenon is particularly easy to observe in the neighborhood of the starting point io. When the detector is cool, the phenomenon is observed in the opposite direction.

From these experiments, I concluded that since a relatively small change of temperature has a great influence on the decrease of the starting voltage, the temperature of the contact, when the microscopic arc is formed, is not over 100 degrees and not 3000 degrees as in the case of an ordinary arc. This leads me to suppose that the conditions of the electronic emission differ from those of an ordinary arc, where the distance between the electrodes is relatively great.

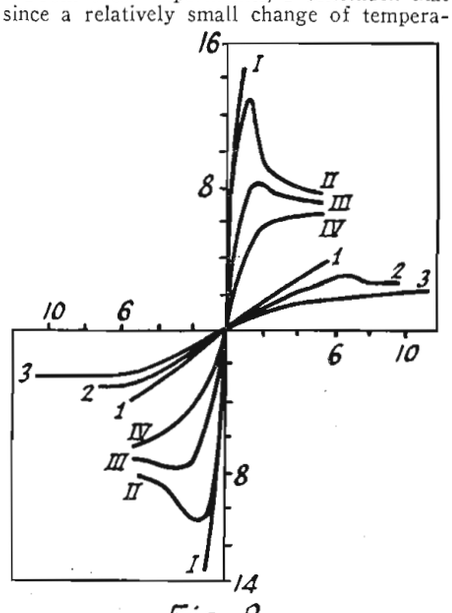


Fig. 8

Changes due to temperature on characteristic curves of a galena and zincite oscillating crystal.

When the resistance of a contact is low, the temperature is higher. The reason why different points of the same crystal have different starting voltages is that their corresponding contact resistance has not the same value. For the same potential drop across the detector with a positive resistance, the current through the contact will be greater than with a low contact resistance. Therefore, with an increase in the temperature of the contact results, the electronic emission (leakage) increases and the characteristic curve deviates from the straight line. The less the resistance, the greater becomes this deviation and the greater the leakage until the arc is formed. That is perhaps the reason why for the same

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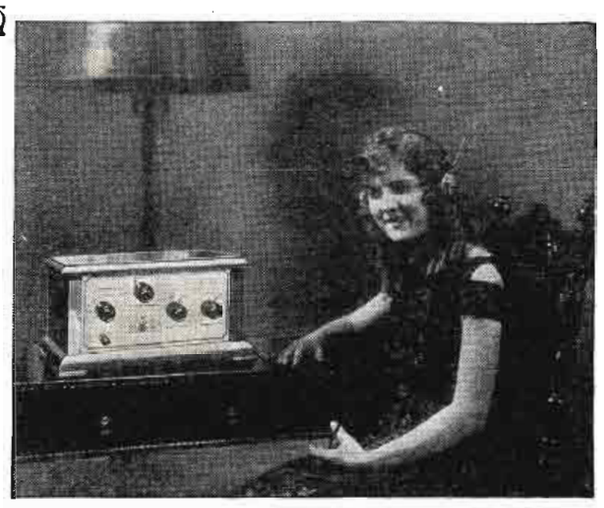
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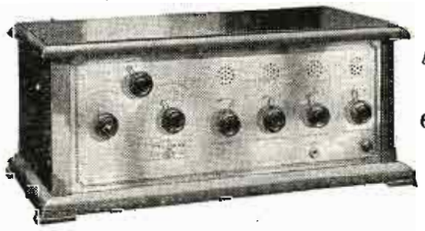
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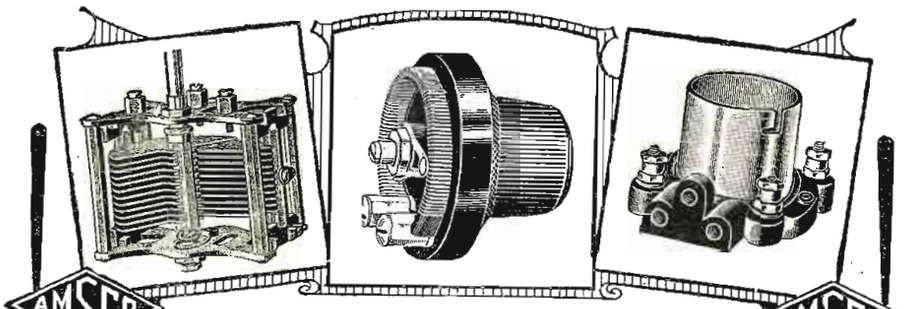
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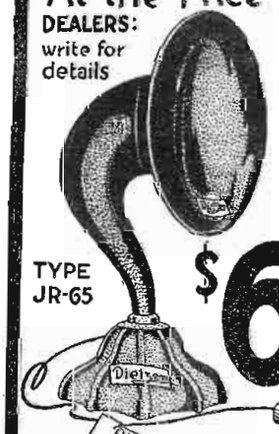
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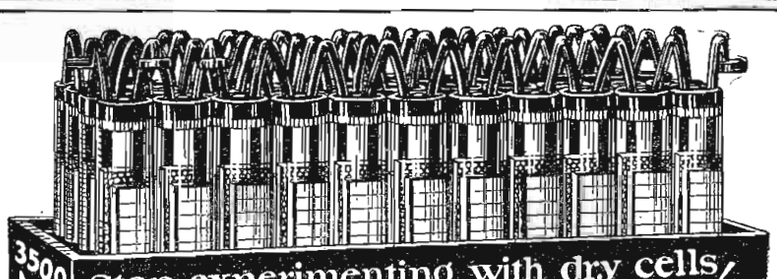
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measurements shows that the first part of the characteristic curve of "good" points is almost a straight line, while that of the "bad" points is curved. See Fig. 4.

INFLUENCE OF THE TEMPERATURE

In an ordinary voltaic arc, the minimum voltage, which was necessary to cause the formation of the arc, was reduced to approximately 1/100 of its voltage after the arc was established without interruption, *i.e.*, the ratio between the breakdown and the operating voltage of the arc is nearly 100. In a case of a generating detector, the maximum value of this ratio is 3.

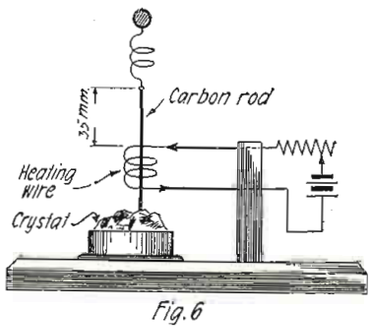


Fig. 6

Spiral heating coil for varying the temperature of the rod.

When a warm body was brought in the neighborhood of the detector, the oscillations immediately stopped, preceded by a decrease of the frequency. If the warm body was removed from the neighborhood of the arc, the oscillations began at once with the same amplitude. The lapse of time necessary to again produce oscillations may be reduced by cooling the detector. The temperature has the same effect either on high or low frequencies.

In the first experiments, the detector contact (metallic or carbon filament) was warmed by a concentric nickel spiral, which was heated by electricity. See Fig. 6. The experiment showed that the change of the contact pressure due to the heating of the filament had no effect on oscillation. Experiments were also conducted where the crystal was heated, nickel, copper, steel, platinum and carbon filament being used to make contact. The results show that heating decreased the starting or breakdown voltage, *i. e.*, the voltage corresponding to the beginning of the negative resistance. As the starting voltage is decreased symmetric-

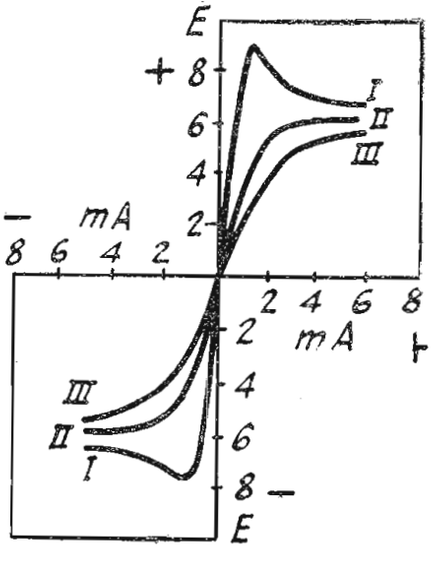


Fig. 7

Changes due to temperature on characteristic curves of a Zincite oscillating crystal.

son's face became redder and redder. "Why, he's filled the window with wires and tubes and things. He's made a regular radio laboratory of it," he spluttered.

"But look!" interrupted Mr. Kent. "Darned if he hasn't made a radio set out of that old bookcase! See the loud speaker on top, the Neutrodyne set in the upper section, and the batteries in the lower?"

"By George, look at those signs!" Mr. Watson exclaimed. "Transform your radio into a handsome piece of furniture," he read. "Open; an easy-to-get-at radio cabinet for your favorite set—close; a bookcase your wife will be proud to have in the living room."

"Say, do you know," Mr. Watson mused, "my wife's been kicking about the mess I make in the living room with my 'A' batteries and wires. I don't know but I'll have to use one of those darned cases when I get home."

"Sold you, too, has he?" Mr. Kent laughed.

They pushed their way into the shop, where they could hear Phil haranguing the crowd from the top of an old packing case. "Books in the air! There's sport, stories, educational stuff, lectures, classical music, jazz. All free for the taking. And here's just the bookcase to hold 'em. Tell me what kind of a set you've got, and I'll tell you how to fit it into the Holdwell Radio Bookcase. Thank you, sir. Twenty dollars, that's right. Joe Dowley will take your address, and see to having the case shipped out."

That evening, Phil was late for supper. Marjorie, swinging back and forth in the big rocker, was just about to question him as to where he had been, when he rushed over and gave her the biggest hug and kiss she'd had for weeks.

"Guess what's happened, dear," he said, excitedly.

Before Marjorie had time to open her mouth, he hurried on, "Got my Super-Het. radio. It's down town now, and we'll have it up here by tomorrow. Oh boy! What we won't get!"

"You don't mean to say you spent——"

"Not a cent, dear! I won the sales contest, and they gave me the finest radio set ever made, for an extra prize. Here's yours——" Phil tossed a fluttering bit of green paper into Marjorie's lap.

"What—five—five hundred—dollars?" she read, with a gasp.

"And Marge, we have something to do with it, too. First, we'll fix up the car for a long ride."

"Why, where are we going?"

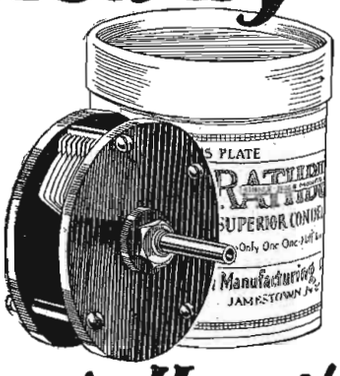
"To Cleveland! I've been made assistant sales manager, in charge of a new division. Sectional radio cases! And the rest of the money you're to use for furnishing the new house we'll buy with my raise in salary!"

Oscillating Crystals

(*Continued from page* 1167)

when the leakage has a large value at the beginning, and the passage through the negative resistance is gradual. Fig. 4 shows that certain curves corresponding to "good" points have even intervals. With a greater ballast resistance it would be possible to obtain points with still steeper tangents. The interval between the maximum and the first point of a tangent with a negative resistance is not stable, the ballast being insufficient. In order to find the "good" points that give a steep characteristic curve, a resistance of 1,000 ohms should be placed in series with the oscillating circuit. If the point is a "bad" one, no oscillations can be observed. Therefore, if oscillations are observed, there is a probability that a steep falling curve will be obtained. A series of

Are You Fooled by "Low Loss" BUNK!



A RATHBUN Condenser is *Honest!*

WHY? The losses in the best tuning inductances are extremely high in proportion to the losses in even ordinary condensers. Rathbun could make grounded-rotor, metal end-plate condensers as well as genuine Bakelite end-plates, but the efficiency of its present type is as high now as any metal end-plate. (See Lefax report.) We are therefore not going to buncombe any one by changing our style just to play "follow the leader." Rathbun condensers are better in many mechanical points than most high-priced condensers and they give more service. Why pay a high price to have a "low loss" trade mark that means nothing in practical engineering? Common sense on your part will help protect an honest name and favor the dealer who stocks condensers that are truthfully advertised.

What Experts Say

"It is undoubtedly true that the losses in tuning inductances such as are available for receiving set builders are so high in proportion to the losses in condensers that much of the efficiency of a so-called low-loss condenser is nullified, and to spend an excessive amount of money on a super-efficient tuning condenser where it is impossible to get a correspondingly high efficiency in the inductance is obviously a matter of false judgment.

"More important in the selection of condensers for tuning units may be the mechanical design which will afford long life and freedom from operating difficulties, together with a sensible consideration for electrical efficiency. Merely because metal end-plates are used does not guarantee that the lowest losses are secured. A good insulation end-plate type may be better."—*American Radio Journal.*

"Condensers with solid end-plates of an insulating material can be made with low losses if the insulating material is something that is good at radio frequencies, the end-plates are large, so the distance between opposite electrodes is great, and the material is not too thick."—*Q. S. T.*

NOTE THESE POINTS!

(1) Low prices: $1.00 to $3.50. (2) One-hole mounting. (3) Overall plate protection. (4) Perfect alignment and rigidity.

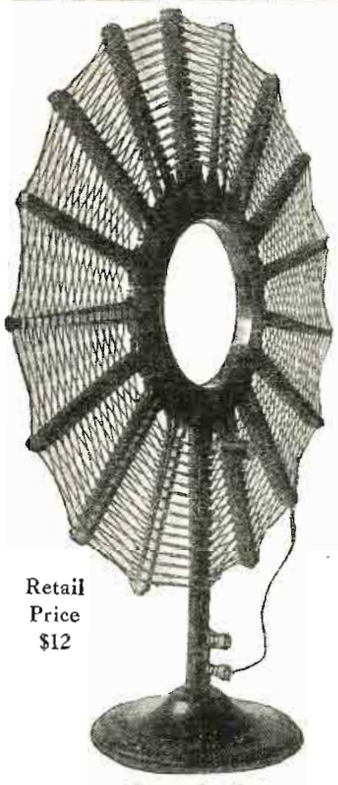
Our circulars indicate that our product is original and distinctly practical. Best for the money in efficiency and service.

If You Can Get Longer Distances or More Satisfaction with Other Condensers, We Will Cheerfully Refund Your Money!

Order direct or through your dealer!

Rathbun Manufacturing Company, Inc.

Jamestown Dept. RN New York



Retail Price $12

Patent Pending

A Marvelous New Invention
The
PARAMOUNT LOOP

Latest master-product of the Paramount Radio Corporation

Spider-web wound with silk over phospher-bronze wire, mounted on a genuine Bakelite frame (lowest in dielectric losses) the PARAMOUNT LOOP gathers and sends direct to the receiver, every electron of current, giving, to a surprising extent:

Greater Volume! Greater Clarity!
Greater Receivability!
Greater Directional Effect!

If not obtainable at your nearest Radio Shop, we will fill your order direct upon receipt of money order covering regular retail price—$12.

"A Loop Eventually—Why Not the Best?"

Paramount Radio Corporation
23 Central Avenue Newark, N. J.

Jobbers and Dealers, Get In On This!

NOW READY FOR DELIVERY



ULTRADYNE
MODEL L.2

Complete parts for this internationally famous improved Ultradyne, including cabinet with drilled and engraved panel. These are genuine parts, endorsed by R. E. Lacault, A.M.I.R.E., Inventor of the Ultradyne. **$99**

ULTRADYNE KIT

Carrying the last improvements of R E. Lacault, whose personal monogram seal is on each Ultraformer. Kit contains, 1 Low Loss Tuning Coil, 1 Low Loss Oscillator Coil, 1 Type A Ultraformer, 3 Type B Ultraformers, 4 Matched Fixed Condensers, 1 Low Loss 180 degree Coupler. **$30**

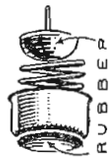
REPAIRING AND WIRING ON ALL TYPES OF SETS

Write for Descriptive Folder

Keystone Radio Service, Inc.

120 West 44th Street, New York, N. Y.

SPRING SUSPENSION



ELIMINATES ALL TUBE AND OTHER NOISES

caused by jars, shocks and vibration of passing automobiles, street cars, dancing, slamming doors and other causes.

Insures Your Tubes Against Damage or Breakage
Greatly Increases the Efficiency of Any Set

CAN BE ATTACHED IN 10 MINUTES
PRICE $1.00 PER SET OF FOUR
At Your Dealers or Direct

SECURITY MFG. CO., 3051 Marcus Ave., St. Louis, Mo.

Mr. Watson put on his spectacles, and began to read. "District A. Moriarty, five. Farwell, two. Lee, four. Sempel, none"

These figures were greeted by mild handclapping.

Through the long list droned Mr. Watson. Every now and then, his monotonous voice was interrupted by applause. Finally, he came to district P, and Mr. Kent leaned forward in his chair, puffing on his cigar to hide his nervousness.

"District P. Felton, two. Taylor, one. Dennis, three. Dowley, seven." Mr. Kent felt a surge of pride as he heard the applause that greeted Joe Dowley's sales. But of course that would be all. Hayden wouldn't sell a case.

But why was Mr. Watson polishing his spectacles? Why did he regard this telegram so closely? "Won't you come up here, Mr. Kent?" he asked. "This must be a mistake."

He spread out the yellow paper on his desk and pointed to the purple figure after Hayden's name.

Mr. Kent shook his head. "I guess that's one on the telegraph company. I'll have them wire back the correct figure."

"Do. Miss Law will take your message."

The conference was just about to adjourn to Mr. Watson's office for a throat moistener before dinner, when Miss Law entered with a yellow envelope which she handed to Mr. Kent. He ripped it open, then threaded his way between the chairs to Mr. Watson's table. "Do you think he could be making fun of us? You know he's practically fired," he whispered, smoothing the telegram on the table top.

Mr. Watson pondered. "Perhaps. But we must give him the benefit of the doubt. I'll read it aloud, anyway."

When the president read the words, "Hayden, thirty-two," the energies of the branch managers, pent up by a day in hard chairs, burst forth in a storm of handclapping. And in Mr. Watson's panelled office, everyone drank the first toast to the man who set up this remarkable record.

Next morning, when the wire came in, Mr. Watson himself took it, and put off the opening of the meeting to read it aloud. "Cases for books in air send hundred more express rush."

"He's followed the company rule about ten words," said Mr. Watson with a wry smile. "It isn't much of an explanation, but that last sentence makes me feel mighty friendly to your Phil Hayden, nevertheless."

When the conference broke up after its allotted four days, Phil had sold 162 cases against his nearest competitor's 34. Mr. Watson told his branch manager, "I guess I'll have to hop the train with you, and see this salesman of yours. Any man who can sell 150 of those stickers in four days must have ideas that are worth something to the company."

As the two men walked down Salina Street, they noticed a big crowd pushing and jostling in front of the Holdwell window. "What do you do to pull 'em in, Kent?" Mr. Watson asked. "I never saw a crowd like that, even in front of our home office displays."

"Lord knows! But what's that sign over the sidewalk?" questioned Mr. Kent. "Book cases—for books—what's that?—in the air?"

"Book cases for books in the air," Mr. Watson confirmed. "But what do they mean by making fun of our product that way? You don't think there's any hoax about it, do you?"

"It looks like Hayden's work, sir. The other fellows would never do it, I'm sure. If Hayden hasn't been entirely on the square with us about these cases——" Mr. Kent's instinctively clenched fists left no doubt as to the result for Phil.

As they forced their way through the crowd that blocked the sidewalk, Mr. Wat-

nant. As Joe was the oldest salesman, and considered himself next in line to the boss, he took it upon himself to read the riot act to Phil.

"Say, mind your own business, Joe Dowley," Phil retorted. "I might come through with some sales of that old piece of junk yet. If you'll give me one of the windows tomorrow, I might show you something that'll surprise you."

"What do you want a window for?"

"Special display of these bookcases. I tell you I think I can sell a few."

Joe reflected a moment. After all, Phil was as good as fired. He might as well be set to work dressing windows as anything.

"Sure, suit yourself, Phil. As long as you feature the two-section cases, go as far as you like."

That evening, when Marjorie returned to the living room, after finishing with the dishes, she was dismayed by the worst clutter she had ever seen there. The parts of the bookcase were separated and scattered over the floor. Books were everywhere, like a giant's confetti. And Phil was absolutely ruining the upper section of the bookcase by boring holes in it, while the chips were falling all over the oriental rug her mother had given them for a wedding present.

"Phil Hayden! What in the world?"

"Oh, it's something about that prize contest at the store, I was telling you about at supper. But please don't bother me, dear. I'm going to be terribly busy all the evening."

"Work? Oh, Phil, you'll drive me crazy. First you take my bread board, then you ruin my chopping bowl for a loud speaker, and now you're destroying our bookcase and all our books!"

"It's all right, Marge. Some day, I'll buy you a dozen bookcases full of books. Only what's the use? Books in the air! That's the thing today!"

"Books on the floor, you mean. Can't you be sensible?" Marjorie flounced out of the room and upstairs, for she knew by experience that while Phil was absorbed in his work, she couldn't expect sense on any other subject.

Early next morning, Mr. Kent reported at the neat brick plant of the Holdwell Bookcase Company, a mile or two west of the viaduct. Mr. Watson, the gray haired president, buttonholed him in the hall, and asked how that young fellow, Phil Hayden, was getting on.

"Not so good, chief. He's so bitten by the radio bug that he can't think of bookcases, even during business hours. I told him I'd give him one more chance. But if he doesn't come through while I'm here at the conference, we'll drop him."

"Right," assented the president. "We can't be loaded down with deadwood, especially if we're to take a big loss on our inventory of two-section cases."

"We'll sure have to persuade authors to write three volume novels again, or bookmakers to print on blotting paper, if we want to get all those cases off our hands," Mr. Kent laughed.

Late that afternoon, through a haze of cigar smoke, Mr. Kent watched Miss Law, as with deft fingers she sorted the telegrams announcing the returns in the salesmen's contest. He was very anxious that his district should win this contest away from the other 50 managers gathered in the stuffy conference room. Besides the prize to the winning salesman, there was a rumor that the sales manager needed another assistant. Someone with ideas, who could find new outlets for Holdwell cases. While Mr. Kent hated the thought of losing Joe Dowley, he could probably help rush through special orders, should he win the appointment.

Finally, the yellow papers were sorted, even to the Pacific coast districts, and Miss Law handed them to old Mr. Watson, who presided behind a mahogany table.



Engineers developed this special panel material for radio ONLY

THE radio amateur is to be thanked for the development of "the supreme insulation." When he made known his demands for DX, and for volume, it was soon evident that ordinary insulation material wouldn't do.

Panel leakage and capacity effects had to be eliminated. Ordinary insulation good enough for a hundred other uses was not good enough for radio. So we put engineers to work to develop a super panel material that would not only give ample proof of lowest electric losses, but would also be easy to drill, saw and cut; nonwarping, and good-looking to boot.

Radion was the result. There is nothing quite like it for real results. Authoritative laboratory tests conclusively prove highest insulation characteristics. In the set you build, it may give you just that extra energy needed to tune in a distant station. When you see Radion in a ready-built set, it is usually an evidence of general good quality in that set.

You can see the difference between Radion and common panel materials, if you will look at the finish. Radion has a high, polished finish. That keeps out dirt and moisture, which, even in little particles on the surface, sometimes cause short circuits and reduce good reception. Look at Radion and other panels under a magnifying glass if you can.

Everyone knows Radion is the easiest panel material to cut and saw. There are eighteen stock sizes, two kinds, black and mahoganite. Sold universally by dealers who know radio. Better performance will make it worth your while to ask for it by name and to look for the name on the envelope, and the stamp on the panel.

Radion dials to match, also sockets, binding post panels, insulators, knobs, and the new Radion built-in horn.

Send for Booklet

FOR 10 cents we will send you our new booklet, "Building Your Own Set," giving wiring diagrams, front and rear views, lists of parts, and directions for building the most popular circuits. Use coupon below.

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Chicago Office: Conway Building
Pacific Coast Agent: Goodyear Rubber Co., San Francisco, Portland.

RADION
The Supreme Insulation
PANELS
Dials, Sockets, Binding Post Panels, etc.

APPROVED RADIO NEWS LABORATORIES 1922

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11 Mercer St., New York City.
Please send me your new booklet, "Building Your Own Set," for which I enclose 10 cents (stamps or coin).
Name .....
Address .....
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Eye Test Beats Ear Guess

WE have been selling tested commercial crystals for ten years. Our new method of **METER** testing is a big step forward. Ear tests, while valuable, are mere indicators. Eye tests with sensitive measuring instruments, are absolutely exact.

N A A Meter-Tested Crystals

Every NAA Crystal is **METER-TESTED** in ten positions to a minimum of 76 microamperes of rectified current, by impulses picked up from a specially designed oscillating circuit. The average crystal is considered good if it rectifies half this current.

Perfect for Reflex

Cold mounted in Newman-Stern improved holder cup (patent pending). No damage to crystal from hot alloy. Recessed for protection. A vital necessity in every reflex receiver—the heart of the set.

NAA perfected METER-TESTED CRYSTALS are sold by best jobbers and dealers, or sent postpaid by mail for 60 cents. Send name of your dealer.

The Newman-Stern Co

1742 East 12th Street Cleveland, Ohio

Originators of tested crystals in 1914. Oldest and largest producers. Pioneers in Radio Equipment in Ohio.



New Model BEARCAT RADIO

Long Distance---Super-Selective



WORLD'S latest, most amazing radio discovery. "Truly wonderful," say experts. BEARCAT gives distance and tone of expensive sets. Most selective set ever built, bar none. In Chicago, with five stations on BEARCAT brought in stations clearly 1000 miles away. Outside of Chicago BEARCAT brings them in from all over. World's most efficient and lowest priced receiver.

COMPLETE KIT

$9.98

FOR A LIMITED TIME

VACUUM TUBE SET KIT including cabinet, drilled panel, all parts and clear, simple instructions and wiring diagram

$9.98 From Factory To You

Bearcat Set completely assembled in cabinet, less accessories $12.98
Bearcat Set completely assembled with genuine 199 tube, all batteries, aerial, ground wire, insulators and fine set of head phones $22.88

Beautiful Mahogany Finish Cabinet Matches finest furniture. An ornament to any home.

BEARCAT FANS RECEIVED THESE STATIONS AND MANY MORE

KDKA Pittsburgh, KSD St. Louis, WHU New York, WOAW Omaha, KGO Oakland, WMC Memphis, WGY Schenectady, WBAP Ft. Worth, WHAZ Troy, N.Y., WTAS Elgin, Ill., WSB Atlanta, Ga., WTAY Oak Park, Ill., WLAG Minneapolis, WCBD Zion, Ill., WSAI Cincinnati, WGN Tribune, Chicago, WHB Kansas City, WEBH Post, Chicago, KFI Los Angeles.

ALL BATTERIES FIT INSIDE CABINET

Complete — compact — convenient. The neatest, handiest little outfit you ever saw. Truly portable. Take Bearcat with you anywhere. Operates on outside aerial or, for $1.50, we furnish plug so you can use electric light circuit for aerial. Most economical set to operate.

EASIEST SET TO USE

One dial controls all tuning. Perfect reception on all wave lengths over great distances. Cuts out local stations and brings in DX. Non-regenerative. No squeals. The finest one-tube receiver ever designed —at the lowest price.

Never before such value. Mark coupon now. Mail today.

SEND NO MONEY!

Simply mark on coupon which set you want and mail it to us at once. Pay postman price, plus small postage, on delivery to you. Immediate shipment direct from factory. No waiting. Get this wonder Radio now.

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Bearcat Radio Co., 646 N. Michigan Av., Dept. 24, Chicago, Ill.
Send me ( ) Bearcat Set Kit—$9.98, ( ) Bearcat Set assembled, less accessories—$12.98. ( ) Bearcat Set with tubes, phones, batteries, aerial, ground wire, insulators all ready to operate—$22.88. I will pay postman correct amount, plus small postage.
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Live Agents and Dealers write for our liberal proposition.

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FOOTE VARIOTECTOR, can't short circuit. Fixed or fixable. Mounts on panel. Maximum volume and clarity. Improves any crystal or reflex set. $1.50.

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FOOTE COAST COIL. Gets more distance. Cuts out local stations. The exclusive Double Rotor principal does it. The best coil for your aerial and your set. $7.00 complete with dial.

FOOTE RADIO CORP., Phila., Pa.
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COAST COIL
The Only Double Rotor



Set-O-Six Radio Socket Wrench

$1.25

A solidly-built wrench for every radio need. Reaches and fits every round and hexagon nut on any set; works with a fast, screw-driver turn. Compact, light, and handy.

If your dealer cannot supply you order from us

THE PERRY-FAY COMPANY
Screw Machine Products
ELYRIA, OHIO

Books In the Air

(*Continued from page* 1153)

Holdwell sectional bookcases, and particularly would try to find a way of selling their big overstock of two-section cases that didn't match their other lines. It was one of the odd cases like the one Phil and Marjorie had in their living room.

As the various salesmen in turn disappeared into Mr. Kent's front office for last instructions, Phil amused himself by looking over the pages of a late radio magazine. He was absorbed in an article telling how to make a Reflex set into a Super-Heterodyne, when he felt a tap on his shoulder.

He looked up, and found himself staring straight into Mr. Kent's gray eyes. He tried to smile, but this attempt was frozen by his boss' cold stare.

"Come into my office, Hayden. Didn't you hear me call?"

"No, sir," Phil apologized humbly, as he followed Mr. Kent's long strides.

After he had closed the door, Mr. Kent accused, "That's the trouble with you, Hayden. So confounded full of your radio that you don't even hear me call you! I'm about through with you, young man."

Phil saw his precious forty a week cut off like pulling a switch. He'd have to sell his car. He might even have to part with his Reflex set. "I'm sorry, sir. I won't read radio again in the office."

"You'd better not. Why don't you spend your time learning about our business. We sell bookcases. Do you know what kind of books people are buying today?"

"Just regular books, I suppose."

"I didn't think you knew. And are you acquainted with the new 'buy a book a week' movement they've been writing up in the papers?"

"I've seen something about it, I think——"

"Another blank. Well, what *do* you know about books and bookcases to hold them?"

Phil wanted to say that books were old stuff, now you could get entertainment from the air, but as that wouldn't do, he remained silent.

"I don't like to fire anybody without giving them one more chance. So today, and the four days of the conference will be your chance. If you haven't turned over a new leaf when I return, you're fired."

"Yes, sir."

"I've been telling the others about a home office prize contest for these five days. The Holdwell salesman who sells the most of those odd two-section bookcases wins a prize of $500 from Mr. Watson himself. There'll be 300 salesmen all over the country competing for this prize, so I guess that lets you out. The winner stands a mighty good chance of a fat home office job, for that's the way they recruit new blood. But what's the use of explaining all this to you? You'll do well to get by without being fired!"

Things certainly looked bad for Phil that morning. His sales were as negligible as Los Angeles on a foggy summer night. When Mrs. Henderson, from James Street Hill, came in and asked to see a small sectional bookcase, Phil should have seen his opportunity. But he started, as if from a daze, and murmured, "Books in the air."

Mrs. Henderson snapped, "Thank you, but I wanted a bookcase. Now, if you don't mind, I'll do business with a salesman who knows something." Whereat, she stalked across the store and bought two prize contest cases from Joe Dowley. Phil watched with regret, as Joe ostentatiously chalked a big two in his column on the contest blackboard.

That afternoon, Joe caught Phil drawing the little sketches of radio hook-ups that always made Mr. Kent particularly indig-

which cannot be had in the United States. The Delegate sends to Holland and obtains them. An economist is looking for information on the single tax movement in Russia. The Delegate writes to the Russian group of Esperantists and secures the facts. The Denver Tourist Bureau likes to advertise Denver in foreign countries. The Denver Esperanto Society is called in for advice and assistance.

Foreigners likewise make use of Esperanto in securing assistance from the United States. A mechanic in Bulgaria wishes to come to the United States. He writes to the Delegate in Denver, who happens to be an engineer, and asks about employment conditions, living costs, immigration laws, etc. A girl in Czechoslovakia has lost the address of her cousin in Denver. The Esperanto Delegate finds it for her. An engineer in Russia is looking for information on Diesel engine projects. He turns to the Delegates of the Universal Esperanto Association. A young lady in Hungary seeks to establish commercial relations with American firms. It is the Esperanto Delegates who help her.

These are all actual instances of the practical value of Esperanto, and may be verified from the corespondence files of the Denver Delegate of the Universal Esperanto Association. There are many similar cases, too numerous to mention. There are also the advantages other than those of corresponding. In travel, for instance, whether for pleasure or business, the Esperantists, who are to be found in over 1200 of the principal cities of the world, are always ready to help a visiting "samideano," to make his desired connections, to secure lower hotel rates, to pass a social evening, etc. In radio, especially in Europe, the radio fan can tune in and hear the broadcasting of the King of England's speech at Wembley, the remarks of ex-Premier Francisco Nitti on "Europe and the Abyss," speeches by Wellington Koo, Chinese delegate to the League of Nations, Foreign Minister Benesh of Czechoslovakia, and many others, all in Esperanto.

These are advantages which the folks in Denver feel should not be lightly cast away because of some slight advantage which may accrue in the change of a word here or a letter there. If Esperanto has some idioms that sound "unnatural" to an outsider, so has Ilo, so has Romanal, so have English and French, and German, and every other language, natural or artificial. Esperanto advocates in Denver, therefore, continue to work for their language, and stand ready to help any reader of RADIO NEWS who wishes to learn it.

There are now three courses offered in Denver, one at the Y. M. C. A. and two at the Denver Labor College. These courses are conducted practically free of charge, the only expenses to the students being two dollars to the Denver Labor College to pay for lights, heat and janitor service, and about five dollars for books, dictionaries, magazines, etc. A special class for radio fans and readers of RADIO NEWS can be arranged in which special attention will be paid to radio terminology, and special study made of radio papers published in Esperanto. Inquiry should be made of Mr. Lofton G. Hand, Secretary of the Denver Esperanto Society, 4400 Osceola St., Denver, Colo. Radio fans in farming communities or small towns not having an Esperanto organization can learn Esperanto by correspondence.

HYMAN LEVINE,
Instructor in Esperanto,
Delegate, Universal Esperanto Assn.

HE TAKES IT

My sweetie bought a radio,
A little cheap affair.
He sat around with it so much,
I've given him the air.



An easy way to get distant stations more clearly

IF you want clear radio reception—with more freedom from those disturbing noises—you must have clean, perfect contact between tubes and sockets. It's the contact that counts.

Perfect Contact assured with Na-Ald De Luxe Sockets. Broad wiping surface of four special dipped phosphor bronze socket clips press both on sides and ends of tube terminals making constant clean, bright contacts.

Clean Easy Feature. The two to eight tubes do not have to be removed and sandpaper used to scrape the socket contacts, within the awkward depths of your set. Duo-contacts are easily cleaned and film of oxide between tube and socket, better known as corrosion, which can ruin contact, is quickly removed by rotating each tube three or four times. This feature of Na-Ald Sockets saves trouble and time.

Highest Insulating Qualities. Lowest loss and highest insulating qualities are insured in Alden Sockets by using Alden Processed genuine Bakelite.

You can obtain Na-Ald Sockets at radio, electrical and hardware stores. Use them not only in the set you build but also install them in the set you buy, if not already adopted by the manufacturer. Sockets for all tubes. De Luxe 75c; others 35c, 50c, 75c.

Send for free copy of radio booklet—"What to Build."

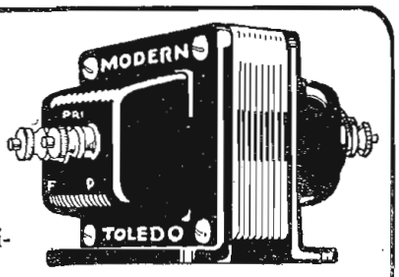
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Also makers of the famous Na-Ald Dials
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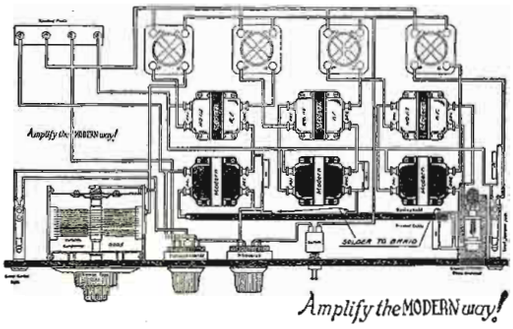
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Please send free copy of booklet "What to Build," showing tested and selected circuits.
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Address.....
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MODERN "Push-Pull" Transformers



Recommended by the leading radio authorities everywhere for all circuits.

Not only was the MODERN "Push-Pull" the first transformer of this type to be offered the radio public but it is also first in the matter of Quality Amplification.



MODERN Super-Six "Reflex"

This Circuit is Easy to Build

Full-size wiring diagram and complete constructional bulletin of above circuit mailed on receipt of 4c in stamps. Write for it today.

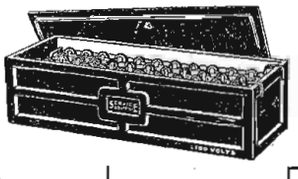
Modern Transformers make any set better. Insist on genuine Modern Transformers.

Amplify the MODERN way! There's a Reason

THE MODERN ELECTRIC MANUFACTURING COMPANY
WORLD'S LARGEST MANUFACTURERS OF RADIO TRANSFORMERS EXCLUSIVELY
TOLEDO, OHIO

NEW! Service Rechargeable "B's" in all-rubber Cases

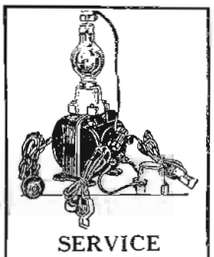
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A neat, compact storage "B" Battery, rechargeable from any 110 volt A. C. line with small home rectifier. Shipped dry charged and ready for use after adding acid. Will last for years with ordinary care.

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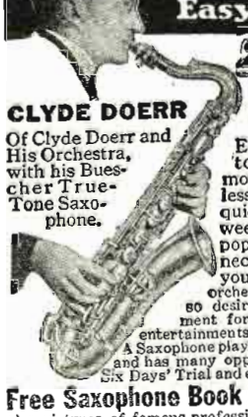
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I myself have tried to modify the orthography of Esperanto and that has led me to the creation of *Esperantido,* which may be considered as a rival of Esperanto, because it has the same structure and a better appearance in writing. I realize, however, that it will be extremely difficult, to introduce changes in Esperanto and I would much prefer to see Esperanto accepted as it is, rather than to accept Ido, because the defects of Esperanto are purely external, while those of Ido are internal and profound.

One of the advocates of Ido (Mr. George Lewis, p. 556, October issue of RADIO NEWS) maintains that Esperanto "does not lend itself to commercial use or literary use!" I admit that, for commercial use, it would be advisable to get rid of the accented letters, but as regards literary use, there is no comparison between Esperanto and Ido. The accord of the adjective with its substantive and the obligatory accusative give to Esperanto a flexibility which Ido does not possess at all, and flexibility is the main quality for a literary language, especially for an International Language, which must be adaptable to the mentality of the different nations. I would suggest that Mr. Lewis read Dr. Vallienne's translation into Esperanto of Virgil's poem "The Aeneid." Then I would further propose that Mr. Lewis try to make an Ido translation of this Latin poem; he will thus have an opportunity to see which language is more flexible, Esperanto or Ido, and which of these two languages is the better for the translation of foreign literature in prose or in poetry.

RENE DE SAUSSURE,
Lauréat de l'Institut de France,
Author of "Esperantido,"
Berne, Switzerland.

THE PRACTICAL VALUE OF ESPERANTO

Editor, RADIO NEWS:

I have been interested in the discussion in your columns of the international languages Esperanto and Ilo, and wish to thank you for the space devoted to it. Several people have, to my personal knowledge, bought copies of RADIO NEWS for the sole purpose of following the discussion, though they were not otherwise interested in the subject.

Here in Denver there is no organized group of Ilo advocates, and I doubt if there are any individual sympathizers for the language. At least I have not yet met any, although several efforts have been made. There is, however, a very active Esperanto Society, and it is practically the only body devoting itself to the spread of an international auxiliary language.

The sentiment among Esperantists with regard to Ilo is not hostile. Though favoring Esperanto, it is fairly well recognized that the language is not perfect, no more than any other human creation, and the possibilities of improvement are frequently discussed. At the same time it is the unanimous feeling that no auxiliary language can have any value unless it stays "put," at least in its fundamentals and for some time. Esperanto has done this, Ilo has not. Some changes have been made in Esperanto from time to time, but they have been comparatively few, and in accordance with the fundamentals of the language. He who learned the language 15 years ago can still understand it, and make himself understood. The same cannot be said of Ilo.

Another reason for the persistence of Esperanto in Denver is its practical value. So much can be done with it that cannot be done with any other language, simply because it is more widespread. A member wishes to buy some plantago psilium seed from France. The Delegate for the Universal Esperanto Association writes to the Delegate in Lyons, and gets it for him. A physician desires some medical appliances,

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A LETTER FROM THE AUTHOR OF "ESPERANTIDO"

Editor, RADIO NEWS:

As my name is mentioned several times in the Esperanto-Ido controversy, I hope you will allow me to express my opinion in this matter, the more so, as I have, during 18 years, studied the question of International Language.

It is impossible to judge the value of a language by a simple comparison of printed texts. This would be as unwise as to buy an automobile just because of its external appearance; the most important part is not the outside varnish, but the inside motor. In the same way, the most vital part of a language is its structure and its "speakability." Ido may have a better appearance in a printed text, but practice has shown that Ido is much more difficult to speak than Esperanto. In fact, most Idists can read and understand Ido texts, but they cannot speak it fluently. I was present at an Ido meeting in Berne; only two or three Idists were able to conduct the business in Ido; the others listened without speaking, or some of them spoke German; the only one who spoke fluently was an Esperantist (a Bulgarian), who spoke in Esperanto!

The reason why Ido is difficult to speak is because its authors have complicated the system of suffixes. For instance, Esperanto has only one ending (*a*) for all adjectives (*hom-a,* human; *frat-a,* brotherly; *sukces-a,* successful; *ag-a,* active, etc.), while Ido possesses four different adjectival endings (*-a, -ala, -oza, -iva*), so that every time an Idist meets an adjective in his speech, he must think over which one of the four endings is to be used, and very often he does not know how to decide!

By reading over the Ido text published in your October number (p. 471), you will notice the following adjectives, *suces-oz-a, histori-al-a, pacienc-oz-a, kontentig-ant-a, malkordi-oz-a, glori-oz-a, mond-al-a,* where the adjectival suffixes *oz, al, ant,* are quite unnecessary to the comprehension. How much simpler and easier are the corresponding Esperanto words: *sukces-a, histori-a, pacienc-a, kontentig-a, malbonkor-a, glor-a, mond-a!*

In Ido there are many exceptions to the rules of grammar. Take for instance in the same text (p. 471) the word *kinemal:* this word, being an adjective, ought to have the ending *a* and the accent ought not to be on the last syllable. The regular form of this word is not *kinemal,* but *kinematograf-al-a!*

I cannot discuss here all points of the language, but this is sufficient to show that the capital error of Ido is an unnecessary complication of the structure of the words. A language is something like a shoe. A varnished shoe will not be fit for the street nor for climbing mountains. An international language for logicians and mathematicians will not be fit for hotel waiters nor for Chinese laundrymen. Esperanto is the only plain international language for all classes of people and for all nations, oriental as well as occidental, and that is why Esperanto is sure to get through sooner or later, in spite of all obstacles and criticisms.

This does not mean that Esperanto has no defects, but these defects (such as the accented letters) are purely external and concern only the appearance of the written language. The structure of the spoken language (and that is the main thing for radio men) is perfectly sound and it would be a folly to change it.

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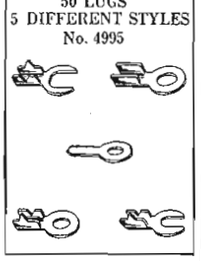
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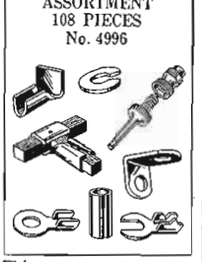
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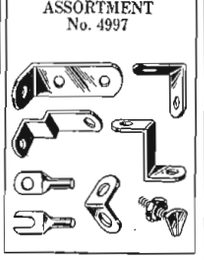
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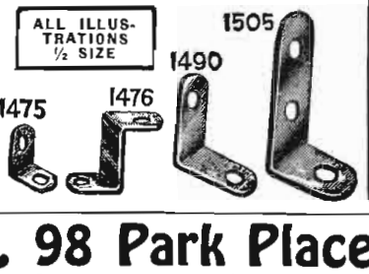
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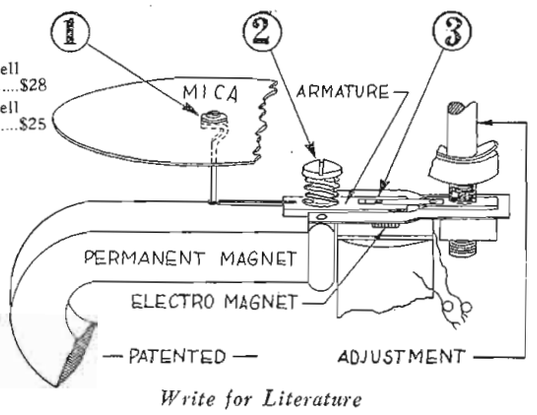
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Tune Out Interference

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The Type 247-W Filter will tune OUT interference from stations you do not want. It will give you greater clarity of reception. Easy to attach — Easy to tune — Wavelength range 150 to 500 meters.

Price $10

Sold by all Good Dealers.

Write for Descriptive Folder N.

GENERAL RADIO CO.

CAMBRIDGE, MASS.

studied insinuations in the above-mentioned article, but to more fully prove, if possible, the habitual inaccuracy and unfair method of its writer, I will touch the following high spots, for this, once and for all, should settle this seeming controversy for the readers of this magazine.

Harry Epstein, instead of Harry Epton, is name of the business manager of the British Esperanto Association. Epstein accused of having several stenographers while the poor Idists cannot afford such. What a slip! I wonder why Esperanto is so much more prosperous? "* * * leading radio engineers of the United States have tested both systems (Esperanto and Ido), some of them as far back as 1905." Ido was not published until 1907! "Dr. Cottrell and Mrs. Dave H. Morris (nee Alice Vanderbilt) supporting the RAIL movement neutrally!" What a paradox! In the World War did anyone neutrally support Germany or France? RAIL is a pet scheme, a skeleton organization for Ido in the radio field, put forth and sponsored wholly by the Boston Idist. Furthermore, it must be quite offensive to Mrs. Morris to see such loose statements about her name in print. She was Miss Alice V. Shepard, not Vanderbilt. Upon her return from her summer home at Bar Harbor, I called Mrs. Morris up for confirmation of the above statements. She repudiated the insinuation that she is supporting RAIL, and asked that the error concerning her name be corrected. She especially emphasized that she as yet is giving strong support to the wholly neutral IAL movement. However, the latest list of large contributors to the Universal Esperanto Association's fund shows Mrs. Morris's contribution of 300 Swiss francs ($60).

In conclusion, I urge those who have started off on the Ido side track and honestly desire constructive changes in Esperanto, to come on in and help us. We all see room for much improvement, for nothing human is yet perfect, but Esperanto is the basis upon which we shall build—conservatively, safely, sanely. You who are recent recruits in the field of international language will, no doubt, find at first many objections to Esperanto, such, for example, as the supersigned letters; we all go through that stage. Later, as you gain deeper, more polished knowledge of the language, what at first seems excessive ballast will fade into thin air, and you will see in Esperanto, not a panacea for myriad world ills, not a fanciful something perfect beyond all need of improvement, but a very wonderful, beautiful instrument given freely and hopefully to the world by a noble, painstaking, sacrificing idealist who himself saw its imperfections and was foremost in the work of organizing machinery by which it should be safely and gradually improved and yet held to a standard basis throughout the world.

Our special field is the widest and greatest of all, Radio. Our International Radio Association (Internacia Radio Asocio) is doing a great work to co-ordinate world-wide radio activity by means of Esperanto. I invite those interested to write me, Box 223, City Hall Station, New York, or Harry Epstein, International Secretary, 17 Chatsworth Road, London, 5e, England.

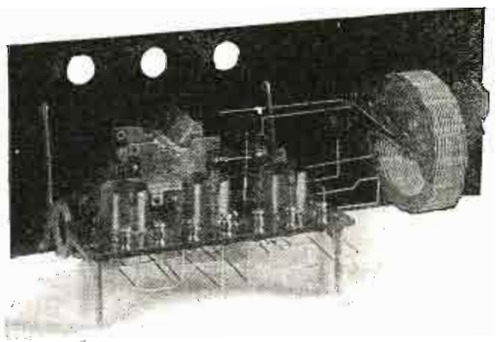
LESSONS IN ESPERANTO

Station CKY, in Winnipeg, Canada, has broadcast several talks on Esperanto. These have been both from a theoretical and practical point of view, and weekly lessons in the universal language are given.

This station is operated by the Manitoba Government Telephone System and is an important factor in the formation of public opinion of Western Canada. They have an elaborate system of remote control, whereby any important event occurring in Winnipeg can be broadcast. The influential Canadian

On those long-cold Winter Nights

THE NEW SHACTON LOW LOSS 3 CIRCUIT RECEIVER



Knock-Down PRICE $27.45
Completely WIRED $10 extra

A cozy warm room—the family circle and a SHACTON for entertainment. Nothing could insure as much pleasure and enjoyment throughout the long blustry winter months.

LEADS THEM ALL

FOR design, construction, performance and ease of operation the SHACTON LOW LOSS 3 CIRCUIT RECEIVER is the most remarkable achievement in Radio as yet. It excels ALL previous three circuit receivers, and combines not only its efficiency as a DX wonder, but its extremely low list price and minimum cost of upkeep. The most important feature, and without a doubt the cause of the SHACTON'S success lies in the fact that Low Loss instruments of the highest grade are used throughout the entire circuit. Our engineers have spent much time and patience in perfecting every minor detail to the fullest extent. Our laboratories have tested and retested it, and have proven that it is the LOWEST LOSS 3 Circuit Receiver on the Radio market today.

STANDARD PARTS

1 7 x 18 Drilled Radion Mahoganite Panel, Engraved in Gold.
1 Brunswick Low Loss 3-Circuit Tuning Coil.
1 Genuine Brunswick Low Loss Condenser.
1 Brunswick Triploid Mounting Socket and Binding Post Strip.
2 Brunswick Cast Foundation Brackets.
2 Brunswick Jacks with Gold-Plated Fronts; 1 for phones; 1 for Loud Speaker.
1 Freshman Mica Grid Condenser.
1 Standard Glass-Enclosed Grid Leak.
2 30-Ohm Shacton Bakelite Rheostats with Gold-Plated Indicators.
2 Molded Mahogany Dials grained to match panel.
5 Lengths Professional Bus-Bar.
1 Special Blue Print for this circuit. Not an ordinary hook-up but a clear picture form that a child can understand and make.

ALL ASSEMBLED READY TO WIRE

ACCESSORIES

Everything needed to operate after building is listed here —

3 Type 201A Tested Tubes	$10.35
1 60-Ampere Hour Storage Battery	11.25
2 45-Volt Extra Large Enco "B" Batteries	6.50
1 Pr. 3000-Ohm Head Phones and Cord	3.75
1 Antenna Equipment	1.50
1 Phone Plug, Double	.70
Complete Outfit	$34.25

Parts also Sold Separately

Send for our Catalogue.

Cabinet Free

Order Set and Accessory Outfit both together, and we will send Fine Mahogany Finish Cabinet FREE!

K. D. CABINETS
$1.25 Up to $125.

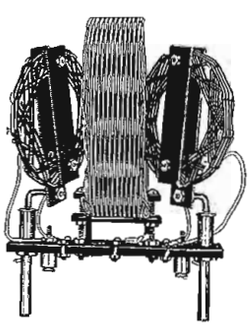
Knocked-Down Ready To Assemble

Seventy-five per cent of cabinet cost lies in the staining and varnishing. K.D. cabinets save you this unnecessary expense. They are made from the highest grade of hard woods, well matched and fitted. All cabinet work such as the drilling of the holes and etc., is done at the factory. They are shipped to you knocked down for convenience and safety. All hardware such as screws and hinges furnished with cabinet.

K.D. cabinets are a real investment considering their extreme low price and the fact that it takes but a few moments to assemble them. They can be stained and finished to your individual desire at an exceedingly low cost.

NONE BETTER AT THE PRICE

BRUNSWICK LOW LOSS TUNER—$7 LIST



The Brunswick 3-Circuit coil was developed in our laboratories after extensive tests. It uses no tubing, the wire being wound in such a manner as to be self supporting. The distributive capacity of the coils used in this tuner is thereby reduced to a minimum, thus making it a true Low Loss tuner. The primary and tickler are wound with No. 20 silk-wire while the secondary is wound with No. 18 double cotton wire, thus cutting down the resistance to the lowest possible point. It is one of the most efficient of its type and for beauty and efficiency it knows no peer. Price $7 list.

SOLD ON PARTIAL PAYMENT

MAIL COUPON TODAY

THE RADIO SHACK, Dept. A-23,
55 Vesey St., New York, N. Y.

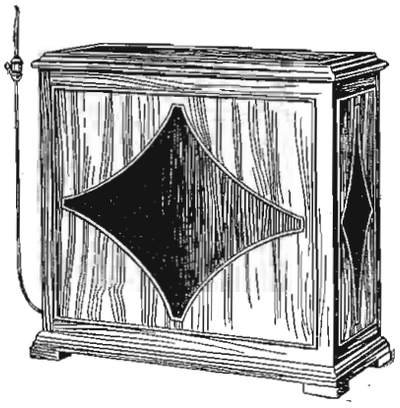
Please send me the "Shacton" outfit I have marked. When it arrives I will pay the postman the amount. If I am not satisfied I will return it in 5 days, and you agree to refund my money instantly. Mark Choice in square.

(A) Complete Building kit .....$27.45 ( )
(B) Operating Outfit .....$34.25 ( )

Name .....
Address .....
City ..... State .....

WE START IT—YOU FINISH IT — THE RADIO SHACK — THE HOME OF SEMI ASSEMBLED KNOCK-DOWN Radio Sets — SAVE 60% ON YOUR SET BY WIRING IT YOURSELF

THE QUESTION of "B" Battery Current Has Been Solved with the Trans-B-former



The Kellogg Trans-B-former furnishes the necessary plate voltages for your radio set, from your 110 AC, 60 cycle, electric light socket, without any interference of any kind.

This unvarying current is furnished at less than one-fifth cent per hour. Throw away your "B" batteries and install a Trans-B-Former and your set will operate at maximum efficiency constantly.

The Kellogg Trans-B-Former will:

Improve reception.
Reduce operating cost to a minimum.
Add to the appearance of your set.
Increase DX possibilities.

Developed, perfected and guaranteed by the Kellogg Switchboard and Supply Company.

At your dealers, each $50.00



KELLOGG SWITCHBOARD & SUPPLY COMPANY

1066 W. Adams Street, Chicago, Ill.



Build a Super-Heterodyne Yourself and Save Money!

EXPERIENCE the thrill of getting all the distant stations with a Super-Het built by yourself. It's easy with the RECEPTRAD KIT shown above. It contains all the essential parts with complete instructions. From your dealer or by mail for the remarkably low price of $53.50. Smaller kit containing only the most essential parts, $33. Either set will operate a loudspeaker on an indoor, outdoor or loop aerial.

RECEPTRAD

GREIFF DOUBLE SELECTOR **MULTIFLEX KIT**

The Perfect 4 Tube Circuit—Loop Operating

Uses four tubes. Two stages of radio frequency, a crystal detector and three stages of audio frequency. No station too distant to be brought in with good clear volume. Assembled by anyone in a few hours. Superior to a 5 tube Neutrodyne.

$29.50 Containing Principal Parts. $50 Including All Parts.

FREE Blue Prints of wiring diagrams of both circuits. Just drop us a line, giving your dealer's name and address.



RADIO RECEPTOR CO.

59 BANK ST., NEW YORK.

RECEPTRAD PRODUCTS

knowledge of Esperanto is a myth, an hallucination, or worse. Long before I became as well instructed in Esperanto as at present, I knew how to say "stolen from" in such a way as to distinguish between that thought and "stolen by." Any student after finishing a course in Esperanto would say, without the slightest ambiguity: "Ido estas forshtelita de Doktoro Zamenhof de Beaufront kaj liaj du kunuloj," which, even the above mentioned writer will admit is quite unmistakable in its meaning: "Ido was stolen *from* Dr. Zamenhof *by* Beaufront and his two companions."

The reference to "ary" of men, and "the good(s) tall(s) strong(s) boy(s)" is further evidence of a desire to injure Esperanto by insinuation of faults that do not exist. One unfamiliar with the subject, as most readers of RADIO NEWS must be as yet, would understand from the above examples that the Esperanto equivalents are just as ridiculous as the English examples. "Ar" is the Esperanto suffix indicating a collectoin of several individual entities, such as, for example, "arbo," tree, "arbaro," forest, etc. It is permissible, for greater elasticity, to use the affixes as nouns, when appropriate, by adding the noun ending, "o." Although we have the word "grupo," group, yet if a Chinese or Malay student of Esperanto had not learned the occidental arbitrary word, "group," he would instantly understand the logical derivative "aro" as meaning a group, without reference to a dictionary, but he would first have to learn the single meaning of the word "grupo" to understand it. "Good, tall, strong boys" in Esperanto as in English would be a rare example of excessive adjectives, but the Esperanto, "bonaj, altaj, fortaj knaboj," although appearing unattractive to an English-speaking stranger, is pleasant enough to the accustomed ear, and there cannot be the slightest doubt about the substantive being plural instead of singular. Such doubt can easily exist in the spoken English form, or the singular mistakenly made by the difference of one letter in printing.

As concerns the relative numerical strength of supporters of Esperanto and Ido: Until the recent impetus given by radio, the movement in North America, north of the Rio Grande, has been very weak in comparison to other countries, because Americans and Canadians, with their immense expanse of English-speaking territory, feel no great need of a world language. But even so, the number of registered and active Esperantists here is far higher than credited in the said article, for in the sectional religious group to which I adhere there are 271. Why the careless omission of figures on the Idist population, which should certainly have been given with greater precision? One in Boston, two in Montreal, one in Cincinnati, two in Pittsburgh and two or three in Washington, with one lone, discouraged, pessimistic, embittered old man in our own little village on Manhattan Island who wrote a grammar, which, with its paper binding is less value in paper and printing than our 50 cent Fryar's Esperanto grammar, offered it at $1.40 and didn't get rich. Who mentioned the "commercial" and "acquisitive" instinct? New York City should be a fair sample of North America. I can speak with precise knowledge here: Over 200 Esperantists and one Idist. The one here, like the one in Boston, tries to organize and teach classes, but after two or three sessions they evaporate. In the world field it is very conservative to say there are 50 Esperantists to every one that has joined the international organization, and there are 7,000 members of the latter, which has never undertaken any organized method of going out for a large membership.

I will not go into detail in pointing out the further mass of misstatements and

THE NEW MODEL C-7 SUPER-HETERODYNE

Important Today

THE EXPERIMENTERS INFORMATION SERVICE, Inc., has been recommending the Super-Heterodyne method of reception since the early part of 1922. In February, 1923, a Super-Heterodyne of our design was installed on the *S.S. Western World,* pier 1, Hoboken, N. J., in the cabin of Dr. Horatio Belt. On the voyage to Rio de Janeiro, Brazil, at a distance of 3,000 miles, southeast of New York, the entire Greb-Gardner fight was received from WJZ, with sufficient audibility for the entire cabin full of passengers to hear the bout, blow by blow, plainly. At 3,300 miles southeast of New York, an entire evening church service was received from Pittsburgh. At that time there was not another single firm advertising or advocating the Super-Heterodyne. Since then Mr. A. Ancieux, Engineer, Trarivia Elec de Arequipa, Arequipa, Peru, has reported consistent reception from KDKA, WDAP, WEAF, WGY and others, a distance of over 5,000 miles, using a Model "C" Super-Heterodyne. The Pratt & Brake Corp., of New York City, sent a Model C to Rio de Janeiro which received American broadcast station at a distance of over 7,000 miles.

Practically all concerns now featuring Super-Heterodyne have copied our original Model C design, and to prove again that we are far in advance of competition, we present this Improved Model C-7 Super-Heterodyne as the *Most Sensitive, Most Selective,* and finest reproducing Broadcast Receiver that can be built.

7 Tubes Give the Results of 10

The Reason:—When regeneration is added to a one tube non-regenerative receiver, the increased amplification is about equal to adding two stages of tuned radio frequency amplification. Heretofore it has been impossible to add regeneration in the 1st Detector of a Super-Heterodyne and accordingly this has been a big loss.

The new Model C-7 Super-Heterodyne has a special 1st Detector circuit with a split antenna inductance so arranged that normally the detector would oscillate continually. However, in addition, a neutralizing condenser is inserted in the circuit which gives absolute control of the oscillations to such an extent that the circuit can be adjusted to just below the oscillating point, as this adjustment gives the maximum regenerative amplification. The new circuit has a bias potential on the 1st Detector grid, in place of the usual grid leak and condenser, and this allows infinitely weak signals to be regenerated and heterodyned through the radio frequency amplifier, which an ordinary grid leak and condenser would block. On a weak signal the difference in sensitivity is very noticeable. Using a 22-foot indoor antenna in the suburbs of New York loud speaker reception has been obtained from KGO, Oakland, California. A normal range of 2000 miles is easily obtained on an average small antenna at night under average conditions.

"The Rolls-Royce of Reception"



MODEL C-7 SUPER-HETERODYNE

Wave-length Range, 200 to 575 meters. Dimensions, 40 in. x 8 in. x 8 in.
Tube Arrangement: Regenerative Detector, Oscillator, 2 Stages Radio, Detector, 2 Stages Audio.

General Information

ANTENNA: Single wire, 30 to 150 feet long. Provision has been made for use of either a short or long antenna. Indoor antenna works very satisfactory.

TUBES: 7 Radiotrons UV201A or C201A, requiring one 6 volt storage battery and one 90 volt B Battery either dry or storage.

DRY CELL TUBES: Radiotrons UV199 or C199 may be used if desired, but the results obtained with dry cell tubes are not as satisfactory as with the Radiotrons UV201A or C201A.

LOOP: As a loop takes considerable space and is objectionable looking, and furthermore an inefficient collector, no provision has been made for loop reception. Local reception can be had without antenna or ground. An indoor antenna 30 to 50 feet long is suggested in place of a loop.

SELECTIVITY: The degree of selectivity is so high that distance stations can easily be tuned in through the local stations. For example, with a C-7 located five miles from WJZ operating on 455 meters, WCAE Pittsburgh on 462 meters can be tuned in without interference with WJZ.

TUNING: There are only two tuning adjustments, one for the detector circuit and one for the oscillator. Each station has a definite point on each dial and will always he found at these calibrations. Individual Verniers are provided for each dial. A third Vernier controls the volume.

CONSIDERATIONS: The Second Harmonic feature could be used with a view to eliminating another tube, but we feel that the many advantages of having a separate oscillator more than compensates for the extra tube. For a similar reason we have refrained from Reflexing the circuit to reduce the number of tubes.

STANDARDIZATION: All the component parts specified are readily obtainable on the market through high-class dealers.

PARTS: The parts specified in this design are all selected with expert consideration with a view to giving the maximum results obtainable. While it may appear that certain other parts could be used to economize, we strongly recommend that you take advantage of our engineering experience and follow the specifications to the letter.

Original Blue Print showing all data, diagrams, circuits, details, etc., $1.00, postpaid

EXPERIMENTERS INFORMATION SERVICE, INC.

476 Broadway, New York City

Designers of the Highest Class Radio Apparatus in the World

New Book, "Modern Radio Reception," by Charles R. Leutz, over 250 Pages, over 150 Illustrations, Fully Bound, $3.00 Postpaid

CLARITY VOLUME ENDURANCE

–and low Operating Cost

The Claritron



The New York Testing Laboratories, famous the country over, after exhaustively testing the Claritron Tube and comparing it with a standard *High Cost* tube, one which retails for $4.00, says that it not only "compares well in general," but that the *operating cost of the Claritron is "lower on the average."*

The Claritron is a safe tube to buy—It is absolutely guaranteed and backed by the exacting tests of experts.

The CLARITRON average current consumption is only .179 amp.—much lower than the standard quarter ampere tube. This is due to the remarkable new filament wire—the heart of the tube—developed by our engineers.

Satisfaction Guaranteed Or Money Refunded
And the Price Is Only $2.30

$2.30 By Mail

ALL TYPES TUBES SAME PRICE

SUPERIOR RADIO CO., Dept. A
176 Shepard Ave., Newark, N. J.

Sent by Parcel Post C.O.D. or Prepaid on receipt of Postal or Express Money Order.



The Halldorson 4-tube set
$75.00

THE Halldorson 4-tube set for $75.00 is one of the greatest values ever offered in radio receivers. Everything formerly found only in high-priced sets you'll now find here.

The set is tuned radio-frequency, easy to tune and operate. Coast-to-coast range. Highly selective-large volume, with a clear mellow tone. Easily logged—a remarkable feature usually found only in 5-tube sets.

The workmanship and material are of the best—standard parts throughout—highly polished mahogany case. The panel is of insulated steel, in a beautiful stucco-ripple finish, with large handsome dials.

See this set at your dealer's today. If he cannot supply you, write direct for complete description.

Also the Halldorson 5-tube Radio Frequency Receiver. A superior set, unequalled for tone quality and all-around performance. A wonderful value at $115.00.

Halldorson
Radio Frequency Receiver

THE HALLDORSON COMPANY, 1772 WILSON AVENUE, CHICAGO

od of keying is in use. By virtue of this method all of the circuits are completed simultaneously. That means, in effect, that with the closing of the starting switch the transmitter radiates constantly, while this switch remains closed. A single turn of wire around the master oscillator inductance is shorted through a relay, when the telegraph key is depressed. This causes the frequency or wave-length to shift slightly; the two frequencies, however, are close enough together so that no difficulty is experienced in tuning-in the signal, once the compensating frequency has been located. If this transmitting equipment is employed for telephone communication, the relay is automatically closed. The voice vibrations are transmitted at the same frequency as the telegraph signals. The radiation of this outfit is one ampere when using phone and two amperes when operating straight C.W.

The antenna employed consists of a single wire 40 feet long. This makes possible the transmission of radio signals irrespective of the location of the *Shenandoah*—that is, signals may be sent when the dirigible is tied up to a mooring mast. In fact, messages were exchanged with the Laboratory, while the ship was anchored in San Diego. The use of a trailing wire antenna of several hundred feet length, commonly installed on aircraft, would not permit transmission under such circumstances.

The transmitter in use by the Laboratory, during these tests, operated on 54½ and 82 meters. The output of this set was approximately 1,500 watts. Two-way communication between the dirigible and the Laboratory, was said to have been perfect, even after the *Shenandoah* reached San Diego. Both transmitters were designed and built by the Naval Research Laboratory under the direction of Dr. A. H. Taylor. This realization foreshadows some of the many eventualities claimed for extremely short waves, which now constitute a large band of more or less idle frequencies.

Just as this article is being completed, the Bureau of Engineering of the Navy Department has received a message stating that the *Canopus*, a submarine tender, picked up signals from the short-wave transmitter on the *Shenandoah* while cruising in the Pacific Ocean. The distance thus covered was approximately 4,400 miles.

Esperanto and Ido

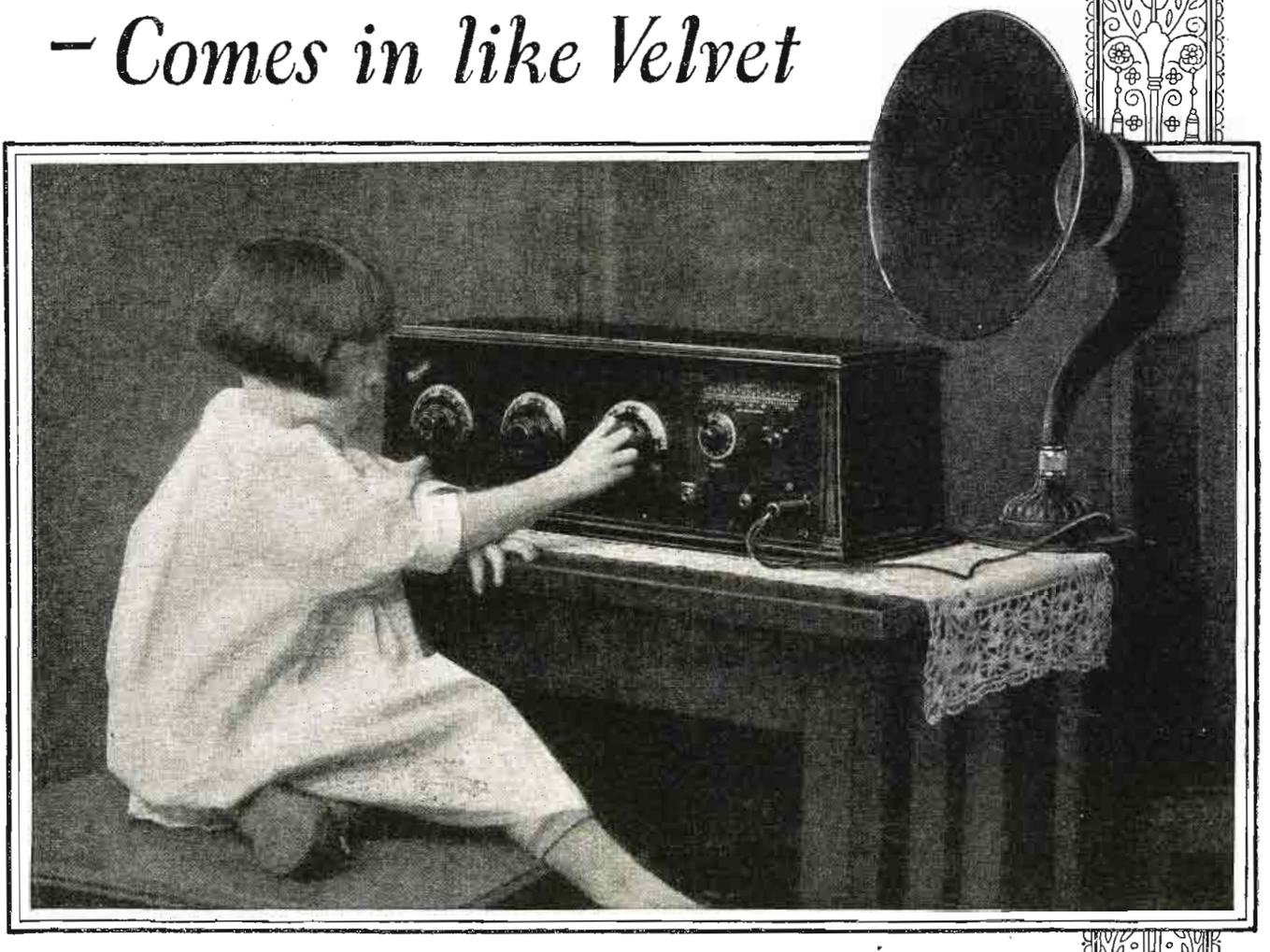
(*Continued from page* 1179)

paragraph: "Let me state frankly that Esperanto, or any language which 'robs' Ilo, as complacently as announced by the French radio amateur Dr. Pierre Corret, and yet calls the resultant 'mixture' Esperanto, has *no* system of growth nor ethics in its 'internal idea' of brotherhood, except commerce and acquisition." Chilly horrors! What terrors are wrought up in the dark for the unsuspecting reader who knows nothing of the subject and sincerely desires to learn. Ye gods of Ananiasland! Can the man have crossed his circuits? Is he really not talking of his own dear plagiarism, Ido, which is admittedly, undeniably a "mixture" made possible by theft of the uncopyrighted original, Esperanto, which the great Idealist, Zamenhof, gave freely to the world, thus innocently leaving it possible for "robbers to break through and steal"? The reference to the eminent Frenchman, Corret, is certainly not completed, and intentionally left thus. Insinuation, innuendo! Thus we build an argument out of nothing. Let us at least admire the finished skill displayed in the effort.

The writer of the article under discussion consistently, by each appearance in print on the subject, shows that his boasted

So Easy to Tune

—Comes in like Velvet



the Pfanstiehl Model 7 Receiver

A 5-tube Receiver using the new system of tuned radio frequency

RADIO is no longer a scientific toy, something to play with. Like the telephone, the piano, and the phonograph, it has become a modern home convenience. The chief use of radio today is that of an instrument of communication and entertainment. Hence, what people want in a receiver is trouble-proof service. That means a simple instrument—a receiver a child can tune. And, they want distance *plus* a tone that is clear, sweet, pure and natural.

A Non-Oscillating System

What Pfanstiehl has done has been to design the simplest and least complicated receiver known in radio. He has developed a non-oscillating system that gets rid of all stray oscillations, that keeps them out. There is no need of choking or neutralizing devices. The absence of all such devices greatly improves tone purity and tone-sweetness. Speech and music are naturally received, naturally reproduced. Distance makes no difference. There is no distortion however great the amplification. And tuning is so sharp that wave lengths can be received distinctly and separately less than 8 meters apart.

See and hear this new system that is revolutionizing radio—the Pfanstiehl Model 7—at your dealers. Or let us send you free descriptive booklet.

Dealers: Write for the special Pfanstiehl proposition.

PFANSTIEHL RADIO COMPANY
Highland Park 24 S. Second Street Illinois

Pfanstiehl

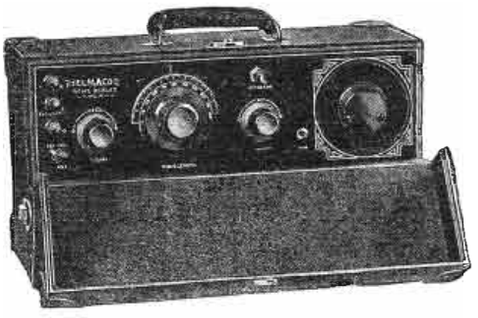
APPROVED RADIO NEWS LABORATORIES

Telmaco Acme Receiver

The Ideal Receiver for all Seasons



The Telmaco Acme Receiver is truly portable. May be instantly removed from handsome carrying case and inserted into beautiful two-tone mahogany case. No outside loop, no aerial, no ground required.



Size of Case 8" x 10" x 18". Weighs only 27 pounds complete. *Easily Carried.*

Acme 4-Tube Reflex Circuit Used

securing selectivity, distance and volume with minimum battery consumption.

Complete in itself. Easily carried from room to room in your home or to office, neighbors, etc. Take it along and have music, entertainment, speeches, news, market reports wherever you happen to be.

Instantly ready for use as it is. You can use external antenna and ground, loop and loud speaker if desired. 4 tubes (fully protected by shock absorber sockets)—equal to 7 tubes, due to reflexing and use of crystal detector.

Reasonably Priced Write for Free illustrated circular fully describing Telmaco Acme Receiver.

Complete Telmaco 64 page catalog containing 20 circuits in blue and describing the best in radio sent postpaid for 10c.

TELMACO

Quality Radio Exclusively Established 1918

Dealers! Catalog and Price List furnished to all bona fide dealers making request on their business stationery.

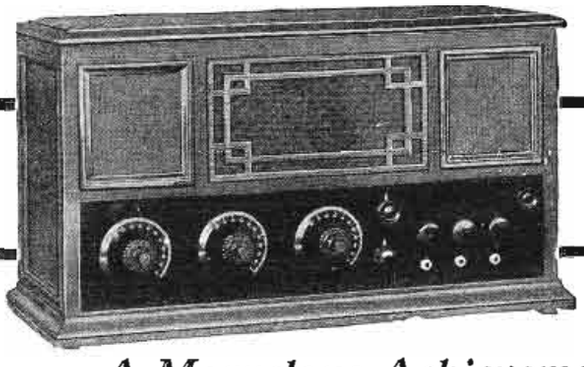
Radio Division

TELEPHONE MAINTENANCE CO.

20 South Wells Street Dept. B Chicago, Illinois

CONSOMELLO GRAND

VOLUME---QUALITY---STABILITY



A Marvelous Achievement

Here are a few of the radio parts which we make:
Sockets
Jacks
Plugs
Rheostats
Condensers
Switches

Insist on them always.

This ideal set brings in the distant stations; has volume but not at the sacrifice of quality; is sensitive and selective; is stable and quiet; not affected by body capacity; it does not howl and squeal at the slightest provocation.

The Consomello Grand is a 6 tube set having two stages of radio frequency amplification, one detector and three stages of audio amplification. The third stage of audio amplification gives extreme volume and through our special control does not in any way distort, its tone being pure and pleasing.

The cabinet is dark walnut, natural finish, a beautiful piece of furniture, well balanced and distinctive, having compartments for both "A" and "B" Batteries as well as built in loud speaker.

Hear this set at your dealer's or write to us for literature.

The MAZDA RADIO MFG. CO.

3407 Perkins Avenue *Cleveland, Ohio*

The introduction and first chapter are devoted to description of apparatus, antenna construction, and many hints for the builder of sets. The next 10 chapters describe the construction of as many receivers, starting with a crystal set and going to the "Ultimate Receiver." Complete data is furnished for the construction of each set, its parts, and operation. The last part of the volume contains the description of commercial types of receivers, a list of broadcast stations and a dictionary of radio terms. We recommend this book to the man who builds his own.

Broadcasting in Great Britain

(*Continued from page* 1139)

will begin in two minutes. After this intermission, a buzzer is pressed and a red light flashes, which indicates that the performance has been renewed. By this control system all of the switching is done in a single small room, and there is no argument between engineer and announcer or between artists.

"Each of the stations, from the output of the second amplifier is enabled to work the central station at London as well as the other stations in the relay system. We nearly always use ordinary land wires, but occasionally when these are not at our disposal, we employ a so-called wireless truck or transmitter. This pick-up device, while transported on a heavy car, can go to most any location where events are subject to broadcasting. Nine of the 21 stations in the British Isles are engaged in local broadcasting, and frequently those stations linked in the relay system cut away from the central station in London, for the moment, to give some event of special significance to their respective localities.

RELAY SYSTEM

"The relay stations operate on wavelengths between 300 and 350 meters. The other nine stations in the Great Britain system, all under the control of the British Broadcasting Co. and its staff of 100 engineers, use master oscillators and operate constantly on the wave-length assigned, as follows: London, 365 meters; Aberdeen, 495 meters: Birmingham, 457 meters; New Castle, 400 meters; Glasgow, 425 meters; Belfast, 415 meters; Manchester, 375 meters; Bournemouth, 385 meters; Cardiff, 350 meters. Practically every station broadcasts five hours a day, seven days a week. Under the reception conditions made possible by the 25-kilowatt station in operation near London, I anticipate that any one owning a crystal receiving set within a radius of 100 miles of that station may hear the programs.

"The broadcast listeners in our country are more interested in receiving an unjammed radio signal with perfect tone quality than in fiddling about and knob-twisting for distant stations. Very simple receivers are in use—probably a large per cent. of the listeners are using crystal detectors. The one- and two-tube outfits are, however, popular types of receivers."

The Shenandoah Short Wave Transmitter

(*Continued from page* 1170)

this radio equipment does not derive its power from an air-driven generator. A motor-generator operating from storage batteries supplies 200 milliamperes at 750 volts, which are charged by means of a gas engine. Due to the low power rating of the generator, it was found impossible to key the transmitting set by breaking the grid or plate circuits, without causing an appreciable shift of the wave-length or tilt in the signals. Consequently, the compensation meth-



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It isn't a genuine WD-11 unless it's a **Radiotron.**

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It isn't a genuine UV-200 unless it's a **Radiotron.**

It isn't a genuine UV-201-a unless it's a **Radiotron.**

Take a peek into any radio fan's set—and you know what to give him for Christmas. Note the type of Radiotron he uses. Go to any radio store—and when you buy, look for the name RADIOTRON and the RCA mark. Then you are sure to be giving him *genuine* Radiotrons. And mighty sure to be giving him the gift for a merry Christmas.

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Primarily, the Mu-Rad B-Radicator is an instrument for transforming ordinary house - lighting current (110 Volt, 60 cycle alternating current) into the same sort of current as was formerly obtained from B batteries. Not in the least complicated to use—the plug on the end of the cord attached to the B-Radicator is screwed into any lamp socket just as you attach a vacuum cleaner, electric heater or iron. The wires which formerly lead to the "B" batteries are connected to the binding posts on one end of the B-Radicator. Takes up no more room than one 45-Volt B Battery—the metal box is 6" wide x 4½" deep x 10" long. Uses ordinary UV-201-A or C-301-A vacuum tubes.

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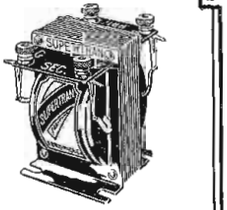
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B Radicator

End of "B" battery troubles—noises, "fading" and frequent replacement. "B" battery current, steady, uniform ALL THE TIME. A practical instrument—not an experiment. Supplies current enough for sets using as many as 8 tubes. No generator hum. Absolutely harmless, does not interfere with lighting current: protected against damage to itself. See the B-Radicator at work in your Dealer's Store.

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Navy Doing Its Bit to Cut Interference

(*Continued from page* 1138)

of our shores, the Navy operates radio only on 317 ships out of a total of over 3,400 ship stations belonging to the United States. This figures out to 13 per cent. of the U. S. ships and only four per cent. of the world's radio equipped vessels.

The Discovery of the Oscillating Crystal

(*Continued from page* 1166)

axis asymptotically. Along this latter part of the curve, an increasing current is accompanied by a decreasing E. M. F., an unstable state of affairs. It resembles the oscillating arc. The latter portion of the curve, in fact, very closely resembles the falling characteristic of the arc."

From the foregoing evidence, it is obvious that the credit for discovery of the oscillating crystal must be given to Dr. Eccles.

Book Review

THE SUPER-HETERODYNE. By John T. Boone, 6 x 9 inches. Stiff paper cover. 63 pages. Diagrams and illustrations. Published by J. T. Boone Radio Corp., 3469 E. Jefferson Ave., Detroit, Mich. Price $1.00.

In the preface of this treatise Mr. Boone makes it plain that his aim is to clear away any mysteries that the Super-Heterodyne holds for the average amateur. The book has four chapters dealing with each part of this interesting circuit; the other three tell about the functioning of the set, how to construct it and its operation. Many of the Super-Heterodyne hand books deal with one particular circuit, but Mr. Boone treats of several. In the chapters on the theory of each part of the circuit, there are plainly set forth many details that ordinarily escape an author and yet are essential for the proper operation of the set. In those chapters devoted to construction, the data relating to the parts and accessories to use, is of the best. If you need a book that tells in a simple manner the main facts of the Super-Heterodyne, we would advise you to consider this one.

WIRELESS POSSIBILITIES. By Prof. A. M. Low, 4½ x 6½ inches. 77 pages. Stiff cloth cover. Four diagrams. Published by E. P. Dutton & Co., 681 Fifth Ave., New York City. Price $1.00.

The author tells about the progress of radio up to the present day and then reveals some of the wonders that are doubtless in store. His chapters on sound and the difficulties encountered in perfect reproduction at the receiving end and the inaccuracies of wireless in general, rehearse well known facts. Of much greater interest are the last two chapters, in which he deals with radio television and radio in warfare. Prof. Low treats these subjects, not with a severe technical attitude, but more with a broad understanding of how radio will effect civilization in the future. We can recommend this little book to the man who is interested in the radio of tomorrow.

HENLEY'S WORKABLE RADIO RECEIVERS. Their Design and Construction. By John E. Anderson, M. A., and Elmer H. Lewis, A. M. I. R. E. Paper cover. 5¼ x 7¾ inches. 196 pages. Diagrams and illustrations. Published by The Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price 1.00.

Several years ago it would seem to have been a comparatively easy task to gather data on the construction of workable radio receivers of the day. The present experimenter can easily realize the enormity of such a task applied to the innumerable receivers of the present. However, the authors have surmounted these great difficulties very ably, the circuits chosen being of the best of their respective types.



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IF you are fortunate enough to own one of the larger sets you should be specially interested in the new Exide "B" Battery.

This new "B" battery, which is obtainable in 24-volt and 48-volt units, has a capacity of 6000 milliampere hours. It is full-powered and noiseless, maintaining a constant voltage on the plate at all times.

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A complete line of Radio Batteries

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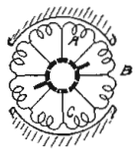
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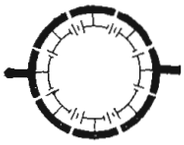
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SLOT RIPPLE. As each slot passes a pole tip there is a slight interruption of the field at this point. Each surge in the field slightly changes the value of the voltage induced in the coils. The resultant ripple is known as slot ripple.

The frequency in cycles per second for the above ripples may be expressed—

$$Fc = \frac{\text{No. of segments X r.p.m.}}{60} \qquad Fs = \frac{\text{No. of slots X r.p.m.}}{60}$$

NOISE OF MOVING CONTACT. The infinitesimal sparking caused by microscopic uneveness in the surfaces of both the commutator and the brushes produce an audible noise in the transmitter

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The ratio of ripple voltage to maximum voltage for R.A.C. equals 100%.

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No sticking or sparking contacts

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The France Multi-Duty Super-Charger is noiseless, non-critical, non heating and exceptionally efficient. And there are no bulbs to break and replace nor acids to spill and spoil clothing or woodwork.



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farads. Making assumptions like this, it will be found that the apparent resistance of the coil is increased considerably for *all* wire sizes, but is *especially* increased for the larger sizes. The resistance curve will, therefore, move to the right and upwards, indicating that to obtain lowest resistance we would have to use smaller wire.

By doing this we are reducing the skin effect so as to counteract the effect of the coil capacity. A typical curve is shown in Fig. 7.

In considering the effect of frequency on the resistance of coils, coil capacity becomes a serious factor. As the frequency becomes higher and higher, curve "B" in Fig. 1 becomes steeper and steeper; at the same time the capacity effects increase, and the combined effects would tend to make the lowest point of the curves move to the right, or toward the smaller wires. This effect is not very great, and it is doubtful if it can be noticed in any measurements on single-layer coils. The reason for this is that we will have to go to extremely high frequencies

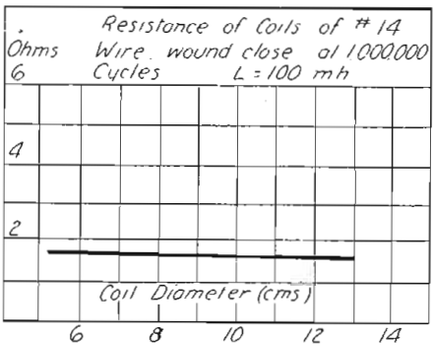


Fig. 7-C.

before the steepness of the resistance ratio curve and the coil capacity counteract the slope of the d.c. resistance curve, which is in the opposite direction. The curves at the same time rise steadily with frequency.

Although all the curves in this article have been computed, the agreement between the results shown and results obtained experimentally is surprisingly good. In this connection we may call attention to some measurements recently made by G. W. Pickard, and recorded in *Q. S. T.* of September. An illuminating chart is presented showing the resistances of basket wound coils of 100 microhenries inductance, at four different frequencies. Although these are coils of the basket wound type, they are, in effect, single layer coils, which have had their turns bent slightly out of shape so as to make the coils self-supporting. They may be considered as single layer coils with an equivalent diameter somewhere between the maximum and minimum diameters.

The lowest points of these curves oscillate back and forth between No. 14 and No. 16 wire, showing that any tendency to shift to the smaller wire sizes is not definitely indicated. The curves rise consistently with the frequency. It is probable that all these coils were of the same diameter, so it is not possible to show on this chart, how the resistance varies with the diameter, if it does at all. The discussion above indicates that it does not. This chart shows that although the calculations of resistance cannot be made accurately, at least they are of value in indicating the proper tendencies to follow in designing coils.

HER REASON

"Are you glad that your husband has bought a radio outfit?"

"Yes; while erecting his aerial today I coaxed him into patching an old leak in our roof."

—*Contributed by Les Van Every.*

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from these Scientifically Designed New Karas Harmonik Audio Frequency Amplifying Transformers

MUSIC that is absolutely true and natural. Clear, round, full mellow tones. Piano music that could never be mistaken for a harp or banjo. Speech so natural that you would instantly recognize the voice if you knew the speaker. Orchestral music poured out of the loud speaker with all the tones of each one of the instruments so accurately amplified that you feel as though you were sitting in the concert hall. This is what you hear when you listen to radio reception amplified through Karas Harmonik Transformers.

It is impossible to picture in words the new thrill you will experience on hearing the exquisite musical quality of reception delivered by this wonderful new transformer.

What a revolutionary change in transformer design must have been made to account for this amazing improvement in radio reception !

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Karas engineers, with the experience gained in building hundreds of thousands of audio transformers, worked more than a year and spent many thousands of dollars to achieve it. Distortion —that bugaboo of radio—is entirely eliminated. Low tones and very high tones are amplified equally with the middle tones. The vital harmonics and rich overtones — the qualities that distinguish music from noise — are brought out in their full beauty.

Important engineering problems had to be solved to accomplish this uniform amplification—and to deliver a high amplification factor absolutely free from the disagreeable distortion characteristic of all ordinary transformers.

Distributed capacity between turns—hysteresis and eddy current losses—and reluctance to the path of magnetic flux, all were reduced to a point never before achieved in transformer design. In every detail of construction, from the windings of the coils to the outer shielding, electrical and magnetic factors have been co-ordinated to produce that much talked of—but never-before-realized result—great volume without distortion.

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Our claims for performance of the Karas Harmonik are enthusiastically endorsed after the many rigid laboratory tests to which they have been subjected by scientists and musicians.

Individuals who have installed Karas Harmoniks in their sets write in most glowing terms of the tremendous improvement in reception. "Super-splendid" is the way one man describes it. "At last a transformer that will give undistorted two stage amplification in a Superhetrodyne", writes another. "The only transformer I have ever found that will handle a reflex circuit" says a third. So it is on every hand. The radio public public is hungry for radio reception of real musical quality. And at last a transformer has been built which DOES produce it.

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No matter what type of receiving circuit you favor, Karas Harmonik Transformers in the audio end will make it a better set than it can possibly be with ordinary transformers. Karas Harmonik Transformers are equally superior for regenerative circuits, radio frequency sets, neutrodyne sets, superhetrodynes and reflex circuits.

It requires an exceptional transformer to function properly in a reflex. *It takes a remarkable transformer to handle the big volume of a "super" through two stages.* Yet these are the critical tests that the Karas Harmonik is meeting every day with unvarying success. Users of Karas Harmoniks are more than satisfied. They are enthusiastic boosters.

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The remarkable performance of the Karas Harmonik justifies an unusual guarantee. Instead of the usual meaningless guarantee of "material and workmanship" we give you a straight-from-the shoulder, money-back guarantee of *satisfaction.*

Put a pair of Karas Harmonik Transformers in your set. Use them for 60 days. If you do not feel that they are giving you a quality of reception far beyond anything you have ever heard before, send them back to us and we will immediately refund your money without question or quibble. No strings to that offer! No reservations! You can't lose by accepting it.

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Your dealer is authorized to make this guarantee if he has our goods in stock. We are supplying dealers as fast as the output of our factory permits. If your dealer is not yet supplied, use the coupon below. Let us send you a pair of transformers direct. Don't wait until you build a new set. Put Karas Harmoniks in your old one. It's easy to make the change. Ask your dealer today if he has secured a stock of Karas Harmoniks. If not, sit right down and mail the coupon at once. Let Karas Harmoniks make your set produce that perfect musical quality of reception it is capable of giving you.

To Jobbers and Dealers

Distribution of Karas Harmonik Transformers through regular jobber and dealer channels is being carried out as rapidly as the output of our factory permits. In the meantime mail applications will be taken care of in the order they are received, on an allotment basis. Write us for test records, discounts, etc.

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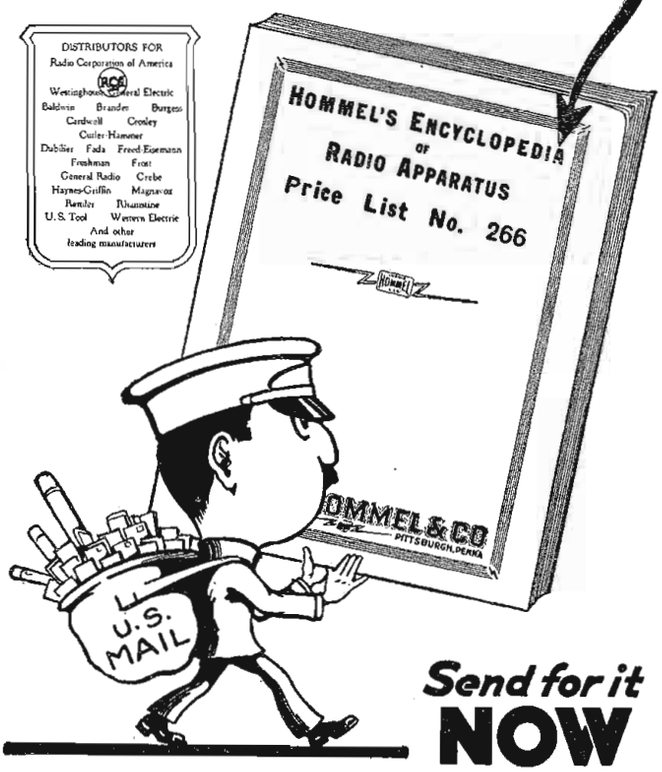
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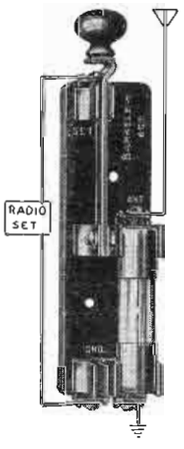
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THE National Electric Code requires an approved protective device (Lightning Arrester) on the lead-in wire of every radio receiving antenna.

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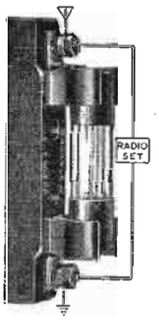
The vacuum tube arrester is permanently in the circuit from antenna to ground, ready to "spill" any overcharge. With the switch blade the antenna may be disconnected from the radio set and thrown directly on ground.

It meets not only the requirements but also the additional recommendations of the National Electric Code.

It is approved by the Underwriters' Laboratories.

Our No. 606 Vacuum Tube Lightning Arrester is less expensive but it meets all the actual requirements of the National Electric Code.

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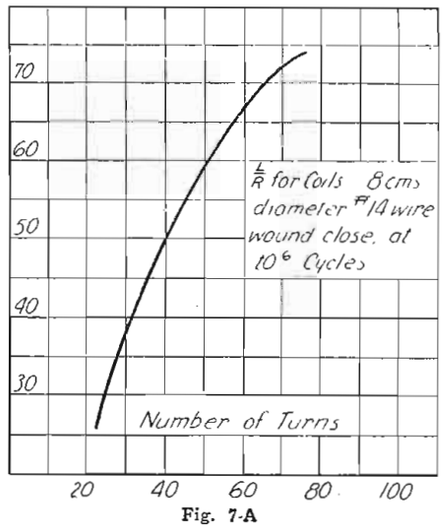


Fig. 7-A

EFFECT OF COIL CAPACITY ON RESISTANCE

We shall now consider the effect of coil capacity on the resistance of coils. Although the writer has no figures at the present time on multi-layer coils, an attempt will be made to illustrate the effect by considering single layer coils.

Capacity distributed between the turns and various other parts of a coil has the effect of making it act as if the resistance of the coil were increased. The coil capacity does not change with frequency, but its effect on both the inductance and resistance varies with frequency, both of which effects can be easily calculated if the coil capacity is known. With regard to the effect on the resistance of a coil, this may be expressed also as a ratio, and if Rt is the total resistance of the coil, with coil capacity neglected (in other words, as we have been considering it) and Ra is the apparent total resistance (taking coil capacity into account), the apparent resistance of the coil may be expressed as

$$Ra = \frac{R}{Ro} \times Ro \times \text{length of wire} \times \frac{Ra}{R} \qquad (7)$$

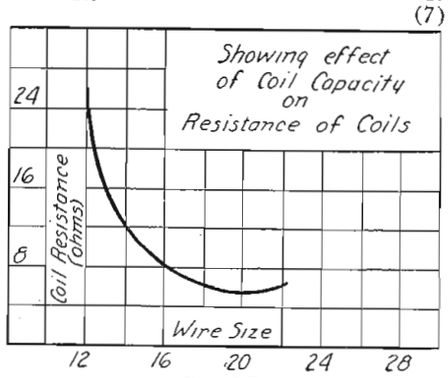


Fig. 7-B.

It has been said before that the effect of coil capacity in single-layer coils is very small; in fact, it may be neglected, in comparison with skin effect. This will become very apparent when we calculate the ratio Ra/R for, say, 100 microhenrie coils, assuming various values of coil capacity. Even when we assume a value as high as 50 micro-microfarads, which is rarely found in single-layer coils, the ratio is only about 1.5. It is easily understood that this is small compared with values of R/Ro, due to skin effect, as shown in Fig. 1, curve B.

The effect of coil capacity can be found if we consider the effect of very large capacities. Suppose, for instance, that a coil wound with No. 14 wire has a capacity of about 200 micro-microfarads. The capacity will decrease regularly as the size of the wire is decreased so that for No. 22, say, the capacity may be about 150 micro-micro-



This WorkRite DeLuxe Neutrodyne Kit contains everything necessary to build a perfect 5-tube Neutrodyne set.

In addition to the parts listed below, the kit contains a mounting angle, book of instructions and full size panel and base layout, picturing every part and wire. Perfect results from sets built with this kit are a certainty. Price $70.00.

3 *WorkRite Neutroformers*
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5 *WorkRite Non-Microphonic Sockets*
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3 *WorkRite ¼" E-Z-Tune Dials*
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Screws, Solder Lugs, etc.

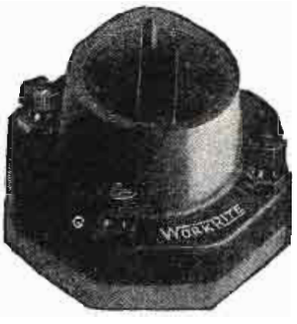
Build Your Set of these Famous WorkRite Parts

THE use of genuine WorkRite parts not only gives you the satisfaction of building your own Neutrodyne set, but enables you to get a high grade receiver at very low cost.

The complete kit shown above provides the ideal equipment for building a standard Neutrodyne set. WorkRite Neutrodyne parts are also sold separately—send for an illustrated price list. If your dealer cannot supply you with a WorkRite Neutrodyne kit or parts, write to us direct.

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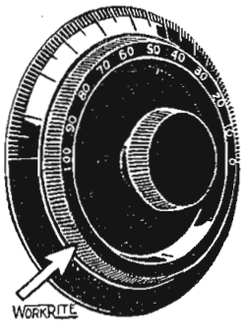
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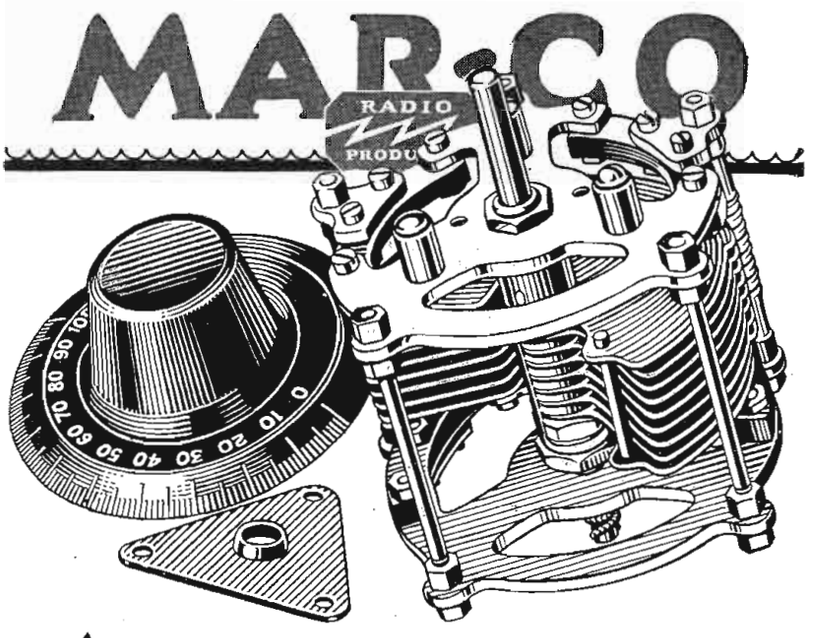


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The formula as shown is due to Prof. Nagaoka. The formula, omitting the factor K gives the inductance of coils of length exceedingly great compared with the diameter. The factor K is called the form-factor, and takes into account the leakage of magnetic flux (or lines of force) at the ends of the coil. It is obvious that the larger the diameter of the coil the larger will be this leakage. Nagaoka has given us very accurate values of K, based on the quantity 2a/b in which a is the radius or 2a is the diameter. and b is the length of the coil. (n, in the equation is the total number of turns in the coil. This must not be confused with the quantity N in formula (2) given above for the skin effect.)

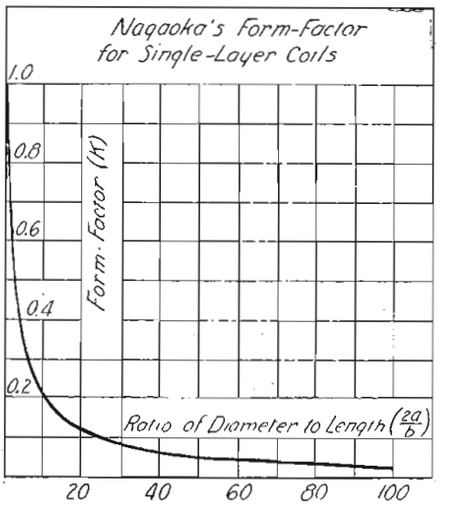


Fig. 7

The point is that when we attempt to obtain more inductance by building our coil of large diameter, we lose almost as much because of the increase in the leakage. This form-factor has been plotted in Fig. 4 against the ratio 2a/b (or diameter divided by length). This curve looks very much like an ordinary curve of reciprocals, such as we would obtain if we plotted the capacity of a condenser against the distance between the plates. As a very rough approximation we may consider that the factor K varies inversely with the ratio 2a/b. We may then write $K = c \times b/2a$, in which c is a constant of proportionality, and insert this in the formula (5). We then obtain a relation $L = k_1 n^2 a$. Then, if R is the high frequency resistance per foot of wire in the coil, and Rt the total resistance of the coil, we may write $Rt = 2\pi anR$ or $Rt = k_2 an$ for a given size of wire. If we then divide the one by the other we obtain the relation

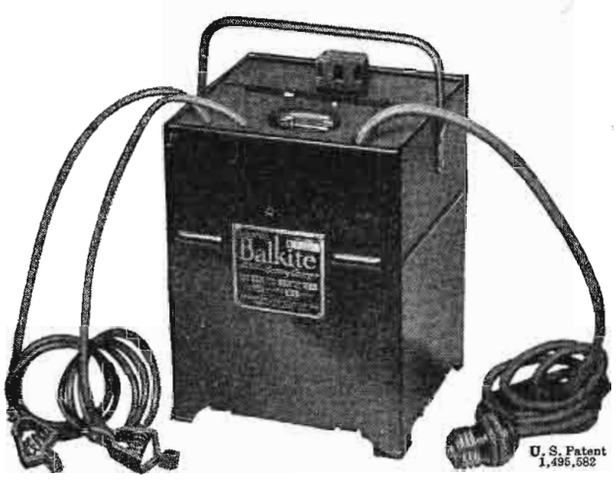
$$\frac{L}{Rt} = kn \text{ (very roughly)} \qquad (6)$$

in which k is a constant.

There are two things that this tells us, first, that the ratio of inductance to resistance increases regularly as the number of turns in the coil is increased, and secondly, since the radius of the coil, a, does not appear in the formula, the ratio of L to Rt does not depend upon the number of turns. In other words, for a given inductance, the coil resistance is not affected by the diameter of the coil.

To further emphasize these ideas, the lowest points of the curves in Fig. 2 have been plotted against the coil diameters. This is shown in Fig. 5. It will be noted that the resistance is nearly constant, regardless of the diameter, at least, within the precision of the work. Ratios of L/Rt have been calculated from the lowest points of the curves in Fig. 1, and these have been plotted against the number of turns, as shown in Fig. 6. It is seen that the ratio increases regularly with the number of turns.

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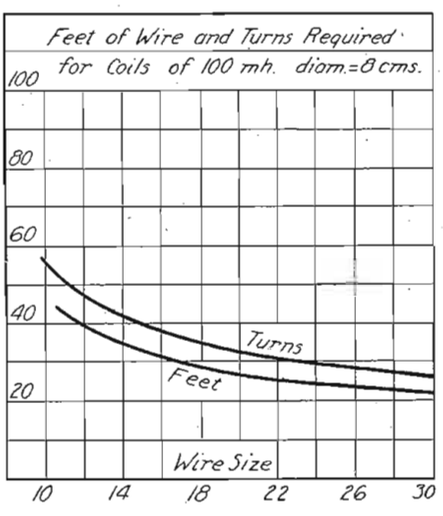


Fig. 5-B

not save much in the number of turns required by using large diameters. In other words, if we have two coils of No. 14 wire and 100 mh inductance, one having a diameter of 10 cms. and the other 12 cms., the former would require 30 turns and the latter 26 turns. Thus, although the diameter of the one coil is ¾ inch larger than that of the other, it is only ¼ of an inch shorter. The writer suggests that a convenient limit to set is about 8 cms. or 3⅛ inches.

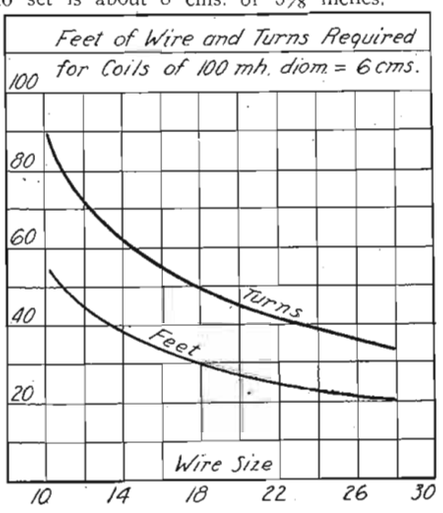


Fig. 5-C

It will be interesting to many readers to know the reason for this—the diameter has no effect on the resistance of the coil. The answer is found in considering the formula for inductance generally used.

$$L = \frac{0.03948\ n^2\ a^2}{b}\ K \qquad (5)$$

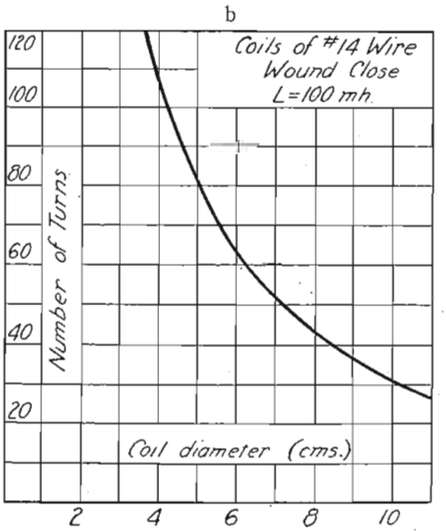


Fig. 6

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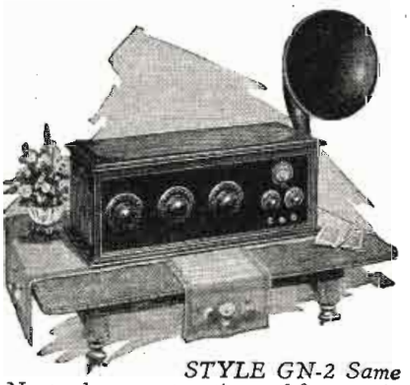
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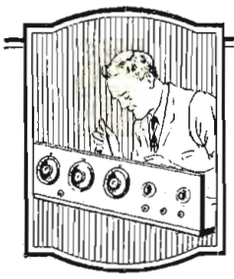
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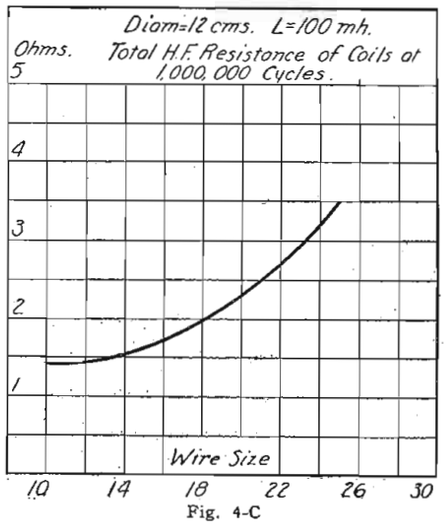


Fig. 4-C

There are two things of interest in these curves; the lowest points of the curves are at about the same wire size, viz., No. 14, and the lowest points all show about the same value of resistance.

We may interpret this, therefore, as meaning that the diameter of a coil has no appreciable effect on its resistances. The only way in which it is necessary to consider the diameter of a coil is in connection with its physical size, that is, how much

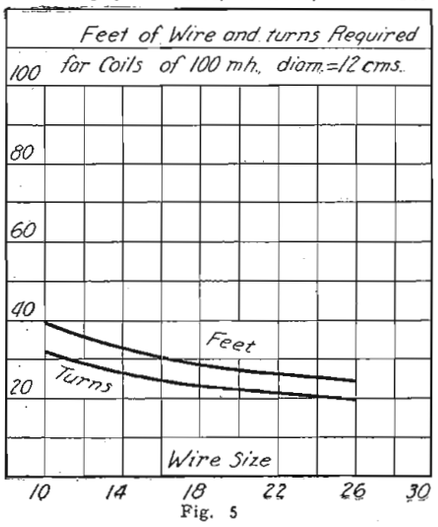


Fig. 5

space it takes up. There is also in connection with this a practical limit beyond which it does not pay to go. This limit can be visualized by referring to Fig. 3, in which the number of turns of wire needed to build coils of 100 mh. inductance, of No. 14 wire, are plotted against coil diameters. At the right hand side, the curve begins to be horizontal, which means that we do

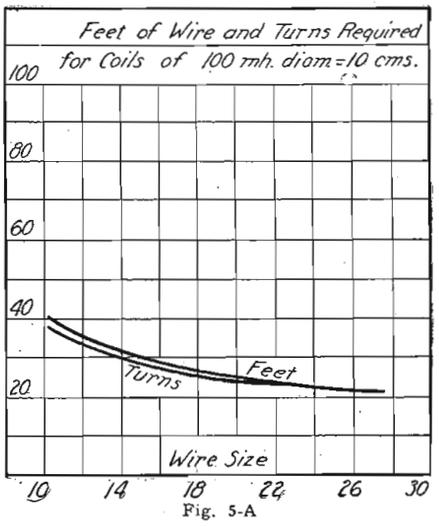


Fig. 5-A



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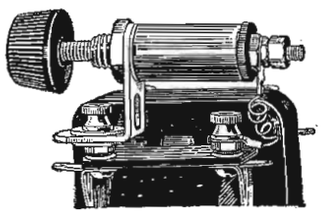
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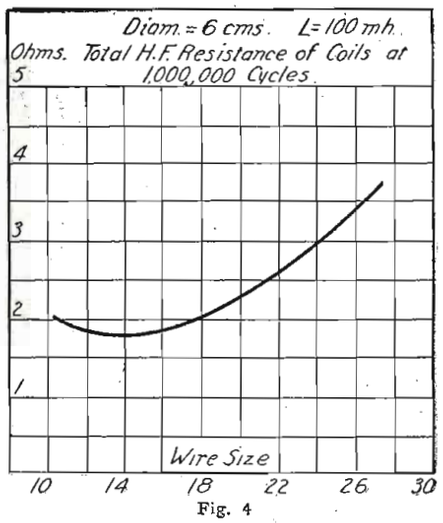


Fig. 4

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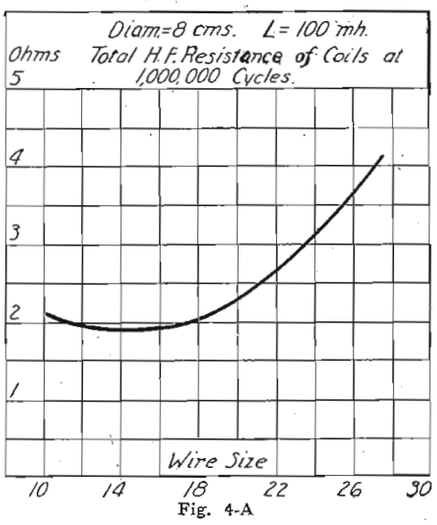


Fig. 4-A

Curves similar to those in Fig. 1 are shown in Fig. 2, which gives the resistance curves for coils of 100 mh inductance and for diameters of about 2¼ inches (6 cms.), 3⅛ inches (8 cms.), 4 inches (10 cms.) and 4¾ inches (12 cms.). The curves "A," "B" and "C" in Fig. 1 apply also to these coils, as, it will be remembered, resistance ratio is independent of the diameter of the coil.

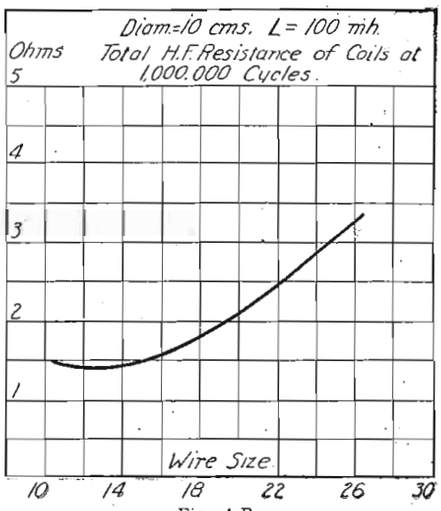


Fig. 4-B

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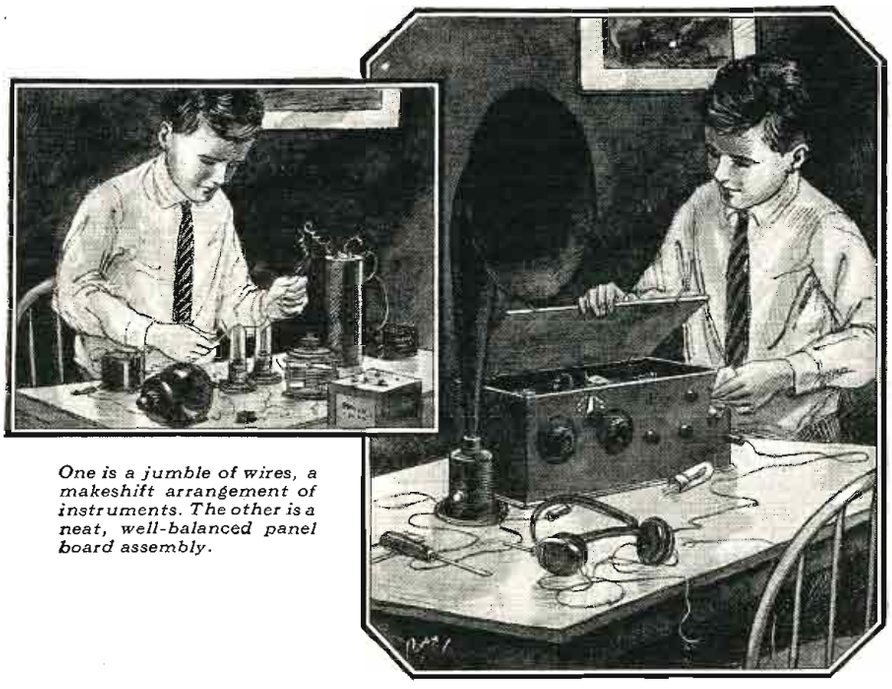


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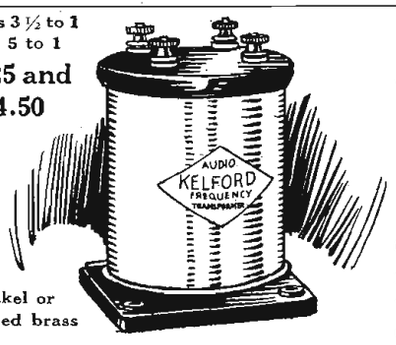
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compare the curves for the 100- and 200-microhenry coils.

The lowest point on the former curve shows a resistance of 1.90 ohms, and that on the latter curve a resistance of 2.85 ohms. We have thus, by doubling the value of L, the inductance, at the same time raised the resistance to about 1.5 times its original value. The voltage across the coil would not then be quite as high in the case of the 100 mh. coil as it is in the case of the 200 mh coil, since, although the resistance has been raised, which means a corresponding decrease in the value of I, the latter has not decreased as much as L has been increased.

Let us consider the size of the two coils. These are marked on the curves. The 100 mh. coil is only a little over 3 inches, while the 200 mh. coil is about 5½ inches. The voltage conditions have suffered little by choosing the smaller inductance; if we should want to build a coil of 200 mh. and only be 3 inches long we should have to use rather small wire and hence drive the resistance higher.

In this connection we will also consider the dotted curves shown in Fig. 1 which apply to coils having spaced windings. These have been derived in a manner similar to the derivation of the solid curves. The spacing is taken as equal to the diameter of the wire and the insulation, assuming double cotton covered wire. If No. 14

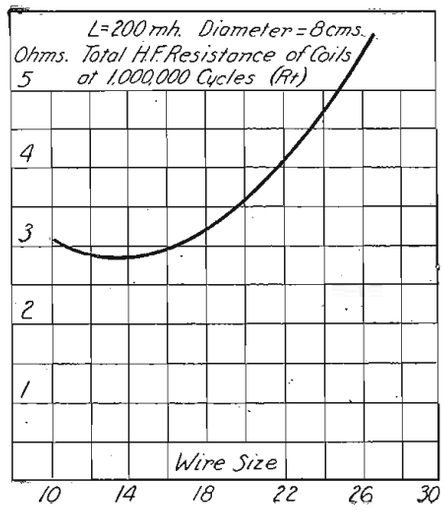


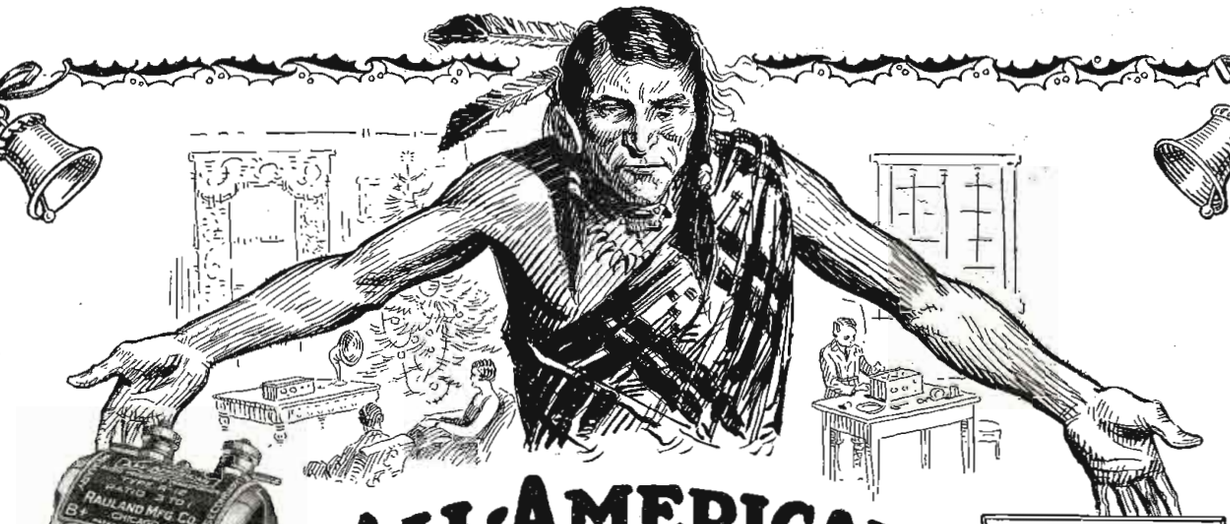
Fig. 3-C

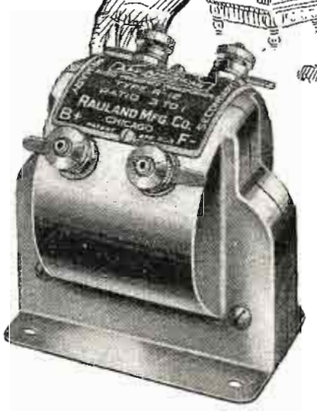
wire be used, 67 turns would be needed which would mean a coil length of little less than 5 inches. At the same time the resistance of the coil has dropped to less than 0.4 the value when close winding is employed. This is a marked improvement over the resistance of the close-wound 200 mh. coil, since it is about 1/5 the value. Furthermore, if we tried to build a spaced coil having a diameter of 3⅛ inches and an inductance of 200 mh. we would have to use a trunk to house our radio receiver.

There is no use using wire larger than No. 14 with spaced winding, although it is permissible, as shown by the fact that the lowest point of the curve has been moved to the left on account of the spacing. There is a limit to which we can reduce the resistance of electrical apparatus, that is, a practical limit, beyond which it does not pay to go.

In this connection it is well to point out that the voltage across the condenser used in shunt with the coil in tuning circuits is the same as that across the coil. Therefore, this has been considered automatically when we considered coils.

The reader must also remember that if he does not take care to build his coils properly, with as little support as possible





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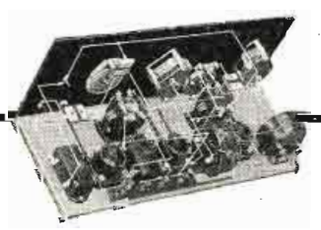
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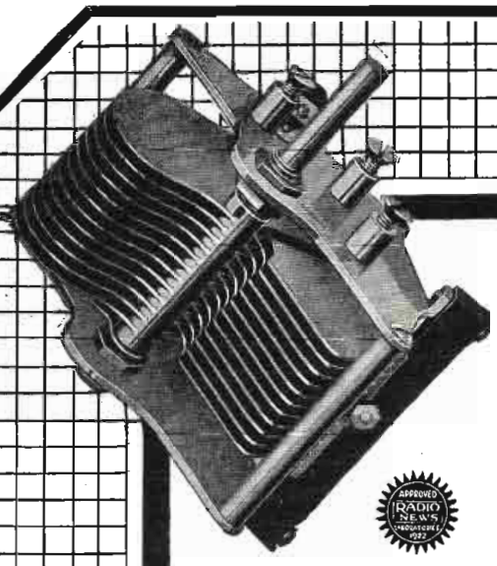
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Note how the resistance begins to climb as we approach the smaller wire sizes. Remember, of course, that all this applies only to single-layer coils.

DIELECTRIC LOSSES

Now as to the dielectric losses. It is highly improbable that dielectric losses will vary much with different sizes of wire, at least in the range of wire sizes generally used, say, from No. 12 to No. 22. In simpler words, the dielectric losses depend so much more on the nature of the dielectric than on the size of the wire that we can without much error for a given construction of coil consider them to remain about the same, no matter what the size of the wire. Although the dielectric losses will raise the curve bodily, showing that the coil has a higher resistance, the lowest point of the curve will remain at about the same wire size, viz., No. 14, providing the insulating material does not add considerable capacity to the coil.

Now the question arises, what is the best combination of inductance and capacity to use in a radio receiver tuning circuit. This has been a long disputed question, and the writer believes that he has been able to contribute something of value in the discussion. To begin with, since electron tubes are in such general use in radio circuits, and since these are essentially voltage operated devices, it follows that what we require is as high a voltage on the grid of the tube as is possible. The voltage on the grid is the same as the voltage across the terminals of the inductance coil, so that the problem finally resolves itself into one of finding the coil which will have the greatest voltage across its terminals for a given current through it. In this discussion we will assume that the coupling between the antenna circuit and the tuning circuit we are considering is so loose that no appreciable reaction can occur.

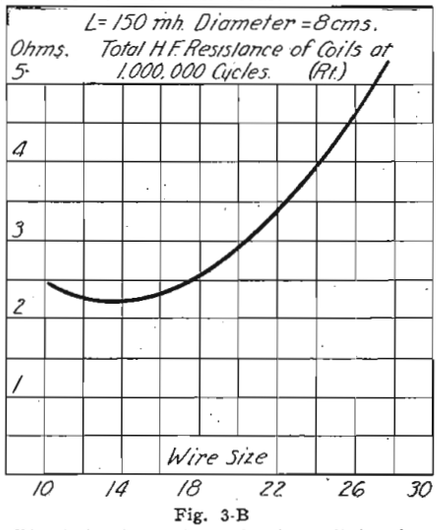


Fig. 3-B

The inductive voltage in the coil is given by the formula

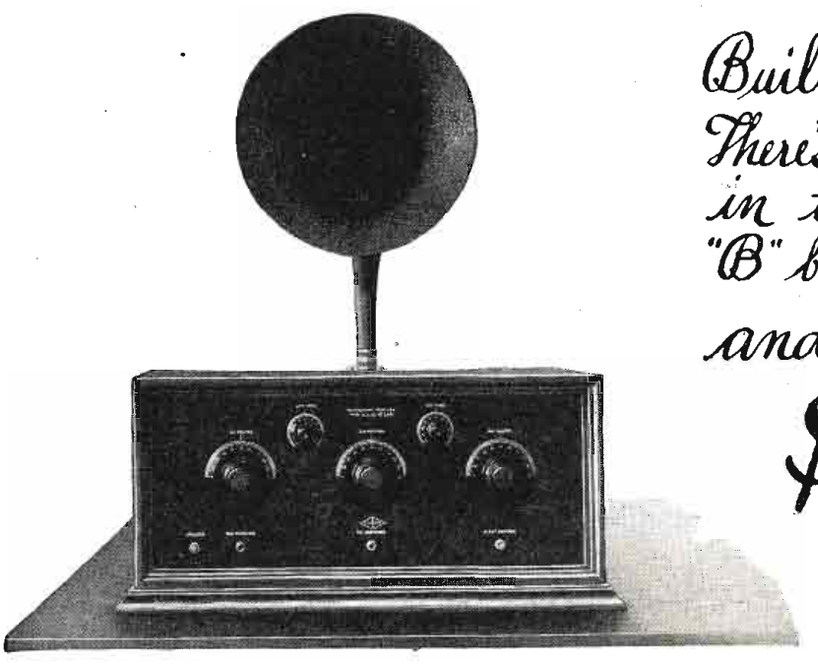
$$V_L = 0.00628\ fLI$$

in which V_L is in volts, f is in kilocycles, L is in microhenries, and I is in amperes. As we are considering only one frequency at present, viz., 1,000,000 cycles or 1,000 kilocycles, we may write this formula as

$$V_L = 6.28\ LI \qquad (4)$$

Now, if we keep one eye on the formula and another eye on the curves we will be able to follow the discussion easily. The formula shows us that to obtain the highest voltage we must have the greatest current. This means that the resistance in the circuit must be lowest, and at once puts out of the discussion coils of 3⅛-inch diameter that are wound with anything other than about No. 14 wire. The next thing the formula tells us is that for a high voltage we must have high inductance values; this is where the difficulty lies. Let us

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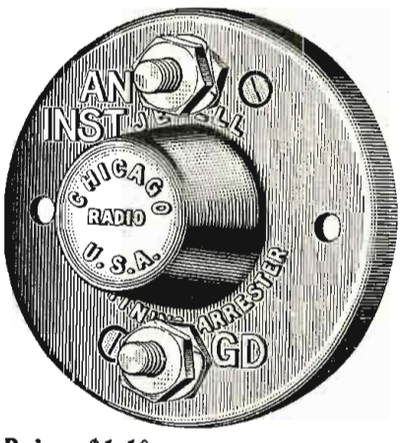
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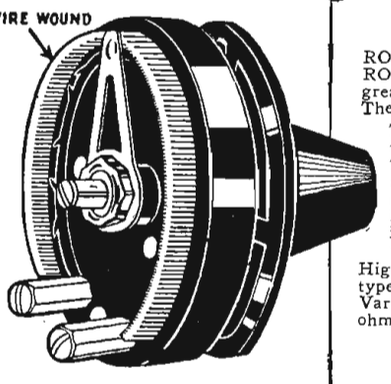
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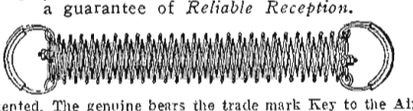
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turns per inch by using two layers of turns in our coil, the skin effect will increase rapidly. It is also interesting to note that there is no term in this formula that considers the diameter of the coil. This is as it should be, since the skin effect has to do only with the amount of magnetic flux present, and does not care whether we get it by using a large diameter with few turns or a small diameter with many turns.

Let us now begin to study Fig. 1. It is to be read from the bottom upwards. The curve at the bottom shows how the direct current resistance of one foot of straight copper wire changes as the wire size is changed. The values used to plot this curve were taken from an ordinary wire table. The curve is marked "A," and gives the value of Rho for any size of wire, ordinarily used.

SKIN EFFECT

The next thing to consider is the skin effect. This has been calculated from formula (2) given above, and is shown in the curve next to the bottom, marked "B," which, like "A," is drawn solid. We have in "C" the product of the two lower curves. In other words "C" represents the value of formula (1) and, therefore, gives the resistance of coils at 1,000,000 cycles in *ohms per foot of wire* in the coil.

In connection with this curve it must be noted that the high frequency resistance per foot of wire decreases consistently as the size of the wire is increased. We might think, therefore, that we could obtain as low resistance in our coil as we could want simply by using larger and larger wire. If it were not for a fact that is to be explained next, this would be true. The truth is that the actual resistance curve has the shape shown at "E," the top curve in Fig. 1. Curve "C" shows us that although the resistance ratio (the skin effect) increases rapidly as the size of the wire is increased, the actual direct current resistance *decreases much more rapidly* so that the product of the two will continually decrease as the wire size is increased. The reader must be very careful to remember that so far we have considered only the *resistance per foot of wire.*

The *total* resistance of the coil is, of course, affected by the amount of wire in it, and it is this that causes the curve to turn upward on the left, as shown at "E," Fig. 1. To consider this in detail, the writer has calculated the number of turns necessary in coils of 3½ inches diameter (8 cms.) and the corresponding number of feet of wire needed, to give us coils having inductances of 50, 100, 150 and 200 microhenries, as noted at the top of Fig. 1. The curves showing the number of feet of wire are marked "D." It is to be noticed that the number of turns required does not change much for the small sizes of wire, but when we get to the larger sizes it changes very rapidly.

Therefore, when we wish to obtain the total resistance of the coil by multiplying curve "C" by curve "D," that is,

$$R \times \text{feet} = \text{total resistance} \qquad (3)$$

the increase in the number of feet of wire needed when large wire sizes are used causes the left side of curve "B" to turn upward, and at the same time raise the whole curve higher.

This same procedure has been followed for the cases of coils of inductances equal to 50, 100, 150 and 200 microhenries, for the purpose of attempting to determine the best value to use in a radio receiver. The most interesting parts of these curves are the lowest points, that is, where the resistance is shown to be lowest for each value of inductance. It falls at about No. 14 wire in every case excepting the smallest coil. Coils on the market are often made of wire as small as No. 26 or No. 28.

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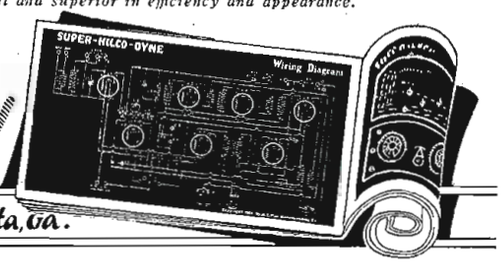
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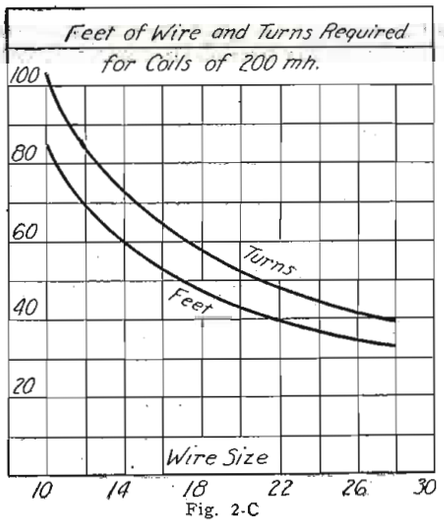


Fig. 2-C

$$\frac{R}{Ro} = 1 + 9.28\ N^2\ d^3\ \sqrt{f}$$

in which N is the number of turns of wire in the coil *per inch of length of the coil.* That is, if there are 60 turns of wire in the coil, and it is 5 inches long, then N is equal to 60/5 or 12 turns per inch. The letter d is the diameter of the wire in inches and f is the frequency of the current in the

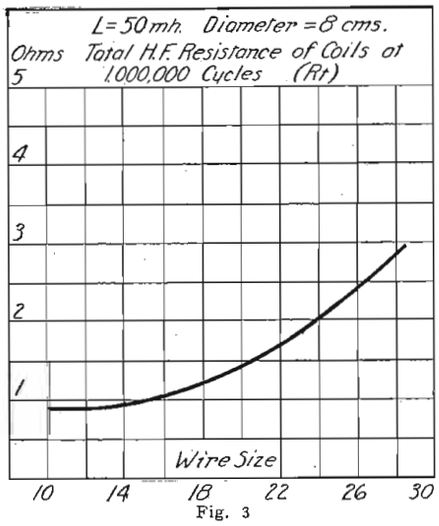


Fig. 3

wire, in kilocycles. All the curves that follow have been computed for 1,000,000 cycles, so that this formula may be written simply

$$\frac{R}{Ro} = 1 + 9280\ N^2\ d^3 \qquad (2)$$

It is interesting to note here that the resistance ratio involves the *square* of the turns per inch. Therefore, if we double the

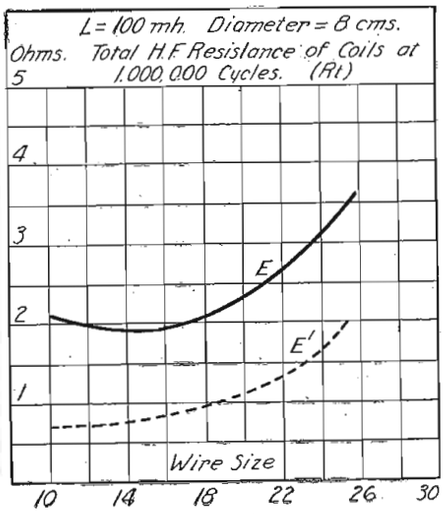
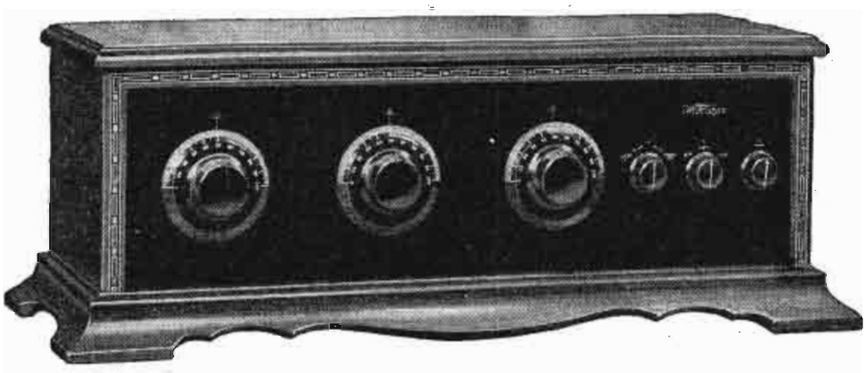


Fig. 3-A



The Deresnadyne Circuit

stops oscillation at its source

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Andrews Deresnadyne, genuine hand-rubbed mahogany cabinet. Price $150, without accessories.

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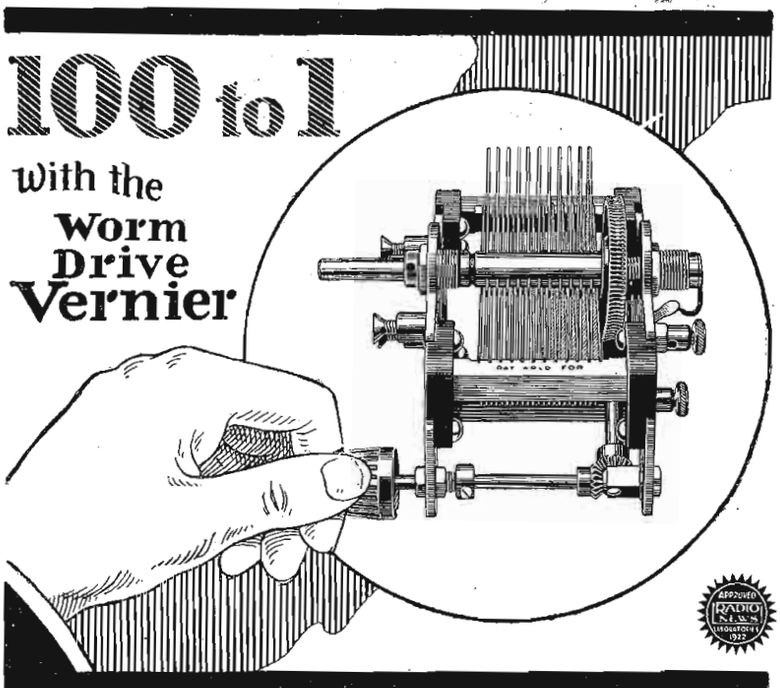
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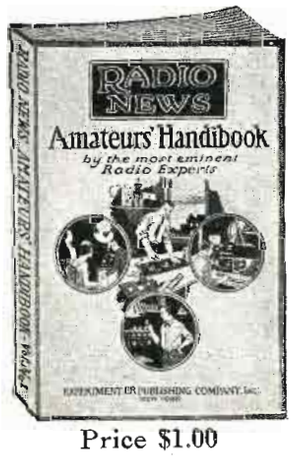
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Note to Dealers: If your Jobber is out of stock, please write us.

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Wud appreciate crds frm any of the abv.

Analyzing High Frequency Resistance of Single Layer Coils

(*Continued from page* 1174)

In the following discussion, we will let Ro be the resistance of *one foot of the wire to direct currents*. Values of Ro can be obtained from any wire table. It is evident that if we know the resistance ratio of a coil, R/Ro, then we can find the high frequency resistance of the coil in ohms per foot of wire in the coil. Therefore,

$$Ro \times \frac{R}{Ro} = R \text{ (ohms per foot of wire)} \quad (1)$$

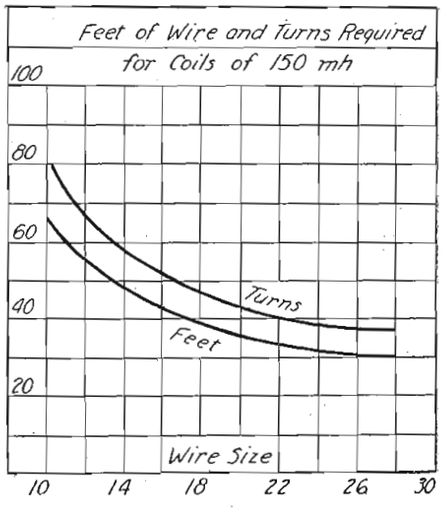


Fig. 2-B

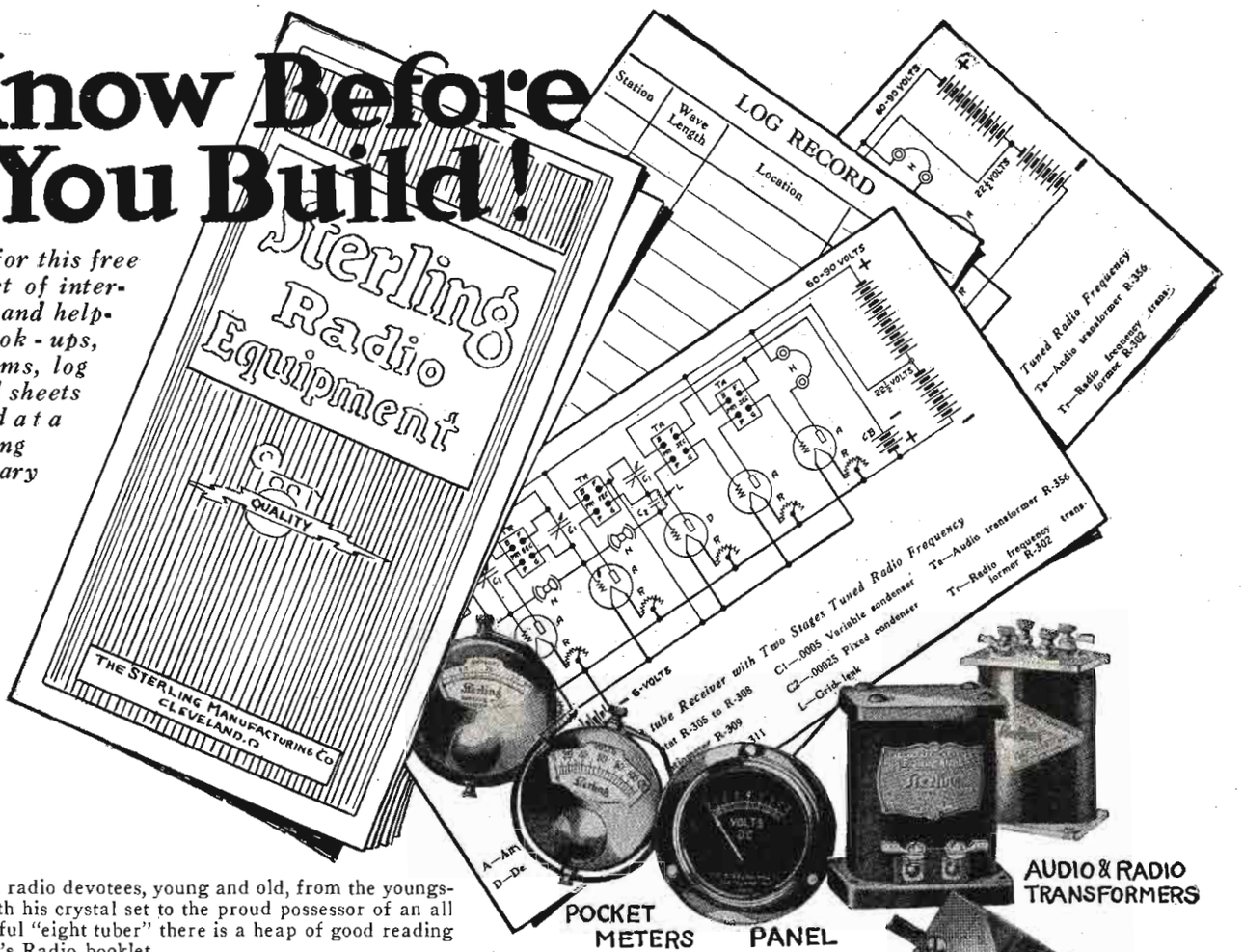
Then, if we multiply this value of R by the number of feet of wire in the coil, we will obtain the total resistance of the coil which is due to the wire only, neglecting distributed capacity.

RESISTANCE RATIO

This is very simple, but how to obtain the resistance ratio? A formula furnished by Dr. Lewis Cohen, of the U. S. Bureau of Standards, has been found to hold fairly well over a great range of frequencies. This formula, converted to a convenient form, is as follows:

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You may find just the information that will give your set the added zest and snap you've long been aiming to attain. Perhaps you've been testing your batteries with the wrong kind of meter—possibly not knowing that "cheap" meters are often worse than worthless. Not only do they give unreliable readings, but on account of their low resistance tend to exhaust the battery under test. You will be interested in learning how perfect amplification is accomplished, how to defeat distortion and what a vast difference the proper selection of audio and radio transformers make in the reproduction of both vocal and instrumental tones. All this and many other valuable suggestions are found in this booklet, which will enable you to secure better results from your radio set, and, at the same time, save the bother and expense of experimenting with untried apparatus or hook-ups.

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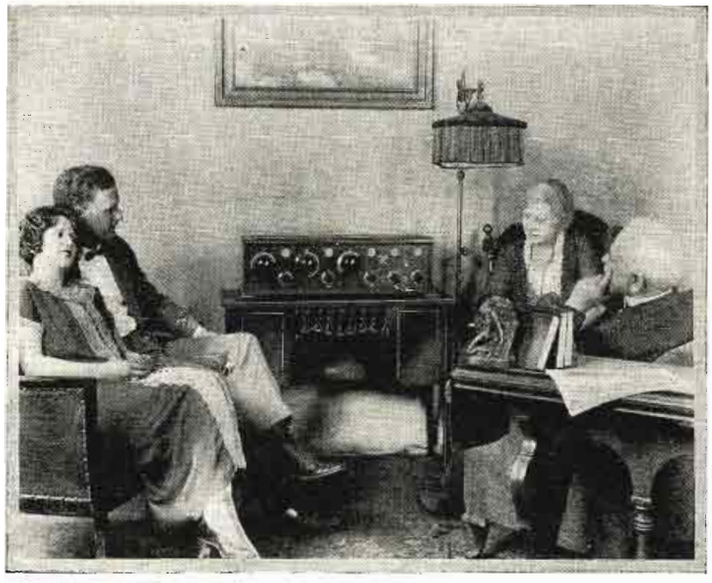
1aad, 1abf, 1aeg, 1ajo, 1ams, 1bbx, 1bdx, 1bhm, 1bic, 1bnl, 1cav, 1ccz, 1crj, 1cue, 1he, 1nt, 1oz, 1py, 1rf, 1zp, 1zv, (2agq), 2agw, (2aig), 2axf, 2bck, 2bkr, 2boo, 2brb, 2cee, 2ub, 2xd, (3bdo), 3bvl, (3cdk), (3gc), 3nf, 4dx, 4eb, 4eg, 4hw, 4my, 4tj, 4un, 5apc, 5cn, 5ek, 5ka, 5mi, 5wo, 5zai, 6ahw, 6anb, 6cgu, 6chi, 6pl, 7bvi, 7ij, 7qc, 9aad, 9adp, 9amp, 9aoo, 9bkj, 9bmx, 9bqh, 9bsz, 9bvn. 9cee, 9cgc, 9coc, 9cro, 9dga, 9dgy.
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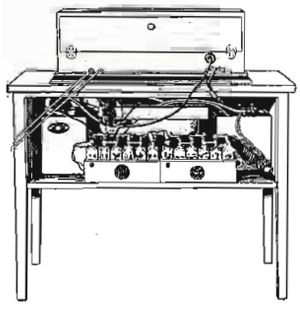
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New Console Has Its Own Perfect Loudspeaker!

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Write us for discounts and particulars of big newspaper advertising campaign.

Investigate!

Dealers everywhere are now showing the Windsor loudspeaker console, and have them for immediate delivery to your home. If you haven't already seen this remarkable contribution to radio enjoyment and convenience, write us now for the name of a nearby store where you may view it. We will also send you complete information. Remember, this console gives you not alone a marvelously faithful reproducing unit and sound-box, but an altogether new beauty and utility in the provision for your entire radio outfit. Mail coupon or postal.



(8)

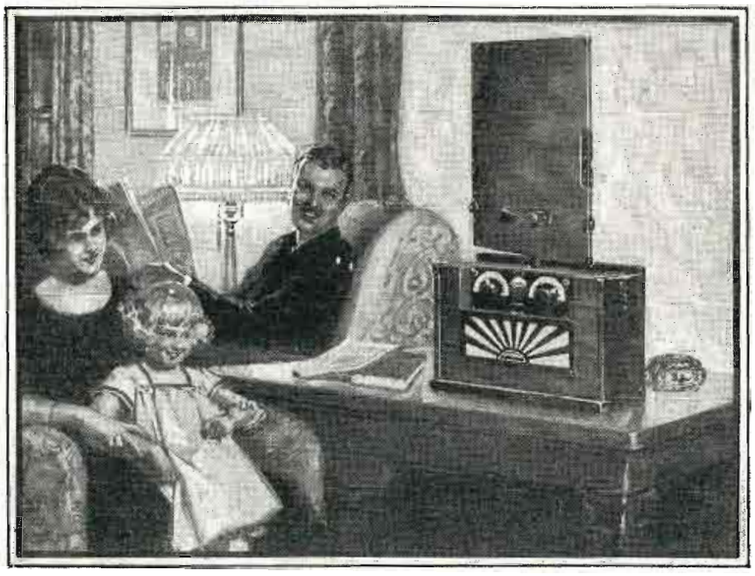
Windsor Furniture Company
1422 Carroll Ave., Chicago

Please furnish pictures and full details, also name of nearest dealer who has the new Windsor loudspeaker console.

Name .....

Address .....

Radio Upstairs-Downstairs Wherever You Go



A Powerful Long Range Set
Engineered to Compact Proportions

The widespread popularity of the 1925 Operadio is due chiefly to the fact that here is a receiving set of the highest efficiency, so compactly and skillfully designed that it may be used anywhere—upstairs, downstairs, or wherever you go.

Enclosed in a convenient case that may be closed and carried, and operating without outside wires or connections, the Operadio is the most convenient set a family can possess.

In the case, which measures 17 in. x 9 in. x 12 in., are contained six "A" batteries and four of the largest "B" batteries, loud speaker, six tubes and all parts. Radio and audio units are removable and contain all the finely adjusted parts in hermetically sealed containers. It is by such construction and design that the remarkable compactness of the set has been obtained.

The Operadio is a set the whole family will enjoy. Attractive in appearance, extremely simple to tune in on long-distance; razor-sharp in selectivity; and widely praised for its clear, natural tone, as well as its volume. Ask your dealer or write for full particulars.

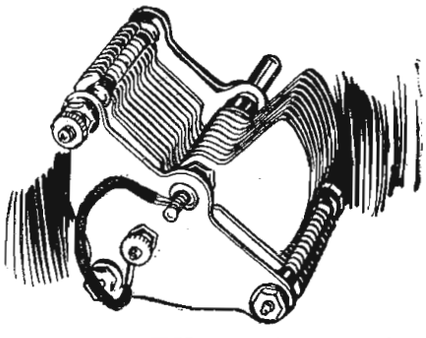
Dealers: Write or wire today for information about the Operadio franchise. There are big selling months ahead—profit by them.

THE OPERADIO CORPORATION
Dept. J **8 So. Dearborn Street, Chicago, Ill.**

No wires or Connections — **OPERADIO** — The Cover Is The Aerial

THE ORIGINAL SELF-CONTAINED RADIO SET

KELFORD CONDENSERS



(Low Loss – Variable)

Built by America's Oldest Manufacturers of Radio Parts

One of our big sellers, because the man who builds his own wants a real condenser. Note the remarkably low prices.

From 5 to 23 plate, from $2.00 to $3.00 list

Drop us a postcard for full description

The American Specialty Co.
170 Holland Avenue **Bridgeport, Conn.**

9elb, 9erm, 9bw, 9in, 9oa, 9oc, 9rr, 9su, 9ug, 9zb, 9ze.

SPARK—9aaw, 9acx.

FONE—5amf, 5amw, 5ana, 8bac, 8brc, 9adr, 9aoc, 9bsp, 9ctl, 9dsp, 9dvo, 9sb.

Wl send a crd to anyone who sends me one. Pse qrk? mi 5 watter.

WILLIAM ATKINS, 3723 EAST NINTH, KANSAS CITY, MO.

1ap, 1aea, 1aid, 1ajp, 1all, 1arr, 1aur, 1bgt, 1bkr, 1boq, 1bgq, 1cfv, 1civ, 1ckp, 1mu, 1my, 1sf, 1zz, 1?, 2bk, 2cu, 2gk, 2ku, 2mu, 2brb, 2btw, 2cee, 2cqg, 2cqz, 2xd, 3bg, 3oq, 3vh, 3ahp, 3ajd, 3bdo, 3bfe, 3bof, 3bpp, 3btu, 3bva, 4af, 4ai, 4ej, 4eq, 4fg, 4hl, 4jr, 4ll, 4me, 4oa, 4rr, 4sa, 5dn, 5cn, 5ek, 5gv, 5ka, 5nj, 5nn, 5nr, 5oi, 5rj, 5rh, 5sw, 5uk, 5un, 5wy, 5xw, 5za, 5zk, 5aai, 5aaq, 5acd, 5adv, 5ack, 5agq, 5ahj, 5ail, 5air, 5ajh, 5ame, 5amw, 5apg, 5beh, 5bek, 5zai, 6ft, 6gg, 6of, 6ry, 6lv, 6aao, 6aup, 6bqr, 6cmq, 6zbn, 6wt, 7fd, 7gk, 7gr, too many 8s and 9s to mention.

9BHH, DAVENPORT, IOWA

1ka, 1cpa, 1byc, 2by, 2cdk, 2brb, 3bnu, 3ws, 4cg, 4ai, 4au, 4cn, 4rr, 5agn, 5apc, 5ar, 5aw, 5ck, 5cn, 5ek, 5fm, 5gj, 5ka, 5kq, 5nk, 5qa, 5wi, 5xv, 5xw, 8abn, 8aeb, 8aee, 8agd, 8ajf, 8ajh, 8aih, 8amf, 8amu, 8anm, 8app, 8apy, 8apn, 8aq, 8aqo, 8art, 8atc, 8axf, 8bah, 8bgu, 8bil, 8bjt, 8bkh, 8blc, 8blr, 8bmb, 8bp, 8brc, 8bpv, 8bzc, 8bzf, 8cci, 8ced, 8cci, 8cia, 8ckm, 8cng, 8cnl, 8cmh, 8com, 8cta, 8cud, 8cwp, 8cwr, 8cwu, 8cyi, 8czf, 8dcb, 8dcd, 8dfo, 8dfv, 8dgf, 8dgo, 8dgp, 8dgt, 8dhi, 8dhs, 8dhw, 8dka, 8dla, 8dma, 8dmg, 8dmk, 8dmx, 8dnk, 8doo, 8dri, 8dvm, 8dzg, 8eb, 8ef, 8er, 8cs, 8gh, 8gz, 8hv, 8ir, 8mm, 8rj, 8uq, 8ux, 8vk, 8vu, 8wo, 8wx, 8xb, 8xs, 8xe, 8zg, 8zz, 9aal, 9aau, 9aaw, 9acq, 9abt, 9ado, 9adp, 9afk, 9afy, 9agl, 9ahy, 9aim, 9ajm, 9ajy, 9alb, 9alr, 9ale, 9alw, 9alx, 9amr, 9aob,, 9aoo, 9aor, 9ard, 9arf, 9arm, 9arp, 9ato, 9att, 9aub, 9auy, 9auw, 9avb, 9avq, 9awp, 9axd, 9axx, 9ayi, 9ayx, 9az, 9azx, 9awf, 9axn, 9baz, 9bbk, 9bcb, 9bcd, 9bcx, 9be, 9beg, 9ben, 9bfb, 9bhi, 9bhy, 9biu, 9bk, 9bkd, 9bkk, 9bkj, 9bmd, 9bmk, 9bmu, 9bmx, 9bpf, 9bpy, 9bqj, 9bre, 9brk, 9bsq, 9bss, 9bsy, 9btk, 9bty, 9buh, 9bwo, 9bwv, 9byc, 9bye, 9bza, 9cee, 9ccf, 9cfi, 9cfs, 9cdv, 9cdp, 9cgr, 9cic, 9cif, 9cii, 9cip, 9ckh, 9clz, 9cmn, 9coi, 9cow, 9cpi, 9cpz, 9cs, 9cvs, 9cxt, 9cxx, 9cyq, 9czo, 9dcp, 9dct, 9dbf, 9ddy, 9dfg, 9dfq, 9dga, 9dgn, 9djn, 9djd, 9dlc, 9dlm, 9dlw, 9dly, 9dmg, 9dnn, 9doa, 9dpx, 9drc, 9drr, 9dqe, 9dsl, 9dsv, 9dsx, 9dtt, 9dvu, 9dvw, 9dwk, 9dwy, 9dxn, 9dyn, 9dyy, 9efz, 9eky, 9elb, 9eld, 9em, 9es, 9fj, 9fk, 9hk, 9hp, 9hw, 9kd, 9le, 9mc, 9nk, 9no, 9pb, 9pq, 9qi, 9tg, 9uc, 9vc, 9vm, 9xb, 9xba, 9xbf, 9xl, 9yz, 9zb, 9zd, 9zk.

A card to any of above who send me one.

1PY, 34 ELLINGTON ST., LONGMEADOW, MASS.

4fs, 4ft, 4dv, 4dx, 4dy, 4io, 4jr, 4mb, 4mi, 4oa, 4qf, (4rr), 4sa, 4si, 4tj, 4xe, 4xx, 5ap, 5aw, (5ce), 5ez, 5ek, 5fa, 5ka, 5kg, 5ll, 5lp, 5mz, 5nj, 5oq, 5qh, 5qi, 5ru, 5uk, 5yd, 5xa, 5aaq, 5aef, 5afs, 5ags, (5agv), 5ame, 5apy, 5are, 6gt, 6ji, 6hs, 6pl, 6of, 6rn, 6ry, 6wt, 6adt, 6ahp, 6alu, 6avj, 6awt, 6atr, 6bbq, 6bkd, 6blw, 6bmv, 6buh, 6buy, 6bwl, 6cae, 6cef, 6cgw, 6cqe, 6crx, 6xad, 7gr, 7ij, 7qe, 7sf, 9es, 9fj, 9mq, 9ny, 9rc, 9wo, 9zd, (9ze), 9zk, (9aad), 9abc, 9age, 9agz, 9ahy, 9aio, 9aks, 9att, 9ayi, 9bbj, 9beg, 9bdu, 9biu, 9bjr, 9hmc, 9hsz, 9bxg, 9caj, 9cap, 9cbe, 9cbi, (9cca), 9cgr, 9cdv, 9cfi, (9ehc), 9cnb, 9ckm, 9ctg, 9dac, 9dau, 9dlc, 9dno, 9dmj, 9dpc, 9dpx, 9dsu, 9dzr, 9duo, 9eac, 9eas, 9ebq, 9eev, 9efy, (9elb), 9ell.

CAN.—1ar, 1dd, 2be, 2mv, 3dz, 3ly, 3om, 3vh, 4er, 4dy, 4io, 4hh, 5cn, 5go.

Additional calls on short waves: (nfv), nkf, poz, uft, zm, 52a.

1AKZ, GARDNER, MASS.

(3ach), 3acy, (3aih), 3bdo, 3buy, 3cdn, (3cel), 3ccx, (3cjn), (3cia), (3dk), (3du), 3js, 3qw, (3mf), (3yw), 4af, 4eg, 4eh, (4dx), 4eq, (4io), 4fg, (4pd), (4sb), 4si, 4su, 4xx, 5aaq, 5adv, 5aer, 5agv, 5ahw, 5ajn, 5akf, 5akn, 5amh, 5aw, 5cc, 5ek, 5ew, 5jf, 5nt, 5ka, 5qh, 5zk, 6cto, 6buh, 6gt, (8aaj), (8auh), 8aub, (8alf), 8apj, 8apn, 8apr, (8atz), (8ase), 8arw, (8asq), (8avx), (8ay), 8ben, (8bmi), (8boc), (8byn), (8bqn), (8cmt), 8ctr, 8dal, 8dem, (8dfm), (8dga), 8dgp, (8die), 8dlg, 8jw, (8nx), (8rv), (8si), (9aal), 9ael, 9agz, 9aib, 9amx, 9anh, 9aor, (9apd), 9arf, (9awf), (9azr), 9bbr, 9bcd, 9bqu, (9bgi), 9bie, (9biq), 9bis, 9bks, (9blg), 9bmk, 9bna, 9boy, 9bvn, 9caa, (9caj), 9cbz, 9cee, 9cey, 9cgm, 9che, (9cjc), 9cp, 9ct, 9ctr, 9cvr, 9czl, 9dae, (9dap), 9dct, (9dfq), (9djd), 9dlj, 9dpr, 9dsv, 9dwx, (9bsz), 9eje, (9eji), 9eky, 9esv, (9lil), 9hp, 9jg, 9pb, 9fj, 9qd, 9tw, 9uz, (9vc), (9ws), 9wy, 9ze.

CANADIAN—1ar, 1bq, (1ei), 2be, 3ad, 3co, (3ly), 3vh, 3wh, 3wv, vdm.

FOREIGN—1do, 1ht.

Qrk mi 5 water? All reports appreciated and qsl'd.

8DOQ, HUNTINGDON, PA.

(1adb), (1bal), (1cit), (1cmp), (2bkr), (2boo), (2buy), (2byg), (2cee), (2chu), (2cji), (2cnk), (2ctn), (2wz), (3uy), 4ji, 4kk, (4pd), 4si, 4xe, 5amh, 5anl, 5aqy, 5qz, 6ab, 6bbh, 6cgw, 6fm, 6ws, 6xad, 6zh, 7eo, (8aly), (8axf), (8bjz), (8boe), (8boy), (8bqi), (8bxd), (8ced), (8dal), (8dfe), (8dkf), (8dki), (8drc), 9aao, 9abn, 9aim, 9ala,



FROST
No. 161, $4.00
No. 171, $5.00
Aluminum Type

FONES
No. 172, $6.00
Genuine Molded Bakelite Type

FROST-RADIO

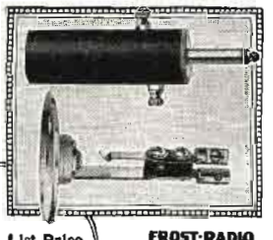
Ask Your Neighbor



FROST-RADIO PAN-TAB JACKS
Utterly unlike any other jacks. Frame serves as bracket for panel-hung assembly. All types.
70c to $1.00 list



FROST-RADIO BAKELITE SOCKETS
Have sponge rubber cushion; non-microphonic. Standard base or C-299 UV-199 type. Panel or table mounting. **List; $1.25**



List Price $1.50

FROST-RADIO LOOP PLUG AND JACK



FROST-RADIO BAKELITE SOCKET
Standard base socket, heavy duty radio-frequeney type. Duplex contacts are self-cleaning.
List Price, 65c



FROST-RADIO MUSETTE UNIT
An aluminum unit which converts any phonograph into a fine loud speaker. Wonderfully clear tone, plus volume. **List; $5.50**



FROST-RADIO TUBE CONTROL UNIT

List Price $1.75

YOU want dependability above all else in your radio parts and accessories. **FROST-RADIO** is guaranteed to give long service and complete satisfaction. We do not qualify this guarantee in any way. **You are to be the sole judge of FROST-RADIO quality.**

How often have you wished that some manufacturer would offer a complete line of radio parts and accessories? **FROST-RADIO** is first to supply this demand with **FROST-FONES, FROST-RADIO** Musette, and Musette Unit, **FROST-RADIO** Plugs, Jacks, Sockets, Rheostats, Potentiometers, Switches, Adapters, Antenna, Protectors, Jac-Boxes, Extension Cords, Tube Control Units and many other products.

On this page we illustrate but a few of the new items in this well known line. Upon request to Dept. 10F501 we will gladly send you a copy of the 48-page **FROST-RADIO** Catalog. Or ask your neighborhood dealer for a copy.

HERBERT H. FROST, Inc.

154 WEST LAKE STREET, CHICAGO, ILLINOIS.
NEW YORK CITY CLEVELAND KANSAS CITY LOS ANGELES

Thousands of dependable dealers throughout the United States and Canada carry **FROST-RADIO** *in stock. See your neighborhood dealer today for what you need with your receiving set*

FAHLBERG
MADISON, WIS.

Safe-quick Soldering at home on the Xmas set

Reddy HOT

Soldering Furnace

(Burns Denatured Alcohol)

and TESTED SUPPLIES

Do Professional Soldering Jobs at Home

WHEN Mr. Fahlberg, manufacturer of Reddy Hot Soldering Furnaces and Supplies, brought out this outfit, it was to place in the hands of the amateur the same scientifically prepared materials that were formerly used only in the manufacturers' laboratories. The Reddy Hot home soldering outfit is complete—weighs only 20 oz.—all you have to do is buy a few ounces of denatured alcohol and start to work.

Hot Irons in 2 Minutes with this Complete Outfit!

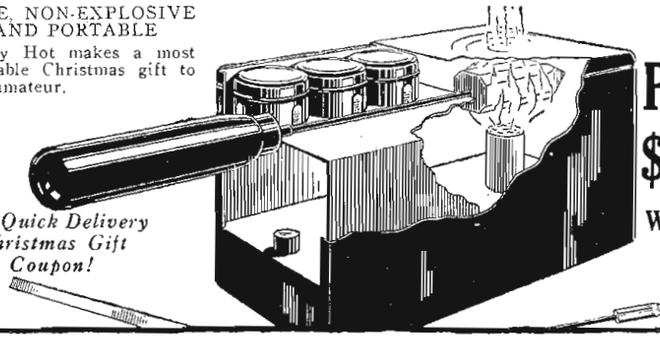
No longer is it necessary for the amateur to worry with bunglesome makeshift irons. Reddy Hot has one delicate copper for fine radio work, another bigger iron for general household purposes—equipped with detachable handle. Each furnace is equipped with *one generous ingot of Reddy Flo Houshold Solder* (highest grade on the market) *one ingot Reddy Melt Electrical Solder*, a special bismuth alloy which melts readily at low temperatures, *one can Reddy Stik Soldering Flux*, guaranteed to be non-corrosive and specially adapted to amateur use, as it provides a surface easily wet by the solder.

There is also one can Reddy Prest Sal Ammoniac to keep your soldering tip clean and bright and one book of Reddy Rub Abrasive Tape for quick cleaning and polishing.

E. D. FAHLBERG MFG. CO.
MADISON, WIS.

SAFE, NON-EXPLOSIVE AND PORTABLE

Reddy Hot makes a most desirable Christmas gift to any amateur.



Price $1.50

Wt. 20 oz.

Use Quick Delivery Christmas Gift Coupon!

E. D. FAHLBERG MFG. CO., Madison, Wis.

Send me prepaid one Reddy Hot Soldering Furnace for which I enclose $1.50.

My dealer's name is .....

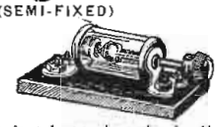
Signed: Name .....

Address .....

Whiz Bang! Detector

(SEMI-FIXED)

Ideal for REFLEX and CRYSTAL Sets.



A detector that is fast becoming the leading instrument in the Radio World. Every spot is sensitive; and produces clear, mellow and loud reception. Guaranteed. Sent C.O.D. to any part of U. S.—or money orders accepted in advance. We pay postage.

75c Each

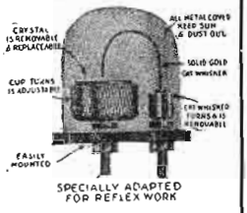
FEDERAL RADIO PRODUCTS CO.
712 Broadway Schenectady, N. Y.

The "LINCOLN"

Enclosed Fixed Adjustable Detector

Kills your Reflex Troubles

New List Price **$1.50**



Manufactured by

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Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

9CDB—William W. Bradley, Lewellen, Nebr. 10 watts C.W., I.C.W. and phone. Pse QSL. All crds answd.

9CDZ—M. R. Williams, Skidmore, Mo. 5 watts I.C.W. All crds QSL'd.

9CEO—Ferman H. Karr, Quitman, Mo. 5 watts I.C.W. All crds QSL'd.

7UB—Perry Wonacott, 536 Liberty St., Silverton, Ore. 5 watts A.C.C.W. All crds answd.

9BQT—(re-assigned) E. William Hesher, 213 So. 7th St., Decatur, Ind. All crds answd.

9BXS—Emmet L. Anderson, 221 Bay Shore St., Marinette, Wis. 5 watts C.W. Will QSL all crds.

8DRV—R. C. Wendler, 5736 Field Ave., Detroit, Mich. 10 watts C.W., I.C.W. and phone.

9AJI—Kenneth Benson, Box 29, Winchester, Ind. RR8. 5 watts C.W., I.C.W. and phone. Will QSL all crds.

8BSR—(re-assigned) L. F. Strobel, 680 Yale St., Akron, Ohio. 5 watts A.C.C.W. Pse QSL. All crds answd.

9AHF—Albert W. Johnson, P. O. Box 202, Wakefield, Nebr. 5 watts C.W., I.C.W. and phone.

9BHH—Leo Junge, 224½ East 3rd St., Davenport, Iowa.

8CDB—Robert J. Wood, Tioga County, Knoxville, Pa. 10 watts C.W., I.C.W. and Fone. Pse QSL. Wl answer all crds.

5ANJ—Glenn C. Grimes, Tuttle, Okla. All QSL's appreciated and answd.

9CEC—Delbert R. Bartsch, 228 N. Main St., Galena, Ill. 50 watts C.W. and Fone. All crds answd.

9BZX—William Dittenhofer, 807 Summit Ave., St. Paul, Minn. 10 watts C.W. All QSL's appreciated and answd.

9RT—J. G. Smith, 325 East Parkway, Columbia, Mo.

9ADB—Robert Knapp, 2006 Garrard St., Covington, Ky. 5 watts D.C.C.W. Pse QSL. All crds answd.

3AGF—A. G. Shafer, 5526 Ridgewood St., Philadelphia, Pa. 5 watts C.W. 77 meters. Reports appreciated and acknowledged.

1ACD—Perry Huntington, 245 Whiting Lane, West Hartford, Conn. 5 watts C.W. and Fone. All QSL's answd.

6BOM—Herbert Perry, Dorm Polytechnic School, San Luis Ohispo, Calif. 10 watts C.W. All crds answd.

Calls Heard

F-8CY, ROGER BURLET; 22 RUE DE SILLERY, REIMS, MARNE, FRANCE (DET. AND A. F.)

1avr, 3bg, 1bkr, 1cpo, 1cln, 3cp, 8pl, 1bgq, 2gk, 3bva.

9AXJ, 300 N. PLEASANT ST., INDEPENDENCE, MO.

2jc, 2xd, 3bcm, 4my, 5amf, 5amw, 5an, 5ana, 5ap, 5ay, 5bz, 5fs, 5hr, 5io, 5jf, 5ka, 5nj, 5pn, 5rm, 5sp, 5sw, 8aed, 8anb, 8awt, 8bac, 8brc, 8btf, 8btu, 8cea, 8ced, 8cmt, 7cnl, 8cwu, 8dgl, 8dgt, 8dhs, 8dlc, 8dmx, 8er, 8fuz, 8vq, 9aan, 9aau, 9aaw, 9acl, 9ago, 9adk, 9ado, (9adr), 9agc, 9aku, 9amb, 9ane, (9aoc), 9aog, 9aqq, 9arr, 9as), 9asz, 9atn, 9auz, 9awm, 9aye, 9ayl, 9bcj, 9bdu, 9bdy, 9bg, 9bkk, 9bm, 9bmk, 9bnn, 9bsb, 9bun, 9bvi, 9bvk, 9bvn, 9buz, 9bx, 9bxg, 9cbq, 9cdo, 9ce, 9cee, 9cer, 9ces, 9cez, 9cfi, 9cfk, 9cfs, 9cgw, 9cje, 9ckm, 9cmf, 9co, 9ctb, (9ctl), 9ctr, 9cyh, 9cze, 9dac, 9day, 9dbs, 9dcd, 9dcw, 9dds, 9ded, 9del, 9dfg, 9dgb, 9dgn, 9diy, 9duv, 9dkv, 9dl, 9dlm, 9dls, 9dly, 9dmx, 9dng, 9dox, 9dpc, 9dsd, 9du, 9dup, 9dur, 9duv, 9dvd, 9dvm, 9dvu, 9dvw, 9dwb, 9dwk, 9dwv, 9dwx, 9ecn, 9efb, 9bfo, 9eky,

CIR-KIT Makes the Greatest Circuits Easiest to Own

In a motor car—the engine. In a skyscraper—the substructure. In a radio receiver—the circuit. The circuit, Erla knew, must be the foundation of finest possible radio. So Erla first evolved those particular circuits which have ever since been rated most powerful, tube for tube, a result inherent only in Erla principles. And today the trend in radio clearly indicates that Erla Supereflex circuits may be selected in full confidence of continued pre-eminence.



That these fundamentally superior circuits are at the same time also easiest to construct, with utmost economy, is another epochal Erla attainment, made possible by the Erla *CIR-KIT*. With *CIR-KIT* you yourself can construct Erla Supereflex circuits from genuine Erla Precision Radio Apparatus, specially designed to assure the most efficient functioning of Erla Supereflex principles.

Erla *CIR-KIT* supplies everything needed, in a factory-sealed carton, sold under warranty. Erla Synchronizing Transformers, Erla Miniloss Condensers, Erla Precision Rheostats, Erla Cushion Spring Sockets, Erla Tested Crystals, and all the other matchless Erla units are provided. You can assemble them with perfect results virtually guaranteed by full-sized blue prints, drilled and lettered panel, stenciled baseboard, precisely locating every unit and connection. There is no soldering, thanks to Erla Solderless Connectors. Pliers and screwdriver alone are needed to bring you the de luxe radio of Erla Supereflex circuits, at lowest possible cost.

ELECTRICAL RESEARCH LABORATORIES
Department J, 2500 Cottage Grove Avenue, CHICAGO



Secondary output windings of high impedance make Erla Push-Pull Transformers, exclusive in design, best suited to high resistance loud speakers. $10 per pair.



Only the special spring arm, perfected bearing and winding of Erla Precision Rheostats permit such supersensitive control. Single-hole mounting preserves factory adjustment. $1.10.



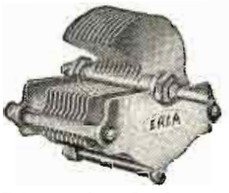
Neatest, most convenient in form, Erla Autogrip 2-Way Phone Plugs assure smoothest connection of tips and most positive contact, with no manipulation. A typical Erla improvement. 75c.



Exclusive in having their correct rectification value pre-determined at the factory, Erla Fixed Crystal Rectifiers of highest stability, are most dependable for the clearest reception.



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Combined solely in Erla Indestructible Sockets are Bakelite base, metal sleeve, and special tilted double cushion springs for perfect wiping contact, and prong protection. Prices 65c—75c.



Without Erla exclusive design and precision methods, it would be impossible to guarantee Erla Fixed Condensers accurate within 1% of rated capacity. Made in 11 sizes. Prices 35c to 75c.

ERLA

Circuits of Certainty

The MOZART Baby GRAND
Radio Reproducer



You Gave the Best

No piece of radio apparatus even in its price class is the best because its maker says so or because its dealer says so. It is only the best when everybody else says so as well.

"To say I was surprised is putting it mildly. It is the best I have ever had and I have had the ——— and others. Am going to recommend the M-G. I like to help a company that is on the square and gives everybody their money's worth."

(Signed) A. S. Kay, Charleston, West Virginia.

Baby Grand Reproducer, with gold plated unit, black and gold crackle or extra heavy coated all black satin finish (approx. 12" bell)	$12.00
Baby Grand Reproducer, with nickel plated unit, black satin finish (approx. 11" bell)	10.00
Electro-magnetic unit (fits almost any horn or phonograph) with cord, nickel plated	4.00
Gold plated	5.00
Mozart Special Headset	6.00

No extra batteries required.

ORDERS. If your dealer cannot supply, order direct.

TRANSPORTATION. Single shipments, strictly F. O. B. factory. Free on two or more orders for each item.

GUARANTEE. One year from date of purchase or money back in ten days.

The MOZART-GRAND CO.

Manufacturers of Fine Instruments

Newark, N. J. U. S. A.

Use "RAGEMCO" Tools to Build Better Radio Sets



WIRE BENDING TOOL

For making eyes, loops, beads, and offsets on Bus Bar wire. With this device any Radio Constructor can wire his set to compare favorably with any factory made set. Easier to use and more accurate than pliers. Full directions in box. Made of heavy steel, blued and finished.

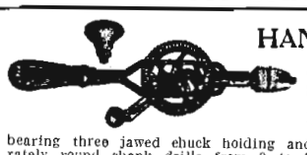
GR-203—Price $1.00



TOOL CHEST

Set consists of "LOCK-GRIP" master handle, 5" long, black Rubberoid finish with steel chuck, nickel plated, buffed and with the following 9 tools: Saw, bradawl, large screwdriver, file, scratch awl, gimlet, reamer, chisel, small screwdriver. Each tool of fine steel, drop forged, tempered, hardened, and nicely finished. Set comes in leatheroid box with tray.

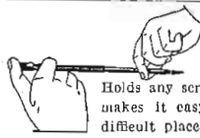
GR-703—Price $1.85



HAND DRILL

The hardwood handle is hollow to store drills. Iron frame, nickeled parts, ball bearing three jawed chuck holding and centering accurately round shank drills from 0 to 3/16. Length of drill, 12 inches.

GR-303—Price $2.25



SCREW STARTER and DRIVER

Holds any screw by its slot with a firm grip, makes it easy to place and start screws in difficult places. Just the tool for the Radio Construetor. All parts heavily nickeled and polished.

GR-304—Price $1.00

ORDER BY ORDER NUMBER

THE RADIOGEM CORP., - - - - 66-R-W. Broadway, New York City

another British amateur, Goyder, heard his call G2FZ, being sounded by the New Zealand amateur, Z2AG. The message from the far Pacific was:

"Please convey to the Radio Society of Great Britain greetings from New Zealand."

The Colonial man also asked Mr. Goyder to tell Mr. Simons that his signals were reaching New Zealand strongly.

THE OTTAWA AMATEUR RADIO ASSOCIATION

The Ottawa Amateur Radio Association, with headquarters in Ottawa, Ontario, Canada, is carrying on a most interesting course of radio broadcasting activities in the Canadian Capital as a definite community enterprise. The Ottawa organization is now entering upon its second year of operations with its own broadcast studio, station CKCO, as a strictly community venture established and financed by the association and offering a wide range of concerts from Sunday church services to regular weekly musical programs with an occasional public meeting or sports event, the concerts being in both English and French.

The association, has a membership which is rapidly growing to the 1,000 mark, making it one of the largest locally-centered radio organizations, and has opened new club rooms at 113 Bank Street, Ottawa, where there is a hall for technical lectures, meetings and other club gatherings. There is also a reading room in which radio literature is on file. During the next seven or eight months, the association will give a series of weekly practical talks and demonstrations, these being held Friday evenings. The regular weekly concerts are broadcast every Tuesday evening, with church services on Sunday nights, followed by sacred programs.

The president of the Ottawa organization is Dr. G. M. Geldert, a well-known local medical man, at whose residence, 282 Somerset Street West, the association's studio is situated. Incidentally, the power of this station has just been increased from 50 to 100 watts, operating on a 400 meter wave-length. The policy of the association is outlined by Dr. Geldert, is to give every possible group of citizens in the Canadian Capital an opportunity to make appropriate use of radio and to offer co-operation for all local events. To overcome the prejudice of musical bodies or service clubs against radio in the light of a competitor or counter-attraction for special recitals or performances, Station CKCO has made the standing offer to all religious, charity, club or orchestral units to broadcast their theatre or other programs without advance notice or announcement that such will be done, such broadcasting to be conducted as a surprise feature and in a way that will not detract from actual attendance at the shows or events.

The Ottawa Amateur Radio Association held its second annual trade show in a downtown building during the week of November 3, with many Canadian radio manufacturers and distributors, as well as many local retailers, having special exhibits.

NEW QRA's

4VQ—William M. Perkins, Box 345, Clinton, S.C. 5 watts I.C.W. Pse QSL. All crds answd.

8LV—Howard MacGuire, 4222 Allendale Ave., Detroit, Mich. Pse QSL. All crds answd.

4XE—4IU—William Justice Lee, P. O. Box 345, Winter Park, Fla.

9HP—R. A. Gerrard, 308 Birchwood, Louisville, Ky. 20 watts C.W. All crds answd.

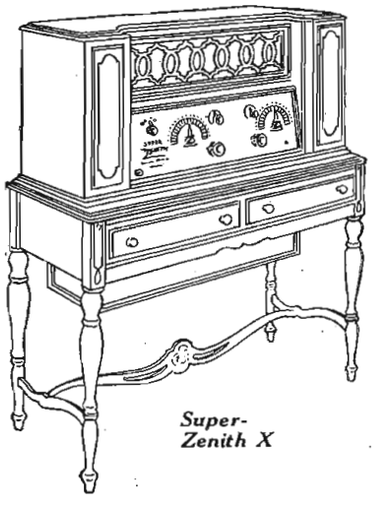
ZENITH RADIO

TRADE MARK REG.



Super-Zenith VII—the ideal radio set for the fine home

They Cost More
But They Do More



Super-Zenith X

Each station comes in at the same point on the dial, *always*

You don't need to be a "radio engineer," and you don't need to have three hands, to operate the new Super-Zenith. Tuning is controlled by ***two dials only***—so perfectly adjusted that each station comes in always at the same dial settings. ***It never varies.*** Powerful locals may be on full blast, yet, if you like, you can tune them out completely, choose the distant station.

Those who know and appreciate truthful tone reproduction find in the new Super-Zenith an unfailing source of delight. Their pleasure is all the greater from the fact that even when silent the Super-Zenith lends to its surroundings charm and distinction.

Write to us for the name of the nearest dealer from whom you can obtain a demonstration of this outstanding marvel of the radio world.

Dealers and Jobbers: Write or wire for our exclusive territorial franchise

ZENITH RADIO CORPORATION

Executive Offices: 332 South Michigan Ave., Chicago

ZENITH—the exclusive choice of MacMillan for his North Pole Expedition —Holder of the Berengaria Record

THE complete Zenith line includes seven models, ranging in price from $95 to $550.

With either Zenith 3R or Zenith 4R, satisfactory reception over distances of 2,000 to 3,000 miles is readily accomplished, ***using any ordinary loud speaker.*** Models 3R and 4R licensed under Armstrong U.S. Pat. No. 1,113,149.

The new Super-Zenith is a six-tube set with a new, unique, and really different patented circuit, controlled exclusively by the Zenith Radio Corporation.

It is NOT regenerative.

SUPER-ZENITH VII—Six tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—44⅞ inches long, 16¾ inches wide, 10⅝ inches high. Compartments at either end for dry batteries. Price (exclusive of tubes and batteries) $230

SUPER-ZENITH VIII—Same as VII except—console type. Price (exclusive of tubes and batteries) $250

SUPER-ZENITH IX.—Console model with additional compartments containing built-in Zenith loud speaker and generous storage battery space. Price (exclusive of tubes and batteries) . . $350

SUPER-ZENITH X—Contains two new features superseding all receivers. 1st—Built in, patented, Super-Zenith Duo-Loud Speakers (harmonically synchronized ***twin*** speakers and horns), designed to reproduce both high and low pitch tones otherwise impossible with single-unit speakers. 2nd—Zenith Battery Eliminator, distinctly a Zenith achievement. Requires no A or B batteries.
Price (exclusive of tubes) $550
Price (without battery eliminator) $450

All Prices F. O. B. Factory.

Zenith Radio Corporation
Dept. 1B
332 South Michigan Avenue, Chicago, Ill.

Gentlemen: Please send me illustrated literature giving full details of the Super-Zenith.

Name .....

Address .....

.....

AMRAD

"The Voice of the Air"

Presents a New

NEUTRODYNE

Two Dials, Five-Tubes

The Neutrodyne is the undisputed leader among broadcast receivers. It's one handicap (shared by other sets) has been that the *powerful models*—capable of producing adequate volume and that fine, clear tone—had to be controlled by *three* tuning dials operated more or less simultaneously.

To meet the demand for simplicity of operation (people have but two hands to use in tuning), the AMRAD Neutrodyne is offered. Here, for the first time, *easy control* (only two dials) and *real power* (five tubes) are combined.

If your dealer cannot demonstrate, send to Dept. N for Folder 520 describing *four other outstanding features* of this truly wonderful Set and why you should have one in your home.



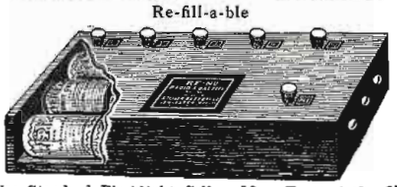
Price Only $85

AMERICAN RADIO AND RESEARCH CORP.

AMERICAN RADIO & RESEARCH CORPORATION LICENSED BY INDEPENDENT RADIO MANUFACTURERS INC. NEUTRODYNE TRADE MARK REG. U.S. PAT. OFF.

Dept. N
MEDFORD HILLSIDE
MASS.

RE-NU Radio "B" Batteries
Re-fill-a-ble



Use Standard Flashlight Cells. More Economical. No Soldering—No Springs. Made for 22.5 and 45 volts
Send for free descriptive literature.
STEINER BATTERY CO., Lancaster, Ohio

SUNSET REFLEX CRYSTALS

Clarity, sensitivity, distance—the prime qualities of the wood-metal mounted Sunset Crystal. Hook one up to your reflex circuit. **50c**



Granular Galena in Bulk.
Mfrs., Dealers, Jobbers: Write for Proposition.
U. S. MFG. & DIST. CO.
45 CLINTON ST. NEWARK, N. J.

RADIO SETS at BARGAIN PRICES



Our Big *Free* Catalog opens the door to many amazing values in *Radio* Sets. Anything you want at wholesale prices direct to *you*.
Send for Catalog
International Body Works
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SOLDER WITH INSULATION
At Least 1,000 Miles More Distance



is the usual reward if you can solder without impairing the insulation of your set.
If you are building a radio-frequency amplifier you should read our free booklet:
"HOW TO SOLDER RADIO SETS"
Write for It
THE VALLEY FORGE CHEMICAL CO.,
Valley Forge, Pa.

Banker, 300 11th Street, N. E., Washington, D. C., got into direct communication with Z-4AG operated by Ralph Slade at Dunedin, New Zealand. 3BHV hearing Z-4AG CQ with mag. for U. S. A. called him on 10 watts, but receiving no answer took down the 10 and had 50 watts working within the space of five minutes after the first call; Z-4AG came back, gave "OK" but unluckily the "A" battery, which was nearly down the night before, gave up the ghost. The communication would have ended right then and there had not 3BHV given Z-4AG a long call in about three minutes, telling him to "QRX for a couple of mins. as A bat. dwn." When a new "A" battery was substituted, Z-4AG was called again. He immediately came back with "OK QSA hr —" No doubt 3BHV's signals were QSA, otherwise Z-4AG would not have been able to QRX for such a long time and come back so quickly. On the first attempt of Z-4AG to shoot over the message it was "ND" on 3BHV's part, as bad induction QRM prevented it. However, on the second try, 3BHV got it O. K., and the message read as follows: "To K. B. Warner, Hartford, Conn., from Biele, U-2AOS. See u in Hartford January.—Sig. Biele."

The conversation between the two was carried on until 6:35 a. m., when 3BHV had to QRT for breakfast. Z-4AG was worked from 5:15 to 6:35 a. m., or one hour and 20 minutes. At 6:35, while Z-4AG was signing off, he actually came in so loudly that his signals were easily readable throughout 3BHV's room on two steps of audio frequency. The transmitter at 3BHV consists of 50 watts in a coupled Harley circuit radiating 1.5 amperes at 78 meters. The transmitter was hooked up for the first time five days before working Z-4AG and previous to that time had worked nine "6's" and three "7's" and 12 Pacific Coast stations. 3BHV has also worked Mexican 1B in Mexico City on the low waves. More power to you OM.

FRENCH DX

Mr. Menars, French amateur, 8FJ, sends his DX report, which is as follows: "On October 8, I received on my three tube receiver U6CEU in the Hawaiian Islands, sending on 80 meters. The distance between U6CEU and my station is 9,062 miles. Altogether, I have received 690 American and Canadian amateur stations, stations CB8 of Buenos Aires, and IHT, an Italian ship, then in the Atlantic Ocean near the coast of Argentine. I have also received 1B, an amateur station in Mexico, seven Cuban stations, and WNP.

MORE FRENCH DX

Mr. Pierre Louis' station has recently been heard in Argentine by Mr. Pierre Moizeux, a French radio engineer in charge of some work at the high power station of Monte Grande. Mr. Moizeux installed a short wave receiver for his own use and heard F8BF while it was working on 108 meters with a power input of 130 watts. The distance between the transmitter and the receiver is 6,930 miles.

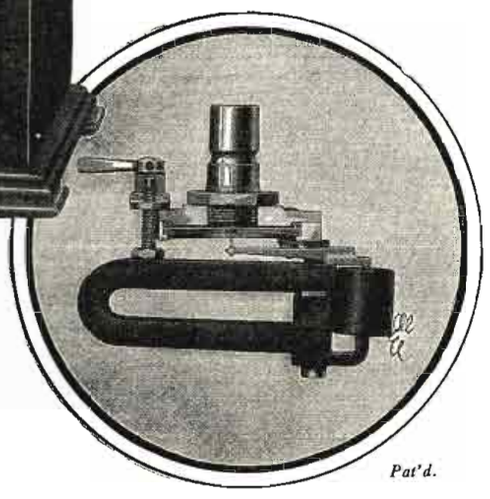
BRITISH AMATEURS GET INTO COMMUNICATION WITH NEW ZEALAND

The 13,000 miles separating London and New Zealand was bridged recently for the first time by radio when two British amateurs exchanged radio messages with low powered home-made apparatus.

The Radio Society of Great Britain announced this feat, naming E. J. Simons, call letters, G2OD, as the man who succeeded in working New Zealand. Mr. Simons first hearing the call letters Z2AG calling an American amateur, and realizing that Z2AG was 13,000 miles distant, got into communication with him. Later the same night



Model "C"
Cabinet Type
$30.00



Pat'd.

The New Cabinet Model

FOR those who admire the full, round, musical voice of the Audiophone, but prefer a cabinet design, we have brought out this splendid model.

The case is of real mahogany, of a character to give it equal fellowship with your grand piano. The design goes nicely with the most tasteful furnishings. The size, 17 x 10 x 10¼, is just right for the top of your phonograph or your receiving set.

It has the sound mechanism of our Model "S," but its square design gives it a sweetness of its own.

The Voice of the Audiophone

Not A "Phone Unit"

The voice of the Audiophone is not a "phone unit." It is a highly developed, electro-magnetic tone reproducer. This results in an instrument which reproduces with natural quality in most powerful tones, yet has a sensitiveness equal to any loud speaker developed.

The Bristol line includes five Audiophones priced from $12.50 to $30.00. If not at your dealer's, write for Bulletins No. 3022-S.

THE BRISTOL COMPANY
Waterbury, Conn.



Model "S"
AUDIOPHONE
$25.00
Rubber horn 14½" diameter. Velvet mat finish of mottled bronze and gold; classic base.

Bristol
TRADE MARK
AUDIOPHONE
REG. U. S. PAT. OFFICE
LOUD SPEAKER

BI METALLIC



"The Phone of Wonderful Tone"

THE only phone made with gold plated diaphragms.

Gold, being one of the best known conductors of sound waves, and the shellaced mica diaphragms—used in other headphones—being poor conductors, naturally the tone of the Bi-Metallic is unrivalled for clarity and exact reproduction.

Greatest Value Head Set That Money Can Buy

Here are just a few of the outstanding features that are definite evidence of the superiority of Bi-Metallic Headphones. You will discover many other superior qualities by comparing them with other phones.

Gold Plated Diaphragms

Perfectly Matched and Balanced **Unusually Durable**
Built for Real Comfort **Absolutely Guaranteed**

The "Gold-Plate" Line



Bi-Metallic Gold Plated Bus Bar—Gold Plated aerial wire—and the Domino Lead-In, equipped with wing-nuts for easy attachment and Valspared against all weather conditions. Get the "Gold-Plate" line at your dealer's. Free literature on request.

JOBBERS *Desirable territory is available to responsible jobbers. Only one jobber appointed in each district. We have an interesting proposition. Write us.*



The diaphragm is gold-plated

BI METALLIC RADIO PARTS CORP.

482 Eighteenth Avenue, Newark, N. J.

Young Men—Turn Your Spare Hours Into Money!

Earn big profits, prizes, and awards selling RADIO NEWS, SCIENCE & INVENTION, THE EXPERIMENTER, and MOTOR CAMPER & TOURIST in your neighborhood. We train you as our salesman and pay you liberally for your time. Write at once and we will help you to get started.

M. BRIDWELL

THE EXPERIMENTER PUBLISHING CO., 53 Park Place, NewYork,N.Y.

how much reserve space is provided over the plates and how much the battery is used). The addition of anything else but pure water will positively do harm. It will either reduce the capacity of the battery or its life, or both, and this is true even though a "dope" electrolyte may temporarily give the battery a false capacity. The temporary increase is due to the use in the "dope" electrolyte of a stronger solution of sulphuric acid than can be safely employed. Any battery maker could use such a strong solution; its increased cost is infinitesimal, but it stirs the active material to over activity for a little while and then renders it inactive forever. No matter how enticing the claims for some marvelous "dope" electrolyte may seem, see that nothing but pure water is ever added to your storage battery.

Storage batteries are a radio necessity because the first essential of clear and distant radio reception is strong, unbroken, non-rippling current, without hum or buzz, and at practically constant voltage. Only storage batteries deliver this.

The romance of radio lies in its lack of restriction, the ability to tune in Chicago or Philadelphia or Atlanta at will, the ability to suit the reception to the mood, to bring in the greatest dance orchestras of the country in lighter moments, or grand opera, a sermon or a lecture when in more serious vein.

Bringing in a distant station is often a matter of nip and tuck. If everything is not just right, you don't get it. You may not go after distance every night, but when you want distance, you want it badly. Perhaps it is a convention in Cleveland or New York, perhaps the President is speaking in Washington. Every week there are one or two major radio events that you want to tune in on. Nothing will help you more to get the full range, clearness and power out of your set than good storage batteries.

Suggestions that Improved One Five Watter

(*Continued from page* 1169)

coupled transmitter causes less interference with other amateurs and broadcast listeners, and transmits less key thumps, to which so much objection has been recently raised. Also harmonics are reduced to a minimum. In addition, as I have gathered from the opinion of different Supervisors of Radio, and other men of experience, it is the general decision to demand the use of inductive coupled arrangements, and this to be required by law, in the very near future. If you are using a reversed feed-back circuit, you can, with the addition of another coil, and a few changes in the circuit, even if the job is "haywire," realize an increase in antenna current and nine-times out of ten greater and more consistent DX. The coupled Meissener is more efficient than any direct coupled arrangement, so why dissipate time, money and patience on inferior arrangements?

Hamitorial

(*Continued from page* 1168)

for the manufacturer and we Hams need him almost as badly as he needs us. In fact, everything appears to be the "microbes' new stilts"—the best ever.

Now, don't things look rather glorious?

L. W. Hatry, 5XV.

TWO WAY DX RECORD

On the morning of October 17, radio station 3BHV, owned and operated by R. E.







Three B Batteries

Another example of the Westinghouse policy of meeting the customer more than half way is illustrated by the three types of B Batteries which are offered for his choice.

On the left is the 22-MG-2, a 22½ volt, glass-cased battery of 1200 milliampere hours capacity. In the center is the 24-RG-2, also glass-cased but larger in capacity; 3500 milliampere hours, 24 volts. On the right is the 22-LG-2, our largest B Battery, 22½ volts, 6000 milliampere hours capacity.

No matter what your set, you can find a Westinghouse B Battery to fit it; all rechargeable and all in glass cases. Sturdy, durable and good looking, they are as good as they look.

A Batteries in glass cases in 2, 4 and 6 volt units, and three capacities of 6 volt units in one-piece composition cases. A 6 volt C battery in a glass case completes the Westinghouse Radio line.

WESTINGHOUSE UNION BATTERY COMPANY
SWISSVALE, PA.

Distributor for South America, Mexico and Cuba
THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY
Mexico City, Buenos Aires and Havana

Distributor for Canada
CANADIAN WESTINGHOUSE CO., LTD.
Offices in all principal Canadian Cities

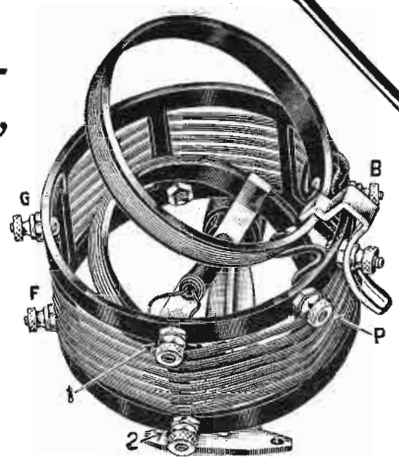
WESTINGHOUSE
RADIO
"A," "B" and "C"
BATTERIES

"B-T for Mine—
For a Radio Good Time"

Says W. Phillips of St. Louis, on Sept. 3rd, 1924, and adds:

> "I am absolutely sold on the B-T tuner and condenser. I enclose a list of stations in all parts of the country to which I listened on the evening of Labor Day.
> I was indeed surprised to hear KGO at this time of the year, using only one stage of audio and the headphones. Had the family not retired, I could have put them on the loud speaker."

He is one of thousands who have known B-T products for originality and excellence and used them with the satisfaction found only in quality.



The "B-T" is the first Low Loss Short Wave Tuner. Type SW covers 50 to 150 meters with a B-T 11-plate Type L Condenser. Type B covers 200 to 565. No taps in either case and price is

$5.00

Read this from Kansas City, Sept. 11th, 1924:

> "As an engineer and electrician using radio as a hobby, I have used dozens of condensers, but none equal the B-T vernier. I have just built a well known circuit and your condensers are the first with which I was able to get and hold stations while K. C. was on the air. The B-T excels anything I have ever used."—A. A. R. (615 Ewing Ave.).

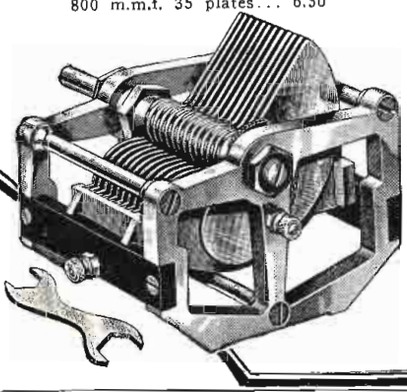
He means the original B-T Vernier, designed two years before the magazines began talking "low losses." "It had the goods." It is still good—thousands will use no other.

And heres a Radio Magazine Editor:

> "Tuesday evening, using a loud speaker and two stages of audio, we brought in practically every station worthwhile and at 2:10 a. m. tuned in KGO (Oakland) and held it until 3:05 with full volume. Such stations as Dallas, and Springfield, Mass., came in easily without interference from the powerful Chicago stations. These stations have been brought in nightly, including KGO, showing that they were not accidents. Saturday evening, with Chicago stations on full blast, twenty-six outside stations were logged without any attempt to make a record."

He's talking about 1924 and the products pictured here.

150 m.m.f. 7 plates...$4.25
250 m.m.f. 11 plates... 4.50
520 m.m.f. 23 plates... 5.00
800 m.m.f. 35 plates... 6.50



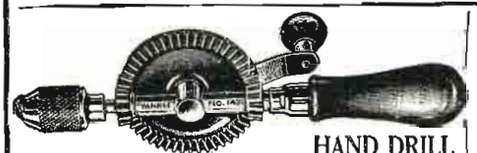
Want to know more?

Our circulars will tell you. Ask your dealer or drop us a line.

We build good parts for those not rich enough to afford poor ones

Bremer-Tully Mfg. Co.
Canal & Harrison Sts., Chicago

Use "RAGEMCO" Tools to Build Better Radio Sets



HAND DRILL

Especially designed for Radio Work by the makers of the famous "Yankee" Tools. A beautiful balanced, small, powerful drill, with 4 to 1 ratio of gears for speed. Special chuck 9/32" capacity, to take largest drill, mostly furnished with drill or tool sets. Length over all, 9½ in. Weight 1½ lbs.
GR-302—Price $2.75

CIRCLE CUTTER



Especially designed for the Radio Constructor. Made of the finest material and equipped with the highest grade high steel cutting bits. It does three things at once. It drills its own pilot, cuts out plug and puts head or scroll around the hole in one operation. Cuts holes ¾ to 4 in. in diameter.
GR-402—Price $3.00
ER 401. Same tool but smaller and not fitted with bead or scroll in one operation.
GR-401—Price $2.00

Order by order numbers. Remit by check, money order, stamps or cash. All goods are shipped free of transportation charges to all parts of U. S. and possessions same day as order is received. If not satisfied, money will be refunded upon return of goods.

We carry a complete list of Radio Tools. No matter what you want we have it in stock. Write for our complete tool list.

THE RADIOGEM CORP., - - 66-R—W. Broadway, New York City

Modern Radio Storage Batteries

(*Continued from page* 1175)

chargers require a 96-volt "B" battery to be split up into two parallel 48 volt sections for charging. This is a simple matter, yet confusing to the non-technical layman. However, by means of two double pole throw-over switches, with half of the 96-volt battery connected to the center poles of each switch, the battery may be paralleled for charging by throwing the switches one way, and placed in series for use on the set by throwing them over the other way. (See Fig. 5.) Completely wired up "B" charging panels are on the market. Some such permanent hook-up of "B" batteries, receiver and charger is desirable not only to make charging simple, but also to avoid frequent disconnecting and connecting of batteries with the attendant danger of touching a "B" battery wire to an "A" connection and burning out tubes.

Reception with storage batteries remains practically at its maximum throughout the entire discharge of the battery. This is because storage battery voltage is constant within 10 per cent. all through the discharge. For the most exacting work, storage battery voltage may be kept constant within 1 per cent. by the simple expedient of throwing the charging switch over every day or two.

It is not advisable to use an automobile battery for radio, because the thin plates necessary for power to start an automobile engine are not adapted to withstand the strain of standing for long periods in a partially discharged condition. Radio demands a battery which can stand in a discharged condition without injury. It is, therefore, better to buy a battery with thick, heavy plates, designed especially for radio service.

INTERNAL DISCHARGE OF BATTERY

Storage battery material must be very pure, or the battery will slowly discharge itself internally even though not used. All large manufacturers maintain extensive laboratories for testing the purity of all raw materials. A small self-discharge takes place even with the purest materials, but this is very much slower than the corresponding self-discharge which takes place in dry cells, and it can be corrected easily by recharging.

There is an impression abroad that storage "B" batteries discharge more during standing than "A" batteries. This is true only if the batteries become slightly short-circuited due to electrolyte getting on the outside, and, as pointed out before, spray can be entirely avoided by buying a battery properly constructed for radio and charging it with a charger not too big for the size of battery selected. A tightly sealed "B" battery, with glass jars properly spaced apart, and charged with a low current charger, will stay dry and clean and will hold its charge for long periods practically as well as an "A" battery.

THE ELECTROLYTE

Pay no attention to solutions which are claimed to rejuvenate a battery or to charge it without electric current, or to do any of several other miraculous things. Every reputable battery company uses in its batteries the one and only proper electrolyte, a dilute water solution of pure sulphuric acid. This electrolyte need never be changed during the life of the battery, unless some of it is spilled. During the charging of the battery and during periods when it is not charging, some of the *water* evaporates and this must be replaced by the addition of water from time to time (once in three to six months or even a year, depending on

form. These improved windings considerably lower the resistance and other losses in the circuit. This results in sharper tuning and greater range.

FILTER AND TESTING CIRCUIT

(2078) Mr. Herbert Chamberlain, Plainfield, N. J., writes:

Q. 1. I understand there is a special filter circuit for sharp tuning. Kindly show this diagram.

A. 1. The filter circuit you mention will be found in these columns. Vernier condensers or attachments will probably be found necessary with this arrangement. The amount of energy transferred is controlled by the variable resistance. The inductive relation must be as shown in the diagram. One is assured of an exceptionally selective regenerative receiver, if this construction is followed.

Q. 2. What are the wiring diagram connections of the Jewell Radio Test Set?

A. 2. This diagram is shown in these columns. This unit has been specially designed for tube testing, and a complete set of curves may be made showing every D.C. characteristic of any vacuum tube, by the use of this instrument. In addition, the individual instruments may be arranged for innumerable other tests. See the January, 1924, issue of *Science and Invention* magazine, which contains an excellent article on modern testing sets, including one for the determination of the A.C. characteristics of vacuum tubes.

It will be noticed that the rheostat is in the positive lead. This is for the purpose of securing a zero grid potential when the potentiometer arm is placed half way between the two ends. Were the rheostat in the negative lead with the grid return to "A" minus, a negative grid bias would he placed on the grid, and this grid bias would not be indicated by the grid voltmeter, unless the grid return connected directly to the filament, when the applied plate voltage would be lowered, due to the rheostat resistance. This drop in voltage will not be shown by the plate voltmeter, in either case. See answer No. 3 to Q. No. 2076, in this issue.

Q. 3. Why does my potentiometer smoke (two of them have burned out) when connected up?

A. 3. You may have an imperfect instrument. Usually, though, it is an entirely different cause. If the potentiometer arm and one end of the potentiometer winding are connected across the "A" battery and the switch arm placed so that only a few turns are included in the circuit, the fine wire, unable to carry the current, will fuse (burn out). Only the two outside ends of the potentiometer winding should be connected across the battery (switch arm going only to the grid return lead). The total resistance of the entire winding is so high that it cannot fuse or melt under this, the correct, connection.

THE "Z" CIRCUIT

(2079) Mr. Chas. Schumachey, Detroit, Mich., asks:

Q. 1. Kindly advise if Federal radio frequency transformers can be used in the "Z" circuit.

A. 1. These transformers, or any other good make of radio frequency transformer, may be used with the "Z" circuit. However, tuned radio frequency transformers of the type used in the Neutrodyne receiver will be considerably better; tuning will be sharper and signal strength will be greater.

Q. 2. What tubes are best suited to this circuit?

A. 2. The circuit shown is more in the nature of an exposition of a principle, rather than a particular system of connections. This principle should be adaptable to any good tubes. A particularly convenient combination would be to use UV-201A tubes for the three amplifying tubes. WD-11 or WD-12 tubes may well serve as the coupling tubes, V-2 and V-4.

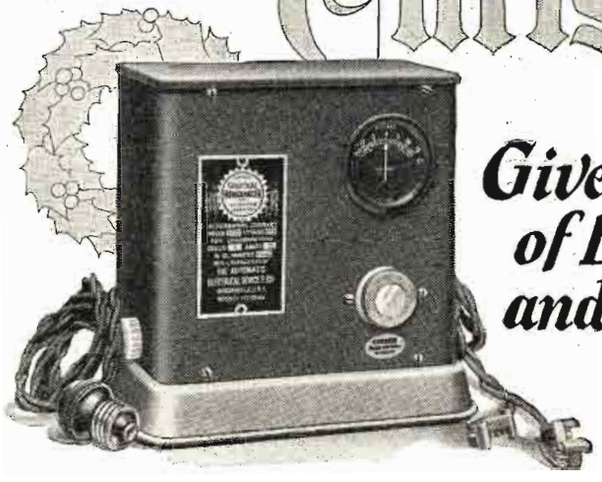
Q. 3. Kindly furnish constructional details for this receiver.

A. 3. A standard variocoupler may constitute L and L-1. Condensers C and C-1 may be of the usual 23-plate variety. If desired, an untuned primary may be used, thus eliminating the aerial condenser C and also simplifying the controls at the expense of slightly reduced signal strength. It is possible, as you suggest, that grounding batteries B-3 and B-4 would assist in stabilizing the action of the set.

The "B" battery voltage will be somewhat higher than usual; probably 90 to 150 volts. The blocking condenser C-3 is .0005 mfd. in capacity. The detector condenser C-5 has a capacity of .00025 mfd. Resistance R may be of approximately one megohm. Resistance R-1 may be two megohms. Care should be taken with the six inductances used. Each set of two inductances should be placed in non-inductive relation to each other set, in somewhat the same manner as Neutrodyne radio frequency transformers. If a variable resistance is used for R-1 it should be of exceptionally good quality, otherwise microphonic noises will be produced.

While the UV-200 tube would function in this set, it is rather critical in adjustment and one is advised to use the more stable UV-201A tube. Of course, the filament batteries used will depend upon the particular tubes used. With WD-11 and WD-12 tubes, only one dry cell will be required for each filament.

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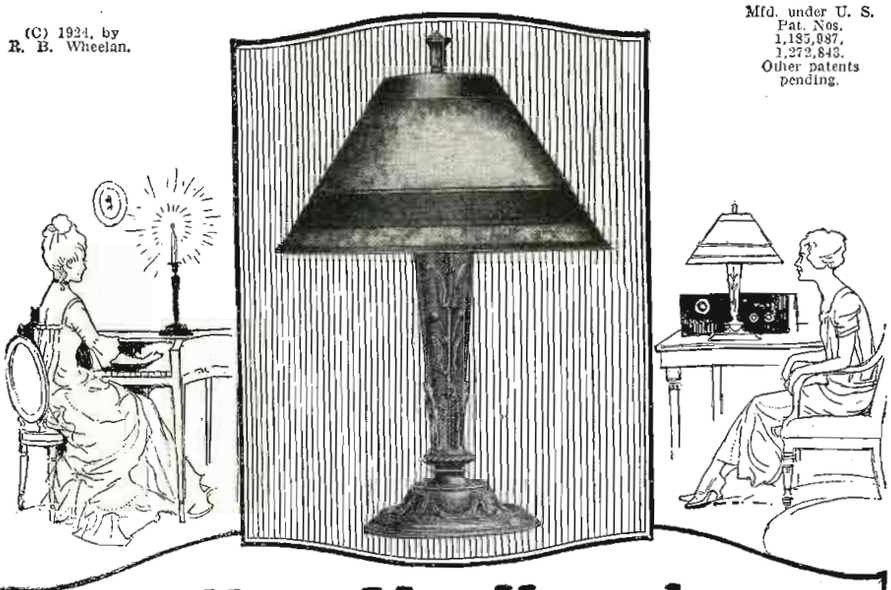
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1—Simple; needs no care.
2—Efficient; costs about 5c to charge the average battery, much less than bulb or liquid types of charger.
3—Quick; brings battery up to full charge overnight.
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9—Safe; approved by Fire Insurance Underwriters. No shock or fire.
10—Beautiful, sturdy metal case finished in mahogany-red and gold.
11—Universal; made in types for all voltages of alternating and direct current. Charges all radio "A" and "B" batteries, and automobile batteries.
12—Quiet; its faint hum cannot be heard in next room.
13—Unqualifiedly guaranteed.
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Mfd. under U. S. Pat. Nos. 1,185,087, 1,272,843. Other patents pending.



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IF you walked into a room where a *Radialamp* is reproducing a concert you would wonder where the remarkable loud speaker was hidden. Certainly you would never suspect the superb table lamp, a matchless piece of lighting art, of being a Radio Loud Speaker as well.

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And when you consider too, the soft mellow light that the *Radialamp* sheds —when you see what an ornament it is even to the most magnificently furnished interior, you wonder that the *Radialamp* can be sold for the astonishingly low price. *Radialamp* has come to stay—even if you have an old type loud speaker you can attach the *Radialamp* to a long wire and use it in a room many feet from your Radio set. For sale at any good Radio Dealer. If he hasn't a *Radialamp* in stock you can get complete description and information if you write to the

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A-1 THE WONDER CRYSTAL

Ideal For Reflex or Crystal Set

Guaranteed Concert Tested

"Have so far received 60 stations on Crystal set with A-1 CRYSTALS; 16 over 1,000 miles distant." — G. B., San Antonio, Texas.

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A remarkable new style of storage "B" battery that gives increased range, volume and clarity to your set. Insures full and uniform voltage on plate. Eliminates all battery noises. An astonishing feature is the perforated, hard-rubber insulating shield (see circle) over the extra-heavy plates. Guaranteed to give 25% to

50% Longer Life

Units of 12 cells (24 volts) placed in a one-piece rubber container—preventing breakage and leakage. If your dealer has not yet stocked the General Radio "B" Battery, send us only $7.00 and battery will be shipped direct with complete operating instructions. Also ask about our wonderfully efficient storage "A" battery. See your dealer or write us today.

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Only "B" Battery With This Unique Insulating Guard

since this condenser is only used when the "tuned aerial" tuning system is employed.

If the "apcriodic antenna" or untuned primary aerial tuning system is employed, this acrial coil may still be used as the coupling coil, should one desire to add radio frequency amplification. Again the variahle condenser would not be required across the coil "B." By using this aperiodic method of coupling it is possible to eliminate one control, at the expense of reduced volume. Just how much this reduction is will depend upon local conditions (action of the particular receiving set used, and electrical characteristics of the antenna system used).

The aperiodic antenna system may be used in the three-coil honeycomb receiver. In this case it is necessary to unwind about 15 turns of wire from a 25-turn honeyeomb. The remaining 10 turns will probably be sufficient for coupling. However, the coil should first be tried with 15 turns remaining; five more turns may be removed later if desired.

Any good make of audio frequency transformer may be used. If it is not expected to add more than one stage of audio frequency amplification, a high ratio-transformer should prove entirely satisfactory. The voltage amplifieation would thereby be greatest (resulting in greater signal strength) and distortion, while present, would not be objectionable.

This circuit should operate a good loud speaker when local stations are being received if only the detector and one stage of audio frequency amplification are used.

Remember to keep all leads as short as possible; do not place variable condensers at the ends of coils; do not place too close to coils (a happy medium must be struck between too close an inductive relation of instruments, and the desired short distance connections).

If the potentiometer should have no effect, carefully check the connections, test the potentiometer for open eircuit and test the radio frequency tube. This tube should oscillate strongly in a regenerative receiving circuit, as the detector tube. The detector "B" battery may be found critical in value. This voltage should be determined while receiving weak signals. For soldering connections use only a resin flux.

Q. 3. Why are rheostats ordinarily placed in the negative lead?

A. 3. If a "C" battery is used, it makes little difference whether the rheostats are placed in the negative or positive leads from the battery. However, if the audio frequency amplifier grid return lead connects directly to "A" minus (no "C" battery being used), there will still be a negative bias, possibly one volt, on the grid of the tube, if a rheostat is placed in series with the tube filament and its conneetion to the *negative* side of the "A" battery. This voltage drop or potential difference would be absent, if the filament connected *directly* to "A" minus (no rheostat at all); and if the rheostat were connected in the positive lead, the grid voltage would be zero, instead of slightly negative. If a "C" battery is used the desired negative potential can then be secured, regardless of the rheostat location. If no "C" battery is used, "B" battery consumption will be less and amplification will be greater, if the rheostat is connected in the negative lead.

In the detector position, it makes little difference whether the rheostat is in the positive or in the negative lead. A regulation of the grid leak will ordinarily adjust the tube for best operation. The grid leak may connect from the grid to "A" plus or minus, as determined best.

Connecting the rheostat in the negative lead of the radio frequeney amplifier tubes will cause the tubes to oseillate a little more readily. This will be quickly noticed if a potentiometer is used to control the grid voltage. With the rheostat in the negative lead, it will be necessary to move the potentiometer arm more nearly to the positive end of the potentiometer than if the rheostat were in the positive lead.

We refer you to the very excellent book, "The Oscillation Valve," by R. D. Bangay, published by The Wireless Press, 326 Broadway, New York City.

L-2 ULTRADYNE

(2077) Mr. Metherell E. Pearce, Anderson, Indiana, asks:

Q. 1. In building a three stage audio frequency amplifier for a Radiola III, wbat ratio transformers should be used? Should tbey be arranged at right angles?

A. 1. Transformers of about 4:1 ratio will probably be satisfactory. It may be advisable, however, to use a 3:1 or even a 2:1 ratio for the last audio frequency transformer. Best results will be had from a push-pull, resistance coupled, or choke coil, third stage amplifier.

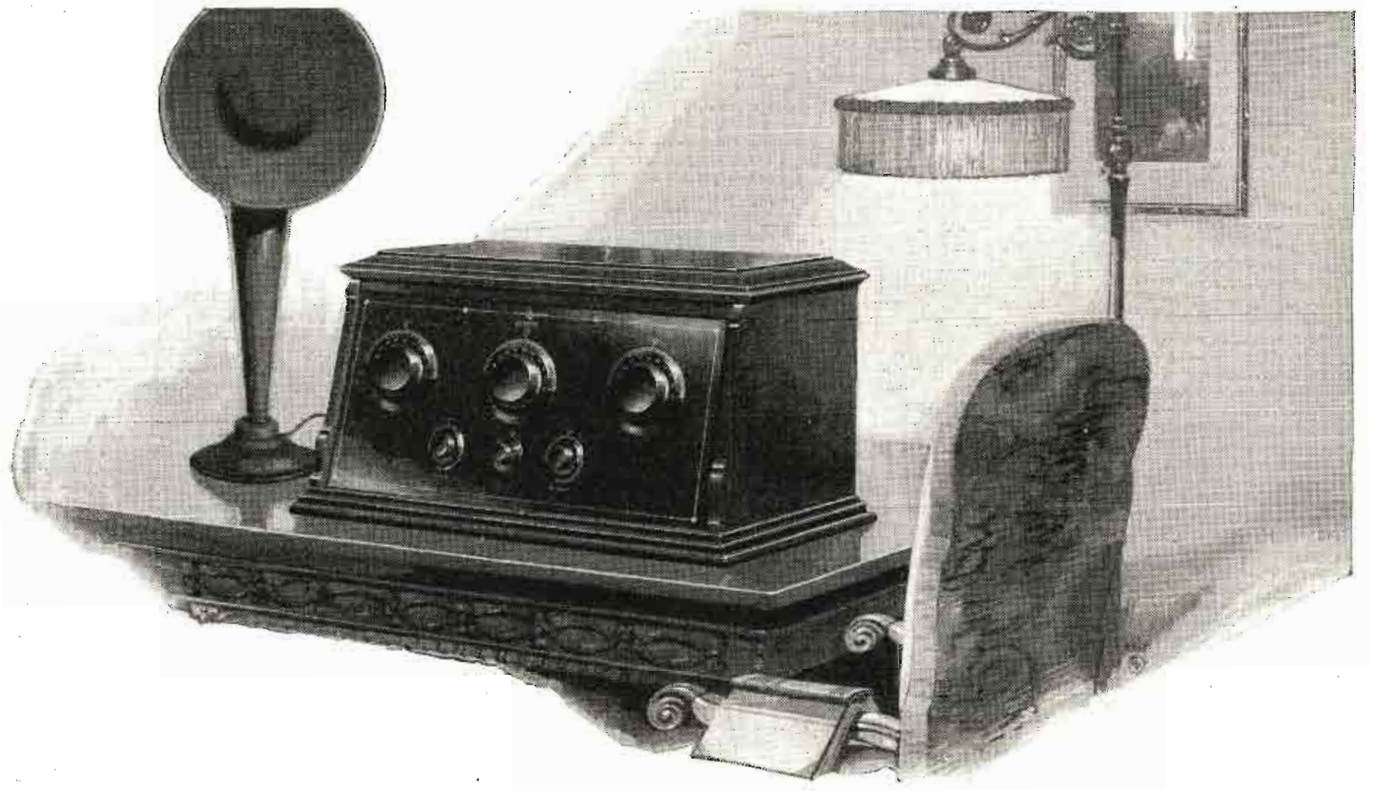
Q. 2. Please show the L-2 Ultradyne circuit.

A. 2. The circuit you request is shown in these columns.

Q. 3. Are therc any improvements in this receiver over the earlier model?

A. 3. It is a much more sensitive receiver than the earlier model, due to the addition of regeneration in the modulator tube circuit. Having ballast resistances, in place of rheostats, tube controls have been eliminated. Furthermore, the latest transformers have a special low loss form of winding. The regeneration coils, tuning, and oscillator coils are of a special spider-web

(*Continued on page* 1233)



The FADA Neutroceiver

will surpass anything you have expected of a radio receiver

VOLUME? The FADA Neutroceiver will give you all the controlled volume you can possibly desire. Designed to use powerful tubes and operate on either indoor or outdoor antenna, it is guaranteed to give powerful results.

Clarity? This wonderful, five-tube Neutrodyne offers you a tone quality which is unexcelled. It reproduces every tone of the human voice and of every musical instrument with lifelike fidelity.

Selectivity? Separates stations, tunes through powerful local broadcasting and brings in distant concerts—even when but a few meters apart.

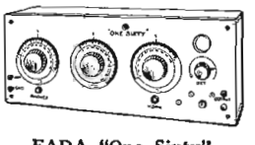
Simplicity of control? Anyone, without previous experience, can operate the Neutroceiver. You can turn your dials to previously located stations and bring them back night after night.

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Supplementing the FADA Neutroceiver and making a complete FADA line, are five other Neutrodyne receivers. Six models in all—three, four and five tube Neutrodyne receivers in plain as well as artcraft cabinets, at a price range from $75 to $295. See your dealer.

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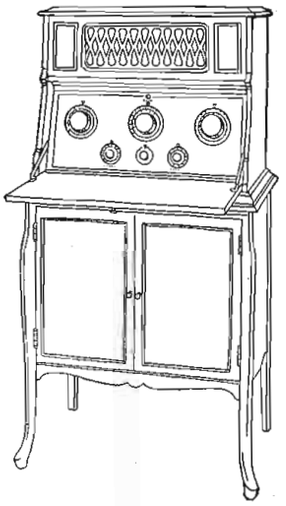


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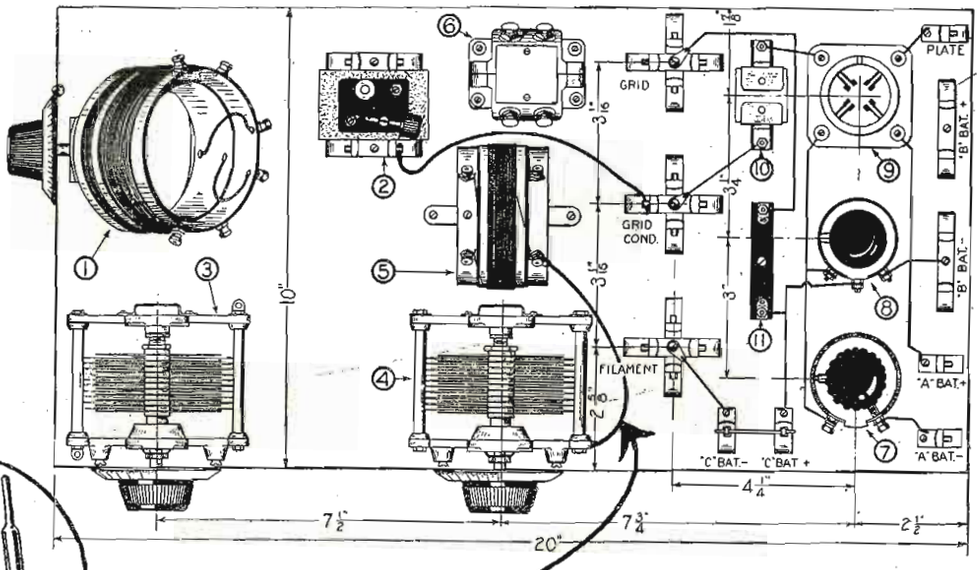
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No. 185/90-A

The five-tube Neutrola 185-A, mounted on FADA Cabinet Table No. 190-A. Price (less tubes, batteries, etc.) $295.

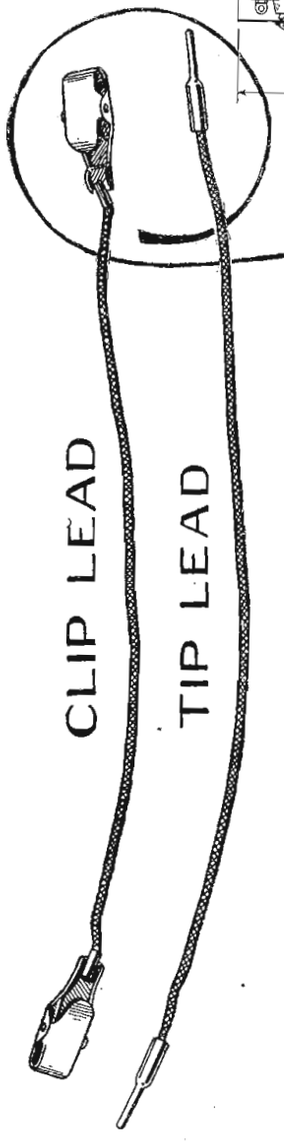


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1000 Hookups



Meet the Hookup Board

Mr. Experimenter:

YOU who are experimenting with hook-ups know what it means to connect and disconnect loose wires from binding posts every time you try out a new hook-up. Sometimes it takes hours to do so and then it is a most tedious task. By means of the hook-up board which is now being demonstrated every month in THE EXPERIMENTER all this hard work has been done away with. Radio experimenting is now a positive pleasure and not tedious work.

You can now make hook-ups in 10 per cent. of the time that it took you previously. All this is accomplished by means of the clip-leads and tip-leads pictured at the left.

A new science,—EXPERIMENTAL RADIO has come into being. You will want to keep abreast with the myriad of hook-ups that are being published in all radio publications every month. Reading a hook-up does not give you any more satisfaction than smelling a steak. You want to experiment with the hook-up yourself. The *Experimenter* teaches you how to do it.

THE EXPERIMENTER now has twelve pages of experimental radio every month,—articles featuring radio from the experimental side only. Buy the December issue now on all newsstands. One copy will convince you that this is the one magazine you must have.

The EXPERIMENTER

25c The Copy—ON ALL NEWSSTANDS

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GERMOTT PUBLISHING CO., 53 Park Place, N.Y. City

do not cut out quite enough wire at the minimum resistance position, resulting in a greatly reduced current supply to the filament (insufficient for operation of the tube). If an adapter is used, contacts may not be perfect. The information you furnished was only fragmentary.

Q. 2. What can you suggest for reducing the rushing sounds heard when no signals are coming through my five tube set (two stages of tuned radio frequency amplification)?

A. 2. You may have a noisy "B" battery or tube. Socket connections may not be good. You may have leaky fixed condensers. The grid leak may be noisy. The "A" battery may be in need of charging, or it may be erratic in action for other reasons. The rheostat or battery switch may not be making good connection. The phone cord may be partly broken and the test for this is to shake the phone cord without moving the phone plug. If loud crackling sounds are heard when the phone cord is moved, it is evident that the cord should be changed. Occasionally phone plugs do not make good connection in the jack. The variable condensers may be making poor contact. If turning the plates produces loud crackling sounds, this may usually be considered the trouble.

Poor connections are easily located by moving the panel and by moving the wires. Often, wires that appear to be firmly fastened may not be making good contact at all. Try a 0.05 mfd. condenser from the last audio tube plate, to "A" minus.

Q. 3. What are microphonic noises?

A. 3. The "imperfect contact" microphone consists, in addition to the battery supply, of metals imperfectly touching. This combination is susceptible to slight motions. If such a condition arises in a receiving set, the result is a "microphonie" effect and the constantly varying current causes the audible sounds usual from imperfect contact microphones.

PICTURE DIAGRAM

(2076) Mr. Clyde Council, Red Springs, N. C., asks:

Q. 1. Please publish the Radio Act of Congress of August 13, 1912. I understand this act contains the regulations covering radio communication.

A. 1. The act to which you refer takes up many pages in the booklet called "Radio Communication Laws of the United States," published by the Government Printing Office, Washington, D. C. This publication may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of 15c per copy.

Q. 2. Please publish a picture diagram of the standard three circuit tuner, using honeycombs. What variations could you suggest for increasing the range or volume?

A. 2. This circuit will be found in these columns. The size honey-comb coils required may be readily determined from the following table of wave-lengths obtainable when standard honeycomb coils are shunted by variable condensers of .001 mfd. capacity. If condensers of .0005 mfd. capacity are used, the maximum wave-length will be approximately half the value shown. The minimum value will be determined by the minimum capacity of the condenser used.

Number of Turns	Wave-Length
25	130—375
35	180—515
50	240—730
75	330—1030
100	450—1460
150	660—2200
200	930—2850
250	1300—4000
300	1550—4800
400	2050—6300
500	3000—8500
600	4000—12000
750	5000—15000
1000	6200—19000
1250	7000—21000
1500	8200—25000

If only the detector tube is used, the aerial and ground conneet to primary B. If the radio frequency unit is added, the aerial and ground connect to a honeycomb coil placed in non-inductive relation to the other three honeycomb coils. Primary B then becomes the coupling coil that couples the output of the radio frequency tube to the detector input.

If an audio frequency amplifier is added, there should be no difficulties. This method of adding an audio frequency amplifier unit may be applied to any set having the same battery connection system.

This circuit is readily adaptable to almost every radio instrument. For example: Primary "A" may be home-constructed of about 55 turns of No. 20 wire wound on a three-inch tube. Or, it may be a variometer. The tickler may be a variometer, while primary "B" and secondary may comprise the usual two-coil type coupler. If desired, the untuned primary, three-coil type of coupler may be used for the primary "B," secondary and tickler. In this case the primary "B" variable condenser would not be required

EISEMANN

ELECTRICAL EQUIPMENT



Type 6-D Broadcast Receiver

Non-oscillating ~ Non-radiating

SPECIFICATIONS

Circuit: Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification. Non-oscillating. Non-radiating. Astatic transformers used to minimize mutual induction.

Tubes: Five in all. Jacks provided for either five or four tube operation.

Batteries: Either storage or dry-cells.

Cables: Complete set supplied for "A" and "B" batteries.

Wave lengths: 200 to 600 meters, with uniform efficiency of reception.

Aerial: 75 to 125 feet, single wire.

Panel: Aluminum, with attractive crystal black finish. A perfect body capacity shield.

Dials: Sunken design. Shaped to fit the hand and permit a natural position in tuning.

Rheostats: Adequate resistance for all standard base commercial tubes.

Condensers: Single bearing, low leakage losses.

Sockets: Suspended on cushion springs which absorb vibrations.

Cabinet: Mahogany, with distinctive lines and high finish. Ample space provided for "B" batteries.

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THE real, intrinsic value of the 6-D Receiver can be fully appreciated only by making direct, side-by-side tests with other makes.

Such comparisons need not be confined to sets in the same price-class. The 6-D is the equal, in every detail, of many receivers priced $25, $50 and even $75 higher.

Performance of the highest order, strikingly attractive appearance and moderate price—all these elements of true worth are found in the 6-D.

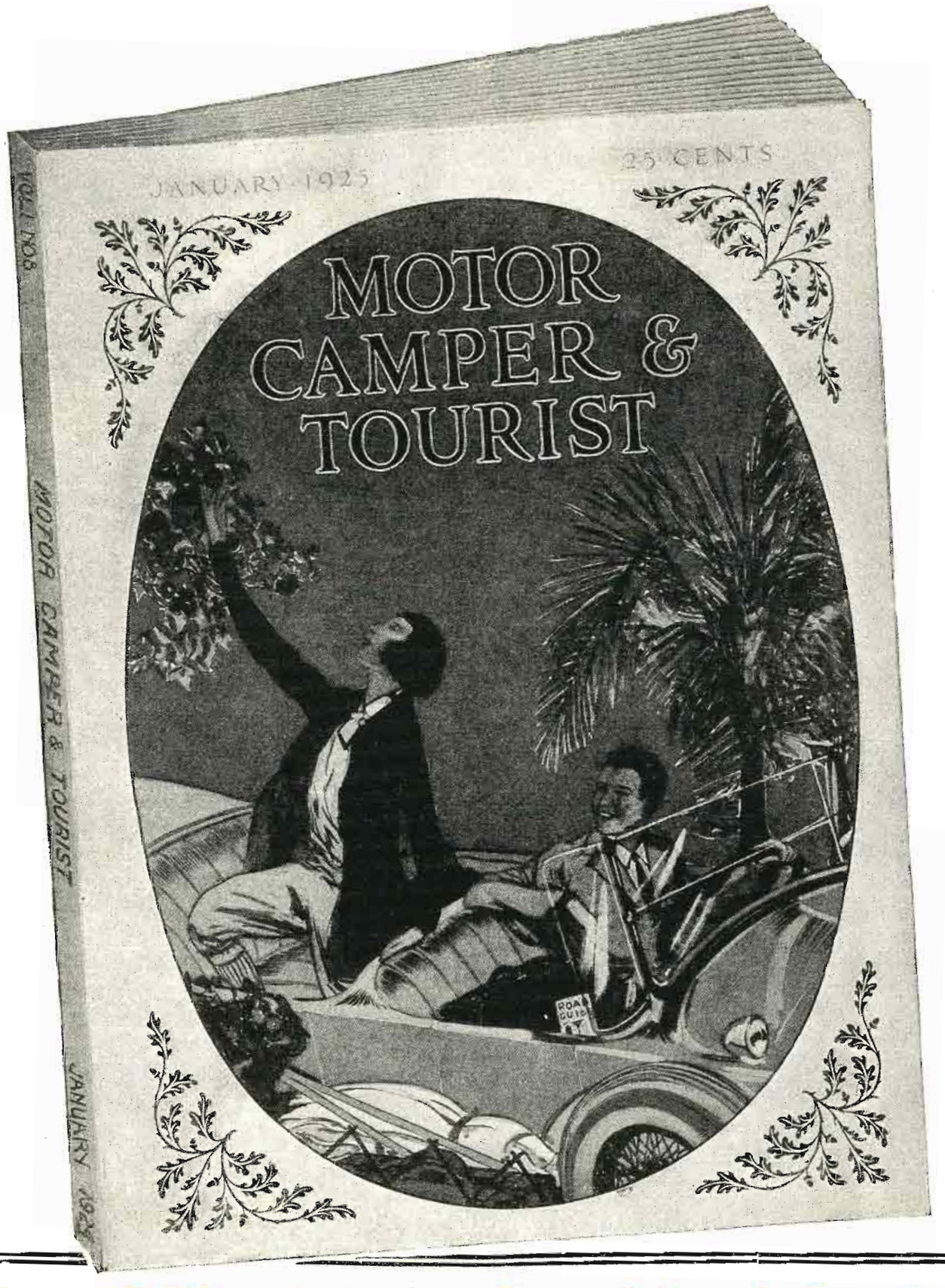
You will note its clarity and the full, generous volume. You will also observe the unusual sharpness of tuning. And the finely carved, high finish mahogany cabinet will make a strong appeal.

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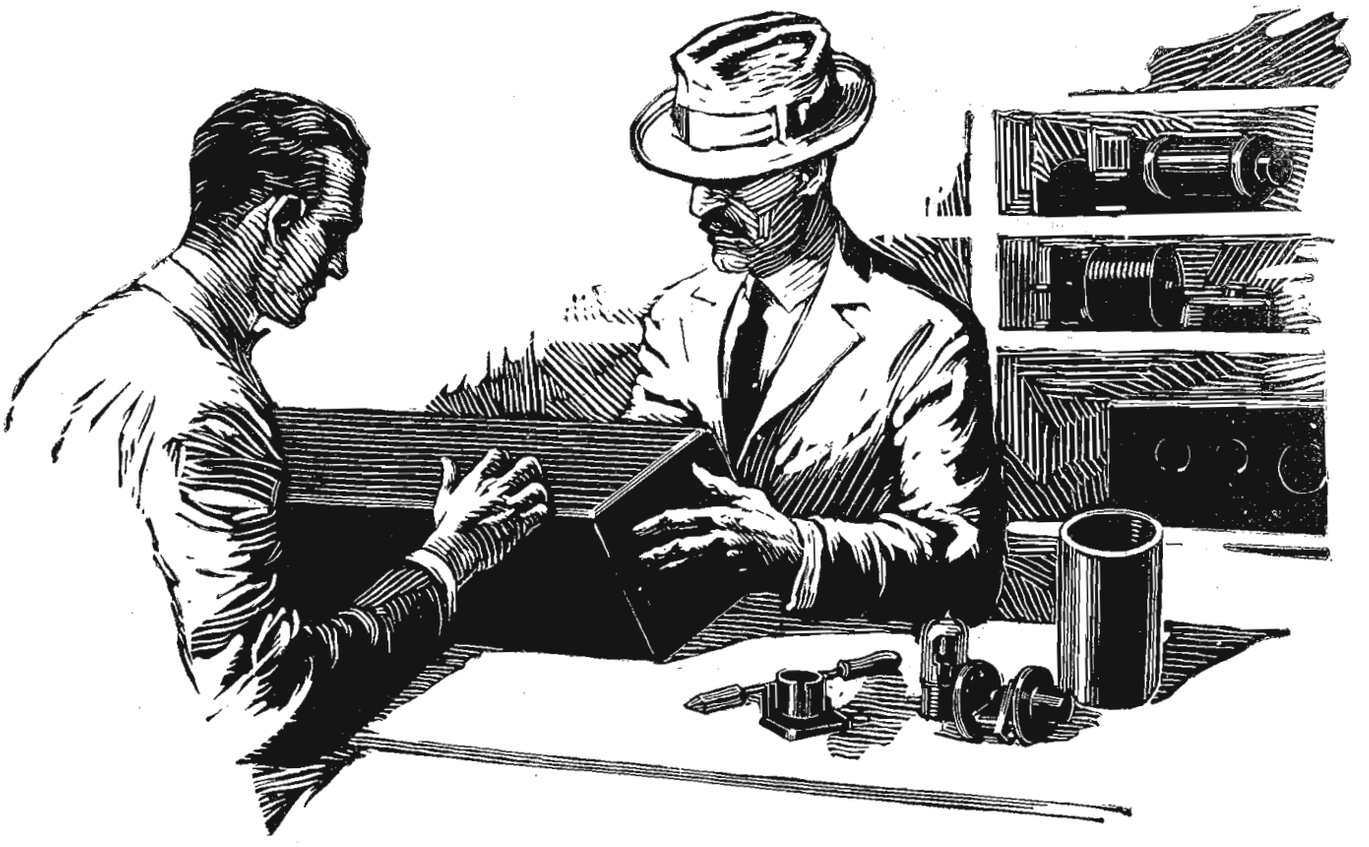
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IF you want real results from your radio set, buy high grade parts, low loss condensers, good transformers and Formica panels! Then after you have labored over your set you will not find others using the same number of tubes who get stations you can not get.

The manufacturers of the finest radio sets built in America have endorsed Formica by using it. It is the panel material of 125 leading makes.

There are reasons for this almost unanimous choice of Formica — and the reasons are longer life, no warping and sagging, low electrical losses and fine appearance. Formica works easily with ordinary tools.

Formica is made in four splendid finishes: Gloss black, dull black, mahogany and walnut.

It is the standard radio panel material from coast to coast. More of it is used every year. In big sets incorporating radio frequency amplification, it is now regarded as essential for base panels and terminal strips. Mount everything on Formica. Don't let it touch wood.

Dealers: Formica service and quality and the universal demand for the material make it the most satisfactory and profitable panel line you can carry.

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SHEETS TUBES RODS



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Out of the many uncertainties, doubts and experiments has emerged the perfected radio—Radyne—developed by two pioneers—men who were radio experts when the number of radio operators could be counted on the fingers of one hand.

This simplified, balanced receiving set is now available to people everywhere—after having become the most popular set in California—an ideal place for testing under all conditions.

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Its clarity of reproduction and simplicity of operation, the most desirable features in radio, place Radyne in a class by itself.

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If your dealer cannot supply you with Radyne, write to us.

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special offer GENUINE DANODYNE $15.00



IF you write today you can have this $20.00 amazing 1500 mile, one tube Low Loss Danodyne Radio Set for only $15.00! An amazing new application of an established radio principle brings in station after station wonderfully loud and clear. Very economical; uses dry cell batteries. Easy to work. Send for FREE CIRCULAR today. It costs nothing to investigate.

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CQ. This little CQ is usually a slow and dragged out affair, and if some passenger boat happens to be copying close by, you can imagine what happens. And it is unnecessary. If the young operator had been placed second operator on a not too busy vessel for a few trips, he could have been taught that the CQ is invariably the mark of a Ham. And no one likes to be classed as a Ham.

Regardless of what may be said, there can be no denying that at its inception the URTA had the proper spirit and plans for making operating at sea a better proposition. Because a few took advantage of the possibilities that presented themselves, it does not follow that a similar organization should fail. It needs men who are now managing the radio companies, such as Mr. Hahne, Mr. Fitzpatrick and several others, whose interest is with the operators, as its leaders.

There are one or two companies which do properly rate a radio man, and one of these is the United Fruit Company. It would, therefore, be well for any organization that might spring up to acquaint itself with the method the Fruit Company employs in handling its large personnel of radio operators.

This article I trust will elicit others from men similarly interested in seeing radio placed upon a man's basis.

Portable Broadcast Stations

(*Continued from page* 1149)

standard broadcasting microphone and line amplifier are used. Three microphones may be used, one for announcing, one for orchestra and one for studio purposes, where these are necessary. A switching control arrangement is provided whereby each one of these, or any of them at once, may be used at the will of the announcer. Special armored cable is provided whereby the microphones can be placed as far as 300 feet from the truck, allowing the broadcasting of performances in halls, etc., with the truck parked outside.

The wave-length is 268 meters. The call letters are WJAZ. The average radiation is four amperes with an upward modulation of about one ampere.

A complete receiving set with loud speaker is provided for checking the modulation and also for maintaining communication, if this is desired at any time.

In the transmitter proper, the Hartley oscillator circuit is used, with Heising modulation.

I Want To Know

(*Continued from page* 1190)

separated from it by an air gap. This diaphragm is also the small end of a funnel which catches sound waves—the funnel being slotted to avoid vibratory distortion. Thus sound oscillations will be transmitted to the glowing portion of the air gap, causing variations in the "emission current." These are registered in the circuit of which this air gap is a part, via a resistance, and thus carried through tube amplifiers.

NOISY SET

(2075) Mr. Chas. W. Hyde, Richmond, Indiana, asks:

Q. 1. Please explain why a WD-11 tube will not work in a set that operates when a UV-200 tube is used.

A. 1. We should say that the WD-11 tube is defective. Or, a higher "B" battery may be required for it. While the UV-200 tube may operate with only 16 or 18 volts on the plate, you may require as high as 45 volts on the plate of the WD-11 tube. It is also possible that your "A" battery was not sufficiently strong; try putting the entire output of a single dry cell on the filament of the tube. Some rheostats

(*Continued on page* 1229)

Atlas

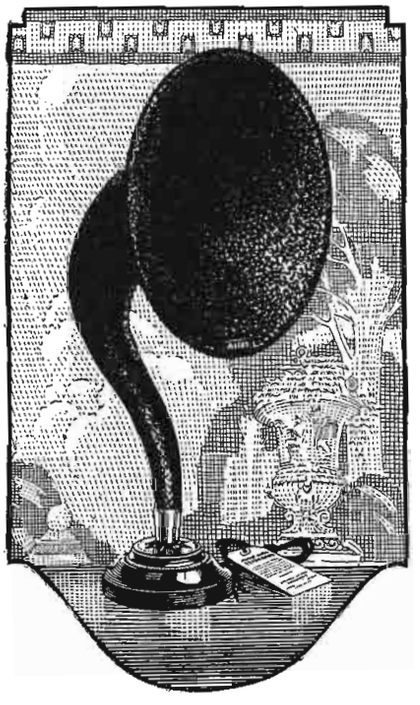
TRADE MARK

RADIO REPRODUCTION speaker



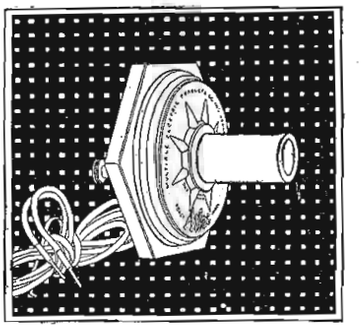
"GIVES THE BEST THAT'S IN YOUR SET"

THE material of the horn plays an important part in the faithfulness of Atlas Radio Reproduction. The resilient core absorbs the vibrations of the horn material; while the rigid surface conserves the sounds you ***ought*** to hear—***as*** you want to hear them.



New Atlas speaker with the exclusive and strikingly beautiful bronze-brown ripple-finish.

All Models Have Harmonizer Adjustment
(Pat. applied for) ***and Compound Diaphragm***



Atlas unit, complete with attachment couplings, to fit all standard phonographs.

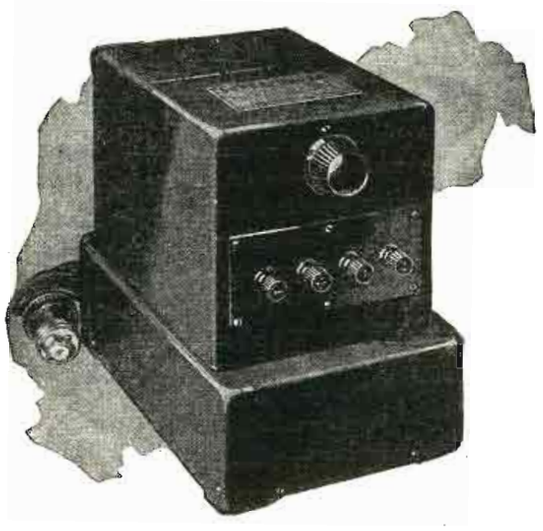
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A Major Radio Invention



A. C. Type
$47.50

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No more "B" batteries!

The Super-Ducon is the most important and valuable radio invention of the year. It brings many advantages to the set owners. Upkeep expenses are cut. No more of the expense and fuss of installing "B" batteries. No more poor reception due to weak batteries, but 100% performance all the time!

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Long Distance 1-Tube D. K. SUPERIOR Set Complete. Nothing Else to Buy.

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Chief?" I inquired. "You've dealt only with our own men." "Yes, and that's all I need to mention, too," the old timer shot back. "If our boys were as good as the Limys, the Frogs and the Spiks—well, we wouldn't have a word to say. Those foreigners are officers on their vessels, and they attend strictly to business. They may not be so much on the key, and a good fast sender can often put them 'under the table' but if we ask them for 'WA force' they GIVE us the word after force—not a bunch of question marks and 'QTA please.' We don't hear any useless stuff come out of their gaps and they get the stuff through. If all our business was with foreign shipping we'd pile up a neat profit."

I thanked the old Chief, and bundled into my overcoat preparatory to again facing the icy blast. The wind had died down a bit and dusk was closing in as I stepped out in the deep snow drifts. It was quite a long walk to the tiny railroad station and I mused on what I had just heard. It was worth considerable thought. It would seem to me that, were I back in a ship's cabin and the words of the old Chief were brought to me, I'd be just a bit ashamed to read my comparison with the foreign operators. I would be inclined to take stock of myself and see if perhaps I wasn't one of the cogs that was not properly meshing with the shore station machine in the greatest game in the world. Give it a thought—are you a contributing factor in the gradual decline of the American radio operator afloat, or are you a valuable asset to the game?

THIS RADIO PROPOSITION

By J. E. HARA

Lately many of the older operators have been heard to voice complaint with the conditions under which they labor. And it seems to us that their dissatisfaction is well founded at that. It is only the new man in the game who shows any content, and that is readily understood. He does not intend to remain long in the game, so while he is seeing the world, as per the advertisements of the school he attended, he can put up with anything, temporarily. But this is decidedly unfair to the man whose profession is that of tapping a key for his bread, butter and bunk.

There is room for considerable change. First, radio operating should be placed on a solid foundation, that is, advancement should be accorded to experience, ability and ambition. It is entirely wrong for a new man, just fresh from school, to draw the same pay that an older man and decidedly more capable one receives. Nor should a new man be given a ship that an older and more experienced one really rates.

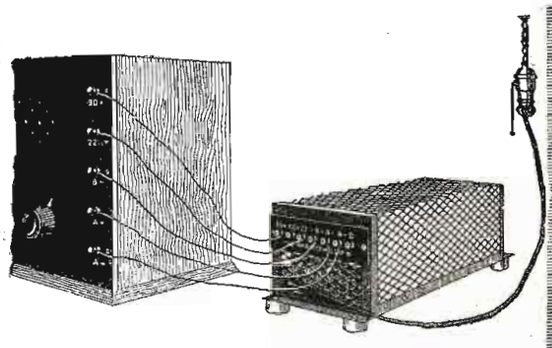
After promotion had been well organized, then a decent maximum remuneration should be set, or better still a legitimate compensation and bonus for years of service.

In this way the youth, who in his teens bounces joyfully out of the Ham factory and realizes that he is in a game where he can get somewhere, if he settles down to the routine, will be an asset to the game. But in the present chaos that exists a young fellow knows he can get nowhere and after a year or two, in which he tries to see as much of the world as possible, he casts the business up.

One of the worst practices known today is the fashion of wedging young fledglings into openings that require one man. The boy is unused to going to sea, to radio operating in its finer points, or to the multitude of little things that count to make up a successful and efficient operator.

He gets outside where many stations are buzzing away, many far too fast for him to understand because he is excited, so fearing that someone might have traffic for him (he prays that no one has) he sends out a

NO MORE BATTERIES



A-B POWER UNIT

The New Radio Unit That attaches to any Radio Set replacing both A and B Batteries. Read These Facts

1—Absolutely eliminates all batteries.

2—NOISELESS at all times.

3—Will operate any set—no change whatsoever necessary in your set.

4—Steady current at full voltage always—a feature not found in batteries.

5—Will not overheat.

6—All connections identical to battery posts.

7—Will operate efficiently up to 10 tubes (¼ Amp. each).

8—Eliminates danger of burning out tubes.

9—Attaches to any Light Socket 110 Volt D. C.

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Better order to-day. In two weeks' time we will be so swamped with orders that they will have to wait their turn. Orders sent now can be filled immediately.

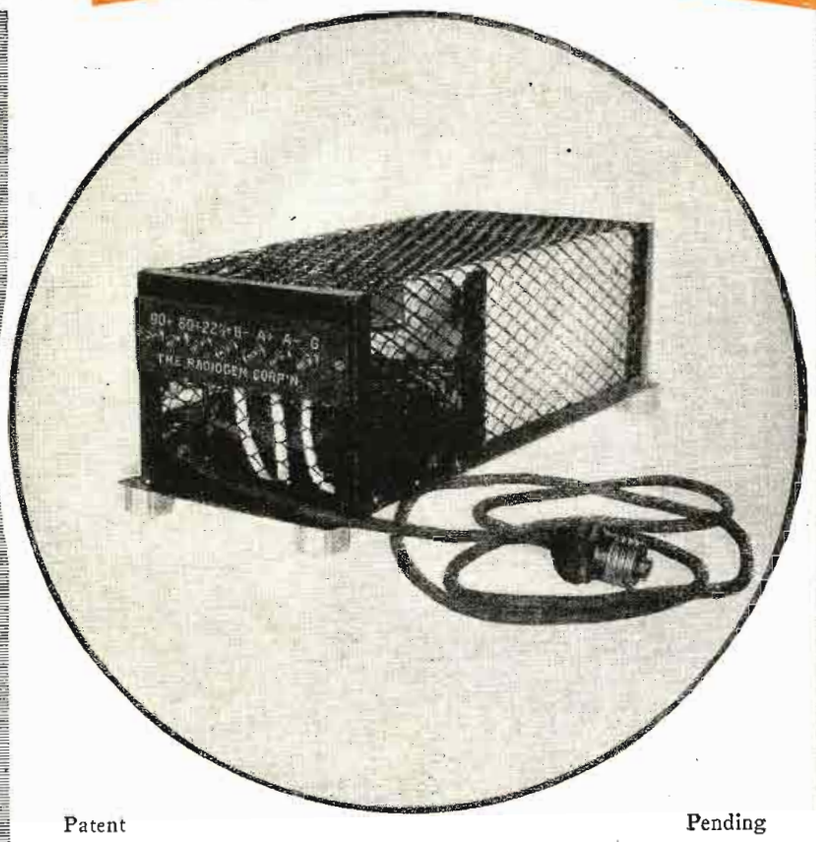
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Gentlemen:—I enclose $25.00. Kindly ship me express collect one A-B Power Unit (for 110 volt direct current only).

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Patent Pending

AT LAST

The Logical Unit for Operating the Radio Set—Cleaner, Steadier, More Compact and More Economical than Batteries

You can dispose of your batteries. Both A and B types. You can use the large space they occupied for other and more valuable material. You can rid your radio set of the unsightliness of the A and B batteries.

We have just perfected this logical ideal unit for the operation of the modern radio receiving outfit, a unit that takes the place of your batteries and operates direct from 110 Volt D. C. house current from the nearest socket.

The unit is small, neat, compact, not messy. It is silent in operation, does not overheat and IT DELIVERS A STEADY CURRENT AT ALL TIMES FOR BOTH FILAMENT AND PLATE, THEREBY INCREASING THE SIMPLICITY OF OPERATION OF THE MULTI-TUBE SET.

It is easier to hook up than batteries, absolutely no change necessary in your set. All connections are identical to battery posts, and are so marked. Has taps for the following voltages: 6, 22, 60, 90.

Entire unit is only 14 inches long by 6 inches wide by 5 inches high. Construction is of the finest materials for dependable long life. The unit is beautifully finished and will not detract from the appearance of the most ornate receiving set.

This Unit for Direct Current Only

AC Unit Under Constuction

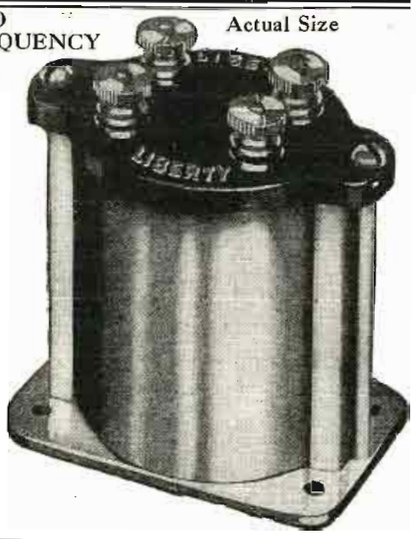
Use the Coupon on the Left

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Actual Size



Radio in a Nut Shell

Get the Distance Hear It Clearly

How to obtain this result for the least expense—the answer is in the transformer.

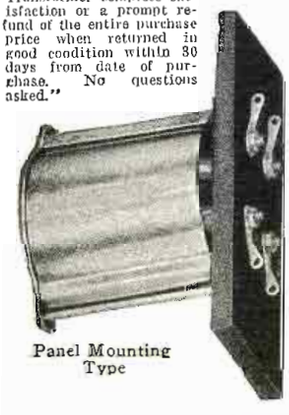
LIBERTY LOW LOSS TRANSFORMER

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Makes Any Good Set Better, or Your Money Back!

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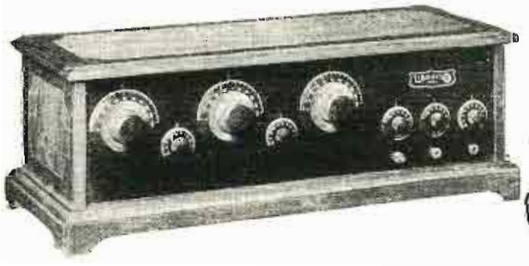
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Audio Freq. Trans.

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Radio Freq. Trans $1.50
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LIBERTY Sealed Five tuned Radio Frequency Receiver ...$100.00

(Write for folder)

Liberty clear tone transformers combined in this perfectly balanced "low-loss" set make it astonish all who hear it. Write for interesting folder "Choosing Your Radio"—which describes the LIBERTY Sealed Five Receiver.

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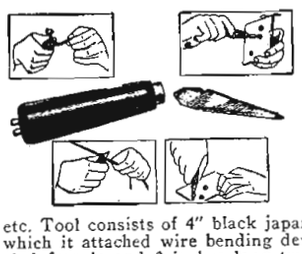
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This is the handiest set of tools ever made for Radio Work by the makers of the famous "YANKEE" Tools. It contains the following: 1 Rachet Screw-driver, 6½ in. long, holding all attachments; 1 Blade, 5½x3/16; 1 Blade, 3½ x ⅛; 1 Blade 2½ x ¼; 1 Countersink; 2 Socket Wrenches for all small nuts; 1 Reamer to enlarge holes in panel from ⅛ x ½; 1 Wrench, one end 5/16" square or hex. for jack, other ½" hex., etc.

GR-701—Price $3.00



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Order by order numbers. Remit by check, money order, stamps or cash. All goods are shipped free of transportation charges to all parts of U. S. and possessions same day as order is received. If not satisfied, money will be refunded upon return of goods.

We carry a complete list of Radio Tools. No matter what you want we have it in stock. Write for our complete tool list.

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of time and expect an operator to take our traffic at a decent rate of speed and with a minimum of repetition. Tell me, then, when an operator has a roomful of giggling, bright-eyed young ladies and witty (?) males, how is it possible for him to handle traffic in any kind of snappy shape? It can't be done; the shore station must lose precious minutes and meanwhile, 'Sparks' flashes meaning winks at some little minx while guessing at what the coastal station just said.

"We have a further reflection of this slipshod method of conducting a legitimate commercial message business in the lack of ability of great numbers of our sea-going operators to grasp the fundamentals of traffic handling. If you have listened to marine communication lately, you'll note that there is a deplorable lack of good senders today. Either they have not properly learned to form the characters of the code, or they have attempted to develop an individual style, or 'personal swing' as they are pleased to term it. This is a most despicable habit and stamps one as a 'ham operator' quicker than any other practice. It is the pride of our coastal stations that we use the Continental code just as it was written, and I'll risk bragging a bit to say that to listen to the clean cut, snappy characters that our coastal boys turn out is a pleasure.

"We suffer all around. The sea-going fellows are for the most part young single bucks who don't give a hang for anything save a place to eat, sleep and a little spending money. Their lack of co-operation means much to us of the shore stations, who are mostly all married and have families. If the sea-going operators are going to play around and make us lose valuable minutes that we might devote to taking traffic from other vessels, we aren't going to get as much business each day as we might, and if we can't show good profit returns, our salary suffers and that works a hardship on ourselves and families.

"Maybe the youngsters don't think. Probably they don't, but we certainly wish there was some way of waking them up, for it means the continued degradation of the former respected position of wireless operator aboard ship, and has even now resulted in classing them with deck hands and oilers, and even to assigning them deck duties in their off time in a number of instances! And they ask—'What is the matter with the game?' It's they themselves—not another thing! When the boys realize this and commence to conduct themselves in a manner that will be a credit to them—really learn 'operating' and not a conglomeration of stuff to just get them by—then their standing will rise—but not until then! It is going to take them a long while to get back where we started—to win the respect of the steamship men—and they'd best start now.

"There's a great deal of blame due the radio schools too, for conditions as they are. It is beyond me to understand why the schools, with few exceptions, do not include a course in traffic handling and conduct aboard ship as part of the curriculum. Doubtless it's because such knowledge is not necessary to acquire a license, and they are not over-anxious to expand their course to include any more than necessary for the tuition fee. A number of schools do not even have a practical commercial man in an executive capacity—merely promoters who hire a few former operators to carry on. What they need in each school is a man who has been through the mill—ship operator, coastal man and such."

Knocking out his pipe and throwing a huge pine log in the heater, he concluded: "There. That may not be what you want, but it's my sentiments and those of my men. If you can do any good by publishing them in a magazine, you're welcome to it."

"But what about the foreign operators,

Line of Radio Receivers

Era in RADIO

But extravagant claims and misleading descriptions will have no part in the sale of any Somerset receiver. This we pledge at the outset.

Every Somerset receiver must stand on its own merits—on its performance as well as its appearance. And every Somerset receiver is backed by the full and definite guarantee that it is exactly as represented or the purchase price will be refunded promptly and cheerfully.

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STANDISH MODEL 4-C

4 tubes—1 dial—synchronized control (with built in loud speaker and storage battery compartment), in hand-rubbed mahogany cabinet **List $150**

Send at once for literature describing the complete new Somerset line of radio receivers—it is well worth your while.

SOMERSET MARS *Model* 5-A

5 tubes—3 dials in hand-rubbed mahogany cabinet with space for "B" batteries
List $75



The Somerset Calibrated Audio Transformer—heralding a new and complete line of radio apparatus, developed in the Somerset Engineering and Research Laboratories and all characterised by the same superior design, highest grade materials and painstaking workmanship as the Somerset line of complete radio receivers.

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