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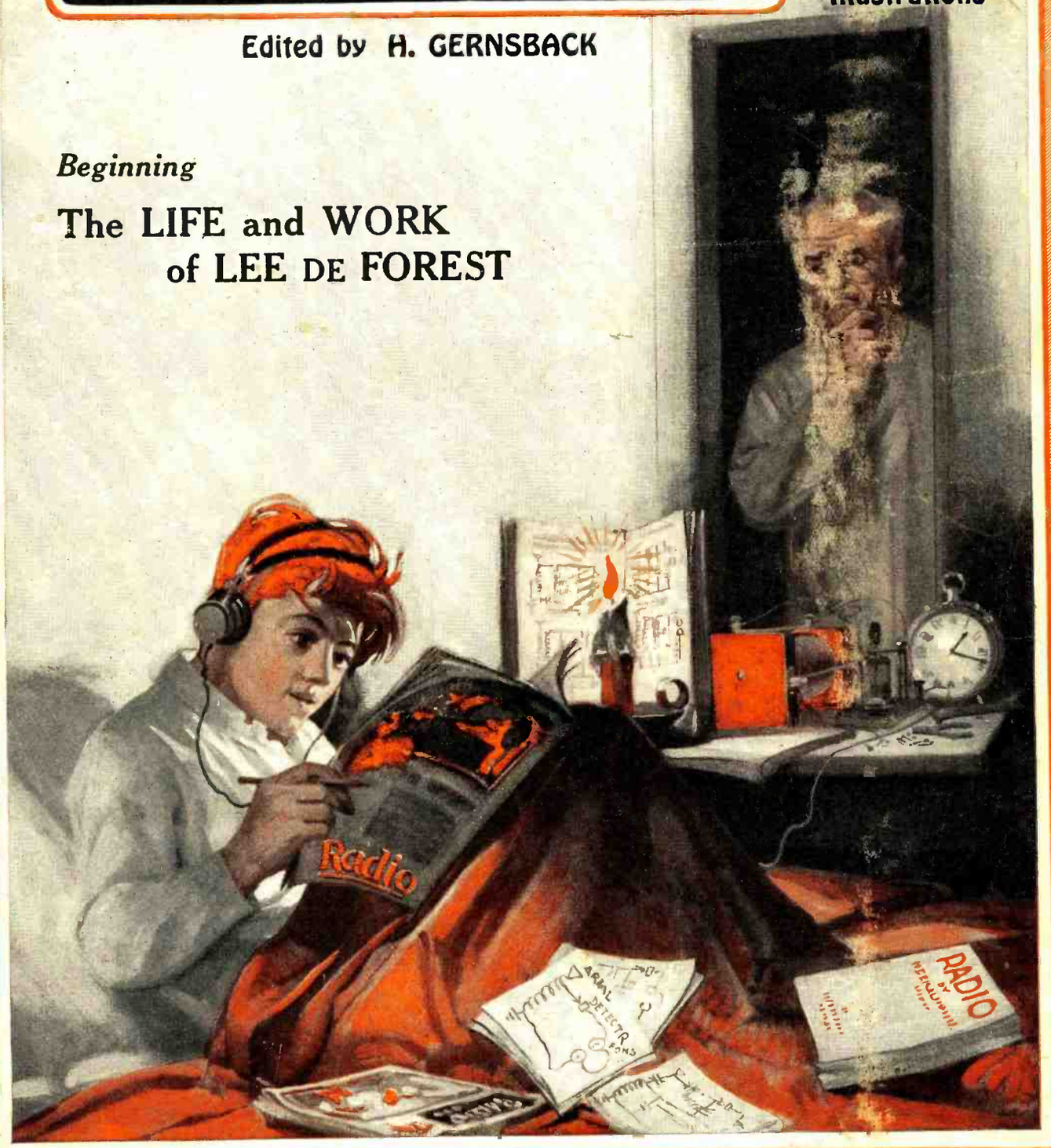

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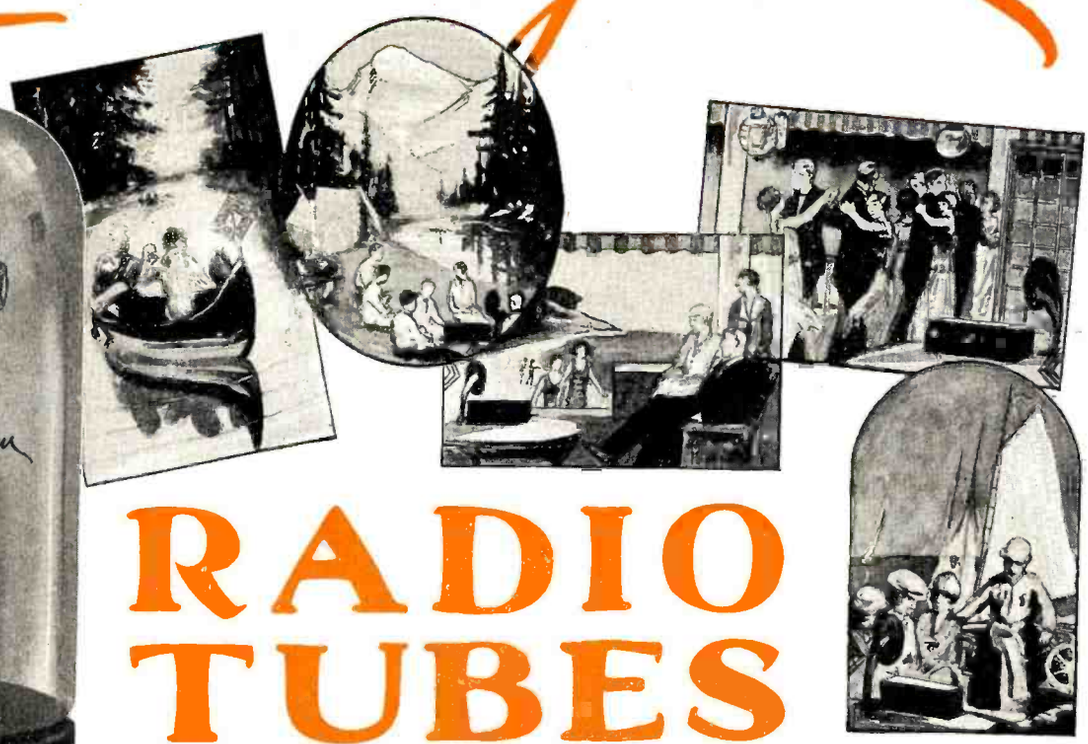

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VOL. 6 CONTENTS FOR OCTOBER NO. 4
1924

	Page
Editorial ..... By Hugo Gernsback	461
Music from Your Lamp Socket By R. D. Duncan, Jr.	462
The Life and Work of Lee DeForest.....	464
Induction and Modulation....By A. P. Peck	466
A Radio Frequency Solodyne Receiver By G. V. Dowding and K. D. Rogers	468
Crystodyne Receivers and Amplifiers By I. Podliasky	470
Esperanto or Ilo—Which?.....By O. C. Roos	471
An Interview With Secretary H. C. Hoover By S. R. Winters	472
Duet with Singers 3,000 Miles Apart To Be Broadcast	478
Radio in South America.....By John English	479
Davy Jones Speaking.....By J. Farrell	480
KDKA to Broadcast for Polar Ship "Arctic"....	481
Pilot Interviewed by Radio While Flying By A. M. Jacobs	482
"Roxy"—The Story of a Dreamer Whose Dreams Come True..By Golda M. Goldman	484
The Wail of the Lonesome Shrine By Robert Francis Smith	485
Soup Modulation.....By Willard Wilson	486
With the Amateurs.....	487
Hamitorial—If You Are To Know It At All, Know It Well.....	488
A Three-Wave Transmitter. By John M. Baldwin	489
Government Extends Radio Channels for Amateurs	489
Automatic Sending Key and Time Relay for Tube Transmitters.....By A. A. Kubiac	490
A Universal Two-Step R. F. Receiving Set By Paul G. Watson	491
Notes on the Super-Heterodyne By Prof. Grover Ira Mitchell	492
Reflex Radio Receivers In Theory and Practice, Part II.....By John Scott Taggart	494
Non-Radiating Regenerative Receivers By Clyde J. Fitch	496
Awards of the $50 Radio Wrinkle Contest....	497
Standard Hook-Ups	499
Radio Humor—Radiotics.....	501
Correspondence from Readers.....	502
New Radio Patents.....By John B. Brady	503
Radio News Laboratories.....	504
The Log of a Lightning Jerker By J. E. Brockway	506
I-Want-To-Know	507
Calls Heard	574
Glossary of Radio Terms Compiled by Lester Maxwell	399
Index to Advertisers.....	444

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Index to Advertisers

Page

A

Ackerman Brothers Co., Inc..594
Acme Apparatus Company....565
Acorn Radio Mfg. Co.....610
Adams-Morgan Co.....550
Adams Radio Mfg. Co., The....538
Alden Mfg. Company.....592-598
Allen, Inc., L. B.....524
Allen-Bradley Co.....632
Ambler-Holman 561
American Art Mache Co.....580
American Brand Corporation...520
American Hard Rubber Co.....590
American Radio Exposition Co. 591
American Radio Mfg. Co....520-532
American Radio Tube Works...613
American Specialty Co.....544
American Transformer Co.....564
Amplex Instrument Laboratories 536
Andrea, Inc., F. A. D.....563
Andrews Radio Company.....512
Aragon Radio Co. 595
Atlantic & Pacific Radio Co., Greater 516
Atwater-Kent Mfg. Co.....541
Atwood-King, Inc.....540
Automatic Electrical Devices Co., The 579
Autotyre Company, The 616

B

B-Metal Refining Co. 615
Bakelite Corporation 536
Baldwin Pacific & Company...544
Barawik Company, The, 448-449-450-451
Barkelew Electric Mfg. Co., The 618
Bel-Canto Mfg. Co.....620
Bell Mfg. Co.....578
Benjamin Electric Mfg. Co.....626
Benson Engineering Co.....594
Blue Seal Mfg. Co. 628
Boice, W. & J.....618
Boonton Rubber Mfg. Co.....560
Brach Mfg. Co., L. S.....626
Brady, John B. 614
Brandes, Inc., C.....533
Branston, Inc. Chas. A.....618
Bremer-Tully Mfg. Co.....538
Bristol Company, The.....627
Brooklyn Radio Service Co., The 556
Brown & Company, Thos.....540
Brownlie & Co., Roland.....518
Bunnell & Company, J. H....566

C

Cannon & Miller Company, Inc.622
Carter Radio Company.....566
Central Radio Laboratories....568
Chalfonte-Haddon Hall 612
Chemical Institute of New York, Inc. 581
Chicago Electric Devices Co....595
Chicago Salvage Stock Store....575
Chicago Solder Company....562-595
Christian Science Monitor, The..530
Clapp-Eastham Company 522
Clark & Tilson, Inc.....536
Cleveland Engineering Lab. Co., The 578
Consolidated Instrument Co. of America 611
Consrad Company, Inc., 512-587-596-604-610-622-629
Continental Fibre Company, The 600
Cosmopolitan Phusiformer Corp..556
Coto-Coil Co. 600
Coyne Electrical School.....514
Crosley Radio Corporation, The.547
Cruver Mfg. Co.....608
Cunningham, Inc., E. T., Inside Front Cover
Cutler-Hammer Mfg. Co., The. Inside Back Cover-454-455

D

D. R. V. Importing Company..578
D. X. Instrument Co.....531
Davenport Radio Labs 627
Dayton Fan & Motor Company, The 593
DeRoy Radio Corp. 574
Dey's Radio Service.....596
Diamond Electric Specialties Corp. 546
Diamond State Fibre Company..542
Dictograph Products Co.....586
Dieterich, Albert E.....617
Don-Mac Co., The.....617

Page

Dubilier Condenser & Radio Corp. 528
Durkee-Thomas Products Co....554

E

E. I. Company 446
E-Z-Toon Radio Co.....618
Eastern Coil Corporation.....620
Eisemann Magneto Corp.....577
Electrad, Inc. 599
Electrical Research Laboratories 551
Electric Service Supplies Co....578
Electric Specialty Company....558
Electric Storage Battery Co., The 553
Elgin Radio Supply Company...532
Empire Radio Supply Co. 615
Erie Fixture Supply Co.....524
Evans & Company, Victor J....615
Experimenters Information Service, Inc. 567
Express Body Corporation.....576

F

Fahnestock Electric Company..604
Fansteel Products Company, Inc.513
Faraway Electric Co., The.....623
Federal Telephone & Telegraph Company 593
Ferbend Electric Company.....528
Ferry & Co.....548
Flint Radio Co.....564
Ford Mica Company.....596
Forest Electric Co.....570
Formica Insulation Company, The 452-453
Fox Mfg. Co.....528
Freshman Company, Inc., Chas.601
Friedlander-Kopple Radio Ser...601
Frost, Inc., Herbert H.....619
Fulton Radio Shop.....562

G

Gardiner & Hepburn, Inc.....610
General Electric Co.....546
General Radio Co.....568
General Radio Winding Co.....626
Gilfillan Bros., Inc.....543
Golden-Leutz Corp. 605
Goldschmidt Corp., Th.....525
Gordon, Milton 592
Gould Storage Battery Co. 616
Graham Company, Alfred.....566
Great Lakes Radio Company...558
Grebe & Company, Inc., A. H..443
Grewol Mfg. Co. 608

H

H & H Radio Company.....542
Hafner Mfg. Company.....582
Halldorson Company, The...562-628
Hammer Radio Company, S. ...548
Hardsocg Mfg. Co.....626
Harvard Radio Laboratories....605
Hayden Radio & Research Co., A. C. 626
Haynes-Griffin Radio Service, Inc. 544
Heath Radio & Electric Corp..609
Holtzer-Cabot Electric Co., The.548
Hommel & Company, Ludwig..620
Hudson-Ross, 530-548-618-624-626-628
Hull & Company, S. W.....618

I

International Correspondence Schools 596
International Heating Co.....582
Inter-State Signal Company....598

J

Jewell Electrical Instrument Co. 564
Jones, Howard B.....628
Jordon Battery Co.....598

K

K Electric Co.....604
Karas Electric Co. 527
Kellogg Switchboard & Supply Co. 584
Keystone Electric & Radio Co.612
Keystone Products Co., The....620
Kimley Electric Company, Inc..624
Klaus Radio & Electric Company 594
Lacey & Lacey 616
Lambert, Leon 617
Lancaster & Allwine.....617
Lee Electric & Mfg. Co.....606

Page

L

Leiax, Inc. 580-585
Lego Corp. 624
Liberty Electric Corp.....594
Liberty Mail Order House, 608-618-626
Liederman, Earle E.....629
Lincoln Mfg. Co., The 518
Lincoln Typewriter Company..600
Listen-In Publishing Company..631

M

Magnavox Company, The.....539
Main Radio Batteries.....524
Manhattan Radio Co.....544
Marle Engineering Company...566
Marshall Radio Products, Inc..447
Martin-Copeland Company.....552
Marvel Radio Specialty Company 597
Mazda Radio Mfg. Co., The..586
Mecky Co., The A.....550
Mercury Radio Corp.....559
Michigan Radio Corporation....522
Midwest Radio Company, The..602
Miller Rubber Company of New York 572
Modern Electric Mfg. Co., The..628
Montgomery Ward & Co.....572
Montrose Mfg. Co.....528
Mozart Grande Company, The..613
Multiple Electric Products Company, Inc. 583
Munn & Company.....614
Mu-Rad Laboratories, Inc.603-607
Murdock Company, Wm. J....529
Music Master Corporation.....545
Myers Co., Ltd., E. B.....554

N

National Airphone Corporation..523
National Carbon Company, Inc..537
National Radio Institute.....459
National Transformer Mfg. Co. 558
Neumade Products Corp.....574
Newman-Stern Co., The.....608
Newton Mfg. Co.....595
New York Institute of Photography 621
Niagara School of Music.....580
Norden, Hauck & Co.....612
Nutron Mfg. Co.....571

O

Ohio Radio Sales 622
Ohio Rubber & Textile Co....530
Omnigraph Mfg. Co., The.....552
Operadio Corp. 595
Owen, Ricahrd B.....616
Ozarka, Inc. 460

P

Pacent Electric Company, Inc..562
Pacific Arms Corp.....550
Parker, C. L.....617
Perry-Fay Co., The.....604
Pfanstiehl Radio Service.....517
Phenix Aircraft Prod. Co.....532
Phenix Radio Company.....549
Philadelphia Storage Battery Co., The 515
Pioneer Radio Corporation....566
Pollard Bros. 590
Polymet Mfg. Corp. 624
Portable Globe Aerial Co., The..616
Precision Coil Co.....544
Press Guild, Inc., The 602
Primary Mfg. Corp.....580
Putt Electric Shop, The.....532
Pyramid Products Company....546

R

Radiall Company 625
Radio Association of America..618
Radio Corporation of America, Back Cover
Radio Doctors, Inc.....582
Radio Electro Labs.....582
Radiogem Corporation, The....597
Radio Industries Corp.....521
Radio Institute of America.....510
Radiolamp Co. 457
Radio Printers 548
Radio Rabat Company, The....570
Radio Receptor Company.....586
Radio Shack, The.....602
Radio Specialty Co. 569
Radio Tube Exchange 576-610
Radio Tube Hospital.....598
Radio Tube Mfg. Co. 631
Radio Units, Inc. 516

Page

Rance Corp. 612
Randolph & Co. 615
Randolph Radio Corp.....509
Rathbun Mfg. Co., Inc. 591
Rauland Mfg. Co.....540
Real Equity Shop, The.....552
Reichmann Company 611
Reliable Parts Mfg. Co., The..576
Remey Radio Mfg. Co.....597
Resas, Inc. 588
Richardson Radio, Inc.....526
Rolls Royce Tube Company....584
Ryder, Frank A.....530

S

S & H Battery Supply Co.....564
Saturn Mfg. & Sales Co., Inc., The 524
Scientific Research Labs. 621
Service Battery Co.....622
Shamrock Mfg. Co.....535
Shepard-Potter Company, Inc..560
Shipman-Ward Mfg. Co.....606
Sidbenel Radio Equipment Mfg. Co. 628
Simplex Radio Sales Co.....538
Smith & Heminway Company, Inc. 620
Smith Typewriter Sales Co. ...592
Spaulding Fibre Co., Inc.....532
Specialty Service Company....625
Springfield Wire & Tinsel Company 584
Stamm-Lawson Radio Mfg. Co..589
Standard Radio Tubes 627
Stanley Radio Supply Company, The 524
Steger & Sons Piano Mfg. Co...608
Steinite Laboratories 613
Sterling Mfg. Co., The.....599
Stevens & Co. 592
Stone Electric Co.....520
Stransky, John A.....522
Stromberg-Carlson Telephone Mfg. Co. 598
Strongfort, Lionel 631

T

Telephone Maintenance Company 550
Teree Electric & Mfg. Company 624
Thompson Mfg. Co., R. E....520
Thor Radio Company.....625
Torrington Mfg. Company, The.560
ower Mfg. Company, The.....441
Tresco Sales, Inc.....606
Triangle Rubber & Supply Company 621
Trimm Radio Mfg. Company...518
Tuska Company, The C. D....555

U

U. S. Tool Company, Inc.....606
Uncle Sam Electric Company...600
Union Radio Corporation.....514
United Distributors, Ltd.....600
United Electric Store 520
Unity Mfg. Co.....526
Utility Supply Co.....631

V

Valley Electric Co. 624
Valley Forge Chemical Co....628
Vesco Radio Company.....601
Vibrar Motor Co.....586

W

Walbert Mfg. Co. 615
Walnart Electric Mfg. Company.618
Wayne Radio Tube Lab. 619
West Angus Show Card Service, Ltd. 530
Western Coil & Electrical Company 588
Western Radio Mfg. Company..526
Western Rubber Mold Company 560
Westinghouse Union Battery Co.557
Weston Electrical Instrument Co. 566
Willard Storage Battery Company 519
Windsor Furniture Co.....511
Workrite Mfg. Company, The..573
World Battery Company..616-631

Y

Y. M. C. A. Radio Institute....628
Yaxley Co. 631
Young Mfg. Co.....590

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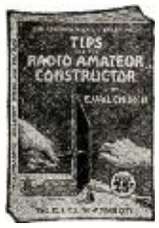

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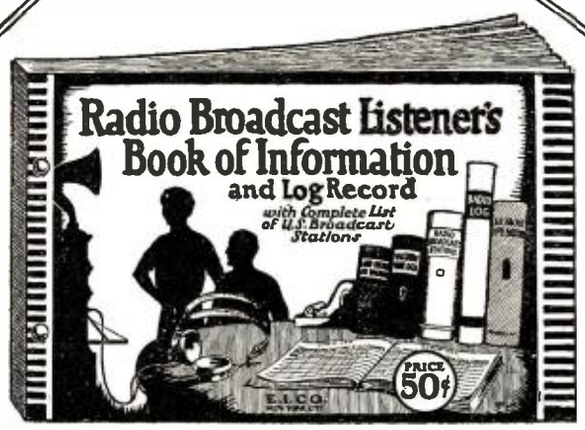

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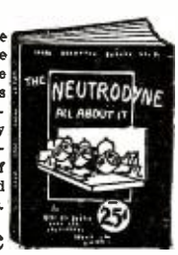

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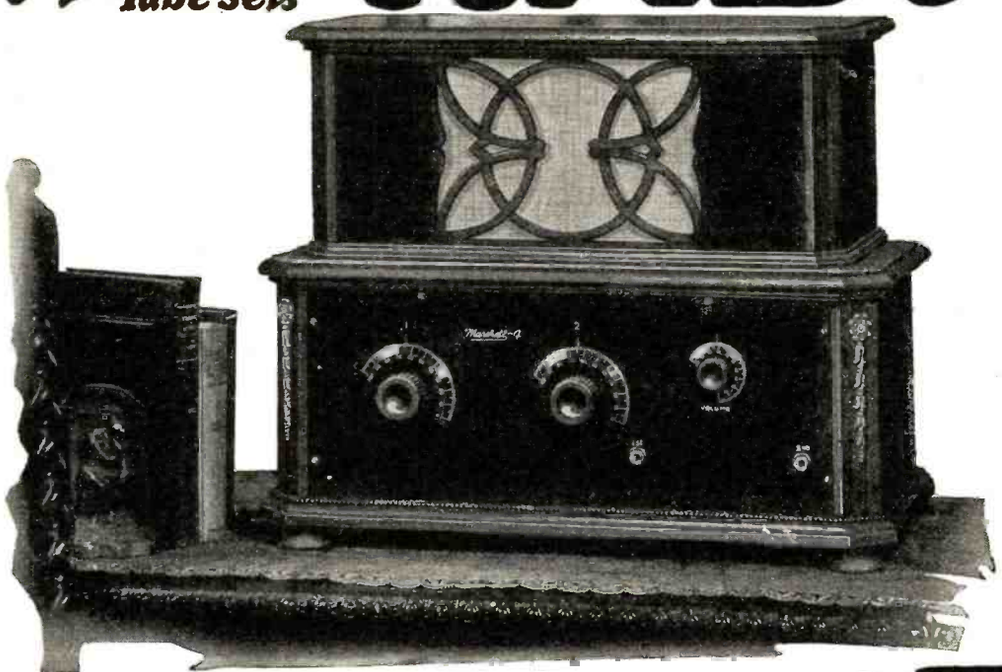

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Marshall Blvd. and 19th Street, Dept. 59-47, Chicago

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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 St., Dept. 59-47, Chicago

Please send me your special offer price, terms and full description of Marshall Radio Outfits. Though I may change my mind on receiving your proposition, my preference now is for a:

------3 Tube ------4 Tube ------5 Tube (Please check)

Name .....

Address .....

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. These home-made sets equal in results the best factory made sets—many are even superior and at a cost only a fraction of the cost of the factory made sets. You can easily equal these results.

OUR SPECIAL VARIOMETER

F410 Variometer. Each $2.10
Accurate wood forms thoroughly seasoned. Plenty of large sized wire insures highest efficiency. A high grade instrument that will give you lasting service. 3/16 inch shaft. Range 180 to 650 meters.

OUR SPECIAL VARIOCOUPLER

F418 Variocoupler. Each $1.80
The most efficient type of coupler. Primary and secondary wound on bakelite tubes. Primary tapped for fine tuning. 3/16 inch shaft. Range 180 to 650 meters.

SUPER MOULDED VARIOMETER

F412 Each.....$2.48
Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade instrument that will get the best results. Wave length 180 to 600 meters.

SUPERIOR 180° VARIOCOUPLER

F521 Each $1.10
A wonderful value. Produces excellent results. Green silk windings on black fibroid tubes. Rigid mounting support. Primary tapped for fine tuning. ¼ inch shaft. Range 200 to 600 Meters.
F522 Variometer—same style. Each..$1.10

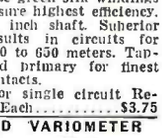
SUPERIOR VARIOMETER

F525 Each $3.68
Forms moulded of red bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ¼ inch shaft. Noiseless pigtail connections. Produces superior results in any type circuit 180 to 650 meters.
F527 Variocoupler. Same style. Primary tapped for fine tuning. Each.....$3.68

SUPERIOR VARIOCOUPLER

F523 Each.....$3.35
Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest efficiency. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.
F526 Special type for single circuit Regenerative Hook up. Each.....$3.75

EXCEL MOULDED VARIOMETER



F524 Each ...$3.95
A wonderful value at our price. Polished black bakelite rotor and stator forms. Large size green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Split stator winding.

PHUSIFORMER

F546 Each.....$6.85
A new device especially designed for tuned radio frequency circuits. Consists of primary and secondary inductively coupled coils connected with variable condenser, all enclosed in moulded case with binding posts and with dial on shaft of condenser. Size about 4½ in. square, 2 in. thick. Three such units occupy small space and can be used to make up a very efficient 5 tube set at low cost.

SWITCH LEVERS

Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch.
F381 1¼" Radius. Each 14c

INDUCTANCE SWITCH

F285 Price including knob and dial $1.18
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 12 switch points, any number of which may be used.

SPIDER WEB COILS

F290— 25 turn 39c F292—50 turn 47c
F291— 35 turn 42c F293—75 turn 54c
F294—100 turn. Each.....68c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with fibre mounting strips.
F299 Form for winding spider web coils 15c

INDUCTANCE COILS (Honeycomb)

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

Tns	Art No.	Not Mtd	Mtd	Tns	Art No.	Not Mtd	Mtd
25	F301	$.28	$.75	200	F307	$ .66	$1.20
35	F302	.30	.90	500	F311	1.06	1.57
50	F303	.32	.96	1000	F314	1.64	2.18
75	F304	.37	1.02	1250	F315	1.86	2.35
100	F305	.52	1.07	1500	F316	2.10	2 50

INDUCTANCE COIL MOUNTINGS

F340 3 Coil.....$2.75
F341 2 Coil 2.35
Made of polished black bakelite. Mount on front of panel.
Back of Panel Mounting
Mounts back of panel, with knobs or dials on front of panel. Takes 3 coils of any size.
F342 Each $3.25

COIL MOUNTING PLUGS

Moulded of genuine bakelite.
F344 Plug for mounting "Honeycomb" coil 36c
F345 Plug to fasten mounted coil stationary to panel.....42c
F346 Movable plug to fasten mounted coil to panel so it can be rotated.....89c
F343 Fibre strip to hold coils for mounting. Two foot piece 15c

BAKELITE TUBING

Best grade genuine bakelite tubing. Pieces 3 inches long only.
F985 Inside dia. 2½ in. 29c
F986 Inside dia. 3 in. 38c
F987 Inside dia. 3½ in.....42c
F988 Inside dia. 4 in. 47c

MAGNET WIRE

Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated. Note, our prices are prepaid.

Double Cotton White	Enameled	Wire Size	Single Silk Green	Double Silk Green
F990	F992		F991	F993
39c	31c	18	54c	75c
43c	35c	20	60c	82c
49c	39c	22	70c	95c
57c	45c	24	85c	$1.05
70c	50c	26	95c	1.30
95c	55c	28	$1.15	1.60
$1.15	60c	30	4oz. .80	4oz. 1.10
1.49	65c	32	4oz. .95	4oz. 1 30
	85c	36	4oz. 1.95	4oz. 2.60

COIL WINDER

F548 Each $1.90
For the set builder. Makes better coils in less time, saves its cost in short time. Clamps to table or bench. Has three adjustable fingers to hold tubes up to 4 inches diameter. Spring in handle prevents unwinding of coil when tension is released.

ENCLOSED DETECTOR

One of the finest crystal detectors on the market, supersensitive Galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.
F730 Each.....89c

GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequaled value.
F732 Each.....59c

DETECTOR CRYSTALS

F736 Galena, Arlington tested, piece 19c
F738 Silicon, Arlington tested, piece 19c
F735 Tested, Galena, Mounted, piece 9c
F737 Tested, Silicon, per piece..... 9c
F739 Genuine million point crystal. Ea 29c
F733 Meteorite crystal. Each..... 12c
F734 Silver Clay crystal. Each..... 23c
F746 Dutec Crystal. Each..... 27c

STANDARD BRAND FIXED CRYSTAL DETECTORS

The latest developments in Crystal Detectors. Give better results and more reliable than old style. Used in Reflex circuits
F742 Grewol Detector. Each.....$1.48
F743 B Metal Detector. Each..... 1.39
F744 B Metal Crystal. Each..... .45
F747 RW Detector 1.29
F749 Brownlie Detector 1.79
F750 Brownlie Renewal ..... .69

PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Our low prices save you money.
F815 3 plate 58c
F816 5 plate 97c
F814 11 plate .00025 mfd. $1.13
F817 17 plate .00035 mfd. 1.20
F813 21 plate .0005 mfd. 1.27
F812 43 plate .001 mfd. 1.40

VERNIER VARIABLE CONDENSERS

Including Dial and Knobs.

These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. One separately controlled vernier plate which permits of the best tuning.
F825 14 plate .00025 mfd. $1.95
F824 22 plate .0005 mfd. 2.33
F826 44 plate .001 mfd. 2.45

LOW LOSS VARIABLE CONDENSERS

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

Vernier Type (No dial included)

F833 11 plate, .00025 mfd. $2.28
F834 23 plate, .0005 mfd. 2.95
F835 43 plate, .001 mfd. 3.80

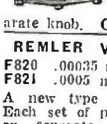
Plain Type (No dial included)

F836 11 plate, .00025 mfd. $1.90
F837 23 plate, .0005 mfd. 2.12
F838 43 plate, .001 mfd. 2.90

ENCLOSED VARIABLE CONDENSERS

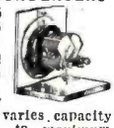
One of the best made condensers. Rigid, accurately spaced aluminum plates. Formica ends. Engraved scale. Knob and pointer.
F806 43 plate .001 Mfd. $2.80
F808 21 plate .0005 Mfd. 2.45

COTO VARIABLE CONDENSERS



F784 .00025 mfd. ...$3.90
F785 .0005 mfd. ... 4.18
F786 .001 mfd. 4.98
An unusually high grade condenser. Copper plates, soldered connections. Low loss type. Friction type vernier controlled by separate knob. Complete with dial.

REMLER VARIABLE CONDENSERS



F820 .00035 mfd. Ea. $4.25
F821 .0005 mfd. Ea. 4.25
A new type of condenser. Each set of plates mounted on separate shafts which are geared to dial shaft. Plates fold into each other complete revolution of dial varies capacity from almost absolute zero to maximum rated. No other condenser has such a range and this feature especially adapts it to superheterodyne and other sensitive circuits. Complete with dial.

ACME LOWEST LOSS CONDENSERS

F810 Each $5.10
Designed by Acme engineers for long service and efficient operation. Losses reduced to a minimum. Rotor plates supported on cast aluminum shaft. Enclosed in dustproof celluloid case. Friction vernier with knob. ¼ inch shaft. Requires 3 inch dial. One size only. Maximum capacity .0005 mfd.

ONE HOLE MOUNT

F832 Each.....$.20
Only a shaft hole need be drilled in panel for mounting variable condensers when using this device. Saves drilling and permits easy secure adjustment in any position.

FRESHMAN CRYSTAL DETECTOR

F760 Each.....$1.10
A double adjustable crystal detector especially suitable for reflex and other sets requiring a high grade detector. For front or back of panel mounting.

DUBILIER MICADON TYPE 601

F502 .0001	28c	F507 .0025	32c
F503 .00025	28c	F508 .003	40c
F504 .0005	28c	F509 .004	40c
F505 .001	32c	F510 .005	48c
F506 .002	32c	F511 .006	60c

DUBILIER MICADON 601G

Same style condenser as above with mounting for tubular grid leak. No grid leak included.
F581 .00025 mfd. Ea. 36c
F582 .0005 mfd. Ea...36c

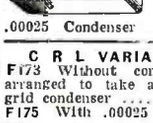
DUBILIER MICADON 601T

Consists of a Type 601 condenser with brackets designed to fit over terminals on audio frequency transformers, binding posts, etc.
F583 .001 mfd. 40c
F584 .002 mfd. 40c
F585 .0025 mfd. 40c

FRESHMAN MICA CONDENSERS

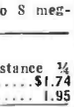
F518 .0001	26c		
F512 .00025	25c		
F513 .0005	26c		
F514 .001	31c		
F515 .002	31c	F516 .006	60c
F519 .0025	38c	F517 .01	80c
F520 .005	60c	F529 .015	$1.15

FRESHMAN VARIABLE GRID LEAKS



F177 Freshman back of panel style.....59c
F178 Freshman back of panel style with .00025 Condenser 79c
F171 Freshman base mounting type with .00025 Condenser 79c

C R L VARIABLE GRID LEAK



F173 Without condenser but arranged to take any standard grid condenser $1.05
F175 With .00025 condenser 1.35
A high grade article. Turning knob varies resistance from ¼ to 8 megohms.

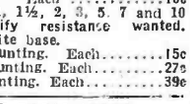
BRADLEYLEAK

F168 Without condenser. Resistance ¼ to 10 megohms $1.74
F169 With .00025 condenser..... 1.95

TUBULAR GRID LEAKS

Cut shows leak mounted. Leaks and mountings quoted separately.
F849 Grid leaks (can be used with Dubilier 601G condensers). Each 10c
Resistances—½, 1, 1½, 2, 3, 5. 7 and 10 megohms. Specify resistance wanted.
Mountings. Bakelite base.
F840 Single mounting. Each.....15c
F842 Double mounting. Each.....27c
F844 Triple mounting. Each.....39c

SUPERIOR RADIO JACKS

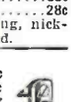


Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
F390 Open circuit. Each.....32c
F391 Closed circuit. Each.....39c
F392 Two circuit. Each.....49c
F393 Single circuit filament control..46c
F394 Two circuit filament control....59c

STANDARD JACKS

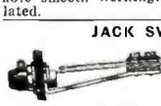
F387 Open circuit jack. Each.....22c
F388 Two circuit jack. Each.....28c
Well made, durable, smooth working, nickel finished frame. Well insulated.

NEW STYLE JACKS



F379 Single circuit 24c
F380 Double circuit 49c
Occupy less space than ordinary jacks. Binding posts make soldering unnecessary. Well made, durable smooth working. Well insulated.

JACK SWITCHES



Compact and durable radio switches. Mount on panel same as jacks. Furnished complete with On and Off name plate, knob and pointer.
F280 Two springs. Usually used as "A" battery switch. Each.....57c
F281 Three springs. For switching from long to short wave, from one battery to another, etc. Each.....65c

RADIO SWITCH

F287 Each.....25c
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

SUPERIOR RADIO SWITCH

F283 Each 25c
A switch fully equal to any on the market at a price about half what is usually asked for a switch of anywhere near equal quality.

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

WITH BARAWIK STANDARD RADIO GOODS

VACUUM TUBES

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

F105 Detector UV200, C300. Each $3.59
F112 Amplifier, UV201A, C301A. Each 3.59
F118 5-Watt Transmitter.. 7.70
F107 WD11, C11. Each... 3.59
F101 WD12, C12. Each... 3.59
F102 UV99, C299. Each... 3.59

ADAPTERS

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

F104 For UV199 or C299 tubes 43c
F109 For WD11 or C11 tubes 42c

VERNIER DIAL ADJUSTER

F941 Each 14c

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

C11 SOCKET

F136 Each 32c
Genuine moulded brown bakelite. Contact springs make firm contact with tube. For C11 or WD11 tubes.

BAKELITE SOCKET

F140 Standard base...33c
F141 UV199 base 33c
Moulded of genuine red brown bakelite. Binding post connections. Strong contacts. Real values.

EXTRA STRONG SOCKET

F142 Each 38c
Extra heavy. Double reinforced contact springs. For standard base tubes. A wonderful value.

PANEL MOUNT SOCKET

F143 Each 42c
The best socket value obtainable anywhere. Extra heavy, moulded, genuine brown bakelite. Double reinforced contact springs. Will mount on panel behind rheostat.

METAL TUBE SOCKET

F134 Each 27c
Nickel plated brass tube set in best grade composition base. Plainly marked binding posts. An excellent value.

STANDARD TUBE SOCKET

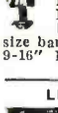
F150 Each.....76c
Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

199 SOCKET

F145 Each 59c
Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

BINDING POSTS

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



F370 Large size — barrel and knob ¾ in. long. Dozen ...70c
F372 Smaller size barrel and knob 9-16" long. Dz. 50c

F376 Large size with hole for phone tip or wire. Dozen ...80c
F378 Small size with hole for phone tip or wire. Dozen 35c

LETTERED BINDING POSTS

F375 Set of eight 39c
Nickel plated washers. Composition tops lettered as shown in illustration. Eliminate engraving. Improve appearance. Sold in sets of eight only.

COMPOSITION TOP BINDING POSTS

F374 Dozen 45c. Hundred $3.00
Composition top, nickel plated body. 6/32 screw with washer.

SWITCH CONTACT POINTS

Brass polished nickel finish. Have ⅝ in. long size 6/32 screws and two nuts.
F363 Dozen ....10c Hundred 75c
Thousand $6.75

Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.
F365 Dozen ....8c Hundred....30c

SWITCH LEVER STOP

Brass polished nickel finish.
F386 Dozen ...18c Hundred....$1.05

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

FILAMENT CONTROL RHEOSTATS

F132 6 ohm. Each....38c
F129 20 ohm. Each....40c
F131 30 ohm. Each....44c
F135 6 ohm. Vernier 95c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛ in. Tapered polished black knob 1¼" diam. Potentiometers. Match above rheostats. Same high grade construction.
F151 200 ohm. Each.....58c
F152 400 ohms. Each.....65c

SUPERIOR RHEOSTATS

F147 6 ohm 60c
F148 20 ohm 65c
F149 30 ohm 70c
One of the finest rheostats we have ever seen at a price that makes it the best value obtainable anywhere. Genuine bakelite base. Beautifully shaped black bakelite knob with white arrow. Single hole mounting. A rheostat you will be proud to have in your set.

FROST METAL FRAME RHEOSTAT

F161 6 ohm plain 50c
F162 6 ohm vernier.....65c
F163 35 ohm plain.....50c
F164 35 ohm vernier....65c
Nickel plated brass frame. Bakelite knob. Single hole mounting. Smooth action. Potentiometers to match above rheostats.
F165 200 ohm 50c
F166 400 ohm 50c

AMSCO RHEOSTATS

A complete line of rheostats and potentiometers of the highest quality. Bases and knob are genuine bakelite. Flange and arrow on knob give same effect as a dial. Smooth action.

F225 6 ohm plain .....$ .85
F226 20 ohm plain 1.05
F227 30 ohm plain..... 1.10
F228 6 ohm vernier 1.28
F229 20 ohm vernier 1.49
Potentiometers to Match Above Rheostats
F230 250 ohm $1.10
F231 400 ohm 1.30

HOWARD RHEOSTATS

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

F211 6 ohm plain rheostat.....$ .85
F212 6 ohm vernier rheostat 1.25
F213 25 ohm plain rheostat ..... .85
F214 25 ohm vernier rheostat..... 1.25
F215 40 ohm plain rheostat..... .85
F216 40 ohm vernier rheostat 1.25
F217 200 ohm Potentiometer..... 1.25
F218 400 ohm Potentiometer 1.69
F347 6 ohm Midget rheostat ..... .85
F348 25 ohm Midget rheostat ..... .85
F349 40 ohm Midget rheostat ..... .85
Single Hole Mounting Type with Dial
F350 6 ohm plain rheostat .....$ .95
F351 6 ohm vernier rheostat ..... .95
F352 25 ohm plain rheostat ..... .95
F353 25 ohm vernier rheostat ..... .95
F354 40 ohm plain rheostat ..... .95
F355 40 ohm vernier rheostat..... .95
F356 200 ohm Potentiometer 1.30
F357 400 ohm Potentiometer 1.69

BRADLEYSTAT and BRADLEYOMETER

F208 Bradleystat. Each ..$1.74
Latest style. Can be used with all types of tubes.
F209 Bradleyometer 200 ohm. Each $1.89
F210 Bradleyometer 400 ohm. Each $2.89

ACME POT-RHEO.

A rheostat and potentiometer combined in one unit. Does the work of two separate instruments. 300 ohm potentiometer.
F237 with 6 ohm rheostat $2.69
F238 with 30 ohm rheostat..... 2.69

AMPERITES

Eliminates rheostats on amplifier tubes where adjustment is not critical. Automatically adjust resistance according to flow of current keeping tubes at proper point for maximum efficiency. Complete with mounting.
F221 For UV201A or 301A tubes....95c
F222 For UV200 or C300 tubes.....95c
F223 For UV199 or C299 tubes.....95c
F224 For WD11 or C11 tubes 95c

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

F549 3 to 1 ratio..$2.25
F550 5 to 1 ratio.. 2.45
In quality of tone and volume of sound, the things a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers.
F587 Thordarson Ratio 3½ to 1 ....$3.30
F588 Thordarson Ratio 6 to 1..... 3.70
F589 Thordarson Ratio 2 to 1 ..... 3.95
F531 All American 10 to 1 shielded 3.80
F532 All American 5 to 1 shielded 3.80
F533 All American 3 to 1 shielded 3.60
F534 All American Push Pull. Each 5.10
F591 Modern 10 to 1. Each..... 4.50
F592 Modern Push Pull. Pair..... 9.90
F555 Federal No. 226. Each..... 4.45
F556 Federal No. 65. Each..... 6.35
F712 Radio Corp. Each..... 5.70
F595 Amertran 3½ to 1. Each..... 6.30
F596 Amertran 5 to 1. Each..... 6.30

TRICOIL RADIO FREQUENCY AMPLIFYING TRANSFORMER

F560 For 201A or 301A Tubes $1.58
F561 For 199 or 11 or 12 Tubes 1.58
This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 60 meters.

DUBILIER RURATRAN

F562 Each.....$3.48
A high grade, efficient radio frequency transformer that will give excellent results. Range 220 to 550 meters.

ACME TRANSFORMERS

F553 A. F. Transformers Each $3.95
Acme transformers are well known to every radio fan. They are made of the best grade materials and will give excellent service.

F565 R2 First Stage. Ea. $3.95
F566. R3 Second Stage. Ea. 3.95
F567 R4 Third Stage. Ea. 3.95

FAHNESTOCK CONNECTORS

F366

F367

F366 Single. Dozen 18c
F367 Double. Dozen 39c
Handy and convenient for connecting wires or making connections on binding posts or other parts of instruments. Wires held firmly in spring grip but may be instantly removed.

FAHNESTOCK ANTENNA CONNECTOR

F368 Antenna Connector. Each 8c
Requires no soldering. Makes connection in a few seconds.

TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.
F957 Round. Ten feet for.....12c
F958 Square. Ten feet for.....14c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.
F955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for 19c
F956 Best quality braid and covered with black insulating compound. 3 feet for..9c

BRASS ROD

Supplied only in 8 inch lengths.
F961 Threaded 6/32, per 8 in. length 6c
F963 Threaded 8/32, per 8 in. length 8c
F965 Solid 3/16 in., per 8 in. length 6c
F967 Solid ¼ in., per 8 in. length.... 9c

COPPER FOIL

F968 Per piece 25c
Thin copper foil for shielding panels. 6 inches wide. 2 feet long. .005 in. thick.

SUPERIOR VERNIER ADJUSTER

F942 Each.....26c
Polished black knob. "Vernier" engraved in white. Spring adjustment. Need not be disassembled for mounting. Easily installed.

RADIO "BAKELITE" PANELS

We supply genuine Bakelite, Condensite, Celeron or Formica, all of which have practically identical properties. Machines well without chipping. Won't warp. Waterproof. Attractive natural polished black finish which can be sanded and oiled.

Panel Size Inches	⅛" thick Art. No.	Price	3/16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	F450	$.55	F460	$.89	F470	$1.15
6x10½	F451	.86	F461	1.39	F471	1.60
7x14	F458	1.38	F468	1.73	F478	2.35
7x18	F453	1.78	F463	2.27	F473	3.15
7x21	F457	2.05	F467	2.65	F477	4.10
7x24	F459	2.42	F469	2.97		
7x26			F462	3.25		
9x14			F464	2.35	F474	3.15
12x14			F465	2.97	F475	3.98
12x21			F466	4.25	F476	5.70

RUBBER COMPOUND PANELS

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

Black Art. No.	Price	Size Inches	Mahogany Art. No.	Price
F481	$ .70	7x10	F493	$ .85
F482	.85	7x12	F494	1.00
F483	1.00	7x14	F495	1.20
F484	1.25	7x18	F496	1.50
F485	1.40	7x21	F497	1.65
F486	1.70	7x24	F498	1.95

COMPOSITION DIALS

Handsome dials moulded in one piece of polished black composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 3⅞ inch size have 180° scale marked 0 to 100.

Black No.	Price	Diam.	Shaft Size	Mahogany No.	Price
F921	16c	2"	3/16	F926	19c
F922	16c	2"	1/4	F927	19c
F923	22c	3"	3/16	F928	26c
F924	22c	3"	1/4	F929	26c
F925	27c	4"	1/4	F930	32c

GENUINE BAKELITE DIALS

F931 2 in. Diam. for 3-16 in. shaft. Each 35c
F932 2 in. Diam. for ¼ in. shaft. Each 35c
F933 3 in. Diam. for 3-16 shaft. Each 39c
F934 3 in. Diam. for ¼ in. shaft. Each 39c
F935 4 in. Diam for ¼ in. shaft. Ea. 48c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Match perfectly.

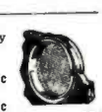
GANG SOCKET

F144 Each $1.39
Same construction as F143 socket but takes three standard base tubes. For base or panel mounting.

UNIVERNIER CONTROL DIAL

F918 For 3/16 in. shaft. silver dial, black knob $1.10
F919 For ¼ in. shaft. silver dial, black knob $1.10
F916 Gold dial, mahogany knob for ¼ in. shaft. Each.....$1.29
Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neutrodyne sets.

BEZELS



Finest quality. Fit any thickness panel.
F904 Nickel ¾ in diam. Each 15c
F905 Nickel 1 in. Diam. Each 15c
F906 Nickel 1½ in. Diam. Each.....15c
F907 Black ¾ in. Diam. Each.....15c
F908 Black 1 in. Diam. Each.....16c
F909 Black 1½ in. Diam. Each.....16c
F910 Gold ¾ in. Diam. Each.....28c
F911 Gold 1 in. Diam. Each.....28c
F912 Gold 1½ in. Diam. Each.....28c

PANEL ENGRAVINGS

F937 Per set 19c
A complete set of transfers in neat white lettering for marking connections, dials, etc. Easily applied in a few seconds. Look like real machine engravings, contrasts neatly on black or mahogany panels. Plenty of titles for the largest set.

BASE BOARDS FOR CABINETS

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

Art. No.	Length Inches	Price Each	Art. No.	Length Inches	Price Each
F435	6½	25c	F439	17½	33c
F436	9½	27c	F440	20½	35c
			F441	23½	37c
F437	11½	29c	F442	25½	39c
F438	13½	31c	F443	35½	50c

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

BUILD YOUR SET BETTER--AT LOWER COST

CABINETS

Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Inside depth 7 inches except 9x14, 12x14, 12x21 which are 10 inches deep.

Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
6x7"	F420	$1.95	7x21"	F425	$3.25
6x10½"	F422	2.45	7x21"	F429	3.60
7x10"	F421	2.60	7x26"	F431	3.95
7x12"	F424	2.85	9x14"	F428	3.55
7x14"	F423	2.95	12x14"	F430	4.00
7x18"	F426	3.05	12x21"	F432	5.05

DE LUXE CABINET

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

Panel Size	Art. No.	Price Each	Panel Siz	Art. No.	Price Each
7x21	F445	$7.75	7x26	F447	$9.50
7x24	F446	8.25	7x36	F448	11.75

RADIO TABLE

F901 Prepaid price, each.....$8.25
Well made of hardwood in fine dark mahogany finish. Extra strong. Top large enough for any set. Shelf holds all batteries and accessories. Drawer for tools and tubes. Just the thing for the home or for displaying sets in stores. Top is 16 by 30 inches. Height 28 inches.

COMBINED RADIO TABLE AND LOUD SPEAKER

F903 Prepaid price, each $19.95
Holds set, batteries and accessories. A very fine loud speaker with grille opening in front is built just under the top. Speaker has unusually good tone and volume. Fitted with genuine Baldwin unit. Made of selected wood with extra quality antique mahogany finish. Top size 29 x 15 in. Height 29 in.

CONSOLE RADIO CABINET

F902 Prepaid price, each $37.50
A high grade piece of furniture. Neat appearance. Elegant finish. Looks well among finest furnishings. Roomy compartments hold any set with batteries, charger and all accessories. Can be entirely closed and locked. Very accessible. Strong durable construction. Paneled doors. Fine mahogany finish. Takes panel 7x33 in. or smaller. 37 in. wide, 14 in deep, 42 in. high.

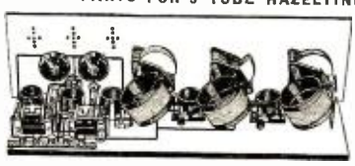
CABINET TYPE LOUD SPEAKER

F605 Prepaid price ea. $12.50
A fine loud-speaker with a ful rich tone and unusual volume. Amplifying chamber and unit enclosed in fine mahogany finished cabinet with silk backed grille front. Very convenient and better looking than most other types of 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 tried and successfully operated under many different conditions. The detailed instructions and diagrams supplied with each set make it easy for any one without previous experience to build an outfit that will give most satisfactory results. Parts supplied are for UV201A or C301A tubes throughout. If dry cell tubes are to be used specify type of tube in order and correct parts will be furnished without additional cost.

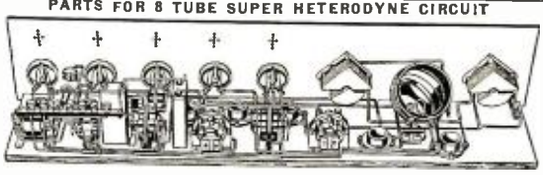
PARTS FOR 5 TUBE HAZELTINE NEUTRODYNE CIRCUIT



F858 Complete set Parts.....$33.50
All the parts needed to build this circuit which is the leader of all circuits today. Tunes thru interference. Easy to find stations once they have been located. Brings in distant stations on the loud speaker in clear pure tones with wonderful volume. Essential parts licensed under Hazeltine patents. Only the higher grade parts are used. The following items are included.

1—Kit containing 3 licensed neutroformers and 2 licensed neutrodons.
1—7x24x3/16 Bakelite panel drilled to mount parts.
1—Baseboard.
1—7x24 high grade cabinet.
3—4 inch dials for neutroformers.
5—Bakelite sockets.
7—Marked binding posts.
2—Rheostats 1-6 ohm, 1-30 ohm.
1—.00025 grid condenser with leak.
2—.006 mica fixed condensers.
2—Audio frequency transformers.
2—Best quality jacks.
1—"A" battery switch.
30 ft. Tinned bus wire.
12 ft. Spaghetti tubing.
Instructions for wiring and assembling.

PARTS FOR 8 TUBE SUPER HETERODYNE CIRCUIT

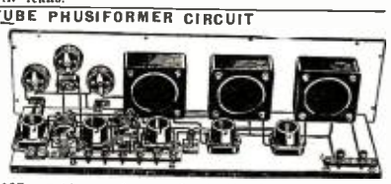


F884 Complete set of parts.....$57.95
One of the newest circuits. Produces wonderful results when properly handled. This set requires careful construction and tuning and we only recommend it to persons who have had some experience in building sets. Designed to be used with loop. Brings in distant stations thru any interference, with good volume and with unusually clear pure undistorted tones. Drilled panel and clear instructions insure best results. The following parts are included.

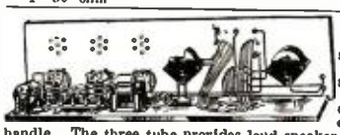
1—7x36x3/16 Bakelite panel drilled to mount parts.
1—Baseboard.
3—Intermediate frequency transformers.
1—Filter coil.
1—Oscillator coil.
2—Best grade vernier variable condensers with dials.
8—Bakelite sockets.
3—30 ohm rheostats.
1—6 ohm rheostat.
1—400 ohm potentiometer.
2—Single circuit jacks.
2—Double circuit jacks.
2—Audio frequency transformers.
1—4 inch dial.
1—"A" Battery switch.
2—.00025 grid condensers with leaks.
5—.00025 mica condensers.
2—1 mfd. by pass condensers.
1—.005 mica condenser.
1—.002 mica condenser.
7—Marked binding posts.
40 ft. Tinned bus wire.
9 ft. Spaghetti tubing.
Screws, lugs, washers, etc.
Instructions for assembling.

PARTS FOR 5 TUBE PHUSIFORMER CIRCUIT

F880 Complete set of parts $35.95
One of the easiest sets to build. Best results assured. Two stages tuned radio frequency amplification detector and two stages audio amplification. Brings in the distant stations with great volume and purest tones. The following parts are included:



1—7x26x3/16 Bakelite panel drilled to mount parts
1—Baseboard
3—Phusiformers with dials
5—Bakelite sockets
2—Rheostats, 1—6 ohm, 1—30 ohm
1—.00025 grid condenser with leak
1—.006 mica condenser
1—.001 mica condenser
1—3 spring jack
1—Single circuit jack
2—Audio frequency transformers
1—"A" Battery switch
7—Marked binding posts
30 ft. Tined bus wire
12 ft. Spaghetti tubing
Instructions for assembling

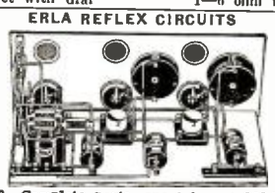


PARTS FOR REINARTZ CIRCUIT

F862 Complete set of parts for one tube set $10.75
F863 Complete set of parts for three tube set $17.95
One of the best circuits for bringing in distant stations. Can be built at very low cost yet produces fine results. Easy to handle. The three tube provides loud speaker volume on distant stations. It contains all parts listed below for a one set and in addition 2 sockets, 2 audio transformrs and 2 rheostats and has a 7x21 Panel. The following parts are supplied for the one tube set.

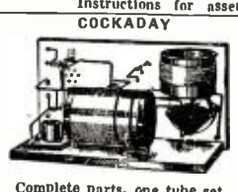
1—Green silk spider web Reinartz coil
1—7x18x3/16 Bakelite panel drilled to mount parts
1—Baseboard
1—11 plate vernier condenser set with dial
1—23 plate plain condenser
1—9 inch dial
3—Switch levers
24—Switch contact points
6—Switch stops
1—Bakelite socket
1—6 ohm rheostat
1—Single circuit jack
5—Marked binding posts
1—.00025 grid condenser with leak
30 ft. Tinned bus wire
12 ft. Spaghetti tubing
Instructions for assembling

ERLA REFLEX CIRCUITS



F876 Complete parts, one tube set $19.75
F877 Complete parts, 2 tube set....: 27.80
F878 Complete parts, 3 tube set.... 34.90
These circuits have opened a new field in radio. One tube does the work of three in an ordinary set, two equal four, three equal five Crystal detector improves quality of reproduction preserving the full mellow tones of the original. Easily handled, will bring in distance well. All parts are exactly as specified in Erla circuits. Panels are drilled for easy assembly. One tube set has 6x7 panel, two tube 7x14, three tube 7x18.

COCKADAY



F873 Complete parts, one tube set..$10.25
F874 Complete parts, 3 tube set.... 18.75
A very selective set that will tune out even near by stations. A favorite circuit with many builders. One tube set has 7x14 panel 3 tube 7x21. Panels are drilled for easy assembly. Instructions furnished for assembly.

IN addition to the circuits described above we can furnish complete parts at attractive prices for Harkness, Acme Reflex and all new circuits. Write for prices on any circuit in which you are interested.

LICENSED NEUTRODYNE PARTS

F852 Licensed Neutrodyne Kit $14.95
Includes three licensed Neutroformers, 2 neutrodons, panel layout, template and book of instructions for building up neutrodyne set. By adding other parts a neutrodyne set can be built at low cost.

FADA NEUTRODYNE PARTS

F855 .....$21.00
A combination package of three neutroformers and two neutrodons with instruction book.

FADA PARTS FOR 5 TUBE SET

F857 Complete $49.00
Contain all necessary parts including drilled panel, careful instructions, sockets, dials, condensers, transformers, bus bar wire and fine mahogany finish cabinet.

SPIDER WEB COIL FOR REINARTZ CIRCUIT

F296 Each $1.10
A very unusual value. Made of green silk covered wire, spiderweb wound, 21 taps so arranged that crossing avoided. Mounting bracket permits various styles of mounting. Directions included.

COCKADAY PARTS

F298 Per set $1.65
Complete set coils for Cockaday circuit. Properly calculated and made to give best results in this new wonder circuit.
F276 Amplex grid-denser for Cockaday Improved 5 tube circuit.....$1.10
F277 48000 ohm genuine "Lavite" Resistances. Each.....$1.05

ERLA REFLEX PARTS

Genuine Erla Parts

F599 Selectoformer $3.95
F578 No. 1 Reflex Transformer 3.95
F579 No. 2 Reflex Transformer 3.95

F597 6 to 1 Audio Transformer ...$3.95
F598 3½ to 1 Audio Transformer $3.95
F740 Erla Crystal Detector 89c

PARTS FOR SUPER HETERODYNE

F885 Raven Super Heterodyne Kit $22.50
Consists of one oscillator coil, one tuned stage transformer coil and three intermediate frequency transformers. Coil forms and trans former cases moulded of genuine bakelite. Book on Super Heterodyne construction included.

REMLER SUPER-HETERODYNE KIT

F887 Per set $22.00
Set includes one oscillator coil, one tuner stage transformer with condenser mountings attached, three intermediate frequency transformers, and wiring diagram. These parts in circuit recommended have been built up into some of the most satisfactory sets.

BRANSTON SUPER-HETERODYNE KIT

F889 Per set $29.50
Contains the special parts necessary for a seven tube Super-Heterodyne set, an oscillator coupler, one tuned stage transformer, three intermediate radio frequency transformers and one antenna coupler. Panel layout and instructions included.

PARTS FOR ULTRADYNE CIRCUIT

F892 Set of four transformers. One input and three radio frequency transformers $22.00
F893 Antenna Coupling Coil..... 1.90
F894 Oscillator Coil 1.90

ULTRA AUDION COIL

F297 Each .....$.85
Spider web wound of green silk covered wire. Four taps. Produces wonderful results. Fibre strips and wooden rod for mounting and directions included.
F865 Complete set of parts for Ultra Audion one tube set using above coils $7.95
F866 Complete parts for 3 tube set $15.95

DIXIE SCREW ASSORTMENT

F351 100 pieces screws and nuts 43c
Contains screws and nuts of size and style needed for assembling any radio set.

PRICES NOW ARE LOWER THAN EVER BEFORE

STORAGE "A" BATTERY

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

F194 6 volt, 60 amp. size. Each...$9.90
F196 6 volt, 100 amp. size. Each...13.25

BATTERY CHARGER

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

F201 For 6 volt battery.....$12.95
F203 For 12 volt battery..... 12.95
Noiseless Rectifier Bulb Charger—King, Tungar or Rectigon.
F255 2 ampere size $15.95
F256 5 ampere size 24.95

HYDROMETER

F190 Each.....48c
Helps keep battery in better shape by showing exact condition.

BATTERY CLIPS

F198 Two for 28c
Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

"A" BATTERY CORDS

F191 Per pair 69c
Two heavy insulated stranded copper wires 5 feet long. Battery clip on one end and binding post terminal on other end. Eliminate shorting of a battery. Provide positive connections.

CONNECTING CORD SET

F192 Each.....48c
Consists of 5 connecting cords with braid over all. Each cord has distinctive colored covering. Terminals for connections. Makes connecting of both A and B batteries to set easy with no mistakes in polarity or voltage. Long enough to reach from table to floor or for use in any type cabinet. Does away with unsightly wires.

PLATE CIRCUIT "B" BATTERIES

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

F180 Small size 2 by 2½ by 3⅝ inches 22½ volts. Each 95c
Ten for $8.60
F184 Large size. 5 taps. Size 3x4x6½ inches. 22½ volts. Each $1.65
Ten for $14.70
F188 Large size. 0 taps. Size 3x8x6½ inches 45 volts. Each.....$2.90
Ten for $27.90

VERTICAL "B" BATTERIES

F181 22½ volt. New upright size 3x2½x5½ in. Takes less space in set. Each.....$1.50
F183 45 volt upright size 3x7x8 in. Each $2.90. Ten for $27.90
F185 New Jumbo size 45 volts. Height 7¼ in. Length 8⅛ in. Width 4½ in. Especially designed for large sets. Gives about twice the service of above battery. Each .....$4.45. Ten for $39.00

"C" BATTERY

F186 4½ volt C Battery size 4x1⅜x3 in. Each .....$.42. Ten for $3.95

STORAGE "B" BATTERIES

F202 12 cells, 24 volts. Each $4.18
More economical than dry cell "B" batteries on sets using 3 or more tubes. Can be recharged when run down. Capacity 2500 milliamperes. A high grade battery. Glass jars with rubber caps. Strong moulded tray. Shipped dry so as to be mailable. No Electrolyte included. If electrolyte not obtainable locally order below.
F204 Electrolyte for above (not mailable) 40c

"B" BATTERY CHARGER

F205 Each.....$8.95
Recharges 24 or 48 volt B batteries from 110 volt 60 cycle light socket rapidly and at practically no cost. Keeps batteries in good condition.

We Pay Transportation Charges In U. S. East of the Rockies

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

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

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

BARAWIK QUALITY HEADSETS

F770 Per Set. 2000 ohms.....$2.60

These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. The receiver cases are fine polished finish with polished black ear pieces. Comfortable fabric covered head band. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them.

STANDARD BRAND HEADSETS

F772 Little Tattler Head Sets.....$2.60
F754 Baldwin Type C..... 8.95
F753 Baldwin Junior Headsets 4.95
F764 Frost, 2000 ohm 3.30
F766 Frost, 3000 ohm..... 3.95
F751 Murdock 56, 2000 ohm 3.25
F752 Murdock 56, 3000 ohm 3.90
F768 Brandes Superior, 2000 ohm..... 4.95
E769 Brandes Navy, 3000 ohm 6.95

BATTERY METERS

F189 Each.....$.89
Reads 0 to 50 volts. Accurately tells you condition of "B" Battery. Convenient watch size. Polished nickel case with wire lead. Tests 22½ and 45 volt batteries.
F193 Combination meter $1.30
Reads 0-50 volts; 0 to 25 amperes. Test "B" and "A" dry cells.

PHONE CUSHIONS

F774 Pair 43c
Made of soft sponge rubber. Light as a feather. Fit any phones. Exclude all noises and make wearing phones a pleasure.

OUR SPECIAL LOUD SPEAKER

F613 Each.....$6.75
Careful tests have proven this speaker to be equal in quality of tone and volume to most speakers advertised at $25.00 or less. That's a strong statement if you bear in mind the price we ask but we are so sure that this speaker will please you that you can try it for 10 days. If you don't like it at the end of that time, return it and get your money back. Beautifully finished fiber horn, bell diameter 10 inches. Height 21 in. Handsome heavy base prevents tipping. Connecting cord included.

STANDARD BRAND LOUD SPEAKERS AND UNITS

F618 Brandes Table Talker.....$9.25
F615 Pathe Loudspeaker 15.95
F616 Atlas Loudspeaker 22.50
F620 Baldwin Loud Speaker 22.50
F604 Baldwin Junior Loudspeaker...14.95
F603 Magnavox M4 Loudspeaker....21.00
F612 Magnavox R3 Loudspeaker ...29.50
F614 Magnavox M1 Loudspeaker ...26.50
F617 Music Master Loudspeaker ..27.00
F757 Morrison Adjustable Unit ... 4.45
F755 Genuine Baldwin Type C unit 4.75
F608 Atlas Unit. Each.....10.75

LOUD SPEAKER UNITS WITH PHONOGRAPH ATTACHMENTS

Make a loud speaker of your phonograph. These attachments consist of a high grade speaker unit arranged to attach to tone arm of phonograph in place of a reproducer. Fit Victor, Sonora, Silvertone and other phonographs having same size tone arm.
F602 Baldwin Loud Speaker Unit with phonograph attachment. $8.80
F607 Western Electric Loud Speaker Unit with phonograph attachment..... 9.95

PHONOGRAPH ADAPTERS

F771 Fits single unit to tone arm. Each 39c
F773 Fits any double headset to tone arm. Each...65c
Convert your phonograph into a loud speaker. Take off the reproducer and replace with adapter and unit or headset. Such a combination will equal or surpass in tone and volume many high priced speakers.

SUPERIOR RADIO PLUGS

Both styles take two sets of cord tips. Polished round barrels.
F397 With turned fiber barrel. Highest grade obtainable. Each.....44c
F395 With black moulded composition barrel. Each 25c

NEW STYLE PLUG

F401 Each.....59c
Cords are held firmly in place but can be detached instantly without taking plug apart. No screws to loosen. Bakelite body. Fits all standard jacks. Best plug made.

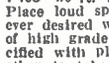
MULTIPLE PLUG

F402 Each.....89c
Attach any number of headsets up to four. Cords attached or detached instantly without taking plug apart.

EXTENSION CORDS

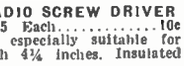
F403 30 ft. $1.95
Place loud speaker wherever desired without moving set. Consists of high grade receiver cord of length specified with plug on one end and jack on other to take plug on loud speaker cord.
F404 30 foot cord only. No plug or jack. Each $1.10

RADIO SCREW DRIVER



F945 Each.....10c
Small screwdriver especially suitable for radio work. Length 4¼ inches. Insulated handle.

LONG BLADE SCREWDRIVER

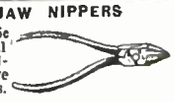


F947 6 inch ...20c
F948 8 inch ...25c
F949 10 inch 30c
Long narrow blade makes it easier to get in difficult places. Wood handle. Length given is over all.

LONG NOSE PLIERS

F970 Each..83c
The handiest pliers for radio work. Made of fine hardened steel. Length 5".

DIAGONAL JAW NIPPERS

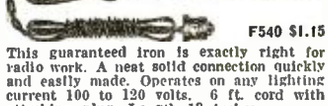


F972 Each.....75c
For fine electrical work, made of hardened steel. Cuts wire clean in tight places. length 5 inches.

RADIO SOLDER SET

F538 Complete ...83c
Handy for soldering radio connections or for general small repair jobs. Consists of soldering copper with handle, sal ammoniac, soldering salts, solder and sand paper.

RADIO SOLDERING IRON



F540 $1.15
This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches.

Heavier irons for general repair work. Wonderful values at our prices.
F541 Medium size $3.48
F542 Large size 4.25

TINOL

F969 Per tube ..19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

AUTOMATIC BLOW TORCH

F543 Each.....$1.19
Burns denatured alcohol. Automatically generates pointed flame in a few seconds. Easy to solder joints in hard places. Lights with a match. Burns 20 minutes on one filling. 5½ inches high, ⅞ inch diameter cylinder. Works fine with Tinol listed below.

SUPER BLOW TORCH

F544 Each.....39c
Burns denatured alcohol. Blowing on rubber tube produces a hot pointed flame. Lights with a match. Burns 10 minutes on one filling. Easy to solder joints in hard places 3 in. high. ⅞ in. cylinder. Produces fine joints with Tinol.

HEXAGON NUT WRENCHES

F950 Set of 3...60c
Handiest tool made for tightening hexagon nuts. Fit nuts for 4/36, 6/32, nd 8/32 screws, the three most popular radio sizes.

ANTENNA MAST FITTINGS

F952 for ½ inch pipe per set $1.00
F953 for 1 inch pipe per set $2.50
Set includes adjustable base to fit roof peak or flat surface, center guy wire fastening ring and top cap with pulley for rope to raise and lower antenna. No pipe included. Makes the installation of a first class antenna simple and inexpensive.

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
F248 100 ft. coil 48c F249 500 ft. coil $2.30

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials. leads or wiring instruments.
Solid Bare Copper Wire. Size 15.
F240 100 ft. coil 42c F242 500 ft. coil $2.05

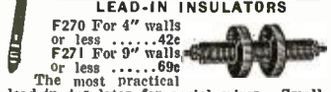
ANTENNA INSULATORS

F263 Ribbed Porcelain insulator, 2½ in. long. Ea. 6c
Dozen 55c
F260 Size 1x3¼. Composition metal eyelets. Two for 17c
F265 Ribbed porcelain insulator—5 inches long. Each.....15c

ANTENNA LEAD-IN

F259 .....17c
Antenna wire is brought in without drilling a hole. Place on window sill and window can be closed down tight and locked as before. Well insulated. Can be bent into any shape. Made of copper strip properly insulated.

LEAD-IN INSULATORS

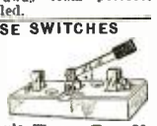


F270 For 4" walls or less 42c
F271 For 9" walls or less 69c
The most practical lead-in insulator for aerial wires. Small, neat, effective, durable. Fits ⅝ inch hole. Securely locked by two adjustable nuts.

WALL MOUNTING INSULATOR

F262 Each 7c
Dozen 65c
Galvanized screw mounting. Lead in wire passes through center of porcelain insulator and is kept away from possible grounds. Easily installed.

PORCELAIN BASE SWITCHES



Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.
F385 Single Pole Single Throw. Ea...20c
F383 Single Pole Double Throw. Ea..32c
F384 Double Pole Double Throw. Ea..50c

OUTDOOR LIGHTNING ARRESTER

F980 .....$1.24
Protect your instruments with this lightning arrester. Weatherproof Bakelite case. Underwriters approved.

JEWELL LIGHTNING ARRESTER

E981 Each.....85c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved. Lists for $1.10.

SUPERIOR LIGHTNING ARRESTER

F982 Each.....59c
Porcelain block with brass binding posts. Dependable and effective.

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

Here are the who have put on Formica

NEARLY every well-known independent radio manufacturer is represented in the list of Formica radio customers which we show below. These men know what they are doing. Their preference for Formica is based only on reasons of quality and service. They have tried everything. They know that the reputation of their sets depends as much on its insulation as on any one thing. Experience with hundreds and in some cases thousands of sets weekly has shown them that Formica fills the bill.

Some of them use Formica panels, Formica winding tubes, Formica base panels and Formica back panels. In all hook-ups incorporating radio frequency amplification, the tendency is distinctly to — *use more Formica!*

A. C. Electric Co.
Acme Apparatus Co.
Ainsworth-Gates Co.
Air-Way Electric Appliance Co.
American Radio & Research Co.
American Steel Package Co.
Andrea, Frank A. D.
Apex Radio Company
Bailey Engineering Co.
Benwood Co.
Bowman Co., A. W.
Brandes, Inc.
Branston, Inc., Chas. A.
Bremer-Tulley Co.
Bunnell, J. H.
Cardwell Mfg. Co., Allen D.
Carter Radio Co.
Central Station Equipment Co.
Chelsea Radio Co.
Chicago Radio Apparatus Co.
Clapp Eastham Co.
Cleartone Radio Co.
Cleveland Apparatus Co.
Cleveland Products Co.
Cleveland Radio Mfg. Co.
Connecticut Telephone & Elec. Co.
Consolidated Radio Cali Book Co.
Coto-Coil Co.
Crescent Radio Mfg. Co.
Crosley Mfg. Co.
Cutting & Washington
Dayton Fan & Motor Co.
DeLancey, Felch & Co.
Doron Bros. Elec. Co.
Eagle Radio Co.
Echo Radio Co.
Eclipse Manufacturers, Inc.
Electric Machine Corporation
Elliott, Howard W.
Experimenters Information Service Co.
Fargo Radio Service Co.
Fast Feed Drill Co.
Federal Institute of Radio Telegraphy
Federal Telegraph Co.
Federal Telephone & Telegraph Co.
Ferbend Electric Co.
Fireside Radio Set Co.
Franklin Engineering Laboratories Co.
Freed Eisemann Co.
Galvin Electric Co.
Garod Corporation
Gled Radio Co.
Golden Luetz Co.
Great Eastern Radio Corporation
Hall Radio Co.
Hallock & Watson
Halliwell Electric Co.
Hartman Electric Co.
Heintz & Kohlmoos, Inc.
Herzog Radio Corporation
Heslet Radio Corporation
Howard Radio Co.

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

Radio Manufacturers their stamp of approval by using it Themselves.

Ingersool Radio Shops
Jones Radio Co.
Karbon Products Co.
Kellogg Switchboard & Supply Co.
Kennedy Co., Colin B.
Klaus Radio Co.
Koehler Machine Co.
Lynn Radio Co.
Luma Electric Co.
Magnovox Co.
Malone Lemmon Co.
Manhattan Electric Co.
Marco Meyer & Co.
Merchant Co., A. P.
Mercury Radio Products Co.
Midwest Radio Co.
Modern Electric Mfg. Co.
Moon Radio Corporation
Murad Radio Laboratories
Murdock Co., Wm. J.
National Transformer Mfg. Co.
Northwestern Radio Mfg. Co.
Ozarka Radio Co.
Pathe Phonograph & Radio Corporation
Phanstiehl Radio Co.
Pioneer Hardware Co.
Precision Machine Co.
Radio Apparatus Co.
Radio Corporation, R. T.
Radio Guild, The
Radio Electric Co.
Radio Instrument Co.
Radio Reception Co.
Radio Service Co.
Radio Service Laboratories
Radio Service & Mfg. Co.
Radio Shop, Inc.
Rauland Mfg. Co.
Reynolds Radio Co.
Sargent, E. M. Co.
Seeley Radio Co.
Signal Electric Co.
Simplicity Mfg. Co.
Simplex Radio Co.
Sleeper Radio Corporation
Stern & Co.
Stromberg-Carlson Tel. Mfg. Co.
Telephone Maintenance Co.
Thompson Mfg. Co.
Trego Radio Co.
Trosco
Tuska, C. D.
Unique Radio Co.
Waveland Radio Co.
Wells Mfg. Co.
Western Coil & Electric Co.
Western Electric Co.
Western Radio Co.
Wholesale Radio Electric Co.
Wilcut, J. A.
Wireless Mfg. Co.
Wireless Shop, The

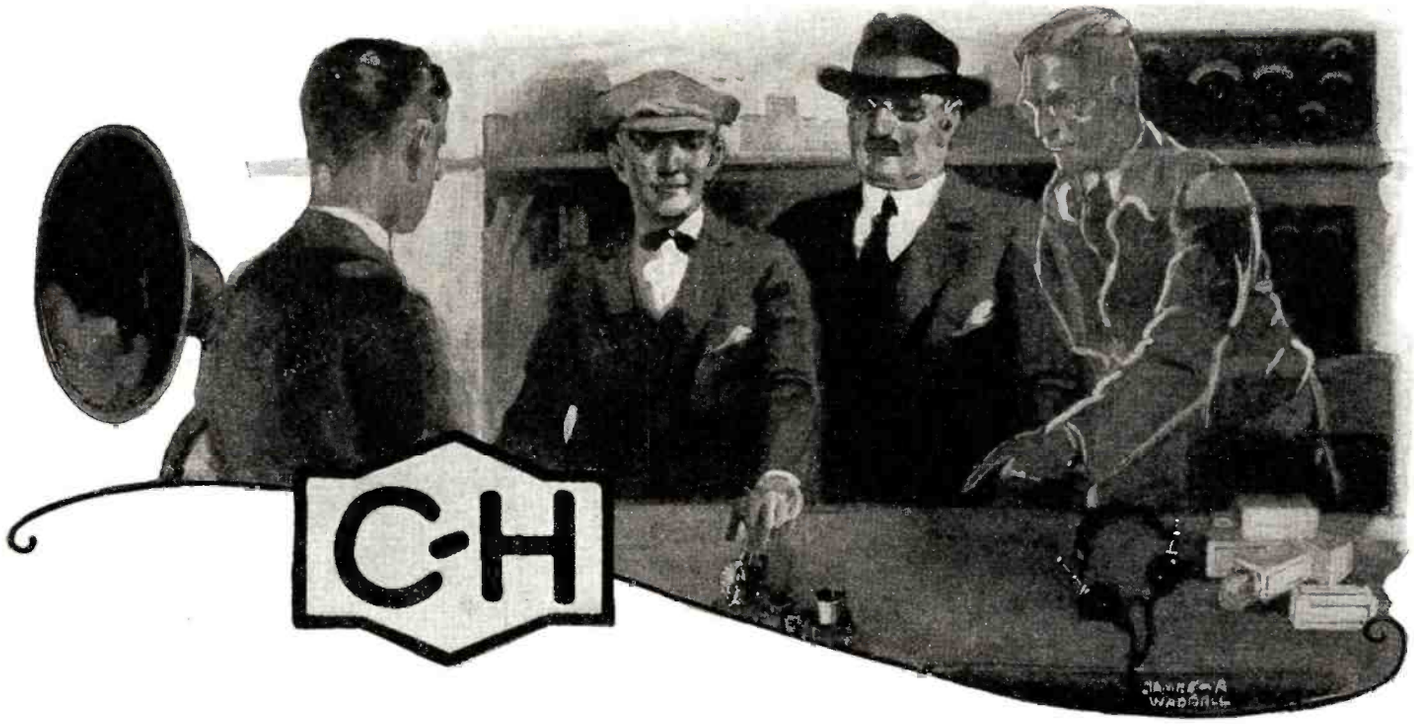
Amateurs naturally feel that if Formica is best for these manufacturers to use in some of the best sets built in America — it is best to use in their own sets. Dealers know that Formica builds business for them — and that Formica service is the best in the business.

THE FORMICA INSULATION COMPANY
4618 Spring Grove Avenue, Cincinnati, Ohio

Sales Offices

50 Church St., New York, N. Y.
422 First Ave., Pittsburgh, Pa.
1142 Granite Bldg., Rochester, N. Y.
419 Ohio Bldg., Toledo, Ohio
1210 Arch St., Philadelphia, Pa.
1026 Second Ave., S. Minneapolis, Minn.
585 Mission St., San Francisco, California
Whitney Central Bldg., New Orleans, La.
516 Caxton Bldg., Cleveland, Ohio
9 S. Clinton St., Chicago, Ill.
708 Title Bldg., Baltimore, Md.
47 King St., Toronto, Ontario

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS



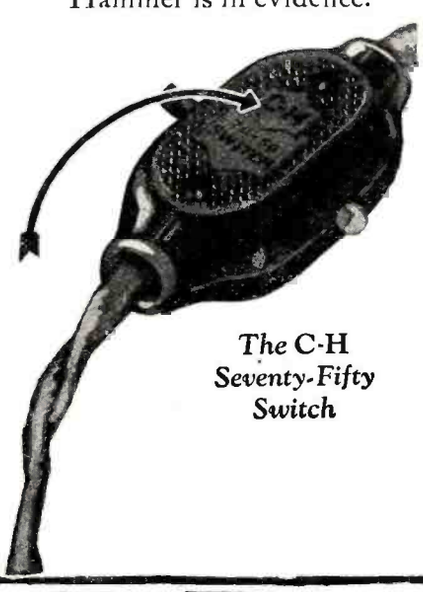
Demanding This Famous Trade Mark Is Like Having an Engineer Buy Your Radio Parts

Built into each Cutler-Hammer radio device is the experience of more than a quarter of a century in electrical control design. When you ask for this trade mark that brings you the best in engineering skill, you are doing merely what electrical engineers in industry have done for several decades.

To thousands of inexperienced radio enthusiasts, this trade mark has been the guide to success in reception—for in demanding it on the apparatus for their sets, they have obtained, without knowing just what to look for, the features and precision that radio engineers recommend.

The Name CUTLER-HAMMER Is Practically a Synonym for Electrical Control

From the large controlling apparatus of giant steel mill machinery to the little 70-50 switch of which more than three million are serving on appliance cords today, the C-H trade mark is a guarantee of satisfaction. Wherever electrical control is required, the name Cutler-Hammer is in evidence.



The C-H Seventy-Fifty Switch

C-H CUTLER-

The Secret of Success in Radio Lies in Precise Control

Rheostats may be built down to a size, a price, or any other restriction—but the Cutler-Hammer engineers recognized that quality and precision were the outstanding requirements of apparatus for control of the very heart of your radio set, the vacuum tube. Hence C-H rheostats were conceived in metal, with *real* bearings to give true operation throughout the entire life of the set. They give an even change of resistance, through long, flexible contact fingers that afford constant pressure. You can demand them for the control of any tube—and *be sure* of maximum receiving pleasure.

Buy With Care—Build With Confidence

The C-H Variable Grid Leak, too, is a refinement worth many times its cost. By accurately controlling the discharge of the grid condenser, signals are given a clarity and roundness of tone that adds a new enchantment to every program.

Then the C-H potentiometer with the resistance unit that does not wear and cannot be displaced, even under continuous use, is ideal for the most exacting requirements of radio construction. The C-H Radio Switch, of which more than one-half million are in use today—the switch with the real radio mechanism—affords convenient and quiet control. The new orange-shell socket whose low-loss design has attracted the attention of every radio engineer; all of these will help you to build a better set, and their cost is no higher despite their guaranteed quality. Demand the C-H trade mark and build with confidence!

THE CUTLER-HAMMER MFG. CO.
Member Radio Section, Associated Manufacturers of Electrical Supplies
MILWAUKEE, WISCONSIN

C-H

Instruments of Guaranteed Quality Assure Success in Radio

The C-H Radio Rheostat
Furnished in 4 ohm, with or without vernier, 30 ohm, and 125 ohm to provide perfect control for any tube.

The C-H Variable Grid Leak
Mounted on the tube socket-panel controlled. Adjustable for all grid condensers.

The C-H Radio Potentiometer
The potentiometer with the resistance unit that does not wear and cannot be displaced under constant use.

The C-H Radio Socket
The low-loss socket with the orange shell. Perfect design—silvered contacts—attractive appearance.

The C-H Radio Switch
The switch with the perfect mechanism for providing easy control of the most delicate circuit without introducing microphonic noises—one hole mounting.

HAMMER

Are You Within the Headlight's Beam?

The big, practical idea behind MOTOR CAMPER & TOURIST is to help everybody get the most from their motor trips, helping everybody to motor pleasantly, conveniently and comfortably and helping everybody to select the most favorable itinerary for their trip.

Each Month are published new, interesting routes, new motoring hints, new scenic points of interest and new ideas for motor campers new and old so that all can keep abreast of the progress of Motor Traveling.

MOTOR CAMPER & TOURIST is the beam of the headlight, illuminating the roadway of Motor travel everywhere. Get in the beam's light by sending in your subscription on the coupon below provided for that purpose inclosing $2.50.

MOTOR CAMPER & TOURIST is edited by H. Gernsback, editor of Radio News, Science and Invention and Practical Electrics. The managing editor, Mr. John D. Long has camped up and down the highways and byways of the United States and is the Author of the book "Motor Camping", the authority on Motor Touring.

FOR YOUR SUBSCRIPTION R.N.-10

GERMOTT PUBLISHING CO., Inc.
53 Park Place, New York City

Gentlemen:

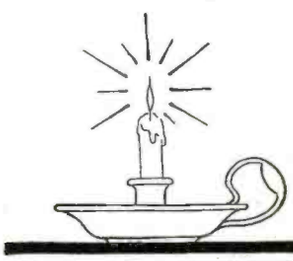
Enclosed find $2.50 for my subscription for one year to MOTOR CAMPER & TOURIST.

Name .....

Address .....

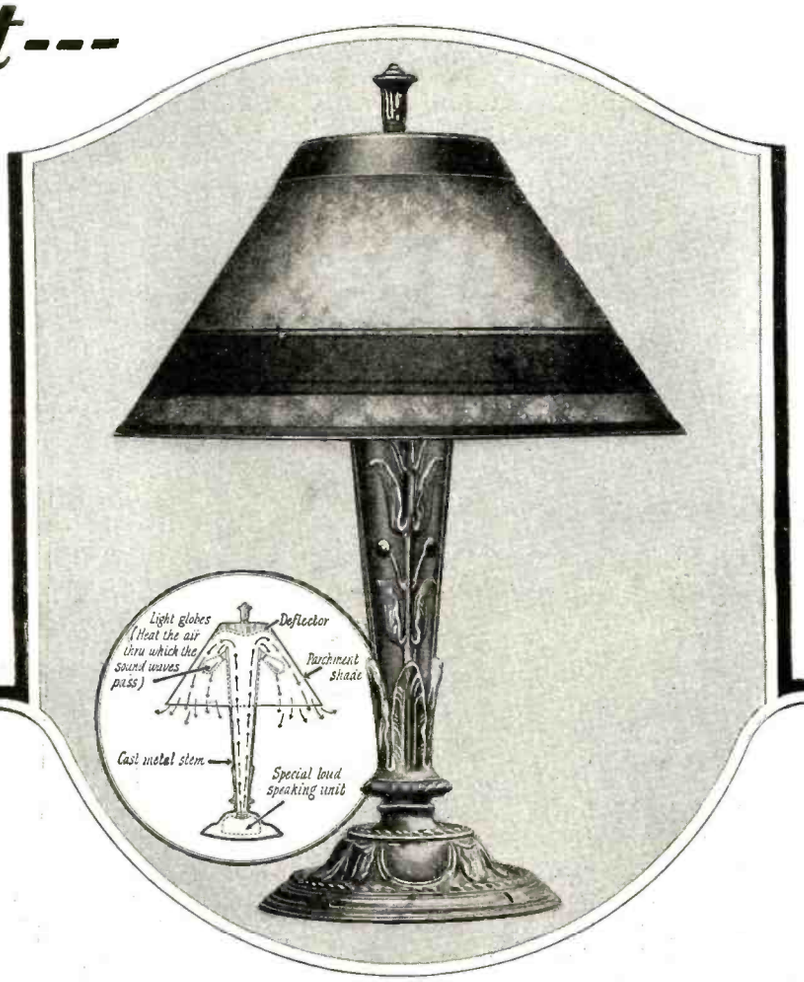
City and State.....

At Last---



Soft Mellow Light

You attach the light cord to any socket and switch on a soft glowing light. Then and there you will be convinced that you have the most beautiful library lamp money can buy.



Clear Resonant Radio Tone

Simply attach the Radialamp in place of the head phones. Then switch on your Radio set. Instantly the room is flooded with music so amazingly clear—so flawlessly resonant—you will wonder that any Radio loud speaker can give such perfect reproduction. No. extra batteries—no adjustments.

This Amazing New Twin-Feature RADIO LOUD-SPEAKER

THERE have been "horn type" loud speakers, box loud speakers, cabinet loud speakers—but never before in the history of Radio has there been such a sensation as the RADIALAMP. It is a loud speaker. It is a library lamp. Also it is an indescribably better loud speaker, from the perfected unit in the base, to the taut parchment shade that gives it the flawless, human tone resonance. And it is an incomparably more beautiful lamp, from the artistic cast metal stem to the light-mellowing shade made of specially selected parchment.

Two Superior Features For the Price of Either

As a loud speaker alone compare the RADIALAMP with any of the old type horns. Examine it carefully—see the latest scientific principles that make it a superior Radio horn. From the loud speaking unit concealed in the base the tone is amplified through the tapered tone chamber to the "sound mirror" in the top of the shade. Here it is deflected into the parchment shade through the warm air which is kept at a uniform heat by the light globes. The sound waves are intensified by the warm air which greatly increases the purity of the tone. Even if you already have an old-type loud speaker you will also want the RADIALAMP for its beautiful music and its excellent reading light. You can put it in another room—if you wish to. Easily connected by a long wire to your receiving set.

Step in to your dealer to-day—see the RADIALAMP for yourself—you will be won over instantly by its astonishing beauty — it will positively add to the grace and charm of the already lovely furnished home. As an art piece—you will see that it is in a class by itself, and the price—the RADIALAMP is a superior lamp and loud speaker for the usual price of either one. If your dealer hasn't it, just fill in and mail the coupon. It will bring you complete information.

DEALERS

You Can Cash In On This Radio Sensation

Put this beautiful lamp and radio horn on your counter and sell it for the price of either a good lamp or loud speaker — both for the price of one. Put it into the window. See the radio fans collect —watch them stream in to ask questions, see them admire the beauty of the lamp—especially when it is lighted and they can appreciate the soft, mellow light as well as hear the perfect tone reproduction. Thousands are buying Radialamps in New York. It will make just as big a hit in your city. Write for further information.

Radiolamp Company
Dept. 110
334 Fifth Ave. New York

ON SALE AT LEADING RADIO STORES EVERYWHERE

RADIALAMP
TRADE MARK
LOUD SPEAKER

Radiolamp Co., Dept. 110
334 Fifth Ave., New York.

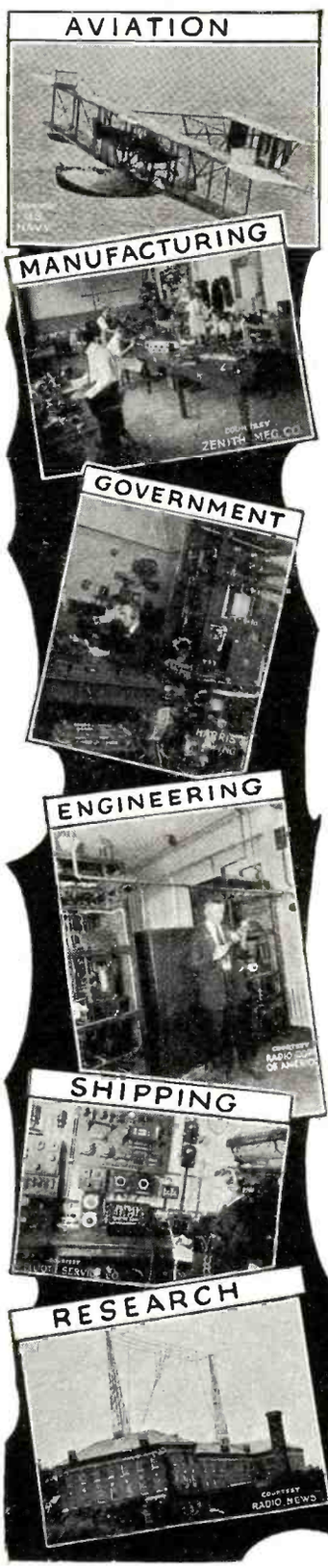
Please send me at once complete information about RADIALAMP loud speaker.

Name .....

Address .....

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

National Radio Institute Graduates Are "Cashing In" On These Wonderful Opportunities!



Austin Riu, one of our graduates, is now an operator of broadcasting station PWX of Havana, Cuba, and earns $250 a month. Merle Wetzel, of Chicago Heights, Ill., another graduate, advanced from lineman to Radio Engineer, increasing his salary about 100 per cent. *even while taking his training!* Emmet Welch of Peculiar, Mo., right after graduating started in Radio, earning $300 a month and expenses as a radio salesman. William West of St. Louis is earning big money as a radio correspondent.

Not a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer" writes a prominent radio firm, "Would appreciate your recommending any person who could fill position." "We want men with executive ability as well as radio knowledge, to become our local managers" writes another firm. "We will require the services of several resident demonstrators"—these are just indications of the great variety of opportunities open to our graduates!

More Money for YOU in Radio

Are you "cashing in" on your Radio Knowledge? If you're not, you are passing up the best bet that has ever come your way. It's entirely up to you. There's nothing impossible in Radio for the man who has nerve enough to try. In a few months at home, you can easily become a *recognized radio expert*—and to these radio specialists, Radio offers remarkable salaries, easy, fascinating work, short hours—and a wonderful future!

Earn $2500 to $10,000 a Year

You can earn bigger pay than you probably ever dreamed possible. Only don't let yourself stay in a rut. Sit up—look up—make up your mind that if others can make big money and big successes in Radio, so can you. The National Radio Institute has a sound practical radio course that defies comparison. It has a record of successful graduates that is unquestionable evidence of its ability to qualify you quickly for a big money position in Radio.

Our Free Book "Rich Rewards in Radio" tells all about the amazing opportunities Radio offers *you*, and describes how you can become a recognized radio expert at home in an astonishingly short time. Now—while your ambition is warm—mail the coupon for this big-money Free Book!
National Radio Institute, Dept. 13KA, Washington, D. C.

THIS FREE BOOK
Points The Way
To Your Success

National Radio Institute, Dept. 13KA
Washington, D. C.

Without obligation send me your book, "Rich Rewards in Radio," which tells all about the opportunities in Radio, how spare time study at home will qualify me quickly as a Certified Radiotrician so I can get one of these splendid positions, and how your Employment Service helps me to secure a big pay position.

Name..... Age.....
Please write plainly

Street .....

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

The Practical Way to Buy Radio

That Button identifies the Ozarka Factory Representative in your city. It is your assurance of complete radio satisfaction.

THE automobile is a success today because of the service station. Little things sometimes go wrong with the best of cars—exasperating to the owner but very easily corrected by the trained mechanic.

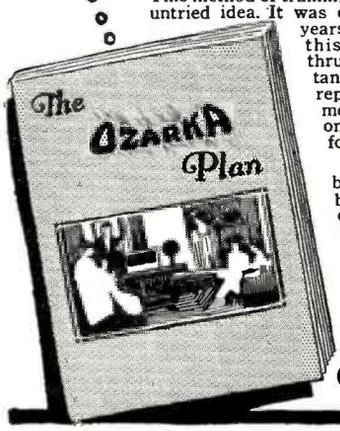
The same condition is true of radio instruments. No matter what anyone tells you, the most perfectly constructed radio instrument sometimes requires service.

The pleasure you derive from radio depends not only on the quality of your instrument, but on the quality of the service you can secure on that particular make of instrument.

Ozarka Radio instruments are sold only by direct factory representatives—men who have been thoroughly trained on our instrument *and no other*

The Ozarka Representative knows every part, every wire of the Ozarka. In fact he completely assembles his own instruments. His training on installations, aerials, ground connections, operation and service comes directly under our own engineers who designed and perfected the Ozarka circuit.

This method of training men for radio sales and service is not an untried idea. It was originated by Ozarka, Incorporated, two years ago. Today nearly 1900 men are delivering this service. More are right now going thru their training. The sign of the long distance goose is your protection. The Ozarka representative will gladly set up an instrument in your home without any obligation on your part. He will set it side by side with all others for beauty, distance, volume, tone and ease of operation.



He won't tell you he has the best—he'll let *you* prove it by your own operating. His complete installed price backed by Ozarka service will be much lower than you can possibly buy any instrument of similar quality. The Ozarka plan of selling direct from factory to you through our own factory representative makes it easily possible to sell four tube long-distance instruments for loud speaker operation as low as $39.50. Our illustrated book No. 200 describes the Ozarka instrument fully. A copy is yours for the asking, Please mention the name of your county.

OZARKA
Four Tube
RADIO
as Low as
$39.50

More Ozarka Representatives Wanted

RADIO under the Ozarka Plan offers an exceptional opportunity to the right kind of men. 1900 Ozarka Factory Representatives have been trained under our plan to sell, install and service the Ozarka Radio Instrument.

The man we want is now employed—he has held his present position for some time—he is not a "floater" jumping from job to job. He feels certain that there must be some way whereby he can better his condition—he is not afraid to try.

He may not be a salesman, but he can talk convincingly on something that he knows perfectly, and firmly believes in. He may not have much money, but he is not "broke." He is mechanically inclined—he is willing to give Ozarka his spare time in study in his own home under our engineering department.

The Ozarka Plan will give such a man more money, more independence, and possibly his first *real* opportunity to build up a permanent, profitable business of his own which will quickly justify giving it all of his time.

The Ozarka Plan is fully described in a large illustrated book. A copy will be sent to men who are willing to tell us fully about themselves. Unlike any book you have ever read, the Ozarka book is a true story of life, of men, of why they fail, and how they succeed. It is founded on the principle that nothing is impossible to the man who is determined and willing to try.

In territory not now covered, the right man is wanted. The investment in money is small, but the investment in time and study is considerable. If you are determined and willing to put forth the necessary effort to obtain a splendid profitable business of your own, write 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

OZARKA, Inc., 804 Washington Blvd., Chicago, Ill.

RADIO NEWS
H. GERNSBACK, Editor and Publisher
ROBERT E. LACAULT, Associate Editor
EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 6 OCTOBER, 1924 No. 4

What Outfit Shall I Buy?

By HUGO GERNSBACK

THIS editorial is addressed to those who are thinking of acquiring a radio outfit for their entertainment. The editor is continually in receipt of letters from readers in every part of the country who wish to know what outfits they should buy. As a rule the correspondents fail to give some of the most important information, namely: First—for what service the outfit is intended; second—what range it should cover; and third—what price can be expended upon the set in question.

In the first place it should be understood that a radio outfit is not very different, as a utility, than an automobile, a phonograph, a suit of clothes or a pair of shoes. Individual taste, usually, is a predominant factor in the choice. Before an adequate reply can be made to anyone, the price, which probably plays the most important part, should be considered.

You can get good radio outfits at costs ranging from $10 to $500. If you are located in or near a city and wish to receive local stations only, and if you do not care to spend more than $10, there is a large number of good crystal sets to choose from; and these sets are not as mediocre as many think. The crystal outfits are famed for their clearness in reproducing sound, and, while they do not give very loud sounds, the tone is usually sweet and clear with a good pair of phones. Loud speakers—in the overwhelming majority of cases—cannot be used with them. With a crystal set, as a rule, radio concerts are not heard clearly further than 15 miles from a broadcast station. While some have received from stations as far as 1,000 miles, no honest manufacturer will claim a great percentage of his sets will actually cover such a range.

We next have the single tube set. If this set is of the regenerative variety—and there is a number of good ones to choose from—the volume from local stations will be very much greater than with the crystal outfit. Good one-tube sets bring in broadcast reception with sufficient loudness to be heard all over the room, in many cases, when the telephone receivers are placed on the table. Such sets usually are just as good for long distance as the multiple tube sets. By that we do not mean to imply that a one-tube set will bring in a 1,000 mile station as loudly as a multiple tube set, but you will be able to hear it well in your telephones and that, after all, suits many people. With such a set, an aerial and ground are, of course, required. The set cannot operate a loud speaker except under very unusual circumstances or in the near vicinity of a broadcast station. Single tube sets, unless they are of the radio frequency-crystal combination, or reflex-crystal combination, are never recommended for loud talker purposes by conscientious manufacturers or honest dealers. A single tube set generally gives very clear reception and good volume, is cheap to operate and fills every want for the man who does not care to expend more than $25 or $30 for the complete outfit, which figure includes the outfit, aerial equipment, two sets of dry batteries (both "A" and "B") and phones.

From the one-tube set upwards it becomes largely a matter of how much the purchaser is willing to pay. The crystal and one tube sets may be compared to the Ford car, whereas all the other larger and multiple tube sets can be compared to the higher priced cars. The Ford car does the service and takes its owner where he wishes to go, just as well as a $10,000 car does. It all comes down to the question of price and utility. As a matter of fact, sometimes the crystal or one-tube set is preferable to the large multiple tube sets, mostly for reasons of portability. A good one- or two-tube set is ideal where there is not much room to be spared at home or when the set is to be carried around for camping purposes, or by salesmen, and for the general traveler who wishes to take his outfit wherever he goes.

Coming now to multiple tube sets it should be understood that, as a rule, it takes a three-tube set to operate a loud speaker. While certain two-tube sets will bring in local stations with fair volume they cannot be relied upon to do so under all circumstances. It should be understood—and the writer has already mentioned this above—that the multiple tube set does not necessarily bring in any more distant stations than the single tube set. What it does, however, is to bring them in much louder. It might be said that the more tubes are used, the louder will be the broadcast reception; but unless the set is a very unusual one, it is not actually more sensitive than a well designed single tube set. The exceptions to this are some of the well designed tuned radio frequency sets and the Super-Heterodyne class. Most of these sets cover greater distances than the single tube variety.

Up to and including a four-tube outfit, speaking generally, it is necessary to use either an outdoor or a good indoor aerial. So-called loop sets, unless they are exceptional, require at least four or more tubes. It is true that there are some three-tube reflex sets that work on a loop, but we doubt if such sets can receive from great distances. They will probably serve well enough for local stations.

So much for the technical side of the question. The next thing most people ask is, why outfits have such a wide variety of prices. Again the answer is that the make and style govern the price. You can buy a good pair of shoes for $3 and you can buy a good pair of shoes for $20, according to the material. Generally speaking, the higher priced sets come in better finished cabinets, the tendency now being towards "furniture" sets. Such apparatus ranges from $150 upwards, and may not work better, speaking of the radio end, than a set costing $60. The difference in price is made up in the cabinet. If your tastes run along expensive "period" cabinet designs made of rare woods, elaborately finished, you are naturally expected to pay more money for it than for those finished in cheaper cases.

When it comes to a choice when buying an outfit, the foregoing paragraphs will probably be a fair guide, but now comes the important question of how to select from the different makes. There may be 50 different five-tube sets on the market ranging in price from $60 up to $500. As a guide, we would say to the prospective buyer—buy only a well advertised set. As a rule, the advertised sets are made by reliable manufacturers who are known for their stability and their integrity. Unknown sets or obscure makes should be shunned, just as you would shun an unknown automobile or an unknown phonograph. If something goes wrong with a widely known and advertised radio set you will find little difficulty in having the trouble rectified. This, as a rule, is not the case with the unbranded and unknown sets.

As for the best time to buy a radio outfit, that time is *now*. All the latest models are on the market this very minute. Do not let the argument that radio outfits will be greatly improved *in the future* deter you from buying a set. Of course radio outfits *WILL* be improved in the future. So will automobiles, houses, shoes and everything else. You know full well that five years from now the automobile will be vastly improved over your 1924 model. That does not deter you from buying your 1925 car. The same logic should be used when contemplating the purchase of a radio set. Even with *all* improvements coming in radio, your set will be good for several years, just as an automobile or a phonograph.

This does not hold true only of radio sets, but of every other merchandise as well. If you stop to reflect about it for a minute you will see the truth of it.

Music from Your Lamp Socket

By R. D. DUNCAN, Jr.*

The recent progress made in wired radio leads us to believe that contrary to popular opinion, it has made a field for itself and will continue to move onward without effecting radio sans wires. Mr. Duncan relates the history and the present activities of this new child of science.

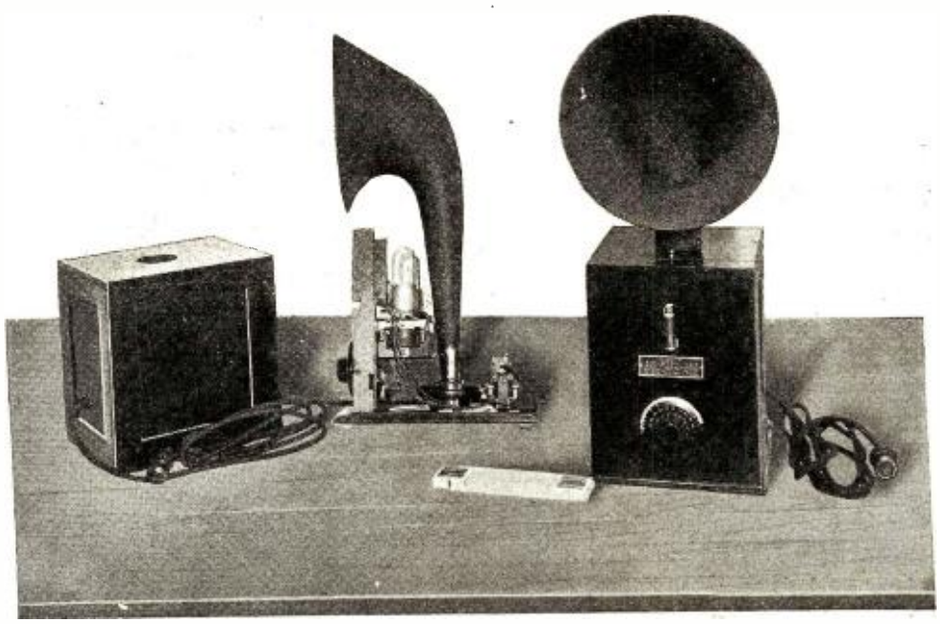


Fig. 4. Assembled and unassembled views of a wired radio receiver employing a two stage audio frequency amplifier and a loud speaker. The tuning apparatus is the same as that employed in the crystal receiver shown in Fig. 2.

TWO years have elapsed since the first experiments in wired radio broadcasting over electric lighting lines were conducted in Washington, D. C., and Cleveland, Ohio. Wired radio or wired wireless, it will be recalled, refers to the use of high or radio frequency currents on telegraph, telephone or electric power wires. Due to the vast difference in frequency of the wired radio and telephone or power currents, and because of the properties of high frequency circuits which permit of obtaining a high degree of selectivity, it is possible to superimpose, not only a single high frequency channel, but a plurality of such channels on the same pair of wires without there being interference either between the normal wire and wired radio services or between the various channels themselves. The use of wired radio for long distance communication over telephone lines dates back several years. Its use, however, for broadcasting over the electric lighting system of a large city is comparatively new.

During the past two years considerable progress has been made in the latter field. Immediately following the Cleveland experiments, research, on a more elaborate scale than had hitherto been attempted, was resumed in Washington, D. C., where, in cooperation with the Potomac Electric Power Company, a wired radio transmitter was installed in the Georgetown substation and operated into the 2300-volt, three-phase lines instead of the usual aerial. Receiving apparatus, which connected with the 110-volt lines by means of a plug and socket, was located at the Bureau of Standards and at a number of other points in Chevy Chase, D. C., and Maryland.

Experimental operations were continued for several months, during which time data was obtained concerning the high frequency characteristics of the high and low voltage lines and of certain power apparatus. Experimental broadcasting was carried on and reception conditions noted at the different receivers for varying conditions at the transmitter such as frequency, power, etc.

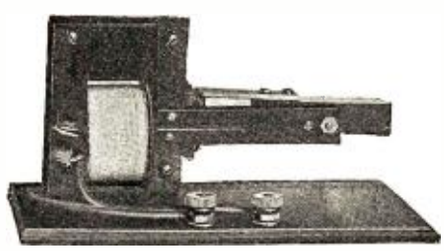


Fig. 6. A high frequency motor which was operated from a wired radio transmitter four miles distant.

EXPERIMENTAL STATION

In February, 1923, experimental operations were transferred to Staten Island, N. Y., which constitutes Richmond Borough of Greater New York City. Staten Island is located in lower New York Bay and has a population of 136,000 with approximately 25,000 electric light customers. In co-operation with the Staten Island Edison Corporation, the first commercial experiment in wired radio broadcasting was conducted. The transmitting apparatus was operated into the 2,300-volt, three-phase, 60-cycle lines, of which there were seven main feeders supplying the light load. The average peak and minimum loads per feeder were, respectively, 375 and 100 k.w. The lines were all aerial. Voltage regulation was effected at the 2,300-volt busses through the Tirrill system.

The objects of the Staten Island operation may be summarized as follows:

1—To bring the development of this system of broadcasting as rapidly as possible to the stage where it could be commercially tested.

2—To initiate commercial wired radio broadcasting.

3—To determine the reaction of the public to this new service.

The transmitting apparatus was initially installed at the power house, but was subsequently moved to its present location approximately three-quarters of a mile distant. Special wires carrying only the high frequency current were run to the power house, there connecting to the high voltage lines. The equipment was housed in a three-story private dwelling which served both as a transmitting center and as a studio from which programs were originated. The basement contained the motor generators for furnishing the high voltage for the plates of the transmitting tubes; the first floor contained the reception room and the studio with microphone equipment; the second floor contained the transmitting, low frequency amplifying, and control apparatus, together with the printing telegraph machine employed by the news service; and the third floor, a small laboratory.

The idea of renting, instead of selling outright, the receiving equipment is fundamental with the scheme of wired radio broadcasting. The use of the lines for broadcasting will be obtained from the lighting company on a rental basis, by a central organization which will supply both the program and the receiving apparatus. The latter will be distributed and serviced either through the existing distributing channels of the lighting company

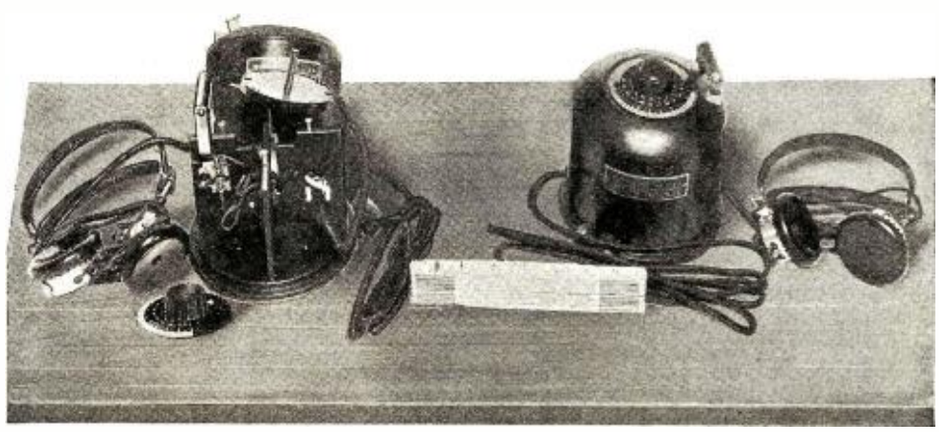


Fig. 2. Assembled and unassembled views of the wired radio crystal receiver. The long flexible wire has a plug on the end which is screwed into any lamp receptacle in the house when it is desired to receive.

*Chief Radio Engineer, Wired Radio, Inc.

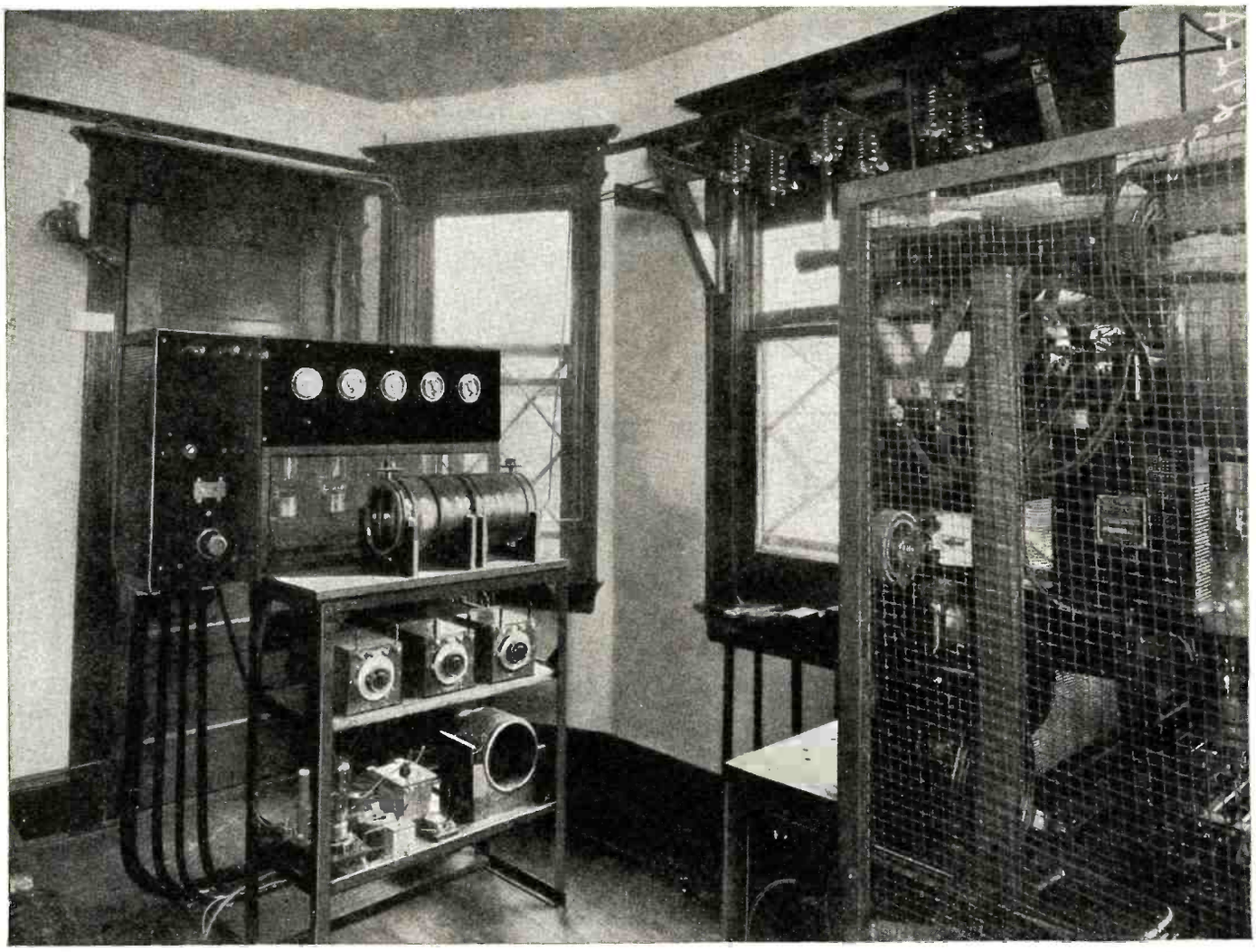


Fig. 1. The wired radio control room showing the one-channel and two-channel transmitters which, instead of connecting to an aerial, are related to the high tension lighting feed wires at a point where they issue from the central power house. The two-channel trasmitter is in the right of the photo.

or through a separate company. Other plans of distribution may, of course, be substituted for this.

By this means, on a "pay for what you receive" basis, it is believed that a broadcasting service may be developed which will be both self-sustaining and entirely satisfactory to the recipient. This plan will permit wired radio to perform a function quite different from that of space radio, and to make a place for itself without hindering the advancement of broadcasting through the air. For the convenience of those who will want both the wired and space radio programs, special receiving apparatus has been developed by which the wired radio receiver may be switched at will into any standard space radio amplifier and loud speaker.

As the receiving equipment is the means through which the wired radio subscriber comes into contact with the central station, and since it is rented and must, therefore, be serviced, it is obvious that it must be simple in operation and very rugged in construction. Two types of receivers have been developed which will be here designated as the crystal and loud speaker types. Both connect directly to the 110-volt lines in the usual manner through a pair of wires and plug, contain a crystal as a detector, and have only a single adjustment. The crystal receiver is furnished with a pair of telephone receivers; the loud speaker unit contains the same tuning elements as the crystal type and in addition two steps of audio-frequency amplification and a loud speaker. The filaments of the amplifying tubes are lighted by alternating current from the 110-volt source through a special transformer. In the earlier type of tube unit the plate voltage was furnished from the small size plate battery, four of which were contained in the set. In the later units, however, both the plate and filament energy are obtained from the 110-volt source. The rental of the crystal receiver was two dollars per month with a dollar installation charge; the loud speaker unit rented for five dollars per month, the customer being required to purchase the two amplifier tubes. Five hundred crystal and 50 loud speaker receivers were constructed with which to commence operations.

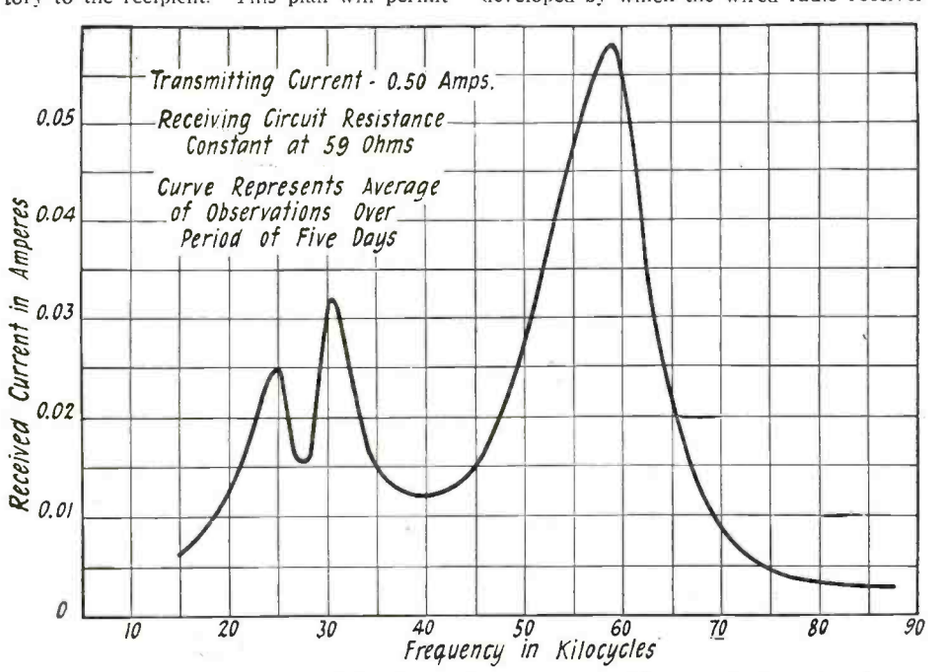


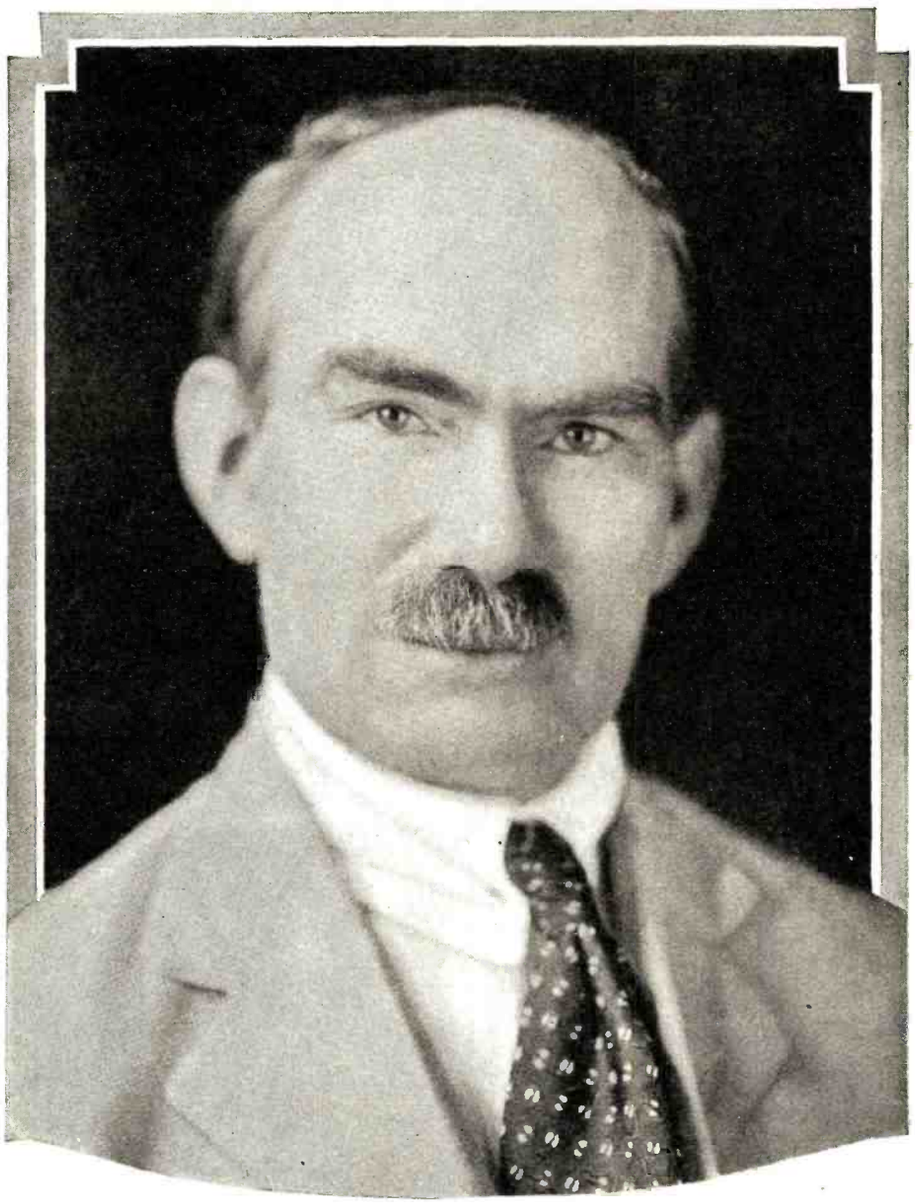
Fig. 5. An interesting curve which shows the current received from the 110-volt lines for one particular receiver location. Note the decided effect the frequency has upon the received current.

COMMERCIAL TEST

Commercial wired radio broadcasting was started in September, 1923. Receiving sets

(*Continued on page* 558)

The Life and Work of Lee DeForest



DR. LEE DE FOREST, B.S. D.Sc.

LEE DEFOREST was born in Council Bluffs, Iowa, August 26, 1873. He is the elder son of the late Rev. Henry Swift DeForest and Anna Margaret Robbins.

The family to which he belongs is one that could be envied. The American branch is descended from Isaac DeForest, who migrated from his home in Leyden, Holland, to New Amsterdam in 1636. The line of descent is unbroken in America from the first of the clan to the present time.

Old Isaac, according to the "History of Harlem" owned "fifty morgen" bordering on The Kills, opposite Harlem River. In recognition of his ability and work and upon the recommendation of Peter Stuyvesant he was made a Great Burgher. His mantle fell upon the shoulders of his son, David, who was a glazier by trade. David moved to Stratford, Connecticut, where he set up shop and raised six sons, one of whom established the "DeForest Fund," which was later a benefit to the subject of this story in obtaining his diploma at Yale.

Gideon, a grandson of the glazier, followed his father's footsteps and raised four sons, all of whom lived to be more than seventy years of age and took a more or less prominent part in the war for American Independence. Abel, the second son, seems to have reached the highest in this war record, for it is recounted that he held personal acquaintance with George Washington and stood with Andre at his death. During the latter years of the war he was captain on a merchantman. During several trips made by his ship, he had a cabin boy who signed the ship's papers with the name Hull. This Hull was later to make more of the country's history as Commander of "Old Ironsides," during the War of 1812.

This Abel was a great uncle of Rev. Henry Swift DeForest, Lee DeForest's father. He named his first son, Lee, after his own father, Lee DeForest, who was a son of Gideon. Gideon had been a trooper in the cavalry of "Light Horse Harry" Lee during the Revolution and named this son Lee out of admiration for his dashing commander.

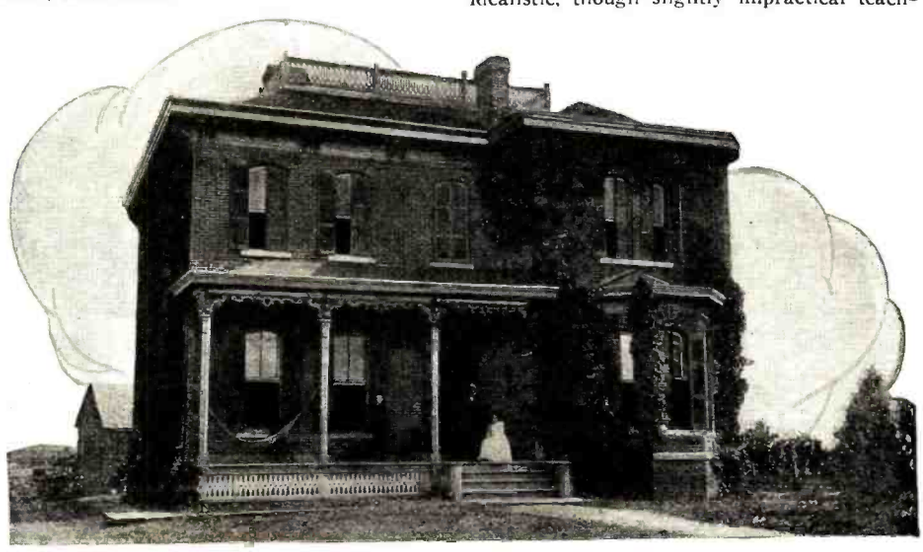
CHILDHOOD IN SOUTH

Practically all of DeForest's early childhood was spent with his father in small communities in the then Far West and South. Acquaintance with the conditions which obtained in such communities at the time gives an easy explanation of the solitary habits and inquisitive nature which manifest themselves through his life.

As a minister and a very religious man, Rev. DeForest was taken by his work to Talladega, Alabama, when Lee was six years of age. This was in 1879 and at the height of the Reconstruction period in the South. The Rev. Dr. DeForest moved to the Alabama town to assume the presidency of a Negro college, called Talladega College, which was being operated with funds raised by the Congregational Church.

An understanding of the attitude of the Southerners to all the attempts on the part of their late enemy to establish a culture and education among the Negroes must be had if the early formative years of DeForest's childhood are to be understood.

The Southerners, or the "nasty little Rebs" as they are referred to in many of the youthful accounts written by DeForest during his years of schooling among them, looked upon the efforts of the high-minded, idealistic, though slightly impractical teach-



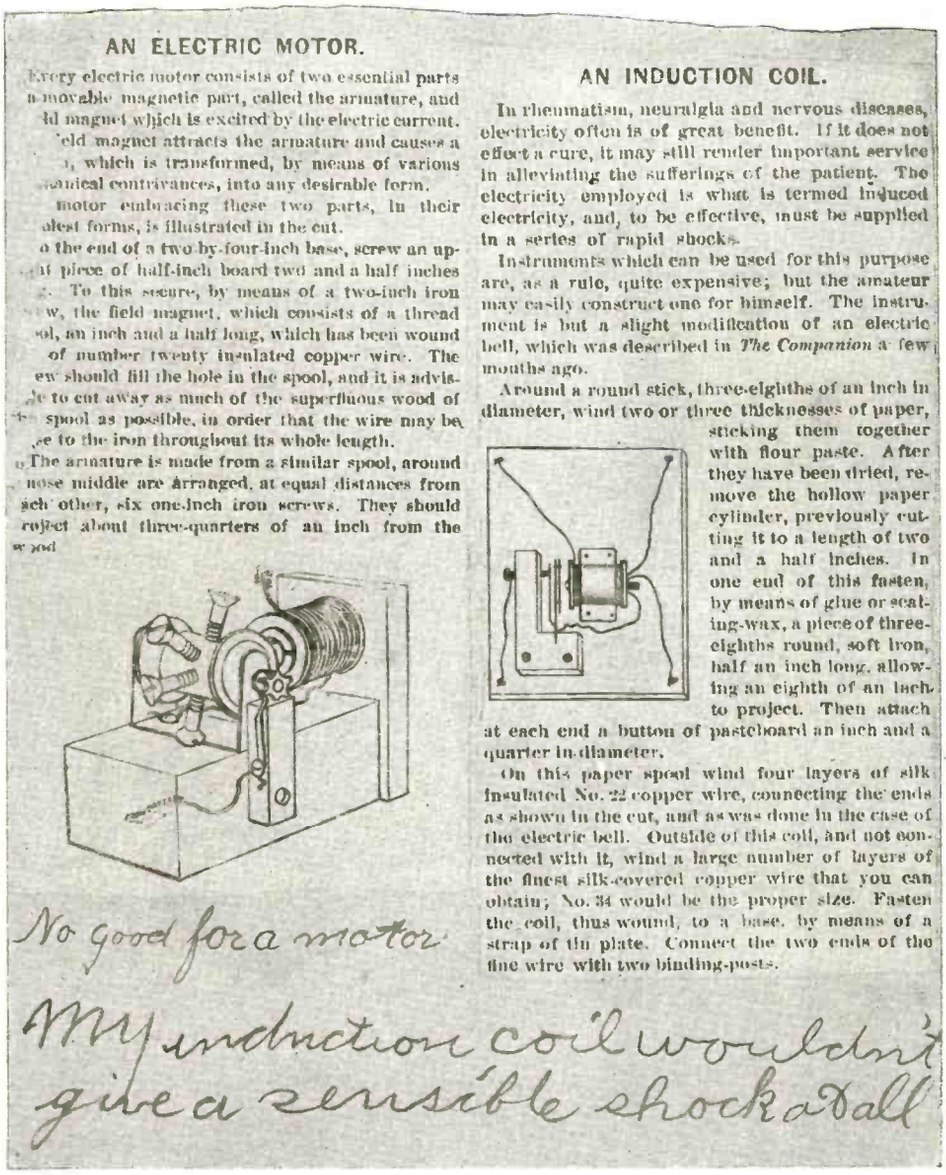
The house where DeForest spent the greater part of his early childhood.

ers and professors, with little more liking than they did upon the carpet-baggers. This may be proved easily by the fact that in none of the accounts of the family during its sojourn at the school contain references to any of the native whites as friends or co-workers. Their social life was restricted almost entirely to intercourse among themselves—the little group of valiant workers whose only remuneration was the hatred of the people of their own class among whom they lived. Such a state of affairs is not at all hard to understand in connection with the DeForests. The account of the American branch of the family is one long tale of pioneers and hard workers—idealists much on the order of the idealized New England Puritan. This was particularly true in the case of Lee's father.

Since all his early childhood and youth was spent in such surroundings it was obvious that there would be a direct effect, caused by them, shown in later years. The immediate effect was, of course, an almost complete isolation from children of his own age and interests. Consequently he had to fall back upon his own ingenuity for play and entertainment. This resulted early in a highly developed skill for handicraft and drawing.

Another contributing factor to this early development was the scarcity of books and other reading matter. Most of his reading consisted of the *Youth's Companion*, "The Patent Office Report" and an "Encyclopaedia of Mechanics." All three of these he read constantly. In note books he kept from his tenth year, there is column after column of building instructions cut from the *Companion* pasted in here and there. It may be inferred from their trend that he shifted his interest chiefly to electricity during his twelfth year.

Each week, the *Companion* carried a special constructor department and each week with religious regularity DeForest attempted to construct the electrical appliance



Notes and sketches taken from DeForest's scrap book. He tried to build the apparatus shown. His results are given in his penciled note beneath.

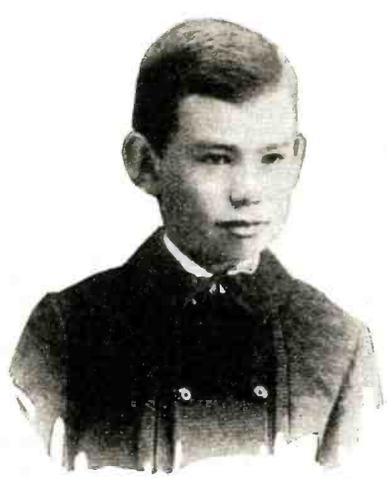
WE are happy to present, beginning with this issue, a biographical series of one of our greatest living radio authorities, Dr. Lee DeForest, B.S., D.Sc.

Dr. De Forest needs no introduction. He is one of the outstanding figures in radio today and his name is known everywhere. As the inventor of the modern vacuum tube, wireless telephony, both transmitting and receiving, was made possible by him.

Dr. De Forest is one of the pioneers of wireless telegraphy. One of the most important of his inventions is the audion or vacuum tube, as it is called today. He is also responsible for regeneration, making long distance radio reception possible. He is also the inventor of the modern talking motion pictures.

He was awarded a gold medal at the St. Louis Exposition in 1904 for "Work on Wireless"; a medal by the San Francisco Exposition in 1915 for the Radio Telephone; the Cross of the Legion of Honor; Elliot Cresson Medal; Franklin Institute; Medal of the Institute of Radio Engineers and many others.

The articles, during the coming 12 months, will tell you all about his early struggles, his inventions, his trials and his successes. We promise an interesting serial.—Editor.



DeForest as he looked at eleven years of age at Talladega, Ala.

shown. They ranged from the simplest magnet to motors and Leclanché cells.

One of the most peculiar traits noticeable in the boy's character is the series of concise notes kept on all his trials with the apparatus he assembled and attempted to make work. With the Leclanché cell these notes tell almost as much as the original article which he followed. The building and making it work covered a period of several months. Living in a small town where there were no modern conveniences and where the chief interest of the shop keepers lay in jeans pants and hickory-cotton shirts it was impossible to obtain carbon for the positive electrode. His first attempt was with coke. Needless to say an electric bell gave no sound when connected to this battery. Then, seeing that another course would have to be followed he proceeded to grind the coke in a home-made pestle and mortar, and bind it together with molasses. The notes state that the combination of this carbon, used in connection with a poor grade of zinc, amalgamated with thermometer mercury, gave "indifferent results." The cell was finally brought to successful operation after a couple of months when Lee and his father made a trip to Chattanooga, Tennessee, and Look-Out Mountain.

While his father was surveying the beauties of the scenery and the battlefields Lee was following slowly behind, insisting on walking in the gutter at the side of the road leading up the mountain side. His father did not notice for some time, but later, after Lee had insisted on falling further and further behind, remonstrated only to find that his son's interest lay not in the fields of history, but in finding carbon stubs thrown on the roadside under the arc lights.

He found several of the carbons and upon his return home finally made the cell and entered in his notes, "Leclanché cell works."

He manifested an extreme interest in all

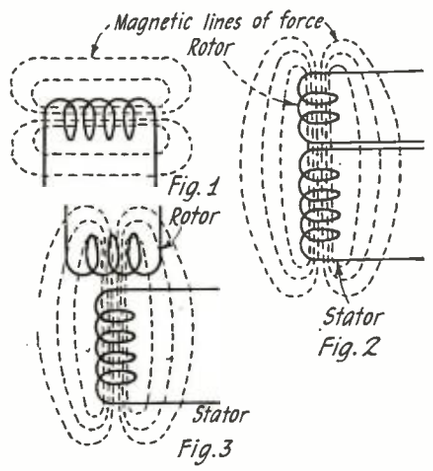
(*Continued on page* 585)

Induction and Modulation

By A. P. PECK

The fourth of a series of articles by Mr. Peck written especially for the layman and covering the fundamental principles underlying radio communication and reception.

WHILE the two subjects mentioned in the title above have no direct relation to each other, still they are the two fundamental principles for the amateur to learn, which have not as yet been discussed in this series. Those who have not been following these articles or are new readers and are desirous of studying radio theory in as nearly words of one syllable as it is possible to put it are referred to the article appearing in the last issue of RADIO NEWS in the Radio Beginners' Department. This article, together with the present one, constitute a comprehensible survey of the subject of radio theory expressed in a manner suited especially to the layman.



Illustrating the path taken by the magnetic lines of force threading a coil of wire and how these lines surround the turns of another coil placed in relation to the first.

INDUCTION

In the last article the subject of inductance was discussed. This action and that of induction are closely related, but they must not be confused as being one and the same. To refresh our minds, we will go over the salient points of inductance once more before we begin the study of induction.

First, we learned that when a current of electricity passes through a wire there are magnetic lines of force set up around that wire. It is characteristic of these lines, which are set up in the ether, that when they cut or pass through another wire they will cause a current to flow in that wire, even though no current were present before. This is providing the wire in which the current is induced or set up is moved so as to pass through the lines of force, or that the lines themselves move. This latter is true when an alternating or pulsating current passes through the coil or wire, causing the lines of force to be set up and collapse a certain number of times per second.

Next we must learn what an alternating current is. Electricity flows in a definite direction, just as water in a pipe or a train on a track. In the case of alternating current, that direction is changed periodically, and the number of times per second that it changes is known as the *frequency* and is expressed in *cycles*, a cycle being one complete change in direction. To bring this action out more clearly, consider the case of a shuttle train. Here the two ends of the track may be likened to the two ends of the electrical circuit and the train to the current. The train runs from one end of the track to the other on a certain schedule just the same as an alternating current changes its direction of flow, but the train, of course, is much slower than the current.

Direct current is just what its name implies. It flows in the same direction all the time, and while it may vary in strength, still it preserves its direction and never reverses. To preserve the train analogy, we might liken direct current to a train running on a circular track. It never reverses its direction of travel, however, it may stop altogether.

When the *strength* of a direct current varies, it is called *pulsating* or *intermittent* direct current, depending on the character of the variations. A current that starts and stops periodically is called intermittent, while a current's strength varies in regular or irregular pulses, called pulsating.

Fig. 5 shows a graphic representation or curve of a direct current; Fig. 6, a pulsating direct current, and Fig. 4, an alternating current. These figures are also used to illustrate the part of this article on modulation.

Speaking of curves, let us explain just what a curve is and of what use it is to us. Note any one of the curves mentioned. You will see that there is a vertical line and a horizontal line joining each other in the form of a T laid on its side. The vertical indicates the strength of the current, the horizontal representing zero. The further a line or curve goes from the horizontal line, the stronger the illustrated current is. This holds true for all kinds of current. The horizontal line serves two purposes. It is a dividing line which indicates a change in the direction of current. That part of the curve above representing flow in one direction and below, another. Also this line is an indication of time elapsed. The curves that follow along it indicate the flow of current over a certain space of time and the length of the horizontal line indicates the amount of time. The purposes of these two lines are also labeled on each of the figures mentioned above.

Now that we have learned about different types of currents, let us see what they has to do with induction. We learned last month about lines of force in wires. In Fig. 1 herewith we show what the lines of force about a coil of wire would look like if they were visible. If a second coil is introduced into the field of the first one, and an alternating or pulsating direct current is flowing through it as shown in Fig. 2, a current similar to that in the initial coil will be induced into the second one. This is what happens in the variocoupler described in this department a few issues ago.

The coils in the figures herewith are labeled stator (fixed coil) and rotor (movable coil) to correspond to those coils of the coupler. The current from the aerial flows through the stator and induces or sets up a like current in the rotor. The greatest current is set up in the rotor when the lines of force from the stator cut or pass through the wires of the rotor at right angles. This condition obtains when the rotor coil is parallel with the stator. If, now, the rotor is turned through 90 degrees to the position indicated in Fig. 3, the wires thereon will not be cut at right angles and

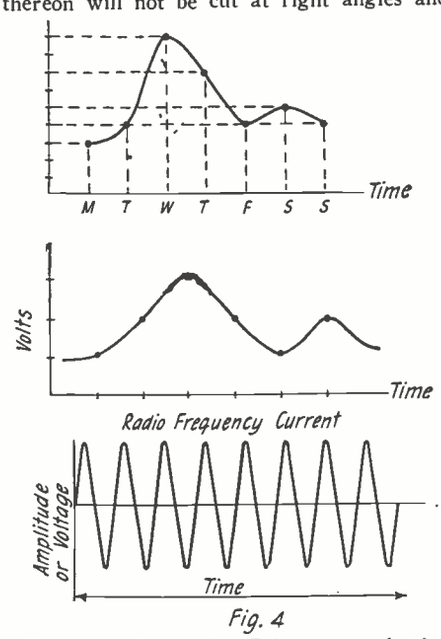


Fig. 4

How to read a graph. Take the top sketch wherein the days of the week are marked on the "time line." Suppose the perpendicular line is a scale of prices for a certain stock issue. By following the graph line we find that the stock was at its lowest on Monday and at its highest on Wednesday. In the second sketch there is a graph showing the fluctuation of a voltage during a certain time interval, say during each hour of a day. The third graph shows a radio frequency current which is changing its amplitude or voltage very often during a short period of time, in this case a fraction of a second.

the current set up will not be so great as when the coils were parallel. The effect of turning the rotor so that it is further from parallel with the stator is termed loosening the *coupling*. In actual radio practice the effect of this procedure is to sharpen the tuning and enable the operator to cut out undesired stations.

Tightening the coupling is, of course, the opposite of loosening it and results in slightly louder signals, but a decrease in selectivity. In regions where broadcast stations are not numerous and interference between them is not found, the greatest signal strength will be obtained by

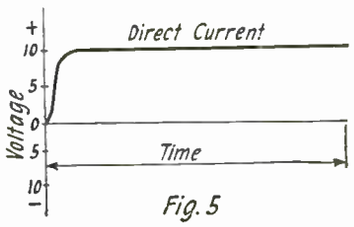


Fig. 5

A graph of a direct current. After once being turned on it rises to a definite amplitude and remains there until turned off when it will again drop to zero.

placing the rotor parallel with the stator and tuning with the taps and the condenser. This is in reference to the crystal set described by the writer.

MODULATION

The term modulation is derived from the verb "modulate," which, according to Webster, means "to vary the sound of, or to change the key of." Strictly speaking, the study of modulation belongs, not to the receiving section, but to that part covering transmission. However, it is such that it is intimately tied up with the subject of reception and, therefore, this discussion is included in this series. Modulation is, in short, the process of impressing voice and music on what is termed the carrier wave of the transmitter so they may be transmitted through space to the receiving set.

To thoroughly understand the principles underlying the modulation process, it will be necessary to first make a study of the various waves and currents used in transmission.

We find that the vacuum tube, the action of which will be taken up later in detail, can do more things, and do them well, than any other instrument in the field of radio. Not only can it be used in reception, but larger editions than those that you see in receiving sets are the heart of the transmitting stations which bring entertainment and pleasure to you. Without these glass enclosed, fragile instruments our broadcast stations of today would be virtually impossible.

Without going into the exact theory of the operation of the vacuum tube, we will study the principle of modulation. In the following paragraphs statements are made and, in some cases, no reasons are given. This is because in order to explain the facts it would be necessary to go into details that would render it impossible to keep this article within the required limits. Therefore, take our word for those statements which are not proven here, as in later articles we will give the reasons and you will see them more clearly.

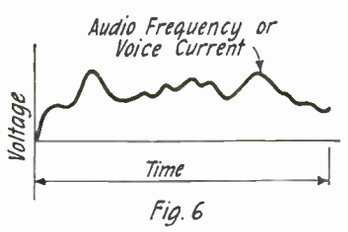


Fig. 6

The graph of a fluctuating or modulated direct current of audio frequency.

In the first place, you must understand that a vacuum tube can be a generator of alternating current. Even the small ones employed in receiving sets can be made to generate such current, or, as it is usually stated, oscillate. You will remember from the last article that an oscillation is one complete cycle of an alternating current. So, you will see, a tube may generate oscillations or alternating current just as surely as the big generators in power houses. What the tube really does is to take direct current that may be supplied to it from any outside source and convert it into alternating current.

RADIO FREQUENCY CURRENT

In transmission, the current developed is called *radio frequency current*. That is, the oscillations are so fast that when they are passed through a telephone receiver they would, if the diaphragm could respond to them, cause the diaphragm to vibrate so fast that the sound waves given off by it would be of such a high frequency that the human ear could not hear them.

The curve of a radio frequency current is given in Fig. 4. This is the type of current delivered by a vacuum tube when used for transmitting. Note that the alternations or oscillations are extremely rapid and that they are even and smooth in character. These oscillations occur many thousands of times per second. The exact rate varies with each station; it gets higher as the wave-length decreases and vice versa. The type of current the curve of which is shown in Fig. 4 is also known as the *carrier wave;*

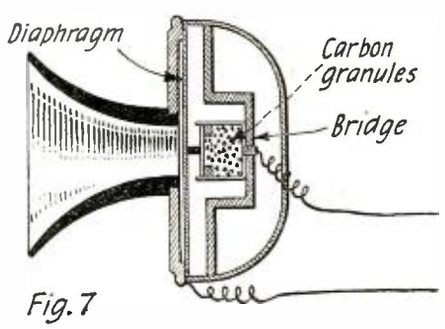


Fig. 7

Showing the interior construction of a common form of microphone.

the reason for this name will be apparent from the following paragraphs.

VOICE CURRENTS

The next sort of current that we will look into is known as *audio frequency* or voice current. These may be alternating or pulsating direct in character, and the type that we will study now is the latter. We have already found out what direct current is, as illustrated in Fig. 5. Voice currents are obtained from this in the manner described below.

If a microphone or telephone transmitter is connected so that a direct current flows through it in the same manner as the transmitter in a telephone, the current will be steady, direct current so long as no sound waves affect the diaphragm. However, as soon as any sound occurs near enough to the transmitter to affect and vibrate the diaphragm, the current flowing through the microphone is no longer steady, but becomes pulsating in character, the pulsations being in accordance with the sound. If the sound is high in pitch, the pulsations will be rapid. If it is deep the variations will be slower. Weak and strong sounds will also affect the diaphragm differently and, in fact, every little inflection or change will cause a corresponding change in the voice current.

The reasons for these changes are readily understood when the construction of a microphone is considered. We show the cross section of one of them in Fig. 7 so as to illustrate the point. Note the path of the current through the carbon grains, which have a steady resistance to the flow of current as long as they are stationary and not compressed. The large diaphragm the sound waves hit is connected to a smaller one in contact with the carbon grains. The grains are held in a cup rigidly fastened to the frame. When sound waves hit the large diaphragm and cause it to vibrate, the carbon grains are compressed and released

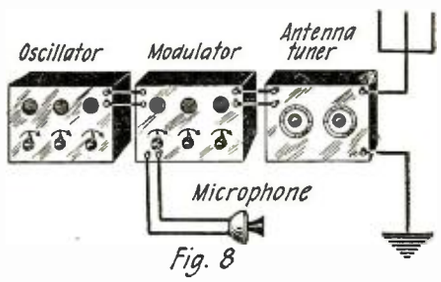


Fig. 8

A simplified layout of a radiophone transmitting station.

in accordance with the variations of the diaphragm. Therefore the resistance of the microphone will change and the current passing through them will also vary. The variations of the current will, of course, be the same as the variations of the voice. Thus it will be seen that the resulting current after passing through the microphone will have a characteristic curve similar to that shown in Fig. 6, although it will vary according to the sounds.

Now we will begin to sum up the various facts we have learned from the above paragraphs and bring them together so as to see how they all bear on the subject of modulation.

Let us first refer to the simplified diagram of a radiophone transmitting station given in Fig. 8. No batteries or other accessories are shown here, as the diagram is only intended to give the idea underlying transmission. Beginning at the left, we see first a box labeled oscillator. This represents a vacuum tube or a series of tubes which act as generators of oscillations or alternating current, and which give rise to a radio frequency current having a characteristic curve such as shown in Fig. 4. This current is known as the *carrier wave*. It serves to carry or support the voice current, and is, of course, oscillating or changing its direction of flow at a rapid rate.

From the oscillator, the radio frequency current goes to the modulator. This latter instrument or collection of instruments may take various forms. It may make use of vacuum tubes or it may work on a magnetic principle. However, as we are interested only in the results and not the action, at the present time we will not discuss the details of the modulator. It is sufficient to say that the modulator takes the microphone or voice current and impresses it upon the carrier wave. The resulting current is then sent out through the antenna for entertainment and education.

(*Continued on page* 570)

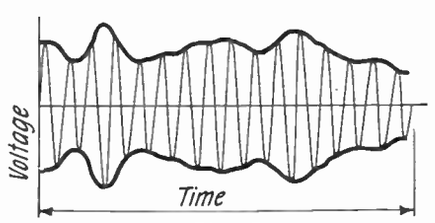


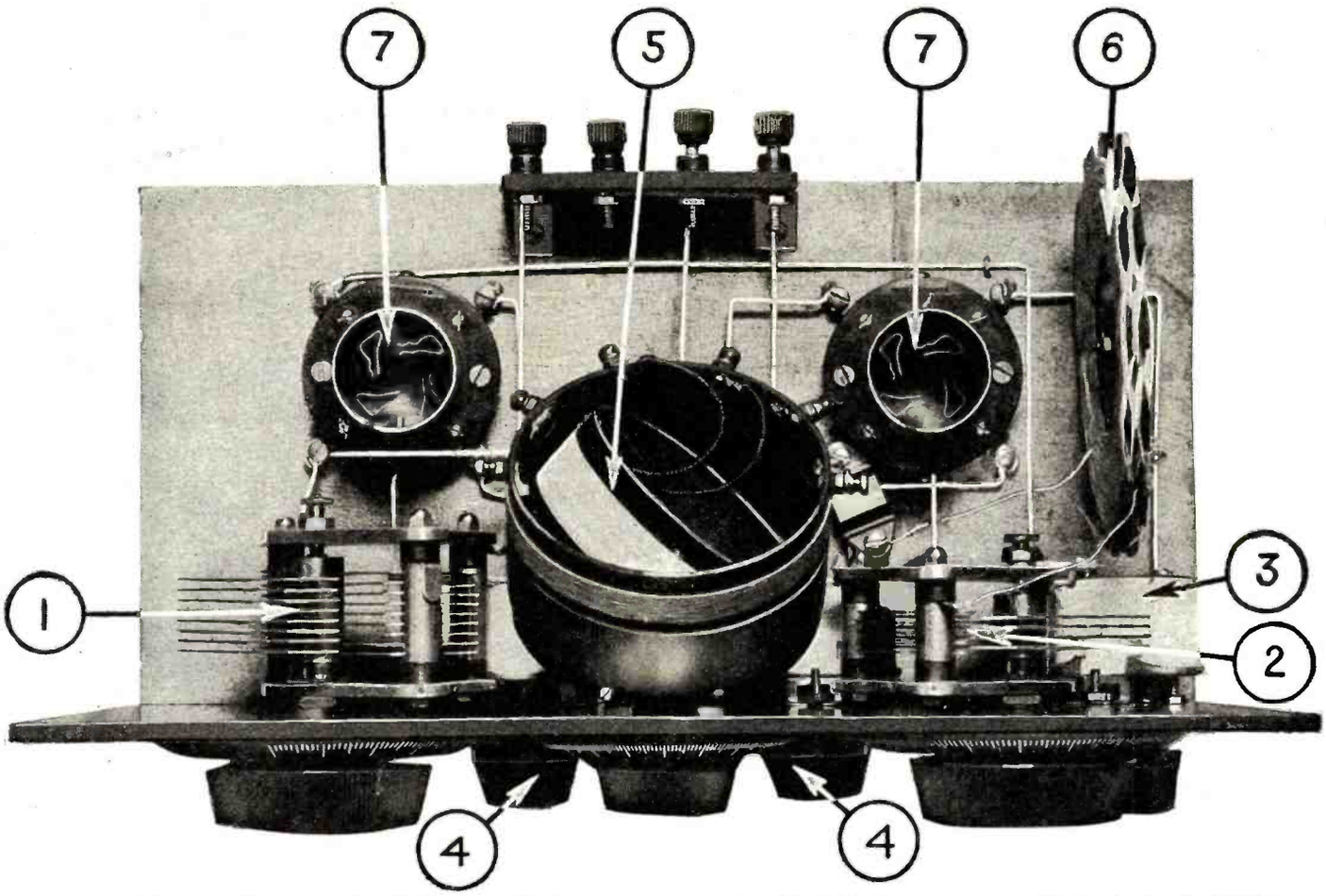
Fig. 9

The graph of a fluctuating or modulated radio frequency current.

A Radio Frequency Solodyne Receiver

By G. V. DOWDING and K. D. ROGERS

An article covering the design, construction and operation of a Solodyne or "B" battery-less circuit with a one stage tuned radio frequency amplifier.



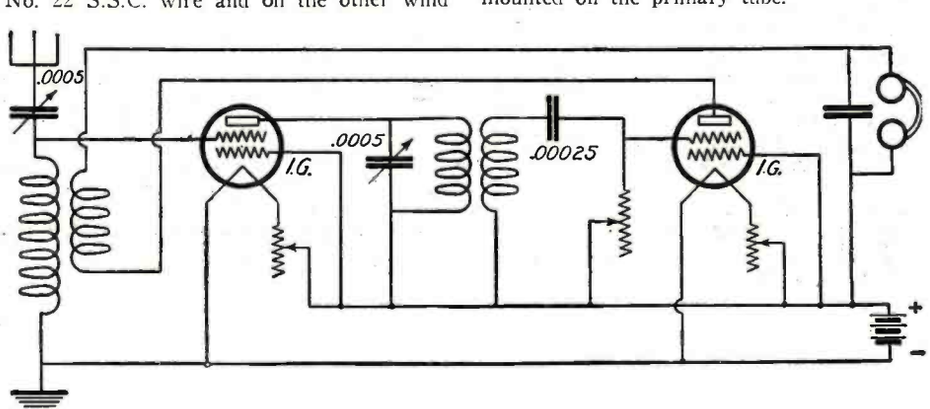
A view of the Solodyne receiver and radio frequency amplifier. The parts as numbered are: 1, series antenna variable condenser; 2 variable condenser in radio frequency amplifier circuit; 3, variable grid leak; 4, filament rheostats; 5, variocoupler; 6, tuned R.F. transformer; and 7, vacuum tube sockets.

BY this time, our readers should be well acquainted with the way the Solodyne operates. No doubt a large number have experimented with the different sets and circuits which we have described and have had varying degrees of success. For this issue, we have constructed a set with one stage of tuned radio frequency amplification combined with regeneration for use with the double-grid tube. Perhaps some readers may wish to try this one.

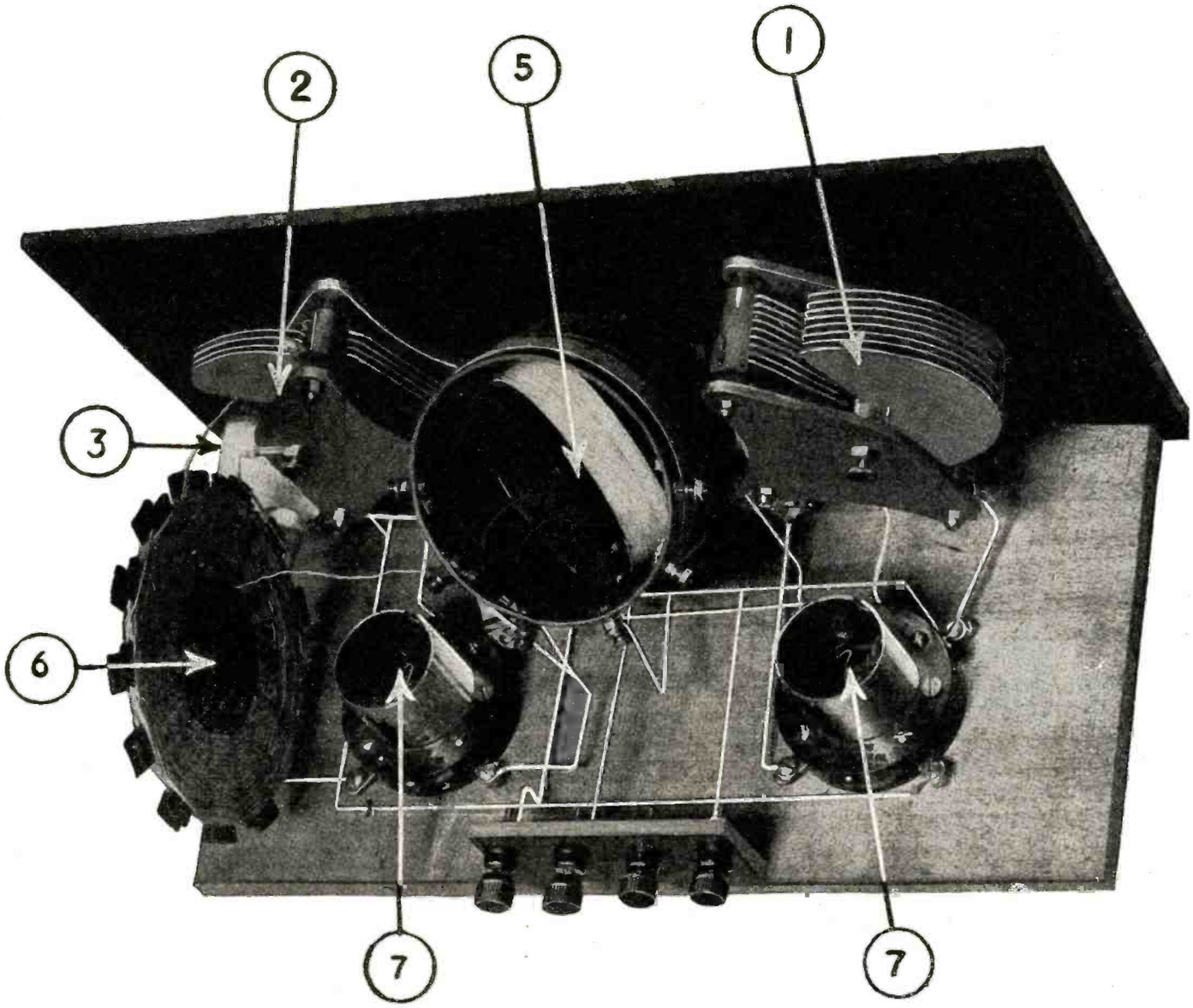
The following list of parts should be procured before work is started:

2—.0005 mfd. variable condensers.
1—180 degree coupler.
2—sockets.
4—binding posts.
1—7 x 14-inch panel.
1—.00025 mfd. fixed condenser.
12—lengths of bus bar wire.
1—variable grid leak.
2—rheostats.
2—4-inch dials.
1—3-inch dial.
1—7 x 3½-inch wood baseboard.
1—single circuit jack.
2—spider web forms 5-inch size with 13 pegs.
1—single circuit jack.
1—.001 mfd. fixed condenser.
1—spool No. 26 S.S.C. wire.
1—spool No 22 S.S.C. wire.

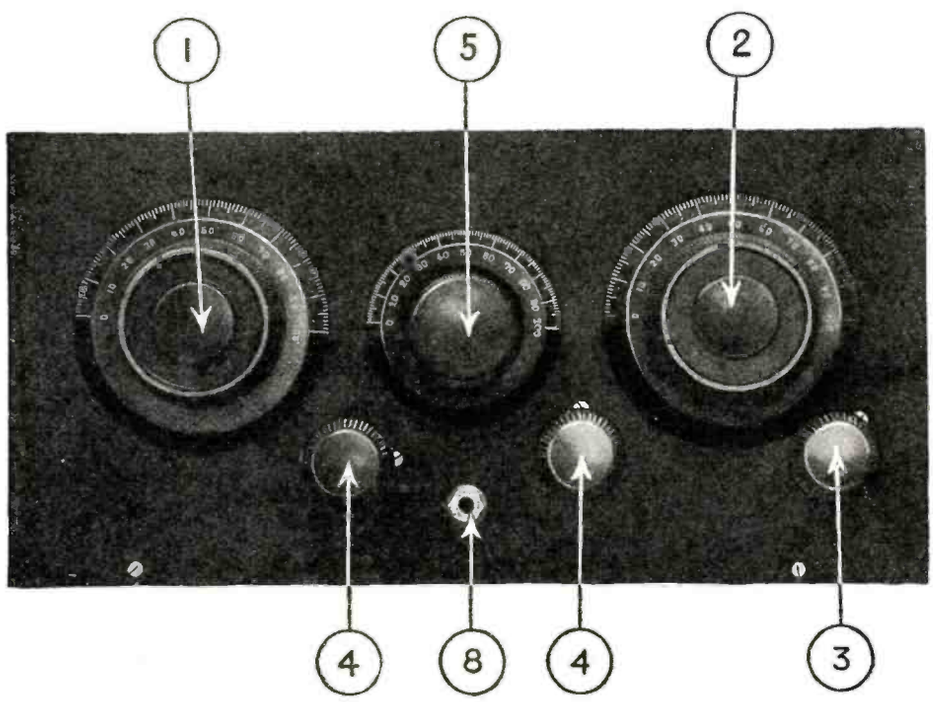
The coupler used in this set may be of standard manufacture or constructed at home. If you happen to have an old coupler in the workshop the two composition tubes and the mountings may be used. It is possible that the windings themselves may be suitable. If no such coupler is available and you desire to make one, secure a 2-inch length of 4-inch tubing and a 1½-inch length of 3-inch tubing, also the necessary shaft and bearing in order to make a complete coupler. On the larger tube, which is to be used as the primary, wind 30 turns of No. 22 S.S.C. wire and on the other wind 50 turns of No. 26 S.S.C. wire in the same direction as the primary. At the beginning and end of each winding drill a hole with a 1/16-inch drill and put the end of the wire through. Each end can be held tight by putting a tooth-pick or tapered match stick in the hole far enough so that the wire is held securely. The end of the tooth-pick or match stick can then be broken off for appearance sake. A foot or so of Litz wire or some other flexible conductor should be used to make the pigtail connection from the rotor of the coupler to the two binding posts mounted on the primary tube.



The circuit diagram of the Solodyne receiver and tuned radio frequency amplifier described in this article. It will be noted that advantage is taken of regeneration.



A rear view of the Solodyne set described in the article. The numbers referring to the instruments correspond to those in the photo on the preceding page. Note that the tuned R.F. transformer is placed at right angles to its variable condenser so as to be out of its electrostatic field.



A front view of the set. The parts are: 1, series antenna condenser dial; 2, transformer condenser dial; 3, grid leak knob; 4, rheostat knobs; 5, variocoupler dial, and 8, telephone jack.

The radio frequency transformer can very easily be made. The spider web forms should be 5 inches wide and consist of 13 webs each. A hole is drilled with a 1/16-inch drill near the center of the form where the wire is started, the ends being fastened in the same manner as the coupler ends. While holding the wire taut, wind in and out of the slots until 65 turns of the No. 22 S.S.C. wire have been wound on. This will be tuned by a .0005 mfd. variable condenser and used for the primary of the transformer. The secondary coil should be wound in the same manner, with the exception that 90 turns are used. These two coils should be wound in the same direction. A little radio cement should be used at the beginning and ending of all these coils to secure the end turns. A machine screw should be passed through the center of each form to hold the two together. Care should be taken that these coils be placed at right angles to the condenser so as to be out of its field.

The condensers should be chosen with care, as the successful operation of any set depends to a large extent upon the tuning apparatus used. The rheostats should match the tubes with which they are used. For example, a 6-ohm rheostat should be used with all tubes which draw approximately one ampere, while a 20-ohm rheostat should be used with a tube consuming about ¼ ampere. The filament voltage of this cir-

(*Continued on page* 598)

Crystodyne Receivers and Amplifiers

By I. PODLIASKY, E. E.

Some practical receiving and amplifying circuits embodying a zincite oscillator.

IN the article published in the last issue of RADIO NEWS was described the principle of the oscillating crystal formed of a zincite-steel combination. It was pointed out that such a contact behaves as a negative resistance, that is to say, it may be used to compensate partially or totally the damping effect of the circuit resistance. It is well known that an artificial reduction of the resistance in a circuit produces an amplification effect, since a given

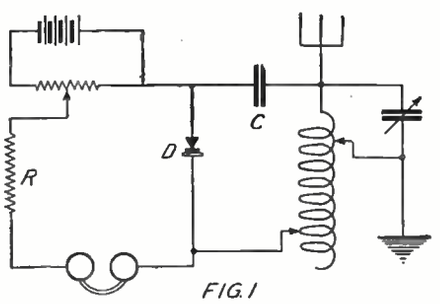


FIG. 1

Regeneration may be obtained in this circuit by adjusting the tuning coil and variable resistance.

current induced in a circuit will be greater in amplitude if the resistance is less. If an inductance coil or a condenser is connected in this circuit, the difference of potential across these instruments will be equal or even greater when the resistance is reduced. The effect is equivalent to an increase in the voltage or intensity of the currents similar to the compensation of the inductance by capacity when the circuit is tuned, although the difference between the two methods of compensation is rather great. The compensating effect in the case of a circuit occurs only at one frequency while the compensation of ordinary resistance by negative resistance is effective over a wide band of frequencies or wave-lengths.

REGENERATION

If the resistance of a circuit is reduced to zero or becomes negative, continuous oscillations are produced. This phenomenon of oscillation and amplification is exactly the same as in a regenerative circuit using a three electrode tube. In both cases a local source of energy is necessary. With oscillating crystals this energy is supplied by a battery of about 15 or 20 volts.

In the last article we mentioned the fact that sometimes crystal detectors oscillated without any local source of energy; however there must have been some continuous current flowing through the detector, possibly produced by a bad contact acting as a thermo element.

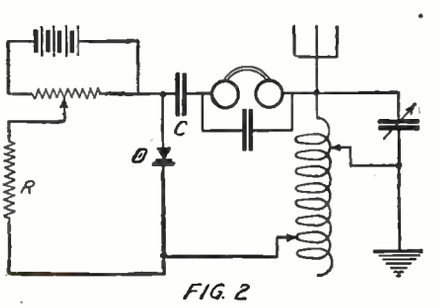


FIG. 2

Another circuit for the reception of spark signals and radio telephony.

In Fig. 1 is shown an oscillating crystal receiver using an auto-transformer arrangement for tuning it. The detector D, condenser C, and part of the tuning coil constitute the second oscillating circuit, the resistance of which may be reduced by adjusting the potential of the battery connected across the crystal through the resistance R. It is possible to obtain regeneration in such a circuit by adjusting the potentiometer until the voltage across the crystal is such that oscillations start. Just before the oscillating point the resistance is decreased to such an extent that radio frequency amplification and detection are obtained.

In this case the contact functions only as a resistance compensating device for very weak oscillations, the detector effect being obtained for oscillations of greater amplitude. The detector effect is due to the bend in the characteristic curve of the crystal. This effect is similar to that noticed when increasing the voltage applied on the grid of a vacuum tube until the bend in the curve is reached.

The hook-up of Fig. 1 is suitable for the reception of spark signals or radio telephony. If the crystal is operated too close to the point where it starts to oscillate, radiophone signals are distorted, this effect being similar to that caused in a regenerative receiver when the feed-back coil is coupled too tightly to the grid circuit. Another

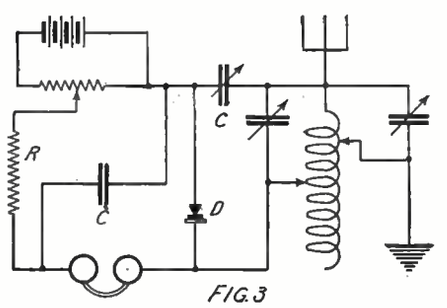


FIG. 3

A practical circuit for the reception of continuous waves.

practical circuit is shown in Fig. 2, but in this case, as well as in any other crystal oscillating circuit, low resistance telephones should be used. For the reception of continuous waves, the oscillating crystal may be used as a separate heterodyne, the frequency of the circuit being adjusted so as to produce a beat note with the incoming signals. It may also be used as an audio frequency oscillator provided the oscillations are strong enough to utilize the modulation of the incoming oscillations by the audio frequency currents produced in the local circuit. In this case a tikker or chopping effect is produced at musical frequencies. Fig. 3 shows a hook-up in which the audio frequency oscillations produced by the crystal chops the incoming waves so as to make them audible. If high resistance telephone receivers are used in this circuit, the resistance, R, of 1500 ohms and the condenser C of .01 mfd. are not necessary.

SOME OBSERVATIONS

It is interesting to note the following facts in the operation of the zincite-steel oscillating crystal:

1st. The stability of the oscillations increase as the value of the series resistance R is increased, and also as the value of the inductance is increased and the capacity decreased.

2nd. The point on the crystal producing oscillations is not the one producing best rectification when the crystal is used as a detector without any battery.

3rd. The oscillating crystal may produce simultaneous oscillations at two different frequencies.

4th. A light contact is not always a good one, as in the case of galena, since

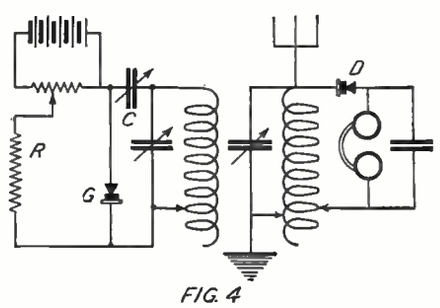


FIG. 4

The oscillating crystal circuit used as a separate heterodyne for the reception of continuous wave signals.

in some instances best results may be obtained by pressing the steel point against the crystal.

5th. If a good, sensitive piece of zincite is used in the oscillating detector, the contacts producing oscillations are generally steady and may be kept for a long time if the detector circuit is mounted on a spring or rubber arrangement preventing vibrations being transmitted to the steel point.

6th. The use of the potentiometer across the battery is useful not only to vary the strength of the oscillations but also to tune or control the regenerative effect obtainable with the circuit. It should be noted that the frequency of the current produced by a zincite oscillator varies with the value of the negative resistance so that the frequency increases as the value of this resistance is increased.

7th. When the zincite oscillator is used just below the oscillating point, weak oscillations are amplified more than strong ones. Figs. 5, 6 and 7 are practical circuits developed by Mr. Lossev, the inventor, in which two batteries are used in order to decrease the current consumed by the po-

(*Continued on page* 540)

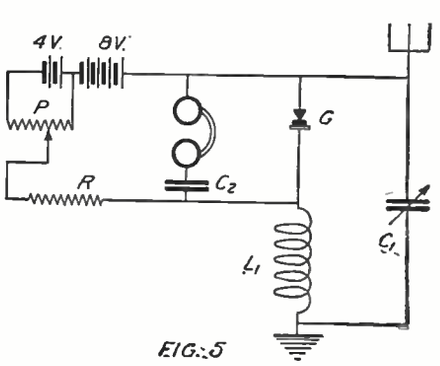


FIG. 5

The potentiometer may be connected across a few cells of the battery only as shown here. This circuit is more adapted for long wave reception.

Esperanto or Ilo—Which?

A Plea for Empirical Methods In Advancing a Radio International Language

By O. C. ROOS, Fellow, I.R.E.

It stands that the Ilists should have their chance in presenting to the readers of RADIO NEWS *the prominent points favoring the language, Ilo. Consequently we publish within the box below, the same English text as appeared in Mr. Sayers' article in the August issue and by its side, the translation to Ilo.*

IN his interesting article on Esperanto as a proposed Radio World Language in the August issue of RADIO NEWS, Mr. J. D. Sayers missed a fine opportunity to let the public compare an Ilo with an Esperanto text. That omission is herein supplied by the appended texts of his WOR address on April 5, to which I replied from WBZ 35 minutes later in Ilo. Ilo is used where Esperanto occurred; as the Ilo address was given from CKAC.

The readers of RADIO NEWS have been given a rosy prospectus of Esperanto promises, based on a mere hope in the ultimate rule of those Esperantists who are satisfied with an easily spoken but very difficultly written system. If majority rule is a sufficient reason for the adoption of Esperanto, then English has the better practical right, on account of its governmental backing in England, in most Anglo Saxon Universities and in the League of Nations.

I shall later indicate how, by clever omissions, the Esperantists have tried to create the impression that the League of Nations recommended their jargon for teaching in the public schools of the world. It did no such thing.

Let me state frankly that Esperanto, or any language which "robs" Ilo as complacently announced by the French radio amateur Dr. Pierre Corret, and yet calls the resultant "mixture" Esperanto, has *no* system of growth nor ethics in its "internal idea" of brotherhood, except commerce and acquisition.

Can one seriously respect a grammar which permits no distinction between the two sentences "stolen from the Ilists" (shtelitaj de la Ilistoj) and "stolen by the Ilists" (shtelitaj de la Ilistoj)? I think not.

In Ilo we have a language which, in spite of Mr. Sayers' insinuations to the contrary, has not been "tinkered" with. Ilo has grown scientifically by the 800 odd discussions, tests and decisions of its Academy. It is now a working tool of far greater refinement for radio than the loosely constructed Esperanto system can pretend to be.

Ilists admit that you can't write good Ilo unless you know the simple rules for forming new words. Esperanto puts things together in a deceptively easy—even careless—system. The result is a mass of hybrid monstrosities, due to the fact that they use "word endings" equally with roots to make new words, *e.g.*—"the ary of men"—is a literal translation of an Esperanto sentence meaning "the collection of men" (from "ary" in "dictionary," meaning a collection! Etymological hootch! This is against natural languages, and is not generally permitted in Ilo.

Esperantists think that "chi" instead of "omna" is a good translation of "all."

An Ilist can say "it is perhaps possible"—the Esperantists must say "it is possibly possible."

Ilists can distinguish between "stolen by" and "stolen from." They say "stelita da" and "stelita de."

To say that Ilo is too rigid and too exact is to praise it in the eyes of engineers and all exact thinkers. So would Latin be, if brought up to date in technical terms and regularized. Yet no one ever complains of Latin's rigid word formation. On the contrary, Ilo is more flexible than Esperanto as it has an *optional* accusative case for inversion. This means a sentence like "the boy who(m) I hit."

As regards Orientals, I taught Ilo during 1911 to 1913 to Filipinos and Chinese who thought Esperanto very hard. Mr. Sayers is wrong if he thinks a sentence like "the good(s) tall(s) strong(s) boy(s)" is found easy for Chinese or Japanese. This agreement is called "accidence" and is conspicuous by its absence in such tongues. Ilists say "the good tall strong boys," as in English. That's why English is a popular business language—out there—and not "pidgeon English" either. If some of the English or American Esperantists spoke Japanese, Tagalog or Chinese they would know this.

Let me say that "Ilo" has a perfect right to this abbreviation, signifying "International Language" as a name. It was the original name used from 1907 to 1909 in the official organ of the Academy, called "Progreso." Why did Mr. Sayers not tell the public how the Esperantists have just changed the name of their British Official Magazine to "The International Language"? These tactics simply offend the public's sense of fair play and avoid the real test, that of translation of technical and scientific works.

To allow the reader to compare an Ilo and Esperanto translation, Mr. Sayers' speech, published in the last issue, is reproduced here.

By a close study of this translation to Ilo and the translation to Esperanto in the August issue, the outstanding differences can be seen.

Since the Esperantists are making the childish claims of having several times the number of adherents professing Ilo, let us note that in May, 1922, their own official organ "American Esperantisto" stated that there were 250 members in North America. Subscriptions to this journal at a dollar a head plus all cash sales and sales of foreign exchange journals yielded $500! Here is the "solid rock" of business support of a system then 35 years old!

When one realizes that the Universal Esperanto Association—the most practical Esperanto body—has less than 10,000 members, one can form a fairly accurate idea as to the real strength of this decadent

(*Continued on page* 546)

Ilo translation of Mr. Sayers' speech published in our last issue. This is for the purpose of enabling our readers to compare a text in Esperanto and Ilo.

Ilo

Nun, kara samideani del Idanaro de la tota mondo. Me esas che la stationo di La Presse, en Montreal, Canada. Esas grandega plezuro mea parte parolar unesmafoye di Nord Amerika trans la maro a mea samideani en altra landi. Se vi sucesoze audas me, facez por Ilo la bona favoro sendar al adrrso antee donita en la Ilo gezetaro, kablogramo e adminime skribez a me letro pri la fakto ke vi audas me.

Ica experimento esas atencata da multa eminenta personi hike e sos historiala okaziono se mea "Ila" vorti audesas en altra landi. Me esas tre felica kun vi, kara samideani, vi idealistt qui laboras sencese, paciencoze por nia amata skopo, pro la kontentiganta progreso avane di Ilo. Ol esas bona just idealo e pro co venkos, sen doute venkos tra la tota mondo, super omna barili e malgre omna-speca, malkordioza homi, qui sempre odias la progreso e feliceso di la homoro, se la grandega zenzono ne existus por la benedikto di Ilo a la sufranta, dividita homaro, lore la finala glorioza venko di Ilo esus dubenda, me la progreso ipsa aduktos Ilo kom la bela mondal helpolinguo, komprenende, per e kun nia kontinua laboro por ol.

Ilo esas la linguo di la moderna marvelo, la radiotelefono en la uzado di ica trans frontieri ed anke esos la linguo di la parolanta kinemal pikturi, qui balde sucesos. Ilo pariros la mondo saltege de nun avane pro ke radio—uzado e parolanta kinemal pikturi portos ol ad omna populi.

Nu, kara samideani, me adios vi a me pregas ke vi telegrafez, se esas posibla od adminine skribez letri quik segun l'adreso donita. Balde ni parolos plu libere ed omna—die en nia kara linguo. "Til la revido,"—pronuncata (teel la rayveedoh) e signifikanta literale—"until seeing" or "until we see each other again"—en plu felica dio. Bona nokto!

English

Now, dear fellow-Ilists of the Ilo world, of the whole world. I am at the La Presse station in Montreal, Canada. It is a very great pleasure to me to speak the first time from North America across the ocean to my fellow-Ilists, in other lands. If you successfully hear me, do Ilo the good favor of sending to the address previously given in the Ilo press, a cablegram, or at least write me a letter, about the fact that you hear me. This experiment is watched by many eminent persons here and will be an historical event if my Ilo words are heard in other countries.

I am very happy with you, dear fellow-Ilists, you idealists who labor tirelessly, patiently for our beloved cause, because of the satisfactory progress forward of Ilo. It is a good, just ideal and, therefore, will conquer, surely conquer, throughout the whole world, over all barriers and in spite of every sort of evil-hearted men who always hate the progress and happiness of humanity. If the tremendous need did not exist for the blessing of Ilo to a divided, suffering humanity, then the final, glorious victory of Ilo would be doubtful, but progress itself will bring Ilo in as the beautiful, world-wide auxiliary language, of course, by and with our continued work for it.

Ilo is the language of that modern marvel, the radio telephone in the employment of the latter across frontiers, and also will be the language of the talking moving pictures, which will soon be a success. Ilo will go by leaps and bounds throughout the world from now on, because the radio and talking movies will carry it to all people.

Now, dear fellow Ilists, I bid you adieu, and I beg you to telegraph, if possible, or at least write by letter immediately to me according to the given address. Soon we shall talk more freely and every day in our beloved language. "Il la revido" (pronounced "teel la rayveedoh" and meaning, literally, "until seeing," or "until we see each other again") in a happier day. Good night.

An Interview With Secretary H. C. Hoover

By S. R. WINTERS

Read what the United States "Chief of Police of the Ether" has to say relative to the radio broadcasting situation. Through this exclusive interview, Mr. Hoover has cast some light on what we may expect in the future.

GOVERNMENT supervision of radio communication, prevention of monopolistic control of broadcasting as a public service, avoidance of Government censorship of broadcast programs and the interconnection of transmitting stations for the dispersion of events of national import—these are among the significant phases of radio broadcasting especially engaging the attention of Hon. Herbert Hoover, Secretary of Commerce. In an authorized interview for RADIO NEWS, he briefly discusses each of these factors and their relations to the government and to citizens of the United States.

"The problems involved in Government regulation of radio are the most complex and technical that have yet confronted us," states Secretary Hoover, who has been picturesquely referred to as the chief of police of the ether. "We must preserve this gradually expanding art in full and free development, but for this very purpose of protecting and enabling this development and its successful use, further legislation is absolutely necessary.

"How profound the changes in this method of communication have been since the regulatory Act of Congress approved in August, 1912, is indicated by the fact that the whole telephonic application of radio is practically a discovery since the act was passed," he continues. "At that time radio was in considerable use as a telegraphic method of communication, more especially with ships, but there was not a single telephone broadcast station in the United States. Some indication of the development of the art is shown by the fact that at the time the act was passed 485 American vessels were equipped for transmission of telegraphic messages. There were 123 land stations, of which one was trans-oceanic. There were 1,224 amateur stations, as I have said, all engaged in transmission of telegraphic signals. Today there are 2,723 American vessels equipped with radio. There are 12 trans-oceanic stations, 790 other land stations and 16,590 amateur sending stations. Where there were no broadcast stations, there are today nearly 600 of them, located in every town of importance in the country. There are certainly three to five million radio telephone receiving sets; therefore, there is a radio audience of anywhere from 10 to 20 million people.

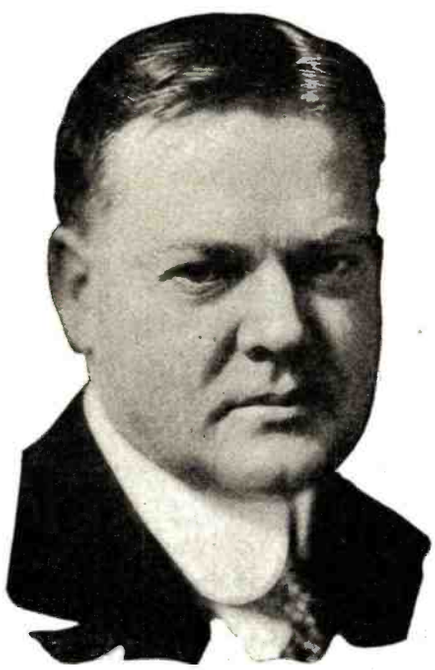
CHANGING CONDITIONS

"The year this act was passed the commercial companies extended heartfelt congratulations and paid a bonus to the operator who, by his skill, reached a nearby station in Porto Rico, whereas today we communicate hourly, with reliability, a vast number of commercial messages over both oceans. Twelve years ago the amateur boasted to his friends of his communications over a few hundred miles. Today our amateurs, to whom much of our radio progress is justly due, nightly send messages across the Atlantic ocean, and within the last 12 months we have been exchanging broadcast programs with Europe.

"During these 12 years radio has come into use for many other important communications. It is used for communication with air craft, and has found a very important development as a practical compass for ships, which seems likely to even reduce the cost of government aids to navigation

"This increase in use has been due to the tremendous discoveries and improvements in the character of apparatus. The discovery of the vacuum tube for amplification is the foundation for all telephonic work. The tuning and assembling of apparatus has been improved to such an extent that we are able to confine the sending and reception of signals to smaller bands of wave-lengths than was the case 12 years ago.

"At the time the act was passed the wave band occupied by each sending station was so broad that only half a dozen channels were open for sending. Now it is possible, if the maximum use were made of technical development, to send many times that number. For practical reasons, however, the wave-lengths available for telephonic purposes in the present development of the art are much more limited than those for telegraphic purposes and are today practically limited to the range between 200 and 600 meters. Within this area we have about seven possible bands, for sending in any one locality. The number of telephone broadcast stations that can be operated from any one place is, however, more limited than this because of interferences of one locality with another. With the system of staggered zones set up by the Department it has been found possible, in some localities, to work broadcast stations simultaneously on three different wave-lengths or frequencies. No doubt the number of available frequencies will steadily increase with improvement in the art and better adjustment between different purposes.



SECRETARY H. C. HOOVER

"If the mechanical condition of the art today were as it was 12 years ago, the vast volume of radio communication now constantly in motion in the ether would create such a pandemonium of interference that the whole art would break down. Were it not for the regulation and the very tenuous voluntary co-operation of today, we should have pandemonium despite the development of the science.

"The tremendous development in electrical communications is to a large extent due to the fact that individual initiative has not only been unhampered by the Government, but has been encouraged to the extent of the Government's ability and regulated so as to give the maximum service. The further legislation needed should, in my view, regulate only to the extent that is necessary in public interest for the development of the science itself, for the service of those who make use of it. It seems to me, therefore, that the fundamental thought of any radio legislation should be to retain possession of the ether in the public and to provide rules for orderly conduct of this great system of public communication by temporary permits to use the ether."

Mr. Hoover has frequently decried any indication that would tend to place radio in the hands of one individual or corporation, or any group of persons. He reiterates his viewpoint in this authorized statement when he declares:

AGAINST MONOPOLY

"It should be kept open to free and full individual development and we should assume that there can be no monopoly over the distribution of material. Radio communication is not to be considered as merely a business carried on for private gain, for private advertisement or for entertainment of the curious. It is a public concern impressed with a public trust and to be considered primarily from the standpoint of public interest to the same extent and upon the basis of the same general principles as our other public utilities.

"I can state emphatically that it would be most unfortunate for the people of this country, to whom broadcasting has become an important incident of life, if its control should go into the hands of any single corporation, individual, or combination. It would be in principle the same as though the entire press of the country were so controlled. The effect would be identical whether this control arose under a patent monopoly or under any form of combination, and from the standpoint of the people's interest the question of whether or not the broadcasting is for profit is immaterial. In the licensing system put in force by the Department of Commerce, the life of broadcasting licenses is limited to three months so that no vested right can be obtained either in a wave-length or a license. I believe it is safe to say, irrespective of claims under patent rights on apparatus, that broadcasting will not cease and neither will our public policy allow it to become monopolized."

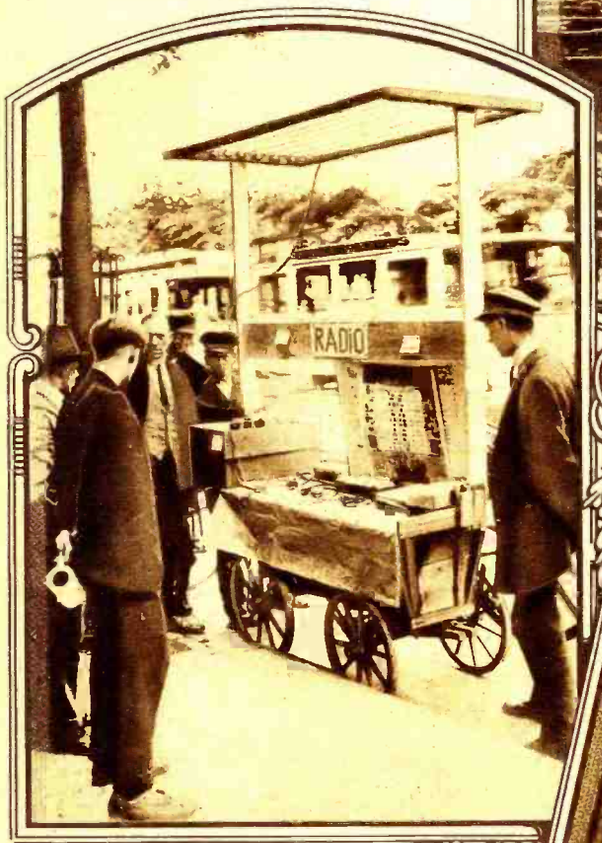
Secretary Hoover believes that the present system of broadcasting will be developed by the more frequent interlinking of local transmitting stations into a unified chain for the dispersion of events of national significance. The broadcasting of proceedings of the conventions of the two great political parties is a notable instance of this interlinking of several broadcast stations.

"Radio interconnection is the next and

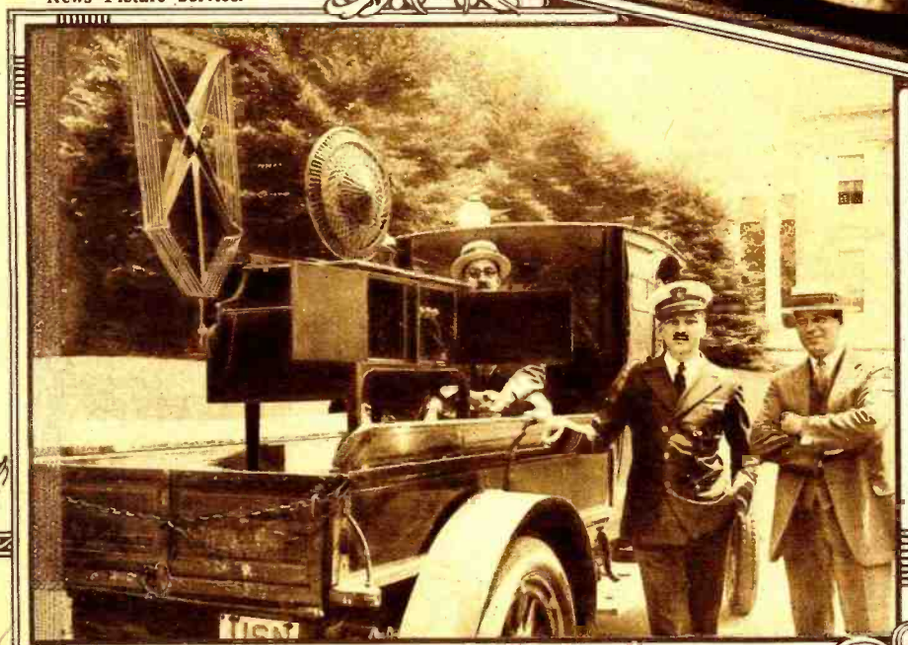
(*Continued on page* 568)

Right: The most novel use of radio is seen here in its introduction into the water, so that bathers may listen in with complete comfort and sip cool drinks at the same time. A loop aerial is sufficient for picking up the signals from local broadcast stations. © The Gilliams Service, N. Y.

Below: In the United States we find that radio parts can be purchased at Cigar Stores and Five-and Ten-cent Stores, but European dealers have gone us one better and peddle radio parts on the streets. The vender's cart above is equipped with a complete receiving set, giving the latest programs to the passer-by as a means of stimulating sales. © The Gilliams Service, N. Y.

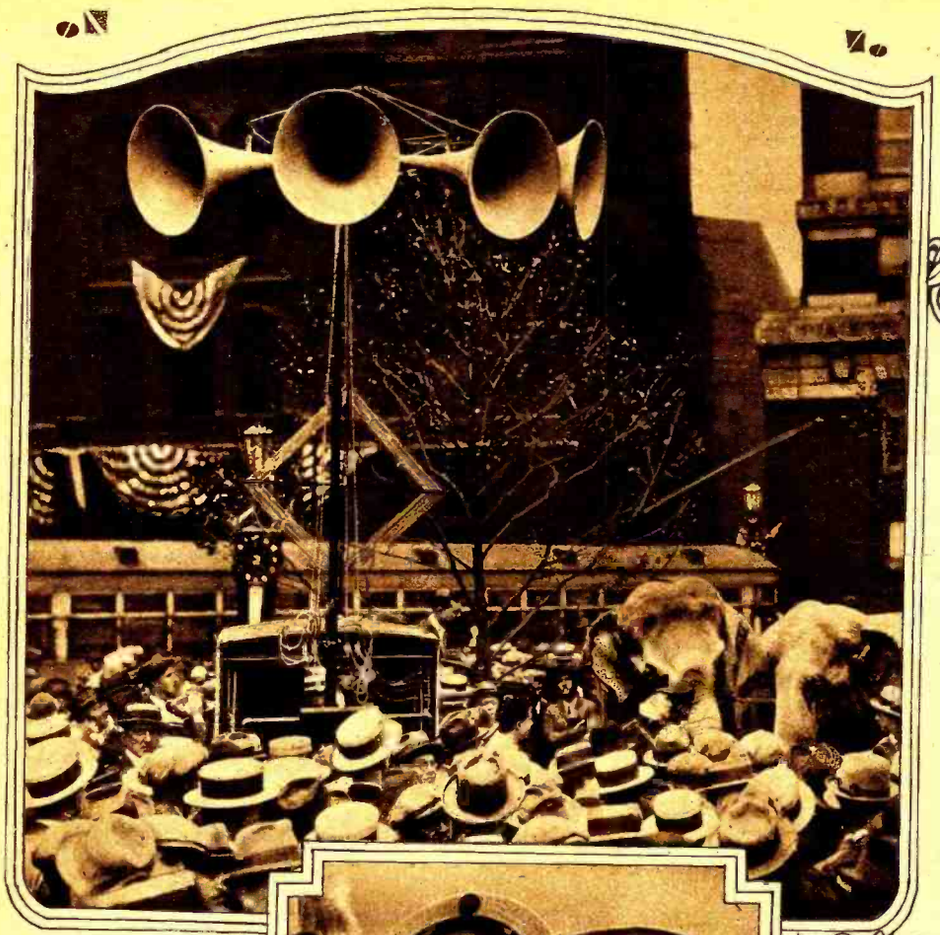


Below: Here is the large Super-Heterodyne receiver, loop aerial, loud-speaker and all, which was installed in the White House during the Republican National Convention that the President might be directly informed of developments. © Henry Miller News Picture Service.



Above: Not to be outdone by "WDAP" in Chicago, which through its radio broadcast station is known from one end of the country to the other, the Hotel Majestic of New York City, has installed a high powered broadcast station of its own with one of the most beautiful broadcast studios in the country. This station is now in operation, using 500 watts of power.

The photo shows a view of the studio. An unusual feature is that all microphones are concealed in the walls, and when the speaker announces, it will not be directly into the microphone. This station is known as "The Voice of Central Park." © Kadel & Herbert.



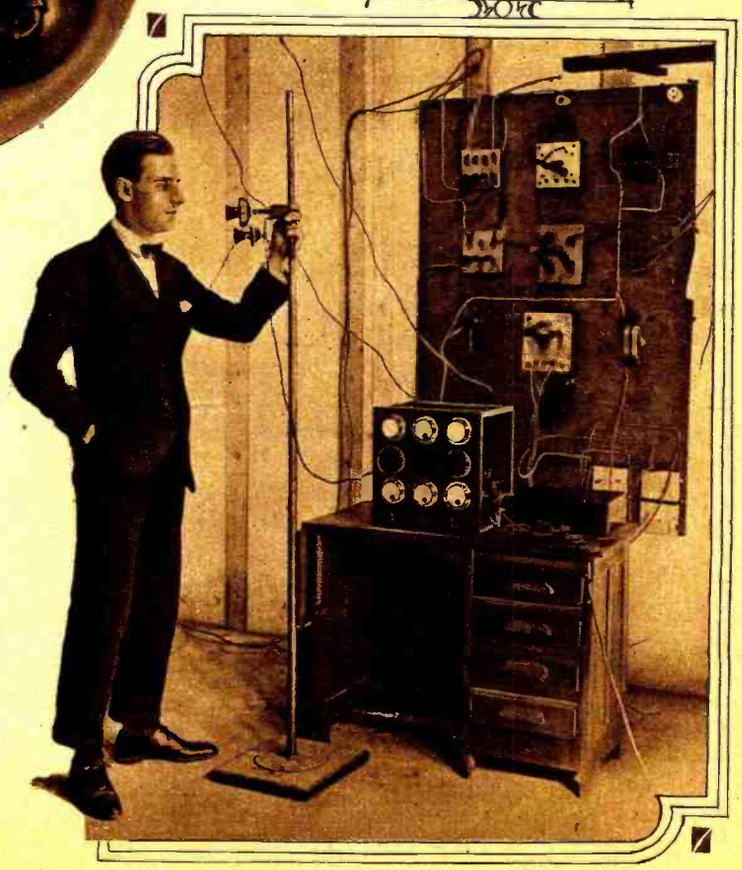
An interested crowd in Cleveland, Ohio, listening to the proceedings of the Republican National Convention via radio, being projected from the loud speaker horns of a Western Electric Public Address System.

A close up view of a new combination loud speaker and table lamp. A receiver unit fits in the base, the column of the lamp is utilized as the horn and the shade as the deflector. © Kadel & Herbert.

A Cincinnati shoe repairing establishment is providing radio entertainment for its patrons. © P & A Photos.

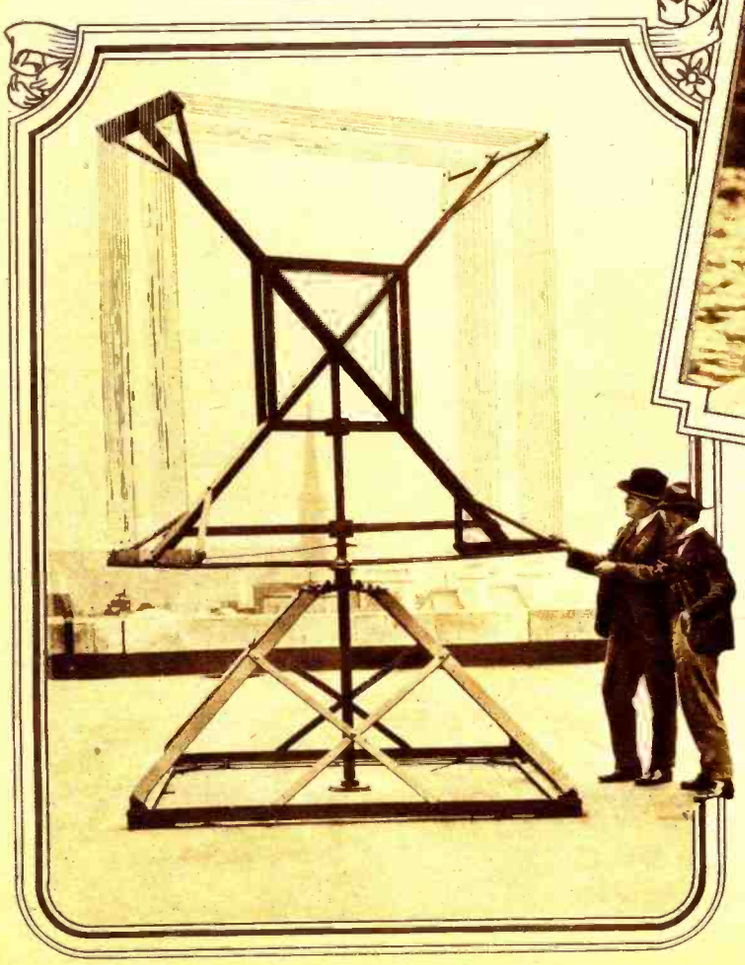
Reginald Gouraud, an American living in Paris, has a 32-meter transmitter. He hopes to bridge the Atlantic. © P & A Photos.

Here is the latest, a shoe box radio set. This young bootblack provides radio entertainment for his customers while they are having their shoes shined. © Kadel & Herbert.



Here is William Arthur Rand, all dressed up as a radio loud speaker, in the pageant held recently at Bradley Beach, N. J., in which hundreds competed for prizes. William won a prize for his unique representation.
© Fotograms, N. Y.

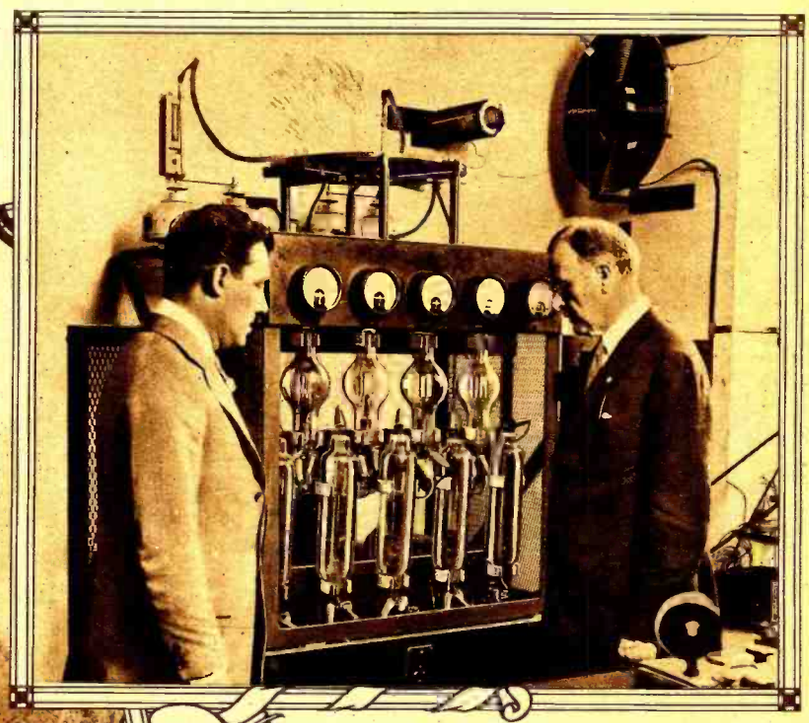
This short wave radio transmitter, installed for the Olympic games at Colombes, near Paris, broadcast the proceedings which were picked up by the large stations throughout France and re-broadcast on longer wavelengths. A power amplifier and a large horn were used locally to announce the result of each contest to the crowds in the grandstand. © International.

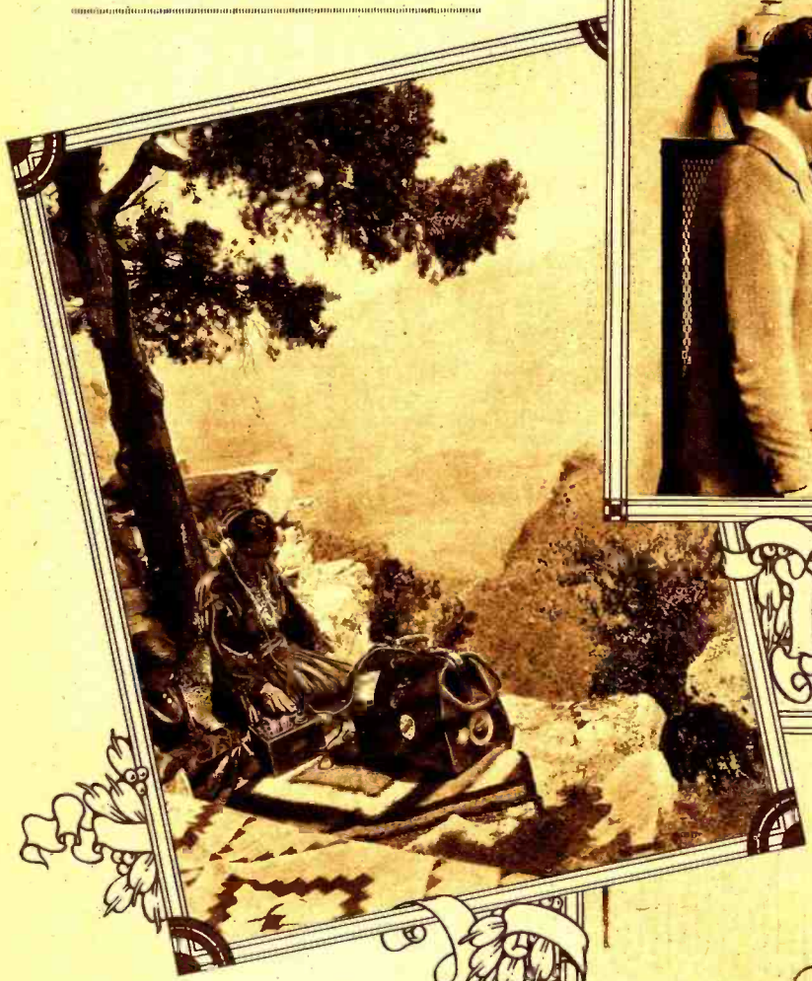


Some of the Boy Scouts at their summer camp at Bear Mountain, N. Y., decided to rig up a radio set in their rowboat so they might enjoy programs from broadcast stations near home. Note the large loop aerial. This they constructed themselves, in true Scout fashion.
© Foto Topics, N. Y.

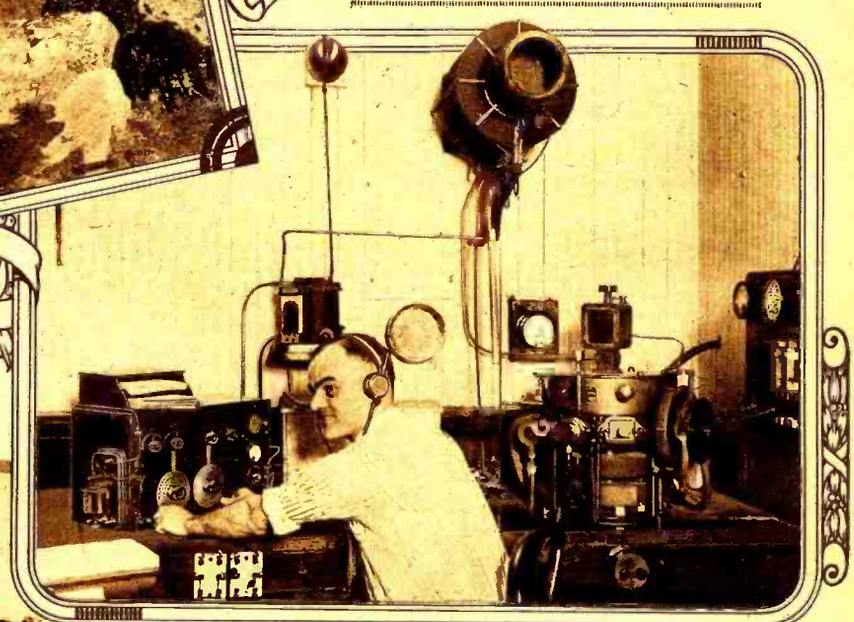
This giant loop aerial, erected atop the Bush Building, London by the U. S. Shipping Board, is 8 feet square and is wound with 48 turns or approximately 1,530 feet of stranded aerial wire. Mounted on ball bearings it can be turned on its axes from the interior of the building. This loop is employed for reception from high powered Naval radio stations in America. © Wide World Photos.

Right: Interior of the new $50,000 Municipal Broadcast Station, WNYC, in New York City. This station was opened recently and is transmitting on a wave-length of 526 meters with a power input of 500 watts. The photo shows Grover Whalen (left), Commissioner of Plants and Structures, and John F. Hylan, Mayor of New York City, inspecting the apparatus. © Fotograms, N. Y.



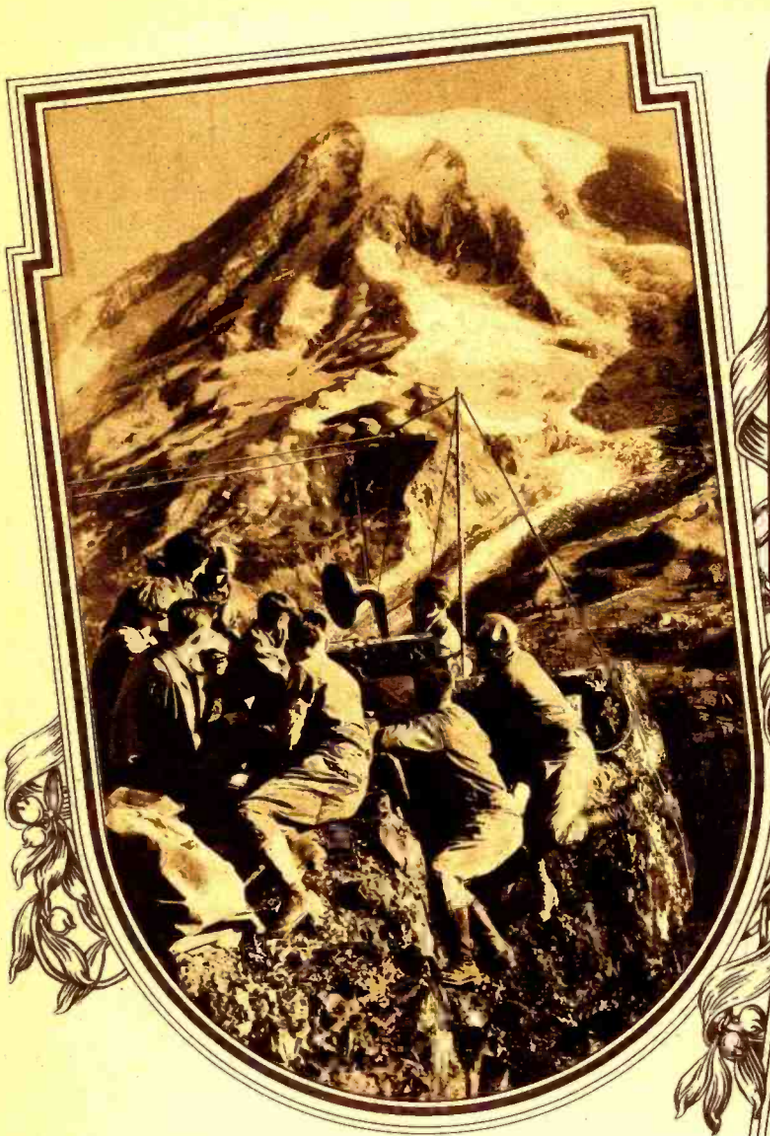


Left: The Navajo Indians at Grand Canyon National Park, Arizona, are very much interested in radio. Reception is very good at Grand Canyon, as the rim is 7,000 feet above sea level. This Squaw and her Papoose are enjoying a radio concert from a nearby station.



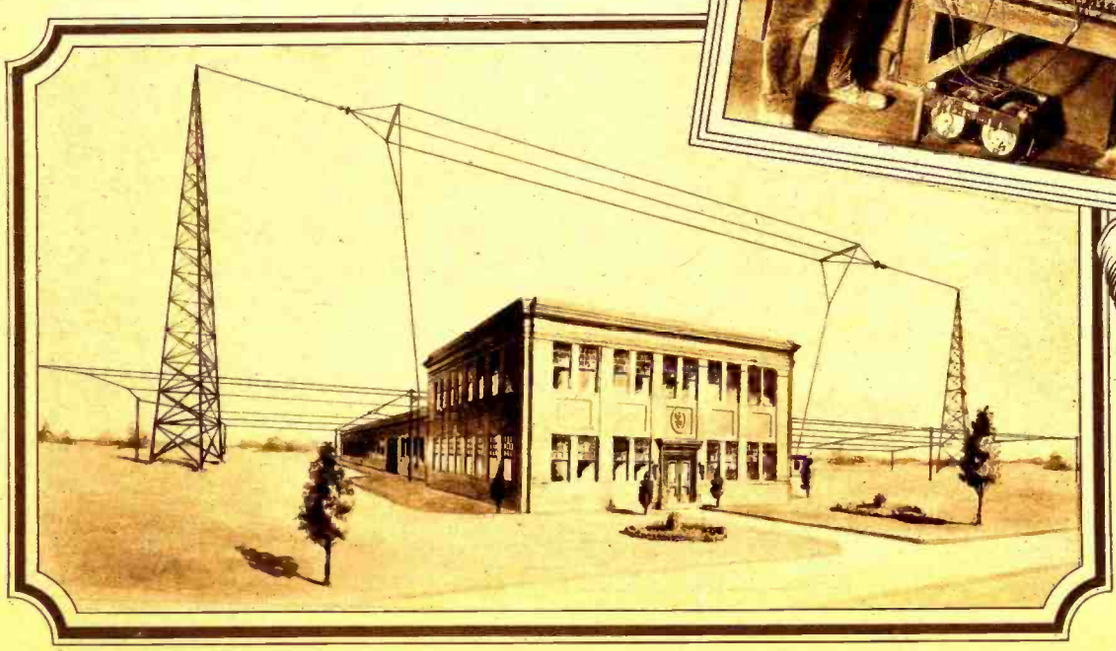
Right: Mr. H. L. Swart, Chief Radio Operator at the Radio Mail Headquarters, Washington, D. C., and the 5-k.w. arc transmitter which furnishes quick service for mail planes. © Henry Miller News Picture Service.

Left: Radio is a boon to the members of this coast-guard station, at Rye Beach, N. Y. Practically every day is uneventful for these men, but now, with the radio, they can listen in to a varied program, which gives them a great deal of enjoyment. They used to hit the hay early; now they stay up and listen in. © Fotograms, N. Y.



Above: Here is a suggestion for carrying your radio when off on a vacation. Alexander Carr is here seen with his radio set mounted in a wardrobe trunk. Batteries and all are included. They are behind the panel. © Kadel & Herbert.
Left: A group of tourists listening in on their radio atop Pinnacle Peak in Ranier National Park, 6,665 feet above sea level. © Kadel & Herbert.

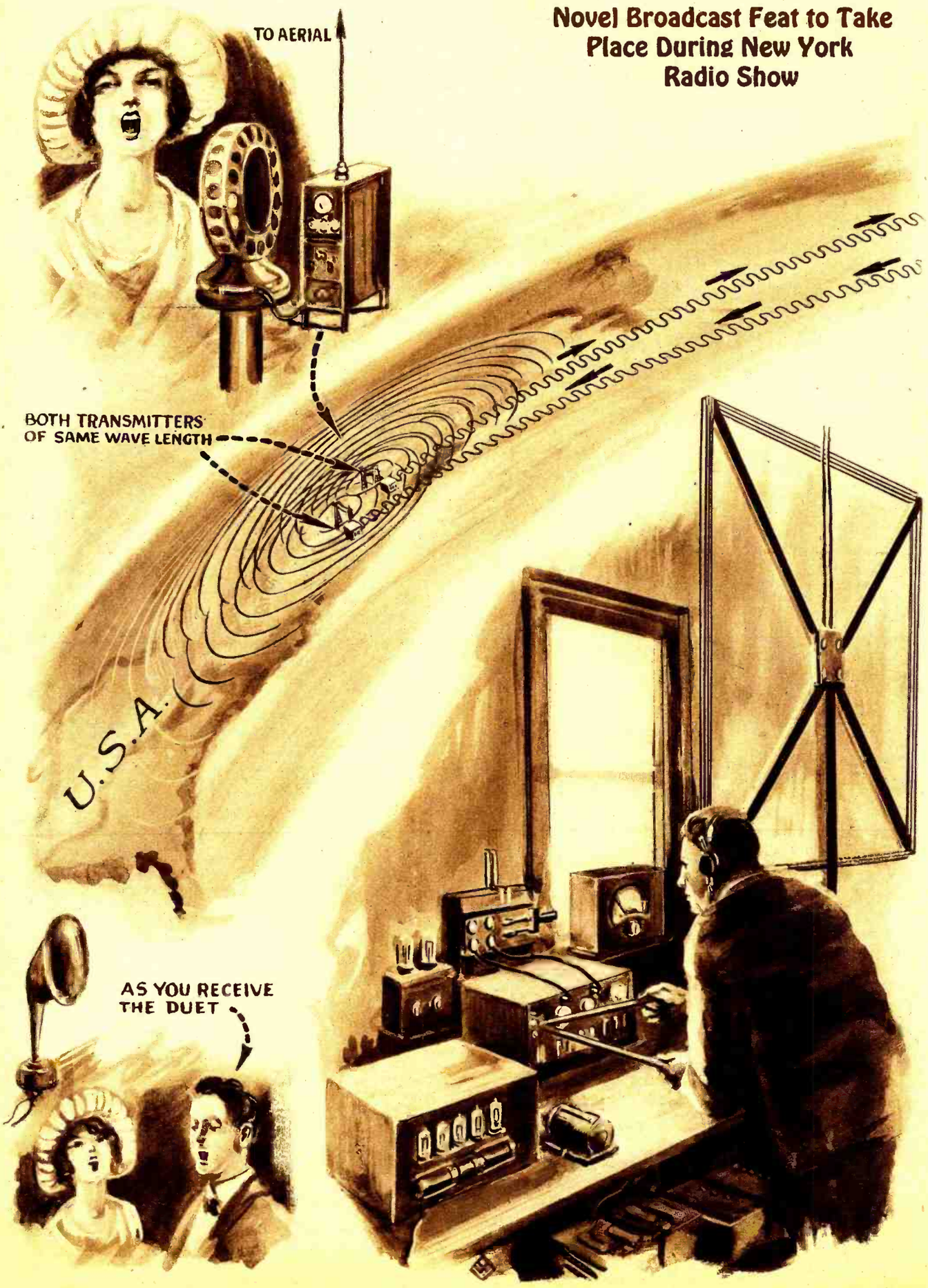
Right: The sending apparatus which is used to communicate with underground radio sets. Tests are being carried on by the Bureau of Mines, in order to perfect the apparatus to enable miners to communicate with the outside world without the use of high powered sets. Such tests are of considerable interest when interpreted with due reference to the conditions underlying each test. The set can be used in cases of emergency for communication between entombed miners and the outside world.
© Henry Miller News Picture Service.



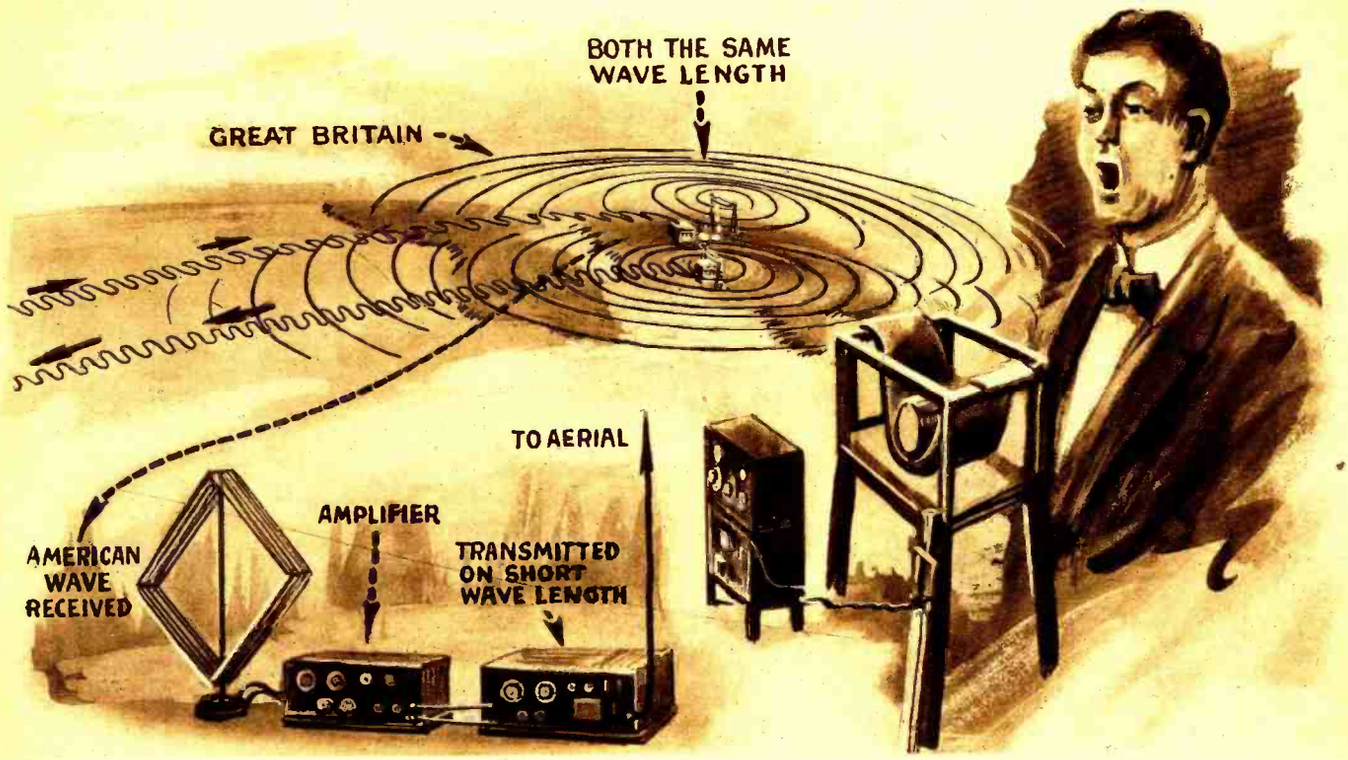
Left: Sketch of the radio broadcast station of the General Electric Company, now being built at Denver, Colorado, to complete the chain of three super stations. The other stations are WGY at Schenectady, N. Y. and KGO at Oakland, Calif. The Denver station will be on the air early this winter.

Duet With Singers 3,000

Novel Broadcast Feat to Take Place During New York Radio Show



Miles Apart To Be Broadcast



This double page illustration shows how the radio duet will be made possible. At both ends there are to be two broadcast stations. Each pair will transmit on the same wave-length. In the United States the male voice from England will be picked up by a sensitive receiver, relayed to one of our broadcast stations and re-transmitted. The other American station will be broadcasting the female voice on the same wave-length; thus you will pick up both of them. England will pick up and re-transmit the woman's voice in the same manner as our station will pick up the man's voice. On the left is a close up of a receiving station.

Radio In South America

By JOHN ENGLISH

THE most striking feature of the South American Radio situation to the United States listener is the entire absence of legal regulations. Such regulations probably exist in most of the republics, but practically no notice is taken of them. As a result, amateurs, almost entirely on telephony, are heard mixed up with the broadcast and commercial stations on all waves from 90 to 500 meters. At times this leads to trouble, but as a rule it is noticeable (and very much to the credit of the local amateurs) that there is practically no interference while concerts take place, in spite of the absence of silent hours and supervision.

There are relatively few broadcast stations in regular operation; the principal station is LOX, of the Radio Cultura organization, situated at Palermo, a suburb of Buenos Aires, Argentina. This is a 500-watt station, and it should be possible for United States listeners to pick up LOX. It transmits every night on 375 meters, from 01.00 (1 a. m.) G. M. T., until about 03.00 (3 a. m.) G. M. T. As a rule, the program is of a musical nature, with rather long pauses between the items, and often with a short speech (in Spanish of course) at 02.00 G. M. T. The station is usually announced as "Estahs*iohn* Elle Oh Eckis *Rah*dio Coolt*oo*rah Pala*ir*moh Bwaynos Ayeres." (If you know Spanish, forgive this attempt to indicate the pronunciation!) Two routine items which may help to pick up the station are the transmission of a 15 minute telegraphy practice (at the start of the program), using buzzer modulation and the hour signal at 02.00 G. M. T., chiming the four quarters and striking 10.

Another Buenos Aires station of equal power, recently re-erected and as yet not giving such good results as LOX, is LOZ, situated at the high-power telegraph station of Monte Grande (illustrated in RADIO NEWS, May, 1924), and operated by the Argentine Broadcasting Association. This station proposes to broadcast the operas from the Colon theatre in Buenos Aires, and also to try re-broadcasting the KDKA 94-meter concerts.

Others of importance are the two Montevideo stations, both using 500 watts. There is another at Santiago, Chile, a French station of the same power, which, up to the present, has not been altogether satisfactory. In addition, there are many smaller stations, giving more or less regular programs, but generally speaking rather less than more.

Most of these, and also the amateur stations (and there is, of course, no hard and fast division between the one and the other), use transmitters made in the Argentine by local firms or the local branches of United States manufacturers. Customs and other import duties make the importation of apparatus rather unprofitable.

In the same way, the vast majority of receivers in the Argentine (in which country radio has developed most rapidly) is made in Buenos Aires, although United States sets, as well as German, French and British apparatus, are all on sale.

THE SHORT WAVES

The interest of the BCL at present is chiefly turned towards North American broadcasting. In fact, the Radio Club of the Argentine proposes to hold a competition in reception of the northern stations. As might be expected, the outstanding stations which everyone tries for and many get are KDKA and WGY. Others of which confirmed reception is recorded are KFKX, WBAP, KPO, KHJ, KGO, WEAF and WDAF. Static and interference (especially in Chile, caused by the spark station at Valparaiso, which is audible 200 miles away on all waves from 60 meters to 1,200 meters) are, however, constant stumbling blocks to the broadcasting waves. Therefore, there is very little pleasure to listen to the U. S. concerts.

On the short waves it is quite another matter, but as yet there are very few amateurs taking an interest in 90- to 120-meter work by KDKA and WGY. Both may be heard thoroughly with the simplest circuit and one tube, and this on practically any night in the year.

Amateur telegraphy has just started to interest the local fans. While this is being written, the first Pan-American tests, organized by the American Radio Relay League and the leading amateur periodical in Buenos Aires, the *Revista Telegrafica*, are in progress. No doubt they will be successful as regards the reception in these countries of North American amateurs, since they are audible every night. In fact, one-way communication has already been established between 1XAM and the writer, but it seems doubtful as to whether our signals will be recorded in North America as yet.

Davy Jones Speaking

By J. FARRELL

Above: The control panel and power amplifier which were installed on the end of the "Steel Pier" at Atlantic City to pick up the minute voice currents coming from the microphone into which Mr. Jackson spoke while walking on the ocean bed. The power amplifier was connected by telephone to station WIP from where the queer monologue was broadcast. © Atlantic Foto Service.

Above: Mr. G. A. Jackson, the deep sea diver, descending into the ocean from the boat off Atlantic City prior to his unique description of what he saw "below." To the left is a photo of the helmet used by Jackson, showing the microphone and the wires leading from it to the world above. © Atlantic Foto Service.

"I'M on my way to the bottom of the sea. On my left I see the wreck of an old boat. It looks like the skeleton of a huge fish. In it a school of little fish is playing. The rays of the sun, which look green at this depth, shine on their backs."

This message was recently broadcast by a deep sea diver from under 50 feet of water off Atlantic City. The diver, in regulation diving costume, disclosed some of the secrets of the deep to a vast radio audience, as he casually strolled about on the sea bed and peered into Davy Jones' locker.

In the performance of this remarkable feat, which has numerous practical aspects, a close contact electric microphone was imbedded in a rubber sponge and the sponge fastened inside the diver's helmet. The microphone was connected by special waterproof wire with an amplifier located on what is known as the "Steel Pier" at Atlantic City, N. J. The message was carried from this point overland and under the Delaware River 60 miles to the control panel of station WIP at Philadelphia.

"Neptune is next on the program," said the announcer at the Philadelphia station, and a swirling and swishing noise was heard by thousands of radio fans in all parts of the country. This noise was made by the air currents in the diver's helmet. Then as the diver went down from a small boat 75 feet off the end of the Steel Pier there came faintly into the ears of the fans a description of what he saw. The almost indistinct quality of the voice was due, explained C. A. Goudy, radio engineer in charge of the Atlantic City station, to the fact that the diver was not speaking directly into the microphone. Later in the evening the diver went down again and his voice was plainly heard.

The station at Atlantic City is connected with the main station at Philadelphia by a special telephone circuit that goes across the state of New Jersey. There is an amplifier at Camden, N. J., on the east shore of the Delaware River. A submarine cable under the river completes the circuit into Philadelphia.

The station, which is operated by Gimbel Brothers, has been heard all over the United States, in England, France, Germany, South America and Hawaii. There are nine remote control rooms located in various parts of Philadelphia in addition to the station at Atlantic City. The wide variety of material broadcast is indicated by the location of the remote control stations which are placed in the Holy Trinity Church, Metropolitan Opera House, Cafe L'Aiglon, Germantown Theater, Forrest Theater, Club

Mr. G. A. Jackson, the deep sea diver, after having broadcast his experiences in "Davy Jones' Locker," and the silver loving cup presented to him by Miss Alma Tell, noted actress. The accompanying sketch shows how Jackson's voice was carried in the form of an electric current, from his helmet to the boat, from the boat to the pier and thence to broadcast station WIP by telephone, from where it was transmitted into the ether to be heard by listening radio fans.

Madrid, University of Pennsylvania, Philadelphia, Police Band Room, and the St. James Hotel.

Numerous microphones are placed around the Steel Pier at Atlantic City to broadcast the various attractions at this world famed playground.

A feature of the service which figuratively brings the Atlantic Ocean into the homes of thousands of people inland, who perhaps have never seen deep water, is the daily broadcasting of the sound of the waves as they break on the beach. "What are the wild waves saying?" this broadcast is called. It is accomplished by placing a microphone inside a waterproof bag and lowering the bag just above the surf. G. A. Jackson, deep sea diver, who made the underwater experiment declares that it was the first radio test of the kind ever made. At the conclusion of the experiment a silver loving cup was presented to Mr. Jackson by Alma Tell, the famous actress. Mr. Jackson represented a Philadelphia salvage company and the inscription on the cup read, "Presented by Radio Station WIP of Gimbel Brothers, Philadelphia, to the Philadelphia Derrick and Salvage Corporation, in honor of the first radio broadcast from the bottom of the sea, July 31, 1924."

Communication between divers under water and operators of the air apparatus on the water is usually accomplished by means of rope signals. Perfection of telephonic communication enables the diver to give a more accurate graphic description of the layout on the ocean floor, and in special cases his description may be broadcast direct to shore stations where drawings of the positions of wrecks and submerged treasure may be made. In his test trip Mr. Jackson found two rotting derelicts, the presence of which had been theretofore unknown.

The success of the radio broadcasts by Gimbel Brothers has been such that the company is now building a station in its New York store, that will embody the latest type of radio equipment. The station will be known as WGBS and will operate on 316 meters.

The operators of the Atlantic City station have had wide experience with the effect of radio broadcasts upon theatrical box office receipts and sales of phonograph records and sheet music. Mr. Goudy stated that following the first broadcast of Earl Carrol's "Vanities" in which Peggy Joyce was the star, station WIP was figuratively flooded with requests from listeners in for reservations for the performance. The practice of broadcasting the first act of "Vanities" on the opening nights was followed in every city played by the show and in every case the house was sold out days in advance. It is simply the inherent human desire to see what is heard, as one turns instinctively to look whence sound comes.

KDKA TO BROADCAST FOR POLAR SHIP "ARCTIC" NOW ON WAY NORTH

Recognizing the fact that the signals transmitted from KDKA, world's pioneer broadcast station, have a world-wide range and offer the only solution to dependable voice communication at immense distances, the steamship *Arctic* sailed recently from Quebec on a voyage to Etah, Greenland, carrying a full complement of special radio equipment suitable to pick up special broadcasts from KDKA.

The *Arctic* is carrying with it two Canadian Westinghouse special receivers, one of which is for delivery to Donald Mix, radio operator of the McMillan Expedition, somewhere along the Greenland coast, the other set is for use aboard the *Arctic*. Both these sets are designed to receive, special signals which will be transmitted from the new experimental station of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., every Monday night from 10:30 to 11:00, Eastern Standard Time.

In addition to its receiving equipment the *Arctic* is equipped with three transmitting sets, one standard ½ kw., 600 meter spark set; one 1 kw., 2100 meter I.C.W. set; one 2 kw., 120 meter I.C.W. set.

The call letters of the *Arctic* are VDM

(*Continued on page* 570)

Pilot Interviewed by Radio While Flying

By A. M. JACOBS
Of United States Army Air Service

"JOHNNIE," said a mother in a comic weekly some months ago, "run in and radio your father that there's a gentleman down here to see him. He just went into that pink cloud."

It's a fast moving age. That which is in the realm of possibility in a flash becomes reality; reality soon becomes history. Yesterday we made the joke come true.

We saw Lieut. A. L. Johnson, McCook Field aviator, take off in his DH P-292 Army plane and head for the clouds. There were plenty of them—though none were pink—and the airplane was soon lost to view. Casually we strolled into the McCook Field Laboratory where "Pop" Leland sat before a ground station radio set.

"Lieut. Johnson is 'up,'" we said, "could we talk to him?"

"Pop" started the motor generator and threw some switches, putting the set in operation.

"Hello—hello—hello," we heard him call into a hand telephone in the most approved radio voice. "This is A-W-5 talking. Somebody wants to speak to Lieut. Johnson. Can you hear me, Johnson? Come in—come in—come in."

Then from the moving plane somewhere in the clouds, out of sight, came faintly and scratchily at first as if through a struggle, but unmistakably familiar, Lieut. Johnson's voice.

"Hello—hello—A-W-5, Lieut. Johnson speaking. Can hear but cannot understand very well—seems to be a great deal of static. Try again."

"Pop" tried again. There was more turning of dials and talking, then we were handed the telephone and the head piece, while "Pop's" nod seemed to indicate that all was very well.

"Hello, Lieut. Johnson," we said, "can you hear us? If so, we'd like to know where you are just now and how the weather is up there."

A TEST

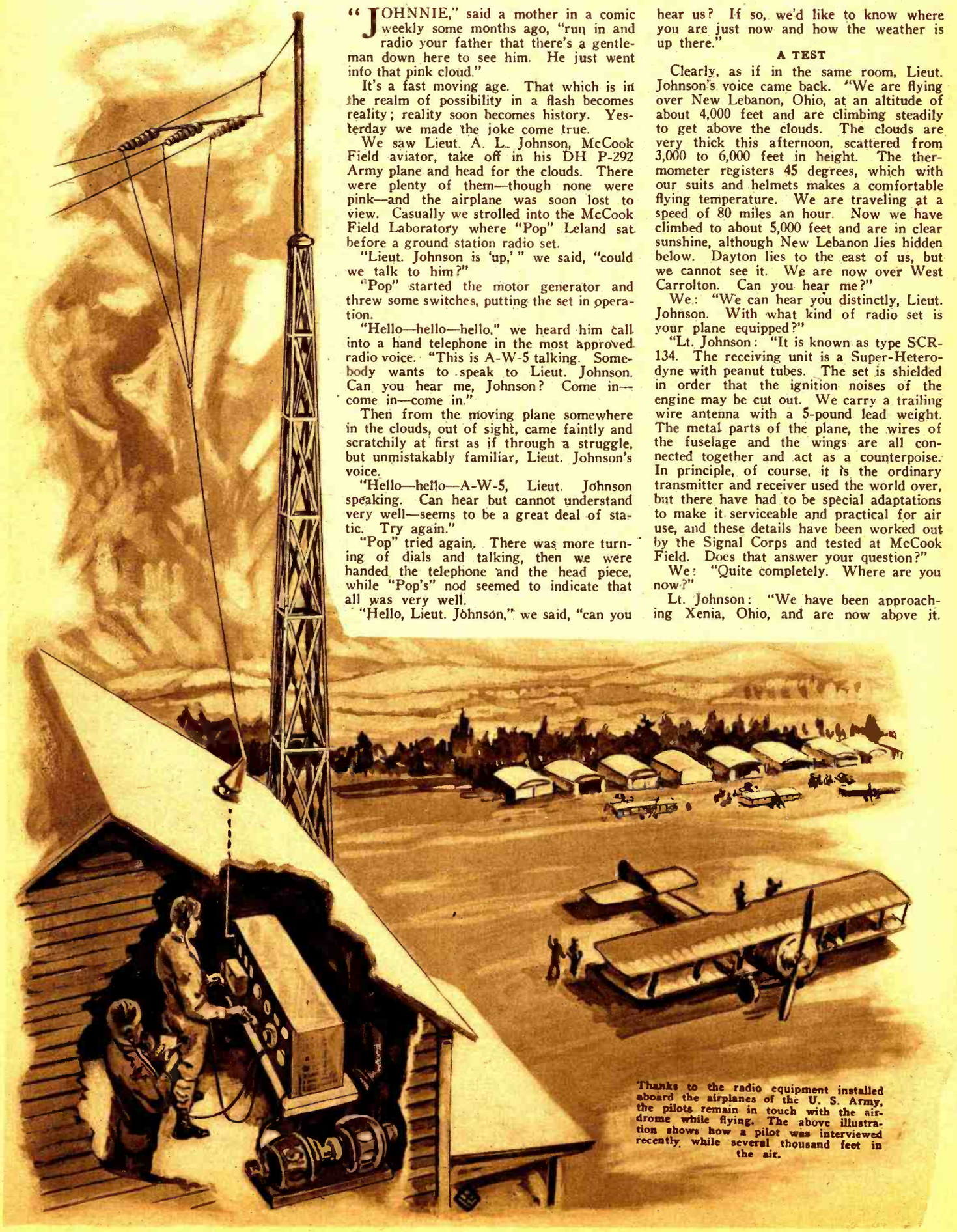
Clearly, as if in the same room, Lieut. Johnson's voice came back. "We are flying over New Lebanon, Ohio, at an altitude of about 4,000 feet and are climbing steadily to get above the clouds. The clouds are very thick this afternoon, scattered from 3,000 to 6,000 feet in height. The thermometer registers 45 degrees, which with our suits and helmets makes a comfortable flying temperature. We are traveling at a speed of 80 miles an hour. Now we have climbed to about 5,000 feet and are in clear sunshine, although New Lebanon lies hidden below. Dayton lies to the east of us, but we cannot see it. We are now over West Carrolton. Can you hear me?"

We: "We can hear you distinctly, Lieut. Johnson. With what kind of radio set is your plane equipped?"

"Lt. Johnson: "It is known as type SCR-134. The receiving unit is a Super-Heterodyne with peanut tubes. The set is shielded in order that the ignition noises of the engine may be cut out. We carry a trailing wire antenna with a 5-pound lead weight. The metal parts of the plane, the wires of the fuselage and the wings are all connected together and act as a counterpoise. In principle, of course, it is the ordinary transmitter and receiver used the world over, but there have had to be special adaptations to make it serviceable and practical for air use, and these details have been worked out by the Signal Corps and tested at McCook Field. Does that answer your question?"

We: "Quite completely. Where are you now?"

Lt. Johnson: "We have been approaching Xenia, Ohio, and are now above it.



Thanks to the radio equipment installed aboard the airplanes of the U. S. Army, the pilots remain in touch with the airdrome while flying. The above illustration shows how a pilot was interviewed recently, while several thousand feet in the air.

This illustration shows the radio installation aboard an airplane. The observing officer operates the set, current for which is supplied by a wind-driven dynamo mounted on one of the wings. The aerial is a single wire hanging under the plane.

The clouds are very sloping and broken. They are apparently headed for the north—at least the wind seems to be carrying them that way. We are now at a bank of cumulus clouds several thousand feet high. We will go over them. Up we go! Up along the side of the bank! Now we are at the top—and down we go—down the other side at a speed of 110 miles per hour. Dayton now lies to the left and Xenia to the right. Could you hear me distinctly during the climbing and diving of the plane?"

We: "Very distinctly. There was no change in sound, whatever."

Lt. Johnson: "I am now circling around another cumulus cloud. Now I am about to enter the cloud—now I am in the middle of it. I can see nothing. Is there any difference in sound?"

We: "None whatever. What are these direction finding sets for pilots that we hear of?"

DIRECTION FINDER

Lt. Johnson: "That is a radio development also, the airplane adaptations of which have been largely worked out at McCook Field. Suppose an airplane were flying from Washington to Dayton by night, or in a storm, so that it was impossible for the pilot to keep to the course with the customary land marks. The radio direction finder will guide him directly from one point to another in this way: The ground station sends out signals, so directed that they are most distinct along the line of the course. The pilot finding his signals becoming indistinct would know that he was leaving his course and would turn his plane until he found the signals distinct once more. With this system the airplane need to carry no transmitter, only a receiving set. This is, of course, the simplest of these systems. There is also what we call the equi-signal system. Two signals of equal wave-length are sent along the line of the course. When the pilot leaves the course, one of the signals becomes louder while the other dies away, so that he is warned to reset the nose of his plane and keep on the line of equal signals if he would come safely to his airdrome. Radio for the airplane is still in its infancy. But these developments are improvements that are making flying safer day by day, against all sorts of hazards and under all sorts of conditions. We are now over Wilbur Wright Field and the Huffman Dam. Since talking to you we have flown over New Lebanon, West Carrolton, Xenia, Wilbur Wright Field, and we are now headed for McCook Field. If there are no bill collectors about, we'll come down."

We: "The coast is clear. This has been quite interesting, Lieut. Johnson, and it would seem to prove that if one wants to interview a pilot while flying, one must work fast."

Lt. Johnson: "You bet."

We strolled out of doors. There were several planes against the sky. At the distance from the ground of even the lowest one, it was impossible to distinguish any sign of a pilot, any sign of human beings within them. Even the sound of their motors came softened through the spaces.

It's a fast moving age!

"Roxy"

The Story of a Dreamer Whose Dreams Come True

By GOLDA M. GOLDMAN

IN a spacious room in the building of the largest theatre of the world, the Capitol Theatre of New York City, a group of about 40 men and women have met every Sunday night for almost two years, freely giving of their time and talent for broadcasting a program of exceptional merit, chiefly for the one definite end of bringing cheer to disabled service men. And the guiding spirit of this group is a man whom thousands speak of as "Roxy."

To understand how true to the character of Samuel L. Rothafel is this great unselfish work, one must go back to the history of the man himself.

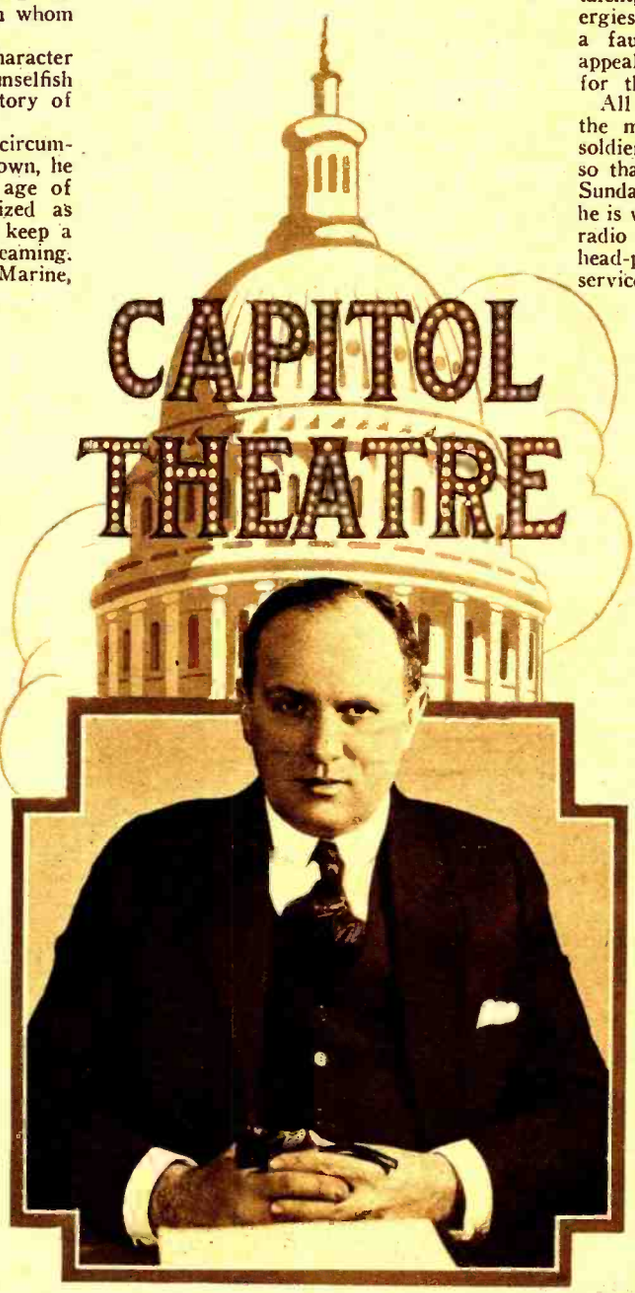
The son of people of ordinary circumstances, born in a small Minnesota town, he was brought to New York at the age of 12 years. He was shortly recognized as the family "black sheep", unable to keep a job, spending his time moping and dreaming. He was a cash-boy, a book-agent, a Marine, and again a book-agent, landing finally in the mining town, Forest City, Pennsylvania, where he married and definitely acquired a purpose in life.

Here, in the rawest, crudest days of the motion-picture, he started a picture business in a hall behind a bar-room, with an entrance in an alley, and borrowed 250 chairs from the local undertaker. In this place of five-cent admission, he painted his own signs, ran his machine, scored and arranged the program, and saw unbelievable and amazing possibilities in the line of motion picture presentation, at a time when all energies were concentrating on the making of the pictures.

Rothafel left Forest City and went to Philadelphia to work with Keith's, and here he developed the system of twilight projection in contrast to the then pitch-black theatre. Then to Milwaukee where he had the good fortune to meet the great Bernhardt, who gave him the opportunity of presenting her picture of "Queen Elizabeth," which was his first chance to use his concert-program ideas. Almost at once he was offered the management of the Regent Theatre of New York.

The Regent has probably been forgotten by all except the pioneers who made it, for the day, the picture house de luxe of New York, and of the country. Instead of a piano, here was Carl Edouarde, now leader of the Mark Strand orchestra, with an orchestra of eight that soon became twelve. Mr. Edouarde has told me of a night early in the Regent's history, when the audience, used to the unspeakable clap-trap of the cheap movies, hissed the rendition of a fine musical number. Rothafel came out and offered to refund money to those who wished to leave. They stayed.

It is Broadway history that Rothafel went from the Regent to the Strand, designed and managed the Rivoli and Rialto, went even to Los Angeles to start a theatre there, and finally, after working with the Marines during the war, was offered that palace picture-house, the Capitol. You in every city of the United States, who enjoy in artistic surroundings the best photo-productions of the day, surrounded with an ensemble of prologue, music and dancing of the highest type for 50 cents, have only the one man to thank for the artistry of the performance you have witnessed, for the comfort and beauty of your surroundings, and the undoubted development of your own aesthetic appreciation of the arts which before were thought to be the property only of the rich.



An intimate study of Samuel L. Rothafel, Manager of the Capitol Theatre, New York City, who, with his "gang" entertains a vast radio audience every Sunday evening. Better is he known by the name "Roxy."

But what of the actual character and abilities of this man who is to-day the most successful presenter of motion pictures in the world? First of all, there is his versatility. Untrained as an architect, he plans excellent theatres, and sees them constructed. Though not a trained musician, he leads his orchestra of 85 pieces. With little knowledge of the technique of electricity, he plans exquisite lighting effects. Nothing is too big or too small for his attention, from stage settings to ushers' uniforms. Simple of habit, going nowhere for inspiration, he still brings into being one daring innovation after another.

He works ceaselessly. He is interested in everything and every person about him. He likes to discover and develop young talent, and have youthful faces and energies about him. And he is generous to a fault. Poor children make an especial appeal to him, and he is always doing things for them.

All of this gives the reason for his being the man to think of bringing joy to the soldiers who are tied to their hospital beds, so that first he thought only of the special Sunday night programs for them, and now he is working on the New York "Sun"-Roxy radio fund, the purpose of which is to put a head-phone at the side of every bed in the service hospitals—and there are 4,000 of them in New York State alone. The mark set by the fund is $500,000, and at this writing over $108,000 has been subscribed by men and women and even children who have enjoyed Roxy's concerts and who are glad to help.

The money he has raised, however, is not the most important thing. More important is the fact that that tremendous vitality of his has kept a volunteer band of broadcasters together every Sunday night for two years. I wish that all of you who have come to love "Roxy and his gang" might spend an evening with them in their studio and see them working together.

The studio itself is big, but a workshop rather than a lounge—plenty of comfortable chairs, a platform for the studio orchestra, a piano, a microphone, and—the gang!

You know their names from long listening-in: Betsy Ayres, Gladys Rice, Evelyn Herbert, Douglas Stanbury, Joe Wetzel, Wee Willie Robyn, Peter Harrower, Dr. Billy Axt, Marjorie Harcum, Ava Bombarger, the Freeman sisters, Daddy Jim Coombs, Eugene Ormandy, Yascha Bunchuk, and David Mendoza and his studio orchestra—you have heard them all many times.

And just as I had always found Mr. Rothafel himself interested, alive and unaffected in manner, so I found his co-workers. Here was nothing of that much talked of professional jealousy or competition. Instead, a group of people intensely interested in each other's performance, truly appreciative among themselves as they sound over the radio, and everything spontaneous and unstudied. Each one had a word to say for the rest, and to a man they wanted to call my attention to some particular quality of their leader's.

What a leader he is! The program that night, was a particularly impressive one, and had of course been specially planned by Roxy, his finger was on the pulse of the entertainment every minute. He stood by the microphone with each performer, beating time

(Continued on page 596)

The Wail of the Lonesome Shrine

By ROBERT FRANCIS SMITH

Everything was quiet and restful. That is, except for a radio concert about half-past eleven. Must have had a big horn on it I guess. Least wise, I heard it like it was all around me.

ME? I'm an actor. Joe Hammerstein's the name. If you insists on the horrible details, I dances. You knows—one of these hard soles that skips out onto the planks and says: "Ladies and Gen'l'men, I shall now do my own original impression of Mr. David Warfield in the Music Box Revue." Not that I'm trying to puff my own clarinet, but it's common talk we're good. By "we" I means myself and the major half of the act, which is Doris, my best gal and nerviest critic. Yeh, I'm married, but I don't hold no grudges. We being a good act, which same is said of us even by booking agents, greater praise than which ain't been spoken, we gets to be headlined. Furthermore, we draws good pay, although I don't see much of it. Most impossible of all, we saves a lot of it, due to there being a little Scotch in both of us, in her veins and in my stomach. The upshot of it all being that we can lay off during the hot spell and chum with the sea gulls and starfish down here at Brightmere-on-the-Deep.

Both of us being naturally and necessarily ambitious we finds time hanging heavy all over us, me in particular. For a while we gets by with a radio, but there ain't much kick for show folks to spend vacations listening to the same stuff they travels with all winter. The wife by this time has everybody's pedigree and our front porch is a first-class reputation-ruiner, which sets Doris on the globe. Me, I don't see the point of it all, so I makes myself previous about the house, spending most of my idle hours with The Master.

The Master is what the servants calls Jerry Lawson. Jerry, to set things right, is a rational millionaire except for a hobby. With him it's science. He likes to fool around with wires and coils and see what happens. So far he always has.

He stages his shows in the second story of a deluxe garage, said second story being fitted up with all the machines that ever kept Edison up nights. So, upon this July day, I breezes into The Master's joint and sits down. Him and me is good friends; politeness is superfluous.

"Hello, Joe," he greets me. "What's the good word?"

"It ain't a good word," I says. "It's a bad word, and I don't mean perhaps."

"Has anything gone wrong?" he inquires.

I shakes my head. "Not like you means," I tells him. "The wife still speaks to me, my income tax is paid and my agent knows where I'm at. The big howl is this: I ain't got nothing to do to kill time. All I does is loaf, and while I'm pretty fair at it, I don't get no unusual thrills. So I'm open for suggestions."

He slowly shakes his well-lubricated locks and stares out of the window. Then he speaks.

"You mean you wish me to help you find a way to pass the hours?"

"All I can do is pass with the kind of deals I've been getting," I grumbles. "I wants you should let me in on something. Give me some work to do—let me carry a lightning rod in your act."

He sort of grins, having a sense of humor at times, although he doesn't look it.

"Really, Joe, I'm sorry," he says, "but at this moment I haven't much of anything you could do. What would appeal to you?"

"I'm a desperate man," I tells him. "Whatever you says goes."

Jerry gazes out of the window some more. Then he turns around.

"Scientific?" he asks.

"Any-tific," I replies. "Science if possible."

"Astronomy, Biology, Chemistry, Dentistry, Entomology, Geology——"

"Interesting if true," I puts in. "Was she hurt much?"

The Master don't get it. "Was who hurt much?"

"Never mind," I soothes. "Go on."

He muses for a few moments, staring out of the window at something. I gives a look. It's a funeral procession.

"Somebody," declares The Master, "is dead."

"I hope so," I remarks. Seeing as how it didn't get over, I makes a stab at humor in Jerry's own line of chatter.

"His flesh will soon be gone, but his spirit forever remains," I states.

Suddenly The Master turns and fires a broadside.

"Joe, do you believe in ghosts?"

The boy feeds 'em too fast for me, so I

(*Continued on page* 510)

Soup Modulation

By WILLARD WILSON

But a or more big congressman is seated next to microphone at speech table, and are continually making noise like gasoline suction dredge when drinking mud from river bottom. Thus, speeches from other end of the table resemble, in volume, thin piping of Chinese doodle-bug in forest of singing donkeys.

TO Editor of RADIO NEWS, which are most picturesque and palatable of all radio mags. per month.

Honorable Sir:—

Having met and also been talked at by many pepl, interested in radio lately, huge and stupendous questions have been popped at me which I think deserve solvation.

Namely: are the radio broadcast studios DOOMED?

Such are at first glimpse foolish and puerile question; but upon deeper think concerning such, assumes very unhumble proportions.

At the inset, Hon. Sir, by studios are meant not ingineer room where transmitting set, batteries, etc. is located. By studio are designationed large, beautifully padded apartment from which many operas, birds, violins, etc., sing forth sweetly, accompanied alternately by lily voice of highly salaried announcer of station.

"But," you gargle with pained also sudden expression, "who is Hon. fools enough to even intimate that such, namely, radio studios, is doomed to quit?"

"These pepl. which have talk to me," I reflex glibly. "They are ones which have put such high-powered question into my head."

"But," you spout forth again, "what things has put such fool ideas into heads of such pepl.?"

"Many nights of listening at radio receivers," I heterodyne triumphly. "Such have loaded many radio fans with huge amt. of alarm concerning future of radio studio. Many nights of fevered search among huge amt. of stations for one studio program have made them became filled with many coiled horror lest such are becoming extinct."

I will withdraw from quotation marks, Hon. Sir, and continue with more fully explanation.

For instance, i.e., etc.

Last night I listened to Hon. radio. First I twist dials until I pick up station which are with me very favorite. Result, huge silence intermixed with clinking of dishware, giggle laugh of many people in dance dinner, and finally faint shuffling music of orchestra playing ancient fox-waltz. Such are no doubt very interesting if I was one of dance shuffling persons. But being in receptive mood and faded kimona for receiving beautiful and educational studio program, such undestinct music is as dish-water to my humble ears.

Next I try another station and get results ditto as above. More clank of dishes and dance feet music!

Next station are at that time broadcasting after-dinner speeches of Hon. plumber's convention in Gargle Hotel. This are much preferable, when heard, to swish-swish music of unaudible dance band. But a or more big congressman is seated next to microphone at speech table, and continually are making noise like gasoline suction dredge when drinking mud from river bottom. Thus, speeches from other end of table resemble, in volume, thin piping of Chinese doodle-bug in forest of singing donkeys.

I mop sweat of madness from brow, Hon. Sir, and twist regenerator again.

This time station UQP are intrapped announcing that they are broadcasting wonderful band concert from distant seaport by line-telephony. Presently come faint squeak-squeak of announcer at distant harbor saying that next number will be that old favorite, "A warm time in the Old Town tonight." Music, after being stepped up howlingly by broadcast operator, are very fair, though deluted with whistles of passing boats, screaming babies, barking dogs, croaking sea-gulls, and other people which infest Hon. band concerts at beaches.

With swift curse or three I swiftly twist dials once more and capture another station. Such are broadcasting whoopingly, with huge fizz, political convention.

For one hour, Hon. Sir, I search undyingly for program emanating from some studio. Finally one are hooked by me somewhere in the south of Arkansas. It are small meatshop station, and music and speeches from it are bunk. But, they is understandable and much preferable to swish-swish, dog howl, suck-suck, fizz whoop, dance clank, etc. of other stations—so I listen with eager pleasure.

Such are condition which have became acute enough to enable many pepl. to ask of me, "is the radio studio becoming extinct?"

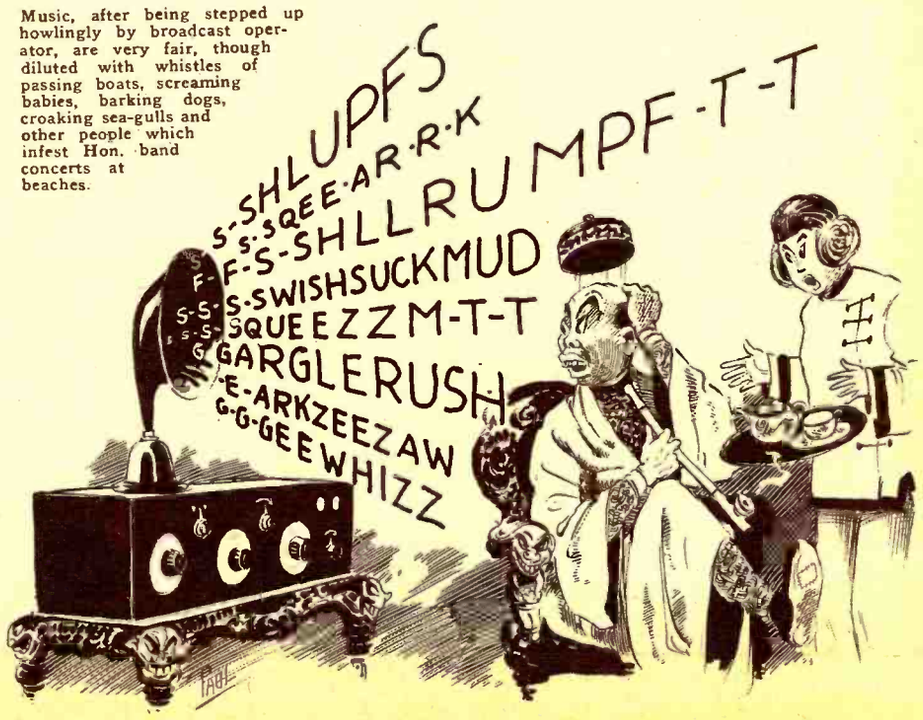
Pepl. appreciate three-stagely all effort of stations to give something new such as dinner speech, political fizz, distant band noise, etc. But also Hon. Sir, they delight to detect an atmosphere, at least sometime, program from cushioned studio where voice, and music are audio as well as radio, and where battle of waiters, scrape of feet, bark of dogs, and other congressmen are illuminated from such.

Those are problem which for short period of time have weighed on mind of your Hon. servant and which are now transferred to publication. As Hon. poet once remarked, "To have studios or not to have such. Those are the question!" Broadcasters desire to please great amt. of pepl. and will no doubt present to air such programs as are desired by largest multitude of listeners.

So the matter are in our hands and I am pleased to sign myself as usual, your's for less dish-washy broadcasting. With salutations to office cat, I am pleased to kiss my hand to you and dictate myself, your's amplifiedly,

Chin Choo Chow,
Shanghai, Ariz.

Music, after being stepped up howlingly by broadcast operator, are very fair, though diluted with whistles of passing babies, screaming babies, barking dogs, croaking sea-gulls and other people which infest Hon. band concerts at beaches.



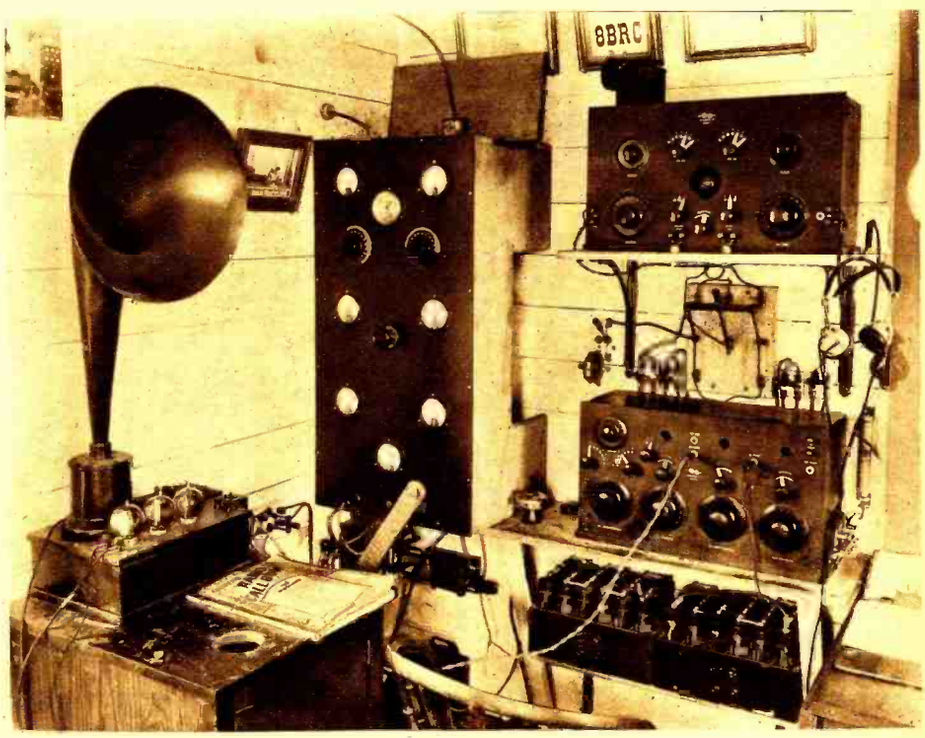
Radio Station 8BRC

By S. R. WINTERS

RADIO amateurs throughout the United States and outlying provinces who have heard the call letters 8BRC may have frequently wondered what manner of man is the operator at the remotely located radio sending and receiving station in Pennsylvania. Situated on a mountain 13 miles south of Oil City, occasionally a fleet-footed deer may be seen passing through the plantation on which the radio masts—outposts of civilization that they are—extend upward for more than 100 feet.

Harry Snow Myers, who presides over the radio telegraph key at station 8BRC, is a genius, and this much-abused term is employed advisedly. He is a self-made man, a master mechanic, and his meteoric rise in the field of practical engineering and radio is an inspirational chapter. His life story did not come from the tightly-closed lips of this reticent man, but was told the writer by a friend of his.

Barely 30 years old, Harry Myers' scholastic training has been nothing more than passing through the grades of a rural school near Van, Pennsylvania. However, when only 19 years of age he built an automobile from old parts of cars. He operated it for 12 months and then converted the automobile into a bailing machine, for pulling and bailing gas wells, and pulling pipes from wells. Later, his mechanical turn of mind resulted in the construction of a tractor, made of old parts of an automobile during his spare time.



The transmitter and receiver of station 8BRC, owned and operated by Mr. Harry Snow Myers, near Oil City, Pa. The transmitter, of the panel type, can be seen in the left background of the photo.

The radio shack and the two immense 100-foot towers which support the aerial of station 8BRC. Another aerial atop Mr. Myers' house is employed for broadcast reception.

Four years ago, Harry Myers was the foreman in a small machine shop in Oil City, Pennsylvania. Today, he is owner and superintendent of a factory manufacturing winches, which he invented, and which are used on tractors throughout the United States. Five patents for inventions have been issued to him and a score of applications for patents are pending.

These manifold activities notwithstanding, Mr. Myers during spare hours has equipped and built a very complete radio transmitting and receiving station. Then, too, he has mastered, without tutelage or systematic instruction, the international telegraph code. By means of the latter, he may exchange messages with Pomona, California, Porto Rico and Cuba. Radio telegraphy is at once a hobby with him and an incentive for further stimulating his talents for things mechanical and electrical.

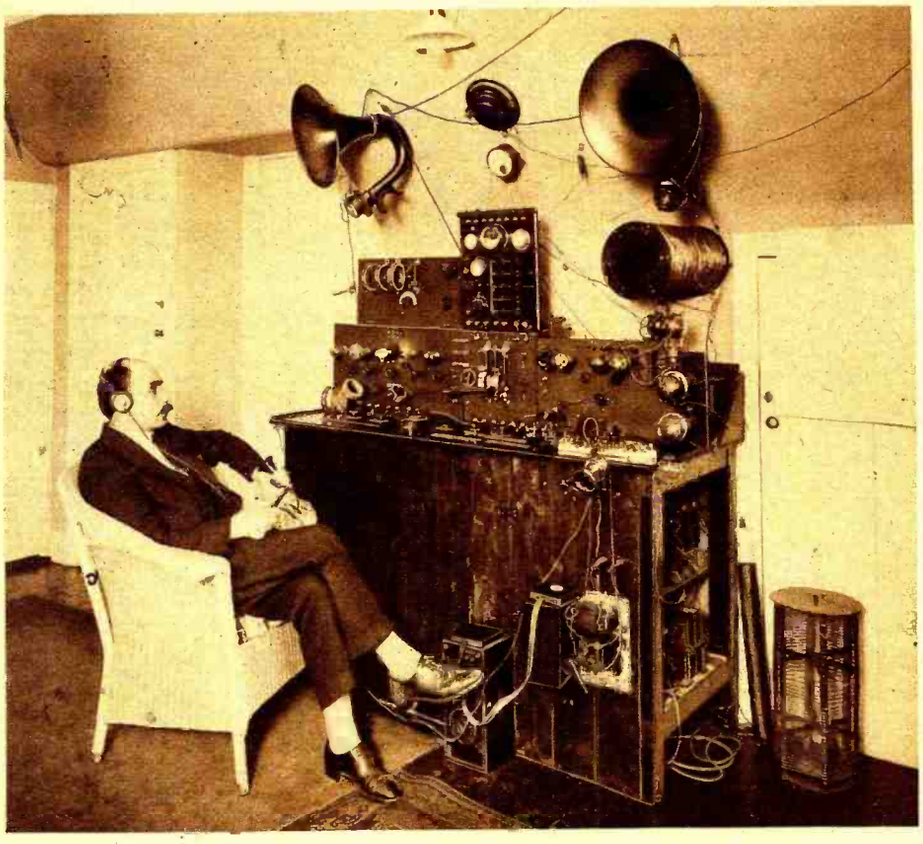
That Mr. Myers is thoroughly imbued with the radio fever may be ascertained by glancing at one of the photographs illustrating this article. He maintains wireless equipment at both his home and office. In fact, the latter is given secondary place, since the radio room is on the ground floor. The towers for the antenna system at his home are 94 feet high, while the masts erected at his office appear to be more than 100 feet in height. He has a splendid transmitter, and uses a standard type of receiving set.

Harry Myers' success is due to unremitting

(*Continued on page* 572)

British Station 5LP

Owned and Operated by L. W. Pullman



Operating room of Station 5LP with Mr. Pullman carrying on a bit of phone work. The appearance of this outfit is no doubt foreign to the eye of the average American amateur, but insofar as results are concerned 5LP can be classed as a native transmitter and receiver.

EVER since 1920 I have been carrying out various experiments in connection with radio telephony and the result is the station shown in the photograph, which, though far from perfect, is fairly efficient, and considering the power allowed for amateurs in this country, has a reasonably good range.

The aerial is of the twin cage type, each cage being two feet in diameter. They are spaced 10 feet apart and have a mean height of fifty feet. A tuned counterpoise, or, rather, earth screen, of ample proportions is also used and is supported on heavy insulators about seven feet from the ground.

The transmitter itself is of a somewhat novel type which is not generally in use in this country, but I must say it is extremely good on wave-lengths from 90 to 200 meters, which is the range generally used by this station.

The grid coil is not coupled to the aerial inductance in the circuit employed and by experience it has been found that it must be isolated from all other parts of the set and then tuned into resonance with the wave-length set on the aerial inductance. This tuning is very critical and calls for a certain amount of practice.

The high tension supply is obtained from the A.C. mains, 250 volts 50 cycle, stepped up to 3,000 volts and rectified by means of two heavy duty tubes. Windings are also provided for lighting the power valves and rectifying tubes, though storage batteries are still used for the other tubes, which consume such a small amount of power that it has not been worth while to set up the apparatus to supply these from A.C.

The receiver is of quite a normal type and has no special features except that insulation has been carefully watched and the wiring well done with heavy gauge bare wire. Five tubes are available which, by an arrangement of switches, can be reduced to one. Every care has been taken to avoid stray capacities. With all its faults and clumsy appearance, the receiver picks up KDKA short wave stuff excellently and without any interference from the local broadcast station which is only three miles away. A change-over switch changes over all the required lines and also switches on the current to the transmitting transformer. This feature, though common in America, is far too often overlooked in this country with the result that a lot of delay is caused when communicating with a station which has dozens of switches to change over, to say nothing of a few wires to disconnect from remote terminals.

From the photograph it will be noticed that there is a closed cupboard under the set which contains two storage batteries of 120 A.H. capacity and the smoothing condensers for the transmitting supply. The condensers, which are of the oil-filled type, may be seen at the end of the set on the upper level and the transformers on the lower level.

In conclusion, I should like to express my gratitude to RADIO NEWS, of which I am a constant reader, for the many helpful tips and gadgets published. We have no such paper over here. I am sorry to say, and so we always await with pleasure the arrival of RADIO NEWS. May I also add that if any station on your side feels inclined to try across on telephony, I am always here, but C.W. has no interest for me as I hold there are many who get across on C.W., but few who manage speech. 5LP is always working from 11 A. M. on Sunday to 1:30 P. M., and again at 7 P. M. to 8:15 P. M. This is the only constant working, but I work any time I have tests to carry out.

L. W. PULLMAN,
213 Golden Green Road,
London, England.

Hamitorial

If You Are To Know It At All, Know It Well

KNOWEDGE is power.

Which, of course, is but another way of saying that experience is the builder of success.

But, you object, it takes so long to obtain experience.

And your objection is wrong. The books and records of the ages are before you for the reading. Experience gone through and ready made that, though it cannot substitute for practice itself, makes it possible for you to absorb the experiences of lifetimes.

Had you thought of the multitude of lives that makes up your library of radio information? Had you thought of the debt that you owe those who have gone before, pioneered and made it possible for you to carry on? A debt that you can never repay, but a debt that you can carry on your soul that you may bequeath a legacy to the present or the future that will in part recompense for what you have taken from the past.

Knowledge is power and as such cannot be confined to a knowledge taken from the things we merely touch upon in our limited reach. Instead we go into the vistas of the imagination, the great, omnipotent reaches of the mind and theorize—from innumerable externals. But it is not the reach of one person or even two, but of multitudes that makes *knowledge*.

Those things have assembled the theory and technique of radio—the knowledge of radio—and you, if you neglect the learning thus before you, are neglecting actual gold for—nothing.

But I am generalizing, which is wasteful, for it lacks application. The aim of this is upon the person who considers radio his avocation or his vocation. Who goes ahead with countless trials in the hope of discovering something. I am talking to the experimental amateur, transmitting or BCL, who is constantly seeking in a field in which he has no basic knowledge. Even Columbus, in an unenlightened age, did not venture until he had all the knowledge available at the time, corralled for his purpose. I have seen some, without an idea of what they were really doing, try to manifest absurdities. I have seen them try the impossible and waste time, money and energy. Often but one hour of reading would have saved many, many times its value, but they blunder on taking no stock in the record of the facts of their hobby (or profession).

These same people would no more consult a doctor without years of schooling in the theory and practice of medicine than they would lap up a dish of battery acid.

They seem to appreciate the value of

(*Continued on page* 574)

A Three-Wave Transmitter

By JOHN M. BALDWIN

An excellent article dealing with the construction and adoption of a wave-change switch to a master oscillator transmitter. Mr. Baldwin has included the necessary information for calculating the three wave-lengths.

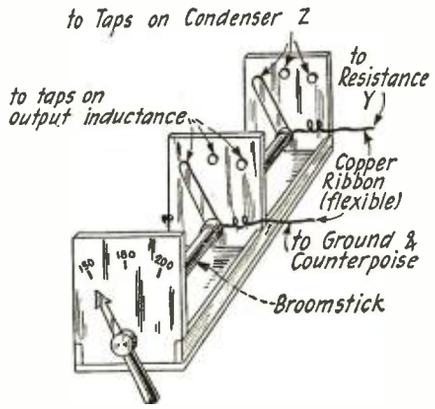
THE accompanying diagram is of a master oscillator transmitter, designed for rapid wave-length change over the amateur band from 150 to 200 meters. It is of special benefit for use in amateur relay stations of the better class where is often felt the need of several wave-lengths at instant disposal, especially when QRM is severe.

As is shown in the diagram, the master oscillator is a common Hartley circuit feeding a dummy antenna (XYZ) and the grid excitation for the power amplifier is obtained from a tap taken from the M.O. inductance. The output circuit has, as usual, the ground and counterpoise connected together.

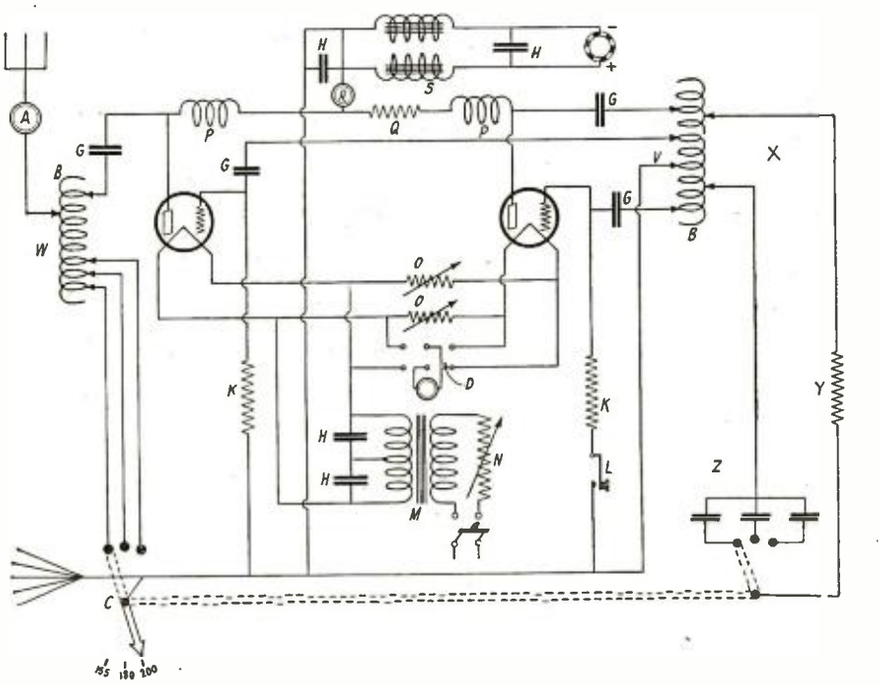
It is possible to wire a common self-excited oscillator in such a way that several wave-lengths will be available, but doing so entails a multiplicity of wiring to the various switches which cause losses—and as losses are the bugaboo of radio amateurs today, this form of construction was left severely alone. Several commercial C.W. transmitters are equipped with multi-wave arrangements, but they have the disadvantage of the above-mentioned numerous leads. A few watts loss in a high-power transmitter is not serious, but the average Ham nurses his few available watts very tenderly and hates, like sin, to lose any more of them than necessary.

In this system, the plate and antenna clips remain in the same position for all waves, and the only adjustment of the output circuit consists of changing the number of turns between the antenna and ground (counterpoise) clips. (In other words, changing the inductance.) The M.O. circuit is readjusted for different waves by changing the capacity in the dummy circuit. The clips of the M.O. remain the same for all three waves. As the construction of the switch, etc., is clearly shown in the diagram, it will be unnecessary to go into details. The principle of the M.O. has been well aired in these columns before, and so questions on any doubtful points may be settled by referring to the back numbers of this magazine.

To give a clearer understanding of the constants involved, we will investigate the dummy circuit. This circuit is made up of capacity, inductance and resistance. The resistance Y should be of the order of one to four ohms and is used merely to keep the R.F. current flowing through XYZ within



Details of the wave-change switch. No dimensions are given, being immaterial. The builder can make it of a size to suit his own conditions.



The circuit diagram of the transmitter employed by Mr. Baldwin in conjunction with the wave-change switch. The components are: A—Thermocouple ammeter; B—inductance coil; C—arm of change over switch; D—DPDT switch; G—UC-1014 Faradon condensers; H—1-mfd. filter condenser; K—5,000-ohm grid leaks; L—key; M—filament transformer; N—rheostat; O—variable resistance; 6-ohm Max.; P—DL250 coil; Q—5,000-ohm resistance (used only when master O. tube is smaller than P. A. tube); R—milliammeter; S—filter inductance; V—ground clip; W—output circuit; X—dummy circuit inductance; Y—resistance (1 to 4 ohms); Z—Faradon UC-1015 variable antenna series condenser, with capacity values of .0003, .0004 and .0005 mfd.

reasonable bounds. The inductance, B, consists of a helix of 24 turns of No. 12 wire, wound on a tube six inches in diameter and eight inches long. Upon calculation, the inductance was found to be approximately 45,000 centimeters. A helix of the same size was used for W in the output circuit. X consisted of 12 turns, six on each side of the ground clip V, with an inductance of 24,800 cms. The capacity used at Z was a series condenser with three taps, giving three variations of capacity, viz., .0003, .0004 and .0005 mfd. The formula for calculation of wave-length—given the inductance and capacity—is $WL = 59.6 \sqrt{LC}$ (inductance in centimeters and capacity in microfarads). Using this formula, we take, for example, the 24,800 cms. (inductance of X) and consider capacity as .0003, and multiply. The result is 6.84. Then extract the square root of this figure, with the result 2.6. By then multiplying the constant, 59.6 by 2.6 we have 155. which is the wave-length. Therefore, if the capacity is .0003 and inductance 24,800 cms., the circuit will oscillate at a frequency corresponding to 155 meters. Similarly, we find that when Z equals .0004, the resultant wave-length is 180 meters, and when Z equals .0005, we have 200 meters. By connecting the three leads of the condenser to the terminals of a triple point switch we have the necessary changes in the master oscillator provided for. It is now necessary to provide means to change the inductance of the output circuit so that it will change in resonance with the M.O. and with the same operation controlling both. This we do by having three taps off the output inductance connected to the terminals of another three-point switch in such a way (see diagram) that the arm of both switches move simultaneously.

The positions of the three clips on the output inductance can only be found by experiment as their location will vary on different aerials, but the tuning of the set is far from being complicated. For full details on tuning an M.O. set, refer to page 1759 of the June issue of RADIO NEWS.

Hoping that this little kink will be of service to the rest of "Us Bugs," I will now QRX and QRT.

GOVERNMENT EXTENDS RADIO CHANNELS FOR AMATEURS

Practically 15,545 amateurs will rejoice over the news that Secretary Hoover's radio aides have opened four new short wave bands for their exclusive use. Today the nine district radio supervisors received orders from Commissioner of Navigation D. B. Carson, under whose direction the Radio Section operates, to issue general and restricted amateur radio station licenses permitting the use of the wave-lengths between 75 and 80 meters; 40 and 43 meters; 20 and 22 meters; and 4 to 5 meters, for pure C.W. telegraphy, 24 hours a day.

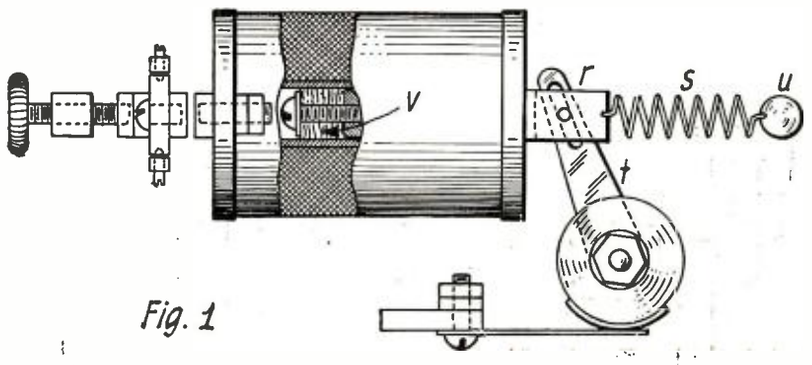
The owners of amateur stations may continue to use the band between 150 and 200 meters, employing C.W., spark, and modulated forms of transmission, including radio phone work, but special amateurs lose the band between 200 and 220 meters, which is now held in reserve. This class of amateurs, however, is granted a new channel between 105 and 110 meters, in addition to the wave-lengths between 150 and 200 meters.

(*Continued on page* 572)

Automatic Sending Key and Time Relay for Tube Transmitters

By A. A. KUBIAC

An excellent automatic key and time control system which is close to human in its functioning. Its use relieves the operator of all necessary manual switching.



A curtailed sketch of the side view of the transmitting key and relay system. The one solenoid does all the work of closing and opening the key contacts and operating the drum selector switch.

AN efficient vacuum tube transmitter is one that, in addition to covering the most miles per watt, is also flexible of operation, one with which two-way break-in operation can be maintained with a minimum of switches. The ideal set would be one which required no manual operation of switches at all to change from "transmitting" to "receiving" position and vice versa. In other words, a transmitting and receiving system in which all controls have been eliminated except the sending key. The key, being the only control, is made to carry out all the operations necessary to turn the transmitter on and off as well as operate a break-in system.

REDUCING CONTROLS

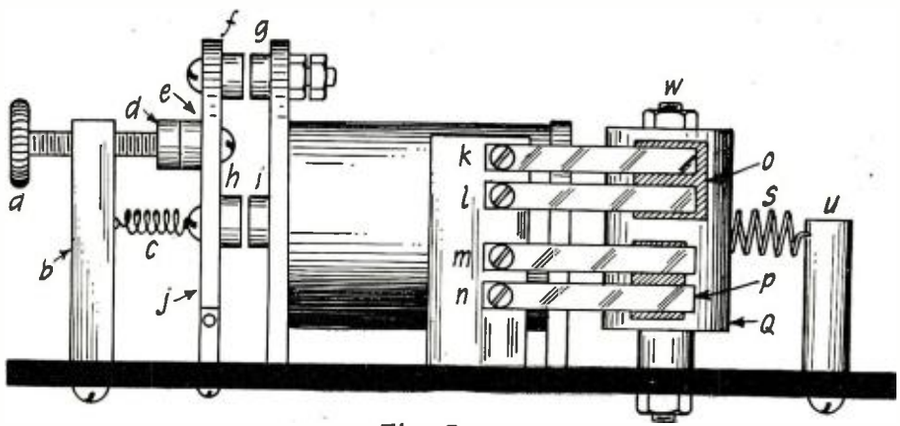
We will consider the average amateur vacuum tube transmitting equipment. A summary of the necessary operations is as follows: (1) Turn on filament current. (2) Turn on plate current. (3) As many amateurs are still using the same antenna for transmitting and receiving, it is necessary to turn the antenna switch to the "transmit" position. After the desired transmission has been carried out, these three controls must again be operated in the reverse order to shut down the transmitter and operate the receiver. This makes six operations to be carried out each time you change from "receive" to "transmit" and back to "receive."

The three controls are incorporated into one, the six operations are reduced to two. For reasons to be explained later, we will consider points 1 and 2 now and take up 3 later. The most logical way to incorporate 1 and 2 would be to turn on the current to the transmitter by a switch in the power supply, but this is dangerous to the tubes. If the plate supply is applied to the tubes first and then the filaments are lighted there is a momentary heavy rush of current into the tubes which would burn out the filaments if the tube is being operated above the normal rating, and is dangerous even under normal conditions. To offset this danger the filaments must be turned on a trifle before the plate supply. A double-pole single-throw switch with the filament clip slightly longer than the plate clip will control one side of the line, with a common return for the other side. We will see later how 1 and 2 are controlled by the sending key.

BREAK-IN SYSTEM

A break-in system has such a tremendous advantage over the usual method of operation that once you use it you would no more think of doing without it than you would think of going back to the old rock crusher. It enables you to hear the station with which you are communicating each time your key is up. This feature alone rids QRM of half its terrors because you are in instant touch with the other fellow and can shoot your messages through the gaps in the interference at times when it would be impossible to operate without a break-in system. Of course, we cannot operate a break-in system if we are hampered with an antenna switch. The most logical way to eliminate the antenna switch is to use a separate single wire antenna for receiving. This will ensure more satisfactory year-round reception and freedom from static anyway, so why use the transmitting antenna for receiving? When the transmitting wave-length is the same or near that to which the receiver is tuned, sufficient current would be induced into the receiving antenna to burn out the receiver. To protect the receiver from this danger we must break the connection of the antenna to the receiver each time the sending key is down. This can be done by having an extra pair of

(Continued on page 564)



The drum selector switch, its spring contacts and the key operated contacts are clearly shown in this sketch of a top view of the instrument.

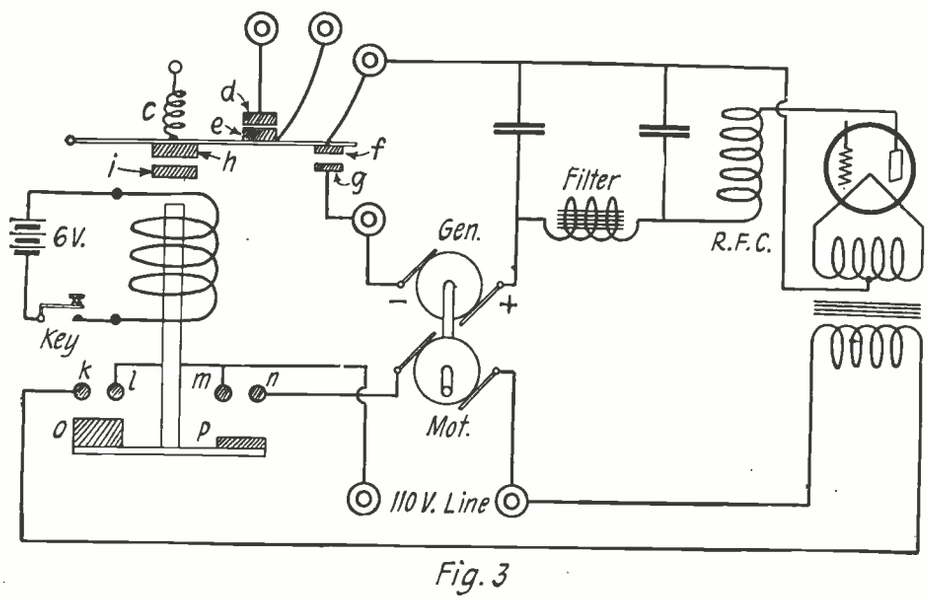


Diagram of connections of the key and time relay to a C.W. or I.C.W. tube transmitter.

A Universal Two-Step R. F. Receiving Set

By PAUL G. WATSON

An exceptionally efficient and well designed receiver employing one stage of tuned and one stage of untuned radio frequency amplification. The set is adaptable to both amateur and broadcast wave-lengths.

THE writer published a circuit in the March, 1924, issue of RADIO NEWS under the heading "The Weagant Circuit" in which the idea of honeycomb coils as radio frequency transformers was introduced. Further experiments along the same lines have resulted in the development of the circuit covered by this article. If compared with the circuit published in the March issue, it will be found to be radically different.

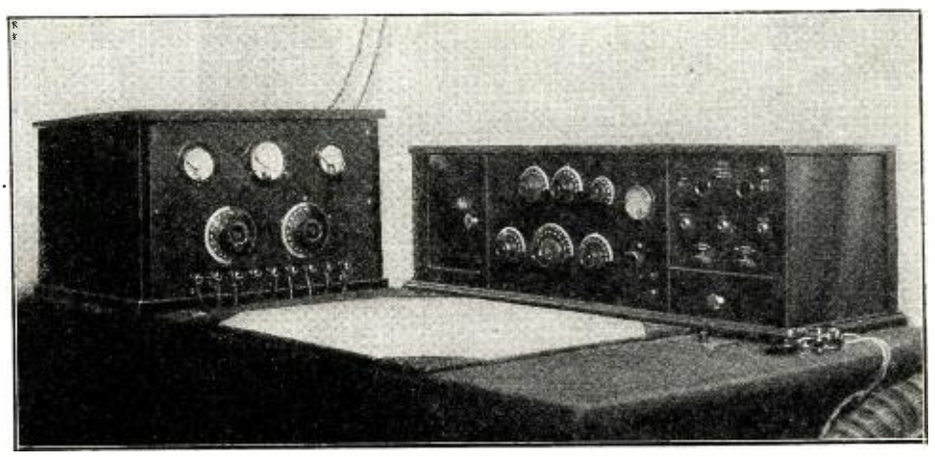
Let us first refer to the circuit diagram and understand what we are doing. Coil "A" is the antenna tuning inductance, tuned with the usual series condenser. For broadcast wave-lengths this should be a No. 50 honeycomb coil. All necessary specifications for coils for amateur wave-lengths will be covered in a separate paragraph. Coils Nos. 1 and 2 are of the same type and size as coil "A." These coils are tightly coupled together in a regular two-coil mounting, preferably of the "back of panel" type, which keeps the coils away from the operator's hands. Coupling need not be variable, although additional selectivity is sometimes gained when they are separated. The letters "T" and "B" signify the respective ends of the coils to be placed at the top and bottom terminals of the coil mounting.

Coil No. 2 is shunted by a .0005 mfd. variable condenser, the stationary plates being connected to the grid side of the coil. This will remove any detuning effect that might result in placing the hands too near the grid circuit. This condenser should be of low loss type. This also applies to the antenna tuning condenser. No. 4 is a standard type radio frequency transformer, the range of which is 220 to 550 meters. Arrangements in its construction provide for its ready removal from the mounting socket. An amateur wave-length device for use in place of this transformer will be covered later. The standard transformer has the terminals marked so no explanations need be given of its connection.

RELIABLE GRID LEAK NECESSARY

A variable grid leak of good construction, shunted by a .0005 mfd. condenser, is used in the grid circuit of the detector tube. A fixed grid leak is impossible for best results, unless an assortment is available for selecting the best value.

The radio frequency grid return is made, from both tubes, to the moving arm of the potentiometer "P" of 400 ohms, which is connected across the filament battery circuit. A fixed condenser "C" is connected from the moving arm of the potentiometer to the negative side, as a by-pass, and to prevent detuning when the arm of the potentiometer is moved. This condenser is of .005 mfd. value. Condenser C_2 is a by-pass on the "B" battery circuit of the radio frequency amplifier, and is a one-half mfd. condenser. The value of this last condenser can be anything above the value given.



The right-hand cabinet contains the receiver and amplifier described in this article. The audio frequency amplifier is separated from the rest of the set. It is a reconstructed commercial unit, only the original panel remaining.

The last two tubes are hooked in as audio frequency amplifiers in the conventional manner, and need little or no explanation. A "C" battery is included for biasing, to reduce distortion and the load on the "B" battery.

The two radio frequency tubes and the two audio frequency tubes may be placed each pair on a common rheostat, as the same type of tube is used in both cases—a UV-201A or C-301A. It is not advisable to combine the audio and radio frequency tubes on a common rheostat, but they may be divided as mentioned without loss of efficiency.

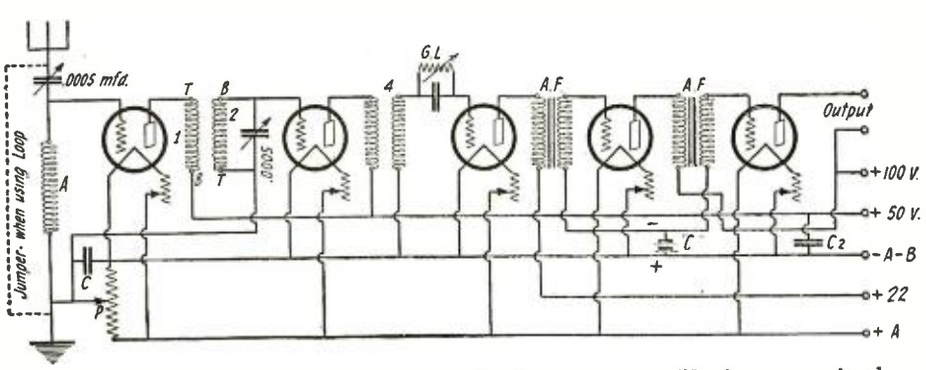
Amateur specifications are very simple. It is understood that this band is from 125 to 220 meters. Coil A consists of 20 turns of No. 22 B and S gauge D.C.C. wire wound on a 2-inch form. Coils Nos. 1 and 2 consist of 25 turns each of the same size wire. The substitute for the transformer is made by taking a piece of ¼-inch bakelite and mounting four ⅛-inch round brass pins, two on each end, with the same spacing as the transformer lugs. Two coils, one concentric to the other, 1½ inches in diameter, should be mounted on this strip. The coil for the plate circuit (primary) should have 30 turns of No. 26 D.C.C. wire, and the secondary should have 30 turns of the same size wire. A slight difference in diameter should be made so the primary will fit inside the secondary.

Panel details can be arranged to suit the constructor as each has his own ideas on panel layout. The writer's idea on this tuner can be secured from the photo of his station, 4XX, located at Savannah, Ga.

The two upper dials control the coupling between coils Nos. 1 and 2. The bottom left dial is the antenna or loop tuning condenser. The bottom center is the condenser across coil No. 2, while the third dial is a condenser arranged for special tuning of the loop, i. e., vernier or close tuning, which is not necessary when using the antenna. It has just been mentioned, or implied, that a loop can be used with this set. One of its many advantages is its equally efficient operation on either loop or antenna. No changes are made for the loop. The antenna and ground are removed from their binding posts and a wire, or jumper, placed between them, as shown by the dotted line in the diagram. This throws the antenna condenser in shunt to the loop for tuning. A 12-turn two foot square loop spaced ½ inch between turns will cover the broadcast range with a .0005-mfd. (23 plate) condenser.

The simplicity and efficiency of such a set is remarkable. Two tuning dials control the wave-length, while one knob (the potentiometer) controls the volume. A fine medium between tuned and untuned radio frequency is struck in this set. The first step of radio frequency is accurately tuned, while the second is entirely untuned.

The small cupboard on the end of the cabinet is for the purpose of holding the base of a loud speaker, the horn projecting through a hole in the top of the tuner. The lid of the portion over the tuner and amplifier is hinged in order that the interior may be accessible. The panel in the photo is 10 by 16 inches, while the amplifier is 7 inches long and 6 inches high. I find the individual units much more efficient than a combination on one large panel.



The circuit diagram of the set. Two stages of radio frequency amplification are employed. The first one is tuned, but the second is untuned.

Notes on the Super-Heterodyne

By PROFESSOR GROVER IRA MITCHELL*

This article is full of valuable information on the Super-Heterodyne. Of particular interest is the discussion of the relative merits of the air core and iron core types of intermediate wave radio frequency transformers.

THE many useful articles which have appeared in the radio periodicals within the past few months have demonstrated the widespread interest in the Super-Heterodyne method of reception. Many directions and specifications for building such receivers have been presented to the public with the result that the reader who has studied several of these articles, each of which stresses the wonderful results which are being obtained with the particular hook-up described, becomes confused and is at a loss to determine just which set he should build. The author of this article hopes to present some suggestion which will clear away much of this confusion.

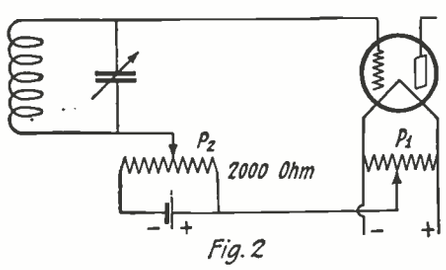


Fig. 2

Method of placing a negative bias on the grid of the first detector tube. This is a more satisfactory means than a grid condenser and leak.

TYPICAL SUPER-HETERODYNE CIRCUIT

A typical Super-Heterodyne receiving circuit employing nine tubes is shown in Fig. 1. This circuit has four stages of intermediate-wave amplification preceded by the first detector and the oscillator and followed by the second detector with two stages of audio frequency amplification. It was designed to operate on a loop and has sufficient amplification to give good volume from very distant stations. The last stage of audio frequency amplification would probably never be used except for very distant stations. Hard tubes of the UV-201A or C-301A types are employed throughout. The "B" battery for the two detectors should furnish 45 volts for the plates while the "B" batteries for the amplifying tubes should be of about 90 volts, while 45 is generally sufficient on the oscillator. It will be noted that one set of "B" batteries is used for the two detector tubes, one set for the intermediate-wave amplifiers, and one set for the audio frequency amplifiers. This requires three distinct sets of "B" batteries.

The reason for using three sets of "B" batteries lies in the fact that the current drain on them for a receiving set having a large number of tubes is so great that if but one set of batteries was used to provide the plate current for all the tubes the life of the battery would be very short and the expense of replacing "B" batteries every few days would be prohibitive. By using the three sets of batteries, thus reducing the amount of current drawn from each set, the life of the three sets is about seven times as long as of a single set used to supply all tubes.

"B" BATTERIES

Some of the manufactuers of the best known brands of "B" batteries are now making a special large size battery for use with the Super-Heterodyne circuit. The high milliampere capacity of these batteries enables them to provide the plate current for a large number of tubes and still have a life comparable to the ordinary sized battery used with the usual three or four tube set. The use of these large batteries is recommended.

The storage type of "B" battery is finding much favor for the reason that it may be recharged. Storage "B" batteries are made in several sizes, ranging from about 700 milliamperes capacity to about 5,000 milliamperes. Only the larger capacities should be used with the Super-Heterodyne.

When the special large sized dry-cell or the larger capacity storage "B" batteries are used, the same battery may supply the plate current for the oscillator and amplifier tubes. The detectors should be operated from a separate battery to secure best reception. This detector battery may be of the ordinary size.

SUPER-HETERODYNE WITH ANTENNA

Although the Super-Heterodyne is well adapted for use with a loop, it may be used with an antenna. This is accomplished by using the coupler shown to the left of the dotted line in Fig. 1, which has an untuned primary. The secondary is tuned in the usual way by means of the variable condenser in the grid circuit of the first detector. A two-circuit jack may be inserted in the secondary circuit, as shown, to permit the loop to be plugged in when wanted. When the plug connected to the loop is inserted in the jack, the inductance of the loop

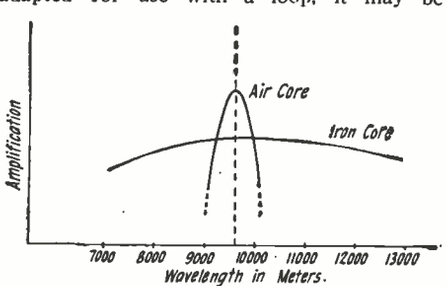


Fig. 3

Respective characteristic curves of an iron and an air core long wave radio frequency transformer.

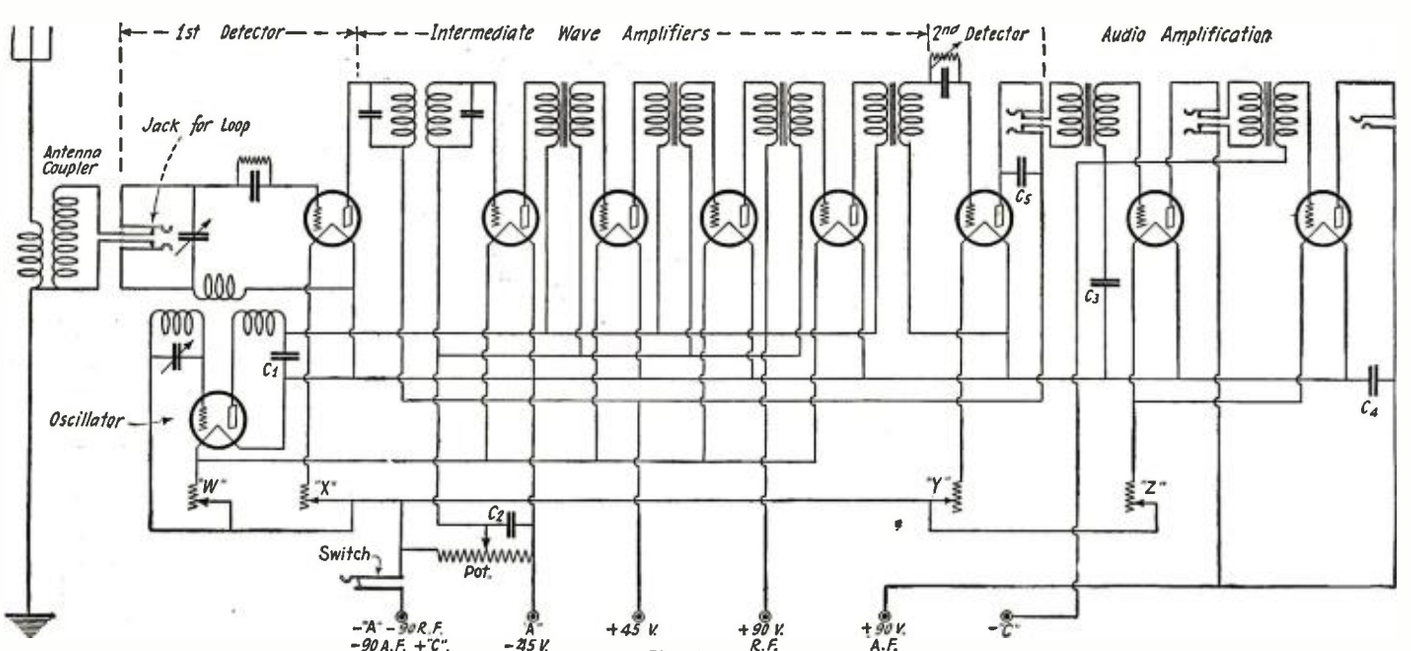


Fig. 1

A typical nine tube Super-Heterodyne circuit employing four stages of intermediate wave radio frequency amplification and two audio frequency amplifiers. It works excellently with a loop aerial even when receiving from distant stations. Tubes of the UV-201A or C-301A type are employed throughout.

*Iowa State College.

replaces the inductance of the secondary coil of the coupler.

GRID CONDENSERS AND LEAKS

The diagram shows a grid condenser and leak in the grid circuits of each of the detector tubes. The grid condenser of the first detector rectifies the signal oscillations as well as the oscillations picked up by the pick-up coil from the oscillator circuit. The two sets of oscillations are heterodyned and sent to the amplifiers. The second detector again rectifies the oscillations and presents its rectified output to the audio frequency amplifiers.

Many who have built the Super-Heterodyne have found that the condenser and leak in the grid circuit of the first detector tube are very critical and have difficulty in securing the proper adjustment of these units.

The author has found that better results are obtained by placing a slight negative bias on the grid of the first detector and omitting the grid condenser and leak. The method shown in Fig. 2 was used. The grid return was connected to the center terminal of the potentiometer P_2 placed across the battery C, an ordinary No. 6 dry cell such as is used for ringing door bells. P_2 has about 2,000 ohms resistance so that the life of the "C" battery here is very long—one cell should last a season. The positive side of the battery was connected to the center terminal of a 400-ohm potentiometer P_1 across the "A" battery. By adjusting the two potentiometers, using the one across the "C" battery as a vernier, any grid bias desired can be placed on the grid. Once the adjustment is correctly made, it is practically permanent. Reception is thus rendered more stable and one of the common operating difficulties of the circuit removed.

AIR OR IRON CORE TRANSFORMER

There has been much discussion as to the use of air or iron core transformers for the intermediate stages. Some manufacturers offer the air core instrument with the statement that it is superior to the iron core type while others maintain loudly for the iron core type.

The answer to these conflicting statements lies in the design of the set. Some circuits work well with iron core transformers while other circuits seem to operate best with the air core type. Properly designed air core instruments are very sharp with reference to the wave bands to which they will respond and the iron core transformers will respond with almost uniform application to a relatively wide band of frequencies. This is illustrated by the amplification curves of Fig. 3, where curves for the air core and the iron core types of transformers are shown. It will be noted that the air core unit peaks very sharply while the iron core unit responds with approximately uniform amplification to a wave band between 6,000 and 12,000 meters.

For a receiving set having four stages of intermediate amplification, five transformers are required. At least one of these transformers—usually the first one—must be of the so-called filter type. The filter transformer selects the frequency at which the heterodyned signal is to be amplified and is very sharply tuned. Only waves of the length to which this transformer is tuned pass into the following stages. In Fig. 1, the filter transformer is of the air core type with each winding by-passed by a fixed condenser of such a capacity that both windings will respond with maximum amplification to the desired frequency and no other. This transformer with its shunt condensers will respond to, let us say, a wave of 9,600 meters as shown by the curve of Fig. 3. It matters little what type of transformer is used in the succeeding intermediate stages so long as they are able to amplify a wave of 9,600 meters with efficiency.

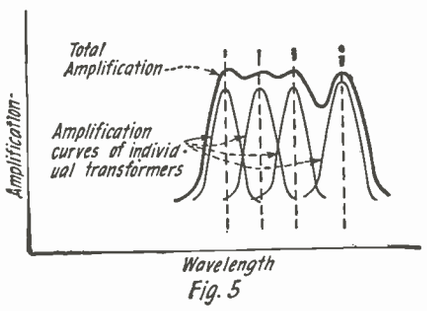


Fig. 5

The curves of four air core transformers not matched, each being tuned to a slightly different frequency.

Although air core transformers in the succeeding stages are able to amplify at a relatively high ratio, they must all be sharply tuned to the *same* frequency as the filter—a condition which is somewhat hard to secure. If a set of perfectly matched transformers of the air core variety can be obtained, the amplification will be maximum and the receiving range of the set exceptional.

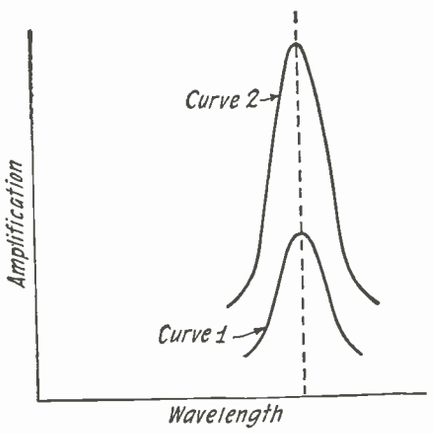


Fig. 4

Curve 1 is that of a sharply peaked air core transformer and curve 2 is that of four such transformers perfectly matched.

On the other hand, if iron core transformers are used in the succeeding stages, they will amplify very satisfactorily and will require no matching. This effect is shown in Figs. 4, 5, and 6. In Fig. 4 is shown the amplification curve produced by four sharply peaked air core transformers, all of which have the same amplification curve (shown at 1). Curve 2 is for the entire group, showing how the four perfectly matched transformers produce an extremely high amplification. Fig. 5 shows four air core transformers which are not matched and whose amplification curves show that they are tuned to slightly different frequencies. The resulting amplification of the set is not as great as that of the perfectly matched unit of Fig. 4. Fig. 6 shows the amplification curves of a filter type air core transformer and the curves of three iron core transformers used as a group. The resulting amplification of the entire group is greater than the unmatched transformers of Fig. 5, but is not as great as the amplification for the group of perfectly matched units of Fig. 4.

It is because of the difficulty of obtaining perfectly matched air core transformers that many builders prefer to use one air core transformer as a filter and iron core transformers in the succeeding stages.

RHEOSTATS

Each detector should have an individual filament control rheostat. The oscillator tube and the tubes of the intermediate amplifiers may be controlled by means of one rheostat and the audio frequency stages by another rheostat. Individual rheostats on the detector tubes permit these tubes to be adjusted there for best action. Individual rheostats on the other tubes offer no advantage.

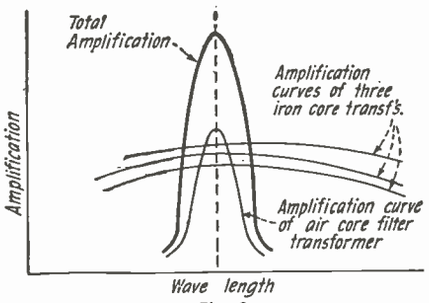


Fig. 6

The total amplification obtained by employing one air core filter transformer and four iron core transformers is shown by the highly peaked curve.

GRID BIAS

Most Super-Heterodyne circuits use a potentiometer the center terminal of which is connected to the grid returns of the intermediate amplifier tubes to place a slightly positive bias on the grids of these tubes to prevent oscillation. The use of the potentiometer effectually prevents oscillations in intermediate stages but at a sacrifice of several advantages which would be secured if oscillations could be prevented through other methods. It is well known that a positive grid potential greatly increases the plate current and thus places a greater load on the "B" batteries. Much work is being done by experimenters and manufacturers in an effort to devise a way to prevent oscillations in the intermediate stages without the use of the potentiometer. One method is a negative feed-back arrangement such as is used in the Neutrodyne circuit. If the oscillations can be prevented, a negative bias can be applied to the grids of these tubes with a great saving in "B" battery current, and better amplifier action.

One method of preventing oscillation in the intermediate stages is shown in Fig. 7. Here the plate and grid of each tube are coupled by the condenser C and the resistance R. The condenser is the ordinary mica type of about .00025 mfd. capacity. The resistance R should be of the pencil mark variety and should be adjusted until oscillations just cease. A "C" battery may then be used to bias the intermediate stages.

EFFECT OF "C" BATTERY

The use of the "C" battery effects a saving in "B" battery current ranging from 100 to 300 per cent. Audio frequency stages are especially benefited by the use of the "C" battery.

Although the "C" battery reduces the amount of current in the plate circuits of the tubes, it does not cause a reduction in the strength of signals when properly used, but rather a slight increase with added signal clarity.

The sound produced by the head set or loud speaker does not depend upon the total amount of current flowing through their

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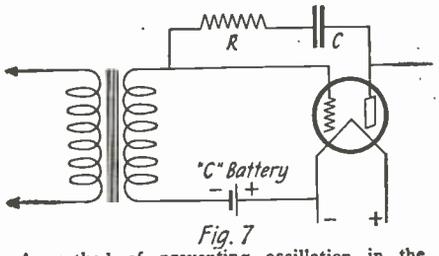


Fig. 7

A method of preventing oscillation in the intermediate stages by the utilization of resistance and capacity from plate to grid members of each tube.

Reflex Radio Receivers In Theory and Practice

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

Part II

The second and final installment of the article dealing exhaustively with reflex amplification in all its forms. Among other things Mr. Scott-Taggart goes into the subject of the addition of regeneration to reflex receivers, a worthy acquisition.

IT is proposed in this chapter to discuss the more common forms of reflex amplification circuits.

In the last chapter a circuit was given in which a reflex amplification effect was obtained and in which loose-coupling was used between the aerial and the grid circuit of the tube, and a transformer to feed the amplified radio-frequency currents into a detector circuit. This transformer was shown aperiodic in Fig. 10, but more usually such a transformer is tuned. Sometimes the

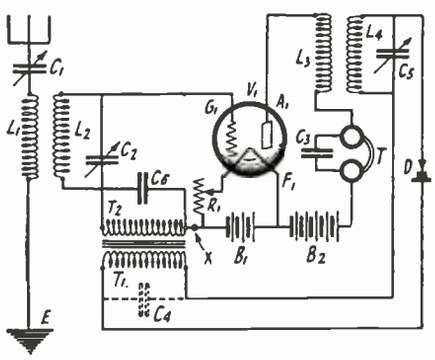


Fig. 11. A loose-coupled reflex circuit employing an air core tuned radio frequency transformer.

primary is tuned and sometimes the secondary, and sometimes both windings are tuned.

As regards which arrangement gives best results, the following remarks may prove of interest:

The transformer itself may consist of two inductances variably coupled, but more usually ready-made transformers are supplied which will cover a given range with, say, a .0003 mfd. variable condenser. If of the variable type, greater selectivity will be obtained by tuning both the primary and secondary. When using a fixed transformer, however, there is no special point in tuning both windings; only one winding may be tuned, and as regards sensitiveness and selectivity, there is, generally speaking, no difference which of the two windings is the one to be shunted by a variable condenser. The question of stability, however, is one which arises, although the matter is not one which has received proper consideration in the past. If the plate coil, *i.e.*, the primary of the transformer, is tuned by means of a variable condenser, the tendency of the tube to oscillate at radio-frequency is much more pronounced. The coupling between the tuned plate circuit and the tuned grid circuit, accomplished through the inter-electrode capacity, the grid and plate forming what is substantially a small condenser. If, however, the secondary winding is tuned and the primary is left aperiodic, the tendency to oscillate will not be so great.

In the case of Fig. 11, this is partly due to the fact that the distance between the coils L_3 and L_4 makes L_3 act more like an aperiodic coil, and partly because the oscillatory circuit has now got the heavy damping effect of the crystal detector and the primary T_1 of the step-up transformer T_1 T_2. It is known, for example, that a tube without any intentional feed-back tends to oscillate quite readily when both the grid and plate circuits are tuned, but when the plate circuit contains an inductance which is not tuned, or approximately tuned to the same wave-length as the grid circuit, the tendency to oscillate is no longer present. If you add to this fact the presence of a crystal detector which may have a resistance as low as 2,000 ohms, or in many cases, very much less, the tendency to oscillate is still further reduced.

The connections to the primary L_3 in Fig. 11 are rather important from the point of view of a tendency of the tube to oscillate. When the coil L_3 is fairly closely coupled to L_4, as it is when transformers of fixed couplings are used, it will be found that making the connections to L_3 in a certain direction will result in the tube V_1 having a much greater tendency to oscillate if the connections to L_3 are reversed. When a fixed or tight coupling of this kind is employed, the coil L_3 does not act as an aperiodic coil, but partakes of the properties of the tuned circuit L_4 C_5, and capacity feed-back takes place through the inter-electrode capacities. If, now, we reverse the connections to the coil L_3, the tendency for regeneration to take place will be greatly lessened and the circuit will be much more stable. It is, therefore, advantageous, when using a circuit of the Fig. 11 type, to be able to reverse the connections to the coil L_3. Sometimes it will be found that louder results are obtained with the coil connected a certain way because of the unintentional capacity feed-back strengthening the signals; but on the other hand, this unintentional feed-back effect may be sufficiently strong to produce self-oscillation, in which case, the coil L_3 should have its connections reversed. As a matter of fact, the chances of self-oscillation are remote when using a crystal detector shunted across L_4 C_5.

It is important to note here that adjusting the crystal detector will vary the damping of the circuit L_4 C_5, and so vary the degree of unintentional feed-back introduced into the circuits L_3, C_2 and L_4 C_5. It may thus happen that a light contact on the crystal detector, although unsuitable from the point of view of actual rectification, will result in less damping on the circuit L_4 C_5 and so cause an increase in signal strength.

Another point to notice is that by the detector having a different impedance at different adjustments, the tuning of the circuit L_4 C_5 will be altered principally by altering the unintentional feed-back introduced into the circuit L_4 C_5. Any variation of feed-back, whether intentional or otherwise, should always be accompanied by retu ning of associated circuits, and consequently, it is desirable, when operating the Fig. 11 circuit, to retune the condensers C_1, C_2 and C_5 after adjusting the crystal detector.

It will be noticed that a condenser C_4 is shown in dotted lines across the primary of the step-up inter-tube transformer T_1 T_2. The writer's experience indicates that this condenser may always be left out without decrease in signal strength, owing to the self-capacity of the primary T_1. If a condenser is used, its value should not exceed .002 mfd.

As regards the connections to the primary, the connections are not so important, as the experimenter will usually care to try reversing the connections. If a rule is desired, it might be sugggested that the right-hand side of T_1 should be the outside primary lead, while the left side, which is connected to one side of the crystal detector is the inside lead.

As regards the fixed condenser C_5, across the secondary T_2, the value of this condenser may be quite low, say, .0003 mfd., and in any case should not be greater than .002 mfd. Even when a .002 mfd. condenser is used, there is a certain reduction in the audio-frequency potentials established across the secondary winding T_2, and for general purposes the writer would recommend a condenser of .001 mfd. A grid battery could be inserted in the point X in the Fig. 11 circuit for the purpose of giving the grid a negative bias.

A few additional connections may be tried by the experimenter. It is usually desirable, in all cases, where a loose-coupled input radio-frequency transformer is used, such as L_1 L_2, to connect the negative terminal of the "A" battery to earth.

Another arrangement worth trying when a transformer L_3 L_4 is used in the output circuit of the tube, is to connect one side of the primary to the negative terminal of the "A" battery; adhering to the note regarding the I.P. and O.P. terminals of primary and secondary, the right side of T_1 may be connected to the negative terminal of "A" battery B_1.

SIGNALS WITH CRYSTAL OUT

Many experimenters will have found that when the catwhisker, or upper

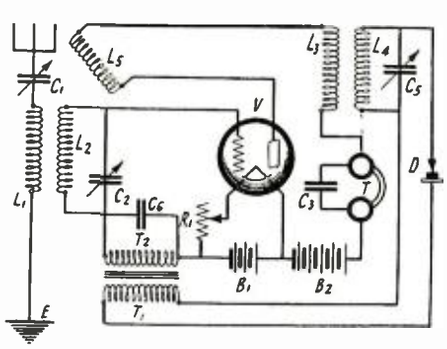


Fig. 12. A novel form of reflex circuit, similar to that of Fig. 11 but with the introduction of regeneration.

crystal, is removed from the lower crystal, singals very frequently come in quite well, and this may prompt some to imagine that reflex amplification is not effective. What really is happening, of course, is that the tube is acting purely and simply as a detector. It is, in fact, almost impossible to prevent a tube acting as a detector whatever the conditions may be under which it is operating.

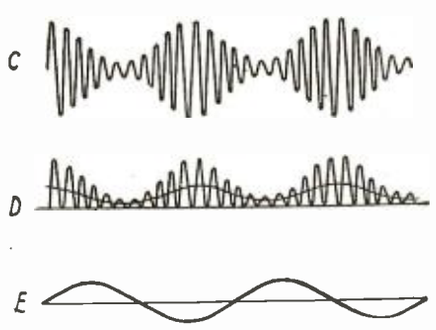
In Fig. 11 the head-phones T are included directly in the plate circuit of the tube, and consequently, if there is any rectification, signals will be heard in the head-phones. There will, however, be no reflex amplification effect whatsoever, the secondary T_2 in the grid circuit having no effect on the operation of the circuit. As a matter of fact, it is rather a good test to see whether signals may be heard with the crystal off in order to ensure that the tube is functioning properly as an audio-frequency amplifier. If good signals are heard in the head-phones it is an indication that the tube V_1 is acting as a detector, and will consequently probably distort the audio-frequency currents which are fed into its grid circuit by means of the transformer T_1 T_2. The rectification effect may be eliminated, or practically eliminated, by giving the plate a suitably high plate voltage and giving the grid a negative potential to bring the operating point about the half-way point along the characteristic curve. Under these conditions signals will not be received in the head-phones T when the crystal D is raised, or if there are signals, they will be very weak. If, however, no grid battery is connected in the grid circuit, signals will usually be stronger, indicating that distortion will occur on the audio-frequency side.

Sometimes the signals obtained by raising the contact from the crystal in reflex circuits are as loud, or sometimes even louder, than when the crystal is employed, and this is a sure indication that something is wrong with the circuit. One of the probabilities is that an inferior crystal detector is employed.

In the Fig. 11 circuit, the raising of the crystal by relieving the circuit L_4 C_3 of a considerable amount of damping, may result in more capacity feed-back in the tube, and this feed-back will strengthen the oscillations in the circuit L_2 C_2. The result is that the tube V_1 is now acting as a detector with regeneration, and the results may be quite good compared to the normal arrangement of Fig. 11 with the contact on the crystal, the regeneration effect being probably very small. This brings us to the question of how we may improve the signal strength of a circuit of the Fig. 11 type by means of regeneration.

ADDING REGENERATION TO A REFLEX RECEIVER

The desire for obtaining the maximum output from a minimum number of tubes will prompt every experimenter to try and obtain better results by the application of regeneration to his reflex receiver. The application of regeneration to a reflex receiver introduces innumerable problems which require solutions and the application of regeneration is usually accompanied by the setting up of loud buzzing noises of audible frequency which are extremely unpleasant to the operator of the set. Ordinary regeneration may cause self-oscillation of an ordinary receiver, but this generally troubles the receiving operator very little; on the other hand, those who have sets in the neighborhood have very good cause to complain owing to the heterodyning of the radiated oscillations with the incoming signals. The average user of a reflex circuit, however, finds that on tightening the regeneration coupling his own set produces an extremely unpleasant noise, and he consequently has to make an immediate adjustment to prevent it. He is, therefore, generally far less troublesome to his neighbors than he who employs an ordinary straight circuit.



Figs. 15 and 16. At C are shown rectified high frequency currents; D, unidirectional currents; and E, the alternating currents produced by the transformer.

Fig. 12 shows a regenerative reflex circuit which only differs from Fig. 11 in that a tickler coil L_5 is connected in series with the primary L_3 of the transformer L_3 L_4. The warning that should be given there is that if the tickler coil L_5 is made of a certain size, the natural wave-length of the plate circuit, due to

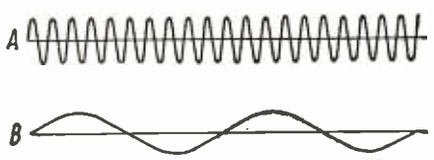


Fig. 14. A conceptional appearance of the high frequency currents, A, and the low frequency currents, B, traversing a radio circuit.

the inductance L_5 and L_3 in series and the capacity between filament and plate and the self-capacity of the two coils, is near to the wave-length being received, the tube will oscillate too readily. It is, therefore, desirable that the coil L_5 should be kept as small as possible, and since a separate aerial circuit is employed a small tickler coil is all that should be necessary owing to the natural damping of the circuit L_2 C_2. The tickler coil L_5 should, of course, be connected the right way round.

The circuit is not recommended as a particularly good one to start with, but most of the troubles experienced with reflex circuits are absent in a simple arrangement such as shown in Fig. 11 and Fig. 12.

Fig. 11, particularly, is calculated to avoid any tendency towards the low-frequency buzzing which is so prevalent in reflex circuits generally. In Fig. 11 we are more likely to get the buzzing because regeneration is employed, and it will usually be found that as the regeneration is increased a certain point is reached when buzzing takes place. This buzzing is due to audio-frequency feed-back, amplified audio-frequency currents produced in the output circuit of the tube being conveyed back to the input side, the degree of audio-frequency feed-back being sufficiently great to cause audio-frequency oscillation. If the audio-frequency feed-back is not sufficiently great to produce audio-frequency oscillation, a big build-up of signal strength is often obtained, but nearly always at the sacrifice of purity of reproduction.

All reflex circuits tend to oscillate, whatever precautions may be taken, and

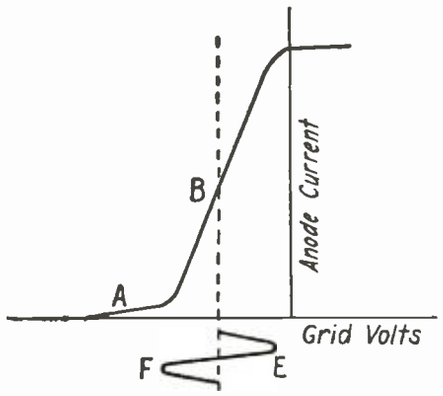


Fig. 13. Characteristic curve of a vacuum tube adjusted for reflex amplification.

the reason is that, although no audio-frequency feed-back is produced through the audio-frequency output currents of the tube being directly coupled to the input circuit of the tube, but because there is, in between, a stage of radio frequency amplification, the radio-frequency oscillations being modulated by the audio-frequency input currents.

We may consider this matter best by considering that the tube in Fig. 12 was oscillating and producing radio-frequency oscillations of a frequency determined by the values in the circuit L_2 C_2. If, when the tube is oscillating we feed audio-frequency currents into the grid circuit by means of the transformer T_1 T_2, we will vary the grid potential at audio-frequency, and these variations of grid potential are liable to vary the amplitude of the radio-frequency oscillations generated by the tube. This, in fact, is a common method of modulating the radio-frequency oscillations of a tube for telephony transmission; but certain conditions are necessary. The modulation effect is not present if the characteristic curve of the tube is absolutely straight, and only a small portion of its straight part is used. In this case the radio-frequency currents are amplified by the tube without any distortion or rectification assuming, of course, that a negative potential is applied to the grid to prevent the establishment of grid current. If, however, the representative point on the characteristic curve, *i.e.*, the point representing general conditions at any given moment, moves along a curved portion of the characteristic curve, modulation will occur. For example, if the whole of the characteristic curve is being traversed up and down due to the oscillating of a tube, and we apply a positive potential to the grid, it will be fairly obvious that the tops of the radio-frequency current half-cycles will be clipped and distorted. Owing to the tube being saturated, the positive half-cycles will not be fully developed because the base line potential for these radio-frequency oscillations has been raised by the application of a positive potential to the grid. If a negative potential is applied a similar effect may be obtained at the bottom bend of the plate current characteristic curve.

Fig. 13 shows a characteristic curve of a tube adjusted correctly for reflex amplification. It will be seen that the plate current curve, A, B, lies to the left of the ordinate passing through zero grid volts; this means that no grid currents will be established. A complete cycle of oscillating current is shown varying the grid potential above and below an average value which results in the middle point of the plate current curve being employed. If an audio-frequency

(*Continued on page* 538)

Non-Radiating Regenerative Receivers

By CLYDE J. FITCH

Some interesting forms of non-radiating regenerative circuits worked out by Mr. Fitch. This article is presented more as food for thought than a practical remedy for the radiation ill. The circuits however are theoretically sound.

IT has often been quoted that any form of coupling which allows signals to pass from the aerial to the radio receiver will also allow radio frequency currents generated by the receiver to pass out into the aerial system. Therefore several forms of blocking tube arrangements have been devised, the purpose of these tubes being to localize the oscillations generated by the receiver and prevent them from entering the aerial. As such systems require an extra tube for blocking purposes, the owners of

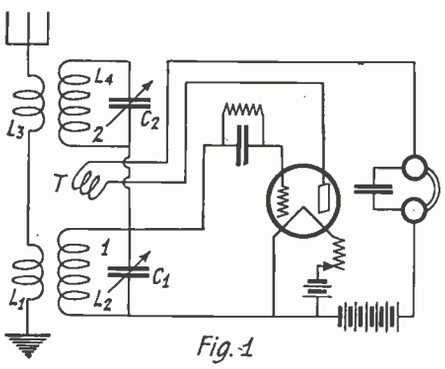


Fig. 1

A regenerative receiver using two tuned circuits, one of which opposes the other thus preventing radio frequency currents generated by the tube from flowing in the aerial circuit.

single tube receivers, who no doubt cause most of the disturbance, do not care to double the expense of their set without increasing its receiving range. In order that the public will not be misled by these iron bound rules, three non-radiating, single tube, regenerative receiver circuits devised by the author will be described herewith. This should be enough proof that a blocking tube is unnecessary as a radiation preventer.

Before describing these circuits it may be well to state that the process of regenerating into the antenna has the effect of decreasing its resistance. Thus, if an antenna has a radio frequency resistance of 30 ohms the current induced into this antenna by a passing radio wave will be infinitely small. By regenerating into this antenna the resistance is apparently wiped out, with a vast increase in signal strength. In fact the apparent resistance may be reduced to zero or even less, in which case the oscillations set up in the antenna by the passing wave continue flowing, and an oscillating current is generated by the receiver. Here is where the trouble begins.

Waves are radiated from the antenna and cause interference in the neighborhood. But if we do not regenerate into the antenna, which will be the case when using the following circuits, or when using any of the present blocking tube methods, the antenna resistance remains high and the signals are considerably weakened. Therefore, those who contemplate building a non-radiating regenerative receiver, are warned in advance that the results which will be obtained from it will be very poor compared with the results possible if the non-radiating feature were eliminated. In giving these circuits, therefore, it is with the idea that they will be used as demonstrations to point out the fact that all present non-radiating schemes are inefficient from a practical standpoint. and to emphasize the following fact: *A radiation eliminator, to be practical, efficient and a commercial success, must not prevent regeneration into the antenna.* Instead, it should allow regeneration to take place in the antenna system up to a point where oscillation is just about to start, and then, automatically stop any further regeneration. There is no such circuit or device in existence today, to the best of the writer's knowledge. Experimenters should concentrate their efforts on such a system, and not try to devise a system that entirely prevents regeneration into the antenna. If we do not regenerate into the antenna, but into some local tuned circuit that already has a low radio frequency resistance, as is the case with the following circuits and those employing blocking tubes, the signal strength will be increased only slightly. A simple single tube circuit that will allow regeneration into the antenna up to a point just before oscillation begins but no further, is the only practical solution of the problem. Otherwise it will require two or three stages of radio frequency amplification to make up for the loss.

CIRCUIT NO. 1

This circuit is the first devised by the writer and is a very effective non-radiating regenerative one. Except for the addition of coils L_3 and L_4 and condenser C_2, it is the standard double circuit arrangement. The signal current is transferred from L_1 to L_2, where it is impressed on the grid of the tube and repeated in the plate circuit and fed back or regenerated by means of the tickler T. Coil L_4 is exactly symmetrical to coil L_2 and is wound on the same tube

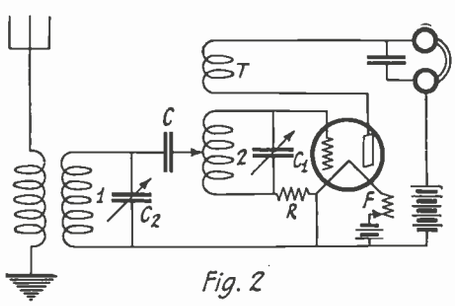


Fig. 2

In this circuit radiation is prevented by connecting the tuning circuit to the nodal point of the regenerative circuit.

and equidistant from the tickler T. The action is as follows: When the circuit is oscillating, current is fed from T into both tuned circuits 1 and 2. From circuit 1 current passes into the antenna circuit via L_1. From circuit 2 current also passes into the antenna circuit via L_3. But L_1 and L_3 are wound so as to oppose each other and consequently the currents neutralize and none flows into the aerial circuit. Circuit 2 does not prevent the signal current from passing to the tube via circuit 1, but does prevent current generated by the tube from passing into the antenna. In this circuit the two condensers C_1 and C_2 must be adjusted simultaneously and must be mounted on the same shaft so as to be controlled by one knob. Otherwise radiation is not necessarily eliminated.

When the circuits are correctly balanced, a simple test is to tune in the carrier wave of a station and then touch the aerial connection with the finger. If the pitch of the carrier wave does not change, the aerial is not radiating. In an actual set built the radiation was not entirely eliminated, but considerably reduced. The amount of radiation depends upon the mechanical accuracy of the parts. There are now on the market double variable condensers, having two sets of rotary plates, that may be used in this circuit.

CIRCUIT NO. 2

Those who read about the Tropadyne circuit in the August issue will recognize this circuit. Although used as a detector-oscillator, or frequency changer, in the above Super-Heterodyne, it makes a very good single tube non-radiating regenerative receiver. The action is as follows: The signal current induced into tuned circuit 1 passes through grid condenser C to the nodal point of circuit 2. The current divides here, charging both sides of condenser C_1 to the same polarity and hence induces no current in circuit 2. As the signal current is impressed on the grid, it is repeated in the plate circuit and fed back by means of tickler T to circuit 2 and amplified by regeneration. Should oscillations be generated in circuit 2, none flows in circuit 1 and the antenna circuit, as the potential difference between the nodal point of circuit 2 and the filament F always remains constant. Resistance R should equal the grid to filament resistance of the tube. It is necessary that circuit 1 and circuit 2 be in non-inductive relation with each other. The two condensers may be controlled separately.

This circuit is very easy to build and to tune, but is more valuable as a first detector and oscillator in a Super-Heterodyne than as a non-radiating receiver, as it eliminates one tube in the Super-Heterodyne.

CIRCUIT NO. 3

This circuit is a very interesting one in that a new kind of aerial is used. As shown in the diagram, the aerial consists of two wires placed close together, and for this purpose a twisted lamp cord is recommended. The condensers C_1 and C_2 must be mounted on the one shaft so as to be controlled by one knob. The ground is connected to the center of coil L. The action is as follows: The signal current flows in both wires of the aerial in the same direction and is impressed on the grid of the tube. It is then repeated in the plate circuit and fed back by means of tickler T to coil L and amplified by regeneration. Should oscillations start, the oscillating current induced in L flows in the two aerial wires in opposite

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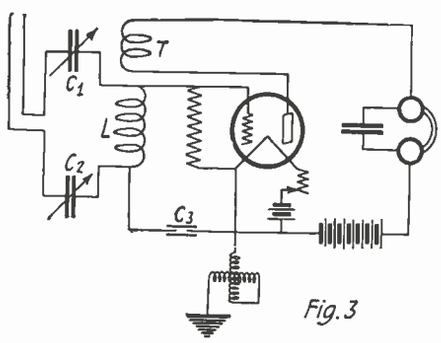
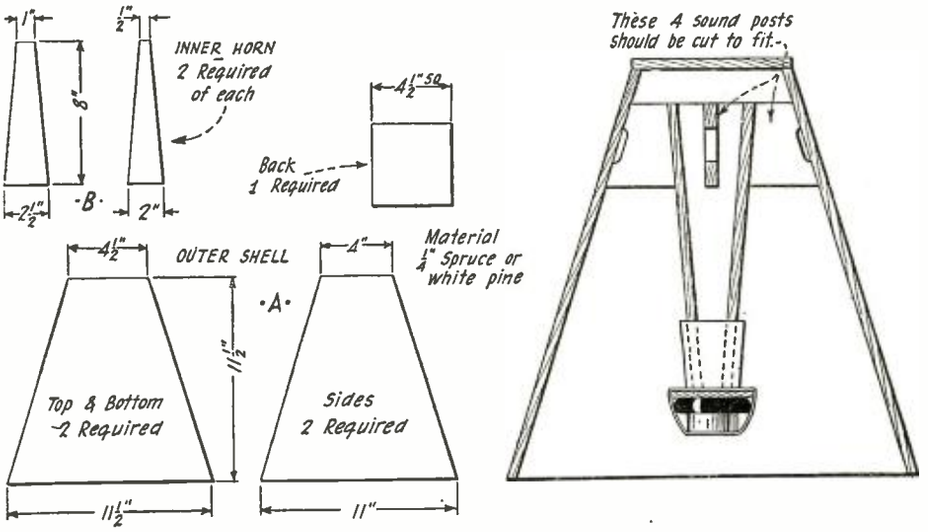


Fig. 3

A double antenna is used in this circuit. The signal current passes through both wires in the same direction whereas local oscillations pass in opposite directions and neutralize.

Awards of the $50 Radio Wrinkle Contest



Construction details of a simple form of loud speaker built up of straight grained spruce board.

First Prize

A REAL LOUD SPEAKER FOR THE MAN WHO MAKES HIS OWN

By JESSE J. HIPPLE

The loud speaker, herein described, was designed and perfected by a man long experienced in the construction of sound producing instruments. The volume and quality do not depend on a megaphonic action but rather upon the vibrations set up by the speaker itself.

The secret of the excellent quality of this speaker is the bridges, similar in action to the sound posts of the violin, which attach the inner horn to the outer shell of the speaker.

The choice of construction material is vital to the success of the finished product. The loud speaker in possession of the writer is constructed of clear, straight grained spruce. While it is true that some of the veneer panels will give fair results, the wood of the spruce or pine will prove best.

The first step is to lay out a full scale plan of the parts of the speaker, then cut the material to be used, exactly to size. The parts should then be assembled, coating each joint with good strong glue and making them fast with small brads.

When the complete instrument has been assembled, let it dry for a day and then give the interior two or three coats of good shellac.

The speaker can then be placed in an appropriate cabinet and a fancy grill for the front cut out with a jig saw.

Any type of speaker unit can be used and the builder will have to construct the inner horn to suit the type of unit he intends to use.

This speaker surpasses in quality any that has been put on the market to date and the volume depends upon the unit employed.

Second Prize

AN AID IN COIL WINDING

By JULIAN L. WILHELMI

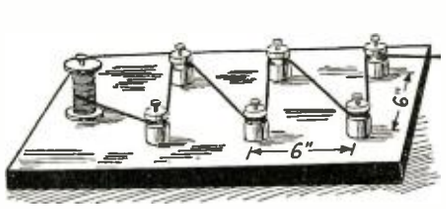
When winding inductance coils, using the conventional small gauge cotton or silk covered wire, which is usually purchased in quarter to one pound spools, it has always been a problem to straighten the wire and also to keep it tight so that a smooth neat winding job can be done. Therefore, I constructed the following handy and inexpensive device that I find to be most convenient and particularly handy for bank winding. The accompanying diagram shows the entire construction of this device and very little description is necessary. All that is required are six porcelain knobs such as are used in house wiring and a small piece of board. These porcelain knobs are loosely nailed to the board in the arrangement shown. The nail should not be driven in tightly as it is necessary for the porcelain knobs to turn freely. The spool of wire is mounted in the same manner on one end of the board and the wire is run around from insulator to insulator. It will be found that this scheme will keep the wire tight and at the same time will straighten out any kinks or bends that it may have. If the experimenter has a great deal of coil winding to do he will find that this scheme greatly facilitates winding and will enable him to make a much neater appearing coil.

Prize Winners

First Prize $25
A REAL LOUD SPEAKER FOR THE MAN WHO MAKES HIS OWN
By JESSE J. HIPPLE
2537 Bedford Ave.,
Brooklyn, N. Y.

Second Prize $15
AN AID IN COIL WINDING
By JULIAN L. WILHELMI
171 S. Schuler Ave.,
Kankakee, Ill.

Third Prize $10
USING A LOOP WITH AN UNTUNED PRIMARY
By H. A. EVEREST
1032 N. Ogden Drive,
Los Angeles, Calif.



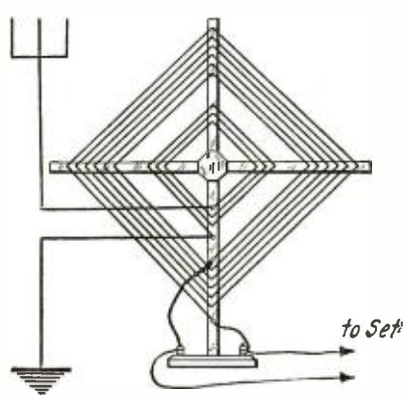
A simple contrivance which will materially assist in winding coils.

Third Prize

USING A LOOP WITH AN UNTUNED PRIMARY

By H. A. EVEREST

Any receiver designed for a loop would naturally give much superior results if it could be employed with an antenna and ground. Most of the loop receivers on the market, however, can be used with a loop only unless a separate tuning unit is employed. Such a tuning unit is, in a majority of cases, inconvenient, and for this reason the benefit of an outdoor antenna must be dispensed with. The obvious solution to this problem is to wind a primary coil directly on the loop frame in inductive relation to the loop winding. This primary winding will consist of about three turns of fairly heavy stranded wire wound on the frame of the loop inside of the loop proper. This winding should be from 1 to 3 inches from the loop winding, depending upon the degree of selectivity desired. The further this winding is removed from the loop the greater the degree of selectivity but the weaker the signal. This primary winding may be connected directly to the antenna and ground and the loop is connected to the set in the ordinary manner. It will be found that the signal strength will be greatly increased over that obtained when using the loop alone and practically the same dial reading will be had in either case. Sometimes greater signal strength will be had by using six or seven turns on this primary winding and connecting a fixed condenser of .00025 mfd. capacity in the antenna circuit.

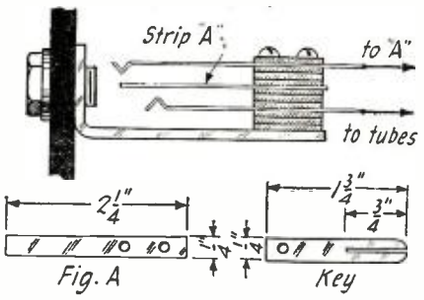


Here is a good stunt. The extra winding on the inside of the loop frame functions as an untuned antenna circuit.

A CLEVER SWITCH LOCK

A very simple and easy way to make a switch lock for the "A" battery line is to use an ordinary telephone jack. This jack is slightly reconstructed and is placed on the panel in any convenient position. It has the same outward appearance as any other jack, but the set cannot be put in operation unless the proper key is inserted. An ordinary double circuit jack is obtained and the two middle springs removed. Cut a strip of brass or fibre (Fig. A) ¼ inch wide, 2¼ inches long and 1/16 inch thick. At one end drill two holes to correspond to those on the insulating blocks of the jack. Assemble the jack again so that the strip A comes in the center of the plug hole. It is now evident that a plug cannot be inserted in the jack unless it is slotted. The

key is made from a piece of ¼ inch brass rod 1¾ inches long. A slot should now be cut in one end of this rod 1/16 inch wide and ¾ inch long. This slot should be cut so that when the rod is inserted in the jack, the strip A will be in line with it.



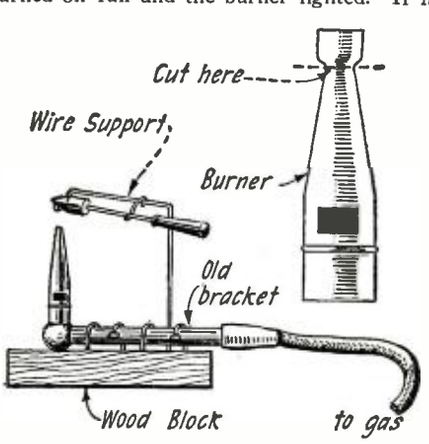
This filament switch requires a special key-plug to close the circuit. Other plugs will not fit the jack.

This end of the rod should also be rounded with a file so that it may be easily inserted. Be sure that the key, when inserted, short circuits the two springs of the jack, otherwise the "A" battery circuit will not be complete. A knob of some sort may be placed on the unslotted end to give it a neater appearance or a hole may be bored in this end so that it may be carried on a key ring.

Contributed by Herbert Frosell.

SMALL SOLDERING IRON HEATER

If the experimenter does not possess an electric soldering iron, he finds it a great inconvenience to heat his iron on the gas range in the kitchen. This trouble can be eliminated by constructing a small soldering iron heater which can be used anywhere there is a gas supply. To construct this heater, it will be necessary to procure a Welsbach Thrift Burner from the 5 and 10 cent or hardware store. With a file or hacksaw carefully cut the top off, as shown by the dotted line in the diagram. An old gas light bracket should be obtained, mounted on a board and the Welsbach burner screwed into it. A rubber tube may lead from the burner to the nearest gas jet. The gas is turned on full and the burner lighted. If it



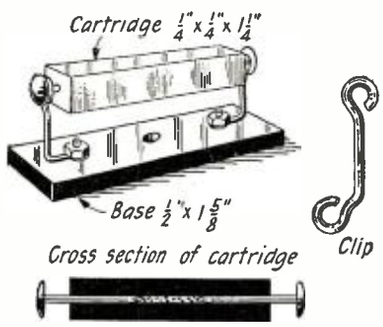
A good soldering iron heater constructed from a Welsbach burner.

flashes back, that is, lights at the bottom, the gas should be turned off and the top of the burner should be squeezed together slightly with a pair of pliers. It may take a few trials to obtain the right size of the opening for best results. It is operating correctly when a roaring blue flame is obtained. A support for the iron consisting of a piece of stiff wire may also be mounted on the wooden block. It will be found that this burner is very efficient and heats a small soldering iron quickly.

Contributed by Walter A. Troup.

A FIXED CRYSTAL DETECTOR

A dependable crystal detector requiring no adjustment can be assembled from the following materials. Two upholstery or thumb tacks, two binding posts, two pieces of bakelite or other good insulating material, a length of hard drawn copper wire for clips and a small piece of crystal. Any good crystal will do, but perhaps best results will be obtained if the crystal is of the synthetic "all sensitive" variety. One piece of bakelite should be at least 1¼ inches long and about ¼ of an inch square. This piece is drilled lengthwise through the center with a small drill of a size to snugly accommodate the two thumb tacks. One tack is inserted in this hole to within about 3/16 of an inch of the center. The crystal should now be pounded to fine grains and ⅜ of an inch of them poured into the hole from the opposite end. The second tack should now be inserted in this end so that the crystal grains make contact between the points of both tacks. A mounting for this crystal detector may easily be made from



A cartridge form of fixed crystal detector especially adaptable to reflex receivers.

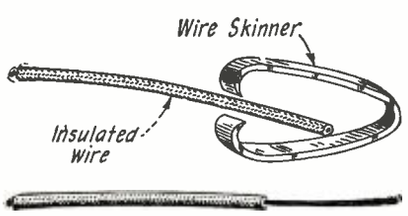
the copper wire and may take the form shown in the diagram. This type of detector will prove both sensitive and stable and may be used successfully in a reflex circuit.

Contributed by E. Lambert McDonald

A HANDY WIRE SKINNER

When using a knife to remove the insulation from a cotton or rubber covered wire it often results in a cut finger. Also, if this work is not done carefully, it is possible that a small fragment of copper in the shape of a splinter will be run into the hand. Herein is described a little device which will safely and easily remove the insulation from any size wire. All that is required is a strip of spring brass 1/16 of an inch thick, 10 inches long, and 1½ inches wide. This piece of brass should be bent into the shape shown in the diagram. The two edges of the wire scraper should then be sharpened on one side only. To use this device it is held in the hand and the jaws forced together over the wire so that it cuts through the insulation. It is now pulled towards the end of the wire and if necessary the operation is repeated two or three times until all of the insulation is removed. This little instrument will prove extremely efficient in removing the insulation from heavy rubber covered wire.

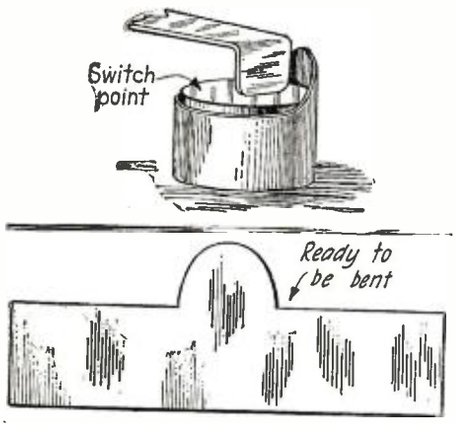
Contributed by T. J. Hacker.



An excellent wire skinner made from a thick piece of spring brass.

IMPROVED SWITCH STOPS

Switch stops are mighty cheap, but they can, however, be considerably improved, as there are several faults with the ones now on the market. Herein is described a system of constructing switch points which will



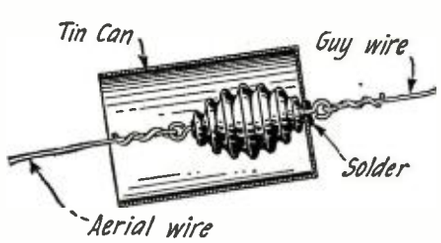
A neat switch stop made from a piece of sheet metal and fitted around the switch point.

prove extremely simple and efficient as stops. They can be made of thin sheet brass, copper or tin and require but a few moments to make them, and when made properly they will not detract from the appearance of any set. The idea is (as may best be seen by the drawings) to cut a thin piece of metal so that it is as wide as the head of the switch points are high, and as long as the circumference of the points. A place should be left in the center, bulging up in the shape of a semicircle. The piece of brass should now be bent tightly around the switch point where the stop is required. These switch stops will be found very neat in appearance, can be put on without drilling holes in the panel and can be removed at any time so that the switch point may be cleaned or the tension of the switch lever adjusted.

Contributed by Watson Brown.

INCREASING THE EFFICIENCY OF THE ANTENNA INSULATOR

No matter how efficient an insulator is in dry weather its efficiency will always materially decrease in rain or snow. This is particularly the case of the common ball type insulator. For a number of years I have been using a scheme to protect the insulators on my antenna which has proved extremely efficient. This simply consists of



A protector for the outdoor aerial insulators.

covering the insulator with a tin can as shown in the illustration. This can should be of such size that there is at least ¾ of an inch clearance on either side of the insulator, and it should be placed so that the opening is at the lower end. A hole is bored through one end of the tin can large enough to pass the insulator eye through and this hole should afterwards be entirely closed with solder. The can should also be painted inside and out to prevent rust and corrosion. This type of covering will keep the insulator fairly dry in the most severe weather and those weak signals will still be picked up during heavy rain storms.

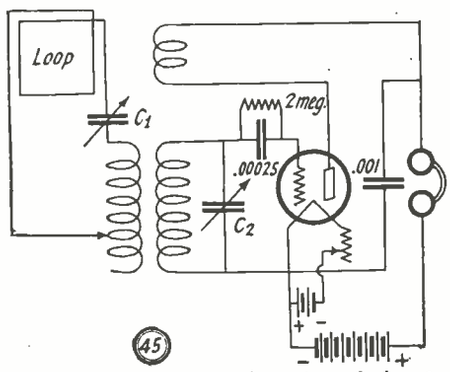
Contributed by Royle B. T. Snow.

STANDARD HOOK-UPS

EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c to pay for mailing charges.

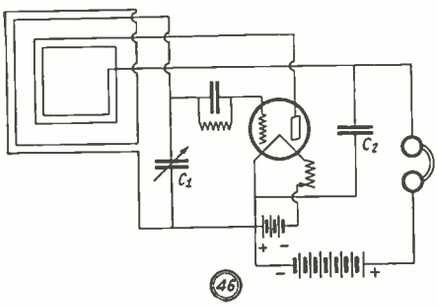
RADIO NEWS has also prepared a handsome heavy cardboard binder into which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

Handy Reference Data for the Experimenter



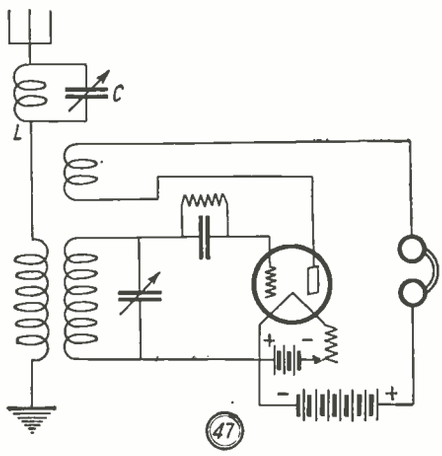
A single tube regenerative set employing a loop aerial.

Where an outside antenna is undesirable and only one tube is to be employed, it is sometimes possible to use a loop when quite near a broadcast station. The circuit for this arrangement is shown in diagram 45. The tuner and tickler may be of any standard form such as a variocoupler, honeycomb or spider-web coils. If a variocoupler is employed, it will be necessary to use 35 turns of the outside winding as the secondary. A separate primary winding may then be wound directly over the secondary and should consist of 25 turns tapped every five turns. The condenser C1 may be of .0005 or .001 mfd. capacity. The condenser C2 which tunes the secondary circuit should be .0005 mfd. capacity. The rotor of the coupler is, of course, used as the tickler.



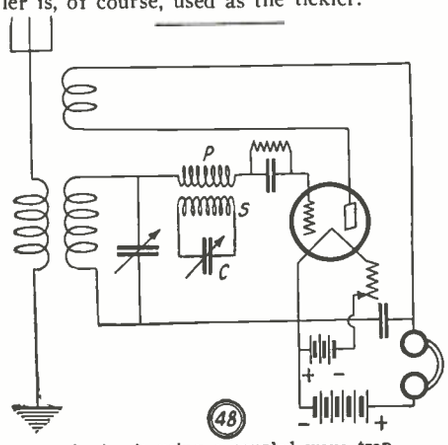
A novel one tube loop receiver.

In diagram 46 is shown another one-tube loop receiver. Two loops are used in this circuit, one as the tuner and the other for regeneration, in the plate circuit. The tuner is the larger loop consisting of 12 turns of wire on a 2-foot frame. As shown in the diagram, the plate loop is placed in the center of the larger loop and is so arranged that it can be rotated similar to an ordinary tickler coil. The number of turns in this loop is not critical, being in the neighborhood of 15. If desired, this loop may be of the same size as the other and arranged so that the distance between it and the other one may be varied. Tuning is accomplished in this circuit by means of the condenser C1, which is of .0005 mfd. capacity. A by-pass condenser will usually be found necessary in this circuit and is shown as C2.



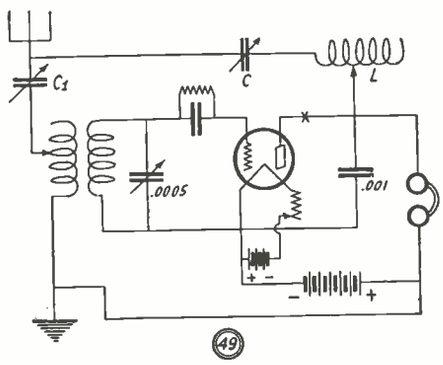
A circuit employing a wave trap.

In circuit 47 is shown a standard regenerative receiver with the addition of a wave trap in the antenna circuit. This wave trap is composed of a fixed inductance L, shunted by a variable condenser C. The fixed inductance may be a honeycomb coil of 50 or 75 turns or, if desired, it may be constructed by winding 45 turns of No. 24 S.C.C. wire on a three inch tube. The variable condenser is of the 23 plate variety and has a capacity of .0005 mfd. When it is desired to eliminate the interfering station the variable condenser should be adjusted until its signal strength is at a minimum or until entirely wiped out.



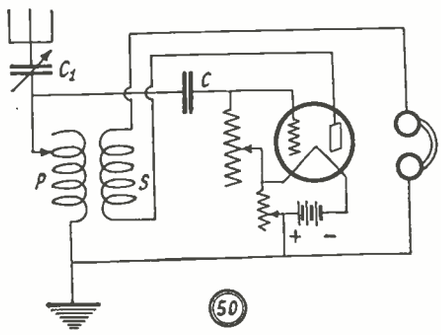
A circuit using a coupled wave trap.

Another type of wave trap which will prove extremely efficient and which can be incorporated directly in the receiver is shown in diagram 48. This wave trap consists of a primary and a secondary coil, the secondary being shunted by a variable condenser. The secondary consists of 45 turns of No. 22 S.C.C. wire wound on a tube three inches in diameter. The primary consists of 10 turns of the same size wound directly over the secondary and separated from it by a single layer of cardboard. The variable condenser C is of .0005 mfd. capacity. The primary of the wave trap is inserted in the grid circuit of the receiver.



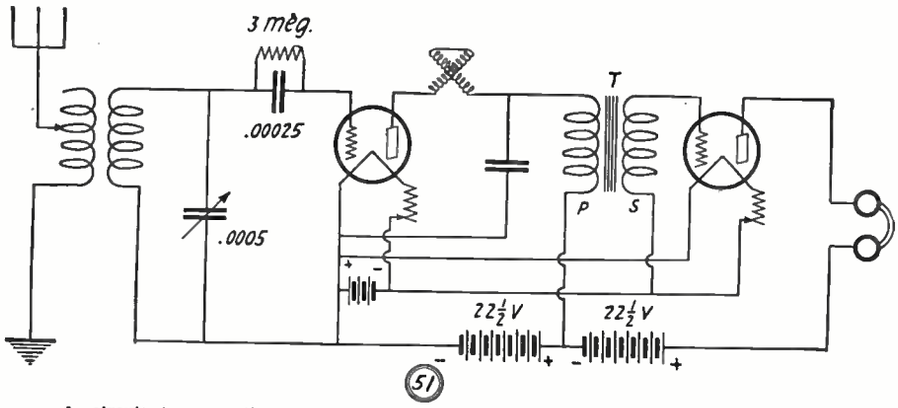
Circuit system for eliminating interference.

In circuit No. 49 is shown another method of eliminating interference. This consists of a variable inductance, L, in series with a variable condenser, C, connected from the antenna to the plate of the tube. In this case it will be necessary to employ a variable condenser, C1, in the antenna circuit. This condenser may be of .0005 or .001 mfd. capacity. The inductance, L, may consist of 50 turns of No. 22 S.C.C. wire wound on a tube three inches in diameter and tapped every 10 turns. The variable condenser may be of .0005 mfd. capacity. If desired, regeneration may be obtained by inserting a variometer of standard size in the plate circuit of the vacuum tube at the point marked X.



A "B" battery-less circuit.

In circuit No. 50 we have a receiver which operates fairly well without a "B" battery. This receiver is of the single circuit type using a variocoupler for tuning. The condenser, C1, may be either .0005 or .001 mfd. capacity. The secondary of the variocoupler is in the plate circuit of the detector tube for regeneration and should contain at least 80 turns of wire. As no "B" battery is used the phones are connected directly to the positive lead of the "A" battery. A variable grid leak of from one to five megohms resistance will be found advisable and should be connected directly from the grid to the positive terminal of the "A" battery. The grid condenser, C, may be of .00025 or .0005 mfd. capacity.

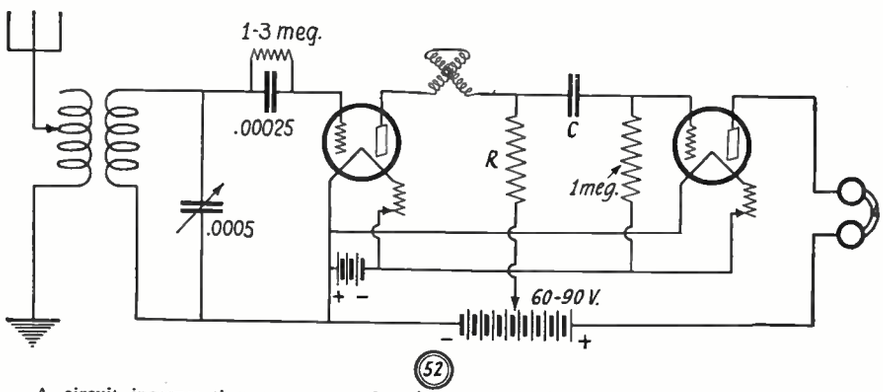


A circuit incorporating one stage of audio frequency amplification, for volume.

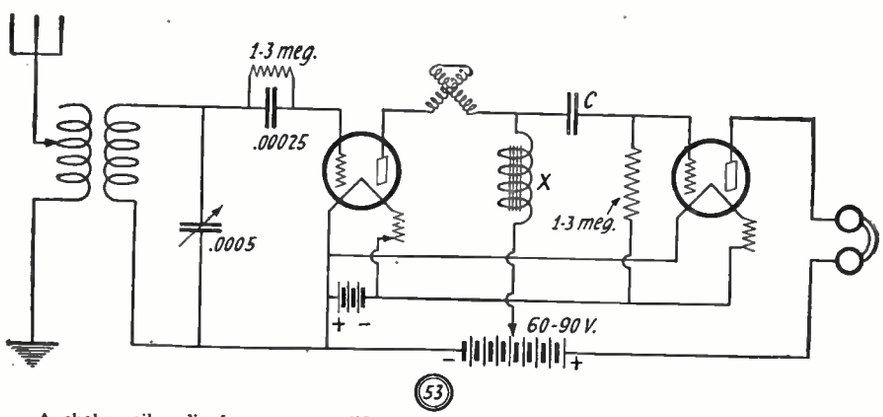
Where greater volume is desired, one stage of audio frequency amplification may be added to practically any detector circuit, and a diagram through which this is accomplished is shown in No. 51. It will be noticed that this one stage of audio frequency amplification is used in conjunction with a standard three circuit regenerative receiver. An audio-frequency transformer must be employed as shown at T. The primary of this transformer is connected in the plate circuit of the detector tube in place of the phones. It is recommended that a transformer with a ratio of not higher than 5 to 1 be employed as otherwise distortion is liable to occur. A hard or amplifying tube such as a UV-201A or a C-301A must be employed as the amplifier. For best results it would also be necessary to use a higher plate voltage on this tube. As a rule 45 volts will be sufficient for one stage of amplification and this is obtained by connecting two 22½-volt "B" batteries in series.

It is almost impossible to obtain an audio-frequency transformer that will not distort to some extent and for this reason a resistance coupled amplifier is sometimes made use of. However, since a resistance coupled amplifier will only give about 2/3 the amplification delivered by a transformer, it is not generally used for one stage. A circuit using resistance coupling is given in diagram 52. It is shown in conjunction with a three circuit regenerative receiver, although any type of receiver may be employed. The resistance shown at R should be of the non-inductive type and of a value of 50,000 ohms. It will usually be found necessary to use a higher "B" battery voltage with resistance coupling than with transformer. A grid condenser will also be required in the grid circuit of the amplifying tube as shown at C so that the "B" battery voltage will not be impressed upon the grid. The capacity of this condenser is not critical and may be from .006 to 1 mfd. As an amplifying tube must be operated with a negative potential upon the grid a grid leak of one megohm is connected from the grid of the tube to the negative of the "A" battery.

In diagram 53 is shown another system of providing distortionless amplification. Instead of a resistance a choke coil is employed and is shown at X. If desired, this choke coil may be constructed by winding 5,460 turns of No. 34 S.S.C. wire in 14 layers on an iron wire core 3½ inches long and ⅜ inch in diameter. In winding it will prove best to separate every two or three layers of wire with a piece of waxed paper. If an old audio frequency transformer which is burned out happens to be lying about, the secondary will function very well as this choke coil. The grid condenser shown in this diagram at C should be of approximately .01 mfd. capacity. The grid leak connected from the grid to the negative filament should be from one to three megohms, best determined by experiment. A hard or amplifying tube must, of course, be used in this circuit and a "B" battery voltage from 60 to 90 is recommended. This type of amplification has been shown with a standard three circuit regenerative receiver, but it may be used with practically any circuit. Although it will not produce the same volume of sound as an amplifier using an audio-frequency transformer, it will, nevertheless, give sufficient volume to operate a loud speaker when fairly close to a broadcast station.

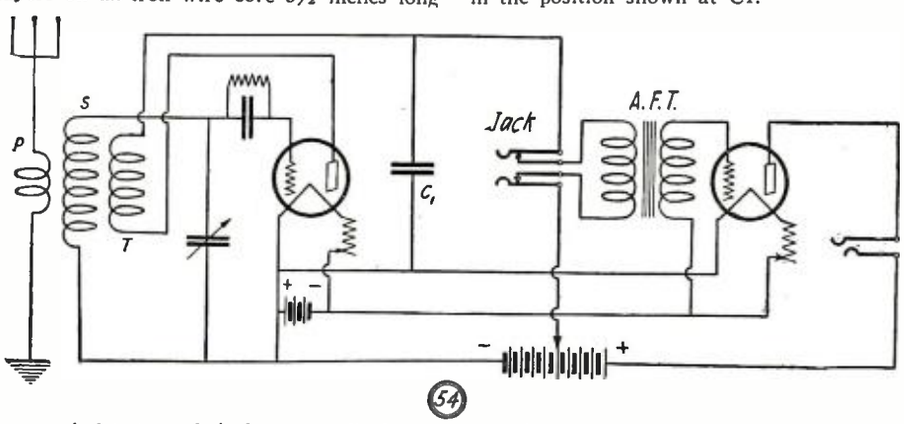


A circuit incorporating one stage of resistance coupled audio frequency amplification.



A choke coil audio frequency amplifier connected to the usual form of receiving circuit.

It is sometimes undesirable to use a stage of audio frequency amplification when the ear phones are employed and some means must be used so that the phones may be plugged in on the detector alone and the amplifier disconnected from the circuit. In diagram 54 is shown how this is accomplished by means of a double circuit jack. This type of jack has two outside and two inside springs which normally make contact with each other. However, when a phone plug is inserted the two outside springs disconnect from the two on the inside, thereby breaking this part of the circuit and allowing the current to flow through the phones instead of the primary of the audio-frequency transformer. A single circuit jack is connected in the plate circuit of the amplifying tube so that the phones may be connected at this point when desired. In this circuit, the audio stage is shown in conjunction with the untuned primary receiver described in diagram 28 in the August issue. It may be necessary to connect a by-pass condenser of .0005 mfd. or .001 mfd. capacity in the position shown at C1.



A detector and single stage audio frequency amplifier circuit employing phone jacks.

Radio Humor

HOW TO ELIMINATE INTERFERENCE

Radio Editor,
International Paper Monthly,
100 East 42d Street,
New York City.

Dear Sir: I have read in this morning's Times *that our local broadcast station is to multiply its power by 10. As I am only a mile away from this station, will you kindly advise me as to the best methods to be used in restraining the impact. Will a shorter acrial help? Thanking you in advance, I am,*

Yours very truly,
H. J. BARRELL.

Mr. H. J. Barrel,
Engineering Department,
International Paper Company,
100 East 42d Street,
New York City.

Dear Sir: Your problem is indeed a difficult one. We have submitted it to the best radio talent in the Company and suggest the following:

1. It will be necessary for you to remove the set to the cellar.

2. The set should be bolted to a very rigid table which in turn should be bolted to the floor.

3. To prevent end movements, guy wires should be strung wherever possible and tightened by means of turnbuckles.

4. A trap-door built of a 2-inch plank should be hung over the cellar window as shown in the accompanying sketch.

5. A barricade of 6-inch I-beams and sand bags should then be constructed for the purpose of absorbing the first impact of the radio waves. An extra strong bedspring bolted to the face of the barricade and covered with heavy planking may help.

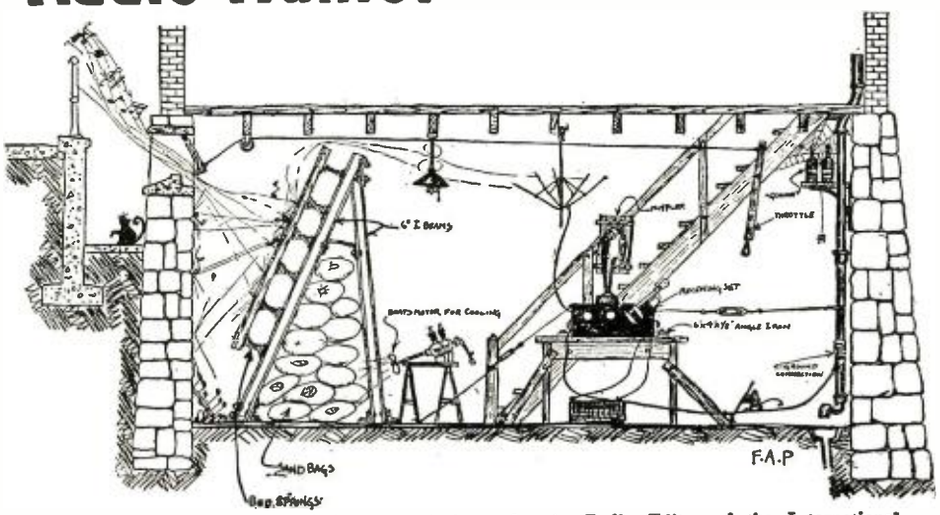
6. The mouth of the loud speaker should be covered with planking.

7. For an aerial we would suggest an umbrella which may be closed to increase selectivity.

8. All bus bar wiring should be removed from the set and a special wire having an extremely high melting point and small diameter substituted. (On second consideration we would suggest that the wiring be left out due to the fire hazard.)

9. To prevent personal danger the operator should wear lineman's gloves and stand on a rubber mat.

(*Continued on page* 518)



The famous Interference Eliminator worked out by the Radio Editor of the International Paper Monthly. Try this on your set.

Radiotics

If you happen to see any humorous misprints in the press, we shall 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. Never mutilate clippings by underlining the misprint. We shall pay $2.00 for each RADIOTIC accepted and printed here. A few humorous lines from each correspondent should accompany each RADIOTIC. The most humorous ones will be printed. Address all RADIOTICS to

Editor RADIOTIC DEPARTMENT,
c/o Radio News

FOR THE BOUDOIR, MY DEAR

From the July 13, 1924, edition of the *New York American* we learn that *Poster & Company*, panel specialists, "have already prepared a Neutroflex panel of bakelite all FRILLED, neatly engraved and highly polished." We take it that the trade has come to the point where it is both necessary and highly profitable to cater to the fair sex. No doubt there will be embroidered variometers on the market in the near future.

Contributed by John Chareland.

A CATALOG WHAT AM!

By all means read the classified advertisement of the *Radio Specialty Co.* in the August issue of RADIO NEWS. They say, "Diagrams will be found in the great 'Rasco' catalog, WHICH CONTAINS RAW MATERIALS AND PARTS IN A GREATER PROFUSION THAN ANY OTHER CATALOG. 15c in stamps or coin will bring the catalog to you." I have sent for several of the catalogs mentioned and I hope to receive enough material so that I may make a set without additional cost.

Contributed by Frederick Attwood.

YOU CAN'T GO WRONG WITH THIS SET

The classified ad. section of the *Telegram and Evening Mail* (New York) for Saturday, July 12, 1924, carried the following: "5-TUBE ATWATER KENT, COMPLETE, WITH MUSIC MASTER." From experience we know that most radio sets require lessons in "reproduction." What could be sweeter than a music master? Training radio sets ought to be a good business.

Contributed by B. F. Corbet.

BUT LAST NIGHT, ON THE LOOP, DEAR, I PLAYED IT BEST OF ALL

Now we *know* radio sets are human. The *Marvel Radio Specialty Company* advertises, in the August issue of RADIO NEWS, a number of "vacation specials" among which is the following: "$125 5-TUBE NEUTRODYNE, CAN PLAY ON LOOP IF DESIRED . . . $55" Possibly it is a young one that likes to frolic, or has it the intentions of a harpist? At any rate, if you don't desire it, the Neutrodyne will no doubt play elsewhere.

Contributed by E. Rypinski.

IF YOU PLEASE, MIXED WITH WHAT?

A poor radio fan is bothered by a very loud howl in his set. Whereupon our esteemed authority, the *Boston Post*, advises him under date of July 3, 1924, to use a "1-3 meg. MIXED GRID LEAK." It would be interesting to know just what ingredients the writer had in mind. Perhaps it was his view that a combination of cyanide, Paris Green and corrosive sublimate would be calculated to cause said howl to lie down and die. But who can guarantee that such a material and worldly fate would successfully annihilate an undesirable noise in a radio set?

Contributed by Alexis M. Russell.

SLOE GIN OR THE TOWER OF BABLE?

At last a real Radiotic! But for the love of Mike, what's it all about? It appeared in the June 26, 1924 edition of the *Philadelphia Inquirer* in the following form, under a heading "Answers in Brief."

"LOUIS MANN—If you take the photograph on the plate of a WD-12 tube. The 22½ volt issue of the *Inquirer* to an up-to-date radio store, someone there should be able to tell you the name of the manufacturer." Someone must be coocoo. That 22½ volt issue of the *Inquirer* must have had some kick to it. But as for taking a photo on the plate of a WD-12 tube . . . !

Contributed by C. W. Driver.

KEEP AWAY FROM CHICAGO!

This hot one was taken from the Radio Section of the *Chicago Daily News*, issue of May 10, 1924, and is certainly enlightening. "There are 7,000,000 radiating regenerative sets in the country, *8,000,000* of which ARE BEING IMPROPERLY TUNED EVERY NIGHT

(*Continued on page* 522)

Correspondence from Readers

CONCERNING RADIO DEALERS

Editor, RADIO NEWS:

I have been noticing the complaints of customers against dealers regarding the poor service given them, that have been published in your columns. Since I am slightly acquainted with both sides of the story I have decided to radiate a few tube squeals.

It must be remembered that radio is a new science and even our best experts often get marooned. About the only way a dealer in radio gets his knowledge is through his customers. If he would listen to the high pressure salesmen now on the road his shelves would be stocked with almost worthless junk. One of the best guides for the dealer and customer is the monthly copy of RADIO NEWS, which carries the regular list of Laboratory Tested Apparatus, Questions & Answers, latest discoveries by well known experts as well as the most popular and efficient apparatus as offered by manufacturers or distributors. A better co-operation is needed between the manufacturer, wholesaler and dealer, as I only know of one wholesaler at this time who sells with the guarantee of "Satisfaction or money refunded" and I am glad to say he carries space in RADIO NEWS. If the dealer can only get the guarantee against poor workmanship and materials from the wholesaler how can he guarantee "satisfaction or money refunded" to his customers with the new apparatus coming on the market daily?

Perhaps, after reading the above you will think all apparatus "ought to go right off" after being hooked up. One of the manufacturer's worst enemies is improper connections. for if the set doesn't work the parts are usually blamed.

Fully 95 per cent. of failures are caused by this enemy. If the set is an assembled one perhaps the instruments are unmatched or acid core solder was used in soldering connections. For the set to operate satisfactorily all the parts must be matched the same as the parts of an automobile or any other machine. If you are a beginner and have no one to assist you in choosing the right apparatus, by all means buy the parts from a reliable company which has a service department to help when you get "stuck" and better yet buy all the parts you can, which are made by one company and you will be sure of getting matched parts.

ALVIE HARDING,
Eldon, Iowa.

REDUCING RADIATION INTERFERENCE

Editor, RADIO NEWS:

Your prize offer in connection with radiation elimination interests me and I believe it will do a certain amount of good, but if the correct device is found it will require laws to force its use, for I find there are only too many who do not care a hoot for spoiling the other fellow's concert.

I have experimented in radio for a long time and have several different sets of my own invention, but the better and more sensitive I make a set the more it will pick up the howls from the regenerative sets. How I overcame this may interest your readers.

I live on the top floor of a three-story building in a congested part of a city in what may be called a regular dead spot for radio, but after considerable experimenting I managed to put up an aerial that would bring in the concerts by using four wires 100 feet long, about 40 feet above the roof. But, as I say, it also brought in the howls so very badly that I was forced to wait until the wee small hours in order to get a decent concert—just a case of sticking it out longer than the howler.

I had a good ground on a water pipe, but so had the howler; therefore, all the sets were connected through the pipe. No wonder I got the howl. I tried out a counterpoise built fan shape 10 feet above the roof and 30 feet under my aerial and the results were surprising, for, while I still get the whistle slightly, it is so diminuitive as not to bother. I have been able to pick up many low-powered stations I could not get before and the volume is far better.

The counterpoise consists of 10 wires about 60 feet long.

I suppose if everyone built a counterpoise we would get back to the same old conditions and there would be a law enacted in both the U. S. and Canada forbidding the use of them with radiating receivers.

I should like to hear how others find a counterpoise in this connection; it certainly has improved my reception 100 per cent.

F. L. BELANGER.
General Agent. B. & M. R. R.,
Sherbrooke, Que., Canada.

FROM A NAVY OPERATOR

Editor, RADIO NEWS:

Owing to my present location, I receive your publication about six weeks later than the majority of your readers. Still, after reading the published letter by Mr. E. A. Starkey of Saugus, Mass., in your March, 1924, issue, I am moved to remonstrate.

In the article, Mr. Starkey made several remarks concerning the general uselessness of what he terms "code stations." I presume that he means high power transcontinental and transoceanic stations, by his remark.

That is like "looking a gift horse in the mouth," and I'm led to believe that he should feel highly elated at hearing anything aside from the "tinkle tinkle of a high pitched set, to the grinding crash of the deeper toned code stations."

What reason can Mr. Starkey give for the U. S. Government's actions in allotting the amateur a wave-length of 200 meters or less, and the broadcast stations their shorter waves? Simply to eliminate their interfering with stations handling the world's traffic.

If Uncle Sam had considered the entertainment of the amateurs as of greater importance than the handling of commercial traffic, he would have restricted the latter stations, instead of the former.

It must be remembered that this nation of ours has thousands of ships, both commercial and men-o'-war, with which communication is limited to nothing *but* radio, by both commercial and Government stations.

Of course, it would be very pleasant for the millions of fans, if these coastal stations, as well as ship installations, were to "pipe down" during concerts, but taking into consideration that these same concerts are on the air from 16 to 20 hours per day, which would leave but 4 to 8 hours for the "code stations" to get off their traffic to every nation on earth.

Mention was also made of getting Hongkong, Liverpool, and Etah Harbor. I wonder if perhaps *these* stations don't receive complaints concerning "tinkle tinkles," and "grinding crashes"? I know that one at Hongkong does, and suppose the others are bothered the same way.

Perhaps Mr. Starkey has interviewed the Traffic Managers of a few of these stations, and in turn received the merry Hi Hi, which may account for his gentle razz in your columns.

I get as much kick from tuning in a DX station, and enjoying a little music as the next fellow, but I can at least appreciate a gift, which is all it amounts to. Radio in the States, as well as elsewhere, is primarily for the purpose of communication, and secondarily for pleasure, as reference to our Government's action during the world war will prove.

Don't take me for an old salt who is prejudiced against present day radio, because I owned my own little spark coil before I became one of Uncle Sam's ops, but I sure hate to see the big stations razzed.

L. D. Coss, U. S. N.,
U. S. S. *Elcano,*
Shanghai, China.

RADIO COMPANIES, PLEASE NOTE

Editor, RADIO NEWS:

It would be most highly appreciated if you would consider this letter for publication in RADIO NEWS. Some time ago I read a letter written by a chief radioman of the U. S. Navy, under the title of "The Wanderer." The author of this letter was seeking employment pending his discharge from the navy and his letter was subsequently published in RADIO NEWS. There was also published a number of replies to his letter, offers of employment from various radio companies, etc. It is with this in view that I am submitting the following.

I will be discharged from the United States Navy December 16, 1924, having completed eight years of honorable service as radioman 3rd, 2nd, 1st and acting chief radioman. My experience in this work has covered quite a broad field; I do not believe there is any branch of radio work that I have not had experience in, also general electrical work. This includes the following: Radio telegraph, all makes, all types and descriptions, both commercial and Navy radio apparatus, from the 200 k.w. high-powered arc down to the smallest of transmitters, usually the 5-watt C.W.; including high-frequency alternators 2 and 30 k.w. arcs, 100-watt tube sets, spark transmitters of all types and descriptions, both commercial and Navy. My experience in high-power work consisted of employment

(*Continued on page* 522)

By JOHN B. BRADY*

VIBRATION TEST FOR TUBES

(Patent No. 1,487,298, J. H. Vennes. Filed Sept. 5, 1919, issued March 18, 1924. Assigned to Western Electric Company.)

METHOD OF, AND APPARATUS FOR, VIBRATION of electron tubes while connected in a circuit for observing any imperfections in the tube arising out of non-rigid mounting of the electrodes.

TRANSMITTER FOR RADIO CONTROL SIGNALS

(Patent No. 1,488,114, J. H. Hammond, Jr. Filed Aug. 24, 1912, issued March 25, 1924.)

RADIO TELEGRAPHY AND TELEPHONY in which the amplitude, or frequency, or both, of the transmitting energy may be periodically varied. A rotary condenser may be interposed in the antenna circuit and driven at a rate where the periodicity of the circuit is varied at a rate above the limits of audibility. The variation is secured in such manner that the time intensity curves shall be peaked and not flattened, whereby a true sinusoidal wave form may be produced at the receiver.

NEW VALVE

(Patent No. 1,488,337, H. Gernsback. Filed May 14, 1921, issued March 25, 1924.)

ELECTRIC VALVE containing a filament heated to red or white incandescence in contact with the wall of a highly exhausted glass bulb. A remarkably high current is produced between the filament and an outside external electrode. The electronic flow is made to pass between the filament and the outside element, although these two elements are not in metallic contact. Under the heat of the filament the wall of the glass vessel becomes a conductor which allows the electronic charges to pass. The tube is shown as applied to receiving circuits functioning as a rectifier.

MODULATOR

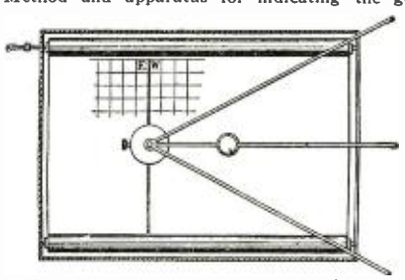
(Patent No. 1,488,489, J. C. Gabriel. Filed Dec. 23, 1920, issued April 1, 1924. Assigned to Western Electric Company.)

WAVE MODULATING at a radio transmission station. The invention consists in the provision of means for connecting a signaling wave device to a modulating device in two ways, each of which produce modulation and which together co-operate to modulate more effectively. The signal controlling device operates directly thereon through the agency of an intermediate variable impedance device or system of variable impedance devices such as several discharge tubes arranged to rectify several phases of alternating current and impress the combined rectified current on the modulating device. As a result of the unidirectional conductivity of the variable impedance tubes the current is variably rectified in accordance with the signals, and the resulting waves into which the rectified current is translated are correspondingly modulated in amplitude. Due to the direct action of the signal controlling device arranged in parallel with respect to the modulator, a further modulation or variation in amplitude of the waves results.

METHOD AND APPARATUS FOR INDICATING THE GEOGRAPHICAL LOCATION OR MOVEMENT OF BODIES

(Patent No. 1,494,770. Walter W. Conners. Filed June 12, 1919. Issued May 20, 1924.)

Method and apparatus for indicating the geo-



graphical location or movement of bodies by indicating in similitude or intelligible signals the location of a moving body. The moving body carries a radio receiving station for the reception of signals from fixed wave transmitting stations. The receiving station on the moving body is equipped with an indicating member which is controlled by received signals for indicating in similitude the signals received from the fixed stations. In this manner the course of the moving body is automatically plotted in accordance with the moving of the body with relation to the fixed stations.

Patent Lawyer, Ouray Building, Washington, D. C.

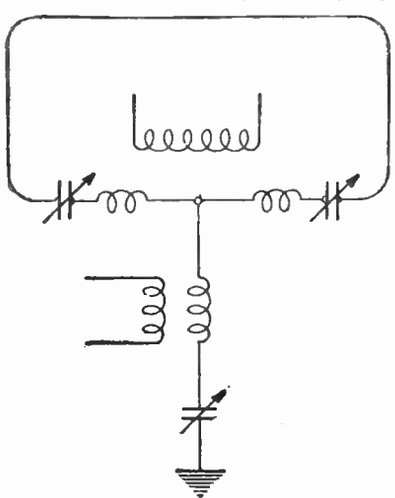
COMMUNICATION SYSTEM

(Patent No. 1,490,958, R. Brown. Filed Nov. 23, 1921, issued April 22, 1924. Assigned to American Telephone and Telegraph Co.)

FREQUENCY CONTROL SYSTEM in which a plurality of radio stations are divided into groups of intercommunicating stations, each group having assigned to it a definite frequency range which shall not interfere with the frequency range assigned to any other group. The frequency used in the various groups for signaling is controlled by generating at a master station a fundamental frequency, transmitting said frequency to the stations of the various groups, generating at said station energy to be used for signaling, and controlling by the fundamental frequency of the locally generated energy without controlling by the fundamental frequency of the locally generated energy without controlling the amplitude of the energy.

ART OF RADIO COMMUNICATION

(Patent No. 1,946,155. F. J. Fransson. Filed Nov. 8, 1919. Issued June 3, 1924. Assigned American Gasaccumulator Co., Elizabeth, N. J.)



Art of radio communication in which a combination loop antenna and open antenna is employed for duplex operation. A transmitter is coupled to one of the antennae while the receiver is coupled to the other antenna with condensers arranged for balancing out interference between the transmitter and receiver during duplex operation.

ELECTRICAL TUNING APPARATUS

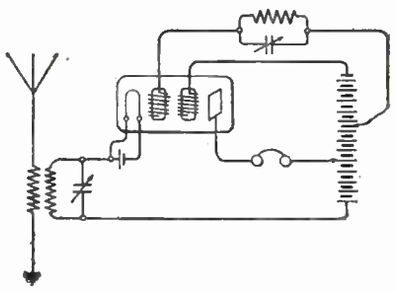
(Patent No. 1,494,803, Michael J. Pupin. Filed Sept. 17, 1915, issued May 20, 1924. Assigned to Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.)

Electrical tuning apparatus by which the elcctrical resistance reaction which a conductor opposes to a simple harmonic electromotive force is rendered selective, that is to say, the conductor opposes a resistance reaction as small as desirable to an electromotive force of a given frequency, while at the same time this reaction may be made as large as desirable to an electromotive force of a different frequency or to electrical impulses. The invention is called a resistance compensator. It is shown as applied to a radio receiver for increasing the selectivity of the receiver by utilizing an antenna system of a resistance sufficient to dissipate the greater part of the incoming signaling energy. The incoming signaling energy of desired frequency is utilized to excite a source of energy by electromagnetic reaction and to transfer to the receiving antenna system a negative resistance reaction of high value as compared with the original resistance reaction of the conductor and of a frequency corresponding to the selected radio frequency to be received.

C. W. RECEIVER

(Patent No. 1,491,405, A. W. Hull. Filed March 1, 1921, issued April 22, 1924. Assigned to General Electric Company.)

SIGNAL-RECEIVING SYSTEM for the reception of continuous wave signals. A tube circuit



is shown in which the potential of the grid electrode is varied periodically between suitable positive and negative values at a frequency somewhat different from that of the signaling currents to be detected so that the resistance of the signaling circuit will be varied between maximum and minimum values at an audible frequency. By tuning the circuit between cathode and the controlling grid, oscillations will be produced in that circuit and the potential of the grid will automatically be caused to vary periodically at the frequency of the oscillations produced.

HIGH POWER TUBE

(Patent No. 1,488,613, G. W. Pickard. Filed Feb. 28, 1919, issued April 1, 1924. Assigned to Wireless Specialty Apparatus Company.)

VACUOUS ELECTRICAL APPARATUS of the electron tube class wherein desired vacuous condition is preserved without dependance upon a continuously operating vacuum pump. The invention has particular reference to high power transmitting tubes where steel containers are employed in lieu of glass and vacuum maintained despite inherent joints and seals. The metallic container which houses the tube electrodes in a vacuum is itself within an outer vacuous container.

STATIC REDUCER

(Patent No. 1,488,791, C. Kinsely. Filed March 29, 1920, issued April 1, 1924.)

SPACE TELEGRAPH RECEIVING SYSTEM for avoiding the effects of static disturbances. A pair of loop receivers which may be differently effected by static disturbances is employed connected to Hall relays. The energies thus separately received in a plurality of wave receiving elements are separately utilized to control the operation of a signal indicator circuit so that the indicator in said circuit is actuated only at times when all of said wave receiving elements are energized. The effects of the strays in several receiving elements are seldom synchronous enough to produce any effect on the indicator.

WATER COOLED TUBE

(Patent No. 1,491,387, P. R. Fortin. Filed Feb. 12, 1921, issued April 22, 1924. Assigned to General Electric Company.)

ELECTRON-DISCHARGE APPARATUS of high power wherein a cooling fluid is circulated around the exterior of the plate electrode of the tube maintaining the electrode at a proper working temperature. The plate electrode is a cylindrical cup-shaped member making a tight joint with the glass envelope of the electron tube.

ELECTRICAL CONDENSER

(Patent No. 1,497,095. W. Dubilier, filed May 23, 1922. Issued June 10, 1924. Assigned to Dubilier Condenser and Radio Corp. of Delaware.)

Electrical Condenser of the micadon variety where the alternate conductive and dielectric sheets are secured together under compression by means

(*Continued on page* 542)

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

THERMON VARIO-TRANS-COUPLER

A very efficient double circuit receiver can be made by using the tuning unit shown in the illustration. The unit comprises primary, secondary and tickler coils. The tickler coil is mounted on the shaft at an angle so as to give 180 degree control. The tickler coil is wound on a wooden form. When used

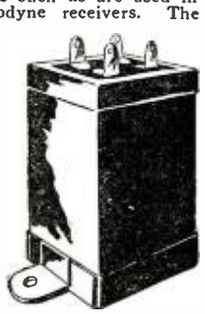
with a .0005 mfd. variable condenser, a wave-length range of 270 to 625 meters is covered. By using a smaller condenser the range is more suitable for broadcast reception. Manufactured by Radio Requirements Co., 70 N. Second St., Philadelphia, Pa.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 511.

JEFFERSON LONG WAVE TRANSFORMER

The Jefferson Type 150 long wave R.F. transformer is of the iron core type designed for amplifying radio frequency currents of long wave-lengths such as are used in Super-Heterodyne receivers. The trans-



former is broadly tuned with a peak in a neighborhood of 12,500 meters. It is enclosed in a metal case and is of very compact construction. Manufactured by the Jefferson Electric Manufacturing Co., Chicago, Ill.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 514.

PYREX ANTENNA INSULATOR

Efficiency in receiving apparatus depends more upon good insulation of the parts than upon any other factor. The antenna insulator shown in the illustration not only gives good insulation during dry weather, but on account of the smooth surface does not collect or absorb moisture and cause leakage of current during wet weather. The

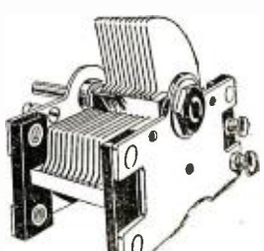
insulator is entirely of pyrex glass and has a high tensile strength. Manufactured by the Corning Glass Works, Corning, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 513.

TRIANGLE 23-PLATE CONDENSER

The Triangle 23-plate variable condenser is of the grounded rotor type. It is insulated with a good grade of hard rubber and has dielectric absorption losses at 1,000 cycles equivalent to a series resistance of 110 ohms. Tests were made



with the condenser set at maximum capacity which was 511.61 mmf. The minimum capacity is 18.60 mmf. The condenser is of very rugged mechanical construction. Manufactured by the Triangle Atlantic Corp., 349 Adams Street, Brooklyn, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 525.

"SYCO" KELCOIL

The "Syco" Kelcoil manufactured by Silverman, Young & Co., 438 Drexel Building, Philadelphia, Pa., is a very compact double circuit tuner. It comprises primary, secondary and tickler coils. With a

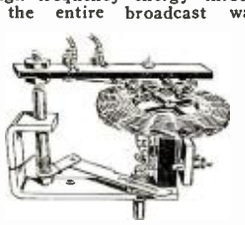
.0005 mfd. variable condenser shunted across the secondary winding, a wave-length range of 255 to 550 meters is covered when using an average size antenna connected to the primary winding.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 516.

PFANSTIEHL OSCILLATOR

In a Super-Heterodyne receiver it is desirable to have an oscillator unit that delivers a uniform amount of high frequency energy throughout the entire broadcast wave-



length range. The oscillator unit shown in the illustration was found very satisfactory for this purpose. It is of the spider web type and covers a range of 200 to 600 meters when used with a .0005 mfd. variable condenser. A small pickup coil attached to the control device may be moved towards or away from the oscillator coil by turning the dial. Manufactured by Pfanstiehl Radio Service Co., Highland Park, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 519.

NOLTE TRAP

As an accessory to any type of radio receiver, the wave trap shown in the illustration will be found very useful for eliminating interference.

This trap is of very neat appearance and covers a wave-length range of 175 to 540 meters. It consists of two windings, one of which is tuned by a variable condenser. Four binding posts are mounted on the panel so that various connections can be used. All insulating material is of hard rubber. Manufactured by Nolte Mfg. Co., 61 Gautier Avenue, Jersey City, N. J.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 520.

RIBBON ANTENNA

The ribbon antenna manufactured by the Colonial Brass Co., Middle-

boro, Mass., is made of a special alloy giving it high tensile strength. The ribbon is ⅜ of an inch wide and is fitted with snap hooks at each end so as to facilitate erecting it. The finish is such that it does not corrode.

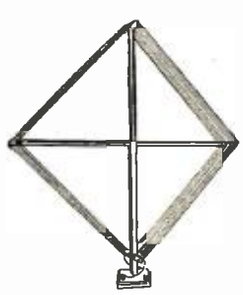
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 522.

MATHIESEN LOOP AERIAL

The Mathiesen loop aerial is of very good construction and attractive in appearance. It is of the folding type, the upper arm telescoping into the lower square brass tube. It may be turned on its base to obtain directional effects, and connections are made to the loop with two flexible wires; 13 turns of stranded wire clamped with bakelite strips are used. With a .0005 mfd. condenser, the wave-length range of 240 to 630 meters is covered. Manufactured by the Mathiesen-Sandberg Co., 5249 E. Ravenswood Ave., Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 515.



POLLARD LOOP AERIAL

This loop aerial is of the folding type and consists of 11 turns of stranded wire clamped with bakelite strips on the loop frame. The frame measures three feet across corners. When used with a .0005 mfd. condenser, the wave-length range of 190 to 525 meters is covered. Manufactured by Pollard Bros., 4034 N. Tripp Ave., Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 518.

CONNECTICUT WAVE METER AND FILTER

The Connecticut type D-5 wave meter and filter is of very elaborate construction and of pleasing appearance. It consists of two windings, one of which is tuned by a variable condenser. By means of a tap, two wave-length ranges are obtained. One range is from 280 to

630 meters and the other from 370 to 850 meters. Binding posts are provided for both coils so that various combinations can be tried. The instrument makes a very efficient wave trap that may be used with any receiving set for eliminating interference. Manufactured by the Connecticut Tel. & Elec. Co., Meriden, Conn.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 521.

AMERICAN BRAND CONDENSER

The American Brand 23-plate variable condenser is manufactured by the American Brand Corporation, Inc., Philadelphia, Pa. This condenser is of the grounded rotor type and has a worm drive vernier attachment with a reduction ratio of 100 to 1. This gives exceptionally

fine tuning control. The dielectric absorption losses at 1,000 cycles are equivalent to a series resistance of 110 ohms with the condenser set at maximum capacity. The maximum capacity is 461.59 mmf. and the minimum 19.80 mmf.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 526.

RADIOLAMP

The usual type of loud speaker is, no doubt, the most unsightly part of the radio equipment. The loud speaker shown in the illustration is not only of artistic design but serves a double purpose. It com-

bines both a table lamp and loud speaker. The phone unit is placed in the base of the lamp and the sound passes up through the stem, where it is reflected by the semi-transparent lamp-shade. Very good volume and quality were obtained from this loud speaker. It is fitted with two sockets for lamps. Manufactured by the Radiolamp Co., 334 Fifth Avenue, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 527.

ULTRA VARIO-CONDENSER

The Ultra vario-condenser is of the triple range type comprising two separate condensers of accurate mechanical construction. The two condensers may be connected in parallel, series or one may be used alone, thus giving three ranges. The maximum capacity with the two units in parallel is 521.37 mmf., the minimum capacity with the two units in series of 6 mmf. This condenser is of the grounded rotor type and is furnished with hard rubber insulation. The equivalent series resistance at 1,000 cycles was so low that it could not be accurately measured on our capacity bridge. Both plain and vernier types were submitted by the Bruno Radio

Corp., 300 Water Street, New York City. The vernier type is shown in the illustration

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 528.

VELDAR VARIABLE CONDENSER

The Veldar variable condensers employ die cast plates, which construction, being very accurate, allows very close spacing of the plates. Consequently for the same capacity rating, this type of condenser may be made much smaller than the ordinary type. Both plain and vernier type condensers were submitted by the Radio Development and Mfg. Co., 45 Lispenard Street, New York City. The illustration shows the vernier type condenser. A gear drive is used having a reduction ratio of eight to one. The maximum capacity of the

plain condenser is 539.67 mmf., and the minimum 7.80 mmf. The dielectric absorption losses at 1,000 cycles are equivalent to a series resistance of 400 ohms. The vernier type condenser had slightly higher losses on account of the extra insulating material used in the vernier attachment.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 524.

STROMBERG-CARLSON TRANSFORMER

The Stromberg-Carlson Type 3-A audio frequency amplifying transformer has an exceptionally flat characteristic curve extending far

into the lower audio frequencies. This transformer is of compact construction and is enclosed in a metal case. It causes practically no distortion when used in standard vacuum tube amplifier circuits. Manufactured by Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 517.

MARLE TYPE A-11 TRANSFORMER

The Marle Engineering Co., Orange, N. J., has submitted one of its improved amplifying trans-

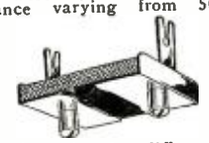
formers having a three to one ratio. This transformer has a very flat characteristic curve which covers the lower audio frequencies. This makes it highly desirable for use in broadcast reception as distortion will be reduced to a minimum.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 512.

AEROVOX CONDENSER

The Aerovox fixed condensers are made in various capacities and are furnished with or without mountings for grid leaks. The .00025 mfd. condenser with the grid leak mountings is shown in the illustration. This condenser and a .001 mfd. type, were submitted and found to be very accurate as regards capacity ratings. The dielectric absorption losses at 1,000 cycles were equivalent to a series resistance varying from 500 to



3,000 ohms in the different condensers. Manufactured by the Aerovox Wireless Corp., 489 Broome Street, New York City.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 530.

LIBERTY INTERMEDIATE WAVE TRANSFORMER

The type R-41 input transformer and the type R-42 intermediate transformers furnished with the Liberty Super-Heterodyne kit are of the air core type and operate with maximum efficiency at a wave-length of 5,200 meters. These transformers give very good results when used in a Super-Heterodyne receiver if constructed according to directions furnished with the kit. They are compact in size and make a neat looking receiver.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 533.

LIBERTY OSCILLATOR PICK-UP COIL

The Liberty Super-Heterodyne kit comprises one oscillator pick-up coil one input transformer, three intermediate wave transformers, one by-pass condenser and constructional blueprints. The illustration shows the type R-41 oscillator pick-up coil. The windings are on the inner tube and protected by the outer one. With a .0005 mfd. variable condenser, this coil oscillates satisfactorily from 170 to 550 meters. This coil is manufactured by the Liberty Electric Corp., Port Chester, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 532.

AMBASSADOR COIL

The well-known Ambassador coil is here shown with a Litz wound secondary instead of the usual winding. This improvement increases the selectivity of the tuning unit and also its efficiency. Connected to a .0005 mfd. variable condenser, it covers a wave-length range of 180 to 550 meters. This coil was submitted by the Ambassador Sales Co., 74 Cortlandt Street, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 531.

PRECISE INTERSTAGE R. F. TRANSFORMERS.

The Precise No. 901 long wave transformers for use in Super-Heterodyne receivers are of very compact construction and shielded. They give high voltage amplification at a wave-length of 8,500 meters. The peak is somewhat broad and the instruments give excellent service when used with the proper input or filter coupler. They are of the iron core type. Manufactured by the Precise Manufacturing Co., 254 Mill Street, Rochester, N. Y.

Arrived in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 529.

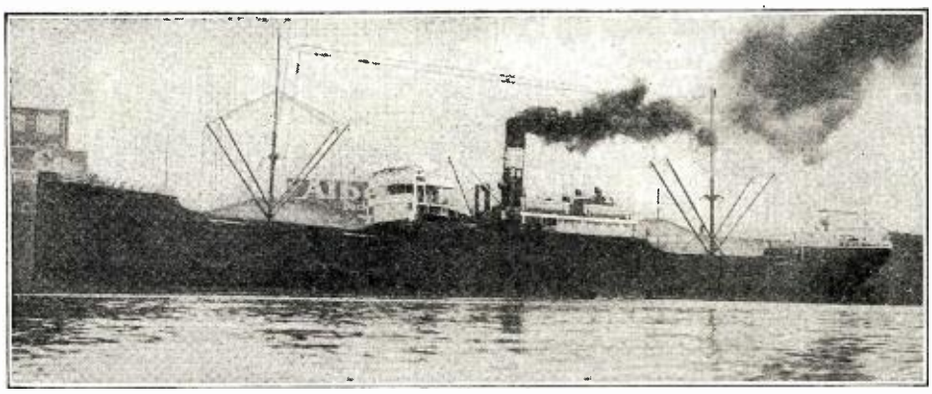
THERMOTRON TUBE

The Thermotron type 201-A vacuum tube is of the standard construction and works very efficiently when used as detector, amplifier or oscillator. The sample tubes submitted by the Emko Radio Mfg. Co., 97 Springfield Ave., Newark, N. J., were found entirely up to standard as regards characteristic curves and operation. The filament is rated ¼ ampere at five volts and may be used with a six volt storage battery and rheostat.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 523.

The Log of a Lightning Jerker

By J. E. Brockway



The S. S. *West Wind*, one of the U. S. S. B. vessels upon which Mr. Brockway shipped is here shown in its home port, Portland, Oregon, after a rather eventful voyage. In the latter part of 1919 she caught fire in the harbor of Yokahoma, lost a propeller blade in the run through the Inland sea and last, but not least, left Shanghai for Honolulu with an empty bottom, struck a storm, ran out of food half way across, secured some beef and potatoes from a ship bound west, thanks to the radio, and limped into Honolulu on the last few drops of oil exactly one month after leaving Shanghai.

SEPTEMBER 18, 1919.—Started out from our well-known Oregon Tech. Radio School, full of confidence in my ability to acquire that coveted sheepskin known as a "commercial radio operator's license, first class." I was successful—the only one out of five who took the examination that fateful day in Seattle.

I returned to Portland and placed my application with Charley Austin, then handling operators for the Shipping Board at that port. He placed me aboard the *S.S. Latoka,* which was loading ties for the United Kingdom. About the same time Ray Foley, now chief on the *President Lincoln,* and "Ben" Enderlin, third-trick operator at "KEK," were also signed for the same destination aboard sister ships to mine. "Ben," I understand, is since code instructor at the same school where he got his start—Oregon Tech.

Those days we had to worry along with only a crystal, but managed to keep "QSO" with each other practically all the way around to the other coast. At Philadelphia my ship got side-tracked and I was paid off with the rest of the crew and furnished transportation back by rail to Portland.

My next venture on the briny deep was undertaken aboard the wooden steamer *Mendora,* which finally landed me in England after all. On this trip we stopped in the Panama Canal for two days, thence proceeding to Horta, Fayal, Azore Islands. It was on this leg of the voyage that we ran afoul the notorious 1920 Gulf hurricane and were blown far off our course. I thought then that if ever I got firm ground under my feet again, nothing short of an earthquake would drive me back to sea.

At last, after 28 days of battling with wind and wave, we made the Azores and laid there for three weeks waiting for coal; our bunkers had been depleted during our struggle with the elements. During our sojourn there I took about 200 pictures of various places of interest. Arriving at the mouth of the Mersey River at last, we were directed to proceed to Birkenhead across the river from Liverpool to discharge. While in this port I journeyed via subway to Liverpool almost daily and visited the British Museum, "Knotty Ash," the Art Gallery and many other places of interest—always armed with the trusty old Kodak.

Upon completing discharge we were ordered to Cardiff to load coal for Malta, but lost the charter. We waited at Cardiff for three weeks before we landed another, and this time managed to get our cargo aboard before expiration of charter.

We cleared for Malta, but had no more than left "Land's End" behind than "GLD" called me with a message diverting us to Gibralter. We experienced a nasty stormy passage through the Straits of Gibralter and pulled into the harbor at night with a drenching rain obscuring the shore lights.

Next morning old Gibralter loomed up even more massive and stern than the insurance ad. pictures show it. There are two towns on the "rock," Irishtown and Waterport, the latter skirting the harbor on the shore side. It is connected with the Spanish town of La Linea by a narrow neck of land called neutral territory. We lay in port long enough to give me plenty of opportunity to explore the surrounding country. I investigated the natural cave that runs under the Mediterranean Sea to the African shore, saw the Governor's Palace, Victoria Gardens, and climbed to what is known as Mid-point, a place on the road half way up the rock which is as far as one is permitted to ascend without a special permit from the commandant. The fort, you know, is a British stronghold.

Next I ventured over to the Spanish town of La Linea and witnessed an exhibition of the national sport, bull-fighting—sometimes a thrilling, but at best a disgusting sight. It did not appeal to my sense of fair play in the least.

Accompanied by the third mate, I boarded a small passenger boat to Tangiers, Morrocco, where I snapped many interesting pictures during the three days of my stay in that most colorful international port. We voyaged out on the Sahara desert aboard a "Rocky Mountain Canary" to view the sunrise's "a la Shiek." Warm? No, *hot!* Say, when old Sol fixed his burning gaze down upon us, sitting on a hot stove was cool and refreshing compared to the heat of that donkey's back.

Having somehow misplaced my passport, we decided to report the loss to the American Consul and proceeded to call upon him. He was the usual type of American to be found representing us in most any such small country, and deeply grateful for our visit. He told us that we were the only countrymen of his who had been there in the last year and a half, so you see how popular the place was.

We met an old Moor who had once been in San Francisco and who greatly obliged us by showing us the town.. "Le Café Chantant" was one of the most popular nocturnal attractions and featured among other things Spanish and French dancers. My friend the third officer "fell" for one of these girls and I had to pay his way back to Gibralter. Fatty degeneration of the pocketbook invariably yields to liberal doses of champagne. A detailed account of the many and varied experiences which befell us since leaving Portland would undoubtedly make interesting reading, but space forbids. To say that we had a good time, if somewhat hectic, is putting it mildly.

Another trip I made to Europe was on the *S.S. West Wind,* an Emergency Fleet vessel which boasted a gold star on her stack, denoting that she was officially credited with the sinking of a German sub. On the way around to the Atlantic after passing through the Panama Canal we were compelled to put in at Charlotte Amalie, St. Thomas Island, Danish West Indies, for fuel. This group of islands had just recently been acquired by the United States as a naval base, and at one time there were 57 other vessels in the same plight as ourselves. We had to wait nearly a month for our bunkers, then proceeded on our way once more. Among the many places visited during our rambles ashore while laying there was the famous "Blue Beard's Castle," the Miller Estate, and Magen's Bay.

Upon arrival at Liverpool I had the opportunity of renewing many acquaintances made during my previous visit and thoroughly enjoyed myself. Our stay was uneventful, but the same cannot be said of our run back across the stormy North Atlantic. In fact, it can hardly be called a "run"; it was more like a limping crawl, for with frequent delays due to turbine and generator trouble, and other annoyances too numerous to mention, it was 28 days before we reached New York. When almost within sight of the Statue of Liberty we ran out of oil, necessitating the sending of an SOS for tugs.

After enjoying myself in the "big city"

(*Continued on page* 584)

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

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

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

POWER SUPPLY FROM A.C. SOURCE

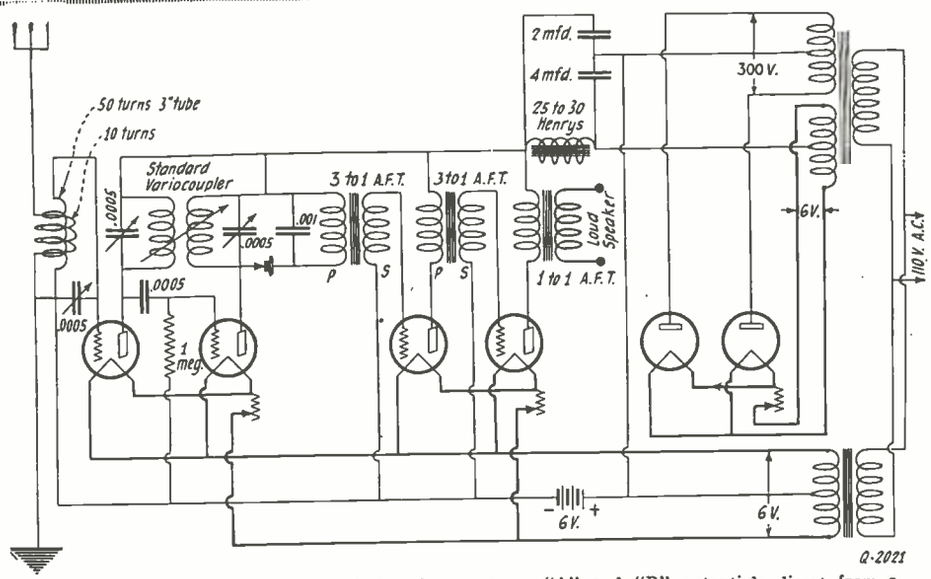
(2021) Mr. Henry Smith, Plainfield, N. J., asks:

Q. 1. What is the diagram of connections of a four tube set, using a crystal for detection, when a 110-volt, alternating current source supplies the necessary "A" and "B" potentials?

A. 1. We are showing the diagram of connections for a four tube set incorporating two stages of radio frequency and a crystal detector. An untuned primary circuit simplifies the tuning. The center-tapped transformers are designed for the output voltages shown.

Q. 2. How can the choke coil, usually used in such circuits, be made?

A. 2. A low-frequency choke coil of about 30 henries may be made according to the description given in the June, 1923, issue of RADIO NEWS. This description appeared in the I-Want-To-Know department, in answer to question No. 683. The primary of a Wayne, or Jefferson bell-ringing transformer will be satisfactory also.



A receiving circuit equipped to derive the necessary "A" and "B" potentials direct from a 110-volt alternating current source. A rectifier and filter system is utilized to eliminate the A. C. hum.

SUPERDYNE

(2022) Mr. Antone Galy. Lyons, France, asks:

Q. 1. In what way can the Superdyne principle be applied, to use the tube unit of an RC set?

A. 2. The method is shown in these columns. The untuned primary consists of about eight turns of insulated wire wound over the secondary.

Q. 2. Are there any special points to be borne in mind when laying out the instruments?

A. 2. It is very important that the plate tuning coil be placed in non-inductive relation to the coils in the grid circuit. If the plate coupling coil (the rotor ball) is placed too close to the stator coil to which it is coupled, regeneration control will not be satisfactory.

Q. 3. Are air-core or iron-core radio frequency transformers most susceptible to close coupling effects?

A. 3. Iron-core radio frequency transformers may be placed much closer together than air-core transformers.

NEUTRODYNING THE REFLEX

(2023) Mr. Herbert Chamberlain, Plainfield, N. J., wishes to know:

Q. 1. Is it possible to incorporate the Neutrodyne principle in a reflex set, thereby eliminating the usual potentiometer used to control tube oscillation?

A. 1. We are showing a reflex circuit incorporating the Neutrodyne principle.

Q. 2. What type of transformers should be used in a circuit of this type, incorporating four tubes, one as detector?

A. 2. Regular neutroformers will give excellent results. Phusiformers will also be satisfactory. It is probable that ordinary radio frequency transformers will have too great coupling and too many turns on the primary.

Q. 3. How may frequency, in kilocycles, be determined, given the wave-length? In cycles?

A. 3. Dividing 300.000 by the wave-length will give you the frequency in kilocycles. To convert kilocycles to cycles, multiply by 1,000.

DEFINITION

(2024) Mr. Urlin Page, Salem, Ore., wants to know:

Q. 1. Is a tuned impedance radio frequency, or a Neutrodyne, circuit better for DX reception?

A. 1. They are about the same. Theoretically, the Neutrodyne has the advantage of voltage step-up, but the tuned impedance radio frequency amplifier more closely approaches the point of maximum regeneration.

Q. 2. Would a potentiometer improve the Neutrodyne?

A. 2. If a potentiometer were used, the advantages of the Neutrodyne would be lost.

Q. 3. Which of the above mentioned circuits is the most selective?

A. 3. They are both exceptionally selective.

RADIO STABILITY

(2025) Mr. Miar Palmer, Jackson, Mich., requests:

Q. 1. Am considering the construction of a set. Is there much possibility of its being useless in a short time, due to changes in the radio field?

A. 1. If a standard circuit is used the set should be useful for a long time to come. The laws governing radio communication are the same now as they were in 1898 and a set built along the standard lines is not likely to pass out of date due to any radical changes.

STUDIO DESIGN

(2026) Mr. Otto Isler, Union Hill, N. J., asks:

Q. 1. Please describe the construction of a modern broadcast station studio.

A. 1. The walls may be constructed of gypsum block. Over this is placed a layer of lith. This is a sound absorbing material. It is also applied to the ceiling. A triple wall construction should be used. Between the walls a thick layer of sound deadening material is laid. The furniture should be wood-doweled, not nailed.

Q. 2. Should draperies be used to prevent echoes?

A. 2. A certain amount of reverberation is required. By use of a partial drapery, the correct balance between reverberation and a total absence of echo may be easily obtained. If the special wall construction described above is used, no drapery is required.

Q. 3. What is the difference between reverberation and echo?

A. 3. Reverberation is a type of echo so closely spaced to the original sound that the separation cannot be detected by the ear. An echo is so timed that the separation can be readily detected.

SUPER-HETERODYNE RADIATION

(2027) Mr. Ivan M. Levy, Wellington, New Zealand, asks:

Q. 1. Kindly explain in detail why 8-tube Super-Heterodynes do not radiate.

A. 1. This is due to the fact that the first tube does not oscillate and therefore acts as an effective blocking tube for currents generated by the oscillator tube, or the intermediate frequency stages. While it has been claimed that there is

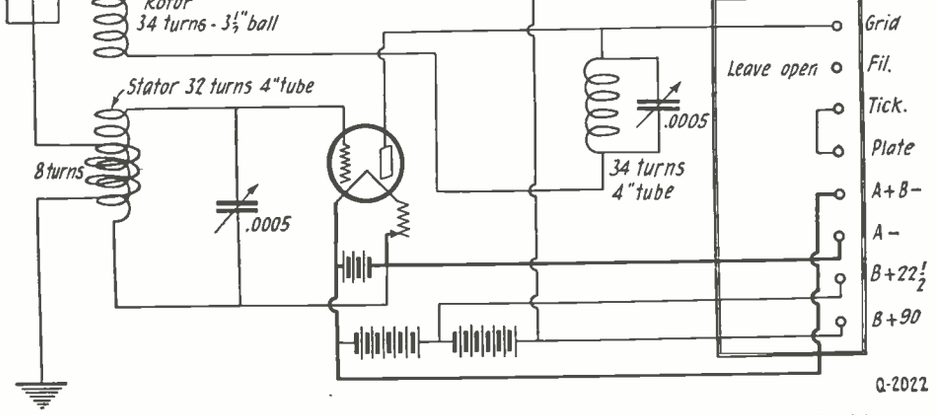
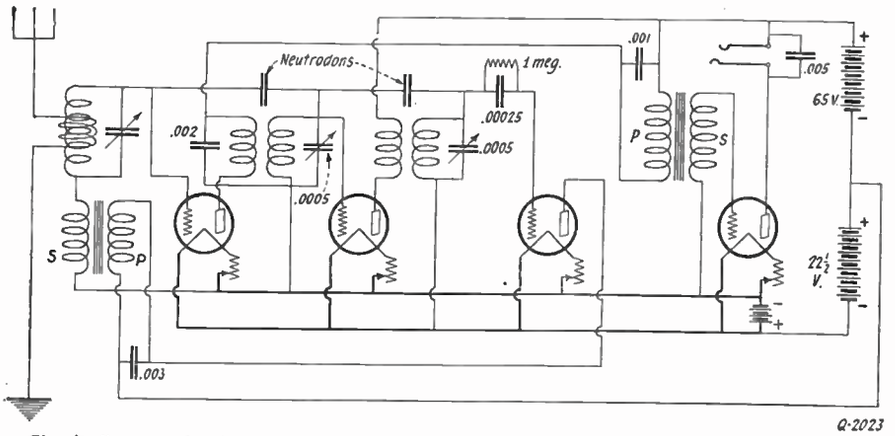


Diagram of connections for changing an RC set into a Superdyne. No change of wiring within the RC unit is necessary.



Circuit diagram of a four tube reflexed Neutrodyne. Through this arrangement the utilization of a potentiometer is done away with. The four tubes in this circuit do the work of five.

a radiation of the oscillator currents this radiation can be detected only a short distance from the set. Of course, there is generally conceded to be a radiation from the oscillator coils, which cannot be prevented except by shielding and it is probably this current, rather than the aerial current, which is picked up by receiving sets in the immediate vicinity. While these coils form an effective antenna and counterpoise system, the amount of energy that can be radiated is very slight indeed. Such currents as may pass the blocking tube due to the grid-to-plate capacity, are only weakly radiated from the aerial. When a loop is used, even this possibility of interference becomes a minimum. Reviewing these facts we may consider Super-Heterodynes as non-radiating.

ELECTROLYTIC RECTIFIERS

(2028) Mr. Hanson Houck, Louisville, Ky., writes:

Q. 1. What is the metal used in the Balkite "Fansteel" charger?

A. 1. It has lately been found commercially possible to use tantalum. That metal is now used in the Balkite charger.

Q. 2. Why are several electrolytic rectifier cells required when charging a high-voltage battery?

A. 2. At 30 to 35 volts aluminum begins to disintegrate. This is also true of tantalum. It is for this reason that storage "B" batteries of more than 20 volts should be connected in series parallel so the battery will comprise banks of cells of 20 to 24 volts each. In this manner a charging rate, equal to the sum of the charging rate of each bank of batteries, is used.

Q. 3. How is it possible to use a tube as a radio frequency amplifier in conjunction with a crystal detector?

A. 3. The diagram shown in answer to your inquiry makes this clear. Need for a potentiometer has been dispensed with by the use of the Superdyne method of controlling oscillations. The inductances used have the constants of those in the circuits shown in answer to question No. 2022. If the aerial is not long, the primary winding may be dispensed with and the connection shown used. The arrowhead indicates the connection for the rotor plates.

DIELECTRIC

(2029) Mr. Victor W. Rausch, Battle Creek, Mich., wants to know:

Q. 1. I recently noticed an article stating that the wax on annunciator (bell) wire reduces the efficiency of an inductance formed with this wire, due to a high distributed capacity. Does it mean that a small amount of paraffin accidentally put on a small portion of the Ultradyne transformers will reduce their efficiency?

A. 1. The reference you mention was to the use of wax or paraffin in considerable amounts. A small amount on the Ultraformers is not injurious.

Q. 2. Does the UV-1714 transformer have a tapped primary and secondary?

A. 2. Yes. There is a tap for short wavelengths taken from both windings.

TUNING

(2030) Mr. John F. Taylor, Pinehurst, N. C., writes:

Q. 1. What is the proper method to tune a three circuit set consisting of a variocoupler and two variometers?

A. 1. The variocoupler is adjusted for the approximate wave-length desired. The two variometers are then varied in unison, for maximum response. The variocoupler coupling is made tight until the desired station has been tuned in. Sharp tuning then results by loosening this coupling as much as possible and re-adjusting the two variometers at the same time.

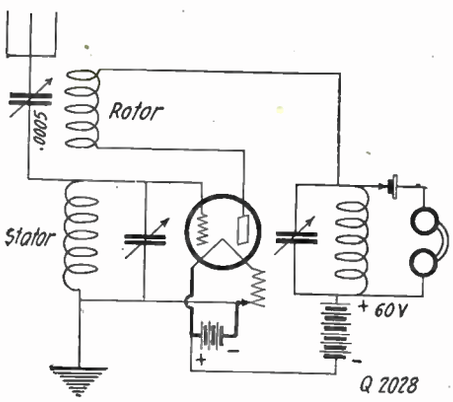
Q. 2. In such a set as the above, if the variocoupler has a range of 200 to 1,000 meters, the variometer in the grid a range of 200 to 600 meters and the variometer in the plate circuit a range of 200 to 900 meters, what is the wavelength range of the set?

A. 2. The approximate wave-length range of the set is determined mainly by the inductance and capacity of the secondary or grid circuit. This gives an approximate figure of 300 to 700 meters as the range of the set.

ACOUSTICS

(2031) Mr. Curtis E. Scherrmacker, Great Kills, N. Y., wants to know:

Q. 1. What is the proper connection for my headphone cords marked red and black? How



A circuit employing the vacuum tube as a radio frequency amplifier and a crystal as the detector. This circuit should prove quite sensitive and selective.

should they be connected to the set for best results?

A. 1. This depends on the make of the receivers. While listening to a weak station reverse the leads and leave the headphones connected in the way that gives loudest response. Make note of the color that connects to "B" plus and always connect the headphones in that way, when trying other sets or circuits. Most usually the red cord should be connected to the "B" battery plus.

Q. 2. What are the first and second series of vibrations of a sound?

A. 2. The first series is the basic tone and that is called the fundamental. The second series is called the second harmonic and has just twice the number of vibrations in the space of a second as the fundamental.

Q. 3. What is the effect of the fundamental and harmonics produced by a musical instrument?

A. 3. Harmonics produce the timbre, or characteristic sounds of the instrument. One musical instrument may radiate 50 per cent. of the sound energy on the fundamental note and the balance is divided in various proportions on higher frequencies or harmonics. Another instrument may radiate 65 per cent. of the energy on the fundamental note and the balance in various harmonics. The easily distinguished tone of the brass horn is due to strong vibrations at the seventh and ninth harmonics.

COMPARISON CIRCUIT

(2032) Mr. J. D. Robson, Dubois, Pa., wants to know:

Q. 1. Please show a diagram of connections of a switching system for making a comparison between a single circuit receiver and a three circuit receiver. One stage of audio frequency amplification may be used for either set.

A. 1. The diagram you request is shown in these columns. Note that provision has been made to apply the correct "B" battery voltage to the particular tube that is used in each set.

Q. 2. Kindly state the general rules for increase of inductive impedance and of capacitative impedance,

A. 2. The inductive impedance increase of a coil is directly proportional to the increase in cycles per second of the current. Capacitative impedance varies as the reciprocal of the frequency.

PHONE CORD CAPACITY

(2033) Mr. F. E. Stewart, Los Angeles, Calif., wants to know:

Q. 1. What type of coil can be used for the iron core choke coil of 50 henries value, shown in the diagram on page 1085, in the February, 1924, issue of RADIO NEWS?

A. 1. The coupling impedance shown may well be a spark coil secondary. A Wayne or Jefferson bell ringing transformer primary will also be satisfactory. If either of the latter impedances are used, it will be well to try connecting the primary and secondary coils in series.

Q. 2. How can capacity effect from the phone cord be reduced?

A. 2. Connect the primary of a transformer in the set, in place of the headphones. The secondary connects to the headphones. It will be necessary to use an iron core transformer having the same primary impedance as the plate circuit of the vacuum tube and a secondary resistance equal to the head-phones. A regular audio frequency transformer will often do. Its primary connects to the head-phones and the secondary connects in the plate circuit of the set, or vice versa, depending upon the transformer. Or, a 1:1 ratio transformer may be used. It is to be noted here that phones having a very low direct current resistance, for example the standard line telephone receivers of 80 ohms, can be efficiently operated in a set by the use of a properly designed transformer having a secondary resistance equal to the resistance of the phones.

Q. 3. What is the approximate increase of "B" battery voltage required when resistance amplification is used?

A. 3. About 50 per cent.

INDUCTANCES

(2034) Mr. J. F. Flores Bayals, Rio Piedras, Porto Rico, asks:

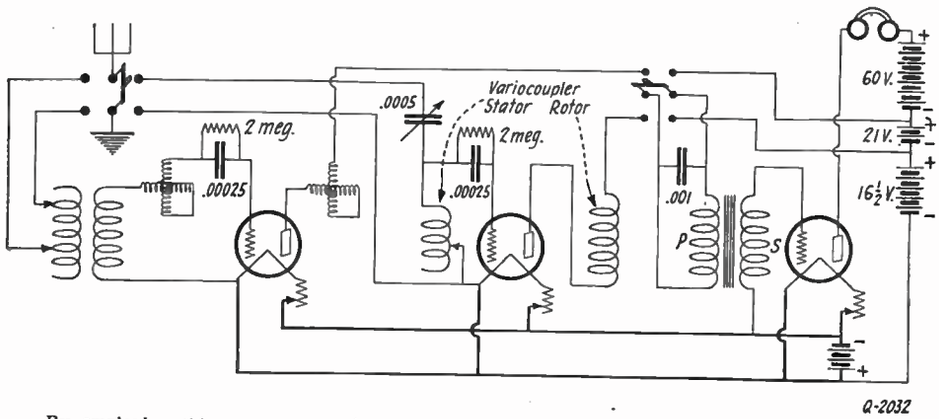
Q. 1. What type of inductances are required for the Kennedy Type 220 regenerative receiver shown in the "I-Want-to-Know" department of the August issue?

A. 1. The first two inductances may be a standard variocoupler. The coil inductively coupled to the variometer may be about 60 turns of wire tapped every 15 turns.

Q. 2. Please describe the inductances used in the Zenith Model 3-R receiver shown in the "I-Want-to-Know" department of the July issue of RADIO NEWS.

A. 2. The coil tapped in the units and tens manner may comprise 80 to 100 turns of insulated

(*Continued on page* 546)



By employing this arrangement the set can be switched from a single to a three circuit tuner at will. The audio frequency amplifier can also be used with one or the other circuit by throwing a second switch.

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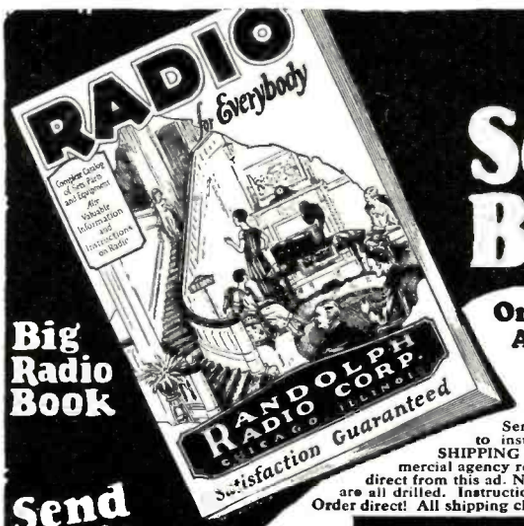

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Two-Stage Amplifier

May Be Used In Connection With Any Receiving Set

1 7x9 or any standard Bakelite Panel.
1 Thordarson or Columbia High-ratio Transformer.
1 Thordarson or Columbia Low-ratio Transformer.
2 Bakelite Rheostats.
2 Bakelite Sockets.
2 2-circuit Jacks.
1 1-circuit Jack.
1 Baseboard.
9 Binding Posts.

$10.90

Diagram and Instructions for wiring.

COMPLETE PARTS FOR 3 AND 5-TUBE NEUTRODYNE RECEIVING SET

Genuine Hazeltine Licensed Fada, Freed-Eiseman, or other Genuine Licensed Parts

PARTS FOR 5-TUBE SET:

1 7x28x⅜ Drilled Panel.
2 All American or Columbia Audio Transformers.
3 4" Bakelite Dials.
3 Filament Control Jacks.
1 Vernier Rheostat—30-ohm.
1 Plain Rheostat—6-ohm.
1 strip Bakelite, 6x1x⅜.
8 Binding Posts.
1 Grid Leak and Condenser.
2 Bakelite Sockets.
1 .001 Condenser.
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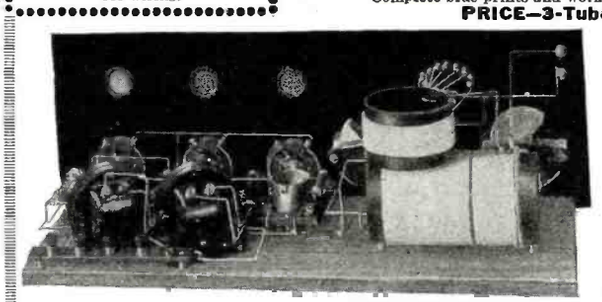

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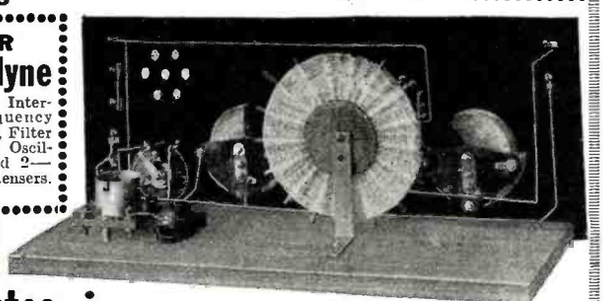

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3 Bezels.
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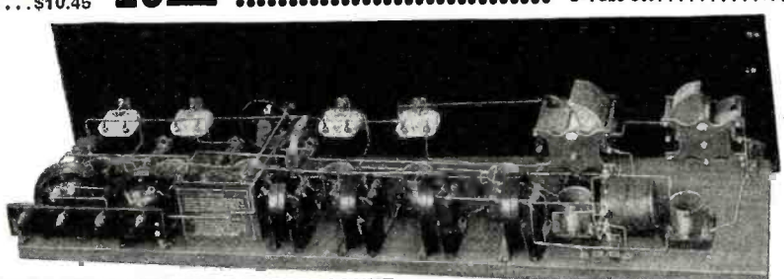

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The Wail of the Lonesome Shrine

(*Continued from page 485*)

counters. "Do I what?"

"Do you believe in ghosts?"

I feels a comedy jag coming on. "Well," I says, "I don't know if I believes 'em or not, because they ain't none of 'em ever told me anything yet."

Bang! The big suggestion comes.

"Jerry," I says slowly, "do you remember Jim McKenna?"

Jerry does, vigorously. You see, Jim's trained crow accidentally put the hook out on a little scientific demonstration of The Master's, and although it wasn't exactly anybody's fault, Jerry sort of has it in for Jim, in a congenial way, if you gets what I means.

"Would you like to put one over on Jim?"

He would.

"Then lend an ear, Friend Roman," I requests. "Jim McKenna don't believe in ghosts. Moreover, he says so every chance he gets. He's positively a nut on the subject. Last winter in Sacramento he offered to sleep alone all night in a graveyard. Does the general idea assimilate?"

It does. The Master catches on with grace.

"Jim's coming back for a few days in a week," I hints.

That starts Jerry's gear-box to running like a mouse animates a meeting of the W. C. T. U. "Do you think he will consent to do the trick when put to it?" he inquires.

"Sure he will," I states. "Jim may be a liar, but he ain't no quitter. He'll sleep—or at least try."

The Master emits a low laugh.

"Do you know any good spooky cemetery?" I asks.

"How about the one on Fairview Hill?" he inquires.

"Too close," I says. "Go out a ways."

The Master brings his hand down on the table with a smash. "I have it!" he exclaims. "I have it!"

"You won't have it long if you treats it like that," I grins. "But where's this lay?"

"About ten miles inland there's an old deserted cemetery, half a mile or so from a road. It's in the center of a grove of trees, and should be ideal."

"Fine," I says.

Jerry rubs his hands in excitement. "Tonight I'll work out an idea I have in mind," he says. "Come over early tomorrow and we'll take a run up to the place."

Well, we does. All The Master said about it don't half describe it. This graveyard, so Jerry says, was built about seventy-five years ago by a bunch of nuts that tried to put over a new religion that flopped. The cemetery is located in what looks like the crater of a small-time volcano; in reality it's just a small hill with a sunken top. There's trees all around the base and up the sides, also well into the cavity, except for a clearing about fifty yards square. The graveyard is inside the clearing, and for a perfect set of run-down tombstones and decayed fences I ain't never seen the beat. But the central figure is a big image that looks like Buddy but has more clothes on. This statue is about fifteen feet high, of solid bronze, and shows a man praying with his hands outstretched towards the sky. A brass plate fastened on the base of the image says the bozo doing the calisthenics is Ezekiel Wells, the producer of the act. The whole place ain't been given no attention for five or ten years, and as a ghost breeder it's a headliner.

"Great little yard," I says. "Now, let's get the mental opus. Radio, I suppose? We scares him out of a week's salary, huh? But won't it interfere with broadcasting?"

"One question at a time," laughs The Master. "This is the proposition. Of late I have been experimenting with short wave transmission. You understand what I mean."

I does, and says so.

"Very well. As it happens, I have successfully transmitted with waves as low as fifty meters, although for our purpose we sha'n't go as low as that. Seventy-five meters will suffice."

"Sure," I agrees.

"You will notice," he goes on, "that many of the lesser tombstones are very thick. This one, for instance, while not high, is better than a foot across. My plan is very simple. We shall construct, out of wood, of course, four imitation tombstones, using old lumber, and paint to achieve the granite effect. These 'stones' will be placed at vantage points about the cemetery, one being just behind the bronze image. In each 'stone' will be a small radio receiving set with a loud speaker, connected with a 48-hour time clock, which will actuate the outfit at a previously arranged time. I shall wire the sets on different wave-lengths; one will be 75 meters, another 85, another 95 and the last one 105."

"And we sets back in the lab and knocks him for a row of skulls," I snickers. "This'll be good."

"No," contradicts The Master. "If we talk, he will recognize our voices. I will arrange a detail of phonographs to take care of that end, using the voices of others. And we must not be in the laboratory. We must be—just a moment! How are we to know Mr. McKenna will stay in the yard?"

Now it's my turn to hog the spotlight. "Easy," I says. "You will observe that from the top of this rim there ain't a farmhouse visible between here and any road."

"There is not."

"He can't get no place without he crosses a road, can he?"

"No. But——"

"Easy," I says grandly. "We takes him up there, undresses him, and leaves him with only an army cot and his pajamas. No sane guy is going to chase around across country roads without his pants."

The Master sees the point. "Capital, Joe," he compliments. "And we shall spend the night at the country club, just to have an alibi."

It's settled. For the next week there ain't a busier couple of spook serenaders in captivity. We gets the fake tombstones and the receiving sets all rigged up in no time; the big bow-wow is Jerry's phonograph outfit. Each transmitter has its own master's voice, consisting of six 24-inch record turntables, with special size records, each turntable above the other like a pile of chips in a game of stud. When it comes to the little intimate details, you can't beat The Master. Not only does each set of turntables work in order, but they mix between the different transmitters, causing the four receiving sets to sort of carry on a conversation between themselves. Jerry has six servants, and he drafts them into making the records, which he tells them is a new device of his to test lung power. Servants is useful sometimes. Anyway, The Master has read up on the history of Ezekiel Wells, and written a neat one-act sketch about him, with four wooden-headed principals. We tries out the works in the lab, and I confesses I gets the creeps right there.

Jim is due Sunday morning, so Saturday afternoon we dresses up the act for the try-out. First we rattles up to the graveyard, sets up the four "stones," and pulls up the aerial. It's a four-wire arrangement, one

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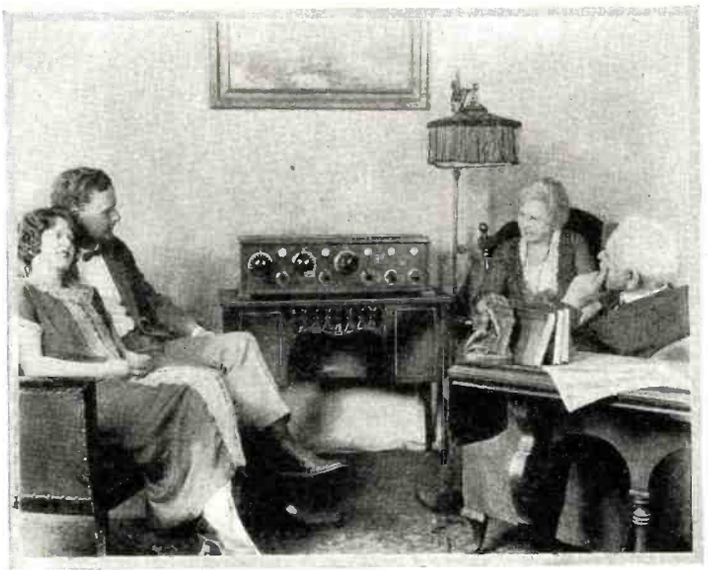

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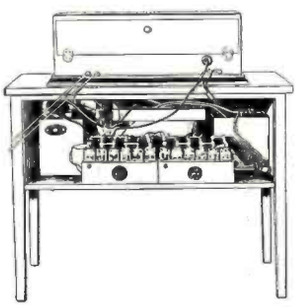

HERE is something that enables you to enjoy radio in the home without the clutter of unsightly apparatus that plays havoc in the decorative scheme of your living room! The horn speaker is out of date and out of place in radio for the home. This console with its in-built loudspeaker is scientific and sightly.

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wire for each receiver. Then we hooks up a temporary field radiophone set for our own personal conversation and The Master goes back to town to start the wheels in motion.

I feels somewhat out of place, up there all alone, even in the day. I keeps Coueing myself about what a hot time Jim is in for, but it don't do much good. Well, in about half an hour the cross-fire begins. They ain't a hitch; it's worse than I thought. Little cold chills plays leap-frog up and down my spine; I craves distance without no delays. But I sticks it out by sheer force of necessity. Then I calls up Jerry on the radiophone.

"She spooks O. K.," I tells him. "It sounds like a convention of saxophones playing off key."

I fixes the time clocks for 11:30 P. M. Sunday, brushes up my footprints and sets the stage for the big show. I takes a last look at the receiver behind the shrine, and in so doing comes face to face with one of these forest felines with a white stripe down its back. Not having no gas mask I beats it pronto, running across the cemetery towards where the radiophone set is at. In running I trips across the cable carrying the aerial wires and falls flat on my Rand-McNally, taking a few cubic inches of flesh off my frame and a load of profanity from my mind.

I ain't particularly superstitious, as stage folks go, but there's one thing that's a sure jinx. For a dancer to fall or tumble the day before he breaks in a new act means trouble, and plenty of it. This is my own pet superstition, and I don't feel so good as I jogs homeward in my rattleabout. I tells The Master, and gets a laugh for my pains.

"Nonsense," he says. "We must all take our bumps as they come, Joe. Cheer up! Think of our mutual friend Mr. McKenna."

I shakes my head. "Never you mind," I insists. "It ain't never been known to fail on anybody else, and I ain't no exception."

The Master laughs. "Really, Joe, I thought you knew better. Forget it."

Well, Jim gets in Sunday morning about eleven. We plays golf most of the afternoon, arriving home about four. We talks shop for a while, until about four-thirty, when The Master, casual-like, drops in. This hands Jim a wow-line.

"How's the voice-thrower, Doc?" he jibes. "Still crowing over it?"

Jerry passes it up like the true gent he is. Pretty soon Jim lets up. We keeps on talking a little longer, until The Master idly picks up the Sunday sheet and gives it the twice under. This is my cue.

"What's new tonight, Jerry?" I asks innocently.

"Oh, the usual thing," he replies. Mostly political scandal. Several holdups. A murder. And—say! Here's a new article by Sir Arthur Conan Doyle on Spirit Moving."

The boy feeds his lines like a veteran trouper. And Jim jumps at the remark like a thirsty man grabs at a straw.

"Ghosts!" he snorts. "There ain't no such animal!"

From this point on it ain't no trouble at all to get Jim heated up and boiling over. The Master and me quietly makes a remark and Jim keeps on denying louder and louder until finally he baits his own trap.

"Ghosts!" he nearly yells. "There ain't none! Why, I—I'd sleep all night in a graveyard just to prove it!"

"The deuce you would," I contradicts mildly.

Amid a new flow of naughty words Jim declares he not only would, but will, and puts up a bet. Just to make the thing ring true me and Jerry puts in ten bucks apiece, figuring it's worth that much to pound a bit of human intelligence into his hardwood cupola.

The Master is very surprised. "Do you really mean it?" he asks.

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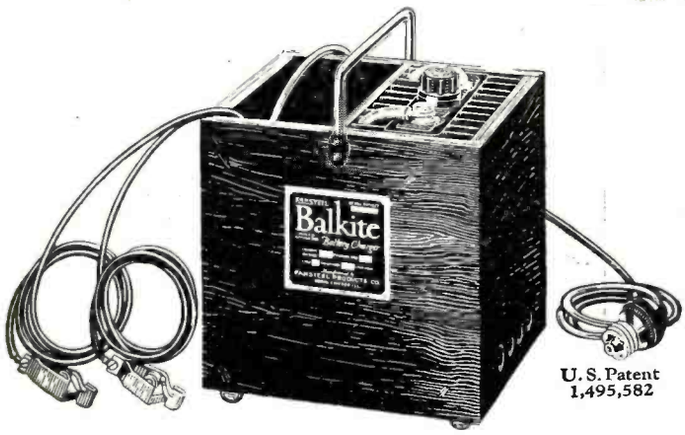

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Jim explains that he is serious.

"Tonight?" I asks.

"Tonight!" snaps Jim.

I turns to Jerry. "Say, where's a good cemetery hereabouts?" I asks.

"The only one I know of is the one on Fairview Hill," he says, scratching his head. "That's right close in."

"Pick a good one," jeers Jim. "A nice lonely one."

Suddenly The Master remembers an old deserted graveyard about ten miles out. He describes it adequate, and I says for Jim he never flinched.

"It's a bet," says he. "How about arrangements?"

"Let me see." meditates The Master. "You will be permitted to have only a small cot and no clothing except your pajamas. We will leave you there, stay all night at, well, say the country club, and call for what remains of you in the morning. How's that?"

Jim don't like the pajama idea none too well but he sees our logic.

"All set," he agrees. "Let's start."

First we has dinner, and we takes our time getting ready, so it's well after nine-thirty when we arrives at the cemetery. The sun has long since done its stuff and taken its bows, so there ain't no light except the stars and our flashes. We sets the cot up, and Jim undresses and hops into his pajamas. I been in a lot of places where I couldn't find no excuse to remain, but this dump wins the celluloid underwear. I feels cold and clammy, and Jerry don't look exactly in his elements, but Jim is as chipper as ever. He even whistles "You Gotta See Mamma."

The Master and me don't waste no time repeating good nights. We steps on the gas and I never saw no fancy edifice that looked more like home than the country club.

There's a Mother Jong contest in full tilt, so we looks on a while just to have an alibi in case Jim makes inquiries. After an hour or so we strikes the new mown, but it's a case of no can do. Both of us keeps wondering how much of Jim is still intact, and our consciences begins to pain a little. After all, Jim never did nothing to us except kid The Master, which ain't no crime legally. I feels slightly guilty, like the first-time tourist who smuggles in a nine dollar pewter spoon. Sleep ain't in us; we simply destroys the bed clothes. Finally, about seven o'clock, we decides to face the opera. So we vaults into the rattler and makes ruts for the spook flop.

When we nears the hill I has a sort of morbid hope to see a few torn pieces of blue cloth on the bushes, but there ain't even a sample. And when we finally gets down into the silent city there is Jim, sound asleep, with all six cylinders hitting regular.

We wakes him up. We should never have done it.

Jim grins sleepily.

"Had a great nap," he yawns. "Outside air's great. Think I'll sleep here right along."

"You slept all night?" demands the two of us.

Jim looks up indignant-like. "Sure I slept," he comes back. "Why not?"

"Didn't the—er, spooks keep you awake?"

"Spooks my eye! I'm telling you there wasn't none, ain't none, and never will be none!"

"T-Then everything was all right?" I asks.

Jim looks kind of funny. "What you guys driving at?" he demands. "Of course everything was all right. Quiet and restful. That is, except for a radio concert about half-past eleven."

"R-radio concert?" repeats The Master.

"Yeh." yawns Jim. "Must be a farmhouse somewheres near here. The fellow had a big horn on it, I guess. Leastwise, I heard it like it was all around me. Had

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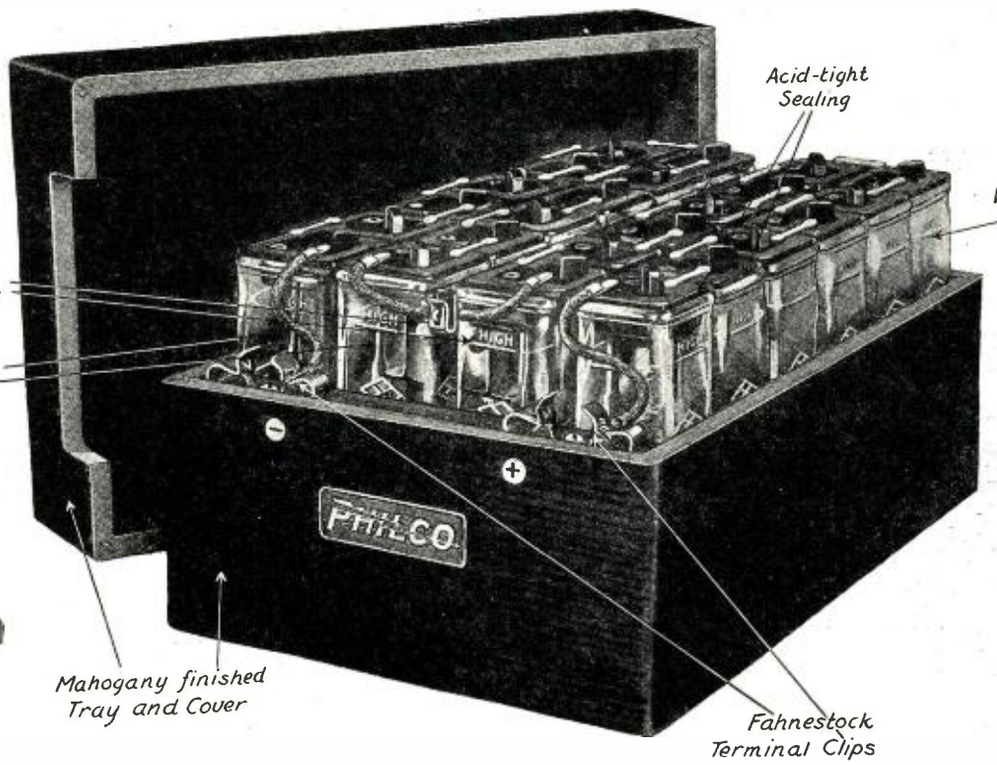

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a good program. Say, yuh got any cigarettes?"

"C-concert?" mumbles The Master.

"Yeh. Lot of good jazz stuff. The announcer said it was WJX broadcasting. New York, ain't it?"

"Uh-huh."

There is silence while Jim dresses. Then he speaks.

"This sure is a wonderful age," he comments. "Say, where's them cigs?"

"I left a pack of 'em over in the car," I tells him. "Run along, we'll bring the cot."

Jim sets foot over the hill. As soon as he's out of sight The Master turns to me.

"Something went wrong," he says. "There isn't a farmhouse in a mile."

"Correct," I agrees.

"The transmitters couldn't all have failed," he goes on. "I took care to arrange them so at least one would operate."

"Yeh," I concurs, not feeling any too keen.

"Therefore, the trouble must have been here. Joe, did you alter anything after I left?"

I shakes my dome. "Not a switch, except to set the time like you told me to."

The Master examines one of the sets. "The time released the switch O. K. here," he says. "Funny. I wonder if——"

He don't say no more, but takes a run up the slope to where the aerial is at. He looks it over. Then he calls me.

"Jim," he asks quietly, "did you say you stumbled over this cable yesterday?"

"I did," I tells him. "Observe my mug and be convinced."

He looks at me sadly, but don't speak.

"Furthermore, it brought bad luck, like I said it would," I states.

"It surely did," agrees Jerry. "Do you know what happened?"

My face gives me away.

"Each wire in the aerial serves one receiver," he explains. "When you fell you jerked the cable, which as it happens twisted the four bare lead-ins together."

"But——"

"But indeed. That threw all the tuning devices in series."

"Well——"

"75 plus 85 plus 95 plus 105 equals 360," says The Master.

It dawns on me. "WJX broadcasts on 360," I says dumbly.

"Precisely."

We don't say nothing for a few minutes. Then I can't help but grin.

"Say, Jerry," I inquires, "do *you* believe in ghosts?"

"Do I what?"

"Do you believe in ghosts? I never thought to ask you before."

He scratches his head. "There have been some manifestations I have not been able to comprehend," he admits. "However, in this case, there is no doubt as to the source of the trouble. It is obviously earthly."

"Not only obviously, but aromatically," I snickers. "Look behind you."

He does. There sits the wood pussy with the white stripe.

The Master stares at the animal. Then he slowly turns to me.

"That, I believe, is the indirect cause of our difficulty." Then his face brightens up and I can see a clever line coming.

"One might call it a radio spook," he smiles.

"Yeh," says I, "the original broadcaster."

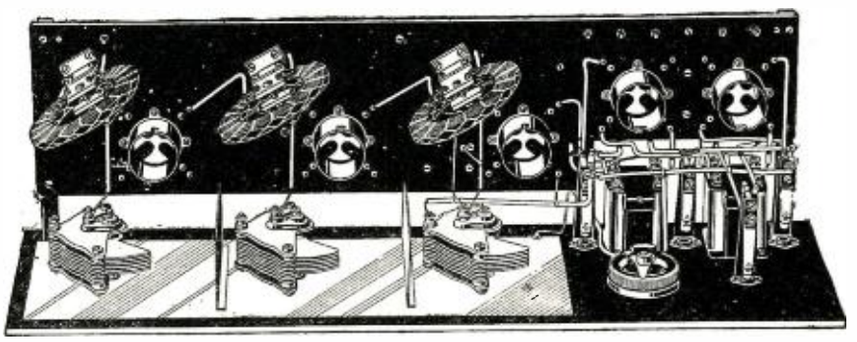
The funny part is The Master sees the point before we're half way home.

TUBE OR NOT TUBE, THAT'S THE?

"You know what the bootleg tube makers are doing?"

"Sure, OM, they are just Flem-Fleming the public."—*Jack Bront.*

The New Pfanstiehl System Is Revolutionizing Radio



Simple— Unfailing— Enjoyable—

HITHERTO radio development has advanced along the line of more and more complication. To get greater distance and louder tone more amplification was needed. Unfortunately, that meant more internal noise, due to the disturbing oscillations inside the set itself. To overcome these, complicated devices were resorted to: potentiometers to choke down the oscillations, neutralizing condensers to offset them. These have never been satisfactory. They only partially do the job. They complicate operation. They get out of adjustment. In spite of them, the undesirable noises occur and re-occur.

A New Principle Needed

Along these lines radio could never become the unfailing and enjoyable instrument of reception people want in the home. There was too much uncertainty about it. The whole dynasty of "dynes," a long line of "supers" and "heters" and "neuters," each contributing its share to the advancement of radio reception, must yield to something very different. They must give place to something much simpler and more trouble-proof. And that something is an entirely new system of radio design, one that is fundamentally correct in so relating the electro-static and electro-magnetic fields in the set that no disturbing oscillations can occur.

A Non-Oscillating System

That is exactly what has been accomplished by the new Pfanstiehl non-oscillating system in the Pfanstiehl Model 7. No oscillations can occur. They are **kept out.** For the first time in the history of radio, the full benefit of tuned radio frequency amplification can be enjoyed always at its best, without the least complication or need for adjustment.

Clear as a Bell

This marks a new era in radio. It makes radio as dependable as a phonograph or the telephone. Reception is as clear as a bell, as natural as the human voice. In this respect distance makes no difference. However great the amplification, no oscillations arise. You can change tubes as often as you like. There is no need of adjustment.

Simplicity Itself

How this has been accomplished is briefly and clearly explained in an illustrated folder which will be sent to anyone on request. Simplicity has been attained by a very simple means.

The "Station Finder"

A NEW simplicity of tuning is attained by the Pfanstiehl Model 7. There are 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. The Pfanstiehl "Station Finder" takes the guesswork out of tuning.

Pfanstiehl

5-tube set tuned radio frequency

Exclusive local franchise still open to strictly high grade dealers in a number of desirable territories. Quick action is necessary.

PFANSTIEHL RADIO COMPANY, HIGHLAND PARK, ILLINOIS

Radio Humor

(*Continued from page* 501)

10. The operator's ears should be filled with cotton and old-fashioned ear-muffs worn.

11. Important. *All spirituous liquids should be removed from the premises due to the fire hazard.*

Yours for better broadcasting,
RADIO EDITOR.

REPLYING TO INQUIRY ON REFLEX

By "ROLAND DAINTY HANDS"

(RADIO NEWS, *August*, 1924)

Reflexes are nice; I have one which doesn't flex, so feel competent to advise him fluently, as follows:

To increase selectivity, erect antenna of standard Pyrex cable parallel to 4th dimension and extend to nth degree. Galvanized insulators match beautifully.

Shield panel with German marks and put vernier on steering wheel.

Solder grid leak and test for capacity in pints.

Larger honeycomb coils will help keep the weak "B" battery alive.

The lack of pep indicates worn pistons which cause carbon deposits inside tubes, and the frying noise is caused by poor lubrication. Respectively remedy by replacing new pistons with oversize filaments (also the use of Tetra-ethyl-lead is highly recommended by its makers), and then drain crank case and refill with Crisco.

Disconnect original leads from cigar lighter on dash, and run square buss wire inside round hose from lighter to center of distributor. Hold well damped tickler closely coupled to lighter and start motor. If it works, test wheels for alignment and inspect ground. Have wheel base lengthened and calibrated with wave meter.

If it doesn't flex, advise you to correspond with the inventor of "27 miles on air" device. or take to roof of Woolworth building and direct dials toward northeast.

Contributed by 9BSK.

RADIO PROVERBS

By PIERRE MACISAACS

Dead tubes bring no music.
Well tuned is half received.
Many tubes make loud music.
One good turn deserves a station.
A rapid turn gathers no stations.
Make haste while the tube shines.
The more wire, the less stations.
"B" batteries make the radio go.
A switch in time saves nine.
Don't hide your tube under a coil.
Distance wise and tuning foolish.
One condenser does not make a radio.
Faint phones ne'er won fair station.
A letter to the singer is sufficient.
The receiver is as bad as the aerial.
It's a long aerial that has no turning.
A radio is known by the stations it gets.
A tube in hand is worth two on the floor.
A little "B" battery is a dangerous thing.
It's a wise owner that knows his own radio.
Many talk of stations who never tuned a set.
Give a man a radio and put him on a desert island.
Don't count your stations before they are tuned.
You can't teach an old battery to get new stations.
He who reckons without static must reckon again.
Take care of the tuning and the stations will take care of themselves.

Dear Jim:

You know how I've been spending my money for parts.

Well, last night our home-made "superhet" was making a lot of noise but little music, when I happened to remark to Nell that a couple of new vernier condensers at $7 each might improve it.

And she snapped right back at me, that one new hat at $14 would improve *her* con-sid-er-ably, and what was more she intended to be improved. Women are so inconsiderate.

I was ready to kick the set to pieces and give up Radio forever, when Eddie who works at Whump's Radio Store called to ask about a little bill which had escaped my mind.

I asked him to look over the set and see if he could tell what was causing the trouble.

"What's the use?" he said. "The set is probably O. K. Why don't you get some batteries you can recharge when they run down? That's what's making it noisy."

Well, to make the story short, I got him to trust me for a set of Willard A's and B's, and you should hear that "super" perform now.

Wife Nell hasn't said any more about the hat either.

Yours for better reception,

Sam.

WILLARD RADIO BATTERIES

WTAM

[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.

Write for WTAM's own booklet, "Better Results from Radio." Most interesting booklet ever published on this subject. Mailed to you with our compliments.

Tear me off the page and mail me to WTAM. I'll bring you "Better Results".

Name .....

City and State .....

Street Address .....

RADIO STORE OPERATES RADIO SCHOOL

At last has come the radio store school for radio fans. A Chicago radio company which operates 12 stores in the city has what it calls radio schools in each.

These schools are, in reality, work shops where the radio builder may come and build his set. To guide him, instruct him, and help out with difficult hook-ups, and to check up the finished set before the current is turned on, is a radio instructor. One instructor is kept at each store. He will be trained by the company before being put in charge. Where it is possible, the instructor also attends to the sales of the radio supplies and sets. Where the volume of business is too great or demands of the "students" too heavy, a clerk is put in charge of all sales and the instructor does nothing but help the builders in the workshop.

In the workshop, which is in a room apart from the sales room of the store, may be found electric drills, soldering irons, pliers, screw-drivers, voltmeters, ammeters, and all the other necessary tools and apparatus to build and test radio sets. At any time of the day, in these stores, may be found men, boys, and sometimes girls and women busily constructing sets.

The work benches are large enough to conveniently accommodate several builders at the same time. Leads from "A" and "B" batteries are connected to marked binding posts on bakelite panels above the work benches so that when a builder has completed his set, he may connect it up in the workshop and test it. Aerial and ground leads are also conveniently placed on the panels.

The instructors have all been trained to explain radio in the simplest terms so that the novice may understand them. Due to the number of complicated and "freak" circuits that appear in radio magazines, and Sunday supplements of the newspapers, the instructors are compelled constantly to study in order to help the builders with the thousands of different hook-ups that are used.

These work shops and the help are offered to the public absolutely free. The reason for it is that they boost the sales of the company. When a man has been striving for weeks to get his pet circuit to bring in the music, without success, he is ready to do anything for the man who can make his set work or show him where the trouble lies. That is what the radio "schools" do.

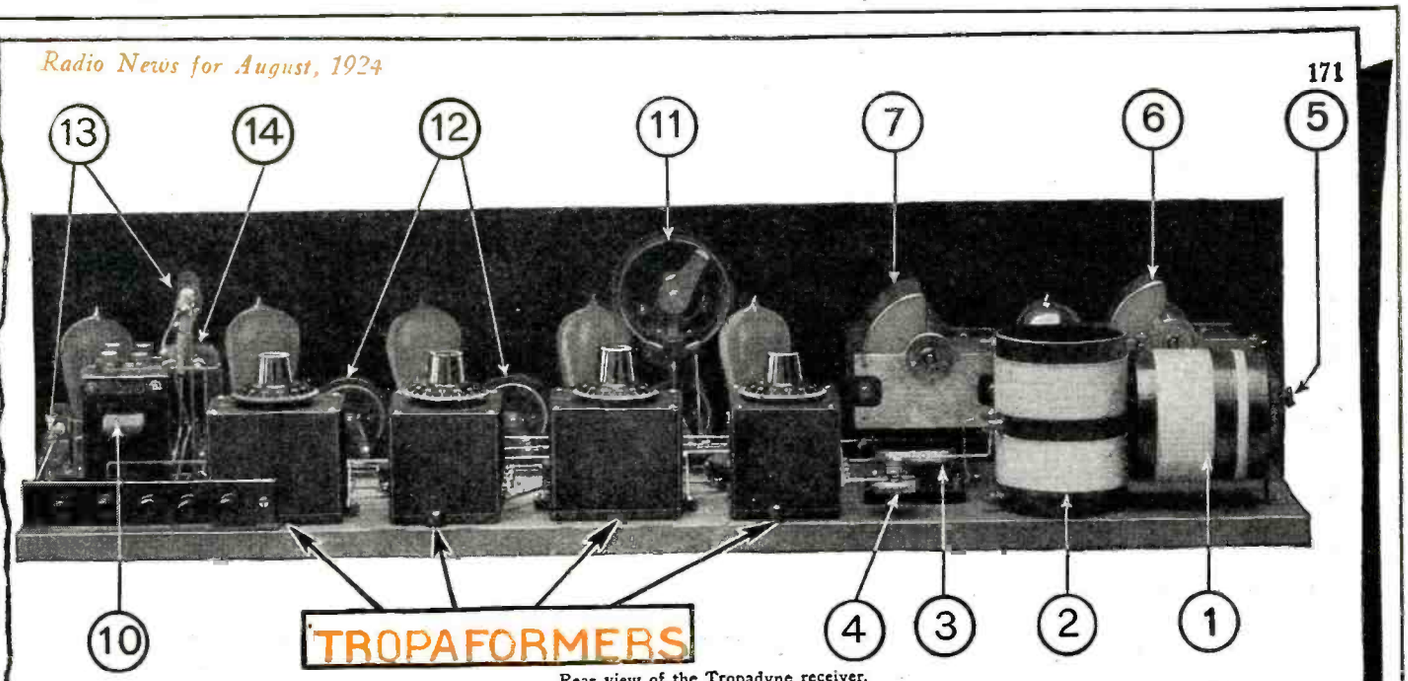
Only recently a street car conductor brought a three tube set into one of the stores for the instructor to look at. The conductor was about ready to give up. He had worked for weeks and had not heard a sound come from his loud speaker.

When the instructor looked over the set he could not find a thing wrong with it. Connecting up the set, the loud speaker still remained as quiet as the Sphinx. When a new detector tube had been inserted, the set almost broke the loud speaker with music. The owner of the set exploded with pride, and in a husky voice he said, "Gee, won't the kids be happy when they hear her now?"

That one man, in appreciation of the little accommodation the instructor gave him, has brought nine customers into the store since then and they have bought several hundred dollars worth of supplies. According to the manager of the company, that is a typical instance of how the radio schools are succeeding in bringing in business.

BEAT INTERFERENCE PRODUCED BY RADIO TRANSMITTING STATIONS

One type of interference to radio reception that is sometimes noticed is the constant pitch whistle produced by the "beat-



Rear view of the Tropadyne receiver.

The spacing of the R. F. transformer coils can be clearly seen. The numbers designate the following instruments: ., the tuner; 2, the oscillator coil; 3, the grid leak; 4 and 5, fixed .0005 condensers; 6, the tuning condenser; 7. oscillator condenser; 8, loop jack; 9, tuned R. F. transformers; 10, A. F. transformer; 11, potentiometer; 12, rheostats; 13, jacks for detector and loud speaker.

the Tropadyne circuit one tube acts both as oscillator and detector, and is a frequency changer. This is where this circuit gets its name; *tropaia* from the Greek, meaning change, and *dyne* meaning force.

Fig. 1 shows the Tropadyne circuit. Only one tube is shown, which is merely a frequency changer when used in a Super-Heterodyne receiver, and may be used with [illegible] type of Super-Heterodyne now [illegible] As shown in the [illegible] both loop [illegible]

The electrical center of the oscillator circuit is approximately at the center turn of the coil. In practice, this connection is not critical. It may be two or three turns either side of the center, without seriously [illegible] ing the efficiency.

Although [illegible] flowi[illegible]

be tuned independently to the same or different wave-lengths. This is a condition [illegible] never before been attained [illegible] tube[illegible]

THE TROPADYNE

Improved Super-Radio

(*Reprinted from August Radio News*)

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

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

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

While some firms are advertising matched or balanced transformers this is a misleading statement because even though they are 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. Fitch—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 shunt 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 containing four TROPAFORMERS with shunt condensers, tuner, shown under (1) in the above illustration, and one oscillator coil, shown under (2). 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**

Use Coupon if Your Dealer Cannot Furnish.

(Patents Pending)

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

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

SEND NO MONEY

Radio Industries Corp., RN 10
131 Duane St., New York, N. Y.

Gentlemen:

As my dealer cannot supply my needs, kindly ship to me direct the following articles, for which I will pay the postman on arrival.

.....
.....
.....
.....

Name .....
Address .....
City .....
My dealer's name is.....

RADIO INDUSTRIES CORPORATION

131 Duane Street, New York

Cable Address: Ricotrade, New York

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, 1141 Eleventh Street, Pukwana, South Dakota, wants agents and is willing to send a sample at his own risk. Write him today. —Adv.

ing" of the carrier waves of two transmitting stations. However, the Bureau of Standards says that the assignment of frequencies to the Class B broadcast stations is such that this interference should not occur. Radio supervisors assisted by the Bureau of Standards are doing their best to set and keep transmitting stations on their assigned frequencies and so eliminate this type of interference. If radio listeners will identify any two stations producing beat interference and report them to the Supervisors of Radio, Bureau of Navigation, it will help very much in this work.

A CURIOUS WIRELESS EXPERIMENT

One morning early in July, a very curious experiment was tried with some carrier pigeons at the radio telegraphic station of Paterna, near Valencia, Spain.

Several of these birds were released near the aerial mast at the same moment as the station was transmitting messages, and it was observed that the birds, through the influence of the electric waves, lost their sense of direction, turning round and round in confusion.

The tests were repeated many times, invariably with the same result, thus proving that the sense of direction of the carrier pigeons was destroyed by the influence of the electro-magnetic waves.

BRAZIL AUTHORIZES BROADCAST STATIONS

Permission to establish four radio broadcast stations has been granted by the Ministry of Public Works of Brazil to the Brazilian Radio-Telegraph Company for the purpose of broadcasting information, lectures, concerts, etc. The four stations are to be located at Sao Paulo, Bello Horizonte, Bahia and Pernambuco.

Radiotics

(*Continued from page* 501)

ON CHICAGO'S NORTH SIDE." This is indeed unusual, in fact it is alarmingly queer and decidedly improper. Imagine the condition in which Chicago's "north side" must be in. And the sets must be ten deep.

Contributed by Robert H. McCormac.

THIS SET WOULD FOIL AN EXPERT

From an article in the July 1924 issue of *QST* we are made acquainted with a new but intricate type of receiver. In the description it is stated that *"The primary coil has five tuners."* Just how the primary coil can have five tuners is a mystery, but if such be the case, the psychological effect of a glance at the secondary coil controls would paralyze us.

Contributed by A. Gough.

Correspondence from Readers

(*Continued from page* 502)

in the Navy at the following naval stations: Newport, R. I.; New Orleans, La.; Port Arthur, Texas; Galveston, Texas; Pensacola, Fla.; Charleston, S. C.; Cayey and San Juan, Porto Rico. My experience with

The Radiotrola "Baby Grand"

Radio Frequency Receiver

Range 500 to 1,000 miles

$18.50 Without Tube, Phones or Batteries

HERE is the New RADIOTROLA **"Baby Grand"** outfit which fills every requirement necessary to enjoy all radio broadcast entertainment.

From its conception, the MONODYNE was marketed as a single unit so that batteries and headphones remained exposed in the open. To meet an incessant demand, we designed a new cabinet, provided with compartments for all accessories and which outfit we take pleasure in presenting herewith.

The RADIOTROLA **"Baby Grand"** has a beautifully designed compact wooden cabinet finished in leatherette throughout. The connections are all wired, —ready for batteries, aerial and ground. A hinged cover with snap-lock protects the entire apparatus from dust. Cover specially provided with a broad flexible leather strap for vacuum tube. The cabinet is also provided with two compartments for phones, "A" and "B" batteries.

The original RADIOTROLA unit, Model GT2, of which tens of thousands are now in use all over the country, are still giving the highest of satisfaction in efficiency and long distance reception. Good as the old MONODYNE is, we have embodied a number of far-reaching improvements which make the RADIOTROLA **"Baby Grand"** incomparably better.

The RADIOTROLA **"Baby Grand"** is a tuned radio frequency amplifier and detector, which receives radio broadcast clear and loud without distortion over an average radius of 500 miles. Good reception over a radius of 1,000 miles has been frequently obtained.

The RADIOTROLA **"Baby Grand"** has ONLY ONE TUNING KNOB. Stations always come in on the same point on the dial. In addition it now is equipped with a new *Volume Control* permitting fine adjustments for long distance reception.

Size of complete outfit 7⅛x7¼x11¼.

Net weight, about four pounds.

For sheer performance, dependability, appearance, quality, long distance reception and price, the RADIOTROLA "Baby Grand" has no equal nor peer and stands in a class by itself.

DEALERS:—Write for Prices and Our Special Agency Proposition.

NATIONAL AIRPHONE CORPORATION

18 HUDSON ST. NEW YORK

IF YOUR DEALER CANNOT SUPPLY YOU USE COUPON BELOW

S-E-N-D N-O M-O-N-E-Y

NATIONAL AIRPHONE CORPORATION R.N.-10
18 Hudson Street, New York City.

Gentlemen:—Please send prepaid one No. GT-10 MONODYNE BABY GRAND outfit, for which I will pay the postman, upon delivery, the advertised price.

Name .....

Address .....

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

receiving apparatus has covered a broad field, all types and descriptions of Navy apparatus, commercial and amateur receiving sets, including the Super-Heterodyne, Neutrodyne and many others.

While stationed at the above mentioned shore stations, my duties were confined to alternate shifting of power man and operator, at the control stations, that is, I was fortunate enough to be able to work at both ends of the line for a considerable period of time, at all these stations. The result was that I developed into a fair operator and a good power man. I understand fully the principles and operation of the aforementioned types of apparatus, which includes the radio compass.

My sea service consisted of two years and eight months during the Great War. I was stationed aboard the Cruiser U. S. S. *Rochester*, and had considerable experience in the war zone; in addition I was stationed on the Destroyers U. S. S. *Nicholson*, U. S. S. *McDougal*, U. S. S. *Hopkins*, and the following light vessels, Nantucket Shoals, Nantucket, R. I., Charleston Light vessel, and Martins Industry Light vessel. This service was during my first enlistment from 1916 until 1924. During my second enlistment I have been doing duty at the aforementioned land stations.

In addition, I have had some experience as a broadcast operator. While stationed at Charleston, South Carolina, was operator in charge of station "WFAZ," of the Jordan Music Company, that city. I do not know whether this station still remains in commission or not. The writer has also had experience in the art of radio salesmanship, having worked in several stores during spare time, selling radio apparatus, demonstrating, installing, repair work, etc.

At the present time I am stationed at the remote control station of the Navy's high powered 200 KW arc station, located at San Juan and Cayey, P. R., jointly, and have been operating here for the past two years, as first class radio operator. I am also the holder of a commercial operator's license, a member of the American Radio Relay League, a member of our local radio club of San Juan, and a graduate from the "International Correspondence Schools" in Electrical Engineering.

The above is only a brief description of my long experience in radio and general electricity. It would require many pages to describe fully and in detail the entire story of my past and present work in this, the greatest and most wonderful of all sciences. The writer is seeking some form of electrical work either in radio or general electrical line, and will be satisfied with most any kind of a reasonable position, and guarantees to do his best and utmost in whatever may follow. The best of references can be furnished if required regarding my ability. It is my hope and desire that this letter may be read by someone who may give it consideration, as I would like to have the assurance of at least obtaining work before my final discharge becomes effective.

STEWART H. BUCHANAN,
U. S. Naval Radio Station,
P. O. Box 788,
San Juan, Porto Rico.

P. S. I also work Morse.

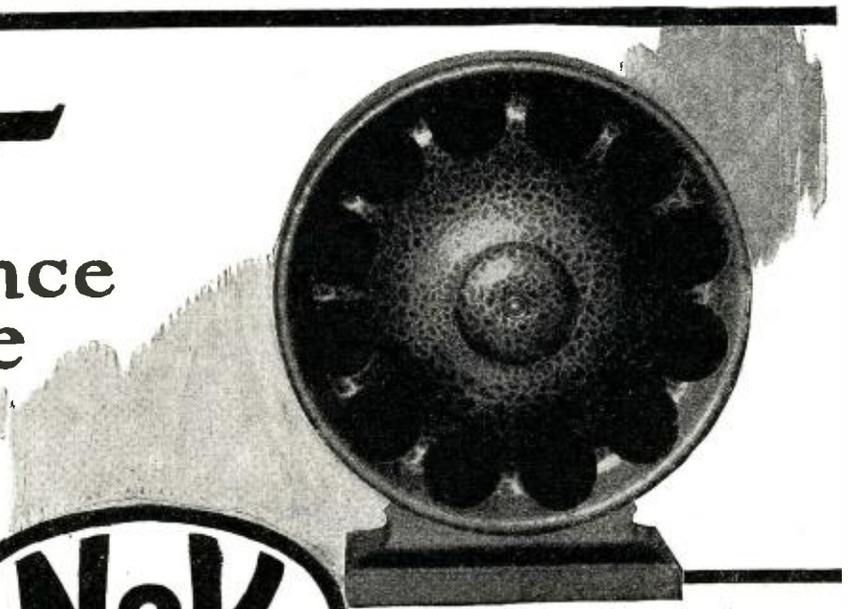
APPRECIATION

Editor, RADIO NEWS:

Let me express my appreciation of Mr. Cowper's article on page 49, July issue of RADIO NEWS. I have experimented with a great many reflex sets for over a year. With Mr. Cowper's circuit I got fair volume on my phonograph through a Baldwin loud speaker on local stations, by adding one stage of audio frequency amplification. I get all seven local stations with terrific volume, also KQO, Oakland, Calif.

new-

in Appearance
in Principle
in Results



N&K

Imported

LOUDSPEAKER

TYPE W

THE new N&K Loudspeaker, Type W, has broken away from all tradition. It is specially designed to overcome the faults common to the hastily produced speakers of the early days of radio.

It projects sound by *reflection*. In this process the sound is *diffused*, so that it issues from the speaker *in all directions*, not merely in one direct line. And it projects the sound waves in their *full* roundness thus avoiding distortion.

Type W is new and pleasing in shape, which, together with its handsome finishes, will harmonize with the most artistic surroundings.

Instead of wood or metal, a new lightweight material, *burtex*, is employed. This material has a quality of eliminating chatter and false vibrations, which so often ruin the effect of a speaker. The base is of wood, felt protected to prevent the marring of polished surfaces. The speaker unit has been designed by the same engineers and developed in the same factory as the famous N&K Phones. As a result, Type W is characterized by extreme clearness, mellowness and the accurate reproduction of high tones as well as low ones.

Operates without auxiliary batteries, and on any plate voltage from 45 to 150 volts. Requires no adjustment, thus eliminating the uncertainty and annoyance of adjustable units.

The N&K Imported Loudspeaker is now having an advance showing at a number of the leading stores in each city. Write us at once for names of dealers in your vicinity. The speaker is sold under a definite guarantee of satisfaction or your money back. Dealers are authorized to send it on *five days' approval* to responsible customers.

Try the N&K Loudspeaker in your own home, on your own radio set, at your convenience and convince *yourself* that it is *the* Loudspeaker for you. Price, complete with 6-foot cord, $27.50.

Free descriptive folder on request

TH. GOLDSCHMIDT CORPORATION, Dept. R10, 15 WILLIAM STREET, NEW YORK

This Loudspeaker is made by the makers of famous N&K Imported Phones, Model D, 4000 Ohms, price $8.50, and the N&K Phonograph Unit, price $7.50

I am using UV-201A tubes and 112 volts on the plate. The plate and Neutrodyne coils have 40 turns each; the choke coil is a 200-turn honeycomb. The panel is 11 x 14 inches, and the crystal is a 25-cent adjustable one. Audio frequency transformer, American 10 to 1 and Jefferson 7 to 1 ratio.

Distant stations require extremely sharp tuning and the local high power stations separate well.

Let me again say it's a bear.

Yours truly,
JOSEPH ERNST,
Seattle, Wash.

TELEPHONE RINGER INTERFERENCE ELIMINATED

Editor, RADIO NEWS:

I would like to express through the columns of your magazine my appreciation of the recent service rendered the radio listeners of our town by the local telephone company. Most of those who live in a small town know what a disturbance is created in local receiving sets by the ringer at the telephone exchange. This interference takes form of a continuous grinding which is impossible of elimination, even with the best of sets.

A few weeks ago I wrote to the American Telephone Co., telling them of this interference and asking them for some suggestion for its elimination. Two days ago their Kentucky representative from Louisville arrived in our little city and stated that he had come to remedy the trouble. After listening in on a local receiving set to ascertain the extent of the disturbance, he proceeded to the telephone exchange and placed *two choke coils and a bridging condenser in the ringer circuit.* Now, I am pleased to state, all interference has been completely eliminated. This simple trick was the solution to all our troubles.

I have told this because I feel sure there are hundreds of persons in the small towns who are being interfered with in their radio reception by the telephone exchange of the town. By suggesting to the local telephone exchange that the above mentioned remedy be used, all noises from this source can be eliminated and listening in will be once more a pleasure.

H. K. MAYFIELD.

ANOTHER REMEDY FOR "RINGER" INTERFERENCE

Editor, RADIO NEWS:

As an appreciative reader of RADIO NEWS, there is something I would like to pass along to other fans experiencing the same form of interference I did for some time.

I am right across the street from the local telephone exchange, where they have pole changer ringers which formerly created grave interference with the reception of broadcast programs on my set. I tried changing the position of my aerial several times and also tried using a loop, but to no avail.

About a week ago the manager of the telephone exchange placed a 250-turn honeycomb coil in series with the ground lead of the ringer circuit and since then I have experienced no interference from the ringers, in fact, I cannot tune them in on any wavelength.

W. E. PERRY,
Hebron, Ill.

RADIO LITERATURE FOR CANADA REQUIRES IMPRINT

Editor, RADIO NEWS:

Inasmuch as the United States radio manufacturers are now shipping large quantities of radio apparatus into Canada, of necessity they send catalogs, leaflets and other printed sales helps to their Canadian jobbers and dealers and, while it is generally not known in the States, the Canadian Customs will not permit literature of any kind printed in the

KARAS HARMONIK TRADE MARK

$7.00

A $20 Transformer for $7

"The Best Transformer Money Can Buy"

BEFORE KARAS designed this perfect transformer, any transformer that could deliver TRUE music would have had o be so large and would have cost so much to build that $20 would be a cheap price for it.

Over a year ago, our engineers were instructed to design the best transformer that could possibly be built — one that would excel all others — one that would greatly improve the quality of radio reception —both speech and music—and yet sell at a low price.

After a year's work and expenditure of many thousands of dollars the Karas Harmonik is ready.

It is not intended for folks who are content with the quality of radio speech and radio music as it has been up to now; but rather for those enthusiasts who want something better.

The price of the Karas Harmonik is $7.00—no more than the price of other transformers that used to be considered best. Only long experience and a highly efficient manufacturing organization could effect the economies that make this price possible. We gained this experience making hundreds of thousands of a very popular brand of transformer, on contract during the past 3 years. Before that we had been making precision electrical instruments for 30 years.

When you first hear music or speech amplified through Karas Harmonik Transformers, you will be delighted with the rich, full, round, natural tones. Musicians have criticised radio for lack of this quality heretofore. But it doesn't take the trained musical ear to recognize it now that we have achieved it—it is at once apparent.

What is it that has brought this wonderful change? The scientist will point to the nearly straight line amplification curve produced by the Karas Harmonik in laboratory tests. He will show you that the low audio frequencies that are not amplified by previous transformers *ARE* amplified by the Karas Harmonik.

He will show you how the high audio frequencies are amplified through the Karas Harmonik to the same degree as the middle tones. He will explain how this even amplification brings out the all-important Harmonics of musical tones—and that the presence or absence of Harmonics makes all the difference between music and noise.

But after all, the one real test is what your own ears tell you. Put a pair of Karas Harmonik Transformers in your old set and see what a tremendous improvement they make in the quality of your reception. Or if you are building a new set, and want the best possible results, use Karas Harmonik Transformers, by all means. They are unconditionally guaranteed to deliver a maximum volume of the best quality of amplification you have ever heard. In case your dealer is not yet stocked with our product, we will gladly supply you with a pair direct. Just fill in and mail the coupon below. No need to send any money unless you prefer to. When the Transformers are delivered to your home, just hand the postman $7 a piece with few cents for postage.

Never before have you been offered any radio apparatus so vital to the satisfaction and pleasure of your radio operation. Make sure of getting what you want by ordering right now, while you have our name and address before you. The coupon will bring you a pair of Karas Harmonik Transformers by return mail. Fill it in and mail today.

KARAS ELECTRIC CO., 4040 N. ROCKWELL ST., DEPT. 59-47, CHICAGO

Radio Jobbers and Dealers

Distribution of Karas Harmonik Transformers through regular jobber and dealer channels is being carried out as rapidly as the output of our factory permits. In the meantime mail applications will be taken care of in the order they are received, on an allotment basis.

Karas Harmonik Transformers will prove money makers for you. They sell on sight, and their unequalled performance in use will bring new customers. Write us today for full information concerning the Karas Harmonik, the laboratory and audibility tests it has passed, discounts and allotments.

To Set Manufacturers

We can positively prove that Karas Harmonik Transformers will vastly improve the musical quality of your set by any form of test you wish to impose. When you are convinced of this you will naturally want to use them. Write or wire us and arrangements for tests will be made promptly.

Karas Electric Co., Dept. 59-47
4040 N. Rockwell Street, Chicago, Ill.

Please send me.....pair of Karas Harmonik All Stage Ratio Audio Frequency Transformers. I will pay the postman $7 a piece. plus postage. on delivery. It is understood that I am privileged to return the transformers any time within 60 days if they do not prove entirely satisfactory to me. and my money will be refunded at once.

Name.....

Address.....

City.....

If you send cash with order we'll send transformers postage prepaid.

U. S. A. through the Customs unless it bears the imprint "Printed in U. S. A."

It occurred to me that, through the medium of your columns, you might advise them of this fact, saving considerable expense and delay in getting the proper literature to their Canadian friends.

E. RYPINSKI,
Manager Radio Department,
Perkins Electric Limited,
Montreal, Canada.

WIRING DIAGRAMS EASY

Editor, RADIO NEWS:

Since I read Mr. Roux's letter in the July issue, I have been thinking about it. Being a school teacher, I am used to making criticisms (both constructive and adverse). In regard to the intricacies of "wiring diagrams," I do not find them any harder than reading a book. The reason is simple; in school we had to learn the alphabet, thus getting a good foundation, upon which to build. If these radio infants would attempt to learn a few conventional radio signs, I do not believe they would find the diagrams hard to follow. I have built numerous sets and of varying types and in no case have I found it necessary to resort to "picture diagrams." The schematic diagrams were sufficient.

I find your magazine very interesting and often read several of the articles two or even three times.

Your RADIO NEWS READER'S BUREAU is a very good idea, since it helps to bring the advertisers and public closer together.

RADIO NEWS is very helpful to me in my experimental work because I can learn what others are doing, compare results and may, perchance, discover something new.

MAURICE A. CHRYSLER,
Topaz, Michigan.

A SUGGESTION FROM A SEA GOING OP'

Editor, RADIO NEWS:

As a radio operator, sea-going at present, and of past broadcasting experience, I have been doing a lot of thinking lately and have a grievance to get off my chest. The other day, while on watch, I happened to remember an article published in the official publication of the Union of Radio Telegraphers. This was written by an old telegraph operator, and as some of his remarks are applicable to radio operating, I am giving them as best I can remember. His remarks were about as follows:

"When I first got a job as telegraph operator in a little water-tank town, and still under the delusion of my own importance, the Division Superintendent came around. He patted me on the back, bade me remember that I held a job of great responsibility—that I was the personal representative of the company, etc. Of course, at that time I was all fed up on the "glory" of my position, but later on began to come out of it when I saw that while glory was a nice thing it didn't pay my bills. My pay was very low, as was usual at that time, and I had a hard time getting along." The writer of this article went on to state that finally the other operators got tired of the "glory" of their jobs, and struck for higher pay, which they got.

Now the condition of railroad telegraphers is much better than formerly, and because they got out of the Glory stage. This same disease is troubling the radio operating game at present. The fledgling operator, usually fresh from a training school, or with a correspondence school certificate in his pocket, goes aboard his first ship, his head full of the Glory of his new position. He remembers the wording of the school ads—"Be a radio Officer—see the world," etc., and consequently is elated with the thought that by a few months' schooling, he has attained the

When the Votes Are Counted—
be there with a Murdock Neutrodyne

THIS is going to be the most bitterly contested presidential election in years. The dominant issues will be fought out by radio. It's really going to be a radio election. When the "big guns" turn loose their battery of eloquence—get it all with a Murdock. Keep on the firing line. Feel all the thrill of it. Be there when the votes are counted.

Hear the real voice of the nation. To hear it full and clear—you want volume. You want selectivity. You want distance. You get all this with the Murdock. Volume that floods your room. Selectivity that enables you to tune out local stations and tune in distant stations—without interference. Distance that permits you to listen-in on the best radio programs of the country.

The unfailing resources, skill and experience of a pioneer manufacturer, who has been making radio equipment of the highest engineering standard for 20 years enter into the construction of the Murdock Neutrodyne.

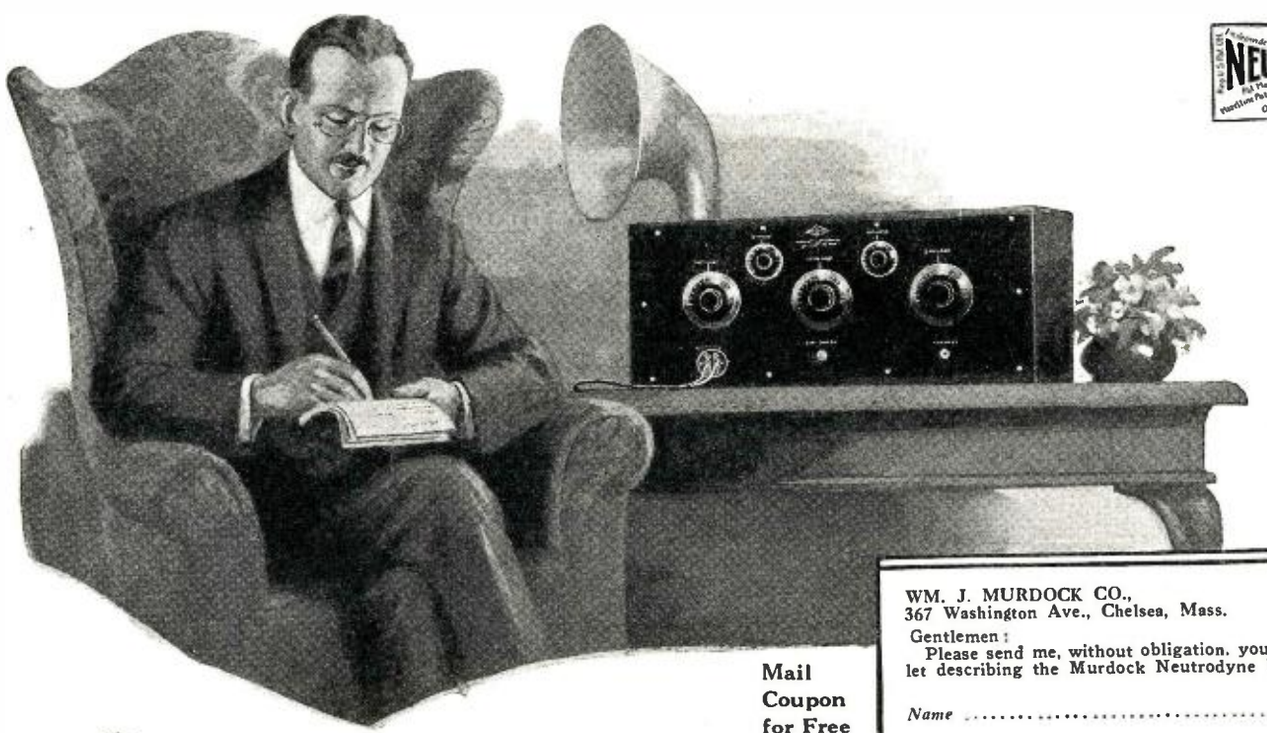
Radio at its best

THE Murdock is the ideal receiver for home use. It meets the most exacting tests of sound reproduction. It is so simplified and sensitive that no technical knowledge is necessary for its operation. You can place the Murdock in your home with full assurance that it will retain its efficiency for years.

Go to your dealer and let him demonstrate the Murdock Neutrodyne for you. He will arrange for installation. Our trade-mark symbol is your guarantee of complete satisfaction.

WM. J. MURDOCK CO., 367 Washington Ave., Chelsea, Mass.
Branch Offices: New York, Chicago, San Francisco

MURDOCK
RADIO PRODUCTS
Standard since 1904



R A D I O
MURDOCK

Mail Coupon for Free Booklet —Today

WM. J. MURDOCK CO.,
367 Washington Ave., Chelsea, Mass.

Gentlemen:
Please send me, without obligation, your Free Booklet describing the Murdock Neutrodyne Receiver.

Name .....
Street .....
City ..... *State* .....

glorious position of radio "Officer" on ship, failing to consider that although he is called an officer, his pay envelope remains thin. After a few months of the glory, he begins to wish that he could trade some of it for hard cash.

Now another howl. Most people after reading glowing advertisements of a radio operator's life, come to the conclusion that it is a snap, with nothing to do but listen in, occasionally punch a key, and immediately when in port, go ashore and "see the world." They don't know that much of the operator's time in port is taken up with necessary repairs on equipment, shining brasswork, and making out abstract sheets, which is a real job. Also there is nothing especially alluring in the prospect of sitting and calling a station for a couple of hours, and then after getting him, wrestle with interference and static while clearing the hook. All ship jobs aren't alike—a tanker or cargo job is pretty good—a man can set his own hours, and doesn't have to dress for dinner. But the grub on board most cargo boats and tankers could be considerably improved. On most passenger ships, except the very largest, two operators are carried, and as the government requires a constant watch held, the ops take turns on duty, in eight hour shifts. This is hard work, as there is little time left for anything except eating and sleeping. Also there is heavy traffic to be handled on passenger ships, so the operator is kept pretty busy all the time.

Now, to get at the root of my kick. Conditions in the game aren't as good as we could make them—and the sooner we operators get out of the glory stage, the better. There are no reasons why a union of radio telegraphers would not be practical now, and if one were formed, it would help to improve conditions. It is true that an attempt was made back in the early days to form a union. and that it blew up. But the reason for its failure was not in the principle, but in the application. If operators would only express their opinions through the columns of RADIO NEWS, and attempt to get together on the question, we could undoubtedly form a successful organization.

JOHN M. BALDWIN,
Operator, KDI; ex-KFGD.

WANTED—RADIO FRIENDS

Editor, RADIO NEWS:

Being a subscriber of your magazine, and having a growing interest for radio and electricity in general, I should be greatly obliged if you would put me in touch with friends through the columns of your magazine.

I am 19 years of age and should prefer to correspond with young fellows of about the same age.

It is my idea to exchange experiences with them.

ERNESTO DIAZ,
Box 224,
Caguas, Porto Rico.

MORE INFORMATION ON STATIC

Editor, RADIO NEWS:

The communication by Mr. Mason in the July issue of RADIO NEWS under the title of "Interesting Notes on Static" is very interesting, but in one instance, at least, somewhat misleading.

Mr. Mason states that "In very dry climates, like in California, there is very little static." As a general proposition this is probably true. but from my personal observation I question whether this is due to the "dry climate." Imperial Valley has practically no rainfall and is about the driest place in the entire State, being surrounded entirely by desert land and depending entirely upon irrigation for crop raising. The month of May was especially unfavorable for radio reception, owing to static which often reminded us of a "bull in a china-shop."

Not being a technical man, I cannot perhaps make clear my theory regarding static under conditions such as ours, and so I shall not try to use technical terms. I shall simply give the results of my personal observations covering a period of nearly two years. When we have a hot day with a temperature ranging from 100 to 115 degrees followed by a cool night we then have static, and the greater the difference in temperature between noon and night the greater the static. If a hot day is followed by a warm night, there is less static than when followed by a cool night. In other words, when the surface of the earth becomes heated, the radiating heat coming in contact with the cool air generates static in a way which our experienced technical men can explain to us. In mid-day, reception is clear, though not strong, but as evening comes on static begins, increasing until about nine o'clock, after which hour it gradually decreases, until by midnight, and often before that time, it has disappeared. It is my belief that the decrease is due to the equalizing of the temperature between the earth's surface and the cool air above. In the winter months we have no static to speak of because we do not have the extremes in temperature between noon and night.

While on the subject of static, may I add this further word. While static cannot at present be entirely overcome, reception has been made much better and therefore much more enjoyable by the installation of the high-powered broadcast station. We have no difficulty in getting the programs of KGO broadcasting on 1000 watts even when the static is quite bad, whereas static interferes greatly with reception from broadcasters using 500 watts. However, the 500-watt stations with low wave-lengths such as KFSG and KFKX come in much better than 500-watt stations with longer wave-lengths.

You certainly are to be congratulated on the splendid magazine you are publishing in the interest of radio.

C. Houston Smith,
Imperial, Calif.

ANOTHER LETTER FROM BRITISH 5XZ

Editor, Radio News:

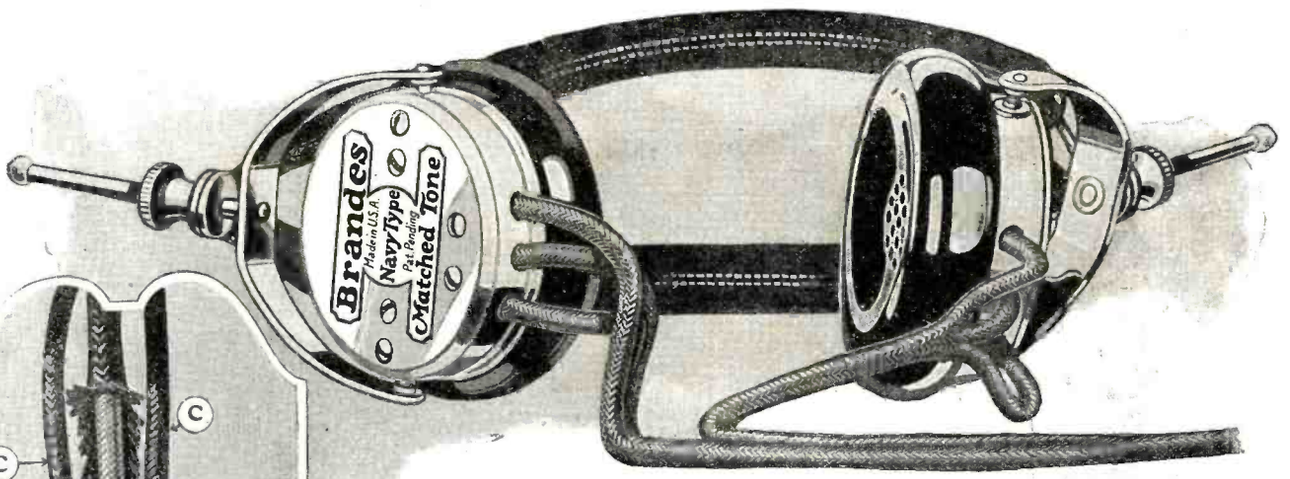
If I may occupy your valuable time once more, permit me to thank you for sending me a copy, gratis, of Radio News for June. Owing to the policy of your Government in retaining second class mail matter for shipment in American bottoms, it did not arrive until my English suppliers of foreign periodicals had obtained and sent me your July issue, and if your manufacturers have their catalogs, etc., dealt with similar dilatoriness, they have my sympathy.

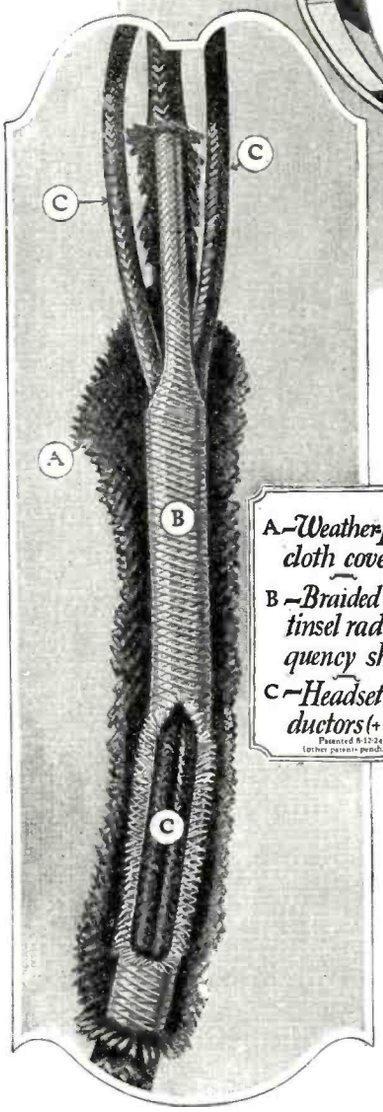
I have had a large number of communications from various American friends consequent on your publishing my original letter, almost all of which show that the ideas current in U. S. A. as to working and incidence of our licensing fees (what you call "Radio Tax") are hopelessly wrong. You no doubt are aware of exactly how our system works, but for the benefit of others may I explain it to you from the listeners' point of view.

Firstly, up to now there have been four sorts of licenses.

Broadcast Listeners' License.—Issued to those who have not ability to construct their own sets and who consequently should not be trusted with regeneration. They must use sets manufactured by members of the B. B. C., which are so designed as to not readily radiate or oscillate except under the conditions of ultra high plate voltage, etc.. such as would not be used in ordinary reception. Fee $2.

Constructors' License.—Issued to those who are able to construct their own sets. May use any circuit they choose. If they radiate and make a nuisance of themselves,





A—*Weather-proof cloth covering*

B—*Braided copper tinsel radio-frequency shield*

C—*Headset conductors (+ and -)*

Patented 9-12-24
(other patents pending)

3 *exclusive features of the* Navy Type Headset

TWO extra technical developments and one extra testing operation! These add clarity and distance. These are the three exclusive features which make the Brandes Navy Type the ideal long distance headset.

1. —The development of the braided copper tinsel radio-frequency shield [shown at the left] surrounds the conductor cords and grounds all radio-frequency currents which might cause detoning effects in the receivers. And in addition, it eliminates cord capacity.

2. —The use of inside terminals, so designed that the cords may be removed or replaced without taking off the cap of the receiver or in any way disturbing the perfectly matched tone.

3. —A very delicate testing operation matches the tone of the two receivers so that both ears hear exactly the same sound at the same instant.

And to assure absolute perfection of every detail, every Navy Type Headset must pass 22 different tests and inspections.

Brandes

Superior *Matched Tone* Headset $6
$7 in Canada

Table-Talker $10.
50¢ extra west of the Rockies
In Canada $14

Navy Type *Matched Tone* Headset $8
$11 in Canada

The name to know in Radio

subject themselves to penalty of withdrawal of license. Must use British parts. Fee $3 (more than BCL license as they do not bring any profit into the B. B. C., not necessarily having to buy parts made by members of B. B. C.).

Experimental Receiving License.—Issued only to those who have serious scientific investigations in view or who are competent to undertake same. May use any circuit or nationality of material. Penalty for interference with others as before. Fee $2.

Transmitting License.—Almost same terms as those in use in U. S. A. Fees depend on size of station, special facilities, etc. Although ordinary transmitting license is subject to a lot of restrictions they are easily waived, the Post Office being only too anxious to help the serious worker. The object is to cut out as far as possible the man who plays at transmitting.

The first two classes of license can be purchased over the counter at any post office.

The fees received from the first three classes are not a tax in the ordinary sense of the word, i.e., they do not go to swell the national revenue. From each is deducted a sum for administrative purposes, average 25 cents, the rest is paid to the B. B. C.

As you know, in the very small area of the British Isles (exclusive of Ireland) there are now eight main (5 k.w. input) B. B. C. stations and five relay stations. (The 25 k.w. station is also under test and will open soon.) This condition compares favorably with the number of stations in any state of similar size in the United States. If what my numerous correspondents tell me is correct, the stations must be fairly efficient as they appear to be often picked up by friends on your side as far west as California.

What all the correspondents who have written me appear to overlook is the fact that someone has got to pay for the loss of interest on the capital outlay of the American broadcast stations, the salaries of their staffs and the stores and current consumed even if the artists give their services free, which is not often the case if first class talent is to be got to broadcast twice, and that the cost of all that comes out of the public somehow. Apparently, the main difference with our system and yours is that the cost of broadcasting is got out of the public through the profits made in the radio industry in your case, which, of course, means that the incidence of the cost is unequal as between the parties benefited, whereas under our system all parties pay roughly equally for what they receive. A sidelight on how broadcasting is paid for in your country is furnished by the letter of Mr. Mortimer on page 76 of your July issue. By the time you get this letter, all receivers here will pay not only roughly, but exactly, equally for the service available to them.

I observe the note to your photograph of the Savoy Band in the July issue refers to their having attempted to broadcast to U. S. A. Why only attempted? I heard from one gentleman who was very proud of the ease with which he had heard them on three tubes in the Middle West.

A. F. C. BAYES.
48 Lavender Gardens. S. W.,
London, England.

BROADCASTING IN MEXICO

Editor, RADIO NEWS:

Two reasons, among others, have prompted me to write this letter to you, and they are the following: (1) The list of broadcast stations published in your July number, and (2) the fact that even though most BCL's consider a good record broken when they listen to some station located in a foreign country, very seldom reference is made to

some Mexican station, even though our stations are undoubtedly heard by you in the United States, which can be proven by the 9,700 letters which one station alone received from the U. S. in the short space of 10 days.

At the London International Radiotelegraphic Conference, two sets of letters were assigned to stations located in Mexico. They are: all combinations from CYA to CZZ and also all combinations from XAA to XDZ. The Mexican Government has reserved the use of all combinations beginning with an "X" for its own stations, and has assigned radio broadcast stations different combinations of three letters starting with CY or CZ. Broadcast stations operating at present are the following (by alphabetical order):

CYA, Mexico City. — Partido Liberal Avanzado, a political organization. It is now using a 100-watt set, which will be changed to a 500-watt one as soon as installation is completed. Its wave-length is 540 meters.

CYB, Mexico City.—"El Buen Tono," cigarette manufacturing company. A 500-watt transmitter is used. Wave-length is 380 meters. (This station has been reported from Rio de Janeiro, Brazil, a distance of nearly 5,000 miles.)

CYL, Mexico City.—"El Universal" and "The House of Radio," which are, respectively, a newspaper and a radio distributor. They use a 500-watt set and transmit on a wave-length of 510 meters. They have received reports from nearly every state in the American Union and every province in Canada, as well as from Panama and Colombia, in South America.

CYO, Monterey, State of Nuevo Leon. —Owned and operated by Constantino Tarnava, Jr. Wave-length used is 280 meters.

CYR, Mazatlan, State of Sinaloa.—Owned and operated by Rosseter & Co. It is a 250-watt station and it broadcasts on a wave-length of 440 meters.

CYX, Mexico City.—"Excelsior" and "Compania Parker." They are also a newspaper and a radio dealer, respectively. A 500-watt transmitter is used on a wave-length of 350 meters. They have also received reports from very many places in the United States.

CYZ, Mexico City.—"Liga Central Mexicana del Radio" (Mexican Radio League). 100 watts, 400 meters.

CZA, Mexico City.—Aviation Department, Ministry of War and Navy. This station is using a Mexican built (everything but the tubes was built in Mexico, and even the tubes could have been constructed here, but it would not have been economical), 100-watt set, while another Mexican built 2,000-watt transmitter is completed and installed.

1J, Mexico City.—An experimental station, owned and operated by Mr. F. C. Steffens, which also broadcasts very fine music on a 250-meter wave.

CYC and CYG are the respective call letters of the experimental (500 watts) station of the Ministries of Communications, and War, respectively. The Ministry of Public Education is now installing a station, which is said to be very powerful and through which courses and general educational features will be broadcast regularly.

Another 500-watt station is now being installed in the southern part of the republic in the city of Oaxaca, State of Oaxaca. As far as the writer knows, no call letters have been assigned to it yet. (As soon as it starts operating we will also have "our voice from the south.")

So you see, we have all the stations we need and, at least here in Mexico City, we get all the radio service we wish. We have our 1:30 p. m. concerts and every evening two different stations broadcast, the first from 7:30 until 9:00 and the second from 9:00 until 10:30.

THIS BATTERY WILL MATERIALLY REDUCE YOUR OPERATING COSTS ON HEAVY CURRENT SETS

NEW!

Eveready Heavy Duty "B" Battery. 45 volts. Three Fahnestock Clips. Length, 8 5/16 inches; width, 4 3/8 inches; height, 7 5/8 inches; weight, 13 3/4 pounds.

New low price, $4.75

New Heavy Duty 45-volt "B" Battery No. 770

Extra Large Cells— Extra Long Service

For maximum "B" Battery economy, use this *New Eveready Heavy Duty* 45-volt "B" Battery, in the following general cases:

1—On all receiving sets operating at 90 volts or more, having four tubes without a "C" Battery, and all sets having five or more tubes, with or without a "C" Battery.

2—On all power amplifiers.

3—On all sets that pull heavy currents from the "B" Battery.

Under the above conditions, the *New Eveready Heavy Duty* 45-volt "B" Battery will give much longer service than the 45-volt "B" Battery of usual size.

If your receiving equipment falls under any of the above classifications, you can make a big saving in "B" Battery costs by using this *New Eveready Heavy Duty* 45-volt "B" Battery No. 770. Buy it and you get the biggest battery value on the market to-day!

Manufactured and guaranteed by
NATIONAL CARBON COMPANY, Inc.
Headquarters for Radio Battery Information
New York—San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

If you have any battery problem, write to Mr. G. C. Furness, Manager, Radio Division, National Carbon Co., Inc., 122 Thompson Ave., Long Island City, New York.

EVEREADY
Radio Batteries
—they last longer

No. 7111
Eveready Radio "A" Dry Cell Specially manufactured for use with dry cell tubes

Eveready 6-volt Storage "A" Battery

No. 772
Vertical 45-volt, large size "B" Battery

No. 766
Eveready "B" 22½ volts. Six Fahnestock Spring Clip Connectors

No. 764
Vertical 22½-volt "B" Battery

No. 771
Eveready "C" Battery Clarifies tone and prolongs "B" Battery life

As to the music broadcast, after having heard repeatedly 36 of the finest American stations, I can truthfully say that any of them would be proud to broadcast the music that our Mexico City stations broadcast. The selections played by the orchestra of our best hotel are broadcast by a station located about a mile away; so you can plainly see we are up to date.

Now, therefore, you BCL's all over the United States, perhaps you have not heard any of our stations just because you have not tried hard enough to. After reading this letter you know that there are good stations both north and south of the Rio Grande, so tune them in, be delighted by good Mexican and Latin-American music, and *let us hear from you!*

FRANCIS GOMEZ, JR.,
Amado Nervo 61,
Mexico City.

Reflex Radio Receivers In Theory and Practice

(*Continued from page* 495)

potential is now applied to the grid, either in a positive or negative direction radio-frequency currents will travel beyond the bends, and the radio-frequency currents will consequently be modulated.

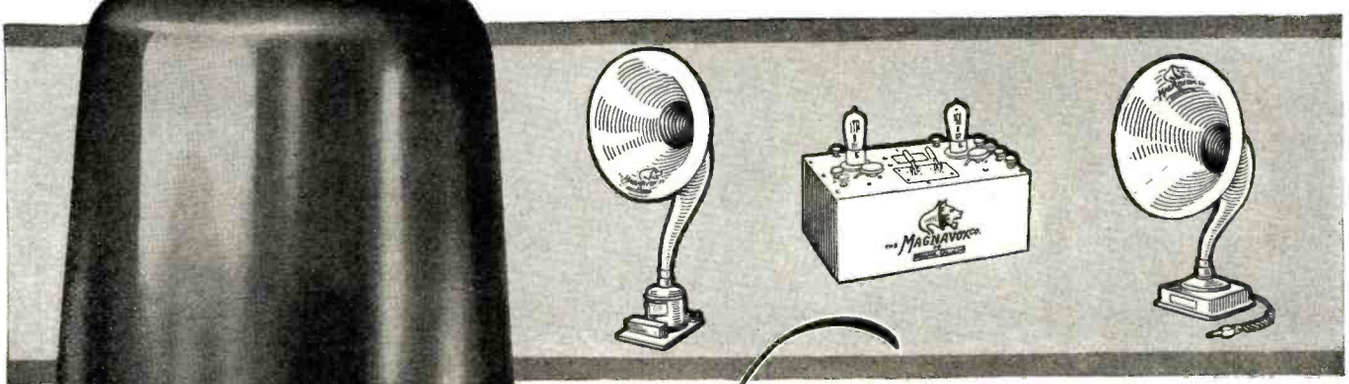
This is probably best explained by Fig. 14. The top line A shows the radio-frequency currents generated by the tube, and the line B shows an audio-frequency alternating current which is applied to the grid.

Fig. 15 shows, on the top line C, the sort of modulated radio-frequency currents produced by the tube as a result of the alternating potentials on the grid. These radio-frequency currents generated by the tube are rectified by the crystal detector in Fig. 12, or by any other detector used in a reflex amplification circuit, because the remarks made here apply equally to all reflex amplification receivers. The radio-frequency currents shown in line C of Fig. 15 are rectified and produce uni-directional currents as shown in line D, and these produce an average current in the form of uni-directional pulses which pass through the primary of the transformer T_1 T_2 in Fig. 12. The transformer converts these uni-directional impulses to alternating currents of the kind illustrated in line E, Fig. 16. These currents are now fed into the grid circuit and reinforce those which we have assumed are already being introduced into the grid circuit by T_2.

AUDIO FREQUENCY

We thus have a chain of audio-frequency feed-back which, while quite different from the ordinary kind of chain of audio-frequency feed-back, yet possesses the same properties of enabling audio-frequency oscillation to take place. The audio-frequency currents are, in fact, carried by the radio frequency currents generated by the tube, and only appear again after rectification by the crystal detector D.

When considering the generating action of an oscillating tube, we always presume that something has set up a momentary oscillation which is rapidly built up and maintained by the tube. So, in the same way, we may assume, in a circuit of the Fig. 12 kind, that there is some momentary audio-frequency potential applied to the grid of the oscillating tube. This will modulate the radio-frequency currents generated by the tube; these radio-frequency currents are rectified by the crystal detector, and the



Now a MAGNAVOX *Tube*

THE engineers who developed the famous Magnavox line of radio reproducing and amplifying equipment have now produced a *vacuum tube* equally distinctive and successful in its own field.

One trial convinces the most exacting user that the Magnavox will replace ordinary tubes to great advantage in any receiving set.

Magnavox Products

Reproducers of electro-dynamic and semi-dynamic type, for all vacuum tube receiving sets; $25.00 to $50.00

Combination Sets combining a Reproducer and Power Amplifier in one unit; $59.00, $85.00

Power Amplifiers for audio-frequency amplification, one, two, and three-stage; $27.50 to $60.00

Vacuum Tubes: A storage battery tube of new and approved design for all standard circuits . . . $5.00

$5.00

MAGNAVOX RADIO VACUUM TUBE TYPE A is a storage battery tube for use as audio frequency and radio frequency amplifier in all standard circuits. Highly recommended also for detector use. This tube is not critical of adjustment either as to plate or filament. Filament consumption one quarter of an ampere.

The most notable feature of the new Magnavox Radio Tube consists in eliminating the grid.

Unlike the ordinary storage battery tube, Magnavox Tubes give the electrons an unobstructed passage between filament and plate, with the result that the Magnavox has less than one half the internal capacity of other tubes of similar type.

Magnavox Radio Products are sold by reliable dealers everywhere. If unacquainted with the Magnavox store in your vicinity, write us for information.

The name Magnavox is your assurance of quality and efficiency.

THE MAGNAVOX CO., OAKLAND, CALIF.

NEW YORK SAN FRANCISCO

Canadian Distributors: Perkins Electric Limited, Toronto, Montreal, Winnipeg

10R

original impulse is reproduced again on a larger scale which reinforces it and a process of audio-frequency oscillation is set up.

This presumes that the tube V has oscillated, and it will be found that the effect of audio-frequency buzzing is always more likely to occur when the tube is on the verge, or is actually oscillating, due to using too tight a regenerative coupling. The same effect, however, may be started even though the regeneration is not sufficiently tight to produce self-oscillation. In this case the incoming currents of the carrier wave are modulated by the audio-frequency currents in the grid circuit. When the carrier wave is very strong this effect may be obtained, and the introduction of regeneration, of course, increases the strength of the carrier wave.

Another thing which starts the circuit buzzing is the actual incoming signal when receiving telephony. The modulated incoming signals are rectified by the detector and produce an audio-frequency current which modulates the carrier wave and so perpetuates the andio-frequency oscillation.

Very often a tube may have the regeneration so high that an incoming strong signal will set the tube oscillating, and once the tube oscillates at radio-frequency it is very liable to start oscillating on audio-frequency, due to the effect which has just been described.

(Published in conjunction with *Modern Wireless* London).

Crystodyne Receivers and Amplifiers

(*Continued from page* 468)

tentiometer. A potentiometer of about 400 ohms or more may be connected across a four or six volt battery connected in series with a second battery of about eight volts. Fig. 5 shows a receiver more particularly adapted to the reception of long wavelengths above about 1000 meters. The condenser C2 has a capacity of .2 mfd., the telephones a resistance of 100 to 150 ohms. For the reception of short wave-lengths, the circuit of Fig. 6 is preferable, especially if an antenna of large capacity is used. The condenser C3, of .0005 mfd., increases the stability of the oscillations. With such circuits it is possible to receive radio telephone signals without distortion by properly adjusting the circuit and the potentiometer.

It is also possible to use the zincite crystal as an audio frequency amplifier. The circuit of such an amplifier is shown in Fig. 7. In this circuit the rectified oscillations from an ordinary galena crystal detector or vacuum tube are applied to the primary of the audio frequency transformer TR, the sec-

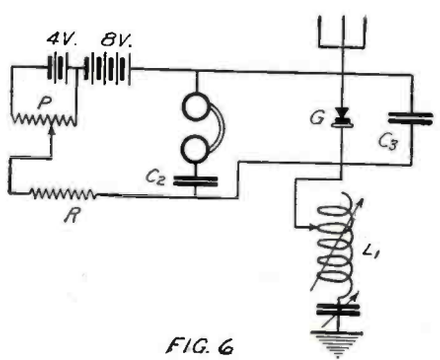


FIG. 6

Another circuit for short wave reception.

ATWATER KENT

RADIO

Simplicity Plus Exquisite Workmanship

IN radio, efficiency increases as experience refines and simplifies it:—If you will examine an ATWATER KENT Receiving Set you will notice the absence of intricate wires and controls:—you will be impressed with the simplicity of its construction.

Largely because of this simplicity—plus exquisite workmanship and precision of engineering skill, ATWATER KENT Receiving Sets have no peer in the combined features of selectivity, distance, ease of operation, tonal quality and volume.

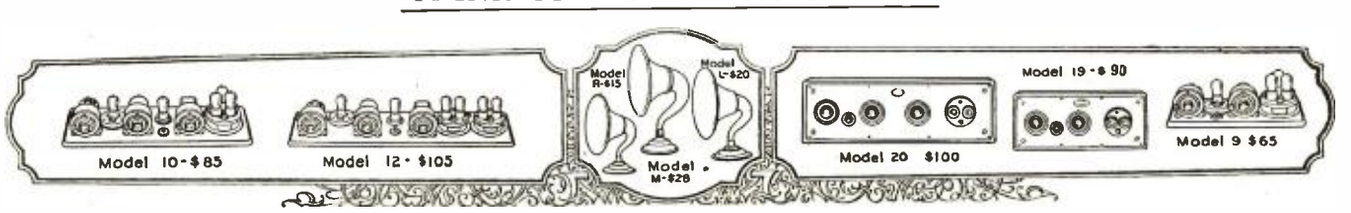
—and it is a significant fact that as radio gains new enthusiasts, the demand for ATWATER KENT grows.

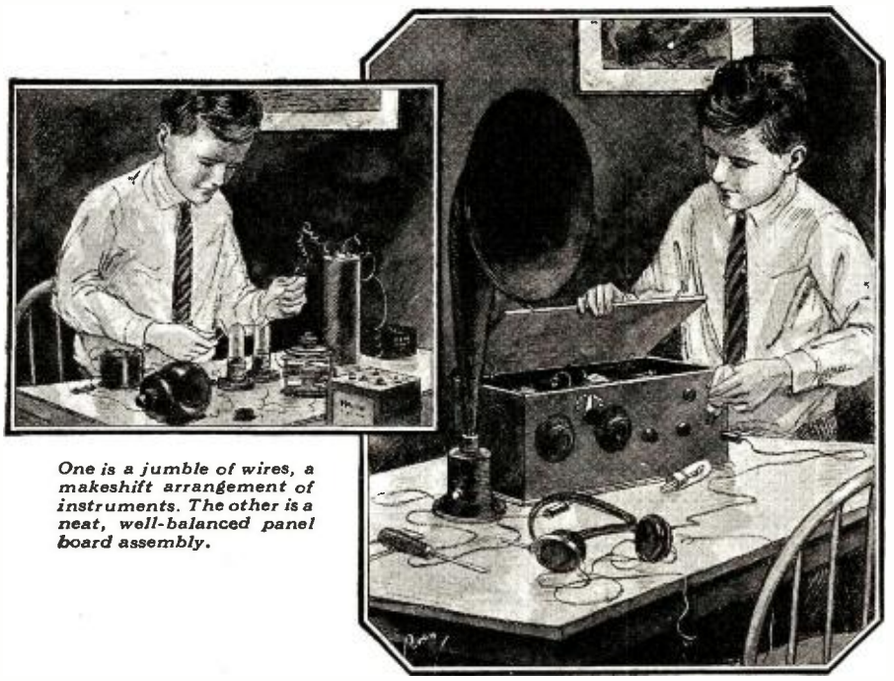
There is an ATWATER KENT Receiving Set to suit your preference, in size, price and type. There are three loud speakers to select from. Before you purchase, make it a point to see ATWATER KENT instruments and compare prices.

Instructive literature sent on request

ATWATER KENT MANUFACTURING COMPANY - *4943 Stenton Ave.*, PHILADELPHIA, PA.

THINK OF WHAT IS BACK OF IT





One is a jumble of wires, a makeshift arrangement of instruments. The other is a neat, well-balanced panel board assembly.

ondary of which is connected to the telephone and the resistance compensating circuit composed of a zincite-steel detector. By adjusting the potentiometer an audio frequency whistle is produced. The potentiometer is then turned back until the oscillations just stop when the antenna is disconnected. Then the antenna may be connected, and audio frequency amplification of the rectified signals is obtained. Since a certain rectification effect is produced in such an arrangement the signals may be somewhat distorted if loud, but it is possible to have clear reception by readjusting the potentiometer slightly.

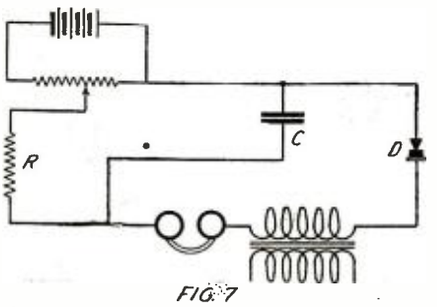


FIG. 7

An audio frequency amplifier using a zincite crystal instead of a tube.

It is needless to say that in all the circuits it is necessary to find a sensitive spot on the crystal exactly as with a regular crystal detector and it is also advisable to try several samples of zincite in order to determine which one is the most sensitive and produces the most steady oscillations.

In the next issue we hope to be able to present the diagram and characteristics of a complete station using zincite oscillators for transmitting and receiving. We wish to acknowledge our indebtedness to our contemporary *Radio Electricite* for the data contained in this article.

New Radio Patents

(*Continued from page* 503)

of a clip engaging each of the opposite ends of the condenser with a rivet passing through the clips to secure the clips to the condenser and cause the clips to press tightly against the plates.

RADIO CONTROL SYSTEM

(Patent No. 1,489,031, J. H. Hammond, Jr. Filed March 25, 1914, issued April 1, 1924.)

RADIODYNAMIC SYSTEM AND METHOD FOR AVOIDING WAVE INTERFERENCE in dynamic control systems. The system contemplates a transmitter of a plurality of differently characterized or contrasting impulses to the first of which only the receiving circuit is responsive and upon receipt of which the electrical constants are automatically changed so that the circuit becomes responsive to the next succeeding transmitted energy upon receipt of which a desired control may be effected. Interference from undesired sources will, therefore, not effect a control, for the particular combination of frequencies to set a control could probably not be determined by hostile stations.

MULTIPLEX RECEPTION

(Patent No. 1,489,287, A. H. Taylor. Filed May 29, 1923, issued April 8, 1924.)

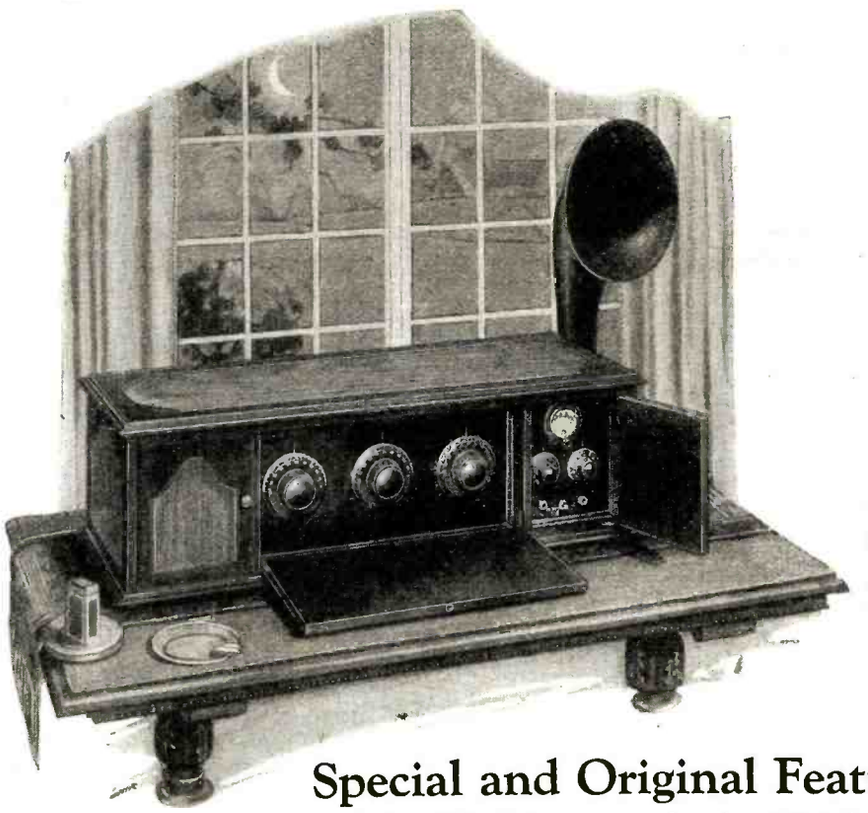
RECEIVER OF HIGH-FREQUENCY ELECTRICAL SIGNALS wherein a multiplicity of separate signal channels may be established on the same antenna. A rejector circuit is interposed between each receiver and the connections with the antenna for eliminating undesired reactions of one receiver upon another.

DIRECTIVE ANTENNA

(Patent No. 1,490,165, L. Espenchied. Filed Sept. 30, 1919, issued April 15, 1924. Assigned to American Telephone and Telegraph Company.

BALANCED ANTENNA SYSTEM for directive reception so arranged that it will produce maximum effect upon the receiving apparatus in response to oscillations received in a given direction, but will produce practically no effect upon the receiving apparatus in response to radiations received from the local sending antenna. Another

GILFILLAN NEUTRODYNE



STYLE GN-1

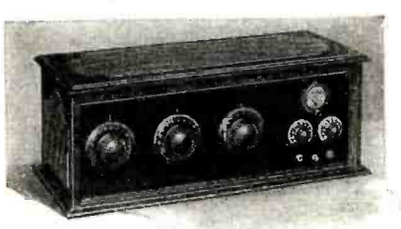
In an artistic two-tone American Walnut cabinet harmonizing with any interior Price without loud speaker, phones, tubes or batteries **$175.00**

Special and Original Features

The handsome cabinet of the GN-1 has space for the "B" battery and may be entirely closed when not in use. The essential parts are segregated into three panels with a door to each. It is a "straight line" set, with loud speaker Jack and ground, antennae and "A" battery Posts at the rear. It has a two-scale Voltmeter and low-loss Condensers of special design.

Parts for these sets are made in Gilfillan factories, and assembled under supervision of Gilfillan engineers. The Gilfillan reputation assures a perfectly balanced neutralized circuit of superior workmanship.

GILFILLAN NEUTRODYNE has a record of exceptional performance in the clear and delightful reproduction of speech and music from Radio Stations far and near. Literature on request.



Style GN-2 has the same NEUTRODYNE construction and features in a smaller cabinet. Price without loud speaker, phones or batteries **$140.00**

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GILFILLAN RADIO CORPORATION
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Independent Radio Manufacturers Inc.
Reg. U.S. Pat. Off. NEUTRODYNE Reg. U.S. Pat. Off.
Pat. Mar. 27, 1923 and April 4, 1924
Hazeltine Pats. NOS 1,450,080 - 1,489,228
Other Patents Pending

feature in the invention relates to a directive receiving antenna so arranged that its direction of maximum absorbing effect may be rotated at will, without affecting its faculty of producing substantially no effect upon the receiving apparatus in response to radiations transmitted from the local sending antenna.

WAVE CHANGER

(Patent No. 1,491,288, G. H. Clark. Filed May 2, 1919, issued April 22, 1924.)

RADIO SIGNALING APPARATUS including a wave changer system for arc transmitters. A loading coil and a fine adjustment coil are connected in the antenna circuit with switch arms adapted to make contact with said coils. Means are shown for connecting said arms to cause simultaneous movement to provide coarse and fine adjustment.

SWITCHING DEVICE FOR CONDENSERS

(Patent No. 1,491,341, A. H. Eaves. Filed Aug. 14, 1918, issued April 22, 1924. Assigned to Western Electric Company.)

CONDENSER made up of a number of fixed condenser units of various capacities with a switching device whereby the total capacity between a pair of terminals may be varied in the terms of the smallest capacity.

VACUUM TUBE BASE

(Patent No. 1,491,362, H. E. Shreve. Filed Feb. 20, 1918, issued April 22, 1924. Assigned to Western Electric Company.)

VACUUM TUBE shell for surrounding the base of a tube. The shell consists of a collar, a plate of insulating material fitted in the outer end of said collar and terminal connections carried by said plate for each of the tube electrodes. The plate is positioned within the collar perpendicular to the axis of the collar.

SELECTIVE RADIO CONTROL

(Patent No. 1,491,772, J. H. Hammond, Jr. Filed April 26, 1912, issued April 22, 1924.)

METHOD OF AND SYSTEM FOR SELECTIVE WAVE TRANSMISSION for control systems wherein the transmission station is provided with circuits for emitting a plurality of co-existing series of waves in groups having different group frequencies. The wave groups are emitted in sets having rates different from the wave group frequencies.

DISTANT CONTROL

(Patent No. 1,491,772, J. H. Hammond, Jr. Filed May 9, 1912, issued April 22, 1924.)

SELECTIVE WAVE TRANSMISSION SYSTEM wherein wave groups are transmitted at a distinctive rate obtained by means of interrupters or variations of wave amplitude. The transmission system includes a circuit inductively connected to the transmission circuit including a source of periodic impulses of a predetermined frequency. These impulses are varied at a frequency different from the first frequency. Another circuit is provided wherein periodic impulses of a still different frequency are produced. At the receiver a plurality of circuits are used tuned to respond to the several frequencies for operating a control by conjoint action of all frequencies.

SELECTIVE TRANSMISSION

(Patent No. 1,491,773, J. H. Hammond, Jr. Filed May 9, 1912, issued April 22, 1924.)

METHOD OF AND SYSTEM FOR SELECTIVE WAVE TRANSMISSION wherein selectivity in transmission is secured by employing distinctive wave-lengths and distinctive wave-group frequencies. A still higher degree of selectivity is secured by transmitting and receiving these waves and wave-groups at a third distinctive rate, which may be obtained by means of interrupters, variations of wave amplitude or in other ways.

SECRET RADIO SYSTEM

(Patent No. 1,491,775, J. H. Hammond, Jr. Filed Sept. 29, 1916, issued April 22, 1924.)

METHOD OF AND SYSTEM FOR TRANSMITTING AND RECEIVING ELECTRORADIANT ENERGY for securing secrecy in radio communication. The transmitting circuit shown includes a plurality of rotary spark gaps and a shunted tone circuit whereby a plurality of effective tone signaling frequencies are secured which are selectively received at the receiving circuit to operate any desired control circuit.

TUBE CONSTRUCTION

(Patent No. 1,492,000, H. J. Round. Filed August 26, 1920, issued April 29, 1924. Assigned to Radio Corporation of America, N. Y.)

THERMIONIC DEVICE FOR RADIO TELEGRAPHY AND TELEPHONY, in which the anode is situated at a distance from the cathode and is constructed of a pair of independent grid-like devices in close parallel planes. One anode is closer to the cathode than is the other anode. The grid is interposed between the anodes and the positive battery applied to the anode structure.

HIGH SPEED RECEIVING CIRCUIT

(Patent No. 1,492,321, H. M. DeR. DeBellescize. Filed Aug. 29, 1921, issued April 29, 1924.)

RADIO SIGNALING SYSTEM comprising an electron tube apparatus wherein the energy from the detector circuit is delivered to two differential low frequency circuits differently tuned. The two circuits have high time constants with respect to the oscillation frequency and the time constants of the high frequency receiving circuit.

It Will

bring in stations you never heard before

Reaching out through the ether—"fishing" for new stations in far away places—is a most thrilling "game." To many it is more than half the fun of radio receiving.

Success in this absorbing venture requires not only a good receiver but a headset capable of bringing in the faintest signal, clear and distinct. Such is the new supersensitive Music Master Headset. "It's equal to another stage of radio frequency," one user said.

The Music Master Headset is to other headsets what the Music Master Reproducer is to other loud speakers, because it is a precision instrument of the highest order.

And it is a handsome, comfortable set—sanitary and enduring. Ask your dealer to let you try one.

Music Master Corporation

Makers and Distributors of High-Grade Radio Apparatus

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Music Master
HEADSET

Music Master
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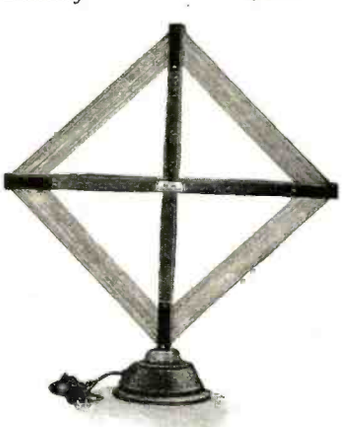
"The Musical Instrument of Radio." Greater volume with clearness. Connect as you would headphones. No adjustments.

14-inch Model, for Home $30

21-inch Model, for Concerts and Dancing $35



Music Master
Loop Aerial

Has perfect "aim" and extraordinary "reach." It is equipped with calibrated dial, and covers the entire band of broadcasting wave lengths.

Price $10

I Want To Know

(*Continued from page* 508)

wire wound on a form about three inches in diameter. The grid and plate coil may respectively comprise 65 turns of wire on a 2½ inch tube, tapped as shown, and about 50 turns of wire on a three inch tube.

Q. 3. Is it practical to use a switching system to secure any desired circuit?

A. 3. Losses, due to long leads and high resistance points of contact would be very high, and this method of connecting is not to be recommended. Coupling effects due to the long leads would prevent a correct comparison of the various circuits, at their maximum efficiency.

TUBE DATA

(2035) Mr. Clion D. Stutler, Salem, W. Va., requests:

Q. 1. What are the advantages and particular uses of the various tubes?

A. 2. The UV-199 tube is a very good radio frequency amplifier. It is an excellent detector and fair audio frequency amplifier. It consumes less current than any other tube, resulting in the lowest upkeep cost. The WD-11 tube operates in about the same manner as the UV-199 tube. One dry cell supplies the correct current for this tube, while a large flashlight battery is the correct supply for the UV-199. The WD-12 designation is for the WD-11, when a standard base is used. The UV-200 is the best detector tube available. It functions best when not preceded by an amplifier. This tube is a poor amplifier of either radio or audio frequency currents, due mainly to a low vacuum and gas content. The UV-200 requires a very high filament supply current, requiring a low resistance rheostat for proper control. The UV-201 consumes the same amount of current as the UV-200. Having a high vacuum, it is a particularly good audio frequency amplifier. The UV-201A tube requires only one-fourth the current of the UV-201 tube, due to a special filament being used, and functions in about the same manner. Having a high amplification factor, but a high internal capacity as compared to smaller tubes, it serves well as the intermediate radio frequency amplifier tube of Super-Heterodynes. This tube, or its equivalent, should be used where high amplification is desired at frequencies under 300 K.C. The Cunningham line, having the letter "C" preceding the tube number, may be considered, for most purposes, as equivalent to the Radio Corporation of America line designated by UV. In the DeForest line (designated by DV), the DV-2 may be considered as equivalent to the UV-201A, while the DV-3 tube closely resembles the WD-11, but where the latter uses a single dry cell, the DV-3 requires two dry cells for its filament supply. All tubes should oscillate easily. The best audio frequency amplifiers are the best oscillators. Myers tubes are designated only as Dry Battery, or Universal (operates with a storage battery filament supply). The former compares with the DV-3 tube, and the latter compares with the UV201-A and DV-2 tubes. Having a low internal capacity, the Myers tubes make very good radio frequency amplifiers. It is possible to use as high as 300 volts, plate potential.

Q. 2. What make is a "peanut" tube?

A. 2. This name has erroneously been applied to the UV-199 tube. It correctly refers to the Western Electric Type "N" tube.

Q. 3. What are the features of the "peanut" tubes?

A. 3. The N tube is about one-half the size of the UV-199 tube. Consuming one-quarter ampere, at 1.1 volts, it requires only one dry cell for best operation. It is an excellent radio frequency amplifier, at high frequencies, but is only a fair amplifier of audio frequencies. This tube is a very good detector.

Esperanto, Ilo, Ido—Which?

(*Continued from page* 471)

system. Decadent? Yes! As Rene de Saussure, who presided over the last Esperanto Congress which his friend Dr. Zamenhof attended, has put into practice a truly reformed Esperanto without Czecho-Slovakian letters. Of course Esperanto booksellers abhor it.

Again we hear noise and propaganda of "greatest numbers" in the fact that Esperantists—partly through paid propagandists—have distributed about a half million vest pocket texts for France alone. Alas, the official number of paying Esperantists there today is about 800 neutrals and 300 members of labor groups.

However, let us give them their due. They

The PAUL REVERE of TODAY

TWENTY miles in a single night. That was the wonderful broadcasting achievement of Paul Revere as he galloped from village to village, waking the country-side with the cry, "the British are coming."

Just one hundred and fifty years ago he made that broadcasting record. Today news flashed in any part of the country is heard almost instantly, not a mere twenty miles, but thousands of miles away.

In every part of the United States Crosley Radio Receivers are bringing in far distant stations clearly and distinctly. Up to the minute news, concerts, music, lectures, are yours to enjoy right in your home when and from where you choose if you own a Crosley.

Keeping always at the head of the procession in improvements and innovations, the Crosley Radio Corporation has made it possible for every one to possess the maximum efficiency in radio reception at the minimum cost.

The Crosley Trirdyn 3R3 illustrated below is, in the opinion of many experts, the best radio receiver ever offered to the public at any price. The experiments of over 200 experts have shown that in ease of tuning, sharpness of signals and nicety of calibration, the Trirdyn cannot be excelled. Local stations may be easily tuned out, even if very close to you, and far distant reception almost instantly brought in.

The Trirdyn 3R3, illustrated below, is a 3-tube set incorporating tuned radio frequency amplification, regeneration and reflex. It has been proven to give the efficiency of a 4 or 5 tube set. And yet it is priced at only $65 without batteries, tubes and headphones. The Trirdyn Special, set in a special solid mahogany cabinet which is made to house all necessary accessories, may be had for only $75.

Before you purchase a radio receiver listen in on a Crosley Trirdyn
For Sale By Good Dealers Everywhere

Crosley Trirdyn 3R3, $65.00

Other Crosley Models

Crosley 50. A one tube Armstrong Regenerative Receiver. Price, less accessories, $14.00. A two stage amplifier, Crosley 50-A, may be added to it for only $18.00, thus making a three tube set.

Crosley 51. The two tube Armstrong Regenerative set that became the biggest selling receiver in the world in just 24 days. Price, less accessories, $18.50. By adding the Crosley 51-A a one stage amplifier at $14.00, a three tube set may be formed.

Crosley 50-P. The Crosley 50 in neat strong Portable quartered oak cabinet less accessories for only $18.00.

Crosley 51-P. The Crosley 51 in compact leatherette portable case completely self-containing less accessories at $25.00.

Crosley 52. A new Armstrong Regenerative 3-tube set assuring loud speaker volume on distant stations under almost any conditions. Price, without accessories, $30.00.

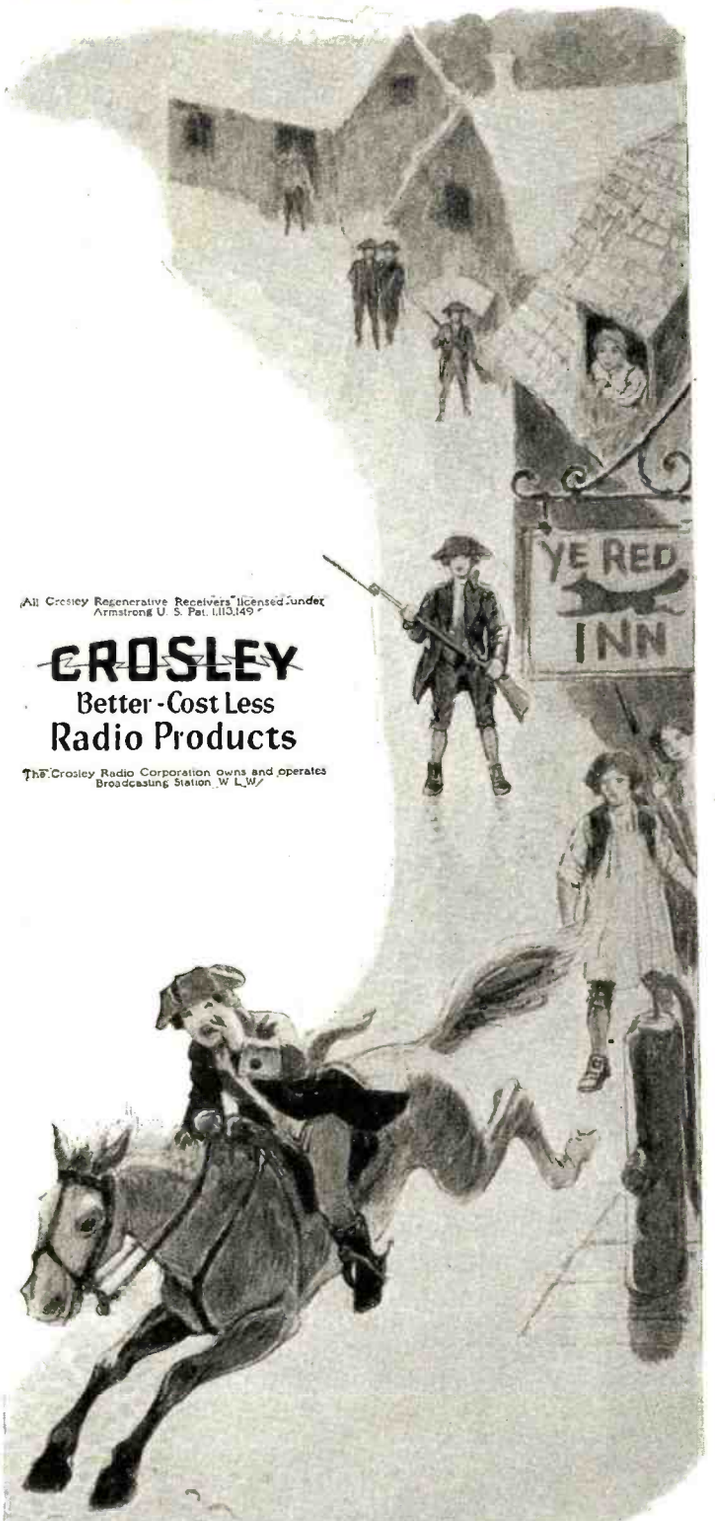
Crosley X-J. One of the best known and most popular 4-tube receivers on the market. A radio frequency set at $55.00 without accessories.

Crosley X-L. A rearrangement of the 4-tube Crosley X-J set in a beautiful mahogany console cabinet. Price, without accessories, $120.00.

THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

1022 Alfred Street Cincinnati, O.



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Better-Cost Less
Radio Products

The Crosley Radio Corporation owns and operates Broadcasting Station W L W

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

Name _____

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are clever propagandists, if somewhat unscrupulous in evading the issue of "trial by comparison." Their British member, Harry Epstein, has several stenographers available, while most Ilists until recently had to sacrifice their own time to get a fair hearing. The idea of paying for distributing Ilo literature has never been dreamt of.

Contrary to the opinion of most Esperantists, Ilists do not regard the growth of Esperanto with entire disfavor. They dislike its vociferous methods of propaganda. More science and less fanfare, brothers!

Ilists recognize the obvious fact that their system was in a formative stage for many years and is only now commencing to carry on an effective propaganda. They admit that it can still grow and they "grow it!"

Research men the world over dislike premature publicity. Hence Ilists regard every Esperantist as a possible adherent, as all leading Ilists are ex-Esperantists. All the members of the RAIL,—who are among the leading radio engineers of the United States—have tested both systems—some of them as far back as 1905. They are now Ilists. Most Esperantists, unless of the "rule or ruin" type of fanatic, can be reached eventually through an impartial exposition—and practical test—of the relative merits of the two.

Dr. Cottrell of the Bureau of Mines, Muscle Shoals Division, and Mrs. Dave H. Morris (nee Alice Vanderbilt) are backing the RAIL movement neutrally, and are building a sound structure to give a real test to both projects within the next two years. This will be under the I. A. L. Association of Washington, D. C., and will be impartial. In the meantime, to get a fair hearing, Ilists are waking up to the necessity of making the public "take notice" of their careful researches from 1907 to 1914, and to insist on a trial of the result.

Do not let Esperantists tell you they have 4,300 roots:—they have about 2,800 and Ilo has four times that number from which "borrowings" are taking place right along by the followers of the "one-man" system.

Now to return to the false claims of the Esperantists of "support" by the League of Nations! This is childishly naive when not downright deceptive—in intent, if not in form.

In spite of the efforts of its partisans, Esperanto failed at the League of Nations. But the "setting" had been cleverly planned. Dr. Privat, an Esperantist, was employed by the League. He succeeded, although a citizen of Geneva, in being named as a Delegate from Persia!

The report presented later, on Esperanto, was largely his work and contained gross inaccuracies and exaggerations. So much so, that one section of it had to be suppressed by the Under Sect. of Int. Bureaus, Dr. Nitobe—somewhat friendly to Esperanto himself!

To show this clearly I quote from a letter to myself from Dr. Nitobe under date of October 9, 1923. Asked why the 5th Chapter in the Report, "Esperanto as an International Auxiliary Language" was omitted, he replied "I would say that the report . . . was intended to be entirely and wholly objective (that is non-partisan—O. C. R.) Chapter 5, however, contained conclusions which were not considered objective enough and it was therefore omitted."

In other words the Esperantists tried to chloroform or stampede the Committee on Intellectual Co-operation making the report. Finally, the Fifth Committee, which looked over this report, did not include the resolutions based on its gross inaccuracies and there the matter rested "up in the air", as the natural languages had been suggested instead, by said Fifth Committee. So much for the great victory! Page 47 of this report gives only 3.300 students (including the merely curi-

Greater Distance
on the loud speaker

NO ordinary standards of distance can be applied to the Ultradyne Receiver. The "Modulation System" of radio reception, used exclusively in the Ultradyne, completely revolutionizes all previous conceptions of range.

The "Modulation System" is the latest development of R. E. Lacault, A.M.I.R.E., Consulting Engineer of this company and formerly Radio Research Engineer with the French Radio Research Laboratories.

This "Modulation System" is a decided departure from the detector arrangement used in all other Super-Heterodynes. It causes the incoming signal to modulate the oscillations produced locally just as the voice modulates the carrier wave of a broadcasting station. Provides greater rectification and produces greater signal strength which is far more noticeable on weak signals.

In addition the Ultradyne incorporates every good feature of all types of Super-Heterodyne receivers.

Just operate one! No description could possibly convey any adequate idea of Ultradyne performance.

Send for the 32-page illustrated book giving latest authentic information on drilling, wiring, assembling, and tuning 6 and 8 tube Ultradyne Receivers.

50c

Ultradyne Kit

Consists of 1 Type "A" Ultraformer, 3 Type "B" Ultraformers, 1 tuning coil, 1 oscillator coil, 4 matched fixed condensers.
The Ultraformers are new improved long wave radio frequency transformers, especially designed by R. E. Lacault, Consulting Engineer of this company and inventor of the Ultradyne.
To protect the public, Mr. Lacault's personal monogram seal (R.E.L.) is placed on all genuine Ultraformers. Ultraformers are guaranteed so long as this seal remains unbroken.

$26.00

Write for descriptive circular

ULTRADYNE
The Improved
SUPER-HETERODYNE

PHENIX RADIO CORPORATION, 3-7 Beekman St., New York City

uos) in all of Great Britain. The League moreover never considered Esperanto as a world culture.

Let us all forget numbers and lump the active opposing camps on the best available statistics as 25,000 Esperantists and 12,000 Ilists.

Esperantido, Romanal, Idiom Neutral, etc., altogether have not 200 active followers, so why does Mr. Sayers bother to knock them down to show his system's strength.

Here's a study in the "jargon" from a recent number of "Esperanto Triomfonta." Note the absurd results of the lack of strict logic—which they hate—in Esperanto work formation.

"Kvankam la strasburgoj "MARISTOJ" ne ELTROVIS novajn kontinentojn au insulojn, ili PERIS la komercon kun multe da europaj urboj kaj al unu el la kuragha ARO la dankema patro urbo starigis tomb-monumenton."

Put into English this means "Although the Strasburg sailors did not discover new continents or islands, they "by-means-of-ed" *i.e.*, "mediated in"! (A beautiful example of logical tiddle-de-winks.) — commerce of many European cities. To one among the courageous "ary" (cf. diction—ary!—*i. e.*, a collection) the thankful "birth-city" set up a tomb-monument!"

Isn't it natural and easy!

It is—not! Play it on the microphone.

In England Major Gen. Sir Francis Mulcahy, K.C.B., wrote to the *Radio Times* of July 4: "If the more logically constructed, more perfect and more euphonious language is to win, then Ido (Ilo) will succeed, just as Esperanto has replaced Volapuck. Wireless can not be bound to any system other than the best, which in this matter is the younger."

The Esperantists are digging up all the pettifogging quibbles which, casuistry and a new sense of insecurity—due to the European and American growth of interest in Ilo—can suggest.

Propagandists like Kotzin, Aymonier, Guerard and Collinson are not to be mentioned in the same breath with Talmey, de Beaufront, Conturat and Jesperson and even de Saussure, who has a reallv improved pure Esperanto dialect.

What should the readers of RADIO NEWS do to get a fair idea of these systems, without too much effort? I suggest they send to me at Beacon Chambers, Boston, Mass., for L. H. Dyer's 170-page book on the whole question. It is fair and impartial and scholarly without being heavy. It has more judgment and common sense in its point of view than anything else that has ever been published about any system whatever.

In the fall Ilo will have the most complete dictionaries of English terms ever produced in any auxiliary language—30,000 words with antonyms and synonyms.

Twenty radio stations in the U. S. and Canada are getting ready to tie in with radio sections of newspapers in teaching Ilo by the "University of the Air."

Vivez Ilo la, futura linguo por omna radiori.

IN SUPPORT OF ILO

Editor, RADIO NEWS:

With Hazlitt I agree: "If we do not vindicate our opinions, we seem poor creatures who have no right to them; if we speak out, we are involved in continual brawls and controversy."

Fine!

Henceforth, the able editor of RADIO NEWS and one of his readers agree to disagree—but, if agreeable to you, let us remain friends.

Continue to toot, with all those who have tried for a long time to force Esperanto upon radio fans, and who failed dismally, and I promise you that I shall do my level best to promote Ilo (Ido). I cannot do otherwise,

Latest Radio Science by the Box

Builds Best Circuit Best

With marked improvement in ease of control, Erla Selectoformer assures maximum range and volume. Cost and complication are reduced. $5 each

Distortionless amplification of 3 stages, exclusive in Erla Audio Transformers, indicates their vast superiority. Price $5.00

Millions of Erla Bezels are in use, enhancing beauty and utility in any set. 1" and 1 1/2" diameter for 3/8" to 1/4" panels. Nickel, black and gold. Price 20c — 30c

Made in 11 sizes, there is an Erla Tested Capacity Condenser which will improve your set by its certified accuracy. 30c to 75c

Actual construction of Erla Duo-Reflex Circuits now is vested with advantages paralleled only by the matchless reception that is assured.

So much more powerful, tube for tube, these extra-efficient circuits now, too, are easiest to build.

Under warranty, factory sealed, the Erla blue-and-white protective carton brings every last thing needed for success. From synchronizing reflex and audio transformers, tested capacity condensers, balanced crystals, clear through to the drilled and lettered panel, stenciled baseboard and full size blueprint, nothing is lacking for correct, confident, precision assembly by any amateur. Professional results are assured.

Typifying the perfect simplicity to be expected, are Erla ingenious solderless connectors, which banish soldering; so that the only needed tools are screw driver and pliers.

The completed receiver is bound to represent in their most intensive, *accumulated* form, all those superiorities of tone quality, selectivity, range, volume, and ease of control, which make Erla units preferred in any set. Ask your dealer about Erla knock-down receivers, factory sealed in the blue-and-white carton, fully warranted. Or write direct, supplying your dealer's name.

ELECTRICAL RESEARCH LABORATORIES
Department C, 2500 Cottage Grove Avenue, CHICAGO

ERLA

Precise synchronization of received and reflexed radio frequency impulses is assured by technical perfection of Erla Transformers, best for reflex work. $5.00

Erla Fixed Crystal Rectifier is the standard for extreme sensitiveness with stability, assuring clearest reception. List price $1.00

Recognized Erla precision, refinement and scientific excellence are offered in the Erla Socket, with neat nickel shell on strong Bakelite base. 2 sizes, 65c—75c

The push-pull principle in an audio transformer of Erla original design and technical excellence, assures unequaled clarity and volume. List $5.00

because I *know* Ilo is the only perfect radio auxiliary international language in existence!

Please believe me when I tell you that I am convinced you are blameless. Sooner or later, you will find out for yourself that your investigator was subjected to a great dose of Espo chloroform, and was, naturally enough, still very much under its influence when he induced you to support a decadent language system, which the men on Main Street will never, never, never, never accept! Too bad, indeed, that the Espists have "put one over on you," via your investigator. They tried the same thing on *La Presse* (Montreal) many times, but we saw them coming, miles away!

La Presse did not want to induce its army of readers into error, so we investigated the problem of linguistic intercommunication in most thorough fashion, with the result that we are now doing so, and shall continue to promote Ilo (Ido) in every way possible. We gave the Espists their chance and our readers refused to have anything to do with it. From CKAC, we gave several Espist talks and radio fans very bluntly told us to choke the lecturer. Poor old gentleman, he did his little best, and failed horribly.

On the contrary, Ilo has proved to be an immense favorite with the public, and from the very start. We are simply delighted, because, in our case, as in others, which I could mention, Ilo is proving to be a magnificent circulation booster, and, at a time of the year when circulation usually drops off considerably. Since Ilo's welcome advent to our columns, our circulation has not only maintained high Winter levels, but is shattering all records. These are ABC facts. Furthermore, CKAC's mail from Ilo enthusiasts is assuming alarming proportions. We know that the public does not want Esperanto. If it did, we would give them all the Esperanto they could assimilate. We know that Ilo is the public's favorite—overwhelmingly so! All the resources of the paper will continue to serve the public and Ilo will go across in double-quick time. We will be on the air every night with Ilo as soon as we get our new, big set installed. Then, nothing shall stop us from spreading the truth everywhere in North America. The big broadcast stations are with us, heart and soul.

Now that you have committed yourself to Espo, you will, no doubt, support the findings of your investigator—that is, you will do so, until you discover the truth and understand the whys and wherefores of Espo's rise, decline and fall. So, stick to your guns and may we both live long enough to congratulate the victor!

The late George William Curtis, of revered memory, wrote in the September, 1886, number of Harper's Magazine, of which he was the editor:

"Progress is completed by persuading the majority, by showing the reason and the advantage of the *step forward,* and that is accomplished by appealing to the intelligence of the majority."

Mr. Gernsback, this "intelligence of the majority" is certain to defeat you or me. *Tekel upharsin!* For all who have eyes to see it is not difficult to read the signs of the times!

Purposely do I respectfully refrain from even attempting to convert you and I have no doubt you would justly resent any such attempt, since you have decided to join the Espo camp. Besides, "he that complies against his will is of his own sweet opinion still."

Nevertheless, I thought you would like to listen to what I have to say in the friendliest spirit possible.

Kun maxim kordiala saluti,

JOHN P. CALLAGHAN,
Manager, Promotion Department,
La Presse,
Montreal, Canada.

(*Continued on page* 554)

New complete line of radio batteries

AN even better battery and at a much lower cost! That is what you will say when you examine the new Exide "A" Battery.

The composition case including handles is moulded in one piece, beautifully stippled and finished in glossy black—an ornament to any room.

Notice the refinements that have been made—broad inter-cell connectors that fit close to the top of the battery and add to its sturdiness. Off-set terminal binding posts that facilitate hooking the battery to the set; the same wonderful Exide plates, the same separators and the same electrical efficiency as the old battery—yet lower in cost!

There are, of course, the Exide two-volt and four-volt "A" batteries for low voltage tubes. These are midgets in size but giants in power.

New "B" Battery in glass jars

With the increase in popularity of the many-tube sets has come the need for a "B" battery of greater capacity than the twenty-four volt, 4000 milliampere hour, rubber cell Exide used with smaller sets.

To meet this need the new Exide "B" batteries in glass jars were designed. They are made in two sizes—twenty-four and forty-eight volts but with larger plates and greater space for electrolyte, they have a capacity of 6000 milliampere hours.

The new Exide rectifier

With this attractive and compact rectifier, your "B" battery can be recharged from your regular alternating house current, at a cost that is insignificant because of its unusually efficient characteristics.

Whatever the size of your set, all of your battery needs can be filled from the complete Exide line. These batteries accepted everywhere as the standard of quality, are made by the world's largest manufacturer of storage batteries for every purpose.

Exide Radio Batteries are sold by Exide Service Stations and Radio Dealers. Ask to see them.

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA
In Canada, Exide Batteries of Canada, Limited, 133-157 Dufferin Street, Toronto

The beautiful new Exide 6-volt "A" battery in one-piece case. Many new refinements but the same old rugged power. $14.60 up f.o.b. Philadelphia.

Exide
RADIO BATTERIES

2-volt "A" battery for low-voltage tubes. Also made in 4-volt size. Prices $5.40 and $7.30 respectively f.o.b. Philadelphia.

New 24-volt Exide "B" battery in glass jars, 6000 milliampere hours capacity. Also made in 48-volt size. Prices $12.00 and $23.30 respectively f. o. b. Philadelphia.

New Exide Rectifier. The economical device for recharging your "B" battery from your house current. $2.00 f. o. b. Philadelphia.

Famous Exide "B" battery for smaller sets. 24 volts, 4000 milliampere hours capacity. $10.00 f.o.b. Philadelphia.

For better radio reception use storage batteries

ESPERANTO, ILO, IDO

Editor, RADIO NEWS:

As a reader and an occasional contributor to your publications from even *Modern Electrics* pre-"tips" days and the little yellow cover, I am sorry to see you advocate Esperanto instead of Ilo. As you are generally ahead I presume it only unfamiliarity with the subject that allows you to do so. Having been familiar with Esperanto since its inception (and being, in fact, the only Esperantist in the late Transvaal Republic) I am not unacquainted with this language. The idea of its grammar is great, but there are weaknesses which are abominable, most particularly the plural j. In "Ilo" these have been eliminated so that the language, retaining all the essentials of Esperanto, lacks its incongruities, and looks and sounds so much more suave.

The arguments brought forward to support Esperanto are to the discerning individual reasons why he should *not* adopt it. In the first place he justly points out that Esperanto greatly outnumbers Ilo in adherents. Sure, the apex of the wedge of civilization is composed of only a few discerning pioneers, and the further back you look, the more you will find it spread out as conservatism increases.

Another objection brought forward is that Ido or Ilo is always tinkered with, thereby implying that Esperanto is not. If things were never tinkered with we would never have the improvements that ultimate in a standardized product like the safety bicycle from the old high wheel ordinary or the automobile or radio.

To Dr. Zamenhoff is unquestionably due the credit for giving us an intelligent auxiliary language, but to insist upon it being perfect is to expose oneself to the inference of mental undevelopment. Although the same holds good for any language, including Ilo, yet it is a very fine step in advance. If our friend seeks safety in the mass we would probably still have nothing but crystal sets and if he went to aboriginal Africa or the Cannibal Isles he might have reason to find himself a pioneer, turn his back upon the mass proposition, and unlike Lot's wife, take no chance and say. *"En avant, toujours!"*

WILLIAM J. COQUELIN,
6058 Horton Place,
St. Louis, Mo.

MORE ON ESPERANTO

Editor, RADIO NEWS:

When the writer returned from our XVII Annual Congress at Arden, Delaware one of the Boston *samideanoj* brought in a copy of the August issue of RADIO NEWS containing the article by Mr. Sayers, "Esperanto, Radio World Language," and several letters on the correspondence page about an auxiliary language and Esperanto in particular.

Letters of inquiry about Esperanto and requests for text-books, are coming to us daily from readers of RADIO NEWS, our address being given at the close of Mr. Frost's letter (p. 210), and I wish to express for the Association our appreciation of your attitude towards Esperanto. These inquiries are of all sorts, and came from Maine to California from Boston to Porto Rico. Some have looked into various auxiliary languages that have been constructed, and have seen the discussions in recent radio magazines and elsewhere about Esperanto and Ido (or Ilo); others seem to have heard about it for the first time.

As you announced in an editorial note preceding the article by Mr. Sayers that "RADIO NEWS accepts it (Esperanto) as the international auxiliary language", there will no doubt be protests from radio fans who are in favor of some other artificial language, —more particularly Ido or Ilo. This how-

TUSKA RADIO

There are only two knobs, one to pick up stations, the other to control volume and eliminate unwanted programs. A guide card is furnished to show dial settings for the different stations. Tuska Superdyne selectivity represents a tremendous advance in radio.

Why wait for the ultimate *it never comes!*

RADIO moves so fast! It *is* bewildering. But why sit back and allow its gorgeous harmonies to pass you by, unheard? If you are "waiting until it is perfected," then you will wait forever, and forever you will miss the riches that radio can pour into the chosen moments of your life.

Through the Tuska Superdyne you can enjoy the best that radio has to offer, to-night if you wish. You can have results that will satisfy the musically critical and astonish the seeker for distant stations; astounding results with maximum ease and minimum expense.

Perhaps some day a better radio receiver than the Tuska Superdyne will be built. But that will not make the Superdyne any less extraordinary than it now is. Complete satisfaction in radio may be yours *now* and for the years to come through the Tuska Superdyne.

Not because it is new, for that is fleeting distinction; not because it is the ultimate, for that is impossible; but solely because in appearance, simplicity, economy and results it permanently fills the most exacting demands, buy the Tuska Superdyne.

THE C. D. TUSKA CO., Hartford, Conn.

Connecticut Hears England

"You may be interested to hear that on Thursday at 7 P. M. I was able to listen in on a concert from Station 2ZY, Manchester, England, using your Tuska Superdyne Receiver. Other people in this locality heard this same station on the same evening, using your three-tube set."

HERMAN H. WEBER,
Rockville, Conn.

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

The Superdyne Radio Frequency Receiver

The model illustrated above is priced at $150, without tubes, batteries or horn. Great for loud speaker reception of distant stations. Full, natural tone. Licensed under Armstrong Circuit Patent No. 1,113,149. Other Tuska receivers from $35 to $350.

Write for Folder No. 11-N.

ever, was to be expected, and need not be disturbing, as you have gone into the subject sufficiently to know whereof you affirm. Quoting Mr. Sayers' letter, p. 197:—

> "The value of an international language depends very largely upon the extent to which it is in use. . . . It seems hardly reasonable to discard all the work that has been done toward the advancement of an international language in the past by adopting some comparatively little used language, even though it may be to some extent an improvement on those that have been in use before."

"QST" for July published an article by Prof. H. W. Hetzel on the general subject of IAL (International Auxiliary Language). The editor decided, after conference with well known Esperantists and radio experts that it might save controversy to present the subject in this way,—but Mr. Hetzel told the writer at Arden that he personally regretted seeming to give Esperanto much less credit than the facts warrant, though it was necessary in order to seem impartial. This article, we understand, is to be followed by others.

You may like to look over the "Report of Progress" by Dr. F. G. Cottrell, Chairman of the Committee on International Language of the International Research Council, and the "Memorial" recently issued by the New York Section. The International Auxiliary Language Association, Inc., with Professor Herbert N. Shenton of Columbia University as its Secretary, has now taken over the work of this Committee. Columbia University has a course in Esperanto this summer, with credit of two points given, and it will be given again next summer. It may be added that after the New York meetings last year referred to in the report, questionaires were sent out and opportunities given for courses in Esperanto or Ido (Ilo) or both. There were three or four applicants for Ido, not sufficient to form a class, while four intensive short courses in Esperanto were given with good sized classes. This is mentioned to show the reactions with every opportunity for choice.

Our Association is planning this fall to do co-ordinated work in all the large cities through radio, giving several general talks on the subject of international language, and these to be followed if the demand comes,—and we feel sure it will . . . by a course of lessons.

We should appreciate any suggestions from you as to the best methods to pursue and shall also be glad to be of service to you in any way that presents itself.

E. J. Meriam, Secretary
Esperanto Association of North America.

MORE OF THE ILO DISCUSSION

Editor, Radio News:

Why does your editorial policy favor Esperanto? Esperanto has served a valuable purpose in the evolutionary progress of universal language, but in principle it is too stiff and academic for other than limited uses of languages. It does not lend itself to commercial use or literary use. Ilo, on the other hand, fulfills these demands. Ilo owes much to Esperanto and could never have been born had not the latter paved the way. Ilo is flexible, euphonious and complete; it has within itself a plasticity which will enable it to develop as natural languages have developed through centuries of use and accumulations of new words for new conditions of society.

George Lewis,
Crosley Radio Corporation Co.,
Cincinnati, Ohio.

Westinghouse Presents A New B Battery

Designed for multi-tube sets, compact in size, large in capacity, this new "B" battery offers you the following distinctive advantages:

A one piece crystal glass container affords you, at all times, a view of the interior.

Easily recharged at slight expense.

No leakage from cell to cell.

Will not pump acid.

Bird-cage plates insure long life.

Large acid space requires less frequent attention.

WESTINGHOUSE UNION BATTERY CO., Swissvale, Pa.

WESTINGHOUSE

RADIO

"A," "B" and "C"

BATTERIES

RADIO AMATEURS TALK 7,000 MILES FOR 2 HOURS

Argentinian and New Zealander Establish What Is Declared a Record for Non-Professionals.

BUENOS AIRES, May 24 (Associated Press).—Carlos Braggio of Bernal, near here, and Ivan O'Meara of Gisborne, New Zealand, radio amateurs with 7,000 miles of South American continent and Pacific Ocean between them, conversed for two hours by radio Thursday morning, establishing what is claimed to be a world's amateur radio record.

Braggio, who knows English, had spent most of the night unsuccessfully attempting to get some North American amateur to answer the signals of his station, CBZ8, when at 4 o'clock in the morning he was amazed to receive an answer from the other side of the globe —O'Meara's station, 2AC.

The amateurs opened a conversation which continued until 6 o'clock, when Braggio told O'Meara he had been up all night and wanted to go to bed. The New Zealander answered that he was sorry because it was only 9 o'clock in the evening at Station 2AC. Later on Thursday, Braggio received a congratulatory cable from O'Meara, confirming the conversation.

In connection with the radio communication test inaugurated this week with the United States, Argentine amateurs are unable to understand why they are able to get signals from North American amateurs while the latter apparently are unable to get theirs, although some of the Argentine stations are more powerful than some of the American ones which have been heard.

It is believed that many of the powerful broadcasting stations operating in the United States nightly interfere with the Argentine waves. In the future Braggio will try sending on a 120 meter wave-length at 3 A. M., Eastern Standard Time.

Argentinian and Jerseyite Exchange Radio Greetings

Special to The New York Times.

HARTFORD, Conn., June 2.—Two-way radio communication by amateurs between North and South America was attained for the first time last week by Norman R. Weible of Collingwood, N. J., and Carlos Braggio of Bernal, suburb of Buenos Aires. The feat was checked and verified today by the American Radio Relay League of this city, which tonight announced that Weible and Braggio had a twenty-minute connection on short wave lengths just before daybreak last Friday.

Braggio heard the New Jersey amateur calling him, and at 4:15 A. M. sent the following: "GM greetings and congratulations QRZ QRK."

Weible immediately replied in Spanish. "Saludo, Amigo de America del sur QRK."

A letter dated May 21, received today from E. J. Simmonds, an English amateur, stated he had heard the South American station transmitting.

Music from Your Lamp Socket

(*Continued from page* 463)

of both types were rented to the electric lighting customers. A program consisting of news reports, music, lectures, etc., was broadcast several hours daily direct from the studio. The news was furnished by the United Press over a special wire to the studio, where an editor re-edited it as it was received from the high-speed printer, later to announce it into the microphone. A special feature which was developed during operation consisted in the repetition of portions of the programs of various space radio stations. That is, a desired space radio station, operating on 600,000 cycles, for example, was received at a point remote from the studio, repeated to the latter as an audible frequency, and retransmitted over the lighting lines on approximately 40,000 cycles.

Broadcasting was continued for several months in order to test the public reaction as thoroughly as possible and to assist the engineering force in solving the many operating problems incidental to a system of broadcasting in which the maintenance of the receiving equipment and the transmission medium as well as the transmitting equipment formed a part of the responsibility of the central station. A small sales force was engaged in renting and distributing the receiving equipment. No intensive advertising or sales campaign was entered into, as the distribution of a large number of sets, while, of course, desirable, was limited to the limit of the number on hand. The distribution of a smaller number of sets properly located over the lines would yield much more valuable information.

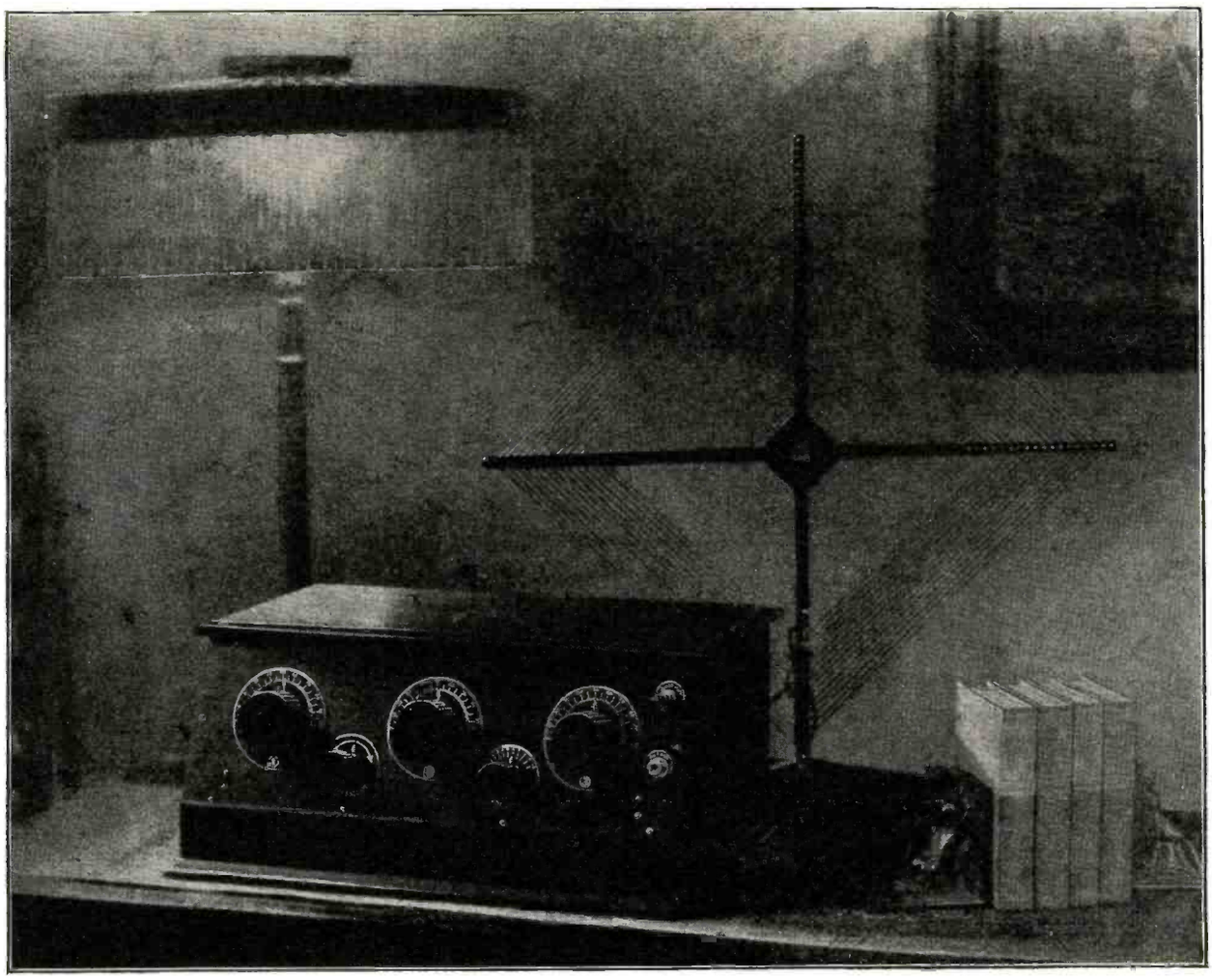
General reaction of the Staten Island customers to wired radio broadcasting was very favorable. This was particularly significant in view of the large number of space radio stations in the vicinity of New York City with a wide diversity of program available. The extreme simplicity of the receiving apparatus, the fact that it could be plugged into any light socket in any room, requiring no aerial, that no storage batteries were required for the loud speaker receiver, that there was no interference from static or other transmitting or receiving stations and finally that the apparatus was serviced, operated greatly in favor of wired radio.

OBJECTIONS

As was more or less anticipated, it became evident at an early stage that a serious objection to wired radio service from the customer's standpoint was the impossibility of receiving more than one program. The demand for diversity of entertainment is fundamental to the theatrical field and is now being felt in space radio in spite of the existence of a large number of stations.

Actual broadcasting also developed two additional sources of trouble which may be classed as "feeder effect" and "night effect." By the former is meant the tendency towards unequal distribution of the high frequency current over the different primary feeders. By "night effect" is meant the diminution of signal strength at night from that obtaining during the day, due to the short-circuiting effect of the hundreds of lamps as they are connected across the lines and which are in parallel with the receiving sets.

In consideration of the demand for multiplex service and of the necessity of overcoming the feeder and night effects, all of which would require more or less extensive research, broadcasting was temporarily discontinued on February 1, 1924, and experimental work resumed. At the present writing a two-channel service has been developed and put into experimental operation. Tests are also under way to effect simultaneous



Four Tube Reflex—Equivalent to Six Tubes

The Stradivarius of Radio

The rich, full tones of the great masters lose none of their original charm with the new MERCURY Receiving Set. Orchestrations in all of their symphonic beauty as well as clarity and naturalness of the human voice, not to mention the current popular divertisements of broadcasting, are NOW yours to enjoy as though these great artists were guests at your own home.

The MERCURY Receiving Set operates with a loop or antenna, with dry batteries which are enclosed in the cabinet, or with storage batteries.

Price, complete with loop (not including tubes or batteries), $165.00.

Write now for full information

MERCURY RADIO PRODUCTS COMPANY
50 Church Street New York City

Inverse Duplex System insures natural tone quality

MERCURY RADIO PRODUCTS COMPANY

Licensed under Grimes Patents—issued and pending

three-channel operation which will be completed in a short time. The feeder effect has been overcome by devising means for controlling the amount of high frequency power admitted per feeder, the means of control at the command of the operator. By directing the power to the feeders where it is especially required and by raising the entire power level at night it is possible to overcome the night effect.

RESUME OF PROGRESS

This, briefly, is the course of development of wired radio broadcasting to the present time. Within a short time it is expected that three program operation will be commenced on Staten Island and subsequently on other lighting systems. The programs are to be furnished, via telephone connection, from a central studio located in New York City and will be of the very highest quality. The fact that the customer pays for the service will insure this, just as it now does in the theatrical, motion picture, baseball and entertainment field in general. The multiplex receiving apparatus will include a variety of types of sets ranging from the simplest unit with telephone receivers to the loud speaker type for the home or concert usage. Each set will contain a multi-point switch, or equivalent, for bringing in any one of the desired programs, with possibly a single additional adjustment for varying the signal strength. No batteries will be required and the set may be plugged into any convenient light socket.

Apparatus employed in the Staten Island operations is shown in the accompanying figures.

The control room with the two-channel transmitting apparatus is shown in Fig. 1. The unit to the left and in the foreground is the transmitter for one channel; the second channel transmitter is shown in part to the right of the figure. The lower shelf of each transmitter unit contains a 50-watt master oscillator; the output of this tube operates into the grids of two 250-watt tubes connected in parallel, shown in the rear of the transmitter, which serve as high frequency power amplifiers and in turn operate through the coil system shown on the top shelf, into the 2,300-volt lines through protective tuning condensers. The two remaining 250-watt tubes serve as modulator amplifiers. The apparatus on the second shelf comprises the rejector units required for multiplex operation. The small panel to the left is the power panel and contains the necessary switches for controlling the plate and filament power to the transmitting tubes.

Both transmitters are the same in construction, and were designed from an experimental standpoint for maximum flexibility in power output and frequency range. The 2,300-volt lines enter the control room through the three high-voltage switches shown above the window to the right.

Connection to the 2,300-volt lines is made through special mica condensers which are contained in oil filled transformer cases mounted on a pole in front of the studio building, there being one .004 mfd. condenser in series with each line. These condensers have an insulation strength of over 15,000 volts and serve the double purpose of preventing short circuit of power currents and affording the capacity necessary for tuning the line circuit. The latter is required, as for frequencies in the neighborhood of 40,000 cycles per second the 2,300-volt lines are practically non-reactive and have an effective resistance of approximately 100 ohms.

SINGLE CHANNEL RECEIVING EQUIPMENT

In Fig. 2 is shown a view of the crystal receiver, and in Fig. 3 the circuit connections. The crystal unit was designed first to fulfill electrically the high frequency requirements and second to be as free as possible from electrical and fire hazard. It consists

"All You Have To Do Is Listen"

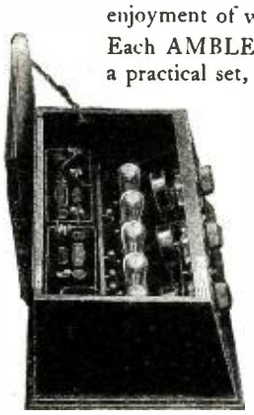
A radio set for people who are better listeners than electricians

AMBLER-HOLMAN Five Tube Radio Sets are expressly designed to bring the magic in the air into fine homes. Their construction and principle of operation have been so carefully studied in our laboratories that all you have to do is listen.

Nothing but the finest materials and expert workmanship go into AMBLER-HOLMAN sets. The cabinet itself is especially designed for us by a leading manufacturer of fine period furniture to harmonize perfectly with good interiors.

In addition to splendid tonal qualities and volume, these sets possess a range of pick-up that permits national enjoyment of worth-while programs and news.

Each AMBLER-HOLMAN set is thoroughly tested before shipment. It has been our object to produce a practical set, as free from fads as a precision instrument should be.



Ease of operation

Once you have "logged" a station it will always come in at the same point on the dials. You operate your AMBLER-HOLMAN just as easily as you do your phonograph.

AMBLER-HOLMAN Receiving Sets are constructed on the tuned radio frequency principle. The transformers used were developed in our own laboratory and radiation has been eliminated. "B" Batteries are self-contained.

The price is $125. The selection of tubes, batteries and loud speaker is left to your discretion.

¶ *Desirable territories are available for a few leading wholesale distributors*

Ambler-Holman
NEW YORK

ELEVEN SEVENTY EIGHT BROADWAY

Distributed by CAPITOL DISTRIBUTING CO., Inc., WHOLESALE RADIO
25 West 18th Street, New York City

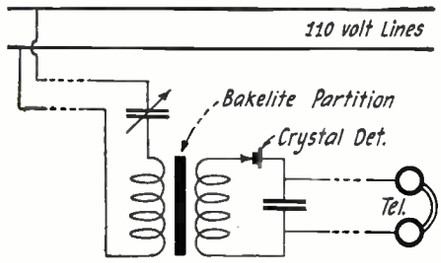


Fig. 3

Circuit diagram of the "wired radio" crystal receiving set, a photo of which is shown in Fig. 2.

of two circuits, one comprising the 110-volt line connection, and the line tuning coil and condenser; the other the telephones, crystal detector of the fixed crystal type, and coil inductively coupled to the line coil. These two circuits are contained in individual compartments separated by a quarter inch bakelite wall, the latter inserted directly between the line and detector circuit coils. The whole is housed in a cylindrical metal case, with the pair of wires and plug for the 110-volt connection and the telephone receiver connection running out on opposite sides. The apparatus is so assembled that, without disassembling, it is impossible to come into contact with any high voltage point. By the use of metal covering and non-inflammable insulation material the fire hazard has been reduced to a minimum. This unit has been approved by the Board of Fire Underwriters.

In the disassembled view in Fig. 2, the line tuning condenser, unscrewed from its base, is shown at the top of the set, and the line coil and connection wires to the right of the central partition. The telephone connection, by-passing condenser and detector coil are shown to the left of the partition. A fixed crystal detector is employed and is supported by the prongs extending through the top of the unit.

The loud speaker receiver is shown in Fig. 4. The circuit of this unit is the same as the crystal receiver with the exception that two steps of audio frequency amplification operating into a loud speaker are substituted for the telephones. Type WD-12 tubes were used in the earlier units, the filaments being energized from 110 volts through a step-down transformer. By means of special balancing circuits the hum in the loud speaker, due to the use of alternating current on the filaments, is rendered inaudible. Four small "B" batteries, contained in a compartment in the cabinet, furnish the plate voltage. A single pair of wires extend from the set, supplying both the low frequency current for lighting the amplifier tubes and the high frequency or signal current.

The line coil and condenser are mounted in the vertical framework shown in the disassembled view in Fig. 4; the two amplifying transformers are mounted directly beneath the tube sockets. The filament current transformer is shown in the rear of the loud speaker. Similar to the type A unit, a fixed crystal detector is employed; the set contains only a single adjustment.

In the latest type of loud speaker receiver both the filament and plate voltages are obtained from the line source, which may be either alternating or direct current.

Experiment has shown that connecting fan motors, vacuum cleaners, flat irons or similar apparatus to the 110-volt lines does not diminish the signal strength or produce undesirable noise, provided in the case of rotary apparatus there is no sparking at the commutator. Connection of a heater unit or other type of low resistance non-inductive load reduces the strength of the incoming signals.

You'll find YOUR SET *among the* FADA Neutrodynes

FADA NEUTROLA GRAND

Model 185/90-A—This is the beautiful new 5-tube Neutrola, Model 185-A, mahogany inlaid cabinet, with self-contained loud speaker, mounted on the FADA Neutrodyne Cabinet Table, Model 190-A, making a de luxe radio unit. Desk lid conceals panel when set is not in use. FADA Neutrola Grand. Price (less tubes, batteries, etc.) $295. FADA Neutrola. Price (less tubes, batteries, etc.) $220.

FADA, the pace-setter of Neutrodynes, leads again, presenting a new 5-tube FADA Neutrodyne in de luxe cabinets, thus supplementing the famous FADA "One Sixty." There is also a new 5-tube FADA Neutrodyne at a price that is within reach of all.

Whatever your radio wants may be, you can now fill them with FADA radio. Appearance, 3, 4 or 5 tubes, price—there is a FADA Neutrodyne to meet your desires.

In the de luxe models all connections are at the rear and there is plenty of cabinet space for dry batteries. The FADA Neutrola and Neutrola Grand have self-contained loud speaker. Woodwork is handsomely inlaid mahogany.

FADA Neutrodynes give you the results you want—distance, selectivity, volume. They produce natural tone quality. A child can operate them.

See the complete FADA line before you make any radio purchase.

F. A. D. ANDREA, INC.
1581 JEROME AVENUE, NEW YORK

FADA *Radio*

FADA NEUTROCEIVER

Model 175-A—Handsome mahogany cabinet, inclined panel and roomy dry battery shelf. 5 tubes—2 radio, detector, 2 audio. Price (less tubes, batteries, etc.) $160.

The Complete FADA Line

In addition to the models illustrated, the new FADA line includes the following:

FADA 160-A—"The receiver that has taken the country by storm." Four tubes. Price (less tubes, batteries, etc.) $120.

FADA NEUTRODYNE CABINET TABLE. Model 190—A handsome mahogany base unit for either the FADA Neutroceiver or Neutrola. Price $75.

FADA NEUTRO-JUNIOR. Model 195-A—A 3-tube Neutrodyne with special circuit arrangement, one radio, detector, two audio stages. Price (less tubes, batteries, etc.) $75.

FADA RADIO PANEL. A panel-mounted FADA Neutrodyne, adapted for installation in prominent makes of talking machines.

F.A.D. ANDREA INC. LICENSED BY INDEPENDENT RADIO MANUFACTURERS INC. NEUTRODYNE UNDER RADIOTRON PATENTS NOS. 1450080 AND OTHER PATENTS PENDING AND TRADE MARK REG. U.S. PAT. OFF.

MEASUREMENT OF RECEIVED CURRENT

In Fig. 5 is shown, plotted as a function of the frequency, the current received from the 110-volt lines for one particular receiver location and for a constant transmitting current. It is observed that, contrary to what might be expected, the received current not only does not uniformly increase with decreasing frequency, but exhibits decided peaks for different frequencies, the maximum peaks occurring at the higher frequencies. Similar phenomenon has been observed on other lighting systems.

HIGH FREQUENCY POWER TRANSMISSION

The high frequency operation of relays forms a very important avenue of wired radio development. Relay operation may be advanced one step and the operation of high frequency rotary apparatus foreseen. In Fig. 6 is shown a view of a high frequency motor which operates on the principle of the induction voltmeter. During the Washington experiments this motor, which requires about .008 ampere, was operated on 18,000 cycles from a wired radio transmitter four miles distant, from the same 110-volt socket and simultaneously with a small fan motor operating on 60 cycles. This is probably the first instance of wired radio power transmission for operating rotary apparatus.

The writer desires to express his appreciation of the co-operation of officials and engineers of the Potomac Electric Power Company of Washington, D. C., and of the Staten Island Edison Corporation.

Automatic Key for Tube Transmitters

(*Continued from page* 490)

contacts on the key that will open when the main contacts are closed. It can also be done by the same relay that fulfills points 1 and 2 as we will see later.

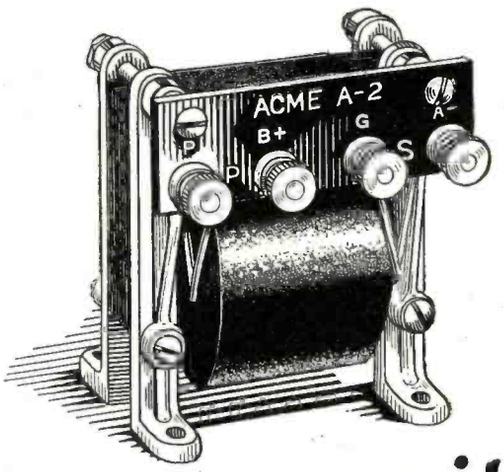
SWITCH AND RELAY

Perhaps you have seen break-in and remote control systems which work entirely satisfactorily, but they are mostly complicated affairs employing two or three relays operated by a switch in order to accomplish the desired result. As this article deals with one relay that does the work of two or three relays, we will go right on with the description, always bearing in mind the fact that not a single switch is required for its operation. This relay was developed by the writer at Station 3ZZ, where it has proven its worth. It is no more difficult to construct than the average well built receiver, and will prove to be well worth the trouble of building to the Ham who desires to increase the operating efficiency of his station. It is not even necessary to use a lathe to turn out any of the parts as they can be made from standard rod and tube stock. The entire relay is mounted on a bakelite panel ¼x4½x9½ inches. Since no part of the relay depends on gravity for its operation, it can be mounted in any convenient position on the table or wall.

With reference to Figs. 1 and 2, the solenoid has two business ends. The one end operates the drum type switch q by the action of the steel armature r as it is drawn into the solenoid. The armature is governed by the dash pot v so that it requires about five seconds to complete one stroke. The other end of the solenoid controls the break-in contacts d and e and the transmitting contacts f and g. The speed at which this end operates is practically instantaneous in comparison to the drum switch.

OPERATION OF RELAY

The solenoid is wound for six volts and is



After distance, what do you want?

Amplification without distortion,

OF COURSE, you want to hear the distant stations but you want these loud and clear so a whole room full of people can understand.

And when you listen to a fine musical program from your local station it certainly is fascinating to get all the notes, all the words, and to be able to close your eyes and just be content.

If you use Acme Transformers in the set you build and insist on their use in the set you buy, you are giving your loudspeaker a chance to reproduce the singer's voice, the violin's notes, the orchestra or lecture, loud and clear, without distortion.

Send 10 cents today 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
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Gentlemen: Enclosed find 10 cents for copy of "Amplification without Distortion."

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operated by a six-volt battery with the sending key in circuit. When the key is depressed the solenoid is energized. However, in order to cause the drum switch to close the filament and plate circuits, the key must first be depressed for about five seconds to allow the slower acting switch to operate. You are now free to go ahead with the transmitting as usual, except that you must bear in mind the fact that the transmitter will shut off if at any time the sending is broken for a period of five seconds, which is the time to which the dash pot is adjusted to complete one stroke. However, this is no disadvantage. Quite to the contrary, it should help you cultivate a snappy, business-like style of sending.

The usefulness of the relay is not confined to code transmission by key. If you wish to adapt the relay to telephone operation, it is only necessary to mount a push button switch on the handle of the microphone in such a position that it can be operated by the thumb. The push button switch is connected in parallel with the six-volt key, and the transmitter controlled by operating the push button.

CONSTRUCTIONAL DETAILS

As many of the dimensions are more or less arbitrary and depend upon the size of the stock you have on hand, only the more important ones are given. The drawings explain the idea clearly, and as long as the general arrangement as shown is adhered to, the details left to the ingenuity of the builder, it will not fail to work satisfactorily.

The solenoid bobbin is of a size which will allow the winding space to be 3½ inches long and 2 inches in diameter. Within this space you will be able to wind about 1,100 turns of No. 18 S.C.C. wire if wound in even layers. When this coil is placed across the terminals of a six-volt battery it draws about 2½ amperes and exerts a pull of about 2½ pounds on the armature. This is more than enough to overcome the friction of the switch and the tension of the spring, but it insures positive action of the switch and you are advised against attempting to cut down on the size of the solenoid however large it may seem to be. The solenoid is wound on a thin brass tube ⅝ inch outside diameter.

The inside diameter of the tube being slightly over ½ inch accommodates the steel rod armature with sufficient clearance to prevent binding. The bobbin end pieces are made of 3/16 inch bakelite. One end is 2¼x2¾ inches while the other end is made 2¼x3½ inches to accommodate the contact, g, which is mounted 5/16 inch from the top, as shown in Fig. 2. The ⅝ inch hole for the brass tube is drilled 1½ inches from the bottom of both pieces. This allows sufficient space for the small brackets by which the bobbin is attached to the baseboard. The contacts d, e, f, g, are made of 7/16 inch brass rod by cutting off 3/16 inch sections, which are afterwards drilled and tapped for 8-32 screws. For the contact surface a small disc of 1/32 inch silver secured with ordinary soft solder will answer very well. The pieces h, i, and the armature r are made of ½ inch wrought iron rod. The piece i is ⅜ inch long and extends into the brass tube for 3/16 inch, where it is held in place with solder.

The piston for the dash pot shown at v, Fig. 1, is made up of small graphite disks secured to the end of the armature as shown. However, if the graphite cannot be procured, leather disks built up to a thickness of ½ inch will serve. The adjustment of the dash pot is obtained by rubbing the piston down to the proper size with fine emery cloth. A little experiment is necessary to cause it to operate in five seconds as mentioned before. It will also be necessary to experiment to get springs of the proper tension. One made of No. 20 spring brass wire wound on a

THE NEW MODEL C-7 SUPER-HETERODYNE

Important Today

THE EXPERIMENTERS INFORMATION SERVICE, Inc., has been recommending the Super-Heterodyne method of reception since the early part of 1922. In February, 1923, a Super-Heterodyne of our design was installed on the *S.S. Western World,* pier 1, Hoboken, N. J., in the cabin of Dr. Horatio Belt. On the voyage to Rio de Janeiro, Brazil, at a distance of 3,000 miles, southeast of New York, the entire Greb-Gardner fight was received from WJZ, with sufficient audibility for the entire cabin full of passengers to hear the bout, blow by blow, plainly. At 3,300 miles southeast of New York, an entire evening church service was received from Pittsburgh. At that time there was not another single firm advertising or advocating the Super-Heterodyne. Since then Mr. A. Ancieux, Engineer, Trarivia Elec de Arequipa, Arequipa, Peru, has reported consistent reception from KDKA, WDAP, WEAF, WGY and others, a distance of over 5,000 miles, using a Model "C" Super-Heterodyne. The Pratt & Blake Corp., of New York City, sent a Model C to Rio de Janeiro which received American broadcast station at a distance of over 7,000 miles.

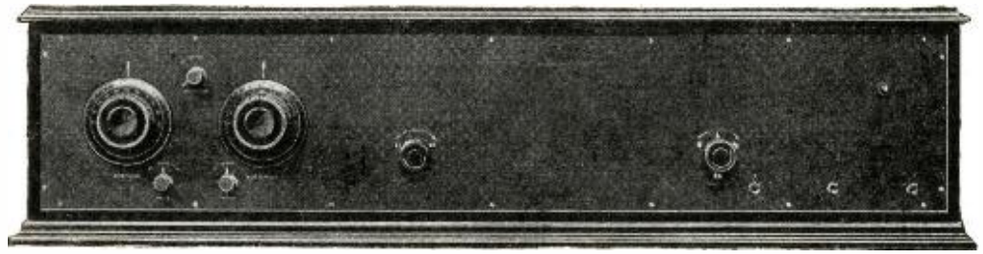
Practically all concerns now featuring Super-Heterodyne have copied our original Model C design, and to prove again that we are far in advance of competition, we present this Improved Model C-7 Super-Heterodyne as the *Most Sensitive, Most Selective,* and finest reproducing Broadcast Receiver that can be built.

7 Tubes Give the Results of 10

The Reason:—When regeneration is added to a one tube non-regenerative receiver, the increased amplification is about equal to adding two stages of tuned radio frequency amplification. Heretofore it has been impossible to add regeneration in the 1st Detector of a Super-Heterodyne and accordingly this has been a big loss.

The new Model C-7 Super-Heterodyne has a special 1st Detector circuit with a split antenna inductance so arranged that normally the detector would oscillate continually. However, in addition, a neutralizing condenser is inserted in the circuit which gives absolute control of the oscillations to such an extent that the circuit can be adjusted to just below the oscillating point, as this adjustment gives the maximum regenerative amplification. The new circuit has a bias potential on the 1st Detector grid, in place of the usual grid leak and condenser, and this allows infinitely weak signals to be regenerated and heterodyned through the radio frequency amplifier, which an ordinary grid leak and condenser would block. On a weak signal the difference in sensitivity is very noticeable. Using a 22-foot indoor antenna in the suburbs of New York loud speaker reception has been obtained from KGO, Oakland, California. A normal range of 2000 miles is easily obtained on an average small antenna at night under average conditions.

"The Rolls-Royce of Reception"



MODEL C-7 SUPER-HETERODYNE

Wave-length Range, 200 to 575 meters. Dimensions, 40 in. x 8 in. x 8 in.
Tube Arrangement: Regenerative Detector, Oscillator, 2 Stages Radio, Detector, 2 Stages Audio.

General Information

ANTENNA: Single wire, 30 to 150 feet long. Provision has been made for use of either a short or long antenna. Indoor antenna works very satisfactory.

TUBES: 7 Radiotrons UV201A or C201A, requiring one 6 volt storage battery and one 90 volt B Battery either dry or storage.

DRY CELL TUBES: Radiotrons UV199 or C199 may be used if desired, but the results obtained with dry cell tubes are not as satisfactory as with the Radiotrons UV201A or C201A.

LOOP: As a loop takes considerable space and is objectionable looking, and furthermore an inefficient collector, no provision has been made for loop reception. Local reception can be had without antenna or ground. An indoor antenna 30 to 50 feet long is suggested in place of a loop.

SELECTIVITY: The degree of selectivity is so high that distance stations can easily be tuned in through the local stations. For example, with a C-7 located five miles from WJZ operating on 455 meters, WCAE Pittsburgh on 462 meters can be tuned in without interference with WJZ.

TUNING: There are only two tuning adjustments, one for the detector circuit and one for the oscillator. Each station has a definite point on each dial and will always be found at these calibrations. Individual Verniers are provided for each dial. A third Vernier controls the volume.

CONSIDERATIONS: The Second Harmonic feature could be used with a view to eliminating another tube, but we feel that the many advantages of having a separate oscillator more than compensates for the extra tube. For a similar reason we have refrained from Reflexing the circuit to reduce the number of tubes.

STANDARDIZATION: All the component parts specified are readily obtainable on the market through high-class dealers.

PARTS: The parts specified in this design are all selected with expert consideration with a view to giving the maximum results obtainable. While it may appear that certain other parts could be used to economize, we strongly recommend that you take advantage of our engineering experience and follow the specifications to the letter.

Original Blue Print showing all data, diagrams, circuits, details, etc., **$1.00**, postpaid

Our new book (Second Edition) "Super-Heterodyne Receivers" covers fully the construction and operation for those who would learn more about this remarkable receiver. Profusely illustrated. Price, Postpaid....$2.00

EXPERIMENTERS INFORMATION SERVICE, Inc.

Designers of the Highest Class Radio Apparatus in the World

476 Broadway, New York City

Midwest Distributor
A. O'CONNOR & CO., 9702 Euclid Ave., Cleveland, Ohio

⅜ inch mandrel will serve as a start. The brushes k, l, m, n, are mounted on a bakelite strip which is secured to the baseboard by a small bracket. The drum q is cut from a 1¼ inch hard rubber rod and drilled to rotate about the rod w. The contact pieces o, p, are cut from a 1¼ inch inside diameter brass tube and secured to the drum q by means of 4-48 brass screws. A word here with reference to the position of the armature will not be amiss. A stroke of 1¼ inches is about right for the armature. Make your adjustments so that at the start the end of the armature will be about ¾ inch inside the brass tube. This allows it to function in the most dense part of the magnetic field.

KEYING THUMPS

It is not generally known that considerable interference is caused by what is known as the "key thump." This form of interference does not extend to any great distance. but is very annoying to anyone in the immediate neighborhood, no matter to what wavelength he is tuned. This "key thump" is caused by sudden surges of current in the plate circuit which are repeated in the antenna circuit, especially so in the case of the direct coupled transmitters. If the current is applied to the plate circuit less suddenly—that is, if some sort of a "buffer" is introduced into the circuit—these surges can be eliminated to a great extent. There are several methods of doing this, but in the case of the motor-generator supply, with a proper filter, the method shown at Fig. 3 is the most logical. You will notice that the contacts f and g are between the generator and the filter, so that the filter serves as the "buffer" in stopping the sudden surge of current that causes the "key thump."

An Interview With Secretary H. C. Hoover

(*Continued from page 472*)

most vital step in the field of all human communication," asserts Mr. Hoover. "We have today about 600 local broadcast stations. We all know that the local station can give better service than those far away. Our available wave-lengths permit us to have from two to four nearby stations to every listener. It is thus possible to have two to four alternate local programs at the same time. While programs of local origin will play a large part in broadcasting, yet radio will not have reached its full service until we have such interconnection of our local stations that we may also enjoy each night the product of our greatest artists and the thoughts of our leading men and women, and may participate in great national occasions.

"All this will add not only great intellectual and stimulative force to the nation. but it will materially help to build up home life. For in the comfort of our own firesides, father can smoke, mother can knit and the family can make remarks upon the performance with informality not permitted in public places.

"Our governmental relationships to this particular problem are complex in administration, though simple in principle. We seek to preserve the ownership of the road through the ether as public property that we may maintain initiative by holding it a free field for competition, to keep alive free speech, to avoid censorship and to prevent interference in the traffic."

HOT OFF THE GRID-DLE

"How do you suggest the radio tax be imposed?"

"I advocate a 'cover charge' on all storage batteries at two bits a plate."—*Jack Bront.*

"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

ZINCITE DETECTOR

(PATENTS PENDING)

CRYSTODYNE LICENSED TRADEMARK

$1.75

6900

Here is a detector which has been especially developed by us for the new **Crystodyne** circuits. This detector while using the natural mineral zincite can be used with any other crystal as well. Several unique features are embodied in this detector. To begin with it is the only detector that has a **sliding crystal cup** with perfect contact arrangement and which cup not only slides but rotates with an eccentric motion. (Note slot A). By means of the small knob the cup slides easily so that any point of the crystal can be brought into contact. A new crystal can be inserted immediately by unscrewing the small knob. The contact plate which at the same time forms the catwhisker is made of spring steel. The combination of **steel-zincite** is the only one that was found practical for the Crystodyne oscillating crystal. Note the micrometric adjustment that can be made by means of the large knob bearing against the steel spring. This raises and lowers the steel point to the finest possible degree. The base is of bakelite, all parts nickel plated and polished.

O6900-Crystodyne Zincite Detector.....$1.75

O6900.Natural Zincite Mounted Crystal especially tested for Crystodyne work, fits any crystal cup $0.60

(Note: Natural zincite is the ONLY mineral which in connection with a fine steel point will produce sustained oscillations in the Crystodyne circuits. Natural zincite is one of the most expensive minerals and the supply has been practically exhausted. It sells now from $25.00 to $30.00 per lb. in the open market. Artificial zincite, a much inferior article, will not produce oscillations at all.)

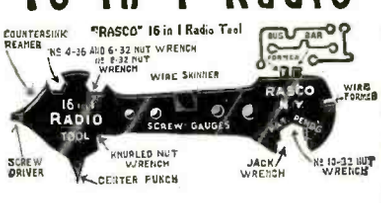
"RASCO" Double Acting Snap Switch

At last a REAL radio switch constructed for radio purposes, not just a battery switch that may be adapted for radio. The RASCO switch is the only switch with a POSITIVE DOUBLE spring action. No more guess work if the circuit is open or closed. A push of the finger and the current is on. A slight pull and **The Handle Snaps Back** of its own accord. An internal coil spring pushes the handle back when a little pull is applied. This switch is intended as a battery switch to disconnect your "A" batteries. **Only one hole to drill. No tools required** to mount except your finger and thumb. Also this switch takes up a minimum of room, much less than other switches, the base of the switch measuring only 1¼x½". All metal parts nickel plated. A switch you will be proud to possess. **No. 04850-RASCO Snap Switch. Each**.....25c

4850

25c

16 in 1 Radio Tool 35c



Here it is! The radio tool that will bring happiness to all radio experimenters and constructors. Here is a tool that does 16 different things and does them well. A tool that does practically everything required in building your radio set. The tool is built of hardened steel, exactly as per illustration, highly finished. Here are some of the uses: 1. Screwdriver. 2. Center punch. 3. Countersink. 4. Bus bar wire bender. 5. Bus bar and wire bender for 8/32 screw. 6. Bus bar and wire bender for 6/32 screw. 7. Socket wrench for jacks. 8. Socket wrench for 4/36 nuts. 9. Socket wrench for 6/32 nuts. 10. Socket wrench for 8/32 nuts. 11. Wrench for knurled nuts. 12. Screw gauge for 4/36 screw. 13. Screw gauge for 6/32 screw. 14. Screw gauge for 8/32 screw. 15. Screw gauge for 10/32 screw. 16. Knife for wire skinning.

These are only the important uses of the tool, but many other uses will readily suggest themselves to every radio experimenter. You will wonder how you have gotten along before without the 16 in 1 radio tool. Get one of these happiness tools. You will never again be without it. Size 4⅝ x 1½ in.

No. O-4800 RASCO 16 in 1 Radio Tool, each.....$0.35

"RASCO" "Jiffy" Jacks and "Jiffy" Plugs

5c

20c

S-4875

Again, Rasco leads with a small but important radio novelty. **JIFFY JACKS** are the simplest, and most efficient Cord Tip Jacks ever designed. Stamped from a single piece of metal they grip any style cord tip from any make phone or loud speaker. The **JIFFY JACKS** take but a minimum of room. All you need do is to drill two small holes in your panel and mount the **JIFFY JACK** with screw and nut furnished. **No soldering necessary** as the wire goes right on the screw. X-ray view shows how two of the jacks are used in conjunction with our **Jiffy cord plug.** The jacks go on in back of panel, only screws show in front. **JIFFY JACKS** take practically no room when mounted and are made of best spring brass that will not wear out. Hundreds of other uses for our **JIFFY JACKS. We will pay $1.00 for every new use for JIFFY JACKS that is accepted by us.**

JIFFY PLUGS are made of semi-hard rubber into which the tips of your phones or loud speaker are pushed. The cheapest and simplest plug ever designed. Its small size and neatness made it famous over-night. Size 1 in. long, ½ in. wide and ⅜ in. thick. No tools required. Just wet the metal cord tips and push through openings. Plug can be used with any standard cord tip jack, but best with **RASCO JIFFY JACK.**

O-4875-Two **Jiffy Jacks** with nuts and screws and one **Jiffy Cord Plug**.....$0.20

O-4870-One **Jiffy Jack** complete with nut and screw 0.05

O-4871-**Jiffy Jacks** without nuts or screws, two for 0.05

O-4860-Rasco **Jiffy Plugs**, each..... 0.10

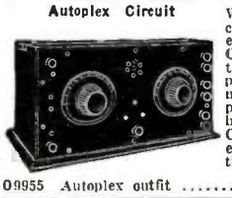
COMPLETE SET SALE AT REDUCED PRICES

Reinartz Receiver

Exactly as shown with mahogany cabinet, panel, all necessary instruments, binding posts and pattern for assembling. This set can be put together by anyone in a few hours.

09988 Reinartz Receiver $13.50

Autoplex Circuit



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

09955 Autoplex outfit $15.00

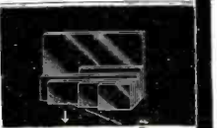
Wanted

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

SPECIAL

Genuine RICO 2000 ohm double head set. Standard phone with 6-foot cord. Tripole type. Regular price, $4.00. Our special price O-6060,

$2.50



FREE

The big "Rasco" catalogue. Contains all Armstrong circuits. Every up-to-date vacuum tube hook-up. Greatest little book printed. **Free upon receipt of postal.**

Moulded Variometer

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

05350 Variometer $3.00

FONEKUSHIONS

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

03550 Fonekushions, set of two .....$.50

Straight Line Condenser

Simplest and most practical type of condenser.

04430 "Rico" Condenser .001 mfd. 43 plate capacity $1.75

04230 .0005 mfd. 23 plate capacity $1.75

04110 .00025 mfd. 11 plate capacity $1.75

All types no dials $1.50

Radio Frequency Transformers

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

02800 Transformer, size 1⅞"x2½" $1.50

NEW!! NEW!!

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

01159 Transformer, Ratio 6½ to 1....$4.00

Dilectryte Panels

Highest dielectric strength as per Bureau of Standards.

07100	7x10x3-16"	..$.70
07120	7x12x3-16"	..$.85
07146	7x14x3-16"	..$.95
07180	7x18x3-16"	..$1.25
07210	7x21x3-16"	..$1.45
07240	7x24x3-16"	..$1.65

NEW THINGS FROM CATALOG No. 11 AT CUT PRICES

Dial Marker

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

07788 Dial Marker, each .....$.05

Vacuum Tubes

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

0201A 5 v., .25 amp. $2.50
0199 3 v., .06 amp. 2.50
012 1½ v., .25 amp. 2.50

"Rico" (Adjustable) Loud-Speaker Phone

Has rubber gasket underneath diaphragm, making phone fully adjustable. Gives amazing results as loud-talker on 1 and 2 stages of amplification.

02525 Speaker with 5 ft. cord $2.65

Cockaday Coil

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

02750 Cockday coil $1.50

Tapped "B" Batteries

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

02250 Sm. 22½ V., $.85
02251 Medium Navy size, 22½ volt.....1.20
04500 Large size. 45 volt 2.30

Audio Frequency Transformer

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

01100 Ratio 4½-1 $2.00
01150 Ratio 6½-1 $2.00

Sponge-Rubber Cushions

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

08989 Sponge-rubber cushions, each .....$.12

RADIO SPECIALTY CO., 98 Park Place, New York City

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

KDKA to Broadcast for Polar Ship "Arctic"

(*Continued from page* 481)

and it will operate on a wave-length of 120 meters.

No more complete plans for carrying on a constant communication with the outside world were ever made by an Arctic expedition, particularly with respect to communication with the *Bowdoin*, McMillan's ship, from which nothing has been heard in months.

To insure that communication from the *Arctic* may be received in civilization, it has been arranged to equip two of the Hudson Bay Company boats, the *Bayeskimo* and the *Nascopie*, with Canadian Westinghouse special receivers, designed not only to pick up KDKA's special wave but also the signals from the *Arctic*. It is hoped by this means to relay messages from the *Arctic* through the Hudson Bay Company's boats to the Labrador Coast stations and then on to G. A. Wendt of the Canadian Westinghouse Company at Montreal or straight through to KDKA. It is anticipated that the *Arctic*, through its transmitting equipment, will be able to keep in communication with KDKA, although it is quite possible that the ship's signals will be lost. However, KDKA will continue to send whether or not any acknowledgement gets through from the *Arctic*.

Non-Radiating Regenerative Receivers

(*Continued from page* 496)

directions and radiation is neutralized. To balance the tube capacity, the neutralizing condenser C_2 is used. A variometer may be included in the ground lead to tune the aerial circuit to the signal frequency. The disadvantage of this circuit is that audio frequency radiations from light and power lines will be amplified.

The three circuits have now been described. It is up to the experimenter to improve upon them. Although they do not radiate, their efficiency, as radio receivers, is poor.

Induction and Modulation

(*Continued from page* 467)

After the modulator gets through with the two currents mentioned above, the current that goes to the antenna has a characteristic curve similar to that shown in Fig. 9. This is known as *modulated radio frequency current*. It has the form of the voice current and at the same time is oscillating at radio frequency. Each one of the little humps or depressions made by the voice or music affects the microphone and causes the diaphragm to vibrate.

When this current reaches the antenna of the receiving station—if the tuner of that station is set for the wave-length of the transmitter—it will be passed on to the detector. This instrument will rectify or change the current so that the carrier wave will be eliminated and the voice current only will affect the telephones and render audible sounds exactly similar to those produced at the transmitting station. The exact process of detection both by crystals and vacuum tubes will be taken up later, after you have added a vacuum tube to the set described in the first of these articles.

AMPLIFICATION *Without "B" Battery*

Thousands now enjoy the clear, distinct reception of the wonderful Solodyne Circuit made possible by Nutron Solodyne Tubes

NO longer is it necessary to suffer from the disagreeable scratching, screeching and howling as the set is tuned in. Nor is it necessary to have speeches and music all garbled up beyond recognition. The Nutron Solodyne Tube (Double-Grid), used in the Solodyne Circuit, is now giving to thousands of radio listeners the peace of mind and satisfaction that come with soft, smooth reception and distortionless amplification.

NUTRON SOLODYNE REG. U.S. PAT. OFFICE TUBES

Nutron Parts for Solodyne Circuits

In the Solodyne Circuit there is not much energy to lose; to secure best results only the best of materials should be used. Low-loss condensers and coils will give results. Nutron parts, condensers, transformers, couplers, and grid leaks, have been especially designed by our engineers for use in the Solodyne Circuit and consequently will give superior results in standard circuits by reason of their unusually exact construction. See price list in coupon below.

Something New and Remarkable in Solodyne Circuits

Parts and diagrams for Solodyne Circuits consisting of one stage of tuned radio frequency and two stages of audio frequency amplification are now available. This is something that has been sought for years and is now completely developed. Our engineers have spared neither effort nor expense in perfecting these hook-ups and you will be simply amazed at the results they have secured.

Complete information regarding details of these remarkable circuits will be sent upon request.

Nutron Tuned Radio Frequency Kit

At last you can build at a very moderate cost "that big set" you have wanted. Build a 5-tube Neutrodyne Receiver or other tuned radio or tuned regenerative receiver. Send for this laboratory tested kit and be sure of distance and selectivity.

We make the assertion that there is not a better set of transformers, low-loss condensers of Nutrons (for neutralizing) on the market than this Kit contains. If you want the best results you must always use the best materials and workmanship. The Nutron Tuned Radio Frequency Kit furnishes the very best available material and workmanship at the lowest possible price.

Each Kit is complete with 3 very low-loss Condensers, 3 laboratory tested R. F. Transformers assembled ready for panel mounting, 2 mounted Nutrons for neutralizing. Price, only $14.00

Broadcasters Seem to be Present

Although there is nothing but silence in the Solodyne Circuit until the desired station is tuned in, the final adjustment brings out the tones so clearly that the broadcasters and the microphone itself seem to be in the very room with the receiving set. That is *real radio reception.*

Those who enjoy smoothness and clarity of tone are quick to take advantage of the Solodyne Circuit made possible by the Nutron Solodyne Tube—*Eliminates the B. Battery.*

Complete diagrams and instructions with each Tube. Price $6.00

In Standard Circuits

Write us for information regarding the use of Nutron Solodyne Tubes in standard circuits for clearer reception and saving of battery current.

Guarantee: Each Nutron Solodyne Tube is guaranteed in every way and will be replaced at once if, within ten days, it should not work and the filament still lights.

Nutron "Triple-Service Super" Tubes

Nutron "Triple-Service Super" Tubes, (.28 amp.) are better by fully 25% than any other tube of the type on the market. They have greater plate area and longer filament and therefore greater electronic emission. At 6 volts "A" Battery—and they will stand a full six volts—and at 90 volts "B" Battery Nutron "Triple-Service Super" Tubes have:

1. Mutual Conductance . over 900
2. Plate Resistance (Impedance) 7000
3. Amplification Constant . 7½ to 8

There are six uses for this tube which every radio owner should know. Send for the tube at once and get more out of your set. These have the same solid guarantee as the Nutron Solodyne Tubes. . . . . Price $4.00

Nutron Dry Battery Tube (1½ volt) Price $4.00
(another Nutron quality product)

Rigid Testing

Each and every Nutron Tube must operate a loud speaker on a one tube reflex set before it is finally passed.

CAUTION!

Be sure to use Nutrone parts for Solodyne Circuits. They are the approved laboratory-tested parts. There is absolute certainty of securing best results when they are used.

TO SET MANUFACTURERS
Our Service Department is at your disposal and gives positive assurance of matched tubes, technical exactness and personal attention. You can guarantee each set on tube operation. Write, wire or phone your requirements.

A MESSAGE TO DEALERS
Distributors have been appointed covering all territories. Upon your request to us our distributor for your territory will furnish you with complete information and ready service.

NUTRON MANUFACTURING CO.

715 MAIN AVENUE PASSAIC, NEW JERSEY

Nutron Mfg. Co.
715 Main Avenue, Passaic, N. J.

Please send me the following Nutron parts indicated by X. Enclosed is check, money-order, for same. (Payment must accompany orders).

- ☐ Solodyne Tubes $6.00
- ☐ "Triple-Service Super" Tubes .28 amp. 4.00
- ☐ Dry Battery Tubes (1½ Volts) . . . 4.00
- ☐ Condensers 3.50
- ☐ Transformers (Vernier). 3.00
- ☐ Couplers 3.50
- ☐ Grid Leaks 1.25
- ☐ Tuned Radio Frequency Kit 14.00

Name _____

Street _____

City _____ State _____

Radio Station 8BRC

(*Continued from page* 487)

effort in applying practical knowledge obtained on the farm and in the machine shop. His achievements have been attained without the aid of capital or collegiate education and his example should serve as an inspiration for others where industry and practical knowledge intelligently applied are the only avenues open to success.

Government Extends Radio Channels for Amateurs

(*Continued from page* 489)

In making the announcement, Government radio officials stated that the opening of the lower wave bands for amateurs was due to increasing interest in short wave transmission, and because the few special experimental stations authorized to use these channels found it difficult to get enough short wave stations to carry on satisfactory experiments and make distant tests. The Government, in other words, hopes additional interest will be aroused and that valuable scientific data may be secured. It is also pointed out that the radio industry will be spurred to put new and better short wave transmitting and receiving apparatus on the market. The opening of this new field to all amateurs, before the national conference meets in September, should provide considerable data of importance to the art and industry, and for this reason the assignment of these wave-lengths is tentative only.

The Department's letter reads as follows:

All Supervisors of Radio.

Sirs:—

Effective immediately you are authorized to issue general and restricted amateur radio station licenses to permit the use of any one or all of the following bands of short wave-lengths: 75 to 80 meters, 40 to 43 meters. 20 to 22 meters, 4 to 5 meters, in addition to the band 150 to 200 meters, provided application is made by the owner of the station, which station must be prepared to use the wave-length, or wave-lengths, requested.

The use of continuous wave telegraphy only will be permitted on wave-lengths other than 150 to 200 meters and the antenna circuit must not be directly coupled to the transmitting circuit.

Silent hours will not be required of amateurs while using the wave-lengths within the above bands below 80 meters except where the transmitting station is so situated as to produce objectionable interference with other services.

Hereafter special amateur stations will not use wave-lengths above 200 meters. They may be authorized to use the band of wave-lengths from 105 to 110 meters in addition to the wave-lengths within the bands authorized for general and restricted amateur use. where the special amateurs are engaged in conducting tests with government or commercial stations.

General, restricted and special amateur stations will be permitted to use the entire band of wave-lengths from 150 to 200 meters employing pure C.W., spark and modulated forms of transmission.

It should be made clear to the amateurs that the authority granted above is necessarily tentative because of the rapid development taking place in radio communication and the bands of wave-lengths authorized may be changed whenever in the opinion of

WORKRITE RADIO SETS WORK RIGHT

"Daddy, let's get Los Angeles!"

"All right son, that's easy. We'll turn the dials to 55 and get it sure, if it's on the air."

That's one of the delightful things about WorkRite Super Neutrodyne Receivers. The first time you pick up a station just jot down the dial settings. After that, simply refer to your "log" and set the dials at the positions it indicates. Immediately, the station you want comes drifting in sweet and clear—and entirely free from disturbing howls or whistles.

Under favorable conditions WorkRite will go clear across the continent for you. It will bring in far-off stations regularly and distinctly on the loud speaker. Broadcasting from points 500 or 600 miles distant comes in almost as strong as that of your own home town stations.

And think of this! You can tune out powerful local stations with the utmost ease, and bring in others, using practically the same wave length, without the slightest interference. For WorkRite selectivity is simply amazing.

Experts endorse WorkRite, of course, but even tho you have never operated a radio receiver, you'll get the real thrill and joy of radio the first time you try one of these remarkable sets. Years of experience in radio manufacture, the finest of materials, and the most skillful workmanship, all combine to make WorkRite wonderfully easy to use.

WorkRite Receivers are as distinguished in appearance as they are in performance. Read the individual descriptions of the beautiful, artistic models shown on this page.

Remember, too, that WorkRite Receivers are absolutely new. Your dealer may not be fully informed as to their advantages. But don't make your radio investment until you know all about the WorkRite models. Any of them will put in your home a source of ever-changing amusement and pleasure. If your dealer is unable to demonstrate WorkRite for you, write us for the name of the nearest WorkRite dealer. Beautifully illustrated folder with full information on all models will be sent you on request.

THE WORKRITE MANUFACTURING COMPANY
1806 EAST 30TH STREET • • CLEVELAND, OHIO
Branches:
Chicago, 536 Lake Shore Drive; Los Angeles, 239 South Los Angeles St.

DEALERS—If you don't know about WorkRite Super Neutrodyne Receivers, by all means write us immediately for full particulars.

WORKRITE
SUPER NEUTRODYNE RADIO SETS

WORKRITE AIR MASTER

Like all WorkRite models, this is a 5 tube 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 behind a handsome grille. Both furnished with plug and special cable carrying all battery wires.

Prices:
Air Master, without accessories, $160
Radio King, without accessories, $220

WORKRITE ARISTOCRAT

In this beautiful mahogany console, the loud speaker with special horn and reproducing unit is placed on one side and compartment for A and B batteries on other side. All connections made inside with cable and plug. Front drops, forming arm-rest for tuning or writing. Drawer beneath drop is provided for log sheets, etc. A set unsurpassed in any respect.

Price, Aristocrat, without accessories, $350

the Secretary of Commerce such change is necessary.

Respectfully,
D. B. CARSON,
Commissioner of Navigation.

Approved:
J. WALTER DRAKE,
Assistant Secretary of Commerce.

If You Are to Know It At All, Know It Well

(*Continued from page* 488)

knowledge about the thing a person practices as possessed by the person practicing that thing—except in themselves.

They are the type that will claim that a particular make of rheostat brings in signals louder than any other make; or, a particular type of jack in the second stage of audio made the receiver twice as selective; or, that a fur trimmed antenna brought in better signals than a similar plain type. Such tommyrot would not be, and never is, perpetrated by the man with a sound and accurate knowledge of fundamentals. Details will not trip him nor, to speak figuratively, would he be unable to see the receiver for its dial.

You can obtain a knowledge by a few hours' study that would save you enormous expense and time—if you only would. Every new hook-up. then, would be transparent. It could be judged accurately and impartially without the necessity of trying it. You could judge whether it would be worth trying or not. You would be able to prophesy its properties, limitations, and advantages accurately, barring new basic ideas, of course.

Truly, knowledge is power.

L. W. Hatry.

Braggio Receives Radio Congratulations

Senor Braggio's record with New Zealand aroused great enthusiasm, as was to be expected. and he was given an ovation by radio which seems worth describing if only to show the excellent relations existing between the BCL and the telegraph amateur in Argentine. Shortly before midnight all the principal broadcast stations announced that they were suspending their programs in order to leave the air free for the official speech of congratulations which a prominent amateur then made from his station—he ended with three cheers, and every transmitter in the country (at least, it sounded like that, and I have not met anyone who did not take part) opened up with cheers, applause, bugle-salutes, and congratulations to Senor Braggio. The effect was overwhelming. every wave-length from 100 to 500 meters being occupied.

John English.

Calls Heard

90A, 408 9TH ST., PETERSBURG, INDIANA C. W.:

1ajp. 1gv. 1iv. 1kr. 1lc, 1cw, 2arz, 2brb, 2cqz, 2by, 2kf, 2le, 2qh, 2rb. 2rk, 2wr, 3ada, 3bdi, 3buy, 4io. 4jr, 4jm. 4ll, 4mi, 4oa, 4og, 4rr, 4sb, 4sh, 4tj, 4ts. 5amf, 5aiu, 5alo. 5amh, 5apo, 5aec, (5aek), 5alz, 5ajj, 5aip, 5ags, 5aac, 5mi, 5kr, 5rc, 5rk. 5qc, 5gi. 5nt, 5es, 5ka, 5ck, 5rd, 5mo, 5fm, 5ql, 5kc. 5lr. 5agv, 5xat, 5za, 5zas, 5cgw, 8aar, 8aij. 8ayt, 8ana. 8ada, 8arv. 8agi, 8app, 9abm, 8acn, 8aol, 8aig. 8apt, 8anp, 8ajh, 8ak, 8kg, 8hk. 8pl, 8fm. 8pu. 8cw, 8gz, 8do, 8uf, 8dc, 8jq. 8lr, 8rj, 8jj. 8ah. 8uq, 8cy, 8bf. 8uf, 8gw, 8vt. 8lw, 8bt. 8jy. 8fu. 8ll. 8kc. 8bfm, 8bhg, 8biz. 8bwk. 8blt, 8bws, 8bmb, 8bmt, 8bop, 8bvr, 8bnh, 8brc, 8bkh. 8bkc, 8bgz, 8bdr, 8cqj, 8cyo, 8cjp. 8chy, 8cfk, 8cqh, 8cul, 8cjc, 8cun, 8caw, 8cei, 8con, 8cjd, 8cwr, 8cmy, 8ckm, 8cci, 8cbf, 8cgj. 8cyv, 8cdi, 8diu. 8dal, 8diz, 8dla, 8doa, 8dia, 8dgr, 8dau, 8dmx. 8dhs, 8dbw, 8dcy, 8dou, 8dhq, 8ex, 8xb, 8xhq, 8yx, 8zc, 9eoa, 9bgi. 9dqu, 9bsp, (9czl), 9aew, 9dyt, 9cfi (9bsc), (9es), (9bcc),

9ajl, (9cic), 9buj, 9doj, 9dlm, 9bcx, 9dhr, 9dro, 9bce, 9eld, 9bgi, 9ajd, 9btt, 9bdj, 9afe 9awf, 9ctt, 9csk, 9efz, (9baz), 9dwk, 9cvo, (9bfy), 9amt, (9bsc), 9dwz, 9awr, 9bpd, (9ejv), (9ell), 9abf, (9duc), 9dnf, 9eky, 9acc, 9aau, 9cow, 8dwa, 9buk, 9aqj, 9ccu, 9elb, 9bpt, 9afy, 9dpl, 9bwu, 9cln, 9cwo, 9alp, 9ckh, 9ccw, 9aja, 9dlw, 9ccs, 9cvr, 9cee, 9czu, 9baw. 9ahj, 9dly, 9bgh, 9buj, 9csg, 9bfq, 9dwx, 9bds, 9drc, 9dzu, 9dva, 9dda, 9cii, 9dyy, 9bsi, 9egh, 9brk, 9aud, 9cly, 9amb, 9dro, 9bdq, 9chc. 9cyq, 9cim, 9cah, 9aaw, 9auc, 9aal, 9cyx, 9cyw, 9aii, 9efe, 9cte, 9apr, 9dlo, 9aea, 9day, 9beb. 9cmd, 9dbw, 9efq, 9bag, 9bes, 9cyj, 9cea, 9cak, (9eak), 9dmc, 9eld, 9aok, (9cmn), 9dln Qra??, (9es), 9or, 9mc, 9wu, 9ir, 9ta, 9vc, 9cr. 9zt, 9qi, 9nc, 9ur, 9ug, 9tg, 9ep. 9uq, 9pw, 9pb, 9ci, 9le, 9em, 9bk, 9we, 9ap, 9kd, (9ng), 9ni, 9nu, 9jg, 9og, 9uk, 9xax, 9xba,

CAN: 2CG, 3CQ.

Will Qsl if requested. Qrk? mi 5 watter?

4PV, 148 AVANT ST., SPARTANBURG, S. C.

(1aft), 1ajx, (1arf), 1auk, 1bie, 1boq, (1bwx), 1ccz, 1py, (1rr), (2acs). (2aet), 2aey, 2agb, 2al, 2azy, 2bbx, 2bsc, 2buy, (2bxd), 2byk, 2cbg, 2ccd, 2cka, 2cpd, 2cwp, (2jc), 2kf, (2kx), (2qf), 2rb, 2sy, 2vh, 2xbf, (3agf), (3ahp), 3ajd, (3apv), (3bay), 3bgt, 3bmm, 3bnu, 3brf, 3buy, 3bva, 3cbl, (3cdu), (3cjn), 3ckl, 3fb, 3hh, (3hs), 3lg, 3mo, (3oe), 3ph, (3qv), 3tf, 3yo, 3zo, 4af, (4ag), 4ai, 4bw, (4dw), 4dy, 4ea. 4eq, (4fs), 4ft, 4gx, 4ia, 4io, 4iz, (4jr), 4kl, 4lo, (4nj?), 4og, 4pk, 4rz. 4si, (4tj), (4ua), 4uk, (4un), 4yz, 5aiy, 5alz, (5amh), 5ck, 5es, 5fm, 5gp, 5ka, (5mi), 5zas, (8abq), 8abs, 8abz, 8acm, 8agl, 8aip, 8alx, (8apn), (8atz). 8aws. (8bca), 8bfe, 8bkh, 8bmb, 8bnh, 8boy, (8bqi), 8brc, 8brm, 8bsq, 8byk, 8cci, 8cdc, 8cei, 8cga, 8daa, (8dae), (8daw), 8dc, 8dfn, 8dgo, 8dhs, 8dnp, 8doi, (8ef), 8er, 8fj, 8fm, (8jq), (8tj), 8ue, 8vq, 8vt, 8yd, 8zc, 8zz, 9aal, 9aau, 9ahh, 9aim. (9aio), 9aqd, 9bcc, (9be), 9beq, 9bjz, 9bk, (9cjb), 9cjm, 9dlw, 9dmc, 9dsa, 9dwa, 9elb.

WI QSL on request. All rpts appreciated es QSL'd.

5QP, 410 REYNOLDS ST., GADSDEN, ALA.

U. S.—C. W.:

2mf, 4ai, 4do. 4ig, 4ia, 4io, 4iz, 4qf, 4sh, 4si, 4tj (qra), 5aw, 5acm, 5aek, (5akp), 5amf (Fone), 5amh, 5cn, 5ek, 5es. 5gi, 5gp, 5ka, 5nt, 5qh, 5qv, 5rg. 5ve. 5vu, 5xat (qra), 5zas, 8bmb, 8ckm. 8do, 8jq, 8wp, 9aau, 9aaw, 9ash, 9aus, 9ayv, (9baz). 9baq. 9bcb, 9blg, 9bh, 9bk, 9brv, 9cee, 9cer, 9cfk, 9cln, 9cm (vy qsa), 9cmc, 9cmn, 9cta, 9cvo, 9czn, 9dcw, 9dwv, 9dzu, 9elb, 9eky, 9wu.

Bd QRN reason fr small list of "Calls Heard" at "5QP" this month.

2WZ, BROOKLYN, N. Y.

C.W.:

1ah, 1cg, 1db. (1do), (1dq), 1fn, 1gv, 1ij, 1kc, 1kr, (1mm), (1pa), (1py), 1uj, (1zt), (1zz), 1aac, 1abf, (1adm). 1aft, (1aid), 1aja, 1ajp, (1aol), 1aqb, 1are, (1arf), 1auc, (1aur), 1ruj), 1avr, (1axa), 1axz, 1azr, 1bbe, (1bcc), (1bdt), (1bdx), (1bhn), 1bic, 1bis, (1bjo), 1bqq), 1bzr, 1cjm, 1cmp, (1cmx), 1cpo. (1cqm), (1ctw), 3dk, 3eh, 3hh, 3hj, 3lg, (3me). 3oe, (3oq), 3ph, 3sf, 3tp. 3uu, (3vw). 3aff, 3ajd, 3aoj, 3apv, 3awv, 3bay, 3bce, (3bdi), (3bqp), 3bta, 3buy, (3bvl), 3bwj (3cdn), 3cdk). 3cgs, 3chl, (3cik), (3cjn), (4ab), 4fa, 4fs, (4su). 4tj, 6awt, 6cgw, (8jq), (8ku), 8qm, 8rj, (8uf), 8xe, 8xx, 8xba, 8zp, (8abm). 8ajn, 8aky, 8avl, 8axf, 8ayw, (8bfe), 8bfh, 8bhc, (8bir), (8bkh), 8brc, 8ccr, (8cdc), 8cei, 8cun, (8cwp), 8daa. 8daw, (8dkm), (8dnf), 8dnn, 8dpo, 8dsc, 9zt, 9ato, 9biv, 9dqv, 9dsa.

I. C. W.:

1ael, (1bdx), (1bgq), (1xak, 1alo), (3cdu), (4su).

CAN:

1ae, 1dd, 1eb, (1ei), 2be, 2bn, 2cg, 3bd, 3fc, 3ty, 3xi, 3aec.

Will qsl to all who ask. Pse report if u have hrd us.

GEO. JUNGE, 2241 E. 3RD ST., DAVENPORT, IA.

C. W.:

1ccx, 4ai, 4bx, 4io, 4ni, 4rr, 5ax, 5ck, 5cn, 5es, 5is, 5rg, 5uy, 5uu, 8acn, 8aig, 8ajn, 8anr, 8amz, 8apw, 8aq, 8ayi, 8azg, 8bbg, 8bcu, 8bdg, 8bew, 8bjk, 8bk, 8bkd, 8bkh, 8bmb, 8brc, 8bru, 8bvr, 8bzc, 8cbx, 8cx, 8cpk, 8cci, 8cud, 8cux, 8cwr, 8czz, 8daa, 8dak, 8dat, 8dfo, 8dga, 8dgo, 8dgt, 8ddt, 8dha, 8dhi, 8dm, 8dv, 8er, 8ga, 8gp, 8if, 8ir, 8lm, 8pl, 8qk. 8uf, 8uk, 8ux, 8vt, 8xae, 8xs, 8zc, 8zz, 9aar, 9aau, 9ado, 9adp, 9aim, 9akf, 9aob 9aok, 9aol, 9alw, 9ark, 9arp, 9arr, 9atm, 9auc, 9auv, 9axd, 9axn, 9axx, 9ayd, 9azw, 9azx, 9bbg, 9bcb, 9bck, 9bcx, 9bcy, 9bfb, 9bfo, 9bhc, 9bhh, 9bib, 9biv, 9bjy, 9bkk, 9blg, 9bmd, 9bmu, 9bna, 9boy, 9brq, 9bru, 9bvr, 9bwo, 9bwu, 9cc, 9ccm, 9cdo. 9cee, 9cei, 9cfk, 9cco, 9chc, 9cii, 9cis, 9cil. 9ckd, 9ckk, 9ckw, 9clx, 9cns, 9col, 9cor, 9cph, 9ctr, 9cvo, 9cyy, 9cyw, 9cyq, 9czm, 9dcy, 9dcw, 9dbf, 9dfq, 9dga, 9dgi, 9dlw, 9dm, 9dni, 9dqu, 9dtk, 9dqw, 9drx, 9dsv, 9du, 9dve, 9dwu, 9dyy. 9dyw, 9efe, 9egw, 9ela, 9elb, 9ell, 9elt, 9ha, 9hs, 9le, 9no, 9xd, 9xw, 9zt.

A card to any of above who send me one.

PAUL BIEDENHARN, 1914 GARRARD ST., COVINGTON, KY. (1 TUBE)

1mo, 2cqi, 2cro, 3abw. 3au, 3le, 3oo, 3pi, 3ts, 4eb, 4ll, 4me. 4ni. 4og. 4qw, 4rr, 5aa, 5aac, 5aak, 5aar, 5ac, 5ahr, 5air, 5aiu, 5ak, 5alm, 5an, 5cn,

5da, 5ek, 5ha, 5hj, 5ht, 5kk, 5mf, 5my, 5mz, 5od, 5oo, 5rk, 5rv, 5sc, 5tj, 5tk, 5uv, 5va, 5vc, 5vv, 6agq, 6am, 6avv, 6bq, 6cmk, 6ma, 7ot,
Canadian: 3db, 4bm, 4eo.
Cuban: 6kw.
Wd appreciate a crd fm any of the above.

ROBERT KNAPP, 2006 GARRARD ST., COVINGTON, KY. (1 TUBE)

1axn, 1fd, 1gv, 1lv, 2ah, 2ajr, 2ana, 2aoy, 2bei, 2cjj, 2cnk, 2cxd, 2czd, 2df, 2ja, 2le, (qra, 2rk), 2sq, 3adj, 3ahp, 3atb, 3bbt, 3bms, 3bro, 3bsi, 3bsy, 3buy, 3bwc, 3bz, 3ccn, 3cdk, 3cel, 3cg, 3cgx, 3cjn, 3hg, 3jc, 3jy, 3lg, 3lk, 3lx, 3ly, 3my, 3od, 3ph, 3rg, 3tg, 3ts, 3yh, 3zi, 3zt, 4af, 4ai, 4ar, 4aw, 4bk, 4bz, 4cg, 4cs, 4eq, 4fa, 4ft, 4gx, 4ht, 4ii, 4jm, 4jr, 4me, 4mi, 4my, 4na, 4nv, 4oa, 4og, 4qw, 4rr, 4rz, 4sh, (qra?—4su, 4sx), 5aa, 5aac, 5aam, 5aas, 5af, (qra—5ag), 5aij, 5air, 5aiu, 5aiv, 5alj, 5alv, 5amh, 5aon, 5cn, 5db, 5ec, 5ek, 5es, 5fg, 5fv, 5gi, 5hh, 5hv, 5hw, 5jw, 5ka, 5lr, 5mo, 5na, 5oa, 5ph, 5pk, 5qh, 5qi, 5ql, 5qz, 5rg, 5sy, 5ut, 5vc, 5vm, 5vv, 5wg, 5xa, 5yw, 5zas, 5zg, 6cgw, 6fp, 6ja, 7co.
Canadian: 2fu, 3bg, 3rg, 3wv, 3yv.
Wd appreciate QSL's frm any of the above stations, especially the QRA's.

D. R. KINNER, 1331 AVENUE ROAD, TORONTO, ONT.

CANADIAN:
1ar, 1ef, 2be, 2bg, 3aa, 3ac, 3adj, 3ads, 3av, 3bj, 3bq, 3cj, 3ef, 3ep, 3fc, 3gg, 3he, 3kq, 3ly, 3mh, 3ml, 3oh, 3pz, 3tf, 3vh, 3xn, 3yh, 3yw, 9al, 9av, 9cd, 9cf.
UNITED STATES:
1aal, 1afc, 1asf, 1bgt, 1by, 1ccz, 1cew, 1crw, 1py, 1rr, 2agf, 2byc, 2os, 2pp, 2wz, 3adb, 3agf, 3ajd, 3ard, 3bva, 3chc, 3chs, 3cjn, 3cju, 3lj, 3ms, 3oe, 3tp, 3zo, 4dk, 4dx, 4ft, 4pv, 4rs, 5ap, 5ka, 5rg, 8aaj, 8acm, 8adh, 8agq, 8aig, 8ajd, 8ams, 8amx, 8aq, 8act, 8avx, 8bce, 8bfe, 8bg, 8bgt, 8bk, 8bkh, 8bma, 8bmd, 8bxh, 8cdt, 8cep, 8ceq, 8chp, 8cjd, 8cl, 8cmu, 8cpx, 8cw, 8daa, 8dac, 8dak, 8dat, 8dem, 8der, 8dfb, 8dfm, 8dgo, 8dhu, 8dsa, 8dk, 8fg, 8fm, 8hb, 8hj, 8ho, 8kc, 8nb, 8ow, 8rj, 8tx, 8uq, 8wq, 8xs, 8xx, 8zh, 8zq, 8zy, 9abx, 9aer, 9ahi, 9alx, 9amb, 9aps, 9au, 9aus, 9bck, 9bcx, 9bhb, 9bis, 9bk, 9blg, 9bmu, 9bn, 9bux, 9bvc, 9cap, 9ccw, 9cdo, 9cgr, 9cii, 9cjr, 9cis, 9cp, 9csg, 9czl, 9dbm, 9dct, 9dh, 9dlm, 9dlw, 9dpx, 9dy, 9dwx, 9ef, 9ela, 9ks, 9lb, 9ll, 9qw, 9ss, 9su, 9th, 9wy, 9xl, 9xn.
(8dot, 8dnf, 8dup, 8dsa) QRA?

5ANE, SELMA, ALA.

1ajp, 2crq, 2kx, 3aow, 3bp, 3bua, 3cdk, 3dg, 3er, 3kk, 3mo, 3ms, 3nz, 3oh, 3ph, 3rg, 3ut, 4ae, 4ai, 4dx, 4eh, 4eq, 4mf, 4ft, 4iz, 4mt, 4sa, 4si, 4sr, 4ta, 4zm, 5aed, 5aef, 5aen, 5ail, 5ais, 5akw, 5am, 5amg, 5amh, 5amu, 5aot, 5apc, 5ar, 5ari, 5ck, 5do, 5ea, 5ek, 5es, 5fm, 5gp, 5iu, 5iz, 5js, 5kn, 5la, 5ll, 5mb, 5nt, 5om, 5pk, 5rs, 5sh, 5sk, 5sw, 5sz, 5uk, 5ux, 5vh, 5vr, 5vt, 5vv, 5wi, 8ajn, 8avx, 8ax, 8bh, 8bit, 8bmb, 8bnb, 8bq, 8brc, 8brm, 8cei, 8cy, 8dae, 8dem, 8dh, 8dhe, 8dhs, 8die, 8dt, 8dtc, 8dtw, 8ik, 8io, 8rj, 8sc, 8up, 9aau, 9aaw, 9acq, 9ada, 9ako, 9ao, 9arp, 9arr, 9ash, 9avc, 9awg, 9baz, 9bce, 9bed, 9bit, 9bka, 9bkk, 9bpt, 9cee, 9cer, 9cfi, 9cfk, 9cnu, 9cud, 9cui, 9dbf, 9dcw, 9dge, 9dkk, 9dno, 9dwx, 9efu, 9ela, 9elb, 9is, 9qr, 9rd, 9um, 9vm.
SPARK:
3bp, 5de, 8aer, 8bv, 8de, 9mc.
FONE:
4ft, 4ll, 6amf, 8brc, 8dwt.
Wl gladly QSL crds frm the above. Copp Cir. es Baldies.

2WZ, BROOKLYN, N. Y.

CW.—(1ah), (1ci), (1da), 1db, (1de), (1es), 1gb, 1gv, 1ka, (1my), (1oa), 1ow, (1pa), 1pl, 1py, 1qr, 1rb, (1rh), 1vk, 1xw, 1ul, 1um, (1zd), (1zg), (1zp), (1zt), (1zw), (1zz), 1aac, (1aal), (1abf), (1abs), 1aea, (1aeg), (1aei), (1aeo), (1aft), (1agt), (1aid), (1ajo), 1akz, 1amw, (1anh), (1anx), (1are), (1arf), (1aur), 1avj, 1avl, (1awy), (1axa), (1aye), 1azr, (1bbe), 1bbo, (1bcc), (1bcu), (1bdx), (1bgt), (1bip), 1bjg, (1bjo), (1bkk), (1blb), 1blx, (1boa), 1bpp, 1bpz, 1bqk, 1bqui, (1bvb), (1bvl), 1bvv, (1bwd), 1bwj, (1bzc), (1bzp), (1cak), 1cba, (1ccx), 1ccz, (1cjc), 1cjd, (1cjm), 1cjq, (1ckk), 1cmp, (1cmx), (1cpc), 1cpf, 1cpo, 1cqk, (1ctw), 1cue, (1xax), (2bm), 3av, (3bm), 3bq, (3bz), (3dk), 3ek, 3fr, (3gc), 3hj, 3hs, 3mb, 3me, (3mf), (3mo), (3oe), 3oq, 3ph, (3qj), 3tp, 3ts, 3ug, 3xx, 3zg, 3zm, (3zs), 3abj, 3ahw, 3acq, 3acr, (3adp), 3afs, 3aha, 3ahp, (3aoj), 3api, (3apv), (3auv), 3bdo, 3bdr, (3bmn), (3buo), 3bnu, 3boa, (3bof), (3bqp), 3bsb, 3btu, (3buy), 3bva, (3bvu), 3bwt, (3cbx), (3cdk), (3cdn), 3cgs, (3chc), (3cjn), 3ckh, 3cvc, 3xan.
(4af), 4ai, 4bx, 4dx, 4dy, 4ea, 4el, (4fs), (4ft), 4it, 4jk, 4jr, (4js), 4kl, 4pk, 4pv, 4rr, 4sy, 4tn, 4ut, 4un, 4xg, 5ad, (5bj), 5in, 5ns, 5oq, 5pr, 5qk, 5uk, 5wo, 5aiy, 5akn, 5amh, 5apc, 5axw, 6cgw, 6cqe, 8bf, 8bg, 8bq, 8bt, 8ci, 8ef, 8ej, 8fj, 8fm, 8fu, 8gp, 8gz, (8jq), (8ku), 8mc, (8rh), 8rj, (8sr), (8vq), 8xs, (8zw), (8aaj), 8aer, 8aes, (8aog), 8aig, (8aii), (8aip), (8ajn), 8ald, 8amd, 8apw, 8apy, (8avd), 8avl, (8aws), (8axd), (8ayb), 8bfe, (8bir), 8bit, (8bkh), (8bkm), (8blp), (8bnh), 8bos, 8boy, (8bpl), 8brc, 8brg, 8bvb, (8bvr), (8bvk), (8byq), (8cdc), 8cdx, 8brc, 8brg, 8bvb, (8bvk), (8byq), (8cdc), 8cdx, 8cei, 8chp, 8chr, 8chv, 8cip, 8ckm, 8cmh, (8cmu), (8con), 8cnw, (8cwp), (8cwr), (8cyi), (8dae), (8dbl), (8dbs), (8dec), 8dem, 8dfm, 8dgo, 8dgv, (8dha), 8dhd,

8dim, (8dki), 8dme, (8dmt qra?), (8dnf), 8doe, (8dsc), (8dsn), 8dtc, 9ck, 9gp, (9gs), 9hw, 9kd, 9mf, 9pq, 9ta, (9uc), (9zt), (9aau), 9abt, 9ado, 9afi, 9afz, 9alb, 9amb, (9auc), 9aud, 9azx, (9baz), (9bcb), (9beb), 9bpd, (9bvn), (9bwf), 9bye, 9byj, 9cca, 9cco, (9ccw), 9cee, 9cfi, 9fk, 9cfs, 9cfv. (9cgr), (9cho), 9cip, 9ckr, 9cmr, 9csa, 9csg. (9ctf), (9cvf), (9cxx), 9cze, 9czl, 9dbm, 9dct. 9dfz, 9dga, 9dhz, (9djz), 9dln, 9dma, 9dmj, 9dms. 9dpx, (9dqu), 9drc, 9dsa, (9dsl), 9dsz, 9dtk, 9dtt. 9dvw, 9ebh, (9efz), 9elb, (9eld), (9eli), 9xbb: NKF (KFTU)

ICW.—(1ck), 1kv, (1xu), (1anx), 1hbo, (1bpz. 3hd, (3gc), 3lg, 3zo, (3cdk), 5wo, (8ku), 8aer, 9arf, (nrg), VDM.

Fone: (1alj), 4dx, 8brc.

SPARK: 1aeh, 4fg, 5fv.

CANADA: C.W. (1ar), (1bo qra?), 1bq, 1dd, 1dj, 1eb, 1ef, (1ei). 1aar, 2be, 2cg, 2fo, 3hq, 3fc, 3gg, (3he), 3ia, (3kg), 3kq, 3ly, 3ms, 3ni, (3oh), 3uj, (3vh), (3yh), 3ze, 3aec, 4cn, 4cr, 4hh, 5cp, 5gu, 9al, 9bc, 9hc.

Please qrk, 2wz, 50 watts.

Will qsls to any who ask.

8RY, SULLIVAN, OHIO

1ci, 1ka, 1my, 1qr. 1abs, 1afc, 1alj, 1any, 1aos, 1are, 1arf, 1aur, 1axa, 1aww, 1bdx, 1bes, 1bie. 1bjg, 1bllb. 1boa, 1bvr, 1bvv, 1bwj, 1bzp, 1cmx. 1ccz, 1cjm, 2bm, 2ev, 2mo, 2mu, 2pd, 2ro, 2sy. 2wz, 2auf, 2bqq, 2bsc, 2cac, 2chg, 2cvu, 2cyq, 3av, 3bm, 3du. 3fr, 3hs, 3mf, 3oe, 3pq, 3qj, 3qt. 3vh, 3aap, 3acr, 3acj, 3api, 3apv, 3auv. 3auw. 3bay. 3bva, 3bcx, 3chh, 3cin, 3cdk, 4dv, 4dx, 4eq, 4fg. 4ft, 4jr, 4jss, 4lj, 4si, 4sy, 4tj, 5gp, 5in, 5ka. 5qh, 5ua, 5uk, 5wi, 5wk, 5aiu, 5ajh, 5amh, 5apc. 6lv, 6bcl 6cgw, 9em, 9pq, 9tg, 9ado, 9agl, 9ahv, 9aks, 9alx, 9anb. 9aud, 9hcx, 9beh, 9bew, 9bkq. 9bnu, 9bwf, 9ccw, 9cpu, 9cuh, 9dhs, 9drr, 9eka, 9ela, 9eld, 9eli. Special—1xu, 1xae. 1xak, 1xay. 2xi, 2xab, 3zm, 4xi, 9xz, 5xab, 5xaw, 5zas, 8xaq. 8xbp, 9xbb, 9xbd, ak5, nfk, whu.

Canadian—c1ar, c1bq, c1ef, c2be, c2cg, c3bd. c3bi, c3co, c3fc, c3gg, c3gk, c3kg, c3ly, c3ml, c3nf, c3ph, c3sp, c9al, c9bc, c9bg, vdm.

Wud like QRA of stn "BM" hrd using "dc" intermediate. QTC anybody ?

8RY pure DC note on 155 meters with Four-Coil Meissner.

NEW QRA'S

6CUD—Geo. E. Butcher, 911 W. 17th St., Santa Ana, Calif., 5 watts C.W. All crds answd.

6BBV—Jack Barsby, 518 West 50th St., Los Angeles, Calif., 50 watts C.W. & Fone. All crds answd.

2AHI—Maurice Suffern, 365 New York Ave., Brooklyn, N. Y. All QSL's appreciated and answd.

9DLH—E. M. Cherrington, Jr., 2512 Francis St., St. Joseph, Mo.

9BIC—John Hooks, 1325 W. 72nd St., Chicago, Ill.

8BFG—Edward Roberts, Skaneatcles, N. Y. W1 QSL all crds.

2AAN—(Re-assigned) Stanley E. Hart. 19 Marshall Road, Yonkers, N. Y. All crds QSL'd.

9RT—James G. Smith, 305 So. Garth Ave., Columbia, Mo.

3FF—Sherman F. Holland, Crisfield, Md.

3UQ—Albert Kump, 31 West Commerce St., Bridgeton, N. J. QSL's appreciated. All crds answd.

2CV—Irving Korenman, 1465 60th St., Brooklyn, N. Y. 10 watts C.W. Pse QSL —QRK?

4TX—Donald Brown, Orange address to 260 Glenwood Ave., Atlanta, Ga. 10 watts C.W. All crds answd.

A LETTER FROM CB8

Editor, RADIO NEWS:

I have the pleasure of enclosing a note of the new stations heard recently on waves of about 150 meters and as I suppose some of them, to judge by the weak way in which they were heard, must use low intensity. I feel that it would be of interest, if you could establish a comparison between the facility with which you hear in this place stations of low wattage.

Having finished repairing an injury suffered by my regenerator, I am now renewing my attempts at distance transmission. trying to communicate with Europe and Australia, the results of which I will report to you.

To be able to study the causes which have

interfered with the few results obtained in the last Pan-American test, I have transmitted to E. H. Knies, radio operator of the S.S. *Southern Cross,* a short wave receiver, so that during his trip from here to New York and return to Buenos Aires, he will note every day the intensity with which he hears my transmitting, which will be sent out at 4:30 a.m. and 4:45 a.m. in telegraphy and in telephony on a 120-meter wave.

I have asked Mr. Knies, upon arriving in New York, to transmit to you a copy of his diary, the notes in which will be of interest, in order to determine in what portion and where the intensity is lost in going and returning.

C. Braggio.

CALLS HEARD BY CB8 ON JUNE 15

1:30 a.m.—9AMB CQ
1:45 a.m.—3BAY calling 1XU
2:05 a.m.—9BLG CQ
2:12 a.m.—9DBY calling 9BLG—not r ur application yet om hw?
2:35 a.m.—1AVL CQ
3:10 a.m.—2BUY calling 8BSJ
3:22 a.m.—2TX calling 8BCU
3:25 a.m.—3BNU CQ
3:35 a.m.—8VQR calling 8DAW

Notes On the Super-Heterodyne

(*Continued from page* 493)

windings, but on the amount of *change* or *variation* in this current. The "C" battery reduces the amount of current supplied by the "B" batteries but does not reduce the variations. This is effectually shown in Fig. 8 where the upper curve shows the plate current without the use of a "C" battery both when no signal is being received and when a signal is coming in. The lower curve shows the plate current when a "C" battery of the proper potential is used under the same conditions. The variations in the plate current at the right-hand end of the curves are what produces the sound and it is seen that the signal strength in each case is the same. The "B" battery will last about three times as long under the conditions represented by the lower curve.

SIZE OF SET

One of the chief objections to building the Super-Heterdoyne has been the large size of the set and the excessive amount of labor required for its assembly. In the large number of units which make it up, mistakes in connecting are the rule rather than the exception. Once such a mistake has been made, it is very difficult for the builder to locate the fault. Then, too, there is the possibility that the parts are not

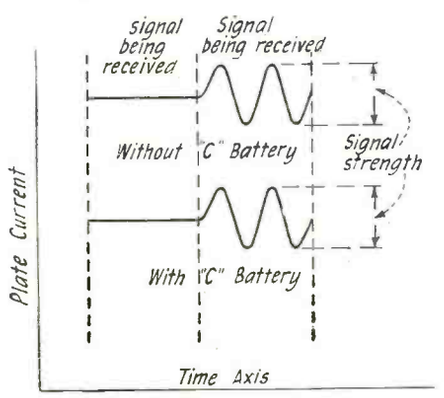


Fig. 8

By comparing these two curves it will be seen that the use of a "C" battery cuts down the plate current but does not detract from the signal strength.

adapted for use together. The builder should therefore buy *sets of parts* which have been tested by the manufacturers. This will give assurance that the various parts are adapted to work together and will insure a set which is capable of giving the best results.

POPULARITY

That the popularity enjoyed by the Super-Heterodyne is well deserved is instanced by the remarkable long distance receiving records being made in all parts of the United States with it. Many radio fans say it is the ultimate set for the present state of the radio art. It is the opinion of many radio authorities that no advancement beyond the Super-Heterodyne will be made until there is some revolutionary invention or discovery which will completely upset our present conceptions of radio communication —an event which seems difficult to realize but which is not beyond the limits of probability.

RADIO OVERSEAS

By E. FAIRHURST

Considerable interest has been aroused by the recent announcement of the British Post Office to the effect that telephonic conversation with America through the medium of radio is likely to be a commercial reality in the near future. Experiments have shown that radio broadcasting from America can be received and switched through to any subscriber of the British Inland Telephone system. It is expected that the new station building at Rugby, England, will be one of the links in this service. The main station at Rugby will be detailed for "Imperial Wireless Communication" and is expected to be completed by the end of the present year. This station will occupy a site of one and a half square miles, and will possess an aerial one and a half miles long and half a mile wide supported on a dozen masts each over eight hundred feet high.

The press disclosures that the Marconi engineers have perfected a system of signaling by radio along a directed beam have brought into prominence the question of the advisability of halting the construction of the high power stations, as the new system promises to revolutionize long distance communication, and in addition to prove far more economical than any system at present in use. Senatore Marconi in a recent lecture before the Royal Society of Arts, London, gave some interesting views on his latest experiments with short wave directional radio telegraphy employing his directed "beam" system. On June 12 last, using 21 kilowatts his station at Poldhu, Cornwall, signaled easily to Buenos Aires. As a result of the ease of this communication over a distance of nearly 6,000 miles the opinion is expressed that the new system is able to do in half a dozen hours what their present high power station can do in 20 hours. His next example was the transmission on May 30 last, of speech from Poldhu to Sydney, Australia, over a distance of nearly 12,200 miles. The power in this case was 28 kilowatts, the wave employed in both cases being 92 meters. Parabolic reflectors are used to concentrate the energy in the desired direction.

So successful have the Marconi direction finders on board British ships proved to be that the Peninsular and Orient Line, one of the largest British shipping companies, has decided to not only equip their steamers but also the lifeboats with direction finding apparatus. The *Maloja* is the first ship so equipped.

A new vacuum tube has appeared on the English market and is claimed to be free from microphonic noises with high signal quality and purity. A special conducting service is deposited on the glass tube and acts as the plate of the valve. As the glass container naturally totally encloses the grid

and filament, full use is made of the whole of the electron emission.

The Radio Electrique Radiotelephone station at Brussels is now broadcasting on a wave-length of 250 meters.

Wireless amateurs in Australia are very pleased at the removal of the regulation which made it compulsory for receiving sets to be sealed on one wave-length only. A fee has been instituted, however (approximately $10 per annum). as a broadcast subscription, and an additional dollar is payable to the Government. It is stated that there are about 3,000 experimental licenses in New South Wales alone.

News received from America, France and Germany at the Osaka Wireless Station is now distributed throughout Japan by the Japanese Department of Communications.

A new high power station has been opened at Bammako in French West Africa. This station will be in direct radio communication with Paris.

At an international conference of wireless operators held in Paris, a proposal was made that a five minute radio silence should take place annually in commemoration of operators lost at sea. The anniversary of the *Titanic* disaster was considered as a suitable date for the carrying out of this proposal.

The British station at Oxford. England, which sends out messages to vessels at sea, has recently reverted to its short wave of 8,750 meters for this purpose. Reports indicated that the longer wave was seriously interfered with when vessels were at extreme range and in order to make the service more efficient for the disposal of marine messages the reversion to the shorter wave was decided upon. The time for the broadcast of ships' messages has been altered from 9 a. m. G. M. T. to 1:10 a. m. G. M. T. and if necessary further work will be carried on at 4:48 a. m. G. M. T.

INTERNATIONAL RADIO CONFERENCE URGED

The need for an international conference on radio telephony, a universal language. more latitude for amateurs, and exclusive wave bands for distress and time signals is recommended in resolutions adopted by the preliminary Conference for an International Radio Agreement held at Geneva in April, and recently received by the Department of Commerce.

The preliminary conference, at which many European nations were unofficially represented, endorsed the belief that the London convention of 1912 and the Washington Conference in 1920 were not adequate to meet the present needs of radio telephonic communications between nations. Urging that a new intergovernmental conference on radio telephony be called soon, the delegates look to the free development of this new means of communication for popular instruction, universal information and social art.

Among the recommendations endorsed are the following:

That certain bands of wave-lengths be reserved exclusively for radio telephony, and that they be distinct from radio telegraphy channels.

Because of the contributions of amateurs to the art, that their rights be given consideration and their certain wave bands be reserved for their experiments.

That the use of distress wave-lengths should be exclusively limited to danger signals from ships and for time signals.

The conferees further recommend that the League of Nations and the Universal Telegraph Union do everything possible to hasten the reconvening of this conference, making it universal if possible, but at least European. They invite all radio telephone organizations to create public interest and address petitions to their governments for the

purpose of urging at Geneva and at Berne the hastening of a general convocation.

A provisional executive committee was authorized to pursue efforts toward an international agreement in radio telephony and to establish permanent bonds between transmitting stations, companies and journals, with a center at Geneva.

It was pointed out at the Conference that Radio telephony spreads the human voice over all borders, but encounters the use of many different languages, and that therefore a universal or auxiliary language is needed for foreign transmissions. Some stations abroad and in America have already undertaken instruction in such a universal means of communication. It is recommended that broadcast stations devote at least one evening a week to transmission in Esperanto. In this connection, the conferees also endorsed the efforts of M. Pierre Corret of Paris in forming the International Radio Association, and urged that he hasten the issuance of the International technical vocabulary of Esperanto for use in radio communication.

States and countries which have forbidden the use of radio were urged to reconsider their decisions in the interest of development, especially in the amateur field.

These are only two instances; there are hundreds of duplicate amateur calls throughout the countries actively engaged in radio communication. Amateurs will also come in for special consideration in the proposed reallocation of wave-lengths, and co-operation in the organization of a national emergency radio net.

Another important question sure to be discussed developed as a result of the Convention broadcasts is: How to encourage first-class broadcast programs which will interest the whole country as well as a single communtiy? In this connection, independent and chain broadcasting will probably be considered. "Shall Class C Stations be permitted to continue on the 360 meter wave?" is another question sure to be on the program. There were 101 of these stations on June 30, most of them serving a single community. They might better serve the radio public if transferred to either Class B or A or shut down permanently. Limits of power for broadcasters will also be discussed in connection with the question of licensing the contemplated higher-powered stations of 5 and 10 k.w. Today 1 k.w. is the limit of Class B stations, and information as to the practicability and desirability of higher-powered stations is desired. Limiting the number of broadcasters in a single community is another important question which may be raised. Other questions include rebroadcasting problems, such as relaying by wires, as was done during the political conventions, and retransmission on short wave-lengths, especially as relates to chain circuits. Provision for handling land SOS calls and emergency traffic, when other communication lines are out of commission, will probably be discussed, as will the question of advertising through the ether, together with government regulations relating to such advertising.

The exact date of the conference and the number of invitations to be issued awaits the return to Washington of Secretary Hoover, but it is understood that all organized interests will be invited to send official representatives to act as delegates, with voting power, while independent and allied interests will be welcomed at the conference, which will be open to the public. Assurance is given that no members of the large radio family will be left out, as a general representative conference, such as has already been held twice, is desired.

WBZ GETS STANDARD FREQUENCY RATING BY U. S. BUREAU OF STANDARDS

As a result of measurements by the United States Bureau of Standards, Department of Commerce, upon the transmitted waves of radio transmitting stations, radio station WBZ at East Springfield, Mass., has been found to be one of the few broadcast stations in the country which maintains a sufficiently constant frequency to be useful as a frequency standard. By reason of this uniform constancy of transmission the Springfield Westinghouse station will be listed as a standard frequency station in the "Radio Service Bulletin," compiled monthly by the Bureau of Standards, along with the call letters of a few more stations in the country.

The Springfield station, over a period of two months, varied but one kilocycle away from its assigned standard. In other words, WBZ retained its frequency of 890 kilocycles for a period of two months, except on one night, when it was found to be 891 kilocycles. The Government tests were taken regularly during that period and at different times during the evening on each test.

How useful the maintenance of such a constant frequency by WBZ or other stations is to a radio fan becomes evident in attempting to calibrate any receiving set. A standard frequency station enables the fan to mark off on the dial of his set the point at which broadcast stations should come in. Instead of "fishing around with the dials," as the expression goes, he is enabled to mark off the point at which certain standard frequency stations will come in and unless a change is made in the set, or the antenna or ground is changed, this point will be reasonably constant. It is helpful also in locating new stations, using the standard stations logged as guides.

HOOVER'S AIDES PLANNING FOR RADIO CONFERENCE

Improved national broadcasting, interference other than radio, and significant calls for long-range amateur stations are three of the important questions which will probably come up for discussion at Secretary Hoover's Third National Radio Conference to be held in Washington this autumn.

Officials of the Department of Commerce are now in correspondence with their field representatives planning a program of sufficient scope to cover all problems of radio administration as it affects commercial, private and amateur radio activities. Each of the nine Radio Supervisors, it is understood, has been asked to submit his views on certain questions and to suggest subjects for consideration during the conference, which will probably run three or four days. The Radio Supervisors are taking up specified questions with local radio interests in an effort to secure their views before the sessions convene in Washington. Both the Department and the Government's Radio Advisory Committee are understood to have taken up pertinent problems with the broadcasting, manufacturing, commercial, and amateur organizations, reports from which are now coming in.

One of the subjects to be discussed, which has hitherto been left to the electrical industry, is whether or not the Government should interest itself in interference coming from other than radio sources; that is, electrical power and light interference and disturbances in the ether emanating from electrical apparatus. Electrical power and light companies have been making a study of these problems themselves. To date no report has been made to the Government, so the question of whether the Department should con-

cern itself with such interference is to be considered.

In the interest of the international activities of our amateurs and the pride of their transmissions to foreign countries, the Government plans to open the question of assuming identifying call letters, without interfering with international regulations. Until recently, amateurs did not come into world-wide prominence and their call letters prefaced by a numeral, designating their national district, were considered sufficient. But now that their messages carry to Europe, as well as to Canada and Mexico and other neighboring countries, it is apparent that 6KW is no longer an identification for the Cuban station; J. H. Hadley of San Francisco also uses 6KW. Canada uses numerical calls for its amateurs, and so does Mexico. The London station 2LO is well known over here and yet we have a station 2LO owned and operated by Nelson Dunham of Highland Park, N. J.

The Log of a Lightning Jerker

(*Continued from page* 506)

for about three weeks, I boarded a train for Portland and arrived in time to spend Christmas at home. After the holidays I decided to explore the other side of the world and did so quite thoroughly aboard the *S.S. West Keats.* I made eight trips to the Orient on this vessel and among the many ports at which we touched were Yokohama, Kobe, Shanghai, Tsing-tau, Chee-foo, Taku, Tientsin, Ching-wang-tao and Darien in Japan and China, and Manila, Cebu and Ilo Ilo in the Philippines.

Tiring of life on a freighter, I began looking for new thrills for my jaded and world-wise self (Hi!). Was offered a position at a big salmon cannery in Alaska and took it. My job was to operate the radio station, act as bookkeeper and storekeeper and tend the still that was supposed to supply the fishermen with alcohol for their cook stoves. (More Hi's!). At the end of the season I received an appointment as operator on the *S.S. President Madison,* which took me back to the Orient again.

Thought I was fed up on passenger vessels with all their gold braid, brass buttons, uniforms and social functions, so with a hankering for a life of leisure and informality that a freighter offers, I shipped on the *S.S. Crosskeys.* Guess I was spoiled all right for I had no more than set foot on her than I wished to be back on the liners again. One trip was enough. I suppose it was the spell of old Cathay, that "Land of Mystery and Romance," as much as anything that took me back to the East again, this time aboard the *S.S. President Jefferson.* Alfred Noyes must have felt the same subtle lure when he wrote:

"You that have known the wonder zone
Of islands far away;
You that have heard the Dinky bird
And roamed in rich Cathay;
You that have sailed o'er unknown seas
To wood of Amfalula trees
Where craggy dragons play;
Oh, girl or woman, boy or man,
You've plucked the Flower of Old Japan.

Ah, let us follow, follow far
Beyond the purple seas;
Beyond the rosy foaming bar,
The coral reef, the trees,
The land of parrots and the wild
That rolls before the fearless Child
Its ancient mysteries;
Onward and onward, if we can,
To Old Japan, to Old Japan."

What broke the spell, I think, was the sickening sights, the gruesome experiences of the terrible earthquake which we were

unfortunate enough to be mixed up in. Our job was carrying refugees to safety, but my particular job was to handle the enormous volume of traffic that we were called upon to get through. Over 14,000 words in eight days and under extreme difficulties. Then I thanked my lucky stars for the thorough fundamental training I got back at the old code tables in school, for we cleared it all in fine shape.

My next ship was the *President Grant*, and in summing up I find that in all I have made 18 trips across the Pacific and back. I found time, along with sightseeing and other diversions, to study and take advantage of the splendid opportunities offered to observe the manners and customs of the peoples with which my calling brought me in intimate contact; learned their business methods and managed to gather enough experience in foreign trade and transportation so that tomorrow I am leaving on my nineteenth trip to the Orient.

This time I sign on, not as a radio operator, however, but as a passenger, if you please. On one of my later trips I managed to establish connections that since have developed into an attractive offer to go to Manila in the offices of a large shipping and brokerage concern, so this voyage may be an extended one.

Before "shoving off," however, I want to say that I'm for radio, first, last, and all the time, and that if any conscientious young man who adopts it as a profession, either for the opportunities for travel which it offers, or as an end in itself—if he will grasp and make use of this means of advancement which is at hand, he may acquire a liberal education that will give him no cause to regret the fate which prevented him from attending college.

—Abstract from "The Lightning Jerker."

The Life and Work of Lee DeForest

(*Continued from page* 465)

things mechanical and electrical from his earliest age. In later years, his memory remained clearer on such things than on other interests which might, logically, be expected to occupy the mind of a healthy growing American child. As a case in point. Shortly after he was three years old, his father took him to view a demonstration of an early Edison tinfoil phonograph. He looked upon it with awe and asked many questions.

FIRST PHONOGRAPH

At the age of three such an interest (as well as the remarkable retention in memory of the occasion) is for the psychologists to work upon. DeForest remarks that this is possibly one of his earliest if not *the* earliest of his remembrances. The incident took place in Waterloo, Iowa, and while undoubtedly many other incidents of equal or greater interest to a child took place, few if any of them are remembered.

With a large number of children—almost all of them, in fact—an interest in "how it works" is demonstrated in connection with all the strange, new things with which they meet. This interest was strong in DeForest. However, living in a Southern town totally without the modern mechanical conveniences with which we are acquainted, he was not privileged to feed his imagination with the hosts of gyrating monsters which give the modern child so much pleasure. There was likewise a dearth of toys, and none of the mechanical variety. As a result, he fell back on the only possible outlet for an ever busy brain and body.

There are any number of stories and tales of humorous practical jokes and weird pranks which have resulted from the imagination and energy of

such children. DeForest seems to have been just such a child.

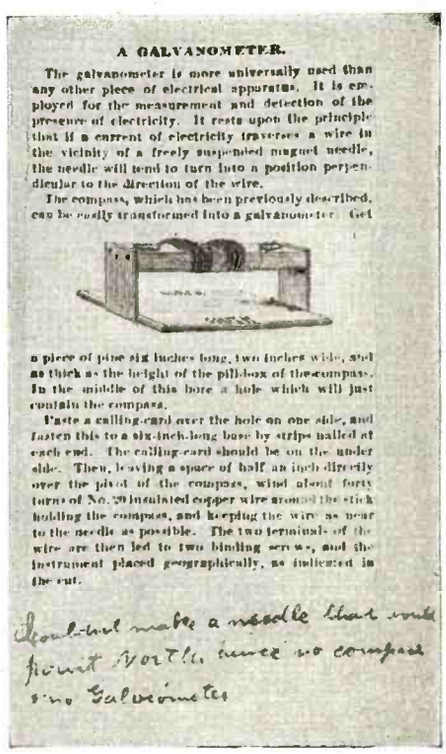
What was to be of more importance was, probably, a tenacity. To those who hold strongly for heredity, it will at once be said that this trait was a direct inheritance from his pioneering ancestors. Possibly it was, anyway, he had it and a large supply of it.

A point here may be the doggedness with which he maintained an interest in things mechanical in the face of his father's almost constant objections. Being a minister and having devoted his life to the ideals of religion he naturally desired his eldest son to take up his work.

The Rev. Dr. DeForest took no vigorous steps to change the course of his son's studies and interests until his tenth year. After he began, however, the two wills clashed often and long. In the end the son came off victor.

"INVENTING"

One of the first of these clashes came when Lee, as was a sort of custom for rainy days, lay flat on his stomach on the living room floor with a large sheet of paper, pencil, ruler and square "inventing." Upon such occasions he would reproduce with great detail the mechanical construction of steam hammers, guillotines and other devices which he had read about in the "Mechanical Encyclopaedia." Sometimes he would not follow the designs shown, at others he would branch into a line of endeavor for himself. It was upon one of these essays that he invented a perpetual motion. It was very simple, he thought. Consisting of electro-magnets, it worked by having metallic shields which alternately cut off and released the power of the lines of force. The notes on the device are enlightening. One sentence says ". . . it is strange that after the years of toil used up by geniuses of the past in attempts to construct a perpetual motion that I, a comparative youth, should succeed where they failed. . . . ! !" It was not until he had read deeper that he learned of the magnetic law which obviously rendered this scheme inoperative.



A GALVANOMETER.

The galvanometer is more universally used than any other piece of electrical apparatus. It is employed for the measurement and detection of the presence of electricity. It rests upon the principle that if a current of electricity traverses a wire in the vicinity of a freely suspended magnet needle, the needle will tend to turn into a position perpendicular to the direction of the wire.

The compass, which has been previously described, can be easily transformed into a galvanometer. Get

a piece of pine six inches long, two inches wide, and as thick as the height of the pill-box of the compass. In the middle of this bore a hole which will just contain the compass.

Paste a calling-card over the hole on one side, and fasten this to a six-inch-long base by strips nailed at each end. The calling-card should be on the under side. Then, leaving a space of half an inch directly over the pivot of the compass, wind about forty turns of No. 30 insulated copper wire around the stick holding the compass, and keeping the wire as near to the needle as possible. The two terminals of the wire are then led to two binding screws, and the instrument placed geographically, as indicated in the cut.

Should not make a needle that would point North, since no compass since Galvanometer

A galvanometer from DeForest's note book.

Other times he would reproduce machines he had seen in his travels about the surrounding country and on trips he made in the company of his father, who traveled a great deal. Near Talladega there was a

large blast furnace. This received his attention a short time after he was taken to the town.

One afternoon, while he and his brother with a couple of "nigs" (as he always referred to the Negro children with whom he played a great deal) started to a creek a few miles away ostensibly for swimming. On the way, in order to take a short-cut, they walked down to the railroad right-of-way. A few miles out of town they passed a blast furnace in operation. The remainder of the diary entry for that day is given over to an exposition of the wonders of the blast furnace. This same smelting plant is the cause for many entries and for one accident in which he might easily have broken his neck.

This episode proved so interesting that he could not confine the copying and reproduction of the new mechanical wonder to paper. With the help of his younger brother he constructed a replica of the furnace. A large, battered ash-can constituted the body of the fire-pot, while an elaborate pine superstructure served as flue. Most of the time the furnace was in operation the two youngsters were busy keeping the flue from passing on with the charge. The furnace operated successfully, however, and poured forth a small quantity of molten lead which elicited shrieks of delight from the youngsters. The delight was comparatively short-lived, however, for the forced air draft for the flame was supplied by a chimney bellows which also happened to be an heirloom of several generations standing of the DeForest family. The youngsters were more careful of the chimney than they were of the air draft with the result that a supply of crude metal ran back into the bellows, leaving it a total loss.

The blast furnace fell terribly in prestige after the sons had had a long and epoch-making conference with their father in his study. At least, it was removed from the back yard shortly after and never again put in an appearance.

EXACT KNOWLEDGE

As with the blast furnace, nothing seemed to interest Lee unless he could examine it thoroughly and find out *exactly* why it worked.

Sometimes, as in the case of the blast furnace, he did not thoroughly assimilate the facts concerning the piece of apparatus at his first view of it. In such cases he returned to the machine again and again in an attempt to master it, finally achieving the desired result.

It could hardly be said that he was greatly imaginative. Rather he gained his ends by hard work. There is hardly a case of his meeting a new theory or idea and mastering it immediately. His mind simply does not work that way. He takes it slowly, piece by piece, and with the mastery of the detail reconstructs the whole.

This is clearly shown by his first encounter with a locomotive. In the town near which his father's school was located he was at the station one day when a train arrived. Of course, he understood the theory of the steam engine, but its application to a locomotive with reversing gears and the juxtaposition of air brake cylinders and oiling adjuncts floored him. There followed several trips to town.

Finally, after many studies of the thing, while the engineer was oiling up or the baggageman exchanging jokes with the station master, he saw it all. Immediately he started for home on a dead run crying under his breath, "I'm so happy, I'm so happy."

A few days later, the DeForest back yard saw another monster worse than the blast furnace bloom into existence. It was a complete replica (as complete and workable as could be made with the aid of pine boards, barrels, hand saw and hammer) of the locomotive including the all-important reversing gear.

This slow thoroughness follows throughout the whole of his life. With it, and possibly very much to his advantage, was an orderliness imbued by early training which worked constantly to make him a success.

The beginning of this orderliness—possibly it might better be called standardizing of routine—was, like most of his other characteristics, noticeable from earliest childhood. His father insisted that each of the children should perform a certain amount of the chores daily and that they take part in some sort of athletics. Day after day his journal carries the entry for splitting the kindling and currying the family horse. The only deviation comes when the horse got herself particularly dirty and caused him to write a tirade on her condition.

A TEMPER

He seemed to have quite a temper then. His first job after arising was the care of the mare and he always wrote the journal entries just before retiring. The twelve or fifteen hours lapsing between currying her and cleaning the manger had no effect whatever in softening his wrath when the job was unpleasant. There was no burst of temper. To the contrary, he did the work and harbored his choler for the rest of the day.

These duties bestowed upon him by his father he never questioned. In just the same fashion he did not question any part of his father's religious dogma until years later.

Religion played an important part in his early life. There was church every Sunday in which he took an active part. Those who are acquainted with the South of the period know the very important part dogmatic religion played in the social fabric of the times. After he passed the age of thirteen religion forced itself more and more into the foreground of his thinking, chiefly through the rigorous religious home life he led. Every Sunday afternoon was given over to reading the Bible and there was family prayer each morning. Before retiring he read the Bible.

As he grew older, the loneliness of his life forced him—not particularly against his will—into deeper and deeper study of his chosen line. From the time of adolescence until he entered prep school his reading became more and more constant and his experiments more and more pretentious. Novels formed a very small part of his interest. In fact, the only one mentioned in his notes or correspondence (which was extremely large) is the "Tale of Two Cities."

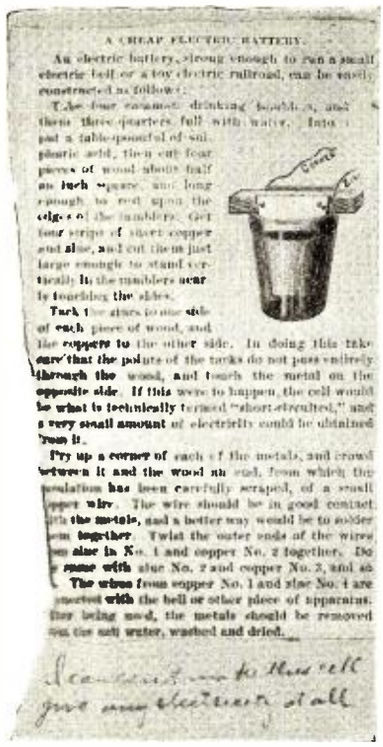
He read with delight, however, all of Cooper's "Leather Stocking Tales," his Sea Tales, and stories of Colonial history.

The mechanical illustrations of the dictionary were discovered and they gave no little interest. The library of the school contained very little along physical or electrical lines except a scientific journal (*Scientific American*) and the *Patent Office Report*. These he read with avidity, making notes of interesting facts he found in them.

The *Companion* ran a large premium list. One item given about the time De Forest was fifteen years old was a complete electroplating outfit. It could be procured with a number of subscriptions to the magazine. He decided to get it and started his subscription campaign. At first the results seemed sanguine but soon he had exhausted the list of his friends and was forced to go out among the "Rebs" for his soliciting. The territory around Talladega was one of poor culture and not at all wealthy. The going was hard and finally, in order to obtain the set, it was necessary for him to save pennies and dimes to assist the credit received from the subscriptions.

After receiving it he immediately began tests. Power was furnished by home-made primary cells.

After the outfit was in working order he took his revenge on the people who had refused to take subscriptions. They wanted



A CHEAP ELECTRIC BATTERY.

An electric battery, strong enough to run a small electric bell or a toy electric railroad, can be easily constructed as follows:

Take four common drinking bottles, and fill them three-quarters full with water. Into each put a tablespoonful of sulphuric acid, then cut four pieces of wood about half an inch square, and long enough to rest upon the edges of the tumblers. Get four strips of sheet copper and zinc, and cut them just large enough to stand vertically in the tumblers near to touching the sides.

Tack the zincs to one side of each piece of wood, and the coppers to the other side. In doing this take care that the points of the tacks do not pass entirely through the wood, and touch the metal on the opposite side. If this were to happen, the cell would be what is technically termed "short-circuited," and a very small amount of electricity could be obtained from it.

Fix up a corner of each of the metals, and crowd between it and the wood an end, from which the insulation has been carefully scraped, of a small copper wire. The wire should be in good contact with the metals, and a better way would be to solder them together. Twist the outer ends of the wires zinc No. 1 and copper No. 2 together. Do the same with zinc No. 2 and copper No. 3, and so on.

The wires from copper No. 1 and zinc No. 4 are connected with the bell or other piece of apparatus. After being used, the metals should be removed from the salt water, washed and dried.

DeForest's first battery.

spoons and silverware plated as they had seen some of their friends' plated and they must needs take them to DeForest.

It was with this outfit that he made his first dollar.

Here it might be interesting to note that he was always practical. With every new idea, new discovery, the question of practicality always thrust itself before him. With all his experiments he sought to find a practical purpose for which to use them.

After the advent of the electroplating apparatus other electrical experiments followed swiftly. There was a horse-shoe magnet that was really worthy of its name since it consisted of a real old, rusty, horse-shoe around the two legs of which were wound the necessary wire.

Then followed in rapid sequence the construction of a compass and galvanometer. The obliging college druggist furnished the case for the compass which took the form of the well known round pill box. The top of the box was removed and faced with glass. One of his mother's needles went to support the magnetic needle which was a piece of main-spring cut from an old clock. After the compass was completed, the wire came off the horse-shoe magnet and was rewound upon two supports for the galvanometer. The compass was placed between the coils and the addition of two wood screws for binding posts completed his first measuring instrument for electrical currents.

At the age of thirteen, DeForest's bent for electricity was well established—so well established, in fact, that his father began a sort of counter campaign in favor of the ministry and the classics. As a result of this campaign, Lee wrote his father a long and elaborate letter, painfully executed on his father's early typewriter, stating in unequivocal terms that it was his desire to follow his natural inclination to take up engineering and invention.

There is no indication in the facts known which would show the inception of this desire to invent. It was natural and evident from the first unfolding of his mind. It certainly must have been natural. It is hardly remarkable, however, since the history of the world's geniuses all followed an almost identical course.

(*Continued on page* 592)

WASHINGTON RADIO ENGINEER PROVIDES INVISIBLE AERIAL FOR PATRON

One day a Washington telephone subscriber and a fan called WCAP and requested the services of a radio engineer; one was sent to his house immediately.

The subscriber, who had just moved into a new house, desired an invisible aerial. The expert asked why he did not use an inside loop. He was informed that, although the set might operate well with a loop antenna, the owner desired maximum distance, and consequently wanted an outside aerial. "But," he admonished, "it must not show: this house is the pride of both myself and the architect and we do not want unsightly aerials overhead."

Realizing the impracticability of installing a real aerial without its showing, the engineer climbed to the roof to look over the arrangement of the eves and chimneys, hoping he could so string an aerial that it would not be seen from the street below. He soon found this impossible. Ready to give up, he was crawling down over the gutter, when he made a discovery. He descended, inspected the down spout and gutters all around the house, then climbed back and soldered the lead in to the down spout. Inside, he hooked up and tuned in several stations with fine results. He called the owner, who was delighted and wanted to see the aerial.

"There isn't any," replied the expert. "You have a very fine copper gutter, completely insulated from the house by a slate roof, and other non-conductors; even the down spout leads into a terra cotta pipe, so I soldered a lead in to the down spout just outside your library window, and there you are. Incidentally, it's probably the first invisible aerial," he added.

His course was well defined before the writing of the letter mentioned above. After that, the matter was practically settled and his schooling was regulated accordingly, in as far as the curriculum of the schools he attended permitted.

While his education continued in Alabama there was little outlet for his mechanical activities. He continued reading such journals and books as he could find with the result that he definitely decided to become an electrical engineer and inventor long before he completed his other plans for prep. school. And always, when he mentioned his occupation as engineer the "inventor" was joined with it.

His development was rather lop-sided all during the period he spent at home. Although he took many trips with his father to all parts of the country, there was little in them save a glorification of what he constantly encountered at home. A continual round of religion and the classics sandwiched, here and there, with some enjoyable scientific adventure, formed a large part of his routine. Throughout it all, however, he was seldom recalcitrant. There seemed to be in him a veneration for the family with his father at its head which forbade him questioning the system.

One instance of his resenting it is shown clearly (and it is practically the only one). It was his last year at home before entering prep. school and his father insisted on his learning the fundamentals of Greek.

This decisoin brought forth a tirade that lasted for weeks. It was not shown publically, however, being confined entirely to a diary.

He had several conditions to make up before his entry for the class of '93 could be made at Mt. Hermon, Massachusetts, Preparatory School, and so the months following were crowded full of work. It was his plan to finish the course at Mt. Hermon in two years, with the assurance of credits he gained through the tutelage of his father. This he did successfully and with extremely good grades.

FOURTH CELEBRATION

The South did not observe the Fourth of July in those days. The DeForest family being good Yankees, however, felt in duty bound to make the usual noisy celebration of their country's independence. No fireworks were obtainable in Talladega, so it devolved on Lee to manufacture the greater part of the family's pyrotechnical display. Some Roman Candles and pin-wheels were imported from the North and, with the assistance of a handful of shot-gun shells and a few fruit tins, the day was celebrated properly. During the day preceding, Lee repaired the flag pole at the college and made one for his home. On the morning of the Fourth flags were flown at both places.

As he returned from hoisting the one atop the college cupola a bunch of the "nasty little Rebs" gave chase, speeding him homeward, so he arrived with lots of time before breakfast.

It was on July 6, 1891, that he left his home in Talladega for Savannah, Ga., and thence by boat for Boston. In Savannah, while waiting for the boat, he used his time in observing the various wonders of the wharves and the vessels anchored there.

During the voyage of the *City of Macon* DeForest kept a full account. It reads almost like a ship's log. Very little attention is given to passengers or other incidents. It consists almost wholly of details of the ship's action. In getting out of the harbor of the Savannah River, the vessel became grounded on a bar and it was necessary to call tugs to pull her off. The process is given in detail in DeForest's account.

On arriving at Boston, his first visit was

to a book shop where he purchased a copy of the "Encyclopedia of Science," which he kept and studied in spare hours for a number of years.

From Boston he entered a boys' camp, where he spent the time intervening until the opening of Mt. Hermon. Here he showed a surprising ability at practical joking which was not particularly marked before. It followed him through his time at Mt. Hermon and cost him many a weary hour of extra duty and not a few fights.

His accounts of them are screamingly funny, not so much because of the stunts themselves, but the manner in which they are told. Set down in the most matter-of-fact way, without the slightest embellishment, it hardly seems possible they were practical jokes. One of them goes something on this order:

"Doused Bob and Joe on the floor below with two bags of water; found my bed torn up when I came home, as a result." All the accounts read similarly. clear. concise, no extra words. He seemed to perform them as though they were a quite regular part of the day's routine.

It was during his stay at this camp that he obtained his first view of the electric lighting system. One of the instructors took a class of boys into a nearby town and conducted a tour through the small generating system.

After the completion of six weeks in the camp he was matriculated in Mt. Hermon. September 2, 1891. The first two days of his stay were given over to examinations, all of which he passed with ease. He says of his first academic day: "Father goes home tomorrow. I had a hard day. Didn't get my books and so lessons will be unprepared. Studied from seven till nine. Then rest. . . ."

WORK HOUR

At Mt. Hermon, each student was required to do a certain amount of manual labor each day. There were assignments that had to be fulfilled even as Greek or Virgil. During his first term DeForest was assigned to farm work and spent two and a half hours a day for the first several days at school digging potatoes.

To those not acquainted with such a curriculum—consisting of Virgil, algebra, geometry and three other subjects, together with two and a half hours of work—such a daily routine seems almost horrible. Add to that training for track work and DeForest's routine results.

Nowhere is there recorded a complaint against the amount of work he was called upon to do. It seems he had become accustomed to a strenuous grind since his childhood so the work at the school was no harder than usual. To make it worse. on account of the diminutive size of his allowance, he was forced to spend many of his weekly holidays working for additional funds. He continued this practice almost constantly throughout his entire stay at Hermon.

It is notable that unless he was actually busy, mentally or physically. he classed the time as "fooled away." Such use of it was seldom made. Through early training or otherwise, he was unable to master the technique of graceful loafing sometimes called "contemplation." His mind demanded some occupation and demanded it in the form of an actual problem. This trait is one that followed him consistently, also.

This seems to have led to a strange deviation. It could be logically expected at his entrance into the life of the school, with the wealth of human contact which had been denied him before, and an untramelled outlet for his actual spirit and moods, that he would have shown some of the spirit of fun and care-free youth. Such was not the case. With a doggedness. which often became almost drudgery, he continued to mull

and work, taking joy in nothing else. Though he was extremely fair with himself, he was almost constantly worried when some trick of chance would force him to let a lesson go unprepared. The ideas which motivated this application were a blind sense of duty to himself, an everburning ambition, a healthy egotism.

AT HERMON

He was not extremely efficient and decidedly was not a hale-fellow-well-met. When a room-mate or fellow student became restless or talked while he was studying, DeForest could not concentrate and would become slightly angry. He had few friends —really no close ones while he was in Mt. Hermon. There was no one whom he considered as a confidant or no particular chum with whom he shared his feelings. It was mostly work—little, if any, play.

Even in athletics, a chance game of tennis or checkers, he looked upon as work and felt hurt if he was beaten. In every note of every game—even an impromptu tennis game played by two couples on a holiday afternoon—he would record the score, and if beaten the reason for it.

In case of defeat, he never made an alibi. If he was beaten on account of training or lack of knowledge he said so. And upon stating the defect would follow it with a resolve to better himself.

He set a record in the one-mile walk during his first year's work, but did not thereafter touch the mark again. In fact, he was beaten when he attempted to uphold the honor of his school the following year.

The summer following his first year was occupied in selling books—the volume was one dealing with handicraft around the home. A fair amount of success crowned a hard, dirty summer's toil.

The last year followed pretty much the same course as the first. Among his studies were geology, chemistry (which he particularly liked), trigonometry, history, Bible and public speaking. Along with the activities of the school went a great amount of church work. Since the school was under the special protectorate of The Rev. Dwight L. Moody, it was no small wonder that the Christian character of the students was pretty thoroughly cared for. There were not more than half a dozen Sundays during the time DeForest was in school when he missed church services. Aside from the regular Sunday services, there was no end of prayer meetings which all students were expected to attend. Many times attendance at them caused him extra hours preparing work which should have been done during the time they consumed.

One of the most enjoyable courses the last year was a laboratory course in chemistry. For the whole semester DeForest kept well ahead of the class and did an amount of extra work.

On account of an enmity which arose between him and one of the monitors, a great deal of bitterness crept into his last weeks at Mt. Hermon, since he was forced to observe work hour almost until graduation day. The remainder of the Seniors were excused.

Graduation, however, made up for a great many inconveniences and ills. He stood among the highest in his class, having made a long list of "E's" in chemistry, geology, algebra, geometry and the very highest grades in the physics class.

The prospect of entering Sheffield Scientific School at Yale in the immediate future where he could continue more actively his studies without the pettiness and bigotry entailed by the religious school, and his nomination by his class to present a scientific oration at the class day exercises tended to ameliorate, to a great extent, some of the ills which fastened themselves upon him during his latter months at Mt. Hermon.

Mt. Hermon closed a definite period in

DeForest's life. It had its effect and the assistance and kindly understanding given him by his science teacher, a Professor Dickerson, remained always as an inspiring and pleasant memory.

(*To be continued*)

"Roxy"

(*Continued from page* 484)

as they sang, humming with them in his enthusiasm, indicating shades of meaning with his hands, never still for a second. He invited the audience to put out their lights to listen to the "Meditation" from "Thais," as the orchestra played it, and he himself turned out the studio lights. Now the orchestra will play "Narcissus."

"How does it go?" asks Roxy. They hum a bit for him, and before they are finished he is on the conductor's stand leading it. Remember, he can't read music! But make no mistake about it—he is really leading it, his face on fire with emotion, his whole body a-quiver with the rhythm. Amazing!

Is it any wonder the band stays together, that Betsy Ayres was there with an infected foot, rather than disappoint him when he had planned a special program? Or that David Mendoza should say to me just before Mr. Rothafel read Eugene Field's poem, "Mother":

"Now you are going to hear a beautifully impressive thing," while the singer who assisted him came back to us with tears in her eyes and explained that she had hardly been able to sing because of the lump in her throat.

It is the recognition of this tremendous personality of his that has caused the government to lend him the assistance of Major-General Ireland, Surgeon-General of the Army, and Rear-Admiral Stitt, Surgeon-General of the Navy, and brought also the co-operation of the *New York Sun* in the raising of the half-milion dollar radio fund.

Indeed, any one need spend little time with this man, who in his early forties is a power, in order to realize that here is a dreamer who makes his own dreams come true.

WHY CONSTRUCTORS SOMETIMES FAIL

No matter how efficient a set may be, no matter how simple the construction, no matter how detailed and lucid the instructions, there are always a certain number who do not get full results, and some who do not get any results at all.

We have made a special study of the constructor's troubles and tried in every possible way to produce constructional articles which would ensure success.

THE CONSTRUCTIVE ABILITY

The constructor, before he makes his set, must not over-estimate his own ability. He must, moreover, have regard for the simplicity of the design of the set. The simpler the design, the greater will be the proportion of constructors who achieve success with the set. For example, a set in which the first tube acts as a detector and the second as an audio frequency amplifier, if built up by 100 readers would probably result in 90 per cent. getting the correct results. Add regeneration to the set and probably 80 per cent. would get the desired results; the others would probably use the wrong sizes of coils, would not tune correctly, would have the tickler coil connected the wrong way, or something of the sort.

RADIO FREQUENCY TROUBLES

If, now, a set in which a stage of radio frequency amplification is made, the chances are that the number of successful sets will

be lower; while if a reflex receiver using two or more tubes is described, perhaps only 60 per cent. would get good results.

The fault is either in the article or in the constructor, or just as likely in the apparatus used.

As regards the effectiveness of the sets described, there can be little question, for they are pretty thoroughly tested during the experiments in which they are evolved. The laboratory workers completely test and chart each new set before releasing for publication.

Readers will also be interested to know that sets constructed for RADIO NEWS are frequently exchanged between different members of the staff for trial. From this it will be seen that every precaution is taken to see that the actual set gives really good results.

As regards the description of sets, the numerous letters which we receive make it clear that even absolute beginners frequently get excellent results the first time.

IMPROVEMENTS

The reason for lack of success, in some cases, must, therefore, be looked for elsewhere. It is astounding, the extent to which designs published in these columns are improved upon by constructors. A straightforward panel set is converted into a most elaborate cabinet set looking like a piece of furniture, with great long leads between different parts of the set, and innumerable switches introduced to enable different combinations to be obtained. When the set does not work, the constructor writes plaintively to us and expects to receive our sympathy and advice.

Some other constructor, even if he adheres to the described arrangement, alters the circuit and perhaps connects in the set some shabby, nameless transformer. While we do not expect every constructor to buy a complete set of new parts for every set he makes, yet if he departs from the description, he does so entirely at his own risk. In some kinds of circuits the substitution of inefficient apparatus causes entirely different results to be obtained.

TRANSFORMER TROUBLES

Where only one stage of audio frequency amplification is employed, the chances are that different transformers may be tried without very much difference, but when two transformers are employed, an audio frequency howl may be set up, or bad distortion may arise. These disadvantages may be corrected to some extent by the man who has a good grounding in the general technique of vacuum tube circuits. The constructor, however, without much technical knowledge of the subject meets with difficulties. This is particularly the case when reflex circuits are being arranged. We do not for a moment suggest that any particular type of transformer is best for reflex circuits; we do, however, suggest that if a constructor departs from the instructions given in the article dealing with a reflex circuit, he may find that the results he gets are very different from those which the author of the article originally obtained.

For example, with a certain pair of transformers, a certain condenser connected in a certain position might be found desirable by the author of the article. The arrangement may be perfectly stable, but if some other kind of transformer is used, the feed-back may be increased, or some other effect may be varied, and the circuit may be unstable and give inferior results.

INFERIOR PARTS

We cannot emphasize sufficiently the dangers of buying inferior parts. Frequently such goods are a trifle cheaper; their origin is always doubtful; and if the apparatus is faulty you have nobody to blame. In the case of named goods, you know the manu-

facturer, and if there is anything faulty he will replace it.

Readers of RADIO NEWS who order apparatus from advertisers are particularly secure. If they have any complaint regarding either the quality of the goods supplied or delay in delivery, and they fail to get satisfaction, they have the whole weight of this publication behind them to have their wrongs set right.

MINOR FAULTS

The experience of individual members of our staff, and of our Information Department, indicates that frequently the source of trouble is in some minor component which is, perhaps, of faulty insulation.

Tuning is also a very common source of trouble to beginners, although to the experienced man it will seem very simple. There are still an extraordinary number of constructors who do not realize that when tuning a set it should be possible to tune out both above and below the incoming wavelength. The question of different aerials is an extremely important one and a set which may be stable on one aerial may oscillate furiously on another.

VACUUM TUBES

As regards tubes, we do not attach very much importance to specifying tubes in constructional articles. The tubes at present on the market are all very much alike, although some manufacturers seem to ensure a uniform standard for their tubes, an extremely important matter for the enterprising tube manufacturer.

As regards distortionless reception, this is a matter in which technical knowledge plays more part than anything else; it is a question of the proper operation of the set, the avoidance of excessive regeneration, the introduction of grid bias on the audio frequency amplifying tubes, the use of good quality transformers and the ability to introduce various correctives, such as resistances and condensers, to ensure perfect reproduction. Only by reading notes of the character outlined above will the home constructor be able to get the best results. There is far more in radio than merely joining together a number of different parts and mounting them on a panel. The best results will always be obtained by those who have some theoretical knowledge of the subject.

A Radio Frequency Solodyne Receiver

(*Continued from Page 469*)

cuit is quite critical, necessitating the use of a rheostat having the proper resistance. The compression type rheostats will work very well, as a fairly even adjustment can be made using any tube. The grid leak will probably give more trouble than any of the other instruments and it should, therefore, receive the most perfect attention. It should have a range of from 500,000 ohms to 30 megohms if possible. We found the compression type works as well as any of the others on the market. The variable grid leak is perhaps the most critical control in the set. One of the greatest difficulties in the set's operation is met here in the large variation of resistance, for an almost minute adjustment of the leak found in many instruments.

Now for the construction of the set: If a panel of dull finish is desired, it may be had at a cost of a few cents. The only things necessary are that the panel be of bakelite or similar material (not hard rubber), a few rags, a small amount of pumice powder and some machine oil. The oil should be spread over the surface and a small amount of pumice sprinkled on the

oiled surface. Rub the panel in one direction only, as any cross rubbing will spoil the appearance of the finished product. The operation just described will have to be repeated once or twice to get the desired result. An oily rag will remove all traces of the powder, after which a dry rag should be used.

The apparatus should be arranged so that the leads will be as short as possible without unnecessarily crowding the different parts. When the location of the parts has been decided upon, the panel can be drillled, using templates if possible. Mount the baseboard and then the apparatus, fastening the latter to baseboard or panel, thus decreasing the chance of loose connections being made as the set is handled. The wiring is the final step to be taken in the construction of the set. Care should be taken that grid and plate leads are kept as far apart as possible, to prevent unwanted feed-back. In case there is any chance of two wires touching, the safest procedure is to cover one with an inch or so of cambric tubing. Solder all connections, except those held by machine screws. In soldering, use a non-corrosive flux which can be bought in most stores, or resin-core solder which is considerably easier to use than the former. Whatever kind of flux you use, do not smother connections with it, because it usually makes a fairly good insulator. When soldering the jack try to use plain solder, as the prongs are usually tinned before leaving the factory.

In operating the set, it is not necessary to have the rheostats turned on full, for, in most cases, the tubes operate best with a voltage between four and five. As mentioned before, the grid leak is very critical and the results obtained will depend to a great extent upon the action of the leak. If no regeneration is obtained, try reversing the tickler connections. The connections of the radio frequency transformers may also need to be reversed.

GLOSSARY OF RADIO TERMS

COMPILED BY LESTER MAXWELL

Aerial.—A system of elevated wires insulated from the ground and from surrounding objects, and intended to impart the radio energy generated by a transmitter into the ether of surrounding space. The aerial may comprise one wire or many wires, and it may be arranged in many different ways, such as a straight wire or a number of parallel wires; a number of vertical wires separated at the top but coming down to a common point, fanlike; a single pole or mast with the wires coming down and radiating away from the pole like the ribs of an umbrella, and so on. When used for receiving purposes, the aerial should be called an antenna, although these terms, erroneously, are often used interchangeably.

Alternating Current.—(Abbreviated A.C.). An electrical current whose direction of flow is constantly changing during a given period of time. The number of changes in a second is called the frequency. A 60-cycle current, therefore, is one that completely reverses its direction of flow 60 times per second. In radio work alternating current plays a leading role. Alternating currents of commercial frequencies, such as 33 cycles, 60 cycles and 120 cycles, are referred to as low-frequency currents, while the radio currents, running up into the tens of thousands and hundreds of thousands of cycles, are referred to as high-frequency currents.

Alternator.—An electric machine capable of generating alternating current. The usual alternator has the general appearance of a generator or dynamo.

Ammeter.—An instrument for measuring the flow of current, in amperes, through a given circuit. The ammeter is connected in series with the circuit, while the voltmeter,

which measures volts, is connected across or in parallel with the circuit. If the meter mechanism cannot handle the entire current flow, which is often the case with heavy currents, the greater part of the current flows through a special conductor of known conductivity, and the ammeter is connected across this special conductor so as to receive a small portion of the current, in a known ratio to the full current. The ammeter can be calibrated accordingly. This special conductor is known as the "shunt."

Ampere.—The standard electrical unit of current flow.

Amplifier.—A device that builds up or amplifies either the radio energy intercepted by a receiving set or the sound-producing current. There are two kinds of amplifiers, namely, the *radio frequency* amplifier and the *audio frequency* amplifier. The former builds up the intercepted wave energy before passing it on to the detector, there to be rectified into audible or sound-producing current. The latter builds up the sound-producing energy; in other words, it does not increase the sensitiveness of the receiving set, as does the radio frequency, but it builds up the strength of the signals so that better results are obtained. The radio frequency amplifier goes ahead of the detector and makes for sensitiveness; the audio frequency amplifier follows the detector, and makes for loudness.

Amplitude.—The crest or peak of a wave or oscillation measured from an imaginary horizontal, median line of rest. In radio the amplitude means the highest point attained by each wave—the crest. A wave may have a large or small amplitude, according to the energy which produced it. Amplitude should not be confused with height of wave, which is measured from trough to crest.

Announcer.—In the radiophone broadcast studios an announcer introduces the singers and speakers, gives out the bulletins and other features of the program, and gives the call letters, name of owners, and location of the station. In the large radiophone broadcast stations the announcer is not a radio operator.

Antenna.—The name given to an aerial used for receiving purposes only. (See Aerial.)

Arc.—An electrical discharge steadily maintained between two electrodes or current-carrying members, such as carbon rods, copper cylinders or plates, silver plates, and so on. The arc is used for generating high-frequency oscillations or waves in transmitting. In the early days of the raidophone it was used almost exclusively as the generator of the continuous waves for radio telephone work.

Armstrong Circuit.—(See Regenerative Circuit and Feed-back.)

Atmospherics.—This is another name for "static." Sometimes these disturbances are called "strays" or "X's." They have been referred to as the "noises of space," by radio men with a poetic turn of mind. Atmospherics are the noises caused in a radio receiving set by atmospheric electrical disturbances. They are at their worst during the summer months, and almost totally absent in winter. Atmospherics are largely caused by miniature lightning storms which take places in the clouds.

Audio Frequency.—Frequency well within the range of audibility of the human ear. All frequencies below 10,000 cycles per second are termed audio frequencies, while those above are called radio frequencies. (See Amplifiers.)

"B" Battery.—A relatively high-voltage battery, say of 22½ or 45 volts, employed for the plate circuit of a vacuum tube. "B" batteries are made in the dry battery form, and as storage batteries which may be recharged. Also, the "B" batteries come in the fixed voltage model, and in the variable

voltage model. For detector work, the variable voltage model should be employed for best results.

Bakelite.—An insulating material moulded in all kinds of forms, such as panels, handles, knobs, dials and binding posts, and largely employed in receiving and transmitting equipment.

Broadcasting.—The simultaneous transmission of music or speech by radio telephone, or the simultaneous transmission of news or special bulletins to a great number of receiving stations. Broadcasting differs from the usual radio communication in that it is public and intended for anyone who cares to receive it, while other radio communication is private and intended for some specific receiving station.

Buzzer.—A device capable of interrupting an electric current so as to produce weak oscillations that may be employed for testing a crystal detector. The detector is tested by running one wire from one of the interrupter points of the buzzer to the ground-lead of the receiving set, and then, while the buzzer is operated, the crystal is adjusted until the buzzer interruptions are heard loudly and clearly, indicating that the crystal detector is at its best. A buzzer is also employed in transmitting work for the interruption of continuous waves so as to make them audible with an ordinary receiving set. This is known as buzzer-modulated C. W.

Capacity (abbreviated C).—This is one of the factors in all radio work. Capacity is the property of circuits or things to accumulate a charge of electricity. The unit of electrical capacity is the farad; but since the farad is too large for practical radio work, the microfarad (abbreviated mfd., equal to one millionth of a farad), is employed. The capacity of a condenser, which is an instrument that represents a given electric storage facility, is always given in microfarads or mfds.

Cascade Amplification.—In all high amplification work the amplifiers are arranged in steps, so that one feeds its output into the next stage of amplification, while the second stage feeds its output to the third stage, and so on. This is known as the cascade arrangement.

Choke Coil.—A device that possesses a marked choking or damming effect when placed in an alternating current circuit. Such choking action is called "impedance" when used in radio work. Choke coils are employed in transmitting work, to prevent the high frequency current from flowing back through the generating members and either using themselves up without doing real work, or even doing damage to the electrical equipment.

Circuit.—The path followed by an electric current is known as a circuit. A circuit, so far as radio is concerned, may be open or closed, primary or secondary, or oscillating.

Coupling.—In certain radio transmitting and receiving arrangements it is necessary to transfer energy from one circuit to another. This is generally done by having a few turns of wire in each circuit, which may be brought nearer together or drawn farther apart. When the coils are brought close together, we have what is known as a *close coupling;* when they are drawn farther apart, we have *loose coupling.* The primary of a coupler, which gives the coupling effect, is the one that has the source of power, while the secondary is the coil that receives the power transferred by the primary.

Condenser.—A device consisting of two or more metallic surfaces, separated by a non-conductor or dielectric, capable of receiving and holding a charge of electricity, and discharging it when called upon to do so. The condenser plays an important role in tuning operations, both in receiving and in sending. It is also employed in the generation of radio waves.

Counterpoise.—One or more elevated wires insulated from and placed but a short distance above the ground, as compared with the usual antenna or aerial which is placed high above the ground. The counterpoise serves as the ground in place of the usual ground connection. Where it is impossible to obtain a good ground connection, the counterpoise is employed. Again, in aircraft-radio the counterpoise arrangement must be employed, and in this case all the metal fittings and guy wires of the aircraft are employed as the counterpoise, while one or two trailing wires serve for the aerial. The counterpoise is used in continuous wave transmission for the reason that it may give greater stability than the usual ground connection.

Continuous Wave (abbreviated C.W.)—This is a form of radio wave which is maintained at a constant amplitude, as distinguished from the damped wave which is produced in trains or groups each consisting of a number of oscillations which rapidly die down in amplitude until zero is reached. Continuous wave transmitters are more efficient than damped or discontinuous waves in radio telegraphy and are absolutely necessary in radio telephone work.

Crystal Detector.—A radio-wave detector device consisting of one or two crystals possessing certain rectifying properties which cause them to rectify or convert radio energy into audible currents, so as to affect the telephones. In some designs a single crystal is used, with a fine wire (known as the "cat whisker") or metal point in contact. In other designs two crystals are used in contact.

Decrement.—The rapidity with which damped wave trains die down or are damped from the maximum amplitude to zero. The radio laws have something to say regarding the decrement of a transmitter, for the decrement has much to do with the sharpness of tuning.

Detector.—A device that rectifies or transforms the intercepted radio waves into visible or audible indications. The two general classes of detectors in present-day use are the crystal detector and the vacuum tube.

Direct Current (abbreviated D.C.).—An electric current that flows continuously in one direction, as distinguished from alternating current which changes its direction of flow. A direct current always flows from the positive source to the negative return.

Duo-Lateral Coils.—Compact inductance coils with a unique winding that makes for great wave-length value with a rather small amount of wire.

Electrolyte.—The liquid used in a storage battery, composed of water and sulphuric acid. The electrolyte changes its density or specific gravity according to the relative charge of the battery, and it is this changed density or specific gravity which serves to indicate condition of a storage battery at all times. (See Hydrometer.)

Electron.—This stands for the ultimate particle of matter, which is a charge of negative electricity. Electrons are emitted by the incandescent filament of the vacuum tube and attracted by the cold plate. The grid, which is placed between the filament and the plate, serves to absorb more or less of these electrons and thus controls the number reaching the plates. It is this action which controls the plate current, and since a very small charge on the grid can control a far greater volume of current in the plate circuit, we have the basis for the vacuum tube detector, amplifier, modulator, and so on.

E. M. F.—Abbreviation for electro-motive-force, meaning the electrical pressure or potential, the unit of which is the volt.

Ether.—Since radio communication is said to be a wave motion set up by a transmitter, it is necessary to conceive of some medium for this wave motion. This medium is called the ether. It is a hypothetical medium of great elasticity and extreme tenuity, and is

said to pervade all space as well as the interstices of solid bodies. It is also the medium which transmits light waves, heat waves, and electric waves. While it is true that the Einstein theories have shattered the former concept of the ether, it is still employed by radio men in explaining the action of radio.

Fading.—Due to certain atmospheric conditions which are not altogether understood but whose existence is well authenticated, radio signals often die down or fade away when received at a distant point. This is especially noticeable when receiving radiophone programs from some long-range radiophone station. The speech or music, loud one moment, gradually dies down, only to come up again some time later.

Feed-Back.—In the Armstrong regenerative circuit a certain portion of the energy in the plate circuit is thrown back into the grid circuit so as to raise the grid potential. The increased grid potential, in turn, gives a greater plate effect, which, once more, feeds back a certain part of its energy to the grid circuit, and so on. This action results in considerable self-amplification. The feed-back action is also employed in the generation of oscillations for transmitting purposes.

Frequency.—In radio work and in alternating current practice, the rapid reversal of the current in a circuit. Frequency is applied only to alternating currents. High frequency currents mean currents above the usual commercial frequencies, which are 33-cycle, 60-cycle, and 120-cycle. Audio frequency currents mean currents up to 10,000 cycles. Radio frequency currents are those above 10,000 cycles.

Grid.—That member of the vacuum tube which is placed between the filament and the plate, and which serves to absorb a greater or less number of electrons. The grid is generally made in the form of a spiral or zigzag or again like a tiny ladder.

Grid Leak.—This is a very high, non-inductive resistance connected across the grid condenser or between the grid and the filament of a vacuum tube to permit excessive electrical charges to leak off to an external point, thus furnishing stable control under all operating conditions. The grid leak may be a pencil line drawn on a piece of paper and clamped between heavy copper washers. The pencil line may be heavier or lighter according to the resistance required.

Ground.—The antenna or aerial is one side of the wave distributing or wave receiving system, while the ground is the other. The ground consists of a suitable connection with the ground, such as a water pipe, steam pipe, gas pipe, large metal plate buried in moist soil, bare wires laid in deep trenches and then covered over, and so on. The British call the ground connection the "earth."

Harmonics.—In receiving radiophone programs, one is often surprised to hear a given radio telephone on an altogether different wave-length. This lower or higher adjustment of the tuner brings in the radio telephone much weaker than the real adjustment, but nevertheless sufficiently loud sometimes to interfere with other receiving operations. In radio work, such interference is due to harmonics, and is most noticeable in undamped or continuous wave operation. These harmonics differ in wave-length and frequency from the original and true operative wave. The first harmonic is three times the true frequency, or one-third the wave-length of the aerial; the second harmonic is five times the true frequency or one-fifth the wave-length; the third harmonic is seven times the true frequency or one-seventh the wave-length. High-power stations are sometimes heard at very short wave-lengths.

Henry.—The unit of inductance.

Hertzian Waves.—Radio waves named after Prof. Heinrich Hertz of Germany, who discovered them in 1887.

Honeycomb Coil.—A compact inductance coil with a unique winding that makes for

great wave-length with a rather small amount of wire.

Hook-Up.—A diagram giving the wiring or connections for radio apparatus. Hook-ups are diagrams which make use of the various radio symbols to represent the different pieces of equipment.

Hot-Wire Meter.—The usual electrical measuring instruments cannot be employed in measuring high frequency radio currents. It therefore becomes necessary to use special instruments which have a fine platinum wire whose expansion and contraction, brought about by the radio current of fluctuating strength, operates an indicator over a calibrated scale.

Hydrometer.—An instrument for taking the specific gravity of the storage battery electrolyte. The hydrometer gives a specific gravity reading, which in turn indicates the relative charge of the storage battery. In this manner the radio operator knows just when to place his storage battery on charge, and when to stop charging.

Impedance.—The term applied to the resistance offered by a coil of wire to an alternating current flowing through it due to the counter-electromotive pressure, irrespective of the actual resistance of the conductor in ohms. Counter-electromotive pressure is developed in all forms of inductance, and this counteracts the flow of current to a greater or less degree. Impedance may be said to be the result of reactance.

Inductance.—The property of a material system by virtue of which it is capable of storing energy electro-magnetically. The unit of inductance is the henry. In radio work the mil-henry and the micro-henry are the units employed.

Insulator.—A non-conductive material through which current will not normally pass.

Jack.—The hole which receives the plug used in making rapid connections in radio receiving and transmission apparatus.

Kick-Back.—The flow of current from high frequency generating equipment back through the current supply line where it does not belong and where it may do some damage. Certain forms of choke coil and graphite resistance rods connected to the ground are sometimes used with transmitting equipment so as to prevent kick-backs.

Kilowatt (abbreviated k.w.).—One thousand watts, a unit used in measuring large amounts of electricity. However, a kilowatt is considerably in excess of an electrical horsepower, which is 746 watts.

Lead-in.—The connection between the antenna or aerial and the receiving or transmitting apparatus.

Log.—The record kept in commercial radio stations of their radio business day by day.

Loop or Loop-Antenna.—A wooden frame with a number of turns of wire wound about it so as to form a square loop. Such a device is employed in place of the usual antenna and ground for receiving purposes. In certain rare instances, such as trench communication work in military operations, it has been employed for transmission. The loop is a directional device, working best when pointing edge on towards the transmitter. The use of the loop gives greater selectivity and also reduces materially the static disturbances that prove so troublesome in the summer. The loop is the basis of the radio compass, now so extensively used in navigation.

Loose-Coupler.—A device that serves to couple two circuits so that energy may be transferred from one to the other and their relation may be increased or decreased by making the coupling closer or looser, as demands may dictate. (See Coupling.)

Loud-Speaker.—A modification of the usual telephone receiver, made on a large scale so as to produce a large volume of sound which is distributed throughout a room by means of a horn. The loud-speaker does away with the necessity of head phones and puts the radio receiving set on a par with the

phonograph, so far as convenience is concerned.

Megohm.—One million ohms.

Microfarad (abbreviated mfd.).—One millionth part of a farad. This is the practical unit of capacity, employed in radio.

Microphone.—An instrument for converting sounds into electrical fluctuations or modulations in a given circuit. The microphone takes the voice or music and converts it into variations of an electric circuit, and these variations, in turn, when passed through a distant receiver, are translated back into the original sounds. The usual microphone, such as is used for wire telephone and also with small radio telephone transmitters, consists of a mass of loosely-packed carbon granules held between two carbon blocks, and subjected to a varying pressure according to the sound waves falling on the diaphragm.

Milliamperes (abbreviated MA.).—The thousandth part of one ampere.

Modulation.—The act of varying an electric current in a given circuit by means of the voice or music. Thus the modulation of a given radiophone broadcast station may be said to be good, fair, or poor, according to how realistic the voice or music sounds at the receiving end.

Natural Frequency.—The natural or fundamental wave-length of an aerial or antenna without inductances or capacities of any kind added to it. Every aerial or antenna has a natural frequency or wave-length of its own.

Ohm.—The unit of electrical resistance.

Ohm's Law.—The fundamental law of electricity is known as Ohm's law. It states that the current in amperes flowing through a circuit is equal to the pressure in volts divided by the resistance in ohms. Thus with any two factors in an electrical problem known, it becomes possible to determine the third or unknown factor, so far as direct current practice is concerned. In alternating current practice there are other factors that must be taken into consideration and that complicate materially such calculations.

Oscillations.—Alternating currents of extremely high frequency are known as "radio oscillations." If the voltage or amplitude of a series of oscillations is constant, the oscillations give rise to continuous or undamped waves; on the other hand, if the voltage or amplitude is not constant but is rather of a damped or decaying nature, like the beats of a pendulum, which swings less and less until it comes to a dead stop, then we have damped waves. A series of waves is called a train.

Parallel.—In all electrical work various devices and equipment, such as lamps and batteries, may be connected in series or in parallel. The series arrangement is such that the current must flow through one device after another until all the devices have been traversed, after which the current returns to the starting point. Parallel wiring means that all the devices are arranged across the two current-carrying members as the rungs of a ladder, and the current, therefore, flows through all the units or devices at the same time. In the series arrangement we build up or require greater voltage. Thus five 110-volt electric lamps, connected in series, would require 5 x 110 volts or 550 volts to light them to full candlepower. The same five lamps, arranged in parallel, require only 110 volts, but if each lamp draws ½ ampere, then the parallel arrangement calls for 2½ amperes, while the series arrangement, calling for greater voltage, requires only the same amperage as is called for by each lamp, or ½ ampere. Please note, therefore, that parallel hook-up calls for greater amperage, and series hook-up for greater voltage. In connecting batteries, the series arrangement builds up the voltage. Five dry batteries arranged in series will give 5 x 1.4 volts or 7 volts. The same batteries, connected in parallel, will give only 1.4 volts, but the amperage will be 5 x 25 amperes (the usual capacity of a dry battery on short circuit)

or 125 amperes. In connecting dry batteries in series, the center post of one cell is connected to the outside of the next cell, and so on.

Plate.—One of the elements of the usual vacuum tube. The plate is the cold electrode which attracts the hot electrons from the filament.

Plate Circuit.—The circuit connected with the plate of the vacuum tube. This circuit contains the telephone receivers and the "B" battery or high-voltage battery, generally of 22½ volts rating. In some forms of regenerative receivers, a variometer is included in the plate circuit so as to tune this circuit for the purpose of feeding back some of the energy to the grid. In other instances, the plate circuit includes a few turns of wire known as the "tickler," which induces some of the plate current into the grid circuit.

Plate Battery.—Usually called the "B" battery. A 22½-volt dry battery or a storage battery intended to supply a steady current for the plate circuit of the usual vacuum tube. In amplifier work the "B" or plate battery may be as high as 45 volts, and for extreme amplifications as high as 90 to 100 volts.

Plug.—A device consisting of two contacts on a brass rod, which may be inserted in a hole known as the jack, the latter making contact with the two contact members of the brass rod. This method ensures a rapid method of making and breaking connections. It is the same arrangement as is found on the usual telephone switchboard. In radio the plug and jack are widely employed, especially for the telephones of the receiving set, and for the microphones of a transmitter. There are certain types of automatic jacks so constructed that when the plug is inserted, a separate circuit is closed, aside from the actual circuit in which the plug is to form part. Such an arrangement is used to light tube filaments when the plug is inserted, and to extinguish them when the plug is withdrawn.

Primary.—The first circuit of an electrical combination where two circuits, which transfer energy from one to the other, are employed. The primary contains the original current or source of power, while the secondary receives more or less of that power. Thus in transmitting practice, the primary would be the coil in the oscillating or local circuit, containing the generating equipment, while the secondary would be the coil in the aerial-ground circuit. The primary of a receiving set, on the other hand, is the coil in the antenna-ground circuit, while the secondary is the local or detector circuit.

Potential.—Another term for voltage, when used in the electrical or radio sense.

Potentiometer.—An instrument for regulating the voltage supplied to a device or circuit within very delicate limits, as compared to the rougher variations obtained with a rheostat. The potentiometer is a resistance which is connected directly across the source of current. It is provided with a sliding contact, which moves from one side to the other. The device or circuit to be fed this delicately varied current is connected with one side of the resistance and with the movable slider. Now, as the slider is moved from one side to the other, current is taken off the resistance in proportion to the distance between the slider and one end of the resistance. This method of regulating voltage is a very delicate one, and it applies a more steady load on the current source. Potentiometers are used in applying very critical voltages on plates in vacuum tubes, when the utmost efficiency is sought.

Radiogram.—A dispatch sent by radio telegraph. It is the word in radio communication that corresponds with telegram.

Radiophone.—A wireless telephone or radio telephone. This word is coming into very general use.

Radio.—This word has more or less supplanted wireless, in the United States at

least, although it dates back only a few years.

Radiation.—The propagation of radio energy through space. When applied in practical radio work, it means the amount of energy that is being delivered to the aerial circuit, and presumably propagated through space. Thus we speak of good radiation and poor radiation, depending on the proportion between what is put into the wireless or radio transmitter, and what actually flows into the aerial in the form of radio oscillations. Radiation is generally determined by means of a hot-wire ammeter in the aerial circuit.

Radio Frequencies.—Frequencies corresponding to vibrations far above those to which the human ear will respond, are known as radio frequencies. All frequencies above 10,000 cycles per second are termed radio frequencies.

Radio Link.—The radio section which forms part of a regular telephone system. Thus in certain parts of the United States, where conditions militate against the installation and maintenance of a telephone line, a radio link can be established, so that radio telephony spans the gap. In California there is a radio link in regular use between Santa Catalina Island and the California mainland. This radio link bridges the gap in the regular telephone system, so that persons talk to each other with regular telephone instruments and in their own homes, little aware that their voices are carried through 31½ miles of space in order to span a bit of the Pacific Ocean.

Reactance.—The reactance of a circuit is a function of the inductance, capacity, and the impressed frequency.

Rectifier.—An apparatus which converts alternating current into direct current. In radio a rectifier is employed in charging storage batteries on alternating current circuits, and for operating vacuum tubes on alternating current circuits. Various types of rectifiers are in general use. Some of these are vibrating devices which serve to take each half of an alternating current cycle and place it on its proper side so that all the + will be on one side and all the — on the other, thus giving direct current. Others have a special form of vacuum tube which permits only half of the alternating current cycle to come through, thus giving direct current. Again, the usual crystal detector is a rectifier, since it converts the high frequency alternating currents of radio energy into pulsating direct current for the telephone receivers.

Regenerative Circuit.—In a circuit containing a vacuum tube, it is possible to take a small part of the plate current and throw it back into the grid circuit, so as to build up a greater potential for the grid. In this manner a more pronounced effect is obtained for the plate circuit, and this, in turn, is again thrown back to the grid circuit, also with an increased effect on the plate, and so on, over and over again. This throwing back or feedback of energy is known as the regenerative action, and is also known as the Armstrong circuit, named after its inventor. This feedback of energy is obtained in two ways, as a matter of regular practice. The first is to place a variable inductance, such as a tuning coil or variometer, in the plate circuit so that this circuit can be tuned until it feeds back energy into the grid circuit. The second method is to connect a few turns of wire in the plate circuit, and to bring these few turns of wire into close quarters with the grid circuit, thus inducing a greater or less amount of plate energy. This arrangement is known as the tickler. The regenerative action results in a marked self-amplification for the usual vacuum tube, and gives excellent results for weak signals.

Relay.—A device employed when one circuit is to cause another circuit to perform some given task. Thus a weak current of

one circuit can close the circuit for a much more powerful current. In radio work the vacuum tube is often used as a relay. Using a very weak current, such as the intercepted radio waves, it becomes possible by means of a vacuum tube to control a relatively powerful local current. The vacuum tube in this case can well be called an electronic relay, for such it is.

Resistance.—Opposition to the flow of an electric current through a conducting medium. There is no such thing as a perfect electrical conductor. Every metal has some resistance for electric current. Copper has very little resistance, and for that reason it is widely used. Silver has even less, but it is too expensive. However, it is well to note that in certain radio instruments the conductors are silver plated, in order to afford the lowest possible resistance to the radio energy which flows on the surface of a conductor rather than through the core.

Resonance.—Resonance in a given circuit exists when the natural frequency of that circuit has the same value as the frequency of the alternating current introduced in it. It is an ideal condition when it does obtain. If a circuit is not in resonance with the applied alternating current, then the best results cannot be obtained because it is forced to function or respond to an abnormal condition. Two circuits are brought into resonance when they are in absolute harmony. Tuning the receiving set to a given radiophone is a matter of bringing the receiving set into resonance.

Rheostat.—A device which provides a variable resistance so that the voltage of a given power source may be regulated to meet requirements. The more resistance is introduced into a circuit by means of a rheostat, the lower the voltage that reaches the apparatus or circuit, and so on.

Selectivity.—In radio work, the ability to select any particular wave-length to the exclusion of others. Thus good selectivity means the picking out of one broadcast station while several transmitters are working in the general vicinity. Selectivity means sharp tuning.

Sharp Tuning.—Instances where a slight change in the tuning adjustments throw out a given transmitter. The sharper the tuning of a given receiving set, the greater its selectivity. In transmitting, sharp tuning means the generating of a very pure wave which will be received within narrow limits on all receiving sets.

Spider-Web Coil.—A novel means of producing compact inductance coils. A piece of fibre, composition sheeting, or other material is first cut down to a small disc, and radial slots are then cut in it so that they come within a reasonable distance from the center of the disc. Then wire is wound in these slots, with the wire first on one side, then on the other, back to the first side, and so on. In other words, each turn zigzags in and out of the disc leaves formed by the radial slots until the winding is completed. Such coils are quite flat yet are highly efficient.

Series.—(See Parallel.)

Specific Gravity.—The relation which any liquid bears to the weight or density of water. In radio work specific gravity is encountered in the electrolyte of the storage battery, which must be constantly watched. The specific gravity of a storage-battery electrolyte, may be determined by using a hydrometer, which indicates the exact condition and tells when to stop charging and when to recharge. The hydrometer has a little float or "bob" which indicates the specific gravity.

Spaghetti Tubing.—Varnished cambric sleeving which is placed over delicate wires in order to insulate them electrically as well as protect them from mechanical injury.

Slider.—A device that moves along and makes contact with a coil of wire or a resistance material at any point.

Stand By.—An expression employed in radio when a transmitting station pauses,

meaning that the listeners should keep their adjustments and wait for a given length of time until the transmitting station resumes.

Soft Tube.—Vacuum tubes are said to be "soft" or "hard" according to their content. Thus the "soft" tube is one containing some gas; in other words, it has not been exhausted to a high vacuum. The "hard" tube, on the other hand, has a nearly perfect vacuum. Soft tubes make excellent detectors, while hard tubes make good amplifiers.

Storage Battery.—A battery that may be recharged whenever it becomes exhausted. In radio work the storage battery is employed for the filament current supplied to the vacuum tubes.

Static. — (See Atmospherics). — Disturbances of an electrical nature which interfere materially with radio communication.

Tickler.—The coil employed in throwing back or feeding back some of the plate energy into the grid circuit.

Transformer.—A device employed in electrical and radio work for the transference of energy from one circuit to another. All transformers have a primary and a secondary. The primary has the original current, while the secondary has the transferred or induced current. The transference of energy can take place so that there is a change in the voltage and amperage, or no change at all, as may be desired.

Tuning.—Altering the capacity and inductance values of a receiving or transmitting circuit so as to vary the equipment for the reception or transmission of signals. Tuning enables the receiving operator to pick up a desired transmitter to the more or less complete exclusion of all others.

Undamped Waves.—A train of radio oscillations that maintain a constant amplitude or potential. Undamped oscillations or waves are known as continuous waves, C.W. for short.

Vacuum Tubes.—The devices used in modern radio for receiving and transmitting purposes. A vacuum tube resembles nothing so much as an electric lamp, containing as it does a filament as well as a grid and a plate. The glass tube of this device has had its content more or less exhausted. In action, the heated filament gives off electrons, or tiny particles of matter which are attracted by the cold plate. Meanwhile the cold plate attracts these electrons. The grid, consisting of a fine wire interposed between the filament and the plate, absorbs more or less of the electrons and, therefore, alters the size of the electronic bridge formed in the tube, over which the plate circuit has been passing.

Variometer.—A device which serves to vary the inductance of any circuit in which it is connected. The variometer consists of two sets of coils, a fixed and a movable set, which may be so placed with relation to each other, or buck their inductances. Thus the wave-length can be built up by means of a variometer, or it can be reduced, according to the position of the coils.

Velocity of Waves.—Radio, electricity and light waves travel through space at the astounding speed of 186,000 miles per second.

Volt (abbreviated V).—The unit of electrical pressure.

Voltmeter.—An instrument for measuring the electrical pressure or potential in volts.

Watt (abbreviated W).—The unit of electric power. To find power in watts, multiply the voltage by the amperage. 746 watts equal one horsepower. 1000 watts equal one kilowatt (K.W.).

Wave-Length.—Radio waves in their passage through space or ether, travel in undulations similar to the waves of the sea. When the wind is blowing hard and steady the distance between each sea-wave crest is comparatively long while if the wind is blowing mildly and in short spurts, the distance between wave crests is accordingly shorter and we have short waves. In radio, substitute the

wind for the transmitter and we have the same action. Wave-length is, therefore, closely related to frequency; *i.e.*, long wave-lengths have low natural frequencies while short wave-lengths have greater natural frequencies. In general, short wave-lengths are used for short distance low-power work, while long wave-lengths are employed for long-distance high-power work.

BALTIMORE RADIO SHOW COMING

Arrangements have been completed for the first Baltimore Radio Show, which will be held at the 5th Regiment Armory, Saturday, October 18, to Saturday, October 25.

This will be the largest and most complete show staged south of New York and will be conducted by the 5th Infantry, Maryland National Guard, and sanctioned by the Radio Board of Trade of Maryland, which will act as renting agent.

These two organizations co-operating make a very strong combination, particularly in view of the fact that the profits derived from this show will be used toward the installation of a broadcast station in the Armory.

This station will be installed prior to the show and will be in use during the show. All features connected with the show will be broadcast.

SENATE COMMITTEE APPROVES FUNDS FOR RADIO ADMINISTRATION

Appropriations for the administration of radio under the Department of Commerce, which were reduced by $21,500 by the House of Representatives recently, have been re-established by the Senate Appropriations Committee at $180,278, as originally approved by the Budget Bureau.

Following the reductions made by the House in the funds to be available for radio inspection, licensing and supervision for the coming fiscal year, Secretary Hoover appeared before the Senate Committee and voiced his opinion that the Departmental radio section absolutely needed the full amount allowed by the Budget. It is now believed that the amount decided by the Senate will finally be passed.

RADIO COMMUNICATION IN SPAIN

The following are the decisions of the recently held National Wireless Conference and the regulations controlling the establishment and working of private radio-electric stations.

The regulations differentiate between official and private stations. The latter stations, radio-telegraphic or telephonic, transmitting or receiving, including those belonging to instructional centers or used for scientific experiments, will be subject to governmental control and inspection of the newly created Technical Committee.

The transmitting stations are divided into five categories: (1) Stations for instruction at official schools. (2) Stations for tests, experiments or studies of centers or persons of Spanish nationality. (3) Stations for direct communication between two or more places, whether fixed or mobile, belonging to the same person or society. (4) Broadcast stations, official or private. (5) Amateur stations.

The General Director of Communications will have the right to grant concessions in accordance with the definitely fixed conditions.

As regards receiving stations, permission will be granted to all Spanish subjects who apply to the chief of the telegraph service in the town where the set is to be installed or to the provincial telegraphic director for towns where there is no telegraph station.

Permission will be granted to foreigners

on their application to the General Director of Communications, subject to recommendation of the Ministers of War, Navy and Foreign Affairs.

Applications for permits must contain particulars of the location of the set to be installed, with sufficient details to enable possible difficulties to be considered, such as interference with neighboring stations.

Receiving stations are forbidden to use any apparatus producing oscillations likely to cause interference with nearby stations. The General Director will have power to locate such interfering stations and to warn them to modify their apparatus. If such warning is ignored, the installation will be treated as a secret one with the corresponding punishment.

The annual fee for each private receiving station will be 5 pesetas and that for apparatus installed in public places, such as cafes, hotels, societies, etc., will be 50 pesetas.

The construction and sale of receiving stations will be free.

The decree mentions the punishments incurred in the event of breaches and the circumstances in which the Government can appropriate all installations.

In conclusion, it is stated that if the newly established free system is found to work badly, on the petition of more than one-half of the license holders for receiving stations, a special committee will be created, with any powers that experience will prove necessary.

RADIO TRAINING IN ARGENTINE NAVY RIGOROUS

The training of radio men in the Argentine Navy is being stimulated by the award of prizes to operators who qualify in copying code messages of 50 words, at the rate of 22, 24, and 26 words per minute. These prizes, however, are withheld for bad conduct and if the man is not in good physical condition. Athletic training is required in all radio stations both afloat and ashore, wherever there is more than one operator.

PROFESSOR JANSKY WITH THE SIGNAL CORPS

Prof. C. M. Jansky, formerly of the University of Minnesota, was appointed Assistant Consulting Radio Engineer of the Signal Corps, on July 1. His duties will include research problems in radio telegraphy and telephony in the Signal Corps Radio Laboratory at Camp Alfred Vail, N. J., where technical problems are worked out and apparatus is designed for the Army.

RADIO AIDS IN SOLVING MIRAGE

When approaching Sydney, Nova Scotia, recently, Captain Bauge of the hospital ship *St. Joan of Arc* was confronted by a mirage which distorted the shore lines so they could not be recognized. Calling his radio compass into service, he took radio bearings from North Sydney, Magdalen Island, and Canso, with the result that he succeeded in locating his position.

BRITISH BROADCASTING COMPANY OPENS NEW STATION

The B. B. C. high-powered station at Chelmsford has been open for experimental work since Wednesday, July 9th.

The hours of transmission provisionally fixed are 11:30 a. m. to 12:30 a. m., 4 to 5 p. m., and 7:30 to 8:30 p. m. The morning and afternoon programs will be mostly speech, but it is hoped that some music will be played during the evening programs.

The wave-length is 1,600 meters. The power will be announced later; it will not be less than 15 kilowatts. The call sign is 5XX.

Listeners are cordially invited to listen for this station and write to the British Broadcasting Company at 2 Savoy Hill, giving details of their results. It is particularly requested that reports should be concise.

The B. B. C. reserves the right to cancel or change these arrangements in any particular, as it is to be understood that these transmissions are purely of an experimental character. It must not be thought that the transmissions are in any way a part of the regular program.

CONTRABAND RADIO CONQUERING CHINA

There are several hundred radio receiving sets in use in Shanghai, though radio sets are upon the contraband list and their importation is absolutely prohibited by the Customs, Consul General E. S. Cunningham reports. Some of the sets here have probably been assembled locally from materials imported under various classifications. The fact that many firms are able to offer these radio receiving sets for sale is evidence that some firms are able to manufacture or assemble them locally.

STANDARD RADIO FREQUENCY TRANSMISSIONS

The Bureau of Standards is transmitting special signals of standard frequency on announced dates. The signals may be heard and utilized in general east of the Mississippi River.

These special signals are of use to testing laboratories, transmitting station operators and others, in standardizing wavemeters and adjusting transmitting and receiving apparatus. The transmissions on September 5 include ship communication, and those on September 22, broadcasting. The accuracy of these signals is better than three-tenths of one per cent. Information on how to use them is given in Bureau of Standards Letter Circular No. 92, which may be obtained on application from the Bureau of Standards, Washington, D. C.

Schedule of Frequencies in Kilocycles

(Approximate wave-lengths in meters in parentheses)

Eastern Standard Time	Sept. 5	Sept. 22
11:00 to 11:08 P. M.	300 (1000)	550 (545)
11:12 to 11:20 P. M.	315 (952)	650 (461)
11:24 to 11:32 P. M.	345 (869)	750 (400)
11:36 to 11:44 P. M.	375 (800)	833 (360)
11:48 to 11:56 P. M.	425 (705)	1000 (300)
12:00 to 12:08 A. M.	500 (600)	1200 (250)
12:12 to 12:20 A. M.	600 (500)	1350 (222)
12:24 to 12:32 A. M.	666 (450)	1500 (200)

UNOFFICIALLY VICAR OF WAKEFIELD

In the little town of Wakefield, located in the Virginia mountains, there dwells a young man named Haywood Williams, who, though crippled and confined to his bed for years, has, through the aid of radio, become the unofficial "Vicar of Wakefield."

This bright and energetic mountain boy suffered a fall when very young, and now, at the age of 23, is confined to his bed, paralyzed for life probably. But his popularity in the community, where there is neither church nor preacher, together with a recently acquired radio set, has made his humble home the community center, especially on Sunday. The radio receiving set was a gift.

Soon after the set was received, the neighbors in this township, 18 miles from the railroad station, began to come in, chiefly out of curiosity, never having heard radio before. Having only one set of headphones, Haywood undertook to repeat for

their benefit such of the broadcasts received as were possible of repetition—chiefly, of course, talks and sermons. Being interested in religion, he found the Sunday services broadcast by the Right Reverend James E. Freeman, Bishop of Washington, of great interest, and as the visitors on Sunday were more numerous than on any other day, he began to repeat the words of the Bishop. Before very long it became a regular ceremony on Sundays for the neighbors from far and near to gather in Haywood's home and listen to his repetition of the Bishop's sermons, broadcast by WCAP from the Cathedral at Washington.

Now, through the activity of Mrs. Barnett, a fund for the purchase of a loud speaker, to which the Bishop himself has contributed, has been started, and within a short time Haywood will be able to reproduce every word of the Bishop's Sunday services, including the music, for his "parishioners." It is even possible that this young layman may become a missionary and function, unofficially perhaps, as a modern Vicar of Wakefield.

AUSTRIAN BROADCASTING BEGAN JULY 1

In view of the great economic and social importance of broadcasting, which has created a new industry in Austria, a permanent service has now been undertaken by the Oesterreichische. Radio-Verkehrs-Aktiengeates with the Austrian Postal authorities in the matter of transmission.

The Radio installation on the building of the War Ministry was used for the first broadcast station. Experiments were made with a normal sending power of one kilowatt. Different wave-lengths are now used; on March 25 broadcasting took place for the first time and on a 1,200-meter wave-length. On Easter another trial took place and regular broadcasting was started July 1.

The tax for a radio set is 10 gold crowns collected by the federal post offices. To cover the expenses of the broadcast station, every owner of a radio set is compelled to pay a yearly fee of possibly 50 gold crowns. This fee is reduced considerably in cases of hospitals, associations, and schools. Motion picture houses and other public places, where radio is used for advertising purposes, pay a higher rate.

PRIVATE RADIO STATIONS IN POLAND FORBIDDEN

The Polish Post Office Department has announced that, pending legislation, private radio sending or receiving installations in Poland are forbidden, advices to the Department of Commerce state. Anticipated legislation, while expected to permit private receiving stations, will control their installation strictly by license. Unauthorized private radio telephone receiving stations will be sealed, upon discovery by the Postal authorities, and the case prosecuted.

Considerable criticism of this restrictive radio policy is expressed but the government is urged not to abandon control of communications, especially with Soviet Russia, due to the presence of numerous communist agents within the country. Efforts of British, French, German and Polish concerns to obtain a monopoly over eventual sales of radio equipment have further delayed relaxation of government control.

HOLY SMOKE—PITTSBURGH!

There now is a lady, they say,
Whose voice carries an awful long way;
Of the air she is master,
She's a bloomin' broadcaster,
Her name must be Katy Kaya.

—*George F. Morgan.*

A MOST ASTOUNDING THEORY!

Are radio broadcast stations responsible for late summers and early winters? A Pattersonville, N. Y. farmer believes so and promises frost in August because of the activity of radio stations. In a letter to WGY, the Schenectady, N. Y., station, he expounded his interesting and novel theory as follows:

"This broadcasting of music is good entertainment for the people in different parts of the country. But why is the weather so cold?

"I think that transmission of power through the air freezes all the heat out of it. Think, 20 broadcast stations in the New England States alone! Why, we have had cold summers for three years, ever since they started broadcasting music and entertainments. Four or five years ago when there wasn't any station transmitting power we had warm summers. You know yourself when it is hot in the summer there are thunder storms. Now there aren't any, and why?

"When it is a hot day and a thunder storm goes over, the lightning burns most of the heat and after the storm it is nice and cool. Now, when about 10 or 15 stations get a-going for about five hours each day, the electricity from these stations burns more heat than 50 storms. The weather is altogether different from what it was years ago. *What* are the farmers going to do?

"I may be wrong, but that is the cause of this cold weather, I think. Please try and get all the stations in the New England states and more besides to stop the broadcasting during the summer months and see if we don't get the good old warm days back again."

WORLD'S FIRST PORTABLE BROADCAST STATION

A very unusual occurrence took place when a metropolitan broadcast station was recently disposed of by one of the pioneer radio corporations in broadcasting, because the station dominated the air to such an extent as to prevent radio listeners within its immediate scope, from hearing any other stations. That was not only altruistic to a marked degree, but highly significant in a radio sense. It probably started a new era in broadcasting. It probably began the movement of broadcast stations having their ultimate location away from the thickly populated areas of the country.

This unexpected stroke of policy was announced by the Zenith Radio Corporation, when it sold the well known station WJAZ, then located on the Edgewater Beach Hotel. Because of the uncontrollable interference caused by this station throughout the entire North Shore of Chicago, the company decided to erect a new station far enough away from the city and its environs so as to be no longer an interference to the three million people who make up the second largest city in the United States.

On the heels of this announcement, the Zenith Radio Corporation was deluged with letters from the Chambers of Commerce of many of the small communities in the outlying districts of Chicago. Some letters came from places two hundred miles away. So urgent were many of the invitations from these smaller towns that it was decided to conduct a series of tests to ascertain the best locality for broadcasting and to determine at the same time the place offering the least opportunity for interference. The best working plan which suggested itself was to erect temporary broadcast stations in all the towns selected for test. Then difficulties developed. For a time, it looked as though the plan of making tests would have to be abandoned because the attendant obstacles seemed to

be insurmountable. But, after considerable planning and experimenting in the company's laboratories, a way out was discovered.

The company now has in the process of construction a complete broadcasting unit mounted on a one-ton Federal truck. There have been portable transmitting stations for code work, but from all available information, this is the first portable broadcast station in history. It will be equipped with a 100-watt transmitter. It will have the unusual setting of a glass-enclosed truck, so that the public may witness the operation of the station wherever it is taken. It will be operated entirely from storage batteries. Part of the truck equipment will be a motor generator for recharging the batteries. The aerial will be supported above the truck by means of telescoping masts. Nothing less than gold plated antenna wire will be used —gold reduces surface resistance, and, as a result, greatly increases efficiency in an antenna of this small size.

Arrangements are under way with the Chambers of Commerce of all towns favorably disposed to receive the new broadcast station. Tests will be arranged in each case for a definite night and the officials of these municipalities will be invited to extend the greetings of their respective communities to the world by themselves speaking into the microphone of the portable broadcast station. Already the programs with two municipalities provide for the local band taking part in the broadcasting. In every town prizes will be awarded for the longest distance reception. This will help towards an accurate diagnosis of conditions in each locality "radioicly" speaking. The data expected to be gathered through these tests will be especially valuable to radio technicians and engineers. For, as is generally known, it is impossible for radio experts, with all their theory and practice, definitely to predetermine the broadcasting value of any given locality without actual tests.

For this series of experiments, which promises to be so intensely interesting, the call letters 9XN, intimately and long familiar to the general public, will be used. They will be remembered as the call letters that played so important a part in the radio communication with the MacMillan Arctic Expedition. The same call letters were prominently connected with the record breaking transmitting reception episodes when music and messages from Chicago were heard in Hobart, Tasmania; Melbourne and Sidney, Australia; and by the British Fleet off Tasmania, after Captain Waldo Evans, U. S. N., Commandant of the Ninth Naval District, extended the compliments of the United States Navy to the British Navy.

OUR RADIO EARS

By R. H. LANGLEY*

The ordinary house fly, as everyone knows, has thousands of eyes. Each of them gives him a different picture of his surroundings. All his eyes, however, are bunched together, and every eye seems almost the same scene. The only way Mr. Fly can see something new, is to go to the new place, and take his generous supply of vision along with him.

Man is pretty much in the same fix. His two eyes see just about as much as the fly's many eyes, and he has to move his whole body around the world, if he wants to feast his eyes on some new picture. Photography and the printing press have, of course, done something for man. They bring him more or less faithful reproductions of distant scenes and objects, and the motion picture puts a measure of animation into these images.

The fly can see the pictures too, so man is not much better off, so far as seeing is concerned. The pictures may not mean much

Radio Engineer, General Electric Company

to the fly, he may misinterpret them, but man frequently makes the same mistake, and no one would choose to look at even a motion picture, rather than see the scene itself.

Man's ears were even more limited than his eyes. He could see great distances, he could look into the very depths of space, and with the telescope and the microscope, see the greatest and the smallest (or almost the smallest) things in the universe. He could only hear over very limited distances, a few thousand feet. and there were no instruments to increase this power of hearing.

Then came the telephone and later radio broadcasting.

The telephone, in its present state of development, makes it possible for one person to talk to another almost anywhere. It extends our ears and our voices, and annihilates the miles that may be between two persons who must talk to each other. It is a tremendous help to us.

Just as the world provides many wonderful things for us to see, so it also provides many fine things for us to hear. Some of us, a very limited few, can find the time and the means to travel and see some small part of a beautiful world. The rest of us must stay at home and be content with what we can learn from pictures and books. Also, some few of us live in the great centers where the feasts for the ear are to be found. and some of us can go and hear them. But here again, most of us cannot hear things, or could not until radio came.

Radio broadcasting extends our ears. Even today, with this new art starting its fourth year, we can send our ears into a dozen different places of amusement, almost any time we wish to. We can send them to great cities to hear the symphony orchestras, we can send them into the churches to hear the famous preachers, we can send them into the studios where carefully chosen artists have come to sing or play for us. We can send them into the hotel dining rooms where dance orchestras are playing, and we can send them to banquets and conventions.

Today our ears can go to many places where we cannot go. They can go out across the miles and listen in places where, even if we had the time and the means we could not gain admission. They can enter the great national conventions, for example, and without inflicting any discomfort on the rest of our body that stays at home, they can hear the deliberations of the political parties, and the speeches of the political leaders. They can even go into the White House, and sit beside our Chief Executive when he reads his message.

The great convention halls that have recently attracted our attention are very large, as such places go, but it would have been quite impossible for even a thousandth part of those who sent their ears to these places by radio, to have been there themselves. Radio not only takes your ears and mine to these places, but everybody's and there is no crowding.

When we send our ears away by radio, let us say to hear a famous orchestra, it is not at all like going ourselves. If we should go personally, we should have to be content with the best seat we could obtain, and we would not know, until the performance started whether it was a good seat or not. Many of us would not have good seats. When we go by radio, we have the best location for hearing the entire program, regardless of whether this is in a seat, on the ceiling, or in mid air. Men who are experts have been there beforehand and have found this the best place.

When we go in person to hear an entertainment, we take our two ears along, and use them as best we can. Unless we are very fortunate, we miss parts of the pro-

gram, do not hear all the words, and are disturbed by others near us, who are not as interested as we are. When we go by radio, we may have a dozen ears, all carefully placed for us to catch every syllable and note of the performance, and protected from any disturbing noise. If it is a church, there is one ear to hear the organ, or perhaps two or three. There is another for the choir, another for the pulpit, another for the belfry, and so on. There is an operator there to change us from one ear to another as the service proceeds.

Each evening we have hundreds of electrical ears, carefully placed for us in the most interesting places in the country. We sit quietly and comfortably at home, and we make any one of those ears our own. We listen where we please, and if we do not like it, we change. If the ear at the Chicago Hotel is not entertaining us, we change to one in Philadelphia, or Montreal. The miles between us have lost their meaning.

Naturally, we are learning to be very critical about what this new extension of our ears brings to us. We have much to say about quality, and faithful reproduction, but we shall have to be patient, and we shall have to be reasonable. Who will say that the radio reproduction of the distant orchestra is any less faithful than the photograph of the Grand Canyon, or the motion picture of Niagara Falls? Who will say that what we get by radio from a national convention is any less accurate or informing than what we can learn about it from the newspapers? Who will say that radio, with its few brief years of development, has made less progress than any other art, in extending our senses to a distance?

THE VALUE OF HIGH FREQUENCIES

Radio experts of the Navy have achieved phenominal results with high frequency short wave transmitters operating in the neighborhood of 3,000 kilocycles.

Commenting on regular tests, Dr. A. H. Taylor, Superintendent of radio at the Naval Research Laboratory at Bellevue, D. C., said:

"The American Radio Relay League is co-operating with us in the tests we are making, and we are receiving reports from observers in the following states: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Virginia, North Carolina, South Carolina, Ohio, Kentucky, Tennessee, Georgia, Florida, Louisiana, Illinois, Wisconsin, Michigan, Minnesota, Iowa, Missouri, Oregon and California.

"We are also receiving reports from Canada regularly and occasionally from Porto Rico. We have had reports from Brazil, France, Holland and England, and hope for some from other countries before long.

"What we are attempting to do is get a line on the seasonal variation of transmission and on the reliable range which can be obtained with a given amount of power. It will take considerable time, perhaps another year, to conclude these experiments and we are now in no position to make final statements as to what can or can not be done. We are simply collecting a large amount of data, increasing the number of observers from day to day and relying very largely on the co-operation of American amateurs.

One of the most interesting things about this work is that it does not in any way interfere with broadcast listeners, as it would be impossible for any of them to be aware of it when we are transmitting on our highest powered set. That is because our sets all operate on pure C.W. with a very steady pure wave, free of those irregularities which

are so prone to cause interference in broadcast receivers. The wave-length is so far removed from the broadcast listening band that it is not possible for such receivers to pick up our signals even if they desired to do so."

Further observations indicate that high frequency transmission is frequently better in darkness than daylight and that it fades less. In a report to the Navy Department, Dr. Taylor writes as follows:

"This laboratory has recently been carrying on extensive tests, both daylight and after dark, at frequencies between 1,500 and 3,000 kilocycles. Long distance so-called freak transmission after dark on high frequencies is no new thing, and has hitherto been of little interest to the naval service because of its utter unreliability, but in recent years, the advent of the tube transmitter for high frequencies permitting C.W. reception, and the enormous improvements that have been made in receivers for high frequencies, puts the matter in a somewhat different light. Furthermore, experimental work done by the Westinghouse Co., by the Bureau of Standards and by numerous amateur experimenters, has shown that if the frequency is high enough, some apparently new phenomena of transmissions take place and the intensity of signals apparently does not in any way follow the well known Austin-Cohen transmission formula. Amateurs have succeeded in bridging almost unbelievable distances, using frequencies in the neighborhood of 3,000 kilocycles.

"The Westinghouse Co. has been experimenting for several years with these frequencies and information is at hand that they have discovered that great distances can be regularly bridged with very small amounts of power if the frequency is high enough. They found, for instance, working between Pittsburgh and Cleveland, that at 3,000 kilocycles transmission was possible by daylight, but better after dark. On the other hand, at 3,500 kilocycles. (80 meters) the transmission was actually better by daylight than after dark. They also found a remarkably lesser degree of fading and swinging of signals on these high frequencies than on those well known in the amateur range within 1,500 kilocycles. They further found very much less in the way of atmospheric disturbances, thus permitting very high amplification in the receiver. They are actually running a regular broadcast schedule between Pittsburgh and Hastings, Nebr., on 94 meters. The Hastings station relays these signals on a wave-length suitable for the broadcast receivers, thus availing itself of the Pittsburgh programs.

"These experiments have been more or less borne out by the tests which this laboratory has made on the intrafleet transmitter. It has been comparatively easy to work as far west as Detroit in the daytime and as far north as Connecticut. As a matter of fact, a considerable number of stations within a radius of several miles have been comfortably communicated with both by daylight and after dark. Until recently, the shortest wave-length which this transmitter reached, was 110 meters (2,726 kilocycles). On this frequency considerable fading had been observed both by daylight and after dark, but it is not as pronounced, as it is on somewhat lower frequencies. This transmitter can readily be modified to go down to short waves or higher frequencies, and further experiments in this laboratory will be made. Successful tests with 54 meters have also been made.

"It is well known that other countries, particularly France and England, are prosecuting such investigations very actively. It is reported that entirely satisfactory daylight transmission between Paris and Nice has been obtained on a wave-length of 56 meters, which is about 5,500 kilocycles. It is well known that Marconi has succeeded in bridging considerable distances in the

neighborhood of 100 miles by telephone at a wave-length of 15 meters, or a frequency of 20,000 kilocycles. This he did with the aid of reflectors, which brings up the point that if the wave is short enough, or the frequencies high enough, it is possible to build a sort of reflecting screen of parabolic shape which is not too large and cumbersome, and will confine the energy to a considerably smaller beam. This obviously permits small power to be used with remarkable efficiency.

"The 100-meter transmitter of the Westinghouse Co., at its Springfield works, is said to have been copied in Denver (telegraphic transmission without the aid of antenna or ground). The Navy intrafleet transmitter has been copied in Baltimore on its lowest power with only a few hundredths ampere in its antenna, also without the use of antenna or ground. The intrinsic radiation on these short waves is extremely high.

"There is a field of investigation here which, in the opinion of the laboratory, should be entered by the Naval service to keep abreast of other countries. The number of possible channels of communication at these very high frequencies is almost infinite theoretically, and is very large practically."

RADIO STATION IN MANILA

The establishment of a large radio station by the Radio Communication Company of Hongkong was discussed recently before the American Chamber of Commerce of Manila, according to a report to the Department of Commerce. This company has already obtained grants from the Portuguese Government for the erection of a station in Macao, and has plans under way for the erection of stations in Hongkong and Shanghai. It is expected that if such a station is erected in Manila, regular programs of music will be broadcast several times a week. Such a project was contemplated by an American firm about a year ago, but the plans fell through.

U. S. RADIO EXPORTS INCREASE

Radio exports from the U. S. during June totaled $307,884, against $295,677 in May and brought the total for the fiscal year up to $4,062,420, an increase of more than a million dollars over last year.

AMERICA'S FIRST FLOATING BROADCASTER

The U. S. S. *Leviathan* is the first floating broadcast station. It is not officially licensed to broadcast, but is operating on an experimental license with the call WSN, and the U. S. Shipping Board has applied to the Department of Commerce for permission to broadcast while at sea.

During a recent trip to Europe, the Leviathan sent out several concerts supplied by this ship's famous band and the artists aboard. These concerts were picked up by several ships which reported them with thanks. A station of the British Broadcasting Co. also intercepted the concerts and rebroadcast them from the company's stations in England, resulting in many letters of appreciation from British fans who enjoyed the entertainment aboard the ship.

Commenting on the experiment, an official of the Shipping Board said that while the broadcasting was not established permanently, the trials had proven that broadcasting of radio concerts at sea was practical and appreciated by thousands of persons out of range of most land broadcasters, and other means of amusement. Little interference is anticipated from the *Leviathan*, and it is pointed out that in New York a number of broadcasters transmit daily although there are several commercial stations in operation and many ships constantly on the air, all operating efficiently and satisfactorily. This is taken as an indication that the sea

broadcasting on a suitable wave-length would be a step in advance, which would not affect adversely the exchange of radio telegraph communications nor decrease the present efficiency in the radio watch maintained for distress signals on 600 meters. The approval of the Department of Commerce is being sought and it is believed that an international understanding will eventually have to be secured in order to eliminate needless interference both afloat and ashore, before ocean radio concerts can be permanently established.

AMERICAN RADIO STATIONS IN EUROPE IMPROVE

Two radio experts of the Navy Yard at Washington have completed the overhauling of the Shipping Board radio receiving station in London and the Naval receiving station at the American Embassy at Paris. Improvements made have greatly increased the efficiency of the two receiving sets and in consequence improved the two trans-Atlantic circuits, it is reported. Improvements made at Annapolis will also tend to improve the long distance transmission of official dispatches to England and France.

In consequence of the added efficiency of the Shipping Board station in London, the officials of the Board may route all European dispatches via London, as that station is apparently better adapted to receive radio messages from the States than is the Paris station. In this event, air mail delivery the same day to Paris would be employed. Improvements at Paris may, however, eliminate this transfer of traffic.

Previously NSS, Annapolis, has been sending official dispatches twice, repeating at a slow rate of speed, to Paris at 4 a. m., after the press is cleared. Sometimes reception has been so bad that delays as long as three days have resulted.

A comparison between radio reception at London and Paris shows that 340 messages comprising 16,878 words were received at London, with the repetition of only 2,174 words, that is, 87 per cent. of the words were received the first time; whereas at Paris, out of 275 messages, including 16,047 words, 5,234 were repeated, in addition to repeating the whole series of messages. Consequently this test, although made some time ago, showed that Paris only received 16 per cent. of the words the first time, causing a great delay. Out of a total of 23,094 words received, 10,468 were repeats.

The personnel of the Shipping Board station in London is said to be anxious to handle more traffic, all scheduled for Paris in fact, unless the recent changes in the set there improves the reception, but the Board has made no announcement approving the plan.

NATIONAL COMMITTEE PLANS MILLION DOLLAR RADIO FUND FOR AILING VETERANS

Once in a century or so, an idealist starts something which gains momentum and size as it is pushed along, like the formation of a gigantic snow ball: This century it was the idea of S. R. Rothafel, of the Capitol Theatre in New York, who thought it would be a boon to sick and injured war veterans if they could hear an occasional radio concert.

Roxy, to use his popular name, was well known in the east, when he conceived the idea a few months ago; now he is known on the other side of the Mississippi and the snow ball, which he started at WEAF, is rolling toward the Pacific coast. It is so large and solid it is not likely to melt before some 200 hospitals are equipped.

His idea has been accepted by the whole country, and a national committee, including the heads of several Governmental Departments at Washington, together with admirals

and generals, has just completed a plan to equip every hospital in the United States, wherever a single war veteran is quartered, with radio receiving facilities. Cities, communities, broadcasters, newspapers, manufacturers and practically everybody has promised co-operation, and to date hundreds of thousands of dollars have been collected or pledged. The aim of the national committee is to raise a million dollars, through the aid of state and municipal committees, the funds to be used solely for equipping local hospitals where veterans of the World War are being cared for. Both the heads of the Army and the Naval medical services have endorsed radio as an efficient aid in the recuperation of government patients.

Already funds sufficient for the military and naval hospitals of the District of Columbia have been raised and the hospitals equipped. New York has collected approximately $125,000; Chicago several thousands of dollars; Providence has given about $15,000; and Boston is conducting a campaign for $50,000. This money is used solely for the purchase of equipment, there is no overhead, and manufacturers are quoting especially low prices.

Soon it was discovered that the scheme was taking everywhere; the burden of the work became too great for "Roxy and his Gang," and he appealed to Maj. General Lejeun, Commandant of the U. S. Marine Corps, and his former commander. Today practically the whole National Government is behind the plan. The executive committee has established National Headquarters of the "Roxy Radio Fund," in the Munsey Building at Washington, D. C.

Experts on radio from the Army, Navy and Bureau of Standards co-operated in designing and installing the first large receiving unit at Walter Reed Hospital, in the District of Columbia, which provides head phones for 1,000 patients, and serves four loud speakers. This model unit worked so well that it has been made the standard of similar equipment for all hospitals.

Surveys of 160 hospitals east of the Mississippi River are already completed or are under way, in order that the individual needs may be in hand when the local district committees complete their canvasses for funds with which to purchase equipment.

The survey itself is now reduced to a simple form, due to the activities and forethought of the experts of the National Committee. A standard form of radio specifications has been adopted, based upon the Walter Reed equipment. A blank form is sent to each hospital, and the data filled in by an attache. He specifies how many patients, what facilities for a central receiving room are available, method of wiring, and the length of wire necessary. He also records the number of insulators needed, switches, bridle rings, receptacles, loud speakers for each assembly room, head phones, which should be ten per cent. over bed capacity of hospital, conduit pipe and even the number of tacks required. To aid him he has the standard specifications and a model wiring diagram of everything from the antenna to the head phones and ground.

WALTER REED EQUIPMENT

The radio programs are received at Walter Reed Hospital on one master receiving set which feeds, by means of an impedance matching transformer, into an audio frequency power amplifier, which, in turn, feeds into the 1,000 phones in parallel through another impedance matching transformer. The lines which run from the output transformer to the various wards and across which the phones are connected, may branch at any point and a double-pole switch is provided at every branch point in order that any trouble which may develop in the system may be isolated and more easily located.

The method of connecting the phones to the line is by means of a two-prong push

plug and receptacle similar to those used for electrical lighting appliances. The phone cords are provided with eyelets instead of the customary tips so that they may be connected or disconnected at will, but all phones connected to the lines must be of the same manufacture and type.

In the temporary buildings the wire (No. 19 copper inside twisted pair) is attached by tacks directly to the walls and is left exposed. The receptacles are mounted at the head of each bed, in wood blocks with brass face plates. The phone cords provided are eight feet long. In the permanent buildings the wire is concealed under wood moulding, which is the height of the beds and is similar to a chair rail around the room. The connections between buildings were carried on bridle rings through corridors connecting the building, No. 17 copper clad outside twisted pair was used.

The entire receiving and amplifying equipment with batteries and charging equipment is housed in a basement room of the main building and is in charge of one man, not a patient, who is responsible for the equipment. It is the duty of this man to take care of the batteries and receiving equipment, to adjust the receiving set and control the volume of sound delivered to the line. A pair of phones is provided in parallel with the rest of the system so that the operator at all times knows the volume with which the patients are receiving the program. As phones are connected and disconnected it is necessary to vary the control to keep the volume the same. The operator must monitor the line continuously. An outlet is also provided in the office of the commanding officer so that he may properly supervise the volume, etc. There are two or more antennae available in order that local or distant stations may be received satisfactorily. A short antenna is used for local reception in order to minimize the noise from atmospheric strays and local disturbances, especially in the summer.

A spare receiving set is provided and so connected with switches that it can be substituted quickly. This makes it possible to select programs while the system is in operation and give continuous programs to the patients and not require them to listen to the noises which may be produced in tuning. Loud speakers are provided in four assembly rooms, and are operated from the same power amplifier.

PRIMARY RADIO FREQUENCY STANDARDIZATION

A method of high accuracy for the primary standardization of radio frequency has been developed by the Bureau of Standards. Comparison is made between the frequencies of two alternating currents, one of radio frequency and one of an accurately known audio frequency by the use of Lissajous figures produced in a cathode-ray tube. The Lissajous figures were formed on the fluorescent screen by the alternating electric fields from two generating sets applied to two pairs of small condenser plates mounted in the tube at right angles to each other and to the electron stream.

The procedure adopted was to adjust a radio frequency generating set to a known multiple of the audio frequency by the use of the Lissajous pattern produced in the cathode-ray oscillograph.

The standard wavemeter was then brought into resonance with the radio frequency generating set and read for the known frequency. A range from 1½ to 22 times the known audio frequency was covered in this matter. Further extension of the frequency was made by use of an intermediate generating set which could be compared directly with the known audio frequency. The range of the wave-meter standardized in this manner is from 3.5 to 5,000 kilocycles.

The paper describing this work is Bureau

of Standards Scientific Paper No. 489, "Primary Radio Frequency Standardization by Use of the Cathode-ray Oscillograph," by G. Hazen and F. Kenyon. Copies may be obtained for 10c each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

U. S. REFUSES TO PUT COMMUNICATIONS UNDER GOVERNMENT

The first Inter-American Conference on Electrical Communications, which met in Mexico City recently, passed conventions controlling cables, telegraphs and radio and adjourned to meet next year at Rio de Janeiro, but the United States is not a party to the agreement, according to Allan H. Babcock, American Delegate, who recently reported to the State Department.

When Secretary Hughes will officially announce the position of the United States is not known, although he has received a copy of the convention passed by the seventeen Southern Republics, and has also the report from Delegate Babcock, on whom the final details of the work fell. Ambassador Warren and Representative White, the other delegates, were unable to remain in Mexico, due to important business in the U. S., and returned to Washington.

The personal opinion of Mr. Babcock, who was interviewed in Washington on his return, is that the United States will not submit to any treaty which would place its communication systems, and the industries back of them, under Government ownership or control. "While recognizing the right of each government to determine its own policy with regard to the ownership and operation of its electrical communications, the United States advocates the principle of private ownership and management, subject to just and reasonable governmental supervision," he said. "This is the basis upon which the comprehensive communication systems of the United States have been developed," he explained; adding that in this country measures adopted for the protection of public interest conform with the principle that governmental supervision of private enterprises must be general in character and must not deny unduly, or interfere with, the rights of management inherent in the ownership of property.

Mr. Babcock believes that Inter-American Electrical Communications can best be extended and improved by encouraging private initiative and the investment of private capital in that field. Capital invested in electrical communication systems, he asserts, should be adequately protected, and the owners should not be deprived of their property without just compensation.

It was for these reasons that the U. S. Delegates felt that they could not even participate in the Inter-American sessions, much less sign the agreements, which make for the establishment of a permanent union for the purpose of promoting government ownership of communication facilities and for the regulation of Inter-American communications in a manner that interferes with the rights of management inherent in the private ownership of such facilities in the United States. The agreement signed by the other American Republics contained provisions applicable only to internal communications, which are not believed to lie within the scope of international conventions. It is not confined to principles, but provides that detailed regulations be drafted later, which would have the same force as the convention proper, committing the signing parties to their acceptance, and also goes farther than was anticipated by the Santiago Resolutions.

Reiterating his statement made at the plenary session on July 16, Mr. Babcock said that on June 11, two conventions were presented on behalf of the United States: The first proposing the revision of the con-

vention for the protection of submarine cables signed in 1884, and the second contemplating the revision of the London Radio Convention of 1912.

Commenting on the latter, Mr. Babcock, who is himself an active radio experimenter, in San Francisco, said:

"It is well known by those familiar with the great advances in the radio art that have taken place since the 1912 conference, that the provisions of the convention drafted there are obsolete and are not applicable to modern conditions and methods of operation. With a view of reaching an agreement which would replace the obsolete provisions of the 1912 Convention with provisions that would encourage the development and extension of radio facilities, it was earnestly desired that the Conference devote its attention to this subject. The draft of the Convention now before this Conference does not in any way take care of the difficulties that exist with respect to international radio communication, and does not deal with the situation in a constructive way. It is hoped that after the Conference adjourns, the proposals submitted will receive further consideration by the Governments represented here. It is the earnest desire of the United States to co-operate fully and whole heartedly in any program which will improve communication services and thereby unite the peoples of this hemisphere more closely and bring about a better understanding and more friendly relations between them. I can not join in recommending to the Pan American Union a Convention embodying principles contrary to the national policies of the United States, and substitute government ownership and operation for private ownership and operation through which its unparalleled communication services have been developed."

BROADCAST INTERFERENCE GREATEST RADIO HANDICAP

On August 1 the Bureau of Standards brought to a close the taking of 50,000 observations in its study of radio distance range, which has been in progress for two years. It had as its aim the securing of statistical data on the actual distances of broadcast reception and the effects of varying conditions such as fading, atmospherics station interference, radiating receiving sets, weather, etc. The observations were made on the signals from stations KDKA, Pittsburgh, Pa., and WLAG, Minneapolis, Minn., by about 200 voluntary observers located at varying distances up to 1000 miles from these stations. These tests were so organized and the recording forms so devised, that it is possible to analyze the complex data with mechanical tabulating machines.

Preliminary results indicate that the major obstacles to broadcast reception in these tests were: other broadcast stations, atmospherics and fading. The analysis of these will require considerable time, but the results will be announced as soon as available.

RADIO BEACON AT DAYTON GUIDES LOST PILOTS

The Army Air Service reports the first practical use of the Signal Corps revolving beacon at McCook Field, Dayton, Ohio, by pilots off their course to Columbus. This beacon, installed some time ago at Dayton, rotates on the principle of a revolving lighthouse, except that, instead of a beam of light, pairs of radio signals are sent out every five seconds. By listening in on a regular radio receiving set the pilot is enabled to steer his plane directly toward or away from the beacon. Keeping the pairs of radio signals at equal intensity makes it necessary for the plane to be either approaching the transmission station or flying from

it, no matter whether the plane is north, east, south or west of the station.

While en route to Columbus from Dayton recently, Capt. W. H. Murphy and Lieut. A. J. Lyon of the Air Service undertook to fly by compass on account of foggy weather, but were unable to keep their course. Lieut. Lyon, the pilot, had never used the radio directional station, but as no land marks were visible and the wind was drifting their plane, further aid was needed.

The plane was the Radio DH, P-292, and as soon as the equal radio signal direction finding system was taken into confidence, the plane was set on the correct course and Columbus was reached without difficulty. There was no question as to its use on the return trip, and the result proved equally successful through persistent bad weather and stubborn drift winds. The compass was forgotten, as its reading was incorrect.

Captain Murphy made an interesting experiment on the return trip which leads to the idea that should two planes be traveling the same course, one, for instance, flying from Dayton to Columbus and the other from Columbus to Dayton, they could each keep slightly to the right of the course, thus avoiding collision and still be led to their destinations with great accuracy by the radio directional beam.

WEST COAST STANDARD RADIO TRANSMISSIONS

Arrangements have been made for the transmission of standard frequency signals for the Bureau of Standards by station 6XBM, Stanford University, Palo Alto, Calif. Beginning in September, these signals have given to the western part of the United States the same standard frequency service that is available in the eastern half of the country through the transmissions from the Bureau of Standards laboratory in Washington. In preliminary trials the 6XBM signals have been heard as far east as Minneapolis, Minn

The signals duplicate those of the Bureau of Standards in schedule, character, and possible methods of utilization. The schedule of transmission on September 5, was similar to the Eastern schedule (also that on Sept. 22), except that the time was Pacific Standard time. The transmissions are from 11:00 p. m. the dates scheduled to 12:32 a. m. On September 5 the frequencies were from 300 to 666 kilocycles (1,000 to 450 meters) and on September 22 they will be from 550 to 1,500 kilocycles (545 to 200 meters).

Esperanto and Radio

An interview with Mr. Franz J. Schade, Gen. Secretary of the Esperanto Club of Austria.

By RICHARD NEWMANN

The question as to how we Esperantists should handle the radio transmission question was taken up during our opening conference in Geneva on April 22 and 23, in association with the International Radio Congress. It is perhaps interesting to note that this movement of ours was especially favored on the side of England, who sees in the Esperanto language a means for practical neutral understanding with the help of which we may hope to acquire a peaceful solution for all sides of the ever-burning problem of international understanding in the ether. The American Radio Relay League is coming to the same result in research now being brought out, namely, that Esperanto may be accepted as the only valid radio world language.

If one considers the ever-spreading scope of the radio movement, which with us is still in its baby-shoes, this question comes

up, and especially for us in Central Europe with its proportionally narrow frontiers, its multitude of languages and its international communications in this period following the war. Esperanto seems especially to be the means attempted for transmitting to all lands, by radio, political interviews and views of important personages; for sending our music, of course, this utility disappears. I acknowledge, without going further, that the Esperanto movement is not recognized sufficiently on all sides nor is the good that is in it yet appreciated, yet radio seems called upon to get a better appreciation of our Esperanto in wider circles, and both these young achievements of the human brain (namely Esperanto and radio) must compliment one another in its own region.

The fact that its importance is understood is shown by the lively interest manifested from almost all regions and stations and was shown in our recent World Congress held in August at Vienna. Visitors from all countries were present, including representatives from Canada, Mexico, Australia, etc., along with the official representatives of almost every European Government. Unfortunately, our communications with some of the large Austrian radio firms asking them to give their services to the Congress have had no practical results in consequence of technical and financial difficulties, so that during the sitting it was left to a sub-committee to take up the question of radio and its relations to Esperanto.

Naturally during the sitting of the International Congress in Geneva messages in Esperanto were broadcast and appreciated by all participants, even those who up to date have not been taking an interest in Esperanto. (Here it must be remarked that in Switzerland there is to be published a radio journal in Esperanto.) In conclusion I might say that the radio movement will certainly find a valuable ally in Esperanto, to help it to reach in its cultural missions ever increasing numbers.

FOR SALE—A RADIO

By HARRY R. LUBCKE

FOR SALE—one good radio
With a slightly used ground,
Two squealing steps of audio
That really belong in the pound;
Six blown tubes—all gone West
At 10 volts filament they worked best;
"B" battery included, long since gone cold,
But the set works very well, I'm told.

Parts are mounted on "Suremika" panel
Including aerial, ten feet long,
Get ten thousand mile reception,
Have often heard Hong Kong;
Music comes in with silent clearness.
Secret—"Flickerstats" used throughout,
Locals, quiet—due to nearness,
Distant stations fairly shout.

One fine shredded rubber "A,"
One charge will last about a day;
Pancake coils, baked fresh last May,
Grid leak made of hard pressed clay.
Hard blubber sockets with cast iron spring,
Condenser plates, all pure tin,
Reason for selling—bound for Sing Sing,
A darn good set for the shape it's in!

A RADIO LOVE TAP

An uninitiated radio bug was winding an inductance coil when a more experienced friend dropped in.

"What are yu' hittin' the coil for?" asked the more experienced person.

"I dunno, seemed kinda funny to me too, but the directions said that if you want sharp tuning you should tap the coil every third turn.

Contributed by W. S. Klein.

A SMALL TRIBUTE

ALL the Big Men have sent their best wishes,
Even Great Men and Mighty enthuse;
Now, a sea-going Sparks from the Oil Tanking Arks
Sends his "73's" to the NEWS.

For five years you have kept us in details
Of advancement, and Ham gossip, too;
There's the Editor's Page full of prophecies sage
Of which many have proven as true.

When occasions have risen you've fostered
The cause of the Amateur game,
And the fair-minded views of the RADIO NEWS
Are most prominent cause of its fame.

So keep up your excellent standard
Of fairness and faith in the Art;
For we've pointed with pride to our text-book and guide
As the RADIO NEWS, from the start.

L. F. M.

THE MAIDEN'S APPEAL

(In view of the fact that a man's heart beating at Pittsburgh has been heard in London, the following is not without interest.)

And does your heart beat true, my love,
Divided though we be?
Across the sea so blue, my love,
Does it still beat for me?

Last night I had an awful bump,
A fact I won't conceal—
It did not seem to me to thump
With quite the proper zeal.

O Henry, let it beat, I beg,
For me through thick and thin.
(She took the head-phone from its peg,
Sat down and listened in.)

Ah, horror, do I hear aright?
Oh, woe unknown and utter!
Last night it flagged a bit; tonight
It does not even flutter.

Pittsburgh I hear on this, my set,
And Paris comes at call,
But woe is me, I cannot get
My Henry's heart at all!

And little joy for me you'll grant,
In Yankee airs or French
If Henry's heart has learned to pant
For some more novel wench.

Now, has he left me on the shelf,
And found some newer queen?
Or his wave-length lost itself?
What does this silence mean?

Quick, quick, a wireless expert fetch,
And save me from hysterics!
Has Henry played me false, the wretch;
Or is it atmospherics?

Lucio,
Abstract "Manchester Guardian."

AIR AND SEA CRAFT NEED MORE RADIO CHANNELS

Those who sail the seven seas, where there is no communication except via radio, and many others who depend solely upon this means of intercommunication feel that, what are technically termed "mobile stations" have not received adequate consideration in the distribution of the radio channels. A strong representation for the mobile services, comprising chiefly ships and aircraft, will be made at Secretary Hoover's radio conference this month, it is believed.

A resumé of the wave allocations made at the last radio conference shows that approximately 110,000,000 people are concerned with radio service from and to 3,100 ships,

300 aircraft and 900 commercial land stations, all of which stations are allotted only 37 separate channels through the ether. On the other hand, 20,000 amateurs have 33 such channels, and 600 broadcast stations, of interest to about 10,000,000 people, are allowed to operate on 53 separate wave-lengths, although several other forms of communication are available for these people.

Especially in the Navy and Shipping Board, Marine operators and experts believe mobile stations deserve a better proportion of operating wave-lengths, in view of their sole dependence on radio and the importance of it in insuring the safety of life and property at sea.

Commenting on the situation a Naval officer recently stated:

"There is one elemental fact in respect to radio which should govern all discussion of the subject and to which all other considerations should be subordinate. It is that radio is primarily an agency for communication with ships and aircraft, and within this field there is no substitute for it. In nearly, if not quite, all its other applications the same ends may be achieved by other means. The importance of radio for communication with ships and aircraft is so great in connection with the safety of life and military considerations, that no other applications of the art should be allowed to diminish its usefulness.

"In the enthusiasm which has developed over radiophone broadcasting and amateur work, many government agencies, private interests and the public generally, have lost sight almost entirely of the foregoing facts. They have lost sight also of the fact that the efficiency of a transmitter depends somewhat on the size and position of its antenna, and that mobile stations are limited in the amount of wire they can carry and the positions in which they can carry it, whereas, while the optimum frequencies for mobile service are undoubtedly convenient ones for stations on land, such as radiophone broadcast ones, such stations can be readily adjusted to other frequencies without causing a loss of efficiency.

"Allowing a separation of 15 kilocycles between channels, the following table recapitulates the recommendations of the Second National Radio Conference:

Service	People concerned	Radio stations	Number Channels
Total Ships 27,000. Mobile Aircraft, 1,200 ..... Land Stations. 900.	110,000,000	3,100 300 900	37
Special Experimental,	560	560	18
Amateur, 20,000.....	20,000	20,000	33
Broadcasting	10,000,000	600	53
Unassigned wave lengths	....	....	6
Reserved wave lengths	....	....	4,020"

BROADCASTING IN CEYLON

The Secretary of State of Ceylon has approved the introduction of wireless broadcasting under state control, though not necessarily operated by the state, Assistant Trade Commissioner Renshaw, at Calcutta, reports to the Department of Commerce.

The Ceylon Government has decided to issue an unlimited number of licenses for receiving sets. Broadcasting will be undertaken by the wireless station at Colombo.

SMITHSONIAN INSTITUTION GOES ON THE AIR

In carrying out its motto: "For the Increase and Diffusion of Knowledge Among Men," the staid and conservative Smithsonian Institution at Washington has turned to broadcasting as the most efficient means of disseminating knowledge.

The Englishman, James Smithson, who died in 1829, bequeathing his estate to the United States to found, at Washington, an establishment for spreading information throughout the country, would no doubt ap-

plaud the modern means of accomplishing his ideals, if he knew of the recent action of his executors. Interpreting his purpose as covering practically all intellectual activities of man, scientific reseach, and exploration have figured as the principal factors in the Institution's increase of knowledge. Until recently, the chief means of disseminating scientific and general knowledge has been through the publication of reports and the exhibits of the National Museum, a branch of this Institution now known throughout the civilized world.

In September the Institution will undertake a definite program of weekly scientific talks over the radio from Station WRC, covering practically every branch of science, but so spoken as to appeal to lay listeners as well as those better informed. The program under the direction of Dr. Austin H. Clark of the National Museum, who has also secured the co-operation of the Carnegie Institution, and several scientific bureaus of the Government.

The first broadcast speech by a member of the Smithsonian staff was that of Dr. Charles G. Abbot, Director of the Astrophysical Observatory, who spoke last November on the heat of the sun's rays and his experiments with a solar cooker. The initial talk was so successful that in the spring other savants who could discuss natural history in a popular style, went on the air. Among the radio talkers were Dr. Clark, who spoke on "Giants in the Animal World," Superintendent Hollister of the Zoölogical Park, who told of keeping and feeding wild animals, and Dr. Merrill, who spoke on shooting stars. Other subjects covered in eighteen Smithsonian talks, included "Children of Greenland." "American Plants," "Dinosaurs, the Terrors of Past Ages," "The Non-Magnetic Ship, *Carnegie,*" and "Big Game of North America." One unique stunt was the broadcasting of real Indian music rendered by natives, to which the Smithsonian officials themselves listened on a radio set installed in the main building. Radio fans bothered by static heard a talk of great interest recently, when Dr. Mauchly of the Carnegie Institution spoke on "Atmospheric Electricity."

Although Smithson, the founder of the Institution, probably never thought of transmitting speech either with or without wires, it was recently learned that during one of his lectures. Joseph Henry, first secretary of the Smithsonian, said he regarded even the best copper wire as an impediment in the transmission of electric currents. He admittedly did not know how to dispense with the electrical communication, but thought that the men in his audience would live to see wireless telegraphy. This was 75 years ago, and today the Institution he headed is broadcasting its information to the country by radio telephony.

NOT WET ENOUGH

MRS. DORCAS: I couldn't hear the prohibition lecture that was broadcast.

DORCAS: Perhaps there was something wrong with the dry battery.—*James J. O'Connell.*

A JOINT REPORT

Newspaper headline—*"Keep Joints Clean."*

ONE READER TO ANOTHER: "That's right, they ought to—but I shouldn't talk to strangers about it; what's your line of business?"

"Oh, that's all right, I agree perfectly. I'm a detective. And you——?"

"I assemble radio sets."

CHORUS: "Oh H——!"—*Jack Bront.*

HAR — HAR!

TED: "Is there any duty on radio parts?"

NED: "No. I guess they come under the head of roar materials."—*James J. O'Connell.*

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 eighteen 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 Dec. issue must not reach us later than Oct. 1st.

CIRCULATION LARGER THAN THAT OF ANY OTHER RADIO PUBLICATION

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

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Get Into the Tailoring Game—one of the most profitable of all lines in the selling field. Experience isn't necessary, and spare time will do. We teach you how to sell our line, and supply you with everything necessary to go out and make from $10 to $20 a day from the very first day. Our selling outfit is the finest ever gotten together and shows almost 150 large samples of finest quality woolens. You do no delivering with our line. You just write your orders. We do the rest. Your profits run big and you get them cash with order. If you want to get into this most profitable business, write us quick. Address Dept. 258, Goodwear Chicago, Inc.

Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 405 Delaware Ave., Wilmington, Delaware.

General Agents—Service Men! Genuine Gold Letters for store windows easily applied. 20 per cent cash commission on all orders from local agents appointed by you anywhere. 50 per cent discount on your own orders. Free samples. Metallic Letter Co., 422 N. Clark St., Chicago.

Agents—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn $100 weekly and bonus. Madison Mills, 564 Broadway, New York.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton St., New York City.

Big Money and Fast Sales. Every owner buys gold initials for his auto. You charge $1.50, make $1.44. 10 orders daily easy. Samples and information free. World Monogram Co., Dept. 27, Newark, N. J.

Earn $10 daily silvering mirrors, plating, refinishing metalware, headlights, chandeliers, bedsteads. Outfits furnished. Bolanger-Decle Laboratories, 1133 Broadway, New York.

Business Opportunities

Make $100 Weekly in Spare Time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarks, 813 Washington Blvd., Chicago.

Advertise, hundred magazines, three issues, 10c word. Pennell Company, Covington, Kentucky.

Chemistry

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 581 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

For Advertisers

24 Words—355 Rural Weeklies $14.20. Admeyer, 4112-R Hartford, St. Louis.

For Inventors

Inventors' Educator: 900 Mechanical Movements. 50 Perpetual Motions. How to procure and sell patents. Mechanical Movements greatly assist Inventors, suggest new ideas. Explains how to select an attorney and avoid patent sharks. Price $1.50. Postage free. Albert E. Dieterich, 690 Ouray Building, Washington, D. C.

Health

Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Box M, Omaha, Neb.

Help Wanted

We Want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton St., New York City.

Help Wanted—Continued

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 973, St. Louis, Mo.

All Men, Women, Boys, Girls, 17 to 65 willing to accept Government Positions $117-$250 traveling or stationary; Write Mr. Ozment, 251, St. Louis, Mo., immediately.

Detectives Needed Everywhere. Travel. Experience unnecessary. Write George Wagner, former Government Detective, 1968 Broadway, N. Y.

Men—Age 18-40, wanting Ry. Station-Office positions, $115-$250 month, free transportation, experience unnecessary. Write Baker, Supt. 44 Wainwright, St. Louis.

Instruction

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 581 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

Used Correspondence Courses bought and sold. Bargain catalogue 1,000 courses free. Students' Exchange, Dept. 5, 47 West 42 St., New York.

Miscellaneous

Men, something you want, send name and address with a 2 cent stamp. Quality Mail Sales Co., 591 Broadway, N. Y.

Motorcycles, Bicycles

Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

News Correspondents

Earn $25 Weekly Spare Time writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 972 St. Louis, Mo.

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Lacey Patent-Sense. See page 616.

Inventors—Should write for our Free Guido Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Free Examination and Instructions. Radio, Electrical, Chemical, Mechanical and Trademark experts. Terms reasonable. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 269 Ouray Bldg., Washington, D. C.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 278, St. Louis, Mo.

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Lonesome—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 58, Kansas City, Mo.

Exchange cheery letters with new friends. Write Betty Lee, Inc., Box 820 City Hall Station, New York City. Stamp appreciated.

Printing

American Gummed Labels Stick! Roll or Flat. Catalog Free. Old Tye Press, Dover, N. J.

Radio

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Attention!—50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalog, which contains raw materials and parts in a greater profusion than any other catalog. 15c in stamps, or coin, will bring the catalog to you. Radio Specialty Co., 96-98 Park Place, New York City.

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Is your Neut Right? To revitalize unneutralizable Neutrodynes, we devised this Kladag Coast to Coast Circuit. Uses same panel, etc., as Neut, except three less parts. Merely rewire. Success certain. Necessary stabilizer. 22 feet gold sheathed wire, circuit and complete, simple instructions—$5.00 prepaid. Many have already rebuilt their Neuts—and written wonderful testimonials. Thousands will do it. Be First—have the finest five tube set in your neighborhood, revitalize others' Neuts. Description, etc.—10c. Radio Lists—2c. Stamps accepted. Kladag Laboratories, Kent, Ohio.

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Mysteries of the Air Solved: Reception intensified; soldering done away with; wear and tear overcome; difficulties of installation removed; never failing service obtained. The Doyle Aerial Clamp does all of these. 1-wire clamp, 25c; 2-wire, 50c; 3-wire, 75c; 4-wire, $1.00; 5-wire, $1.25. Money or money order. Agents wanted, everywhere. B. Jarvis Doyle, Patentee, Dept. AC-26, Washington, D. C.

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The How and Why of Radio Apparatus, by H. W. Secor, E. E. This newest book on radio matters fulfills a distinct gap in wireless literature in that, while the treatment is made as understandable and as free from mathematics as possible, it at the same time incorporates a wealth of technique and instruction for the Radio Amateur—the Radio Operator—the Installation and Designing Expert—as well as teachers and students of the subject in general. A very broad field has been covered by the author, at the same time giving a great deal of information not found in other text books. If you are engaged in any branch of the Radio or allied arts at all you will surely need this latest contribution to radio literature, which is destined to be found on every radio man's book shelf before long. A glance at the following list of chapters gives but a very scant idea of the extensive and useful radio knowledge provided in its text. The Induction Coil; The Alternating Current Transformer; Radio Transmitting Condensers; The Spark Gaps; Radio-Transmitting Inductances; Radio Receiving Tuners; Radio Receiving Condensers; Detectors; Telephone Receivers; Radio Amplifiers; Construction of a Direct Reading Wavemeter and Decremeter; Antenna Construction; The Calculation and Measurement of Inductances; Appendix containing very useful tables, covering all subjects treated in this very unusual book. This newest of Radio Works, cloth bound in Vellum de Luxe, Gold Stamped and Hand Sewed, has 160 Pages. Size of book, 6x9 inches. The How and Why of Radio Apparatus, Postpaid, $1.75. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

Experimental Electricity Course in 20 Lessons. By S. Gernsback and H. W. Secor, E.E. A course of the theory and practice of Electricity for the Experimenter. Every phase of experimental electricity is treated comprehensively in plain English. New experiments are described and explained and nearly every application of Electricity in modern life is given. 160 pages—400 illustrations. Flexible cloth cover, 75c, postpaid. Stiff cloth cover, $1.25 postpaid. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

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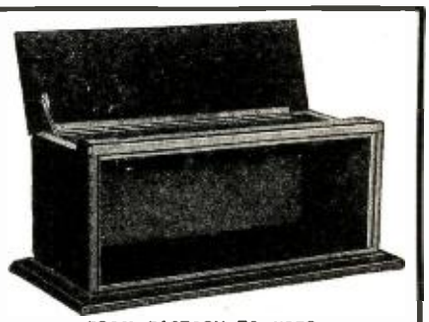

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High Grade Radio Cabinets sturdy built and fine looking. Built from select genuine black walnut or birch. Elegantly finished. Tops on all cabinets hinged. Fronts of cabinets are rabbeted to take panel. Walnut cabinets have continuous piano hinges and lid holders. Birch cabinets have regular hinges. (No lid holders). Walnut cabinets finished in French walnut. Birch cabinets finished in Adam brown mahogany. (Panel not included). Money back if not satisfied.

For Panel	Deep	Birch No Base	DeLuxe Black Walnut	Monarch Black Walnut
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6x10½	7"	2.25	4.65	5.35
6x14	7"	2.75	5.45	6.20
6x21	7"	3.25	5.90	6.80
7x12	7"	2.80	5.50	6.50
7x14	7"	3.00	5.80	6.70
7x18	7"	3.25	6.00	6.80
7x21	7"	3.60	6.50	7.40
7x24	7"	4.10	7.25	8.00
7x26	7"	4.75	7.80	8.50
7x27	7"	5.00	8.50	9.00
7x28	7"	5.25	9.50	10.00
7x30	7"	6.00	10.00	11.00
7x24	10"	5.60	9.25	10.00
7x26	10"	6.25	9.80	10.50
7x27	10"	6.50	10.75	11.50
7x28	10"	6.75	11.50	12.00
7x30	10"	7.00	12.00	12.50
8x40	8"	6.00	11.50	12.50
9x14	10"	3.95	6.40	7.00
9x21	10"	5.00	7.70	9.25
9x24	10"	6.00	9.50	10.50
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12 Cells 24 Volts Solid Rubber Case

$4.00 C.O.D. SPECIAL

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For a limited time *only*, and to introduce this new and superior Storage "B" Radio Battery to the Public, we are selling it for $4.00. Regular Retail Price is $6.00. You save $2.00 by ordering NOW. A finer battery cannot be built than the

World Storage "B" Battery

(12 CELLS—24 VOLTS)

To ten million homes with Radio Sets—and to countless millions of prospective buyers—this WORLD Storage "B" Battery brings a new conception of battery economy and performance. Here is a battery that pays for itself in a few weeks—will last for years and can be recharged at a negligible cost. *And you save $2.00 by ordering now.*

A *Superior* Battery Equipped With Solid Rubber Case

Has heavy duty 2 1-8 in. x 1 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and seepage of current. It holds its charge, while idle, at constant voltage. You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static." Mail your order today.

SEND NO MONEY

Just state number of batteries wanted and we will ship day order is received. EXTRA OFFER: 4 batteries in series (96 volts), $15.00. Pay Expressman after examining batteries, 5 per cent discount for cash in full with order. Send your order NOW and save $2.00.

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Makers of the famous World Radio "A" Storage Battery
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SEND US YOUR BROKEN OR BURNED OUT RADIO TUBES

REPAIRED AND LIKE NEW

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Radio (Continued)

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The original and correct design and superior construction of Yaxley Approved Radio Products guarantee the best results for you.

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Gives fine tuning without use of vernier attachments. Has one nut mounting in single panel hole. Can be turned in any position to suit your wiring layout. You will like these and the other features of this new efficient rheostat. Fully guaranteed.

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What answer did you get, when you first asked your father or mother where babies come from? Did they tell you anything to satisfy your natural, childish curiosity? Did they post you, as you grew up into the age of puberty, on the great facts of life? Have you ever learned ANYTHING about those facts which did not come from a dirty source?

It's the Crime of our age and generation—a satire on our so-called civilization—that the vital facts about the human body which every young man and young woman ought to know and understand, should be kept concealed from them; that an old-maidish prudery and sense of false shame should permit young people to marry and bring children into the world while utterly ignorant of the frightful consequences their own physical condition may visit upon their innocent offspring.

Two thousand years ago, in the civilization of ancient Rome, they did things differently. "Nosce teipsum"—KNOW THYSELF—was the watchword of the race which ruled the world. Learn the facts on which are based Health, Strength, Virility, and the ability to transmit undimmed the Vital Spark of Life.

I have spent a quarter century studying these facts, experimenting with them, classifying them. I have put them into concrete, condensed, easily understood form in one of the most fascinating books you ever read. "Do it with Muscle." It's FREE—yours for the asking. Send for it NOW, enclosing a dime (10c) to pay mailing expense. You'll wish you could have had it years ago. Fill out and mail me the coupon NOW.

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FREE CONSULTATION COUPON

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..Rupture	..Biliousness	..Heart Weakness
..Lumbago	..Torpid Liver	..Poor Circulation
..Neuritis	..Indigestion	..Skin Disorders
..Neuralgia	..Nervousness	..Round Shoulders
..Flat Chest	..Poor Memory	..Lung Troubles
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THE ONLY "LISTEN-IN" BOOK

KEEP A RECORD OF STATIONS HEARD, DIAL SETTINGS, RECEIVING CONDITIONS, ETC.

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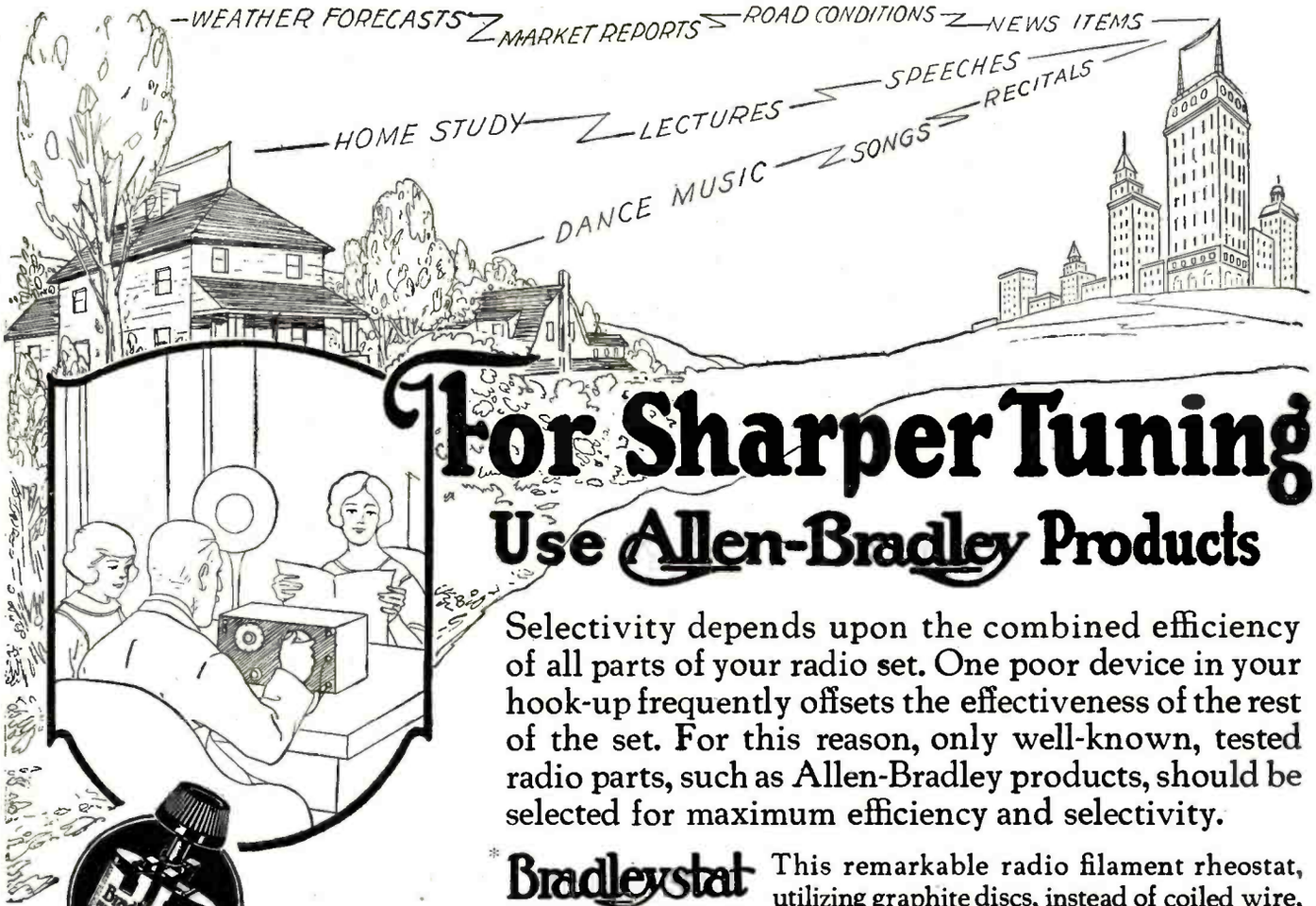


For Sharper Tuning

Use Allen-Bradley Products

Selectivity depends upon the combined efficiency of all parts of your radio set. One poor device in your hook-up frequently offsets the effectiveness of the rest of the set. For this reason, only well-known, tested radio parts, such as Allen-Bradley products, should be selected for maximum efficiency and selectivity.

Bradleystat
PERFECT FILAMENT CONTROL

$1.85
For All Tubes

This remarkable radio filament rheostat, utilizing graphite discs, instead of coiled wire, stands supreme for noiseless, stepless control. It is standard equipment on many fine sets.

Bradleyleak
THE PERFECT GRID LEAK

$1.85
¼ to 10 Megohms

Proclaimed by Crosley, Kennedy, Amrad, Cockaday, Flewelling, and other leading radio experts, as the perfect grid leak. A range of ¼ to 10 megohms assures maximum efficiency for all tubes.

Bradleyohm
THE PERFECT RESISTOR

$2.00
No. 10
10,000 to 100,000
No. 25
25,000 to 250,000
No. 50
50,000 to 500,000
ohms

A highly-praised adjustable resistor for radio circuits. It is made in three sizes, and provides a marvelously smooth and noiseless variation that assures rapid adjustment to the point of highest efficiency.

Bradleyometer
THE PERFECT POTENTIOMETER

$2.00
for 200 ohm
$3.00
for 400 ohm

Another Allen-Bradley contribution to radio. Made in two sizes for all types of radio frequency circuits. No coiled wire to slip or break in operation.

Bradleyswitch
PERFECT BATTERY SWITCH

60c
for A or B batteries

A totally-enclosed convenient battery switch for A or B-battery circuits. Requires only one hole in panel for mounting, and is completely protected against accidental injury. Saves batteries and tubes.

Allen-Bradley Co.
Electric Controlling Apparatus

287 Greenfield Ave. Milwaukee, Wis.

Manufacturers of graphite disc rheostats for over twenty years.

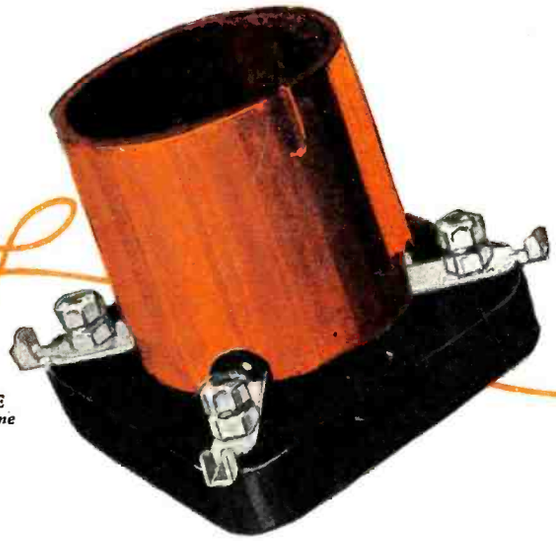
Allen-Bradley Co.
287 Greenfield Ave., Milwaukee, Wis.
Please send me a complete set of your bulletins of Allen-Bradley radio products.

Name .....

Address .....

.....

THE PERIOD



The shell is **ORANGE** *Bakelite—the base genuine Thermoplax*

At Last—A Radio Socket Worthy of This Famous Trade Mark

After months of experiment and research the Cutler-Hammer engineers announce this masterpiece of radio socket design. With features never before found in any socket, it brings to your set a degree of efficiency that means added miles of range and hours of clearer, more enjoyable reception.

Capacity has been absolutely minimized—without sacrifice of mechanical strength, and its base of ebony black Thermoplax in beautiful color contrast with the thin shell of orange Bakelite adds as much to the appearance of any set as this socket's construction does to its efficiency.

You'll like all of its many exclusive features—the silvered bronze contacts that afford *permanently* perfect contact; the slotted binding nuts; the handy terminals for soldering; the wide spacing of current carrying parts.

You'll like its appearance—neatness—small size. You'll like the way the tube is inserted and removed without twisting. And best of all, you'll 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.* Until all dealers have been stocked, you can be supplied direct from the factory at the retail price plus 10 cents for packing and postage. Be sure you have the genuine—it will pay you in every way to refuse all substitutes.

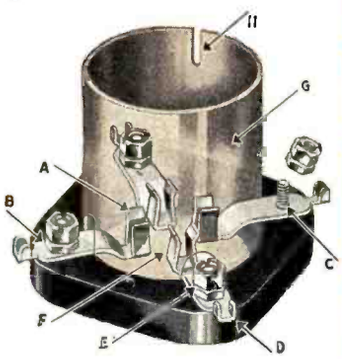
THE CUTLER-HAMMER MFG. CO.

Member Radio Section, Associated Manufacturers of Electrical Supplies

MILWAUKEE, WISCONSIN

C-H

These Exclusive Features Assure Better Reception



A

Perfect contact. Both sides of tube prong cleaned when inserted—no contact or wear on soldered end.

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 binding post is NOT a part of the circuit—the wire to the socket always touches 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 handy 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

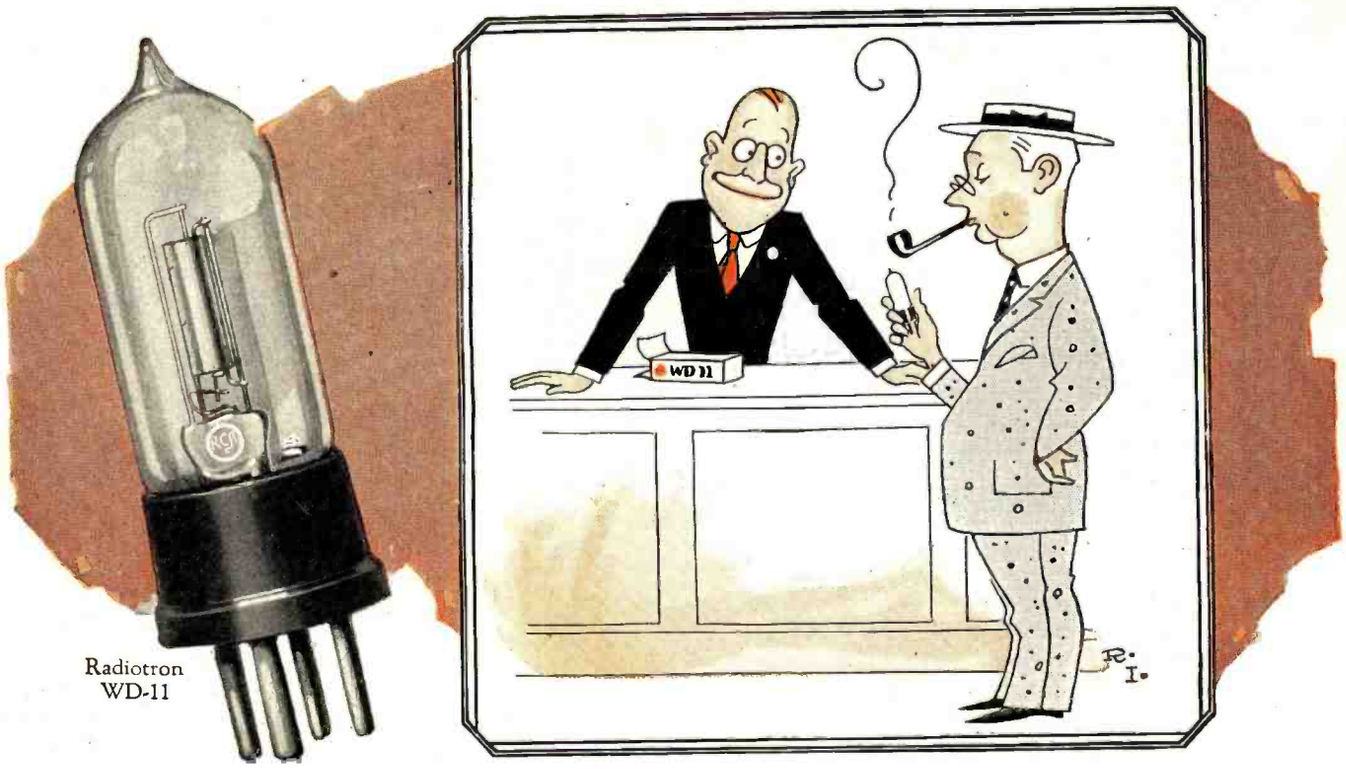
A minimum of both metal and insulation for low capacity. Shell of thin Bakelite—the base of genuine Thermoplax.

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 both on the socket and on the orange and blue box is your genuine protection*

RADIO SOCKET



Radiotron
WD-11

Don't Buy *Just Tubes!*

If you go into a reliable store and ask for a vacuum tube, you will probably get a genuine Radiotron, because most reputable dealers carry nothing else. And most buyers mean "Radiotron" when they say "tube." But the wise man *says* "Radiotron." And he takes the precaution to look for the name on the base, and the RCA mark on the glass. Those names have a history of invention, research and development back of them that has resulted in the production of the finest tubes possible today. And they have a history of *best performance* right within every fan's experience. That's why knowing fans buy by the name: Radiotron.

RCA

This symbol of quality is your protection.

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.

Radio Corporation of America
Sales Offices:
233 Broadway, NewYork
10 So. LaSalle St., Chicago, Ill.
433 California St., San Francisco, Cal.

Radiotron

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