CIRCULATION OF THIS ISSUE OVER 400,000 COPIES

RADIO NEWS

REG. U.S. PAT. OFF.

25 Cents

DECEMBER

Over 200 Illustrations

Edited by HUGO GERNSBACK

GRANDMA'S X-MAS SHOPPING

RADIO'S GREATEST MAGAZINE

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF

SCIENCE and INVENTION THE EXPERIMENTER MOTOR CAMPER & TOURIST

Christmas

---and the whole world is young again

THE Air is a-quiver, the Ether crowded, with the Yule-tide Music. The carols, the simple songs, that carry us back to a rose-tinted childhood are beating . . . beating . . . beating . . . their soundless tattoos at our Hearth-Stones.

Radio is the Magic-Key that translates it all into vibrant glorious sound.

Only a Scrooge, untouched by the Christmas Spirit, will leave the Key unturned.

Of course, for the utmost in Radio enchantment, you will equip your set with tubes of the rarest scientific accuracy—

Quality Plus Service Since 1915

Cunningham RADIO TUBES

Patent Notice: Cunningham tubes are covered by patents dated 2-10-03, 2-10-12, 12-30-13, 10-20-17, 10-23-17, and others issued and pending. Licensed only for amateur experimental and entertainment use in radio communication. Any other use calls for an arrangement.

Cunningham 40-page data book fully describing care and operation of Radio Tubes now available by sending 10c in stamps to San Francisco Office

Price the same on all five types
C-301A, C-299, C-300, C-11, C-12

E. T. Cunningham Inc.

182 Second St.
Home Office: SAN FRANCISCO CHICAGO NEW YORK

RADIO NEWS

Published by EXPERIMENTER PUBLISHING COMPANY, INC.,
Publishers of "Radio News," "Science and Invention," "The Experimenter" and "Motor Camper & Tourist"
Editorial and General Offices 53 Park Pl., N. Y. C.
H. GERNSBACK, President S. GERNSBACK, Treasurer R. W. DEMOTT, Secretary
MEMBER: AUDIT BUREAU OF CIRCULATIONS

VOL. 6 CONTENTS for DECEMBER NO. 6
1924

RADIO NEWS is published on the 10th of each preceding month. There are 12 numbers per year. Subscription price $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. G. H. Clem as well as U. S. Money forward has foreign stamps). Single copies, 25 cents each. A sample copy will be sent upon request. Check and Postal Money Orders should be drawn in favor of EXPERIMENTER PUBLISHING CO., INC.

All communications and remittances in this Postal should be addressed to Editor, RADIO NEWS, 53 Park Place, New York, N. Y. Unsolicited manuscript cannot be returned unless full postage has been included. All accepted manuscripts are paid for on publication. A special rate is paid for novel circuits, good photographs accompanying them are likely desirable.

RADIO NEWS, New York, entered as second-class matter at the Post Office at New York, N. Y., under the Act of March 3, 1879. Entered as second class matter at Post Office at Chicago, Ill., Los Angeles, Calif., and San Francisco, Calif. This publication is published by the Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y. Hugo Gernsback, President; S. Gernsback, Treasurer; R. W. DeMott, Secretary.

RADIO NEWS is for sale at all newsstands in the United States and Canada, also at The International News Co., Ltd., Breams Buildings, London, E. C. 4, England, and at Brentano's, 37 Avenue de l'Opera, Paris.

HOW TO SUBSCRIBE FOR RADIO NEWS. Send your name, your town, address and remittance to Experimenter Publishing Co., 53 Park Place, New York. Write on the letter or money order exactly how you want it. We can mail you RADIO NEWS, SCIENCE AND INVENTION, the EXPERIMENTER and MOTOR CAMPER & TOURIST, or RADIO NEWS, SCIENCE AND INVENTION, the EXPERIMENTER and MOTOR CAMPER & TOURIST. Price per year, $2.50 in U. S. possessions, Canada and foreign countries. Subscriptions may begin with any month. When remitting be sure to state clearly, in the letter or money order, which publication you want. Avoid sending your remittance in the form of postage stamps if possible. Stamps are difficult for us to handle and we do not like to be compelled to do it. Subscriptions will be received for less than one year, but no one accepted. Subscriptions can commence with any month. Subscriptions can be made to RADIO NEWS, SCIENCE AND INVENTION or the EXPERIMENTER.

POSTAGE. We pay postage to all parts of the United States, Mexico and Island possessions. For foreign or Canadian subscriptions add 50 cents to above subscription rates for additional postage charges.

CHANGE OF ADDRESS. Notify us at once if address is changed. It requires several weeks to make an address change on our records. Always write clearly and give us your old address as well as the new one.

IN EXPIRATION of your subscription we enclose a renewal blank in our last number sent; we also do a follow up to save expiration.

New York City Classified Advertising Dept. 53 Park Place	Western Advertising Representatives Finlay & McCoy 350 East St., Chicago, Ill.	Pacific Coast Advertising Representatives A. J. Norris Hill Co. Hearst Bldg., San Francisco, Calif.	Kansas City Advertising Representative George E. Dolley Republic Building, Kansas City, Mo.

Synchrophase
with Battery-base

GREBE SYNCHROPHASE

TRADE MARK

"Of what use is cleverness of speech?"
—Confucius

Words, even though selected and phrased with the greatest deliberation, cannot do full justice to the Grebe Synchrophase—and its performance.

Peter Tyler

IN THIS outstanding triumph of fifteen years of radio development, a new type of fieldless "Binocular" coil transformer—unaffected by local interference—is used for tuning the detector and two stages of *Balanced* tuned radio frequency.

The settings for the various broadcast stations are equally spaced over the dials. The S-L-F (straight line frequency) condensers accomplish this.

Write for literature

A. H. GREBE & COMPANY, INC.
Van Wyck Blvd., Richmond Hill, N.Y.
Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

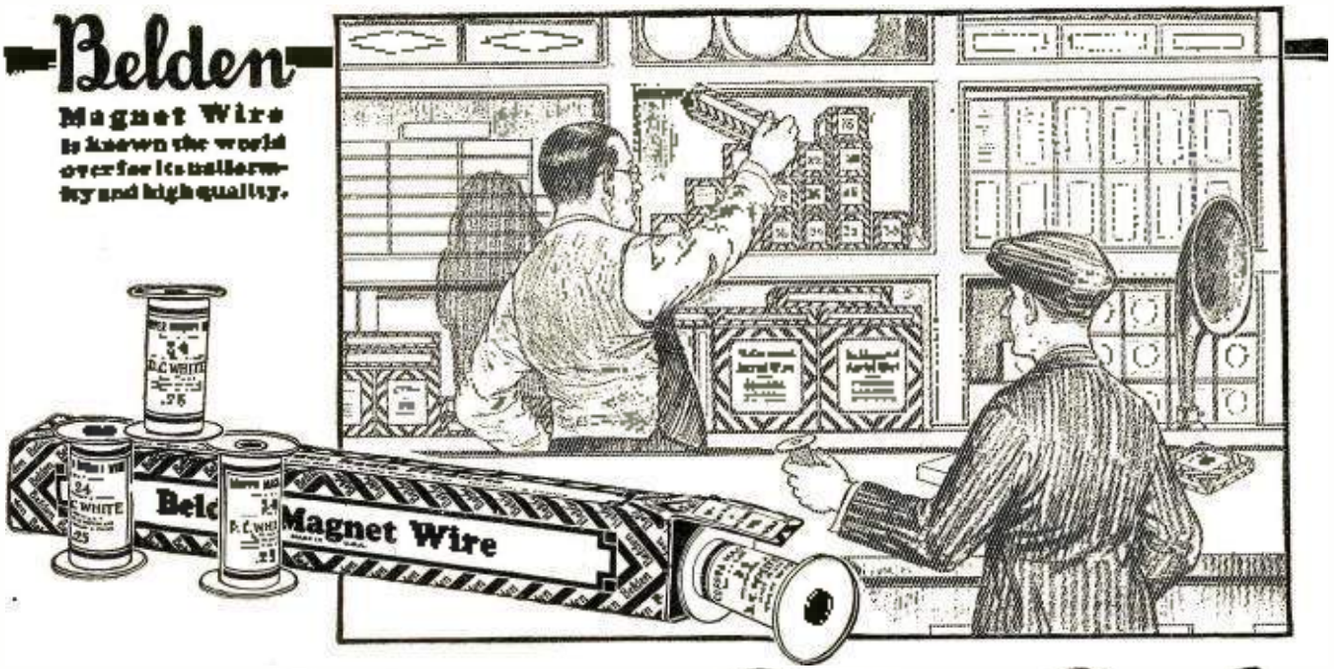
GREBE RADIO
TRADE MARK
REG. U.S. PAT. OFF.

All Grebe apparatus is covered by patents granted and pending.

INDEX TO ADVERTISERS

Belden

Magnet Wire
is known the world over for its uniformity and high quality.



Wind Your Own Coils
for the New Hook-ups!

The joy of real accomplishment comes to the radio fan who tries the new hook-ups and succeeds in making new records of long distance reception. He leads—others follow!

This fascinating work calls for special coils of new specifications. The enterprising experimenter winds his own coils to save time and to be sure that the new set will operate at the highest efficiency. To him comes the thrill of true scientific discovery and research.

Belden Radio Magnet Wire has been used for many years by famous manufacturers of radio devices. They require wire of uniform gauge, carefully insulated with high grade cotton or silk insulation from one end of the spool to the other.

You should insist on Belden Radio Magnet Wire for your own protection. Every spool is full weight, plainly marked, and of full gauge throughout. Be sure to get Belden Wire—it makes a world of difference!

Other Belden Radio Products

Our instructive booklet, "Helpful Hints for Radio Fans" describes many other Belden Radio Products, such as Enameled Aerial Wire, Loop and Litz Wires, New Terminals, Sockets, and many other important items. Know all about these efficient radio products. Send for the booklet, now!

Send for this Free Booklet!

Radio Dealers

Belden Magnet Wire is merchandised in handy cartons of 5 spools each. Every spool is marked for weight, insulation and gauge. Send for complete dealer bulletin, by writing us on your business letterhead. Write, today.

Belden
Manufacturing Company
4634 West Van Buren Street
CHICAGO ILLINOIS

Belden Manufacturing Company
4634 W. Van Buren St., Chicago, Ill.

I would like to know more about Magnet Wire. Send me your latest booklet—Helpful Hints for Radio Fans. Be sure to explain Litz Wire, too.

Name _____

Address _____

_____ _____

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-12
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.

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 .....

Earn $5.00 to $20.00 a Day in RADIO

You can't Hundreds of ambitious men are already earning thousands of dollars in this wonderful new industry—you, too, can get your share. Mail coupon below for Free Book which describes fully the amazing money-making opportunities in Radio and tells how YOU can earn from $5,000 to over $10,000 a year.

The astounding growth of Radio has created thousands of big money opportunities. Millions of dollars were spent during the past year on Radio, and thousands of young men are needed right now to meet the ever-increasing demand of work.

Men are needed to build, sell and install Radio sets—to design, test, repair—as radio engineers and executives—as operators at land stations and on ships traveling the world over—as operators at the hundreds of broadcasting stations. And these are just a few of the wonderful opportunities.

Easy to Learn Radio at Home in Spare Time

No matter if you know *nothing* about Radio now, you can quickly become a radio expert, by our marvelous new method of practical instruction—instruction which includes all the material for building the latest up-to-date radio apparatus.

Scores of young men who have taken our course are already earning from $75 to $200 a week. Merle Wetzel of Chicago Heights, Ill., advanced from lineman to Radio Engineer, increasing his salary 100% *even while taking our course!* Emmett Welch, right after finishing his training, started earning $300 a month and expenses. Another graduate is now an operator of a broadcasting station—PWX of Havana, Cuba, and earns $250 a month. Still another graduate, only 16 years, is averaging $70 a week in a radio store.

Wonderful Opportunities

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.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating easy work—a chance to travel and see the world if you care to or to take any one of the many radio positions all around you at home. And Radio offers you a glorious future!

The National Radio Institute is America's Pioneer Radio School—established in 1914. Our course is the absolutely complete one now being offered which qualifies for a government first-class commercial license. It gets you the *bigger* paying jobs in Radio.

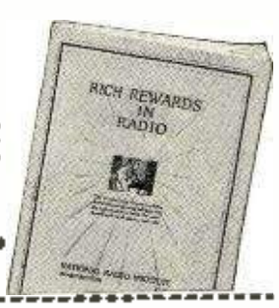
Send for FREE RADIO BOOK

Learn more about this tremendous new field and its remarkable opportunities. Learn how you can quickly become a radio expert and make big money in radio.

We have just prepared a new 32-page booklet which gives a thorough outline of the field of Radio—and describes our amazing practical training in detail. This Free Book, "Rich Rewards in Radio," will be sent to you without the slightest obligation. Mail coupon for it now!

For a short time we are offering a reduced rate to those who enroll at once. Act promptly and save money.

NATIONAL RADIO INSTITUTE
DEPT. 13-MA
Washington, D. C.



NATIONAL RADIO INSTITUTE
Dept. 13MA, Washington, D. C.

Please send me without the slightest obligation your Free Book, "Rich Rewards in Radio," and full details of your special offer and Free Employment Service. Please write plainly.

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

Address.....

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

IT IS EASY TO BUILD YOUR OWN RADIO SET

Over 50,000 Barawik Radio Sets Are Operated All Over the World

All of these sets were built with Barawik Standard Radio Parts, mostly by persons without any previous radio experience. They have made such usual results the best factory made sets—that are now operating and at a cost of only a fraction of the cost of the factory made sets. You can easily equal these results.

OUR SPECIAL VARIOCOUPLER

H412 Each $1.65
The latest efficient type of coupler. Primary and secondary wound on Bakelite tube. Primary shunted for fine tuning. 3/16 inch shaft. Range 150 to 600 meters.

MOULDED VARIOMETER

H412 Each $3.38
Polished black moulded rotor and stator forms. Absolutely inductance was secured efficiency and minimum distributed capacity. Antiphenolic instrument that will not warp results. Wave length 150 to 600 meters.

EXCEL 100 VARIOCOUPLER

H321 Each $1.88
A wonderful value. Produces excellent results. Green silk windings. Rigid moulded construction. Primary and secondary tuning. Wave length 300-600 Meters.
H322 Vernier—same as the Each $0.98

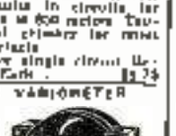
SUPERIOR VARIOMETER

H323 Each $3.38
Purple moulded of red bakelite. A real handsome instrument. Green silk windings separated for highest efficiency. ¼ inch shaft. Nickeled distinct connections. Produces superior results in any type circuit. 150 to 600 meters.
H327 Variometer Same style. Primary tuning. Each $5.68

SUPERIOR VARIOCOUPLER

H325 Each $3.38
Mahogany finished moulded bell of specified red brown bakelite. Looks like a high class instrument. ¼ inch shaft. Superior results in circuits for use with 600 meters. Tapped primary for most tuning. Nickeled contacts.
H324 Special case for single circuit receiving set. Each $1.75

SPLIT STATOR VARIOMETER



H326 Each $3.38
A wonderful value at our price. Tapped black bakelite rotor and stator (split). Large blue green silk wire insures maximum efficiency. ¼ inch shaft. Nickeled circuit connections. Phosphor bronze contacts. Adjustable for all wave lengths.

SPIDER WEB VARIOMETER AND VARIOCOUPLER

H406 Variometer Each $3.35
H403 Variocoupler Each 4.95
Short lathe, high efficiency and near-silence to distant signals are superior at long wavelengths due to absence of any insulating material in the magnetic field. Low energy loss. Secondary adjustment provides sharp tuning. Panel to table mounting. Complete with dial.

GOLD COMPACT VARIOMETER AND VARIOCOUPLER

H408 Variometer, Each $4.10
H409 Variocoupler, Each 4.35
Small in size. Highly efficient. Unexcelled for portable use. Variometer measures 2½x3½x3½ inches. Variocoupler 3½x3½x4½. Stained basswood base. Silk covered wire coils. Table or panel mounting. ¼ inch shafts. Range 200 to 600 meters.

SWITCH LEVERS

Very best polished phosphor bronze blades. Extended metal parts polished nickel finish. Panel size hard rubber bushing and top nut. Has a high grade polish. ¼ inch radius.
H381 With slate base. Each 15c
H382 With bakelite knob. Each 10c

INDUCTANCE SWITCH

H385 Wire wound inductance knob and dial $1.10
Mounts switch points and contact lever behind panel. This does away with the switch arms, any number of which may be used.

SPIDER WEB COILS

H390—	35 turns 25c	H395—	50 turns 40c
H391	75 turns 42c	H392	85 turns 50c
H394—	100 turns. Each		60c

A very popular type of inductance of high efficiency. Several distributed capacity and lowest ohmic resistance. Fine green silk windings with insulating strips.

H393 Panel for winding single web coils 10c

INDUCTANCE COILS (Honeycomb)

Carefully made—fine quality coils. Low resistance—high efficiency. Very fine discrimination. Standard wave lengths mounted single coil assemblies. Specify when ordering whether primary or secondary tuning is wanted.

Tube	Ant. No.	Ant. Wind	Grid No.	Grid Wind	PANEL MOUNT Tuned Ant.	PANEL MOUNT Tuned Grid	PANEL MOUNT Reg. Ant.	PANEL MOUNT Reg. Grid
35	H381	.35	75	.75	200	11200	$3.65	$1.20
35	H383	.40	90	.90	300	3218	1.75	1.45
50	H393	.52	125	.95	1000	4618	1.85	1.58
75	H394	.57	1.02	1250	4625	1.90	1.72
100	H395	.52	1.07	1500	4630	2.00	1.80

INDUCTANCE COIL MOUNTINGS

H340 1 Coil $2.75
H341 2 Coil 3.35
Made of Polished black bakelite. Mount on front of panel. Back of panel mounting. Shows back of panel. Wire ends or leads at rear of panel. Takes 2 coils at any time.
H340 Each $3.35

COIL MOUNTING PLUGS

Moulded of genuine bakelite.
H344 Plug for mounting "Honeycomb" coil 35c
H345 Plug to tap any coil coil successive to panel... 42c
H346 Bakelite plug in tension mounted coil to panel so it can be rotated..... 90c
H342 Fiber strip to wind coils for mounting. Two feet piece 25c

BAKELITE TUBING

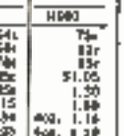
Genuine bakelite tubing. Finish 3 inches long only.
H685 Inside dia. 2⅜ in..... 42c
H684 Inside dia. 3 in..... 52c
H687 Inside dia. 3½ in..... 62c
H686 Inside dia. 4 in..... 72c

MAGNET WIRE

Enamel coated for 8 or single silk insulation stated. Prices are postpaid.

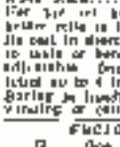
Double Cotton	Enamel	Wire Size	Single Silk Covered	Double Silk Covered
H700	H695		H697	H693
30c	31c	18	54c	70c
41c	35c	20	48c	62c
49c	40c	22	70c	85c
57c	45c	24	85c	$1.05
73c	60c	26	95c	1.30
95c	75c	28	$1.15	1.50
1.15	88c	30	1.40	1.80
1.45	1.05	32	1.75	2.20
	1.25	34	2.25	2.80
		36	2.95	3.60
		38	3.75	4.50
		40	4.95	5.90
		42	6.50	7.80
		44	8.50	10.00
		46	11.00	13.00
		48	14.00	16.00
		50	18.00	20.00

COIL WINDER



H348 Each $1.90
For the experimenter. Makes better coils in less time. Adjustable to coils of any size. Winds coils or bases. Has three adjustable. Covered to hold tight so to 4 inches diameter. Spring in handle reverses automatically or coil when complete. Is reliable.

FUSIDEN DETECTOR



One of the finest crystal detectors on the market. Guaranteed. Five Zones crystal exposed to bring clear sound. Quick, positive adjustment. Three Dana polished nickel finish.
H750 Each 60c

GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup finished brass and both. Brass parts polished nickel finish.
H732 Each 35c

FRESHMAN DETECTOR

H749 Each $1.10
A double adjustable crystal detector assembly suitable for panel or base and other jobs required a high grade detector. Put front at back of panel mounting.

DETECTOR CRYSTALS

H734	Galena, Arlington tested, blue	15c
H738	Silicon, Arlington tested, piece	15c
H735	Tested Galena, Specially, piece	15c
H737	Tested Silicon, per piece	15c
H736	Genuine millimeter tested crystals	Ea. 25c
H733	Dictocator crystal	Each 12c
H734	Silver Cup crystal	Each 35c
H736	Blue Crystal	Each 12c

STANDARD BRAND FIXED CRYSTAL DETECTORS

The latest development in Crystal detectors. Glue holder passing and never requires clean old wire. Cast on Bakelite cabinet.
H742 General Detector. Each $1.10
H743 Bi Metal Detector ..... Each 1.35
H744 Bi Metal Crystal. Each ..... .65
H747 DX Detector 1.25
H745 Detectite Detector 1.75
H750 Essential Galena ..... .60

PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and are guaranteed them to be mechanically and electrically perfect. Plus polished end plates of heavy bakelite. Rotor ¼ inch diameter. Sturdy, heavy aluminum alloy plates properly spaced to insure proper low radiation capacity. Dial and knob of vernier type. No dial on plain type. Has low ohmic loss and minimum.

No. Plates	Mfd. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
3		H815	$ .50		
5		H816	.57		
11	.0003	H814	.75	H825	$1.05
17	.0005	H817	1.20		
25	.0007	H813	1.27	H824	1.90
43	.001	H812	1.90	H823	2.45

LOW LOSS VARIABLE CONDENSERS

The latest 1924 condensers. Reduce natural losses increasing efficiency of panel. Specially designed plates. Vernier type has single control by turning ¼ inch shaft. Dial required for vernier type.

No. Plates	Mfd. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
11	.0003	H838	$0.90	H835	$2.35
23	.0005	H837	2.42	H834	2.85
43	.001	H836	2.90	H833	3.60

LOW LOSS VERNIER VARIABLE CONDENSERS

H827 .0003 mfd. Each $1.85
H826 .0005 mfd. Each 2.30
H824 .001 mfd. Each 2.60
Highest grade instrument. Accurate calibration. Embodies all the latest improvements. Improved contact positive adjustment. ¼ inch shaft. No dial included. Dial required.

ENCLOSED VARIABLE CONDENSER

One of the best made condensers. Rigid, aerodynamic shape. Finished nickel. Enameled ends. Does not require. Has ¼ inch shaft.
H808 43 plate .001 $3.80
H808 41 plate .0005 3.45

GOLD VARIABLE CONDENSERS

H784 .00025 mfd. $2.80
H783 .0005 mfd. 4.10
H780 .001 mfd. 4.90
An absolutely high grade condenser. Copper plates, soldered connections. Low loss type. Bakelite ends. Metal cover cancelled by removable knob. Complete with dial.

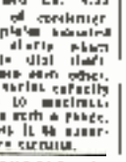
DUAL LOW LOSS VERNIER VARIABLE CONDENSER

H843 21 plate .0005 $3.75
H844 17 plate .0003 3.35
H844 23 plate .0005 4.20
H843 43 plate .001 4.95
A specialty with many new special features. Three are brass soldered together. Hard rubber insulation. Pointer drive on side. Knob, vernier and escher metal dial for front of panel make striking appearance. Metal connections. Brackets on 17 and 23 plate for mounting radio frequency coils.

AERLER VARIABLE CONDENSERS

H820 .0003 mfd. Ea. $4.25
H821 .0005 mfd. Ea. 4.55
A new type of condenser. Each set of plates mounted on separate plastic piece are mated to dial itself. Plates don't come each other. Complete insulation of dial varies capacity ratio almost absolute zero to maximum. Read No over condenser has such a range. This feature especially adapts it to super-heterodyne and other sensitive circuits.

ACME LOWEST LOSS CONDENSERS



H818 Each $1.65
Designed by Acme engineers for long service and efficient operation. Brass rotor is a miniature. Knob plate connected to rotor shaft. Enclosed in dustproof polished hard Bakelite cover with knob. ¼ inch shaft. Requires 3 inch dial. One hole only. Maximum capacity .0005 mfd.

STANDARD JACKS

H387 Open circuit jack. Each 25c
H388 Two circuit jack. Each 35c
Well made, durable, specially switch. Nickeled frame. Well insulated.

DUBILIER MICADON TYPE 601

H562	.0001	H507	.25c
H563	.00025	H508	.30c
H568	.0003	H509	.001
H509	.001	H510	.005
H506	.002	H514	.04

DUBILIER MICADON 601-G

Consists of a Type 601 condenser with brackets designed to fit any panel on a radio frequency performance, grinding basis. Fit
H583 .001 mfd. 40c
H584 .002 mfd. 40c H583 .0025 mfd. 40c

DUBILIER MICADON 601-K

Consists of a Type 601 condenser with brackets designed to fit any panel on a radio frequency performance, grinding basis. Fit
H583 .001 mfd. 40c
H584 .002 mfd. 40c H583 .0025 mfd. 40c

FRESHMAN MICA CONDENSERS

H818	.0001		.35c
H813	.00025		.35c
H813	.0005		.35c
H814	.001		.35c
H515	.002	H519	.006
H512	.0025	H567	.01
H520	.005	H522	.025

FRESHMAN VARIABLE GRID LEAKS

H122 Type of panel mount 5 to 10 megohms
H120 10 megohms of panel style
with .00015 Condenser
H121 Same mounting data with .00025 Condenser

C H L VARIABLE GRID LEAK

H123 Without condenser but arranged to take any standard grid condenser
H125 With .00025 condenser
Genuine knob metal resistance from ¼ to 5 megohms.

HANDLEAK

Latest improved type.
H160 Without condenser. Resistance ¼ to 10 megohms
H161 With .00025 condenser

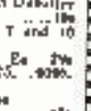
TUBULAR GRID LEAKS AND CONDENSERS

Cut sheet lists of condenser required, but all parts are listed separately.
H649 Grid leaks can be used with Dubilier grid condensers
Built only in 1, 2, 3, 5, 7 and 10 megohms. Strictly reliable.
H650 Grid and Plate Condensers. Each
Capacities .00025, .0001, .00025, .0005. Strictly reliable.
Mountings—Essential Base
H640 Single Mark
H642 Double Mark
H644 Triple, Each

SUPERIOR RADIO JACKS

Finest quality jacks. Tripod design. Bell mouth. Chamber bronze bushings. Silver contact points. Nickel finish. Means on panel ⅞ to 1¼ in.
H390 Open circuit. Each
H391 Closed circuit. Each
H392 Two circuit. Each
H393 Single circuit filament control
H394 Two circuit filament control

NEW STYLE JACKS



H385 Single circuit. Each
H388 Double circuit. Each
Small in size open end shelf type. Binding posts accepted connector. Well made, durable spade mountings. Well insulated.

GOLD TIP JACKS

H389 Pair
Eliminates expensive lugs and nuts. Mount on panel and insert tip at top of socket and clip. Nickel finish.

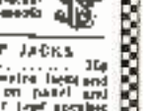
JACK SWITCHES

Compact and efficient radio contacts. Same as Jacks. Furnished complete with six and one open plate. Rear and screws.
H380 Two Strings. Usually used as "A" battery switch. Each
H381 Three strings. For switching from one to three wires. Each

RADIO SWITCH

H387 Each
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

SUPERIOR RADIO SWITCH



H383 Each
A switch fully equal in appearance and in the manner of a Jack. Has a short lever that is usually good for a switch of anywhere near usual quality.

ONE HOLE MOUNT

H402 Each
Only a panel hole need be drilled to mount for mounting variable condensers when tuning inductance. Saves drilling. Permits secure adjustment in any position.

WITH BARAWIK STANDARD RADIO GOODS

YOU SAVE MONEY WHEN YOU BUY FROM US

WE PAY TRANSPORTATION CHARGES IN U. S. EAST OF THE ROCKIES
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
FAST SERVICE—TRY US AND BE CONVINCED

THIS GUARANTEE PROTECTS YOU—Examine the goods as they arrive. They must feel you as every unpack. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid.

VACUUM TUBES

Standard Brands—Guaranteed. Radiotron Every one guaranteed new and perfect. We will duplicate in stock tubes not specified otherwise.

H105 Detector UV200, C300, Kent $3.50
H112 Amplifier, UV199A, C301A, Kent 3.50
H116 6-Watt Transmitter 3.50
H107 UV211, C11 Kent 3.50
H101 WD11, C11 Kent 3.50
H102 UV199, C300, Kent 3.50

ADAPTERS

To use the C11 tubes in standard base sockets simply insert one of these adapters in the socket.
Uses amperes or 199 tubes....35c
H104 For 201 or WD11 or C11 tubes 40c

C11 SOCKET

H106 Each..... 35c
Genuine moulded bakelite. Contact surfaces make firm contact with tube. For C11 or WD11 tubes

BAKELITE SOCKET

Nine Standard base . 3½ pins UV199 type 25c
Moulded of genuine red brown bakelite. Unaffected by moisture or heat. Contact points of phosphor bronze. Screw terminals. Best value.

EXTRA STRONG SOCKET

H140 Standard base 35c
H138 UV199 type 35c
Extra heavy. Moulded base. Double reinforced CONTACT springs. For standard tubes only. A wonderful value.

PANEL MOUNT SOCKET

H103 Each..... 45c
The best socket value on the market anywhere. Extra heavy, moulded, genuine Bakelite. Double reinforced contact springs. Will mount on panel from behind. Standard base.

THREE GANG SOCKET

H144 Each..... $1.25
Extra heavy, moulded, genuine brown bakelite. Takes three standard base tubes. For base or panel mounting. Highly reinforced contact springs.

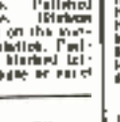
METAL TUBE SOCKET

H134 Each..... 25c
Nickel plated brass tube set in base made of genuine bakelite. Plainly marked binding posts. An excellent value.

STANDARD TUBE SOCKET

H150 Spring Gang....75c
H151 Phoenix Gang....$2.25
Bakelite base. Polished nickeled tube. Bakelite moulded socket on the market. Heat insulated. Full line contact. Marked terminals. For base or panel mounting.

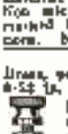
CUSHION BASE SOCKET



H145 UV Base 35c
H146 Standard Base 75c
Mounted on high insulated special bakelite tubes. Non microphonic. Highly nickel binding post connections. Most dependable.

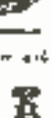
BINDING POSTS

Brass, polished nickel finish. Washer and nut ¼ in. screw extending ⅜ in.



H329 Large size — thread and knob ⅝ in. high. Doz. 70c

H330 Large size with hole for phone tip or wire. Doz. 80c



H332 Rubber base thread and knob ⅝ in. high. Doz. 70c

H328 Small size with hole to insert tip or wire. Doz. 35c

LETTERED BINDING POSTS

H329 Set of eight ...35c
Nickel plated engraved. Complete Lugs and Lettered as shown in illustration. Absolutely guaranteed. Improves appearance. Sold in sets of eight only.

COMPOSITION TOP BINDING POSTS

H324 Dozen 45c Mounted $1.00
Composition top, nickel plated body. 6/32 screw with washer.

SWITCH CONTACT POINTS

Those polished nickel points. Base ⅜ in. long also 6/32 screws and two nuts.
H303 Dozen....10c Hundred....70c
Thousand $5.75

Solder Lugs Of All Combined Points Also for connecting wires to binding screws, etc.
H305 Dozen 4c Hundred 30c

SWITCH LEVER STOP

Brass Polished nickel finish
H306 Dozen....15c Hundred $1.05

SUPERIOR RHEOSTATS

H147 6 ohm 45c
H148 30 ohm 55c
H149 30 ohm 70c
One of the best rheostats we have ever seen at a price that looks to us like value at. Unsurpassed shaped black bakelite knob and noise silent. Single hole mounting. A rheostat you will be proud to have in your set.

FILAMENT CONTROL RHEOSTATS

H152 6 ohm. Each....30c
H153 20 ohm. Each....35c
H151 30 ohm. Each....35c
H150 6 ohm. Vernier 75c
Dual Brass. Will give right current. Durable and better. Black hard rubber knob. Single hole mounting. Smooth action. Dependable contact. Quick to make. Have thousands in use.
H152 200 ohm..35c H154 400 ohm..35c

FROST METAL FRAME RHEOSTAT

H161 6 ohm plain ... 50c
H162 6 ohm vernier ... 65c
H163 25 ohm plain ... 50c
H164 25 ohm vernier ...85c
Nickel plated brass frame. Bakelite knob. Single hole mounting. Smooth action. Dependable contact. Quick to make. Have thousands in use.
H162 200 ohm..50c H164 400 ohm..50c

AMSCO RHEOSTATS

A complete line of rheostats and potentiometers of the highest quality. Bezel and knob are genuine bakelite. Panel and arrow on knob aids true effort as a dial. Smooth action.
H335 Plain 6 ohm H336 Vernier $1.20
H338 Plain 1.05 30 ohm H339 Vernier 1.40
H337 Plain 1.10 30 ohm
H339 Potentiometers to Match Above Rheostats
H339 350 ohm $1.10 H321 400 ohm $1.20

HOWARD RHEOSTATS

A well known line of rheostats and potentiometers that is always very satisfactory serves to its users. Complete with knob and DIAL.

H211 Plain 45c 6 ohm H212 Vernier $1.25
H213 Plain 45c 25 ohm H214 Vernier 1.25
H215 Plain 70c 40 ohm H216 Vernier 1.25
H217 200 ohm Potentiometer 1.50
H218 400 ohm Potentiometer 1.50
H347 6 ohm Midget rheostat .... .85
H348 25 ohm Midget rheostat .... .85
H348 40 ohm Midget rheostat .... .85

Single Hole Mounting Type with Dial

H338 Plain 45c 6 ohm H335 Vernier $1.25
H339 Plain 45c 25 ohm H339 Vernier 1.25
H340 Plain 70c 40 ohm H339 Vernier 1.25
H339 200 ohm Potentiometer 1.50
H339 400 ohm Potentiometer 1.50

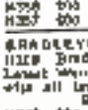
GRADUATED POTENTIOMETER

H339 Brand new. Each..... $1.50
Latest improved type. Can be used with all types of tubes.

Graduometer

H209 200 ohm. Each.....$1.00
H214 400 ohm. Each 1.00

ADAPTO POTENTIO



A standard and potentiometer combined in one unit. Does the work of two separate instruments. Use same potentiometer.
H237 With 6 ohm rheostat . . $3.50
H238 With 30 ohm rheostat 3.50

AMPERITES

Electronic rheostats or amperites takes where accuracy is not critical. Automatically adjust themselves according to flow of current keeping same at proper point for maximum efficiency. Complete with mounting.
H231 For UV201A or 201A tubes.....25c
H232 For UV200 or C300 tubes.....25c
H233 For UV199 or C299 tubes.....25c
H234 For WD11 or C11 tubes.....25c

TINNED COPPER "BUS BAR" WIRE

Also by cleaned rubber wire. For wiring sets. Uses wire for neat set and easy replacing.
H237 Tinned. Ten feet for 25c
H238 Square. Ten feet for 14c

BRADENITE

For covering connecting wires in sets. Per foot 12 and 24 wire.
H283 Flexible stranded tinned and insulated with best rubber lustrous transparent insulating varnish. 3 feet for 10c
H285 Best quality braided and covered with fine insulating compound 3 feet for..10c

OUR SPECIAL A. F. TRANSFORMER

H348 3 to 1 ratio..$2.25
H350 5 to 1 ratio.. 2.45
Is quality of tone and volume of sound. Take it unless a manufacturer is to pay for we guarantee it to equal or surpass any other transformer. Used in thousands. Carefully made. Fully guaranteed. Handsomely mounted with plainly marked binding post connections. Wonderful results. Fully described without distortion or noise or blank spot. A quality that is worth your while. A marvelous value at a modest price. A transformer you will be proud to have in your set.

OTHER STANDARD GRAND AUDIO FREQUENCY TRANSFORMERS

Grade. Cheap Made in Switzerland Consistency

H347 Thordarson Radio 2½ to 1.....$3.50
H348 Thordarson Radio 5 to 1..... 3.75
H349 Thordarson Radio 2 to 1 ..... 3.95
H351 A.R. American 10 to 1 shielded 3.00
H352 Ab American 3 to 1 shielded 3.00
H355 Ab American 5 to 1 shielded 3.00
H354 All American Push Pull, Each 3.50
H351 Sleeve 10 to 1 Each..... 4.50
H352 Sleeve Push Pull, Pair 8.00
H344 Federal No. 250, Each..... 4.00
H345 Federal No. 61 Each..... 6.00
H312 Radio Corp. Each 5.00

TRICOIL R. F. TRANSFORMER

H308 For 200A or 201A Tubes $1.50
H381 For 199 or 12 or 71 Tubes 1.50
This transformer will produce wonderful results in any type of regular or tuned R.F. circuit. Perfect for use in Tuned Radio Frequency circuits. Perfect for use in one or three stages. Connect, completely turn, easily mounted. Ranges 125 to 600 meters.

DURALITE DURATRON

H301 Each $3.48
A high grade, efficient radio frequency transformer that will give excellent results. Ranges 220 to 550 meters.

ACME TRANSFORMERS

H353 A. F. Transformer Each $5.50
Acme transformers are well known to every radio fan. Made of best grade materials. Will give excellent service.

ACME R. F. TRANSFORMERS

H385 R.F. Tuner Each..... $5.50
H390 R.F. Secondary Each..... 5.50
H395 Set of R.F. Tuner and Secondary 10.00

ERLA REFLEX PARTS

Genuine Erla Parts

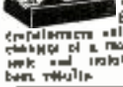
H379 Detector $5.95
H378 No. 1 Radio Transformer 3.95
H378 No. 2 Radio Transformer 3.95

H367 5 to 1 Audio Transformer $3.95
H388 3½ to 1 Audio Transformer $3.95
H380 Erla Crystal Detector 25c

RESISTANCE COUPLED AMPLIFICATION

H370 1st Stage Unit $2.50
H371 2nd Stage Unit 2.25
H372 3rd Stage Unit 2.25
Complete with all resistances, condensers, sockets, mounting panel, binding posts, hookup wire, etc. Each unit complete with all resistances and condensers other than those in the amplifying circuit. Each unit consists of a resistance with condenser, grid leak and resistance of proper value for best results.

FARNSTOCK CONNECTORS



H386 Single Cam Connector. Each 25c
H387 Double Cam Connector. Does the work of two single connectors. Each 35c
H389 Antenna Connector. Each 15c
Handy and convenient for connecting wires or making connections on binding posts or other parts of instruments. Wires held firmly in spring also but may be instantly removed.

COPPER FOIL

H358 Per Piece 25c
Thin copper foil for shielding panels. 6 inches wide, 2 feet long. 288 in Block.

INSULATED BUS BAR WIRE

H359 Package of 8-20 inch pieces....49c
Tinned copper bus wire insulated with tasteful cambric varnished covering 5 pieces, one each color—Yellow, brown, black, green and red. Using different colors makes tracing of circuits easy and quick. Solder and keep neat.

RADIO "BAKELITE" PANELS

We supply genuine Bakelite, Condensite Celoron or Formica, all of which have practically identical properties. Highness well without chipping. Won't warp. Waterproof. One side has pleasing natural polished black finish which can be sanded and filed. Other side rough or fine. Rubber side may be used as desired.

Panel Size Inches	4" Thick Art. No.	Price	3/16" Thick Art. No.	Price	¼" Thick Art. No.	Price
5x 7	H458	$.55	H488	$.64	H439	$.85
6x7½	H459	.65	H481	1.10	H441	1.60
7x14	H460	1.30	H486	1.75	H442	2.35
7x18	H453	1.70	H463	2.20	H443	3.15
7x21	H457	2.05	H487	3.65	H477	4.10
7x24	H458	2.42	H488	2.90		
7x30			H452	3.25		
8x14			H464	2.35	H474	3.15
10x14			H483	3.50	H435	3.80
12x21			H466	4.55	H436	5.75

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 3/32 inch.

Size Inches	Price	Size Inches	Art. No.	Price
H481	$ .70	7x10	H493	$ .85
H482	.85	7x12	H484	1.00
H489	0.85	7x14	H485	1.20
H484	1.35	7x18	H488	1.50
H483	1.40	7x21	H490	1.85
H489	1.50	7x24	H491	1.95

COMPOSITION DIALS

Genuine dials beautiful in one piece of polished composition 3 inch size has 270° scale marked 0 to 100 deep engraved and contrasting white enamel 3 and 4 inch size have 180° scale marked 0 to 100

Diam. No.	Price	Small Size Diam	Small Size No.	Small Size Price	Midget Size No.	Midget Size Price
H421	15c	2"	3/16	H431	10c	
H422	18c	2"	1/4	H432	15c	
H423	22c	3"	3/16	H433	20c	
H424	25c	3"	1/4	H434	25c	
H425	33c	4"	1/4	H435	35c	

GENUINE BAKELITE DIALS

H431 2 in. Diam. for 3-16 in. shaft....25c
H433 3 in. Diam. for ¼ in. shaft.....35c
H423 3 in. Diam. for 3-16 in. shaft....30c
H434 3 in. Diam. for ¼ in. shaft....35c
H435 4 in. Diam. for ¼ in. shaft....45c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved dials in contrasting white enamel. Both dials have dip the degrees. Highest grade dials for good jobs. Stands perfectly.

SUPERIOR VERNIER ADJUSTER

H342 Each 25c
Polished black knob "Vernier" engraved in white. Silver adjustment. Need not be disassembled for mounting. Easily installed.

VERNIER DIAL ADJUSTER

H335 Each..... 15c
Easily installed at edge of dial, gives finest vernier adjustment of condenser as indicated. A great value. Polished black knob.

UNIVERSAL CONTROL DIAL

H318 For ¼ in. shaft, silver dial, black knob $1.15
H319 For ¼ in. shaft, silver dial, black knob 1.10
H315 Gold dial, engraved knob for ¼ in. shaft Each.....$1.25
Improves ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, rheostat, potentiometer, etc. Easily installed. Turns easy action. Turns Dial. Equally suitable for panel mounting. Extremely desirable in every instrument.

BEZELS

Finest quality. Fit any standard panel.

Size Inches	Nickel No.	Nickel Price	Black No.	Black Price	Gold No.	Gold Price
2½	H361	15c	H362	15c	H316	20c
3	H363	15c	H364	20c	H311	25c
3½	H365	25c	H365	15c	H313	35c

PANEL ENGRAVING

H313 Per set 40c
A cutting set of tungsten is used which is guaranteed not marking connections. Dials are easily applied in a few seconds. Look like real switching apparatus. Contrasts neatly on black or mahogany panels. Prices of sides for the largest set.

BRASS ROD

Supplied cut in 3 inch lengths.

H361 Threaded 6-32, per 5 in. length 5c
H362 Threaded 8-32, per 5 in. length 5c
H363 Solid 3-16 in. Per 5 in. length 5c
H367 Solid ¼ in. per 5 in. length.... 5c

DIXIE SCREW ASSORTMENT

H360 140 pieces screws and nuts 45c
Complete screws and nuts of size and style needed for mounting any radio set.

BUILD YOUR SET BETTER–AT LOWER COST

Complete Sets of Parts for Popular Circuits

Only high grade parts are used in these sets and each part is guaranteed to be perfect. Each one of these circuits has been wired and successfully operated under many different conditions. The detailed instructions and diagrams supplied with each set make it easy for one not withstanding previous experience to build it and get wire real satisfactory results. Parts specified are for UV201A or C301A tubes throughout. If dry cell tubes are to be used specify type of tube to occur and correct parts will be furnished without additional cost

CABINETS

Fine looking cabinets solidly built. Highest grade of workmanship and finish. Will be found at home in any of these cabinets. Sloped tops. Panel rabbeted to take panels. Panels not included. Inside depth 7 inches except No. 1411, 12x21 which are 10 inches deep.

Panel Size	Art. No.	Each	Panel Size	Art. No.	Each
6x21"	H4281	$1.85	7x18"	H4251	$2.25
6x18"	H4321	2.00	7x21"	H4281	2.50
7x14"	H4311	2.00	7x24"	H4311	2.85
7x15"	H4381	2.00	7x21"	Height	2.75
7x18"	H4391	2.00	14x21"	H4391	3.00
7x18"	H4401	2.00	15x21"	H4392	4.00
7x18"	H4405	2.00	15x28"	H4402	4.50

BASE BOARDS FOR CABINETS

Base to consist of panel and 2x inside cabinet. ¾ inch wide, ¾ inches wide.

Art. No.	Length Inches	Price Each	Art. No.	Length Inches	Price Each
H4431	6½	25c	H4438	12½	35c
H4435	9½	27c	Same	20½	35c
			H4441	23½	38c
H4437	11½	28c	H4442	25½	38c
H4438	13½	31c	H4443	28½	38c

DE LUXE CABINET

The finest quality cabinet. A piece of furniture worthy of the best set. Piano of genuine solid walnut in elegant hand rubbed brown finish. Top has piano hinges and lid supports. Front has solid panel opening appearance. Inside depth 9 inches.

Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
7x21	H4451	$3.98	7x24	H4455	$4.25
7x24	H4461	4.50	7x24	H4499	13.50

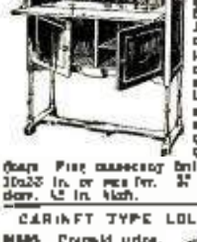
RADIO TABLE

H501 Parcel post. each $4.25. Solid maple or mahogany in fine finish, rubber feet. Extra strong. Top large enough for any set. Shelf holds all batteries and accessories handy. Just the thing for using and using. Just the thing for the home or for displaying sets in stores. Top is 18 by 30 inches. Height 28 inches.

CONCEALED RADIO TABLE AND LOUD SPEAKER

H503 Parcel post, each $7.50. Holds set, batteries and accessories. A very fine loud speaker with artistic covering in front is built just under the top. Speaker has a concealed sound door with volume. Panel which contains Baldwin units. Made of selected wood with extra quality antique walnut finish. Top size 19 x 16 in. Height 28 in.

CONSOLE RADIO CABINET



H502 Parcel post, each $17.50 A high grade piece of furniture. Most appearance. Elegant finish. Looks well among best furnishings. Novel compartments hold each set with batteries, chargers and all accessories. Can be entirely closed and locked. Very accessible. Strong durable construction. Piano hinges. Fine appearing finish. Takes panel 10x28 in. or less. 27 in. wide, 24 in. deep, 42 in. high.

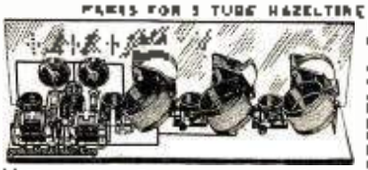
CABINET TYPE LOUD SPEAKER

H505 Parcel post, each ..... $13.50 A fine loud speaker with a full rich tone and musical volume. Amplifying chamber and unit enclosed in the mahogany finished cabinet, some with hooked doors front. Very economical and better looking than most other types of speakers. A wonderful value at our price.

Complete Sets of Parts for Popular Circuits

Only high grade parts are used in these sets and each part is guaranteed to be perfect. Each one of these circuits has been wired and successfully operated under many different conditions. The detailed instructions and diagrams supplied with each set make it easy for one not withstanding previous experience to build it and get wire real satisfactory results. Parts specified are for UV201A or C301A tubes throughout. If dry cell tubes are to be used specify type of tube to occur and correct parts will be furnished without additional cost

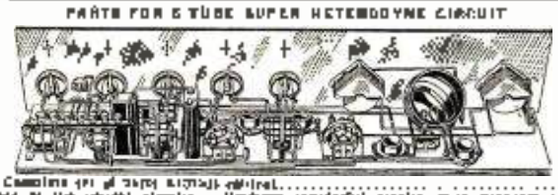
PARTS FOR 3 TUBE HAZELTINE NEUTRODYNE CIRCUIT



H550 Complete as parts, including polished cabinet $55.50

All the parts needed to build this circuit which is the leader of all circuits today. Takes first consideration. Does not disclose even their name based on. Points to distant stations clear as the best Pocket in clear Durolac with wonderful volume. Essential parts mounted upon Bakelite panel. Complete Bakelite panel Drilled ready to mount parts. Complete instructions furnished for assembling and wiring. Price is prepaid.

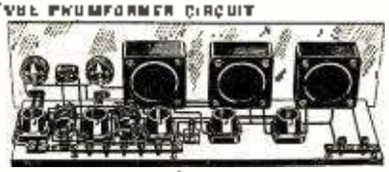
PARTS FOR 6 TUBE SUPER HETERODYNE CIRCUIT



H554 Complete set of parts including cabinet..... $57.35

This is the newest circuit. Produces wonderful results when properly handled. This set requires careful construction and wiring and we only recommend it to persons who have had some experience in building sets. Designed to be used with loop. Points to distant stations very sharp interference, with good volume and also unusually clear wire undisturbed tones. Best grade mahogany finished cabinet. Genuine bakelite panel 7x36x3/16" drilled ready to mount parts. Instructions furnished for assembling and wiring. Price is prepaid.

PARTS FOR 5 TUBE PHUMFORMER CIRCUIT



H560 Complete set of parts, including high grade cabinet..$55.85 Also if the cabinet only is built, first choice quality. Two stages tuned radio frequency amplification detector and two audio stages amplification. Wiring in the direct stations with great volume and purest tone. Best grade parts furnished throughout. Genuine bakelite panel 7x36x3/16" drilled ready to mount parts. Complete instructions furnished for assembling and wiring. Commercial grade

REFLEX CIRCUIT

H618 Complete parts, one tube set..... $41.90
H617 Complete parts, 2 tube set..... 51.35
H625 Complete parts, 5 tube set..... 58.50

These circuits have proved a very big hit in radio. One uses does the work of three in an ordinary set, two equal to four. Have great fun. Unusual distance. Improved quality of reproduction, possessing the full mellow tones of the original. Easily handled, will prove a delight to all. All parts are exactly as specified in this circuit. Panels are drilled for our ensemble. One tube set has 7x7 panel, two tube 7x14, three tube 7x18. Prepaid

FREEMAN MASTERPIECE SET

H650 Complete with tubes, batteries and accessories as listed below $107.00

A five tube tuned radio frequency set that brings in distant stations on the loud speaker with remarkable volume and excellent quality of tone. By careful arrangement of apparatus a panel 7x21 inches is used without crowding the parts. Engraved label. Finely finished cabinet of selected mahogany. Highest grade parts throughout.

Our price includes the following: Set complete with cabinet, five genuine C301A or UV201A tubes, two genuine Bear Success "A" Battery, one 45 volt "B" batteries, one H613 special loud speaker and complete antenna equipment consisting of wire, insulators, lightning arrester, etc.

At our price this outfit is the best value obtainable anywhere. Note our price is complete. The price quoted is all you have to pay. Nothing else to buy.

HAMROCK FIVE TUBE NEUTRODYNE SET

H800 Complete with tubes, batteries and accessories as listed below $109.50

A high grade, besides the tube Neutrodyne set at an exceptionally attractive price. Manufactured under the Hazeltine patents. Most finest parts assembled by skilled workmen insure highest efficiency. Beautiful Panel and finely finished solid mahogany cabinet. Loud pictures and dials to be appreciated. Easy to tune. When Hollow has been heard once and record made of dial setting you need only set dials at same point and 11 stations at least-

cation it will be heard. Points to distant stations loud and clear on full speaker. Our price, which is unprecedented, includes the following: Set in cabinet, five C301A or UV201A tubes, two genuine Bear storage "A" batteries, one 45 volt "B" batteries, one Magnavox R-1 loud speaker and complete antenna equipment consisting of wire, insulators, lightning arresters, etc. A high grade outfit for those who want the best. Our price is prepaid.

FADA 8 TUBE KNOCK DOWN NEUTRODYNE SET

H693 Without cabinet $48.00

Complete of all parts necessary to build a high grade receiver capable of receiving over long distances. All parts are genuine Fada, well known for their high quality and efficiency. Parts include a drilled bakelite panel drilled and engraved ready for mounting Fada licensed neutrodynes and preselector equipment. Equipment and all other necessary parts. Complete instructions for assembling

LICENSED NEUTRODYNE PARTS

H652 Licensed Neutrodyne Kit $16.85

Includes three licensed Neutroformers, 2 condensers panel tuned, complete panel and set of instructions for building up neutrodyne set. By adding other parts a receiver can be built at low cost.

TUNED RADIO FREQUENCY UNIT

H653 Each $3.98

Three for 9.25

Consists of radio frequency transformer wound on bakelite tubing and high grade variable condenser. Two can be tuned radio frequency amplification. Specify band in coils of three. Condenser shaft ¼" dia.

BALANCING CONDENSERS

H654 Pair ..... .49

Sold in pairs for neutralizing the capacity in two stage tube receiver circuits.

PARTS FOR SUPER-HETERODYNE

H684 Baron Super-Heterodyne Kit $22.50

Consists of one oscillator coil, one tuned filter transformer coil and three intermediate frequency transformers. Coil forms and mounting. All diagrams. Coil forms and transformer cans mounted on genuine bakelite. Kit is for Super-Heterodyne construction included.

REMLER SUPER-HETERODYNE PARTS

H687 Per set $22.40

Set includes one oscillator coil, two tuned stage impedance rich condenser mountings mounted, three intermediate frequency transformers, and wiring diagram. These parts in circuit recommended have been built up into very satisfactory sets.

BRANSTON SUPER-HETERODYNE KIT

H688 Per set $28.50

Contains the special parts necessary for a seven tube Super-Heterodyne set, as oscillator coupler, one tuned stage transformer, three intermediate radio frequency transformers and one antenna coupler. Panel layout and instructions included.

LARGE CAPACITY FIXED CONDENSERS

Tested for use in the most radio circuits listed here. Soldering lugs for easy connections. Specially made.

H358 .25 mfd	.25c	H1359 .5 mfd	.5.85
H360 .1 mfd	.15c	H361 1 mfd	.1.55

SPIDER WEB COIL FOR REINARTZ CIRCUIT

H694 Each $1.10

A very unusual value. Made of brass with covered wire, windings wound. It has an adjustable that crosses itself, so. Mounting bracket. Parallel various types of mounting. Directions included.

H692 Complete parts for one tube set using the above coil. Test drilled panel mounted cabinet $10.75

H693 Complete parts for three tube set mounted cabinet 7x21 panel 17.00

COCKADAY PARTS

H688 Per set .. $1.95

Consists set coils for Cockaday circuit. Primarily calculated and wound to work best results on with new neutral circuit.

H689 Jewell grid-leak for Cockaday Improved 5 tube circuit 1.70

H677 H688 ohm grid-leak "Lavite" Resistance, each 31.00

H693 Complete parts for one tube set using the above coil. Test drilled panel mounted cabinet $10.25

H694 Complete parts for three tube set mounted cabinet 7x21 panel 12.75

ULTRA AUDION PARTS

H690 Each 1.65

Holder set wound of drum silk covered wire. Four less. Produces wonderful results. Plans which and wooden coil for Cockaday and directions included.

H695 Complete set of parts for Ultra Audion set using one tube shown coils 87.15

H696 Complete parts for 3 tube set 51.35

COILS FOR HARKNESS CIRCUIT

H255 Per set of two $1.85

Close silk windings on cardboard paper tubes. Properly calculated to give best results.

PHUSIFORMER

H646 Each $4.85

A new device absolutely 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, 3 in. high. Three coils occupy small space and may be used to make up a very efficient 3 tube set at low cost.

Build the Neutro-Reflex—

Complete Set **$15.00**

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.

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 postcard from you.

If your dealer cannot supply you use the coupon below

"RICO" Straight Line Condenser

New manufactured in three types, to replace 43 plates, 23 plates and 11 plates.

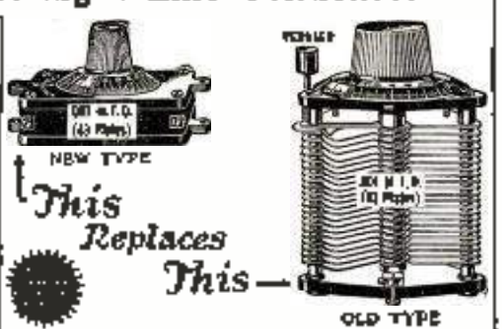
No. 450 "Rico" Condenser .001 mfd. 143 plate capacity) **$1.75**

No. 423 "Rico" Condenser .0005 mfd. 123 plate capacity) **$1.75**

No. 411 "Rico" Condenser .00025 mfd. (11 plate capacity) **$1.75**

All above types without dial **$1.50**

THREE STYLES
.001 mfd. 143 Pl.)
.0005 mfd. 123 Pl.)
.00025 mfd. 11 Pl.)



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.

The "Rico" condenser weighs 6 oz.

The old style weighs 15 oz.

"Rico" vernier type has only one dial.

Old type requires difficult mechanism.

SPECIAL ANNOUNCEMENT

"Rico" No. '6' Headset Now $2.95

GUARANTEED FOR ONE YEAR

FAMOUS TRI-POLE PULL

Finest pair of Headsets made—DON'T PAY MORE *INSIST ON "RICO"*

Our large Production enables us to give you the full benefit of this unusually low price

IF YOUR DEALER CANNOT SUPPLY YOU USE THE COUPON BELOW

Radio Industries Corp., RN12
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

The Tropadyne
Super Radio Outfit

Greatest Distance, Superior Volume, No Distortion. Positively Non-Radiating, Six Tubes Do the Work of Eight—The Only Super Radio Set with Tuned Intermediate Transformers

Kit No. 350 PRICE $28.75

$6.75

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.

The Tropaformer does away with special input couplers, grid leak, fixed by-pass condensers and inefficient, broadly tuned transformers. It may be tuned to any wave-length from 2500 to 30,000 meters, thus the advantages of either low or high intermediate frequency can be had.

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. Unequalness 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."

It is now possible to build a real Super-Heterodyne that not only exceeds them all, but is the only Super-Heterodyne *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 balanced ever so well, when placing them in the circuit they become unbalanced automatically due to inductive effects between transformers, lead wires, etc.

The TROPAFORMERS built according to the inventor's—Mr. C. Fisch—specifications can be scientifically balanced by anyone. Each transformer is equipped with one of our well known condensers which is shunted across the secondary of the transformer. This is the big secret of the TROPADYNE circuit and accounts for its wonderful work. Once the TROPAFORMERS are tuned by means of the three condensers they need not be touched again; *the balancing is permanent.*

Any other technical information will be gladly supplied by us. We offer to the trade and those interested in building their own TROPADYNE Super-Heterodyne the following.

No. 350 Kit consisting 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

IF YOUR DEALER CANNOT SUPPLY YOU USE THE COUPON BELOW

RADIO INDUSTRIES CORPORATION

133 Duane Street New York City

RN12

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.....

Crosley
Head Phones
Better—Cost Less
$3.75

Of Course It's a CROSLEY

Better-Costs Less Radio

TO COMBINE the two most desirable things in radio distant clear reception at the lowest possible price—there is only one radio receiver for you. That is a Crosley.

When you listen in on a Crosley—no matter what the price—you wonder, as thousands of others have, that such exceptional results can be obtained, and so reasonably.

The answer is simple—quality radio receivers built in quantity production. During the past twelve months, we believe Crosley made and sold more sets than any other manufacturer in the world. This is self-evident proof of Crosley Quality and Crosley Performance. Combined with Crosley excellence are such additional advantages as selectivity, ease of tuning, simplicity and beauty—all at the lowest radio cost.

THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

1222 Alfred Street, Cincinnati, O.

Crosley Owns and Operates Broadcasting Station WLW

Crosley Trirdyn Newport, $100.00
With tubes and Crosley Phones $115.75

CROSLEY has made it possible for everyone to own a radio receiver. You can start with the one tube Armstrong Regenerative Receiver at $14.50, without accessories—$22.25 with tube and head phones—the lowest priced regenerative set on the market, and equivalent in reception to many two tube receivers. Then as more volume is desired, you can add to it at a very low cost.

Or, you can purchase the three tube Crosley Trirdyn Regular, which has come through the summer period of comparatively poor reception with colors flying—for only $65. In Special Mahogany cabinet to house necessary accessories—$75, or the beautiful new Crosley Trirdyn Newport as shown herewith, $100. The combination of one stage of tuned radio frequency, with regenerative detector and reflexed amplification, has proven beyond a doubt that the features of selectivity, volume and ease of operation can be obtained with three tubes better than heretofore has been possible with five tubes. We believe that no other set on the market combines these features so well incorporated in the Trirdyn.

In addition there are the Crosley 51, the two tube Armstrong Regenerative Receiver that became the biggest seller in the world in just 24 days, price $18.50. This set will at all times bring in local stations on the loud speaker and distant stations under fair receiving conditions. Distant stations can at all times be heard with ear phones. The three tube Armstrong Regenerative Receiver Crosley 52, that brings in distant stations with loud speaker volume under practically all conditions, price $30; and the Crosley 50 and 51 set in portable cabinets at $18 and $25. These receivers, each in its own class, though assuring you as good or better reception than any other instrument of the same number of tubes, are by far the least expensive ever offered to the public.

Before You Buy—Compare Your Choice Will Be a Crosley

For Sale By Good Dealers Everywhere

Write for Complete Catalog

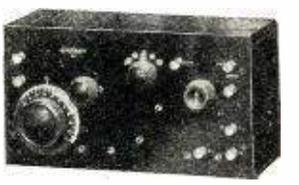
The CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

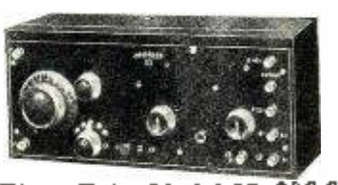
1222 ALFRED STREET CINCINNATI, OHIO

Crosley Owned and Operated Broadcasting Station WLW

Crosley One Tube Model 50, $14.50
With tube and Crosley Phones $22.25



Crosley Two Tube Model 51, $18.50
With tubes and Crosley Phones $30.25



Crosley Three Tube Model 52, $30.00
With tubes and Crosley Phones $45.75

Crosley Two Tube Model 51-P, $25.00
With tubes and Crosley Phones $36.75

Crosley Regenerative Receivers are licensed under Armstrong U. S. Patent 1,113,149. Prices West of the Rockies add 10%.

Crosley Trirdyn Regular, $65.00
With tubes and Crosley Phones $80.75

Crosley Trirdyn Special, $75.00
With tubes and Crosley Phones $90.75

Mail This **Coupon At Once**

The Crosley Radio Corp'n.
1222 Alfred St.
Cincinnati, O.

Mail me, free of charge, your catalog of Crosley receivers and parts with booklet entitled "The Simplicity of Radio"

Name_____

Address_____

Every one of the C-H Radio products—the famous Rheostats, Grid Leak, Potentiometer, Radio Switch and Socket—was designed by these engineers whose successes in electrical design are acknowledged throughout the world.

A Moments Care in Buying Assures Hours of Better Reception

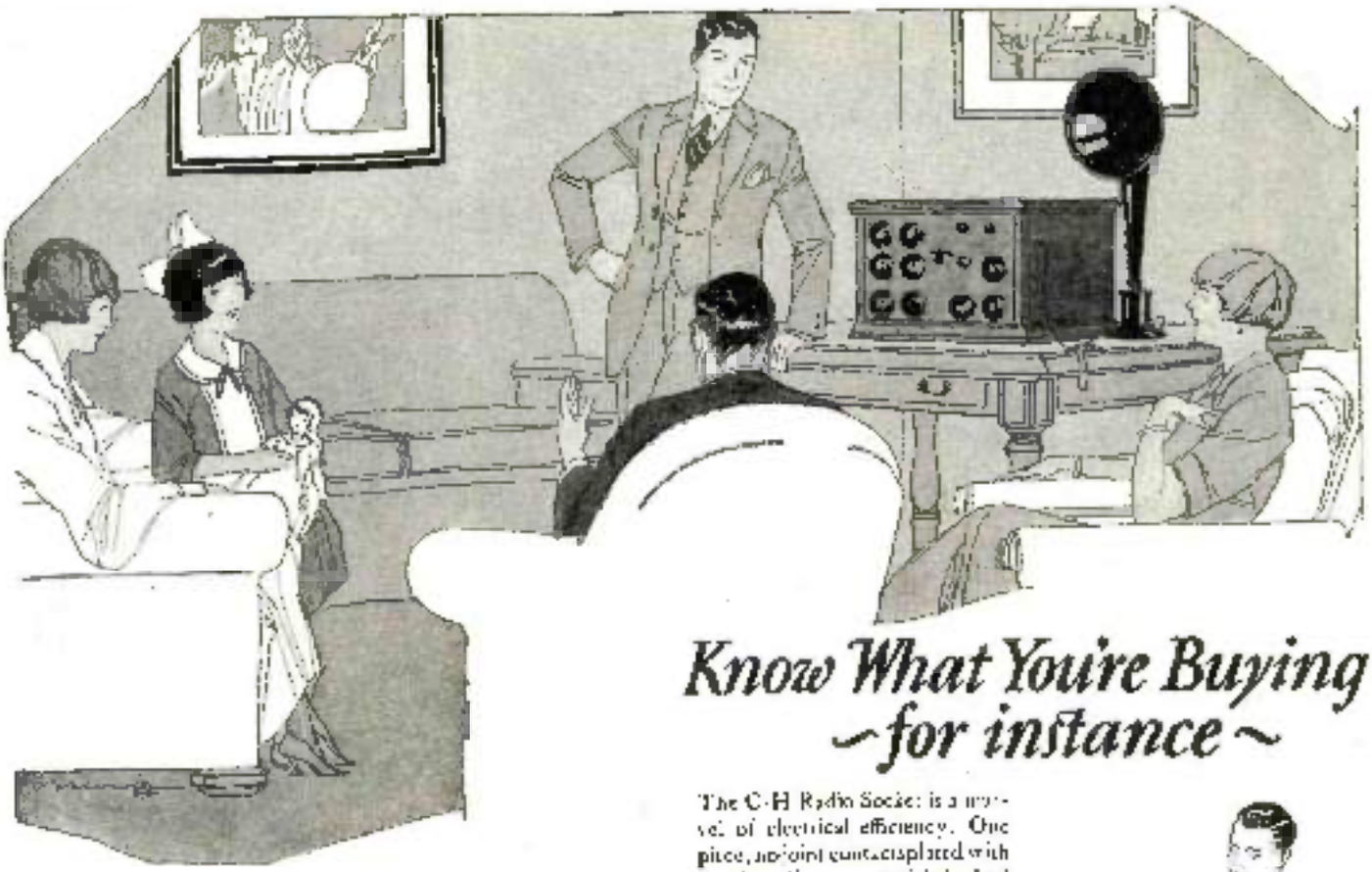
Your set starts with the first instrument you buy. It and every other part you put behind your panel determines the results you obtain for the money you spend.

In radio, because of its very nature, the receiving set is only as good as its weakest part. One instrument of poor design or improper construction limits the efficiency of the entire circuit.

Because of this the man who builds his set and buys with care can be assured of maximum receiving pleasure at the lowest net cost. He can buy each part with understanding and combine in his set the cream of the engineering knowledge of the entire world.

For the delicate parts of your circuits—where the feeble energy received *must* be conserved—the Cutler-Hammer engineers, world famous for more than a quarter of a century as the master builders of all electrical control,

C-H CUTLER-



Know What You're Buying —for instance—

The C-H Radio Socket is a marvel of electrical efficiency. One piece, no-joint contacts plated with genuine silver—not nickel. And they are spaced wide—true low loss construction. The shell is real Bakelite and the base genuine Thermoplax. No "molded mud" or other poor construction in this socket. Prove it by holding a match to the base—it can't burn. But, be sure you see the C-H trade mark first—the dealer won't let you do that to most sockets.

have safeguarded the radio buyer with a trade mark that allows the most inexperienced enthusiast to buy with the confidence of seasoned engineers.

In their rheostats, grid leak, potentiometer and other radio parts, they have provided a degree of precision that means added miles of range and hours of clear, enjoyable reception. When you start to build, start right the dealer is glad to recommend C-H parts—this trade mark is his protection and yours too.

Before you buy a radio switch ask regarding its mechanism. You can now get many switches that provide the convenience of the original C-H "Bang-in-it" motoring—and buttons that make them look like the C-H Switch from the panel front. But no switch can give you the quiet reception, and positive operation that you get with the C-H patented Floating Contactor construction. Know the mechanism and you will know why all the leading set manufacturers are using it as standard equipment—and why there are almost a million in use today.

THE CUTLER-HAMMER MFG. CO.

Member Radio Section, Associated Manufacturers of Electrical Supplies

MILWAUKEE, WISCONSIN

Diagram of cover of C-H Radio Switch removed to show unique mechanism.

HAMMER

How many radio miles did you go last night?

HOW many radio miles did you travel last night—that's the up-to-the-minute question. Did you voyage from New York to Chicago? Did you look in on Boston fifty seconds after, and on Philadelphia half-a-minute after that? If you didn't, why didn't you? There's fun and excitement, too, in a De Forest Radio—and it's ready to "get to work" five minutes after it enters your home.

Here is a Radiophone so astonishingly simple for the work it does that it's your best introduction to the marvels of radio space. Here is one so perfectly developed that it invites graduation from other less efficient instruments.

Here is a receiving set sponsored by the very genius who made radio, as we know it, possible—an instrument which offers a really remarkable demonstration in radio performance at a price far less than any instrument whose achievements compare with it. Here is a practical, a modern Radiophone, depending upon no out-strung wire to obtain results, but which, with a simple loop the size of a picture frame, opens to you a far-flung range of concert, speech and lecture—and all with a tonal purity, a sensitiveness of choice that is rare to any but De Forest users.

DE FOREST RADIOPHONE

D-12 REFLEX

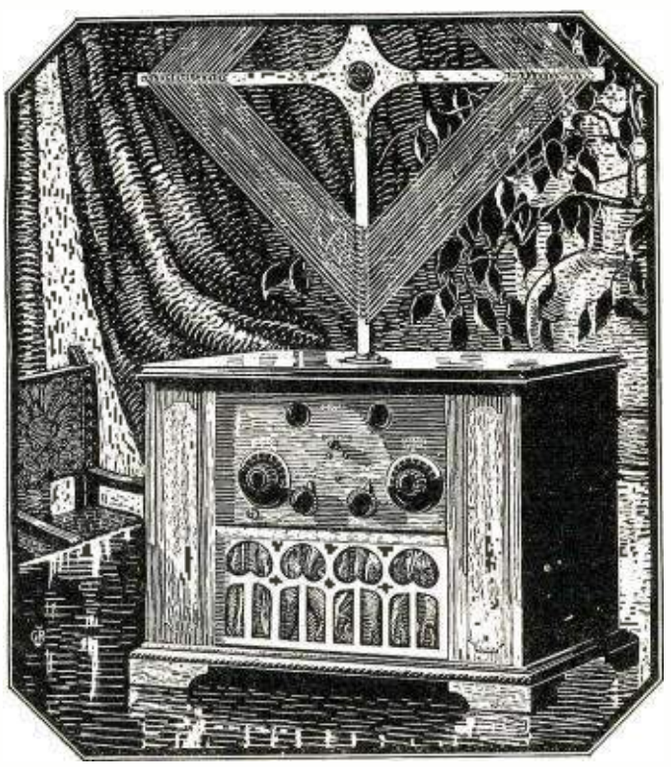
For Beauty and Clear Reproduction

Use the De Forest Loud Speaker. It reproduces naturally, brilliantly, without distortion. The adjustment of the reproducing unit assures uniform response over entire range of audible frequencies. Its horn is shaped to retain the full brilliancy of the original sound, and also to add volume. The complete unit is free from rattles. No rattles can ever develop. Every De Forest Loud Speaker is thoroughly tested and is guaranteed free from defects.

Sold by authorized De Forest dealers only. Price, with 6 feet of cord, $25.00.

The De Forest Radiophone is a complete four-tube receiver, built on the best reflex principle. Its four tubes and crystal detector do the work of seven tubes with four-tube economy of operation.

We could be extremely technical in telling you how the four tubes do the work of seven and why the crystal detector gives both power and economy to this instrument. If you are technically inclined we shall be glad to do so if you will write us. Technical or not, however, know this: You can get splendid results from a De Forest D-12 Radiophone. Its upkeep is low. Its tone is clear and pure. It can be moved easily from room to room.



DE FOREST D-12 RADIOPHONE
Seven-tube efficiency with four-tube economy. Ask the De Forest agent to demonstrate.

Why it pays to look for the De Forest agent

De Forest from first to last stands for all that is substantial and thorough and fundamentally right in radio. De Forest agents are qualified to give you sound and practical advice and help in radio. When you find a De Forest agent 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. He has been carefully picked and schooled in the operation and care of De Forest Radiophones. He will install your instrument and explain to you simply how to get the fullest satisfaction and enjoyment from it.

Avail yourself fully of his help. You will find it valuable.

Prices on De Forest D-12 Radiophones

COMPLETE

Including loop, self-contained loud speaker, four De Forest tubes, A and B batteries, and all equipment ready to operate.

With Dry Batteries

In two-tone gray and black Fabrikoid cabinet	$161.20
In two-tone Mahogany cabinet	176.20

With Storage Batteries

In two-tone gray and black Fabrikoid cabinet	180.00
In two-tone Mahogany cabinet	195.00

De Forest D-14 Radiophone

In burl walnut cabinet with loop and loud speaker built in. Price, including five DV-2 tubes, four B batteries, and storage batteries.	371.50

DE FOREST RADIO COMPANY
Jersey City, N. J.

DE FOREST RADIOPHONE

D-12 REFLEX

Your Set Deserves De Forest Tubes

De Forest DV-3 Tube for use with Dry Cell Batteries

The original De Forest three-electrode vacuum tube was the first of many millions of De Forest tubes that have never been excelled in quality of workmanship, or performance. Today, as in the past, De Forest tubes are unsurpassed for giving volume and beauty of tone. They are non-microphonic. They can be used with all standard circuits. The DV-3 is for use with dry batteries, the DV-2 with storage batteries. They are guaranteed against defects in material and workmanship. Sold only by authorized De Forest dealers. Price, $4.00 each.

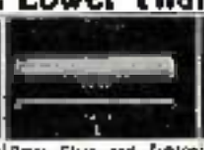
De Forest DV-2 Tube for use with Storage Batteries

"BUILD YOUR OWN" WITH "RASCO" PARTS!

Prices Lower Than Ever

"Perfect" Legs

Spider Web Forms



Metal Sliding Tuners

Vernier

"Rasco" Socket Panels

Moulded Dials

Tuner Radio Frequency Kit

Push Switches

Bakelite 180° Coupler Or Lock Style

Tips and Plugs

Cord Tip Jack

Series Parallel Switch

Fixture Lock Sockets

Copper Foil

Wood Cabinets

Low Loss

"T" Wire Connectors

Brass Screws

Copper Foil Coil

Binding Posts

Double Potentiometer

Cardboard Tubing

Nuts Coupled

Bus Bar Wire

Phone Cords

Shielded Wire Battery

COMPLETE SET SALE AT REDUCED PRICES

Roberts Receiver

Flewelling Circuit

Will bring broadcast on loud speaker at one single take. Complete as pictured, with Cabinet. All parts, including rubber panel, engraved, drilled, ready to assemble. Instructions, schematic diagram, hookup, etc. Can be put together by anyone in a few hours. Can be put together in a few hours time.

$15.00

Wanted

This Company is always on the market for new ideas, due per [illegible] or devices or ran radio line will be handsomely welcomed by us. Some of the articles shown on this page originated with our customers, whom we fund well for the [illegible]. Send your sketch or model addressed to Research Department, c/o this Company.

06060

SPECIAL

Genuine RCA 2nd stage Audio Transformers. Ratio 3:1. Tube type. Regular price $7.00. Our special price DG868

$2.50

Add 10c extra if sent by mail

NEUTRO-REFLEX—The Wonder Circuit!

3 Tubes Do The Work of Five

500 MILES ON LOUD SPEAKER

Here is one of the most talked of radio circuits that has been produced this year. Why build a five tube Neutrodyne or 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 184-189. 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.

Our outfit comprises all necessary parts to build this set as follows: 1 "Rasco" NEUTRO TRANSFORMERS; 2 "Pilot" low loss 21 Plate Condensers; 2 "Rasco" standard Audio Frequency Transformers; One "Rasco" Jack; One "Rasco" Grid-Leak Condenser; One "Rasco" 001 Fixed Condenser; 3 Bakelite Sockets; 3 "Rasco" 30 ohm Rheostats; One 7 x 21 Mahogany Cabinet, 7 Binding Posts; One 7 x 21 Dilecto Panel; 30 feet Bus Bar Wire, One Base-Board; 7 Bi-Cine Fuse Nameplates; One set of direct coils, Blue Prints, etc. Total price of the goods listed $35.00

OUR SPECIAL PRICE FOR THIS MONTH ONLY D3599 ..... **$25.25**

The "Rasco" Catalog

CONTAINS 76 VACUUM TUBE HOOK-UPS. 200 ILLUSTRATIONS. 300 ARTICLES, 96 PAGES.

All Amateur Circuits: These important circuits are explained clearly, all calculations have been given, leaving out nothing that could puzzle you.

Just to name a few of the Vacuum Tube circuits. The VT as a detector and one stage 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 amplifiers, inductively coupled amplifier; Armstrong superheterodyne, etc.

FREE. A POSTAL BRINGS IT

RADIO SPECIALTY COMPANY, 98 PARK PLACE, NEW YORK CITY

The Service Behind OZARKA Makes This Distance Possible

Pittsburgh, Pa.

Ozarka, Inc.
Chicago, Ill

Gentlemen:—I want you to know that I think I have received the greatest distance possible on my Ozarka—KGU, Honolulu, Hawaiian Islands.

A great many friends who have radio instruments of all kinds and bought at all kinds of prices, but no one has yet told me knowledge ever received from such a great distance. I am sure that I am pleased with my instrument is putting it mild. Yours very truly,

H. J. K.

Alden Bridge, La.

Ozarka Incorporated,
Chicago, Ill.

Gentlemen:—A few nights ago I heard the beautiful Hawaiian Orchestra, direct from Honolulu, territory Hawaii. When you consider the distance that this is from Alden Bridge, I certainly think it ought to be a record. This music came in beautiful and clear, in fact, it could not have been any better.

Yours very truly,

W. E. B.

Roseville, Texas
May 14, 1924

Ozarka, Inc.
Chicago, Ill.

Gentlemen:—I consider my best night when I successfully connected in with the following stations: KFAC-Admiral, KGU-Honolulu, WAAP-Fort Worth, WGN-Chicago, WJZ-Springfield, WOAI-San Antonio, KTHA-Interstate, KFAE-Pullman, KFAY-Fayetteville, WFAA-Dallas, WCY-Schenectady, The recent night Station KYW, Chicago, gave a special program lasting all night.

Yours truly,

O. C.

Why Ozarka Receives from Honolulu

OCCASIONALLY some owner of a radio instrument receives from London, England. But did you ever hear of any one receiving Honolulu, Hawaiian Islands? We will gladly give you the names of the writers of the letters reproduced here, as well as send copies of many letters showing how other Ozarka owners have had results from London, England; Cardiff, Wales and Glasgow, Scotland.

These cases are exceptional, of course, but they must prove to every thinking person that the Ozarka is the greatest distance receiving instrument known today.

In the ownership of an Ozarka Instrument, you are assured of not only the last word in radio, but you will receive expert service, which is far more important than the instrument itself. This is a point you should keep well in mind when you buy radio. Be absolutely sure that the person or the firm from whom you purchase is thoroughly capable of keeping that particular instrument in perfect condition. The situation in Radio is exactly the same as that of the automobile. Both are mechanical—both have little things go wrong at times, and both are quickly and easily fixed by the man who knows how.

The Ozarka Radio instrument is sold only by trained factory representatives who know every part, every wire of this instrument. Before he can wear the Ozarka gold button he must satisfy our engineers that he is thoroughly capable of delivering trained service.

More Men Wanted To Sell Ozarka

RADIO offers today an exceptional opportunity for the right kind of a man to build up a permanent, substantial and profitable business of his own. Ozarka factory representatives are today building up very satisfactory incomes for themselves.

Internecy which is not now retrenchment is still an opportunity for a mechanically inclined man who is willing to place himself under our training. We can show such a man how it is possible to build up a business in his own town, possibly in spare time to start with, but sooner or later will justify giving it all of his time.

We are looking for men who realize that there must be some way of improving their condition. We prefer men who know absolutely nothing about radio, because we can then train them according to our own method.

The man we are looking for has a good reputation, is well and favorably known in his community, may not be a salesman but can talk convincingly on something he knows perfectly and fully believes in.

The Ozarka Plan will give such a man his first real opportunity to establish himself in a business of his own. Investment of money is small but necessary.

All we must make sure of is that you are determined and willing to put forth the effort. If you will do this just make and say, "Send me your Ozarka Plan Book No. 100." It may be the turning point in your life. Don't fail to mention the name of your county.

This man specifies Ozarka Representative is your city—your assurance of complete radio satisfaction

4 Tube Ozarka Radio $39.50 and Up

The Ozarka representative will gladly set up this Ozarka instrument in your own home on trial. He will not make any claims but will let you operate it and prove to yourself that it absolutely has no equal for volume, tone, distance and ease of operation. This will not obligate you in any way.

And as for price, you will, no doubt, be agreeably surprised because Ozarka Four Tube Instruments, for loud speaker operation, are sold as low as $39.50. Let us send you more information about Ozarka, including hundreds of letters giving the most marvelous results ever received on a radio instrument. Drop us a card for our free illustrated book No. 200. Please give name of your county.

OZARKA, Inc., 804 Washington Blvd., CHICAGO

RADIO NEWS

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

EDITORIAL AND GENERAL OFFICES 53 PARK PLACE, NEW YORK

Vol. 6 DECEMBER, 1924 No. 6

Your Boy and Radio

By HUGO GERNSBACK

The following is an editorial published by the writer in 1914:

A SERMON TO PARENTS

"Keep Your Boy at Home"

THE strongest ties in life are the home ties. It makes a lot of difference, both to you—his parents—and to him too, when a young man grows up, whether his thoughts dwell with sweet pleasure upon his old homestead, or whether the remembrance of his home and his past home-life is painful to him.

How many well-meaning, fond American parents develop the home idea in the young boy? Are you not a bit to blame if your boy, when still in his teens, is seen too much in questionable company and in questionable resorts? Your boy is not naturally inclined to stay away from his home and his family. *He is usually forced out*, for want of something to keep his growing, inquisitive mind occupied; it's the something that he can't find at his home that forces him out. So out he goes. He drifts on, away from you,—the heartstrings loosen more and more, you—his parents—wonder and wonder and the boy becomes a stranger before you realize it.

Then It Is Usually Too Late to Mend

This is—alas—only too true a picture of the average American youth. And it is so easy to keep your boy at home. He doesn't want much, just something to dabble, to tinker, to experiment with and to keep his inborn insatiable curiosity satisfied.

You know your boy likes nothing better than this, he was born for it; are you going to club it out of him?

He has the right idea—the home idea: Somewhere in him is a spark alive that needs but proper fanning to create a future Edison, a coming Marconi.

Electricity, especially Wireless, are positively the strongest home-magnets today. His workshop, his small electric laboratory or his Wireless Den are the most powerful home attractions for the 20th Century Boy.

Electricity and Wireless are the coming, undreamed of, world-moving forces. *Don't kill the electric spark* in your boy. It costs little to keep it going, and some fine day it will pay you and your boy handsome dividends.

Only one boy in 300 is interested in Electricity and Wireless. Your boy has the electric "bug." Thank the stars for the fact that he is so deeply interested in the greatest art the world has ever known. It's a distraction, besides:

"It Keeps Your Boy at Home."

THE views expressed therein are just as true today as they were 10 years ago with the exception that at that time the message was intended to reach only 100,000 where the same message today concerns literally many millions of young men, not only in this country but throughout the world.

It is true that today millions of boys and young men all over the world are experimenting with radio, and it is also true that it would be a still greater boon if many more millions were to take it up. To the uninitiated, to the layman, and to most parents, radio today is still a big enigma. Many people still look upon it with a feeling of trepidation; stranger yet, many parents view it with apprehension when their bright off-spring begins spending their hard earned money on radio paraphernalia. There are still many people who have the idea that radio is only a fad which will disappear sooner or later. To these good people we wish to say that radio today is a vast industry which stands 34th on the list of all the industries in this country. It is an industry already greater than that of railway car building. It also already rivals in dollars and cents the ship-building industry which, as everyone knows, is of considerable size.

The writer's message years ago to the parents of the young men then was that radio kept their boys at home, off the streets and away from bad influences. This is just as true today as it was then. The modern boy easily becomes bored at home. He has the adventurous spirit and it is a matter of vital importance for him to use his surplus energy. For that reason, as a rule, he seeks amusement away from home, whereas it is quite a simple matter to cultivate the home ties of the parents go about it in the right way. If the young man becomes interested in radio he will soon forget the pool room, the corner hangout and the questionable "gang" he was getting to know so well—too well. He will be so busy at home trying out the latest hook-ups that it becomes somewhat of a problem to get him away from his radio. Of the two evils this seems to be the lesser, for, as long as he is at home, at least the chance of his going wrong is more remote.

But this is not the important consideration. The far greater and vital point is that we know of nothing that sharpens one's wits more effectively than the intricacies of radio. Not every boy has the brain or the inclination to ferret out the mass of radio circuits and technique. It takes *real* brains and stick-to-iveness to build a radio outfit and make it work.

If the young man shows an inclination toward radio he should be encouraged with all possible means. The expense in no case is very great and the educational value derived by the boy can never be figured in dollars and cents. Impressions upon the mind are strongest in youth as we all know. What is learned and learned well in youth is hardly ever forgotten. The boy experimenter of today may be the radio magnate of tomorrow. The radio industry which today has already reached tremendous proportions will probably be one of the leading industries ten years hence, and those who get their feet firmly implanted in that industry will surely grow up with it.

If Edison had not been an experimenter in his boyhood he would not have attained his present success. If Henry Ford had not been mechanically inclined in his childhood the world might not have a reasonably priced car today. The list could be continued indefinitely. In radio it is all-important that when a six or an eight year old boy shows any leaning towards it, the spark should be fanned with all possible zeal.

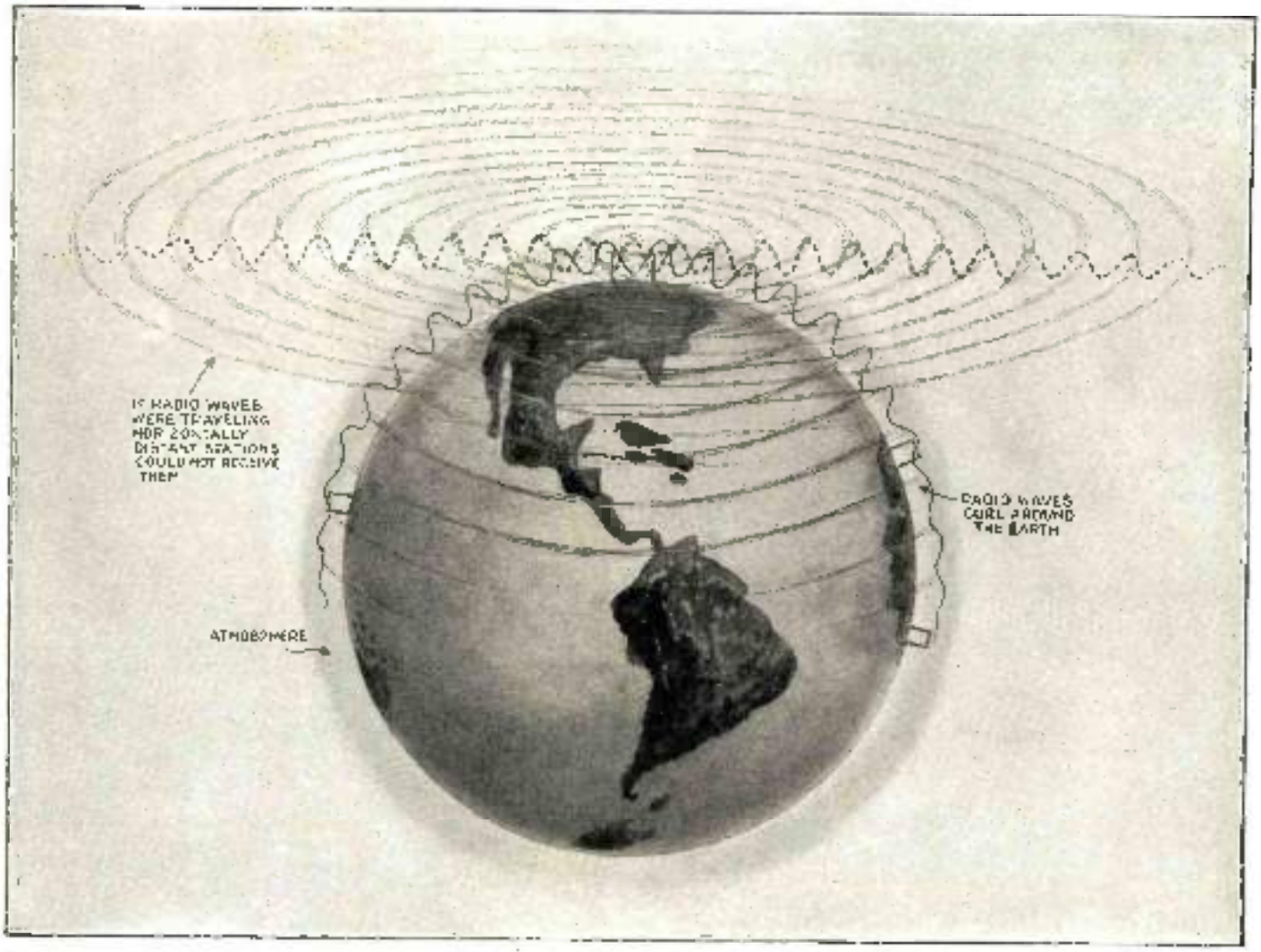
Radio is vastly more complicated than the electrical and mechanical arts just now. Important changes occur almost every month. It takes many years of hard work and training to become a radio engineer. Too many "radio engineers" today masquerade under that name, some of them have been at it but a short time, while many boys of 16 have been at it since they were eight years old and probably know more about the new art than many self-styled radio engineers. It is a fact that when radio became a big thing in 1921, practically every radio amateur was immediately drawn into the new industry and a great many of them today are in some commanding position. Even if the radio enthusiast who has been at it a number of years should find it necessary tomorrow to go into some other line of endeavor the writer still maintains that the radio training will leave its mark upon him during the remainder of his life.

The radio mind is always keen and sharp, and whether this thinking is applied to the radio or the banking business makes little difference. It is a valuable acquisition that will probably grow more valuable as the years go on. Radio to the young man today is a valuable college education. It not only trains the mind to useful and careful thinking, but it trains the young man manually as well. In building a number of radio sets he becomes well versed in the handling of tools and the handling of a surprisingly large amount of materials. He comes into close contact not only with a vast number of various metals which he must not only know thoroughly but also various kinds of woods, hard rubber, bakelite, cottons, silks, and many other products. He soon learns to appreciate values in a business sense because he is quickly trained where to buy his materials and how to buy them at the lowest price. This is an education in itself.

Radio to the youth is the best possible foundation of the future self made man.

The Behavior of Radio Waves and the Heaviside Layer

By SIR OLIVER LODGE, D. Sc., LL.D., F.R.S.



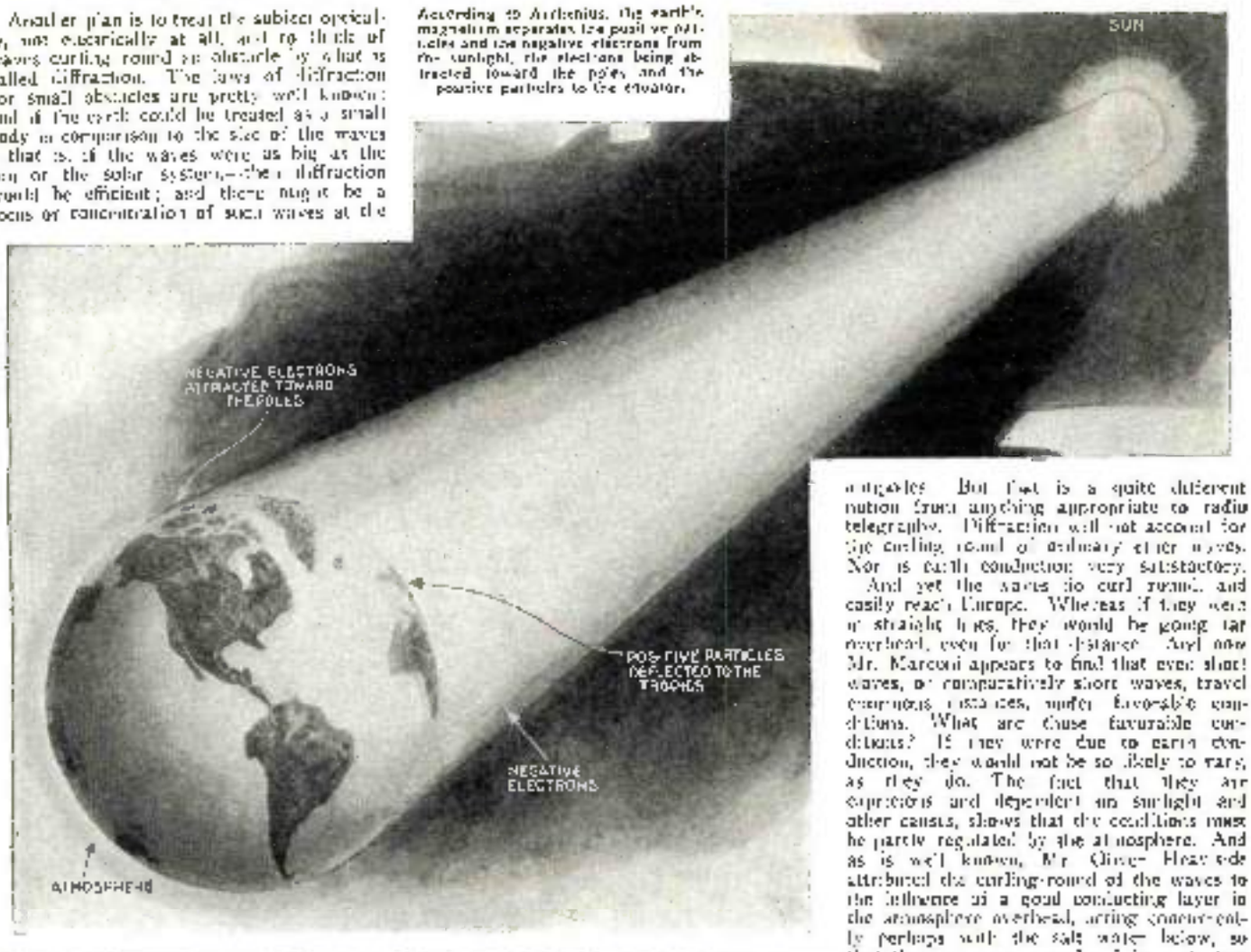
THE fascinating fact that electric waves travel around the earth instead of spreading out in straight lines like the rays of ordinary light, has set a problem to mathematicians, which many have taken up and found to be of considerable difficulty. It is known that waves can be guided along conductors under certain conditions; in fact, that is how ordinary telegraph signals are conveyed, whether by land wire, or by cable. They travel through the insulator, but are guided by the conductor. Conductors are opaque to waves, they cannot be penetrated, at least the better the conductor the more opaque it is. But a conductor can reflect waves. If they establish a loothing on its surface they can creep, or rather flash along it, with great ease, leaving a little energy behind them if the conductor is imperfect, and becoming thereby somewhat distorted, but traveling almost free from distortion if the conduction is nearly perfect.

One way, therefore, of treating the problem of long distance transmission mathematically, is to imagine the earth a perfectly conducting sphere, and find out what would happen in that case. After solving this difficult problem, the data may then be modified so as to introduce a certain amount of resistance making the earth an imperfectly conducting sphere, as if for instance it were totally covered by sea-water. A third attempt, hardly one tractable mathematically, can aim at distributing land and water into continents and oceans, and seeing what happens then. That, however, is one of the numerical problems that can only be approximated.

This graphic representation of wave propagation shows that if the energy of a radio wave were radiated horizontally, distant stations would not be able to receive the signals. The waves, according to scientists, are either reflected on the Heaviside layer or follow the curvature of the earth.

On the right the photographic of high frequency discharge shows that the currents of very high frequency do not follow the shortest path.

Another plan is to treat the subject optically, not electrically at all, and to think of waves curling round an obstacle by what is called diffraction. The laws of diffraction for small obstacles are pretty well known; and if the earth could be treated as a small body in comparison to the size of the waves - that is, if the waves were as big as the sun or the solar system,—then diffraction would be efficient; and there might be a focus or concentration of such waves at the antipodes. But that is a quite different notion from anything appropriate to radio telegraphy. Diffraction will not account for the curling round of ordinary ether waves. Nor is earth conduction very satisfactory.



According to Arrhenius, the earth's magnetism separates the positive particles and the negative electrons from the sunlight, the electrons being attracted toward the poles and the positive particles to the equator.

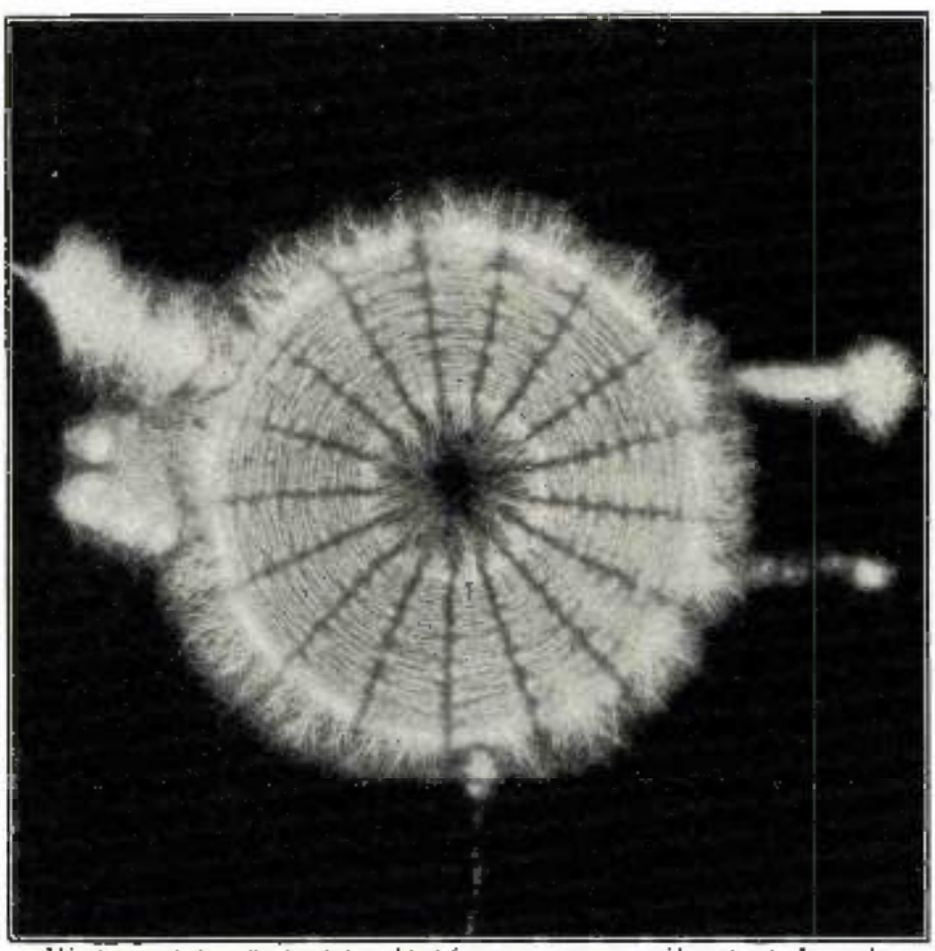
And yet the waves do curl round, and easily reach Europe. Whereas if they went in straight lines, they would be going far overhead, even for that distance. And now Mr. Marconi appears to find that even short waves, or comparatively short waves, travel enormous distances, under favorable conditions. What are those favorable conditions? If they were due to earth conduction, they would not be so likely to vary, as they do. The fact that they are capricious and dependent on sunlight and other causes, shows that the conditions must be partly regulated by the atmosphere. And as is well known, Mr. Oliver Heaviside attributed the curling-round of the waves to the influence of a good conducting layer in the atmosphere overhead, acting concentrically perhaps with the salt water below, so that the waves were enclosed in a stratum between two conducting surfaces, the air effect on the whole being more efficient than the earth conduction.

Everyone who has worked with vacuum tubes, with an air-pump, knows that at a certain stage of exhaustion, the residual air is conducting, or at least breaks down very easily, conveying a current and lighting up at very small voltage. Whereas, when the air is at high pressure, or very low pressure, great voltage is needed to drive a current through it. But at the best conducting exhaustion, very small voltage suffices.

Now as we ascend through the atmosphere, we pass from ordinary atmospheric pressure to zero. Consequently a best conducting layer must exist. But a stratum of that kind is so gradual that it is not likely to be able to serve as the layer postulated by Mr. Heaviside, even if it were sufficiently conducting. But it is well known that air can be made conductive by various means, notably by X-rays, and even by ultra violet light, also by combustion, as by flames; and by various kinds of physical or chemical action, even by splashing water. These agents are said to ionize the air, that is, to eject electrons from atoms so that electric charges are free in the air for a time, and are able to conduct, as they do in metals, where for another reason they are extremely free.

The chief ionizing factor in the atmosphere is probably the solar rays. What we get down here of sunshine has been filtered by the atmosphere. But the upper layers of the air have to stand a bombardment of the unfiltered sunlight. By ascending a very high mountain or going up in a balloon, we may experience the sunlight only partially filtered. The result is that we get first bronzed and then blistered. There can be little doubt that the really unfiltered sun-

(Continued on page 1046)

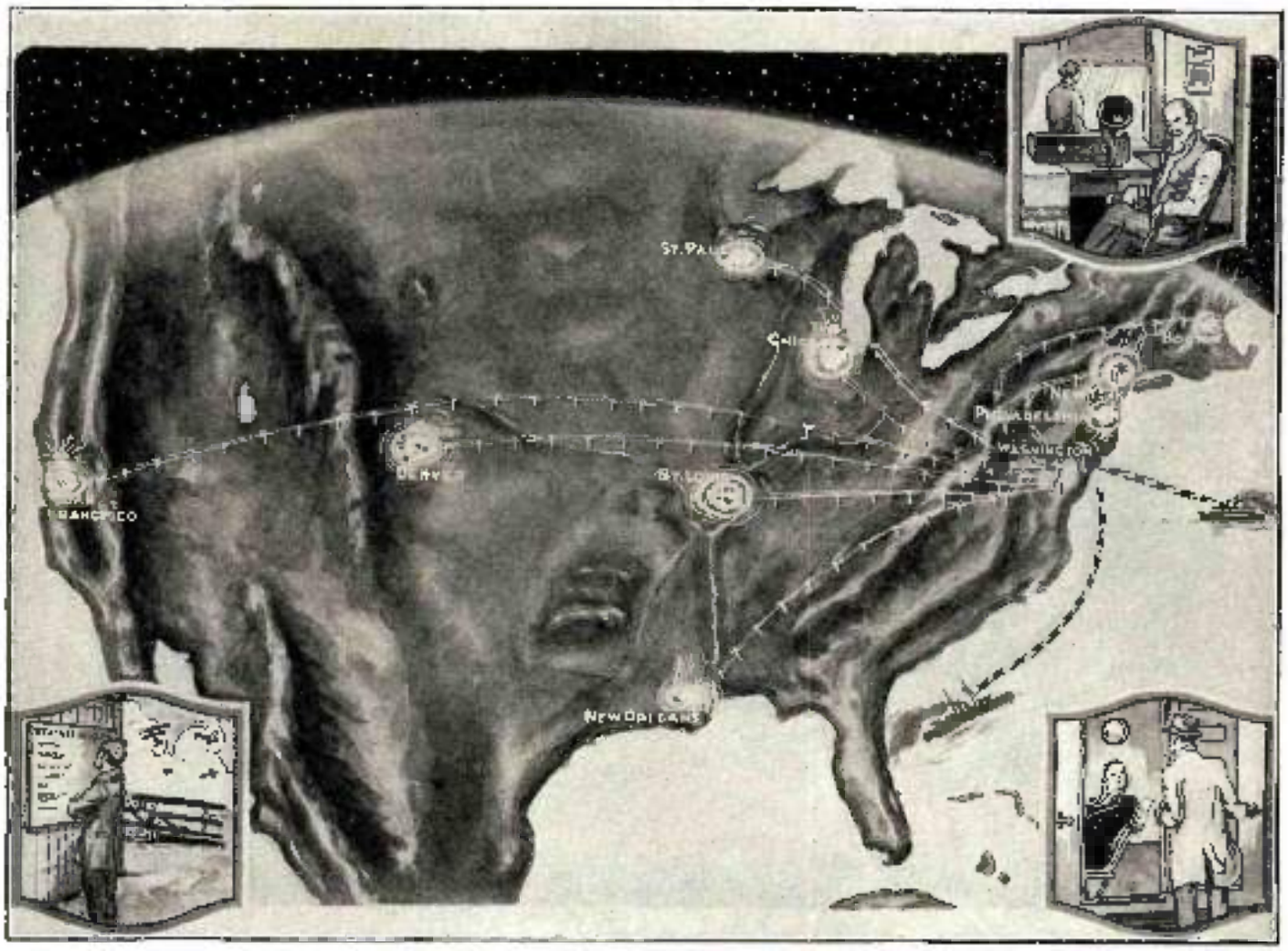


This photograph shows the distribution of high frequency current in a spider-web coil. It spreads on the outside of the conductor, but follows it. The same thing probably happens around the earth.

"We Will Now Give the Official Weather Forecast"

By FRANCIS DASHIELL,* M.. I.R.E.

Describing how weather reports are compiled and broadcast.



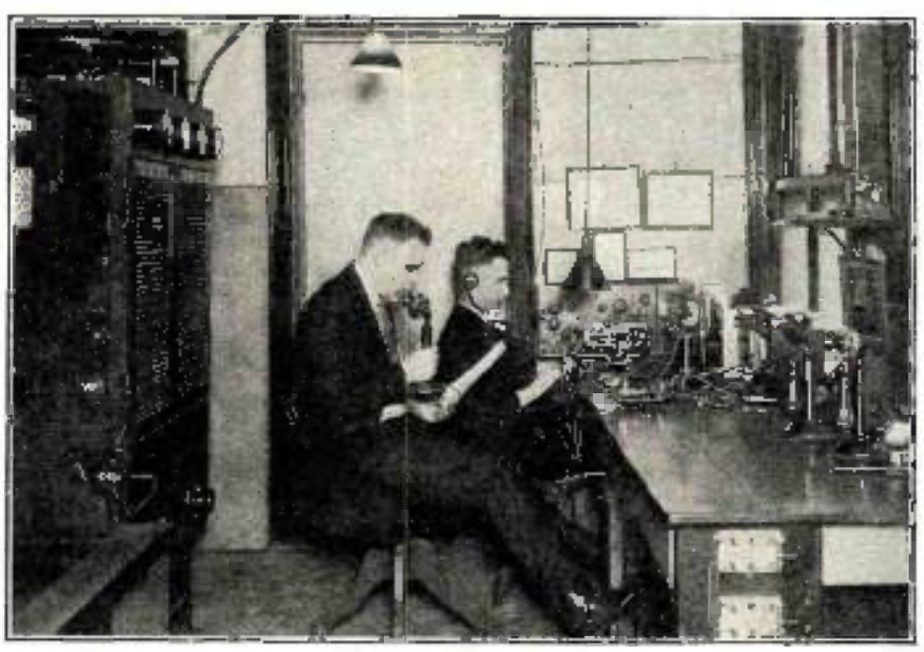
This map illustrates how the local weather conditions from all parts of the United States and from the ocean are sent to the weather Bureau at Washington, D. C. and how these reports are transmitted to the various broadcast stations by telegraph, from which they are broadcast.

IT is quite safe to assume that practically every radio broadcast listener has heard some announcer say, "We will now give the official weather forecasts." A simple statement, 'tis true, and the time it takes to broadcast it is very short, but how many listeners realize just what is behind the forecast, from whence does it come, and what is the use and extent of its distribution?

The United States Weather Bureau at Washington is, without exception, the greatest scientific agency ever established for the study of meteorology and the distribution of weather forecasts, throughout the world. It issues official forecasts of expected weather conditions, storms and hurricanes, under the specific authority of Congress, which established the Bureau about 50 years ago. Any weather forecasts which may be issued as coming from the Federal Bureau are a violation of the law. Therefore, as will be seen later, the forecasts which you may hear over the radio and credit to the Weather Bureau are official, and can be counted upon to prove correct nine times out of ten, according to actual verification figures.

The radio stations broadcasting weather forecasts are especially licensed by the Department of Commerce, after a complete investigation by the Weather Bureau at Washington. It is a violation of the Federal radio regulations for a station to broadcast any Government weather forecasts without this license. This prevents spurious forecasts from being broadcast to millions of listeners who would become aroused at some radical and incorrect forecast. In order to receive a recommendation from the Weather Bureau for a weather broadcasting license, a sta-

(Continued on page 1154).



Broadcasting weather forecasts from station KYW, Chicago, Ill. The operator near the window is receiving the forecasts by radio, in code and on a long wave. The complete information on a typewritten sheet is passed to the other operator who announces it over the radiophone.

*Observer, United States Weather Bureau.

Third Radio Conference Makes for Better Radio Service

By CARL H. BUTMAN

THE third annual radio battle ended Oct 11 at Washington, D. C., and the clean-up squad of supervisors and technical experts has finished its work reassigning stations and reallocating wavelengths. Practically everything went through and in general the radio public and industry will be better served in the future.

The first report of the Conference was made by Mr. W. D. Terrell, Chief Supervisor of Radio of the Department of Commerce, who is chairman of the sub-committee on general allocation of frequency or wavelength bands. The allocation for marine communication allows ship communication between 600 and 1,051 meters with wave bands provided for radio compass stations at 800 meters and radio beacons at 2,700 meters, with suitable protective bands on either side. It was recommended that ships be no longer required to maintain the 300 meter adjustment as required by international regulations. The wave band reserved for marine telephone, telecon and Government use from 1,054 to 1,579 was continued. Wave bands from 1,579 to 1,817 meters were assigned to point to point and marine use for spark, C.W. and I.C.W., and 1,847 to 1,910 meters for use of point to point and marine, C.W. and I.C.W. non-exclusive. 1,910 to 2,500 meter length is reserved for the exclusive use of marine communication on C.W. and I.C.W. The band for Government use between 2,500 and 3,150 meters as fixed by the previous Conference, was left unchanged. The band for broadcast purposes was extended to include 200 to 545 meters and cleared from all other types of service thereby permitting it exclusive use for broadcasting.

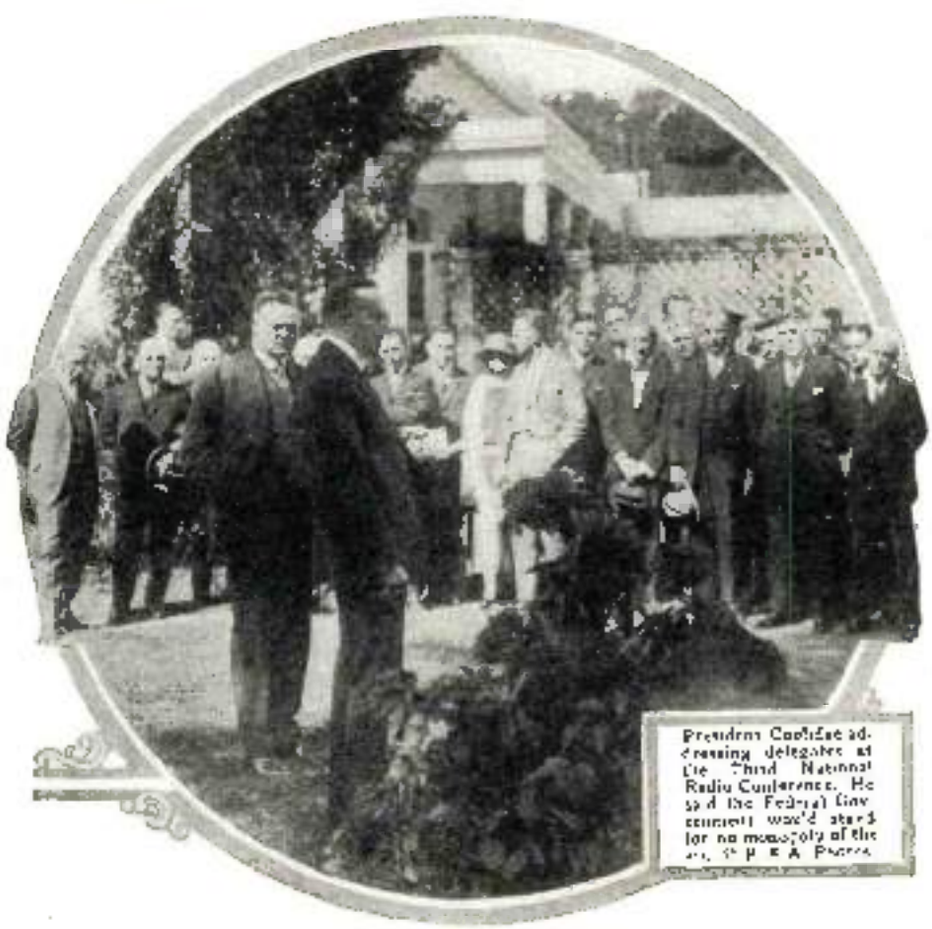
The radio amateurs were allowed to retain the wave bands previously assigned, with slight changes. They were assigned 150 to 200 meters, 75 to 80.6 meters; 37.5 to 32.8 meters, 18.7 to 21.2 meters, 4.6 to 5.3 meters. These allocations were made for C.W. and I.C.W. and telephone operators only.

Dr. George K. Burgess Director of the Bureau of Standards, reported as chairman of the sub-committee on allocation of frequencies to broadcast stations. This allocation does not differ except in degree from the allocation now in force. The extension of the broadcasting service to 200 meters allows a large number of simultaneous, non-interfering communication channels in this class. It was recommended that the present Class C licenses be discontinued after November 15, 1924. This will make available several new channels for Class B broadcasting and will eliminate one of the most important causes for congestion in the broadcasting band. It is also recommended that the frequency assignments on the Atlantic coast be repeated on the Pacific coast. This has been shown to be practical in the experience of the Department. The zoning system of the United States was, therefore, changed in some degree to take care of this alteration and allows a large number of frequencies for the congested areas. This new allocation makes possible 61 Class B channels, 32 Class A channels and a new class is created and given five channels. This latter class includes all broadcast stations having a power of 1,000 watts or less. It is proposed that instead of designating stations as Class B and Class A, the three classes be designated as Class 1, now Class B; Class 2, now Class A and Class 3, which are local low power stations. The plan retains all of the principles of the present Class B assignments, that is, the 50 kilocycle separation in each zone and minimum of 50 kilocycles separated in adjacent zones. It is further recommended that in a given locality no more than two Class 1, now Class B, stations be licensed on a given frequency. Any additional applicants should be temporarily assigned to frequencies in the Class 2, now Class A band, until a frequency is available. Thus, there would be a possible maximum of 126 Class 1 stations. These changes in the allocation of frequencies to broadcast stations require that general alterations be made in existing assignments. Such changes are inevitable, but the reassignments should be made. It is recommended that a small engineering committee be designated by the Conference to remain in Washington and collaborate with radio supervisors in a reassignment of the broadcast station frequencies in accordance with the recommendations of this Committee.

General George O. Squier, formerly Chief Signal Officer of the United States Army, reported that the work of Subcommittee No. 3 on general problems of radio broadcasting was practically completed after three extended sessions. This report states that due consideration has been given to the class of programs broadcast from various stations.

(Continued on page 1106)

Hon. Herbert Hoover, Secretary of Commerce, opening the Third National Radio Conference with an important talk on the vital problems of radio. © Henry Miller News Picture Service, Inc.



President Coolidge addressing delegates at the Third National Radio Conference. He said the Federal Government would stand for no monopoly of the air. © P. & A. Photos.

The Progress of Radio

An Interview with Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards

By S. R. WINTERS

© Harris & Ewing

Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards.

VACUUM tubes of increased efficiency, transmitting stations with reasonably greater power, and the elimination of batteries and antennae! These are among the radio developments foreshadowed by Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards, in an interview with the writer. The progressive changes outlined, according to his version, will also be attended by a greatly increased popularity of this medium of communication—that is, radio receiving sets will be as common as telephones and automobiles, and the number in use in the United States is likely to approach 12,000,000.

"In the next few months we shall doubtless see the beginning of a steady development of cheaper, simpler, and better receiving sets," predicts Doctor Dellinger, with the added comment that this is already being accomplished. "Radio sets are now in the same stage as the early automobile when they had a whipsocket on the dash board. Ten years from now it will be hard to believe that the complicated jingermails we now call receiving sets were used at all.

"We shall certainly see the elimination of batteries and antennae. Perhaps even the electron tubes will go, and crystal detectors come back, if broadcasting is distributed from a sufficient number of stations. These stations will be linked together, so as to send out the same material simultaneously. The stations will be connected by one of three methods, namely, wire telephone distribution, radio relaying, and the carrier-current system. The receiving sets will be such so the pressing of a button will adjust the set to bring in the particular material desired. One thing about radio sets that now appears certain is that practically everybody will have one.

"Is the present trend toward the use of radio receiving instruments with a great number of tubes, or will the one- and two-tube sets be the popular type of the future?" the doctor was asked.

"Certainly there will not be an increase in the number of vacuum tubes used," he replied. "Distant reception is not always due to the sensitivity of a receiving set or to the power of the transmitting station." he added. "Favorable atmospheric conditions and the absence of electrical disturbances occasionally make possible long-distance reception, thus accounting for the freak records reported. On the other hand, static, electrical interference and other limiting factors, operate against the full possibilities of a receiving set."

Pertinent to this conclusion are the results of a two-year study recently completed by the Bureau of Standards. About 50,000 observations were made with respect to the distance ranges of broadcast reception and the effects of varying conditions such as atmospheric disturbances, fading, interference from other transmitting stations, radiating receiving sets and weather characteristics. The results, which are now being tabulated, indicate that the major obstacles to radio reception are other broadcast stations, atmospheric disturbances, and fading. These forms of interference are stated in the order of their relative extent. These tests were participated in by 200 voluntary observers, located at varying distances up to 1,000 miles from the broadcast stations whose signals were under study.

"The necessity for fewer tubes goes hand with the assurance of an increased use of power at the transmitting stations," relates the Chief of the Radio Laboratory of the Bureau of Standards. "Already there are instances in the United States and Canada where broadcasting stations have increased appreciably their consumption of electric energy for broadcasting purposes."

HIGH POWERED STATIONS MUST MOVE

With the general use of high-powered stations, according to Doctor Dellinger, there will arise a demand for their locations to be removed from the congested centers of population. That is to say, as the stations increase their powers, there will be a tendency to erect them in the country or open spaces, thus reducing interference. A notable instance of this was the removal of a powerful broadcast station from the suburbs of London, England, to a point 30 or 40 miles from the city.

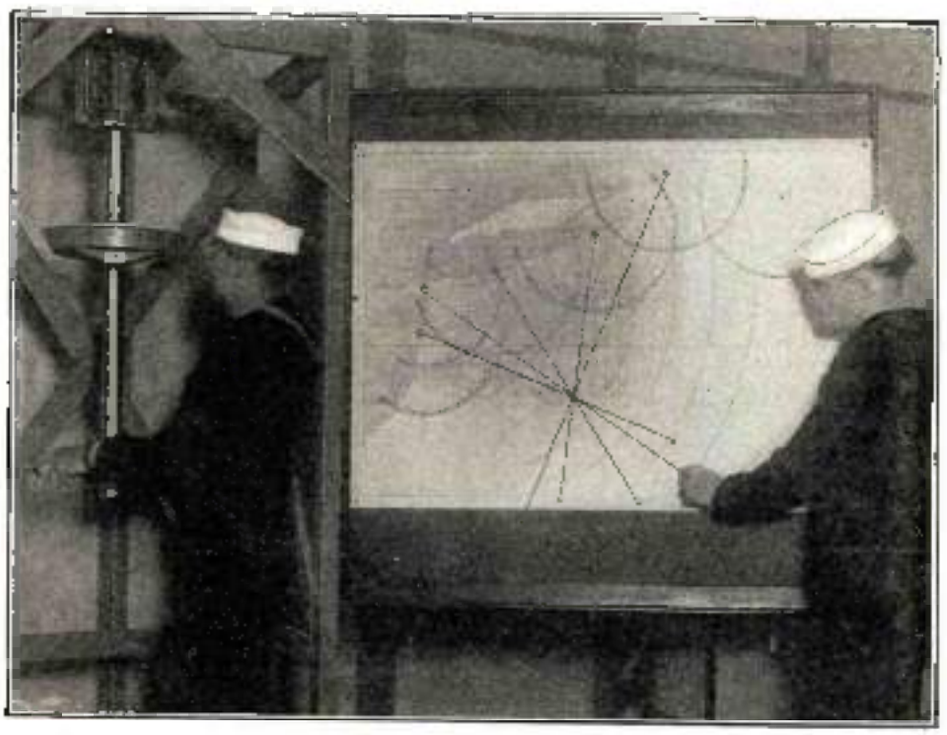
The commercial development of a 3-electrode vacuum tube with a filament heated by alternating current, according to Doctor Dellinger, is indicative of the trend toward greater efficiency and more power in the path of transmitting and receiving sets. Outdoor antennae will gradually be eliminated and the electric light socket will become both the tube power supply and antenna.

The use of increased power by transmitting stations will necessitate that they adhere accurately to the wave length or frequency assigned them. In this connection, it has been discovered that small slices of quartz crystal, one or two inches long, have a natural frequency of the same order as the frequencies of currents used in radio communication. It has been found too that the frequency of the crystals is surprisingly constant, and are thus extremely useful in establishing and maintaining radio standards.

QUARTZ CRYSTALS

"The quartz crystal may be used in many ways," comments Doctor Dellinger. "In one method, it forms an auxiliary condenser in a resonance circuit and when the current in the circuit is made to have a frequency equal to that of the natural vibra-

(Continued on page 1050)



One of the many U. S. Radio Compass Stations, the original system was improved upon by the radio laboratory staff of the Bureau of Standards. A ship's bearing is determined by the combined angle readings obtained at a number of compass stations, and plotted on the map in the manner shown. Where the strings intersect is the position of the ship. © Fotu Topics, Inc.

Will Radio Make Our Railroads Safe?

By HOWARD S. PYLE, A.M.I.R.E.

Showing how the oscillator circuit gives radio frequency energy to the rails through intermediate coupling circuits. A change of frequency at the oscillator, accomplished automatically by the block signals, affects either one of the two pickup loops on the locomotive. These loops may be seen under the cow catcher

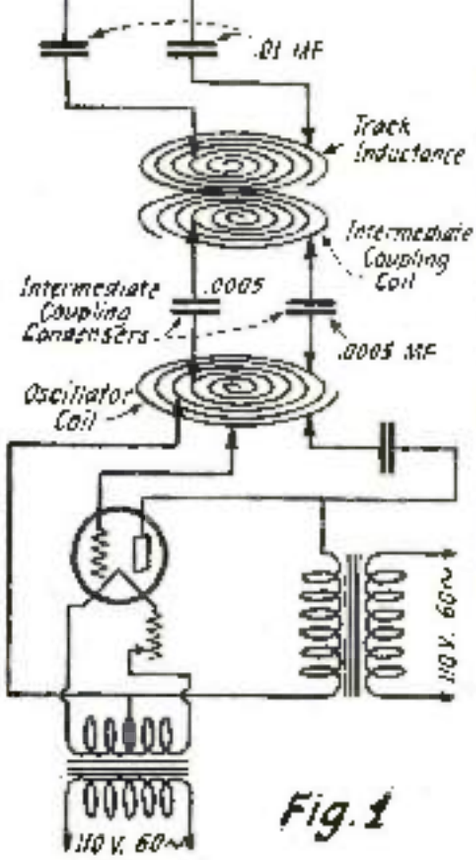


Fig. 1

TO you who have accepted radio as a household necessity, a medium of education and entertainment, it has possibly not occurred that radio is being developed in other ways to provide enormous benefit to the public, probably to a degree of far greater importance than radio broadcasting, for its application to train control work involves the protection of human life and property.

It was not so very many years ago that the present efficient block signal system, in use on practically all our railroads today, was almost unknown. Signals were then looked on by many veteran engineers as a nuisance and they resented the installation of the new familiar semaphore arms at fixed points along the right-of-way. Perhaps the feeling was somewhat similar to that of many old salts—captains of the world's vessels, who objected strenuously to the installation of radio telegraphic equipment on their vessels on the grounds that it took the supreme control of their ship out of their hands, enabling the owners to control the vessel's movements through the medium of a bit of wood operated manned by a smooth-faced youngster. Although that feeling still is present to some extent among old mariners, this does not hold true in the railroad sense.

In talking with a veteran engineer the other day, the writer questioned him regarding his resentment against signals which was so enormous among the old engineers, and he said, "Resent them? Why man, I consider it is just the difference between life and death for me as well as my passengers to have the security of block signal protection, and I think you'll find a pretty large majority feel the same!" They do! Further inquiry developed that, just a few days ago, while he and his fireman were engaged in experimental work along the Pere Marquette right-of-way, his attention was attracted by several short, sharp blasts from a locomotive whistle just outside the experimental station. Casting my inquiring glance, the engineer called, "What's the matter up ahead? I haven't any signal" and glancing at the signal lights, I noted that they were out. It developed that a house was being moved across the rails, temporarily interrupting the system, but the engineer was lost—helpless, without his indication.

Present methods of block signaling are developed to an amazing degree, and with the recent installation of three-color lights, rather than the more common type of semaphore arm, the Pere Marquette Railway has what is considered the most modern and up-to-date signal system today. It has just one fault, a weakness that is evident in all

(Continued on page 1101)

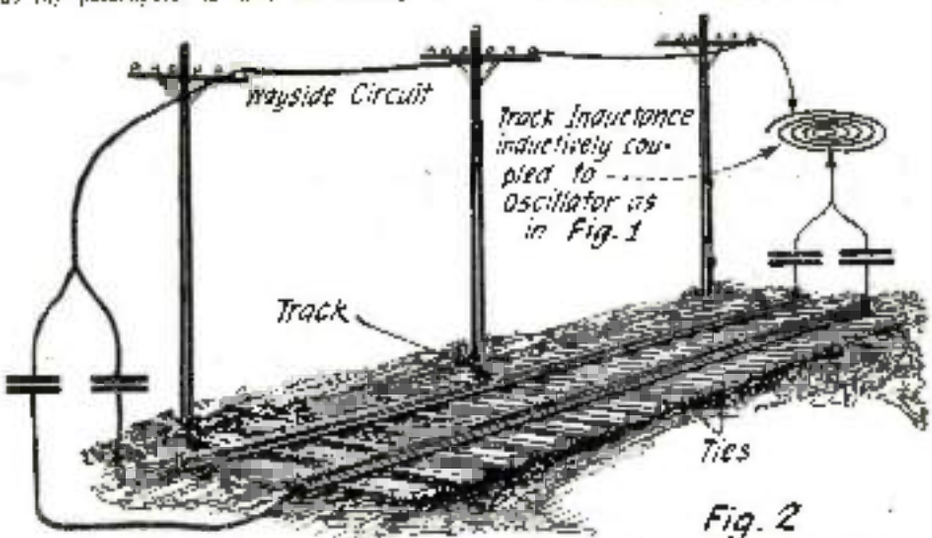
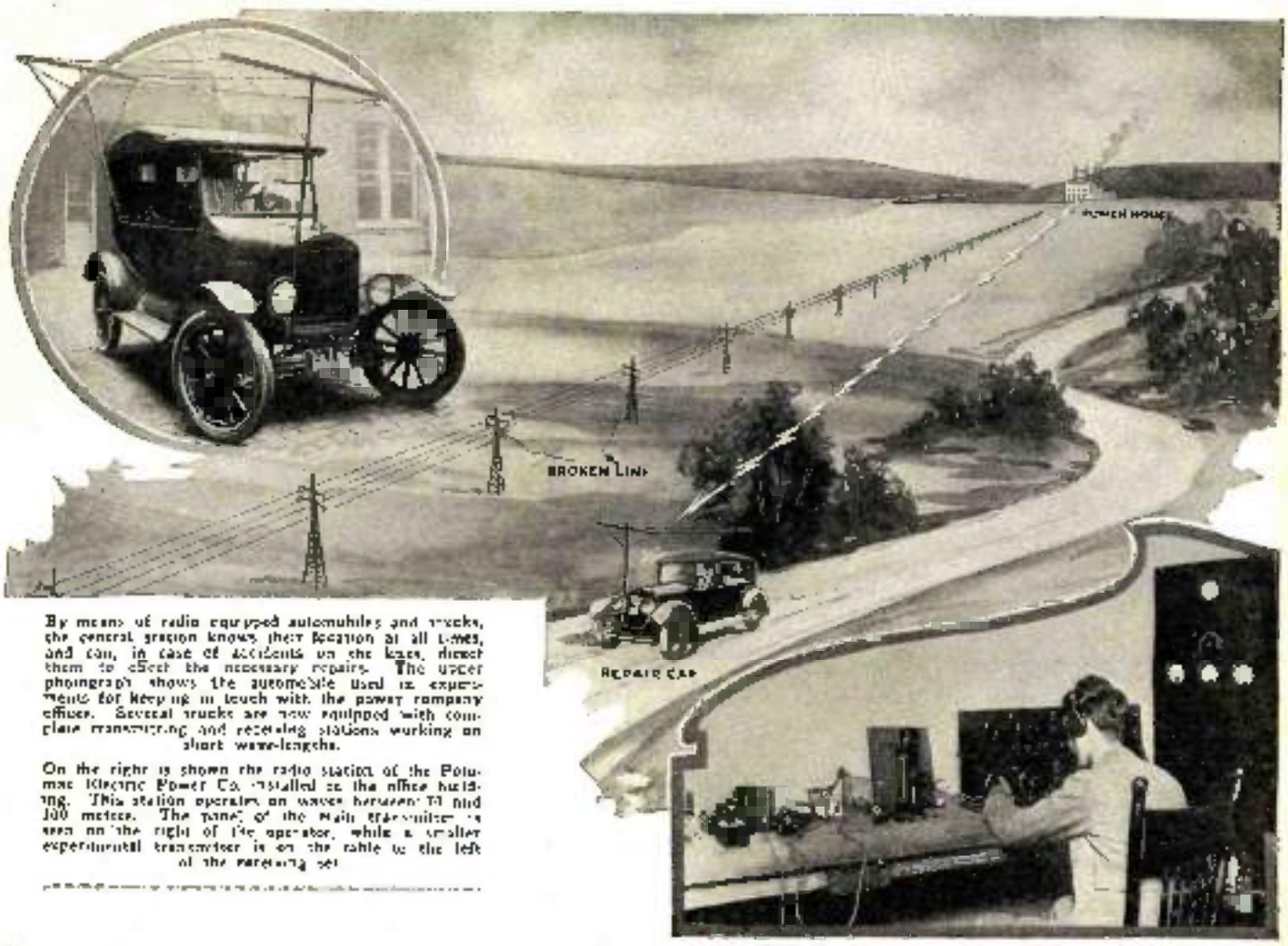


Fig. 2

Leakage from rail to rail through the ties is eliminated by employing a separate return circuit and connecting the two rails in parallel.

Radiophone Serves Power Company

By S. R. WINTERS



By means of radio equipped automobiles and trucks, the general station knows their location at all times, and can, in case of accidents on the lines, direct them to effect the necessary repairs. The upper photograph shows the automobile used in experiments for keeping in touch with the power company offices. Several trucks are now equipped with complete transmitting and receiving stations working on short wave-lengths.

On the right is shown the radio station of the Potomac Electric Power Co. installed in the office building. This station operates on waves between 75 and 100 meters. The panel of the main transmitter is seen on the right of the operator, while a smaller experimental transmitter is on the table to the left of the receiving set.

IT was only a short while ago that the Radio Laboratory of the Bureau of Standards conducted experiments in the transmission and reception of radio telephone communications by means of short wave-lengths—between 10 and 205 meters. Now, short wave lengths or high frequencies for radio telephone communication have been introduced in practical service.

The Potomac Electric Power Co. of Washington, D. C. has equipped two radio transmitting and receiving stations for dispatching messages between the main office in Washington and the power plant on the outskirts of the District of Columbia. This traffic will be negotiated on wave-lengths between 100 and 70 meters, a band of frequencies sufficiently removed from those allocated to popular broadcast stations as to cause little or no interference.

The local electric power transmission company will not only use radio as a means of communication between headquarters and its power plant, but will keep in touch with repair trucks through that medium. This involves the departure of equipping about 12 repair trucks with radio receiving sets whereby signals may be intercepted from the transmitting station at headquarters. In operation this plan means that the foreman of each repair truck will listen for signals the first 15 minutes of each hour. Thus, the main office will be enabled to issue instructions and direct the movements of repair trucks in the field without the necessity of their returning to headquarters.

This is a novel use of the radio telephone. However, this more novelty should not overshadow the significant thing of utilizing short wave-lengths or high frequencies in commercial traffic. It means that the increasing use of wave-lengths around or below 100 meters will serve to eliminate some of the interference encountered in broadcast reception. The fact is, the Bureau of Standards emphasizes this very point as one of the chief advantages in employing high frequencies. The wave-lengths between 200 and 600 meters are already congested by increasing allocations to broadcast stations.

The transmitter at each of the two sending stations of the Potomac Electric Power Co. consists of a 50-watt oscillator and a 50-watt modulator. Signals from the radio telephone station, operating on a band of wave-lengths between 70 and 100 meters, have been heard by amateurs in a middle western state. The feasibility of repair trucks picking up signals from the station at headquarters has already been determined by the experimental use of a Ford automobile equipped with a portable receiving outfit.

IMPORTANT NEWS

ALONG the well-established policy of RADIO NEWS to give its readers only the best, we are pleased to announce that beginning with the January issue we shall begin a new serial entitled:

"The Inventions of Reginald A. Fessenden"

Dr. Fessenden needs no introduction to the radio fraternity. He is one of the outstanding figures in the radio world today. He is the original inventor of the modern radio telephone. His was the first experiments to send the human voice and music through space without wires—the forerunner of the present day radio telephone. He is also the inventor and patentee of the Heterodyne principle, now used in all of the Super-Heterodyne radio sets.

In addition to this he is the inventor of almost one hundred important radio and electrical inventions.

As scientific and experimenter of note, he will give RADIO NEWS readers the benefit of his many years of experimentation. The serial will run in RADIO NEWS for the next year and will be published exclusively and for the first time in RADIO NEWS. —EDITOR

COLD WEATHER AIDS RADIO TRANSMISSION

A new natural phenomenon in the form of cold waves improves radio transmission especially at a distance of between 155 to 186 miles, radio engineers of the Bureau of Standards at Washington state. In daylight cold waves affect the radio transmission of long wave signals from trans-Atlantic stations at New Brunswick and Tuckerton, N. J., a preliminary report from the Bureau points out.

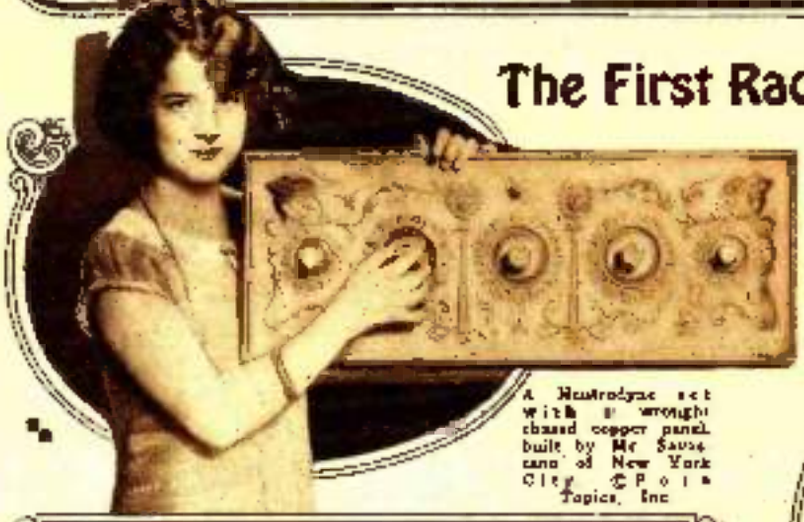
The signal strength varied and the apparent direction of the sending station deviated, according to the observation. From a moderate distance the signal strength was found to be quite uniform during most of the year, but with the coming of cold waves in January, the signals increased to more than twice their normal strength. At the same period there were deviations of many degrees in the apparent directions of the trans-

(Continued on page 1096)

© Kadel & Herbert.

The First Radio World's Fair

One of the greatest Radio Exhibits ever undertaken



A Neutrodyne set with a wrought chased copper panel, built by Mr Savastano of New York City. © Pictorial Topics, Inc

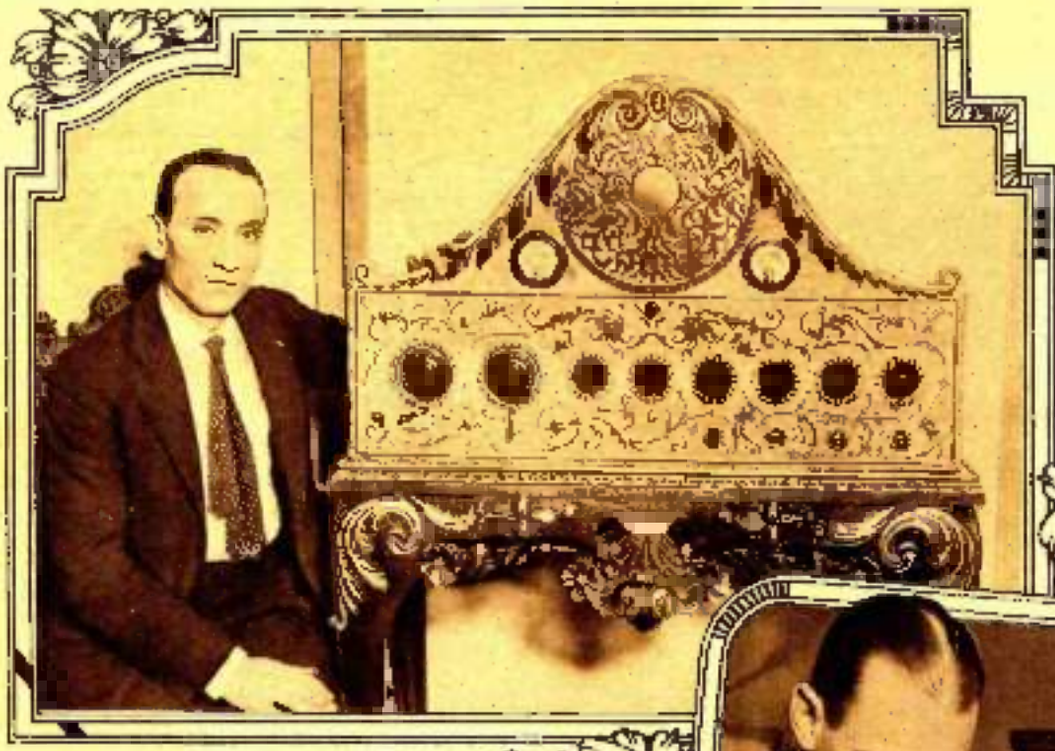
Truly, this is a really good loud speaker, regardless of the fact that the young lady has her hand to her ear. © Kadel & Herbert

Radio World's Fair Great Success

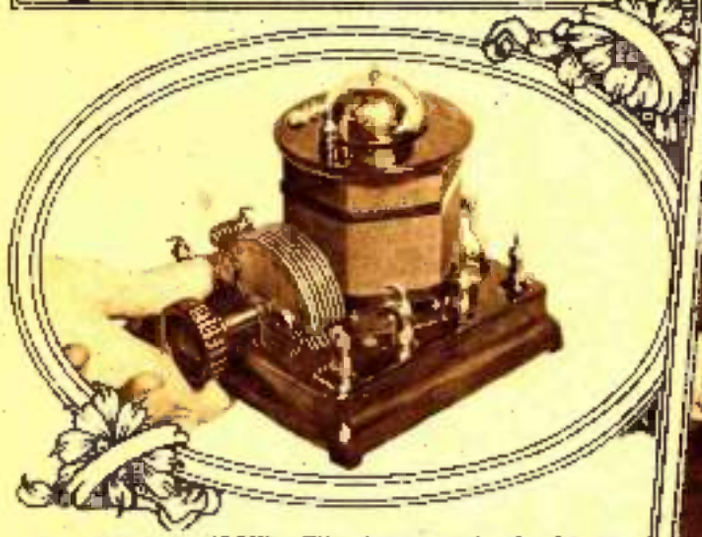
The First Radio World's Fair was a great success from a number of standpoints. The attendance was far greater than was expected, in fact a few of the nights during the exhibition it was found necessary to close the doors at both Madison Square Garden and the 69th Regiment Armory as early as 8 30 o'clock because the crowds were so great. It has been estimated that 175,000 people saw the exhibits. Special details of police were required to maintain law and order. But the success of the Fair was not in the record attendance, but in the volume of business transacted during this period. Eight European countries were represented in the special foreign section and it is understood that their wares were given favorable notice, which of course means business with the United States. Practically every American manufacturer of radio apparatus was represented and many new and novel devices were exhibited for the first time. Neutrodyne sets predominated in the showing of complete receivers and there are so many good ones it is hard for a person to make a final selection of the one he would want.

Any number of contests were held, one of the most interesting being the Homemade Set contest. Some very ingenious and decidedly original outfits were entered. It has been suggested that manufacturers would do well to follow a few points of design incorporated in some of them.

Seen at

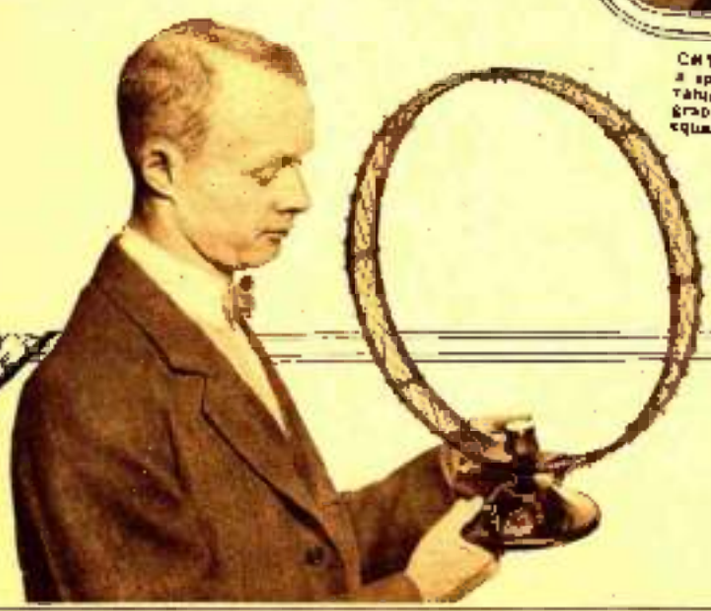


A HAMMERED COPPER PANEL is the novel feature of this Super-Heterodyne receiver built by Alfred Sevaseano, of New York City, who is shown beside it. The panel is made of hammered chased copper and is a thing of rare beauty. It seems an effective shielding. © Kadel & Herbert



JUST A HANDFUL. This miniature 5-gang tube regenerative set of original construction works as well as its big brothers. Note the scale engraved on the forement rotary plate of the variable condenser. The panel is mahogany. © Kadel & Herbert

CRYSTAL SET OPERATES LOUD SPEAKER, but a special attachment is necessary. The special apparatus is seen attached to the turn table of the phonograph. The volume obtained on local broadcasting is equal to ordinary phonograph volume. What more could one want? © Kadel & Herbert.



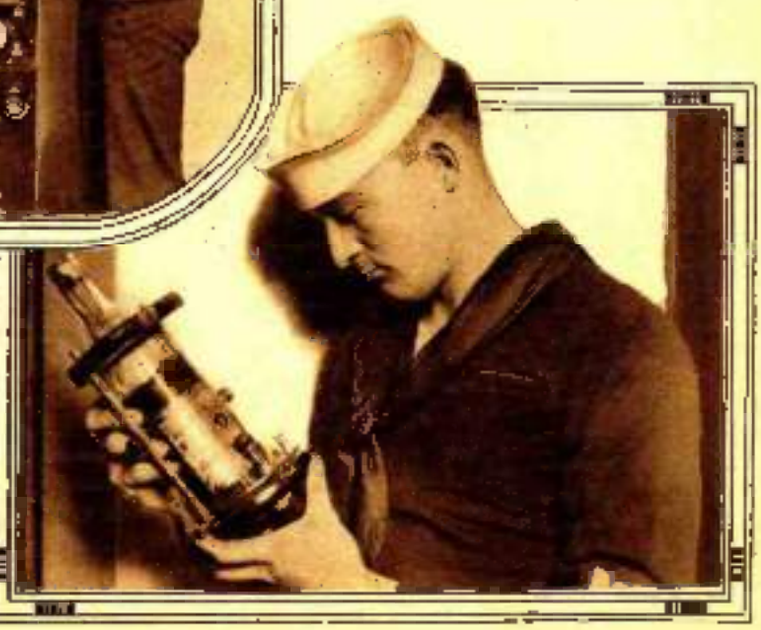
A MINIATURE LOOP AERIAL of singular construction was one of the many interesting exhibits. The frame is moulded out of pyradialin, a composition similar to bakelite, and the method of winding the turns gives a low distributed capacity. © Kadel & Herbert.

the Radio World's Fair

THE 69th REGIMENT ARMORY, New York City, where a portion of the Radio World's Fair was located. © Kadel & Herbert.

THE LARGEST RADIO INSULATOR in the world; one of the many insulators designed particularly for the high powered short radio stations of the U. S. Navy, exhibited at the Radio World's Fair. How about a couple of these for your aerial? © Kadel & Herbert.

NEW NAVY TRANSMITTER with a power of 300 watts. It employs twelve 50 watt tubes and can be used for C.W., I.C.W. or Radiophone. It was designed especially for use on the Man-o'-wars. Chief Gunner F. C. Hantz and John Cox are shown demonstrating it at the Radio World's Fair. © Kadel & Herbert.



A WEAK BOTTLE RADIO SET exhibited at the Radio World's Fair. This interesting two tube receiving set operates not as made out of a German wine bottle that has seen better days but judging from its novel employment it still has one or two kicks left for the owner. © Kadel & Herbert.

MAKE MUSIC TO THE CROWD BELOW. The idea of a Berlin merchant who desired a novel form of advertising. A huge loud speaker was placed on the roof of the building and the best of German broadcasting fed to it, through a power amplifier. There is a public park below where the people gather to listen to the program. © Kadel & Herbert.

RADIO IN A TEA-POT. What an idea! How sweet! And the damsel in the picture none other than the nationally known dancer — Gilda Gray. This receiving set was entered in the prize contest for sets of amateur construction at the Radio Exposition. © Kadel & Herbert

CAPTAIN DONALD B. MACMILLAN RETURNS FROM THE FAR NORTH: The doctor anchored in Wiscasset, Maine, after his trip to the Arctic. Radio WNP, the "Boudoin" was almost constantly in touch with the "outside world" through amateur stations in the United States and Canada. Donald Mix, the operator of WNP, is to be given credit for his excellent work during the absence of the "Boudoin" from civilization. © Pathe Topics, Inc.

SET YOUR CLOCK BY RADIO. The photo shows the apparatus which does the trick. This is the result of recent experiments carried out by experts of the U. S. Bureau of Standards. The result is accomplished by the use of a standard form of radio receiver and a series of retardation relays. One of these days, no doubt, it will be a little ether wave that will make you in the morning—by shutting off your alarm. © Kadel & Herbert.

A SINGING ARC OF OLD was one of the novel attractions at the Radio World's Fair. This queer looking machine is an old singing arc radiophone transmitter, a relic of bygone days; it was built in 1917 by P. E. Butler, who is shown on the extreme right, demonstrating it to a group of interested spectators. © Kadel & Herbert

BOTTOM -RIGHT

DONALD B. MACMILLAN TELLS THE WORLD of his trip to and from the Arctic, near the radio. He is shown here speaking into the microphone at station WAHG, Richmond Hill, L. I. He had with him his favorite Eskimo dog, which also gave a short talk on "The Call of the North" © Underwood, N. Y.

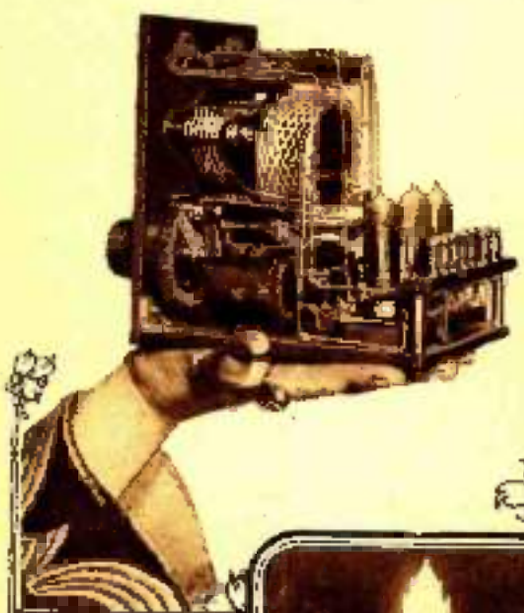
TOP. LEFT

GENERAL PERSHING'S FAREWELL SPEECH to his comrades at arms was delivered through the medium of the radio, his words being carried over thousands of miles of telephone wires from coast to coast and border to border as they entered a microphone at the War Department. His message was relayed through 38 broadcasting stations. This was the most wonderful piece of work ever accomplished in the art of broadcasting. © Henry Miller News Picture Service, Inc.

LOPEZ AND DEMPSEY, yeah, Vincent is explaining the mysteries of radio to Jack while gazing in on his own orchestra. You see, Jack visited Vincent. He said, "I learned about jazz from Vin.; but Vin. didn't learn anything about the art of fighting. © Fotoplayer, Inc.

THE FORGOTTEN APPLE. A typical case of radio fever. Master Herbert Roy Fox is so taken with a radio program that he has entirely forgotten about the beautiful apple mother gave him. Radio fever affects the young as well as the old it seems.

TO SCHOOL WITH THE RADIO is Master James Scull's idea of real fun, but he doesn't let it interfere with his lessons. He dared to leave his radio set all day so he rigged up this three tube reflex on his bike and listens in at lunch time and on his way to and from school. © Atlantic Rose Service.



A MIDGET THREE TUBE SET said to be the smallest of its type in existence, is 15½ inches long and 8½ inches high. All the apparatus is standard except the vacuum tube sockets. It employs a regenerative circuit and a two stage audio frequency amplifier. The set was built by P. F. McGuire, Bayonne, N. J. © Fotogramps, N. Y.

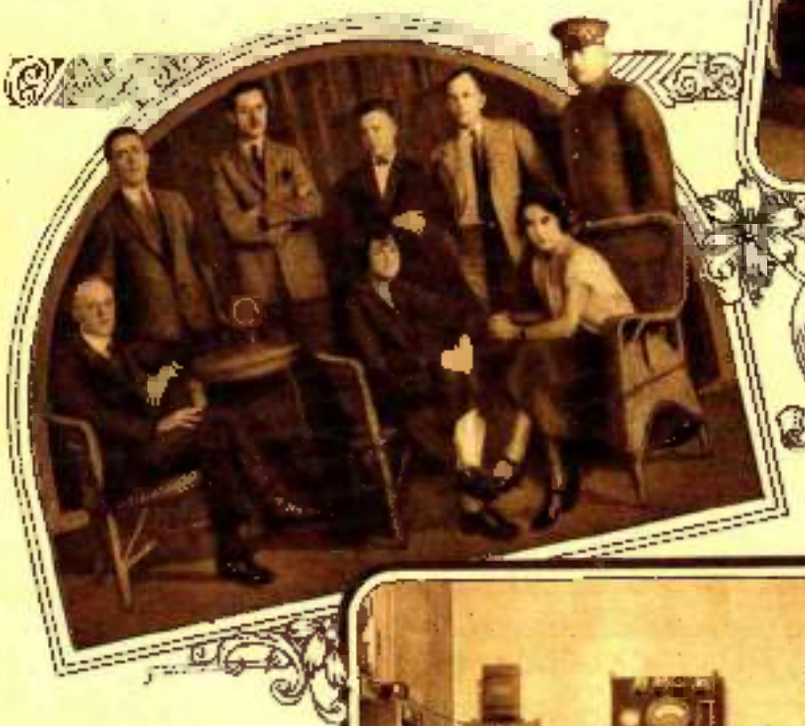
COLONEL GREEN in his radio Laboratory at Round Hills, Mass., surrounded by a number of embryo inventors employed by him to work for the advancement of radio. At present they are experimenting with a radio station picture system. © Fotogramps, N. Y.

YOU CAN'T HELP BUT SEE THEM day or night. The two antenna towers supporting the antenna of station WHO, Des Moines, Iowa, as they appear at night. They are illuminated by search lights and each tower has a beacon light on its top. © Kadel & Herbert.

La Presse
CKAC
Montreal, Canada

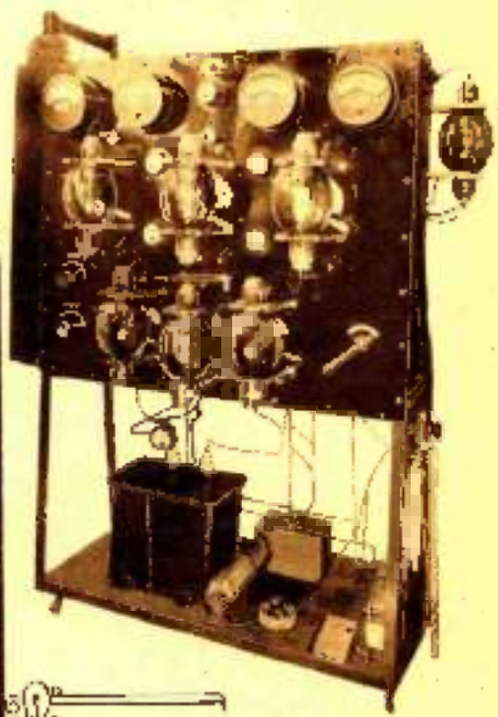
THE STUDIO OF CKAC is unsurpassed in its beauty—the interior decorator was truly inspired. Note the microphone and stand in the foreground

THE STUDIO ORGAN is a work of art in itself. Its soft tones are picked up by the microphone in the foreground and reproduced perfectly for critical ears



AN ALL BILINGUAL PERSONNEL is the staff of CKAC La Presse. We introduce, from left to right, standing, Arthur Dupont, Assistant Announcer; Adrien Arcand, Radio Editor; Leonard Spencer, Technical Assistant; J. N. Cartier, Director and Chief Announcer; A. Lebeau, Master of Ceremonies; and sitting, J. P. Callaghan, known to Bidding as Pathar Radio; Mary Brocman and Norah O'Donnell, Bilingual Montreal stenographers

THE CONTROL ROOM is shown in the photo to the right. From this point the big transmitter is made to "do its stuff" and do it in a manner to your liking. It is carefully trafficked on the 435 meter wave and is not allowed to roam. Over-modulation is never allowed



THIS IS THE TRANSMITTER and it is a new one, with a power of 7½ kilowatts! See the nice big tubes? It is seldom that they are worked hard, but when they are its noise there is no telling how loudly CKAC will be heard in Europe

The Life and Work of Lee DeForest

PART III

THE day was a warm one in Spring. The laziness of late June was announced by the drone of insects and the gentle rustle of leaves. The tall stately elms of Yale stood in the heaviest of verdure keeping a lazy watch over the campus against the return of the hordes in search of knowledge. Commencement was just over, the last of the stragglers had just seen their trunks and luggage hauled off to the station in the town's disreputable express vans and the stragglers themselves stood about smoking a last pipe while they prolonged a good-bye until train time.

The walks and campus greens were deserted in a few days. Summer had settled down over New Haven in its fullest sense. A young man strolled leisurely up to Jackson's restaurant. He had a couple of books under his arm and was holding a paper with his free hand. Evidently he had come from the railroad station and was in search of some one. In the restaurant he went to one of the tables in the rear, after speaking to the waitress, sat down and ordered a cup of coffee. He asked after his friend Barbour. He hadn't, the waitress said, been in that day, but she added that the day was yet young.

CONTEMPLATES POST GRADUATE WORK

Immediately the young man pushed his paper to one side and opened the larger of the two books, which was a heavy treatise by an Englishman named Maxwell who had done, it seemed, a great deal of experimenting with electricity and had developed several theories concerning the magnetic properties of coils through which electric currents were passed. The young man was extremely interested in his book for he had, less than a week before, graduated from the Sheffield Scientific School of Yale University in the class of '96. Nevertheless, he was already contemplating three years of post graduate work looking toward a degree of Ph. D. and he chose to make investigations along the line of those in the Maxwell volume, except of course, experiments would go further than those delineated in the heavy book. He was also extremely interested in the wave motions which seemed to postulate themselves more and more prominently as the underlying principles of electricity became better known.

The diploma which the young man had recently received, and which he still placed on his bureau to gaze upon each night before retiring, was given, according to the Latin inscription upon it, to one Lee DeForest.

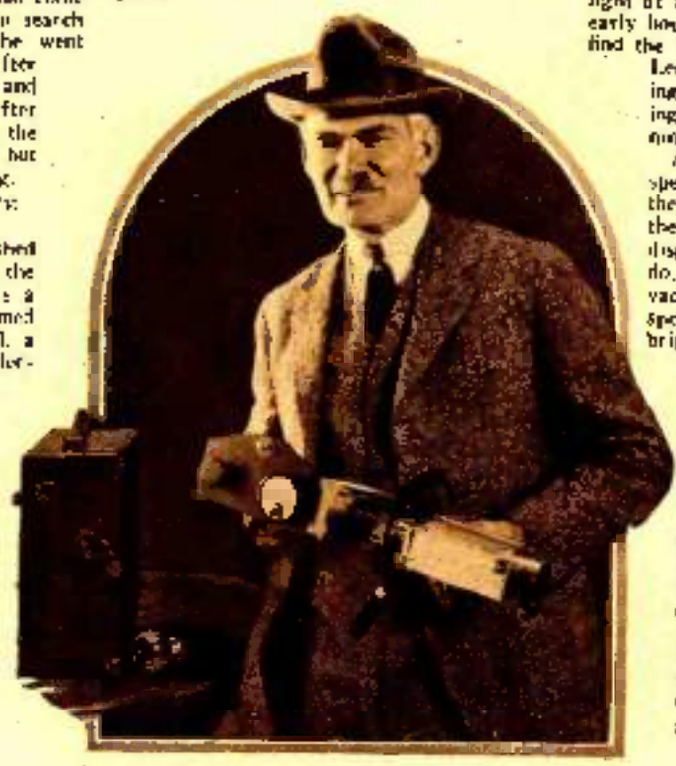
From time to time as he sat pouring over the pages of fine print he took a drink of the coffee before him. When the coffee was all gone, he paid for it out of a well worn wallet and walked slowly out to the street and up toward the campus, his two books under his arm. As he started to take a short-cut up toward one of the dormitories, a decided expression came over his face. He looked around, seemingly as if he were trying to find himself in some strange surroundings. Then he lowered his head a little and hastened his speed. Near the dormitory he looked up and called "Oh Barbour."

"Ye-ho" came the answer and a tousled head thrust itself out of one of the upper windows. A few minutes later Barbour came down the last flight and asked DeForest if he had had lunch. DeForest had, so they decided to walk to the lake.

"OLD GRADS," BOTH

As they left the campus, both looked fondly and sadly around at the buildings, the ivy and the marching trees. They reminded each other of the good old times represented at each of the crannies about the buildings. They consoled themselves at having passed the under graduate days and being at last lonely "old grads."

They were sad. Every man who has left an Alma Mater after four wonderful years understands the feeling. With such a sentimental person as DeForest it is not unusual that this feeling should run to the highest pitch.



Dr. Lee DeForest holding the Phonofilm recording device, one of his latest inventions

Once away from the campus, however, their talk turned to other subjects. With the last of the summer came the great Presidential election and the first race made by William Jennings Bryan. It was the first election in which either of the young men could take a part, both having just recently become of age. They had long talks as they walked, and covered the whole field of politics from the theoretical limitations of the state to the comparative honesty of the two chief candidates.

From politics the two young philosophers would pass on to the inevitable dream of youth—a Utopia. Hour after hour they would devote to the specifications of their perfect state, dealing in details of the wonderful organization down to the mechanics of the Public Health system. This latter point always obtruded on account of the very bad and ever debated sewage system of New Haven. From their Utopia they would pass on to some engineering problem of the time. It was DeForest's general procedure to name some great want of the country such as electrification of the railroads and then proceed to plan ways and means for doing it. They would spend hours on the problem at hand and having exhausted themselves with their labors, return late to town, go to Jackson's for an omelette or a very thin steak and a cup of coffee, thus closing an enjoyable day.

At other times Barbour would not go and DeForest would start out by himself. Some new creek or small river would catch his fancy. He would make a long exploration trip in search of a fairy-like spot in which to sit and contemplate the woes of the world and the beauties of Nature. Sometimes he would find a particularly fetching place and would return home with the light of a Thoreau convert in his eye. The early hours of the following morning would find the light still burning in his room and Lee sitting at a table laboriously pouring forth his soul on paper, attempting to put the beauty of the past evening into his diary.

As the summer moved on, DeForest spent more and more of his time in the country around New Haven. For the first time in years, much to his disgust and chagrin, he had little to do. He could find no work during vacation time, so most of his time was spent to suit himself. During the bright days he roamed the fields and took hikes. In the evening he returned home to his books, the reading of Maxwell and Hertz occupying most of his time. Toward the latter part of the summer he discovered Emerson and immediately became a slavish disciple of the Boston sage. For recreation from his studies he read the poems and tales of Poe—for the fourth time. He obtained odd jobs with various companies around New Haven. He spent a few days reading meters for the gas company and did some work for older post graduate students in the laboratories.

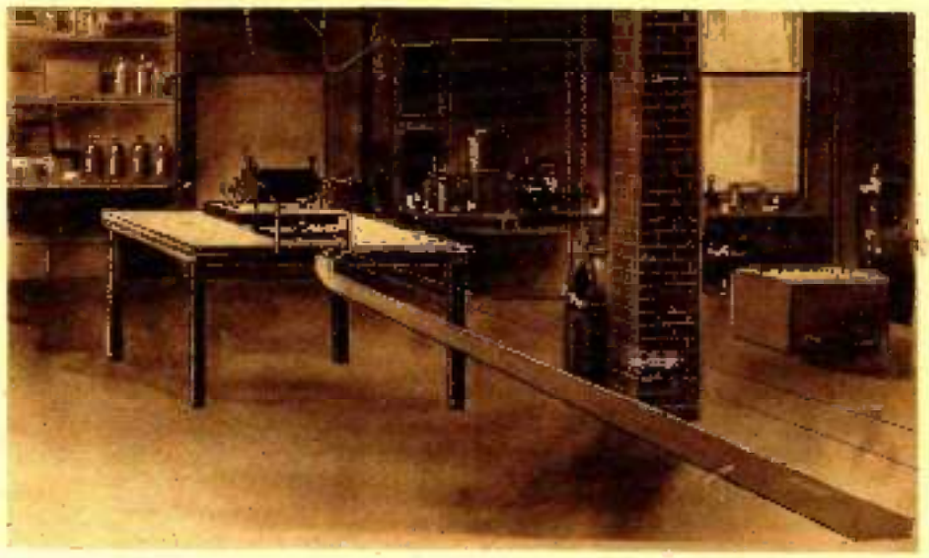
BEGINS POST GRADUATE WORK

The beginning of the school year in September brought back the old accustomed rush of activity. His course consisted of higher mathematics, with particular relation to vector analysis and analytical equations, alternating currents, theories and history of electricity, and advanced mechanics. For his laboratory work, he was given a place in one of the laboratories under Prof. Chas. Hastings. The first couple of months in the school year were spent entirely in lectures and reading. His first actual experimenting along original lines was begun in the autumn of 1896, in November of that year to be exact. His first step done, being assigned to a division of the laboratory was to select the various instruments and calibrate them. He spent numerous unpleasant hours at his work, since a veritable flood of logarithms occupied his hours while he was calculating the constants of the various measuring instruments. He ate

and dreamed logarithms for a week at a stretch. He almost considered memorizing the tables in order to save the time necessitated in looking them up.

The work was so entirely new to him and the professors were proceeding at such a rate he had little time for anything else. The first break in his routine after the beginning of the work was the death of his grandfather, just at Christmas time.

Coming just 11 months after the death of his father, the blow was exaggerated. He felt it not so much from a sense of personal loss as from the effect it had upon his mother. She had not yet fully recovered from her husband's tragic death. Then, too, it was mid-winter and the family was in dire financial straits. The Christmas had promised to be a sad one—the year had been the hardest in the history of the family. And to add to the already great load of sadness, a few hours after the arrival of the telegram announcing the tragedy, the postman brought a letter to each member of the family written by the old man just a few hours before his death. Each one contained a new dollar bill as a gift of the season.



Some of the busiest days of DeForest's life were spent in the laboratory shown in the above picture. It was here he made his first acquaintance with ether waves.

THE PROM AND HELEN

However, such sloughs of despondency never held him entirely for long. About that time he had decided upon inviting his beautiful Boston cousin to the annual Junior Prom. He had already broached the subject to her in letters and as the time for it drew near he pressed his invitation. After posting the letter in which he urged her acceptance, he immediately was brought back into the old pit of torture. His conscience troubled him for days. And to make it worse, the return of his mother from Iowa was delayed a few days, and the acceptance from Helen, his cousin, was in his hands before his mother returned.

The situation came to more pleasant results than he expected, however. His mother was compliant; in fact, she was more or less in favor of the visit. The Prom was set for a few weeks after Christmas. Preceding Helen's arrival on the scene, the house was decorated and the rooms rearranged. Lee was a victim of himself. Having the best room in the house he was forced out of it in order to make room for his visitor.

She arrived. There was a pleasant day of walks about the campus and the favorite haunts of the students. Then the big night. Dressed as he had never been before, he hired a cab, weeks before he had, with four other social climbers of Yale, bought a box at the Prom and was prepared for the most enjoyable evening of his academic year. All went well at the start, but one can never forecast events. Before the evening was over, a combination of pride and jealousy arose to take the keen edge from his happiness. Helen was dancing with a great number of other men. Lee was self-appraised as to his abilities on the dance floor. But he did not think that this slight defect in his social equipment was sufficient to warrant the coolness in his cousin toward him, which he accused her of showing. The evening was not totally spoiled. There were many pretty girls and the atmosphere was one of gayety and abandon. By comparison to his general routine it was a Bacchanalian revel.

LOVE ATTEMPTS TO ENTER

At four o'clock in the morning, with an air of the Gay Dog, Lee held his arm for his lady, hailed one of the cabs standing by, with a bit more of a flourish than was actually necessary to call the cabby's attention, helped Helen into the dark recesses of the musty-smelling vehicle, took his own seat and gave the man on the box the address. As the street lamps temporarily lighted up the interior of the cab, a young man might have been seen gazing with a discernible bit of worship in his face at the very tired and sleepy, though happy young girl beside him.

As with most such cases of young love there is an anticlimax, and it usually is surprisingly humorous and often pathetic, to the onlooker. At the house, the two revellers slipped into the parlor and doffed their wraps. Lee showed Helen to her room and on the stairs dared to mention his extreme happiness at having her as his guest to the greatest of Yale's annual functions.

Now it has been mentioned that the young lady made her home in Boston and it is a generally known fact that Harvard is situated almost within a stone's throw of that town. And, one may conclude from the fact that the young lady was pretty, well bred and of good family, that she knew a much larger number of Harvard men than students from Yale. All these young men, in justice to their alma mater, had told her of the virtues of their own institution as opposed to the vices and shortcomings of their opponents, Yale. The volume of evidence decided the issue. At heart, Helen was loyal to Harvard. As the hour was very late and a drowsy hack ride had just been concluded, the young lady's reaction was more natural than studied. She repeated some chance remark that one of her Harvard friends had made. The result was instantaneous. Lee resented the fact that she should make so obvious her preference to a rival, nay a hated university, and said so.

Helen ended the incident with hauteur.

HELEN IS TAKEN ILL

The following morning found the young lady dangerously ill with appendicitis. After three days passed with a growing seriousness in her condition, her mother was called to the bed-side and a medical consultation was called. The girl was too ill to be moved and the doctors declared that an immediate operation was necessary. She was taken to a local hospital where the operation was performed. Lee paid her a visit every day while her condition was serious. Sometimes he would send flowers.

He had announced himself in several places in his diary as being "upon the verge of falling in love with Helen." He still held this idea even after the Prom episode. The visits to the hospital were sometimes tender and charming. After a long and perilous convalescence Helen was able to return with her mother to her home. "Poor little Prom girl," Lee wrote in his diary in closing this sad episode.

All the while, he was continuing his work in the laboratory and keeping constantly at his reading in electricity and mathematics. It was shortly after the beginning of 1902 that he made his first real acquaintance with the electric condenser, that is, he began some experiments with it. Immediately, thousands of possible uses for this device thrust themselves into his consciousness. Of them he wrote in his diary, "It flashed across me today—my special first field of electrical enterprise—the condenser half brother to the transformer, more efficient, cheaper, lighter,—to develop it. Make it take the transformer's place both for phase alternation and also for step up and down—superseded everywhere—Millions! Then find

(Continued on page 1087)

As DeForest looked during his Spanish American War experiences. He was fond of riding and loved his horse.

The Latest Radio Swindle

By HUGO GERNSBACK
Member American Physical Society

Every new industry as a rule is exploited by legitimate business as well as by "business" that is neither legitimate nor anything else. Attempts are often made to defraud the general public by pseudo-scientific means. One of the most flagrant recent swindles is here described.

Right: Posing the "Interference with Transmission." Another caption under the same photograph taken from Dr. Rogers' pamphlet. If we can believe Dr. Rogers, by means of this hokum, box potion — hoop-la — we can "test the capacity and inductance of the brain and the chiropractor will know the degree of INTERFERENCE in the flow of life force." Sad to relate, however, we do not believe Dr. Rogers.

Above: "Determining the capacity and inductance of the brain. Absolutely no electricity gets to the patient." So reads the highly interesting but nonsensical caption printed underneath this picture in Dr. Rogers' pamphlet

SINCE radio became popular, the general public has pounced upon it as the marvel of the age, which truly, it is. The non-technical man, if told of any new and seemingly impossible wonder that has been performed by radio is not at all incredulous, but willing to believe anything and everything, as long as the magic word of radio is connected with the new wonder. If it were to be announced tomorrow by some exploiter that by means of a new radio outfit we could live to be a hundred, there would be a huge sale for such an outfit. Indeed, there is very little the public will not believe that cannot be accomplished by means of the marvelous radio.

We had occasion before to mention through the columns of RADIO NEWS a new crop of unscrupulous exploiters who have sprung up of late to take advantage of the public belief in radio in order to make huge sums of money. In our June, 1921, issue we showed some of the faking which has already been carried out. It seems that only the fullest and widest publicity can eradicate the new evil with which radio is threatened. To the non-technical man, we give this warning—IF AT ANY TIME YOU ARE APPROACHED BY A SO-CALLED "DOCTOR" OR PRACTITIONER TO UNDERGO A PHYSICAL TREATMENT IN WHICH A REGULATION RADIO OUTFIT IS USED—SHUN HIM AS YOU WOULD SHUN A BURGLAR. Both operate on the same principle, namely, to extract money from you, with the difference that the burglar should get the benefit of the doubt—at least he is fair minded about it and does not deprive you of your hard earned money under false pretenses.

We have to do today with the Wonder (?) of the Age—THE NEUROPHONOMETER, manufactured by one George D Rogers, D.C., Ph.C., former Dean of the Texas Chiropractic College, 1715 Main Avenue, San Antonio, Texas.

We give Dr. Rogers full publicity on the Neurophonometer so that any individual who desires to know all about the "conductivity of his nerves" can buy this $50 radio outfit masquerading under the high-sounding name of neurophonometer, for the small sum of $500—CASH, as advertised by Rogers.

The Neurophonometer, as our illustrations show, is a regular radio outfit thinly disguised. On the front panel there is a vacuum tube for some reason or other not very clear to anyone and a Baldwin phone. The outfit looks very formidable, to say the least, and the poor victim who is to undergo treatment must certainly be inspired by the sight of the variegated knobs, voltmeter, dials and other paraphernalia which are soon to help cure him.

The Neurophonometer is of course never sold to private individuals. It is sold to certain practitioners who fall for the humbug and who in turn tickle their prospective victim's spine by means of a "free" electrode supposed to carry the radio current.

The following paragraphs are taken from Dr. Rogers' pamphlet.

"The Neurophonometer is a highly sensitive electric instrument constructed to measure the exact conductivity of the nerves of the entire body. The Neurophonometer does not measure the conductivity by a hypothetical point called normal, BUT IT DETERMINES THE VARIANCE FROM THE CAPACITY AND INDUCTANCE OF THE BRAIN (DYNAMO) WHICH GENERATES THE LIFE FORCE OF THE BODY. THE RATE OF THE GENERATION IS THE RATE OF CONDUCTIVITY, IF THE NERVE IS FREE FROM PRESSURE. If there is interference with the flow of life force, the Neurophonometer will register the degree. Surface temperature does not alter the efficiency of the Neurophonometer, because IT IS ACTUALLY DETERMINING THE CONDUCTIVITY OF THE NERVE. This was determined by locating an impinged nerve with the Neurophonometer under ordinary conditions, then heat was applied over the

$1,000 Reward

RADIO NEWS challenges Dr. George D. Rogers, D. C. Ph.C., the manufacturer of the NEUROPHONOMETER, to come to New York City and demonstrate his NEUROPHONOMETER before a body of twelve scientists, composed of six physicians and six scientists, all of good repute and standing. If these independent twelve men decide that the claims put forth for the NEUROPHONOMETER by Dr. Rogers are founded upon scientific truth, RADIO NEWS will pay over to Dr. Rogers the sum of ONE THOUSAND DOLLARS ($1,000) plus HIS TRANSPORTATION TO AND FROM NEW YORK.

THIS OFFER WILL BE OPEN FOR SIX (6) MONTHS.

ove being tested, then the instrument owed that the heat increased the conavity of the nerve about one fourth one unit, an ice pack was then apd over the same nerve, and the inrement showed that the interference is increased by the cold one third of e unit. BY ELECTRICAL LAWS HIS TEST PROVES THAT THE EUROPHONOMETER ACTUALY MEASURED THE CONDUCIVITY OF THE NERVE

"Probably the most important feature the Neurophonometer is the establishment of the positive normal conducity of the nerves. This is important. ECAUSE EVERYONE HAS A IFFERENT FREQUENCY, therere, it would be very difficult to determine an average, even then the test ould not be specific. BUT BY DEERMINING WHAT THE INDIIDUAL PATIENT'S FREQUENCY , then test the nerves by comparison, HE TEST IS ABSOLUTELY SPEIFIC AND SCIENTIFIC.

"AFTER THE CAPACITY AND NDUCTANCE OF THE BRAIN AS BEEN DETERMINED, the free ectrode is placed over the nerve to be sted. If this nerve is free from pres- IT WILL TEST IN RESOANCE WITH THE BRAIN, but if ere is pressure it will test BELOW HE CAPACITY AND INDUCANCE OF THE BRAIN, and the hiropractor will know the degree of terEference to the flow of life force

"The tests are made with an oscilting circuit that is made audible by e aid of radio principles. Therefore, e test is an audible test, which is six nes as sensitive as the most sensitive ysiological tester. This, of course, increases the efficiency of the instrument locating nerve impingements

"The Neurophonometer is so conructed that the technique is easily and ickly mastered, but of course, experice increases your efficiency. Its wearg parts are only three, and they are expensive to replace and your local ectrician or radio man can make all cessary repairs or adjustments. You n learn to operate it in a short while, d practice makes perfect.

"Should you buy one, you will be instructed in its use. Its value or worth nnot be estimated in dollars and cents owever, we have decided upon a fair ce which will always remain at a minimum of $500 cash. Labor conditions and supplies may make it go higher, but there is little possibility that it will ever be cheaper.

"Don't be afraid you cannot be supplied!

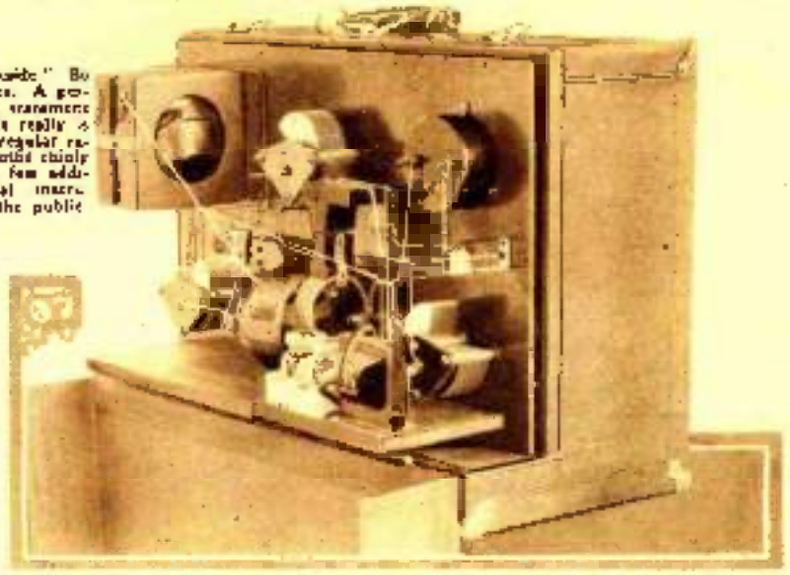
"We guarantee delivery in thirty days. There is no hurry.

"You have until tomorrow to decide, and should you want advice, seek it. Good advice is always desirable.

"The Neurophonometer is constructed and operated by POSITIVE LAWS OF PHYSICS. It will be opened up at any time for inspection by electrical experts, and its every part explained in detail. It can stand the test—it is so constructed.

"The Neurophonometer has been in the process of making for over a year, and it has proved its value to Chiropractic to the entire satisfaction of everyone who has seen the demonstration. The alarmist, the skeptic and the non believer have all had their fling at this instrument and, as strange as it may seem, THE LITTLE VOICE OF INNATE SPEAKS THROUGH THE TRANSMITTER just the same and tells the Chiropractor THE EXACT POINT OF INTERFERENCE WITH THE TRANSMISSION OF VIBRATORY LIFE FORCE.

"Don't discard your X-ray, it may mean dollars and cents to you sometime in a malpractice suit.



"This is the inside." So says Dr. Rogers. A perfectly truthful statement in this case. It really is the inside of a regular radio receiving outfit thinly disguised by a few additional electrical instruments to fool the public.

QUESTIONS ANSWERED BY DR. ROGERS

"Q. How does the Neurophonometer differ from other instruments announced?"

"A. We have not seen the other instruments. The Neurophonometer is A PROVEN SCIENTIFIC INSTRUMENT, WHICH REGISTERS THE LIFE FORCE being carried by a nerve.

"Q. Is the Neurophonometer difficult to operate?

"A. No. The instructions furnished are sufficient to learn to operate this instrument. You will improve continually as you use and operate the instrument, the same as driving a car. It is operated similar to a radio receiver, BUT MORE SIMPLE.

"Q. How long does it take to make a reading or analysis of the spine?

"A. Average, ten minutes.

"Q. Does the patient feel any shock?

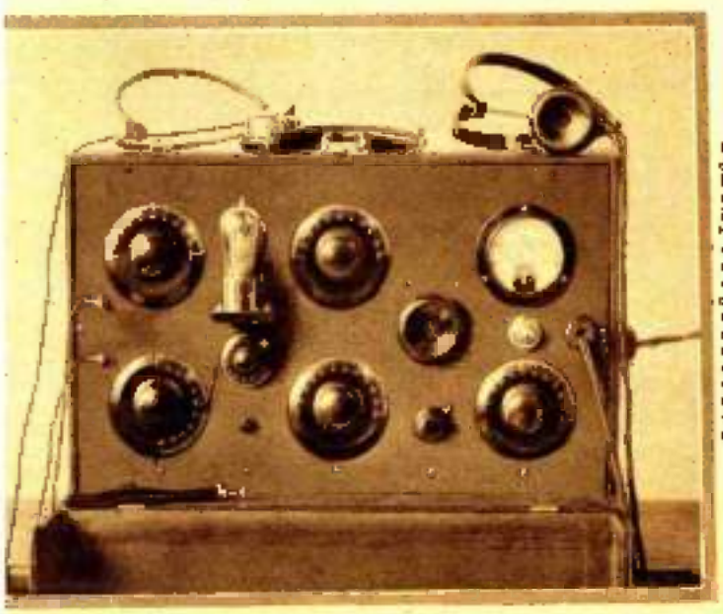
"A. Absolutely none.

"First, the Neurophonometer is not a mere finder of hot-boxes. In fact, its functioning does not depend upon surface heat at all. What the Neurophonometer really MEASURES IS THE ELECTRICAL CONDUCTIVITY OF THE NERVE, and research as science has virtually established the fact that the transmission of impulses over nerve is essentially electrical in nature. THIS MEASUREMENT OF ELECTRICAL CONDUCTIVITY CONSTITUTES A DIRECT INDICATION OF THE ABILITY OF THE NERVE TO TRANSMIT MENTAL IMPULSES. Here we have a direct means of determining the degree of impingement on any nerve.

"The second great advantage of the Neurophonometer is that in getting a reading the operator is guided by his ear. With receivers clamped over his ears, he adjusts the dials so as to get the maximum sound. Such a method is regarded by workers in the exact science as being at least six times as sensitive as any recording device and is resorted to whenever great precision is desired and the nature of the work permits of its use."

The parts which have been capitalized by us show the silly nonsense that is being paraded before unsuspecting buyers. If Dr. Rogers sells many of those $50 outfits for $500 he should soon grow rich, but it is particularly the crass nonsense of the technical verbiage that Mr. Rogers uses which is so offensive to the man of science. For instance, the sentence—*"after the capacity and inductance of the brain has been determined, the free electrode is placed over the nerve to be tested. If this nerve is free from*

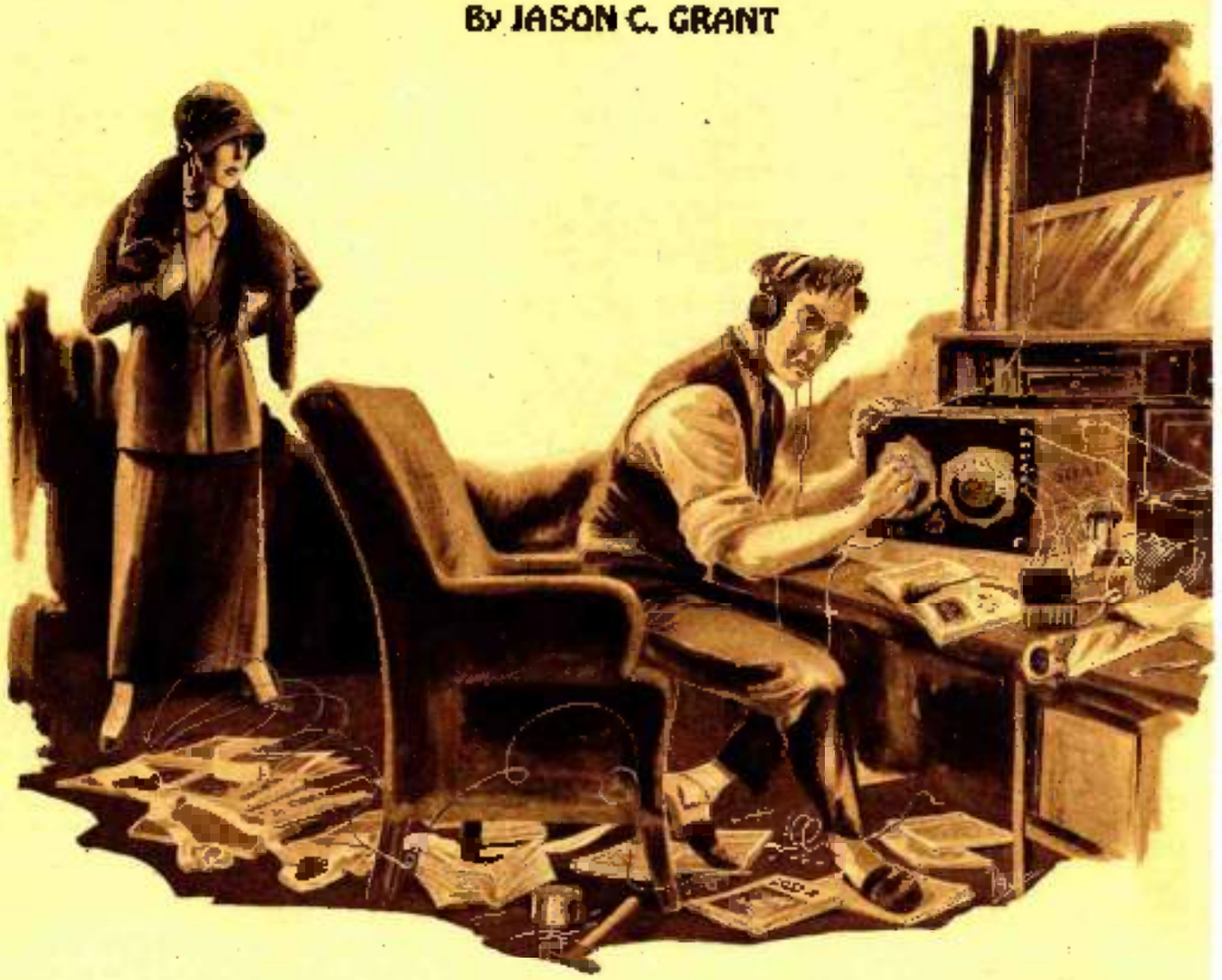
(Continued on page 1003)



Meet the latest radio wonder. — the Neurophonometer, shown here in all its glory. In addition to being a regular radio outfit it also possesses an extra built-in front of the panel, also a telephone receiver shown to the left of the meter. Nifty contraption, we say. It will positively "determine the capacity and inductance of the brain"— NOT

A First Night With a First Set

By JASON C. GRANT



She stepped forward so heavily that the floor actually shook, and began in a high pitched voice the harangue to which I had resigned myself. "Bill Gosling! Are you a fool? Do you mean—" She never got a syllable further.

I DIDN'T know much about radio in those days back in the summer of 1922 (I don't know much about it now.) I had never even seen a receiving set except in pictures. What one looked like on the inside was both a puzzle and a mystery. Nevertheless the articles on radio, the reports of people who had successfully built "their own," the pictures in the advertisements, not only aroused in me an interest in the subject but fanned it into a zealous desire to make a set.

"Why not?" I asked myself. Even kids were getting a thousand miles on sets they had built.

I fell hard. I use these terms not because I have any regrets to offer, for I have none, but there is one incident in my career as a fan which came near ending in a manner which would call for regrets. It is this incident that I am about to relate.

As mentioned above, I fell completely for the game. I decided to build a radio set, although I had never used a saw except on coed wood. I had a purely imaginary conception of a breast-drill, a bushing, a binding post and a tension spring. Of course variocouplers, variometer, condenser, grid leak and rheostat meant absolutely nothing to me. And then there were EMF, DPDT, mfd., D.C.C., D.S.C., and a whole host of symbols, abbreviations, and equations which rendered, with rare exceptions, the technical articles on radio enigmatical to me.

And still I was mystified. But one writer had said, "Anybody with common sense can —." I had common sense, or at least I thought so, and I jumped into the thing without knowing just where I'd come out, or even whether I'd come out or not.

The trouble started when I got my first box from the grocery store. I had selected it with great care,—all of the boards were whole, and so I carried it home with a fine feeling that I had started well. Then came thoughts of the panel and the baseboard I could make out of it after I had knocked it down, dressed the boards with someone's plane, yet to be borrowed, and sawed them into the proper lengths. I was quite in another world. When I arrived home, I hid the box under the back porch, returned to the front door, and entered in the usual manner. Two days later I discovered the box filled with ashes and rubbish of all kinds. There was no use saying anything about it, no use arguing: I could get another. The only thing I regretted was that I had asked my wife where the box was before I found it, for she attached significance to my asking and, by going through an elaborate process of reasoning, reached the conclusion that the box had something to do with radio. In a word, she sensed just what I was planning.

She didn't mind my being interested in radio, but she did mind my making a ca set out of the salary of a common cl and she did mind the mess I had alre made about the house and would make. thought I should be doing the house cleani gardening, house painting, and numero other things she had on her list for me do during my vacation. All of thes gleaned from her answers to questions lating to radio that I had put at vario times when the psychological moment see ed to be at hand.

But I had gone too far to be stopped stood the strain as long as I could and th decided one Friday afternoon to buy so of the parts that were listed in a how-make-it article. I made my mind up in moment. I would make a variocoupl Straightway I went downtown to a har ware store,—I didn't know there were th regular radio stores in the little town. Bo ly I went into the store, affected a rath careless, know-all-about-it attitude, and as ed with indifference for the article I sired:

"A pound of No. 24 direct current copp wire, please."

"You want what?" inquired the clerk, little puzzled.

(Continued on page 993)

Oscillations

By WILLARD WILSON

o Editor of Radio News, wish to ...nt condemn of high-voltage ideas, k-ups and other useful pieces of radio raledue

nored Sir —

...arly," huge re-radiation have been ...ed in literary world of radio by many ..., regulations, laws, etc., concerning ...dcasters, amateurs, commercial opera- ... and other inhabitants of radio world. ...ile laws for such are borne made so ...ty, Hon. Sir, I desire to insert plea for ... laws concerning other pepl. connected ...h radin -namely, men which sell radio ...ts, sets, etc.

...dy reason for such highly amplified de- ... are as following:

...great while ago I became painfully in- ...rested in radio, and also consumed with ...ire to possess receiver yet to pluck radio ...es from air. Thusly I went to neigh- ...ing garage man which have became im- ...portu dealer in radio parts.

"Oh," he squawk learnedly, "you wish to ... your own, yes?"

"I desire to do such," I refab timidly. "I ...ire to have small diagram of hook-up for ...sual set."

"Blah!" he snort with nose wrinkle of ...ontempt. "Such set can hear but small ...istance. You shall buy nice box of parts ... cute hyper-super-done. Such are en- ...tely preferable to cheap crystal set."

"Maybe yes," I gargle back uneasily, "but ...have small amt. of cash at present for ...h set. It will be too strained for me."

"Ah," he snort painfully, "then I will ...e you small one-tube receptor for negli- ...ible sum of 80 becres."

"Eek!" I squeal jointly. "But I have ...ly ten for investure in set at present!"

"Ten?" he gasp nosedingly. "Oh! I will

"Ten?" he gasped unceasingly. "Oh! I will give you small piece of nice enameled wire, one spiderfoot coil and small paper condenser for that sum."

give you small piece of nice enameled wire, one spiderfoot coil, and small paper condenser for that sum."

With protests of good-will I flee from clutches of such dealer, Hon. Sir, and slink into my home via back door of such.

Those, Hon. Sir, were my first experience with robber-thiefs under disguise of garage radio dealers. Since then I have became skinked by such in more deals than are tasteful to relate. I have emptied pockets of week's wages to receive in return, small, crippled battery of uncertain volting! I have paid converted bicycle man—who now rides in limousine and sells radio parts—great pile of cash for worthless Marda lamps under name of V. T.

After great amount of earbreaking experiences, Hon. Sir, I have became forced to admit to myself, also wife, that many radio dealers, make wealthy foreign brokers (of pawn variety) look like generous philanthropers.

Do not understand such talk from me. At present I am no more skinked of huge amounts of cash, for reason that I have became acquainted with decent and honest radio dealer which are not trained as bus mechanic. There are such, Hon. Ed., if one are able to find them. There are also mine cheap, better parts, which are able to be bought at standard prices.

Such radio dealers, however, which are

(Continued on page 1044)

A Guess Evermore

(As Poe might have written it.)

By WARREN W. SCHULTZ

ONCE upon a midnight dreary, while I pondered weak and weary,
Before the dials which I had purchased lately from a Radio store;
Suddenly there came a tapping, as of someone gently rapping,
Rapping at the speaker's core.
'Twas some static then I muttered rapping at the speaker's core.
'Tis this and nothing more.

It could not be I had blundered, yet the good loud speaker thundered,
For the tapping, growling tapping, waked the dog outside the door.
Quickly out the door he lumbered, and he neither slept nor slumbered,
While the good loud speaker thundered, thundered at its very core.
But he joined the mellee howling, sometimes barking, sometimes growling

As he'd never done before.
Only this and nothing more.

Now this stirring set me thinking, for I know I'd not been drinking,
Thinking evil thoughts about the man in our own Radio store.
Then I wanted to start cussing, just like married people fussing,
But I dared not do a thing that I had never done before.
Instead within me I enquire, that all Radio men are liars.
That the fools of course are boyers, and it made me very sore.
And that next day I'd consult him, use the noose and big tree on him,
Or knock him down upon the floor.
Only this and nothing more.

Quiet, quiet, awful quiet, as in some great Chinese diet;
For the tubes which glowed so brightly now were silent evermore.
All the air rushed from my sails, and not as slow as pair of snails;
So I stayed inside the door.
Still on the rack reclines my hat, for I mistook "B" for "A" bat,
Which I shall do nevermore.
Only this and nothing more.

MORAL

If you blame anyone for anything, first be sure you are not to blame yourself.

How Your Ear Helps Out Your Loud Speaker

By PAUL B. FINDLEY, E. E.*

Did you know that your ears have the habit of fooling you at times? Much to the credit of the loud speaker. Mr. Findley explains how and why the ear does it

Dr. J. C. Steinberg adjusting a vacuum tube oscillator which will produce a pure musical tone of any pitch. Note the various filters under the table.

WHEN radio broadcasting started, the fan who had any sort of a set drew gasps of wonder from his friends when they heard some local station grinding out phonograph music. A year later and the craze was for long-distance records. Then came loud speakers whose raucous bleatings were an insult to the public's musical good taste.

Developed by men of brief experience in the art, having little or no knowledge of the acoustic principles involved, many of the early loud speakers were merely glorified telephone receivers, fitted to a horn and designed "by guess, and by gosh." Now that radio is settling down to a means of entertainment that must stand on its own merits in competition with other forms, the public is demanding a quality and volume of reproduction so faithful to the original that the listener can close his eyes and believe himself in the studio or concert hall.

Such faithful transmission and reproduction of a radio program is possible only when every link in the chain is carefully designed and skillfully operated.

The system must not fail to transmit the full range of tones; it must not add any tones of its own, recognized as "blur" or "fuzz," caused by overloading one or more elements; it must not introduce noise, and it must give enough volume for comfort, yet not so much as to make the lower tones "heavy."

RESEARCH NECESSARY

To avoid these troubles, "cut and try" methods with the human ear and memory as guides will not serve. Present-day achievements have been possible only because measurement methods and standards rest on fundamental researches extending over more than a generation. The high-quality carbon microphone of today is a direct descendant of the granular carbon transmitter on which Bell System engineers were working as early as 1886.

In the great research laboratories engineers are constantly studying every element in telephonic transmission, from the speaker's voice to the listener's ear. Many fascinating stories could be written about the things these engineers are doing; one of them, perhaps the most important to the radio listener, deals with his own ears and how they interpret the air-waves in terms of sound. This work has been carried on by a group of scientists headed by Dr. Harvey Fletcher of the Western Electric Co.

Sound is carried from the loud speaker to the listener's ear by air-waves. "Frequency," that term which recurs so often in radio literature, means the number of waves per second that pass a given point. The ear can hear—that is, translate from air-motion into sound—frequencies from about 20 to 20,000 waves per second, but the range from 100 to 5,000 is the one that must be considered for good broadcasting.

The human ear itself is a fascinating study.

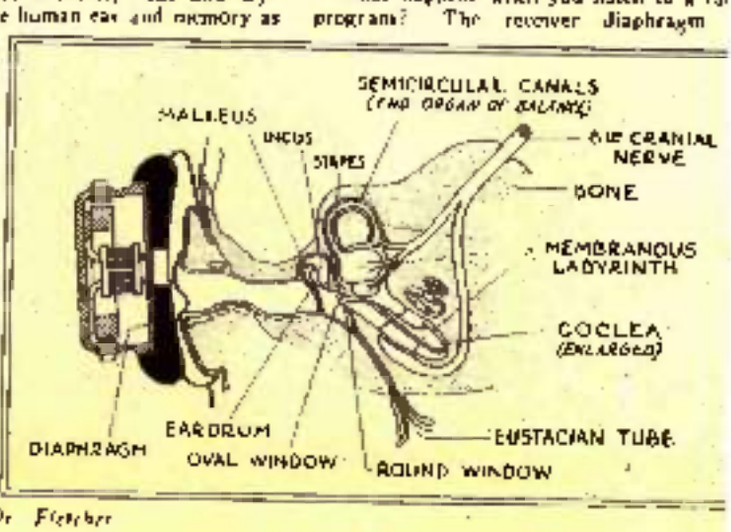
Beginning with the ear-drum, which is a thin membrane stretched across the end of the canal from the open air, the parts are as follows:

FIVE PARTS OF THE EAR

The drum, which converts the air-waves to mechanical vibrations.

A chain of three small bones—hammer, anvil and stirrup—follow. The last fits into the oval window, an opening in the cochlea. This is a spiral chamber like a small shell, which is filled with a fluid. Down its center as a partition called the basilar membrane, dividing the cochlea into two parts. From one side of this membrane emerge a lot of fine hairs. The roots of these hairs are in little sacs connected to the auditory nerve.

What happens when you listen to a radio program? The receiver diaphragm



A schematic representation of the human ear. Note the numerous organs necessary for our hearing

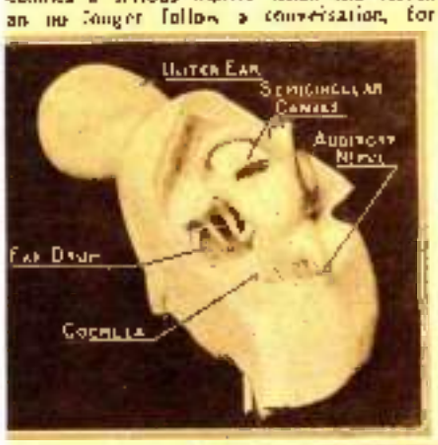
*Member of the Western Electric Staff, associated with Dr. Fletcher

ates sending off air-waves. These in rn set the ear drum into vibration, passing e motion along through the three little nes to the oval window. The vibrations avel down one side of the winding chan- r in the cochlea to a point determined by eir frequency (number of waves per sec- nd). Here it becomes easier for them to through the curtain and start back up the her side than to keep on down the original ssage. Slow vibrations may go the length the cochlea; higher pitches can go only a ort distance. Where the vibrations pass rough the curtain they make it move, and is tickles the fine hairs growing out of it. hese in turn excite the auditory nerve, and e brain gets the sensation of sound.

WHEN SOUND BECOMES FEELING

If the air-waves come in at less than out 20 per second, the whole fluid in the chlea is moved back and forth, and the nsation is of "feeling" rather than of und. This is what happens to some people hen the lowest of organ notes are played; ey feel a heavy fluttering sensation rather an a musical tone. And when the sound- aves come in at 20,000 per second and up e moving parts of the ear offer so much mpedance that practically nothing gets into he cochlea.

Within the range of pitch that can be eard there are definite limits to the needed nergy, or loudness, of the sound. Beyond he upper limit sounds are felt, and are nipleasant if not even painful; below the ower limit they are not heard at all. The imit is lowest for sounds pitched about hree octaves above middle C. Taking the ouder vowel sounds of an average voice s the speaker's lips as a very rough stand- rd, the upper limit is 10 times as loud, hile the lower limit for people of good earing is one ten-billionth as loud. The range of loudness from the most intense owel sound to the weakest consonant in ordinary speech is about one million to one. The range of sensation is shortened as the ir waves grow weaker and to a partially leaf person they fade out sooner. This ecomes a serious matter when the victim an no longer follow a conversation, for



Two views of a plaster model of the ear made by Dr. Fletcher for demonstration purposes. By comparing these with the diagrams one may have a good idea of the exact shape of each organ.

By the use of this table full of apparatus, Dr. Harvey Fletcher (right) can imitate the vowel sounds of the human voice. This is accomplished with the aid of vacuum tube oscillators. © Knickerbocker Photo Service.

speech is our most powerful social instrument. So every year has seen new kinds of hearing aids, from the tin trumpet to the vacuum tube amplifier. Eager to re-establish communication with their fellowmen, hopeful sufferers have purchased according to their means and sometimes beyond, and have all too often been sadly disappointed at the results. For the plain truth is that, beyond a certain point, hearing cannot be restored by amplification. If your deaf friend cannot understand when you talk directly into his ear in a loud voice, then probably no hearing aid can be of much use to him.

THE DECEITFUL EAR

But how does your ear help out the loud speaker? An experiment of Dr. Fletcher's throws light on this subject. He arranged 10 separate vacuum tube oscillators so that they produced an electric current from 100 cycles per second up to 1,000 at intervals of 100 cycles. These were connected through switches to a special telephone receiver. When all were connected a full tone was heard which had a pitch corresponding to 100 cycles. *Switching off the 100-cycle tone had no noticeable effect on the pitch*, nor did the pitch change when the first seven tones were cut off and only the 800, 900 and 1,000 cycle currents reached the receiver. In fact, any *three* consecutive currents gave the sensation of a pitch corresponding to 100 cycles, while with any four consecutive currents the apparent 100-cycle note was very prominent.

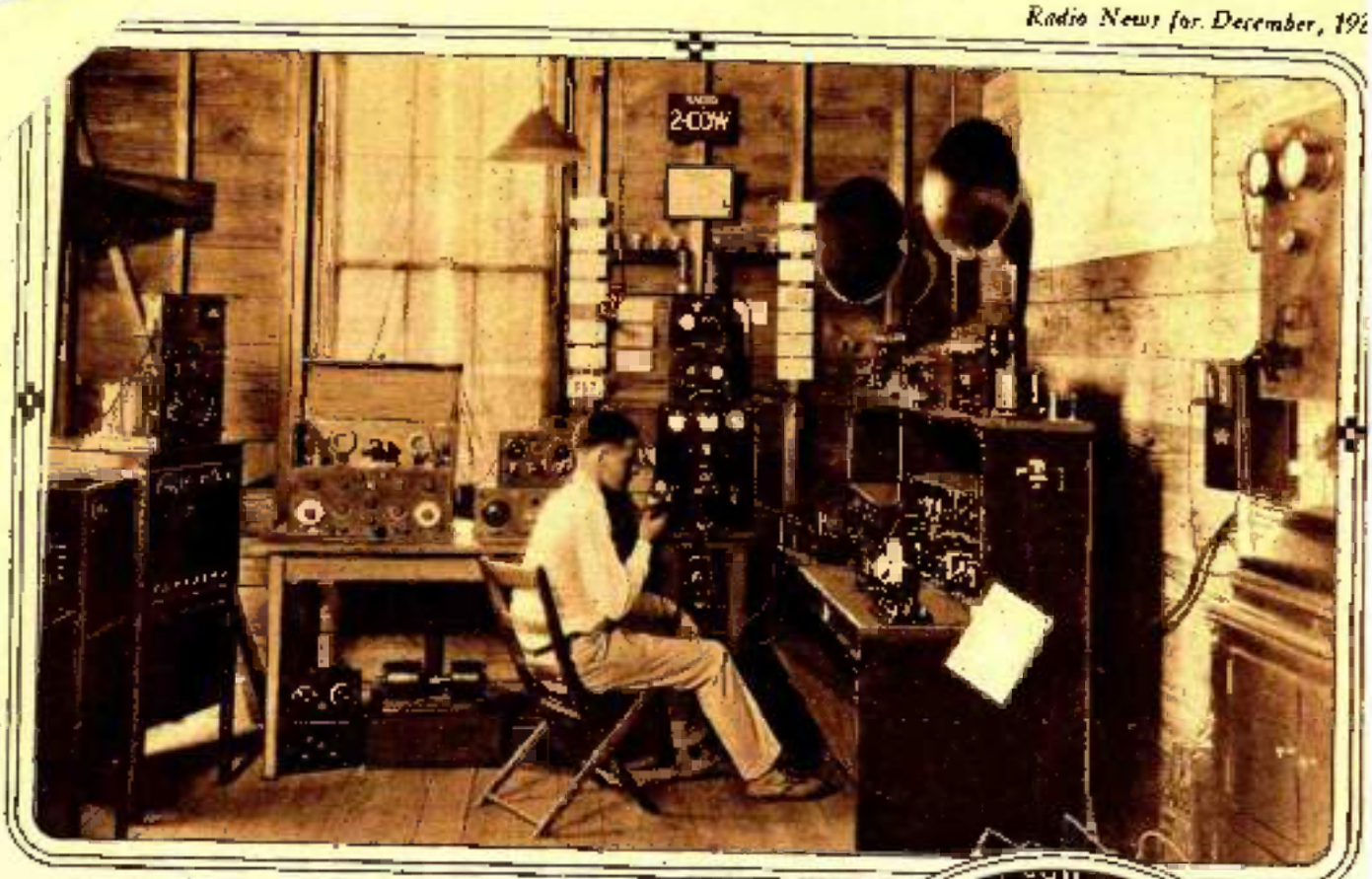
Where did the ear pick up the 100-cycle note if it wasn't sounded by the receiver? To tell the truth, the ear "made it out of whole cloth," just as some men make up a breakfast-table story of what they did the preceding night. In justice to the ear, however, it must be said that it must have something to work with, and what it does is to combine the sounds that enter it and make up a new tone from them. The action is strictly analogous to that of the vacuum tube detector, which makes an audio frequency current out of the difference of two radio frequencies. The air waves of frequencies 500, 600, 700 and 800 cycles have a common difference in tone which gives us the sensation of hearing it.

BRAIN NOT ALWAYS FOOLED

"From the results which have been described" says Dr. Fletcher, "one might conclude that the pitch of a musical tone was determined by the common difference in the frequency of the harmonics, rather than by the frequency of the lowest component. This suggested trying a combination of frequencies which are separated by a common difference, but which are not necessarily multiples of this common difference. For instance, 300, 400, 500, 700, 900 the common difference is 200, but none of these are multiples of 200. What happened? Just a noise; and the same thing happened for 100, 400, 700, 1,000; and for 100, 500 and 900. So the brain shows its suspicion of the ear and its tricky ways, and won't allow itself to be imposed on too far."

These experiments were on putting tones together. In many practical radio and loud speaker systems actual tones are cut apart. So Dr. Fletcher took his high-quality experimental telephone system, one which transmitted faithfully all tones from 100 cycles to 5,000 cycles—and inserted an elec-

(Continued on page 1006)



Interior of 2COW showing one of the campers operating the radiophone transmitter. Note how the wavemeter is suspended above the transmitter.

A De Luxe Amateur Station

2COW, New Paltz, N. Y.

COINCIDENT with the call, 2COW is located in the heart of the Hudson Valley dairy country at Camp Wallkill, New Paltz, N. Y. The station has been in operation for two seasons and has been logged many times in every district.

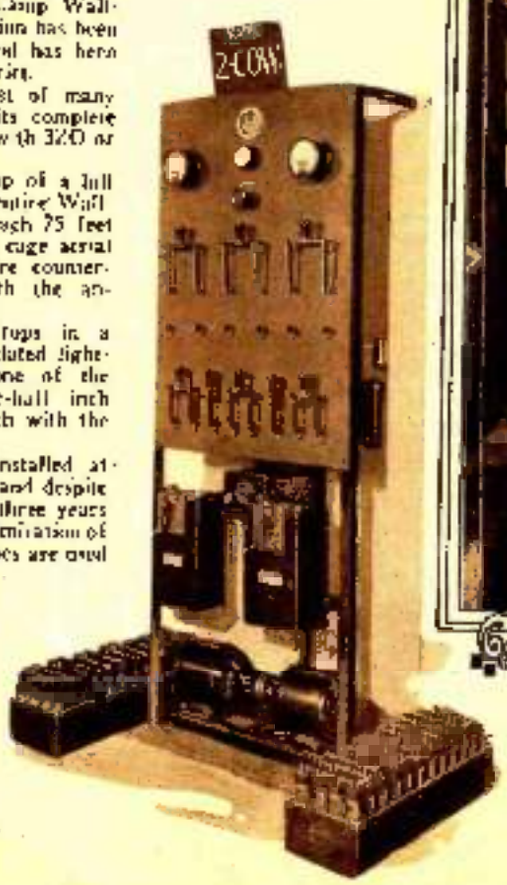
2COW was erected at a cost of many thousands of dollars and for its complete equipment can only be compared with 3ZO or 2HQH.

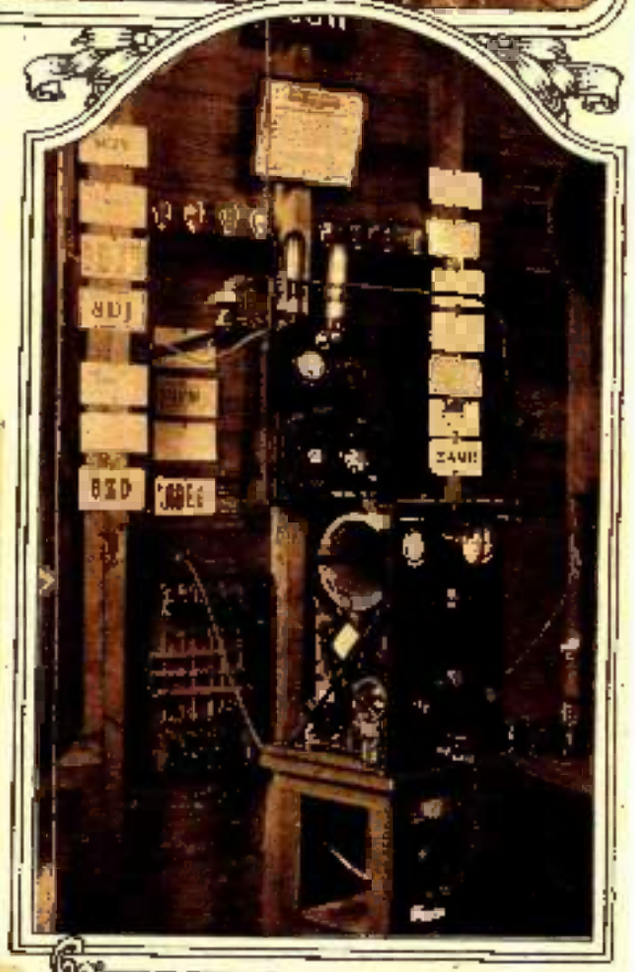
It is ideally located on the top of a hill commanding a wide view of the entire Wallkill valley. Two steel towers, each 75 feet high, support a beautifully made cage aerial about 70 feet above the six-wire counterpoise suspended directly beneath the antenna proper.

A miniature cage lead-in drops in a straight line to the porcelain insulated lightning switch mounted outside one of the operating room windows. One-half inch copper tubing connects this switch with the ground on the apparatus.

The main transmitter, once installed at old 2LH, has won several prizes, and despite the fact that it was built nearly three years ago it never fails to arouse the admiration of those who see it. Two 50-watt tubes are used in a Hartley circuit. A small double-pole double-throw switch mounted on the panel connects the tubes in parallel for C.W., or in a Heising modulation arrangement for voice transmission. Two 5-watt speech am-

(Continued on page 1096)





Above: The main transmitter at 2COW. A duplicate of the famous transmitter used at old 2LH. Note the copper tube lead-in. This photo affords a better view of the wavemeter and its position in relation to the transmitter.

Right: The switchboard, motor generator and section of the storage "B" battery used for transmission.

Hamitorial

Experimental Technique

SEVEN different transmitting hook-ups in a month and no one of them thoroughly tried is the record of experimentation, with one Ham we know. And the sad part of this tale of woe is that the same procedure is followed by many of the fraternity, though possibly not in so virulent a form.

Not that the diligence in the search for the ultimate Non-Doggest transmitter is to be decried. Nay and again nay. That is not the point. The point is, as George Ade says, "If you are hasty in your drinking you may pass up a good cocktail." Which is to say, sloppy, superficial experimentation results in little more than piling slips on the traffic hook and generally incurring a reputation for not being dependable.

The whole idea underlying experimentation is to search out the best, and the best means that which is most efficient under all conditions and under all circumstances. The only way to test a set for such qualities is to try it under *all conditions. And three nights' work does not constitute all conditions.* As a matter of fact, with the proper precautions almost that time is consumed in getting a new circuit tuned, particularly if it happens to be one embodying a major change in the arrangement of the apparatus. After the first preliminaries it is always necessary for the operator to become acquainted with a new arrangement—he must learn what to expect of it, where to look for idiosyncracies, what usually constitutes a mechanical stomach ache or electrical tonsilitis.

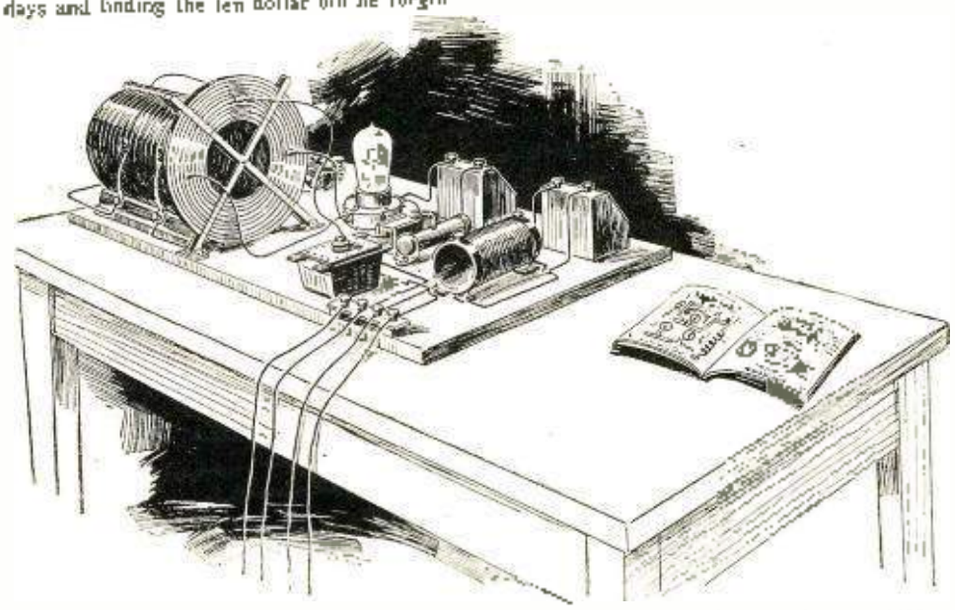
The usual custom—the custom, at least, with far too many Hams—is nothing more nor less than a system of untidy mental habits. He finds a promising new line of research. After thinking it over for a few days and finding the ten dollar bill he forgot and left in last year's vest pocket, he buys a new tube and proceeds to take another chance. Down comes the whole lay-out and up goes the new. The chase is on again.

The set may prove promising at first but before the completion of the preliminary tests a condenser, hooked up with a couple of pieces of loose No. 14, slips over and touches the unprovided antenna inductance with the result that the tuning clips all fall to the floor. Several days pass on account of a bit of extra work at the office. Upon the resumption of experiments it turns out that the cat has used the original hook-up—with some slight changes made before the complete erection of the set—for an artificial mouse.

Well, the set wasn't so wonderful, anyhow. Down it comes and the old one punches the jigs across the change-over the following week.

The Ham's experience spoken of in the beginning of this spleen may prove a further guide. He has tried several circuits at least three times in his various radio gyrations because he has not kept competent notes on his work—not that they would

Slipshod methods result in inaccurate conclusions by the experimenter. Diligent methodical and orderly procedure results in accurate conclusions worthy of a place in your note book. Glance at these layouts.



ever frighten the world as posthumous masterpieces if they were kept—and as a consequence he can never give absolutely accurate dope regarding any circuit.

Why, oh why, will the Hams not cultivate habits of a respectable scientist? They have given radio as much or more than any other group of experimenters and yet they continue in the old careless ways. What would they have done if a little care had been taken and inexplicable demonstrations which they encountered fully noted for further investigation; if some line of research were followed to its end; if there were competent records including notes on conditions, etc.?

Of course, there are the stations with complete logs covering every possible scientific contingency in connection with tests, but they are the exception and not the rule.

Just suppose some diligent brass pounder were to notice a change in the operating efficiency of his set in working two stations equally distant and in the same direction. What would he do about it? Usually he would not even make a note of the fact under the night's entry in the log—if he kept one.

With every deviation from normal, there is a possibility of discovering a new and perhaps fruitful line of investigation that may turn up—Jupiter knows what.

Why not keep a record of such instances, ready for reference when some explanation presents itself? The only way one may make a journey across the sea is by charting a course. The only way a Ham can hope to make any progress in the more or less unknown field of research is by keeping some sort of record of the journey.

Also the only way a course may be taken is by observation, very careful observation. No Captain ever sees his course but one peep through the sextant. He makes many of them in order to be sure of getting accurate results. With a new vessel he must take a long time with her before he is perfectly sure in his knowledge as to how she will behave in a Nor'wester in mid-winter, or how she will carry herself with an empty forehold.

Likewise it is necessary for the Ham, not only to keep careful records as to his observations, but it is equally important that he make his observations with due care and over a sufficiently broad range of circumstances to warrant accurate and complete final results.

A search through the history of abstract science will show you obviously that all the details of a seeming deviation from natural laws may be important in analyzing the reason for the deviation. How is the experimenter to know that his deviation is a mistake or a bona fide demonstration of some new idea unless he has the dope complete for comparison?

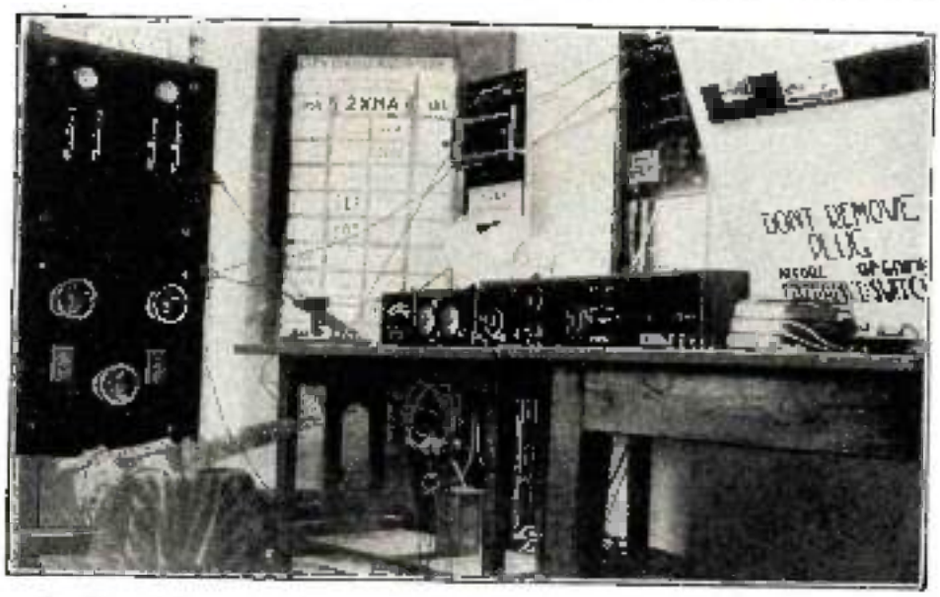
It's old stuff, but like certain merchandise very popular, although quite sparse at present, it's better for the age, this platitude, that most of the world's discoveries were accidents.

Ergo, put your accidents in a book. You

(*Continued on page 1083*)

Station 2XNA of the College of the City of New York

By SIDNEY FISHBERG, 2AHT



Interior view of amateur station 2XNA of the College of the City of New York. Some of the best second district amateurs are operators of this station, probably the most well known is 2BRB, who is chief operator.

STATION 2XNA is located at the College of the City of New York, St. Nicholas Terrace and 140th Street. The station is owned and operated by the City College Radio Club. Through the kindness of the faculty, one of the towers on the main building has been set aside for the use of the Radio Club. The operating room is located in a deck house on top of this tower, 110 feet above the ground. Since the College itself is on the highest point in Manhattan, 2XNA enjoys an excellent location.

The transmitter was designed by the famous 2BRB, with the aid and advice of Prof. A. N. Goldsmith of the Radio Corporation of America. It consists of a 200-watt Hartley set, and may be used for C.W. or I.C.W. Only direct current is available in the tower, consequently a motor-generator is used. This consists of a 1½-horsepower 220-volt compound wound motor driving a 600-watt, 1,000 volt double commutator generator. In order to supply filament current, the motor has been equipped with slip rings which turn out 30 cycle, 154-volt alternating current. A special transformer steps this down to 12 volts. The two meters on top of the panel are plate current and antenna current meters. The filament voltmeter is placed on the operating table, so as to be in easy view of the operator; it may be seen on the extreme left in the picture. The four switches below the meters control the filament supply to the tubes. The top rheostat on the left is the generator field rheostat, that at the right is the filament rheostat, and the one in the center is the motor starter. There is a special contact on this rheostat which automatically turns on the filaments before the motor can be started. A small knife switch on the left side of the transmitter starts the chopper motor. The chopper gives a 300-cycle note which carries very well. The two tubes on top of the panel are defunct navy 50-watters which died gloriously at their post, and were placed in their present position by a member who had just come from an art lecture.

Two receivers are in use: an amateur set going from 50 to 220 meters, and a broadcast and commercial receiver, the range of which is 220 to 880 meters. Both of these sets are of the low-loss type and give excellent results. English stations have been heard often on the Hop receiver, while KGO can be received any good night on the broadcast set. In the picture, the amateur receiver is on the left, next to the filament voltmeter. The set next to it is the old variometer set now hidden in a closet. Next is a two step amplifier to actuate a loud speaker. This amplifier uses 220 volts from the power line, and gives plenty of pep to the signals. In the fall a loud speaker is installed in the student concourse, and the World Series and the collegiate football games are reproduced to a howling, roaring mob of frenzied students.

The antenna at 2XNA is not to be found in the heart of a city ham. As has been said before, the operating room is on top of a 110 foot tower which is high above the surrounding country. The mast is 40 feet high and supports an 88-foot six-wire cage. It is supported at the other end by a wire which runs to the main tower of the building. The counterpoise consists of a seven-wire fan, five feet above the roof and 50 feet below the antenna. At 180 meters an antenna current of 2.5 amperes is obtained with 430 watts in the antenna. This current is not abnormally low, for the fundamental is 215 meters.

All the apparatus at 2XNA was donated by Dr. A. N. Goldsmith who is also a professor of engineering at the College. Dr. Goldsmith has given liberally his time, and technical advice as well, and has done much toward getting the station to its present state of excellence.

Station 2XNA is on the air every night of the school year, and handles traffic directly to all points of the United States. The station is operated by the following men: 2BRB "EG", Chief Operator, 2ABN "DW", 2ABW "DC", 2AET "AC", 2ANV "FK", 2NOP "EL", 2CBJ "ES", 2CBC "HO", 2CRB "IG".

Calls Heard

2WZ, BROOKLYN, N. Y.

C.W. U. S. A.

(1HO), 1Id, 1pk, 1ks, 1ar, 1Cnn, 1ku, (1BN), (1mh), 1mq, (1mz), 1mdl, (1mt), 1us, 1nE, (1phl, 1py, (1ne), 1rl, 1ry, (1sel, 1tm, 1ww, (1vb), 1sd, (1vk, 1ac, 1zz, 1aab, 1aad, 1ab1, 1abe, (1ep, 1ar2, 1ifa, (2aid), (2anh, (1ap), 2ajl, 2ats, 1ass, 2all, (2alx), (2aol), 2aot, (2aou), (2apr), 2are, (2ash), 2avp, (2awq), (2aww), 2aw, 2axn, (2axr), (2ax), (2azr), (2Bad), 4Bnd, (2bcu), (2bfe, (2bgs), (2bgu), 2bgw, (2bhq), (2bhp), 2bhu, 2bhy, (2bi2, (2bjo), (2bjg), (2Bkh, (2bou), (2bqe), (2bq), 2bqu, 2bnq, 2brl, 2bsd, 2bjt, (2bwd), 2bzu, 2cak, (2cas), (2cbb), 2cc, (2cgd), 2cjz, 2ckk, 4Ccm), 2cll, 2c c, 2cmq, (2cmy), 2bj, 2bu, (2cqr), 2dq, 2rk, 2dj, 2bw, 2jb, (2jsk, 2kl, (2kq), 2mb, 2uc, (2mq), 2on, 2l", (2mv), (2rrl, 2r, 4Ivw), (2wbl, 2ww, 2xp, 2za, 2yhw, (2zch), 2zdp, 2zdw, 2zen, 2zzl, (2abp), (3ar), 3ajd, 3arx, (3aur), (3bcx), (3bnr), 3bcx, (3bcy), 3bar, 3bu 3bwc, (3bw2), 3bqf, (3bza), (3bc), 3bvx (3bva), 3bvf,

(Continued on page 1057)

Station 9BPT, owned and operated by Harry D. Clingenpeel, Flora, Ind. The transmitter is a 100-watt C.W. and a 50-watt phone set. The Hartley circuit is used and the radiator is 4½ amps on 180 watts C.W. and 3½ amps. on 90 watt phone. Current supply is from a Ray-li-co 1,000-volt A.C. motor generator. Plate current is 250 milliamperes. The receiving equipment consists of a Grebe CR-9 and a DeForest DRT. The aerial is a six-wire cage 92 feet long and 50 feet and 25 feet high with lead-in at low end. The counterpoise is fan type, and extends radially beneath the cage for 70 feet.

A New Oscillator for Very Short Waves

By ROSS GUNN, B.S., E.E., M.S.

Due to the fact that the Department of Commerce has presented the amateur with some choice short wave bands he will no doubt wish to take advantage of them. Mr. Gunn's short wave oscillator opens the field well. It is decidedly superior to the average oscillator circuit.

THE new range of wave-lengths assigned for experimental and amateur work opens up an interesting field for experiment. For wave-lengths down to perhaps 25 meters the usual methods apply, such as the standard Hartley circuit, but for wave-lengths from 2 to 25 meters, special care and different methods become necessary.

The writer recently devised a new circuit for these very short waves that is far above anything else he has seen for reliability and power output. This circuit oscillates freely and works every time if one or two precautions are taken in selecting the tubes and properly arranging the various parts. The circuit is essentially a Colpitts type and makes use of the internal capacity of the tube to couple the plate and grid circuits. The circuit is novel in that there is no external connection between the filament and the oscillating circuit and, therefore, would not be expected to oscillate. By drawing the Standard Colpitts circuit and replacing the coupling condensers by the tube capacities, the action is readily understood.

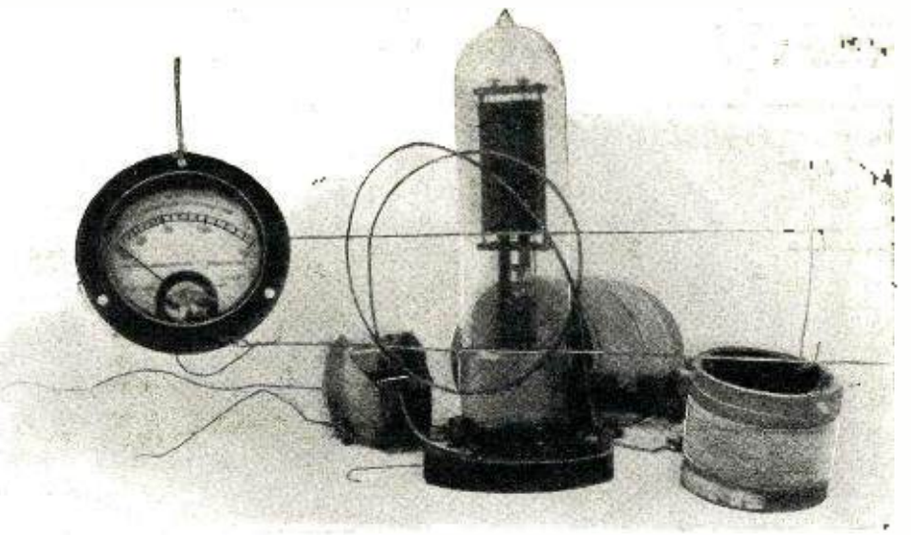


Fig. 3. This shows the tube used in a standard socket. The meter, the two parallel wires and the slide (extreme right) are used to measure the wave-length of the oscillator.

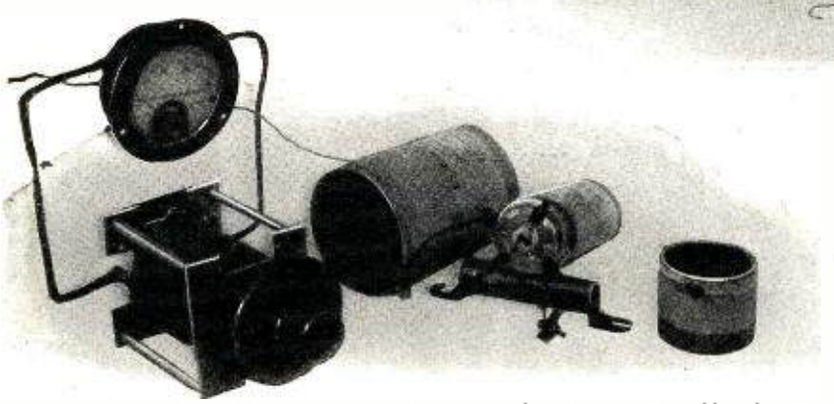


Fig. 4. Another view of the tube with its base removed, resting on the grid leak. Note the R.F. chokes on either side of the tube. The wavemeter is in the foreground.

Fairly large tubes may be made to oscillate satisfactorily at these short waves if this new circuit is employed. The writer has succeeded in securing wave-lengths as low as three meters from a standard Western Electric 50-watt tube. In using this circuit the tube is first isolated as far as high frequency is concerned, from everything else by placing suitable chokes in all the leads to the tube. The oscillating circuit then consists of a turn or two of wire and a mica stopping condenser together with the internal capacity of the tube. The wire L_5 and the stopping condenser C_3 are connected between the plate and grid terminals, as shown in Fig. 1. The output or antenna circuit ABCDE with a hot wire ammeter in series is coupled inductively to L_5. The plate and grid chokes L_1 and L_2 should be made by winding at least 125 turns of No. 27 D.C.C. to No. 30 D.C.C. wire on a cardboard tube 2 inches in diameter. The filament chokes L_3 and L_4 are conveniently made by winding at least 50 turns of No. 20 D.C.C., two wires in parallel, in a single layer on a cardboard tube 3 inches in diameter. Under no circumstances should a jumble winding or honeycomb coil be used, as these are inefficient chokes at short wave-lengths. The grid resistance R has a resistance of from 4,000 to 10,000 ohms, the exact value being determined by experiment. The condenser C_1 is a mica stopping

(Continued on page 1073)

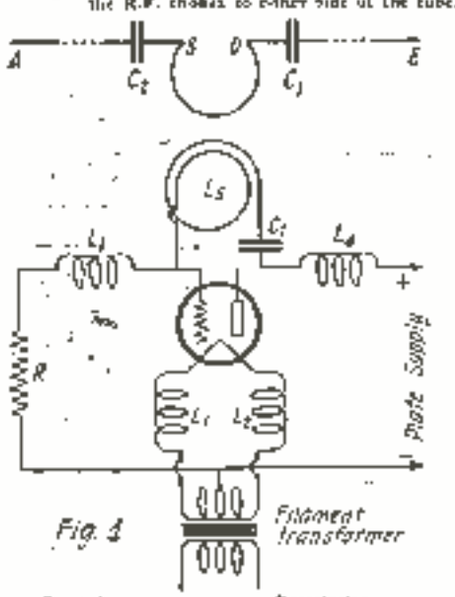


Fig. 1

Symbol — Description

L1 — L2. Chokes — 2 No. 28 D.C.C. in parallel — 50 turns on 3-inch form.

L3 — L4. Chokes. No 28 D.C.C. — 125 turns — 2-inch form.

L5 Oscillating circuit inductance. ½ to 1½ turns 4½ inches in diameter.

C1 Stopping condenser. Either fixed or variable. Value .002 mfd. to .0002 mfd.

C2 — C3 Adjustable tuning condenser made of two copper disks 3 inches in diameter soldered to antenna tubing.

R Grid leak 5,000 to 10,000 ohms.

Length A-B-C-D-E in meters should be from 90 per cent. to 75 per cent. of the working wave length.

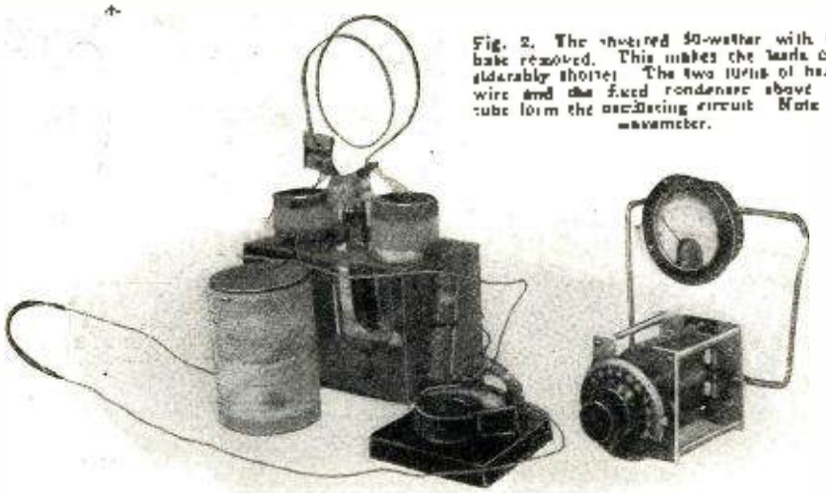
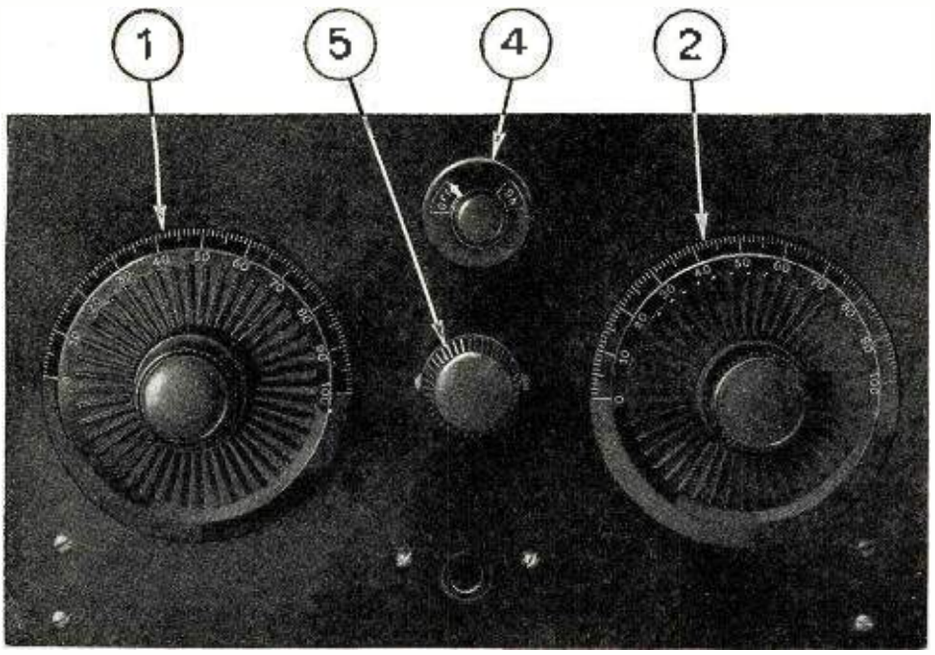


Fig. 2. The shortened 50-watter with the base removed. This makes the leads considerably shorter. The two turns of heavy wire and the fixed condenser above the tube form the oscillating circuit. Note the wavemeter.

A Short Wave Adapter for the Broadcast Receiver

By J. L. CASSELL

The popularity of broadcasting on short wave-lengths below 100 meters has brought in many new designs in receiving apparatus. By means of the adapter shown here, the short wave signals are heterodyned to a longer wave-length and received on a standard broadcast receiver.



FOR the past two years much has been said and written concerning the experiments with short waves, those waves which lie below the broadcast and amateur bands. However, most of the stories concerning the great distances and ease of communication made available by the use of this new field told of much special apparatus and great technical questions involved. After reading a few such reports, the ordinary fan relegated the subject to the scientist and went again to more pertinent problems dealing with questions nearer his heart concerning the efficiency and the distortion in his loud speaker.

Many of the largest broadcast stations in the country such as WGY, KDKA and KFKX are now using short waves with regularity and it only remains for the fan to construct a set or an attachment for his present set which will enable him to receive these wave bands in order to get into the forefront of radio experimentation.

With the simple device shown in these columns attached to any receiving set one may listen nightly and with less trouble to the programs of KDKA at Pittsburgh, WGY at Schenectady and KFKX at Hastings, Nebraska, and many experimental European stations as they put their programs on the air for trans-Atlantic tests.

Above: Front view of the completed short wave adapter. The numbers refer to the following parts: 1, tuning condenser; 2, oscillator condenser; 4, switch; and 5, variable grid leak.

Right: Circuit diagram showing connections of the short wave adapter. The Tropadyne principle is used for heterodyning the incoming signals.

Below: The method of coupling the short wave adapter to a standard broadcasting receiver. The illustration shows the adapter coupled to the Neutrodyne, which combination works very well. Note that this arrangement forms a Super-Heterodyne circuit.

List of Required Parts for the Construction of the Short Wave Adapter

2—Low loss straight line wave-length low minimum capacity condensers with frame insulated from plates.
1—Pound No. 18 D.C.C. magnet wire.
1—.00025 low loss fixed condenser.
1—One-half to 10-megohm variable resistance of the compression pile type.
1—UV-199 vacuum tube with "A" and "B" batteries.
1—Vacuum socket, panel mounting, with shock absorbing base.
1—Two-foot length of telephone receiver cord.
1—Sixty turn spider-web coil.
Panel 7 by 12 inches, screws, nuts.

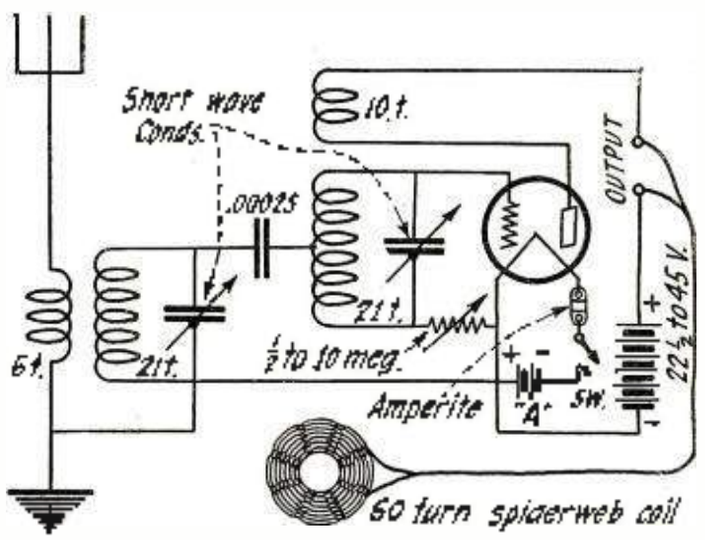


Fig. 3

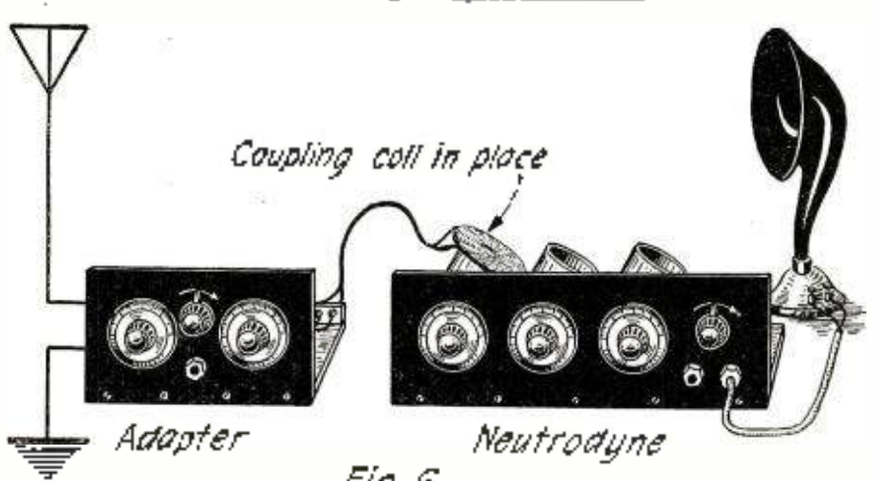


Fig. 6

Advantage is taken of the Super-Heterodyne principle. Essentially, the apparatus is a short wave tuner with an oscillator. The incoming signal, which for example may be of a 60-meter wave-length, is picked up by the tuner, passed on to the oscillator and heterodyned to a higher wave-length of about 350 meters which may be easily picked up by the ordinary tuner. Thus every set can be easily made into a Super-Heterodyne receiver.

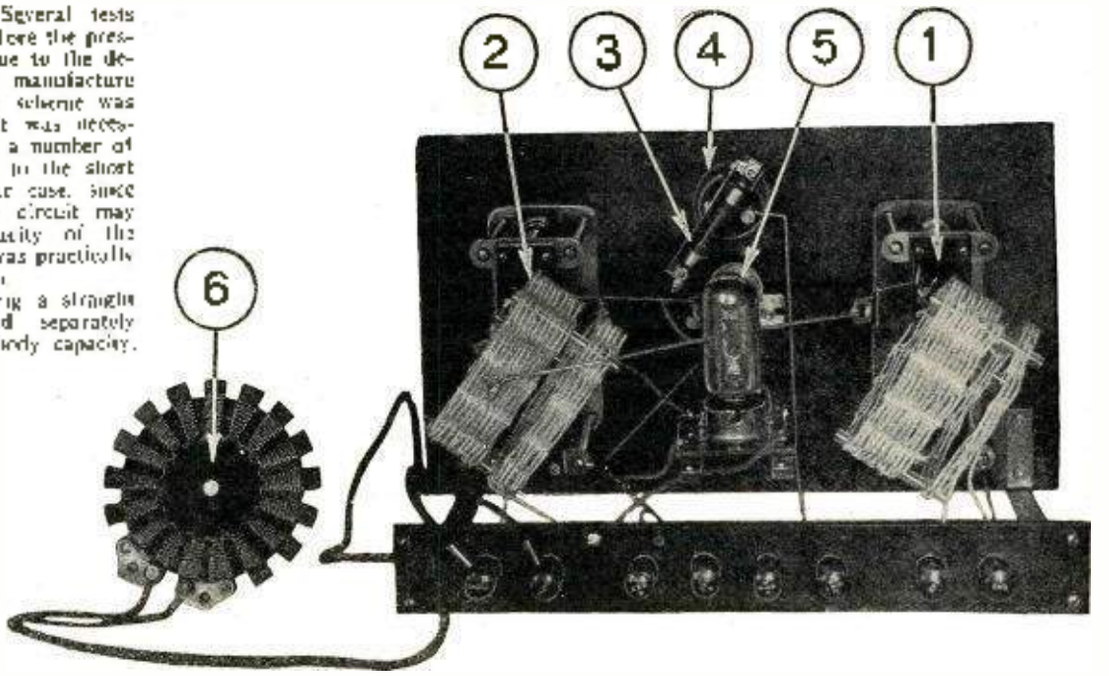
And the addition of the short wave oscillator tube increases the range of the set since it acts as an amplifier. Also, the receiving set proper may be worked at its most efficient point.

Still another betterment is gained through the adoption of the Tropadyne principle in the short wave tuning unit. By using the standard Super-Heteradyne circuit the short wave adapter would require two tubes. In this case only one tube is required.

The heart of the apparatus is embodied

in the variable condensers. Several tests were made with the adapter before the present design was evolved, but due to the design usually employed in the manufacture of commercial condensers the scheme was found to be impracticable. It was necessary with their use to cut out a number of plates in order to tune down to the short waves. And in this particular case, since neither side of the oscillator circuit may be grounded, the body capacity of the operator was so great that it was practically impossible to tune in a station.

A low loss condenser, having a straight line wave-length curve and separately grounded frame to eliminate body capacity,



Rear view of the short wave adapter. Note the spider-web coupling coil and the four row staggie wound tuner and oscillator coils.

was used. With this type of condenser, the adapter works admirably.

Of course, the ordinary type may be used for the tuner circuit if its capacity is reduced. Usually four plates have to be taken from the ordinary .00025 condenser, to make it serve for short wave work. The condenser selected must have low losses, or the efficiency of the adapter will be dropped to a low point.

Figs. 1 and 2 are photographs of the completed unit and Fig. 3 is the wiring diagram. In constructing the adapter, the first point is to wind the low loss coils. Fig. 4 is a template for the winding form and may be cut from the page and used as a marker for the base. A bit of one inch soft wood may be used for the form base. Over this the template is pasted and nails or pins driven in as indicated. If nails are used, the heads will have to be sawed off before being driven into the wood as the completed coil will slip off the form. The coils will have a mean diameter of three inches.

No. 18 D.C.C. wire is used throughout in making the coils. Four are necessary. The first consists of six turns. Begin at any pin on the form and wind the wire in front of one pin and behind the next. On account of the odd number of pins, each turn will be staggered over the next. Besides the six-turn coil, one of 10 turns and two of 21 turns will be necessary. In the center turn of one of the 21-turn coils at the opposite side from the beginning of the coil a tap is taken. This is exactly at 10½ turns. The windings are securely bound with twine before being taken from the form.

The six turn coil and the 21-turn coil are fastened together with three glass tubes two inches long, as shown in Fig. 3, and form the primary and secondary of the tuning circuit. Very little insulating substance should be used in supporting the coils as insulating substances increase losses. The primary and secondary are spaced one-quarter inch apart. The 21-turn coil, with the tap in the center, and the 10-turn coil are mounted together with three more bits of glass tubing and serve as the oscillator circuit.

The apparatus is mounted on a standard 7 by 12 inch panel. Instead of the usual sub-base, brass strips were used as seen in the photographs of the set. The extra bracing strips shown will be found necessary for the stability of the set, as the least vibration will distort it. An insulating strip of hard rubber 1½ by 11 inches to carry the eight binding posts is mounted at the back of the two bottom strips.

(Continued on page 1099)

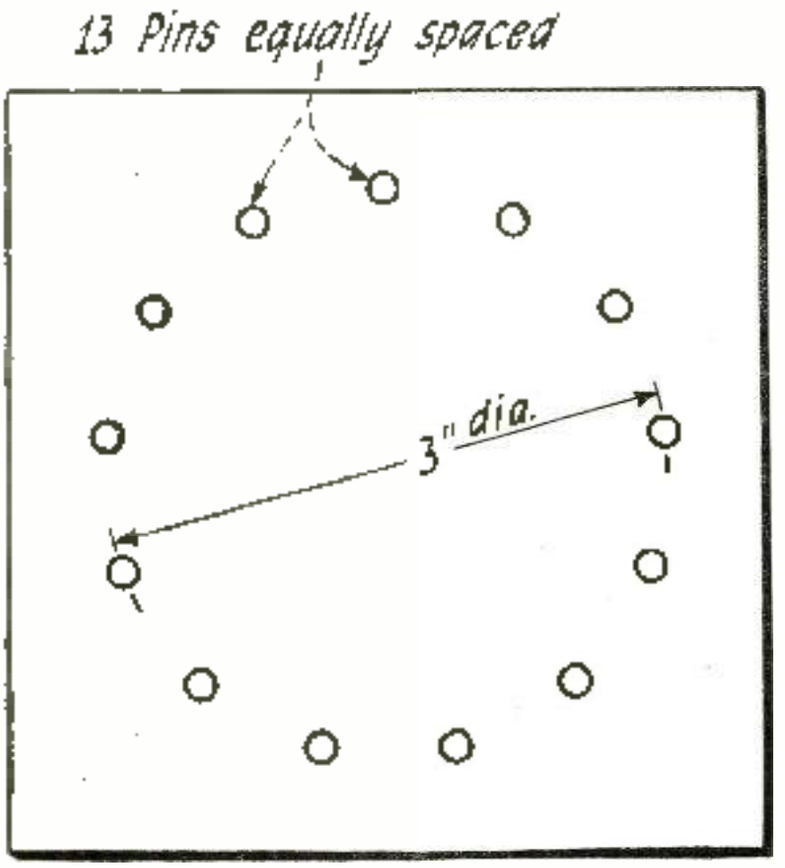
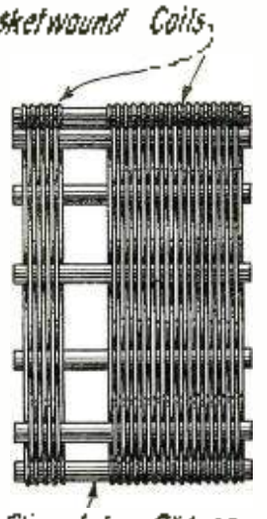


Fig. 4: Full size template for making a form for winding the low loss coils. This should be cut out pasted to a board and nails driven through the centers of the small circles. The heads of the nails must be removed in order to remove the coil.



Right: The finished stagger wound coil. Note that the wire passes under one glass rod and over the next.

Fig. 5

The Heterodyne Wavemeter

By JAMES WOOD, JR., 2ALG

Part 2

This article deals exclusively with condenser calibration and inductance measurement by use of the Heterodyne Wavemeter described by Mr. Wood in the November issue of Radio News.

THE wavemeter described in the first part of this article can be put to a great many uses. Some of these will be described below. The wave-length range of the wavemeter is from 60 to 235 meters, which is ample for ordinary requirements in the experimenter's laboratory.

In the formulae given below, capacity is expressed in microfarads, inductance in microhenries and wave-lengths in meters. The symbol C1 will be used to denote all the capacity in the circuit which is not due to

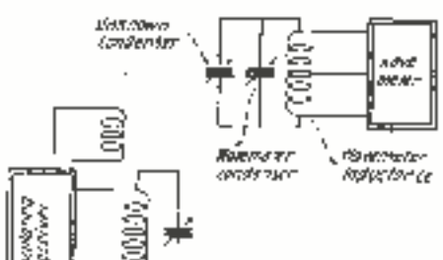


Fig. 4

Circuits and arrangement and method employed for the calibration of a condenser of unknown capacity; capacity curve of wavemeter condenser known.

the receiving condenser or to the condenser being calibrated. This will include stray capacity due to leads, the vacuum tube, and the distributed capacity of the inductances, except where otherwise noted.

CONDENSER CALIBRATION
WAVEMETER CONDENSER CAPACITY CURVE KNOWN

Set the wavemeter at any convenient value above 150 meters, and adjust the receiver to resonance (zero beat). Note the wavemeter condenser reading. Then shunt the wavemeter condenser with the unknown condenser (See Fig. 4) and re-tune the wavemeter to resonance with the receiver. The unknown capacity is then equal to the difference in the capacities of the wavemeter condenser in the two positions. This is of course relatively simple. As is often the case, however, the wavemeter condenser's capacity curve is unknown and it then becomes necessary to use a slightly different method.

WAVEMETER CONDENSER CAPACITY CURVE UNKNOWN

For this method we also require a standard capacity, but it need not be variable. It should be known accurately to three significant figures, for example .000357 mfd. The method is as follows:

(a) Allow the receiver to oscillate and connect the standard capacity, which we will call C, across the receiving inductance. Bring the wavemeter to resonance with the receiver. Note the wave-length and denote it by λ.

(b) Disconnect the standard capacity and connect in its place the unknown variable capacity. (See Fig. 5). Set the latter at any desired value. Now bring the wavemeter to resonance with the receiver. Call this wave-length λ_1.

(c) Now disconnect the unknown capacity and allow the receiver to oscillate without either condenser. Bring the wavemeter again to resonance with the receiver. Call this wave-length λ_2.

The capacity of the unknown condenser at the particular setting chosen, corrected for the capacity we denote by Cx (see above) is given by the expression:

$$Cx = \frac{C(\lambda_1^2 - \lambda_2^2)}{(\lambda^2 - \lambda_2^2)} \qquad \text{eq. (1)}$$

The value of C1 may be obtained from the expression:

$$C_1 = \frac{\lambda_2^2 C}{\lambda^2 - \lambda_2^2} \qquad \text{eq. (2)}$$

It becomes apparent that if it should so happen that the wave-length of the circuit, when both standard and unknown capacities have been disconnected, is lower than the minimum wave-length of the wavemeter, the method fails down. This can be easily remedied. Tune the wavemeter until its second harmonic is in resonance with the receiver. Note the wave-length, divide by two and call it λ_2. The above formula (1) then gives the capacity of the unknown condenser. Care should be taken to see that the adjustment of the receiver is not changed except as directed.

The above method is very satisfactory for all ordinary capacities used by the radio experimenter (.00001-.0005 mfd.). For example, assuming the accuracy of the wavemeter calibration to be .1 of 1 per cent., which is the value given for WWV's standard signals, the wavemeter when calibrated

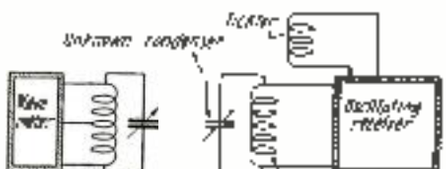


Fig. 5

Method utilized for determining capacity of a condenser when the wavemeter condenser capacity curve is unknown.

from this source would very likely read anywhere from 1994 to 2006 when actually the wave was 200 meters. Working it out mathematically shows that this inaccuracy in the wave-length will cause the condenser, which was just calibrated by the above method, to vary from 1 per cent. below to 1 per cent. above its actual value. In other words, the capacity of the unknown condenser might come out anywhere from say .000311 to .000316, when the actual capacity is .000313. Toward the upper end of the wavemeter scale we may expect an accuracy of 1 per cent. provided the measurements are carefully made. This is about the greatest accuracy possible with the type of wavemeter described. It is, however, quite sufficient for most purposes. This degree of accuracy will not be obtained on small capacities. It is not very satisfactory, for example, to measure capacities of less than .00001 mfd., since even on this capacity the value obtained may vary 10 per cent. either way. On this account it is often useless to correct for distributed capacity and other capacity which is not due to the tuning condenser. Most of the formulae given are corrected for these capacities, not because it is necessary but to show how it can be done.

For capacities larger than .0005 mfd. the method is very much the same. Perform parts (a) and (c) as above. In place of part (b) proceed as follows:

Connect the known and unknown capacities in series. Bring the wavemeter to resonance with the receiver. Call the wave-length λ_3. The capacity of the unknown condenser at the particular setting chosen is then given by:

$$Cx = \frac{C(\lambda_2^2 - \lambda_3^2)}{(\lambda^2 - \lambda_3^2)} \qquad \text{eq. (3)}$$

The above methods of capacity measurement are accurate and in addition allow the use of the capacity standard for other purposes. The writer wishes to again emphasize the importance of careful adjustment and the necessity of leaving the receiving set in one adjustment whenever the directions call for this. The experimenter should make a practice, in all calibration work, of taking several readings for each particular point. Individual readings are bound to vary somewhat and it is only by taking several readings and averaging them that the most accurate results are realized.

Once we have a calibrated variable condenser, the problem of other types of measurement is greatly simplified.

INDUCTANCE MEASUREMENT
CAPACITY CURVE OF WAVEMETER CONDENSER KNOWN

Bring the receiver and wavemeter to resonance. Use a known wave-length (λ) of at least 150 meters, since the accuracy of the final result will be greater and the adjustments will be more easily made. Call the wavemeter condenser reading C. Shunt the unknown inductance across the wavemeter condenser (See Fig. 6) and re-adjust the latter to bring the wavemeter again to resonance with the receiver. The capacity of the condenser will always have to be increased in this case, because when two inductances are connected in parallel, the effective inductance of the whole system is reduced. The receiver should not be touched throughout the experiment. Call the second capacity of the wavemeter condenser C1. The unknown inductance uncorrected for distributed capacity is then given by:

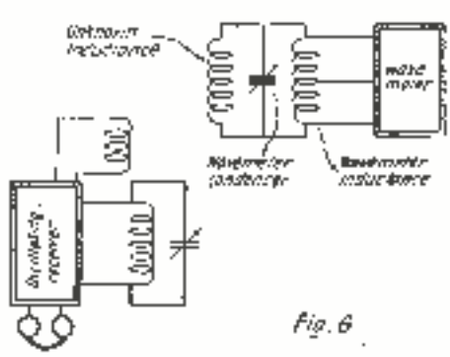


Fig. 6

Circuits and arrangement used in determining the inductance of a coil; capacity curve of wavemeter condenser known.

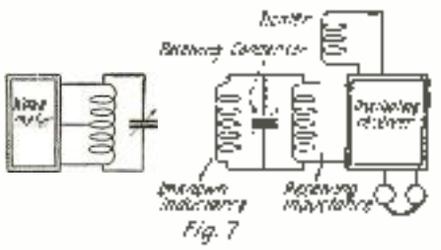


Fig. 7

Circuit and arrangement used in determining the inductance of a coil: capacity curve of wavemeter condenser unknown.

$$Lx = \frac{\lambda^2}{(1885)^2\,(C_1 - C)} \quad \text{eq. (4)}$$

To correct for the distributed capacity of the inductance proceed as follows:

Adjust the receiver and wavemeter to resonance and read the wavemeter condenser. Call it C. Call the wave-length λ. Shunt the wavemeter condenser with the unknown inductance and again bring the wavemeter to resonance with the receiver, leaving the latter in its original adjustment. Denote this second reading of the condenser by C_1. Now reduce the wavemeter condenser capacity until the wavemeter is in resonance with the second harmonic of the receiver. Read the condenser again and this time call it C_2. The inductance of the coil corrected for distributed capacity is:

$$Lx = \frac{3\lambda^2}{(1885)^2\,(4C_1 - 3C - 4C_2)} \quad \text{eq. (5)}$$

The distributed capacity may be found from the expression:

$$Cd = \frac{C_1 - 4C_2}{3} \quad \text{eq. (6)}$$

CAPACITY CURVE OF WAVEMETER CONDENSER UNKNOWN

When the capacity of the wavemeter condenser is unknown we proceed in much the same manner as in the corresponding case for capacity. Here, however, we must use a calibrated variable condenser to tune the receiving set.

Bring the receiver and wavemeter to resonance. Denote the receiving condenser capacity by C and the wave-length used by λ. Now shunt the unknown inductance across the receiving condenser (See Fig. 7) and readjust the latter until the receiver is again in resonance with the wavemeter. The wavemeter is of course left as it was first adjusted. Call the second reading of the condenser C_1. The inductance of the coil will then be given by equation (4) above. The value obtained is not corrected for the C1 capacity nor the distributed capacity of the unknown inductance itself. To get the once inductance requires more measurements. Get the following as described above: C, C_1, C_2 (eq. 2) and λ. We also must take one more reading with the wavemeter. After C and C_1 have been determined as above, leave the unknown inductance connected to the receiver, but reduce the capacity of the condenser until the receiver is in resonance with the second harmonic of the wavemeter. Call the capacity of the receiving condenser in this adjustment C_2. The pure inductance of the coil is then given by:

$$Lx = \frac{3\lambda^2}{(1885)^2\,(4C_1 - 4C_2 - 3C + 3C)} \quad \text{eq. (7)}$$

The distributed capacity of the coil can be found by substituting the value obtained for Lx in equation (7), in the following expression:

$$Cd = \frac{\lambda^2 - Lx\,(1885)^2\,(C_1 - C)}{Lx\,(1885)^2} \quad \text{eq. (8)}$$

This completes the measurement of capacity and inductance.

WAVE-LENGTH OF TRANSMITTERS

The wave-length of a transmitting station is found by the same method that was used for calibrating the wavemeter from the standard signals of WWV.

MUTUAL INDUCTANCE

When two coils are connected in series and electromagnetically coupled, the mutual inductance is given by:

$$M = \frac{L_a - L_s}{4} \quad \text{eq. (9)}$$

In the above L_a is the effective inductance when the fields of the two coils assist each other, and L_s is the effective inductance when the fields oppose each other. The degree of coupling must remain the same when the fields are changed from assisting to opposing. (See Fig. 8.) To measure M by means of the wavemeter, all that is necessary is to measure L_a and L_s by one of the means already suggested, and substitute the values in the above equation.

Sometimes we also wish to determine the degree of coupling between the two coils. This is also easily done.

COEFFICIENT OF COUPLING

The coefficient of coupling tells us how closely two circuits are coupled. For the two coils considered above, the coefficient of coupling is given by:

$$K = \sqrt{\frac{M}{L_1\,L_2}} \quad \text{eq. (10)}$$

To find K it is simply necessary to measure individually the inductance of each coil and substitute the two values, together with the value of the mutual inductance found above, in the formula

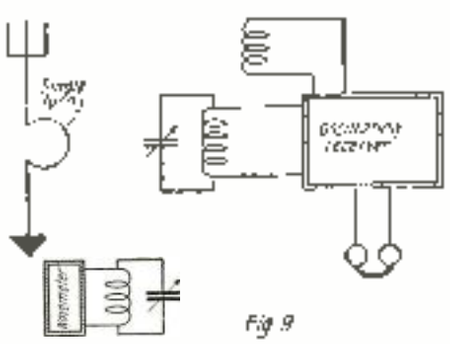


Fig. 9

Arrangement for measuring the fundamental wave-length of an antenna system.

ANTENNA MEASUREMENTS

With the aid the Heterodyne wavemeter we may measure the fundamental, the capacity and the inductance of the antenna system. We cannot, however, measure the resistance of the antenna. This is due to the fact that the energy delivered by such a low powered oscillator as the one described, would not be sufficient to actuate any but a very sensitive meter, which few experimenters possess.

FUNDAMENTAL WAVE-LENGTH

Connect the antenna directly to the ground, make a single turn loop of the lead and couple this closely to the receiver. (See Fig.). Allow the latter to oscillate and gradually adjust the receiving condenser. A point will be reached where the oscillations will cease and the familiar click will be heard in the phones. If the condenser is turned further, the circuit will again oscillate and the click will again be heard. It will usually be found that these two points are quite a few degrees apart on the condenser scale. Reduce the coupling between the single turn loop and the receiver until only one click is heard when the resonance point is passed. Now reduce the coupling a little more until the receiver just oscillates at the resonance point. Tune the wavemeter to resonance with the receiver. Read the wave-length. This is the antenna fundamental.

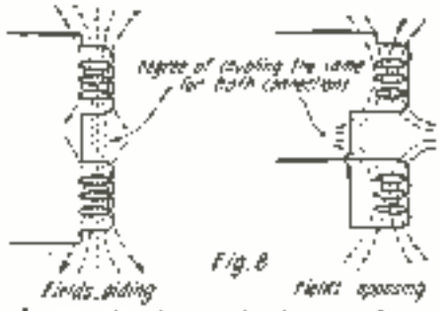


Fig. 8

In measuring the mutual inductance of two coils, the coupling between them must remain the same for both aiding and opposing fields.

ANTENNA CAPACITY

The capacity of the antenna system can be measured quite accurately in spite of the fact that as yet we do not know its inductance. By taking three separate measurements we can get an expression for the capacity of the antenna system that does not involve its inductance.

First find the antenna fundamental by the method already described. Call it λ. Now connect an inductance, which has been calibrated by one of the methods already described, in series with the antenna. (See Fig. 10). Call the inductance L_1. Find the wave-length of the antenna system with this coil in series. Denote it by λ_1. Now disconnect L_1 and connect in its place another standard inductance which will denote by L_2. Again measure the wave-length of the antenna system. Call it λ_2. The capacity of the antenna is given by:

$$Ca = \frac{\lambda^2\,(\lambda_2^2 - \lambda_1^2)}{(1885)^2\,(\lambda_2^2 L_1 - \lambda_1^2 L_2)} \quad \text{eq. (11)}$$

The above formula may look a bit formidable to those unaccustomed to algebra, but it is only necessary to substitute the numerical values for the symbols and then do a little simple arithmetic. The formula given does not take into account the distributed capacity of the inductances used, but on well-made inductances of the size used in the average experimenter's laboratory, the distributed capacity is so small that it can be disregarded. It is a wise plan, when inductances are made up for use as standards, to keep the distributed capacity as low as possible. This can be done by using spaced windings and as little insulating material as is consistent with rigidity.

ANTENNA INDUCTANCE

Once the fundamental and the capacity of the antenna have been measured, it is a simple matter to determine the inductance by means of the formula:

$$La = \frac{\lambda^2}{Ca\,(1885)^2} \quad \text{eq. (12)}$$

(Continued on page 1038)

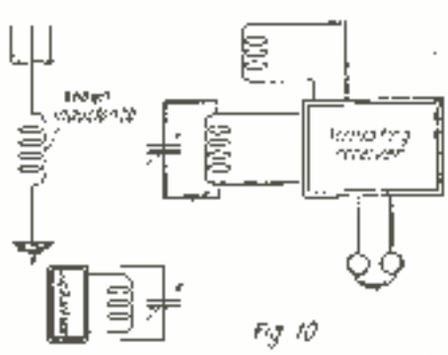


Fig. 10

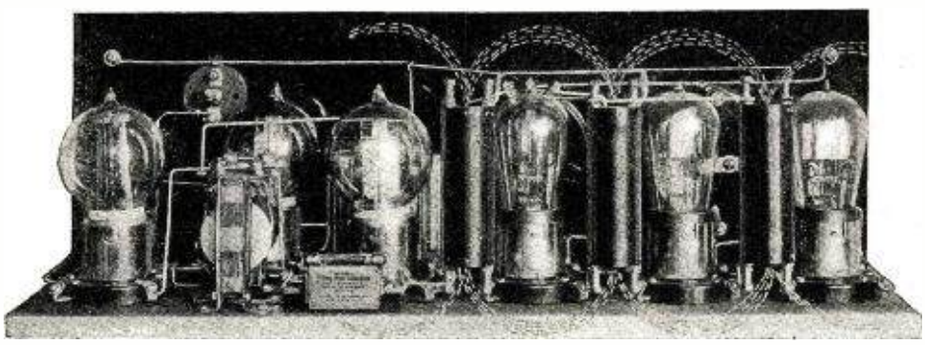
Arrangement for measuring the capacity of an antenna system.

Multi-Stage Radio Frequency Amplification

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

Part II

This, the second article of a series, deals principally with the stabilization of multi-stage radio frequency amplifiers and is probably the most important consideration relative to circuits of this nature.



The dotted lines representing the magnetic fields of the radio frequency transformers show how one transformer is coupled to another. This is one of the most common troubles in radio frequency amplifiers.

A VERY common and successful method of reducing the tendency of oscillation in a tube is to place a resistance in the grid circuit. Sometimes it consists of an actual resistance of the ordinary kind, and in other cases the grid to filament path itself is used as the resistance.

In the latter case what we do is to take advantage of the fact that when the grid becomes positive with respect to the negative end of the filament, electrons are attracted to the grid from the filament; these electrons are attracted to the grid from the filament; these electrons travel around the grid circuit, through the grid inductance, back to the filament. This setting up of a grid current introduces damping into the grid circuit. In other words, some of the energy in the grid circuit is consumed and losses are incurred by making the oscillations in the grid circuit produce a grid current. this loss may be made sufficiently great to stabilize the circuit in which it is used and prevent the tube from oscillating. To set up a steady grid current is a simple matter, and the usual method is that illustrated in Fig. 15, where the slider S moves along a potentiometer of about 400 ohms resistance connected across the filament battery B_2. A fixed condenser C_3 of .002 mfd. may be connected in the position shown to avoid making the radio frequency currents travel through the potentiometer resistance itself. This condenser C_3 may frequently be omitted. When the slider S is at the extreme left position, the grid is at zero volts; as the slider is moved further to the right the grid will be given an increasing potential, which will become 6 volts positive if the slider S is moved to the right side of R_2, assuming the battery B_1 gives 6 volts. Any degree of damping, within limits, may therefore be introduced into the grid circuit, and the slider S will usually be adjusted to such a point that the tube is just off the oscillation point.

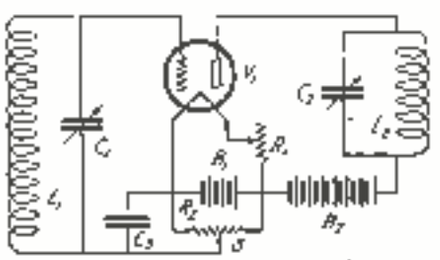


Fig. 15. The usual method of setting up a steady grid current: the employment of a potentiometer connected across the "A" battery.

It is rather important to note in this method that the position of the rheostat R_1 is of importance. If it is connected in the negative lead it will not be possible to give the grid the full 6 volts because when F is at the left side of R_1 the grid will be at a negative potential depending upon the drop in potential across the rheostat. As F is moved to the right a point will be reached where the grid has a potential of zero volts and a further movement of F to the right will begin to give the grid a positive potential. If the drop in potential across the rheostat is normally two volts, it will only be possible to give the grid a maximum potential of four volts positive which, however, in most cases, would be all that is necessary. Where it is desired to be able to give the grid any positive voltage from zero to positive 6, it is desirable to connect the rheostat in the positive lead.

Fig. 16 shows the connection of an actual resistance element R_3 in the grid oscillatory circuit. This resistance may have a value between 20 and 50 ohms, according to various factors, such as the amplification factor of the tube and the constants of the oscillating circuits and the natural coupling between grid and plate circuits. Its correct value is best found by experiment. If it is variable, so much the better.

Fig. 17 shows the resistance R_1 included in the plate oscillatory circuits. This is an alternative arrangement and self-oscillation may be prevented, either by introducing damping into the grid or the plate oscillatory circuits. In some cases the damping is introduced into both circuits by any of the methods specified.

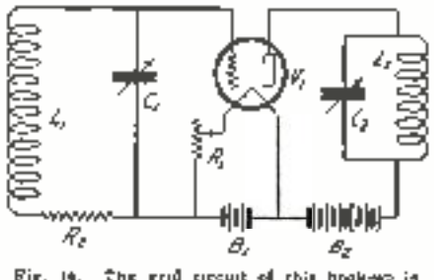


Fig. 16. The grid circuit of this hook-up is dampened by the insertion of a resistance directly in the grid circuit.

Fig. 18 shows the use of a resistance R_1 in parallel with the oscillatory circuit L_1 C_1. This method has been advocated by the author on several occasions, because it does not involve the production of direct currents in the grid circuit which are liable to cause distortion. The resistance R_1 now has a value of the order of 100,000 ohms, and a variable resistance having this maximum value will be found very convenient.

Fig. 19 is the same arrangement as Fig. 18, except that the resistance R_1 has been connected across the plate oscillatory circuit.

Fig. 20 shows the use of a resistance R_2 in the grid circuit of the tube, but in rather a different position to that shown in Fig. 16. The effect, however, is very similar, and the value of R_2 is usually of the same order as the resistance R_2 described in connection with Fig. 16.

It is desirable to make all the resistances used in these various cases devoid of capacity.

OBTAINING STABILITY BY REDUCING AMPLIFICATION

A rather obvious method of increasing the stability of a radio frequency amplifying circuit is to reduce the amount of amplification given by the tube. We can do this, either by a tube having a poorer amplification factor or by reducing the amplification given by the tube in use. This may be done by reducing the filament current, a very common expedient, and by reducing the "B" battery voltage. Dulling the filaments is usually a very effective method of stabilizing a radio frequency amplifier, but at the same time, any beginner will appreciate that reducing the efficiency of the apparatus in this way is wrong, and that the necessity for doing this is merely due to lack of proper design elsewhere.

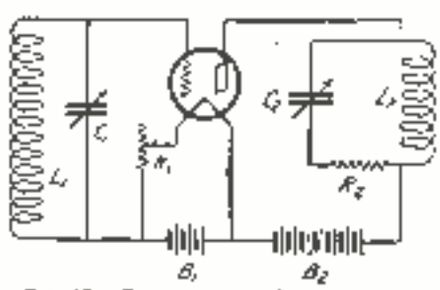


Fig. 17. The utilization of a resistance in series with the plate oscillatory circuit is another effective method of preventing self-oscillation.

PLATE IMPEDANCE METHOD

An interesting and useful method of stabilizing a radio frequency amplifier is that illustrated in Fig. 21. We have an impedance Z shunted by a variable condenser C. The impedance Z, which may be a choke coil with or without an iron-core inductance, has in parallel with it the small variable condenser C_2 and the choking effect on the radio frequency oscillations in the

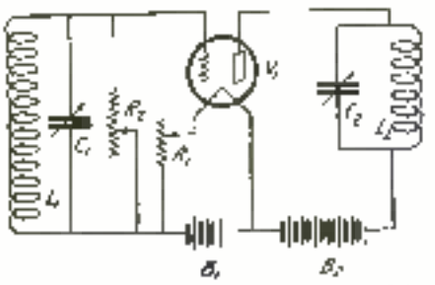


Fig. 18. A variable resistance connected in parallel with the grid oscillatory circuit provides a means for controlling self-oscillation.

plate circuit may be controlled by means of a condenser C_p. The smaller the value of C_p the less tendency will the tube have to generate oscillations and vice versa.

USE OF REVERSED FEED-BACK

Reversed feed-back, which consists in feeding back energy into the grid circuit in a direction opposite to that which produces the signal effect, may be employed for stabilizing a radio frequency amplifier.

Fig. 22 shows how the inductance L_2 is connected in a reverse direction to produce an inverted feed-back effect which will tend to oppose the natural reception effect due to capacity coupling, etc.

In the Fig. 22 arrangement the reverse feed-back effect may be obtained when the coils L_1 and L_2 are fairly loosely coupled in a reverse direction. If L_2 is brought too close up to L_1, the reverse inductive effect is swamped by the increased capacity coupling between L_2 and L_1, and this produces a greater tendency to self-oscillation. A coupling of two tuned circuits to feed-back effect is, therefore, not a very practicable arrangement, although when the plate circuit is not tuned, reversed feed-back may be quite useful in stabilizing a receiver.

Fig. 23 shows a modified arrangement in which the feed-back coil L is not a part of the main tuned plate circuit but is connected in series with it. This circuit will, in general, be found better than Fig. 22, although the coil L should be kept small.

ELIMINATING THE CAUSES OF OSCILLATION

The method we have described above may be regarded as general means of counteracting the ill-effects of faulty design. The design of the receiving apparatus should be such that palliatives should not be necessary, but while it is a simple matter to make theoretical comments on the problem of radio frequency amplification, the fact remains that there is today no really satisfactory method of radio frequency amplification. If all experimenters who at present are working in directions where great success has already been achieved were to turn their attention to the problem of long distance reception and multi-stage amplification, probably some solution could be found.

It is the purpose of this article to explain the difficulties and to indicate what has already been done to overcome the troubles experienced in multi-stage radio frequency amplification. A method of the author's own is also given.

The elimination of the causes of oscillation is a practical impossibility, but much can be done to balance them out with a minimum of energy loss.

In the first place, since the grid-to-plate capacity of the tube is one of the chief troubles, an improvement is made by decreasing it. Sometimes the capacity is between the electrodes themselves, but more often in the leads to the electrodes. The B_1 tube, for example, which is an audio frequency amplifier of great utility, has the advantage that the grid-to-plate capacity is large. The Myers tube and the V_p are, however, admirable for radio frequency work, because the capacities between the electrodes, and the leads going to the electrodes, is small.

Much can be done, however, with the ordinary type of tube, provided a suitable

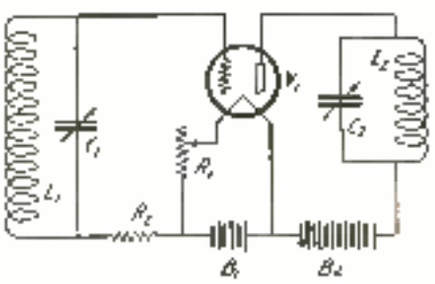


Fig. 20. An arrangement similar to Fig. 19, but with the resistance in a slightly different position.

tube holder is used. Quite apart from the other merits the widely-spaced contacts on certain types of special tube holders are particularly suitable for radio frequency work. The ordinary arrangement where the socket pins are very close together, the nuts and washers being frequently only a matter of 1/16th inch apart, are entirely unsuitable

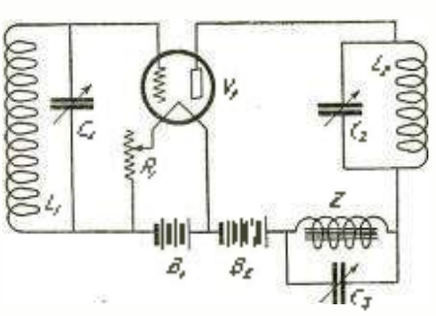


Fig. 21. A circuit employing a variable impedance in the plate circuit as a means for stabilizing the radio frequency amplifier.

for radio frequency, or, in fact, for any other work.

All leads, of course, should be kept as short as possible, and as far apart as can be arranged. Bell's bus bar wire connections are probably the best for wiring a set with several stages of radio frequency amplification.

OVERCOMING INDUCTIVE COUPLING

The overcoming of inductive coupling has received very little attention, probably because capacity coupling is much more insidious and dangerous.

Inductive coupling may be made very small by arranging that the fields of coils in the grid and plate circuits do not interact. The coils should be kept well apart, so as not to influence each other, and they may conveniently be arranged at right angles. To keep the inductive fields as small as possible the coils may be wound on small diameter tubes with fine wire, but this may lead to a certain amount of inefficiency. It is, however, a direction in which experiments may

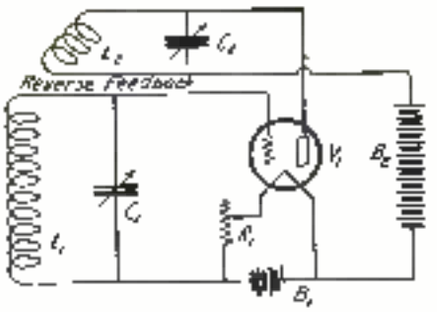


Fig. 22. A circuit employing reverse feed-back for preventing self-oscillation. This is similar to the system employed in the Superdyne.

be made. The smaller the coil the less will be the inductive effect of it on another coil.

A method of reducing the magnetic effect of one coil on another is illustrated in Fig. 24, which shows both coils L_1 and L_2 enclosed in metal boxes, having only small openings to allow the connecting wires to pass through. The metal casings E_1 and E_2 should be of fairly substantial size, and the coils arranged clear of the sides. Sometimes it may be desirable to earth the fields.

Fig. 25 shows the inductances L_1 and L_2 wound on tubes which are staggered in relation to each other. This arrangement has been used by Prof. Hazeltine in his Neutrodyne receiver, which involves the use of radio frequency transformers. The same arrangement, however, could be used for tuned plate circuits. The fields of the two coils are shown in dotted lines, and it will be seen that by arranging the coils in a suitable manner it is possible to avoid any appreciable inductive coupling between the inductances.

An interesting arrangement which has been tried by Mr. G. P. Kendal and the author is that illustrated in Fig. 26. Here the inductance coils L_1 and L_2 are in the form of toroids. The inductances are shaped like a certain ring. If we obtained a wooden certain ring and completely wound it with insulated wire, the ends, however, being separated by a fraction of an inch and leads taken from the ends, we would have a toroidal coil. The same effect would be obtained by taking a long cylindrical coil and bending it round so that the ends met. In the case of such a coil the magnetic field is entirely enclosed, and while the coil possesses all the properties of an inductance, there is no external field which could influence another coil. In Fig. 26 both grid and plate coils are shown of toroidal shape. A practical coil may be made by taking, say, a 3-inch length of insulating tubing 3 or 4 inches in diameter and cutting a slit in the tube. A toroidal coil can then be wound on the tube.

Fig. 27 shows a circuit using two tuned plate circuits employing toroidal coils. In this arrangement there will be no inductive effect between the coils, but this does not mean that there will be no capacity coupling which is the most trouble in multi-stage radio frequency amplifiers. The fact that

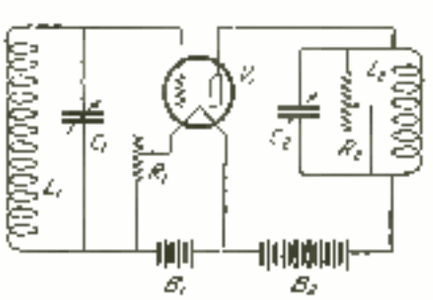


Fig. 19. Practically the same arrangement as that of Fig. 18, except the resistance is in parallel with the plate oscillatory circuit.

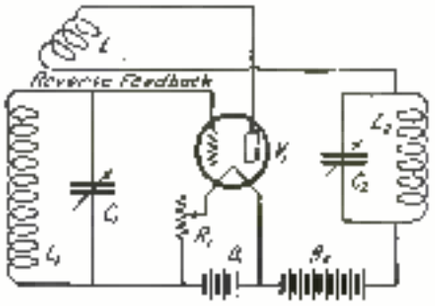


Fig. 23. Another reverse feed-back system wherein the tickler coil L is a part of the tuned plate circuit.

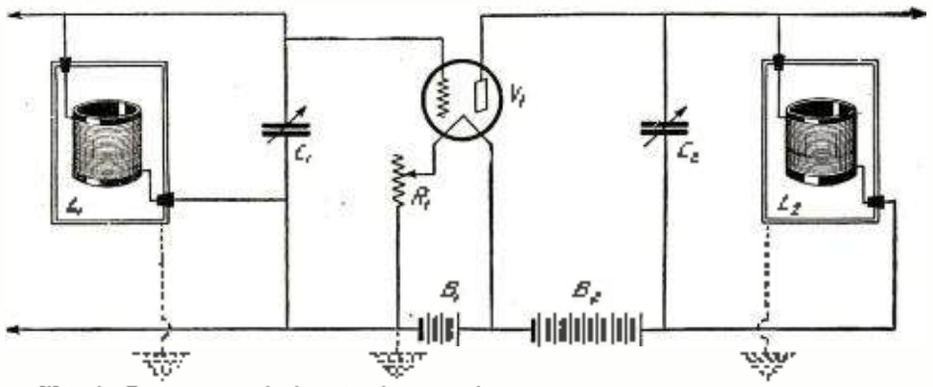


Fig. 24. Enclosing coils having extensive magnetic fields, in metal boxes, reduces or eliminates magnetic interaction between one and another.

toroidal coils are used does not mean that the coils can be put close together because we then get a substantial capacity coupling between the coils, even though there is no inductive coupling, and the capacity coupling is generally the most troublesome. The Fig. 27 arrangement must therefore not be taken as a solution of the problem of multi-

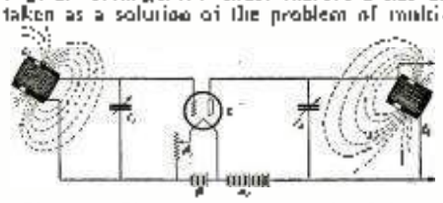


Fig. 25. The usual system employed in a Neutrodyne. The coils are placed at conventional angles so that the magnetic field of one cannot enter the magnetic field of another.

stage radio frequency amplification; it is, however, a very interesting suggestion for overcoming one of the coupling effects likely to cause instability.

THE "ASTATIC" PLATE COIL

An interesting suggestion for the plate circuit of a tube to the grid circuit is that illustrated in Fig. 28. We here have two plate coils L_2 and L_3 wound in opposite directions. The idea is that the inductive effect of L_1 on L_3 would be neutralized by the opposite inductive effect of the coil L_2 on L_3. The coupling between L_2 and L_3 should not be sufficiently great as to add materially to reduce the total inductance of

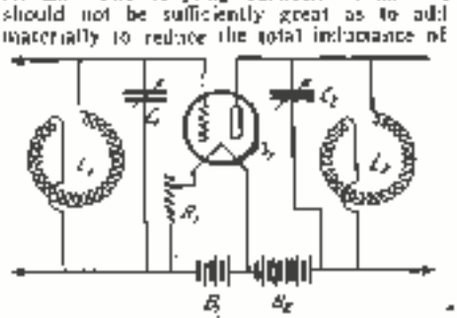


Fig. 27. A circuit employing toroidal coils. In these coils the magnetic fields are enclosed by the coils, that is, the fields are confined to the center.

the two coils in series. It would seem that the positioning of the combined coil L_2 L_3 should be symmetrical with respect to the coil L_1 in any set built using such a coil.

BALANCING OUT THE CAPACITY EFFECT IN A TUBE

Since the coupling inside the tube is effected by means of a capacity, it is only natural that we should turn to a capacity for the purpose of neutralizing this coupling. The effect of the coupling inside the tube is for potentials to be communicated from the plate circuit to the grid circuit in such a direction as to increase the tendency to oscillate. To counteract this capacity effect, we therefore require to introduce to the grid potentials of opposite, but similar magnitude. If the capacity of the tube is more than balanced, a reverse feed-back effect will be obtained which will weaken signals. It is therefore desirable, that the balance should be an exact one. It is, of course, no use connecting a condenser from the plate to the grid because this condenser would merely assist the existing capacity. What is necessary to obtain a reversal of phase and this reversal may be obtained by tapping either the grid or plate inductance or by the use of transformer coupling. These methods will now be described.

Fig. 29 shows a simple tube amplifier in which, however, the direct current plate circuit contains only a portion of the oscillatory circuit. In this figure it will be seen that a tapping S is taken away from about half-way along the inductance L_3 and, therefore, the direct plate current only flows

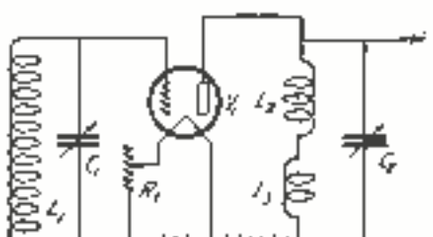


Fig. 28. Coils L2 and L3 are wound in opposite directions, consequently the inductive effect of L2 on L1 is neutralized by the opposite inductive effect of the coil L3 on L1.

from the top of the inductance L_3 to the middle tapping. It is, of course, sufficient to pass a varying plate current through a part of the oscillatory circuit to set up oscillations in that circuit, but it will be found in practice that usually the maximum amplification is obtained when the whole of the inductance in the plate circuit is included in the direct current plate circuit. In Fig. 29, when the end E_1 is negative the end E_2 will be positive with respect to the tapping S, and therefore with respect to the filament of the tube, the end E_1 being connected to the grid of the tube through the grid to plate capacity shown in dotted lines by the condenser C_p, and these potentials will be opposite at any given moment to those at the end E_1. We now connect the end E_1 through a very small condenser C, to the grid of the tube, and it will be seen that, whereas the capacity in the tube producing certain potentials on the grid, exactly opposite potentials are being communicated to the grid through the condenser C_1 from the end E_1 of the inductance L_3. By making C_1 of the correct size, the feed-back impulses communicated through C_p will be exactly neutralized by the reverse feed-back through C_1. The result is that the capacity of the tube has been neutralized, and the circuit will consequently not oscillate.

The condenser C_1 may also be used to balance out the capacity coupling between the coils L_1 and L_2. In order to enable a more correct balance to be obtained I have

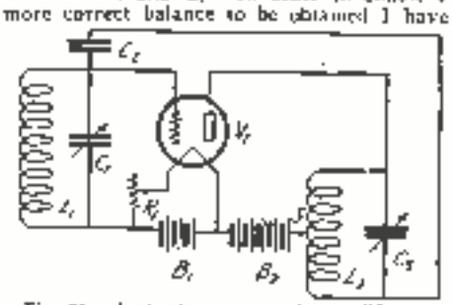


Fig. 26. A simple vacuum tube amplifier in which the direct current plate circuit contains only a portion of the oscillatory circuit and the direct plate current flows through only.

suggested connecting an actual condenser in the position shown in C_1 in Fig. 29. This condenser will actually increase the tendency to oscillate, but by making C_1 larger it is possible to balance C_p and C_1 accurately, whereas when we are relying upon capacity between grid and plate of the tube, we are dealing with a very small capacity and one which is liable to fluctuate; a change of tube might easily upset the balance.

Having got the amplified oscillations in the circuit L_2 C_2, we have to find some method of using them and we can couple an inductance to L_2, this inductance being connected in the grid circuit of another tube. Another arrangement would be to connect the point E_1 through a grid condenser to a second tube, but in this case we would only be obtaining about half the potentials developed across the inductance L_2. We can, however, overcome this difficulty by seeing that the tapping S is not in the middle but nearer to the end E_2. In order to obtain a balance we then have to make the condenser C_1 very much larger, and if the distance S and E_2 is, say, one-tenth of the distance between E_1 and E_2, then the capacity C_1 will have to be ten times the capacity between the grid and plate of the tube (and, of course, the other undesirable coupling capacities).

(Continued on page 1106)

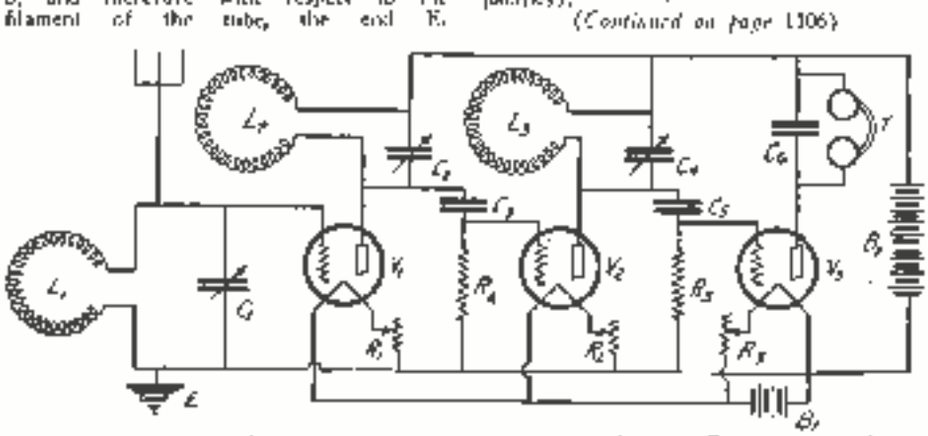
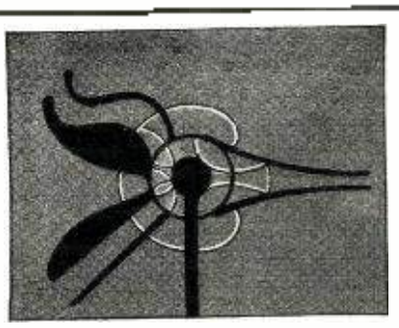
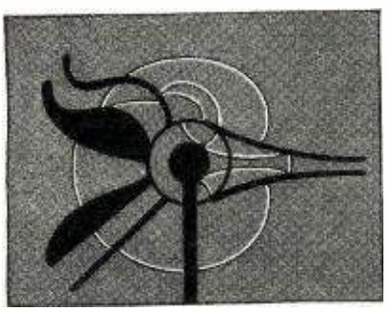
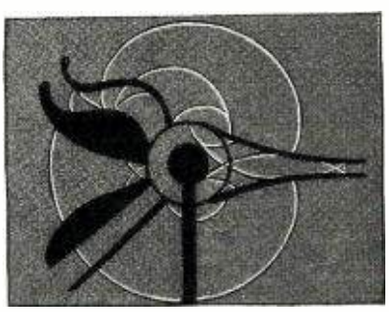
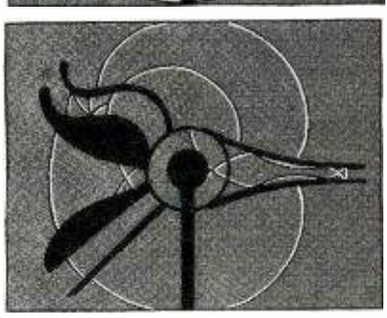
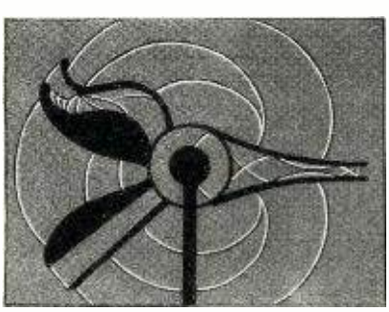
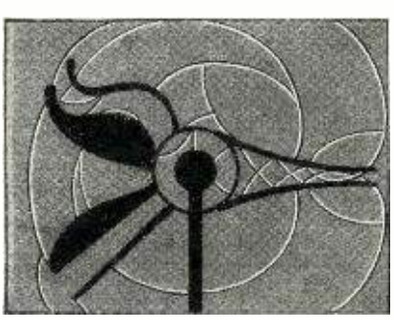


Fig. 27. A circuit employing two tuned plate circuits, with toroidal coils. There is no inductive effect between these coils.

These pictures show the propagation and reflection of sound waves through various shapes of horns.

What's What About Radio Horns

By CARTER FISKE

A description of some interesting tests made to determine the behavior of sound waves in loud speaker horns.

ALTHOUGH the radio horn is apparently one of the least technical things about a radio set, it is at the same time the least understood. The physical appearance of a thing is not always an indication of the way in which it functions. A piece of newspaper wound into a cone makes a horn, but the way the sound waves leaving the diaphragm of our loud speaker unit act when they burst forth from this horn is quite another matter. The most peculiar thing about the simple megaphone is that physicists themselves are not familiar with its operation and they are constantly contradicting each other. One says, "It is this way" and another says, "No, it is this way."

Now a radio horn is a mighty important part of a radio outfit—far more important than the average radio fan realizes. In this regard, it is interesting to know that the phonograph manufacturers had many worries over the horn for their reproducing unit. They spent barrels of money in experimentation and they found that the various horns they used made a world of difference in the quality of the music. Whether the horn was large or small, of tin or wood, long or short, round or square, made a great difference.

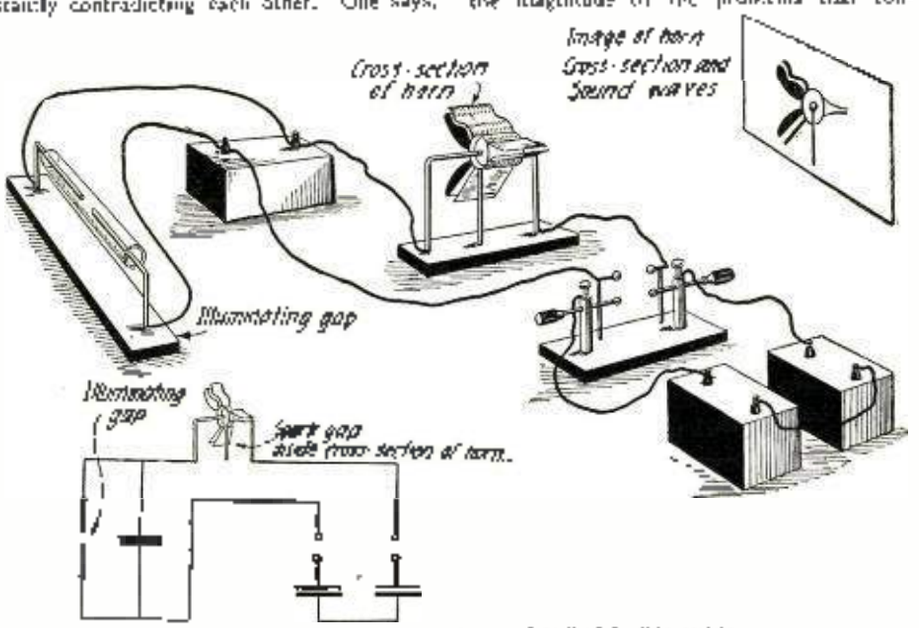
It is evident that a radio horn performs the same function as the phonograph's horn. We have the diaphragm of the reproducing element. At the small end of the radio horn we have exactly the same thing. The problem is the same, yet what manufacturer of radio horns has spent the money that the phonograph people spent on the same problem? Not one, indeed. The art is too young, and it goes without saying that 95 per cent. of our loud speaker manufacturers completely overlooked the technicalities of the problem and simply went out and bought a stock horn to fit their reproducing element. This procedure is fundamentally wrong to say nothing of being unscientific. Consequently we have numerous loud speakers on the market not worth the powder to blow them up with.

If there is anything that will chew up and destroy the symphony and harmony of a good reproducing element it is a poorly constructed horn. Since no two reproducing elements of different design have the same acoustic properties, it is evident that the horn which will serve one efficiently will not serve the other. All the logic of the physics of sound point to the necessity of designing a special horn to fit each reproducing unit.

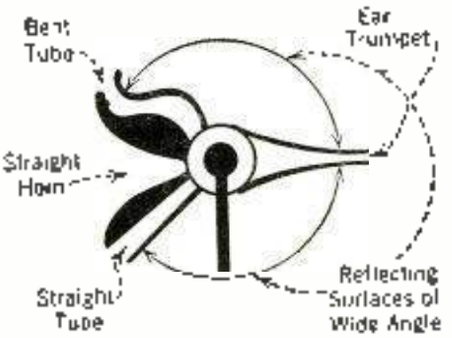
We have some especially good horns today, and in every case they are produced by manufacturers who thoroughly appreciate the magnitude of the problems that confront them. They have spent money experimenting, and as a result they put forth a product which was as well as could be expected considering the youth of the art. With due respect to the efforts of these conscientious manufacturers—God bless the few of them—the author still holds that there is a great deal of room for improvement. The market is still thirsty for a horn that will give absolutely faithful reproduction for all the varied frequencies that come forth from the loud speaker.

If the author were purchasing a radio

(Continued on page 972)



The apparatus used in the experiments described in this article.

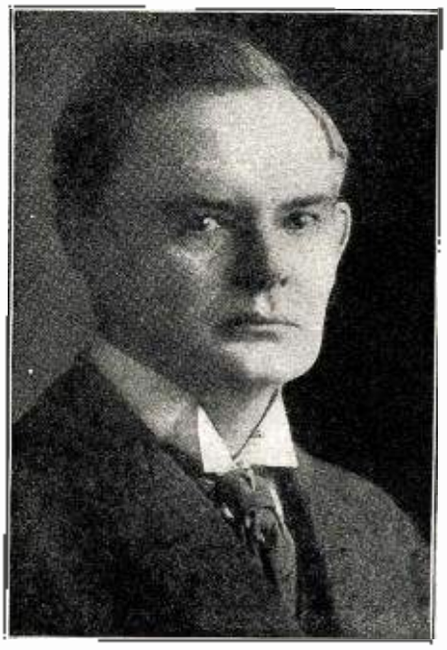


The sound produced in the center of this instrument is amplified through the various horns attached to it and photographs taken in rapid succession. These pictures are shown on the left.

The Significance of Rays In Physics

By Prof. BARON HEINRICH VON TRAUBENBERG

The first of a series of articles dealing with that part of Physics closely related to radio.



PROFESSOR BARON HEINRICH RAUSCH VON TRAUBENBERG

LIFE OF THE AUTHOR

The author of this article, Professor Dr. Baron Heinrich Rausch von Traubenberg, was born in Estland, which was then a part of Russia. He got his scientific training in Germany and after the completion of his physical studies in Wurzberg under Professor Wien in 1905, he took occasion to devote himself for several years to wireless telegraphy, taking part in its rapid development. Even today it is remembered with pleasure, how he, along with his friend, the then director of the Signal Company, B. Hahnemann, was in active touch with Duke Arco in the rational development of the spark machine of those days. The system of producing undamped waves of Waldemar Poulsen made such a sensation in its application that our author resolved to make a connection with the newly founded Amalgamated Radio Telegraph Company.

Interesting experiments with the new system in England, Russia and Germany, in which the author took an active part, led to great activity in this branch.

In the following years he devoted himself again to pure science; he worked first in the Interior Academy of Science in St. Petersburg with Prince B. Galitzin and then went to the University of Goettingen. At the end of the war he took up again the work of the wireless company to solve a technical problem, which was the determination of the absolute radiant energy of a modern great station. He succeeded in carrying out the incomplete work of the former superintendent, Professor F. Braun, of measuring accurately the radiations of far distant transmitters. Further experiments in which Professor Max Abraham, who died all too early, one of the most renowned students of the Maxwell theories, took active part by theoretical co-operation, touched upon the resistance of the surface of the earth and upon the grounding of antennas. Various publications of the author, in cooperation partly with Professors Abraham and Pusch embodied the results obtained.

After peace was declared the author returned again to Goettingen and was called therefrom to serve as Professor of Experimental Physics and Director of the Physical Institute of the German University in Prague, where for a while he busied himself with his second important range of studies, that of the atom.

RADIO NEWS is a distinctive paper. It will hardly be possible to find another in which the field of pure science, technics and practical application of science is so thoroughly covered and in which nor even humor is omitted. It is easily understandable then, that the circle of readers belonging to such a publication should be interested in a wide field and should have great interest in the constant advances of science.

The object of these articles is to show as clearly as possible how this constantly

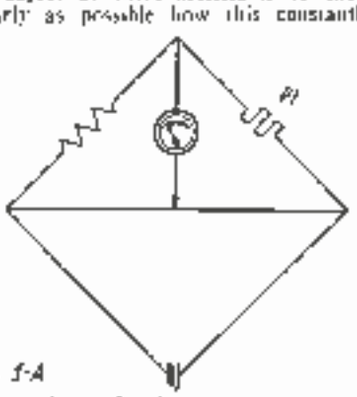


Fig. 1-A

Diagram of the Langley Bolometer. The radiator heats the platinum foil Pl, whose changes of resistance in a Wheatstone Bridge connection give the desired reading.

broadening range of science going hand in hand with a similar advance in technics, is enabling us to go deeper and deeper into the secrets of Nature. Most particularly we will deal with the adaptation and use of rays in physical investigation. As the name of the magazine indicates, its readers are not only interested in radio communication but also in new things or developments made in connection with rays.

While man is unacquainted completely with the laws of nature, he cannot of course appreciate entirely certain phenomena which seem apparently arbitrary. The development of more than a century was necessary before physicists investigating such phenomena were able to distinguish between accidental and subjective nature. By the discovery of objective power, however, we have been able to change ourselves from the slaves to the masters of Nature.

Since the greater part of nature's powers are electro-magnetic, I will not attempt to show without going into the intricacies of mathematical, physical and technical developments, the Gargantian scope of this subject. It is easy to imagine a wave receiving apparatus constantly being acted upon by molecules, receiving rays of all sorts. Suppose this receiving apparatus to be a dozen times more complicated or more sensitive than the most intricate radio receiver. Such an apparatus is the human mind. The reader need not be frightened because of the enlarging on the peculiarity and intricacies of our mental process, but I may at least say this much in outline:

The happenings of the outside world are conveyed to us through our senses and every improvement and refinement brought about in the method of physical observation is made solely to establish a greater range or give greater perfection to these senses of ours. Although the civilization man has brought about has actually diminished the sensitiveness of many of our senses—shown clearly by the supremacy of many beasts to man in this particular realm—modern physical methods and apparatus of such fineness and exactitude have been perfected to assist our regular senses that man is able to "hear and see" the most subtle sounds and moves in nature. Through the use of such apparatus our scope of reception is widened. Every day our world becomes richer and more beautiful. Today we know with equal

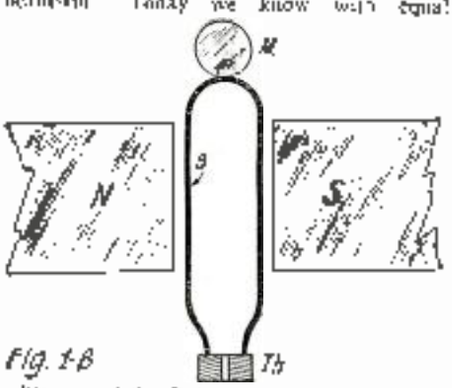


Fig. 1-B

Diagram of the Radio-micrometer; the radiations heat the thermo-element Th; the current thereby produced in the coil B, which lies in the electromagnetic field NS rotates the mirror M.

exactitude the chemical composition of a star 100,000 light years distant and the size and construction of a Hydrogen atom. We can give with absolute accuracy the law con-

(Continued on page 1084)

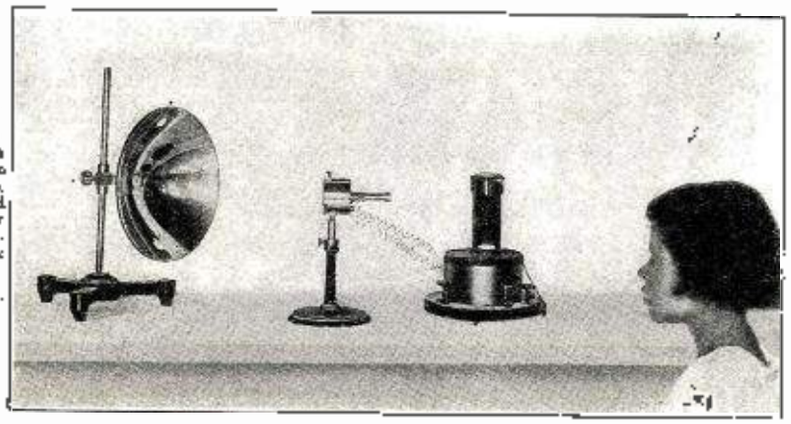


Fig. 2a. Photograph of a typical form of Photoelectric Cell employed principally for the measurement of weak light rays.

The Barometer and Radio Reception

M. J. CAVENEY, CAN. 3GG

An exceedingly interesting article dealing with the effects of the rise and decline of barometer readings on radio reception. Mr. Caveney's tests covered a period of two years, in which time he collected enough data to form definite and, let us say, authentic conclusions on the subject.

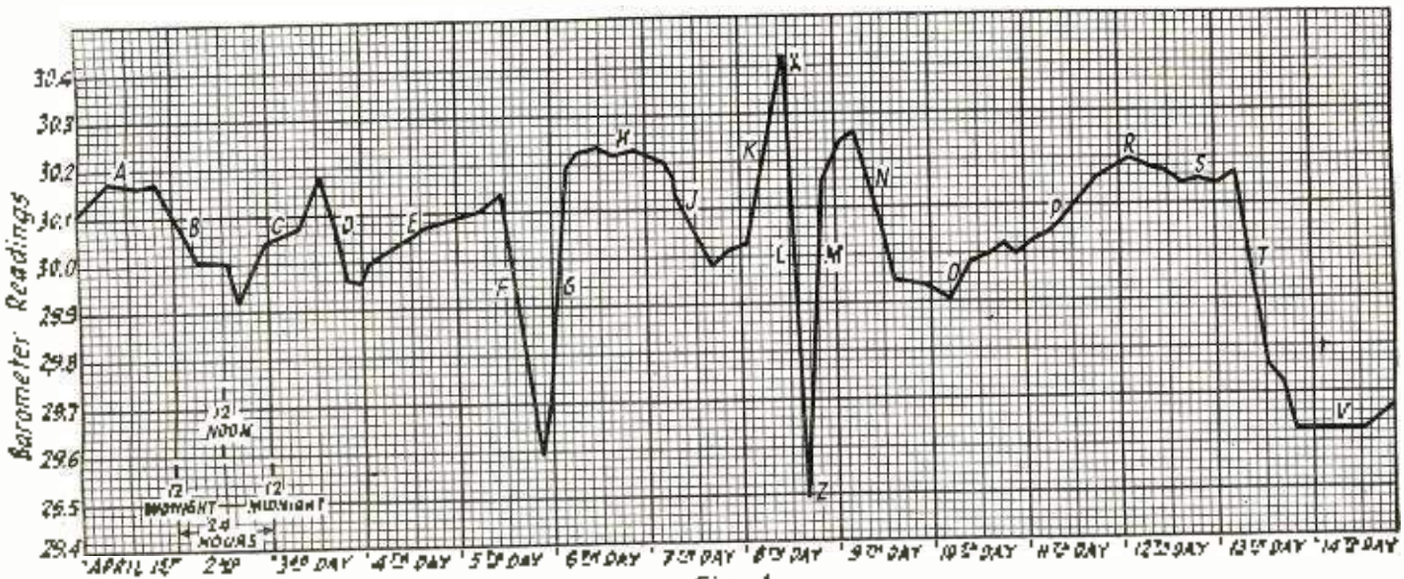


Fig. 1

Typical graph of barometer readings, these for the first 14 days of April, 1923. Note that a sudden decline of pressure is invariably followed by an immediate rise and that the average normal is usually reached again. As a rule radio reception is bettered by a rise of the barometer and hindered by a decline

DOES the weather affect radio reception? If so how?

Why do we get "good air" on one night and "poor air" the next night when both are clear, moon light nights?

If the weather *does* affect our indoor pastime, then what kind of weather will give us those nights when the air is like clear, sparkling wine—when the "lid" of receiver does her stuff. And you can roll the dials any place at all, and pull in DX stations from way over the other side of the radio map?

On the other hand, if the weather man is the real "nigger in the woodpile," then just what particular brand of weather does he use to spirit away those distant and unfrequent visitors to our dials and also seriously reduce the volume of those nearer stations which we always call upon for music when skeptical friends or boasting radio rivals call on us?

In an endeavor to answer some of these questions I began, two years ago, to keep a record of the weather in conjunction with daily curves of the atmospheric pressure as shown by the barometer.

The quality of the radio reception was also recorded each night on the barometer-chart, with special notes of any exceptionally good or poor reception.

To eliminate as much as possible the chances of error or variation here at the receiving station, the design of the receiver and antenna were left constant, not a wire or a vacuum tube being changed during the whole period of two years. The makers of the tubes may be pleased to know that they were Radiotrons 200 and 201. They have been burning over 4,000 hours now, and are still going strong.

Storage batteries were installed, for both the filament and plate supply, and kept fully charged each day. Meters were used in the filament and plate circuits and when once the correct setting was found, it was never changed from year to year.

In addition, and in order to test the transmitting qualities of certain weather conditions here in this locality, (Lat. 48, Long. 81, Northern Ontario, Canada) a low powered radiophone was installed using 10 watts with 500 volts of storage battery for the plate supply, and 10 volts of storage battery current for the filaments.

The transmitting tests were recorded each night to run concurrent with the reception records and weather chart, and it might be well to mention that this station is 500 miles from the nearest broadcast station and 250 miles from any radio transmitting station either amateur or commercial.

If the readings of any ordinary barometer are taken every few hours and the readings plotted on squared paper, with a line running from one reading to the next, it will be seen that the atmospheric pressure is constantly varying from day to day in an irregular manner, as shown in Fig. 1.

A cursory glance will show that the "glass" as it is more exact, the atmospheric pressure, rises and falls also at *variable speeds*. Sometimes it rises or falls slowly, sometimes not at all. Take the curve at the fourth day at the point E. Here we find our glass climbing slowly at an angle of about 25 degrees. If we now move along the curve to the right, on the eighth day we reach the portion of the curve M. You will notice that the angle of climb now is about 88 degrees, the ascent being almost vertical in fact. A study of the curve at points marked R, S and V will show how the barometer at times moves steadily in an almost straight line at a comparatively high or low position on the pressure chart.

It should be clearly understood at the start that the barometer does not tell the present weather so much as the future weather, which may arrive within the next 24 or 48 hours. Almost without exception when the glass falls, making a steep curve, as shown at Fig. 1 at F, L or T, it will bring stormy weather, and short dips in the curve like those of B, D, J, etc., will usually foretell a change in the weather prevailing at the time of the barometer decline. When the barometer rises rapidly, making a curve like that shown at G and M, it usually ushers in an improvement on the bad weather caused by the previous swift drops on the curve and invariably is accompanied by fresh, brisk or high winds, now and again amounting to a gale but eventually clearing up for much better weather.

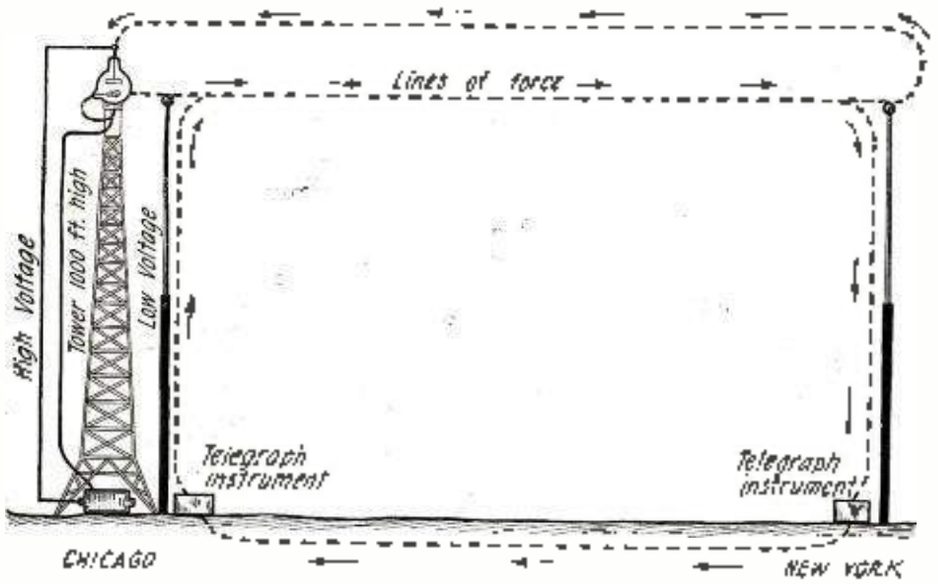
The portions of the barometer curve most favored by mariners, farmers and all those persons whose lives are spent mostly outdoors, are the sections shown at A, E, R and S. Here we find the glass either steadily rising at an easy sloping angle or traveling leisurely in a somewhat straight line from one day to the next; an almost infallible

(Continued on page 982)

A Three Electrode Tube in 1899?

By D. C. WILKERSON

Another page of radio history which is exceedingly interesting if only for the reason that the system suggested is parallel in principle of operation to the vacuum tube of today.



A copy of the original sketch of Dr. Pratt's system of signaling without wires. The upper atmosphere was to act as the conducting medium for the X-Rays, the return circuit to be through the earth. This system could be compared to a huge vacuum tube; the principle of operation is similar

WITH the courts of the United States jammed with legal proceeding of all sorts, injunctions, damage suits patent litigation and suits for recovery, the radio business is suffering from a somewhat uncertain patent basis. Many manufacturers are disinclined to hazard the manufacture of any radio accessories whatsnever on account of it, and the producers of complete sets are in a similar predicament.

The question of the three electrode tube now being discussed throughout the radio trade, and also in the United States and other courts is one of the most involved subjects in the radio field.

DeForest was supposed to be the originator of the device when he added the grid to the old two electrode tube brought out by Dr Fleming. Armstrong claimed the origin of the discovery of regeneration and Meissner and Langmuir also filed patent claims on the same idea.

The history of the radio art in the United States is a colorful one, and in its entire length, from the days of the early 1860 experiments of the Washington, D. C. dentist Loomis, up to the present day, there have been constant arguments as to the men entitled to the proper credit for the inventions related to the development of the radio art.

There is a matter of public record of a three electrode radio tube transmission system which was proposed to send signals from Chicago to New York, in 1899. This device was supposed to be directional in its transmission, and it had the advantage that it actually did function at short distances.

The device referred to, is the one brought out by the eminent Dr. H. P. Pratt, noted Chicago scientist, who has been interested and engaged in the problems of signal transmission for over 40 years.

It consisted of a tube constructed in the manner of the X-ray tube of the early non-filament type, and its secondary circuit was intended to take a potential of from 2,000,000 to 5,000,000 volts. At the time there were no accurate means of determining such high voltages, and even today, the measuring of such high electrical pressures is only approximate, so the calculation of the Pratt secondary voltage was of a guesswork character.

This tube developed a cathode stream, from a source of emission, which was to be modulated by a magnetic device operated from a low voltage source. This means of modulation, please note, is included in the first DeForest patent, where he desired to modulate the current of electrons from the source of emission to the collector electrode by exactly the same means.

Another interesting feature of the Pratt transmission system was the means for collecting the energy at the receiving end. He desired to use a tall mast with a large metal ball affixed to the top, properly connected to the ground through recording instruments.

This X-ray method of transmission can be appreciated when we consider the interference set up by the average X-ray tube of today in the reception of radio programs. Especially is this annoying in metropolitan districts where dental and surgical laboratories are in continuous operation each day. Surely, a source of such heavy interference could certainly operate as a radio transmitter.

These experiments were carried on at South Bend, and in Chicago, in conjunction with tests parallel to the work with the Marconi System. It is noteworthy, also, that the scientists of that day realized the universal dispersion accompanying the transmission of radio signals, and turned their endeavors towards accumulating the transmission of energy in a directional manner to avoid waste and to attain a degree of secrecy.

That this Pratt system was designed to transmit telephone as well as telegraph signals is noteworthy and this development shows itself to be one of the eddy currents set up by the ambitious Bell, in scientific waters, when he actually performed the feat of telephoning down a beam of light, so many years ago. Bell modulated a beam of light with the current flowing in a microphone circuit, and Pratt proposed to do the same with the X-ray discharge.

In this system, however, the third electrode was placed outside of the tube containing the emitter of electrons, and the collector plate was placed 1,000 miles away, connected by a common ground the earth itself.

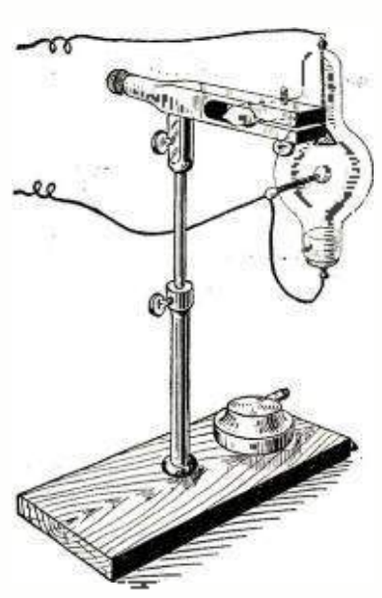
Regarding this Pratt device in the light of the present day vacuum tube containing three electrodes, one would have to consider the whole area located between Chicago and New York as the electrostatic field between the grid and plate electrodes. In other words, Pratt was trying to set up a cathode tube source of electronic emission in Chicago, modulate the stream from outside the tube, and put his plate *1000 miles away in New York*. The fallacy of that, in the light of present day knowledge, is that the ionization collision caused by the many gaseous molecules in the atmosphere would rob the electron stream of so much energy, that its effect would be lost within a few feet, or fractions of a mile from the transmitting station.

At that, Dr. Pratt recognized that he had to get into rarer atmosphere approaching a vacuous condition, and he thought rightly enough that the higher he went into the air, the rarer it would be, and, therefore, the greater the range of his signals.

The system which was designed to transmit signals from Chicago to New York was never installed on the scale projected but the fact remains that in this experimental work a vacuum vessel, having a source of electron emission, a collector plate and a means for modulating this electron stream, was devised.

The world owes a debt of gratitude to these hardy, early experimenters who supplied the groundwork for the marvelous development of the radio art of today, and

(Continued on page 1041)



A copy of Dr. Pratt's original sketch of his X-Ray tube and mounting, originally printed in the "Chicago Daily News" in the year 1899.

The Cold Tube of the Future

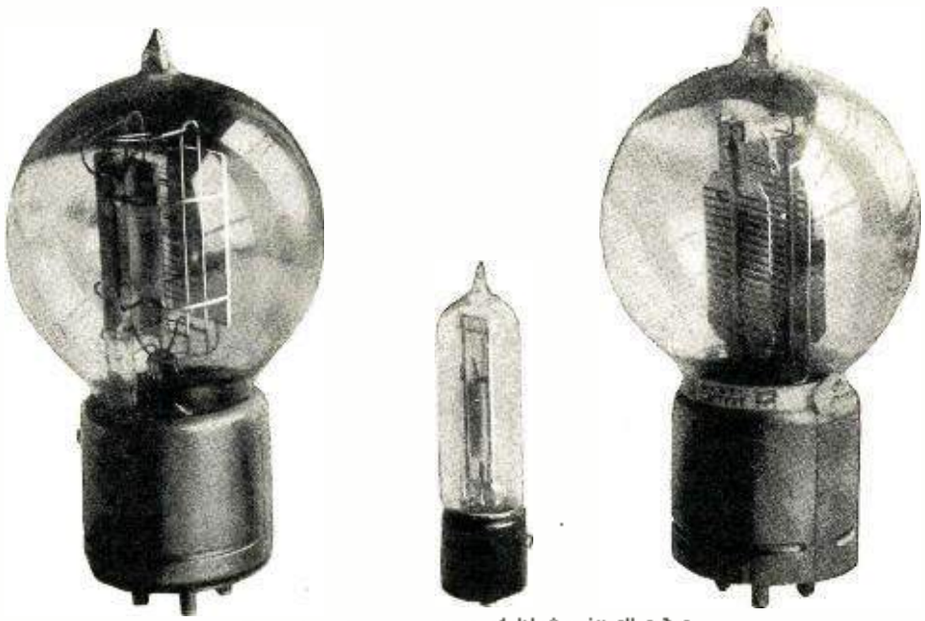
By J. H. T. Roberts, D.Sc.

It is evident that future tube developments must tend towards the production of an appliance which does not make such exorbitant demands upon its supply batteries as the present type. Dr. Roberts indicates in a most interesting manner the lines upon which the desired ideal may be approached.

THE recharging of the storage battery which is employed for heating the tube filaments constitutes perhaps the principal item of expenditure in the maintenance of a receiving set. It is natural, therefore, that many attempts should be made to produce a tube which should be altogether independent of heating batteries—in other words, a "cold tube."

This desirable appliance has been approached, but has not, up to the present, been reached. Tubes have recently been introduced with special filaments, which require only about one-tenth of the heating current consumed by those with the ordinary metallic filament. Such tubes are known as "dull emitters," because they give the necessary electronic emission when their filaments are raised merely to a dull red heat. They have proved very successful in operation, and mark an important step forward in the simplification of radio apparatus.

The ideal cold tube, however, still remains a dream of the future, and as its development constitutes one of the fascinating problems of radio, the reader may be interested in a short description of the *methods employed* of the present-day tube filaments, followed by a simple account of the phenomena of radioactivity, which will enable him to indulge in speculation as to the form which the cold tube of the future may possibly take.



Examples of various types of "dull-emitter" tubes.

EMISSION OF ELECTRONS FROM HEATED SUBSTANCES

It is well known that the electric current which passes in the plate circuit is carried through the tube by a stream of electrons which are emitted from the heated filament. Let us consider for a moment why it is necessary to have a heated filament to provide these electronic carriers in the tube.

The theory of the conduction of electricity through a metal conductor supposes that the atoms of the metal readily part with electrons which, under the influence of the electromotive force, pass from one atom to the next, and so on; there is thus an average "drift" of electrons in one direction, and it is this electronic drift which constitutes the current. But in so drifting an electron is never very much out of the sphere of attraction of one atom before it is within the sphere of attraction of another, and so the electromotive force required to maintain the drift is comparatively small. If an electron wished to leave the metal altogether and escape entirely from the attraction of the atoms, it would need a large force to enable it to do so. Under ordinary circumstances, therefore, the electrons are unable to leave the metal, and they can only be enabled to do so by special influences. If, for example, the metal is sufficiently heated, the vibrations of the atoms may become so great that some of their electrons are thrown out far enough to escape from the ordinary atomic attraction. This is what happens in the heated filament of the tube.

It must not be supposed that a substance must be electrically heated to make it emit electrons. The tube filament is electrically heated merely for convenience, and it is true that the heating in this case is supposed to be caused by the agitation of the molecules of the metal by the rapid drift of the "free" electrons. But a substance heated in any other way (*e.g.*, a metal ball heated in a flame) will similarly emit electrons.

WASTE OF ENERGY

The heating of a filament is a wasteful method of causing it to emit electrons, for only a very small portion of the energy employed in heating the filament is used in detaching the emitted electrons—most of the energy is conducted and radiated away as heat. We are obliged to put up with this waste, however, as we do not at present know of any other convenient way of producing our tube-electrons. In the ideal "cold tube" the electrons will be emitted spontaneously, or the energy absorbed by the tube will be only that which is necessary for the emission.

COLD LIGHT

There are many other cases of this incidental waste. In order to obtain light from an incandescent gas mantle we have to raise the mantle to a high temperature and only a very small percentage of the total energy reappears in the required form of light, by far the greatest part being lost as heat. All practical lighting devices are extremely inefficient in this sense.

The cold emission of light has, however, been more nearly approached (in a practical way) than has the cold emission of electrons. The phenomenon of phosphorescence apparently represents the production of light with only a small incidental loss of energy in the form of heat. It is thought by some that the glow-worm and certain fishes and insects hold the secret of cold light—light without heat.

Much experimental work has been done on the discharge of electricity through glass tubes containing certain gases at fairly low pressures, and cases are known where the incidental waste of energy in the production of light energy has, in this way, been very considerably reduced. This problem is a very important one and about as difficult as the production of cold electronic emission.

EVAPORATION OF ELECTRONS

The emission of electrons from a heated filament has been usefully compared with

(*Continued on page 1088*)

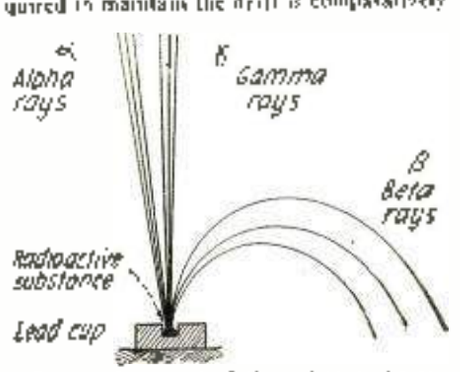


Fig. 1. A magnetic field at right angles to plane of paper deflects alpha and beta rays in opposite directions and to different extents, but does not affect the gamma rays since these are not electrical particles, but waves.

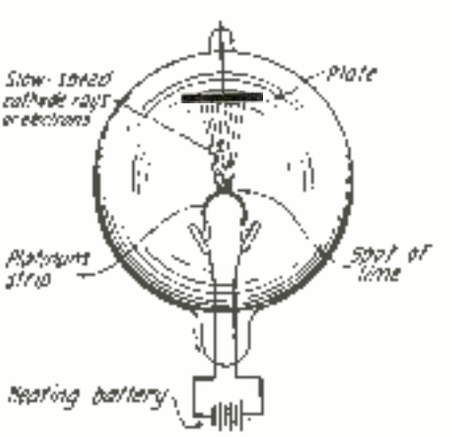


Fig. 2. A large number of electrons are emitted from the lime at a dull red heat, when the emission from the untreated part of the strip is practically nil.

Some Loop Aerial Circuits

By A. D. COWPER, M. SC.

A few excellent loop aerial circuits employing one and not more than two tubes which are particularly adapted to sets of the portable type and are sensitive enough for good reception from local stations.

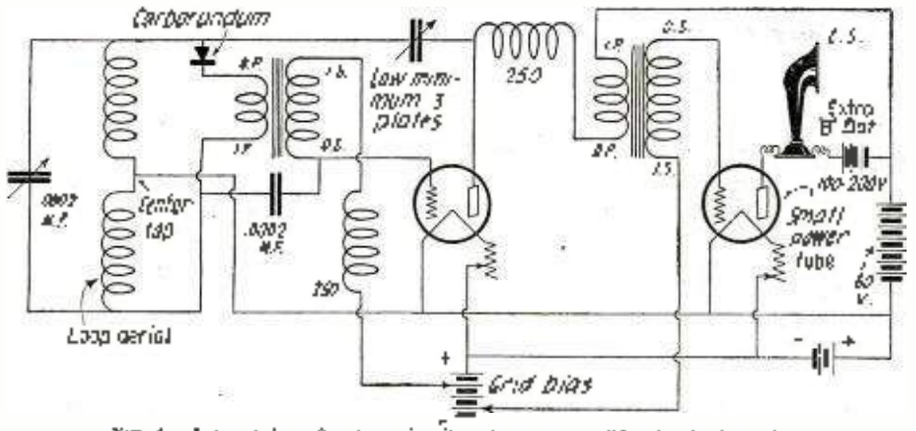


Fig. 1. A two tube reflex loop circuit with power amplifier for loud speaker.

WHILE it is always advisable to use the best possible aerial that can be erected under the particular circumstances, there are occasions when a loop aerial is actually the best available, as in the case of really portable sets, and for those whose accommodation is greatly limited.

The limited power available with a small indoor loop aerial, even for local broadcast reception, involves the use of a sensitive circuit, with extremely finely-controlled regeneration; and if possible the reflex amplification principle, so that a stage of R.F. amplification is possible before detection. The time has passed when we may be glibly told that six tubes are necessary for successful loop aerial reception, it has been shown in innumerable cases that, given a fairly favorable environment and efficient apparatus, at least two of the broadcast stations should be readable on a two-tube loop with one tube.

The circuits described here were inspired by an exceedingly interesting account written by Messrs. Medlam and Schwald of the effect of using a tapping-point for "ground" connection in a loop aerial circuit —with quantitative measurements, a paper which was a model of how such pieces of investigation should be done, to have any scientific value. These authors found, by means of actual measurement of signal-voltage, a very decided increase in efficiency by using a middle tapping in the loop aerial for connection to the tube filament; and that then the tuning could be done by a single condenser right across the whole inductance, after the style of certain transmitter circuits. After the experimental work, the results of which are given here, was finished, an article appeared, written by Mr. Reymer, showing the use of the Reinartz type of regeneration with a loop aerial, in straight and reflexed circuits; but with a separate tickler coil coupled magnetically with a small coil in series with the actual loop. The writer's aim was to use the principle of the tapped aerial, after Messrs. Medlam and Schwald's circuit, but applying Reinartz regeneration to the circuit by using the free half of the loop as Reinartz tickler coil; getting back, in fact, to a transmitting circuit of well-known type, but using the whole inductance for the loop aerial.

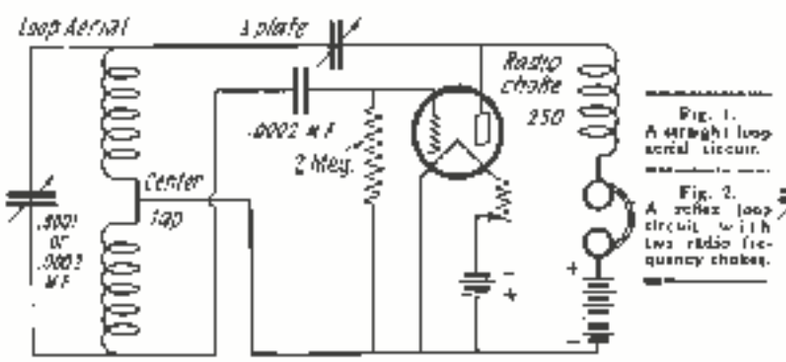


Fig. 1. A straight loop aerial circuit.

Fig. 2. A reflex loop circuit with two radio frequency chokes.

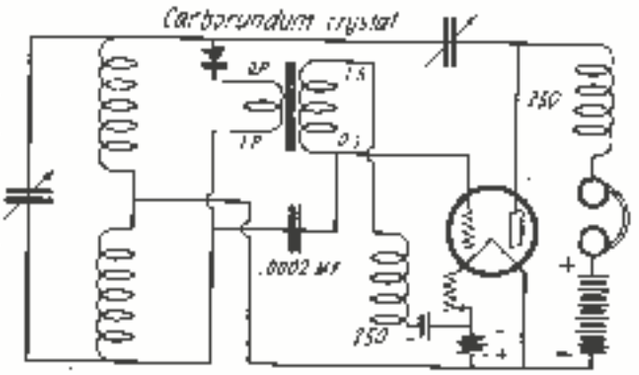


Fig. 3. An alternative to Fig. 2, eliminating one of the radio frequency chokes.

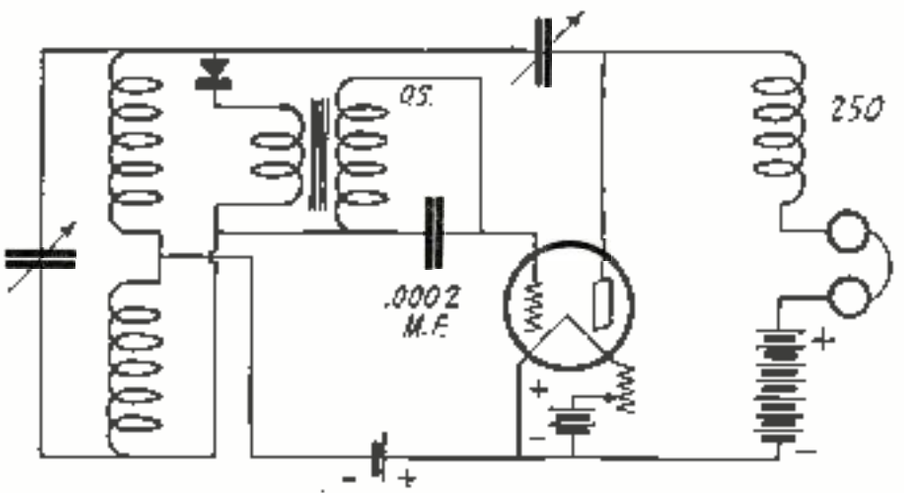


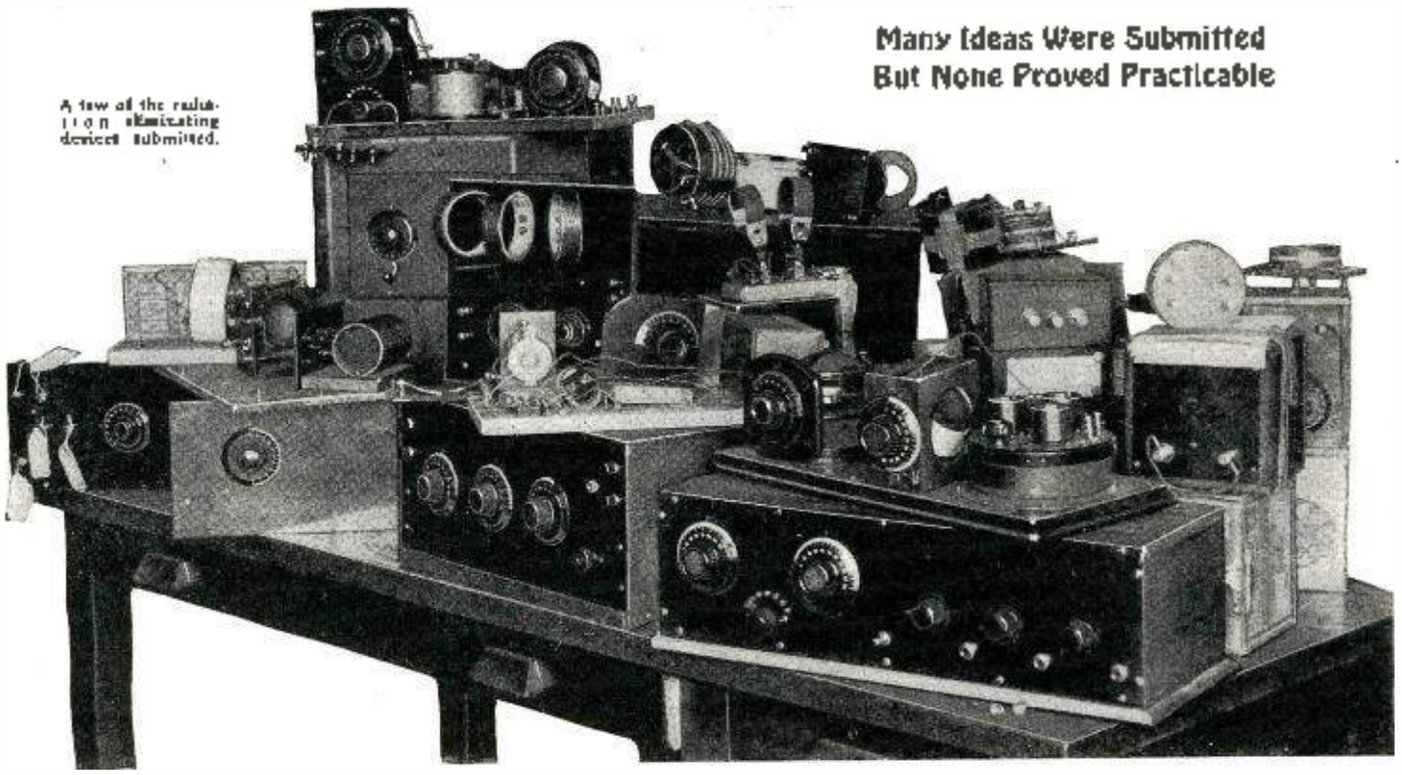
Fig. 1 indicates the circuit resulting, which is undoubtedly the most powerful and easiest controlled single tube straight circuit with which the writer has experimented. Transmitters will recognise the close resemblance to a simple C.W. transmitting circuit. As this mode of connection has the effect of minimizing casual capacities, an exceedingly small tuning condenser across the loop will cover a large range of wave-lengths. A low-minimum .0001 mfd. will cover the whole broadcast belt with a loop aerial 2 feet square with about 25 turns of No. 20 or 22 wire spaced ¼ inch and with a center tap for the filament connection. The tapping point need not be exactly at the center, there is no particular advantage in placing it much to one side or the other of the center. On account of the powerful regenerative effect given by this type of circuit the controlling Reinartz feedback-condenser must be very small and of extremely low minimum capacity. Even some three-plate "vernier" condensers, especially some with metal end-plates and small insulating bushings, have so high a minimum capacity that the circuit will oscillate hopelessly with them. With a liberal wave, a two-plate condenser made up with the usual plates and spindle, with ample clearance, will often suffice.

With this circuit and a moderate "B" battery supply, a local station is read at a dozen miles at comfortable phone strength. Hand capacity effects are marked, of course so that long tuning handles are called for;

(Continued on page 1044)

The Radiation Eliminator Contest

Many Ideas Were Submitted But None Proved Practicable



A few of the radiation eliminating devices submitted.

THE Radiation Eliminator Contest run by RADIO NEWS in an attempt to find a practical device which would prevent radiation from regenerative receiving sets in a state of oscillation was greeted with a huge response.

Every conceivable form of device was submitted, ranging from special condensers and special coils to complete receivers embodying complicated circuits. This proves that a great many radio enthusiasts were interested in the problem and that many had attempted to prevent their sets from interfering with the reception of programs on neighboring receivers. For this, at least, they should receive credit, although their devices DID NOT prevent radiation. All the sets and instruments submitted were thoroughly tested in the RADIO NEWS LABORATORIES, but not one was found to be practicable.

Much to our surprise, the majority of the devices submitted failed to comply with the rules of the contest, yet the rules were specifically stated. Nevertheless, we tested these devices, which, like the rest, proved of no value.

Some of the devices submitted managed to reduce radiation slightly, but they also reduced the volume of received signals and in proportion to the reduction of radiation. Such devices are of no value.

The contest has disclosed one fact, namely, so-called radiation eliminators had been devised before our contest was announced and were being used, but to no avail. It is assumed that propaganda against radiating receiving sets has at least managed to stimulate interest and that numerous experimenters have striven to devise a fool-proof attachment. We regret that none of the entries in our contest succeeded in doing so.

Of course, we can award no prizes. We offered prizes for devices, easily attached to any receiving set, which would ELIMINATE RADIATION. As stated, none of the devices submitted did any such thing.

Why Radio News Favors Esperanto

VARIOUS International Language Associations have been striving to stimulate an interest in the United States in their pet tongue. Up to the present time so little publicity has been given the International Language Movement on this side of the water that very few people are aware of its existence. However, the times show that in the United States even as in Europe there will be a use for one of the many tongues advocated. The extent of the usefulness of a Universal Language in the United States as a matter of speculation and whether or not it would benefit more than a choice few at present is a question. Nevertheless, the ever increasing adaptability of radio to commerce, entertainment and its usefulness as a medium for the advancement of education and complete understanding between the Nations of the earth warrants the use of an international language.

It is fully realized by Radio News that some day a Universal Language is to play an important part in world affairs. It is realized equally well that at the present time the employment of an international language in the United States would prove of little value.

The American amateurs, however, who communicate nightly with amateurs in foreign countries are in dire need of a simple universal language. Communication is greatly hampered for the want of such a medium of speech. Still, with a thought to the American amateur and a thought to the future, we see no harm and possibly some good in promoting one of the many so-called international languages now in existence. But at the same time we strongly believe that the greatest care should be taken in selecting the particular language which will be the most serviceable from all standpoints. In selecting an automobile it is usually very pleasing to purchase one that is different, in some respect at least, from that of your neighbor. It is a human whim to be exclusive, but when it comes to the selection of a language that is to be universal, it is quite important that all whims be set aside and that each lamb follow the next, not of course to the exclusion of the best, but we argue from the point that the people are intelligent enough, with the help of authentic information to select the most desirable tongue.

The International Language movement has been run to extremes; there is no doubt of this, for at the present writing there are some 20 odd languages, all being pushed to the front, and there are only two which have even a slight chance of being recognized, Esperanto and Ido! The followers of the less prominent manufactured tongues might realize that all their gains are in

(Continued on page 1052)

Over 18 Pages of Advertising Omitted From This Issue of Radio News

Owing to the tremendous increase in the circulation of Radio News to 400,000 copies and the record breaking growth of advertising to over 63,000 lines per issue, it became necessary to adhere rigidly to our schedule for closing this and all subsequent issues.

Consequently we were unable to handle any orders for advertising on which the copy was not received by our published advertising closing date—December 1st for advertising forms for Radio News close on the 1st of the second month preceding the date of issue.

Although we were forced to leave out 8127 lines of advertising from this issue, because it reached us after the closing date the December number has again broken all preceding records for advertising lineage with the stupendous total of 63,957 lines of paid display space.

The Beginner's Tube Set

By A. P. PECK

The fifth of a series of articles by Mr. Peck written especially for the layman. Instructions are given for the construction of a simple vacuum tube receiving set and each part is lucidly described.

THE winter season is now coming on and, to the dyed-in-the-wool radio fan, that means good reception weather. Then static, that growling and grumbling heard all summer, will be at a minimum and DX or distance reception will be at its best. With a vacuum tube detector added to the set described in this department stores of stations will be heard that could not be picked up with the crystal outfit. So we are sure you will agree that now is the time to start work on a tube set and later a study may be made of its action after you are familiar with the handling of the dials.

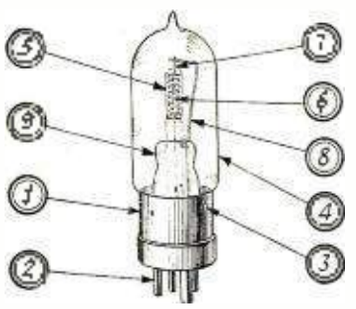


Fig. 1

Details of a vacuum tube. The prominent parts are designated by numbers and described in the text.

THE TUBE

The most important requisite for the new set is, without a doubt, the vacuum tube, or as it is variously called, the tube, bulb audion or light. The last name is one to avoid as it smacks of ignorance and its use leads to misunderstanding.

Let us see what the essential parts of a vacuum tube are. Refer to Fig. 1. Here we show a view of a standard dry cell type of tube in phantom. That is, the interior parts that are not ordinarily seen are indicated in dotted lines. The numbers on the drawing indicate the following parts. No. 1 is the base or shell. It is usually made of brass. No. 2 indicates the prongs. To the ends of these, enclosed in the base, are fastened wires connected to the elements. In other words, the prongs connect the elements with the other instruments of the set through the socket. No. 3 indicates the pin. It is placed on the base so that the tube will fit into the socket in the correct position. The glass bulb is indicated by 4. The interior of this bulb has been exhausted of almost all traces of air so that the filament can be lighted without its burning out as would be the case if it were in the open air. The glass here plays the same purpose as the glass in an ordinary electric light bulb. Heated wire oxidizes rapidly in open air and soon burns up. Also, molecules of air would impede the progress of electrons from the filament to the plate, but this will be explained later.

The plate, 5, encloses the other elements. It usually consists of a nickel or a nickel plated metal sheet pressed to the required shape. The grid, 6, is placed between the plate and the filament and is usually a length of nickel or copper wire wound in a spiral form. The filament is a fine wire that becomes red hot when a current passes through it. In the latest types of tubes, this wire is coated with a chemical which increases its activity with a relative decrease in the brilliancy to which the filament must be lighted and a consequent increase in efficiency and saving of current from the battery which lights it.

All of the elements of the tube are supported on wires. The glass rod into which the supporting and connecting wires are sealed is shown at 9 in Fig. 1.

When you go into a radio store, the salesman may try to sell you what is known as a "bootleg" tube. Many of these "bootleg" or "independent" tubes are very good and will give perfect satisfaction, but unless the dealer will absolutely guarantee them, the purchase of one is a big gamble since it may be unsatisfactory. At best, the purchase of any tube, genuine or otherwise is somewhat of a gamble. Genuine tubes are stamped and the guarantee and license numbers are stamped on the carton.

There are many types of tubes for sale and each operates on a different "A" battery voltage. The "A" battery heats or lights the filament. Therefore the type of tube you buy will depend on facilities available for using it.

If you have electricity in your home to charge a storage battery or have facilities near at hand for so doing and you can afford the initial cost of a storage battery, by all means get one of the 6 volt, ¼ ampere or 6 volt, 1 ampere tubes. They give best results, and when the set is eventually made into a multi-tube one, the battery on hand will operate it at the least possible expense.

However, many either cannot invest in a storage battery, as it is expensive, or the facilities for charging it may not be available. In such cases the so-called dry cell tubes are practical. These tubes are so designed that the filament may be heated by one or more dry cells, which are obtainable almost everywhere. When they are used up, they can be replaced very cheaply. There are two prominent types of tubes operating on dry cells. One uses one cell and the other, three. The former consumes .25 ampere and the latter .06 ampere. Roughly speaking, the latter is somewhat cheaper to operate.

> The parts necessary for converting the Beginner's Crystal Set to one employing a vacuum tube and capable of greater distance reception and louder reproduction of music and voice are:
>
> One vacuum tube.
> One vacuum tube socket.
> One grid leak.
> One grid condenser.
> One rheostat.
> "A" battery.
> "B" battery.
> One variometer.

THE BATTERIES

In every practical receiving set yet in general use, two and sometimes three separate and distinct batteries are necessary. This statement does not include the Solodyne circuit that is, as yet, in the experimental stage and which only uses one battery. In detector circuits such as we are concerned with at the present time, only two batteries are used, so we will confine ourselves to a discussion of them. These two are known as the "A" or filament battery and the "B" or plate battery. The former is of the lowest voltage and it is essential that in connecting a set, the "A" and "B" battery wires do not become mixed.

Every battery has what is known as polarity, and has at least two poles or terminals to which connections may be made. These are known as the negative and the positive terminals and are usually plainly marked. At "A" in Fig. 2, we show a standard dry cell with the terminals marked with their

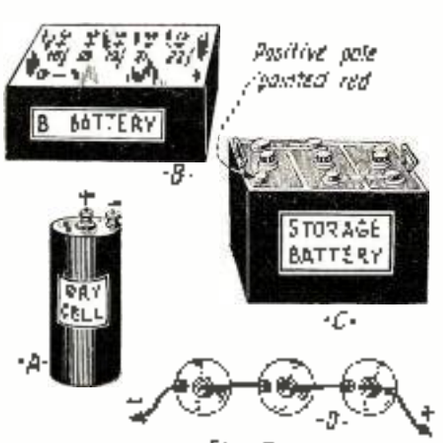


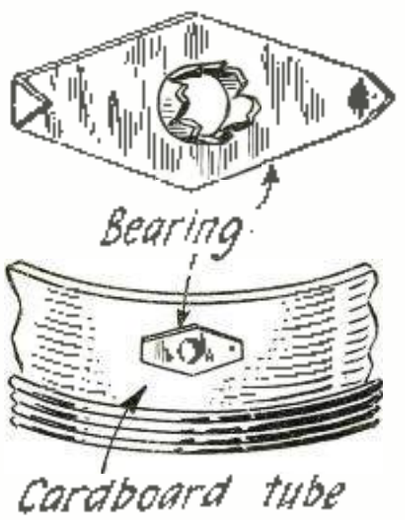
Fig. 2.

Forms of batteries employed in connection with a vacuum tube receiving set.

wax or paraffin over the binding post screw heads. Take a permanent magnet to the nearest machine shop and with it gather up the fine iron filings around the emery wheel. Pack these filings tightly around and in the center of the coil, which is on the tin cylinder. Then fit a tin circle to the bottom of the cylinder and solder in place. Be sure the coil is entirely surrounded by the filings. The coil should also be tested for an open circuit before putting in the tin cylinder. The condenser which is included with the Ford spark coil should also be taken out and used in series with the plate of the tube and the loud speaker as shown in the diagram. When using this current high voltages may be used on the plate of the tube without fear of demagnetizing the magnets or burning up the windings of the loud speaker.

ROTOR SHAFT BEARINGS FOR CARDBOARD TUBES

Since paper tubes are both common and admittedly good from the electrical standpoint, it is desirable to have suitable bearings in them for the rotor shaft. The paper



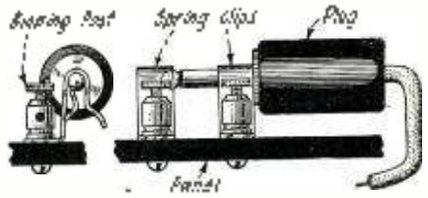
A cotor shaft bearing made from a piece of sheet brass. The hole for the shaft is made with a router punch.

tube is not sufficiently rugged in itself to have a hole through it remain a permanently good bearing and though the tube can be reinforced with leather-board or other material, and the whole treated with shellac, it is better to provide metal bearings. My first were made with pairs of sheet brass strips, one piece each side of the tube wall—a laborious and unsatisfactory method, but later good bearings were quickly and easily made by cutting diamond-shaped pieces of sheet brass or aluminum, say 1½ inches long, with enough of each end bent to a right angle to reach through the paper tube and clinch, making a good and substantial bearing.

The hole for the shaft should be made with a small punch and then spun out to the required size by revolving a smooth tapering spindle in it; this is better than a drilled hole, as it leaves the bearing with considerable wearing surface and the burr tends to hold the shaft snugly and without play. —*Contributed by Frank X. Binko.*

A QUICKLY MADE EXPERIMENTAL JACK

To the experimenter who delights in making up new circuits in breadboard fashion, the jack described here will prove very handy. It is constructed of two ordinary spring clip binding posts, as shown in the illustration. Two holes are drilled in the board for mounting the clips and should be about 1⅜ inches apart. The spring clip binding posts are fastened to the board by two standard binding posts and are then



A simple jack made from two Fahnestock clips attached directly to the phone binding posts.

bent upward as shown. The plug can easily be forced under the spring clips so that the tip and the main shaft are securely held by the spring binding clips. If it is not desired to use the plug, the phones may be fastened directly to the spring clips in the usual manner. With this emergency jack in use it will not be necessary to disconnect the phones from the plug when changing from the regular set to the experimental one.

—*Contributed by J. E. Dixon.*

A SIMPLE "B" BATTERY ELIMINATOR

The radio fan desiring to build a rectifier which will take the place of "B" batteries is often puzzled as to how to secure a transformer to step up the A.C. voltage before rectification. Fig. 1 shows how a bell ringing transformer can be used for this purpose. This half wave rectifier will supply both detector and amplifier plate current and give excellent results on sets using up to four tubes.

Transformer No. 1 steps the 110-volt A.C. down to 6 volts to light the filament of the tube also 12 volts to transformer No. 2, which is used as a step up transformer. By applying 12 volts from No. 1 to the 6-volt winding of No. 2, 220 volts A.C. is obtained from No. 2, which is supplied to the grid and plate of the tube. The secondary of an audio transformer can

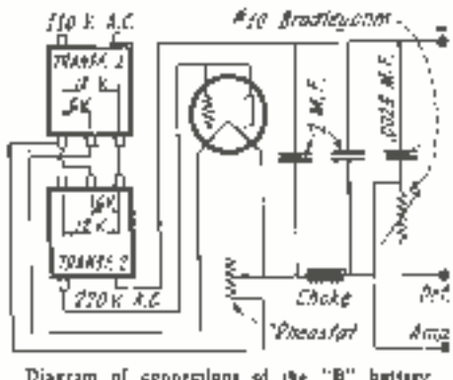


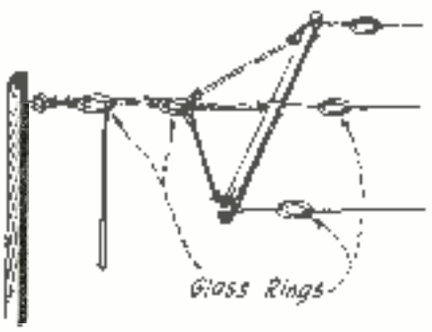
Diagram of connections of the "B" battery eliminator. With this arrangement the 110 volt A.C. can be used in place of the "B" batteries.

be used for a choke coil, but it is better to rewind it with 5,000 turns of either No. 42 or No. 34 B. & S., S.S.C. wire, which will give sufficient choking effect with a minimum of D.C. resistance so that the drop in voltage is small. The Readyohm is used to cut down the voltage to 22½ volts for use on the detector. In checking voltages obtained from the rectifier, only a high resistance voltmeter should be used, otherwise, the reading will be incorrect. The small watch case type should not be used, as it is too low in resistance.

—*Contributed by J. R. Deuge.*

A CHEAP AND EFFICIENT INSULATOR

Here is a cheap but very efficient antenna pulley or insulator, which I have been using for quite some time with excellent results. It consists of glass rings such as are used on awnings and which can be obtained at



Glass awning rings make excellent antenna insulators. They are tough and will stand considerable strain.

any hardware store for five cents each. These rings will withstand several hundred pounds direct pull and can be safely used wherever a good insulator is required. The rings make excellent pulleys, as they will not rust or bind and they work very smoothly. Where only a receiving antenna is erected, they will prove extremely satisfactory and if two of these are employed in series they may be used for a low power transmitting antenna.

—*Contributed by E. H. Parker.*

AN AID TO PANEL MARKING

One of the most important things to be done in building a radio set, as far as looks are concerned, is laying out the panel. A great many schemes have been proposed, such as laying out on paper the proper place for each instrument, pasting this on the panel and then drilling. However, the writer has found by experience that drawing the locations directly upon the panel itself is much easier and more accurate. Here is the trick. Procure a black waxed crayon such as is used for marking packages. Leather, glass, etc.; smear the crayon upon the panel where it is desired to draw a line. Measure exactly where the line is to be drawn and with a ruler and tooth-pick draw the line through the wax. Should it be in the wrong location, it is a simple matter to smear the crayon over it and try again. When drilling is completed, a soft rag will remove the crayon, leaving the panel in perfect condition.

Contributed by Edw. B. Johnson.

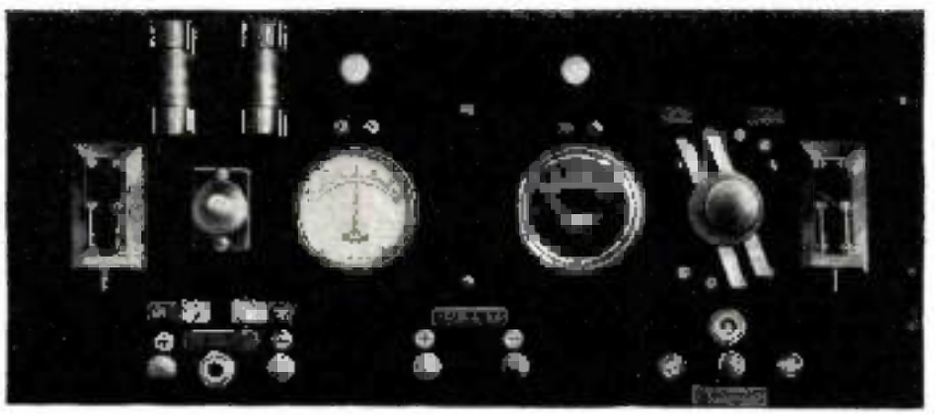
THE SIMPLEST SWITCH STOP

In building a receiver in which switches and points are used, this little device will be found of value to the constructor. It will not be necessary to drill extra holes.

(*Continued on page 1078*)

How to Build A Battery Control Panel

By RUDOLPH G. LAWRENCE

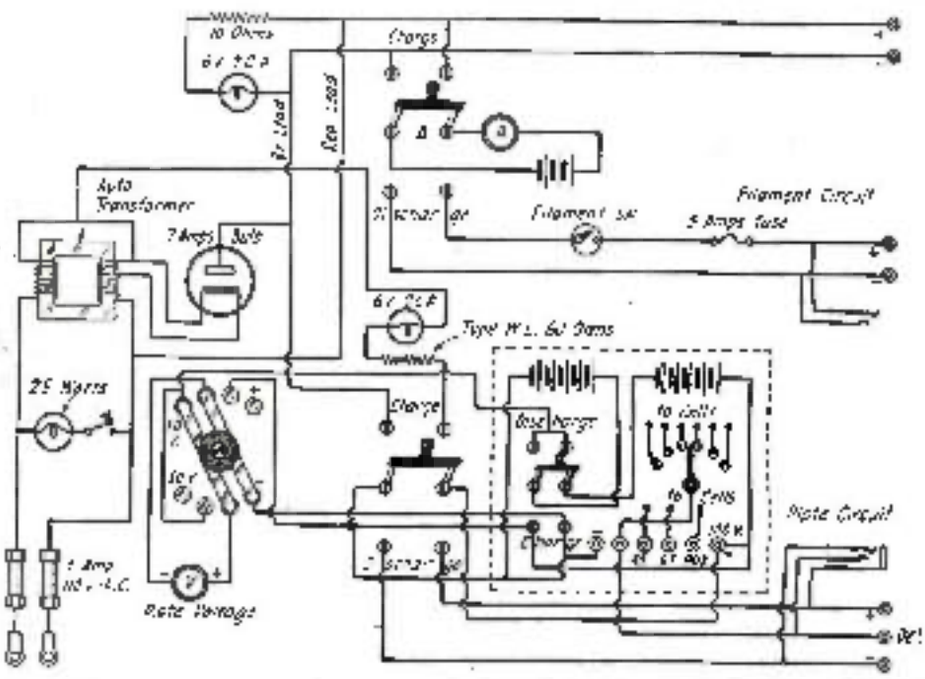


A front view of the completed battery charging panel. All the controls and measuring instruments are mounted on the front of the panel

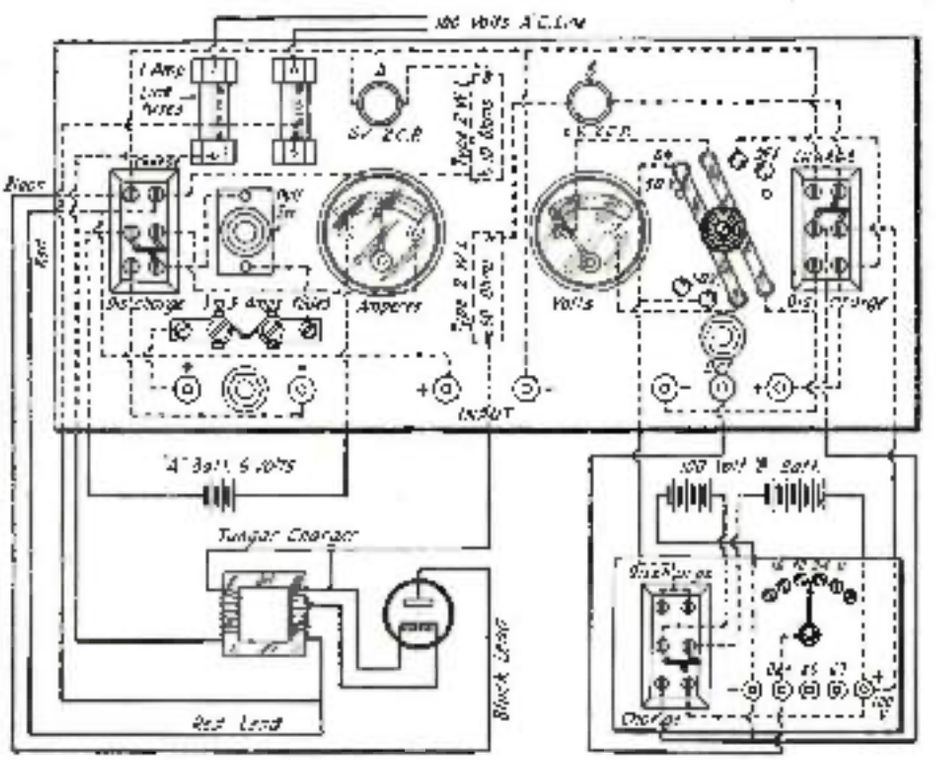
WITH the larger type radio sets, the wiring problem becomes an important one. When three or four separate sets of batteries are used to supply the power and the various charging agents for the batteries are installed, the usual result is a mess of barum scarum wiring making an otherwise efficient layout resemble the junk shop of an experimenter. About the only practical way to bring order into this chaos is the use of a charging panel such as the one delineated in this article. With its use the necessity for thousands of loose wires, voltmeters, ammeters and other measuring instruments lying about the work table, is obviated.

One of the most distinct advantages to be gained through the construction of such a control device lies in the fact that when the operator has before him, easily accessible, means for measuring the battery charge, the chances are much greater in his giving these power units proper attention than when he must dig down through a pile of his radio instruments in order to obtain the necessary voltmeter. Another distinct advantage of the same style is that the operator has a constant check on the plate voltage supplied to his set. Immediately it drops below normal, resulting in howls and noises in the set, the voltmeter across the plate makes known the seat of the trouble, and the operator will not have to look through the entire set for the difficulty.

The layout and construction of the panel is very simple, as will be seen from the wiring diagram shown in Fig. 1. The "A" battery circuit is entirely controlled by a D.P.D.T. switch. In the upper position the "A" battery is on charge. In the lower position it is connected to the filaments of the set. The leads from the battery are connected to the center terminals of the switch, the positive one passing through the ammeter. The lower points of the switch



Above is the schematic circuit diagram of the battery control unit and below is the working diagram showing all the connections in their proper positions.



connect to a pair of binding posts which, in turn, lead to a filament set. The positive lead to the panel is interrupted by a filament pull switch. A five ampere fuse is also provided in these output leads for protection of the battery as well as the filaments.

A Tungar charger is used to supply power to the battery from the 110 volt A.C. line. The red and black leads from the charger go directly to the upper terminals of the D.P.D.T. switch, the red lead going to the positive side. Across the charger is placed a six volt two C.P. lamp which is used as a monitor serving to indicate when the battery is on charge. It is mounted on a bracket behind the panel and is seen through a bevel.

A 10-ohm resistance is put in series with the lamp to decrease the current consumed by it. Two other binding posts are provided for the purpose of charging auxiliary batteries.

The "A" battery Tungar charger is also used to charge the "B" battery, provided the proper connections be made and the correct resistance used. It is understood that the "B" battery used in this device is the storage or rechargeable type. The battery used is 100 volts, alkaline type, built with Edison

(Continued on page 1082)

Single Control Receivers

One of the latest developments in radio sets is here pictured. Instead of using two separate dials for the two tuning condensers, the condensers are geared by means of fine mesh fibre gears. There is, therefore, only a single control directly attached to the center gear. The system works out surprisingly well in practice and will probably be the forerunner of such simplified sets.

SINGLE control for receiving sets has become a guiding principle with the radio designers during the past year. From time to time new sets having complete control vested in one adjusting dial have made their appearance. The matter was comparatively simple when dealing with the single circuit receiver. But even with the addition of regeneration the problem was complicated. And it has been only quite recently that serious thought has been given to ways and means of incorporating the single control idea in the multistage amplifier set.

With the use of tuned radio frequency amplification constantly increasing, it was obvious that, if the set was to become a popular one with the fans, the controls would have to be simplified. One of the greatest difficulties with tuned radio frequency receivers is the multiplicity of controls.

The latest development along this line is the use of gears for connecting the tuning condensers on the radio frequency amplification stages with the detector circuit condenser and working all of them from a common control.

It is often difficult with such an arrangement to obtain sharp tuning in all the circuits on account of the small differences which are practically unavoidable in the variable condensers and the radio frequency transformers. The system of tuning several stages of radio frequency amplification with a single control is more practicable when only one stage of radio frequency amplification is employed in the receiver.

In the set used in the illustration, the arrangement is plainly seen. Advantage is taken of a small vernier condenser to make the final adjustment of the tuning if necessary.

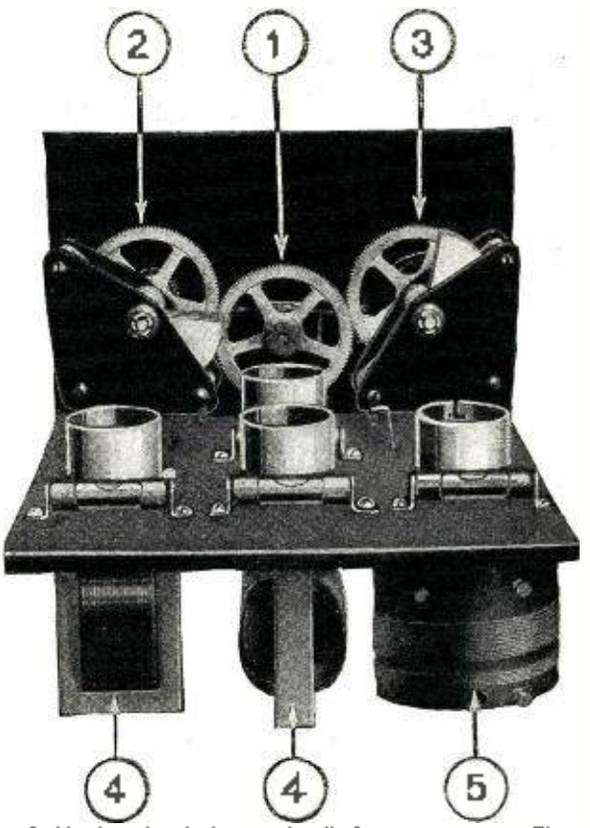
In the assembly of the set the condensers and coils are matched as carefully as possible so that the adjustment of the vernier will be reduced to a minimum.

Still another simplification has been used in the adoption of a somewhat new principle of damping in the radio frequency stage. Until the advent of this new principle, it was necessary to rely upon the neutralization of the internal capacity of the tube by the use of the Neutrodyne principle or through the addition of another control in the form of a potentiometer. Otherwise, the tendency of the tube used in this position to oscillate could not be controlled. It was, of course, necessary to give the grid a negative bias in order to get the greatest efficiency from it, and in doing so, it was brought near the point of oscillation necessitating some sort of oscillation control.

In the present set, the filament resistance of the tube is incorporated in the grid circuit. The addition of this resistance allows the tube to be operated at the proper point for greatest efficiency and at the same time introduces just enough damping to prevent the unwanted oscillations.

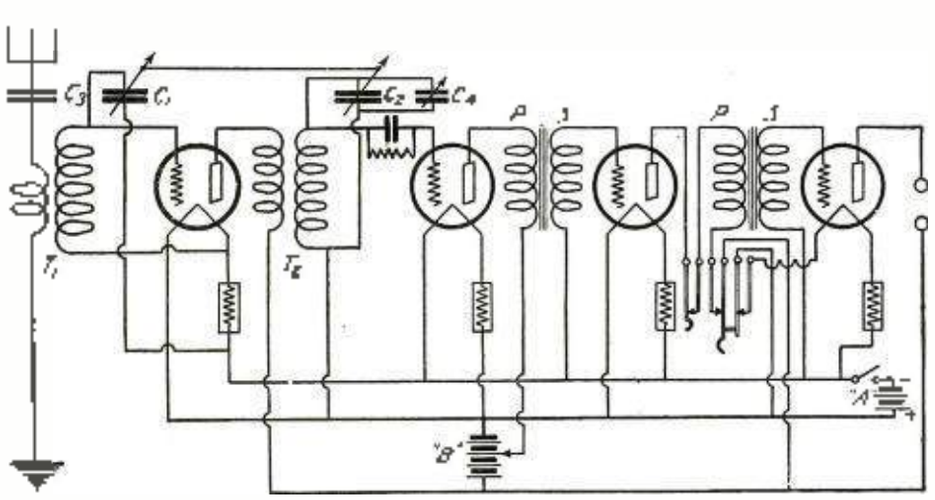
Experiment has shown that a set can be so built as to obviate the use of a separate adjustable rheostat for each tube. The addition of the automatic filament resistances, amperites, cares for the necessary adjustment without being hand operated. The set used for the illustrations employs such devices for each tube. The set consists of one stage of tuned radio frequency amplification, detector and two stages of audio frequency amplification. On the front panel a large dial in the center does the bulk of the tuning. After the station has been brought in, final tuning for clarity and volume is made with a small vernier knob under the larger one. The only other instrument on the panel is the filament switch.

A word might be said regarding the complete set. It is self contained. The actual tuning instruments, tubes, etc., are contained in the center portion of the cabinet behind the panel. At the left is the mouth of the loud speaker, also contained in the cabinet. The left side of the cabinet is reserved for batteries. There is ample space for a 50-ampere hour storage battery and two 45-volt "B" battery units.



Inside view of a single control radio frequency receiver. The main gear, No. 1, turns the two variable condensers No. 2 and No. 3 simultaneously. Below the sub-panel the radio frequency transformers No. 4 and tuning coil No. 5 may be seen. *Photo by courtesy of National Airphone Corp.*

Altogether, a design of this type is the forerunner of the chief developments to be made in the commercial broadcast receivers to be brought out during the coming year. Simplicity is the pass-word.



Circuit of the single control receiver. Note that the two variable condensers C1 and C2 are moved simultaneously. C4 is a small vernier condenser.

NATIONAL BROADCASTING NETS

Very soon now the radio public, even the crystal listeners, in New York, Washington, Schenectady and possibly also in Pittsburgh, Hastings and Oakland, may get more long-distance radio programs. The Radio Corporation has a wire line connecting its New York broadcasters, WJZ and WJY with WGY in Schenectady, and a line strung between New York and WRC at Washington ready for use. The Corporation is planning to extend its inter-connections by both wires and radio retransmission to include several radio stations, which will of course compete with the big circuit of the American Telephone & Telegraph Co.

In confirmation of Secretary Hoover's prophesy that intercommunication through the interconnection of high-power broadcasters was the greatest development in broadcasting, the Bell System and the Radio Corporation are extending their broadcasting nets. On Defense Day, 19 stations were connected by telephone, the greatest number ever hooked up, and, as radio fans from coast to coast know, it worked excellently.

Radiotics

HARNESS YOURSELF TO A RADIO WAVE

The July 26, 1924, issue of the *Radio Digest* carried an advertisement of "HARNESS REFLEX KITS." We knew the average reflex set required some sort of harnessing, but never knew how to go about it. Supposedly one need not worry about this any more. *Contributed by Willard Gano.*

WHAT DO YOU GET?

The Sohman Brothers in the Los Angeles *Examiner* carried the following advertisement: Crosley 3-tube sets WITHOUT PARTS .....$30. This, no doubt, is the new Crosley Model 00 set with etherial instruments an' everything. It would seem that this set would present a serious problem in tuning to the average radio fan.

Contributed by D. I. Ives.

MOTHERS, JUST THE THING!

The Radio Specialty Company carried a classified advertisement in the August issue of Radio News reading as follows: "Boys! Don't overlook this True Radio BABY DETECTOR." I think we all feel that this is just the thing for Mother who has stopped long enough for little brother to get out of sight. Kidnappers had better be careful after this. The Baby Detector is infallible.

Contributed by John D. Davis.

A PYRADIOMANIAC!

The Washington *Herald* informs us in a news item that a "six tube radio set operated at No. 1621 K St. N. W., IGNITED BED CLOTHING LAST NIGHT." Must have picked up some hot stuff from a nearby broadcast station. But these big sets will bear watching. Never can tell what they will do next.

Contributed by Solomon Fishman.

HOLD 'EM BACK!

In the June issue of *QST* there is a Ham ad. reading: "For Sale —One ten watt C.W. transmitter complete with power transformer and everything except tubes. 50c!" I bet the rush for that set would put a silk stocking sale on a Saturday afternoon in the shade. Must have been some straw hats broken in the stampede.

Contributed by Harry Wanderfish.

A SHANGHAI CREATION

The Oakland *Tribune* of August 17, 1924, carried the advertisement of the Offenbach Electric Company in which we find listed "Variometer, WITH PIGTAIL, $1.95." Is it that Mah Jongg is having such an effect on the design of radio apparatus that they have to put a pigtail on a variometer? An Oriental atmosphere is quite the thing, but why stretch the fad to include radio?

Contributed by Nathan H. Saunders.

A WILD ONE, THIS

The *North Carolina State College Alumni News* relates the story of a "210 Pigeron couple in cascade by resistance and CAPTIVITY. Guess they put it behind bars to keep it from oscillating all over the place, and possibly to keep it from igniting bed clothing! It had 2,000 volts on the plate. That's a bad symptom. *Contributed by Robert S. Morris.*

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 $1.00 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

THE GOLEM

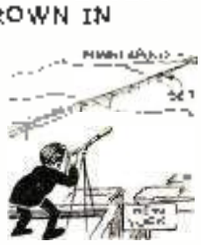
One John R. Meagher in his article "Make Your Own Power Unit" in the Radio Section of the New York *Sun* July 26, 1924, speaks of "A" battery chargers as "usually of FORMIDABLE proportions!" Now possibly they are, to the uninitiated who, for the first time, connects one up to his storage battery and hopes it will "charge" or something, but we are more inclined to believe that someone has been having nightmares.

Contributed by Paul F. Heinz.

NO MORE "B" BATTERIES

The See Jay Battery Company blare forth in the August 10, 1924, edition of the *New York Herald-Tribune* with an advertisement of "100 VOLT MAHOGANY CABINETS." Now that's a right fine idea. Helps to make a set portable but a rubber insulating covering would be necessary if you are to carry it. This is the original "Kabinet with a Kick." *Contributed by Marian Frankel.*

A CHUNK OF THE WESTERN UNION THROWN IN



The following ad appeared in the Boston *Globe*, August 10, 1924: "A Radio Tube Set for $12: this includes the tube on a circuit of 1,500 miles!" Zowie, there wasn't anything wireless about that set, it must have included a chunk of the Western Union Lines. What will they give away next?

Contributed by John F. Coulon.

FOR THE PORTABLE SUPPR-HETERODYNE

Sears, Roebuck & Co. in their advertisement of WD-12 and C-12 vacuum tubes state that they have "standard 4-POUND BASE." Sure, and this is a weighty argument in favor of the tube. The advantage is, if you drop one, it won't land buttered-side down.

Contributed by Paul K. Whitaker.

ALL SET FOR THE WINTER

The Detroit *News* of Sept. 12, 1924, carries the advertisement of the Calfan Radio Company in which they announce something new under the sun, namely an "Acme FUR-TUBE Reflex Kit!" No wintry blast will be able to give your vacuum tubes the oscillating shimmeys when dressed with these "Cats Overcoats." *Contributed by Edward Abood.*

A NEW RADIO INSTRUMENT

In the Boston *Post* of August 29, 1924, is advertised: "U. S. Tool VERNIER BENCHES." Just the thing for the set showing symptoms of body capacity. Tune in the desired station and make the final adjustment for volume and clarity on the bench. More power to the U. S. Tool Company!

Contributed by Rowland M. Ware.

LET US IN ON THE SECRET

In the advertisement of the National Radio Institute in the August, 1924, issue of Radio News, is a letter in which is stated: "I had a first-class outfit WITH A WAVE-LENGTH CAPABLE OF 'PICKING UP' THE PROGRAMS FROM DISTANT STATIONS." He must have trained that wave-length to go out and bring back the goods. Not knowing how much programs weigh we do not know whether this is a feat of strength or not, but anyway, it's a good stunt.

Contributed by E. A. Morrison.

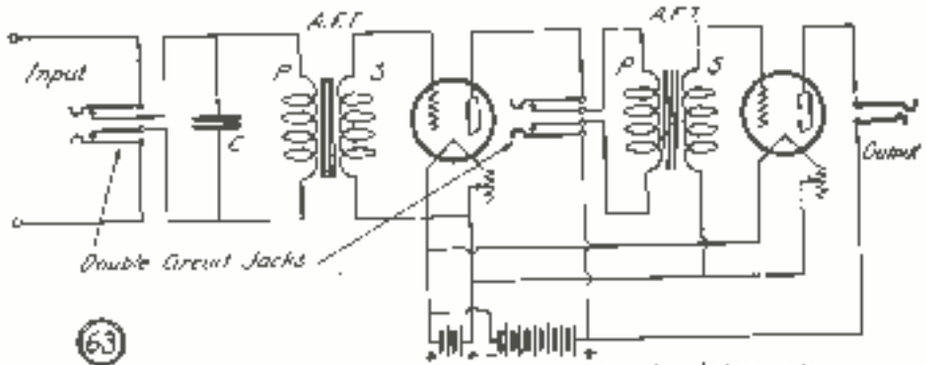
STANDARD HOOK-UPS

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 lefthand 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 systematizing and classifying the various hook-ups.

Handy Reference Data for the Experimenter

Circuit No. 63. In this diagram we have a circuit of a two stage audio frequency amplifier which may be added to any stand and one tube receiver. Audio frequency transformers are used and a ratio of not higher than five to one is advised. One single circuit and two double circuit jacks are employed, thus allowing either detector, first or second stage of audio frequency to be used. The output of the detector tube is connected directly to the two input binding posts on the amplifier. A fixed condenser C is shown shunted across the primary of the first transformer. This condenser is of low capacity, approximately .00025 mfd., and is employed to compensate for the loss of capacity of the phone cords when the phones are removed from the detector circuit. If this condenser is of the right size, there will be no need of retuning when the change is made from the detector to the first stage. The same "A" and "B" batteries are employed for both detector and amplifier.



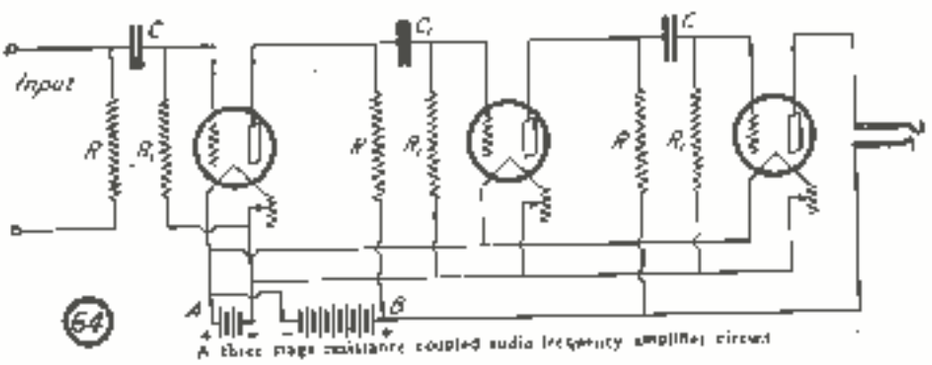
Circuit diagram of a two stage audio frequency amplifier with telephone jacks

All that is necessary is to connect the positive and the negative filament binding posts of the detector to the respective terminals of the "A" battery and take a tap off at 22½ or 45 volts on the "B" battery and connect it to the plus "B" battery post of the detector on the receiver. No wire need be connected to the minus "B" battery binding post on the receiver as the negative circuit of the "B" battery is completed to the "A" battery in the audio frequency amplifier.

The type of tube to be employed in this audio frequency amplifier circuit is a matter of preference. If WD-11, WD-12 or UV-199 tubes are used, employ a 1½ volt "A" battery for the first two types and a 4½ volt "A" battery and 25 to 30 ohm rheostats for the last mentioned type. "B" voltages from 45 to 60 can be safely utilized. If UV-201A or Western Electric E tubes are used, a six volt "A" battery will be required, and 25 ohm rheostats if one of the first two mentioned types of tubes are employed. "B" voltages from 45 to 100 may be used.

Circuit No. 64. Where an audio frequency amplifier is desired, which will give very little distortion, three stages of resistance coupled amplification are recommended. Distortion is always present when audio frequency transformers are employed, as there is a considerable drop of potential across the resistances, thus making the effective plate voltage a good deal lower than the actual voltage of the "B" battery.

This circuit is shown to be used in conjunction with any standard receiving circuit and is arranged so that the "A" and "B" batteries are common to both. The return circuit to the filament of the first resistance R is completed through the receiver as the



A three stage resistance coupled audio frequency amplifier circuit

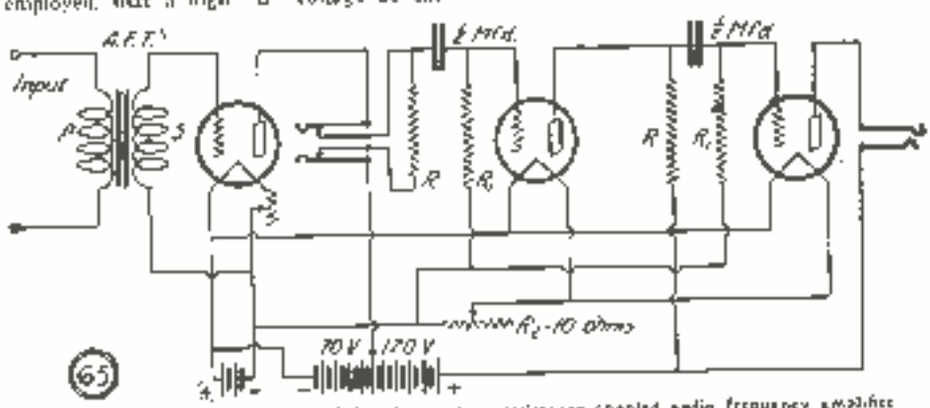
amplifier is not applied to the grid of the tubes. The resistances shown as R1 are ordinary grid leaks of approximately ½ megohm resistance. Best results will be obtained with a rather high "B" battery voltage and 120 to 150 volts are recommended.

It is necessary, no matter the type of tube employed, that a high "B" voltage be employed, as there is a considerable drop of potential across the resistances, thus making the effective plate voltage a good deal lower than the actual voltage of the "B" battery.

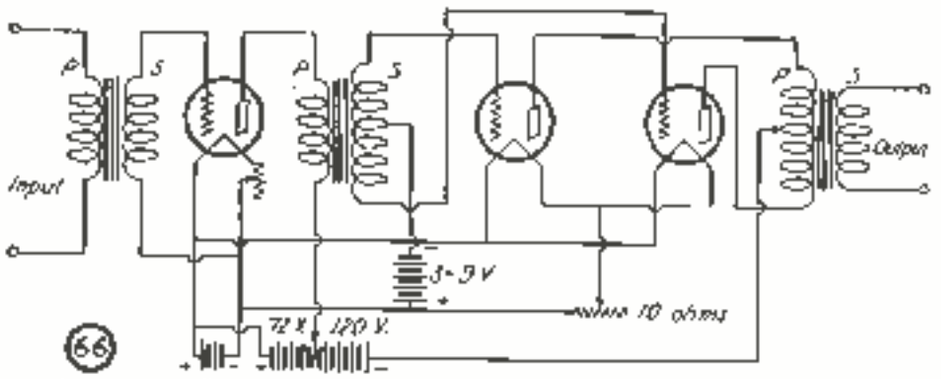
This circuit is shown to be used in conjunction with any standard receiving circuit and is arranged so that the "A" and "B" batteries are common to both. The return circuit to the filament of the first resistance R is completed through the receiver as the

Circuit No. 65. Here is a three stage audio frequency amplifier combining an audio frequency transformer and resistance coupled amplification. The audio frequency transformer is employed in the first stage and a double circuit jack is also used after the first amplifying tube so that the phones may be plugged in at this position. The grid condensers in the grid circuits of the last two tubes are of ½ mfd. capacity and the resistances R are approximately 50,000 ohms. The grid leaks shown as R1 are of ½ megohm resistance and are connected directly to the negative of the "A" battery. One rheostat of 10 ohms shown as R2, is employed to light the filaments of the last two tubes. The same "B" battery voltage may be employed for all three stages, but it is recommended that the last two tubes have a much higher voltage than the first. This amplifier may be employed with any standard one tube circuit and will give exceptionally good results.

The combination is exceedingly good



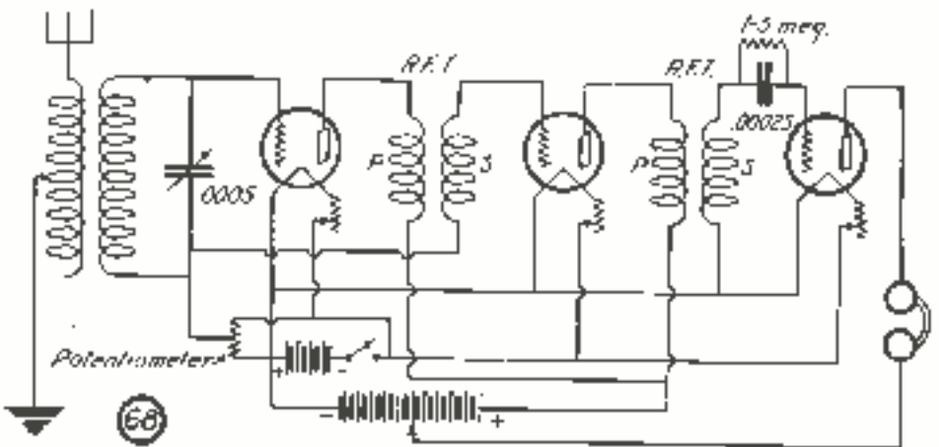
A single stage transformer coupled and two stage resistance coupled audio frequency amplifier circuit.



A two stage audio frequency amplifier circuit the last stage being a push-pull amplifier.

Circuit No. 66. Here we have a two stage audio frequency amplifier using the push-pull method of amplification. In a circuit of this kind three tubes are employed for two stages of amplification. It will be seen that special transformers are employed for the last two tubes. The secondary of the first transformer has its two opposite terminals connected to the grids of the tubes and the primary of the last transformer has its two end terminals connected to the plates of the tubes. These two windings have center taps which are connected to the negative filament and positive "B" battery respectively. It will be readily seen that while one end of the winding is negative, the other end will be positive and a continuous action will thereby be had which will eliminate to a great degree the distortion which is prevalent in the standard amplifier. This type of amplifier will also give greater volume on most stations received. Push-pull transformers are obtainable on the market, they being manufactured by a number of companies and sold in sets of two.

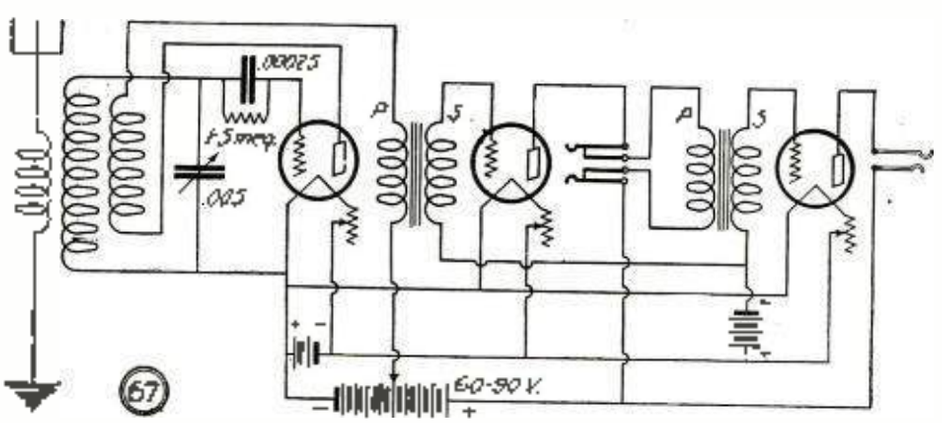
Circuit No. 68. Where long distance reception is desired, together with simplicity of tuning, the circuit shown here may be used. This consists of a tuner employing two stages of radio frequency amplification. As regeneration is not employed in this circuit, a coupler should be used which is capable of very loose coupling between the primary and secondary, otherwise the tuning will be broad. A variable condenser of .0005 mfd. capacity is employed across the secondary of the coupler for tuning. To avoid capacity effects, this condenser must be connected with the rotary plates to the filament. If a good make of radio frequency transformer is used, the tubes will oscillate and consequently a potentiometer must be employed so that this oscillation can be controlled.



Receiving circuit employing two stages of untuned transformer radio frequency amplification.

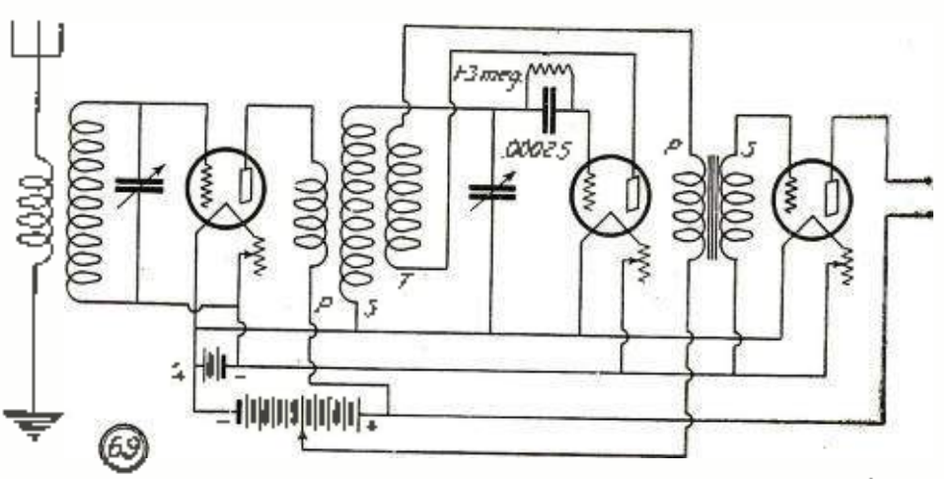
when a high voltage is used on the plates, as it cuts down the current consumption and helps toward the elimination of distortion.

Circuit No. 69. Here we have a circuit combining one stage of radio frequency with regeneration in the detector circuit. As one stage of audio frequency is also used, a loud speaker may be employed on practically all stations received. The antenna tuner consists of an untuned primary coupler without the rotor. The radio frequency transformer is an ordinary untuned primary coupler, like that described in circuit No. 28 of the August issue. The primary of this coupler must be wound with large wire, of not more than 20 turns. The secondaries of both couplers are shunted by variable condensers of .0005 mfd. capacity for tuning. Both condensers must be varied at the same time, as both secondary circuits must be in resonance before any station can be picked up. No potentiometer is necessary in this receiver, the grid return of the first tube being connected directly to the negative of the "A" battery. Properly handled, a circuit of this kind will be equivalent to one having two stages of radio frequency amplification and long distance stations will be easily picked up.



A regenerative receiving circuit and two stage audio frequency amplifier.

Circuit No. 67. Here is shown a regenerative receiver in conjunction with two stages of audio frequency amplification. The tuner in this receiver is an untuned primary coupler and was described in circuit No. 28 in the August issue. Audio frequency transformers are used in the amplifier and should not have a ratio higher than 5:1. A double circuit jack is inserted after the first stage so that the phones may be plugged in at this point. When the loud speaker is used, it is plugged into the single circuit jack after the last stage. If a good antenna is used with this receiver, fair volume will be obtained on the loud speaker on the first stage when local stations are received. The grid returns of the two amplifying tubes are connected together and run to the negative terminal of a "C" battery which will have a voltage of from three to nine volts, depending upon the voltage of the "B" battery. This "C" battery has its positive terminal connected to the negative of the "A" battery. A "C" battery is necessary



One stage of R. F., one stage of A. F. and regeneration in the detector circuit.

Correspondence from Readers

THE MARS RADIO CHECKUP

Editor, Radio News:

Your readers may be interested in knowing that important discoveries may result from the assistance given by the use of radio at the "Mars Checkup" conducted by a committee headed by Professor David Todd, the noted astronomer-physicist, under the auspices of the Aerial League of America.

Those of your readers who have records of the radio audibility covering one or more days between July 24 and September 24, 1924, can aid the Committee in ascertaining whether or not Mars' magnetism, or other factors, were responsible for the electromagnetic phenomena registered when Mars was close to the earth.

This Mars Radio Checkup may give the world more knowledge about the "ruddy" planet than has been obtained by astronomic study since Aristotle made his first observation of Mars 356 years before our era, or 2380 years ago.

All that Professor Todd needs from radio fans is a record of the radio strength at the time they listened to whatever happened to be on the air, with the approximate time when it was strong or faint. Reports covering a day or longer will be most helpful, but those covering an hour in a day will have value.

These reports should be addressed to Professor David Todd, Chairman of the Mars Checkup, Aerial League of America, 280 Madison Avenue, New York City.

This information will be tabulated and compared with similar tabulations of the magnetic variations registered for the same period of time, and data from astronomic observations of Mars and other data, and it is expected that the results will make it possible to ascertain whether Mars and other planets affect the earth's conductive media and aid or interfere with our radio communication.

The Aerial League of America had asked Professor Todd to ascertain, if possible, by a world-wide checkup, using radio astronomic and magnetic instruments:

(1) Whether the mysterious flashes on the surface of Mars heretofore registered by astronomers are likely to be huge curtains of auroral lights, from 300 to 500 miles deep, similar to the auroral displays that are registered in the Arctic and Antarctic regions of the earth, and caused by electro-magnetic discharges from the sun striking the planets' most intensive magnetic fields in the magnetic polar regions.

(2) Whether any electromagnetic disturbances took place on the earth within three minutes of the auroral flashes appearing on Mars, and whether these disturbances correspond in time sufficiently to justify a belief that there is an interplanetary electromagnetic effect playing upon the two planets at the speed of light, above 186,000 miles per second.

(3) Whether it is justifiable to hold that Mars has north and south magnetic poles and a magnetic equator the same as the earth, and whether they are sufficiently powerful as magnets for the earth to be affected as they present to each other intermittently their positive and negative poles in their daily rotation, as well as in their portion along their celestial orbits, and other motions.

(4) Whether the earth is as sensitive to the nearness of other magnetic bodies as all magnetic bodies are, and as compasses are sensitive to the changes of direction of terrestrial magnetism and whether radio reception is affected by the variations in the direction of the earth's magnetism, and whether it is affected by the disturbances created by auroral displays.

(5) Whether through the above or other phenomena the earth's conductive media for radio communication is aided or interfered with the nearness or position of other planets, or other phenomena yet undefined, acting upon the earth's radio conductive media as auroral displays have been shown to do by the data already secured in the 12-month Aurora Checkup started by the League a few months ago.

Scientists are placing great reliance on the results to be obtained by the radio checkup.

HENRY WOODHOUSE, President,
The Aerial League of America.

ABOUT THE "SIX TUBE RECEIVER OF ADVANCED DESIGN"

Editor, Radio News:

I wrote you September 3 in regard to first night's DX on your "Six Tube Receiver of Advanced Design" described in the September issue, and requested a little information regarding best aerial to use. Tried it out on an aerial using "Radio in the Home" formula but it did not balance. So I am still using it with a small variable condenser in the aerial circuit.

Would say that the set has brought in California stations 11 different nights, including KPO, KFI, KFI and KGO; this was practically every time KGO had operated. Several nights with WSAI on the air, KGO was brought in perfectly, and I shifted from KGO to WSAI with the vernier of the second condenser throughout the evening. On September 1, WSAI seemed to have moved over to KGO's wave and I was unable to tune either clearly; however, with the setting on WSAI I immediately picked up KGO when WSAI shut down, and shortly after got that station on the speaker, when I heard a talk by the Superintendent of Schools of Oakland, followed by Joseph Henry Jackson literary editor, with an eulogy on Wallace Irwin. During this broadcast I used a UV-199 tube in the R.F. circuit with about 90 volts on the plate of the RF tube, and with careful tuning seemed to advance the tickler to a higher point without spilling, actually bringing KGO in with the clearness of an eastern station. WFAA, Dallas, Texas and Fort Worth were nearly as good earlier in the evening. Seventy stations were logged in one night's test recently. However, picking up the Pacific Coast 11 times in 12 tries, between September 3 and September 15 inclusive, proves the set is exceptionally good on DX, the one failure being caused by heavy static. I will experiment further on this with English stations as soon as the evenings become longer.

B. H. TAYLOR,
Haverhill, Mass.

NOT A BAD IDEA

Editor, Radio News:

I suggest the following plan to get more applause cards:

(1) Radio Listener has on his table a pencil and a few dozen pieces of paper about two inches square. He listens to a program, likes it, and then writes on one of the slips something as follows:

To WNAC.
Ukelele concert great.
John Doe.
Bank Street.
Boston, Mass.

(2) Once or twice a week he collects the slips, puts them all in one envelope with a two-cents stamp and sends them to the local broadcast station.

(3) Local station assorts slips from the various senders, in piles, each one containing slips sent to a specific station.

(4) One to seven times a week, depending on number, local station sends slips for a specific station to them, putting them in one envelope with needed postage.

Thus the individual BCL sends large number of applause cards at lowest possible expense, and the broadcasters, by mutual cooperation, will get lots of "applause."

H. FLAGELMAN,
37 Schuyler Street,
Boston, Mass.

NEUTRODYNE VS REGENERATIVE SET

Editor, Radio News:

Upon reading an article in Radio News, written by A. L. Groves, in regard to the Neutrodyne receiver, I discovered what appeared to me to be an inaccurate statement of the results usually obtained from such a receiver as compared to a *good* regenerative set, and wish to give my experience as well as observation of the two receivers. The statement I refer to is contained in paragraph five of the article where Mr. Groves in substance says that the Neutrodyne is the equal of a regenerator only on strong signals and that the regenerative set will pick up weak signals that will not be audible on a Neutrodyne. To a person who has used both receivers the statement needs no correction, but for those unfamiliar with the results of the Neutrodyne it does.

Facts upon which I base the statement that the Neutrodyne gives louder results on the same signal than a *good* regenerator follow: I travel over the State of Texas, a place far removed from the principal broadcast stations and where one must have a good receiver to get loud speaker results. For the past two years I have taken particular notice of radio receivers that were used throughout the state, in such places as drug stores, electric shops and radio stores. At most of those places during the early part of last winter a set put out by the Radio Corporation and known as the "RC" was used, a single circuit receiver, a regenerator and a set that gave good results. Always in connection with this three tube receiver you would find some type of power amplifier, either one or two stages. I also found in use other types of receivers such as Ken-

(Continued on page 1008)

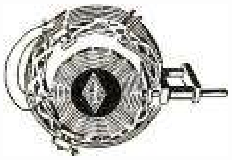
RADIO NEWS LABORATORIES

RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratories tests, 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

GEN-WIN LOW LOSS TUNER

Selectivity in a receiving set is obtained only by the use of low loss instruments in the radio frequency circuits. This is especially true of variable condensers and tuning coils. Insulating material causes losses, and as little insulating material as possible should be used in the construction of the instrument. The Gen-Win tuner employs a stagger wound secondary,



spider-web tickler and a bare wire silver plated primary outside of the secondary. Three small clamps of insulating material are used for supporting the instrument as the illustration shows. It covers a range of 150 to 550 meters when used with a .0005 mfd. variable condenser. Manufactured by the General Radio Winding Co., 214 Fulton Street, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 558.

PALL MALL VARIOCOUPLER

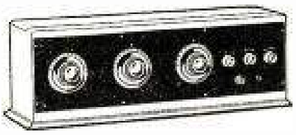
The Essex Manufacturing Co., 117 Mulberry Street, Newark, N. J., submitted a sample of their improved Pall Mall 180-degree variocoupler. This coupler employs two windings, primary and secondary. The primary winding is provided with eight taps. On the last tap

it covers a range of 320 to 1,000 meters when used with a .0005 mfd. variable condenser. The instrument is small in size and may be conveniently mounted in a set. Either single or double circuit may be used.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 560.

DERESNADYNE RECEIVER

This is a five tube receiver of excellent electrical and mechanical construction. It consists of two stages of tuned radio frequency amplification, detector, and two stages of audio amplification. Low loss variable condensers and spider-web inductances are used in the radio frequency amplifier. It is a non-neutralized receiver, but a variable resistance of about 100,000 ohms maximum is connected in the plate circuits of the radio frequency tubes for stabilizing the circuit. This



gives a very fine degree of control and the selectivity of the receiver is thereby increased considerably. A switch is provided for connecting to the first stage, second stage or off positions. Manufactured by the Andrews Radio Co., 327 South La Salle Street, Chicago, Ill.

Arrived in excellent packing.

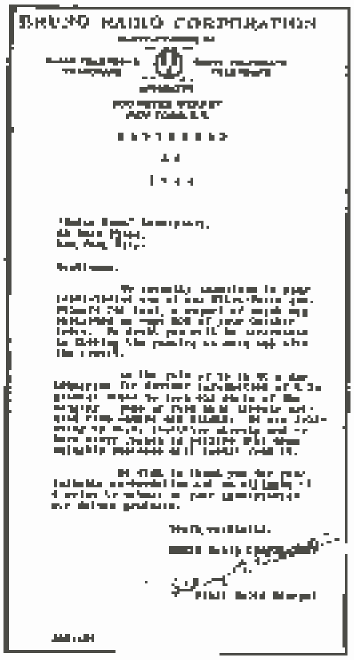
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 576.

HARMONIK TRANSFORMER

The Harmonik All-Stage Resistance audio frequency transformer manufactured by the Karas Electric Co., 4040 North Rockwell Street, Chicago, Ill., is of heavy construction and operates with uniform efficiency over practically the entire audio frequency range. The voltage amplification curve is exceptionally flat and extends far into the lower frequencies. An average amplification of from four to four and one-half is obtained. The instruments cause very little distortion and the quality of the reproduced concerts is exceptionally good. The transformer is entirely protected and shielded by a metal casing.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 562.



BRUNO RADIO CORPORATION

BRUNO TUNER

This tuner comprises primary, secondary and tickler windings of Litz wire wound on bakelite tubes. The instrument is very neat in appearance and of rugged mechanical construction. When used with a .0005 mfd. variable condenser it covers a wave-length range of 175 to 560 meters. Excellent results were obtained with this tuner when used in a three tube receiver. It is manufactured by the Bruno Radio Corporation, 303 Water Street, New York City.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 561.

AIR CORE TRANSFORMERS

When shunted by a .0005 mfd. variable condenser, this transformer covers a wave-length range of 230 to 625 meters. This secondary is wound honeycomb fashion and the primary is bank wound on a cardboard tube over the secondary. The transformer is equipped with an angle bracket for mounting. Three of these transformers will make an excellent two stage tuned radio frequency receiver. Manufactured by the General Manufacturing Co., 7614 South Shore Drive, Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. [illegible]

EVEREADY "B" BATTERY

The Eveready No. 770 heavy duty 45 volt "B" battery is specially designed for use in multi-tube receiving sets where there is

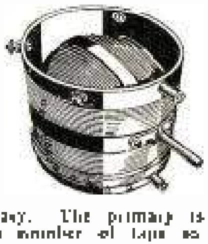
a heavy drain from the "B" battery. The normal rating of this battery is from 15 to 20 milliamperes. Those who have multi-tube receivers will find a rugged battery of this type less expensive in the long run than smaller batteries. As shown in the illustration this battery is provided with a 22½ volt tap. Manufactured by the National Carbon Co., Inc., Thompson Ave. and Orton St., Long Island City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 575.

SHEPCO COUPLER

The illustration shows the Shepco All-Wave Junior DX coupler. This instrument comprises a [illegible] and bank wound primary and a rotary



secondary. The primary is tapped with a number of taps so as to cover a wide wave-length range. The construction of the coupler is very simple and it responds with efficiency throughout the entire range. Manufactured by the Shepard Potter Co., Inc., Plattsburg, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 566.

GOODRICH RADIO PANEL

The Goodrich radio panels are made in highly finished black and mahoganite hard rubber. These panels are very accurate and are easily machined. A minimum amount of sulphur is used in the material so that it does not turn green with age as some cheaper grades of hard rubber usually do. The material was tested for losses at a frequency of 1,000 cycles and a phase difference angle of 2 degrees 11 minutes was obtained. This small phase difference angle indicates that the material is one of the best obtainable for radio use. Manufac-

ured by the B. F. Goodrich Rubber Co., Akron, Ohio.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 575.

GOODRICH HARD RUBBER TUBES

As hard rubber is one of the best insulating materials for use in the construction of radio instruments, it is of course advisable to use hard rubber tubing for supporting radio coils. The B. F. Goodrich Rubber Co., Akron, Ohio, recently placed on the market suitable hard rubber tubes for this purpose. Although the tubes have only a 1/16-inch wall, they are strong enough for the usual windings.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 576.

DAVENPORT LOW LOSS TUNER

The Davenport low loss tuner comprises three stagger wound coils, consisting of primary, secondary and tickler. This tuner is manufactured by the Davenport Radio Laboratories, 847 Cedar Street, Davenport, Iowa. As shown in the illustration, very little insulating material is used for supporting the windings. The coupling be

tween the primary and secondary, and between tickler and secondary is variable. This allows a maximum selectivity. This instrument covers a wavelength range of 175 to 600 meters when used with a .0005 mfd. variable condenser.

Arrived in fine packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 559.

RADIO FREQUENCY TRANSFORMER

A wavelength range of 230 to 575 meters is easily covered with this fixed radio frequency transformer, provided a good low loss tuner is used in the grid circuit of the first tube. When so used, the circuit oscillates freely throughout the above range and the oscillations

are easily controlled by a suitable potentiometer. The transformer is small in size and easily mounted. It is manufactured by the Uptegraff Electric and Manufacturing Co., 1108 National Bank Building, Pittsburgh, Pa.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 557.

SHEPCO SINGLE TUBE RECEIVER

This receiver is furnished all assembled with leads brought to a row of binding posts in the top of the panel and separate bus bar connections supplied, so that the experimenter may connect it up and use any circuit he desires. The directions furnished with the receiver show several circuits that may be used. The receiver consists of a Shepco rheostat, variable condenser, vacuum tube socket and the necessary accessories. A tap switch is provided for changing the wave length range which may be covered. On the last tap a range of 500 to 1,000 meters is obtained. Manufactured by the Shepard Parts Co. Inc., Plattsburg, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 561.

LEGO FIXED DETECTOR

The Lego fixed crystal detector is enclosed in a glass tube fitted with metal end caps and binding post. The detector is small in size and can easily be connected in any part

of the receiver. This detector is very good for reflex receivers and works well in the ordinary crystal set. The three samples submitted by the Lego Corporation, 607 West 42nd Street, New York City, were all very sensitive and uniform as regards sensitivity. The resistance of this detector is about four times as great with the current passing through one direction as the other.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 554.

RADIO CRYSTAL DETECTOR

This is a very neat crystal detector that may be panel or base mounted and is constructed of two parts so that the crystal holder can be easily exchanged. The novel features of this detector are the means or micrometer adjustment provided and the use of an insulated metal screen in front of the crystal. The purpose of this screen is to hold the cat whisker in a fixed position so that its pressure on the crystal can be regulated without

having it slip off the sensitive spot. This detector is manufactured by the Electric City Novelty and Manufacturing Co., 126 Odell Street, Schenectady, N. Y.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 560.

TWIN DRY CELLS

The Twin Dry Cell Battery Co., 11401 Madison Ave., Cleveland, Ohio, submitted samples of their general duty No. 6 1½-volt Du-Al dry cells, No. 211 1½ Twin Radio dry cell, and No. 62 1½ Twin Radio Special cell battery. These dry cells are of somewhat different construction than the usual type. The number six cell is of the standard size and construction. The number 211 is somewhat larger in

size and has a greater output. The 62-cell battery is larger than the other two and is specially designed for radio work where long life is required. The illustration shows the number six type. All of these cells gave excellent service for a considerable length of time.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 571, 572 and 573.

REMLER VARIABLE CONDENSER

The Remler variable condenser is of a radically different construction than the familiar type. Instead of the usual rotary and stationary plates, this condenser has two sets of plates mounted so that both swing and mesh into each other. Each set of plates is mounted on a shaft geared to the dial shaft and one complete turn of the dial varies the condenser from maximum to minimum. On account of this special design the condenser has the

extremely low maximum capacity of 340 mmf. The maximum capacity is 518.98 mmf. The dielectric absorption losses at 1,000 cycles with the condenser set at maximum capacity are equivalent to a series resistance of 169 ohms. The plates are shaped so as to give practically a straight line wavelength curve on the first 180 degrees of the dial and a straight line capacity curve for the remainder. This instrument is manufactured by the Remler Radio Manufacturing Co., 192 Sansome Street, San Francisco, Calif.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 555.

THE KANT-BLO SIGNAL POST

This is merely a binding post for the negative "B" battery connection fitted with a series resistance and a signal lamp. In case of a short circuit inside of the set that

would ordinarily burn out the vacuum tubes or ruin the "B" battery, this safety device limits the "B" battery current, saves the tubes and gives the signal to the operator by lighting the lamp. It is merely a protective device and is recommended for use on all receiving sets. Manufactured by the Kanter Manufacturing Corp., 120 Broadway, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 568.

THE KANT-BLO SIGNAL SWITCH

The Kant-Blo signal switch comprises both "A" battery switch and vacuum tube protective device. Only one hole is required for mounting and it is easily installed in the

set. It is fitted with a separate terminal for the negative "B" battery lead. In case of a short circuit outside of the set that would cause the "B" battery current to flow through the filament, the Kant-Blo device is fitted with a signal lamp and a resistance that limits the "B" battery current and saves the tubes. As the lamp lights up in case of a short circuit, the operator instantly knows where to look for trouble. Manufactured by the Kanter Manufacturing Corp., 120 Broadway, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 567.

CALIBRATED TRANSFORMER

The Calibrated audio frequency amplifying transformer manufactured by the National Airplane Corp., 16 Hudson Street, New York City, embodies all the latest improvements in audio frequency transformer design. It operates with high efficiency over the entire audio frequency range, and the voltage amplification curve is exceptionally flat and extends far into the lower frequencies. An average

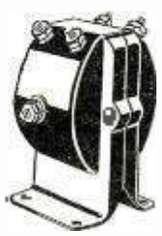
amplification of 5 to 5½ volts is obtained throughout the entire range. The core is clamped with a metal casing and no holes are drilled through the iron. The ends are protected with bakelite shielding so that electro-static coupling between the plate and grid circuits is reduced.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 574.

PRECISE PUSH-PULL TRANSFORMERS

Although small in size the Precise push-pull transformers give excellent results throughout practically the entire audio frequency range.



The voltage amplification curves of the input transformer, No. 390, measured between the center terminal and each outside terminal of the secondary, are practically identical. The curves extend well into the lower audio notes—in the neighborhood of 200 cycles—and consequently cause very little distortion. A voltage amplification in the neighborhood of two and one-half to three is obtained throughout the entire range. The output transformer, No. 561, is of the same general construction and appearance as the input type. Manufactured by the Precise Manufacturing Corporation, 214 Mills Street, Rochester, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 563.

KEYSTONE TUBE

The Keystone Electric and Radio Co., New York City, submitted three of their type 20-A tubes. Although no life tests were made on these tubes, all three gave very good results. The amplification factors range from seven and one-half to eight and one-half. The filament consumes one-quarter ampere at five volts. The tubes ampli

fy very well as oscillators, detectors and amplifiers and will stand 90 to 120 volts on the plate.

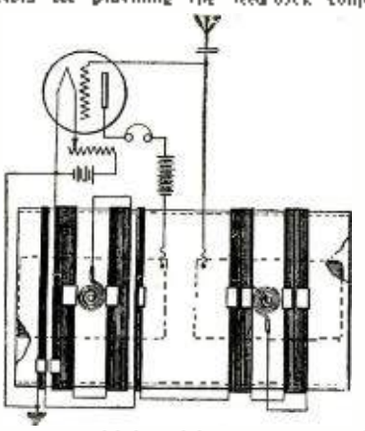
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 564.

By JOHN B. BRADY*

RADIO RECEIVING CIRCUIT

(Patent No. 1,490,331, M. C. Batsel. Filed Dec. 21, 1922, issued July 1, 1924. Assigned to Westinghouse Electric & Mfg. Co. of Pa.)

Radio receiving circuit employing the feed-back principle where the input and output circuits of an electron tube each are provided with variable inductors for providing the feed back coupling

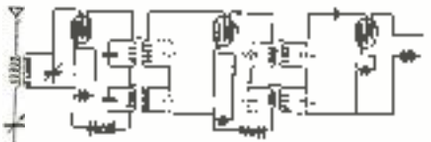


there between. Additional inductance is provided in each of the circuits for establishing such additional feed-back coupling that the degree of regeneration is substantially independent of all adjustments of the inductor in the input circuit of the tube. The circuit arrangement provides a compact radio receiving set.

METHOD AND APPARATUS FOR ELECTRICALLY TRANSFERRING ELECTRICAL OSCILLATORY ENERGY

(Patent No. 1,458,828, H. W. Houck. Filed March 29, 1920, issued Dec. 13, 1922.)

Method and apparatus for selectively transferring electrical oscillatory energy of any frequency or frequencies lying within a continuous band of frequencies from one electrical system to another.

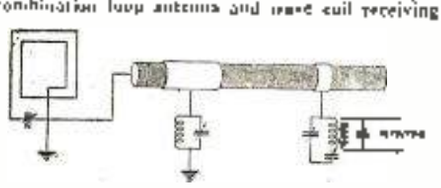


This patent shows an electron tube amplifier in which the input and output circuits of the several tubes are coupled by means of a series of oscillatory circuits tuned to different frequencies. Each circuit is resonant to a different frequency so that the circuit has a highly efficient collective effective range of resonance which includes the band of frequencies.

ELECTRICAL SIGNALING

(Patent No. 1,494,370, J. O. Stenzinger et al. Filed July 26, 1922, issued Aug. 12, 1924.)

Electrical signaling wherein radio signals may be received substantially free of interference by a combination loop antenna and wave coil receiving



circuit. The loop antenna is closed through a variable condenser and connected at one point to ground and to the terminal of a wave coil. The receiving apparatus is coupled by means of a movable ring to the wave coil which is moved along the wave coil to a position for best operation.

ELECTROSTATIC CONDENSER

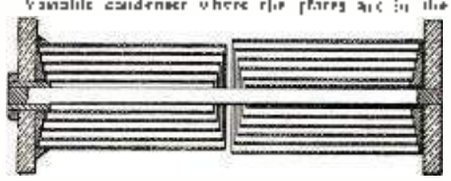
(Patent No. 1,504,082, E. Thomson. Filed Nov. 13, 1920, issued Aug. 5, 1924. Assigned to General Electric Co. of New York.)

Electrostatic condenser for high power operation where the condenser is constructed in a stack of thin sheets of alternate conducting material and insulating material. The feature of the invention is the insertion of heat conducting sheets between the several condenser sections for conveying away heat developed in the condenser.

VARIABLE CONDENSER

(Patent No. 1,502,860, D. S. McCrum. Filed Nov. 24, 1923, issued July 29, 1924.)

Variable condenser where the plates are in the

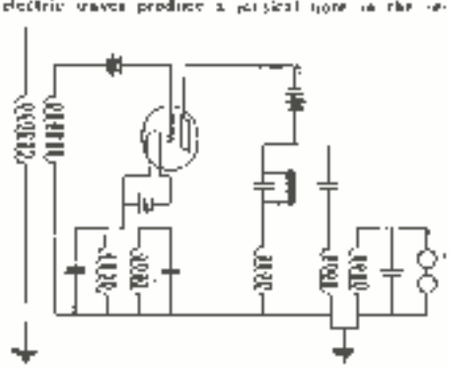


form of cylinders arranged to interpose one within the other forming extended cylindrical capacity areas.

TONE PRODUCING RADIO RECEIVER

(Patent No. 1,502,858, M. L. Pupp et al. Filed Feb. 14, 1916, issued July 29, 1924. Assigned to Westinghouse Electric & Mfg. Co.)

Tone producing radio receiver, wherein the receiving amplifier is arranged to repeat the incoming waves at an amplitude which varies periodically at an audible frequency so that the resultant electric waves produce a musical tone in the re-



ceiving system. An electron tube circuit is provided at the receiver with a filter coupling the input and output circuits thereof, the filter including a plurality of like units, each unit comprising two reactances of opposite sign with all the reactances of one sign connected in series and all those of the other sign connected in parallel whereby electrical currents are repeated at a periodically varying amplitude.

SYSTEM FOR TRANSMITTING ENERGY WITHOUT WIRES

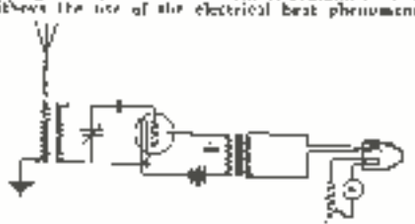
(Patent No. 1,504,974, C. Reed. Filed March 8, 1920, issued Aug. 12, 1924.)

System for transmitting energy without wires in a confined path in any direction. A spirally revolving magnetic field is produced in a pair of symmetrically segmented conductors. A parabolic reflecting circuit is arranged for focusing the magnetic field in a desired direction.

METHOD OF AND APPARATUS FOR ELECTRICALLY TRANSMITTING INTELLIGENCE

(Patent No. 1,503,508, C. D. Thiel. Filed Oct. 27, 1920, issued July 29, 1924.)

Method of and apparatus for electrically transmitting intelligence in the form of sustained waves wherein the use of the electrical heat phenomena.



The signals are caused to produce a high frequency and at a point adjacent the production of such high frequency a magnetically produced sound wave is generated. The sound wave produced by the incoming signal combines with the mechanically produced sound wave to produce a wave beat of audible frequency for observing the incoming signals.

MEANS FOR PROTECTING RADIO OUTFITS FROM STATIC DISTURBANCES

(Patent No. 1,504,600, O. A. Bracken. Filed Jan. 16, 1919, issued Aug. 12, 1924. Assigned to Westinghouse Electric & Mfg. Co.)

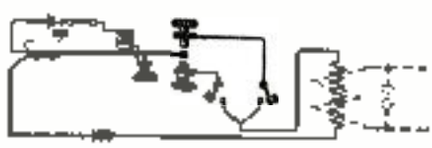
Means for protecting radio outfits from static disturbances wherein the major portion of the energy of static disturbances is shunted around the receiving apparatus so as to be substantially ineffective in disturbing the receipt of signaling impulses. A pair of rectifying devices are connected in shunt with each other and placed directly across the receiving circuit.

SECRET SYSTEM FOR RADIOTELEGRAPHY

(Patent No. 1,505,055, A. R. Nallins. Filed May 19, 1922, issued Aug. 12, 1924.)

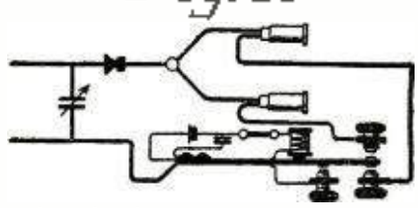
Secret system for radiotelegraphy wherein a

Fig. 1.



tuning fork is provided at both the transmitting and receiving stations and arranged to vibrate in synchronism to close sets of contacts connected in different circuits whereby one series of signals

Fig. 1a

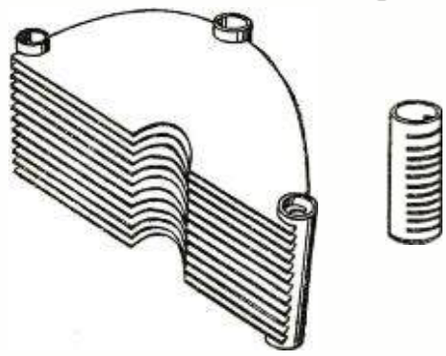


may be radiated through the spaces of another series of signals. The messages are therefore transmitted in mixed relation and separated by a synchronized device at the distant receiving station.

VARIABLE PLATE ELECTRIC CONDENSER

(Patent No. 1,500,528, F. R. Rathbun. Filed July 3, 1922, issued July 8, 1924.)

Variable plate electric condenser having cast in



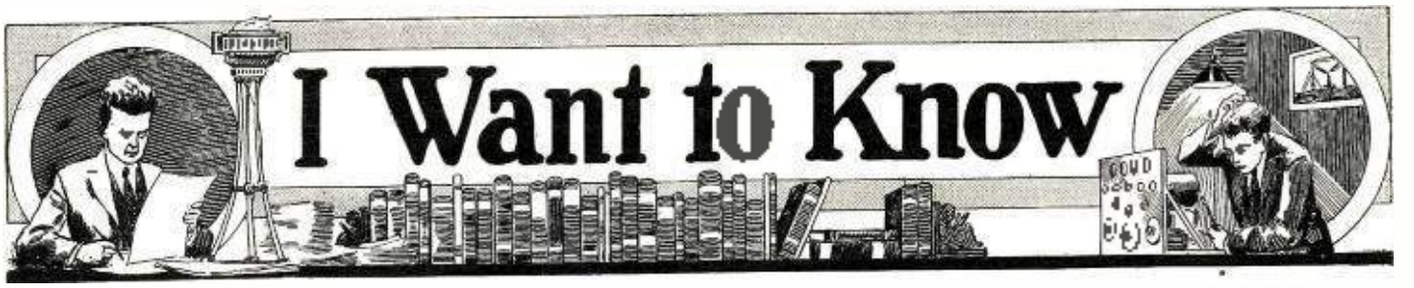
stationary and movable plates for facilitating the protection of the instrument. The stationary plates are supported at three points about the periphery thereof by cast metal poured into slotted tubular members. The movable plates are similarly supported by a slotted tubular member in which molten metal is poured over the plates.

TUNING SYSTEM OF ANTENNAE

(Patent No. 1,502,848, P. Conrad. Filed July 7, 1923, issued July 29, 1924. Assigned to Westinghouse Electric & Mfg. Co.)

(Continued on page 1028)

*Patent Lawyer, Ouray Building, Washington, D. C.



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. The 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 pencilled 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 charged.

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

INVERSE DUPLEX RECEIVER

(2053) Mr. Henry Smith, Plainfield, N. J., asks:

Q. 1. Please publish a picture diagram of the Inverse Duplex Receiver.

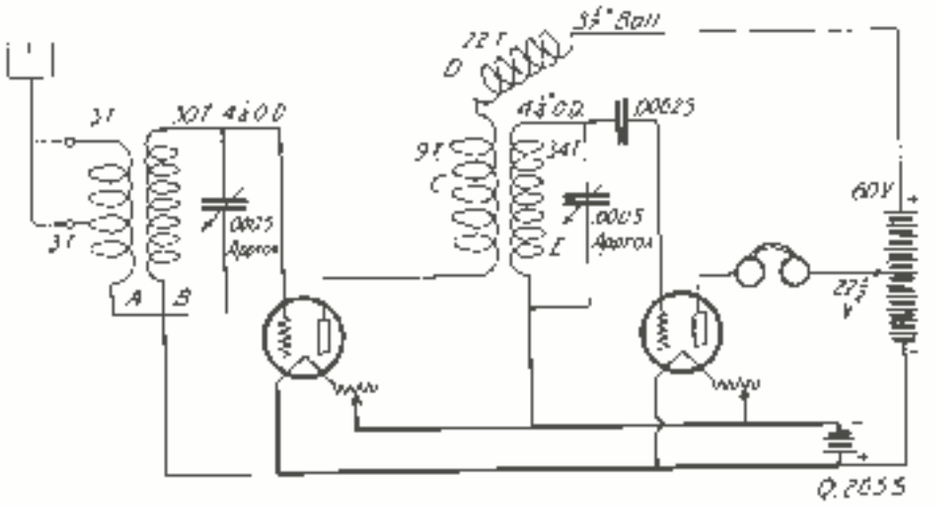
A. 1. The diagram is shown in these columns.

Q. 2. What suggestions can be made for correct construction of this receiver?

A. 2. A tapped loop may be used, as shown, or a standard loop may be used. High ratio audio frequency transformers introduce considerable distortion. We recommend ratios of the order of 3 1, unless of course, a crystal detector is used. Additional stability is had by connecting grid return leads "A" and "B" to individual potentiometers of about 200 ohms. This results in a better control of the grid voltages of the tubes being refleved. Should the potentiometers be used, it will not be necessary to use by-pass condenser "C-1." If desired, grid return "C" may be connected to "A" plus, or to the negative connection of a small "C" battery. This results in a wide control of the grid voltage of the detector tube, resulting in maximum efficiency of this tube. Only the very best of tubes can be used in a reflex receiver, with anything like satisfactory results. It is also very important to have well-designed radio frequency transformers, low loss condensers are also a necessity. This latter is due to the fact that regeneration is not present to reduce the effects of resistance present in poorly designed condensers. The battery voltages used must be determined by test. Reversing primary leads is often helpful in reducing or eliminating audio frequency howls that occasionally develop in such receivers. Fixed condensers, or resistances, placed at proper locations determined by experiment, are also often helpful.

Q. 3. Can a "B" battery be constructed from home-made cells, employing carbon and zinc, in some manner?

A. 3. A very satisfactory battery may be built up with cells constructed in the following manner: Secure as many carbon rods, 5mm old dry cells, as there are cells wanted. Heat these in a very hot red. After they have cooled to a point where they will not ignite paraffin, dip them in melted paraffin and leave them there until they are saturated. Then drill quarter inch channels for nearly the entire lengths of the rods. A zinc wire about a .064-inch diameter forms one electrode, of which the carbon tubes form the other. This wire is of such a length, and is bent in such a fashion, as to reach over to the next carbon tube to the outside of which it is fastened. It can be tightly bound thereto by means of wire. These carbon tubes are insulated from each other. The zinc wire is insulated from the carbon tube by means of a couple of pieces of soft rubber, one piece being fastened to the top of the zinc wire, so as to prevent it touching the bottom of the carbon tube. The tubes are filled with an electrolyte consisting of water, 1 part; salt ammoniac, 3 ounces, zinc chloride, 1 ounce. Paraffin oil spread over the top of the nearly filled tubes will prevent rapid evaporation of the electrolyte. As a protection against corrosion, all exposed metal parts should be well insulated by an application of the paraffin.

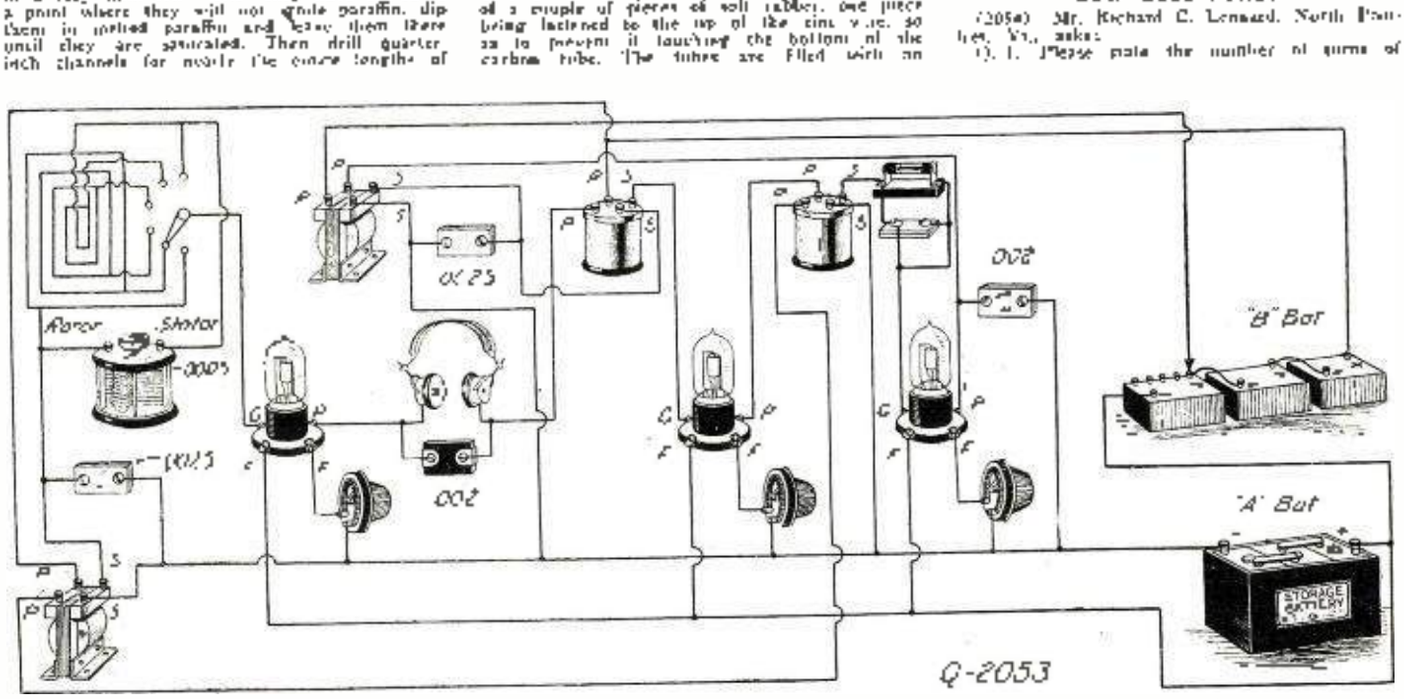


The new Superdyne circuit is a distinct advance over the old one. The quality of reception will please the most critical. The amount of distortion caused by an additional audio frequency amplifier will depend upon the perfection of the amplifier design.

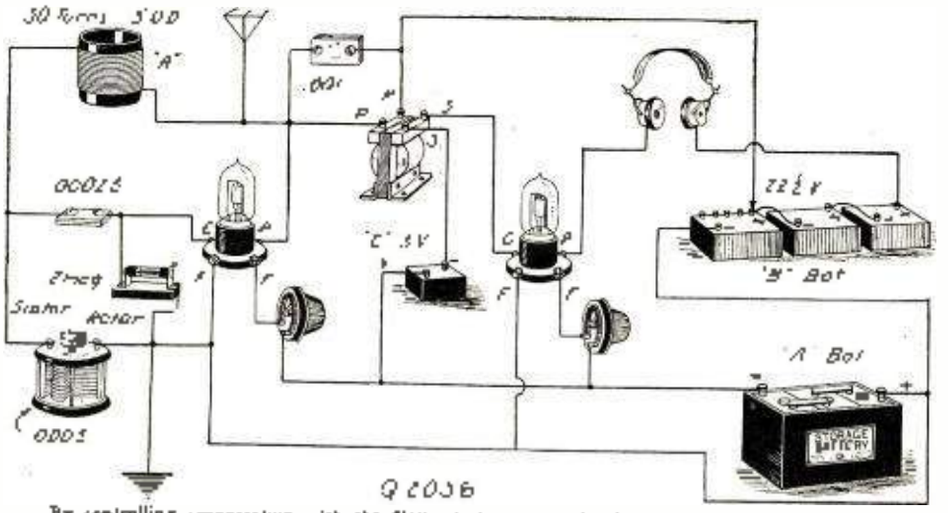
LOW LOSS TUNER

(2054) Mr. Richard C. Leonard, North Plainfield, N.J., asks:

Q. 1. Please state the number of turns of



The Improved Inverse Duplex circuit. As with most reflex receivers, exactly the correct apparatus must be used, in exactly the correct way. The particular feature of this circuit is the equalizing of the load imposed on the tubes.



By controlling regeneration with the filament rheostat, and using the correct constants, it is possible to make a sensitive receiver with only one tuning control, the variable condenser. This is the best regenerative circuit ever used. A power detector tube will give particularly good results in this circuit. Vary the grid leak for best signal strength from distant stations.

were used in the General Radio Winding Co's broadcast coupler

A. 1. Primary, 10 turns of No. 14 bare copper wire; secondary about 50 turns of No. 18 D.C.C. wire; tickler, about 50 turns No. 23 D.C.C. wire

Q. 2. Is this a low loss arrangement?

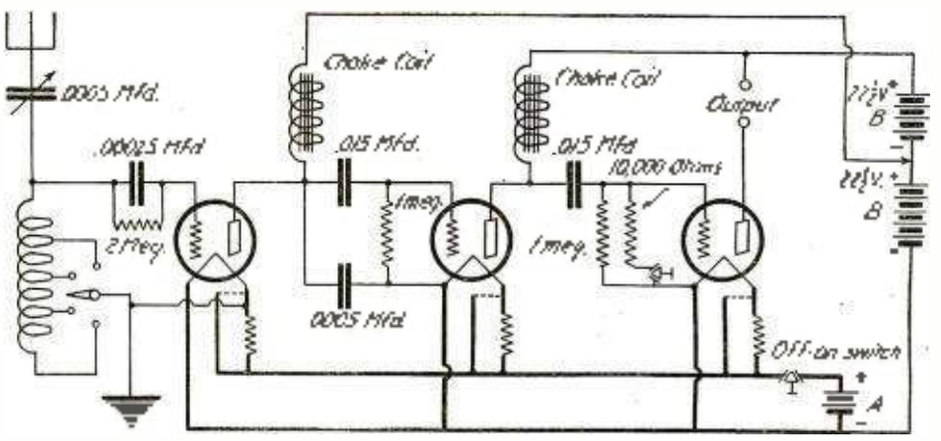
A. 2. This coil employs the better principles of coil construction. For example, all insulation is of hard rubber. Only three supports are used for holding the set of three coils. The primary winding is insulated almost entirely by air. It is in the form of an ordinary solenoid, but with the turns well spaced. A peculiar form of winding, Lorenz type basket-weave, is used for the secondary. The tickler is wound in spider web form resulting in very slight coupling at its nearest to zero setting.

THE NEW SUPERDYNE

(2045) Mr. W. B. Campbell, Marshall, Wis., asks:

Q. 1. Please show the wiring diagram and give constructional details for the new Superdyne receiver.

A. 1. The circuit is shown in these columns. Note that the new Superdyne is quite different from the old one. The two tuning condensers have been combined in one control. The remaining control is that of the negative feedback, if such it may be called. The most important point to observe in the construction of this receiver is to keep inductances A and B in non inductive relation to inductances C, D and E. Should the inductances couple in any extent, it will not be possible to neutralize the set. With coils A and B separated from C, D and E about 6 inches, it was not found possible to prevent oscillation only coils A and B had been turned to exactly the right angle to the other inductances, a variation of 30 inch being sufficient to throw the set out of balance. Also note that coil A consists of only nine turns. Set it is so wound as to take up the entire winding space of coil B, over which it is wound. This also holds true for coil C. Special condensers of 25 plate size are used. The rotor, D, should be rotatable through 180 degrees zero coupling being at 90 degrees from either extreme. No detector grid leak is used, sufficient leakage being furnished by the condenser itself. UV 201A or C-301A tubes are used in both positions. Note the absence of a phone condenser.



A variometer used in place of the single tuning inductance shown will result in considerably sharper tuning. Audio frequency transformer secondaries make excellent choke coils for such a circuit. Being non-oscillating, this receiver cannot radiate, but sensitivity is sacrificed thereby. This is a Signal Corps Airplane receiver.

Q. 2. What is the advantage of a "B" battery with several taps?

A. 2. Tubes work best with a certain voltage on the plate. This value is most critical for detector tubes. A difference of 2½ volts will often make the difference between the set working well, or working poorly. In the case of some tubes that are used. This is particularly true of tubes designated as being "soft" (having a low vacuum), or "gassy" (having certain gases inside, either by design, or as a result of the tube having been in operation for some time. The continued use of a tube sometimes liberates a sufficient amount of gas from the glass, and from the elements of the tube, to cause a radical change in its operation. Modern tubes are considerably more stable in operation than the older ones and the critical point will be found very close on 22 volts, usually. Some of the older tubes were so variable that it was not unusual to find one that would work perfectly with only three or four volts on the plate. It controlled by a switch, the taps must be so spaced that the switch arm will not connect two working contacts at the same instant, since this would short circuit part of the battery.

Q. 3. Will the insertion of a variometer between the aerial and the plate, in an ultra audion circuit, cause the set to be regenerative?

A. 3. This is a regenerative circuit without the addition of the variometer. Should you find that the set does not oscillate, it will be necessary to locate the fault which may be a poor tube, wrong "B" battery voltage, wrong connections, poor connections, or poor instruments.

TRANSFORMER MARKINGS

(2054) Mr. H. Henderson, Detroit, Mich., writes:

Q. 1. Please show a picture diagram of a standard Super-Heterodyne.

A. 1. This diagram would take up considerably more space in this department than is available if shown in picture form. The schematic circuit was shown in the September, 1923, issue of RADIO NEWS, in the I Want-To-Know department.

Q. 2. Please show the picture diagram of the correct circuit for the ultra-audion regenerative receiver, with one stage of audio added.

A. 2. This circuit is shown in these columns, to the number you request. Any type of inductance, such as a variometer, honey-comb, spider-web, or plain tapped coil may be used for "A". A smaller variable condenser may be used, if desired, depending upon the particular inductance construction adopted.

Q. 3. Why are radio frequency and audio frequency transformers in diagrams not marked with the numbers to designate the connections, the same as the manufacturers?

A. 3. Different makes of transformers have different markings, thus making such a procedure impossible. Just remember to connect the outside secondary lead of transformers to the grid, and the primary connection will usually take care of itself. Reversing the primary leads may improve reception a little.

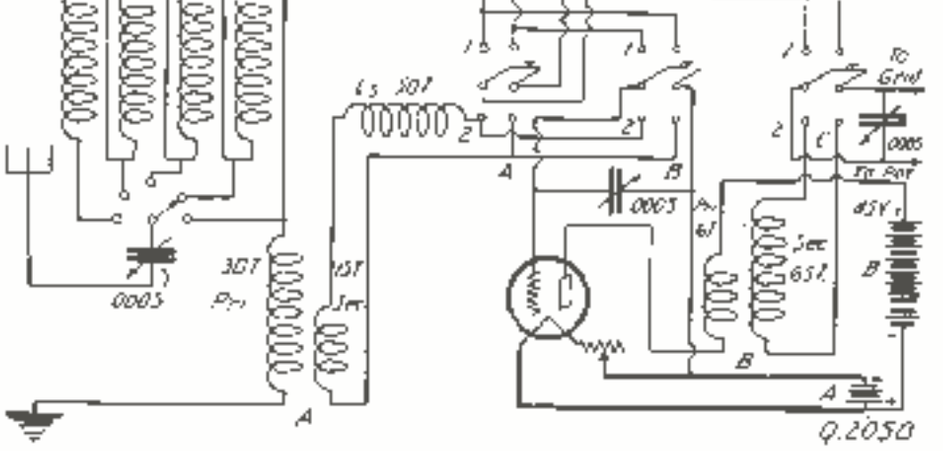
S.C.R.-54 AIRPLANE SET

(2057) Mr. Edwin Thompson, Olmstead, Okla., asks:

Q. 1. Please show the diagram of the Signal Corps Airplane Receiving Set, type S. C. R. 54, manufactured by the Western Electric Co.

A. 1. This diagram is being shown in these columns. This receiver was designed for W. E. type VT-1 tubes. Nevertheless, standard tubes will give excellent results in this circuit. Only one dial is necessary for tuning. This receiver will require a rather short aerial, if maximum selectivity is desired. The circuit is a standard non-regenerative one with two stages of impedance, or choke coil amplification. Considerably greater signal strength would result by the interposition of some sort of inductance such as a variometer, or a tapped coil, in the plate circuit of the detector to give regeneration. However, maximum quality of reproduction results in the system employed in this receiver. The choke coils may be made in the following manner: Wind a core about two inches long and one-half

(Continued on page 1010)



This radio frequency amplifier has been designed to be adaptable to any set using a loop. Some Super-Heterodynes are exceptions. The switches must be well insulated; their bases should be tested for leakage by means of headphones and a battery of about 60 volts. Correct layout of the apparatus is another important consideration.

With the Sea-going Op's

This "Service Farce"

By HOWARD S. PYLE

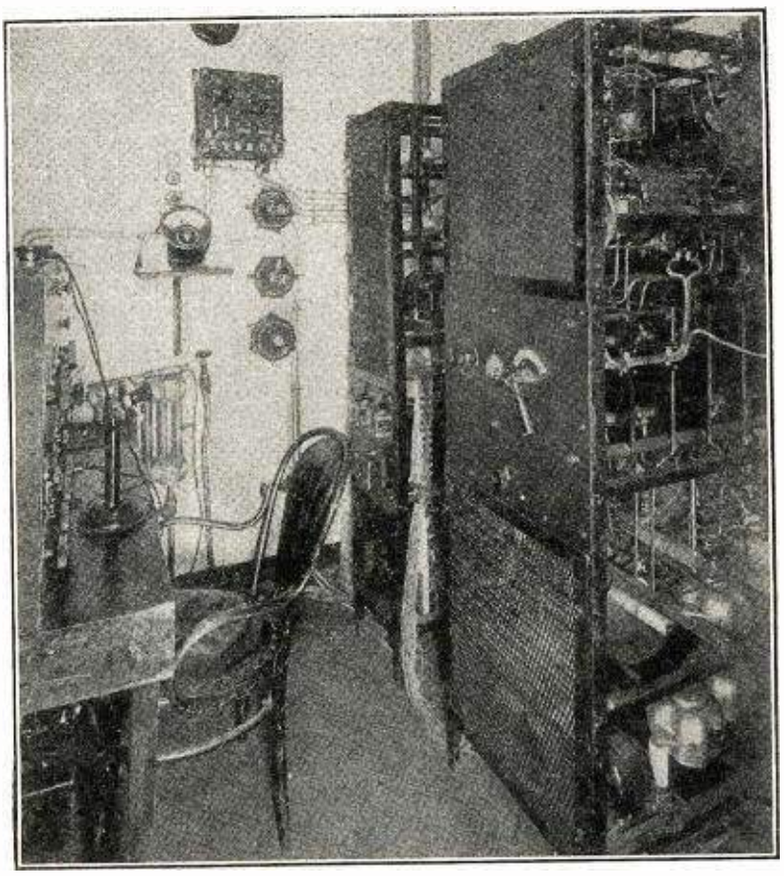
"ABCD de MNOP Hr Svc Sa Om Ani chance to cum aboard and look u over when we reach port?" Service? How do they get that way? And yet, 15 minutes casual listening on 600 meters will bring in several similar "Services." The practice is on the increase; particularly on the Great Lakes is it extremely obnoxious. The prefix, "SVC" is used as a thin veneer to disguise unnecessary and prohibited conversation between commercial radio stations. The practice is despicable from many standpoints and its early elimination should be one of the objects of commercial radio operators. There is now a tremendous amount of necessary interference—from the standpoint of communications handled—without adding to it, such unofficial and unlawful transmissions.

A more mild form of service message, but one which is also inherently wrong in structure, is that relating to the radio equipment or service between stations. It seems that the meaning of a service message is generally misunderstood, but reference to the London Convention or to a Western Union tariff book will reveal the fact that a service message is one referring strictly to tariff handled. It is as short and concise as possible to still convey the necessary information. An inquiry relative to the shipment of certain spare parts for a ship's transmitter, sent by that vessel to a shore station is distinctly not a service message. Neither is a request to the shore station to have the office mail additional stationery to the next port, a message of this class. These are actually messages and should be handled and abstracted as such and carry a full address and the signature of the sending operator. Whether or not they are charged for or are "franked" messages depends entirely upon whether they reach their destination entirely through the stations of the radio company or whether "other line charges" enter into it.

Proper structure of a service message is also something not generally known among the present day marine operators. Again reference to a Western Union or Postal Telegraph tariff book will show the proper procedure. A service message, by reason of the fact that it ordinarily carries no charges, and is in reference to another message, and as such is handled only by operators, can be abbreviated considerably, and should be. The more common abbreviations in general use are as follows:

GBA—Give better address.
GSA—Give some address.
NSN—No such number.
SYS—See your service.
SOS—(Should not be used in marine work.) See our service.
UNLOCATP—Unable to locate.
UNDELD—Undelivered.

Others will occur as the occasion arises. An example of the proper use of a service message where a message has been undelivered by a shore station, would be addressed to the office of origin and read somewhat as follows:



The Duplex Radio Telephone Equipment aboard the S.S. American. the first set of its type to make two way communication by radiophone a possibility. The receiving equipment consists of long and short wave receivers each with a separate heterodyne for the reception of C.W., and a Super-Heterodyne receiver. All of the equipment is of General Electric Manufacture.

"S. S. Greater Detroit
Yr Ne 4 date Simpkins sined Thompson Undeld NSN. GBA.
CX Boston Mass. 15th"

Interpreted the above would be:
"S. S. Greater Detroit:
Your message number four of this date to Simpkins signed Thompson undelivered. No such number. Give better address.
CX Office. Boston. Mass. 15th."

It is readily apparent that the above service applies directly to message traffic and is, therefore, greatly shortened by using the abbreviations that have become standard.

Let us endeavor to eliminate the unnecessary conversation and confine ourselves to actual business. It gains a better name for the operator, both professionally and with the company, and it is only a selfish operator who will clutter the air with such useless stuff as quoted at the beginning of this article, and thus deprive others of the legitimate use of the air.

A MARINE RADIO OPERATORS' ASSOCIATION

FOR well over a year almost every article or letter published as written by a Marine Radio Operator contains a few lines, or in way of conclusion has something to say regarding a Union or an Association for the Marine Operator and these articles or letters invariably end with the words, "Why Not"? A few of these appear in some of the back issues of RADIO NEWS and now that the "With the Sea-going Op's" department has started again, more and more, no doubt, will be written by operators regarding an association, and the profession, as it may be called.

The whole thing is that the operators really want an association "by, for and with" the Marine Operator. Many of the older group of operators generally favor an association; but all of the operators, both the old timers now at sea and the newcomers into the game will come to the conclusion that they will not desire to support any kind of a "money making scheme" while they are doing their duty at sea and have someone at the head of their organization at a desk ashore holding down a so-called "soft job."

A great number are truly contented with their lot. One of the good reasons for this attitude is that most of the men doing their very best and being conscientious in their work are quite aware of the fact that the radio service companies are very fair and do justice to their desirable operators. On the whole they are "by, for and with" those who do what is right. Operators employed aboard the Shipping Board vessels who have had occasion to find out know that the Board Radio Supervisors back up their men.

(Continued on page 1048)

Complete List of Broadcast Stations of the United States

Corrected to September 2, 1924.

Call Letters	Name	Location	Power & Wave Length
KDKA	Westinghouse Electric & Mfg. Co.,	East Pittsburgh, Pa.	1000—326
KDPM	Westinghouse Electric & Mfg. Co.,	Cleveland, Ohio	500—370
KDPT	Southern Electrical Co.,	San Diego, Calif.	50—244
KDYL	Newhouse Hotel,	Salt Lake City, Utah	100—360
KDYM	Savoy Theatre,	San Diego, Cal.	100—250
KDYQ	Oregon Institute of Technology,	Portland, Ore.	50—360
KDZB	Frank E. Siefert,	Bakersfield, Calif.	100—240
KJBS	Rhodes Department Store,	Seattle, Wash.	100—270
KDZR	Bellingham Publishing Co.,	Bellingham, Wash.	50—261
KFAD	McArthur Bros. Mercantile Co.,	Phoenix, Ariz.	100—360
KFAE	State College of Washington,	Pullman, Wash.	500—330
KFAF	Western Radio Corporation,	Denver, Colo.	500—278
KFAJ	University of Colorado,	Boulder, Colo.	100—360
KFAN	The Electric Shop,	Moscow, Idaho	50—360
KFAR	Studio Lighting Service Co. (O. K. Olsen),	Hollywood, Calif.	500—286
KFAU	Independent School District of Boise City, Boise High School,	Boise, Idaho	150—270
KFAW	The Radio Den,	Santa Ana, Calif.	10—280
KFAY	Virgin's Radio Service,	Medford, Ore.	50—283
KFBB	F. A. Buttrey & Co.,	Havre, Mont.	50—360
KFBC	W. X. Ashill,	San Diego, Calif.	5—254
KFBE	Reuben H. Horn,	San Luis Obispo, Calif.	50—242
KFBG	First Presbyterian Church,	Tacoma, Wash.	50—500
KFBK	Kimball-Upson Co.,	Sacramento, Calif.	500—283
KFBL	Lamm Bros.,	Everett, Wash.	15—229
KFBS	Trinidad Gas & Electric Supply Co., and Chronicle News,	Trinidad, Colo.	10—360
KFBU	The Cathedral,	Laramie, Wyo.	50—283
KFCB	Nielsen Radio Supply Co.,	Phoenix, Ariz.	50—238
KFCF	Frank A. Moore,	Walla Walla, Wash.	100—360
KFCL	Leslie E. Muir,	Los Angeles Union Stock Yards, Los Angeles, Calif.	500—536
KFCP	Ralph W. Flynn,	Ogden, Utah	50—360
KFCV	Fred Mahaffey, Jr.,	Houston, Texas	50—360
KFCZ	Omaha Central High School,	Omaha, Neb.	50—253
KFDD	St. Michaels Cathedral,	Boise, Idaho	50—252
KFDH	University of Arizona,	Tucson, Ariz.	50—268
KFDJ	Oregon Agricultural College,	Corvallis, Ore.	50—360
KFDL	Knight-Campbell Music Co.,	Denver, Colo.	5—226
KFDX	First Baptist Church,	Shreveport, La.	100—360
KFDY	South Dakota State College,	Brookings, S. D.	150—360
KFDZ	Harry O. Iverson,	Minneapolis, Minn.	5—231
KFEC	Meier & Frank Co.,	Portland, Ore.	50—248
KFEL	Wright Radio Corp.,	Denver, Colo.	50—254
KFEQ	Scroggin & Co. Bank,	Oak, Neb.	500—268
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	10—252
KFEX	Augsburg Seminary,	Minneapolis, Minn.	100—261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.,	Kellogg, Idaho	100—261
KFEB	Jenkins Furniture Co.,	Boise, Idaho	50—360
KFEE	Eastern Oregon Radio Co.,	Pendleton, Ore.	10—240
KFEP	First Baptist Church,	Moberly, Mo.	10—360
KFER	Nevada State Journal,	Sparks, Nev.	50—266
KFFV	Graceland College,	Lamoni, Ia.	10—226
KFFY	Pincus & Murphey,	Alexandria, La.	100—280
KFGC	Louisiana State University,	Baton Rouge, La.	50—275
KFGD	Chickasha Radio & Electric Co.,	Chickasha, Okla.	100—254
KFGH	Leland Stanford University,	Stanford Univ., Calif.	806—248
KFGL	Snell and Ivey,	Arlington, Ore.	500—273

Call Letters	Name	Location	Power & Wave Length
KFGQ	Crary Hardware Co.,	Boone, Iowa	10—286
KFGX	First Presbyterian Church,	Orange, Texas	500—250
KFGZ	Emmanuel Missionary College,	Berrien Springs, Mich.	500—286
KFHA	Western State College of Colorado,	Gunnison, Colo.	50—252
KFHD	Ute Electric Shop Co.,	St. Joseph, Mo.	100—226
KFHJ	Fallon & Co.,	Santa Barbara, Calif.	100—360
KFHK	Star Electric & Radio Co.,	Seattle, Wash.	50—285
KFI	Earle C. Anthony, Inc.,	Los Angeles, Calif.	500—469
KFIF	Benson Polytechnic Institute,	Portland, Ore.	100—360
KFIO	North Central High School,	Spokane, Wash.	50—252
KFIQ	First Methodist Church,	Yakima, Wash.	50—242
KFIU	Alaska Elec. Light & Power Co.,	Juneau, Alaska	10—226

Call Letters	Name	Location	Power & Wave Length
KFJX	Reorganized Church of Jesus Christ of Latter Day Saints,	Independence, Mo.	250—240
KFKZ	Daily Commonwealth and Oscar A. Tiplatzen,	Fond du Lac, Wis.	100—224
KFJB	Marshall Electric Co.,	Marshalltown, Iowa	10—248
KFJC	Seattle Post Intelligencer,	Seattle, Wash.	100—270
KFJF	National Radio Mfg. Co.,	Oklahoma City, Okla.	20—254
KFJI	Liberty Theatre,	Astoria, Ore.	10—252
KFJK	Deland Radio & Electric Co.,	Bristow, Okla.	100—213
KFJM	University of North Dakota,	Grand Forks, N. D.	100—280
KFJQ	Electric Construction Co., Valley Radio Division,	Grand Forks, N. D.	5—280
KFJR	Ashley C. Dixon & Son,	Stevensville, Mont. (near)	5—258
KFJX	Iowa State Teachers College,	Cedar Falls, Iowa	50—286
KFJV	Tidwell Radio Co.,	Fort Dodge, Iowa	50—246
KFJZ	Texas National Guard,	112th Cavalry, Fort Worth, Texas	20—254
KFKA	Colorado State Teachers College,	Greeley, Colo.	50—273
KFKB	Brinkley-Jones Hospital Association,	Milford, Kan.	500—286
KFKO	Conway Radio Laboratories,	Conway, Ark.	100—250
KFKV	P. F. Gray,	1208 Richardson St., Rolla, Mont.	50—283
KFKX	Westinghouse Electric & Mfg. Co.,	Hastings, Neb.	1000—541
KFKZ	Missouri Rug Radio Co.,	Colorado Springs, Colo.	10—254
KFLA	Abner M. Watson,	1321 W. Platinum St., Butte, Mont.	5—283

Call Letters	Name	Location	Power & Wave Length
KFLB	Signal Electric Mfg. Co.,	Menominee, Mich.	50—248
KFLE	National Educational Service,	Denver, Colo.	25—268
KFLJ	Bizzell Radio Shop,	Little Rock, Ark.	20—268
KFLR	University of New Mexico,	Albuquerque, N. M.	100—254
KFLC	Rio Grande Radio Supply House,	San Benito, Texas	500—216
KFLV	Swedish Evangelical Mission Church,	Rockford, Ill.	100—229
KFLW	Missoula Electric Supply Co.,	Missoula, Mont.	5—234
KFLX	George R. Clough,	1214 40th St., Galveston, Texas	10—240
KFLZ	Atlantic Automobile Co.,	Atlantic, Iowa	100—273
KFMB	Christian Churches of Little Rock,	Little Rock, Ark.	10—254
KFMQ	University of Arkansas,	Fayetteville, Ark.	100—261
KFMR	Morningside College,	Sioux City, Iowa	10—261
KFMT	George W. Young,	2212 W. Bryant Ave., Minneapolis, Minn.	5—231
KFMW	M. G. Sarazen,	827 Blanche St., Houghton, Mich.	50—266
KFMX	Carleton College,	Northfield, Minn.	500—283
KFNF	Henry Field Seed Co.,	Shenandoah, Iowa	500—266
KFNG	Women's Radio Shop,	Coldwater, Miss.	10—254
KFNL	Radio Musical Association,	Paso Robles, Calif.	10—240
KFNV	L. A. Drake,	505 Third St., Santa Rosa, Calif.	5—234
KFNY	Montana Phonograph Co.,	Helena, Mont.	5—261
KFNZ	Royal Radio Co.,	Burlingame, Calif.	10—231
KFOA	Rhodes Dept. Store,	Seattle, Wash.	500—455
KFOC	First Christian Church,	Whittier, Calif.	100—255
KFOD	The Radio Shop,	Wallace, Idaho	10—224
KFOR	Rohrer Electric Co.,	Marshfield, Ore.	10—240
KFOJ	Moberly High School Radio Club,	Moberly, Mo.	5—248
KFON	Echophone Radio Shop,	Long Beach, Calif.	100—234
KFOO	Latter Day Saints University,	Salt Lake City, Utah	10—261
KFOQ	Ora W. Chancellow,	3216 Ave. O, Galveston, Texas	50—240
KFOX	David City Tire & Electric Co.,	David City, Neb.	10—226
KFOT	College Hill Radio Club,	Wichita, Kan.	50—231
KFOU	Hoosier Manufacturing Co.,	Richmond, Calif.	100—254
KFOX	Technical High School,	Omaha, Neb.	100—348
KFOY	Nelson Radio Service,	St. Paul, Minn.	50—226
KFOZ	Leon Hudson Real Estate Co.,	Fort Smith, Ark.	20—231
KFPG	Garretson & Dennis,	Los Angeles, Calif.	100—258
KFPH	Edward C. Hallander,	502 Lake St., Salt Lake City, Utah	50—242
KFPL	C. C. Baxter,	205 Grafton St., Dublin, Texas	15—242
KFPM	New Furniture Co.,	Greenville, Texas	10—242
KFPN	Missouri National Guard,	70th Infantry Brigade, Jefferson City, Mo.	10—242
KFPO	Colorado National Guard,	Forty-fifth Division Tank Co., Denver, Colo.	500—231
KFPP	G & G Radio & Electric Shop,	Olympia, Wash.	20—236
KFPR	Los Angeles County Forestry Department,	Los Angeles, Cal.	500—231
KFPT	Cope & Johnson,	Salt Lake City, Utah	500—268
KFPV	Heintz & Kohlmoos,	San Francisco, Calif.	50—236
KFPW	St. Johns Church,	Centerville, Mo.	10—268
KFPX	First Presbyterian Church,	Pine Bluff, Ark.	100—242
KFPY	Symons Investment Co.,	Spokane, Wash.	100—283
KFQA	The Principia,	5539 Page Ave., St. Louis, Mo.	50—263
KFQB	Searchlight Publishing Co.,	Fort Worth, Texas	100—254
KFQC	Kidd Brothers Radio Shop,	Yale, Calif.	100—227
KFQD	Chevin Supply Co.,	Anchorage, Alaska	100—240

(Continued on page 956)

Send For This Sensational Radio Bargain Book-FREE

Order Direct From This Page! Save About One-half! Compare our prices with others. Only highest grade nationally known GUARANTEED parts. OUR GUARANTEE PROTECTS YOU. Money cheerfully refunded if you are not satisfied. Remit by money order and write direct to us. Save time and delay. Do not write or express money order or bank draft for total amount by usual process. All PRICES ON THIS PAGE INCLUDE SHIPPING CHARGES RIGHT TO YOUR DOOR. Refer to any bank or commercial agency regarding our reliability. If your favorite circuit is shown here, order direct from this ad for all required to build your set complete with Randolph parts. Panels are all drilled. Instructions are simple and complete. Everything comes ready to assemble. Order direct. All shipping charges prepaid.

COMPLETE PARTS FOR 5-TUBE NEUTRODYNE RECEIVING SET

Absolute Hazeltine Licensed Neutrodyne Parts Furnished.

PARTS FOR 5 TUBE SET

- 1 5x24x3/16 Drilled Panel
- 5 Bradleson or Columbia Audio Transformers
- 2 Variable Condensers
- 2 Vernier Binding Posts
- 1 Grid Leak and Condenser
- 5 Benjamin Sockets
- 1 .001 Condenser
- 1 .005 Mica Condenser
- 1 Hazeltine Licensed Kit of Parts
- 1 Radion Binding Post Strip
- 80 feet Bus-bar Wire
- 1 Set (consisting of 3 Hazeltine Licensed Neutrodynes and 2 Neutrolas)
- 1 Baseboard
- 5 Dials

Complete parts and instructions for making

$33.75

OUR CATALOG IS FILLED WITH Bargains Like These

CONDENSERS

23-plate Panel Condenser $1.20
23-plate Vernier Condenser 2.60

RHEOSTATS and POTENTIOMETERS

Bakelite Rheostat, 6 ohm .50
Bakelite Potentiometer, 400 ohm .75
Bakelite Vernier Rheostat 1.45
Bakelite Potentiometer, 200 ohm .55

TRANSFORMERS

Audio Transformer, Ratio 3 to 1; 3½ to 1 1.95
Amplifier Special, 3 to 1; 5 to 1; 7½ to 1 2.24

TUBE SOCKETS & DIALS

4" Upright Dial .50
Bakelite Socket .25
Western Dial .75

VARIOMETERS

Mounted Vario-coupler 2.25
Bakelite Variometer 3.48

HEADPHONES

Randolph Special, 2000 ohms 2.45
Nine Foot Special 3.95

LOUD SPEAKERS

American Bell 3.95
With adjustable loud speaker unit 5.00

COUPLERS and COILS

Basket Vario-coupler .95
Genuine Coils 1.25
Electric Soldering Iron .95
Coupling Coil 1.65
Three Circuit Tuner 2.85
Two Bakelite Rheostats 2.35

Complete Parts for Two-Stage Amplifier

May Be Used in Connection With Any Receiving Set

- 1 6x24 Bakelite Panel
- 3 Bradleson or Columbia Audio Transformers
- 1 Bradleson or Columbia Low Ratio Transformer
- 2 Bakelite Rheostats—11-ohm
- 2 Bakelite Sockets
- 2 Circuit Jacks
- 1 Filament Jack
- 1 Binding Post
- 1 Baseboard
- 3 Binding Posts

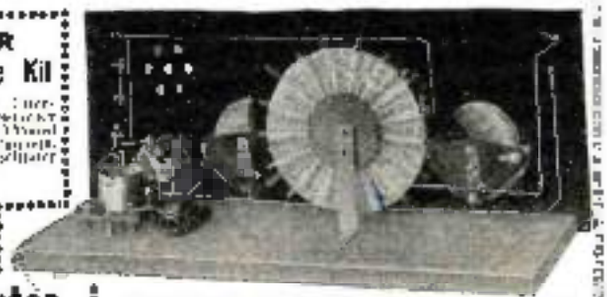
$10.90

Materials and instructions for making

SUPER Heterodyne Kit

Consisting of Three-circuit Tuner Panel, Vernier Condenser, Wound Coupling Transformer, Special Oscillator Coupler.

$19.75



COMPLETE PARTS FOR 5-TUBE COCKADAY RECEIVING SET

- 1 Cockaday Oil
- 1 Strobon Bi-Grid Cond.
- 1 Bakelite Rheostat, 30-ohm
- 1 Bakelite Socket
- 3 Bakelite Sockets
- 3 Columbia or Bradleson Audio Transformers
- 1 Single Circuit Jack
- 1 Double Circuit Jack
- 1 Switch Arm
- 1 Switch Stop
- 1 Set Switch Points
- 1 Baseboard
- Complete instructions and wiring diagram
- 1 Tube Set

19.95

Our Guarantee

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

PARTS FOR ONE-TUBE REINARTZ RECEIVING SET

- 1 Tube Bakelite Panel
- 1 Bakelite Rheostat, 6-ohm
- 1 Bakelite Socket
- 1 Bakelite Vernier Coil
- 1 Bakelite Vario Coil
- 1 Bakelite Dial
- 1 Bakelite Detector Coil
- Directions for Making and Operating
- 2 Set Switch Points and Blade
- 2 Binding Posts
- 80 feet Bus-bar Wire
- 1 Grid Leak Unit
- Mica Condenser
- 1 Baseboard
- 3 Binding Posts

1-TUBE SET

$10.45

Complete Parts for 2-TUBE HARKNESS SET

- 2 x 14" Drilled Bakelite Panel
- 2 Harkness Mellow Transformers with Condensers
- 2 Dials
- 2 Bakelite Sockets
- 2 Amrad Bell Transformers
- 1 Single Circuit Jack
- 1 R-V Crystal Detector
- 1 Bakelite Rheostat, 6 ohm
- 2 Binding Posts
- Baseboard and Bus-bar Wire

Blue Print to complete wiring

$17.95

Add 1 Tube Radio Set $17.45
Add 4 Tube Radio Set $39.85

COMPLETE PARTS FOR 8-TUBE SUPER-HETERODYNE

- 1 23-Plate Vernier Fully or Twelve Low Loss Condensers
- 2 Radio or Columbia Tuned Audio Transformers
- 1 Range or Detector Tuned Choke Transformer
- 1 Special Oscillator Coupler
- 1 Shunt Condenser
- 8 Bakelite Sockets
- 2 Bradleson & Columbia A. F. Transformers
- 1 Crystal Detector Set with Crystal
- 1 Bakelite Panel
- 3 Binding Posts
- 1 Baseboard and Bus-bar Wire
- 1 .0005 Mica Condenser
- 1 .001 Mica Condenser
- 1 .006 Mica Condenser and 2 Vernier Grid Leaks
- Complete Wiring Diagrams, Detailed Instructions and Blue-print

$59.75

RANDOLPH RADIO CORPORATION

159 N. Union Ave. Dept. 244 Chicago, Illinois

FREE

BIG MONEY-SAVING RADIO CATALOG

containing a thousand bargains of every description in radio—sets, supplies, complete parts for sets, complete sets, etc. plus a mass of very latest information on all different circuits. Complete list of tested, filled stations, and other valuable, up-to-the-minute radio data and your name and address on a Card or Letter. We will send catalog free.

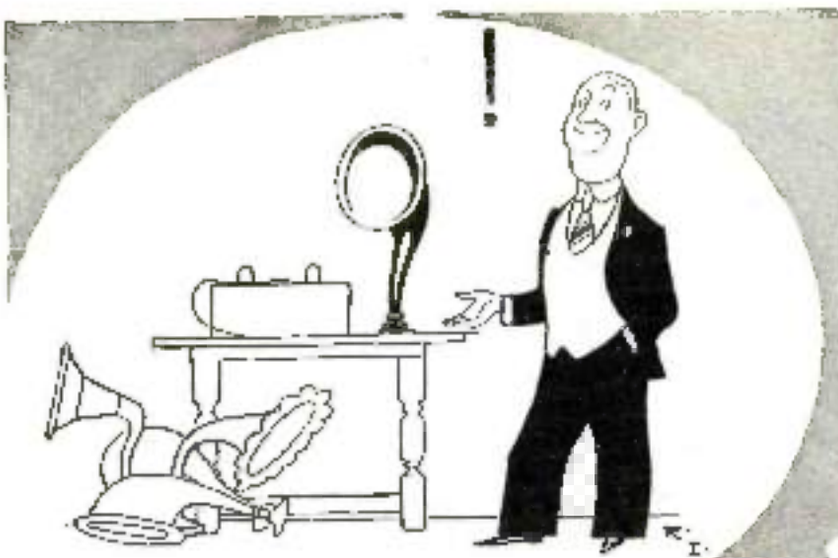
Free Service Department

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

List of Broadcast Stations

(Continued from page 954)

Call Letters	Name	Location	Power & Wave Length
KFQE	Dickmann-Henry Radio Laboratories,	Colorado Springs, Colo.	5—224
KFQF	Donald A. Ruth, 2544 Pleasant Ave.,	Minneapolis, Minn.	10—224
KFQG	Southern California Radio Association,	Los Angeles, Calif., Armory, Exposition Park.	800—226
KFQH	Albert Sherman,	Hillsborough, Box 51, Burlingame, Calif.	50—231
KFQI	Thomas H. Ince Corp.,	Culver City, Calif.	100—254
KFQJ	Harbour-Longmire Co.,	Oklahoma, Okla.	50—346
KFQK	Democrat Leader,	Fayette, Mo.	10—246
KFQL	Oklahoma Free State Fair Association,	Muskogee, Okla.	20—252
KFQM	Texas Highway Bulletin,	Austin, Texas	300—258
KFQN	Third Baptist Church,	Portland, Oregon	5—255
KFQO	Hoyer Radio Shop,	Russell, Kansas	10—261
KFQP	George S. Cansler, Jr.,	906 E. College St., Iowa City, Iowa	10—226
KFQR	Walter L. Ellis,	625 East 8th St., Oklahoma, Okla.	10—250
KFQS	Dickenson-Henry Radio Labs.,	Manitou, Colo.	10—246
KFQT	Texas National Guard,	Thirty-sixth Signal Co., Denison, Texas	10—252
KFQU	W. Biker,	Holy City, Calif.	100—214
KFQV	Omaha Grain Exchange,	Omaha, Neb.	100—231
KFQW	C. F. Knierim Photo Radio & Electric Shop,	North Bend, Wash.	50—248
KFQX	Alfred M. Hubbard,	314 Green Bldg., Seattle, Wash.	250—273
KFQY	Farmers State Bank,	Belden, Neb.	10—27.1
KFQZ	Taft Radio Co.,	6855 Fountain Ave., Hollywood, Calif.	250 240
KFRC	Radiocast Studio,	San Francisco, Calif.	5—280
KFRP	W. B. Brown,	Alexandria, La.	10 242
KFRQ	Cleveland High School,	St. Louis, Mo.	20—236
KFRH	The Radio Shop,	Gallup, N. M.	10—268
KFSG	Echo Park Evangelistic Association,	Los Angeles, Calif.	500—278
KFSY	Van Bleecker Co.,	20 So. Main St., Helena, Mont.	10—261
KGB	Tacoma Daily Ledger,	Tacoma, Wash.	50—252
KGG	Hallock & Watson Radio Service,	Portland, Ore.	50—360
KGO	General Electric Co.,	Oakland, Calif.	1000—312
KGU	Marion A. Mahoney,	Honolulu, Hawaii	500—360
KGW	Portland Morning Oregonian,	Portland, Ore.	500—492
KGY	St. Martins College,	Lacey, Wash.	5—258
KHJ	Times Mirror Co.,	Los Angeles, Calif.	500—395
KHQ	Louis Wasmer,	Seattle, Wash.	100—360
KID	C. D. Gould,	Stockton, Calif.	5—273
KJR	Northwest Radio Service,	Seattle, Wash.	50—23.5
KJS	Radio Institute of Los Angeles,	Los Angeles, Calif.	750—360
KLS	Warner Bros. Radio Supplies Co.,	Oakland, Calif.	250—360
KLX	Tribune Publishing Co.,	Oakland, Calif.	500—505
KLZ	Reynolds Radio Co.,	Denver, Colo.	500—283
KMJ	San Joaquin Lt. & Power Corp.,	Fresno, Calif.	50—248
KHO	Love Electric Co.,	Tacoma, Wash.	10—360
KNT	Walter Heinrich,	Kotzebue, Alaska	800—263
KNX	"Hollywood" — Los Angeles Evening Express		—
KOB	New Mexico College of Agriculture and Mechanic Arts, State College, N. M.		500—360
KOP	Detroit Police Dept.,	Detroit, Mich.	500—286
KPO	Hale Bros.,	San Francisco, Cal.	500—423
KQP	Apple City Radio Club,	Hood River, Ore.	10 360
KQV	Doubledor Hill Electric Co.,	Pittsburgh, Pa.	500—870
KQW	Chas. D. Herrold,	467 First St., San Jose, Calif.	50—360
KRE	Berkeley Daily Gazette,	Berkeley, Calif.	50—275
KSD	Post Dispatch (Pulitzer Pub. Co.),	St. Louis, Mo.	500—546
KTW	First Presbyterian Church,	Seattle, Wash.	250—360



Hear the difference!

A loudspeaker is a critical thing. Any vibration in the horn adds sounds that nature never gave to the speaker's voice. And limited range thins down the tone to flat, unreal quality. Some people think that a near-real voice is the best that radio can give . . . but not after they have heard a Radiola Loudspeaker!

The difference is the result of elaborate experiment and extended scientific study. The Radiola Loudspeaker has an extraordinary range—gets the full richness of tone. And it adds no sound of its own. To know how clear—how mellow—how *real* your music can be—ask to hear a Radiola Loudspeaker.

Radiola Loudspeaker
Type UZ-1325
Now $25.00

Radiola

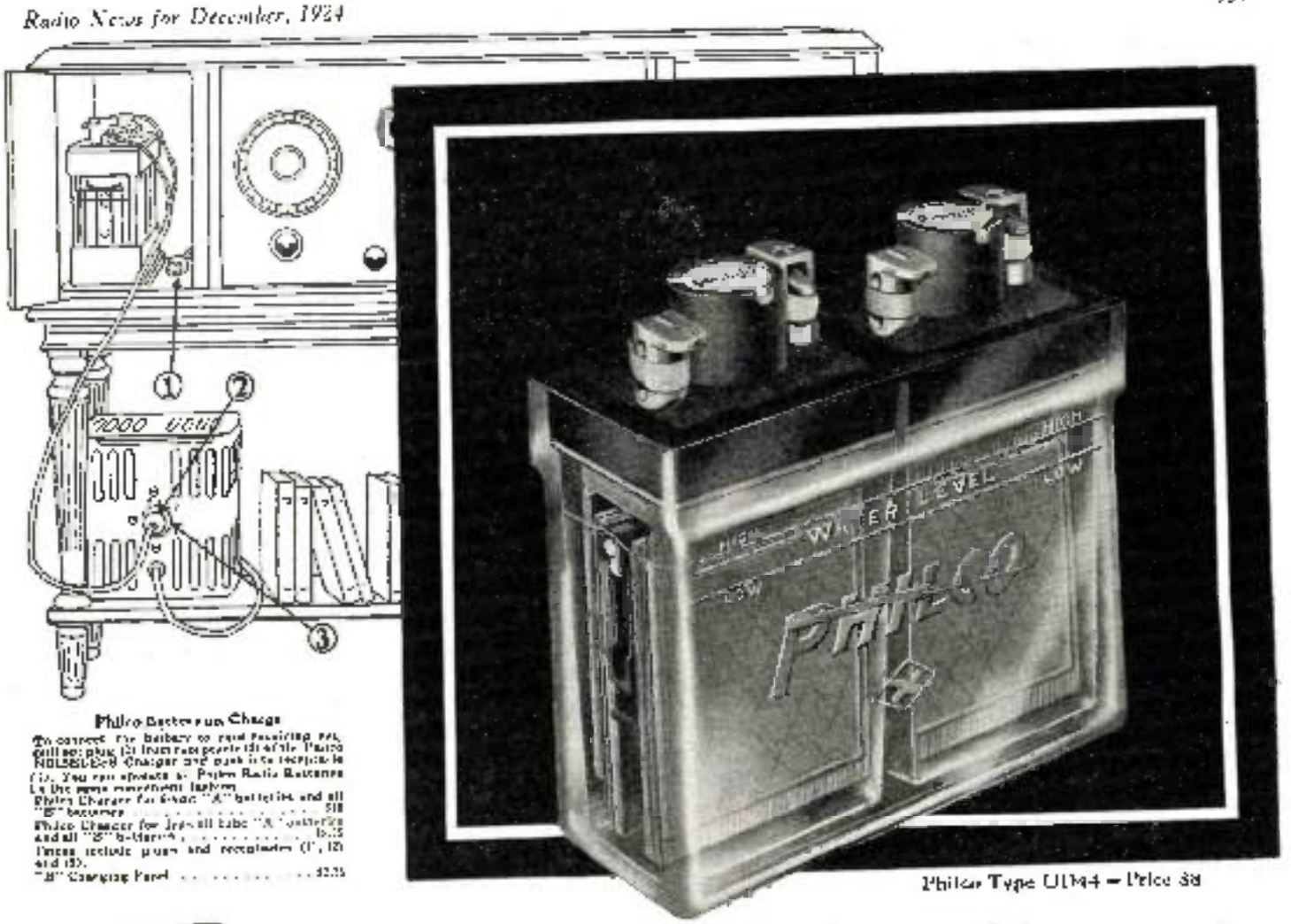
U. S. PAT. OFF.

LOUDSPEAKER

This symbol of quality RCA is your protection

RADIO CORPORATION OF AMERICA
Sales Offices:
233 Broadway, New York
10 So. La Salle St., Chicago, Ill.
28 Geary St., San Francisco, Cal.

Call Letters	Name	Location	Power & Wave Length
KTO	Examiner Printing Co., San Francisco, Calif.		350—360
KUY	Coast Radio Co., El Nido, Cal.		50—256
KWG	Portable Wireless Telephone Co., Stockton, Calif.		50—360
KWH	Los Angeles Examiner, Los Angeles, Calif.		250—360
KVQ	Electric Shop, Honolulu, Hawaii		100—270
KUV	Westinghouse Electric & Mfg. Co., Chicago, Ill.		1000—346
KZM	Preston D. Allen, Bills & Franklin Sts., Oakland, Calif.		100—360
WAAB	Waldemar Jensen, 137 N. St. Patrick St., New Orleans, La.		100—360
WAAC	Tulane University, New Orleans, La.		400 -360
WAAD	Ohio Mechanics Institute, Cincinnati, Ohio		25—360
WAAF	Chicago Daily Drover's Journal, Chicago, Ill.		200—286
WAAK	J. R. Nelson Co., Newark, N. J.		256—361
WAAN	University of Missouri, Columbia, Mo.		50—254
WAAW	Omaha Grain Exchange, Omaha, Neb.		500—286
WADB	Harrisburg Sporting Goods Co., Harrisburg, Pa.		10—266
WABD	Porter High School, Dayton, Ohio		5—261
WABE	Young Men's Christian Association, Washington, D. C.		100—283
WABH	Lake Shore Tire Co., Sandusky, Ohio		10—240
WABI	Bangor Railway & Electric Co., Bangor, Maine		300—240
WADI	Connecticut Agricultural College Storrs, Conn.		100—283
WARM	F. K. Doherty Accessories & Radio Equipment Co., Saginaw, Mich.		100—254
WABN	Otz Radio, Inc., 1627 Starr St., LaCrosse, Wis.		500—244
WABO	Lake Ave. Baptist Church, Rochester, N. Y.		50—281
WADF	Robert E. Weisig, 522 Wooster Ave., Dover, Ohio		200—256
WABQ	Haverford College Radio Club, Haverford, Pa.		50—261
WAIR	Scott High School, Toledo, Ohio		50 270
WARU	Victor Talking Machine Co., Camden, N. J.		50—256
WABW	College of Wooster, Wooster, Ohio		50—254
WABX	Henry B. Joy, Mount Clemens, Mich. Creek		500—270
WADY	John Mapalli, Jr., 813 Kimball St., Philadelphia, Pa.		50—242
WABZ	Calvary Place Baptist Church, New Orleans, La.		50—263
WBAA	Purdue University, West Lafayette, Ind.		250—286
WBAN	Wireless Phone Corporation, Paterson, N. J.		100—211
WBAO	James Millikin University, Decatur, Ill.		50—256
WBAP	Worth-Carter Publishing Co (Star-Telegram), Fort Worth, Texas		350—476
WBAV	Kiser & Hopkins Co., Columbus, Ohio		500—422
WBAX	John E. Stenger, Jr., 66 Gildersleeve St., Wilkesbarre, Pa.		20—360
WBAY	The Western Electric Co., New York, N. Y.		500—492
WBDO	Barber Bakery Service Radio, Inc., Pa.		50—254
WBRC	Temple Vernuhya, Mattapoisett, Mass.		500—248
WBRH	J. Irvine Bell, 1511 Gordon St., Port Huron, Mich.		50—246
WBHL	Grace Covenant Church, Richmond, Va.		5—252
WBRP	Pejepscot High School, Pejepscot, Mich.		100—246
WBRR	Peoples Pulpit Association, Rossville, N. Y.		500—278
WBRT	Lloyd Brothers, Philadelphia, Pa.		5—234
WBRU	Iroka Motor Sales Co., Monmouth, Ill.		10—224
WBRV	Johnstown Radio Co., Johnstown, Pa.		5—248
WBBW	Huffner Junior High School, Norfolk, Va.		50—272
WBDV	Washington Light Infantry, Charleston, S. C.		10—268
WBBZ	Noble B. Wasson, 253 Towa St., Indianapolis, Ind.		50 227
WBL	T. & H. Radio Co., Anthony, Kansas		100 254
WBS	D. W. Mar (Inc.), Newark, N. J.		50—360
WBT	Southern Radio Corp., Charlotte, N. C.		250—360
WBZ	Westinghouse Electric & Mfg. Co., Springfield, Mass.		1000—337
WCAD	St. Lawrence University, Canton, N. Y.		250—286
WCAE	Kaufmann & Baer Co., Pittsburgh, Pa.		500—462
WCAG	Clyde R. MacCall, 2811 Calhoun St., New Orleans, La.		50—268
WCAH	Entrekin Electric Co., Columbus, Ohio		300—256
WCAJ	Nebraska Wesleyan University, University Place, Neb.		500—252



Philco Type UD44 — Price $8

Philco Battery on Charge

To connect the battery to your receiving set, pull out plug (2) from receptacle (1) of the Philco NOISELESS Charger and push it in receptacle (3). You can operate a Philco Radio Battery in the same convenient fashion.

Philco Charger for 6-volt "A" batteries and all "B" batteries $18

Philco Charger for 1½-volt tube "A" batteries and all "B" batteries 16.75

Prices include plugs and receptacles (1, 2, and 3).

"B" Charging Panel 12.75

Philco "B" Battery

Storage "B" batteries are obtainable for clear and distant reception. Philco "B" batteries give clear and dry.

With de luxe mahogany finish case and cover (as shown) 10.50

With handsome mahogany finish case without cover (as sold) 12.50

Philco "A" Battery

For standard 6-volt tubes. Amp-hour glass case. Built-in Charge Indicator tells when it's time to charge. 10.75

Philco "A" Battery

Non-spilling type for standard 6-volt tubes. Price 15.00

Charge only—recommend's economical trickle rate—21 volts. Avoids burning out a hydrometer.

A Philco Rechargeable "Dry-Cell Replacement" Battery

A Philco "dry-cell replacement" storage battery gives better reception at much less expense than dry cells even on dry cell tubes. There is no appreciable drooping in reception from the start to finish of a discharge.

Dry-cell voltage falls continuously from the very day the cell is manufactured, whether it is used or not.

Storage battery voltage stays within 12% of maximum at all times and can be restored to maximum at any time by recharging.

Recharging with a Philco NOISELESS Charger means merely pulling a plug from the radio socket and pushing it into the charger socket. No wires to change. No worry about getting positive and negative mixed.

This Philco "dry-cell replacement" battery has other big advantages. It has a built-in Charge Indicator that tells you at a glance how far the battery is charged or discharged. Exclusive acid-tight sealing makes it practical for use inside radio cabinets.

It delivers strong, non-rippling current without hum, roar or buzz — an absolute essential for clear radio reception.

Like all Philco Rechargeable Radio Batteries, it is Drynamic (shipped by the factory dry but charged). Its life doesn't start until you or your dealer pours in the electrolyte. You are sure to get a new, fresh battery.

This Philco Type UD44 operates either UV199 or WD11 type tubes. It occupies only the same space as three dry cells but easily replaces six dry cells as used on multi-tube receivers.

Philco also makes batteries of similar convenience and economy for storage battery tubes and for your automobile. See your nearest Philco Service Station, Radio or Music Dealer.

The Philadelphia Storage Battery Company, *Philadelphia*

PHILCO DRYNAMIC RADIO BATTERIES

RADIO DEALERS—Let us send you our new Radio Manual. It tells you all you want to know about radio batteries. Just sign this coupon and mail to us.

Name .....

Business .....

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

RADIO WHOLESALERS—Your customers want radio batteries of Philco Battery service. Write for details.

Call Letters	Name	Location	Power & Wave Length
WCAK	Alfred P. Daniel, 2504 Rugby St.,	Houston, Texas	10 360
WCAL	St. Olaf College,	Northfield, Minn.	500—360
WCAO	The Sanders and Stayman Co.,	Baltimore, Md.	50—360
WCAP	Chesapeake & Potomac Telephone Co.,	Washington, D. C.	500—469
WCAR	Southern Radio Corp. of Texas,	San Antonio, Texas	500 360
WCAS	Wm. Hood Dunwoody Industrial Institute,	Minneapolis, Minn.	100—280
WCAT	South Dakota State School of Mines,	Rapid City, S. D.	50—240
WCAU	Durham & Co.,	Philadelphia, Pa.	250—256
WCAV	J. C. Dice Electric Co.,	Little Rock, Ark.	10—360
WCAX	University of Vermont,	Burlington, Vt.	50—360
WCAY	Milwaukee Civic Broadcasting Station,	Hotel Mathers, Milwaukee, Wis.	250—361
WCBA	Charles W. Hornbuckle,	1015 Allen St., Allentown, Pa.	10 280
WCBC	University of Michigan,	Ann Arbor, Mich.	500—250
WCBD	Walter G. Values,	Zion, Ill.	500 345
WCBE	Chase Radio Co.,	New Orleans, La.	5—263
WCBG	Howard S. Williams,	Passagrille, Miss. (portable)	10—360
WCBH	University of Mississippi,	Oxford, Miss. (near)	10—242
WCBI	Nicoll, Duncan & Rush,	Bruin, Penn.	50—250
WCBJ	J. C. Mans,	Jennings, La.	10—244
WCBK	E. Richard Hall,	2801 Central Ave., St. Petersburg, Fla.	500—268
WCBL	Northern Radio Mfg. Co.,	Houlton, Me.	50—280
WCBM	Charles Schnarr,	Charles and North Aves., Baltimore, Md.	50—220
WCBQ	Radio Shop (Inc.),	Memphis, Tenn.	20—250
WCBQ	First Baptist Church,	Nashville, Tenn.	100—250
WCBR	Charles H. Mesaber,	Providence, R. I. (portable)	5—246
WCBT	Clark University,	Worcester, Mass.	250—360
WCBU	Arnold Wireless Supply Co.,	Arnold, Pa.	50—254
WCBV	Tullahoma Radio Club,	Tullahoma, Tenn.	10 252
WCBW	George P. Rankin, Jr., and	Malcolm Solomon, Macon, Ga.	10—226
WCBX	Radio Shop of Newark,	Newark, N. J.	100—215
WCBY	Parks Electrical Shop,	Bark Hill Falls, Pa.	10—268
WCBZ	Carpinelli Brothers	Movie House, Chicago Heights, Ill.	50—248
WCK	Stix, Baer & Fuller Dry Goods Co.,	St. Louis, Mo.	100—360
WCX	The Detroit Free Press,	Detroit, Mich.	500—517
WDAE	Tampa Daily Times,	Tampa, Fla.	250 360
WDAF	Kansas City Star,	Kansas City, Mo.	500—461
WDAG	J. Lawrence Martin,	Amarillo, Texas	500—263
WDAH	Trinity Methodist Church (South),	El Paso, Texas	50—268
WDAR	Lit Bros.,	Philadelphia, Pa.	500—395
WDAS	Sam Waite's Radio Shop,	Worcester, Mass.	10—360
WDAU	Slocum & Kilburn,	New Bedford, Mass.	100—360
WDAY	Radio Equipment Corp.,	Fargo, N. D.	50—244
WDDD	A. H. Wade & Co.,	Taunton, Mass.	10—229
WDEC	Kirk Johnson & Co.,	Lancaster, Pa.	50—238
WDED	Herman E. Burns,	Martinsburg, W. Va.	5 -268
WDHF	Robert G. Phillips,	Youngstown, Ohio	50—246
WDHH	C. T. Stowe Co.,	Worcester, Mass.	100—268
WDHI	Radio Specialty Co.,	St. Petersburg, Fla.	20—220
WDHJ	Richardson-Wayland Electrical Corp.,	Roanoke, Va.	50—220
WDHK	M. F. Bros. Furniture Hdwe. Gate & Radio Co.,	Cleveland, Ohio	100—248
WDHN	Maine Electric Light & Power Co.,	Bangor, Me.	5—252
WDHO	Rollins College,	Winter Park, Fla.	50 240
WDHP	Sunrise State Normal School,	Superior, Wis.	50—263
WDHQ	Morton Radio Supply Co.,	Salem, N. J.	10—254
WDHR	Tremont Temple Baptist Church,	Boston, Mass.	100—256
WDHS	S. M. K. Radio Corp.,	Dayton, Ohio	5—231

THIS BATTERY WILL MATERIALLY REDUCE YOUR OPERATING COSTS ON HEAVY CURRENT SETS

NEW!

Eveready Heavy Duty "B" Battery, 45 volts. Three flat-stock clips. Length, 8 5/16 inches; width, 4 1/16 inches; height, 7 1/16 inches; weight, 13½ pounds.

Price $4.75

Stands up to heavy duty

THE new Eveready 45-volt heavy duty "B" Battery (No. 770) is made to stand up and deliver the large plate current required by multi-tube receiving sets. Extra large powerful cells, packed with the famous Eveready vim and vigor, give longer life on severe service. For "B" Battery economy use the Eveready 45-volt "B" Battery No. 770 on receiving sets using four or more tubes and operating at 90 volts or more, and all power amplifiers. There is an Eveready Radio Battery for every radio use. Buy them from your dealer.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.

Headquarters for Radio Battery Information

New York — San Francisco

Canadian National Carbon Co., Limited, Toronto, Ont.

No. 772
Vertical 45-volt, large size "B" Battery
Price $3.75

No. 744
Vertical 22½-volt "B" Battery
Price $1.75

No. 711
Eveready Radio "A" Dry Cell
Specially manufactured for use with dry cell tubes
Price 40 cents

No. 766
Eveready "B" 22½ volts. Six Fahnestock spring clip connectors
Price $2.00

EVEREADY
Radio Batteries
—they last longer

Call Letters	Name	Location	Power & Wave Length
WDBT	Taylor's Music Store, Hattiesburg, Miss.		10—252
WDBU	Somerset Radio Co., Skowhegan, Me.		10—286
WDBV	Strand Theater, Fort Wayne, Ind.		100—238
WDHW	The Radio Den, Columbia, Tenn.		25—268
WDHX	Otto Rau, 139 Dyckman St., New York, N. Y.		7—233
WDBY	North Shore Congregational Church, Chicago, Ill.		500—259
WDEZ	Boy Scouts of America, Ulster County Council, Kingston, N. Y.		5—252
WDM	The Church of the Covenant, Washington, D. C.		50—214
WDZ	J. C. Bush, Tuscola, Ill.		10—278
WEAA	Frank D. Fallain, Police Building, Flint, Mich.		50—280
WEAF	American Telephone & Telegraph Co., New York, N. Y.		1000—491
WEAH	Wichita Board of Trade, Wichita, Kan.		50—280
WEAT	Cornell University, Ithaca, N. Y.		500—256
WEAJ	University of South Dakota, Vermillion, S. D.		100—26[illegible]
WEAM	Borough of North Plainfield, North Plainfield, N. J.		150—[illegible]
WEAN	Shepard Co., Providence, R. I.		100—275
WEAO	The Ohio State University, Columbus, Ohio		500—361
WEAP	Mobile Radio Co., Mobile, Ala.		500—214
WEAR	Evening News Publishing Co., Baltimore, Md.		50—26[illegible]
WEAU	Davidson Bros. Company, Sioux City, Iowa		100—273
WEAV	The Electric Shop, Highland Park, N. J.		15—233
WEBC	Walter C. Bridges, Superior, Wis.		10—242
WEBD	Electrical Engineering Service Co., Anderson, Ind.		10—216
WEBE	Roy W. Waller, Cambridge, Ohio		10—215
WEBH	Edgewater Beach Hotel Co., Chicago, Ill.		1000—3[illegible]
WEBI	Walter Gibbons, Salisbury, Md.		15—212
WEBJ	Third Ave. Ry. Co., New York, N. Y.		500—275
WEBK	Grand Rapids Radio Co., Grand Rapids, Mich.		20—231
WEBL	U. S. A. United States Quartermaster		100—226
WEBP	Spanish Fort Amusement Park, New Orleans, La.		50—280
WEBQ	Tate Radio Co., Harrisburg, Ill.		10—226
WEBR	B. H. Russell, Jamaica, N. Y.		15—240
WEW	Hartford Self Electrical Co., Houston, Texas		200—263
WGW	St. Louis University, St. Louis, Mo.		100—240
WHAA	The Dallas News, The Dallas Journal, Dallas, Texas		500—476
WEAR	Earl F. Wiser, 804 Melvale St., Syracuse, N. Y.		100—231
WEAM	Times Publishing Co., St. Cloud, Minn.		50—252
WEAN	Hutchinson Electric Service Co., Hutchinson, Minn.		10—[illegible]256
WEAV	University of Nebraska, Lincoln, Neb.		25[illegible]—273
WEBB	Eureka College, Eureka, Ill.		50—240
WEBG	William F. Gable Co., Altoona, Pa.		100—263
WEBH	Concourse Radio Corp., New York, N. Y.		50—273
WEBI	Cabin Radio Supply Co., Camden, N. J.		100—256
WFI	Strawbridge & Clothier, Philadelphia, Pa.		500—395
WGAL	Lancaster Elec. Supply & Const. Co., Lancaster, Pa.		10—[illegible]48
WGAN	Carl E. Lloyd 316 W. Romana St., Pensacola, Fla.		50—[illegible]40
WGAQ	Vource Hotel, Shreveport, La.		150—252
WGAZ	The South Bend Tribune, South Bend, Ind.		250—[illegible]20
WGI	American Radio & Research Corp., Medford Hillside, Mass.		100—360
WGL	Thomas J. A. Hoadley 3301 N. Broad St., Philadelphia, Pa.		500—[illegible]86
WGN	Drake Hotel, Chicago, Ill.		1000—370
WGR	Federal Telephone Mfg. Co., Buffalo, N. Y.		750—319
WGY	General Electric Co., Schenectady, N. Y.		1020—39[illegible]
WHAA	State University of Iowa, Iowa City, Iowa		500—484
WHAD	Marquette University, Milwaukee, Wis.		100—250
WHAG	University of Cincinnati, Cincinnati, Ohio		100—22[illegible]
WHAR	Roberts Hardware Co., Clarksburg, W. Va.		15—258
WHAM	University of Rochester, Rochester, N. Y.		100—283

Science Finds Perfect Loud Speaker in This Beautiful Table Lamp

Nothing like this marvelous *Radialamp has ever before been* devised. It combines perfect radio tone production with an artistic home fixture of unusual beauty and charm. A demonstration at your dealer's will delight you. Or we'll gladly send complete descriptive literature. Simply mail the Coupon.

Manufactured under U. S. Patents Nos. 1,165,501 1,375,343. Other Patents Pending.

Attach In An Instant

Simply attach the Radialamp to any socket and switch on light. The result is a soft, mellow glow. Then attach Radialamp to your receiving set, or the small head phones—and enjoy the clearest, loudest, purest tones ever reproduced. No extra batteries required—no adjustments to make.

YOU may have the finest radio set money can buy. You may have tried about every kind of loud speaker—box, cabinet, and the old horn types. But a delightful surprise awaits you if you have not seen and heard that marvelous new invention—the *Radialamp*.

This amazing twin-arrangement, which has created a sensation among radio-lovers in New York and elsewhere, offers two astonishingly big values in one. It combines the perfect loud speaker—the last word in radio tone reproduction—with a library lamp of artistic beauty and charm. And the price is no more than if you bought either a loud speaker or a library table lamp separately.

User Praises Radialamp

"We have had a few nice days in the last two weeks or enough to demonstrate that you have not exaggerated any when say of your lamp speaker was the best in the world. I would not take a hundred dollars for mine, if I could not get another. Every one who has seen and heard it are loud in their praise of same."

W. R. COOPER
Bishop Apts.,
P. O. Box 72
Exeter, Pa.

And that is but one of the many enthusiastic letters received.

New Scientific Features

The *Radialamp* is an incomparably better speaker because it is constructed according to the most recently discovered scientific principles. From the perfected loud speaking unit concealed in the base of the lamp, the tone is amplified through the tapered tone chamber in the stem to the "sound mirror" in the top of the shade. Here the sound passes through the warm, dry air of the light globes and is deflected by the specially constructed parchment shade. The result is an evenness, a purity, a clear, human tone found in no other type of loud speaker. You can keep your receiving set in a separate room if you wish to—connecting it by a long wire with your table lamp.

But to fully appreciate how wonderfully successful this unique combination is—both as a loud speaker and as a permanent, artistic, useful fixture in your home—you should see the *Radialamp* for yourself. Step in at your dealer's today, and ask for a demonstration. Or if he hasn't it, mail the coupon for free descriptive literature. This will place you under no obligation. So act at once—right away.

Radiolamp Company
Dept. 112
334 Fifth Avenue, New York

On Sale At Leading Radio Dealers

RADIALAMP
TRADE MARK
LOUD SPEAKER

RADIOLAMP CO., Dept. 112,
334 Fifth Ave., New York.

Please send me at once complete information about the *Radialamp* loud speaker.

Name .....

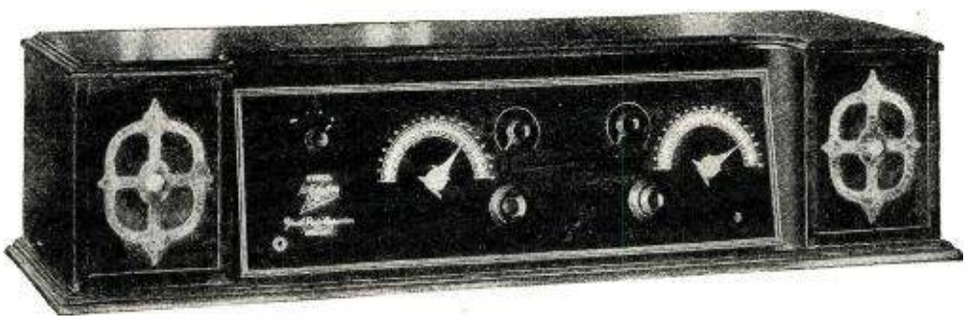
Address .....

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

Call Letters	Name	Location	Meters & Wave Length
WHAR	Seaside Hotel,	Atlantic City, N. J.	100—272
WHAS	Courier-Journal and Louisville Times	Louisville, Ky.	500—400
WHAV	Wilmington Electrical Specialty Co., Inc.,	Wilmington, De.	100—360
WHAZ	Rensselaer Polytechnic Institute,	Troy, N. Y.	500—380
WHB	Sweeney School Co.,	Kansas City, Mo.	500—411
WHK	Radiovox Co.,	Cleveland, Ohio	100—28.
WHN	George Schubel, Loew's State Theatre Bldg.,	New York, N. Y.	500—360
WHO	Bankers Life Co.,	Des Moines, Iowa	530—526
WIAB	Art A. Johnson's Garage,	Rockford, Ill.	50—25
WIAC	Galveston Tribune,	Galveston, Texas	100—461
WIAD	Howard R. Miller,	4618 N. Park Ave., Philadelphia, Pa	100—75
WIAK	Journal Stockman Co.,	Omaha, Neb.	250—254
WIK	R. & L. Electric Co.,	McKeesport, Pa.	100—214
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAB	American Electric Co.,	Lincoln, Neb.	100—229
WJAD	Jackson's Radio Engineering Laboratories,	Waco, Texas	150—366
WJAG	The Norfolk Daily News,	Norfolk, Neb.	250—282
WJAK	Clifford L. White,	Greenfield, Ind.	50—254
WJAM	D. M. Perham, 311 Third Ave. W.,	Cedar Rapids, Iowa	20—268
WJAN	Peoria Star,	Peoria, Ill.	150—280
WJAR	The Outlet Co.,	Providence, R. I.	400—509
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	500—280
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	20—360
WJD	Denison University,	Granville, Ohio	10—220
WJID	Mesaabeare,	Metaebeare, Ill.	500—276
WJY	R. C. A.,	New York, N. Y.	750—405
WJZ	R. C. A.,	New York, N. Y.	500—454
WKAA	H. F. Parr,	1414 Second Ave. E., Cedar Rapids, Iowa	50—270
WKAD	Charles Looff (Crescent Park),	East Providence, R. I.	20—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	105—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—224
WKAP	Dieter W. Flint,	Cranston, R. I.	50—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—364
WKAR	Michigan Agricultural College,	East Lansing, Mich.	500—280
WKAV	Laconia Radio Club,	Laconia, N. H.	50—254
WKBP	Dieter W. Flint,	Cranston, R. I.	500—286
WKY	W. K. Y. Radio Shop,	Oklahoma City, Okla.	360—360
WLAH	Samuel Woodworth,	267 Brownell St., Syracuse, N. Y.	100—434
WLAL	Naylor Electrical Co.,	Tulsa, Okla.	200—360
WLAP	W. V. Jordan,	304 W. Hegenheimer St., Louisville, Ky.	50—286
WLAX	Greencastle Community	Broadcasting Sta., Greencastle, Ind.	10—231
WLBL	Wisconsin Department of Markets,	Stevens Point, Wis.	560—278
WLS	Sears, Roebuck & Co.,	Chicago, Ill.	500—345
WLW	Crosley Radio Corp.,	Cincinnati, Ohio	500—422
WMAC	Clive B. Meredith,	Cazenovia, N. Y.	360—261
WMAF	Round Hill Radio Corp.,	Dartmouth, Mass.	100—500—360
WMAH	General Supply Co.,	Lincoln, Neb.	360—254
WMAK	Lockport Board of Commerce,	Lockport, N. Y.	500—272
WMAN	First Baptist Church,	Columbus, Ohio	10—280
WMAQ	Chicago Daily News,	Chicago, Ill.	500—445
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMAY	Kingshighway Presbyterian Church,	St. Louis, Mo.	100—280
WMAZ	Mercer University,	Macon, Ga.	100—261
WMC	Commercial Appeal,	Memphis, Tenn.	500—500
WMH	Amsworth-Gates Radio Co.,	Cincinnati, Ohio	750—309
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	100—20
WNAC	Shepard Stores,	Boston, Mass.	360—275
WNAD	University of Oklahoma,	Norman, Okla.	50—360
WNAL	Omaha Central High School,	Omaha, Neb.	20—258
WNAP	Wittenberg College,	Springfield, Ohio	100—275
WNAR	First Christian Church,	Butler, Mo.	20—221
WNAT	Lemay Bros. Co.,	Philadelphia, Pa.	100—360

ZENITH RADIO

—it tunes through everything



Super-Zenith VII

The New SUPER-ZENITH

for people who take pride in their homes

ONE glance at the new Super-Zenith and you are instantly impressed with the sheer artistry of its design, the excellence of its craftsmanship, the superb beauty of its finish—you know that within its case is a receiving set capable of the most extraordinary performance—a receiving set entitled to the place of distinction in the finest home.

Radio enthusiasts: Note that the new Super-Zenith is NOT regenerative. It is a six-tube set in four different models ranging from $230 to $550, with a new, unique and really different patented circuit controlled exclusively by the Zenith Radio Corporation. Amplification is always at a maximum in each stage for any wave-length. *The Super-Zenith line is not affected by moisture.* For the first time, you have here a set that—

1—tunes through *everything* and selects the station you really want.
2—requires only *two* hands—not *three*—to operate.
3—brings in each station at *only one point* on the dial.
4—affords such mathematical precision and simplicity that you can run over the entire dial in 1½ minutes and pick up more stations with greater clarity and volume than any other set on the market. Direct comparisons invited.

Write 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

Eastern Office
1269 Broadway, New York

Executive Offices
332 South Michigan Ave., CHICAGO

ZENITH—the exclusive choice of MacMillan for his North Pole Expedition—Holder of the Bernegaard Record

Super-Zenith VII (Not regenerative)—6 tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—44¾ inches long, 20¾ inches wide, 15¾ inches high. Door panels inlaid. Sloping panel of sheet bronze, mahogany finish, with points and indications in metallic relief. Gold plated pointers, to prevent tarnish. Compartments at either end for dry batteries. Can be operated on either wet or dry batteries. Either inside or outside antenna. Price (exclusive of tubes and batteries) $230

Super-Zenith VIII Same as VII except—built with mahogany legs of well-proportioned appropriate design, converting model into console type. Price (exclusive of tubes and batteries) $250

Super-Zenith IX Same as VII except—built with legs and additional compartments containing built-in Zenith loud speaker on the one side and generous storage battery space on the other. Price (exclusive of tubes and batteries) $350

Super-Zenith X Contains two new features superseding all previous. 1st—Built-in, patented, Super-Zenith Duo-Loud Speaker, (harmonically synchronized tone apparatus 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 or charger. Price (exclusive of tubes) $550

Zenith Radio Corporation
Dept. 12B
332 South Michigan Avenue, Chicago, Illinois

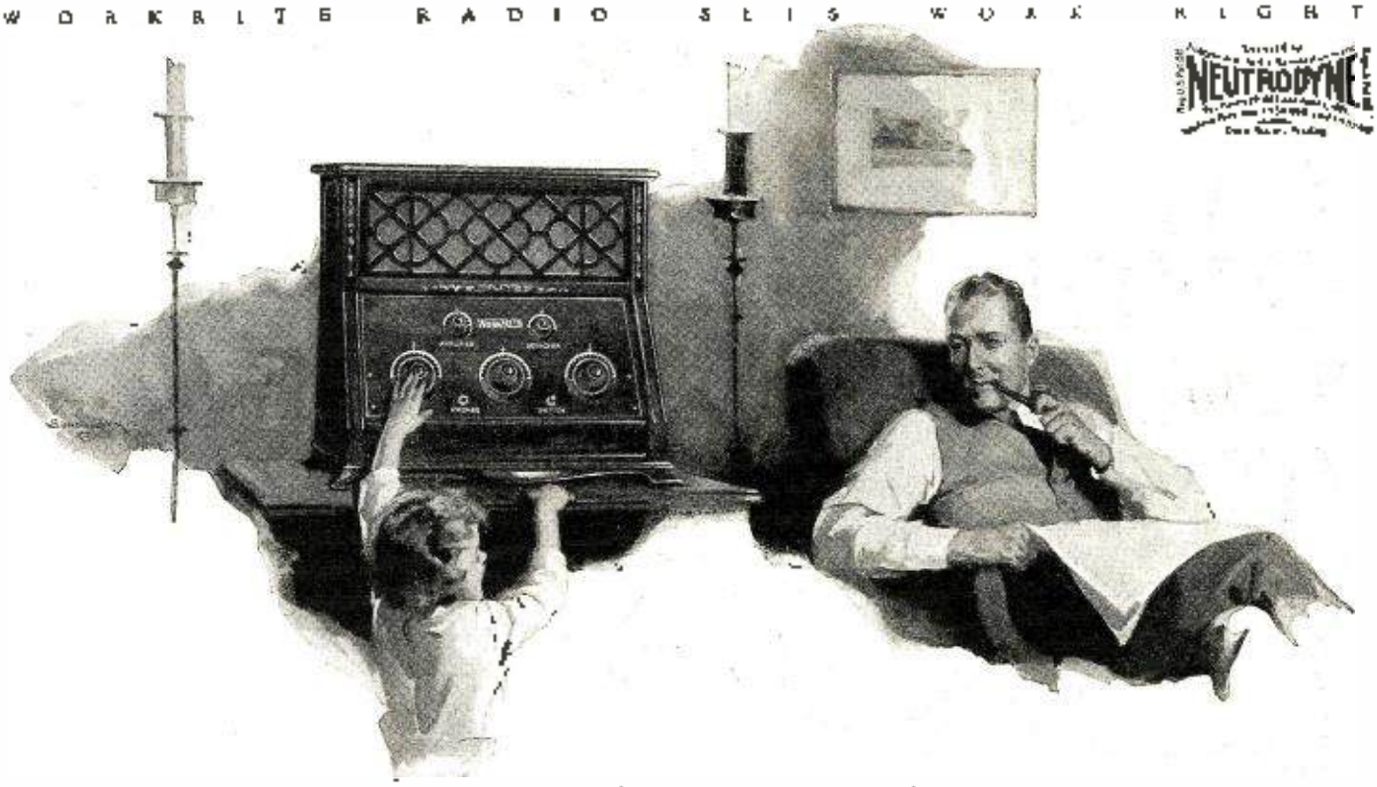
Gentlemen: Please send me illustrated literature giving full details of the Super-Zenith.

Name .....

Address .....

Call Letters	Name	Location	Power & Wave Length
WNAW	Henry Kunzmann, Box 167,	Fort Monroe, Va.	5—360
WNAX	Dakota Radio Apparatus Co.,	Yankton, S. D.	100—244
WNYC	City of New York,	New York, N. Y.	1000—526
WOAC	Page Organ Co.,	Lima, Ohio	50—266
WOAE	Midland College,	Fremont, Neb.	15—280
WOAF	Tyler Commercial College,	Tyler, Texas	10—360
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385
WOAJ	Ervint Electrical Co.,	Parsons, Kan.	15—258
WOAN	Vaught Conservatory of Music,	Lawrenceburg, Tenn.	200—360
WOAR	Henry P. Lundahow,	Kenosha, Wis.	50—225
WOAV	2nd Battalion, 112th Inf., N. G.,	Erie, Pa.	50—242
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wirth,	600 Jonquil Ave., Trenton, N. J.	500—246
WOC	The Palmer School of Chiropractic,	Davenport, Iowa	500—484
WOI	Iowa State College,	Ames, Iowa	500—360
WOO	John Wanamaker,	Phila., Pa.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N. J.	500—405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Pa.	500—283
WPAC	Donaldson Radio Co.,	Chickasha, Okla.	500—360
WPAJ	Doolittle Radio Corp.,	New Haven, Conn.	100—268
WPAK	North Dakota Agricultural College,	Agricultural College, N. D.	50—283
WPAM	Auerbach & Guetzel,	Topeka, Kan.	100—275
WPAR	Ward Battery & Radio Co.,	Sedan, Kan.	10—256
WPAU	Concordia College,	Moorhead, Minn.	50—286
WPAZ	Dr. John R. Koch,	Charleston, W. Va.	50—273
WQAA	Horace A. Beale, Jr.,	Parkesburg, Pa.	500—350
WQAC	Gish Radio Service,	Amarillo, Texas	500—234
WQAE	Moore Radio News Station,	Springfield, Va.	50—275
WQAP	Sandusky Register,	Sandusky, Ohio	5—240
WQAM	Electrical Equipment Co.,	Miami, Fla.	100—261
WQAN	Scranton Times,	Scranton, Pa.	100—280
WQAO	Calvary Baptist Church,	New York, N. Y.	100—360
WQAQ	West Texas Radio Co. (Abilene Daily Reporter),	Abilene, Tex.	100—360
WQAS	Prince-Walker Co.,	Lowell, Mass.	100—266
WQAX	Radio Equipment Co.,	Peoria, Ill.	100—240
WQJ	Calumet Rainbo Broadcasting Co.,	Chicago, Ill.	500—448
WRAP	The Radio Club,	Laporte, Ind.	10—234
WRAL	Northern States Power Co.,	St. Croix Falls, Wis.	100—236
WRAM	Lombard College,	Galesburg, Ill.	100—244
WRAN	Black Hawk Electrical Co.,	Waterloo, Iowa	10—256
WRAO	St. Louis Radio Service Co.,	St. Louis, Mo.	10—252
WRAV	Antioch College,	Yellow Springs, Ohio	100—242
WRAW	Avenue Radio Shop,	Reading, Pa.	10—238
WRAX	Florens Garage,	Gloucester City, N. J.	100—268
WRBC	Emmanuel Lutheran Church,	Valparaiso, Ind.	500—278
WRC	Radio Corp. of America,	Washington, D. C.	500—468
WRE	Doron Bros. Elec. Co.,	Hamilton, Ohio	200—360
WRL	Union College,	Schenectady, N. Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRR	City of Dallas Police and Fire Signal Dept.,	Dallas, Texas	30—360
WRW	Tarrytown Radio Research Laboratory,	Tarrytown, N. Y.	500—273
WSAH	South East Missouri State Teachers College,	Cape Girardeau, Mo.	100—360
WSAC	Clemson Agricultural College,	Clemson College, S. C.	500—360
WSAD	J. A. Foster Co.,	Providence, R. I.	100—261
WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove City College,	Grove City, Pa.	250—360
WSAP	Seventh Day Adventist Church,	New York, N. Y.	250—283
WSAR	Doughty & Welch Elec. Co.,	Fall River, Mass.	100—256
WSAU	Camp Merrifield,	Chesham, N. H.	10—220

WORKRITE RADIO SETS WORK RIGHT



"Look Daddy! I can make music, too!"

Anybody can "make music" with WorkRite Super Neutrodyne Receivers. WorkRite is so simple to operate and yet so unerring in results that it is a continuous source of delight and fascination for everyone in the family.

Really, if you've never used a WorkRite set you'll be astonished to learn how easy it is to get—and hold—any station you want. You'll find no provoking interruptions, no irritating distortion. And once you have tuned in a station you can get it instantly at any time, simply by using your previous dial settings.

WorkRite positively assures an unusually vigorous reception with all the original depth and clarity of tone—unmarred by howls, whistles and other disturbing noises.

Another WorkRite superiority that's a revelation even to experienced radio fans, is the astounding selectivity of these superb sets. Just a slight turn of the dials tunes out the most powerful local stations—and keeps them out. If you live in a city you know what an advantage that is.

Then there's WorkRite's exceptional range! Under favorable conditions it will easily span the continents for you. Even distant stations come in regularly and distinctly on the loud speaker.

There are other WorkRite advantages, of course. The ingenious super neutrodyne "hook-up"—the fine materials that we use—the painstaking care given to building each individual WorkRite set—all these combine to make receivers that establish a brand new peak in radio performance.

Don't be disappointed if the dealer you visit can't demonstrate WorkRite for you. WorkRite has won such tremendous popularity both among novices and experienced operators that most stores find themselves pressed to meet the demand.

So, if the one you visit hasn't WorkRite in stock, write us and we will send you the name of a store that has. Also, if you want a beautifully illustrated rotogravure folder, giving full information on all WorkRite models, fill in the coupon below and send it to us. You'll get the booklet by return mail.

But above all, know what WorkRite will do before you invest another dollar in radio.

WORKRITE AIR MASTER

A 5-tube Neutrodyne Set

Encased in genuine brown mahogany cabinet with graceful sloping panel. Almost identical with WorkRite Radio King, shown in main illustration, except the latter has a loud speaker built into cabinet.

Prices:

Air Master, without accessories, $160
Radio King, without accessories, $210

WORKRITE CHUM

A 3-tube Neutrodyne Reflex Set

Similar to Air Master in appearance. Equal to 4-tube sets in performance. Cabinet provides space for both A and B batteries.

Price, without accessories $75

WORKRITE ARISTOCRAT

A 5-tube Neutrodyne Set

In this beautiful mahogany console, the loud speaker is placed in one side and compartments for A and B batteries on other side. All connections made invisible with cable and plug. A set that cannot be surpassed in any respect.

Price, without accessories $250

Send Coupon for FREE Rotogravure Booklet

THE WORKRITE MANUFACTURING COMPANY
1106 EAST 36TH STREET CLEVELAND, OHIO
Branches: Chicago, 536 Lake Shore Drive; Los Angeles, 239 South Los Angeles Street

The WorkRite Manufacturing Co.
1106 East 36th Street Cleveland, Ohio

Please send me FREE a copy of the Roto-gravure booklet which describes WorkRite

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

WORKRITE
SUPER NEUTRODYNE RADIO SETS

Call Letters	Name	Location	Power & Wave Length
WSAV	Clifford W. Vick Radio Construction Co., Hopeton, Texas		100—360
WSAZ	Chase Electric Shop, Pomeroy, Ohio		50—258
WSB	Atlanta Journal, Atlanta, Ga.		500—429
WSL	J. & M. Electric Co., Utica, N. Y.		10—273
WSOE	School of Engineering of Milwaukee, Milwaukee, Wis.		100 -244
WSY	Alabama Power Co., Birmingham, Ala.		500—380
WTAB	Fall River Daily Herald Pub. Co., Fall River, Mass.		100—256
WTAC	Penn Traffic Co., Johnstown, Pa.		150—275
WTAF	Louis J. Gallo, 2222 Lapeyrouse St., New Orleans, La.		10—268
WTAF	The Radio Shop, Portland, Me.		10—256
WTAL	Toledo Radio & Elec Co., Toledo, Ohio		10—252
WTAM	Willard Storage Battery Co., Cleveland, Ohio		1000—390
WTAP	Cambridge Radio & Elec. Co., Cambridge, Ill.		50—242
WTAQ	S. H. Van Gordon & Son, Osseo, Wis		100—254
WTAR	Reliance Elec. Co., Norfolk, Va.		100—280
WTAS	Charles E. Erbstein, R. F. D. 6, Box 75, Elgin, Ill. (near)		500—286
WTAT	Edison Electric Illuminating Co., Boston Mass. (portable)		100—244
WTAU	Buegg Battery and Electric Co., Tecumseh, Neb		10—242
WTAW	Agricultural & Mechanical College, College Station, Texas		250—280
WTAX	Williams Hardware Co., Seneca, Ill.		50—233
WTAY	Oak Leaves Broadcasting Station, Oak Park, Ill.		500—285
WTAZ	Thomas J. McGuire, Lambertville, N. J.		15—235
WTG	Kansas State Agricultural College, Manhattan, Kan.		50—273
WTI	H. G. Saal Co., Chicago, Ill.		10—263
WWAT	Wright & Wright, Inc., Philadelphia, Pa.		100—360
WWI	Ford Motor Co., Dearborn, Mich.		250—273
WWJ	Detroit News, Detroit, Mich.		500—517
WWL	Loyola University, New Orleans, La.		5—280

BROADCAST STATIONS OF AUSTRALIA

1 VA Auckland Radio Service, Ltd., Auckland—500 watts; 360 meters.

2 YK Dominion Radio Company, Ltd, Wellington—500 watts; 275 meters.

4 YO Radio Supply Company (Herman Arundell), Dunedin—500 watts; 370 meters.

4 VA British Electrical and Engineering Co. (F. J. O'Neill), Dunedin—500 watts; 370 meters.

2 VBI Gisborne Radio Company, Gisborne—500 watts; 385 meters.

1 YB Pearson, Charles Henry (on behalf of Newcomile, Ltd.), Auckland—500 watts; 360 meters.

2 YB Wellington Broadcasters, Ltd., Wellington—500 watts; 275 meters.

EXPERIMENTAL STATIONS

4 XO Professor Robert Jack (for University of Otago), Dunedin—50 watts; 395 meters.

2 XB—Victoria University College, Wellington—50 watts; 395 meters.

1 AH Harris Gray & Co.

BROADCAST STATIONS IN FOREIGN COUNTRIES

Austria.—Vienna (Radio-Hekaphon), 600 meters.

Belgium.—Brussels, BAV, 1,100 meters, at 2 and 6.50 p. m., meteorological forecast. Brussels (Radio Electrique), 265 meters, daily at 5 to 6 p. m., concert at 8 to 8:15 p. m., general talk at 8:15 to 10 p. m., concert.

China.—Macao (Portuguese colony), no particulars available except that an excellent station of high power is located there.

Czecho Slovakia.—Prague, PRG, 1,800 meters, 8 to 12 a. m. and 4 p. m., meteorological bulletin and news; 4,500 meters, 10 a. m., 3 and 10 p. m., concert. Khely (near Prague), 1,150 meters, weekdays 7:15 and 10 p. m. Sundays 11 to 12 a. m., concert and news. Brunn, 1,800 meters, 10 to 11 a. m., concert, 2:30 p. m. news.

Denmark.—Lyngby, OXE, 2,400 meters,

Selectivity!
a dominating Ultradyne feature

AN Ultradyne receiver operating in New York City easily tunes out the powerful broadcasting of WOR, Newark, N. J.—405 meters and brings in WDAR, Philadelphia 395 meters; PWX Havana, Cuba- 400 meters; WDAF Kansas City- 411 meters.

Regardless of close similarity in wave-length, the Ultradyne selects any station within range—brings in broadcasting clearly, distinctly, faithfully.

In addition to this Ultra-selectivity, the Ultradyne is the most sensitive receiver known. It employs the "Modulation System" of radio reception, the achievement of Mr. R. E. Lacault, E.E., A.M.I.R.E., Consulting Engineer of this company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

The "Modulation System" responds to weaker signals than the conventional method of detection—because it provides greater rectification. Weakest signals are made to operate the loud speaker.

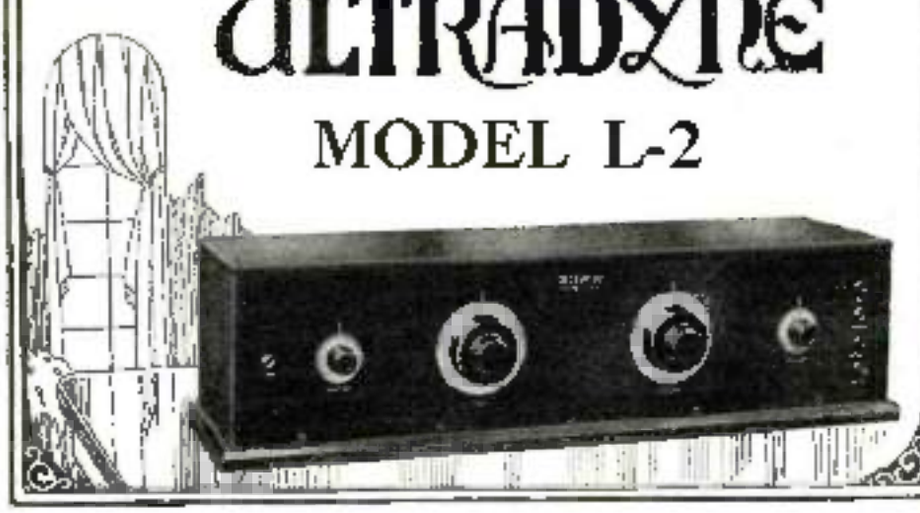
Ultradyne performance is the envy of the radio industry.

Write for descriptive circular

PHENIX RADIO CORPORATION

3-7 Beekman Street New York

ULTRADYNE
MODEL L-2



Modulation Plus Regeneration in the New Ultradyne

To the "Modulation System" of radio reception, R. E. Lacault has successfully applied the use of regeneration in the new Model L-2 ULTRADYNE.

The result is ultra sensitivity never before thought possible. The use of regeneration produces tremendous amplification which is more noticeable when receiving weak signals.

The Radio Section of the U. S. Bureau of Standards has proven by actual measurement that regeneration becomes more effective as the received signal diminishes in strength.

Regeneration applied to the "Modulation System" allows the ULTRADYNE to respond to an extremely small amount of energy. This energy is further amplified thousands of times by the intermediate frequency amplifier before it is detected and made audible. Thus amplification is designed for maximum efficiency without decreasing the tone or quality of music and speech.

The reception of distant stations is only limited by atmospheric conditions and ceases beyond the control of Model L-2 ULTRADYNE.

Loud Speaker Reception Using Loop Aerial

Efficient loud speaker reception using a loop aerial is possible with the Model L-2 ULTRADYNE. Ordinarily loop reception is considerably less efficient than an outside aerial. However, the application of regeneration to the "Modulation System" reduces the resistance of the loop circuit, thereby allowing the loop to pick up infinitely weak signals.

The use of a loop also increases selectivity and decreases static and other interference.

How to Build the New Model L-2 ULTRADYNE

This 32-page illustrated book gives latest authentic information on drilling, wiring, assembling and using the new Model L-2 Ultradyne. This book explains the "Modulation System" in detail and also deals with the application of regeneration to this new system of radio reception.

It is edited by R. E. Lacault, inventor of the Ultradyne Receiver. Price 50c

Model L-2 ULTRADYNE Kit is Ready

This is the new Model L-2 Ultradyne Kit which contains one low loss tuning coil, one low loss Oscillation Coil, one special low loss Coupler, one type "A" Ultraformer, three type "B" Ultraformers, four variable Condensers.

The Ultraformers are new improved long wave radio frequency transformers, especially designed by R. E. Lacault, inventor of the Ultradyne. As a precaution against substitution, R. E. Lacault's personal monogram seal (R.E.L.) is placed on all genuine Ultraformers. All Ultraformers are guaranteed so long as this seal remains unbroken.—Adv.

$30.00

8:30 to 9:45 p. m. weekdays, 8 to 9 Sunday concerts.

France.—Paris (Eiffel Tower), FL, 2,600 meters, 7:40 a. m. weather forecasts, 11 a. m. Sunday; 10:45 a. m. cotton prices, 12 noon market report; 12:15 to 12:30 weekdays, time signal and weather forecast; 3:40 p. m. financial reports; 5:30 p. m. Bourse closing prices; 6:15 p. m. concert; 8 p. m. weather report; 9 p. m. Wednesday and Sunday concert, 10:10 p. m. weather forecast. Paris (Radio Paris), SFR, 1,780 meters; 12:30 p. m. cotton prices and news; 12:45 p. m. concert; 1:30 p. m. Exchange prices; 4:30 p. m. financial report; 5 p. m. concert; 8:30 p. m. news and concert. Paris (Ecole Superieure des Postes et Telegraphes), 450 meters, 3:45 p. m. Wednesday talk on history; 8 p. m. Tuesday English lesson; 8:30 p. m. concert; 9 p. m. relayed concert or play. Paris (Station du Petit Parisien), 340 meters, 8:30 p. m. tests.

Germany.—Berlin (Koenigswusterhausen), LP, 2,370 meters, Sunday 10:40 to 11:45 a. m., concert 4,000 meters, 7 to 8 a. m. music and speech; 12:30 to 1:30 p. m. music and speech; 5 to 5:30 p. m. news. Eberswalde, 2,930 meters, daily 1 to 2 p. m. address and concert; 6 to 7:30 p. m. address and concert; Thursday and Saturday 7:20 p. m., concert. Berlin (Vox Haus), 430 meters, 11 a. m. stock exchange, 1:55 p. m. time signals; 5:40 to 7 p. m. concert; 7 to 8 p. m. Sunday, concert. Breslau, 415 meters. Frankfurt Am Main, 467 meters, 7:30 to 10 p. m., tests, graphophone records. Hamburg, 392 meters. Konigsberg, 460 meters. Leipzig (Mitteldeutsche Rundfunk A. G.), 452 meters. Munchen (Die Deutsche Stunde in Bayern), 485 meters. Stuttgart, 437 meters.

Great Britain.—Aberdeen, 2BD, 495 meters. Birmingham, 5IT, 475 meters. Bournemouth, 6BM, 385 meters. Cardiff, 5WA, 351 meters. Chelmsford, 5XX, 1,600 meters, weekdays, 11:30 a. m. to 12:30 p. m., 4:30 to 5:30 and 7:30 to 8:30 p. m., tests. Edinburgh, 2EH (relay), 325 meters. Glasgow, 5C, 420 meters. Leeds-Bradford, 2LS (relay), 346 and 310 meters. Tuesdays, Thursdays and Fridays, 1 to 2 p. m. (2LO only), regular daily programs, 3 to 7:30 p. m., 8 to 11:30 p. m., Sundays, 3 to 5 and 6:30 to 10:30 p. m. Liverpool, 6LV (relay), 318 meters. Manchester, 2ZY, 375 meters. Newcastle, 5NO, 400 meters. London, 2LO, 365 meters. Plymouth, 5PY (relay), 335 meters. Sheffield, 6FL (relay), 303 meters.

Holland.—Amsterdam, PAS, 1,050 meters (irregular), 8:40 to 10:10 p. m., concert Amsterdam (Vas Diaz), PCFF, 2,000 meters, 9 a. m. to 5 p. m., share market report, exchange rates and news. Hilversum, 1,050 meters, 9:30 to 11:10, Sunday, concert and news. Ijmuiden (Middelraad), PCMM, 1,050 meters, Saturday, 9:30 to 10:40 p. m., concert. The Hague, PCGG, 1,070 meters, 4-6 p. m., Sunday 9:40 to 11:40 p. m. Monday and Thursday, concerts. The Hague (Velthuisen), PCKK, 1,050 meters, 9:40 to 10:40 p. m., Friday, concert. The Hague (Heussen laboratory), PCUT, 1,050 meters, 10:40 to 11:40 a. m., Sunday, concert; 9:40 to 10:40 p. m., concert; 8:45 to 9 p. m., Thursday, concert.

Italy.—Rome, ICD, 3,200 meters, weekdays, 12 a. m., 1,800 meters, 4 and 8:30 p. m., tests and graphophone records.

Portugal.—Lisbon (Aero Lisboa), 370 to 400 meters, Wednesdays and Fridays, 9:30 to 12 p. m., irregular tests.

Spain.—Carragena, EBX, 1,200 meters, 12 to 12:30 and 5 to 5:30 p. m., lectures and concerts. Madrid, PTT, 400 to 700 meters, 6:08 p. m., tests. Madrid (Radio

ATWATER KENT
LOUD SPEAKERS

Bring Out the Best from Any Set

TO the never ceasing thrill of your radio; add a final touch — the ATWATER KENT Loud Speaker.

Radio Reception is for all your family to hear—free them from the bondage of earphones. Let the music pour forth into your home from some far-distant orchestra.

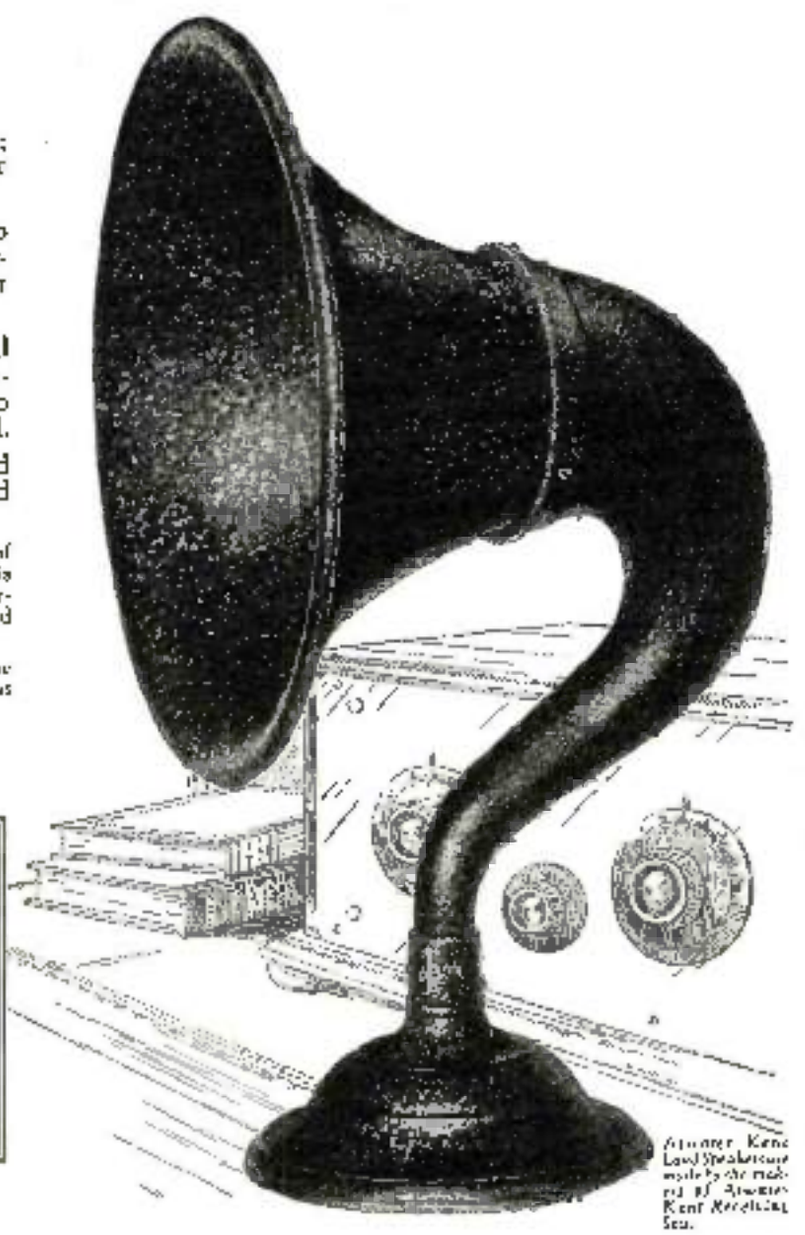
Your ATWATER KENT Loud Speaker will faithfully recreate the notes of every instrument, from the sweet piping of the piccolo to the deep, booming chords of the bass viol.

It is this natural reproduction of sound that is the basis of ATWATER KENT Loud Speaker success.

In the basic niceties of design, and in the use of correct master alloys for every part, lie the secret of this new joy in radio. It is living music, clear and generous in volume, made possible by fine materials and master workmen.

You'll always remember the day you took home an ATWATER KENT Loud Speaker. Your dealer has three models for your selection.

ATWATER KENT MANUFACTURING COMPANY
4924 Wissahickon Ave., Philadelphia, Pa.



Atwater Kent Loud Speakers are made by the makers of Atwater Kent Radio Sets.

Iberica), 392 meters, daily, except Thursdays and Sundays, 7 to 9 p. m. Thursdays and Sundays, 10 to 12 p. m., concerts. Madrid, 1,800 meters, irregular.

Sweden.—Boden, 2,800 meters, Tuesdays and Fridays, 6:30 to 7:30 p. m., Sundays, 5:30 to 6:30 p. m., concert and news. Gothenburg (Nya Varvet), 700 meters, Wednesday 7 to 8 p. m. Stockholm (Radiotelegraf), 470 meters, Tuesdays and Thursdays, 8 to 9:30 p. m., concert and news. Stockholm (Telegrafverket), 440 meters, daily 12:45 to 1 p. m., weather report and Nauen time signal; Monday, Wednesday and Saturday, 8 to 9 p. m., concert and news; Sunday 11 a. m. to 12:30 p. m., divine service from St. James Church.

Switzerland.—Geneva, 1,100 meters, weekdays, 1:15 and 6 p. m., concert or lecture. Lausanne, HB2, 850 meters, daily, 9:15 p. m., concert and address.

—*Abstract from Service Bulletin.*

(*All schedules given in time of locality.*)

What's What About Radio Horns

(*Continued from page 941*)

horn he would shop for days until he found one that would suit his sense of musical values. Many fans assemble their sets with great care, choosing their transformers, sockets and vacuum tubes with infinite pains, and yet buy the first radio horn they see. The chances are about 99 to 1 that they buy the wrong horn and then wonder why the quality of the reproduction is so poor, never once thinking that their troubles might be located in such a simple thing as the horn. To many people a horn is simply a horn, but these people do not fully appreciate the peculiar properties of sound waves and their associated phenomena.

Experimentation has caused the sound physicist to vote the metal horn out of order. Regardless of its design it is responsible for a tinnish tone and is altogether too resonant to be suitable. A horn should be made out of a non resonant material such as wood, fibre or paper mache.

There are a lot of other fallacies about loud speakers. They are called amplifiers by those who do not understand their operation. Just how they amplify is quite a mystery if we are to still maintain our respect for the law of the conservation of energy. If a horn can be made to amplify, why use vacuum tubes? The truth of the matter is that they do not amplify. They concentrate and condense. When we take the horn from our loud speaker unit, the sound waves it produces spread out in all directions, just like an electric light without a shade. When we put an electric light in front of a reflector the light is concentrated and shoots off in one direction. Such a light can be seen a greater distance than a light that is shooting its rays out at all points of the compass. As proof of this, look at the railway signals. A radio horn acts in much the same manner. When it is put over the loud speaking unit the sound waves are concentrated and they come forth in much the same way that they leave the mouth of a person.

As the author has said, many of the great sound physicists are in thorough disagreement regarding the phenomena associated with horns, or exponentors as they are called. One peculiar thing about them is that the dam things appear to work at both ends. When the sound is put into the small end it comes forth from the large end apparently increased in volume, and when a deaf person puts the small end to his ear and the sound goes in the large

end it would also appear that amplification is effected.

Let us hear what Lord Raleigh has to say in his famous book, "The Theory of Sound" "The case of progressive sound waves moving in a tube of variable section is also interesting. In its general form the problem would be one of great difficulty, but where the change of section is so gradual and no considerable alterations occur within a great many wave-lengths, the principle of energy will guide us to an approximate solution. It is not difficult to see that in the case supposed, there will be no sensible reflection of the wave at any part of its course, and that the energy of the motion must remain unchanged From which it follows, that, as the waves advance, the amplitude of vibration varies inversely as the square root of the section of the tube In all other respects the type of vibration remains absolutely unchanged. From these results we may get a general idea of the action of an ear trumpet. It appears that according to the ordinary approximate equations there is no limit to the concentration of sound which may be produced in a tube of gradually diminishing section."

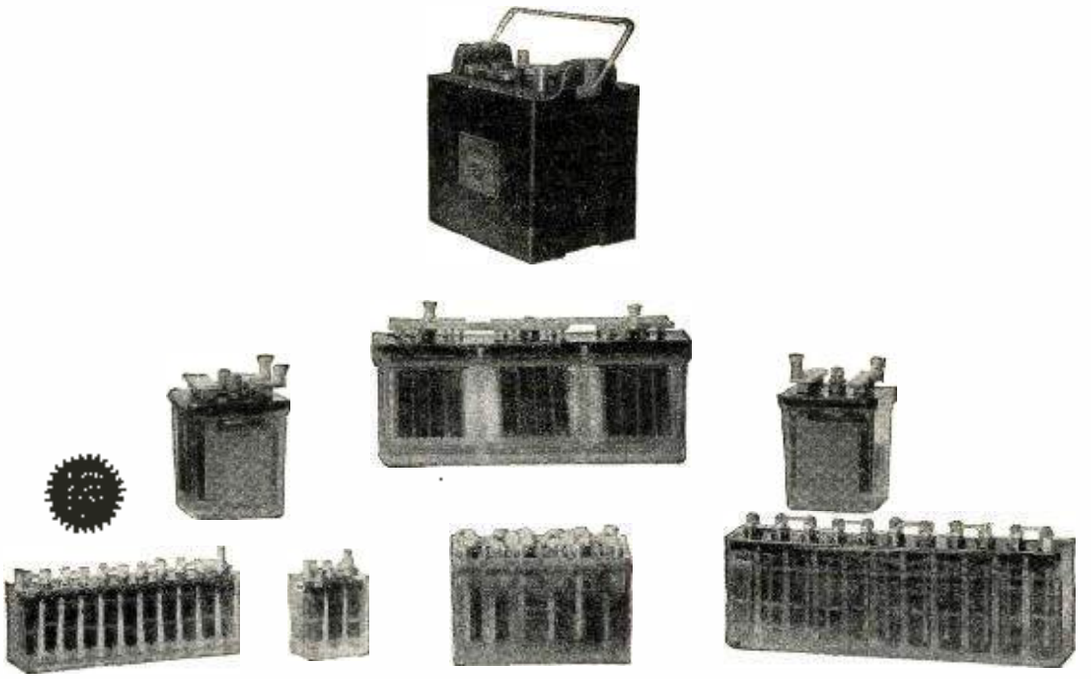
Needless to say, there are lots of physicists who do not agree with Lord Raleigh. In this connection it is interesting to briefly review the work of a man who has recently actually photographed sound waves as they originate and leave various shaped horns. This man is Arthur L. Foley. Mr. Foley holds that seeing is believing. He became tired of reading the contradictions of sound physicists, so he rigged up an electric apparatus which will allow him to photograph sound waves The device is extremely simple and we see it pictured in the sketch. In place of using the regular conical shaped horn, Mr. Foley employed what would amount to a cross-section of a horn. This cross section he made up of brass plates. In the sketch AA are spark gaps and BB condensers. C is another spark gap employed for illumination purposes. D is another condenser, and E is a photographic plate. In the center of the dummy horn there is another spark gap which is used primarily to set up the sound waves. The whole device is operated from a small spark coil. When a spark passes across the gaps a shadow of the horn is thrown upon the photographic plate by the light-giving gap C. This throws not only a shadow of the horn, but of the sound waves as well. Since we know that sound effects the density of air it is evident that the light will also leave an impression of the waves. In some of the photographs attached, Figs. 2 to 7, Mr. Foley shows the successive stages of an expanding wave, the average time interval between each of the six wave processes being about a 300,000th of a second. The pictures show that there was energy reflection in every wave, except when the wave front was at right angles to the surface of the air parallel to the surface of the tube. During these experiments Mr. Foley brought forth the fact that the condensing power of a horn is not the quotient of the area of the two ends, that it is not even of the order of magnitude in the size of horns of considerable angle.

Mr. Foley's general conclusions follow

1. The amplifications of sound at the small end of a conical receiving horn is due to pure resonance and condensation.

2. The amount of sound energy "condensed" at the small end of a conical horn receiver is but a small fraction of that demanded by the "condenser" theory. This theory is not tenable.

3 Sound pulses do not "glide around bends" on tubes and "slip" along slanting walls "without appreciable reflection." There is reflection at a surface wherever the molecules of air next the surface vibrate in any direction not parallel to that surface.



A BATTERY FOR EVERY RADIO NEED

It makes no difference what set you are using, whether one or nine tubes, whether two or six volts, single or multiple circuit, regenerative or reflex, or one of the numerous "dynes," there is a Westinghouse Rechargeable "A," "B" or "C" Battery to fit it.

Furthermore: If you are not already a user of Westinghouse Radio Batteries, you have no idea of the increased economy, reliability and all-around satisfaction to be had by using storage batteries, particularly Westinghouse Batteries, for all receiving sets.

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

Huygens construction applies in every case.

4. Much of the energy of the waves reflected in a crooked tube of small angle may eventually emerge at the far end, but the several waves arrive at different times. Thus the form of the emerging wave may be widely different from that of the entering wave.

5. Much of the energy of a wave entering the large end of a conical horn is reflected and eventually *leaves the horn at the end* it entered. The wider the horn angle the greater the per cent. of energy thus "lost."

6. Of the energy of an emerging sound wave the per cent. reflected at the open end of the tube is small.

Now that we have a method of actually seeing sound waves and the manner in which sound waves effect them, the day when we shall have a perfect radio loud speaker is not so far away.

The Beginner's Tube Set

(Continued from page 939)

springs) will not make good contact with the prongs on the base of the tube.

It is necessary to have an electrical connection to the socket springs so that wires can be conveniently fastened to them. This point is illustrated at 3 in Fig. 3. Be sure that a good connection is made here. If it is not, and the remainder of the socket seems to be in good working condition, tighten the connection with a screw driver.

A slot or bayonet joint is cut in the side of the socket as shown at 4 in Fig. 3. This is for the pin on the side of the tube to engage with so the tube will be held in place and in good contact with the springs. The slot also serves another purpose, it forces the prongs to make contact with the proper springs. All four of the binding posts on the rim of the base of the socket are marked with letters which stand for the elements of the tube with which they are connected. Since the set will work only when the elements are connected in a certain definite way it is absolutely necessary that this pin and slot be used. The slot serves as a guide in placing a tube in the socket and makes a mistake impossible.

THE RHEOSTAT

As mentioned above, the "A" battery heats or lights the filament. It is necessary to control the flow of current from the battery to the filament for reasons to be discussed in detail in another article. Here, an instrument known as the rheostat comes into play. There are three different types illustrated in Fig. 4. The purpose of all of them is the same, that is, to control the current from the battery by placing resistance in the circuit. Just as too much body surface (resistance) on a racing automobile cuts down the effective road power of the car, so does the rheostat cut down the power of the battery, and because the rheostat is adjustable, we are able to accurately control the current. This is essential, because when new batteries are used, that is "A" batteries, more resistance will be required in the circuit than when the batteries are partly worn out. The use of the rheostat enables us to use a stronger battery than the tube calls for and as the battery wears out, we can compensate for it by decreasing the resistance. Also, some tubes will work better when a certain current is supplied to them. This critical point can be found by the use of the rheostat.

At 1 in Fig. 4, we show what is generally known as a plain type, wire wound, rheostat. This is provided with an arm controlled by a knob, by means of which more or less of the resistance wire of the rheostat may be cut into the circuit. No 2 in Fig. 4

ADLER-ROYAL 199 *Operates on dry cells. Price* $165.00.

A 5-tube Neutrodyne *that operates on dry cells*

YOU may have your choice of two different styles of Adler-Royal Neutrodyne. Set 201A operates with the usual storage battery. Set 199 operates on dry cells. This is an achievement that has baffled radio engineers since the introduction of Neutrodyne.

Adler-Royal Neutrodyne also has separated the control for radio frequency and audio frequency. In simple language this means that with Adler-Royal, when a station is amplified, the desired tone quality and volume is controlled without detuning or distortion.

Not only their beauty of cabinet design but the workmanship and simplicity of the sets themselves are outstanding features of Adler-Royal.

Adler-Royal is on exhibit only at the higher class stores whose reputation is an additional guarantee of the quality of the Royal line.

ADLER MANUFACTURING COMPANY, INC.
General Sales Office: 881 Broadway, New York City
Factories: Louisville, Ky.

ONE of the three cabinet sizes of Adler-Royal Combination Radio and Phonograph Cabriolet Model 10. Price $300.00

Licensed by NEUTRODYNE

The Adler-Royal Neutrodyne is licensed under the Hazeltine Neutrodyne patents and manufactured for us by King-Hinners Radio Co.

ADLER-ROYAL Elizabethian Floor Type Neutrodyne No. 1 in figured walnut or mahogany finish; storage battery or dry cell equipment. Price $350.00

Adler-Royal
NEUTRODYNE

simply a vernier type, wire wound, rheostat. A vernier is simply an attachment by means of which the resistance of the instrument may be varied in smaller steps than with the plain type illustrated at 1. The vernier type is extremely useful in connection with a tube requiring critical adjustment of the filament current. This is particularly true of the 6-volt, 1-ampere type, known as the UV-200, which, by the way, makes an excellent detector tube for use with a storage battery.

There is still another important type of rheostat to consider that combines the plain type and the vernier type into one adjustment. It is illustrated at 3 in Fig. 4.

This does not make use of resistance wire, but consists of a series of carbon disks or a quantity of carbon grains so arranged that they can be compressed or released at will. The resistance of the carbon decreases as it is compressed and increases when released. By using a fine pitch screw thread on the rod compressing the carbon, very fine control can be obtained, fully equal to a wire wound rheostat with a vernier. This type is also very good for use with a tube requiring a critical adjustment of the filament current.

Regardless of the type of rheostat selected it should be mounted on a small unit panel so that it will match up with the other instruments. The method of mounting will depend upon the type bought. The unit panel will be the same as that used for the coupler or the variable condenser, but, of course, smaller. The mounted rheostat is indicated in Fig. 6.

THE GRID LEAK AND CONDENSER

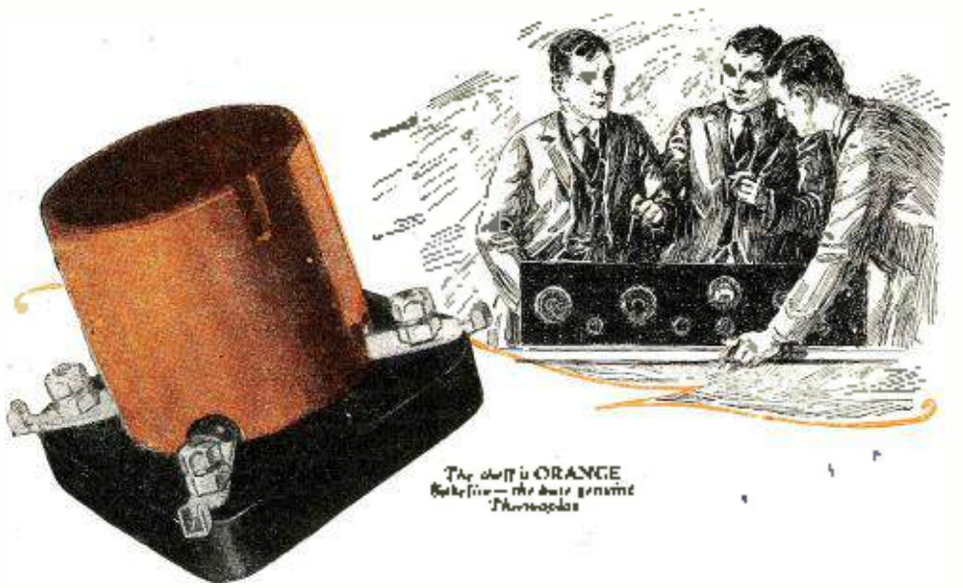
The grid condenser is very similar in construction to the phone condenser described in this department in the July issue. However, it must be more accurate in construction and it is advisable to buy one rather than attempt to make it. In purchasing this instrument get one made with mica insulation and equipped with two clips for holding the grid leak. Since the leak is to be connected in parallel with, or across, the condenser, you will save space and wiring by getting one of the type described. A condenser and leak of this type are shown in Fig. 5.

The grid leak is nothing more than a high resistance. It should be so made that it cannot be affected by the weather, because if it is, the resistance will be lowered when the weather is damp and increased when dry and poor reception will be the result. All good leaks are usually sealed air-tight in glass tubes. The leak may be of a fixed resistance and should be rated at about 2 megohms (two million ohms).

If, however, you wish to have your set as flexible as possible, equip it with a variable leak. There are many of these on the market but most of them have the fault of being open to the air and therefore not reliable. Others have a sliding or scraping contact on a carbon or graphite surface that soon changes the resistance of that surface at any particular setting by wearing or scraping the resistance material away. Thus it is soon rendered unreliable. The best leak is the one illustrated at Fig. 5A. This is a small glass cylinder with metal ends. Within is a small quantity of a liquid that has a fairly high resistance. Two peculiar shaped electrodes are arranged in the tube, one fastened to each metal cap. They are so arranged that by rotating the cylinder as it is held in a standard leak holder, they will dip further into the liquid and so lower the resistance of the unit. Turning back or past the minimum mark on one of the ends increases the resistance. This type of variable leak is efficient and regular in action.

THE VARIOMETER

The variometer is very similar to a coupler in that it consists of two coils of wire placed one within the other. There is a differ-



The More You Know About Radio the Better You Will Like This Socket

If ever a device were designed to increase the efficiency of all receiving sets, it was this new socket by the Master Builder. Radio engineers praise it —new set builders marvel at its ease of installation and the clear, loud reception obtained that bespeaks the absence of losses—many old-timers have even rewired their sets to establish new distance records and enjoy clearer reception with this better socket.

You'll like its construction, embodying a minimum of both insulation and metal—capacity absolutely minimized *without sacrifice of mechanical strength*. And its base of ebony Thermoplax in beautiful color contrast with the thin shell of orange Bakelite adds as greatly to the appearance of any set as the construction does to its efficiency.

You'll like its contacts (the source of losses and noise in most sockets); they are radically new in design, formed of phosphor bronze and *silver* plated—because the contact resistance of silver does not increase as it stands exposed to air. Then, too, electrical losses are minimized by providing maximum spacing between terminals, both in the insulation and in the air.

You will like the way the tube is inserted and removed without turning—which prevents twisting the bulb from its base. You will like its appearance—its small size—its neatness. You will like its silvered posts with slotted nuts that are fastened *well* with either screw driver or wrench. You will like the way these terminals are arranged for soldering—extra long so that they may be bent down where under-wiring is desired—and provided with ears to hold the wire in place for soldering. And best of all you will like the price, 90c. *This socket that meets the specifications of the most exacting radio engineer costs no more than most of those on the market today!* If your dealer has not yet been stocked, you can be supplied direct from factory at regular price plus 10c for packing and postage.

THE CUTLER-HAMMER MFG. CO.

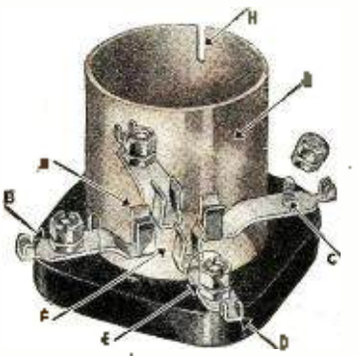
Member Radio Section, Associated Manufacturers of Electrical Supplies

Works: MILWAUKEE and NEW YORK

"Built By The Master Builder"

C-H

These Exclusive Features Assure Better Reception



A

Perfect contact. Both tube prong cleaned when inserted—no contact on worn or polished spot.

B

All metal parts *silver* plated—perfect contact for the life of the set. Silver may tarnish but its contact resistance does not change.

C

One piece contact construction. The bending part is NOT a part of the circuit—the wire to the socket always bonders the contact strip which carries the current direct to the tube prong—no joints to cause losses.

D

Convenient terminals for soldering—full length to allow bending down for under-wiring. Ears hold wire in place for soldering.

E

Extra loudy binding posts—tight connections with either wrench or screw-driver. Lock washers hold terminals rigid.

F

Wide spacing of current carrying parts both in air and insulation—true low-loss construction.

G

A minimum of both metal and insulation for low capacity. Shell of thin Bakelite—the base of genuine Thermoplax.

H

The tube is held in place by merely a vertical motion—no twisting to separate bulb from base.

The attractive orange shell helps identify this better socket, but the famous C-H trade mark dark on the socket and on the orange and blue box is your genuine protection

C-H **RADIO SOCKET**

ence, however, in that the two coils of the variometer are connected together while those of the coupler are not. Also, there are no taps on the stator or stationary coil of the variometer as there are on the coupler.

Although this instrument is not difficult to construct it is suggested that one be purchased, as a variometer with a wooden form is quite cheap; the price would probably be no greater than that of the parts for one, were they purchased.

LAYING OUT THE SET

Now that all of the instruments are collected together, they may be laid out on the baseboard as shown in Fig. 6. The instruments are shown somewhat spread out but they may be placed closer together if desired. However, the same general layout should be adhered to.

The next step is to connect all of the instruments together. The circuit is given in Fig. 7. The same wire advised in past articles may be used for connections, namely bell or annunciator wire.

OPERATING THE SET

After making all of the connections and placing the batteries in the circuit, do not place the tube in the socket at once. Instead, turn the rheostat to its "full on" position and connect the voltmeter across the filament posts on the socket. The reading should be the same as that of the "A" battery. If it is higher, something is wrong

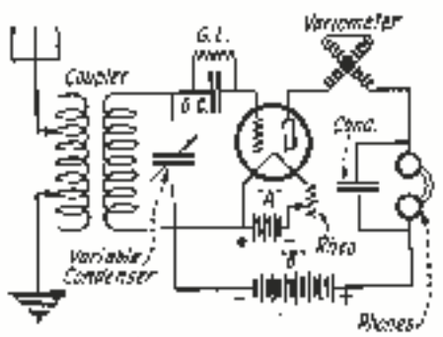


Fig. 7. The circuit diagram of the vacuum tube receiving set described.

and if the tube were to be placed in the circuit, it would burn out. Trace the connections and find the mistake. Then test again. When all connections are correct, insert the tube, place the phones on the head and turn the rheostat about half way on. Place the variometer rotor almost parallel with the stator and place the coupler stator the same way. Tune the set in the same way that you did with the crystal detector until it squeals. Then change the variometer setting until the squeal just stops. Then by varying the wave-length controls, a station will be heard as a whistle. If not, tighten the coupling of the variometer a little and try again. After picking up a station whistle (this whistle is the carrier wave), balance the tuning controls until it is loudest and then adjust the variometer to a point where the station is clearest and loudest. Then try adjusting the rheostat to the best point.

It takes some time to become accustomed to the tuning of a vacuum tube set, but practice will bring results if you follow the above rules. They are not inflexible, but should be kept in mind when tuning as they are basic.

GERMAN FANS MUST PAY

The exploitation of radio broadcasting in Germany as a source of revenue to the Government and the licensed broadcasting companies has been practiced for some time. The regular annual fee for listening in is 24 marks, or about $6. Recently the service

Dear Jim:

Last night I heard them sing, "Give a Man a Horse He Can Ride", from old WTAM.

I'm going to write a new title for that song. "*Give a Man a Radio Battery He Can Charge*," I say.

Willard Rechargeable Radio Batteries remind me of a fine bag clock. A good clock keeps time, all the time, because you wind it occasionally.

That's the way with Willards. They keep the power in the radio set and you don't have to wind them often. Just a little freshening charge once in a while and they're good as new again. Seems like you can't wear 'em out. I know lads who have had them for several years and their Willards are just as good now, as the day they bought them.

Get the kind that last, I say.

Sam.

WILLARD RADIO BATTERIES

FOR SALE AT WILLARD SERVICE STATIONS AND RADIO DEALERS

Write for WTAM's new booklet, "The Proper Use and Care of Radio Storage Batteries." Mailed to you with our compliments.

Write to WTAM *for this booklet—*

The Voice of the Storage Battery

WTAM is the Radio Research Laboratory and Broadcasting Station of the Willard Storage Battery Company, Cleveland, Ohio.

Its function consists of research which is being done to improve the quality of radio reception and the broadcasting of radio programs for your entertainment.

Tear me off the page and mail me to WTAM. I'll bring you "The Proper Use and Care of Radio Storage Batteries."

Name .....

City and State .....

Street Address R.N.-3

has been extended to include what are termed free stock exchange reports rendered daily. Now it is planned to further extend the service so as to cover agricultural information, for, about $42 annually is to be added to the regular charges. How American fans would swear if NAA or KDKA began charging for this sort of information. Owners of receiving sets in Germany are called "amateurs"—certainly then, the broadcasters are "professionals."

The Barometer and Radio Reception

(Continued from page 933)

harbinger of fine settled weather when the day sky is a clear blue, and beautiful white clouds sail stately overhead, and the dark purple dome of night shows the moon like a silver queen silently gliding in parade before the admiring gaze of a billion brilliant stars.

So the task in hand was to discover if there were any portion of the atmospheric pressure curve, or combination of curves which would be more favorable to radio reception than other sections. While an exhaustive study of the data accumulated within the last two years has failed to bring to light any formula, which by using the barometer curve as the major factor, would enable one to accurately forecast the quality of radio reception for two or three nights in advance, yet there seems to be quite a mass of evidence in favor of the theory that a slowly rising barometer, or better still, a barometer whose curve is virtually steady, or flat in any position, is the most favorable for radio reception. On the other hand, there is ample evidence on record which points to the rapidly falling glass as the most persistent enemy of good radio reception.

There are exceptions, of course, strikingly so in some cases, but as I am writing more for the sake of presenting the facts rather than trying to prove anything, it might be interesting for those who have kept a log of their radio reception for the last year or so, to check up on any dates I may mention as I go along. To begin with, 100 good nights were selected from the records which stated that these nights were ideal for reception, many in fact being what might be termed "super" nights with "DX" rampant from sundown to far into the following breaking day.

RESULTS

On 48 of these nights the barometer was found to be *rising*,—on 40 more it was *steady* and showing curves similar to A, B, R and S in Fig 1, and on the remaining 12 nights the glass was *falling*, thus showing that out of 100 excellent nights for radio reception 88 per cent. of the total found the barometer either rising or set steady. Again, selecting 100 instances when excellent runs of good reception or average reception were broken up, we find that in 72 per cent. of these cases a rapidly falling barometer preceded them, in 12 per cent. of them the glass was halted in a "valley" similar to that shown under D and E in Fig. 1, preparatory to a "climb." The remaining 16 per cent. of the time, when our reception went bad, the glass was found to be climbing at various angles from 60 degrees to 85 degrees.

For the benefit of those who desire to check their reception logs, I will quote a few instances, specifying the dates. In the following, the symbol R will mean that the glass was rising, and the symbol D will show that the barometer was dropping. The numbers accompanying the symbols R or D are used to show the rapidity of rise or fall: for instance, R30 would mean that the glass was rising at an angle of 30 degrees, and a D48 would be used to show where the glass

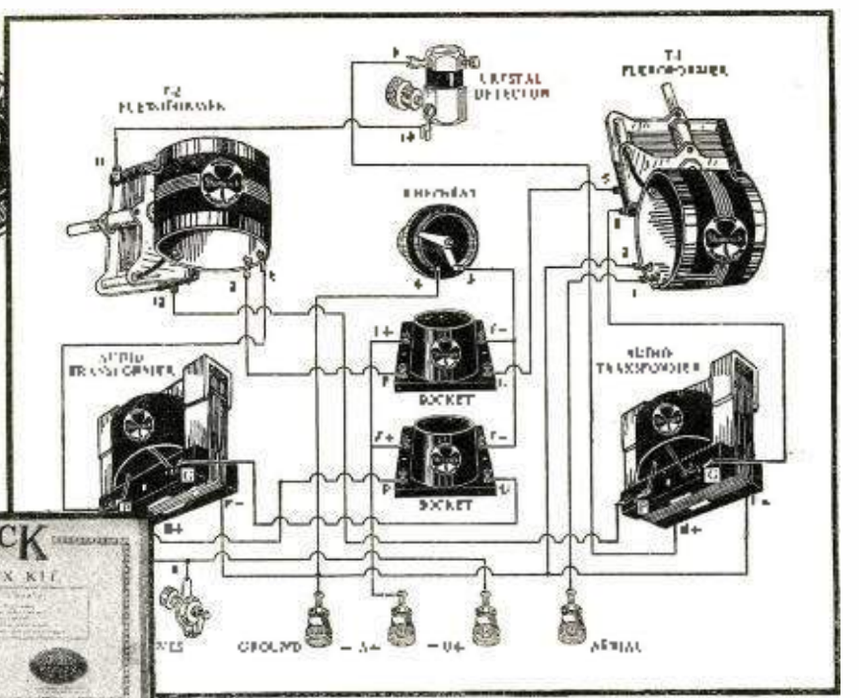
Enjoy the best radio in your neighborhood

The Shamrock-Harkness Two Tube Reflex!

LICENSED MANUFACTURE HARKNESS REFLEX NONE GENUINE WITHOUT THIS TRADE

Licensed under U. S. Patent Office Serial No. 719,284 for Radio Receiving Sections.

PRICE $35



The set for the masses as well as the classes.

Combines best features of leading circuits

NEUTRODYNE DISTANCE
+
REFLEX CLARITY
+
REGENERATIVE VOLUME

THAT'S the Shamrock-Harkness Two Tube Reflex which has created such a sensation among experimenters and amateurs by its amazing performances. It combines the best features of the leading circuits in use today.

FEATURES

- Operates a loud speaker.
- Two tubes do the work of five
- Cuts battery costs 60%.
- Does not squeal, howl or radiate.
- Stations can be logged.
- Amazing clarity and volume.

DISTANCE AND SELECTIVITY FROM THE NEUTRODYNE: Radio frequency controlled by variable condensers mounted on air core transformers gives the Neutrodyne its remarkable distance and selectivity.

CLARITY FROM THE REFLEX: Just one unit is responsible for the reflex's well-known tone clarity. This is the crystal detector.

VOLUME FROM THE REGENERATIVE: The two audio transformers found in the regenerative are responsible for its powerful loud speaker volume.

THE SHAMROCK KIT CONTAINS all parts necessary to build this marvelous set. Enjoy the best radio in your neighborhood this winter. Buy this Shamrock Kit and make your own set at half the cost.

BUY ONLY SHAMROCK-HARKNESS LICENSED PARTS: True Harkness reception can only be achieved by using genuine licensed parts. Avoid imitations. Accept only the genuine.

BEFORE BUILDING YOUR SET mail coupon for "Shamrock Radio Builders' Guide Book."

SHAMROCK MANUFACTURING CO.
Dept. 66, Market St., Newark, N. J.

SHAMROCK
FOR SELECTIVE TUNING

SHAMROCK MANUFACTURING CO.,
Dept. 66, Market St., Newark, N. J.

I enclose 10 cents (U. S. stamps or coin) for copy of "Shamrock Radio Builders' Guide Book" containing diagrams and complete instructions for building 12 sets at prices ranging from $15 to $50

Name .....

Address .....

Dealer's Name .....

was *dropping* or falling at an angle of 48 degrees.

Beginning on July 25, 1922, a series of good nights terminated with the barometer showing D30. After a week of bad static the glass climbed on an R38 on August 4. Remarkable DX was accomplished until August 6, when the good air was spoiled by a D42 and restored on August 7 by an R35. Another horrible run of reception ended with a D62 on August 17, 1922, but the following day an R38 repaired the damage, and the glass settled slowly, giving us two splendid nights on August 19 and 20, only to desert us again when a D60 appeared on August 21 disturbing things temporarily, for a night until an R51 came along and handed us a beaut of radio nights worth staying home for. On August 24 we had a D55 and poor reception, and on August 25 good work being done on the receiver with an R70; also, the barometer took a vacation and rested on a practically "flat" curve similar to H in Fig. 1 for a period of five days, during which time the air was first-class all through, yet it is certainly interesting to find a D43 again putting a stop to such ideal conditions on Sept. 1, giving only indifferent reception for the next two days. As usual, an R75 cleared things up again for us, but a D62 next day ended the good work, the latter eventually giving way to an R53 again on September 5, which packed us until September 7, when a D58 served up such a very poor quality of reception for four nights straight that we were extremely thankful for the surprisingly slow climb of the glass on an R19 to perch on our battered air again on September 11, 1922.

While I am around this date, let me tell of an unusual occurrence on September 13. This particular night was really a wonderful one for radio and the glass was passing through a relatively high position, climbing at the rate of 06 degrees, the pressure registering 30.25 inches, but the barometer evidently felt youthful and vigorous that night for it went on climbing to an abnormally high position seldom attained here, namely 30.5 inches. For a period of four days after that "Super" night of September 13 when the glass climbed out of sight, the air was simply "dead" and it took three more days before the barometer got over its foolish notions and slid down to a rational level when our reception materially improved on September 20.

This phenomenon was duplicated more recently on April 20 this year, when the barometer curve almost ran over the top of the pressure chart, soaring to an altitude of 30.65 inches at 12 noon that day. The reception that night was exasperating, to say the least, yet at midnight the glass relented and was seen to be tumbling and keep the following day, passing through a normal area of 30.13 on April 27, the night of which was exhilaratingly crammed with hitting pax. To quote each instance in detail would take up too much space, but in very many instances we find the reception curve rising and falling in direct sympathy with the barometer curve. The first two ideal weeks of January, 1923 succumbed finally to a severe attack of the barometer which, after being passive in those two weeks, ran amuck. On January 30 it dove violently, and rose again,—then plunged again like a bronco early on January 20. That was enough. Our long spell of lovely reception while the glass was steady suffered terribly under such treatment, sitting almost exactly from that time on, and was at a critically low ebb on January 26, when a long looked for DX just arrived in time with an antidote for our disgust of radio in general and on January 29 we were back on full force, during royally an plump DX reception again.

I am simply repeating the story with a change of dates when I refer to February 20, 1923. Here again, a light-weight like D86 scattered a splendid succession of good

"MONODYNE," the Universal Receiver

SPECIAL MONODYNE FEATURES

1. The single tube on the Monodyne acts as amplifier and detector equaling a volume of two tubes.
2. Uses but one dry cell tube, preferably WD-12 or C-12.
3. Only one tuning control—simple and easy to operate.
4. Selectivity — sharp tuning always on all wave lengths.
5. No storage batteries. Operates on single dry cells.
6. Easy to install—permits all kinds of "hook-ups."
7. Can be used with head phones or loud speaker.
8. Costs only $10 postpaid (without tube).

Within everyone's purse. Operated by anyone using only one Tuning Knob and one Tube.

PRICE including two inductance coils, but without tube, batteries or phones

$10.00

Only one knob for tuning. No longer do you spend half the night in needless fussing, turning this and twisting that, missing all the pleasure of the entertainment.

"Like talking over the back fence" is the way one customer describes a political speech he heard broadcast over a thousand miles away.

The MONODYNE circuit is one of the most radical advances in Radio engineering. Parts heretofore considered essential are omitted with no loss of efficiency. One simple tuning control gives selectivity equal, if not superior, to sets costing hundreds of dollars.

Size 4¼x6½ weighs less than 3 lbs.

ALL WAVE LENGTHS—NO STORAGE BATTERIES

Calibrated Audio Transformer

Here is a transformer that not only positively eliminates all the drawbacks of other makes, but in addition stands head and shoulders above any other audio frequency transformer on the market today. To prove this seemingly flowery language, note the following:

From recent tests conducted in the RADIO NEWS LABORATORIES this transformer was found to have the following characteristics: The voltage amplification curve, obtained by applying a constant peak voltage across the primary in series with a 10,000 ohm resistance and measuring the secondary peak voltage at various audio frequencies without absorbing any current from the secondary, was found to be exceptionally flat throughout the entire band of audio frequencies. Tests were made at frequencies ranging from 150 to 6000 cycles, and the curve extended well into the lower frequencies where other transformers fail. In fact the amplification at 200 cycles was almost equal to the amplification at 1200 cycles, a condition not found in any other high grade transformer. The curve is flat from 1200 to 4000 cycles, giving a direct voltage amplification of from 4½ to 5 times throughout the entire range. Thus

$5.00

there is virtually no distortion caused by the transformer.

Tests made on the transformer in actual operation corroborated our electrical tests. Broadcast music was not only amplified and reproduced with life like faithfulness but the volume was greater than that obtained from other transformers. The transformers had no tendency to oscillate at audio frequency, or squeal, as many do, and consequently require no shunt fixed condensers or resistances. Of particular interest was the volume and quality of the base notes of the saxophone, piano, etc. These notes, although missing in most receivers, came through with astounding volume.

A Calibrated Transformer

A print showing the calibrated curve is included so the user can tell how to get best results.

The "Calibrated" Audio Transformer is specially designed for Radio Broadcast reception reproducing voice and music faithfully and with freedom from distortion. High amplification at all frequencies. A high grade transformer giving results heretofore unattainable. Superior in design and beautiful in appearance. Improved terminal mounting giving maximum separation of grid and plate and admitting connections being made with equal facility in any direction. Ideal insuring short leads.

Manufactured in 2 styles: 3½ to 1 (Monodyne ratio) and 4½ to 1 (all stage ratio). Price each style..... **$5.00**

If your dealer cannot supply you, use coupon

NATIONAL AIRPHONE CORPORATION
18 HUDSON STREET
NEW YORK

S-E-N-D N-O M-O-N-E-Y

NATIONAL AIRPHONE CORPORATION R.N.-12
18 Hudson Street, New York City.

Gentlemen:—

Please send prepaid ☐ Monodyne Receiver ☐ Calibrated Transformer for which I will pay the postman, upon delivery, the advertised price.

Name .....

Address .....

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

nights and practically left us desolate for five or six days. Coming further and picking at random we find September 14, 15, 16 and 17, 1923, delivering superb radio, but a D78 put an end to it all until the 20th of the month, when an R65 was exceedingly welcome.

Rippling over the months for the benefit of our newcomers who only got into the game this year with their logs, let us go to Jan. 25 of this year (1924) and see how poor the stations were and failing very had. Well, a nasty D76 set in on the day before and the glass had fallen remarkably low on the 25th with a frightful blizzard here. On Jan. 25 an R70 arrived, continuing through the 27th, on the night of which your logs will undoubtedly prove unique for startling DX records.

EFFECTS OF RAPID DECLINE

Since recently still, let us pause at the first week in July, 1924, so as to select a difference in seasons.

Here we watched the barometer ambling along for several days on a comparatively "flat" curve, nice and steady in a fair weather zone. Radio reception was very good during the whole of this period, but on July 7 the break came. The glass fell away rapidly and was in a "bad low" next day, reaching its worst on the night of July 9.

Thousands of logs of radio amateurs will show that the Canadian Polar ship *Arctic* (call VEDM) whose signals had been roaring in for several days, then fell away to a weak whine on July 11. Turning back now to July 10 on their log books, these amateurs will find that their transmitters put over some nice DX (if they were working) for the time of the year, but on the night of July 11 that strange magic which flung their signals into distant states had vanished and on the whole reception was jotted down as very poor.

Once again the charts show that the DX night was the night of the rising glass and the poor night the one of the falling glass.

The *Arctic* was wonderful in volume when the glass was steady or rising,—wheezy and swinging when the glass was falling, and back to her usual trumpet note on the 14th when the glass rose again, although the ship was considerably further away.

The evidence up to now tries to show the rising or steady barometer as our best friend, and the falling or erratic barometer our worst enemy, but there are exceptions, of course; as fact there are instances which will cause one to ponder before coming to a conclusion on anything. A log of transmissions from this station shows that while the bulk of my DX was accomplished during the periods of the rising or steady glass, yet I was only able to reach the West Coast (2,500 miles distant) and to England once in a period of four months with 20 watts of C.W.

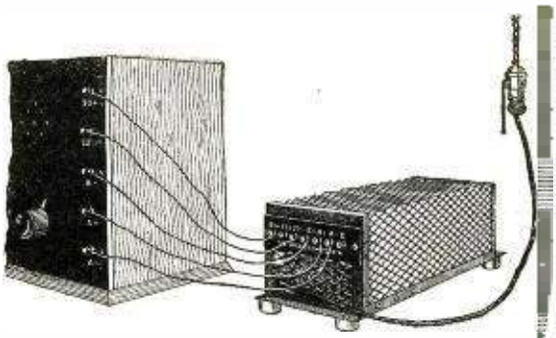
Then one morning I worked the West Coast three times *inside the hour* on 15 watts C.W. while the barometer was *falling rapidly*.

We will carry confusion further by relating that my average range on the phone (10 watts) was 800 miles, easily conversing for hours at a range of 600 miles, and many reports from ranges of 1,000 to 1,200 miles of good reception, yet on both occasions when I have been notified that my voice has been heard plainly 1,300 miles South, the barometer was *falling* here.

CLOUDS

Many lovers of radio prefer clear bright nights and others favor a dark cloudy night. Let me tell them that the records show that first class reception has been tabulated on innumerable occasions with both clear and cloudy nights, with the balance in favor of a night with low lying rain or snow clouds after a generally cloudy day which seems

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.

PRICE $25.00

Sent Express Collect

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.

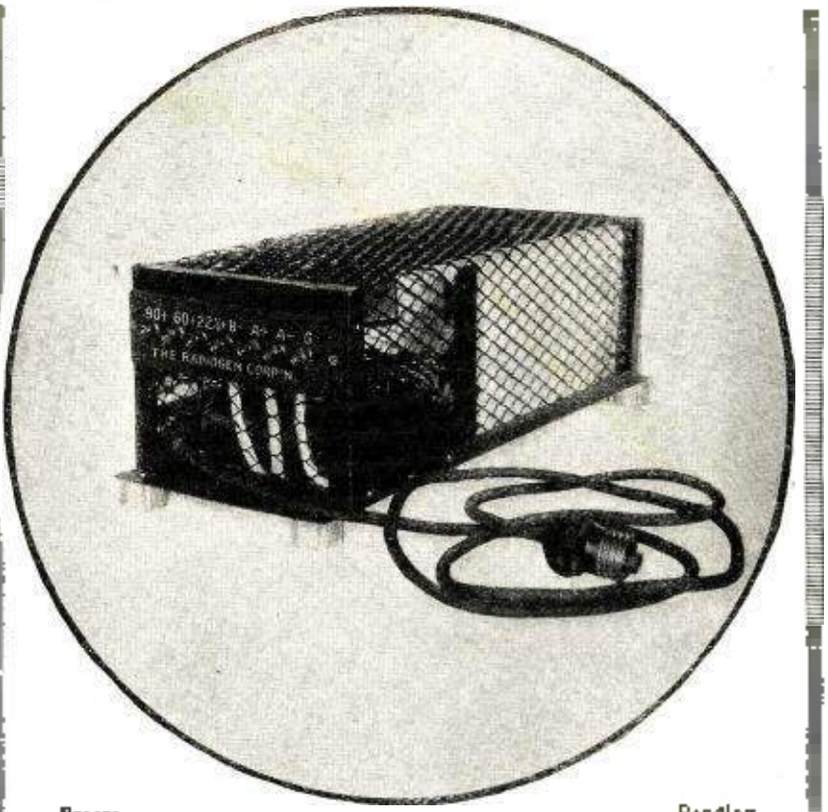
THE RADIOGEM CORP.,
66-R—West Broadway, New York City.

Gentlemen.—I enclose $25.00. Kindly ship me express collect one A-B Power Unit (for 110 volt direct current only).

Name .....

Address .....

City and State .....



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 8 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

The Radiogem Corporation

66-R-West Broadway New York City

to prevent the bright sun from sending the DX out of the air.

RAIN

No evidence is at hand that rain helps or hinders radio transmission. Rain as generally precedes after a barometer decline, and very often also when the glass is recovering after a bad "low." However, we have then DX can be brought in during a deluge, whereas right, very poor work on the receiver will be recorded under like conditions.

SNOW

Usually the majority of snowy nights are good, but so is the season during which snow is encountered.

Blizzards have a bad habit of tying up reception, on first thought, until we note that it is the falling barometer that foretells the blizzard, so why blame the blizzard?

WIND

Severe fading has been noted on many nights during a high wind, and on quoting figures we find that fading appeared on 81 nights out of 100 nights that signals were known to be swinging.

I am prone to blame quite a deal of this upon antenna systems both at the transmitting and receiving ends. A high diving or fast climbing barometer invariably brings winds ranging from a brisk breeze to a young tornado and a characteristic symptom of unsettled weather is the slow "fade out" of our music, which appears to leave us and go somewhere to recoup its strength and after periods ranging from 15 and very seldom of more than 90 seconds, return to us with apparently renewed vigor. It might be interesting to note here that very often what a station fades from the East coast receivers it is reported strong to the West of the transmitter, and vice versa.

NORTHERN LIGHTS

While the Northern Lights may have a lot to answer for in the way of interfering with telegraph and cable communication, the records reveal nothing substantial in the way of evidence to show that they are very detrimental to radio reception.

Both excellent and poor reception have been had when the Lights have been playing. I will quote the log of some exceptionally unique displays:

Oct. 14, 1922. 1:05 p.m.—North Lights magnificent tonight, swaying and in broad curtains of varied colors, coming from the N. W. horizon to the S. E. Some curtains sweep so low a hissing crackle as plainly heard overhead. Reception is splendid tonight.

March 26, 1923. 11:30 p.m.—North Lights making wonderful picture tonight. Dogs are loaded with static, sparks flying from ears, nose and tail when fur is rubbed. Radio is simply rotten.

PHASES OF THE MOON

It may not be generally known that the first quarter of the moon surely earned a bad reputation in 1923 as a breaker up of good radio weather. Look at these records:

Jan. 24, 1923. Reception has fallen off considerably tonight.—First quarter of the moon.

Feb. 23, 1923. First quarter of the moon.—No radio concerts heard at all for three nights since that date.

March 26, 1923. First quarter of the moon. Hardly a radio station in the world for the next six nights!

It looked very bad for that particular phase of the moon, but before or since I have been utterly unable to fasten anything definite on to that, or in fact any phase of the moon. There is nothing consistent about it. Even as I write (September 6, 1924) it is the first quarter of the moon and my wife is filling the sitting room with radio music from almost anywhere on the American continent. As the Irishman said, "There's good an' bad everywhere."

A VIOLIN *could crash it!*

TUNE a violin closely to the tremors of the greatest of symphonies. Amplify sufficiently—and note what happens to the building!

Unbelievable? Hardly more so than the proportionately greater amplification which is Radio itself.

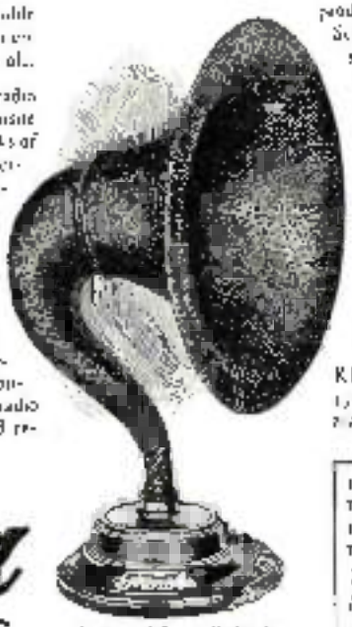
Out of the air your antenna sifts infinitely tiny impulses. Your receiver nurses them along, amplifies them stage by stage, and transforms them into sound waves—whispers which can be made audible a city block distant by Thorola Loud Speaker.

The very volume which only Thorola makes possible, allows you to tune closer for local stations, and it does bring in weak, distant signals with strength never known before. Double the power of your set and hear two stations for the first time on The other.

Thorola power alone marks a radio epoch. Even greater is the exquisite reproduction. Famous singers, works of greatest composers, entertainers' personalities all come to you with unprecedented fidelity. Such marked entertainment results only from the many Thorola betterments which go to radio to make it fundamental as a great musical instrument.

The Thorola reproducer, in size and design, reflects perfect true precision construction. Thorola Controlled Metal Diaphragm brings radio the highest development in sound reproduction. The exclusive Thorola Separo eliminates blurring and preserves every overtone. The Thorola horn—composite, Thorite, ends compromise with acoustical laws. And, finally, the exclusive Thorola Synchronizer harmonizes your Thorola with your receiver.

Whatever your choice of radio now, go hear Thorola. New character of entertainment, new stations most likely await you. The Thorola 10-Day Refund Warranty is a guarantee to assert that Thorola fulfills every claim.



An Imperial Period Model (No. 36) Thorola Loud Speaker

RICHMANN COMPANY
1243-45 West 74th St., CHICAGO
RICHARDSON RETRACTILE THOROPHONE

THOROLA, 42½	THOROLA, 31.50
THOROPHONE, Compact Junior	8.75
THOROLA, Floor and Console	65
THOROLA, Cabinet and Speaker	350

Thorola demonstrations and sales are in the hands of the most discriminating dealers. If one is not located near you, we will gladly give you name of your

Thorola
THE SPEAKING LIKENESS

Hadn't I followed that radio writer's instruction? I pulled up the easy chair, settled myself, and with great care and dignity adjusted the head phones. Apprehensive, expectant, I turned on the rheostat. The tube lighted up brilliantly and then suddenly went out. "Great Caesar!" I groaned, "She can't be busted!" I turned and turned again, but the tube very politely and quietly refused to respond to my frantic attentions.

In perfect agony, I heard a car drive up and I knew that in it was my wife, who, evidently, had been brought home by a friend. First I thought I'd hide the whole "darned" mess quickly. That would be better than being found with it and displaying it to Herb's gang when they came in later. But that was impossible. I just had to try it once more. And so, once more I wrenched the rheostat, but to no avail. In utter disgust, I tore off the phones. And the most surprising thing. The tube lighted of its own accord!!

Quickly I returned the phones to my head. I turned the dials until they fairly whirled, but all I heard was a bedlam of whistles, scratches, and howls,—enough to wake the dead. I turned and adjusted, redoubling my efforts desperately when I heard the front door open and slam, and a sweet, clear voice call "Where are you, dear?" I gave the condenser one last, mad wrench and the set settled into the quiet silence of the tomb of an Egyptian mummy!

A rather creepy sensation was coming over me. Somebody was watching me. I just knew Alice was in the room; I could feel her eyes upon me; I could imagine how her little mouth was just twitching to find the appropriate word with which to begin as she looked first at me and then at that clamming mass of barrels, and zinc, and tangled wire. I turned ever so little with lowered eyes, with the trepidation of a child caught in a forbidden act. And there, sure enough, she stood, arms akimbo, eyes a picture of amazement, mouth quivering, face suffused with angry blushes. Her eyes traveled down to my ankles and centered there so long that I was constrained to look there myself. What I saw was a pair of perfectly healthy ankles, unclamaged by any bruise. Evidently I had lost the bandage in the "shuffle." A groan escaped me. That must have been the signal for action. She stepped forward so heavily that the floor actually shook and began in a high-pitched voice the harangue to which I had resigned myself.

"Bill Gaskins! Are you a fool? Do you mean—"

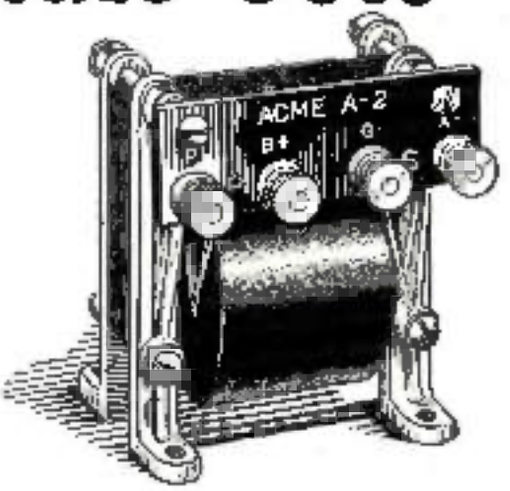
She never got a syllable further. I came near jumping out of the window. Perhaps I should have, but I, now, was paralyzed with astonishment and thrilled into a state of trance. I simply could not believe my ears. Without one whistle, or one scratch, or one howl, came clearly and distinctly a voice announcing,—

"This is KDKA, the station of the Westinghouse Manufacturing Company, East Pittsburgh, Pennsylvania. . . . . "

Dumfounded, I could only gasp, "Pittsburgh Pennsylvania! And me in Marshall, Texas!"

Until two o'clock in the morning I had to stay up for my wife, for she became so fascinated that she wouldn't let me have the head phones for more than a minute at a time. Cuba, Schenectady, Detroit, Denver, Los Angeles, Atlanta, Davenport, Min-

This Transformer Has Improved Thousands of Radio Sets



ACME A-2
—for volume

". . . Your letter answering mine of December 10th came just as I got home with an ACME A-2 in my pocket. I installed it in my reflex set in place of the —— and believe me you cannot exaggerate its good qualities . . ." From Winnetka, Illinois.

". . . Am using your four-tube Acme circuit, using three audio and three radio transformers, and can pick up any 50 watt station in the U. S. A. . . ." From Fitzsimmons, Colorado.

These are just typical samples of testimonials picked out at random from our files. If we tried to show them all to you, we'd have to publish a book. You couldn't read them through in a day.

But right here and now today you can, if you will, get the benefit of ACME Transformers. Use them in the set you build. Insist on them in the set you buy. Then your loudspeaker will have a chance to reproduce loud and clear without distortion.

Send 10 cents for 36-page book, "Amplification without Distortion," containing many practical wiring diagrams and many hints for getting the best out of your set.

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Dept. 71, Cambridge, Mass.

ACME
~ for amplification

ACME APPARATUS COMPANY,
Dept. 71, Cambridge, Mass.

Gentlemen: Enclosed find 10 cents for copy of "Amplification without Distortion."

Name .....

Street .....

City..... *State*.....

It is only a matter of time to descend the ladder from one task to another until the performance of menial work in connection with operating will be a regular thing. Obviously the only solution when matters reach this point is for all operators to refuse to accept employment under such conditions.

I wish to take exception to the use of the word "humble" in Mr. Pyle's article. I do not believe he intends it the way it will generally be interpreted. It seems to me that a policy of some operators in being "too humble" is the direct cause of the subject of Mr. Pyle's complaint. When we succeeded in having our status recognized as that of an officer, it does not follow that we should be more humble than any other officer, but an attitude of fellow-officer, the same as they assume toward each other, is in my opinion the only one to be taken. Modesty and respect for others, as well as for yourself, however, are commendable qualities at all, be it of high or low grade, and when coupled with a thorough knowledge of one's job cannot fail to command respect in return.

Every ship presents its own particular problem, and as circumstances alter cases and every individual is different, a superabundance of plain common sense and good judgment is a prime requisite of every operator. If he has these, it won't take long to adjust himself aboard any ship and uphold his end with credit and to the betterment of the profession.

In the matter of extra tasks, these are usually begun as favors and in a spirit of accommodation, but people are prone to take advantage of good nature. This is especially true of sea-captains, so it is always best to let it be known early that there is a limit to this accommodation, or it won't be long before accommodation turns to obligation in the eyes of the Captain.

Another thing mentioned by Mr. Martin, to which I can bear witness (although I didn't know cases of this kind were happening in the past two or three years, as I thought our status as officers was established well enough to preclude this form of abuse) is the habit of some Captains ordering the operator to take his meals with the petty officers. I signed on a ship in 1919, after two years operating in the Navy, during which time I had considerable experience aboard merchant vessels, so I wasn't green; I found, however, I was to eat in the petty officers' mess. When I protested to the Captain, he informed me that his word was law aboard his vessel (note: Sea Wolf type) and that if I didn't like it, I would soon find myself in the forecastle. Later, however, I had the satisfaction of having him come to me with an invitation to eat in the Saloon, which I refused with the explanation I found the petty officers preferable as table mates. After a six months' voyage, needless to say, I refused to ship on that vessel again.

I agree with Mr. Pyle in that the dignity of the profession can be realized and upheld only by the conduct of the men in it. It seems strange, however, considering the growing use and importance of radio in navigation that it should be necessary to be continually fighting in some quarters to maintain our position. It can be readily seen what a handicap a young operator just out of school is laboring under should he find his first assignment aboard a ship where such antagonistic ideas are prevalent. Incidentally, the profession in itself is a handicap, in that it is one into which a great amount of new blood is always being infused. New blood in itself is well enough and is essential in all lines of endeavor, but where this fact alone is a cause of contention with some Captains and Steamship Companies it requires a particularly high type of man to overcome this disadvantage.

The schools, as Mr. Martin says, can help to remedy the situation to a great extent in

The
RED SEAL
VARIABLE
CONDENSER

At Last—an ideal vernier to control a low-loss condenser

You have probably often wished for such a combination. Now for the first time the vernier of the Red Seal enables you to easily take full advantage of high condenser efficiency without tuning right through the sharp peak of the wave.

No more slipping, lost motion, or tight bearings. No more tuning with one knob and adjusting with another. All the adjusting may be done with the vernier knob alone.

The above does not give you an adequate picture of the Red Seal Condenser. Go to your dealer and ask to see it. As you operate the vernier for yourself, note these six important features which make it the ideal control for this efficient, low-loss instrument.

1. The action of the vernier is *particular*, giving delicate, smooth adjustment.

2. There is no lost motion or play at any point.

3. All tuning may be done with the vernier alone.

4. Only one dial setting—stations easily logged.

5. There is no fibre, rubber, or gears. Nothing to wear or get out of order.

6. Plates turn freely. Balanced vernier eliminates need for friction at bearings.

The Red Seal has four other points of note:

1. Plates are of brass and are *soldered*.

2. Spring "pig-tail" connection employed.

3. End plates are grounded, eliminating the effect of hand capacity. For supercritical work, insist on the Red Seal Variable Condenser.

4. To facilitate tuning the movable plates are given a special shape, making the Red Seal of the "straight-line" type.

Manhattan Electrical Supply Co.
Incorporated
New York Chicago St. Louis
San Francisco

Manhattan
RADIO PRODUCTS

MADE BY THE MAKERS OF THE FAMOUS RED SEAL DRY BATTERIES

Manhattan Junior Loud Speaker

A real musical instrument containing a specially designed reproducer unit for loud speaker work. Not just a headset in a base. Has "Concert Modulator" adjustment giving best results under all conditions—$10.00.

Red Seal Headset

Designed for "DX" work. Tone quality excellent. Workmanship the best. No distortion or chattering. Bakelite case, soft rubber sanitary headband —$6.00

Red Seal Phonograph Attachment

Makes a loud speaker of your phonograph. A high grade reproducer reproducing the work of the broadcasting artists with fidelity—$5.00

Red Seal Batteries

The dependable dry battery for "A" circuits. Long operating life and great recuperative power make Red Seals ideal for radio work. Sold by all classes of dealers. Remember, *fresh* Red Seals bring in fresh stations

providing truthful instructions as to the various conditions likely to be met with aboard ship, but experience only can give that confidence and knack of "fitting-in" before one is accepted as a member of the "Sea-going Fraternity."

Wm. S. Marks,
Opr. SS. *Birmingham City.*

FROM AN ENGLISH OPERATOR

Editor, Radio News:

Regarding the correspondence in your esteemed paper between 2LZ and 5XZ, I should like to correct some of their impressions re— comparisons of English and American radio work.

Surely 2LZ was not serious when he stated that it was impossible to tune out 2LO in London, he has only to peruse the pages of "Modern Wireless," to note reports of sets there, on which this has been done.

Regarding English and American periodicals, the former can certainly hold their own. For instance, in the September issue of Radio News, appears an account of oscillating crystals, now will 2LF please note that an article on this subject appeared in the August number of "Modern Wireless," and also one in "Wireless Weekly" previous to this?

Another of your contributors, Mr. James Vinal, speaks of Dr. Work. Does he know that 2LO is practically consistently received in the Mediterranean Sea (2,000 miles) on a crystal, and has been heard as far down as Freetown? Also 2LO has come built in Calcutta and South Africa, on a Marconi set, of which, still another of your correspondents, Mr. Howe, does not seem to have a great opinion.

Mr. Howe has certainly *some* receiver if he can only get British broadcasting up to 500 miles.

Considering programs, the British stuff, in my estimation, is undoubtedly the best.

Tubes in England cost far less than they do in the States, for instance, the best bright emitters retail at 12 shillings, 6 pence and 10 shillings, for example; the Canadian Myers tubes, selling in the States for $6, cost but 12/6. ($3). in England.

Perhaps Mr. Howe will remember that there are also English operators sailing consistently to American ports, who are quite as well aware of American conditions as Mr. Howe seems to be unaware of English

Chief Operator.
R. F. Ellis,
S/S *Tabhuba.*
(English)

BRITISH vs. AMERICAN BROADCASTING

Editor, Radio News:

It has been my privilege to read extracts from your paper in which various correspondents have argued as to the relative merits of British and American broadcasting.

The line unfortunately taken by certain of your correspondents has been wholeheartedly to condemn British broadcasting in favor of America. The writers may or may not have been to America. In one case certainly a direct comparison was made; in the other case (a certain Mr. Mayer) I should very much doubt if the comparison had been made under the same conditions.

There are always to be found in all countries people who are ready to condemn their fellow-countrymen, and over here I have often run across Americans who have condemned American broadcasting, but they, at least, have had the decency not to publish their views in our English journals.

It would seem to me to serve very little useful purpose to make invidious comparisons, inasmuch as the conditions in the two countries are wholly different—a fact that none of your correspondents seem to have

Exclusive features give Erla Minilow Condensers high efficiency. Dielectric and resistance losses absolutely minimized. Compensating plate form. 3 to 41 plates priced $1.50 to $5.50 each.

Uncanny smoothness and sensitiveness bespeak the advanced design of Erla Precision Rheostats. Single hole mounting eliminates need for disassembly. 6, 25, or 40 ohms. Price, $1.10 each.

Built for permanent trouble-free running; with Bakelite knob shaped for sensitive touch and highly dramatic calibration, Erla dials better any panel. Three sizes for ¼" shafts. Price, 50c to $1.25.

Never approached in design, and precision construction, Erla Synchronizing Transformers stand alone as an aid to maximum amplification, selectivity and tonepurity. $5.00 each.

Adding to receiving efficiency is the advanced Erla Loop. Rigidly erected—compactly folded—easy to rotate—beautifully finished. Standard and De Luxe models. $7.50 and $10 respectively.

CIR-KIT builds new Supereflex —Greatest of Erla Circuits

Erla led the radio amateur out of the wilderness of circuits. Erla initially introduced exclusive circuit ideas which made radio history, particularly because those ideas have uninterruptedly kept Erla circuits in advance of contemporary radio.

Remarkably significant is the fact that so many thousands of seasoned experimenters, once attracted to Erla circuits, consistently adhere to Erla. So there is a note of finality when Erla now announces the new Erla Supereflex Circuits. They represent highest development of the inherently superior Erla principles, acknowledged responsible for the most powerful circuits ever built, tube for tube.

Bringing these latest and finest circuits within the reach of everyone is the Erla *CIR-KIT*, effecting not only extreme economy, but also greatest ease of construction. Only screwdriver and pliers are needed to transform any Erla *CIR-KIT* quickly and skillfully into the most efficient of radio receivers.

CIR-KIT provides you with *everything* including specially designed Erla Synchronizing Transformers, Erla Certified Capacity Condensers, Erla Cushion Sockets, and finally Erla famous Solderless Connectors, banishing all soldering difficulties. Each unit and connection is unerringly located through full-size blue-prints; drilled, lettered panel; and stenciled baseboard.

With Erla *CIR-KIT* you yourself can confidently and proudly put into finished form the highest achievement of Erla radio engineers—Erla Supereflex Circuits. *CIR-KIT* receivers of one to five tubes are available, in loop and antenna types. See the Erla dealer, or write direct, mentioning your dealer.

ELECTRICAL RESEARCH LABORATORIES
Department C, 2500 Cottage Grove Avenue, CHICAGO

ERLA

Circuits of Certainty

recognized. Americans who have been over here—and we have met many who are responsibly connected with American broadcasting—have on the whole expressed the opinion which I expected them to: namely, that British broadcasting was, at any rate, equal to American broadcasting, but of course the conditions on the technical side were entirely different.

The chief complaint against British broadcasting is that the signals are weak. If I were to enter into a foolish comparative argument, I could point out that London has been heard in Rome at night, has been picked up in South Africa, that people dance to the Savoy bands in Iceland, that Cardiff has been heard in the Azores—in fact, I could give a list of information of this sort backed by written reports, but it seems to me that it would serve very little purpose.

Professional radio engineers are agreed that with a station employing 1½ kw. power to the aerials of the oscillators it is not worth while listening to such a station at ranges much over 30 or 40 miles, as the listener is to have a sole interest in the program.

I know that many people will entirely disagree with this remark, and perhaps in America you have far better ranges than these. I am not talking about a station being heard, but about a station coming out of a loud speaker in no way different from the voice of the announcer at the other end, undisturbed by atmospherics, jamming or a background of mush.

In England, at any rate, our stations are no better than this, because we have concentrated not on power, but on quality, and we think that our quality is about as good as any in the world, and our view is confirmed by many persons who have visited all the broadcast organizations.

For this reason we have tried to cover the British Isles with broadcasting by a great number of stations. We have, as I said before, an entirely different problem, and we are able so to duplicate stations on account of our population being far greater over the whole country than that in America. I think I am right in saying that if and when our new 25 kw. station is opened, something like 80 per cent. of the population of the British Isles will be able to receive broadcast on a crystal.

This is the problem, as we see it—to make broadcasting possible for all, and it would be interesting to compare figures as to crystal reception with America. I would ask your correspondents both on the other side of the water and on this to approach this matter of comparison in a somewhat more open frame of mind. It is so useless making invidious comparisons, if the conditions and very possibly the ideals of the two organizations are so widely different.

It always has been of the greatest interest to me to talk about broadcasting to Americans who have come over here, and they one and all have confirmed me in my view that, seeing that the problems are so widely different, we have solved ours as adequately as they have solved theirs. In cases, be it whispered, they have said that we have done better, owing to a unity of control.

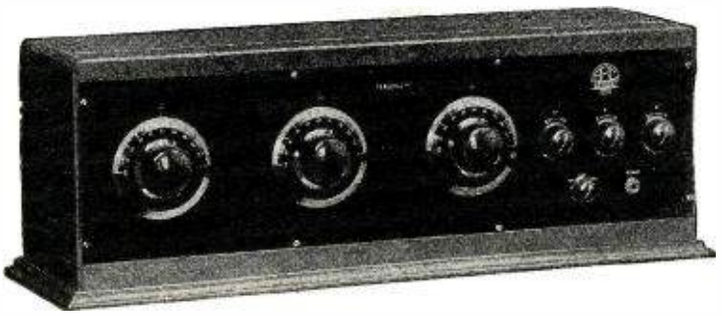
P. P. Eckersley, *M.I.E.E.*,
Asst. Controller & Chief Engineer,
The British Broadcasting Company,
London, England.

MORE FROM MR. BAYES

Editor, Radio News:

I read with considerable interest your September issue, which only reached here in September, and not in August, as in the United States, and of the letters therein printed I will deal with 21Z and 5tr N-tre first.

I am sure I thank both gentlemen for their expert criticism of my "talking



And now the Andrews Deresnadyne–

successfully *combines* tone quality and selectivity with distance and volume

Hitherto it has been possible to purchase in a radio set one of two groups of qualities—tone and selectivity on the one hand, and distance and volume on the other—but not both. Now the Andrews Deresnadyne 5-tube Radio Receiving Set, using the new Deresnadyne *principle of the balanced plate circuit*, for the first time successfully combines the two. It secures the finest tone and high selectivity *with increased volume and distance.*

The tone quality of the Deresnadyne has never in our belief been equalled by any radio set on the market. It brings to the home for the first time a reproduction of music really comparable to the original. In volume the Deresnadyne will give anything from a mute tone to a volume that fills a large hall. It is highly selective. It will go through a powerful local station to reach a weak distant station with only a few meters difference in wave length. This selectivity is secured by the remarkably low resistance of specially designed transformers. It secures great distance by conserving signal strength through unusually close transformer coupling. The Deresnadyne circuit stops the oscillation which produces whistling and distortion in the plate circuit, before it reaches the grid, which is extremely sensitive and where all adjustments are very critical. It is the only circuit which stops oscillation at its source, where it can be easily and efficiently controlled.

The Deresnadyne is extremely simple in operation and construction. It is easy to log. You can change from 1st to 2nd stage or turn off the set by simply turning the switch knob, eliminating jacks and plugs. A special feature is the Plate Balancer, which enables you, by simply turning a knob, to accentuate either tone quality or distance, as you wish. The case is genuine hand-rubbed mahogany.

Few sets have ever received the enthusiastic comments of radio authorities given the Deresnadyne. Robert J. Casey, head of the Chicago Daily News Laboratory says about it: "The circuit combines selectivity, range and quality in a degree that will astonish the old experimenter." Hear the Deresnadyne at your dealer's. Or write to us.

DEALERS: *Order through your jobber.* JOBBERS: *Exclusive rights in open territory may be secured by aggressive jobbers of high standing.*

ANDREWS RADIO COMPANY · 327 S. LA SALLE STREET · CHICAGO

Andrews Deresnadyne

DĒ-RĒS'-NĀ-DĪNE : PATENTS PENDING

Radio Receiving Set

Price, without accessories

$150

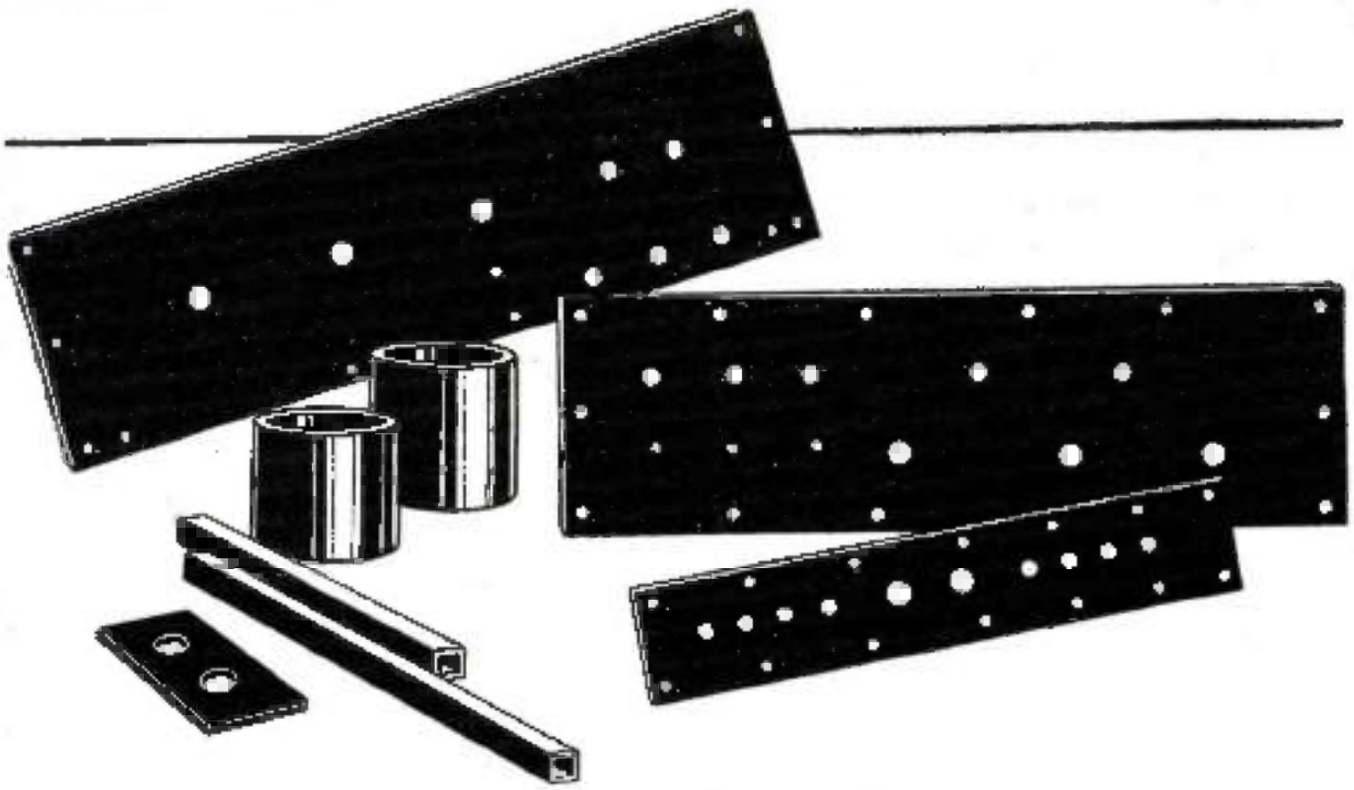
American." so much. Particularly 2I.Z. I had the pleasure of doing a good bit of liaison work with your engineers in the war and generally made myself understood. As to "Bootleg", I heard it long before the Volstead Act came into force meaning, as you say, illicit. In a country where no receiving yet can be illicit "a bootleg station" necessarily means an unlicensed transmitter and as such I took it to mean. Personally, were I financially able I should be only too pleased to entertain Mr. Gernsback as my guest, but being in a country where the war devastation in commerce has caused unprecedented depression, I have to be thankful I have a job paying $25 per week so I can't do much international entertaining. I will, however, do whatever I can, if he cares to come, and can put him wise to DX merchants, if he chooses. Last winter I could always get four or five B.B.C. stations at two miles from 2I.O on a single circuit tuner with one tube, and on two tubes our office buggers all but 6BM, so I must conclude that 2I.Z is a poor hand. I hope for the sake of the transmitting fraternity his first is better. Why he should be proud of putting out mystery retransmissions of 2I.O on short wave I don't know. Capt. Ian Fraser, the totally blind Ham, did it some time ago and gave his call sign, and it was free from distortion. If 2I.Z's reception is so poor, why bother to retransmit the received signals? They cannot have been very enjoyable. If you know how, you can pick up 2I.O on 96 meters or thereabouts, and it makes a useful test with short wave sets. 2I.Z doesn't know, of course, that your correspondence column is a little behind hand, so will be unaware that my letter was written before the increased powers of 6 k.w. and 25 k.w. were authorized. As to the rebroadcasting stunt, what I meant in my original letter was to enquire, if a country where radio is dead can do it with special arrangements, why can't the only country (?) where it is alive, do it without.

As to Mr. Nitre and tuning dead on the allotted wave, doesn't Mr. Nitre know that the Hams do not, here and in the United States, have any allotted wave? They have an allotted wave *band*; references to an allotted wave are (in the minds of anyone who knows anything of the subject) necessarily limited to commercial and broadcast stations with fixed schedules.

Both gentlemen mentioned above seem to think that my criticism of your programs is based on the quality of the received signals. My criticism was intended against the programmes themselves, i.e., the selected items for transmission, not the quality of the transmission, which owing to swinging, fading, etc., is often distorted when received here. I don't blame the distortion on the engineers of your big stations, but some of the little ones do need scratching up now don't they?

To our friend the operator on the S.S. *Ronda*, I can only say that he is a first-class distorter of the truth. I suppose he doesn't realize that some of us may, by reason of business, come in daily contact with the Americans who visit us so often and be well aware of how often so many of them are (until they know us better), so full of bombast and self adulation. I have no peeve against the Yanks, as I have some very good friends and correspondents there but I have against people who lie about affairs in my country. How does Fred. Howe account for the fact that all the B.B.C. stations are received in Geneva, Switzerland, on two tubes using a factory-made standard instrument, that 2I.O has been heard in Calcutta, India, in South Africa and the Argentine? His 320 miles is some exaggeration, believe me. Taking the Harmsworth Encyclopedia as the latest authentic British information is pure foolishness, and he knows it. Was that the only paper he read?

I do like Mr. Howe; he must have con-



Why is Formica the leading radio insulation?

THE demand for Formica for radio insulation has forced the building of the largest plant in the world for the production of laminated bakelite — and the only plant in the world devoted exclusively to this one product. This year 60,000 feet of floor space have been added to assure everyone prompt service.

This volume has been built up because Formica production under close laboratory control has provided the most uniform, best looking, and most easily worked material. It is used by 125 leading radio manufacturers who have tested all materials and who know that Formica is best!

There are four beautiful finishes: Gloss black, dull black, walnut and mahogany. Formica will not sag under the weight of condensers and other instruments; it will not cold flow under the pressure of screws and binding posts; its insulating strength gets better with age.

It is being used by many manufacturers for front panels; base panels; terminal strips; transformer cases; condenser ends; for jack, head phone and loud speaker insulation.

Dealers: Formica advertising and sales promotion will be greater this year than before. No other product is so well known for quality.

THE FORMICA INSULATION COMPANY
4618 Spring Grove Avenue, Cincinnati, Ohio

Sales Offices

10 Church St., New York, N. Y.
422 First Ave., Pittsburgh, Pa.
1142 Granite Bldg., Rochester, N. Y.
415 Ohio Bldg., Toledo, Ohio
1210 Arch St., Philadelphia, Pa.
1226 Second Ave., S., Minneapolis, Minn.
583 Mission St., San Francisco, California
Whitney Central Bldg., New Orleans
516 Caxton Bldg., Cleveland, Ohio
3 S. Clinton St., Chicago, Ill.
Title Bldg., Baltimore, Md.
47 King St., Toronto, Ontario

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

absence in himself. What would he think if I judged American radio by a visit to one store on the waterfront at New York? On the subject of tubes he is more than ingenious. It was a great idea of his to price only the thoriated filament tubes which are the subject of a world agreement as to prices. He forgot to tell about the Dutch tubes we can get for $1, the British and French at $2, numerous special types of tubes such as the Cossor P.2. and Mullard Master Valves for Special R. F. and A. F. amplification at $3. Myers tubes, for which you pay an extra dollar, can be bought for $3 also. How he knows the quality of our apparatus from glancing through our magazines beats me. I send a good many of our periodicals to the United States and get quite a few instruments for free-ie. What about four electrode tubes at $3.25? Can you beat it?

I can say that the latest Marconi ship sets are as good as any American ship sets, that is, if the same amount of money is expended in both cases. Mr. Howe should get an introduction to the Marconi stand at Wembly and see for himself. I shall be glad to have the receiver at his expense. Make it a Super-Heterodyne will you, as I am too poor to buy one.

Strange enough, Mr. Howe, I do study American methods. What is good in America I raise my hat to as any of my correspondents will assure you. I don't believe, however, except in certain lines, that you are the only people on earth who are any good. There are lots of good things done here, but our trouble is that we don't blow our own trumpets enough. I could wish, however, that you Americans had started the "Truth in Advertising" Convention at home instead of leaving it here, and starting with seeing that the views on his own nation and its fulsomeness of ultra superiority in everything that the Average American seems to advertise were strictly truthful.

A delightful piece of self admiration is contained on page 293 of your September issue as to KDKA's copper tube aerial, from which I am sure Mr. Frank Conrad will be the first to disassociate himself. Such aerials were no more his idea than they are mine; they were fully discussed for Ham use in an English magazine in 1922, and were used by the Marconi Co. in their 100 mile 45 meter transmissions before that.

A. T. C. Rayne
British 5XZ
45 Lavender Gardens,
London, England

FOR REFLEX FANS

Editor, RADIO NEWS:

I am a reader of RADIO NEWS and think it is the best magazine in the United States. I wish to exchange hook-ups with other radio fans. I have a three tube "Erla" Reflex and would like to hear from others using the same set.

L. D. Wise,
84 W. Maynard Ave.,
Columbus, Ohio.

RADIO IN GERMANY

Editor, RADIO NEWS:

The following notes from an American living far away in Stuttgart, Germany, may be of interest to your readers.

Last fall the German Government lifted its ban on amateur radio activities. The result was a sudden flood of interest in radio, accompanied by feverish activities on the part of manufacturers, most of whom had scarcely an idea of the rudiments of the art. Today aerials are to be seen everywhere, but most people have to content themselves with crystal detector sets, and "DX" receiv-

TRF-50
A handsomely carved cabinet—utmost efficiency 5-tube circuit with Unit Tuning—built-in Magnavox Reproducer. The receiver you have been waiting for; study the details.

MAGNAVOX

Patented in U. S. A. and foreign countries

MAGNAVOX

Receiving Sets which establish an authoritative standard of excellence for the daily enjoyment of radio.

LONG identified with the most efficient radio reproducing and amplifying equipment, Magnavox has developed its new Receiving Sets under conditions insuring superior design, precision of manufacture, and a gratifyingly low cost.

Exacting tests prove that the Magnavox Receiver is not only the simplest to operate but one whose daily performance will satisfy the most discriminating.

Magnavox Radio Receivers, Vacuum Tubes, Reproducers, Power Amplifiers, and Combination Sets are sold by reliable dealers everywhere.

THE MAGNAVOX COMPANY, Oakland, California

New York: 350 West 31st Street *San Francisco:* 274 Brannan Street

Canadian Distributors: Perkins Electric Limited, Toronto, Montreal, Winnipeg

12R

Receiving Sets

TRF-50 (as illustrated above)—is a 5-tube tuned radio frequency receiver with carved doors and built-in Magnavox Reproducer $150.00

TRF-5 is identical with TRF-50 but encased in smaller cabinet without built-in Reproducer . . $125.00

Type A and Type D—Six-volt storage battery amplifier and detector tubes with standard base $5.00

ing is a little known sport. Indeed, most of the tube sets are not especially conducive to "DX." I have had two German sets, one with three tubes and the other with five. With the first I could hear the Stuttgart broadcast station located a mile and a half away moderately well, and with the second not quite so well; as for any other broadcasting, one a peep! I do not mean to imply that there are not a good many German sets with which one can hear London and Paris and other "DX" to the extent of 500 miles or so, but it may be admitted that my first experience was a little discouraging; so I resolved upon the typically American expedient of building my own. With a few parts screwed to a drafting board, I now manage to pull in most any of the European stations which use a respectable transmitting power. For Europe, 500 watts is to be considered very respectable.

A few words then, as to European broadcasting. The two most important stations are Radiola at Paris and London 2LO. In the August issue of Radio News, the power of Radiola is given as 15 kw., under the title, "The New French Broadcast Station." It is true that the equipment provides for this amount of energy, but as a matter of fact only 1.5 to 3 k.w. are actually used. I am located only about 100 miles from Paris, but hear Radiola scarcely louder than London 2LO (Chelmsford transmitter) 450 miles distant. Chelmsford, by the way, seems to be almost unknown in the U. S. This is a transmitter at the Marconi works near London which transmits the programs of 2LO with an energy of something like 5 kw., at a wave-length of 1,600 meters. This new sender is vastly more powerful than the one using 365 meters, which is occasionally heard in New York. At 365 I get London just loud enough to be comfortably followed with the phones, but at 1,600 meters, the same program may be heard on the loud speaker a block away. This bit of information ought to be of great interest to all DXers. 2LO sends daily, almost continuously from 4 to 12 p. m., often until midnight. There is always a pause between 7.30 and 8. Chelmsford appears to be in use only from 8 o'clock on. It should be remembered that London and Paris as well, are six hours ahead of New York. Radiola sends from 12:30 to 2, from 4:45 to 6, and from 9 to 10:45, using a wave-length of 1,780 meters. The Eiffel Tower, at 2,600 meters, gives a concert daily at 6:15, which comes in here just about as strong as Radiola. American jazz is the popular form of music in London and Paris, so don't be surprised to hear familiar melodies floating in at these wave-lengths. The German stations use only about 500 watts, and would scarcely be audible in America. Frankfort (190 miles), Munich (420 miles), and Berlin (300 miles) all come in with about the same strength as London on 365 meters. Berlin is reputed to use something like 1.5 kw., however. The stations are all under the control of the Post-Office Department, and are supported by the contributions of the licensed listeners, which are collected at the rate of 2 marks (50 cents) monthly by the letter-carrier. Naturally, there are *Schwarzhörer* ("black listeners") who do not pay their share, but the penalty is fine and imprisonment. The system works quite well, in general, and the programs are good. As a general thing, only receiving sets approved by the postal authorities and guaranteed not to radiate or go above a wave-length of 700 meters are permitted. However, an experimental license to build what you like is obtainable on joining an approved radio club and passing an examination on the technical side of radio. The authorities are, above everything, bent on keeping off the squealing nuisance. Experimenting with regenerative sets is quite *verboten* in the periods when the local sender is in operation. The wave-

Anti-capacity **JACKS**

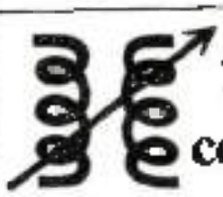
Anti-capacity **SWITCHES**

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

For Your New Hookup—

Build with less work and have a better set. Build with JOS. W. JONES RADIO PARTS.

Less drilling—no soldering—contact by simple binding posts.

Whatever the hookup, Jos. W. Jones parts will increase its efficiency.

$1

Double Circuit JACKS

JOS. W. JONES

Anti-Capacity

$1

"A" Battery SWITCHES

Jos. W. Jones Jacks—made for radio use only—have no long parallel leads, and so eliminate capacity effects. Binding posts make connections simple—no soldering. Jos. W. Jones switches are also anti-capacity. No soldering. The little red button shows outside the panel.

For Better Results Build With JOS. W. JONES

Jacks · Switches · Variable Condensers · Phone Plugs
Vario Couplers · Rheostats · Potentiometers · Grid Leaks
Inductance Switches · Sockets

JOS. W. JONES RADIO

TRADE MARK.

"IMPROVED"

radio parts

JOS. W. JONES RADIO MFG. CO., Inc., 40-42-44-46 W. 25th St., New York
(Formerly Radio Improvement Co.)

Headed by JOS. W. JONES—for 25 years a successful engineer and builder of precision instruments.

lengths used are between 390 and 500 meters. Berlin sends on 430 and 500 meters. There are altogether in Europe some 50 broadcast stations, with wave-lengths ranging from 250 to 3,200 meters.

Here I come to one of the chief problems which faces the radio enthusiast who will listen to European programs, that of covering the wide wave-band involved. Practically no attention appears to be paid to this problem in the modern American hook-ups. Anyone wishing to hear the higher powered European stations must be prepared to cover wave-lengths between 1,500 and 3,000 meters. The discussions in Radio News of an international language for radio are strong evidences that program broadcasting is taking on a world aspect. But no less important than a cosmopolitan language is a wide wave range for all receiving sets of international radius. There is one rather high powered German station known as Königswusterhausen which even sends on a wave-length of 4,000, giving stock exchange and similar reports almost hourly throughout the day. What is really needed for international broadcast receiving is a highly sensitive set with a range of from 100 to 4,000 meters. Of course, the set must be highly selective, for the interference from high power code stations on the longer waves is often very thick. I know of no arrangement which is practical and convenient for covering efficiently the international wave-band. If anyone reading these lines does, I should be most glad to hear from him. Up to the present I have simply employed two stages of R.F. tuned impedance amplification, whereby a considerable portion of the joy of hunting for different stations consists in plugging in and out a set of honeycomb coils. Not less than 15 or 20 coils are required to do the job right. This is not what I call practical. Besides, the arrangement is quite unsatisfactory to tune in, owing to three condenser controls and the aggravating unstability of such an unneutralized system. I am at present experimenting with a Super-Heterodyne hook-up, but do not know whether this system can be persuaded in any practical way to go up and down the scale as required. I hope to hear from readers who have worked out anything practical along this line. I am aware that there are some simple hook-ups which will do the job, but what is required is an extremely sensitive multi-tube set which will work on a loop and do trans-Atlantic broadcast receiving.

There certainly is a tremendous fascination in international receiving. About 10:45 I hear Radiola close down with a "Bon soir Mesdames, bon soir Mesdemoiselles, bon soir Messieurs," in suave Parisian accent. A little later the tones of "Deutschland, Deutschland Uber Alles" may be heard floating in from Berlin. Then I switch over to England, perhaps just in time to hear "God Save the King" and an engaging, "Good night everybody, good night." Three times a week at least, London gives us dance music from the Savoy Hotel, generally until midnight, when the station switches over to Big Ben and we hear the chimes and then the ponderous tones of the famous old clock pounding out the hour of 12. Then all is quiet on the air, except for a little station away off somewhere which uses an understandable tongue and keeps on going until about 12:30 o'clock.

By the way, don't take offense at the "Deutschland Uber Alles" from democratic Germany. This much maligned song had a most democratic origin, and the opening line is as innocent in intent as "The Stars and Stripes Forever."

S. McCutcheon,
Leuzhalde 45, Stuttgart, Germany.

Atlas

TRADE MARK

RADIO REPRODUCTION speaker

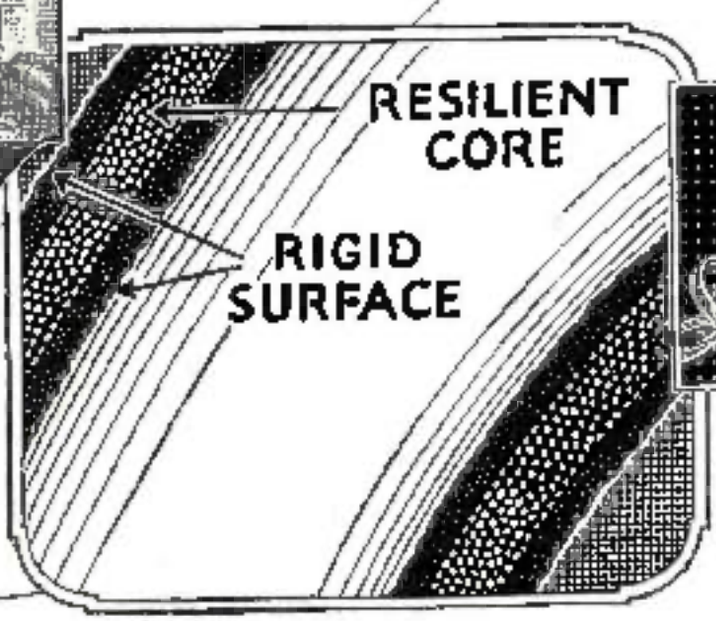
THE material of the horn itself plays an important part in the faithfulness of Atlas Radio Reproduction. The magnified cross-section below shows how the resilient core absorbs the vibrations of the horn material, while the rigid surface conserves the sounds you *ought* to hear —*as* you want to hear them.

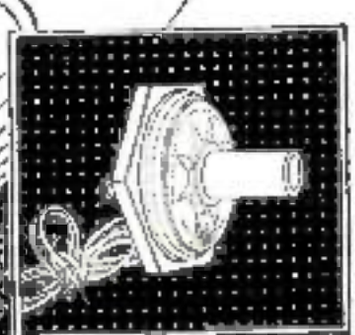
Multiple Electric Products Co., Inc.
36 Spring St., Newark, N. J., Dept. F

New York, Boston, Philadelphia, Baltimore, Pittsburgh, Detroit, Chicago, St. Louis, Denver, 550 Howard Street, San Francisco.

Marconi Wireless Telegraph Co. of Canada Ltd
Sole Canadian Distributors

New Atlas speaker with the exclusive and strikingly beautiful bronze-brown ripple-finish.





Atlas unit, complete with attachments couplings, to fit all standard phonographs

New Radio Patents

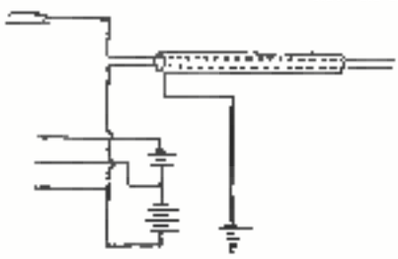
(Continued from page 950)

Tuning system of automatic for radio receiving apparatus where the receiving circuit may be broadly tuned to resonance for a given wavelength and next changed tuned to resonance for increasing the intensity of the received signal. The receiving circuit is provided with a variable inductor and a variable condenser mechanically connected to be simultaneously varied so that the algebraic sum of their reactances remains approximately constant.

TELEPHONE RECEIVER CIRCUITS

(Patent No. 1,504,940, C. W. Carpenter et al. Filed Jan. 29, 1921. Issued Aug. 12, 1924.)

Telephone receiver circuits wherein the telephone headset is electrostatically shielded from radio frequency coupling currents which might arise from other parts of a sensitive electron tube



amplifier. The shielded cord is claimed in this patent to a feature of the Navy Type Brandes telephone headset.

INTERFERENCE PREVENTION IN RADIO RECEPTION

(Patent No. 1,500,436 F. K. Vreeland. Filed July 28, 1920. Issued July 8, 1924.)

Interference prevention in radio reception, having a pair of energy collecting systems electrically coupled one with the other. The system is tuned to the desired signaling frequency and then another current of interfering frequency, whose effect on the receiving system is opposite to any interfering effect which may be present with the signal is produced. These opposite effects are balanced in intensity and phase so that the resultant effect on the receiver is nil. This balancing of the interfering signals is accomplished without appreciable reduction in the signal strength of the energy desired to be received.

ELECTRIC WAVE RECEIVER

(Patent No. 1,502,063. W. Schottky. Filed Nov. 6, 1920, issued July 22, 1924. Assigned to Siemens & Halske, Aktiengesellschaft, of Siemensstadt, near Berlin, Germany.)

Electric wave receiver wherein a local source is provided to superimpose on the received frequency a local frequency different from that received and arranged to produce a beat frequency current above the limit of audibility. A rectifier is provided which rectifies the beat frequency current. This current is transformed into an alternating current which is then rectified and observed.

METHOD OF AND SYSTEM FOR RADIO SIGNALING

(Patent No. 1,502,849. H. J. Van Der Bijl. Filed Jan. 8, 1918. Issued July 29, 1924. Assigned to Western Electric Co.)

Method of and system for radio signaling by which a large number of messages may be transmitted simultaneously without the use of a corresponding large number of high frequency carrier waves. At a receiving station the high carrier frequency components of the received waves is first eliminated and each of the modulated auxiliary carrier frequency components is transmitted to a modulator from which the various signaling components may be picked out by suitable band filters.

VACUUM TUBE CIRCUITS

(Patent No. 1,507,700 H. M. Priest. Filed April 1, 1923, issued Aug. 5, 1924. Assigned to Western Electric Co. of New York.)

Vacuum tube circuits having automatic means for providing for the continuous flow of heating current from a common source through a plurality of electron tube cathodes when one or more of the cathodes become broken or otherwise removed from the circuit. The invention relates to a bank of electron tubes where the circuit remains operative even though one of the tubes may be burned out. A relay is provided which substitutes a resistance for the burned out filament when such filament becomes open.

Pure, clear tones from your speaker, must *start* with your transformers

You want more than noise from your loud speaker.

You want *pure* tones, clear, mellow reproduction.

But no speaker can be *better* than your A. F. transformers.

And *any* speaker will be improved when you use transformers that are designed for loud speaker use!

Transformers that produce the greatest possible *amount* of amplification unfortunately also introduce imperfections in the tone. And the speaker magnifies such imperfections.

Fortunately, however, when the *tone* is clear, you don't need anywhere near so much *volume* of sound.

In designing MAR-CO transformers, an amplification ratio has been used, which provides the *most* volume that is consistent with absolute purity of tone. And, of course, they are built, like all other MAR-CO parts, with the famed MAR-CO precision that stops leaks and conserves radio energy!

So, now, those who value tone purity highly, will use two and sometimes three stages of MAR-CO amplification this Fall, and replace squeals with music!

MARTIN-COPELAND COMPANY
Providence, R. I.

RATIO
3½ : 1

PRICE
$5.00

MAR-CO

AUDIO RADIO FREQUENCY PRODUCTS

TRANSFORMERS

POWER LIMITING AMPLIFYING DEVICE

(Patent No. 1,504,547. H. De F. Arnold. Filed Sept. 3, 1915, issued Aug. 12, 1924. Assigned to Western Electric Co., Inc., of New York.)

Power limiting amplifying device for use in a radio receiving apparatus whereby further disturbances and heavy starts of large magnitude may be reduced to a value not exceeding that of the signaling energy for enabling the signals to be observed through such interference. The principle of unilateral conductivity is employed by which to distinguish between the signaling energy and heavy strike disturbances. In the preferred form of this device the unilateral conductivity is secured by causing part of the circuit to be in the paths of thermionic currents between hot cathodes and cold anodes, said thermionic currents being oppositely directed with respect to said circuit. These thermionic currents are caused to flow by impressing upon their limiting electrodes, in multiple, an electromotive force operating through a high impedance, said high impedance performing an important function in connection with the power or current limiting action of the device.

I Want To Know

(Continued from page 932)

inch in diameter, to a diameter of one inch, using No. 34 enameled wire. It is best to enclose this coil with a soft iron case. When General Electric tubes are used, the direct line connection is used, eliminating the fixed filament resistance. This resistance may be a standard rheostat, where it is desired to construct this receiver, of a type suitable for the type tube being used. The tuning inductance may be any type of coil having a value enabling tuning to the desired wave-length band. A variometer could be used.

Q. 2. If turning a variometer in a set produces squeals and whistles, what is the cause of inability to produce them?

A. 2. We presume you are referring to the variometer in some sort of a regenerative receiver. There are three conditions possible in such receivers. First, non-regenerative; second, regeneration; and, third, oscillation. The first is the most insensitive condition of the set. Practically every regenerative receiver is in a regenerative condition at even the least regenerative setting of the instruments. Regeneration in the receiver results in greatly increased signal strength. Pushing the regenerative too far results in the production of continuous oscillations. During this condition, signals received will be heterodyned by the oscillations generated by the receiving set. This results in the production of the whistles and squeals referred to. Detection of the tuner results also. Should the exact center of the transmitting station carrier wave be tuned in (zero beat reception), voice and music may be received with only slight distortion. This exact tuning, though, is very difficult to keep. Signals received from radiating receiving sets will be heterodyned by the locally generated current and will produce whistles, etc., in addition to such audible signals as are being radiated by the outside receiving set. A receiving set only regenerating will pull receive any audio frequency whistles or squeals that are radiated. That is why sets of congested localities will receive all sorts of peculiar sounds. These usually take the form of whistles. These whistles are not caused by the regenerative receiving set properly handled, but are the result of radiations from regenerative receivers allowed to oscillate. If the receiving set cannot be made to oscillate, it is doubtful if the point of maximum regeneration can be reached. There are two causes for this. One is lack of coupling between the grid and plate circuits and may be overcome by increasing or decreasing the inductance of the plate tuning inductance to the correct value, or by arranging the plate inductance so as to be in strong inductive relation to the grid inductance, or by increasing the capacity of the tube in some manner, such as by connecting a very small capacity from the grid to the plate of the tube. The second cause is excessive resistance in the grid or plate circuits. This resistance may take the form of poor instruments (poor construction, or poor material), or of poor connections. Testing is about the only way to determine the exact location of undesired resistance in sets.

Q. 3. What are the advantages of push-pull amplification?

A. 3. Using this system of amplification, it is possible to handle considerably greater volumes without distortion. Where a single tube would be operated beyond the correct point on its characteristic curve, due to overloading, thus producing an over amplification of certain frequencies resulting in distortion; in push-pull amplification the work can be divided between the two tubes, neither tube being overloaded and each tube operating at maximum efficiency. In addition, variations of current in the push-pull circuits are balanced out and only the impulses of current are amplified.

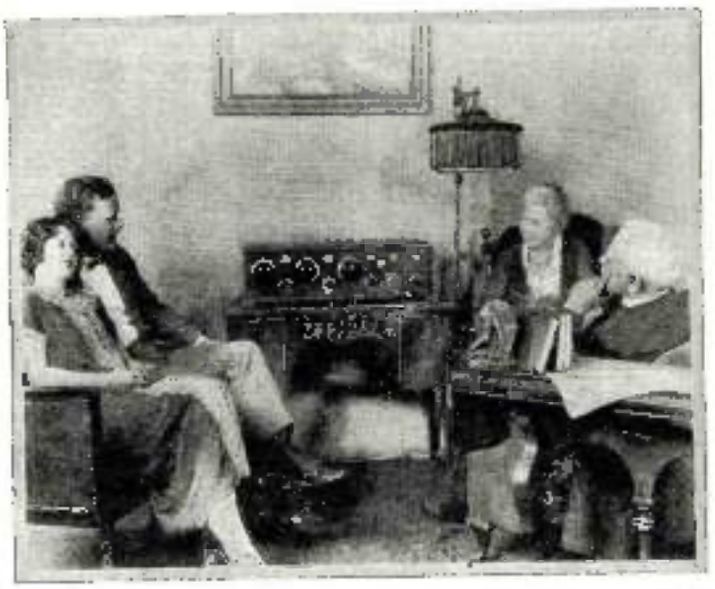
SWITCHING SYSTEM

(2058) Mr. Harry B. Smiter, Elysburg, Montana:

Radio Without the Horn!

Goodbye to the Old-Fashioned Horn Speaker!

A Vastly Better Reproduction With this New Radio Console!



"Our old horn speaker never gave tones like this! An artistic addition to the living room—everything in its place—it's a joy!"

New Console Has Its Own Perfect Loudspeaker!

Ample Space for All the Rest of Your Outfit!

HERE is something that enables you to enjoy radio in the home without the clutter of unsightly apparatus that plays havoc with the decorative scheme of your living room! The horn speaker is out of date and out of place in radio for the home. This console with its in-built loudspeaker is scientific and sightly.

A Truly Wonderful Tone

It does a better job of reproducing, for it has the best unit of all that have been tried and its sound-box is of resonant wood instead of metal, fibre, or composition.

The appearance of a Windsor loudspeaker console is a delight. Its convenience is a joy. A piece of real living room furniture of pleasing lines and finish—and it accommodates all the miscellany of equipment which hitherto had no place except on table tops, shelves or floor. Ample space on top for any set, with plenty of elbow room in front. Nothing in sight but the dials. Everything else goes inside—from behind—in spaces cleverly designed to hold the largest batteries and outfit—besides the self-contained loudspeaker—all unseen and protected from dust or disturbance.

Dealers!

The sale of this remarkable [illegible] has already reached [illegible] They are selling a surprising quantity in [illegible] smaller stores where there is one [illegible] the year [illegible] or on the floor. It is a [illegible] and a value not to be duplicated.

Write us for [illegible] and particulars of [illegible] campaign now [illegible] page.

You Need This Console Whatever Your Present Outfit Is

It makes no difference what kind of radio outfit you have—this console was designed for your use. The graceful exterior of this console gives no hint of its inner utility, for it is a simple and effective piece of furniture in every line. But a glance at the interior reveals a most ingenious arrangement of the in-built loudspeaker with space on either side and in front. These spaces are ample for the largest A battery, and the largest wet B batteries and the largest charging outfit. It is 38 in. long, 18 in. deep, and 29 in. high. Notice the artistic grill that conceals sound box, and the provision of "knee room" beneath. Made in mahogany or walnut finish, *and the price is only $40!* (West of the Rockies $42.50.)

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.

4B51

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 .....

Q. 1. Please show a switching system for connecting a set to either a loop, or to a regular aerial and ground. Also show a method for adding one stage of radio frequency amplification at will. It is desired to use this system with a four-tube reflex receiver.

A. 1. This request is shown in three columns. The switching system is as follows: Loop and set. A1, B2, C3; aerial and set. A2, B1, C1; loop and set, plus the additional stage of tuned radio frequency amplification, A2, B1, C2; aerial and set, plus radio frequency unit, A1, B2, C2. This switching system could be simplified, if double-pole, double-throw switches were used. As shown, it will work correctly, with push-pull switches. It is very necessary to have the correct number of turns on the primary coil B. A re-wound variocoupler may be used for the two A coils. Spider-web or honeycomb inductances may be used for the five loading coils and the two B coils. If spider-web coils are used, the loading coils may be placed parallel on an insulating rod, and separated about one-half inch, or a trifle less, with the exception of coil C3, which is placed in non-inductive relation to the other inductances in the set, to reduce the possibility of coupling to such an extent as to affect tuning. The primary and secondary B coils should be in very close inductive relation. Spider-web coils are preferable here. The audio frequency amplifier is designed not to oscillate and very low loss apparatus must be employed for maximum results. Due to the lack of regeneration, it is necessary that special attention be paid to the design of the tuning inductances, and their relation to the rest of the set, in order to reduce the possibility of hand tuning, especially when the aerial and ground are used. The regular batteries supplying the main set may be used for the additional amplifier as well. The UV-199 tube is admirably suited for the radio frequency amplifying tube.

BEST SUPER-HETERODYNE

(10589) Mr. John Walker, Jr., Pedrocitos, Santa Catalina Island, Calif., asks:

Q. 1. Is an Isla Selectaformer as efficient as a variocoupler?

A. 1. A variocoupler permits selection of the optimum coupling of primary and secondary inductances, for a given wavelength. In addition, the optimum value of inductance for a given wavelength may be had. The vacuum tube functions best when the highest voltage variation is secured. Using the maximum amount of inductance possible, for a given wavelength, produces this condition. However, changing the inductance value for the various wavelengths changes the electrical coupling of the primary and secondary coils. On weak signals this is particularly pronounced. The correct coupling may be restored by changing the coupling.

Q. 2. Is a potentiometer required in a reflex receiver?

A. 2. This depends upon the particular receiver. Some receivers require a variable control of the grid voltage. Considering the case of two reflex receivers constructed of exactly the same parts, in seemingly the same way, one may oscillate freely, unless controlled by a potentiometer, while the other may be operated at very nearly the point of maximum regeneration, without requiring the control afforded by a potentiometer. Should the set not oscillate, it is seldom that maximum results can be secured. This is because maximum amplification results from maximum regeneration, which point is reached just before the tube starts to oscillate. The very peak of regeneration, though, usually results in considerable distortion of the signals, and the generation of objectionable tube noises. The maximum desirable amount of regeneration varies, usually, according to the wave-length to which the set is adjusted. Potentiometers afford a nicety of control for maintaining the grid voltage, at the best value for the desired amount of regeneration.

Q. 3. There are so many descriptions for Super-Heterodyne construction, that it is almost impossible to decide which is the best. What is the most sensitive and selective Super-Heterodyne known at present?

A. 3. Theoretically, there is only one result possible from a given type of set. To compare the theoretically possible results of certain sets and reject those receivers which would seem to incorporate undesirable principles would seem to be the solution. Practically, the problem is an entirely different one. Almost every type of Super-Heterodyne described so far has had its construction description attended with long lists of distant stations received. It is not so much a question of "which is best?" as it is "how best can I construct which?" Because they practically all follow the same principles of operation, there are very few which will not give exceptionally good results if experimented and operated in the best manner possible. True, certain modifications have been developed, each having its merit, but the actual value of these modifications, in a construction, must be determined by personal test. Since two people may try identically the same idea and secure diametrically opposite results.

LIBERTY TRANSFORMERS

give the amazingly clear tone of this remarkable set

AUDIO FREQUENCY
base mounting type.

Ratio	Price
3 to 1	$4.50
5 to 1	4.75
9 to 1	4.75

Amateur set-builders and manufacturers can obtain equal tone quality by using Liberty Transformers

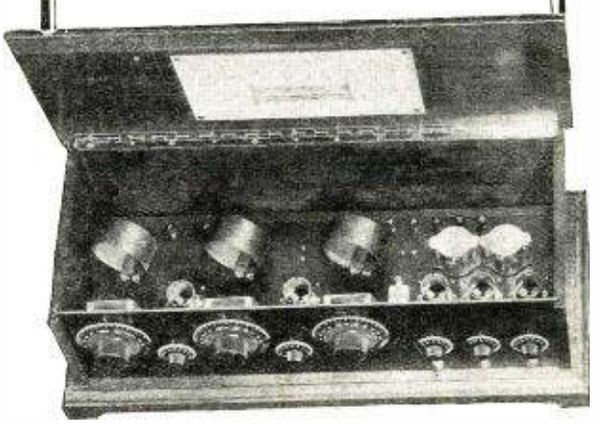
LIBERTY Sealed Five

5-tube tuned radio frequency receiver. In handsome solid walnut two-tone cabinet $100.00

(Less accessories)

Equals any original or reproduced music for clear tone. LIBERTY clear tone transformers combined in this perfectly balanced set make it astonish all who hear it.

(Write for booklet "Choosing Your Radio"—describes the LIBERTY Sealed Five.)



Obtain any of these guaranteed products from your dealer or post paid from us at list price.

LIBERTY TRANSFORMERS

They make any good set better

Your money back if they fail!

These transformers are so good because we take the time to make them properly—and have the machinery to do so. Coils are all wound perfectly. Insulation is ever-sure. Silicon steel laminations. Pure bakelite tops.

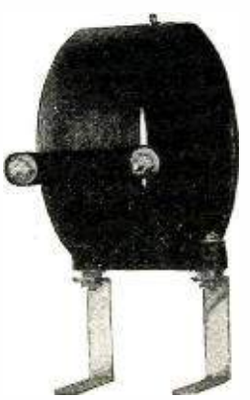
No transformer—at any price—possesses an essential feature not found in LIBERTY TRANSFORMERS.

Panel Mounting Type
(price same as for base mounting type shown above)

LIBERTY TERMINAL LUGS

Per dozen 15c
Per 1,000 ...$1.00

Write for folder.



(Air-core)
Radio frequency transformer $1.50

Liberty Transformer Co., Inc.

555 N. Parkside Ave., Chicago

STRAIGHT LINE CONDENSERS

(7060) Mr. Solomon Eagle, Kwiguk Slough, Alaska, asks:

Q. 1. What is the main difference between a fine telephone receiver and a regular loud speaker?

A. 1. The fine telephone receiver is now required to respond as truly to such a wide range of frequencies as the loud speaker, also, the resistance of the fine receiver is considerably lower. The usual resistance of fine receivers is only 75 to 80 ohms, while loud speakers operating directly in the plate circuit of the tube are wound to resistances between 1,000 and 4,000 ohms. Where fine receiver diaphragms are considered satisfactory, if made of ordinary ferrotype iron, loud speaker diaphragms must be of exactly the right material and dimensions, or distortion of certain frequencies will result. The physical construction of the loud speaker case and parts is designed with exactness down to the minutest detail, greatly exceeding the thought expended on the ordinary fine receiver. But each unit suits its particular purpose in a quite satisfactory manner.

Q. 2. What is a straight line condenser?

A. 2. A condenser whose value varies directly according to the position of the plates. A condenser may be calibrated, or its curve plotted, in one of three ways, according to wave-length, capacity or frequency. A condenser having a straight line calibration for frequency will not have a straight line according to wave-length. A condenser having a straight line according to capacity cannot be of the straight line type for either of the other two. No two of these curves can be the same. When a condenser is stated to be of the straight line type, no information is given until the statement is completed by the words, "for wave-length," or "for capacity," or, "for frequency."

Q. 3. What are the advantages and disadvantages of straight line condensers?

A. 3. Condensers with decrement plates, or their equivalent, have a straight line for capacity. The value of this is mostly in work where it is desirable to know the capacity at each setting of the pointer. The capacity will be proportional to the scale readings. In tuning on stations, the stations will be bunched at the lower end of the condenser, making tuning more difficult as the short-wave lengths than if the condenser design were changed so as to have a straight line variation for wave-length. When the latter is the case, the dial degrees will be proportional to the wave-length and there will be a certain number of meters per degree of variation. Occasionally, it is desirable to have a condenser so designed as to have straight line calibration for frequency. Knowing the frequency of the stations, the location of the correct tuning point is readily determined, since the dial variations will be proportionate for the variations in frequency. The practice of referring to a station's frequency, rather than its wave-length, is becoming more general and condensers designed for straight line frequency variation will be in greater demand.

W. E. TRANSMITTING TUBES

(2061) Mr. A. F. McCullough, Akron, Ohio, asks:

Q. 1. Can honey-comb coils be used to advantage as the construction of transmitters for an Autoplex receiver?

A. 1. By connecting two honey-comb coils in series, each of about 30 to 50 turns and sliding one across the other, a variometer action will be had which may be satisfactory. The wave-length range of such a construction is rather limited and it is doubtful if results will compare very favorably with those secured through the use of a standard variometer of correct design. Of course, a high natural inductance and low natural capacity is thus secured, but the equal honey comb construction does not permit a very wide variation between maximum and minimum.

Q. 2. What general information is available on the Western Electric transmitting tubes?

A. 2. The 50 watt "G," or 218-A tube, has the following characteristics: It fits a standard 50-watt socket; the filament is oxide coated and is kept constant at 3.4 amperes; the filament voltage varies, the correct voltage is between 9 and 9.6. It is not advisable to operate the tube with more than its optimum voltage of 750 on the plate although the maximum permissible potential is 1,000 volts. The grid bias voltage varies between —30 volts and —60 volts. The plate current is 65 milliamperes, with a grid voltage of —30 volts and a plate voltage of 950. The voltage amplification is 11 to 13 and the impedance between plate and filament is 1,500 ohms.

The 250 watt 212-A, or "T" tube, has these characteristics: A special four-prong socket is required; constant filament current, 6.25 amperes; filament voltage, 9 to 9.8; grid voltage, —50 to —60 volts; plate voltage, 1,000 to 2,000, with best operation at 1,500 volts; with a grid bias voltage of —60 and a plate voltage of 1,500, the voltage amplification is 15 to 17 and the impedance is 2,000 ohms. Do not impress the supply on the plate until the tube has been heated for five minutes. The filament may be burned out if the full plate voltage is then applied; one-half the voltage should be applied at first. If de

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, Tranvia 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 to 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, 50 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 or 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 be found at these calibrations. Universal 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

used, a high grid bias may be employed to reduce the plate voltage. As this bias voltage is reduced to normal, the plate voltage will increase. The grids and plates of these tubes are made of metallic nickel which has been coated with black nickel oxide. It is very important that the plates are not heated beyond a faint red at the center.

Q. 3. What is the maximum transmitting range of an oscillating receiving set using a UV-201A tube?

A. 3. The results of several tests made of dependability indicate that there is no difficulty in transmitting by phone and code for a distance of 15 miles. This is a concrete example of the great interference that can be caused by a receiving set on the oscillating condition.

BATTERY TESTING

(2062) Mr. P. Cherubini, Rome, Italy, asks:

Q. 1. Should my 28 volt "B" battery, acid electrolyte, be tested with an ammeter?

A. 1. An ammeter should not be used for testing batteries. It is sometimes desirable to test storage batteries with a special ammeter, but a voltmeter is the safest instrument to use. Do not permit the voltage to drop lower than 1.8 volts per cell. A hydrometer is usually used for testing storage batteries, but there is too little electrolyte in "B" battery cells for it to be used there.

Q. 2. Should an Edison alkali electrolyte battery be tested with a hydrometer?

A. 2. The specific gravity of this battery changes but little between charge and discharge. Use a voltmeter.

Q. 3. What is the correct speed for drilling small holes in bakelite?

A. 3. A little out on small drills rotating at about 1,200 r.p.m. will be correct.

BAKELITE

(2063) Mr. Santiago Ventura, Sagua la Grande, Cuba, asks:

Q. 1. Kindly describe the general construction of bakelite.

A. 1. The reaction of formaldehyde and carbolic acid, under certain conditions, produces a resin-like material. Alcohol or acetone will dissolve this compound. This compound, which has been termed synthetic resin will first melt, upon the application of heat, but the heat produces a chemical change that causes the liquid to harden. Once hardened, it cannot be softened, not even by the use of the former solvents. Once permanently hardened, it becomes infusible, insoluble, and impervious to oil or water. It has become "chemically inert." There is no gradual deterioration, such as we see in the rusting of iron, the hydrolyzing of abeltae compositions, or the sulphur "bloom" on rubber.

Q. 2. How is it possible to mould bakelite?

A. 2. Powdered bakelite is mixed with some filling ingredient, such as fibre, wood pulp, asbestos, or wood "flour." This powder is "plastic moulded" by being put in a heating press exerting a 2,000-pound pressure per square inch. The chemical change referred to above then takes place, the compound first melting and conforming to the mould form, and then hardening permanently.

Q. 3. What is the specific gravity of bakelite?

A. 3. Approximately 4.5 to 5.5.

TRANSFORMER SPACING

(2064) Mr. J. S. Shiner, Jr., Gatun, C. Z., Panama, asks:

Q. 1. Would it be advisable to use a push-pull amplifier instead of the regular second stage amplifier in a Neutrodyne set?

A. 1. Greater clarity and somewhat greater volume would result. While it would mean greater expense for materials and upkeep, the labor of its construction, and the use of additional space in the cabinet, we believe the results would be worth it, if the work were done carefully and the transformers and wiring not crowded.

Q. 2. How was it possible for WEAF, as recently stated by the press, to broadcast with a power of 5 K.W., when the legal limitation is 1 K.W.?

A. 2. This was permitted under the special license held by that station.

Q. 3. What is the correct spacing distance for intermediate frequency transformers?

A. 3. This depends upon the design of the transformers. Placing them end to end, as you suggest, is even more undesirable than placing them side by side. If placed side by side, the spacing may usually be about three inches. The best procedure is to put the coils at right angles.

TRANSFORMER CONNECTIONS

(2065) Mr. John Penar, Racine, Wis., asks:

Q. 1. What size honey-comb coils are required to receive 5,000 to 8,500 meter stations?

A. 1. The wave range of the average Sicuum coil is 5,000 to 8,500 meters, when shunted by a variable condenser of .001 mfd. capacity. This coil will be about right for the primary. Use a 600-turn coil, wave range, 4,000 to 12,000 meters, for the secondary. The tickler may be between 400 and 600 turns. For those who do not mind the extra work entailed in tuning, a third variable condenser connected in parallel to

Table-Talker

What *greater* gift?

Joy for the holidays—for all the year. Joy for the fellow who gets the gift—and for the family. Give it all—give a *Table-Talker.*

You're *sure* of its tone. Sure that it will always be loud yet pleasant, because its horn is matched to the unit. It reproduces every word, every note with vivid clarity—it makes the joys of radio *real!*

Brandes

The name to know in Radio

the tickler coil will be found to result in the reception of more distant stations. A good procedure is to tune in the desired station, then reduce the coupling between secondary and tickler, increasing the capacity of the tickler condenser, which condenser should previously have been set at its lowest capacity. Maximum amplification from the tube will result when the coupling is least. It may be found possible to reach a nearly zero inductive coupling of the coils, inasmuch as the tube elements may furnish sufficient capacity coupling to maintain oscillation or reception.

Q. 2. What is the correct way to connect up a transformer marked P1, P2, S1 and S2?

A. 2. P1 ordinarily designates the outside end of the primary winding. S1 ordinarily designates the outside end of the secondary. The outside ends of the primary and secondary windings should usually connect to the points of highest potential (the exception is in reflex circuits). This would be, respectively, the plate and grid. See question No. 2508.

Q. 3. Is there any satisfactory method for cleansing sulphated plates?

A. 3. The most thorough method is described below: "Tear down" the battery, so that the elements can be immersed in a solution made by dissolving ½ pound of ammonium acetate in 1 quart of water, in an earthenware jar; leave them so for ½ hour. This will free the plates from the sulphate. Wash in clear water and dry. The battery may now be reassembled.

FUSIBLE ALLOYS

12066) Mr. Ralph Fishburn, Signal Mountain, Tenn., asks:

Q. 1. Please give information on the fusible alloys of Rose, Wood, Newton, Newberg.

A. 1. Rose's Metal, lead, 3; tin, 2; bismuth, 5; melting point, 93 deg. C. Wood's Metal, lead, 2; tin, 1; bismuth, 4; cadmium, 1; melting point, 60 deg. C. Newton's Metal, lead, 2; tin, 1; bismuth, 8, melting point, 94 deg. C. Newberg's Metal, lead, 1; tin, 2; bismuth, 5; melting point, 91 deg. C. The fusing temperature may be further reduced by the addition of a slight amount of mercury. Any of the above amalgams will be entirely satisfactory for mounting crystals. The proportions are by weight.

Q. 2. What vacuum pump would be advised for the home construction of a Geissler tube?

A. 2. First use a Gaede mercury pump capable of producing a vacuum of .0001 millimeter, then use a piston pump of the bicycle type, or equivalent.

The Heterodyne Wavemeter

(Continued from page 927)

EXTERNAL HETERODYNE

The wavemeter may also be used as an external Heterodyne and has the advantage of being calibrated. It is simply necessary to couple the wavemeter loosely to the receiver, keeping the latter below the oscillating point. The simultaneous adjustment of the wavemeter and receiver will bring in the continuous wave signals.

This about completes the directions for the more general uses of the wavemeter. The batteries should of course always be in good condition. As soon as any of them show signs of deterioration, they should be renewed.

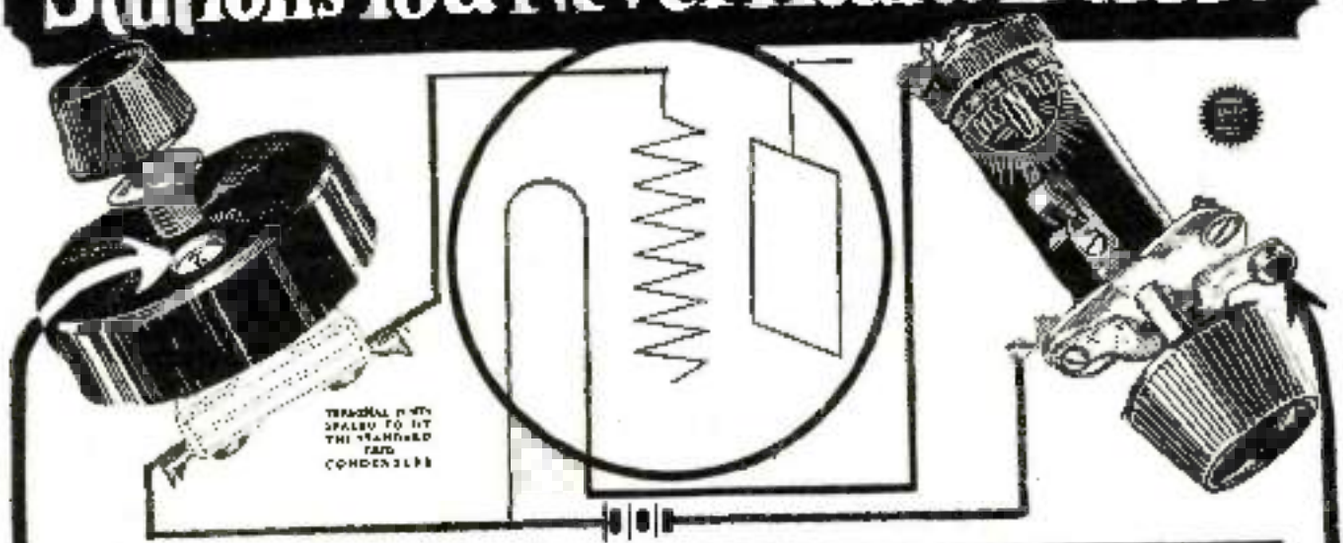
From the foregoing description of the wavemeter, it is apparent that it is an extremely useful piece of apparatus to have in the laboratory, for it will settle many problems that would otherwise remain unsolved.

The Cold Tube of the Future

(Continued from page 935)

the evaporation of molecules from a heated liquid (in fact there are points of definite relationship between these two phenomena). In evaporating a liquid we have to supply an amount of heat which is greater than that employed in detaching the molecules from the surface as vapour (latent heat of vaporisation) in order to make up the loss of heat by conduction, convection, and radiation.

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

SCIENTIFICALLY CORRECT VARIABLE GRID LEAK

Individually Calibrated

$2 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

SCIENTIFICALLY CORRECT RADIO RHEOSTAT with Battery Switch

$2 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¢ Canada 70¢

150 stations were logged on a Fil-KO Stat equipped set, at Harrisburg, Pa., using a 1 meg. fixed grid leak. A calibrated Fil-KO-Leak was substituted for the fixed leak and in two nights 27 *new* stations—*never heard before*—were added.

Joseph J. Scott of Ottawa writes, "Among the *fifty-four new stations* I tuned in with my Fil-KO-Stat was 6KW, Trinidad, Cuba, which I consider exceptional as it is only a small 100 watt station." And we have hundreds of other testimonials on file!

FIL-KO-ARRESTER

SCIENTIFICALLY CORRECT RADIO LIGHTNING ARRESTER

with the $100 *Guarantee*

$1.50 In Canada $2.00

The "DX Booklet" on "Improved Reception Through Scientific Tube Tuning" sent on receipt of 2c postage.

FIL-KO

DISTRICT SALES OFFICES

DX INSTRUMENT CO

MADE AND GUARANTEED BY

HARRISBURG PENNSYLVANIA

DISTRICT SALES OFFICES

FIL-KO-ARRESTER

DULL EMITTERS

The analogy of the evaporating liquid helps us to understand the action of dull emitters. It has been found that the admixture of thoria with the metal of the filament, or the coating of thorium oxide on its surface, increases the emissivity of the filament enormously, with the result that a required amount of electronic emission can be obtained at a much lower filament temperature. This corresponds, in a general way, to the evaporation of a liquid of low boiling point (e.g., alcohol), where the same rate of evaporation may be obtained at a lower temperature. Owing to the lower temperature the incidental losses are reduced.

The enormous emissive power of these coated filaments may be judged from the fact that a tube has recently been made fitted with such a filament, capable of transmitting over a thousand horse-power.

Dull emitters, then, represent the most important practical step in the direction of the cold tube.

POINT-DISCHARGE EMISSION

An ingenious attempt of quite a different kind has recently been made to produce a cold tube and is based upon a very familiar electrostatic phenomenon. It is well known that the surface density of electrification upon a solid conductor is greater in the region of protuberances or projections. If a projection takes the form of a sharp point, the surface density of electrification may become so great that a silent discharge of electricity takes place from the point and may be maintained by a comparatively low potential.

It will easily be seen how this principle may be embodied in the design of a tube, the filament being sharply pointed. The "B" battery alone would be necessary, the filament heating battery being dispensed with.

A tube of this kind is said to be in the experimental stages and it will be interesting to see if it can be applied to practical purposes.

RADIOACTIVITY

We have seen what efforts are being made to produce filaments which will emit at moderate temperatures; these consume less energy, but they are different only in degree, not in kind. What, then, are the possibilities of a filament generating its electrons spontaneously? In this connection we naturally think of radioactive substances, and they have, indeed, been proposed and tried for this purpose.

There are many radioactive substances, of which radium is probably the most popularly known. Their characteristic property is that they *spontaneously* emit certain rays known as alpha rays, beta rays, and gamma rays. Some, but not all, radioactive substances emit all three kinds of rays. The alpha rays consist of positively charged atoms of helium gas; the beta rays are electrons, and the gamma rays are ether waves of very short wavelength.

At first sight the problem appears to be solved—why not substitute for the filament a radium-tipped wire?

If we consider the mechanism of radioactivity and compare it with that of thermionic emission (i.e., the emission of charged particles from *heated* bodies) we shall see why, unfortunately, the matter is not so simple.

THE ATOM

An atom of any substance is supposed to consist of a nucleus and a number of surrounding electrons. The nucleus is a compact group of electrons and protons, the electrons negatively charged, the protons positively charged, the charge of the proton being equal in amount to that of an electron.

Model S Audiophone $25

Non-metallic Horn 14½" diameter. Velvet mat finish of mottled bronze and gold classic base.

Both Must Be Musical Instruments

IF you are to enjoy the rich resonance of an old Cremona violin, your loud speaker must also be a true *musical* instrument. So designed and powered as to respond as faithfully to the inspiring crescendos of a Wagner opera as to the whispers of a Moonlight Sonata.

The new Bristol AUDIOPHONE does that. With its joyous, open-throated non-metallic horn, and its finely adjusted transformer, it is on a musical plane with the noblest instrument or voice at your favorite station.

In addition to Model S, shown here, the Bristol line includes Model 1, $20, Baby Grand, $15, and the "Baby" at $12.50. Send for Bulletins No. 3011 and 3017-S, mentioning name of your dealer.

THE BRISTOL COMPANY
Waterbury, Conn.

BRISTOL AUDIOPHONE

TRADE MARK REG. U.S. PAT. OFFICE

LOUD SPEAKER

The mass of a proton is approximately equal to that of the hydrogen atom, the mass of the electron being by comparison negligible. In the atomic nucleus there are more protons than electrons, so that the nucleus has a positive charge; this is ordinarily neutralized by a certain number of surrounding electrons. The electrons in the nucleus are called nuclear electrons and the surrounding ones are called planetary electrons, since they revolve round the nucleus after the manner of the planets round the sun. Now the first important point for our present purpose is that the planetary electrons are comparatively loosely held. There are many methods by which we may detach one or more of these electrons from an atom, or "ionize" the atom as the process is called. One simple method is to heat the substance, when many of the atoms will part with planetary electrons. These are the electrons which we make use of in the tube; being easily detached they may be made to leave the parent substance with a small velocity, which makes them easy to control. Furthermore under the conditions in the tube, practically no other rays but the electrons are emitted, and we are not troubled with a mixture of rays requiring different controls.

On the other hand, the protons and the nuclear electrons are very tenaciously held, and they must develop large amounts of energy before they can escape from the atom. These are the particles which form the alpha and beta rays from radioactive substances. Their velocities are very large compared with the velocities of thermions from hot filaments; for example, the velocity of emission of electrons from a heated filament may be about 6 inches per second, whereas that of the beta rays may be 100,000 miles per second.

Thus our first difficulty in attempting to make use of a radioactive substance as a source of electrons is that the electrons issue forth with such a high velocity that they cannot conveniently be controlled. And there are many other difficulties. The emission may consist of a mixture of negative and positive charges, the positive being even more unmanageable than the negative. The gamma rays complicate matters, and secondary rays are produced by the impact of the primary rays upon surrounding objects. The total emission from a convenient amount of radioactive substance may be too small to be of practical use, and there are still further difficulties—the production of gas, the cost, and so on—into which we cannot at present enter.

But our knowledge of radioactivity is rapidly progressing. New radioactive substances may be discovered; induced or indirect activity may prove available, or methods for the control of the activity be found. Again, development may come along the lines of the cold light experiments, or it may come in some hitherto untried direction.

To some these may seem fantastic speculations. But how many times, particularly of recent years, have we learned the wisdom of reserving judgment in scientific matters. It is as unsafe to dogmatize in the negative sense as in the positive, and the tapping of the intra-atomic energy may yet be added to the list of the greatest achievements of science.

HAD BIG EARS

SHE (reading newspaper): "Woman born without arms gains college and musical education; is adept at domestic tasks.' Born without arms! How could she play an instrument?"

HE: "Couldn't she play by ear?"—*Joseph M. Straughro.*

FADA

Improves the 5-tube Neutrodyne

YES, sir! We've made it better in every way. Improved its looks, improved the circuit, eliminated unnecessary detail in making, and incorporated the latest and best ideas in Neutrodyne efficiency. Letters from ten thousand FADA boosters have helped us work out the new and improved FADA 5-tube Neutrodyne. We've put all binding posts in the rear, simplified the wiring and beautified the panel arrangement. Two stages of radio frequency, detector and two stages of audio frequency amplification (using the new FADA Audio Transformers) make this new FADA Neutrodyne about the best looking and most dependable radio receiver anyone can make. Your dealer sells the new FADA knock-down set of Neutrodyne Receiver Parts No. 169-A for $72. Look for it in his window. With every one goes the new and enlarged edition of

"How to Build
FADA Neutrodyne Radio Receiver"

This is the latest and most up-to-date 76-page text-book on Neutrodyne 28 pages of pictorial description, 44 illustrations, 30 pages of receiver trouble shooting in general and a fine, big full-size picture wiring diagram. This picture wiring diagram alone is worth the price of the book. Book sold separately on receipt of price—use coupon below.

F. A. D. ANDREA, Inc., 1581 Jerome Ave., New York

NEUTRODYNE

F. A. D. ANDREA, INC.
1581 Jerome Ave., N. Y.

Gentlemen: Enclosed find 75 cents for which send me the new FADA book, "How to Build FADA Neutrodyne Radio Receivers."

Name .....

Street or R. F. D. .....

City .....

State .....

Some Loop Aerial Circuits

(Continued from page 936)

and the loop-aerial should be mounted well away from the experimenter, as otherwise his movements in its proximity will interfere with the tuning. The regeneration-control is wonderfully smooth. Stations at 300 miles, as well as local 10-watters, can be read in a favorable location. The radio-choke is the customary coil of about 200 to 300 turns of any convenient size and build, but of fairly low distributed capacity.

Developing this into a reflex circuit, of the general type already described by the writer for an Ultraudion circuit, we get Fig. 2. As there is plenty of power available now, and stability is all important, the writer prefers to use the reliable and trouble-proof carborundum crystal, without potentiometer. The connections should be made as shown, the crystal being next to the O.P. and the contact spring (the writer uses a plain piece of tinned iron: "tig") next to the feedback-condenser end of the loop. As the transformer has an R.F. potential relative to earth, it should be well insulated. The connection via a grid-bias cell being taken to the lowest point of the "A" battery through a radio-choke of the same type as that used in the plate-circuit. This can be avoided by making the slight modification indicated in Fig. 3—which suggests dimly certain American reflex circuit arrangements. Either of these gives most excellent reception of local broadcasting in an outer suburb, with careful tuning; and is easily controlled. Distant stations can be read at comfortable strength, searching in the reflex arrangement being unusually easy.

Loud-speaker reception in the vicinity of the local station is given by No. 4, where a stage of power amplification is provided, with extra "B" battery and proper grid-bias on each tube. As different grid-bias will be needed on the two tubes, the No. 2 circuit is used for the first tube. As indicated, excellent loud-speaking is reached with this circuit up to a dozen miles, using a good tube and a U.S. or small power tube and 100 to 300 volts "B" battery on the plate of the second tube.

The same general principle has been applied by the writer to an Armstrong single-tube super or "flivver" circuit with admirable results. Tuning for wave-length was fine, but the rage for a particular loop-aerial without variable tappings was unusually great, while signal-strength was satisfactory on a very small loop, several of the distant stations being easily readable under favorable circumstances.

Oscillations

(Continued from page 917)

deceit and also men, are not ones for whom I plead new law administering. With other radio laws, Hon. Sir, should be coupled one which are intended for bootlegger of radio parts and sets which accumulate huge fortune from ignorant, helpless, pepl. which are burned up with hasty desire to secure parts for radio sets.

These proposed law should provide means for arresting such sharks of deceit commerce, and also punishing such. Minimum small punishment for such cheatment should be hanging till dead by thumb, tongue, nose,

or other prominent part of physiognomy of such persons.

If hangmen for such job are desired, I will be pleased to apply for such position, and can be secured at undersigned location at reduced salary.

Sensitively,
Chas Chew Crow,
Shanghai, Ariz.

The Behavior of Radio Waves and the Heaviside Layer

(*Continued from page 899*)

light would be fatal both to animal and vegetable life. The radiation from so extremely hot a body as the sun is of a very violent character, having all the deleterious qualities of X-rays, and others in addition. So unfiltered sunlight constitutes a powerful ionizing agent. Also it appears that the sun itself shoots off free electrons, mingled probably with positive particles. These, according to Arrhenius, would be sorted out by the earth's magnetism, the positives falling mainly at the tropics, the negatives being deflected to the Poles, where they give rise to aurorae, the opposite charges ultimately recombining with recognized atmospheric effects and earth currents and other disturbances.

Sunlight is one of the main causes, therefore, which may give us a fairly sharply bounded conducting stratum in the atmosphere; though it may be corrugated and otherwise distorted by heat effects. And this layer it is which has been treated as the main reflector or whispering gallery responsible for keeping the waves traveling around the curvature of the earth, and partially preventing their escape into space.

Dr. Eccles has dealt with the theory of an ionized atmosphere very thoroughly. And on the whole the Heaviside layer has been felt fairly competent for its work, though admittedly the whole subject demands extensive observation and record of experience before the theory can be considered in any respect complete. Like all meteorological phenomena it is complicated by a multitude of causes and no one simple theory can adequately cover the ground.

In one of the interesting and instructive radio articles which Professor Howe contributes to the London paper "*The Electrician*" once a month, he comments (in the issue of June 13, page 720) on what he calls "the overworked Heaviside Layer" in the upper atmosphere, and on the criticism of it by Professor Guinchant of Bordeaux. This gentleman objects that the layer is not sufficiently conducting for low E.M.Fs. unless it is ionized; and he claims that the sun cannot ionize it, for two reasons: First, because a constant supply of electrons would soon overcharge the earth and deplete the sun; much as a thoroughly insulated filament in a vacuum tube could not continue to do its work properly. And secondly, because ultra-violet light can only ionize things when it encounters dust or solid particles. But I suggest that Professor Guinchant overlooks the exceedingly high frequency of some of the radiation likely to be emitted by a body at the temperature of the sun. Some of it would be X-rays, competent to ionize even oxygen atoms; and anyhow there is no doubt that the upper atmosphere is ionized: the Aurora is sufficient evidence of that.

The problem of the transmission of waves round the world is a most interesting and difficult one, and certainly the last word on it has not yet been said. But few acquainted with the facts can doubt that the atmosphere is largely responsible for the possibility. It must be the main deflector for world trans-

Marshall 3-4 and 5 Tube Sets

The Greatest Advance yet made in RADIO

Receiver and Loud Speaker in Combination Cabinet of Solid mahogany

This Beautiful Marshall 4 Tube Non-Oscillating Receiver

only $5.00 DOWN

Complete with all accessories

WRITE TODAY for full particulars of this most exceptional offer. Marshall Sets embody the very latest improvements known to radio. The wonderful new principle involved is proving the sensation of the 1924-25 radio season. Zero Coupling—the problem which radio engineers have been working on for years—has at last been solved. As a result, the Marshall has no need for neutralizing condensers or other make-shift methods of avoiding internal oscillations which invariably reduce efficiency. The Marshall Tuned Radio Frequency Receiver brings to radio a new degree of musical quality. Its selectivity will delight the experienced radio operator. Yet it is so easy to tune that the novice will handle it like an expert.

Easy Monthly Payments—2 Weeks Free Trial

This is the remarkable offer we are prepared to make you. Two weeks to prove that the outfit you select is everything we have said for it. If it doesn't make good our claims, back it comes, and your deposit will be cheerfully refunded. But if it fulfills all your expectations, you may pay for it in easy monthly instalments. You don't risk a cent when ordering from us. You must be satisfied, or we don't do business. Is it any wonder that radio buyers the country over are rushing to take advantage of such an offer? If YOU are interested, figure on getting your order in early, while prompt shipment can be made. Everyone predicts a serious shortage of radio supplies this season. Send for full particulars today.

Beautiful Solid Mahogany Combination

Compare the beautiful Combination Cabinet, pictured above, with the metal sets but and horn. Here the receiver and Loud Speaker are combined in a single handsome cabinet. Of the greater, we also have the Receiver in a separate cabinet of the same design. These cabinets are the work of a master designer - fashioned of solid mahogany. They will harmonize with the furnishings of the finest homes. In spite of the extra value, these Marshall sets are surprisingly low in price. Compare them with others which sell for more. Then remember you can order a Marshall outfit on two weeks' free trial and pay for it on very easy terms.

Complete Outfits If Desired

In buying from Marshall, you have the choice of a set complete with all accessories, or the set alone. You have choice of dry cell or storage battery outfits. Unless you already own the accessories, you can buy these from us at less than market prices, with your set, on easy terms. Your outfit will come all ready to set up and operate within a few minutes,—saving time and trouble—and saving money, too.

Send Coupon for Special Offer!

If you have any idea of buying a radio set this year, don't let this chance slip by. Our terms and liberal guarantees have set a new pace in the radio business. The low prices we will make you on a 3, 4, or 5 tube Marshall set will surprise you. A letter, postcard, or just coupon will do. But send it today.

We also have a most favorable offer for radio dealers. Write

MARSHALL RADIO PRODUCTS, INC.
Marshall Blvd. and 19th Street, Dept. 59-49 Chicago

Marshall Radio Products, Inc.
Marshall Blvd. and 19th St., Dept. 59-49 Chicago

Please send me your special offer price, terms and full description of Marshall Radio Outfits. Though I am under no obligation in sending your free offer, my preference now is for a:

.....3 Tube .....4 Tube .....5 Tube (Please check)

Name .....

Address .....

Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

mission. If it is ever found that short waves are able to go around as well as long ones,—and some recent statements suggest that facts are trending in that direction; as then the whole question—I do not say it will have to be reopened, for it has never been closed—but the whole question will enter on a new phase.

The way in which natural conditions seem to assist long-distance radio communication, and as it were unexpectedly to lend a helping hand, is rather remarkable. It is generally said that the perfect adaptation of ways and means to ends, which we frequently encounter in the operations and processes of live things, must be due to their long continued adaptation through the ages, and survival of the fittest. But that explanation cannot be applicable to a recent innovation like radio telegraphy; and it is interesting to find in the earth's atmosphere a favorable agent which indirectly promotes radio communication, even at enormous distances, and thus lends itself to the convenience of man, although the very recent inception and development of the process cannot have allowed any time for adaptation and survival.

A Marine Radio Operators' Association

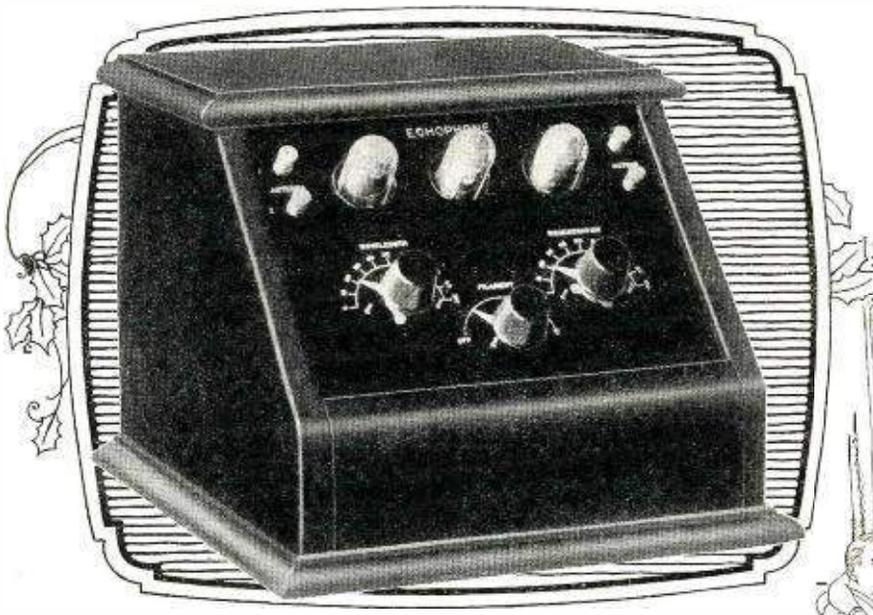
(*Continued from page 953*)

The mates and engineers have their associations, which are to be commended. However, in contrast to the radio operator, in some places they are over-organized with more than one association. Some of the mates or engineers belonging to more than one are oftentimes "on the fence" when certain issues develop. So it would be best for the operators to let their plight be an example and when they do unite, all belong in one organization.

When considering a Marine Radio Operators' Association, the following self-evident truths should receive some thought. Consider an increase of personal efficiency as a basis for the organization and stabilization of the profession; for betterment of the profession for present and future time. The profession can be bettered, and with a clean association as an agency, the present rights, position and remuneration can be maintained, thus granting basis for future augment. In Mr. Pyle's article, September issue, he states: "Very likely the operators on the lakes or on salt water doing the work mentioned, do it because if they protest they have no one to back them up!" When a steamship company cannot get an operator for a certain vessel they are bound to investigate the whys and wherefores and probably will, in a very short time, correct the existing condition in that particular case.

An association for the marine operator must issue an official organ to produce and give growth to the fraternal spirit which must exist. The "I Tappa Kee" Fraternity is described briefly in this department in the September issue, in which article it is stated, "Were it not for the strong fraternal spirit of these men it would be difficult indeed to keep in touch with them." Due to shifting around or changing of runs, the operator has no opportunity for organizing personally and the bonds of the Association must be through letters and an official organ. The organ must be kept up and besides being instructive it must serve as the outlet for the human and personal element found in the profession.

It is evident that an honest, good, clean association for the Marine radio operators of this country could exist. Instead of "Why Not?" the question really is: "What is the most practical way to form such a 'Marine Radio Operators' Association'?"



The Echophone "V-3"

The Super-Volume
3-Tube Regenerative

Without Tubes and Batteries

$50.00

The Ideal Gift

Distinctively Superior Yet Moderately Priced

WHEN you give your family the Echophone "V-3" for Christmas you are giving them radio entertainment of a noticeably finer quality than is afforded by any other three tube receiver on the market

For here is a machine that brings "real music" into your home—that reproduces even on a loud speaker all high and low pitch tones, all voice modulations exactly as they are when they enter the microphone a half mile or eighteen hundred miles away. The Echophone "V-3" is a receiving set any novice can operate. It has only two tuning controls which once set brings in only the stations operated. Operates with dry cell batteries, which fit into the handsome Adam Brown finished self contained cabinet.

As comparison readily reveals, such performance as available at moderate cost only in the Echophone "V-3." It is the result of special construction features and the use (through license obtained under U. S. Patent No. 1,113,149) of Armstrong's famous regenerative circuit.

For those who want the ultimate in radio reception there is the Echophone "F-5." The 5-tube combined radio and audio frequency set that assures loud speaker reception of distant stations from either loop, indoor or outdoor aerial.

Ask your dealer about these sets today. Meantime send for our descriptive folder. Address

The Armac Radio Company, Agents
1120 N. Ashland Ave., Chicago, Ill.

Manufactured by THE RADIO SHOP, 1120 N. Ashland Ave., Chicago, Ill.
Long Beach, Cal. Sunnyvale, Cal.

ECHOPHONE RADIO

ECHOPHONE "F-5"
Without Tubes and Batteries
$110.00

ECHOPHONE

Storage Battery Results at Dry Cell Cost

Dealers: Get in Touch With Your Jobbers.

THE ARMAC RADIO CO.
1120 N. Ashland Ave., Chicago, Ill.

Please send folder describing fully the Echophone "V-3" and the Echophone "F-5." My Radio dealer is

.....

Name .....

Address .....

Automobile Makes 27 Miles on Air

An automobile goes 27 miles on air by using an automatic device which was installed in less than 5 minutes. The automobile was only making 30 miles on a gallon of gasoline but after this remarkable invention was installed, it made better than 57. The inventor, Mr. J. A. Stransky, 4129 Eleventh Street, Pukwana, South Dakota, wants agents and is willing to send a sample at his own risk. Write him today.—Adv.

ting into port. Aviators, whose lives depend upon good atmospheric conditions, trust implicitly in these forecasts. Contractors on distant plains vary their work when the voice from the air says—"rain." Fishermen who leave shore in the early hours of the morning, long before papers are available, obtain the predictions by radio about 10 p. m. They obtain the latest information when at sea by the same means. Orchardists, mechanics, fruit growers, at home and in the tropics, statesmen, resort managers, railroad and automobile touring campers, and many others, all bear heavily the results of unfavorable weather, and there is no extensive method by which they can obtain weather forecasts other than the night weather broadcasts. So, when the announcer simply reads a short telegram of weather predictions, you will know that thousands will either rejoice or sorrow at his words.

HOW IT IS DONE

As an example of the manner and speed with which this work is expedited, we will take station KDKA, at Pittsburgh, Pa. The Weather Bureau observer at Pittsburgh telegraphs his observation report to Washington at 8 p. m., and then goes home and turns in. At 9:30 p. m. the announcer at KDKA receives the telegram containing the forecasts for Pennsylvania, New York, Ohio, Indiana, Michigan, West Virginia, Virginia and Maryland, which he broadcasts at 10 p. m., immediately following the time signal. The Observer can hear the forecast within two hours after he made his observations, upon which the forecasts are based. Hundreds of thousands listen in this particular service every night, many living in remote and inaccessible regions. Thus is a service that is typical of all the other broadcast stations.

The broadcasting co-operative system of the Weather Bureau includes 115 of the best and most powerful radio stations in the United States.

Why Radio News Favors Esperanto

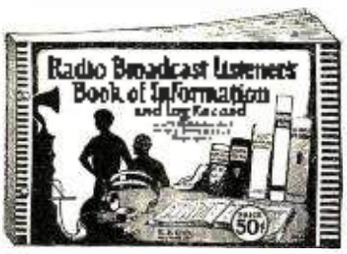
(Continued from page 937)

vain; they have no chance; but if they desire to be exclusive, all very well, but then of course their pet lingos are eliminated from the entries in the International Language race. For any language to be International, it must be universally employed or it is of no service to the peoples of the earth.

For instance—the Continental Code used for radio communication may not be the best, but since everybody uses it, it is possible for operators of different nationalities to copy any message sent in any language, since each group of dots and dashes represents the same letter.

Now, as to the point of the desirability of the two mentioned languages, Ido has some advantages over Esperanto as a technical language, but fails in some other respects. We advocate Esperanto because it has admirably filled the requirements demanded of it and has by far the greatest number of followers, about twice the number of adherents as Ido. This means that should you take up the study of Esperanto and it is a very easy language to master—there are quantities of people all over the world with whom you could communicate, while on the other hand should you learn Ido or one of the other tongues, you would be in the same boat as a person who can speak Latin fluently. You would have learned a language for which you had little use. You would be greatly disappointed because of its lack of serviceability. Esperanto, at the pres-

One Radio Book Everyone Reads



The Radio Broadcast Listener's Book of Information and Log Record

is not only a complete, practical book of those essential Radio facts that everyone who owns a radio should know, but it is also a handy log record for those who want to keep a record of the stations they receive. The book is enclosed in a handsome two-color cover, bound in Loose-leaf fashion, so that new pages can be inserted if necessary. It contains 60 pages, each one containing information more valuable than the last.

The following is a brief summary of the information contained in this book:

Information for the Broadcast Listener; Various Time Tables; Make your own Radio Receiver; Practical Hints; Radio Receivers; Practical Hints; Radio Receivers; Practical Hints; Radio Receivers

ENGLAND · SCOTLAND · WALES · IRELAND · NORWAY · SWEDEN · DENMARK · HOLLAND · BELGIUM · FRANCE · SWITZERLAND

Give them an Amplion this Christmas!

The new Amplions!

WITH THE "FLOATING DIAPHRAGM"

Amplion Vibratory Diaphragm is cushioned and kept from contact with metal by rubber gaskets. Rests on narrow ledge, lightly held there by spring ring with enough pressure to prevent "chatter" when extreme volume is desired. Diaphragm thus "floats" free from stress or undue tension, and free to vibrate in exact accord with variations of current flowing through electro-magnetic system. Result: faithful reproduction over entire musical scale—*without distortion.*

HAVE YOU seen, have you heard, the wonderful new 1925 Amplions? The latest creations of the world's oldest loud speaker makers—*thirty years experienced!*

Hear these new Amplions—*in comparison with the loud speakers you thought were best.* Gain an entirely new conception of how flawless loud speaker reception can be! Never before have you witnessed such supreme sensitivity, such beautiful purity, clarity, natural tone and distortionless volume over the entire musical range.

You will no longer wonder that Amplions, the world over, outsell any other loud speaker. That abroad, they outsell *all others* combined. That America, too, is demanding them in such numbers that it was necessary to form The Amplion Corporation of America to market and manufacture as soon as possible here under the Amplion patents held by Alfred Graham & Co., London, England.

Your ears will quickly verify that the Amplion is the finest loud speaker you have ever heard. Your eyes will be delighted with the Amplion beauty of appearance. Don't miss this treat. You will never know how good your set really is until you hear it over an Amplion.

Find the dealer who has been selected to demonstrate the Amplion in your locality. Or write us for literature and his name.

THE AMPLION CORPORATION OF AMERICA

Executive Offices: 280 Madison Ave., New York City

Canadian Distributors: Burndept of Canada, Ltd., 172 King Street West, Toronto.

AMPLION

The World's Standard Loud Speaker

Prices are slightly higher in the far west.

The new Amplion Bungalow, Model AR-18, stands 43½" high. The beautifully curved parallel horn is at once attributed by Architects as embodying the height of elegance of the season. Pyramidion stands on carved pedestal and mid-fold floating diaphragm. Cabinet hinged to be supported sideways by nickel plated brass, enabling horn to be tilted to any angle. Equipped with the "Floating Diaphragm" adjustable device, assures soft, violin tone to be restored whenever desired and with proper manner allotted to a phonograph. Requires no power amplifier or booster. Price $60.50

The new Amplion Amplion Diaphragm Unit—the equivalent in it and unchanged since the "floating diaphragm". Handsomely finished in crystalline enamel, aluminum metal. Model AR-57 produces exceptional clarity without loudness in power amplifier. Price $15.00. Model AR-57-A, the "cutout type" Includes three volume effects, bronze or ivory shades. Has in addition also a special resistance which for use with a power amplifier for extreme volume. Price $15.00

The new Amplion Junior Unit, Model AR-111, also has the exclusive "floating diaphragm," non-corroding, rubber insulated, metal conduit, stands 15½" high. The usual horn is 10" in diameter of the regular Amplion finished any of the exquisite cabinet designs of Amplion nickel-plated brass, specially horn to be fitted to any make. Equipped with the exclusive "Floating Diaphragm" adjustable electric magnetic unit. Requires no power amplifier or booster. Price $24.00

The Amplion Junior Unit, AR-111, has a good horn similar to that of the Dragon. Price..$22.50

The Amplion "Dragonfly," Model AR-185, is a perfect replica of a typical scale of the new Amplion Junior. Exclusive now! Although it stands only 6" high, and the metal horn but 4 5/8" diameter, it is outstanding in efficiency for reproducing to considerable volume with extreme clarity and remarkably "full" tone. Price $12.50

The unit alone is considerably amplified for use in console sets and cabinet Loud speakers.

ant time, is being used extensively throughout Europe and is helping to do much in the way of stimulating commerce as well as good will between the nations. If we learn Esperanto, we can talk to these people; if we learn one of the other tongues, we cannot talk to them. It is the logical thing for the people of the United States to select Esperanto as the International Language. The sooner the others are forgotten, the better, and the nearer all the nations of the world will be to a mutual understanding, that for which we are working and which is impossible without a common tongue.

In conclusion, we repeat Radio News favors Esperanto as the International Language for the reason that it is the most widely used and is too strong to break down. It can be weakened by the building up of Ido, but then we are back in the same old run, two Universal Languages, two factions and ever so slight a gain in the direction of the desired goal. In such a case "each to his own language."

Following is an article published by Dr. Pierre Corret, president of the Internacia Radio Asocio (International Radio Association), in the "International Language" magazine in which he clearly explains why Esperanto is the International Language to use for radio communication.

The Morse code, which is used for telegraphy, with wires or without, is international. It is, therefore, easy for a telegraphist to receive a telegram in a language which he does not know. The apparatus as it were, "dictates" to him letter by letter. It is only necessary for him to write down the letters one by one as he receives them, and there is no necessity for him to understand the meaning of the words and sentences, which he writes. The multiplicity of languages, therefore, is not a very serious bar to telegraphy if the operator has only to write automatically telegrams not addressed to him personally.

But it is quite another matter when he has to abandon this merely mechanical role and enter into direct relations with his correspondent. If two parties using the telegraph have no language in common, it is impossible for them to achieve mutual understanding. And this state of things is fairly frequent in the case of radio, for in that field one is liable at any moment to get into touch with a telegraphist whose language is different from one's own.

In order to facilitate international communication, the London Conference on Radio Telegraphy accepted 40 or so conventional groups of letters, beginning with "Q," by means of which information may be asked or given as to the service, usually between ship stations. Thus, QRA? means: *What is the name of your station?*; QRD?: *Where are you going?*; QRF?: *Where do you come from?*; QRK? *Do my signals come through properly?*; QRX: *Must I wait?*; and so on.

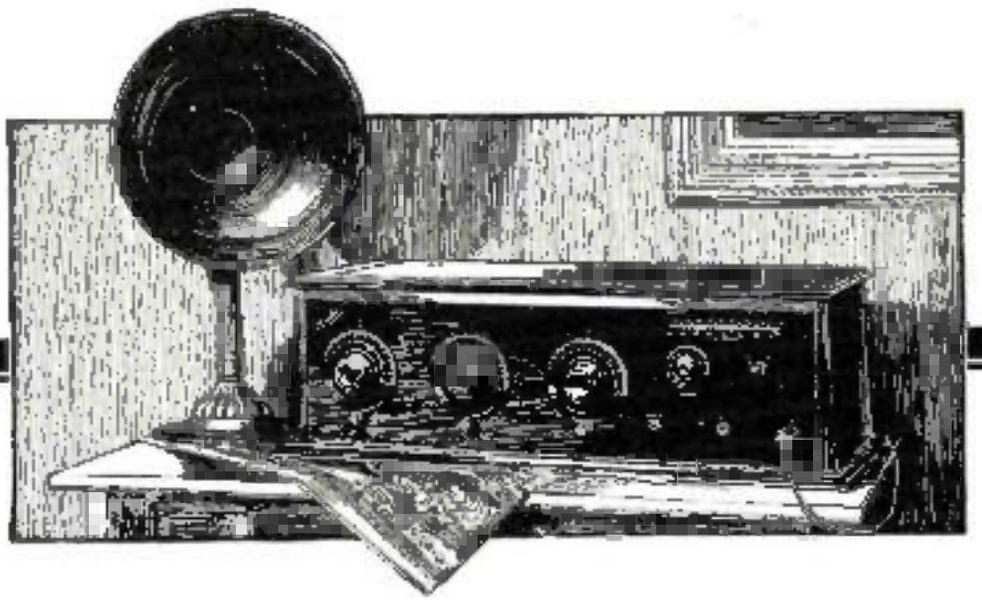
There exists also a maritime "international code of signaling" by means of which certain set phrases may be exchanged. DAV means: *I was aware*; OSD?: *What has happened?*; DOQ *What do you advise?*; KWF: *Send a description*; OQV: *Are you in good health?*; UCT: *I am ill*; TMV: *When will you start . . .*

But these means are wholly insufficient when it is necessary to telegraph something outside the scope of these prearranged phrases, or when those telegraphing have no language in common. The following for example was written to me a few months ago by a British radio-telegraphist (notwithstanding the fact that his language is one of the most widely known):

"There are few English or American stations that understand any other language than English, and French or

A New Way to Get

Supreme Purity and Sweetness of Tone



—the Pfanstiehl Model 7 Receiver

A 5-Tube Receiver using the new system of tuned radio frequency

AN entirely new stage of radio development has been reached by the Pfanstiehl non-oscillating system. Radio has not been entirely satisfactory hitherto. It has been more or less of a scientific toy, furnishing excitement for the radio fan rather than dependable enjoyment for the home. People *now* want trouble-proof service and purity of tone. The new Pfanstiehl meets those requirements, as they have never been met before, by avoiding complications. It is surprisingly simple, trouble-proof, gives a clear, natural tone at any distance. Internal noises have been absolutely eliminated.

The Pfanstiehl Non-Oscillating System a Revolutionary Improvement

Hitherto radio has been advancing along the line of more and more complication to get a higher sensitiveness. As amplification increased, internal noises developed. These were due to stray oscillations throughout the receiver which had to be choked down or neutralized by extra condensers, stabilizers and wiring—complications which get out of order and need adjustment. This was not the way to make radio a dependably enjoyable instrument for the home. It was not simple enough.

Simple—and Clear as a Bell

What Pfanstiehl did was to design a non-oscillating system, which gets rid of all stray oscillations—keeps them out. There is no need of choking or neutralizing devices. You can change tubes as often as you like. No adjustments are needed. *The absence of such devices greatly improves purity and sweetness of tone.* Speech and music are naturally received and reproduced. In this respect distance makes no difference. There is no distortion, however great the amplification. Tuning is so sharp that wave lengths can be distinctly and separately received less than eight meters apart.

The "Station Finder"

is another big Pfanstiehl improvement that takes the guesswork out of tuning. This consists of three large dials which tune the three successive circuits. Therefore these dials are turned identically, or to the same number, for any given station. This means that to receive on any one "wave length" you need to know but one number. That number is given by the "Station Finder" on the right-hand upper corner of the panel. On its lower scale, read the "wave length" of the station desired. (This information is obtained from the daily program in the newspaper.) Directly above the "wave length" read the number at which the three large dials are all to be set to secure reception.

DEALERS: Exclusive local franchise open to strictly high-grade dealers in a number of desirable territories. Act quickly. Write for the Pfanstiehl Proposition

PFANSTIEHL RADIO COMPANY

Highland Park 20 S. Second Street Illinois

Pfanstiehl

Italian ships accordingly often have difficulties with these stations. I myself experienced this when traveling to the Argentine. I was then on the English ship *Demetrius* bound for Buenos Aires. On meeting an unknown ship I hailed, asking: QRA? *What is the name of your station?* It replied QRA *Argentine ship "Asturias."* I then continued QRD? QRF? *Where are you going? Where do you come from?* The reply was: QRD *Cadiz*, QRF *Montevideo*. I gave this information to the Captain who said "Ask what weather they have had since leaving Montevideo." Here my trouble began. I could not speak Spanish, therefore I asked in English, *What weather have you had?* The ship replied something in Spanish which I could not understand. One of our Officers knew a little French and he translated the sentence into French. I sent it to the *Asturias* and received the same reply as before. They could not understand my question. I asked in Esperanto with the same result. It was impossible to continue the conversation."

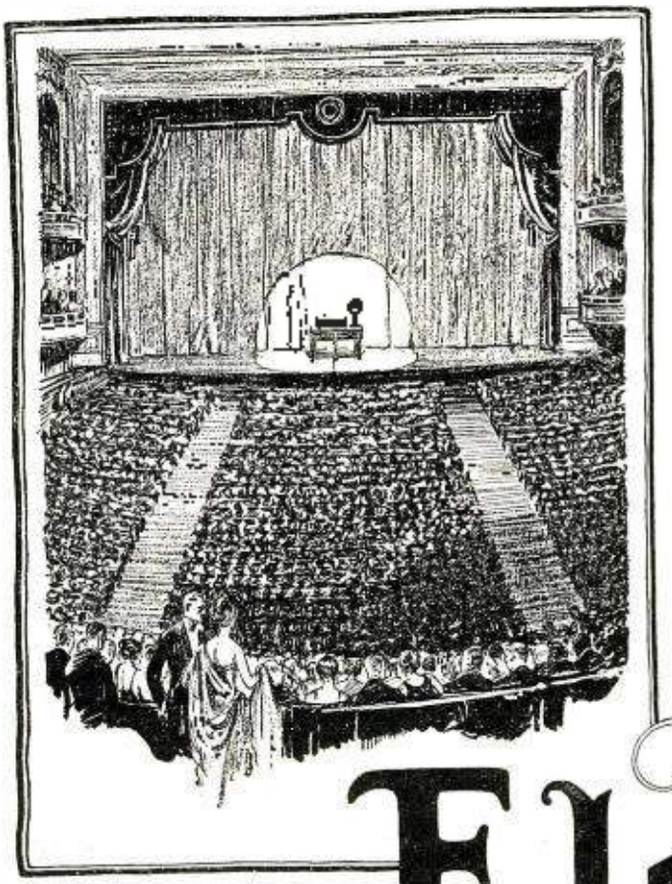
It is a matter of common knowledge that experiments in trans-Atlantic transmission are at the present time being made on a short wave-length. Experience has proved that reception may be attained at very great distances. European and American amateurs have succeeded in getting one-two-way communication with wave-lengths of 200, 100, and even only 43 meters, with comparatively small power. Once when experimenting at my own transmitting station BAE, on a 200-meter wave, I got into touch with the British Station 2OD. Unfortunately, the man at 2OD, who was a very skilful experimenter, knew no French at all, and I myself am quite unable to use English. After the interchange of a few words in English and French with difficulty, and only partial understanding on each side, the station 2OD finally informed me that it did not wish to waste my time any longer and thus the interesting experiments which without the barrier of language we could have made, had perforce to be abandoned.

Over the whole vast territory of the United States, where there is one common language, amateurs relay telegrams to far distant places. In Europe the position is quite different. Even a comparatively weak station has within its range countries where many different languages are spoken. As Mr. H. A. Eplon very truly remarked in the "Wireless World," for amateurs who wish to get into touch with only one country, it suffices to learn the language of that country (although the study of even that one language may be a long and difficult process). But for those who wish to be in touch with many countries, for example, Denmark, Holland, Czecho Slovakia, Germany, Spain, etc., it will manifestly be necessary to find some solution other than the learning of a multitude of languages.

In the case of radio telegraphy the diversity of languages is only a comparatively minor inconvenience—for it is not always necessary that the message should be understood at the moment—in radio telephony, on the other hand, the case is quite different. A telephone message which is not at once understood by the listener himself, misses its aim and is completely lost.

In many countries there are now to be found radio broadcast stations, which transmit not only concerts, but also speeches and other communications, each using its own national language.

These concerts and communications are heard at distances far beyond the frontiers of the country concerned. And though it is possible to enjoy music internationally, it is



—and then we heard

Electrola

The Musical Instrument of Radio

SUCH volume that it is necessary to warn users not to turn it on full—lest the loud speakers be thrown out of adjustment. A new tuned radio circuit—developed by the pioneer makers of radio parts in this country. Batteries and tubes will last from twice to three times as long. Marvelous selectivity. These are the high spots. The whole story in a booklet. Shall we send it? Jobbers: write for exclusive territory proposition.

The Famous Line of Kelford Radio Parts include a remarkable low loss condenser, a laboratory precision rheostat and an audio frequency transformer. These parts are more efficient because of our long experience—and at lower prices because of our facilities.

THE · AMERICAN · SPECIALTY · COMPANY

168 Holland Avenue, Bridgeport, Connecticut

America's Oldest Manufacturers of Radio Parts

otherwise in the case of speeches which are unintelligible for the majority of listeners.

Even music needs an International Language. In the days when Great Britain had no radio stations of its own, and British amateurs listened to Continental concerts, many of them used to write to me asking if it would not be possible for the Eiffel Tower station to announce the titles of the musical items "in English also." Undoubtedly this solution of the difficulty would meet the needs of the British amateurs, but it would not in any way help the Spaniards, Italians, or Czechs, who also were listening.

It is unnecessary to labor the point any further, for it is obvious that communications broadcast in national languages are intelligible to only a small proportion of those who hear them, and very rightly Mr. Hugh S. Pocock, the Editor of the "Wireless World," has named Esperanto "The Key to World Broadcasting."

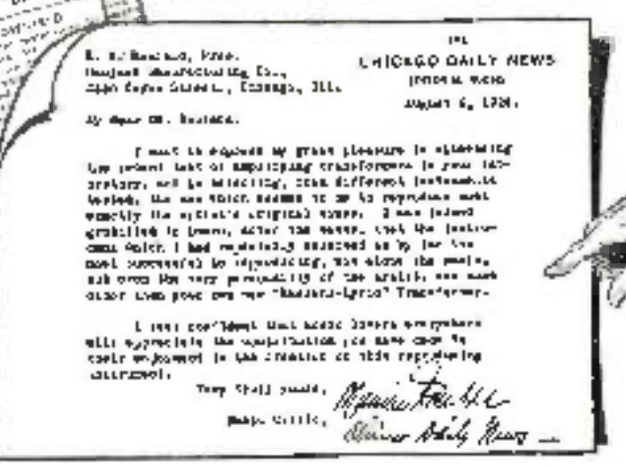
How few, for example, of the French amateurs, who, to use the current phrase "hear the British," are able to understand the speeches transmitted by the stations of the British Broadcasting Company! What is the proportion of British amateurs who understood the French discourses?

Even in the case of technical experiments in radio, the language barrier stands in the way. One of the tasks of the experimenter which needs the greatest care is to reproduce to perfection the right modulation or timbre of the voice. An eminent engineer then in charge of the first experiments in radio at the Eiffel Tower once asked me to listen to the foreign stations, in order to report to him to what extent success was obtained in this respect. I could only reply: "You are asking me for something which is quite impossible, for even when an Englishman standing by me speaks in English, his 'modulation' sounds to me quite imperfect!" In order to have the power of giving an expert technical opinion on the quality of telephonic transmission of a foreign language, it is absolutely necessary to know that language perfectly. As a matter of fact, British experimenters have often requested me by radio telegraphy to listen to their radio telephony. But in every case, even if they tried to speak my language (and in what a way!) their transmission seemed to me poor. Without doubt direct speech with them would not have seemed much better!

It has often been said that the spread of the means of international communication will inevitably necessitate the adoption of an International Language. Railways, steamships, and aeroplanes, are the means referred to, but it is only to a comparatively small number of persons that they have brought home the need of an International Language. In the case of radio communication, and especially of telephony, the opposite is the case. There are thousands of persons at the present time who need only light up at home certain little lamps to get into direct communication with many different countries whose languages they do not know. They hear clearly, but understand nothing! If the saying is true, that necessity is the mother of invention, then there is no doubt that radio will bring about the definite adoption of an International Language, and that Esperanto, though scoffed at by some, and opposed by others, will very soon become the necessary handmaid of radio telephony.

The ever-increasing success of Esperanto has of course given rise to many imitations which are more or less noisily boomed. Each of these, of course, claims to be "better" than the original, and than all the others, as is usually the case with imitations. Their authors apparently have not realized the evil they do by discrediting in the view of the world the whole idea of

At Last!
Radio That Satisfies
The Music Critic



THE CHICAGO DAILY NEWS
JOURNAL BLDG.
August 6, 1924.

E. N. Rauland, Pres.
Rauland Manufacturing Co.,
2046 Cuyler Street, Chicago, Ill.

My dear Mr. Rauland,

I must be enjoying my great pleasure in witnessing the recent test of comparing transformers in your laboratory, and in detecting, some different instruments working, the one which seemed to me to reproduce most exactly the artist's original tones. I was indeed gratified to learn, after the tests, that the instrument which I had selected as by far the most successful in reproducing, was alone the medium through the very personality of the artist, was made clear when you used your "Rauland-Lyric" Transformer.

I feel confident that music lovers everywhere will appreciate the application you have made to their enjoyment in the creation of tone reproducing instruments.

Very truly yours,
Music Critic,

Price, $9.00

In placing his mark of approval upon Rauland-Lyric, Mr. Maurice Rosenfeld has invested Radio with a new beauty and dignity. His words carry positive assurance, to music-lovers and trained musicians, that they can now admit Radio to their field of appreciation and enjoyment, with the certainty that all voices and instruments will be reproduced with their original and distinctive Tone Quality.

Mr. Rosenfeld, a veteran among metropolitan music critics, selected Rauland-Lyric upon the sole basis of Tone Quality, from a group of the world's best audio transformers.

Karleton Hackett, famous critic of the Chicago Evening Post, pronounced Rauland-Lyric a "distinct advance in the musical quality of radio reproduction."

You can have, in your home, the amplifying instrument which has been commended by eminent critics. Rauland-Lyric can be installed in your present set, or one that you may buy, to replace any ordinary audio transformer.

Ask your dealer.

RAULAND MANUFACTURING COMPANY
Pioneers in the Industry
2046 Cuyler St. Chicago, Ill.

THE RADIO KEY BOOK contains clear explanations and charts of the action of audio amplification and equally valuable discussions of many other subjects in Radio. Send for it (only one per dealer).

Rauland-Lyric
AN
ALL-AMERICAN
TRADE MARK
TRANSFORMER

The **RADIO KEY BOOK**
E. N. Rauland

Standard Audio Frequency Transformers
"All American for Reliability"
Primary Style 1 ... $ 11.50 Primary Style 2 ... $ 11.50
Primary Style 3 ... $ 11.50

Each is a premium quality transformer, designed and constructed to give the best results possible with any standard detector.

Long Wave Transformer
For reception and amplification of radio signals between 600 and 2000 meters. Ratio 10 to 1 ... $ 10.00

Power Transformers
For Tone Quality in a Class B Stage of Audio Using Two or Four UX Tubes
Input type ... $ 12.50 Output type ... $ 12.50

Self-Tuned Radio Frequency Transformers
"Wound to Split the Tube"
Extremely sensitive and efficient ... $ 10.00
For "UV" Tubes ... $ 10.00

10,000 Meter Transformer
Will cover from 1,000 to 10,000 meters. Ratio 1 to 3. Primary tuned by 23 plate variometer with high selectivity and wide band dimension ... $ 10.00

Radio Frequency Coupler
Universal Coupler. A variable tuned air core coupler ... $ 10.00

Universal Coupler
Will cover the broadcast or short wave range ... $ 10.00

ALL-AMERICAN

Largest Selling Transformers in the World

an International Language, and giving to sceptics, for the sake of their personal whims, the impression that there exists a second Babel of International Languages beside that of the national languages. No, there must be *one* International Language, or none!

The radio field naturally has open to Esperanto. More than 40 radio stations in Britain, Czecho Slovakia, France, Germany, U. S. A., etc., have already used Esperanto for transmitting purposes. For example, the British Broadcasting Company simultaneously brodcast from all stations the speech of H. M. the King of England on the occasion of the opening of the British Empire Exhibition at Wembley. An Esperanto transmission from station WOR in Newark, N. J., was perfectly clearly heard and understood at Japan, across the whole continent of America and the Pacific Ocean. "The American Radio Relay League" has just adopted Esperanto and has officially decided to recommend that language as the International Language of the International Amateur Radio Union.

Under the title "International Radio Association," there was founded on Jan. 1, 1924, an International Society which in the short space of only a few months has been joined by people in 30 different countries, and has national secretaries in Britain, Canada, Czecho Slovakia, Denmark, France, Holland, Ireland, Italy, Jugoslavia, Spain and U. S. A. It aims at abolishing, by means of Esperanto, difficulties raised by the language barrier in the path of radio telephony, and at bringing radio users of different countries into touch with one another, even if they have not yet learned Esperanto. It further intends to publish, in Esperanto only, a radio magazine "Internacia Radio Revuo," by means of which, without the necessity of learning various foreign languages, radio-technicians can keep in touch with the work of investigators in other countries, and amateurs can read articles written by an international staff of contributors. This they will be able to do very easily after only a few weeks' study of Esperanto, and they certainly will not regret the small amount of time and effort expended for the purpose of learning the International Language.

INTERNACIA RADIO ASOCIO
(International Radio Association)

President

Pierre Corret, 97 rue Royale, Versailles, France.

Secretary

Harry A. Egton, 17 Chatsworth Road, Lundon, E. 5 England.

Corresponding Secretary

Cleko-Slovakia—A. Pitlik, Krenerova, 17, Praha, II.

Denmark—S-ro P. Lendorff, Dybbolsgade 35, Copenhagen, B.

France—C. Rousseau 4 Place de la République, Levallois-Perret (Seine).

Spain—S-ro F. Sofer, cef-telegrafisto, Centro de Telegrafos, Valencia.

Ireland—S-ro F. R. A. McCormick, 5 Mount Eden Road, Donnybrook, Dublin

Italy—G. Saggiori, Corso Vittorio Em. II, N.6, Padova.

Jugoslavia—Nikola Lesac, Rogatica, Bosnia.

Canada—C. C. McFarquhar (C.300), 363 University Avenue, Toronto.

Holland—Ir. J. B. G. Ghijsbrecht, v. Beverningstraat 10, 's-Gravenhage.

United States—E. Jay Quimby, 587 West 181st Street, New York City.

A SUPPORTER OF IDO

Editor, Radio News:

For many months I have enjoyed your prophecies as to the future of Radio (and

Ensure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

"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.

NEW AND EXCLUSIVE "RASCO" GOODS

Money refunded if goods do not satisfy

"RASCO" 16 in 1 Radio Tool

HERE it is! [illegible]

35c

CRYSTODYNE DETECTOR

(PATENTS PENDING)

6900

Here is a detector which has been especially designed for use for the new Crystodyne circuits. [illegible]

D6900—Crystodyne Detector with Crystal $1.75

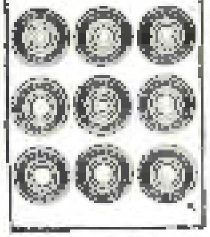
[illegible]

"RASCO" Snap Switch

[illegible]

4850 25c

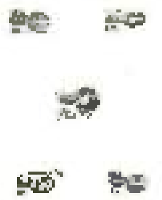
[illegible]



"RASCO" NAME PLATE ASSORTMENT No. 4984

This Name Plate Assortment [illegible]

[illegible] Assortment $0.25



"RASCO" LUG ASSORTMENT 30 LUGS 3 DIFFERENT STYLES No. 4995

[illegible]

D4995 Lug Assortment $0.22

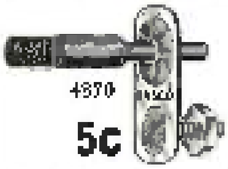
"RASCO" RADIO WELDS ASSORTMENT 105 PIECES No. 4996

[illegible]

D4996 RADIO WELDS Assortment $0.40

"RASCO" "Jiffy" Jacks and "Jiffy" Plugs

[illegible]



4870

5c

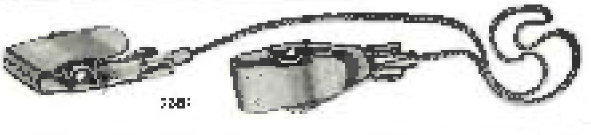
20c

D-4875

[illegible]

"RASCO" Clip Leads

[illegible]



[illegible]

D7887 RASCO CLIP LEADS. Pair ..$0.12

[illegible] .... .35

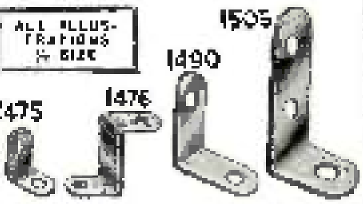
"RASCO" Brackets

Here is a line of small brackets [illegible]

D1475	[illegible]	$0.03
D1476	[illegible]	.05
D1490	[illegible]	.03
D1505	[illegible]	.05

[illegible]

ALL ILLUSTRATIONS ½ SIZE



SEE OUR 2-PAGE AD ON PAGES 994 AND 995 RADIO NEWS

Dealers and Jobbers

[illegible]

[illegible]

RADIO SPECIALTY COMPANY
Wholesale Department
25a West Broadway, New York City

RADIO SPECIALTY CO., 98 Park Place, New York City

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

other things) in the columns of your editorial pages. Now I am going to assume the role of the prophet. Sooner or later you will find you have made a mistake in adopting Esperanto as the official radio world language. I have followed them all. Over 30 years ago I was a member of the first Volapuk club in Boston.

When Esperanto came, it seemed at first to meet all requirements, but a few small defects and one or two major ones proved its undoing. Perhaps Ilo may later be found wanting but thus far it seems entirely satisfactory. In the meanwhile my prophecy stands! But I wish to commend your willingness to open your columns to a discussion of the whole question. That is the best way to hasten matters, at least up to a certain point. Anyway, the discussion serves to advertise both languages. Let it continue!

H. L. Sprir
Nashua, New Hampshire.

ESPERANTO vs. ILO

Editor Radio News:

I was indeed glad to have the opportunity of making a comparison between Esperanto and Ilo, the modified Esperanto language. I say modified Esperanto because it is quite evident that both languages have practically the same common international vocabulary, and I do not consider it of vital importance whether nouns form their plural in "oj" or in "i" which seems to be one of the differences between the two languages. I do not know what Mr. Ross has in mind when he says reformed Esperanto without Czecho-Slovakian letters, unless he refers to the marked letters in Esperanto. If this is the case, then why doesn't he criticize English for its dotted i's and j's?

In this article it is further stated that Esperanto is an easily spoken language. Would not such language be the one for radio and international use? He admits that the Ilists cannot write good Ilo unless they know the rules for forming new words. This might apply to Esperanto also, but I have successfully carried on a correspondence with more than 50 nations concerning both business and social affairs, and I am glad that it was only necessary to learn 2800 roots instead of four times this number in order to do so.

The paid propagandists must be very numerous throughout the world when they have succeeded in registering 250 members in North America for a cause that is 35 years old. How many members did the Ilist association have in May, 1922? During the two years in which I have been interested in an International language movement I must confess that I have never heard about Mr. Harry Epstein; however if he has a force of stenographers at work I do not think they are there for propaganda purposes, but for looking after those interests which mean the making possible of world peace and the true realization of the brotherhood of man. I had to write to a newspaper information bureau in Washington to secure my first information about Esperanto, and this was less than two years ago.

If the League of Nations did not accept Esperanto, did they reject it completely? What was the League of Nations' report about Ilo? Since this investigation involved practically the entire world, I am sure it must have been an impartial one.

Is it any wonder that the Ilists look with favor upon the growth of Esperanto when their own proposal depends upon the success of Esperanto. This must be true of all leading Ilists are ex-Esperantists. I believe these same Ilists are the ones who wanted to tinker with Esperanto before the proper time. No doubt, Esperanto will be changed and improved if it continues to grow and finally becomes the International Auxiliary Language.

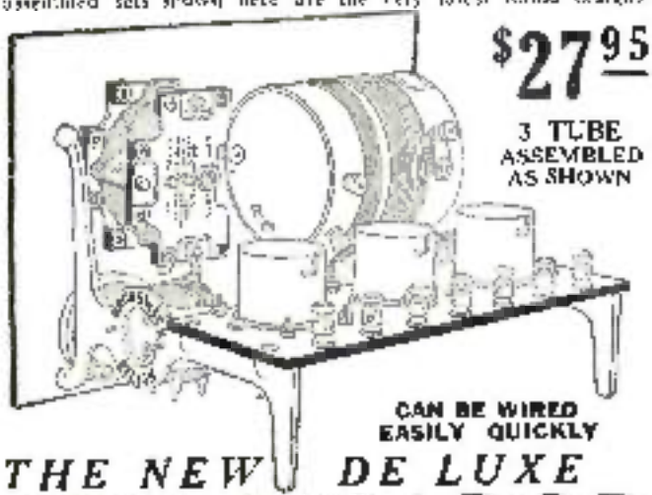
The "beautiful example of logical riddle-

Build Your Own Low Loss Receiving Set and Save 50%

SEND NO MONEY — Mail Coupon

All Building Parts Furnished at Amazingly Low Prices

You know that the expensive part about building a receiving set is the wiring and assembling. The labor charges of high priced experts must all be included in a receiving set you buy all assembled ready to operate. But you save all this when you buy one of the Radio Shack's semi-assembled kits. You get all the parts, the wires, screws, panels drilled, sockets and a chart and directions to wire and assemble it. This is so plain and clear that you can put a set together so easily—so quickly that you will be surprised. Even though you know nothing at all about radio you can assemble one of these sets. The two semi-assembled sets shown here are the very latest Radio designs. Both sets have low-loss parts which mean that practically none of the program it receives is lost before it reaches you. When assembled you will have a set worth $75 to $150. Will operate any loud speaker clear, loud and distinctive. You don't need to send a penny in advance to get either of these sets—just mail your name and address on the coupon below and mail it. Then when the semi-assembled set or other arrives merely pay your postman the amount, plus the small carrying charges. If you are not delighted with it—return the set as sent to you and every cent of your money will be refunded. The Radio Shack, 55 Vesey St, Dept. RN12—New York, N. Y.



$27.95

3 TUBE ASSEMBLED AS SHOWN

CAN BE WIRED EASILY QUICKLY

THE NEW DE LUXE AMBASSADOR

This kit enables you to build a set that will compare with any factory built set. The mounting brackets, one of the special new features, are the product of our own moulds and bear our name. The Low Loss Condenser used in this kit has been designed for use with this coil. The panel is Mahogonite, engraved in gold, the dials also engraved in gold. All outside metal parts gold plated. The best value in radio today. Send no money—just mail coupon today. Written money back guarantee with every order.

WHAT THE AMBASSADOR KIT CONSISTS OF:

1 DRILLED 7 x 18 Radion Mahogonite Panel, engraved in gold
1 Genuine Ambassador Radion 3-Circuit 3-Layer Basket Coil
1 Genuine Hammarlund Low Loss Condenser
1 Bradleystat Rheostat
2 Premier Hazeltine Guaranteed Matched Audio Transformers
1 Brunswick Ambassador Low Loss Variable Grid Condenser
2 Brunswick Tubeless Non-Leakable Grid Leaks
1 Set of Engraved Name Plates
1 Pair Gold Plated Binding Posts
1 Pair Gold Plated Switch Levers
1 Fahnestock Clip
1 Set of Engraved Dials
1 Special Jack for Use with Phones
1 Special Plug for Use with Phones
Full Instructions and Hook-up

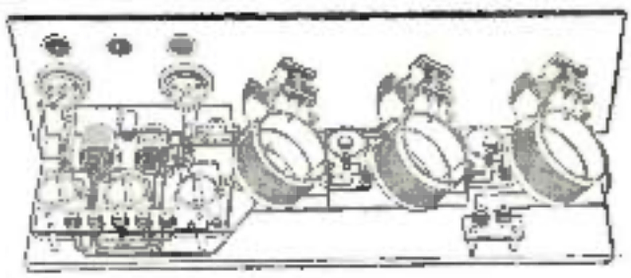
Complete. Only . . . $27.95

WHAT 5-TUBE NEUTRODYNE SET CONSISTS OF:

2 Drilled Mahogonite Panels, 7 x 18 x 3/16 inches, engraved in gold
2 Genuine Radion Mahogonite Dials, gold engraved
2 Gold Plated Jacks
2 Genuine Hazeltine Neutrodyne coils, matched for tuning. Brunswick Low Loss Condensers. Possibility of only Station Clark Bill Broadcasting them.
1 Bradleystat Rheostat
2 Brass Lacquered Sockets
1 Glass Universal Grid gold plated Leak in metal tube
1 30 Ohm Impedance coil gold plated 200 to 550 meters
2 Genuine Radion Guaranteed Matched Audio Transformers
1 Bradleystat
2 Gold Plated Binding Posts
1 .0005 Fahnestock Grid Condenser
1 Glass Grid Leak
1 Set Engraved Binding Posts
1 .002 Micro Condenser
1 .005 Micro Condenser
Panel and Sub-Panel Size given and Mahogonite

Building Kit Complete . . . $39.49 C.O.D.

5 TUBE KNOCKED DOWN KIT DE LUXE COAST TO COAST NEUTRODYNE **$39.49**



Genuine Licensed Hazeltine Parts, Synchronized and Matched

Think of getting a genuine *Neutrodyne radio receiving* set at this amazing low price! The "De Luxe" is a five tube knocked down Kit, consisting of genuine licensed coils and transformers to build a genuine *Hazeltine set*. You can spend more money on another set, but you can't get better reception! Get in broadcasts from coast to coast. Loud- clear -powerful—delicate tuning—the superlative realization of months of preparation—new among Neutrodyne sets—*thousands* in use. *Send no money*, just name and address on the coupon. Written money back guarantee with each kit.

ACCESSORIES

Everything needed to satisfactorily operate listed below:

3 Cunningham Detector Tubes	$10.65
1 Cunningham Four Stream Vernier	11.25
1 3-Foot Twin Lead Wire	.90
1 Loudspeaker	9.50
1 4 Volt Dead Blow Storage Battery	5.75
1 Battery Plug, Double	.50
1 Antenna Equipment	1.50
Cost us retail	$53.15

(Parts Also Sold Separately)

CABINET FREE

Order Outfit No. 410 Accessory Outfit both together, and we will send Fine Mahogany Finish Cabinet FREE.

OPERATING OUTFIT

1 Tested Radio Tube (Type 201-A)	$10.50
1 Set Well cut & Large Variable Grid Leak	0.50
1 Binding Post Strip	11.25
1 Set Engraved Name Plates	
1 Set Engraved Dials	
1 Pair Phone Tips, Double	.75
1 Antenna Equipment	.35
	4.50

COMPLETE OUTFIT
$13.40 C. O. D.
PARTS ALSO SOLD SEPARATELY

FREE

FINE MAHOGANY FINISH CABINET

If you order Radio or Kit and Operating Outfit both together, we will include Fine Mahogany Finish CABINET FREE.

FREE BIG RADIO BOOK

Send for our Big Radio Book, filled full of standard radio parts at Shacklady low prices. Just send name and address. Mailed FREE. Send for it at once. Radio Shack, Dept. RN12, 55 Vesey St., New York.

BRUNSWICK LOW LOSS CONDENSER

A new low loss condenser so that old set. Hard rubber plates, permanent adjustable, positive contact, provides vernier. If you want the best on the market order this one.

11 PLATE	$2.75
13 PLATE	$2.95
23 PLATE	$3.25

SENT C. O. D.

MAIL THIS COUPON NOW—SEND NO MONEY

RADIO SHACK, Dept. RN-12, 55 Vesey Street, New York, N. Y.

Gentlemen:—Please send me the new illustrated radio catalog with 8 page instruction booklet. When it arrives I will pay the postman the amount, plus the small carrying charges. I understand that if I am not pleased with it I have the privilege of returning it, as soon as I see it, and you agree to refund my money. I have marked in square what I want.

CABINET FREE OFFER (A) Accessories for Building Outfit $27.95 ☐
OPERATING OUTFIT (B) Ambassador Operating Outfit $13.25 ☐
OPERATING OUTFIT (C) Neutrodyne Building Outfit $39.49 ☐
ORDER BY NUMBER ONLY (D) Neutrodyne Operating Outfit $13.40 ☐

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

de-winks" referred to in Mr. Reed's article happens to conform to one of the principles of Chinese grammar, and Dig, together with a few more of the beautiful examples, led the Chinese to accept Esperanto as their International Auxiliary Language and probably accounts for the reason why there are 25,000 Esperantists against 12,000 Idists today. The 13,000 more Esperantists might also be those who became interested in Esperanto before 1907. Considering this, it appears that Esperanto has still been able to remain in the lead of the plagiarism Ido, and I cannot see where the public demands Ido, as was stated by Mr. Callaghan of "La Presse." Why does "La Presse" continue to publish its newspaper in the French language when the people want Ido? Why not give them Ido or else publish a paper in English which is surely the national language of Canada?

I also disagree with Mr. Lewis of the Crosley Radio Corporation, who says, "Esperanto does not lend itself to commercial use." I have secured orders not only from Switzerland, but also from China, Japan and Oceania. As far as getting orders from Switzerland is concerned I feel satisfied that I could have done this by using either French, German or even English. If the Crosley Corporation would avail itself of the opportunity to use Esperanto and the services of the 1,187 representatives of the Universala Esperanto-Asocio, they could distribute their products all over the world and with but little financial embarrassment.

Radio News certainly made a step in the right direction by accepting Esperanto as the International Auxiliary Language. I, from experience, have found that it is practical and satisfactory. If the common people are to be classified with the "intelligence of the majority" and I have the right to vote, my vote is cast for Esperanto.

WALTER A. DONNER,
1439 E. 65th St.,
Cleveland, Ohio.

ACKNOWLEDGEMENT FROM ENGLAND

Editor, Radio News

I was pleased to read a most interesting article on the subject of an "Esperanto Radio World Language" by Mr. James D. Sayers in your issue of August, 1924. This article I consider to be one of the finest I have ever read on the subject of Esperanto, and both yourself and Mr. Sayers are to be congratulated upon it.

I am particularly pleased to note that Radio News has decided to accept Esperanto as the international auxiliary language. I presume that this decision was reached after due consideration of the subject from all its standpoints.

There is no doubt whatever that an international language for radio is an absolute necessity, and that, of course, there can only be one such language accepted. That Esperanto is the most suitable is a foregone conclusion, not only on account of its intrinsic superiority over all others, but also because of the strong footing it has obtained throughout the whole world. I have just heard that the A.R.R.L. has decided to support Esperanto, and to recommend its adoption by the International Amateur Radio Union.

This should convince all those who have not yet made up their minds on the subject that Esperanto is "The goods."

HARRY A. ERTON
Hon. Secretary
Internacia Radio-Asocio
London, England.

ESPERANTO OR IDO

Editor, Radio News:

The October issue of Radio News has given a fair chance for a plea of Ido or Ito

All Esperantists, especially the Idoexponents, have laid down the principle "The best International Language is that one which represents the greatest facility for the greatest number of people, and this definition suffices to completely determine the solution of the problem."

Esperanto has half the amount of root-words of Ido, yet as Mr. Roos makes a statement that "the Esperantists are satisfied with an easily spoken, but very difficult written system," he proves that Esperanto is the language which gives the greatest number of people the greatest facility.

As to the system of writing, few have found difficulty with Esperanto, for even children learn to read and write it within a very short time. There exists only one rule for spelling. Each sound is represented by one letter, and this letter always has the same sound. This makes its spelling phonetic and easy, also pleasant. There are no silent letters. For this reason, ear and mouth get excellent training for reading, writing, speaking, singing, grammar, art, dictation and stenography.

This system has enabled a great number of blind people in different countries to master Esperanto and to carry on correspondence in Braille script.

The pool Idists make the world believe that Esperanto has Polish and Czechoslovak accents, because they despise the Slavonic peoples. Esperanto has not their accents, but entirely its own. The letters c, s, j, g, h, and u, are written with a little accent on the top. If these six letters are not to be gotten in printer's sheps an "h" added to the first five will do, and the last one can go without it. It is true that the above mentioned peoples possess accented letters, but so do the French, Hungarians, Jugoslavs, Spaniards, Germans, Portuguese, Roumanians, Lithuanians, Latvians, etc.

Of these letters it is chiefly the "j" which seems to offend the English eye! This is because the English read this letter like "g" in George, ginger, etc., but for this "g" Esperanto uses a "g" with an accent or "gh." The "j" in Esperanto sounds always and without exception like the English "y" in "hallelujah," for you say "hallelooyah" and not "hallelajahjah!" The Esperanto "j" sounds, therefore, like "y" in yes, yet, yard etc. If this "j" follows an "a" like "ay" it sounds like "I or ey", if it follows an "o" it sounds like "oi" in coin, join", if it follows an "u" it sounds like "ui" in "ruin", if it follows an "e" it sounds like "ei" in "vein"; if it follows an "i" it sounds like "ea" in "peach." What a moron one must be to consider Esperanto a system of difficult writing? Bulgarian shepherds, Dalmatian peasants, Polish laborers, and children have no trouble with Esperanto spelling. This was proven by the Chamber of Commerce of Los Angeles, Calif. for which its secretary Mr. Harrah, has been touring Europe to invite above mentioned people to California by the medium of Esperanto. His success was great.

Esperanto with its 16 fundamental grammatical rules and no exceptions has been easily mastered even by the "one-languaged" Englishman and American. It gave but a better comprehension of English, for practically all English words derived from Latin or Roman languages are found in Esperanto.

Mr. Roos claims that not the greatest number of people will decide which of the languages is to be internationalized, and before Esperanto should be that language, English could make the same claim. Every blast up to this time was made in the business to blot out Esperanto and to ridicule it as much as possible. But English is not

made for internationalization, it is entirely a national language, and as such it will not permit all peoples to use it as they like, and why should English alone get such an eminent prestige, when French, German, Italian, Spanish, Russian and Swedish have brought so much for the benefit of the human mind? It follows then, we would never come out of the language-solution! Anyone interested in this solution must necessarily make a study of this problem, and take time to visit the New York Public Library. There one sees what the number of books in the various languages are. "A short history of International Languages," by Albert L. Guerard, Page 139, reads: "I may affirm, whoever denies the possibility, the practicability, the facility of the International medium Esperanto is either hopelessly biased or woefully misinformed."

"International language" and "Esperanto" are synonymous terms and, therefore, Esperanto is the preceptor of all interlinguists.

There is also the largest Spanish Enciclopedia, Hispano-Americana in 50 volumes in which each word is named in both Spanish and Esperanto. This is a fundamental work, and Mr. Roos claims Esperanto is lacking words!

There are also the large directories of Paris and Berlin. The first one contains 18 pages of Esperanto-French business terms, the latter shows 26 Esperanto societies to exist there.

To Mr. Roos, no person who recommends Esperanto amounts to anything, even Dr. Talmey stands above Prof. Guerard! Look for Talmey in the Library and you will see that he wrote an Esperanto grammar. As it had practically no sale, Dr. Talmey left the Esperantists, who took more interest in Edward Baker's or Helen Fryer's grammar. He became an opponent of Esperanto, and a hot-headed Idist, having issued a large Ido-dictionary. I do not know whether Romain Rolland, Henri Barbusse, Ernst Toller, Albert Einstein, the famous relativist Upton Sinclair or Edward Markham count with Mr. Roos, for they recommended Esperanto to all the world! Perhaps Francesco Nitti, the former Premier of Italy counts something with Mr. Roos. In his work "Europe at the Abism," which had an Esperanto translation, Nitti said he was well pleased with the fact that his work reached the world through Esperanto, "because Esperanto is the greatest experiment in the history of human culture" and he added that he hoped Esperanto would rapidly become the greatest instrument of help for uniting all peoples.

To Mr. Roos everyone is a paid propagandist for Esperanto. I challenge Mr. Roos to publish names and sums received, i.e., facts as otherwise this statement must be regarded as false.

I come here with facts before the public. Mr. Roos states there are only 24,000 Esperantists altogether, or say 5 per cent. But there are 12,000 Idists! This means 50 per cent.

All newspapers had cable reports that the last Esperanto Congress in Vienna had 3,000 delegates, i.e., for every eight Esperantists one delegate. All right Mr. Roos.

Now where did the Idists have this year an Ido Congress with 1,500 delegates? Let us go 50-50, a fair American calculation!

In 1921 the Esperantists had their World Congress in Prague, the Idists in Vienna! Prague had 2,600 delegates and Vienna 103.

Esperanto has in every country a newspaper and an organization. The three great Esperanto monthlies, *Esperanto, Kosmopolita, Mondo and Sennacieca Revuo*, appear regularly in several thousand issues and *Esperanto Triumfonto* of Horrem near Koelln in Germany, a weekly, has about 5,000 sub-

scribers. There are two Protestant newspapers, *Dio Regno* and *Kristana Espero*, a Bahai monthly, *La Omagxo Tutmondaro*, a single-tax bulletin, *La Teriisto*, a police bulletin, *La Poeziisto*, a literary monthly, *Literaturo*, a monthly magazine for the blind, *Esperanto Ligilo*, and perhaps five others, issued entirely in Esperanto.

There is only one Ido magazine in existence, *La Progreso*. And this appears irregularly.

Should the 20 broadcast stations introduce "Ido" and nor allow Esperantists throughout the States to broadcast in Esperanto, it will follow, that many people will feel insulted by such an offense against Esperanto.

Mr. Roos says Esperanto cannot express "stolen from" and "stolen by." Please translate this into French "volée de" and "volée dire," the same it is in Esperanto, "ŝtelitajo de" and "ŝtelitaĵo diri!" But Mr. Roos is less a linguist than a fighter. The good Idists had always to find fault with Esperanto but not with their own grammar which says: Aprilala, bazilita, libelalo, patrulo, expreseskez, gloriizesez, cirkule, vilaje, humoralajo, linguala, where Esperanto uses: Aprila, bazita, libelo, patro, ekspriimo, glorigo, sxtrate, vilage, humorajo, lingva. They were ridiculing the Esperantists for their fundament, which is not a Bible nor a Talmod nor a Koran, but the Grammar on which it rests until governments come together and give reason for changing one or the other rule! But 217 operations which the Idists wanted to perform on Esperanto has aroused all Esperantists.

Ido or Ilo, remains a jargon of Esperanto an infringement upon invention. Dr. René de Saussure at least says in his paper "Esperantido is a jargon of Esperanto" but the Idists and Illists say this differently! Now you who don't investigate, learn the language of frauds! But Esperanto should remain pure for the pure!

D. A. Klagin,
1 West 14th St.,
New York, N. Y.

(*Correspondence continued on page 1068*)

Calls Heard

(*Continued from page 922*)

(1edgl, (1dek), (1cdn) (2efel, 2ege, (2egsk, (2chel, (2elig), (2eml, (2cps), 3cka, 3ckl (4gsk, 4ek), 4gs, 4bk, (4hs), 4ntz, 4eq, 4cq, 4ar, (4fgk, 4fl, (4hw), 4io, (4jt), 4ka, (4kk), 4ll, 4mb, 4my, 4oa, 4pv, 4rf, 4rr, 4sb, 4st, (4sul, 4sy, 14ip), 4tu, 4uh, 4cd, 5ap, 5gw, 5cn, 5ek, 5is, 5lc, (5kak, 5rx, 5ss, 5un, 5vl, 5vq, 5ok, 5jp, 5qh, 5sy, (5amq), 5wm, 5xg, 2ar, 5zjy, 5alh, 5akd, 5zh, 5amh, 5anq, (6aml, 6lv, 6pl, 6li, 6awq, 16aul), 6ahp, 6aja, 6ajm, 6als, 6arh, 6awe, 6avi, 6awi, 6bea, 6bcl, 6bkb, 6blw, 6cgf, 6bus, 6cba, 6cgw, 6chl, 6cne, 6cra, 6cad, 7gk, 7akk, 8als, 8oy, 8bl, 8bu, (8bp), 8bw, (8dc), 8el, 8es, (8fm), 8lu, (8hh), (8ir), 8ju, (8jw), 8ku, (8la), 8mt, 8oh, 8nl, (8nv), (8oj), 8re, 8ry, (8sf), 8rl, (8tw), 8ut, 8vq, 48wx), 8zg, 8ct, 8qam, 8ahm, 8adn, (8arb), 8anh, 8aer, 8agw, 8aig, 48iii), 8all (8alt), (8anh), 8pd, (8apm), (8apn), (8apt), (8asc), 8atc, (8ald), (8alzk, 8avb, 8avp, 8awk, 8ed, (8axm), 8bhf, 8bwn, 8bgn, (8bhj, 48bkh), 8bip, 18bm), 8bos, (8bor), (8bqn), 8bov, (8bpl, 8bpn, 8bqv, (8bqx), 18bch), 8bsc, (8bsj), 8bva (8bvw, (8bvl), (8bvr), (8byl), 48bzd), 8bzf, (8cdb), 8chh, 8clp, 8cct, 8cdc, (8ced), (8cej) 8cgt, 8cky, (8cnx), 8cmh, 8cmr, (8cml), (8cnw), 8cui, 8ccj, (8c0n), 8cnl, 8cnr, 8cwn, 48cyn), 8dat, (8dbo), (8des), (8dlm), 8dqa, (8dqb), (8dgo), (8dgp), (8dhab, (8dhv), (8die), (8dil), (8dlr), 4ddkl, (8dln), 8dmx, 8dnd, (8dnv), 8doi, (8deh), 8dpj, (8dph), 8dss, (8dsn), (8esh), 9ai, 9li, 9gs, 9ls, 9my, 49nk), 9nw, 9ny, (9ns), 9pb, 9rr, 9rc, 9vm, 9cd, 9zal, 9ael, 9alw, 9bb, 49ach), (9alo), 15adk), 9ard, 9afi, (9agn), 9ahc, 9ahr, 9aig, 9ais, (9anb), 9anp, 9ans, 9ank, 49aog), (9aqo), (9ard), (9asn), 9ain, 9awn (9avl), (9av), 9bbj, 19bnb), 9bdn, (9bda), 9bew, 9bfb, 9bhb, (9bli), 9bis, (9bnj), 9bil, 49bnc), 9bkj, (9bkr), 9bmk, 19bmx), (9bna), 15bre), 9bsz, (9bvn), 9bxg, 9bri, 9cas, 9cej, 49cek), 9cdv, (9ced), 19clsh, 9cgi, 9cii, 9cib, 49cic), 9cjh, 9chh, 9cln, 9cic, 9cnh, (9cov), 9cra, (9cnl), 19cnb), 9cni, 9cqr, (9csg), 19cur), 9cxk, (1dap), (9da1), (9dcw), (9dek), 3del, 9dlc 9dge 9dgs, 9dix, 9dil, 9dkv, 9dlc, 9dlk, 9dlw, 9dwi 49dug), 49drx), 9du.

9dyt, 9dzz, 5clx. (9ehi). [9clb), (9eji). (9eic). (USA?), 9eky, 9ell, 9clz, 9abb.

L. C. W.—4bcl, 4ldb). (1ra), (1so), (2aavi). (1adb). 1clp, 1zo. (3bigk, 3san. (4hxj, 44dx). 5aw, (5nil, 8rb. krr, 8aru, (9rc), (9dwx). nrg. wjm. wnp.

Fone—(1sj) (4apn) (5bnq). 8brc.

Spark—1azl, 1hcl. (5qul, 4lg, 9aaw.

Canada—1hq, 3dil, 71ell. (1al). 2ar, 2fj, 3buq, 3co, 3gk, 3he, 3kg, (4kq) 4vh. 4wg, 5ev, (5alp). 5in.

Please report on 2wz signals. Will get in all who ask.

J. H. STRONG, 302 NO. STATE ST. ROADHOUSE, ILL.

C. W.:

2bgm, 2cqi, 4mc, 5ll, 6bvw. 6sh. 7mw, 8dgo. 8dok. 8wy, 8zz. 9aau. 9ain. 9aim, 9aoo, 9ast, 9bhi. 9bzg, 9bhh, 9bck, 9blx, 9bn. 9bpx, 9cbg. 9com. 9crs. 9cy. 9cyu, 9dbn, 9dc, 9dgo, 9dmp, 9dyv, 9eac, 9ehn, 9em, 9eky. 9im. 9lka, 9mc. 9nac, 9rl.

Fone—5li

Heard Sept. 17, 18, 19, between 5:30-7.30 p.m.

Will QSL all calls.

9DHJ—CROWN POINT, INDIANA (ONE TUBE)

C.W.:

1acj, 1bic, 2aac, 2anm, 2azy, 2bpb, 2byw, 2cbg, 2cpj, 2cuk, 2cpa, 2cru, 2rwp, 2ub, 3ri, 3agl, 3bv, 3bpp, 3bfg, 3bwt. 3cu, 4cct. 4chg, 4cw, 4ur, 4qav, 4aww, 4bu, 4ca, 4dx, 4ea, 4eq, 4es, 4in, 4lp, 4pa, 4ql, 4xa, 5ajf, 5amb, 5ame, 5amh, 5hp, 5ck, 5cr, 5ic, 5lm, 5ka, 5ls, 5nj, 5uk, 5wi, 6awt 6lig, 7ob. Too many eights and nines, over 200.

Spark—1cm, 4ac, 8dj, 9bcr, 9clp, (9dmy).

I. C. W.—2cnk.

Fone—5ek, 8dat, (9ahd), (9aoh, (9atn). (9awp, 9hl, (2bch), (9bmc), (9cfa), 9dhl, (9dza).

Canadian C. W.—2bm, 3afp.

2CYX, 1104 CLAY AVE., BRONX, N. Y.

(1agi), (1ain), (1agr), (1aoa, (1bbo). (1bcu), (1bm), (1bqk), (1bic). (1bqc), (1cjc), 1dn, 1ee, (1ghl, (1nl). 1px. (1qv). (1rb). (1ve), (1vr). 1yb, (2ai), (2ack), (2aih), (2aoj), (2awr), (2bay), (2bhs), (2bwa), (2bvz), 2cur, (2chc), 2chr, 2dkg. 2hg, 2wx, 4ai, (4dx). 4eg, 4ef. 4gs, (4gw), 4ir, 4id. 4lp, 4mz, 4on, 4on, 4pd, 4rg, (5ack), 5acq, (5agv), (5ar), 5akd, 5ali, 5amf, (5apc), 5aph, 5agy, 5zai, 5zw. 5ck, 5ls. (5ok), 5pe, (5kal). 5nc. 5nj, 5ow, 5po 5nh, 5qk, 5ug, 5uk, 6aao, 6arh, 6aw. 6ogs. 6kzd. 6pl. 7abb, 7cm, 7ry, 7qz, 8aeb, (8agu), (8alf, 8alw, 8aw, (8awx), 8bhf, 8bcn, (8bgu), (8bhj), 8boy, (8bqe) (8bwc), 8cr, (8rdf), (8cedf. (8cel), 8cnt. (8cxm), (8dfm), (8dgx), 8dmr, (8dma), 8dre, (8dsn), 8is, (8rt), 8ss, (8uf), (8ye). 9ap, 9adq, (9apo), 9ayq, (9ayx), (9bcd), (9bdat, 9bhh, (9big), 9bix (9bmk), 9bnw, 9bnk, 9bpd, 9brs, (9bwl. 9bqh, 3caj, 9cap, (9cel),

Wud appte reports on mi 50 on 45 cc 80 meters. All trds answered.

A SUPPORTER OF ESPERANTO

Editor, RADIO NEWS:

As a regular reader of RADIO NEWS, as well as one who has for many years been interested in the question of an international language, I wish to congratulate you, and also to congratulate the friends of the international language movement, on the stand you have taken in favor of *Esperanto*. Your decision shows that you must have made more than a superficial investigation of the subject, as from the extravagant claims made by some of the would-be competitors of Esperanto, one might be led into believing that they were in use by millions of people, as their clientele, though very small, seems to be composed mostly of press agents, with their proverbial disregard for the small details of truth in their statements.

You will doubtless be bombarded with protests from the adherents of one of these in particular, called Ido or Ido, the followers of which seem to be the most vociferous in their claims, but cannot produce any literature worth mentioning, as against a list of hundreds of books, which have been published in Esperanto, among which are many of the works of Shakespeare, Molière, Pushkin, Defoe, and other well-known and less well-known authors, including poems from many languages.

Your investigation doubtless revealed the fact that Ido or Ido is an offspring of Esperanto, but you may not have been informed that, as is well known to those conversant with the facts of its origin, the bar sinister occupies a prominent place in its escutcheon.

I was especially pleased with the article you printed, from N. W. Frost of Cambridge, Mass. Mr. Frost is well known here, and you may be sure that any statements

he may make can be backed up by incontrovertible proof.

Ernest F. Dow,
993 Watertown Street,
West Newton, Mass.

ESPERANTO INTERNATIONAL COMMUNICATION TONGUE

Esperanto has been adopted as the auxiliary international language in telegraphic intercourse by the League of Nations according to a cablegram from International Esperanto headquarters at Geneva. This is interpreted as applying to radio and cable communication, as well as purely telegraphic, by those familiar with the plans for its use in international communication. Recently the American Radio Relay League recommended this universal language as the most suitable for world wide communications by radio.

REGARDING MR. ROOS' ARTICLE

Editor, Radio News.

It seems that the Idists care more about throwing mud into the eyes of people regarding Esperanto than to tell them something constructive about Ido (Ido). If you had read the Report of the General Secretariat of the League of Nations, as adopted by the Third Assembly 1922" you certainly would not permit such remarks about it. The League of Nations is too serious an institution to be made fun of.

Mr. Roos admits that Esperanto is easily spoken, but contradicts himself by adding "but a very difficultly written system." Isn't the easily spoken International Language just what the radio stations are demanding? The radio people cannot be blind to the fact that Esperanto is entirely practical for International Congresses and is the medium for millions of letters annually.

If Ido has claim for popularity, then what of Esperantido, Idiom-Neutral, Panroman, etc.? If the world suddenly becomes aware of a half dozen so called international languages, it necessarily will have to drop the subject because we will be in the same position as to which national language to use, French, English, German or Spanish. The world must use Esperanto for the present and the governments will in time see to it that it evolves along sensible lines. Otherwise, the great amount of work done in the past along this line because of Esperanto, will be lost and a great apathy towards an international language will be the result, to the detriment of the international application of Radio.

On September 11, I gave a talk on Esperanto, in Esperanto, from station WHK at Cleveland, and received so many responses that we immediately organized a large class. This course will continue for 20 weeks. I am also arranging with one of the leading papers in Cleveland for placing radio Esperanto lessons in the paper and working out these lessons by radio. Will tell more about this after the date is set.

All this is going on in Cleveland in spite of the feeble and bombastic efforts of the one Idist in Cleveland.

Our society is now making preparations to invite the National Esperanto Congress to Cleveland.

Have you seen the May number of the "International Language" published in London? Following are the broadcasts in and about Esperanto. These items will convince that Esperanto is already the language for radio.

Broadcasts in Europe in 1922— 1
Broadcasts in Europe in 1923— 9
Broadcasts in Europe in 1924—14
Broadcasts in America in 1922— 3

Broadcasts in America in 1923—4
Broadcasts in America in 1924—16

If the Esperanto broadcasts have made such a jump in 1924 up to May 7, the total can well be imagined up-to-date. Get the Ido broadcast by comparison and you will satisfy yourself as to which to choose.

The Idists stress the term "more scientific." Where the Ido principle seems more scientific in places, it is too cumbersome for fluent speech. They make fun of the Esperanto j's, how about their numerous Oxa's. I was a follower of Ido for a few years, but now I have a greater appreciation of the euphonious and internationally practical Esperanto.

Have you seen the Esperanto publication "Internacia Radio Revuo?" Are you aware of the magnitude of "La Internacia Radio Asocio" with headquarters in London, Paris and New York City? These papers and associations are *facts*, not dreams of "what we will do."

Out of our membership of 68 there are 59 radio fans. We link up Esperanto with radio.

STANLEY KOKINESES,
Sec. The Cleveland Esperanto Society
3406 Meyer Ave., Cleveland, Ohio.

ESPERANTO AND ILO

Editor, RADIO NEWS:

I do not know whether you intend giving further space for controversy as to the relation of Esperanto and Ilo. If so, may I check the following item in Mr. Roos' article in your October issue?

Mr. Roos says: 'Let us all forget numbers and lump the active opposing camps on the best available statistics at 25,000 Esperantists and 12,000 Idists"; he gives neither source nor data on which to justify the final cipher. My estimate of 25 to 1 on page 210 of your August number gave the basis for the estimate. The importance of the ratio to a radio fan seeking practical use is apparent. The test of actual practical use has been made in Europe and 25 to 1 represents the resulting judgment between the two projects after 15 years of competition. Why, then, should we not class Ilo with the other minor projects named? Possibly in North America, thanks to the lack of competition in practical use, 250 to 120 may represent the opposing forces, but why bother with an auxiliary language for North America alone?

Passing from the realm of estimates to that of fact, Mr. Roos declares, "Do not let Esperantists tell you they have 4,300 words, they have about 2,800." I have had for some two years the "Vortaro de la Oficialaj Radikoj de Esperanto" by Th. Cart, President of the Esperanto Lingva Komitato. It contains just 4,296 word roots, all of which had been before accepted and announced as official and are in regular use.

Esperanto may be "etymological hooch," but it does the work efficiently. It is "perhaps possible" that some Esperantist may be redundant barely possible that he may escape that logical *error*. The Esperantist is not likely to hesitate in translating "shtelitaj de la Ilistoj"; yet perhaps it is only fair to confess that it is possible for an opponent to make unclear phrases in Esperanto if he seeks to. The use of the accusative eliminates almost every excuse for using "shtelitaj." The correct translation of "The words were stolen by the —ists" would be "La vortojn shtelis la —isto." As to the attack upon Mr. P. Correl, President of the Trans-Atlantic Tests Committee (France), Vice-President of the French Society for Study of Wireless, President of the Internacia Radio Asocio, and Vice-President of the International Union of Radio Amateurs, that is not within my province.

Did Esperanto fail at the League of Nations? The wise man will get his facts from

Geneva direct or from Radio News and the A. M. R. L. findings. The Poincare government did succeed in blocking Esperanto in the Committee on Intellectual Co-operation, but the assembly promptly rejected the committee's report on the matter and sent the question back to the committee for further consideration. The Heriot government is not opposing Esperanto. Why torture Dr. Nitobe's word "objective" into "non-partisan"? The suppressed section in my opinion was not "objective"—i. e., statement of fact—but was "subjective"—i. e., urged use of Esperanto at Geneva and in teaching everywhere—and therefore the section was outside the competence of the League Secretariat which compiled the report, "Esperanto as an Auxiliary International Language" (obtainable from any League agency, e. g., World Peace Foundation, 40 Mt. Vernon St., Boston 9, Mass., or through any Esperantist at 20 cents a copy, 57 pages).

Mr. Roos thinks that the "real test is the translation of technical and scientific works." Esperantists generally feel that Esperanto must not be made more difficult for the ordinary human being—by large dictionaries and excessive precision—in order to make it easier for the few scientists and technicians.

Yours for accuracy,
NORMAN W. BROST.
12 Ash St. Place,
Cambridge 38, Mass.

Copies re International Institute of Agriculture, Rome, and its use of Esperanto in correspondence
United States Department of Agriculture
Bureau of Plant Industry
Washington
December 1, 1923.

Office of
Associate Chief of
Bureau
Dr. Asher Hobson,
American Representative
International Institute of Agriculture
Rome, Italy

Dear Dr. Hobson.—

I have recently been discussing with Dr. Cottrell of the Fixed Nitrogen Laboratory of this Department the Progress of the International Auxiliary Language Association, and to indicate briefly the activities that are under way by those interested in the possibility of such a development I am enclosing a Report of Progress made by Dr. Cottrell to the Committee on International Language of the International Research Council in August and a report by a special Committee that is undertaking to provide more definite support for the investigation of the feasibility of using an auxiliary language.

I understand from Dr. Cottrell that for several years correspondence addressed to the Bureau of Standards in Esperanto is answered in Esperanto, and that certain other institutions have extended somewhat the same kind of support to the auxiliary language movement, and that the International Labor Office permits the release of certain of its information through a supplement to the Esperanto Journal. This supplement, I believe, is prepared for publication in Esperanto by Mr. Brock, who is on the editorial staff of the International Institute.

I am not particularly campaigning for the use of Esperanto rather than any of the other proposed auxiliary languages, although I believe that at the present time Esperanto has been more widely used and has perhaps a larger number of supporters than any of the other proposed auxiliary languages. This has led Dr. Cottrell to make the suggestion which appeals to me as worthy of trial—to undertake to answer correspondence on agricultural matters in Esperanto. If it is practicable and if the correspondents

desire answers in that language, and possibly also to permit the Esperanto Journal to carry a supplement in that language summarizing points of interest that develop in connection with the work of the International Institute of Agriculture.

You will note that I am not suggesting the official adoption, or official recognition even, of an auxiliary language but merely the experimentation with it in the hope of determining whether it has any useful place in the handling of correspondence or distribution of information on the part of the institute.

Any comments or suggestions regarding this general subject that you would care to make I will be very glad to receive.

Very truly yours,
(signed) K. F. KELLERMAN,
Associate Chief of Bureau.

(Copy)

Rome 16 Jan. 16, 1924

Institut International
D'Agriculture
Le Délegue
Des Etats-Unis-D'Amerique

Dr. K. F. Kellerman,
Associate Chief, Bureau of Plant Industry,
U. S. Department of Agriculture,
Washington, D. C.

Dear Mr. Kellerman:—

Since receiving your letter of December 1, I have made some inquiries concerning "Auxiliary Languages" and the extent of their use. I was surprised at the amount of recognition which Esperanto seems to have won. No one appreciates more than those engaged in foreign fields the present handicaps in international communication because of language difficulties. Hence, you will readily understand that I am a hearty supporter of any movement which gives promise to lessen these difficulties.

Upon inquiry, I find that our Mr. Brueck made definite proposals to the Administration here in the Institute that Esperanto be utilized in a limited way in the distribution of information pertaining to the Institute. I am enclosing a copy of the memorandum containing Mr. Brueck's proposals. As a result of these proposals Mr. Brueck was warned by the Delegate of France, who is also the Vice-President of the Institute, that any activity on his (Brueck's) part in promoting his proposal endangered his position with the Institute.

The language question in the Institute is not encumbered with unhealthy animosities. The nations preferring the English language have just terminated a winning fight to place that language on a par with French at the Institute. Although that question is settled, feeling still runs high on the part of the delegates.

Because of the known attitude of the Administration and because of the delicacy of the language question here, I do not believe it an opportune time to bring the matter up for discussion. You may rest assured, however, that I am personally in sympathy with the auxiliary language movement and shall keep your proposals in mind with a view to presenting them to the Permanent Committee should a more favorable opportunity present itself.

Yours truly,
(signed) ASHER HONSOR,
Delegate of the United States of America.

P. S. I am sending a copy of this letter to others who have written me on the same question.

This will probably explain the attitude of CKAC and *La Presse* and it illustrates what happened in the Committee on Intellectual Co-operation.

A New Oscillator for Very Short Waves

(Continued from page 925)

condenser of .002 mfd. capacity, and must be able to withstand full plate voltage. If a variable condenser that will stand full plate voltage is available this may replace the fixed condenser and will serve to make the adjustment much easier. By using a variable condenser having low losses, the maximum capacity need not be over .0005 mfd.

Fig. 2 gives a good idea of the arrangement used to get the shortest waves. The base of the tube has been removed and the chokes arranged to make the leads to the tubes as short as possible. A portion of the oscillating circuit is seen connected between the plate and grid terminals. This figure also shows the wavemeter which was calibrated from 4 to 25 meters by the method to be described later. The wavemeter consists of one turn of wire 4½ inches square, a low loss condenser and a thermo-ammeter.

Fig. 3 shows a similar arrangement of the tube, but here the tube is used with its original base and socket. It was possible with this arrangement to get down to as low as 5 meters or if a small variable condenser is used to 4½ meters. The following table shows roughly what should be expected using a 50-watt tube:

Western Electric 50-watt tube

Base on and in socket and stopping condenser of .002 mfd.

Length of inductance	Wave-length
7 inches	5½ meters
16 inches	6½ meters
2½ turn 3 in. in diam.	12 meters

Base removed and stopping condenser of .002 mfd.

Length of inductance	Wave-length
5 inches	4.4 meters
3 inches	3.9 meters
1½ inches	3.25 meters

With base removed and variable condenser variable down to .0001 mfd. 6-inch length of wire worked down to 3.1 meters.

Considerable care is necessary in the selection of tubes for this class of work and the following suggestions are given.

1. The tube must be a good oscillator at ordinary wave-lengths for it is obvious that if the tube is made to oscillate with difficulty at 200 meters it will seldom oscillate at 5 meters.

2. The wires leading to the plate, grid and filament should be separated as far as possible.

3. The connecting coil inside the tube connecting the seal and the plate or grid should be either small or absent, for otherwise it will become red hot at short wave-lengths indicating a great loss in efficiency.

The radiating system ABCDE shown in Fig. 1 consisted of several feet of copper tubing supported on pyrex. The condensers C_2 and C_1 are made up of two circular copper plates 5 inches in diameter and they are so arranged that the distance between them may be adjusted at will and thus tune the circuit. The total distance (expressed in meters) from A to E via BCD should be from 50 per cent. to 80 per cent. of the wave-length used.

The wave-length for a definite adjustment was determined by the usual method using two parallel wires. Two parallel wires 25 feet long and separated about four inches were stretched between insulators and coupled conveniently to the oscillator. One end was closed through a hot wire galvanometer or other indicating device (a 4½-volt flashlight bulb will do) and a connecting bar slid along toward the open ends of the wire until an indication was obtained. (See Fig. 3.) This indication should be sharp if everything is working properly and should

A Three Electrode Tube In 1899?

(Continued from page 934)

who have furnished such a splendid basis for the more marvelous achievements of tomorrow, which are beyond our comprehension at the present time.

No credit is subtracted from DeForest or from any of the others who have been instrumental in taking the Bunsen burner electrode device of 25 years ago, and transforming it into the efficient, reliable vacuum tube of the present day.

Extract from the Chicago Daily News for Wednesday, April 19, 1899

PHONE LIGHT WITHOUT WIRE

Dr. H. P. Pratt of Chicago evolves a plan to go a step farther than wireless telegraphy.

WOULD MAKE USE OF THE X-RAY

Plan of sending messages through the air from this city to New York explained.—Lofty towers would be needed.

Accounts of the experiments at South Bend with the Marconi system of wireless telegraphy, published in the Daily News, have aroused the keenest interest among Chicago electrical experimenters, and one of them, Dr. H. P. Pratt of the Masonic Temple, believes he has devised a plan for both telegraphing and telephoning without the use of wires.

Dr. Pratt, who was formerly one of the electricians for the American Bell Telephone Co. and a manufacturer of electrical apparatus, is now connected with three local medical colleges as professor of electrotherapeutics. His specialty is the X-ray machine and the production of shadowgraphs and it is through the X-rays that he claims to have solved the problem upon which Marconi and the Notre Dame professors are now at work.

ENDORSED BY A NUMBER OF EXPERTS

The preliminary experiments of Dr. Pratt have been made with the co-operation of George H. Bliss, formerly superintendent of telegraph for the Northwestern Railroad. A number of other local scientists have endorsed the proposed method.

Briefly stated, the idea is to employ the lines of force thrown out in a certain determinate direction by an X ray apparatus of enormous voltage, as an invisible telegraph or telephone wire. To this X-ray current, which the physician says can be directed as accurately as a ray of light, he proposes to add another current of lower voltage controlled by an ordinary telegraph or telephone instrument. The idea was suggested by Bell's experiment of telephoning over a short distance on a ray of light.

"In the European attempts to send messages without wires, for even a short distance, the trouble is that the force thrown out from the starting point is diffused on all sides," said Dr. Pratt. "There is nothing to prevent it from going all over the universe, as well as in the direction desired.

"For instance, if you wanted to send a message as far as from here to New York there would be nothing to prevent it from being picked up at Cleveland, Pittsburgh, or any other intermediate place. Thus a large amount of force is wholly wasted.

ADVANTAGE OF THE X-RAY

"But the X ray apparatus and the Crookes tube discharge a direct current in a straight line. The tube is a condenser, a form of Leyden jar. The X-ray," and the doctor quoted from one of his recent lectures, "is an electrostatic phenomenon, an accumulation of the lines of magnetic force of high potential in a circuit. It decomposes substances capable of being decomposed in its path and renders every substance over which it travels a conductor of electricity. And right here on the ground, I can, with an ordinary apparatus, send a line of magnetic force through buildings, and every other obstruction straight as a shot for 10 miles at least.

"Now the idea is to get up where the atmosphere is rarer and clearer, say 1,000 feet or more, on top of a metal tower. Perhaps a stationary balloon would be better. At the base of the tower is a Ruhmkorff coil 10 times as big as any we have now,

sending a current of from 2,000,000 to 5,000,000 volts to the Crookes tube, to be placed at the apex of the tower.

ON PLAN OF SEARCHLIGHT

"The tube would be mounted on a pivot, like a searchlight so as to be turned in any direction. The exact latitude and longitude of the New York receiver would be known and the point toward which to turn the lines of force could be found by nautical instruments.

"Alongside the tower would stand a mast or pole of equal height capped by a metal globe. A current of low voltage would be sent up this pole, and as the high voltage X-ray current from the tower struck the globe, it would pick up and carry along the weaker current. The latter would be governed by a telegraph or telephone instrument.

HIGH POLE AND METAL GLOBE

"At the New York end of the route would stand another 1,000-foot mast or pole surmounted by a metal globe, and as the X-ray current from Chicago reached it, the pulsations could be recorded by a telegraph sounder or heard by a telephone receiver.

"Of course the lines of force would extend beyond the last globe for a distance, but ultimately they would return to the original tube and complete the circuit. The telegraph or telephone instruments would both be grounded and the return circuit would be completed in the same way.

WOULD FOLLOW EARTH'S CURVE

"While the lines of force are practically straight, yet the earth itself is a magnet and would deflect the current sufficiently to make it follow the curve of the earth's surface. Mountain ranges would not prove a bar to its progress.

"The great initial cost would be the building of the tower and the poles, but aside from that, the equipment would not be expensive."

A BOOTLEG AERIAL

POLICEMAN to DRUNK—"Come now, how did you get it?"

SOUSED RADIO FAN—"On a shick beverage antenna, of course."

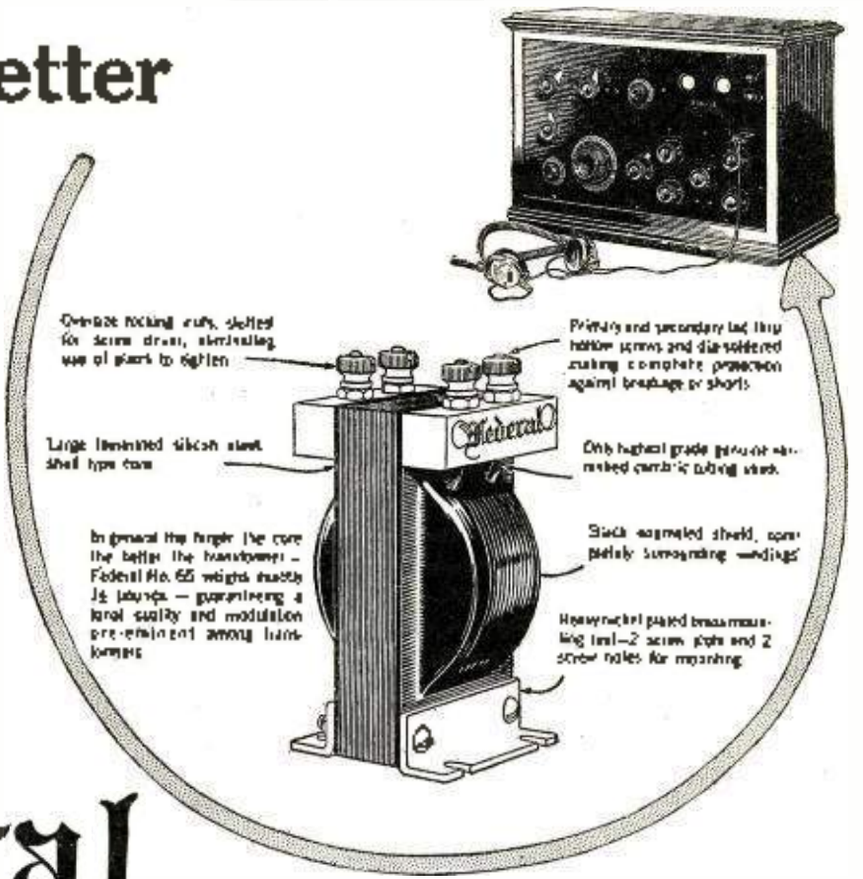
Contributed by Eugene Kelver.

Why it is Better

"MASTER of Every Note in the Orchestral Range" is the proven claim of the Federal No. 65 Audio Frequency Transformer! Volume without distortion is the basis for the beauty of Federal Tone.

From its oversize locking nuts to its heavy brass mounting feet the Federal No. 65 Transformer incorporates the same engineering skill that has made Federal the recognized leader in electrical communication apparatus since 1890.

Insist upon Federal parts for your "pet" hook-up. There are over 130 standard parts bearing the Federal iron-clad performance guarantee.



FEDERAL TELEPHONE & TELEGRAPH CO.
Buffalo, N. Y.
Boston New York Philadelphia
Chicago Pittsburgh
San Francisco Bridgeburg, Canada

Federal
Standard RADIO Products

ROFFY CIRCUITS

Economy with Efficiency

This is the Keynote of all Roffy Hook-Ups

The much discussed theory and practice of Radio Frequency Amplification has been brought to its maximum efficiency, to date, by Mr. Roffy's research. Mr. Roffy has been able to leave the beaten track of circuits, by evolving a new and improved method of winding Radio Frequency Transformers; and applied this to the Roffy No. 7 and Super Roffy, already published in this magazine.

A beginner in the construction of Radio Circuits can follow the extremely simple instructions inclosed with each carton of Roffy transformers; and build a set saving at least $100.00 and in performance equaling or even surpassing the best factory built product.

ROFFY Transformers

$6.00 Each

DEALERS AND JOBBERS are requested to write for attractive proposition.

STAMM-LAWSON RADIO MANUFACTURING CO.

Sole Manufacturers of ROFFY Transformers

UPLAND CALIFORNIA

USE THIS COUPON

STAMM-LAWSON RADIO MANUFACTURING CO.
Upland, California.

Please send me the new illustrated and educational pamphlet describing in detail the properties and principle of Roffy Transformers and circuits. I am inclosing 4c to cover mailing cost.

Name .....

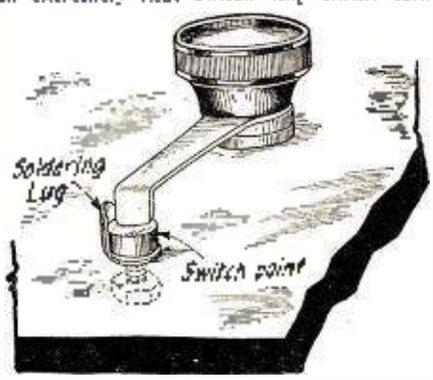
Address .....

City .....

The Simplest Switch Stop

(Continued from page 941)

as for the standard switch stop sold on the market. All that is required is an ordinary straight soldering lug which is placed underneath the first and last switch points with its tip bent upright. This makes an extremely neat switch stop which compares favorably with any that can be bought. As the switch point will be raised slightly above the others, it may be necessary to file down the face of it in order that the switch lever may slide upon it smoothly.



A simple switch stop made of a soldering lug fastened under the switch point.

—Contributed by James Wardell.

SILVER PANEL MARKINGS

The old methods of marking radio panels proving unsatisfactory, I finally hit upon the following method. This gives a very pleasing effect, more so than the plain white, and in addition is very simple and cheap.

First mix up some coil dope of acetone and celluloid. Then brush the mixture in to the mark to be filled, making sure all of the surface of the mark is covered. A toothpick will help here. While the dope is still wet, quickly dust some aluminum paint powder thickly over the spot, and rub it in well. Let the dope dry, then brush off all surplus matter, using a match in

order not to scratch the panel. Now sprinkle some "3 in 1" oil around the mark, and rub it well into the panel picking up all stray grains of the powder. Wipe this off with a cloth, and only the mark will remain, showing up with startling distinctness.

—*Contributed by D. H. Anderson.*

The Progress of Radio

(*Continued from page 902*)

tion of the crystal there is a definite power absorption from the circuit. In another method, the crystal, in association with a small vacuum tube, acts as an oscillator or generator of a current, the frequency of which is that of mechanical vibration of the piece of crystal. As the frequency is accompanied by numerous harmonics, the crystal is a standard which gives several frequencies. It is thus a supplement to the wavemeters which have hitherto been used as standards. The crystal appears to be a standard of greater constancy than the best wavemeter.

"Studies being made by the Bureau of Standards indicate that a quartz oscillator has many valuable applications in radio work. Means of producing audio as well as radio frequencies are being worked out. The crystals can be used to control or determine the frequency of a transmitting station and to hold it strictly constant. This will mean a great advance in radio transmission technique. The crystals are also useful for setting accurately receiving apparatus and for controlling the frequency of radio frequency generators used in laboratory measurement work. The value of these various applications will be particularly great at the frequencies above 2,000 kilocycles which are now rapidly coming into use."

The Doctor says 1,150 channels have been added to the erstwhile 148 channels utilized for radio telephony. "This business of radio interference is the real problem of radio today," he adds, "and there are several factors which point to an amelioration of the present condition. The principal cure is keeping different kinds of radio messages on different frequencies. Thus the amateurs are down at, or below, the low end of the broadcast listener's tuning dial; ships are just beyond the upper end of the dial. Special radio telegraphic services, like the radio beacons for ship navigation, are just above the ships and away beyond all the others are the high-powered trans-oceanic station. This progress of assigning frequencies is not yet perfected. It is still in progress. Radio has grown so fast it has outstripped the slow processes of national legislation and international agreements."

"There will be developed an effective line-radio or 'wired wireless' system," the Doctor continued. "Use will be made of a current above the audio range to carry entertainment both by power-transmission and telephone lines. This will unquestionably provide a means for distributing entertainment to those who wish to pay for it. In fact, we shall soon see wide extension of non-radio broadcasting by the aid of electric-wire systems. This will be done with line-radio or carrier-current methods, entirely independent of the regular uses of the wires."

SOME FREAK RADIO USES

The transmission of power, the curing of diseases, and the transmission of thought or psychic influence by radio, are suggestions which the Chief of the Radio Laboratory of the Bureau of Standards regards as vision-

...ay the least. He adds, however. "I ...uess that some of the realities of radio, on the other hand, seem almost as wild, and one of these is seeing by radio. This is no dream, but a fact that is being steadily perfected. Probably within five years radio audiences in remote cities will see the facial expressions as well as hear the words of the speaker."

Despite the recent development in the experimental use of short, directional waves, Doctor Dellinger does not contemplate that radio telephony will displace the long-distance wire telephone. "As to universal use of the radio to communicate between individuals, I think not," he asserts. "On the other hand, improvements in methods of concentrating the waves in a desired direction, increase in the restriction of the wave to its proper frequency, the use of much shorter waves than those employed at present, these and many other developments by the scientists in various laboratories will steadily increase the extent of the manifold service that radio can render.

"Eventually, every hospital in the United States will be equipped with radio," says the doctor. "This is the most benefcent use of radio. Besides the benefit to patients through providing entertainment, medical authorities testify to the actual therapeutic value of the mental relief thus afforded." The Bureau of Standards is extending valuable aid in the technical equipment of these hospitals. The system employed is the use of a single receiving set and a powerful amplifier to supply entertainment to all of the occupants of a hospital. Each patient is provided with receivers.

The increasing use of short waves or high frequencies and the elimination of spark transmitting equipment will relieve the ether of some of its interference and further contribute to the improvement of radio communication. Already, transmitting stations have installed auxiliary equipment and are employing high frequencies for trans-oceanic communication. The powerful sending station at St. Assise, France, is utilizing frequencies of the order of 3,000 to 4,000 kilocycles (100 to 70 meters) for trans-oceanic communication. This is an experimental undertaking, but there is likelihood of it being a permanent service.

"Spark-transmitting equipment," observes Doctor Dellinger, "is being eliminated. This not only means greater transmitting and receiving ranges but interference is reduced. I think that owing to the cheapness of spark transmitting equipment it will be used on ships for many years to come, but eventually both spark and arc transmitters will disappear."

RESEARCH WORK

No research laboratory is doing more to realize the improvements and bring to a fruition the benefits foreshadowed in this interview than the Radio Laboratory of the Bureau of Standards. Radio frequency standardization, the testing of receiving sets to determine their relative selectivity and sensitivity, observations to determine the range of receiving equipment and the limiting factors attending broadcast reception, the testing of vacuum tubes, finding uses for and standardizing of very short waves of high frequencies and the application of radio as a life-saving agency at sea and for utilitarian purposes on aircraft, are among its manifold activities. For instance, a vibrating or shimmying machine has been designed for determining the relative ruggedness of receiving sets. A new method of primary radio frequency standardization has been developed, using cathode rays and a tuning fork. Means have been devised for guiding aircraft in flight and ships at sea by use of radio compasses on land. With respect to the testing of vacuum tubes, these questions are being asked and answered in this Radio Laboratory: How long is the life of various types of vacuum tubes? What is the power rating of a power tube? What is the effect of regeneration in radio receiving units? How can radiation be avoided in regenerative circuits?

How To Build a Battery Control Panel

(Continued from page 942)

elements and test tubes. It is necessary to split the battery in half for the purpose of charging, since it increases the charging rate. This is a feature which does not seem to be understood by many; when charging a battery, in order that the current may flow from the charger to the battery, the voltage of the charger should always be higher than the battery voltage, otherwise the current will not flow. The splitting arrangement is controlled by a D.P.D.T. switch, which acts as a series parallel affair, connecting the two halves of the battery in series when discharging, and in parallel when charging, so that the voltage across the negative and positive terminals is only 50 volts instead of 100. This switch is mounted on the battery panel, and not on the power panel as described in this article.

The "B" battery circuit is controlled by a D.P.D.T. switch as in the "A" battery circuit with the battery panel switch as described above. The middle terminals are connected directly to the negative and positive terminals of the battery, at which point the voltage is varied by the panel switch. On the upper part of the switch are connected the leads from the charger. The positive lead is clipped onto the exposed wire coming out of the transformer coil on top of the charger, when a 2-ampere Tungar is used, and to the wing nut with a 5 ampere size. The negative, black lead used in charging the "A" battery is also used in charging the "B" battery, connected to the upper negative side of the switch. On the positive is provided the 60-ohm resistance and a 6-volt 2-candlepower lamp, both connected in series. The lamp serves as an indication that the battery is charging.

The "A" and "B" battery lamps are quite important, as they prevent, by their indication, the charging of both batteries at the same time because the operator of the device should know that when lamp one is lighted he should not attempt to light the other by charging the second battery. More than one lamp should never be lighted at the same time.

The most interesting feature of this panel is the switching arrangement for measuring the voltage across each half of the battery separately. This is done by the aid of a series-parallel switch connected as shown in the wiring diagram, Fig. 2. Eight switch points are also needed for the purpose. The wiring is plainly shown in the diagram. When testing the first half of the battery the 50-volt connection becomes positive and when testing the second half, it becomes negative. The operation is very simple, the test of the first half of the battery is made when the switch is in a position as indicated in the diagram. The next position shows the test for the other half of the battery. In this case the two arms of the switch should be perpendicular. With this arrangement a 0-50 range voltmeter has been found best, because the percentage of error in reading a low-range scale is less than in a high-range one where the divisions of the scale are smaller.

Do not attempt to test the voltage across the battery while charging because the charging voltage is much higher than the battery voltage. The voltage of this battery immediately after shutting down the charge should be a little over its rated value, that is it should indicate on the voltmeter a little more than 50 volts. The normal voltage throughout most of the period of discharge should be about 46 volts for half the battery. When it drops to 35 volts it should be recharged.

The wiring diagram, Fig. 2, will give a very good idea of the layout. It shows clearly the entire wiring of the panel. The wiring of the Tungar charger is given to help the reader understand the entire circuit. The "B" battery panel wiring is also shown in the lower right hand corner of the diagram.

The photo of the panel, Fig. 3, will show how the apparatus is mounted on the panel.

The writer feels confident that any one who will build such a panel will find the maintenance of the radio receiving set more agreeable.

Experimental Technique

(Continued from page 921)

may copy a thousand in vain but the thousand and first may prove extremely valuable. Anyway, if they all prove nothing more than bells, it will increase the fun of the thing and at the same time teach extreme care and workmanship and after all, workmanship of a high standard is the perfect joy.

So get rid of the sloppy habits and do the thing up brown. It will increase your range, see if it doesn't!—*Jay Hollander*

Radio Swindles

(Continued from page 915)

pressure it will test in resonance with the brain, but if there is pressure it will test below the capacity and inductance of the brain, and the Chiropractor will know the degree of INTERFERENCE (?) to the flow of life force."

If you have ever read any greater nonsense in your life than this, we would like to see it.

That the Neurophonometer will not only test nothing, but will do nothing else either, is absolutely certain. That it cannot do anything is for the simple reason first—that

it is absolutely impossible by any present means to measure the exact conductivity of the nerves of the entire body, as claimed by Rogers. It is impossible for the simple reason that nearly all nerves are embedded in conductive tissues of the human body. If you could take out a nerve from the human body and connect two wires to it, you could test the conductivity of such a nerve. It is impossible with means available today to test the conductivity of anything within the human body for the simple reason that you cannot get at it. Even if you did get at it, it would do you no good. This for the simple reason that it would be impossible to measure the conductivity of the nerves as long as they are embedded in other tissues of the human body because such tissue is a conductor itself.

To illustrate this point, it is exactly as if you took a large bundle or bare copper wires and twisted them up into a single solid strand. If all the wires were touching each other it would be impossible to measure the conductivity of any one strand. In the human body such a test would be even more complicated because the different tissues have different values of conductivity.

It will be noticed that in one of the captions under one of the photographs we say as follows: "Determining capacity and inductance of the brain—ABSOLUTELY NO ELECTRICITY GETS TO THE PATIENT." This is a caption taken from the Rogers' pamphlet. If no electricity gets to the patient, how then can you "measure the capacity and inductance of the brain"? In the first place you can just as well determine the electrical capacity and inductance of the brain as you can scientifically measure the capacity for Chinese in the tail of a smoked herring, both are equally nonsensical—both mean nothing.

In one of the other captions, it will be noticed, it says, "*Finding the interference with transmission.*" In another part of the pamphlet Dr. Rogers tells us that "absolutely no electricity gets to the patient," but some of it must get to the poor patient somehow, because otherwise how could you "find the interference with transmission?" Also, how does Rogers get the interference and how the transmission? All v-e-r-y deep and dark, and all of it PURE BUNK!!!!

But we are at least thankful to Dr. Rogers for printing his pamphlet. It has caused us many a good laugh and anyone who wants to laugh long and loudly, should send for one to Dr. Rogers, at the address we have given. We are sorry that we have been unable to print all of it, but we assure you it is all good.

In making our $1,000 offer to Dr. Rogers, we do so light-heartedly. We could just as well have made it $10,000, for we know it will never be claimed.

The Significance of Rays in Physics

(Continued from page 932)

structure of a complicated crystal or count the number of atoms in a gram of matter with the same certainty as the money in our pockets. It is the study of radiation we must thank for these incredibly great additions to our knowledge. A practiced telegrapher can identify a station many times, simply by the length of its wave, the quality of sound it emits or a peculiar characteristic in its quality. However, it is impossible for him to deduce, no matter how sharp his perception, the construction of the transmitting station from the characteristics or length of its waves. From this the reader readily understands how ex-

cessively difficult, in spite of the use of modern methods, is the work of the physicist in his attempt through the analysis of rays to determine the structure of the atom radiating the wave, or when he seeks to reconstruct the linear formation of a crystal with the aid of Roentgen rays reflected from it. The determination of the ray transmitter simply through the characteristics of its transmitted signal is a comparatively simple matter compared with the identification of a ray in the field of physical radiation. While the radio operator is able to isolate the wave he is investigating, the physicists must deal simultaneously with a large number of rays, none of which he is able to eliminate.

The chief reasons for this sensitiveness to every ray is the formation of the eye, which is primarily and solely the receiver of electro-magnetic oscillations. All the greatest of science's recent discoveries are dependent exclusively on electro-magnetic oscillations. The messengers from the most distant realms of space, as well as those delineating the operations of that smallest division of matter, the atom, are received by the eye as electro-magnetic oscillations. The eye is, of course, the most sensitive of our preceptive organs. According to the researches of Henry Norris Russel and Prescntice Reeves,

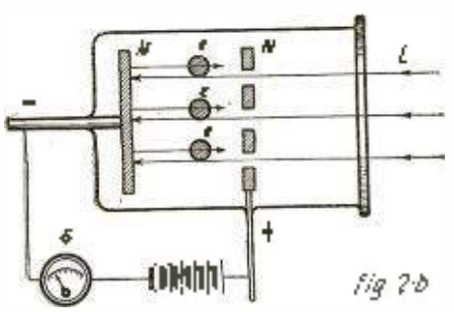


Diagram of the photoelectric cell: the light rays L set free electrons from the metal M which carries current through the galvanometer G.

the well practiced eye can appreciate light energy of the order of 10^{-16} watt as a true sensation.

We can, by simple comparison, make clear this extreme sensitiveness. The energy mentioned which gives the eye an appreciable sensation would need to be expanded over a period of many years, if its total power were to be able to raise one gram of water one degree centigrade. Another illustration is the fact that were the air perfectly clear from dust and moisture, the human eye could, ordinarily, perceive the image of a lighted candle at the distance of 62 miles. It is a well known fact that unaided the eye can perceive a sixth magnitude star.

Unfortunately the eye, while an extremely suitable a receiver of electro-magnetic rays, has at the same time, one great failing, i.e., it is extremely capricious with regard to surroundings. If one has been looking toward a bright light, a sense of fatigue results, causing an immediate loss of sensitivity. It also is extremely restricted in its range of effectiveness. The range of waves over which it acts is comparatively small including only those oscillations whose wavelength lies between .0003 and .0008 millimeters. The difficulty here is easily understood, when it is known that the modern physicist's investigations lead him into work covering waves ranging from 12½ miles in length down to 10^{-10} centimeters.

Luckily, we are able to assist the eye in this work with a number of artificial detectors of one sort or another which enable us to cover a great majority of these vibrations.

The first and one of the most important of these detectors is the photographic plate,

It is affected not only by the ordinary band of light to which we are accustomed, but by a band which lies below the ultra-violet. By only a sufficiently long exposure, sometimes running as high as a day, impressions of invisible light can be caught upon it which are much beyond the power of the human eye. This detector—as most others—has its defects. It is extremely sensitive to very short waves (Roentgen rays) but begins to fail when the higher bands are interrupted. These oscillations jump above the red. It is also extremely difficult to bring the darkening of the plate into any dependable relation to the intensity of the light upon it.

A great step was made toward the extension of our knowledge concerning radiation through the invention of that great physicist Langley, in the construction of his bolometer. (See Fig. 1-A) This instrument consists of an extremely fine strip of platinum which is heated by the rays which fall upon it. This heating has a very definite effect upon the resistance of the wire and so will give an appreciable change of an electric current passing through it. In the bolometer and the radio micrometer (See Fig. 1-B) we have two of the most sensitive measuring instruments known to man. With the former instrument there is no difficulty in measuring the heat falling upon the earth due to the light of the moon or that of a very distant star.

The modern physicist can predict even greater wonders than these, with instruments that far surpass those just mentioned in sensitiveness and at the same time are equally exact. I refer to the audion bulb or the vacuum tube which is frequently used in the present day radio receiver and transmitter. As a detector of electro-magnetic light waves it has attained an extremely important position. For the development of its use in this connection, two German professors, Elster and Geitel, have attained far-reaching merit. The principle of the vacuum tube is, of course, understood by the readers of RADIO NEWS, as they are also fully acquainted with the peculiarities of electrons through their knowledge of these same tubes.

Every substance, as is well known, is composed of a great number of minute bodies, is electronic. When a metal is subjected to the effect of extreme heat, a large number of these tiny bodies are forcibly ejected from it, or literally, are called out into the surrounding space. We can also draw them out of a cold metal under certain conditions if light is caused to fall on the outer surface of the metal. The shorter these rays are the more prolific is the electronic emission and the sensitive is their use. The more intense they are, the greater is the number of the electrons, derived from gases and molecules. The collision will set free more electrons and build up ions, which are in a condition to send an easily measurable electric current through the cells. The use of power outfits and gas content has given to this appliance such sensitiveness that by its help one can follow the change of light of a distant double star.

If a light electron cell is combined with an amplifying tube or audion the sensitiveness of the same cell can be multiplied 15 million times and so at last we are able to note the sensitiveness of the human eye, but this cell has the advantage over the human eye in that it is free from all subjective sources of error and can give an exact quantitative estimation of the minimum light intensity. This electric eye unfortunately shares with the human eye a lack of sensitiveness for long light waves.

Now we may compare the detector for light waves with the detector for wireless telegraphic waves. We will find as follows:

By using amplifiers, it is perhaps quite possible today that with a small antenna of a little over a yard square area to receive a powerful sending station 12,000 miles away.

If we assume that the sending station is distant 60 miles our receiver will be operated on by radiation of energy of about 2×10^{-9} watts. Even if we take a more favorable view of these figures with an idea that a great part of the radiated energy is lost—before it reaches us, the sensitiveness of our eye or of the light-electric cell (see Fig. 2-B) is many thousand times greater than that of the wireless receiver. If we could see the waves of wireless telegraphy, that is, if our eyes could react with electro magnetic waves of such great length some like a blind man would need a receiving station.

To end this chapter, I might point out that our bodies possess another natural detector which excells the sensitiveness of our eyes in a very large degree. This is our ear. This organ can be affected by waves of the order of about 5^{-9} watts, according to the measurements of Mr. Dixon.

It is therefore not surprising that many of the African races have constructed acoustic telegraphs without wires which as transmitters use a drum, and as receivers use the ear. What an important rôle our ear, only susceptible to sound waves also possess for reception of electro magnetic waves everyone knows who has heard a wireless concert. If our ear had not possessed this sensitiveness in spite of all Amplification wireless telephony would have remained an unattainable utopia and wireless telegraphy operated by a mechanical Morse instrument would never have obtained such popularity among amateurs.

We hope that we will succeed in making clear to the readers of RADIO NEWS, how our senses and our modern physical methods supplement each other, how both taken together form a "sense apparatus," and how one can easily see what man at present only looking into a very small range of waves, for other waves are supplied by nature with refined "wonder glasses," and that modern physicists becomes a being that can look into light by a modern speaking station as well as into the light of the ray of radio active substances.

(To be continued)

The Life and Work of Lee DeForest

(Continued from page 913)

how it can as well replace the storage battery, then store "Heaven's Fire"—and the world lies at my feet! My specialty then—the condenser—to lead instead of to lag! It is much more the stepping stone between the electrical art of today and the finer, more etherial, mysterious, "wavey" form to which we must come. It is a ladder to the finer realms of God." Today the immense utility of the condenser, brought about chiefly by the development of the Radio Art which DeForest did so much to make possible, has strangely proven the foresight of this early prophecy.

This great vision of revising entirely the electrical field proved to be temporary, as his studies moved on and left the field of the condenser, passing to something else. Possibly it was because his next Coxen lectures led him directly to the study of the self-same transformers which his new condensers were to supersede. One of his first laboratory assignments in connection with the study was the measurement of the self-inductance of the device with the aid of a

Wheatstone Bridge and a telescope. He spent one whole Saturday at the task and at its conclusion asked God's deliverance from a repetition of it.

With these intensive measurements and calibrations in the laboratory he learned the application of his higher mathematics. And with the actual application of this entirely abstract subject he began to take an interest in it for its own sake. He joined the Math. Club and began attendance at its meetings regularly. At one of these meetings a certain Mr. Hopson of his former class read a paper dealing with the Grant root-finding machine. This paper set off again that constant searching mind. DeForest immediately began to ponder a machine along somewhat the same lines as the Grant model, but electrical in nature, an adaptation of the Wheatstone Bridge principle.

He thought that such a work would give him a "pull" with the professors and possibly might add a little to his chance for employment with Nikola Tesla. At least, he started the work and after a few preliminary trials adduced a fairly workable form. This he submitted to the mathematics professor and was received with several chuckles from that worthy, who immediately ordered him to prepare a paper covering the construction and operation of the apparatus for the next meeting of the Mathematics Club.

Continuing his studies of alternating current and his measurement and testing of various pieces of apparatus he came to the detailed study of the alternator. With the first investigations he noted what he thought was inefficiency in the type of machine he was analyzing. The ever-practical twist of his mind exerted itself immediately, he at once set about solving the problem of bringing out the defects in the machine and making it more efficient.

ALTERNATOR STUDY

During the Spring term he devoted his mornings to the study of the alternator with a garnishing of thermodynamics, vector analyses and a deal of analytical equations. Most of the course was a continuation of the previous term's work and he carried it on with his outside work. Under this last heading was the attendance at the Math Club, the translation of reams of French technical works and the preparation and sale of the "Prom Book." This latter was a scheme worked out by DeForest and Stires to supplement their income. On the order of a souvenir of the occasion it gave, of course, complete information as to the event itself, such as names of patronesses, history of the affair and other germane facts. The book also carried many pretty scenes around the university, and touched on such other points as athletic victories and records, histories of the various buildings, and some editorial matter. The book was a success from the financial point of view. Each of the men made nearly a hundred dollars out of it—a genuine fortune to DeForest.

Aside from the work of getting the editorial matter together, DeForest collected and selected the views to be used, sold over half the printed copies and solicited a good part of the advertising.

The financial success of this venture had entirely separate results from that of removing the ever-present bug-bear of poverty temporarily from DeForest's mind. It, for a little while, placed him within the good graces of the family. During the first of the year he had talked as if he would like to take a second year of post graduate work in order to take his Ph. D. degree. As time wore on and the economic condition of the family grew constantly worse his brother Charles, particularly, began to hint rather broadly that it was about time for the "parasite" to go to work so that his wages might supplement the family income. His mother never made a direct statement upon

the subject, but she would show herself to be a little hurt, feeling the impression that she entertained Lee to be a bit selfish in his plans. The older sister too was sometimes explicit in her comments on the plans of her brother. None of them sympathized with or understood his ideals, the goal to which he was working.

There followed long soliloquies in which he attempted to get at the problem from every angle. He considered carefully the added advantages that would be given him by a second year of the purely technical work. There was always the DeForest scholarship upon which he might depend for help through the remainder of his work. He continued his correspondence with Tesla and came to the decision that he should stake everything upon the Great Inventor's acceptance of him into the laboratory.

The whole future would unfold itself to him at such mental meanderings. He could see clearly as state in 10 years. The vision was one of a great man in an experimental laboratory. He was dealing with little known phenomena. Problems were presenting themselves in such a manner as to be entirely new to the history of science. There was no one to whom he might turn for assistance in their solution. He would then consider the years spent in post graduate study of the finer, more technical, more abstract studies and be thankful that they had prepared him for just such an occasion as the one presenting itself. Such day dreams gave him a great frenzy of zeal for his work. In his diary he would declare in the loftiest terms that he would not let his life's goal be snatched from him by the pleas of relatives. Then (he usually went in Lake Whitney at some of the other nature haunts to local when bent upon deciding such a problem) as he walked home the vision of the family would flash across his mind and the spirit of the day would protrude itself strongly upon him. The loftiest repentance would take the place of the former high righteous resolve. By the middle of the first post graduate year—in the beginning of 1897—he had fully resolved to take the Ph. D. He did not mention the fact at home except at such times as it would be received with some show of co-operation.

Thus it was that the success of the Prose Book and the possibility of his getting out a similar souvenir for the intercollegiate boat regatta and for future Proms made it possible for him to get in a large amount of propaganda for the second post-graduate year. Even under these conditions Charles' attitude was one more of dignified condescension than hearty co-operation. And since he was with his family more than he was with his soul in some chosen tower of interest it was inevitable that the family should lend the greater weight to his decisions. Therefore, he declared himself as willing to go to work without the additional year, if a place could be found for him in Tesla's laboratory. The "Great Inventor," however, had a complete staff for the coming year so he could not use DeForest's services immediately, but wrote a warm letter in response to DeForest's query, stating that he would possibly be able to use him a year later. Faced with the absolute, Lee took the situation tightly in hand and forced the remainder of the family to his will. He declared he would continue his studies in the face of every objection, even if he had to "fire furnace and do year at Jackson's!"

MORE PLANS

With his next year fully planned, he again slipped back into the regular routine of laboratory work, lectures and reading. The paper on the "Equalizer" as he called his Wheatstone Bridge application of the Grant machine was duly read and appreciated by the Math Club. Following its presentation there he worked it into form and submitted

it, with illustrations, to the *Scientific Monthly*.

It seems that he completed the article in one afternoon. Of this accomplishment he said: "Am glad the article is off my hands so quickly. How I thank myself already for the hard teeth pulling work I did trying for the 'Monthly' last year, my essay, thesis, etc. It pays now in the ability to state concisely and at the first writing my scientific thoughts. I hope to have more such work to do through life."

This same interest in writing brought him many hours of happiness and not a little satiric humor. He practiced it with the greatest care when he composed his letter to Tesla at the time he was applying for a position at the conclusion of his first post graduate year. After the completion of the letter he was moved to be honest with himself. To soothe his conscience concerning its slight artificiality he wrote: ". . . composed the long anticipated letter to Tesla—with its orthodox out-cropping of genius, characteristic but inadvertent of course!"

Still better, he waited until the *Scientific Monthly* had been published and saw to it that a copy containing his article on the "Equationer" was mailed to his revered peer.

The same trait appeared while he was preparing the copy and ads for the Regatta Book—he and Stires, encouraged by their first success, decided to follow the same practice for the Intercollegiate regatta at Poughkeepsie that Spring. In New York he was selling advertising for the volume. Confronted with the need of contract forms and not wishing to increase the overhead on the book, he set about writing his own agreements. Of it he wrote, "I wrote out my first contract fully sprinkled with 'hereby', 'said', 'party of the first part', etc., giving it a quite official appearance."

FROM the original orthodox Protestant minister's son of the early days, DeForest was continuing his transformation into the humanitarian and the true scientist. His observation of life was keen. Any new set of characters or circumstances were certain to warrant a long and complete analysis. The visits to New York necessitated by the business of the Regatta Book netted one of these outbursts which is worthy of repetition. "I am all fired out," He wrote. "Short sleeps and long hard days trudging in the dim cars and elevators will soon crush out all the juice of a life, make a man a mere narrow grubber for money, knowing no rest nor thought but to save time, see some one, make money. The newspaper is his only solace and soon becomes like an intoxicant, a necessity. No time to think, to look within, to see what one really is and what actually is calling him. The great Juggernaught of city business makes of man a mere dry shell, perpetually weary, forever alert, always on the go. The intellect cannot work. How can one in such a life know what is in him? I could never guess my genius there. It cannot be *Life*, to any. Many must be the great lives that are forever shriveled, locked in, undeveloped and unknown in the grimy city.

"Happily for me I know my life, and this is but for a brief space, a necessary, but unwelcomed interruption."

Further opinion of the modern business man in the eyes of DeForest is forthcoming from the same episode. For the sake of advertising he was called upon to write hundreds of letters to prospective purchasers of space. Of this grind he said, "The number of letters I write these days is astonishing. How few in return! I long to be at least in an agreeable business, any business, where there is none of this small fret and worry about other men. But I suppose I must face more or less of that all through

hire. This is good training for me, meeting business men."

This view is just another application of the previous one adopted both in his years at Mermont and later at Shelf. It seems that he demanded earnestness more than anything else. The person who had any of the air of the dilettante was not for DeForest. His own burning zeal and great pride combined with a lack of self-confidence in meeting others socially, all joined to make his a comparatively lone figure.

HUMAN NATURE

There was always something in the ordinary human equation that DeForest at this time never thoroughly understood. He realized this and strove to solve it. The most complicated thesis concerning the philosophical trails of *Homo Sapiens* were his delight. In such cases the conditions, the constants and the variables of the equation were thoroughly understood, for they were plainly set forth. It was like mathematics, physics or electricity; there were certain conditions given and certain laws by which to predicate the results. With such problems DeForest was perfectly at home. He had a feeling, an instinct, which acted as a guide.

With the bulk of his fellow men, however, it was an entirely different matter. Never having had any great amount of social contact he had never become versed in the gentle art of polygon-living an individual upon first acquaintance. He was very real himself, and so, judging by the only standard he knew—himself—he expected others to fall into the same class. The results, as might easily be expected were many times disastrous. He had a pride that was nothing less than fierce. And it was invariably attacked in its most vulnerable spot, i.e., he was often laughed at.

He knew nothing of the generally used subterfuges of society and business. Those bits of it which he violated from time to time filled him with disgust. He could never consider a person who stooped to them as a friend.

It might have been one of Freud's commensations but nevertheless it was very true and very real that DeForest considered most social intercourse, as ordinarily indicated by the term "society" a complete waste of time. If it was a "compensation" it was because he felt a loss in not being able to join in it on account of deficiency in learning. It is more probable, however, that his early formative years were so thoroughly given over to his chosen branch of work and knowledge that the other was completely crowded out. And since he never learned the rules of the "social game" he could never appreciate the value of the plays. It left him in very much the same position as the Englishman viewing an American baseball game for the first time. The whole thing appeared extremely silly.

Then his own reality and constant search after truth left him with an extreme distaste for the obvious (to him) superficiality and insincerity of the more socially inclined.

After each encounter with this philosophy which seemed to him so stupid he rushed back to his science with a relish. And as time went on and the exposition of the whole of science's realm unfolded itself to him, he grew more and more to appreciate his mathematics, that wonder branch of science which acts as a guide to the other fields. At times he was actually ecstatic in its praise. One such an occasion prompted him to declaim

"The insight this mathematical study gives to the forms and laws of electrical (or of any natural) phenomena is wonderful. How this abstract generalizing can lead us to foretell most unexpected and startling results, about the real, final nature of which we can guess absolutely nothing is most mystifying. Yet how often are we thus directed to the

solution that experiment later proves true and which would never be reached otherwise! I marked especially the wave surface on two plates close together. Perhaps this form of wave will be useful. Will mathematics ever lead us to an explanation as to a theory of the final or semi-final nature of matter and force? I don't believe that any system we have now will. Something radically different must be invented. I want to see a model of molecular action.

"My mathematical training this year I find already of the greatest practical value. Without it and every bit of it I could not read these books leading up to Maxwell, I want more and higher. Then I can expect to deal intelligently with light and wave phenomena along which lines I see lies the great future of electrical advance. Those who know, instead, dynamo construction and manipulation will soon be out of a job along lines of their training. And then they must learn again and shift anew; the *leaders* and those to employ and reap benefits will be those who know rather a higher theory of waves and oscillations; and a *transmission by these means of intelligence and power*. So in this training I am already cutting loose and relying on the correctness of my one aim. Should I prove wrong I will be far behind and it will go hard for me not knowing better my engineering. But I risk all on the cast of the die. I aim at Tesla. If I reach that I am a long way ahead. If I fail and seek elsewhere, what good chance have I? Especially after another year. But I shall not miss. I shall go on cutting orthodox lines towards my unique aim. The years will prove the soundness of my judgment."

This outburst seems to have filled him with further ambition, for the following day he applied himself with the utmost care to his experiments saying that he was entirely too careless in his work and must cultivate more precision.

He became so zealous in his work that he envied every moment consumed in the mere business of getting a living. He and another student decided that the "Prom Book" idea would go well at the Spring regatta and proceeded accordingly. They prepared the forms, sold the advertising and attempted to peddle the books. It meant more hard labor and time taken from his beloved experiments. He deplored the diversion of this "side line" upon his studies and "the time taken from his *life*." The only reason he considered it was because he planned on making enough money through the scheme to allow him to continue his experiments and study through the summer instead of working at something outside.

The venture was a miserable failure, however. Only a very small part of the books found buyers and the result was that DeForest soon felt the ire of his creditors. As soon as the accounts were balanced and the printers found that he did not have enough money to pay them, they went straight to the sheriff's office. It was only by wheedling and promises that he kept out of the hands of the law. He was forced to make a couple of quick loans from friends to pay off the most urgent of the debts.

With the financial failure of this venture, he was thrust back again into the old familiar despondency over money. He was called to New York for a completion of the business. He paid a call to Tesla in the hope of securing work for the summer as a computer, on the strength of his mathematical work. The great man received him, told him that he could take several of the sons of wealth at a remuneration to him (Tesla) of $10,000 a year, but he refused, preferring, rather, to take the man who was in earnest and loved his work. He was extremely friendly in his reception of DeForest, but deplored the fact that he had a full staff

for the summer, but would try to make a place for him the following year. He wrote of the visit in glowing terms.

Seeing more clearly than ever his need for immediate funds he went back again to his inventing. The bicycle craze was at its height so he looked about for some invention which could be applied to it. He decided upon a system of hydraulic drive. A flexible tube was substituted for the chain drive. Filled with a liquid, oil preferably, the pedals operated rollers which compressed the tube, thus creating a pressure. At the rear, a second set of rollers was attached to the wheel and was forced to revolve by the pressure in the tube. He sent the idea over working it out completely, to one or two companies in America. When they returned it he submitted it to an English firm. The idea was good except that the wear and tear to which the tube would be constantly subjected would cause it to wear out in a short time. Again he was disappointed, for the English firm pointed out the deficiency of the device and DeForest immediately gave it up.

A few days following the disastrous regatta brought the close of the collegiate year. Always a happy time, with the constant stream of school activities, his disappointment at the defeat was alleviated and he slipped back into his old ways, enjoying the graduation events and continuing with deep interest his studies in electricity. He continued them all that summer.

ASTRONOMICAL WORK

A few weeks after the termination of the term he was given a place in the astronomical observatory taking photographs of shooting stars or meteors. This position gave him several weeks work and he liked it very much, since the actual attention needed for the business at hand was not so great as to take his mind from his beloved specula tions. When he was not employed with the stars the local gas company gave him work reading meters. At night the summer he continued his reading, and covered, aside from his regular text books, a work by Poincaré on Oscillations, a treatise by Sir Oliver Lodge dealing with the "Modern Science" and all the current scientific literature in the periodicals. One of these latter was an extremely learned treatise upon the modern theory of the ether and vortex rings. Of this he said: "My very soul is inflame with desire, and burns with unspeakable zeal for scientific research. I must learn these truths. I must master the secrets of re search, familiarize myself with the methods by which the evidence is found, probe deeply into these new fields which fascinate beyond all else.

"I shall learn to weigh an atom and circumscribe it, vortex ring—shall guess its shape and invent the less primeval knots and intertwinings that make up the several elements—shall postulate the causes of the attraction and dare to carry back to the ultimate (the particle) and the final force (the impetus) and dare not speak of affinity as such, for that our whole experience will not allow. I shall play how gold and silver may be interchanged, and reveal the reason for the universal course of energy, and prophesy the last and final destination. *Gravitation, Electricity, Thought, Life, God.* These notions must be analyzed."

The summer drifted on into the following school year without the slightest ripple in DeForest's affairs. He studied all the time. The routine of lectures and matriculation were simply slight changes in the day's routine. He had continued some of his laboratory work during the vacation so early in the second of his post graduate years he plunged into Hertz's experiments. It was on October 11, 1899 that he began them. From that moment on, his interest, already at a high pitch, increased. Of the beginning of this work he wrote: "Through-

out this work the most important part of it shall be my own observations of original phenomena and investigations which I may follow up. Sometimes it is fascinating—most of the time. Of course there is always an amount of drudgery due to the scouring of prof. H---- pa per in which he seems to take delight."

He continued to follow out Hertz's work for more than two months until he had covered that work completely. It was during the latter part of these investigations, while he was doing some work with resonator wires at night that he was almost forced out of laboratory work entirely. The generator he was using was inadequate and Prof. H---- knew it. On the night in question there was a lecture, illustrated with stereoptican views being given in another of the college buildings while DeForest was carrying on his experiments. During the course of the lecture something went wrong with the stereoptican lantern and the fuse was blown. No one at the lecture knew where to find the offending safety device and the lecture had to be terminated. Prof. H---- at once offered the explanation that DeForest had drawn too much current and overloaded the line, blowing the fuse. He acted accordingly, going to the laboratory to prove the correctness of the assumption. On arriving there he forgot to look for proof when he found a number of nails driven into an old work table for suspending the wires of the resonator. He flew into a rage—a rage which had been gathering for months. He told DeForest that this "conclusively proved his total unfitness for research work," and to betake himself elsewhere to carry on his future laboratory work. As DeForest expressed it in later years: "That audience was dismissed by candle light, and I was dismissed by day light, next morning."

There was an alternative. An interview with one of the professors in the University post graduate school. Prof. "Buffalo" Wright's gave him the use of a part of Sloane laboratory whence he moved his apparatus and carried out the remainder of his work.

THE winter moved on toward spring and DeForest moved closer to his goal. But with the opening of fine weather there came the historic incident of the blowing up of the *Maine* and the attendant difficulties with Spain.

Always a heroic high-spirited person, extremely patriotic, the uproar between the sinking of the *Maine*, the investigations and the notes and the actual declaration of war, were for DeForest weeks of disorganization, arguments, quarrels excitement and frenzy. One day he was fully decided to enlist at the first opportunity. The next he could not console himself to thrust all his hard earned knowledge upon the alter of Cuba's freedom. But as the time passed and the feeling grew more and more intense, the spirit of his ancestors found its place in his character. He settled the point with his mother and prepared to enlist in the Yale Battery.

Chance again played her false and he was too late by one man to be given a place in the company. But having decided that the war could possibly last no longer than six months and having assured himself that he could make up the time lost to his studies, he would not be hampered by the mere fact that he could not get into the company of his choice. Cuba had to be freed and he must help. When the Battery took train at New Haven for the impromptu camp a few miles out of town, DeForest, with a number of other aspirants, went with them as a camp follower.

For a couple of weeks he lived in barns and under hay stacks, eating with the soldiers

not hoping for a place in the Battery. Tired of waiting, after a time, he decided to join the Connecticut National Guard. On May 18, 1908 he was mustered into the service of the United States of America as a private, first class. Later he became bugler with, as he said, "a horse to ride, two red stripes on my blue pants and no guard duty, hooray."

During his stay in camp he wrote long treatises on the war, its inefficiency and the rottenness of his own luck in getting no nearer the action than Long Island Sound. His company stayed at the original camp for the entire term of the fighting. Patriotism bloomed in him and became one of his strongest emotions.

The outdoor, rough life of the army camp did him a deal of good physically. After the one sickness in his second year, he had never recovered full health on account of the large amount of work he was carrying and the scant chance for proper exercise. He was kept so busy with drill and the routine of army life that very little record of any sort is left which would be interesting to the reader.

Early in the following September the troops were returned to New Haven on furlough subject to call. Shortly after, they were mustered out. His back pay, given him at the time allowed him to start his work again with a clean financial record. At last he was completely out of debt, due to the army pay and a gift from an old friend of his father.

With the return to his work he heaved a great sigh, dusted off his books, looked around the laboratory making plans for immediate experiments, selected his subject for the Ph.D. thesis and within three days was back into the harness as though nothing had happened. Indeed a record.

The fall of the year was spent in work of the most intensive sort—he was compelled to review in turn each of his last year's subjects completely forgotten during his five months in camp; Prof. Gibb's Thermodynamics, Maxwell and higher mathematics, and pass a final exam in each in sequence. This all in addition to his new and difficult lecture courses. Never before or since, says DeForest, has he worked so steadily, uninterruptedly, for so many hours a week, week after week, month after month, as during the last year at Yale. By the New Year (1899) he was in the midst of his work on the thesis was carrying out a great many investigations on his own account in the field of electric oscillations and Hertzian waves.

Time passed faster and faster as he came within hailing distance of his final college achievement, his Ph. D degree. Work piled up and the strain constantly increased since the back work left undone through his enlistment in the army was not discharged until well after the first of the year. But when these tasks were finally off his mind, there was so much of the new that no respite offered. He had time to think of little else save the eternal grind of reading, lectures and experiments. Nevertheless we still find long dissertations, philosophical and literary in his faithfully kept diaries.

Cold Weather Aids Radio Transmission

(Continued from page 904)

quiting stations shown by a radio compass, even on forenoons, when long wave compass bearings are usually free from errors.

When cold waves subsided at the end of January, uniform transmission conditions were not restored, but an unstable condition persisted throughout the milder weather of February and March. The signals frequently fluctuated from high to normal vol-

ues, through apparently no connection with the weather. After March 19 the irregularities disappeared.

Observations on other long wave stations indicated that these large variations do not occur at a distance of 31 miles, but are large between 155 and 180 miles, and again decrease between 248 and 434 miles.

No definite explanation of this phenomenon has been found, although the cause is believed to be atmospheric. The connections with the cold waves suggest that either the part of the atmosphere concerned with the signal variations lies much below the Heaviside layer, between 50 and 62 miles or that weather phenomena are correlated with atmospheric action at much greater heights than has been supposed.

How Your Ear Helps Out Your Loud Speaker

(Continued from page 919)

treal filter which would cut off either the upper or the lower end of the scale at will. One man sang "ah" at a pitch corresponding to 145 cycles per second. While an observer listened, the filter operator began to cut off the lower end of the pitch scale. As more and more frequencies were blotted out the pitch remained unchanged, but the quality grew worse and worse, until with all tones cut out below 1,500 cycles the sound was merely a noise.

THE EAR AND THE PIANO

Results with the piano were impressive. When the C key (129 cycles) was struck there was a small change in quality when all below 250 cycles was cut off; when all below 500 cycles was cut off the tone was metallic; when all below 1,500 cycles was eliminated the tone was clanging. Yet through it all the pitch remained unchanged.

For the violin, clarinet and organ pipe the results were the same.

What had happened? All energy below a certain pitch had been suppressed, yet a note in that range was heard. What is the explanation?

When you strike a piano key you send off air waves whose frequency is that to which the string is tuned. This note is called the fundamental. Also you send off waves at twice, three times, four times, etc., that frequency. These are called the first, second, third, etc., harmonics. In the case of the C_1 note on the piano (129 cycles) there are at least 10 harmonics. The number and relative loudness of these harmonics give the characteristic tone of the instrument by which we can tell a piano from a clarinet or a violin. They also make the difference between a $20,000 Stradivarius and a cigar-box fiddle. And they make it possible for your ear to re-create the tones your loud speaker does not give out. Suppose the fundamental and the first two harmonics of the piano note C_2 are suppressed. We have eight or more harmonics left and from them the ear makes up a tone whose pitch is that of the missing fundamental. The tone doesn't sound like the original.

WHIMS OF TRANSMISSION

Of course, some orchestral instruments are transmitted by wire and radio better than others. In general, the higher toned instruments sound more life-like. Deep-toned ones, like the piano or organ and kettle drums, fare the worst.

Since the piano has so many overtones, it is logical that cutting them off at the upper end would have quite an effect on the quality or naturalness of the transmission. This is true in practice: observers reported that cutting off the sixth and higher harmonics killed the brilliance characteristic of a fine piano. Curiously, a male voice is in-

men can make than a female voice by cutting off the accentuated frequencies above the same point, the richness of a man's voice comes from the presence of harmonics, while the rich notes from a woman's throat indicate the lack of harmonics in the region cut off by the filters.

Perfectly intelligible speech can be transmitted in which tones ranging from 500 to 2,500 cycles only are employed, but in order to obtain naturalness of effect comparable to that of the original, the range must be extended at both ends to include 100 cycles and 3,000 cycles. If music also is to be transmitted, the range must still be further extended to 5,000 cycles or more. To include so long a range requires close attention to the receiving apparatus, and the tendency to carelessly designed microphones, transformers, lines, etc., is to cut off both ends of the range.

In order to satisfy a radio audience that is growing more and more critical, it is necessary to transmit music with such naturalness that the listener can close his eyes and forget that he is not in the studio or concert hall. In other words, a must reach him in the form in which he would care to hear it if he were free to choose his own location with respect to the source of sound.

SOME REVERBERATIONS NECESSARY

In the arrangement of a broadcast studio a room which gives no reverberation is just as bad as one giving too much. It is generally recognized that a hall room is undesirable as the reverberations cause one note or syllable to follow over into the next, producing an unpleasant jumble of sound, but it is a very common error to cover the walls, floor and ceiling of the studio as completely as possible with sound absorbing material, cutting off all echo and making the music sound "dead." This condition also makes it very difficult for a singer or violinist to keep on the key, as they are accustomed to getting the path of each note from the reverberation of the preceding one.

When, as is often the case, the program is presented in an assembly room or theater hall it is obviously impossible to change the acoustic properties of the room. The best solution of the problem is then in properly locating the microphone transmitter. When a symphony concert is broadcast, the best place for the microphone has been found to be from 20 to 30 feet in front of the orchestra and 10 or 20 feet from the ceiling. This location picks up the sound of the orchestra as a whole, and does not catch too much reverberation or accidental noise from the audience. It is also desirable to scatter several microphones through the orchestra as with this arrangement the notes from some of the instruments will be transmitted with greater intensity than that from others and the balance of the ensemble will be lost.

VARY AMPLIFICATION

Some idea of the difficulty of artistically transmitting a program by radio is given by the fact that in one selection by a brass orchestra, the volume of sound produced may be 10,000 times greater at one time than at another. As no broadcasting equipment has yet been devised which will handle such a range of intensities, it is necessary to vary the amount of amplification given the current from the microphone so that the sending apparatus will not be overloaded. This adjustment is made at the amplifier associated with the microphone, and calls for the greatest skill and care and the assistance of testing and recording instruments of extreme precision. A "volume modulator" bridged across the wires from the microphone follows accurately the strength of the current which is being delivered, and the operator varies the amplification so

that off tones will be audible to the listener and the extremely loud tones will not overtax the capacity of the apparatus.

RECEIVING TROUBLES

Receiving sets are found in so many varieties that no generalizations are practicable. Some of the most common sources of trouble, however, are these. Getting good results with a receiving set is largely a matter of arranging the various pieces of apparatus with a proper understanding of their characteristics. Transformers have been the causes of considerable trouble, although when the correct types are used satisfactory operation is obtained. Headsets, amplifiers and loud speakers of correct design will also tend to prevent the distortion which too commonly characterizes the output of an amateur's outfit.

With the broadcasting apparatus now available, practically perfect transmission can be obtained, although with most of the loud speakers now on the market it is not possible to take the fullest advantage of this high class material. Recent scientific research, however, based on the science of acoustics as well as of electricity, is producing apparatus which will satisfy even the most critical.

A De Luxe Amateur Station

(Continued from page 920)

plifiers insure complete modulation with any type of microphone. During the past season a standard Western Electric "broadcasting" microphone and input amplifier was used for phone work and extremely high grade modulation was obtained.

Plate supply is obtained from a bank of Willard storage cells totalling 550 volts, or from an Esco motor-generator capable of delivering 1,500 volts to the tubes. An efficient filter system consisting of two 10-microfarad condenser banks and a total inductance of 70 henries produces a pure D.C. plate potential when the generator is in operation.

Power to run the plate supply motor-generator is obtained from a 5-K.W. gasoline driven lighting generator installed in a separate building.

The radio room switchboard controls the generator output, chargers for the six filament batteries, and the high voltage Willard cells.

In order to keep vibration at a minimum, the motor-generator is mounted on a heavy section of cocoa matting, which in turn is located on a concrete support extending into the ground.

Filament and plate voltmeters are located on a small panel fastened above the transmitter. Suspended beneath this panel, which also holds the spare 50's, is a General Radio wavemeter. This provides an unusually clever method of maintaining a constant check on the operating wave-length. The wavemeter and the inductance of the transmitter are about 15 feet apart, and by merely turning the wavemeter dial an accurate reading is made possible. As the meter is in exactly the same position throughout the summer, any difference in the output of the set is instantly noticed.

The receiving equipment is the unusual feature of the station. There are 21 complete sets, ranging from an eight tube Super-Heterodyne to one tube receivers, in operation during the camp season. All amateur code work is copied on a home-made low-loss receiver. Headphones are very seldom used, as practically all DX can be received with sufficient intensity to operate the Western Electric or the Magnavox loud speakers. Stations in every district, and in England, have been logged by this method nearly every evening, and it is apparently easier

to copy through summer static with a speaker that with bor gloves.

Two power amplifiers, a Western Electric, and a Magnavox, step up signal strength to a degree great enough for loud speaker operation, and a Central a tone connected across the amplifier reduces tube noise and takes the edge from static. Practically silent amplification is thus secured.

The QSL card of the station is quite original and is very cleverly arranged. The station description is printed within the figure of a crow in outline. A large numeral two in the center of the card completes the pictorial arrangement of the station's call. As a further take-off on the call the tubes are classified as quart bottles and pint bottles—meaning, of course, 50-watt and five-watt tubes respectively.

The operator at 2COW, Wm. S. Halstead, is well known to most amateurs because of his activities at old 2LH and at the Haverford College station 3DVN, 3ZG and WAHQ, where he is traffic manager of the Radio Club, and the Intercollegiate Radio League. His own station, old 2LH, now dismantled, was one of the leading amateur stations in the East and was awarded first prize several years ago by Radio News.

A Short Wave Adapter for the Broadcast Receiver

(*Continued from page 925*)

The socket is of the panel mounting type and has a shock-absorbing attachment. This latter feature is not absolutely necessary but is desirable since working at the high frequencies for which the adapter is designed, stability is both elusive and of the greatest importance. A UV-199 tube is used because of its low internal capacity. In making the connections to the socket flexible wire is used. Bus bar is suitable for the remainder of the set, but since its stiffness might pass on a measure of outside vibration, its use is prohibited in the socket leads.

For laying out the panel, pass a center line through the panel and drill the center holes for the condenser shafts on this line. The condensers are spaced seven inches apart. The variable resistance and filament control switch may be placed as convenient. The lay-out depicted in the illustrations is good and may as well be followed.

If care is taken the coils may be attached directly to the rear of the condensers as shown. This is by far the best method and should be followed. The heavy wire of which the coils are wound is sufficient to support them and the advantage of short leads is gained, which advantage is extremely important in short wave work. No appreciable losses are incurred by mounting the coils close to the condensers because of the small amount of metal used in their construction. The coils are mounted at an angle of approximately 60 degrees so as to minimize the coupling between them. They are placed so that the condenser plates are out of their magnetic field.

The variable resistance having a range from one-half to 10 megohms, is of the commercial carbon compression type. No rheostat is used in the filament circuit since the tube is oscillating continuously while the set is in operation. An ammeter may be employed for the protection of the tube.

As shown in the wiring diagram, the frames of the variable condensers are grounded. This is extremely important as any condenser used in the set must be constructed with the plates insulated from the frame and the frame so constituted that it may be separately grounded. This feature must be included in order that the body capacity effect of the operator between

negligible and also, for the sake of the lowest possible minimum capacity of the condenser. And further, the plate-to-frame capacity must be as low as possible.

With the condenser used, a vernier adjustment is incorporated, a gearing arrangement from the knob to the plate shaft having a 32 to 1 reduction ratio. This vernier control was found absolutely necessary in order to tune in a short wave station. The complete gearing mechanism of the vernier shaft and gearing is also grounded to the framework, so that the motion of the gears causes no change in capacity. It is absolutely noiseless in operation, which is a distinct advantage.

The brass supporting strips and braces are also grounded. The leads from the condenser frame and the supporting strips are passed to the ground binding post and attached.

Three dry cells or a 4½-volt "C" battery may be used for furnishing the supply to the UV-199 tube; 22½ to 45 volts will be required on the plate. When the set is ready for operation, a test will have to be made for oscillation. If the grid leak is screwed out to maximum the set will squeal. Before tuning in a station, the leak should be turned down until the squeal stops. The set can be easily tested by connecting a head set to the out-put terminals and leaving out the coupling coil described below.

The coupling method for attaching the heterodyning apparatus to the set will depend upon the set and its peculiarities. In the diagram a coupling coil is used. The coil is nothing less than a 60-turn spider-web coil connected to the output binding posts with a two-foot length of telephone cord. This cord is for the purpose of gaining the proper capacity for by-passing the short wave oscillation. Any other lead may be used so long as the necessary capacity is given. However, the wire mentioned is probably the easiest obtainable and will serve the purpose admirably.

The coupling coil is placed in the maximum inductive relation to the first Neutroformer in the set. See Fig. 6. (This is presuming that the adapter is to be used in connection with the standard Neutrodyne or similar tuned radio frequency receiver.) Other connections are optional. The coupling coil may be disconnected and the leads taken directly to the aerial and ground binding posts on the set, if there is no series condenser in the circuit, or to the top and bottom lead of the Neutroformer. In each case, the two-foot capacity lead must be used. The coupling coil usually gives the best results.

In tuning the apparatus, the receiving or intermediate frequency, as it may be called, is selected with an eye to the most efficient point in the standard receiver. In the case of the Neutrodyne a low wave-length is chosen, since by principle the set works best below 360 meters. After the coupling coil is in place, adjust the three dials of the Neutrodyne to about the same setting in the neighborhood of about 20 or 30 degrees. Turn the tube condensers of the heterodyning unit until the station is brought in and then readjust the three dials of the Neutrodyne for loudest reception. Following this, the oscillator is again tuned and then the process is repeated until the Neutrodyne end of the apparatus is in as perfect tune as possible. The Neutrodyne is never touched after being once brought into perfect resonance. All short wave stations are brought in with the heterodyning unit alone.

In the case of a regenerative receiver, the coupling coil is put in place, as above, in maximum coupling to the secondary of the tuner. If there is a tuned primary circuit, although not necessary, remove it. Then the short wave signal is heterodyned with the secondary at any wave the operator may

desire. The most efficient setting would probably be somewhere above the center of the condenser. While the preliminary tuning with the oscillator is taking place, the regenerative set may be oscillating so that the squeal of the received station's carrier wave can be heard. The tickler is then turned back until the set is just under the point of oscillation. When very carefully adjusted for signal strength and clarity, readjustments are unnecessary.

The procedure in other sets is practically the same. The system works very well when used in connection with a standard Super-Heterodyne. The writer obtained excellent results with this arrangement. It is interesting to note that the short wave signal of about 60 meters was first heterodyned to about 350 meters, amplified by regeneration and heterodyned again to about 6,000 meters and amplified again by regeneration, detected and then amplified at audio frequency.

In closing, it might be well to reiterate a few warnings as to the placement and choosing of apparatus. The condensers are chosen for their low minimum capacity, as well as for the other reasons stated. Their minimum is less than 25 micromicrofarads. When used with the above coils, an approximate wave-length range of 50 to 150 meters was obtained. The leads must all be kept as short as possible and as direct to the terminals as the position of the apparatus will permit. For this reason it is best to follow the plan given in the present layout.

For the sake of low internal capacity, the UV-199 type of tube is about the only one permissable in the set. Its low capacity fits in perfectly with the other specifications and demands of the unit. No spaghetti should be used if practicable and the design allows perfect protection for the wiring and tube without its employment.

When complete, the unit may be slipped into a standard 7x12-inch cabinet.

Preliminary tests showed that an indoor aerial 10 or 15 feet long gave best results. Properly, the antenna length should be near one quarter of the wave-length to be received. For this reason the standard out-of-door type is out of the question. For instance, for the reception of a wave-length of 80 meters, the aerial should be about 20 meters long, including the lead-in. A meter is equivalent to 40 inches.

The set is grounded in the regular fashion, i.e., to the nearest water pipe. If the aerial is well insulated and the set constructed carefully, when it is first connected it will work, and there will be no lack of short wave signals on the air with which the enterprising builder may plunge himself in this, the newest field of radio research.

And let him not forget. The experts of the industry are already saying that the next three years will find all broadcasting being done on these short waves.

Will Radio Make Our Railroads Safe?

(Continued from page 903)

present forms of signaling. Great dependence and responsibility is placed on the human element. The train itself, through its wheels and axles, controls the signal and its indication, but beyond that, it is up to the engineer: he must interpret the signal and act accordingly. Supposing that a "danger" or red indication is flashed to the locomotive engineer from a wayside block signal; it is his cue to come to a stop or proceed under a permissive speed allowed him by his company, 10 or 15 miles per hour, perhaps. All is well if the engineer is alert and his senses are functioning

normally. But—suppose something has distracted his attention for the moment and he turns his head, passing the signal without giving an indication. Or suppose a sudden bit of dizziness seizes him, just for a moment, but long enough to dim his vision against that significant red light. All the electrical signaling systems in the world would not help him then—that is, other than the continuous train control method.

It is to meet just such conditions as those above described and countless other similar situations, that Mr. Thomas B. Clark, of Detroit, Michigan, has spent the last 15 years in the development of a really efficient continuous train control system. Mr. Clark will be remembered by many old-timers in the radio communicating field, when the Clark Wireless System was in active operation on the Great Lakes. Up until 1910, Mr. Clark's entire time and efforts were directed to the development of an efficient radio communication system on the Lakes, but since his retirement from that field, his whole interest has been devoted to train control work.

That he has achieved success is best understood by the fact that he has been granted numerous patents on various devices in connection with train control, and these have been taken over by a prominent New York engineering concern, which is pushing the development work with all possible speed, making actual installation tests on the prominent railroad systems of the country. It has been the writer's privilege to be associated in this work in and around Detroit, and it is from his personal experiences and observations that the present paper is prepared.

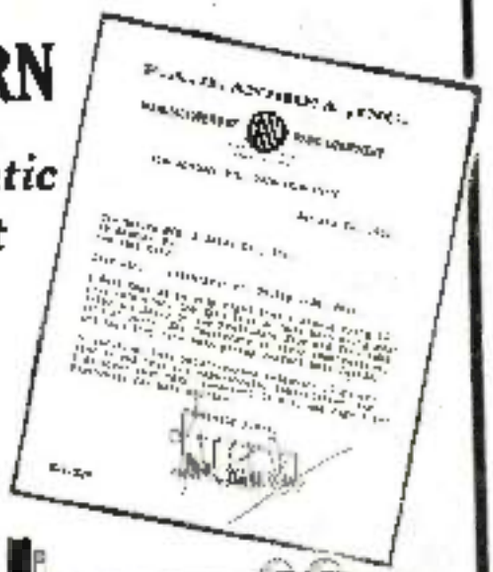
The primary purpose of the continuous control or railroad trains is to offer absolute protection to human life and property. Such type of protection has been carefully considered important by the U. S. Government, that the Inter-State Commerce Commission has actually ORDERED all first class railroads in the country to install continuous train control within a definite specified time limit. In spite of the fact that no such system is actually in its final form for installation. In order to obtain such protection it is agreed that the human element must be eliminated and the train actually controlled from a start to a dead stop without the aid of human endeavor. While this may sound

FADA'S Choice

TRADE MARK SATURN

Imported *Automatic* Plug & *Perfect* Jacks

for Better Connections!



YOUR own examination of *Saturn Products* will confirm the wisdom of this big manufacturer. The hidden construction is as conscientiously made as the exterior is carefully finished. The Plug is encased in genuine bakelite—no metal projecting. No tools necessary to connect. Simply insert shank and tips—instantly gripped and as easily released by a light touch on the small lever. The new reduced price of the automatic Plug is 75c.

Perfect Jacks with rounded corner brass brackets, nickel-plated; German silver blades; Sterling Silver contact points and crowfoot offset features described in the adjoining panel. Unconditionally guaranteed.

Crowfoot Offset

This exclusive feature of SATURN Jacks and Switches assures positive connection and [illegible] offset at the [illegible] rule and the thread with a screw [illegible] [illegible] [illegible]

to the uninitiated, like an insurmountable problem, it is really quite simple.

In working out such a control system it must be considered that the present signal system utilizes the two rails to carry direct current as supplied from a storage battery, to actuate the signal mechanism. This current flow is quite small, being about one half volt at from 200 to 300 milliamperes. When no train or other metallic obstruction is in the particular track section protected by the usual signal lights, the lights are normally dark. However, if a train enters the preceding section, approaching the signal, the effect of its wheels and axles short-circuiting the rails causes the proper light to show, dependent of course upon the conditions in the block thus protected. Obviously, then, any control system which utilizes the tracks to carry an electric current will experience difficulty in preventing a short circuit of the rails by the control wiring, thus rendering the block system practically useless. It, therefore, develops that a current of some characteristic which will not cause such a condition be used. Radio frequency currents solve this problem admirably, for they may be fed into the track through an ordinary fixed condenser, passing through it easily whereas the direct current used in the signal mechanism is effectively blocked by a condenser. Further precautions to keep the radio frequency energy from entering any signal equipment are taken by inserting proper radio frequency chokes in the direct current wiring.

Feeding radio frequency current into the rails may sound very simple, but it nevertheless presents a number of complications. Using a vacuum tube oscillator, conceded to be the most efficient producer of radio frequency currents, makes it essential that a comparatively high voltage be fed into the tracks, even though the current be kept low. When it is considered that with the latest type of railroad tie, which is zinc-treated, a resistance of but about ½ ohm per section (1,000 to 5,000 feet) exists between rails, it is a difficult proposition to keep the relatively high voltage from leaking. Radio frequency will follow the two rails for a distance that presents less resistance than that between rails, but once the stretch of track increases its resistance, as it is bound to do with length, the energy naturally following the easiest path returns across the ties to the other rail, rendering the energy useless beyond the leakage path. Such a path has been found to be but a few hundred feet from the point where the energy is fed into the rails, whereas it is essential that a good bit of the initial energy reach the extreme end of the block, sometimes 5,000 feet distant. Leakage conditions are almost double during rainy weather or whenever the ties are coated with moisture. This makes it essential that practically double the required energy be available in the rails during dry weather to take care of the wet condition.

After considerable exhaustive experimental work had been conducted, it was finally determined to use one or both rails, as experimental work proved most desirable, and a wired circuit carried on poles along the right-of-way. Any leakage effects, steady or varying with weather conditions, would then present no obstacle to the radio frequency energy. Tests made with this system established the fact that it was easily possible to get about the same energy at the extreme end of the block as at the entrance point, and accordingly, experiments are being conducted on this score.

Once the proper value of radio frequency current is established, and maintained in the rails, it remains only for a suitable loop pick-up device to be installed on the locomotive, with the pick-up loop in inductive relation to the rail or axle, as found most desirable. The current thus induced in the

pick-up coil is carried to two tuned circuits employing a variable condenser and a sensitive relay, capable of operating on minute values of current ⅔ milliampere or so. The relay obviously, upon closing, actuates any desired electrical circuit.

In actual practice, radio frequency energy of a wave-length of, say, 10,000 meters, will be pumped into the track when the oscillations are started by applying proper plate and filament potentials to the vacuum tube oscillator. This will be started and stopped by an additional contact on the present signal relay mechanism, so that the train control current is fed into the rails only when the block signals are in circuit for that particular block. This prevents the constant use of current by maintaining the oscillator always in a condition of oscillation.

Such 10,000-meter waves, following up the rail, are picked up by the loop placed in inductive relation thereto, and actuate the relay in the circuit that is tuned for 10,000 meters. Upon closing, this relay will cause a light (green or "clear" for purposes of illustration) to light in a miniature signal tower in the engine cab. The engineer then knows the traffic conditions ahead of him, and the train is left entirely within his control.

Should the main signal light, beside the track, show yellow, or "caution", however, a 12,000-meter wave would be pumped into the rails and actuate the other tuned circuit, which has been adjusted to resonance, lighting a yellow ("caution") signal in the cab indicator, and through additional equipment, operating a speed control governor, automatically reducing the speed of the train to a predetermined speed of say, 30 miles an hour. This is done without the engineer making a move.

Suppose, however, a "danger" condition exists, and a red light shows beside the track. In this case, the oscillator is not energized, and no radio frequency current enters the rails. Both relays in the cab being open contacts are engaged, which light a red signal in the cab indicator, and apply the brakes, slowing the train to a permissive speed of 10 or 15 miles an hour, or bringing it to a complete stop as the governor may be set at the shops.

Obviously then, as no energy produces the danger indication, the failure of the control system, such as the destruction of a tube, the interruption of the circuit, or the rails short circuited by some object, would also produce the same identical danger condition aboard the locomotive. The great value here, though, lies in the fact that regardless of whether the engineer is alert and on the job, or whether a sudden attack of heart trouble has left him without life, the train is perfectly controlled in harmony with the traffic conditions ahead.

Many little difficulties have been encountered; for instance, the effect of the train moving through the block producing a constant change of wave-length was found necessary to overcome. This the writer did by the use of an intermediate circuit, capacity coupled to a Hartley oscillator, and inductively coupled to the track. This appeared to give the tube the same action substantially, as the impact type of spark radio transmitter; the "antenna" (rail) circuit oscillated at its own natural frequency, regardless of what the oscillator was doing. Incidentally, the same circuit, applied to a vacuum tube radio telegraph transmitter, produced remarkable results and the writer intends to investigate this further.

Continuous train control seems to offer a solution to the great question of 100 per cent. protection to the traveling public. Hundreds of wrecks have been investigated by those interested in train control work, and in each and every instance it was found that the human element somewhere had been

responsible. An engineer had disregarded a danger signal, a brakeman had failed to properly close a switch, or some similar little carelessness or neglect had been the primary cause for such an accident. Obviously, with an efficient system of continuous train control, such accidents could never occur.

Many prominent railroad men, as well as numerous electrical experts have great faith in the early development of a practical train control system. They feel that it is but a question of time before our railroads will consider train control in the same sense that they now look on block signaling, and so pensable. The Clark organization is making rapid strides in its efforts to offer the first perfected system of automatically controlling railroad trains, and it would seem that with properly directed energy and concentrated effort, surrounded by a capable development staff, they should early achieve success.

Multi-Stage Radio Frequency Amplification

(Continued from page 930)

In Fig. 30 we have reproduced the arrangement of Fig. 29 in a manner which may be a little clearer to some. We have now shown the grid to plate capacity of the tube by the condenser C_1, while C_2 represents the neutralizing or balancing capacity which actually consists of a real condenser. In this circuit it will be seen that the point G will, as far as any amplified currents in the plate circuit of a tube are concerned, always have the same potential at the point S and therefore the same potential as the filament of the tube. By

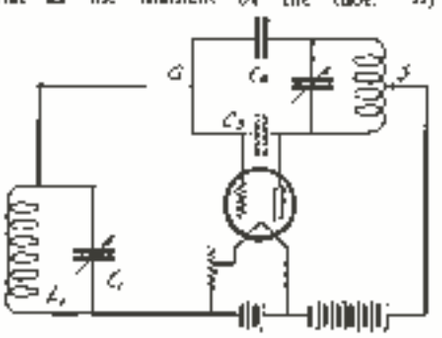


Fig. 30. A more lucid drawing of the circuit of Fig. 29. Inherent capacities are represented symbolically so that the action of the circuit may be clearly understood.

connecting the middle point between C_1 and C_2 to the grid of the tube we ensure that oscillations in the plate circuit of a tube will not in any way effect the potential of the grid, the potentials on which will now be simply those due to the oscillations in the circuit L_1 C_1.

The arrangements of Figs. 29 and 30 may be reversed so that the plate circuit remains normal, but the grid circuit has a middle tapping to enable the neutralizing electromotive forces from the plate circuit to compensate for the grid to plate capacity of the tube.

(To be continued)

Third Radio Conference Makes for Better Radio Service

(Continued from page 901)

After an extended discussion on the details of making recommendations to the Conference it has been deemed advisable for the Department to follow a "hands off" policy regarding material broadcast, as it is believed that each station desires to cater a certain field and to entertain or educate a

certain class of people. To regulate the programs under these conditions would mean censorship, and official censorship is not recommended.

In regard to the changing of the requirements for operators' licenses, it has been recommended by this Committee that the present experiment and assistance in grade of license be made more elastic if possible to permit the holders of such licenses to operate broadcast stations when such licenses are issued to professors of physics and fellows of the Institute of Radio Engineers, and men of equal qualifications. It has been decried advisable that the operators employed at broadcast stations throughout the country should not be required to secure the same class of license as required for marine communication. The present so-called marine license insists that the holder have a thorough knowledge of all modern systems of radio communication, and as radio broadcasting and the apparatus pertaining thereto is a science within a science, this Committee recommends that a new class of operators' licenses be created, different from the license required of other types of service and the examination for it be based upon the needs of the broadcasting service.

The question of increased power for broadcast stations has been considered in detail, and the Committee has decided: "to determine the advisability of permitting the expansion of broadcasting by the employment of increased power beyond that prescribed in the regulations for Class B stations, and to permit the use of apparatus for this purpose to any individual and to remove certain limitations now prescribed for Class B stations, and for the purpose of observing what interference, if any, might result to public broadcast reception in the various localities, this Committee recommends that a new class of license be established and that licenses in this class shall be granted by the Secretary of Commerce, who shall have discretionary power to prescribe the type of apparatus, location, frequency, power requirements of operation of such stations, and that licenses for such stations shall be granted on an experimental basis only, and for such period or periods of time as the Secretary of Commerce may determine."

Although the Government refused to take off the lid in regard to power limitations, experimental licenses for high-power broadcasting are assured and it is up to the radio engineers to show the radio supervisors and the listening public the benefits of high-power broadcasting. The engineers of the Radio Corporation, who propose to erect a 50 to 50 k.w. station outside of New York in the near future are going forward with their plans and will request the first super-power broadcasting license under a revised Class D or development permit. As soon as the technicians work out the details of minimum interference and set up the station, the public within a range of a thousand miles of New York, at least, will have an opportunity of listening in on the R. C. A. super-broadcaster. No doubt, it will also carry to Europe and South America as well as all over the United States. If the inspectors or the public find that this station interferes seriously with the reception of other stations, the Department will cause it to close down, since this is a requirement of the special permit.

It is also probable that nine smaller broadcasters will also apply for permission to broadcast with 5 k.w. sets under the same conditions, and, as was pointed out, a broadcasting system of pure radio may soon be competing for radio popularity with the chain of the inter-connected stations served by the American Telephone and Telegraph Co., which has made possible nation-wide broadcasting.

Among the important decisions reached were: The addition of 10 wave channels for

The Standard Super-Heterodyne

Build It Yourself With This

SUPER PATTERN

The Consrad Method

As illustrated above, "Consrad" patterns are the simplest ever originated. You have blueprints, full size, and an instruction book to follow. You cannot go wrong. Write for our full list of publications on reflex, crystal and tube hookups.

All Patterns are complete with Blueprints and instruction pamphlet.

Write for our Free Catalogue of Modern Radio Hookup Patterns and Radio Books.

THE simplest, greatest and most revolutionary Radio Pattern ever designed. The complete super-heterodyne as shown above can be built with this pattern by anyone. The secret of the marvelous simplicity is the gigantic blueprints that are drawn the full size of the super-heterodyne itself. The blueprint of the wiring diagram measuring 19½" x 44" as drawn by a master radio engineer, every conceivable measurement is given right on the pattern so that you need not measure a single wire.

The blueprint of the panel layout is made up so that all you need to do is to lay it flat on the panel and then take a pencil and carefully trace each hole as shown because the blueprint measuring 19½" x 44" is the exact size of the panel required.

Then extra comes a 16 page booklet, size 8" x 12", the most complete booklet of this kind ever made up. It describes every little detail, shows you how to proceed in building. What parts are necessary, how to set them up and learn how to operate them.

The price of the complete pattern, comprising two blueprints, size 19½" x 44" and a 16 page booklet size 8" x 12" and enclosed in an extra heavy cardboard box printed handsomely in two colors is only $1.00.

Here is the most wonderful opportunity for every radio amateur to have the finest set ever designed for radio receiving.

GET YOUR ORDER IN EARLY OR SEE YOUR DEALER TODAY

ON SALE AT ALL RADIO AND NEWS DEALERS

Price $1.00 Prepaid

or Direct from Us

The CONSRAD COMPANY

233 Fulton Street New York City

Consrad

DIO'S FOREMOST PUBLISHERS—Everything in Books, Patterns and Diagrams

broadcast stations, bringing the total to 600; the removal of the marine sparks on 300 meters from the broadcast band, and the designation of 600 meters for calling and distress calls only, clearing the air programs of code interference. A re-classification of broadcasters and the transfer of all Class C stations from 360 meters, improves the situation further, while the re-zoning of the country into six zones will further aid broadcast operation. This will provide a separate zone for the New England States, including New York City and part of New Jersey. Zone Two will comprise the remainder of the Atlantic states, Pennsylvania, West Virginia, and the western part of New York. Zone Three, Michigan, Ohio, Illinois, Kentucky, Tennessee, West Georgia, Alabama and Mississippi; the Central States are divided horizontally, the southern states forming Zone Four, and the northern, Zone Five; all the Pacific States with Idaho, Utah and Arizona, constitute the Sixth zone. When assigning experimental stations high power licenses, the Department intends to use this system and in assigning new Class I station waves.

Marine communications will be handled on 660, 730, 875 and 706 meters, giving the ships five channels instead of two, also removing coast-wise interference and congestion. Amateurs retain substantially the same wave bands as heretofore, but benefit by low wavelengths assigned temporarily by the Department recently; all of which assures the amateurs an increase in channels over what they had a year ago, and permits greater latitude in 24-hour operation.

The conference voted not to interfere with broadcast programs, discouraging censorship definitely. The conferees found that simultaneous broadcasting of national events is practical over a large area and believes that nation-wide broadcasting by interconnecting stations deserves encouragement.

Additional funds for the administration of matters radio were urged of Congress in a special plea of the whole Conference.

Hiram Percy Maxim, President of the American Radio Relay League, reported as chairman of the subcommittee on amateur problems. It was recommended by this committee that the use of receiving sets capable of radiating be discouraged for use on the short wave relay broadcast band.

In order to eliminate as far as possible the interference from amateur transmitting sets, it was recommended that, except in case of transmitters using coil antennas or loops, of transmitters using coil antennae or loops, radiating system or a device producing an equivalent effect be required in all amateur transmitters. All of the amateur bands shall be open to telegraphic communication by tubes or devices producing similar effects, except those outlying forms of I.C.W. obtained by mechanical interruption on radio frequency circuits. A band of 170 to 180 meters was assigned non-exclusively to amateur radio telephone and I.C.W. stations which employ apparatus in which one of the radio frequency circuits is mechanically interrupted. This keeps those types of amateur transmitting sets which are capable of producing the greatest amount of interference well within the largest amateur band.

Previous to his remarks, Secretary Hoover had been thanked personally for his service to radio science, on motion of Earle C. Anthony, of California, who said: "Mr. Hoover has practically given up his time day and night to this work, and it shows the interest of our Secretary in radio. I would, therefore, like to call for a vote of thanks to Mr. Hoover for his personal interest." The motion was seconded and carried with applause.

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 February issue must reach us later than Dec. 1st.

CIRCULATION LARGER THAN THAT OF ANY OTHER RADIO PUBLICATION

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Agents Wanted

Agents Wanted in every city and town to sell stand and trunk accessories. Attractive discount given. Experience unnecessary as we train you. Write for full particulars. Continental Electrical Specialty Co., Inc., 403 Delaware Ave., Wilmington, Delaware.

Agents—Write for Free Samples. Sell Negligee Shirts. "Ready-Made" Shirts for large Manufacturer direct to wearer. No capital or canvassing required. Many earn $100 weekly and bonus. Madison Mills, 503 Broadway, New York.

Rug Makers and Fur Tans. Every home buys rugs. Tan furs for fur coats. You charge $1.50 each $1.25. Tan orders come easy. Write for particulars and free samples. Atlantic Monogram Co., Dept. 188, East Orange, N. J.

District Managers Wanted. Appoint Local dealers for us in your locality. No canvassing or delivering. Also an auto to call on customers. Experience unnecessary. Rob Russell, Y 3300 Archer, Chicago, Ill.

Write and learn how to start profitable business without capital or experience. Silvering mirrors, refrigerator and headlights, tableware plating. Outfits furnished. International Laboratories, Dept. 30, 806 Fifth Ave., New York.

Big money selling new Household Gadget. Washes and dries windows, dusts, scrubs, mops. Complete outfit $1.00 cash brings. Over 100 percent profit. Mercer Novelty Works, 109 3rd St., Fairfield, Iowa

We want Salesmen and Agents, either whole or side line, to sell our low priced radio hooks to the trade. Excellent proposition for live wires. The K. J. Company, Pittsburgh, 311 Fulton Street, New York City.

Agents Big Earnings! Selling direct to consumer Radio Insulator. Newly patented. Low price. Tremendous Market. Nationally advertised. Radio Equipment, 306, Ninth, Beaumont, Texas.

Demonstrator Carrying Gold Leaf Letters among cars put on paid customers. Large profits, permanent demand. Free samples. Metallic Letter Co., 432 N. Clark, Chicago.

Young men who want to make Real Money this pay time 100 p. a. a week are offered an opportunity to sell an article which every man buys on sight. Apply at interest the dollar watch man; results for $1 you don't need to be a salesman, learn to show it to sell big profits. Write sales and credentials (state previous) write today. Robert H. Lagowall 434 Broadway, Dept. 500, New York

Agents—$36 a week to advertise and distribute samples to consumers. Write quick for territory and particulars. American Products Co., 5338 American Bldg., Cincinnati, O.

Monthly Auto Pass, write for wholesale Patent. General Mdse. 459, Dept. 11338, Boston, Ohio

Business Opportunities

Make $100 Weekly in Spare Time. Sell real estate public auction—big distance sells realizing sale. Wide sale assists local firm people. No big investment, no canvassing. Manager of Colorado made $625 in one month. Representatives earned $1 over. Your plan in assuring the country—write today before your county is gone. Curtis, 843 Washington Blvd., Chicago

Advertise hundred magazines, gross issues. 10c each. Prompt Company, Covington, Kentucky.

$50 Money-Making Plans Free! Wholesale Bargain, T. N. S., Middletown, Pittsfield.

Rush Lettering Cash. Make $100 mail order business; home or traveling; spare time. Outfit furnished. Dept. 813 Portland Block, N. Y.

Make money with four sheets. Lancaster H. Pen 458, Los Angeles, California.

Come in on Radio! Build and sell sets for us. No trouble to earn $5 an hour in your home at night. Auburn Radio Co., Dept. M, Cincinnati, O.

Chemistry

Learn Chemistry at Home—Dr. W. O'Connor Bloom, noted educator and scientific authority, will assure you. Our home study correspondence course has won to take a position as chemist. See our ad on page 1415 of this issue. Chemical Institute of New York, 69 West Broadway, New York City.

Correspondence Courses

Used correspondence courses of all prices sold, rented and exchanged. Lists free. (Courses bought). Lee Newcomb, East Chattanooga, Tenn.

Educational

Civil Correspondence School Courses 40% over half. Harvard Class courses free. Used courses bought. Exchange, Dept. A, 47 West 42d St., New York.

Exchange

$50.00 000 meter Receiver including Radiola $25.00. Two step Amplifier $18.00. Smith, 4134 Harlem, Milwaukee

For Advertisers

24 Words—250 Postal Weeklies $14.00. Advertiser, 6118-B Plainfield, St. Louis.

For Inventors

Inventors' Booklet, 900 Mechanical Movements. 50 Patented Ideas. How to conceive and sell patents. Mechanical Movements greatly needed. Journals, outlines, free ideas. Complete book to select an attorney and avoid Patent Sharks. Price $1.50. Postage free. Albert E. Hilscher, 806 Gerst Building, Washington, D. C.

For Sale

Will sell one Ortho CR-12 in original packing case for $100.00. Will ship C.O.D. subject to your inspection. Clifford Tyson, 501 Jefferson St., San Antonio, Texas.

Health

Free Book tells how to stop tobacco. We will also free poisonous effect of nicotine habit, quickly and permanently. Remedy Guaranteed. Anti-Tobacco League, Box M, Omaha, Neb.

Help Wanted

We Want Salesmen and Agents, either male or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The K. J. Company, Publishers, 311 Fulton St., New York City.

All Men, Women, Boys, Girls 17 to 65 willing to accept Government Positions $117-$250 traveling or stationary; write Mr. Ozment, 701, St. Louis, Mo., immediately.

Salesmen Needed Everywhere. Travel. Experience unnecessary. Write George Wagner, former Metropolitan Detroit Mgr., 1969 Broadway, N. Y.

Become a Landscape Architect. Wonderful profession of wonderful opportunity for home-loving. Easily mastered by mail. Earn while you learn. Write for book. American Landscape School, 1105 Search, New York.

Instruction

Learn Chemistry at Home. Dr. W. O'Connor Bloom, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 1415 of this issue. Chemical Institute of New York, 69 W. Broadway, N. Y. City.

Languages

Warren-Ramsay System. Disclaimers in all languages. French, $2.00; Chinese, Greek, Spanish. Pronunciation-Tablet, 50c. Dictionaries, $2.50. Languages, 5 West 45th, New York.

Miscellaneous

Want Finance patent (good proposition) to interest U. S. c/o Patent Sense, Washington, D. C.

Distributors—Never-failing Spot Price. Handiest tool ever invented. Tripletex makes Transmitter dependable upon opening! Write Coburn Tool, 320 Baronne, Room, Bank.

Beautiful engraved bell 3-4 Cloth. Bulletin. 521 Richmond, Dallas, Texas

Motorcycles, Bicycles

Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Reno Mfg. Co., Dept. 6, Hatchford, Kansas.

Patent Attorneys

Patents. Send drawing or model for examination and report as to patentability. Advice and booklet free. Highest references. Rapid results. Prosperous secured. Watson E. Coleman, Patent Lawyer, 624 G Street, N. W., Washington, D. C.

Lacey Patent-Sense. See ads 1088.

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 cases. Terms reasonable. Victor J. Evans & Co., 925 Ninth, Washington, D. C.

Patents Secured for Your "Evidence of Conception" to be Filed and Examined. Prior to schedule. Information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 348 Ouray Bldg., Washington, D. C.

Patents for Inventors. Long experience, highest professional references, terms reasonable, best co-operative advice as to patentability. Wm. Ashley Kelly, 41 Park Row, New York.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 276 N. Leeds, Mo.

Personal

Lonesome—Join our club—make acquaintances everywhere. BLF Diamonded book with descriptions and photos, sent in plain wrapper for ten cents. Rosedale Co., Dept. 58, Kansas City, Mo.

Exchange cheery letters with new friends. Write Patty Lee, Box 1, 624 Ellis Hall Station, New York City. Stamp appreciated.

Free to Men or Women—Description of a scientific system that has brought physical vigor and happiness to thousands. No charge; no solicitor. Write Vair Salve Co., Dept. 2484, Colorado Springs, Colo.

Lonely Hearts—Exchange letters; make interesting new friends in our Inter-club. Mrs. Wood, Box 903, Jacksonville, Florida. Enclose stamp.

Your Handwriting Portrays Your Character. Send 3c in stamps or friend's address for amazing analysis plus 25c for outstanding characteristics of dominant characteristics. Most guide to parents. E. Devereux, Colfax, New York.

Radio

Make Your Next Reach Out—Some Day!, inside insert, dozen cards. Use $5 de Kle formula the one different hard, 32 text real gold sketched mine. Hieroglyphed print of Xhosa Coast to Coast Circuit, and complete, simple instructions. Nothing else to buy. Gives scientific with easy, natural values. Not obtainable elsewhere. The price-tool sale and can name name of buyer if job published. Satisfaction Guaranteed. Detailed 10c. Will forward anywhere, $1.00. Now 40 Xhos available, thousands of Xhosa, copy of Chatterbox Book. The above serious stamps coin is Chi. Kipling Radio Laboratories, Xenia, Ohio.

Every Radio Fanatic Desired thing "Everything" makes most beautiful set of all. Guaranteed satisfaction. And also 2.25" Black and Grapnell 3 per square inch. Sample free. E. F. Mathes, Dept. N, 814 Main St., Fort Worth, Texas.

Radio Books. Catalog free. R. Denbark, 248 N. 22nd St., Indianapolis, Ind.

Radio Fans and B. C. L.'s unite and work—$50 suggestion and Reward. Their learning records at school. Regular method $2.50. Radio Radio Service, Dept. N, Bloomington, N. Y.

Send me your burned out or broken Fuses today—10 cents or over. Will pay liberally. M. Radio, 30 W. 20th St., New York City.

Make your Radio and Burned out Fuses right, 10 cents or over. Fuse used to 10 for Return. Charges reasonable. Wm. Tuhy, 34 W. 20th St., New York City.

Royal Don't Overlook This Free "Radio" Radio Selector. Greatest material ever brought out with unified Sam. Philip Adjustable. See latest advertisements in this publication, or our catalog. Interior with Colors Control, complete 50c, two coils directly with Radiotron (Tube), 75c complete. Send for free book. Radio Apparatus Company, 84-88 Park Place, New York City

Attention!—50 Famous prize book out. The greatest collection of amateur tube circuits ever brought under two covers at low half-price. Many diagrams will be found in the Book "Haven" catalog, which contains new circuits and parts in a greater profusion than any other catalog. Do it always, or else, still using the catalog is the Radio Specialty Co., 84-88 Park Place, New York City

Receiving installed for manufacturing Radio Cabinets. We have dry kits and complete machines including finishing facilities. Methods reasonable only considered. XYZ.

Telephone Receivers. Are new, 4,000, Thursday 2, $11.00. Receivers $3 per pair different. Catalog for stamp C & T Radio Service, 102 Chestnut, Phelps, Mich.

10-20 per cent discount on complete receiving sets and parts. Send us your needs. Bee Electric Company, 1645 Third Avenue, New York.

Radio (Continued)

For Sale: Fully equipped Radio Broadcasting Station complete and ready. Two transmitters 500 and 250 watts. Ready for operation. Reason for offer to responsible parties. Henry Semmelroth, Lubbock, Oklahoma

Science Committee: Our Mystic Reflector Grill consisting of an electric coil, card play, paper and pad for secret drill to Scientists, which warm effect, Keyless and simple drawings. Be careful to your dept for $1.00—fully guaranteed. Kent Radio Specialty Co.(Dept. 1407) Seminole Street, Grand Rapids, Michigan

50 Watt Transmitter complete with Tel Engine and set of photographic tubes. Tube and filter complete. Have several filters complete tubes with sheet. For sale. Jno. H. Dilley, Mt. Castle, Missouri.

Solid Mahogany Cabinets—5x7—$3.45; 7x10—$4.75; 7x14—$5.50; 7x18—$6.40; 7x21—$7.50; 7x24—$8.50; 7x30—$10.00. Panel mtg. Variometers—Solenoid, finest silk stockings, $1.50 value for $2.75 (limited). Magic Cabinet Company, Tiffin, Ohio

Radio parts bought, sold or exchanged. Write for Offerings. Thompson, Box 369

Black Fibre Panels—Black grained 7x7 thick, 75 cts. 7x21 to 8x10 inch also. Immediate delivery. Parcels prepaid. Pearl Phelps, Box 304, Lovell, Wyo.

Learn to "Send" for sale, one speed. Code taught by mail, starts real at any rate from 5 up. $5. Money back guarantee. John Penfold, 1411 Nevada, Colorado Springs, Colo. Established 20.

Helps Sale—Stamped 1924 Log and Reading Booklet contains Original Distance and Volume. Worthwhile reading. Illustrated folder and booklet for stamp. Cub Radio Supply Store, Elkhorn, Wis.

Edison Storage "B" Battery elements 8 per pair. Edison cells available 1-2 volts, 30c per. Satisfy or money refund. E. W. Decker, Merrill's Ave., Peabody, Mass.

Magnavox MA Loudspeaker $21.00. Music Master $25.00 (6 jacks) Amplifiers at similar reductions. Radio Shop, Box 53, Bowen, Ill.

Helps Test Signals—and prove out. UV201 $1.75, 201, 200 c. Pri. UV12—$3.00, 202 $3.25. Receiver and Ballast set complete. S. Seidel & Co., 2219 N. 4th St., Philadelphia, Pa.

25,000 Meters Receiver with Amplifier. Just New Apparatus and Tubes included. All for Cash—$35.00. 3000 ft. No. 14 Wire, 2025 N. 6th St., Philadelphia, Pa.

Wanted Pic. Nos. 508.00. Peter, Schorr, 4542 Berteau St., Chicago, Ill.

Salesmen Wanted

A Salesman wanted in every town or city to call on dealers and introduce a fast selling line of Radio Specialties. Our complete sales proposition will show you how to make $5 to $10 per day. With this you have a valuable asset to buy—the entire business of the dealer you contact regularly. 1,000 new leads and sales with the cheapest radio outfit on the market—yet as practical as the most efficient. The money in the right line. Send $2.00 for sample outfit. The Radiotex Corp., 76-78 West Broadway, New York City.

Want You Ever Called a Dollar Store? Our proposition is better. We are quite sure, several goods, dealers deal, sales or quality lots of specialties on sale at 10 cents and retails, selling and profitable and are open to be set in easy no trade required. Your sales added from dealers. Good for established and help gaining. Mailer Supplies Co., 1001 Chestnut Hill Sq., Dept. 201 Chicago, Ill. Reference: Any bank or Federal Reserve.

Scenery to Rent

Sell-ins for Dance, Stage, Moving Pict. Plays Drops. Address Amelia Grain, Philadelphia

Song Poems Wanted

Song writers Attention! Let us revise your poems in Real Music. Have us "Shop Talk" proposition to offer. Publishers rejects illustrated. Examination free. Francis Course, Washington, D. C. N. J.

Stamps and Coins

California gold. Quarter size 25c, half-dollar size 50c. Half dime and Carolina 10c. Nevada, Montana, Colorado Stamps, Coin.

150 Genuine Foreign Stamps, Stamps Will Buy, Approvals. Reliable and Extra Service. Stamps in China, etc., only 5c. Fine approval sheets 50 to 60%. Agents wanted. Big 72-p. Lists free. 50 for stamps. Ryan 72 Ryan Building, St. Louis, Mo.

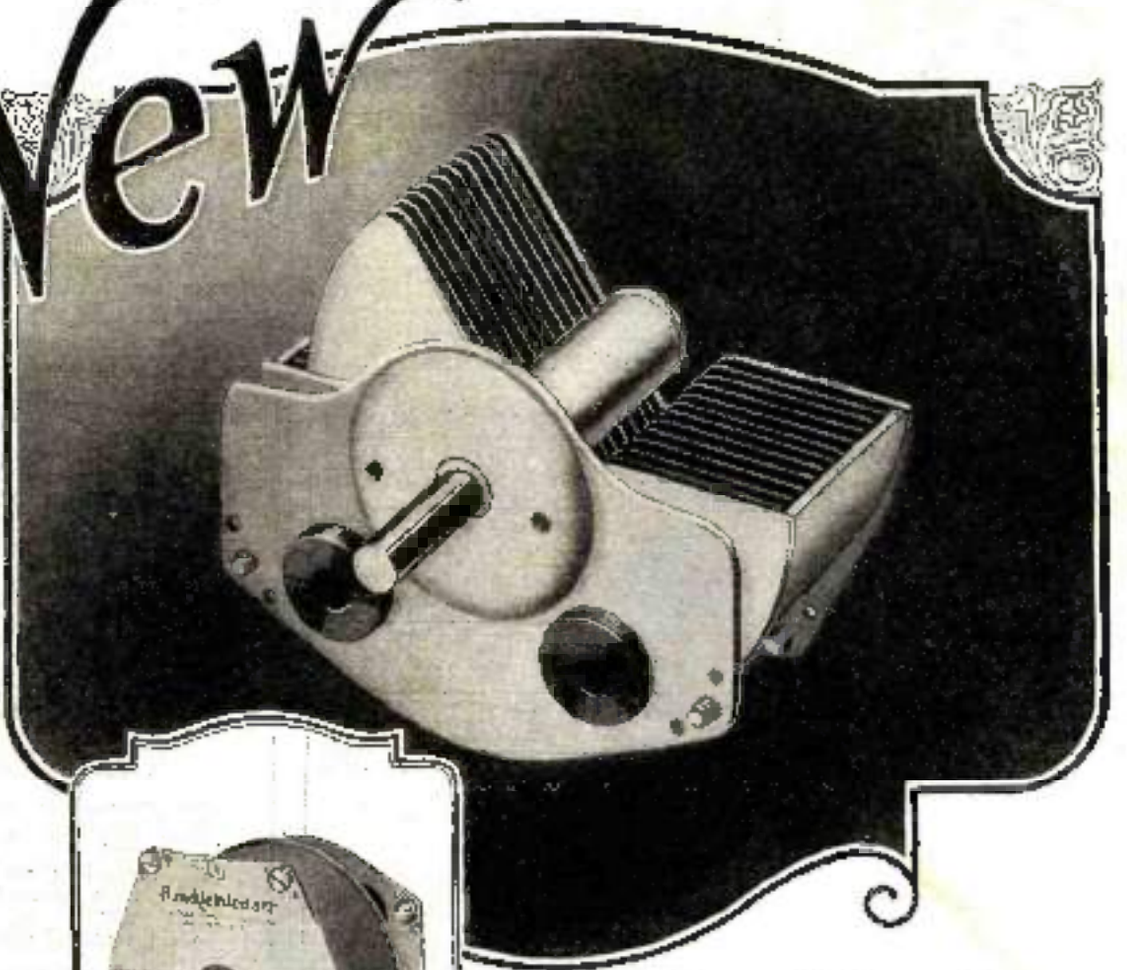
Telegraphy

Telegraphy—Both Wire and Wireless taught thoroughly by Actual Practice. Wonderful opportunities. Prepare for Civil Service. Special rates this month only. 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 (any old) electric points, old false teeth. Packages returned if not satisfactory. United Mines Smelting Works (The Old Reliable) 150 So. State St., Dept. 82, Chicago, Ill.

New



The Bradleydenser Perfect Variable Condenser

The Bradleydenser

PERFECT VARIABLE CONDENSER

Brass Plates—Grounded Rotor—Low Loss

PERFECTION to the last detail! Even the unique bearing of the new Bradleydenser is a marked improvement over the older types. The rugged brass plates, the grounded rotor construction, and the new detachable dust shield are other details that serve to increase the high-frequency efficiency of the Bradleydenser. Exhaustive laboratory tests reveal exceptional improvements in efficiency. In fact, the Bradleydenser sets a new low record for losses. It tunes the weakest oscillations with the least energy loss, and, therefore, increases the range of any set. There are many other new and striking features of the Bradleydenser. Our new literature explains them, fully. Send for our latest bulletin on the Bradleydenser today.

Standard Capacities

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

Furnished without vernier plates, only.

Allen-Bradley Co.

Electric Controlling Apparatus

287 Greenfield Ave.

A-B

Milwaukee, Wis.

Standard Carton

The Bradleydenser is sold in the well-known Allen-Bradley checkered box by all leading radio dealers and jobbers.

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

THE PERIODICAL PRESS, NEW YORK

The New Bradleystat

A Remarkable Achievement

Many refinements are embodied in the new Bradleystat. The graphite discs or pile are enclosed in a smaller container; two terminals suffice for ALL rules; a new mounting simplifies installation, the knob is of a daintier pattern. And the remarkable stepless control of the old Bradleystat remains, unchanged. Such a combination of advantages can be found in no other filament rheostat.

Every radio set can be improved by substituting the new Allen-Bradley radio devices.

Only One Hole required in Panel

Ask your radio dealer about the new Allen-Bradley line

A DISTINCTLY new and valuable contribution to radio! That is the verdict of all radio engineers and designers who have seen the new Allen-Bradley radio devices and have witnessed their amazing performance. The new "one-hole mounting," which replaces the older clip mounting, makes for marvelous compactness and simplicity of installation. The new Bradleystat, Bradleyleak and Bradleyohm require only a 11/16-inch space behind the panel, and the Bradleyometer only 7/8-inch. Thus, the new models can replace inferior wire rheostats and potentiometers without disturbing the arrangement of the set. Our new literature is ready. Send for it, today!

Allen-Bradley Co.

Electric Controlling Apparatus

287 Greenfield Ave. A-B Milwaukee, Wis.

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

"Are those Tubes Genuine?"

All Radiotrons Now Reduced to $4.00

It isn't a genuine WD-11 unless it's a Radiotron.

It isn't a genuine WD-12 unless it's a Radiotron.

It isn't a genuine UV-199 unless it's a Radiotron.

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.

The question is heard at every radio counter: "Is it a genuine Radiotron?" Almost every dependable manufacturer uses genuine Radiotrons in his sets. Everyone who builds his own knows enough about radio to know that nothing else but the genuine will do. And the man who replaces used-up tubes in his set knows that to get the same performance, he must have the same tubes—genuine Radiotrons only. So everybody asks "Is it genuine?" And asks to see the marks that prove it—the name "Radiotron" and the "RCA" mark.

RCA

This symbol of quality is your protection

Radio Corporation of America

233 Broadway, New York

Sales Office
10 So. La Salle St., Chicago, Ill.

433 California St., San Francisco, Cal.

Radiotron

REG. U.S. PAT. OFF.