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Radio Listeners' Guide and Call Book

Combined With

RADIO REVIEW
Reg. U.S. Pat. Off.

Edited by S. Gernsback

Radio Broadcast Station Popularity Contest

See Page 71

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HOW TO GET INTO THE RADIO BUSINESS"

J.E.S.

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Without obligating me in any way, send me your FREE BOOK, "Rich Rewards in Radio," and all information about your practical, home-study, Radio Course.

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Town.............................. State...................

Radio Listeners' Guide and Call Book

Combined With

Radio Review

Volume I — Number 12

MARCH, 1927

Contents *of* This Issue

RADIO LISTENERS' GUIDE AND CALL BOOK, Combined with RADIO REVIEW
VOLUME I, NUMBER 12 — MARCH, 1927

Published quarterly by The Consrad Co., Inc., 53 Park Place, New York, N. Y., telephone number Barclay 7220; H. Gernsback, President; S. Gernsback, Vice-President and Treasurer; R. W. De Mott, Secretary. Price 50c a copy; subscriptions $1.75 a year in the United States of America, Canada and all countries within the domestic postal zone; elsewhere $2.00 a year, payable in advance. Subscriptions only acceptable in U. S. currency or stamps. No foreign currency or stamps. Checks and money orders should be drawn to the order of THE CONSRAD CO., Inc.

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Over 2000 —ITEMS— Everything in RADIO

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Every article in our catalog is based on careful laboratory analyses and tests. We guarantee to back up every item in our catalog with our own as well as manufacturer's assurance of quality.

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Because we handle radio exclusively and sell a tremendous volume of everything in Radio, we can concentrate our buying power for the benefit of our customers.

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City ________ *State* ________

YOU MUST HAVE THIS BOOK

Space limitations here prevent our telling you more about the Randolph Catalog. Simply fill out and mail the coupon—or you may send a postal or letter—and this truly remarkable Radio book will come to you **ABSOLUTELY FREE. MAIL THE COUPON NOW.**

Randolph Radio Corporation

180 North Union Avenue • Dept. 222 Chicago, Ill.

INDEX TO ADVERTISERS

Radio Listeners' Guide and Call Book Readers' Bureau

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IN every issue of RADIO LISTENERS' GUIDE AND CALL BOOK you undoubtedly see numerous articles advertised about which you would like to have further information.

To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

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

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

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

This service will appear regularly every month on this same page in RADIO LISTENERS' GUIDE AND CALL BOOK.

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

TEAR ALONG THIS LINE

RR-3-27

TO: READERS' SERVICE BUREAU,
THE CONSRAD COMPANY, INC., 53 PARK PLACE, NEW YORK, N. Y.

FROM WRITE YOUR NAME and ADDRESS HERE:

NAME ....

ADDRESS .... CITY, STATE ....

Gentlemen: Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the .... issue of RADIO LISTENERS' GUIDE AND CALL BOOK.

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

Check here if you are a dealer

Your Dealer's Name ....

Address ....

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A NEW COMPANION TO THE "SILVER GHOST"

TRANSOCEANIC "PHANTOM"

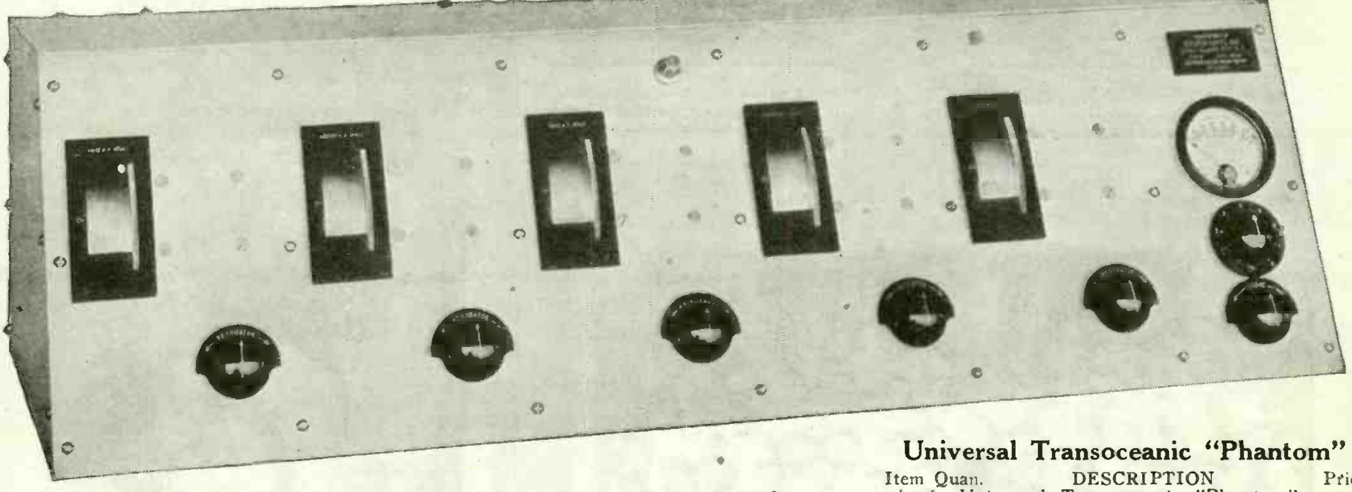
NINE TUBES—100% SHIELDING—TUNES 35 METERS to 3600 METERS

$250 (NO ACCESSORIES)

We are now ready to demonstrate that the Phantom Model has a far greater range, greater degree of selectivity, easiest means of operation, finest electrical design and construction and the best quality of musical reproduction as compared with any radio broadcast receiver in the world.

MOST POWERFUL IN THE WORLD

Phantom models are now in use on the U. S. S. Vaga and U. S. S. Utah



COMPARE THESE FEATURES WITH ANY RADIO

* INDICATES ORIGINAL GOLDEN-LEUTZ FEATURE AS APPLIED TO BROADCAST RECEIVERS, # EXCLUSIVE FEATURE

		Golden-Leutz Transoceanic	Any Other Radio
1.	100% shielding—Interstage shielding—Complete external shielding against extraneous disturbances*	√	
2.	Totally shielded low loss variable condensers to prevent interaction between condenser and transformer fields* #	√	
3.	Complete shielding between stators (grid circuit) of multiple condensers*	√	
4.	Use of Indicating Meters and special switch to read "A," "B" and "C" battery voltages*	√	
5.	Licensed under Hogan Patent 1,014,002 for single control (first licensee)*	√	
6.	Optional individual control or simultaneous control of all tuning controls*	√	
7.	Use of interchangeable tuned radio frequency transformers to tune all broadcast wavelengths in the world, viz, 35 to 3600 meters* #	√	
8.	A special filter circuit in the output to exclude detrimental plate current from the Loud Speaker	√	
9.	Use of Resistance Coupling in the Audio Amplifier, combined with impedence and transformer coupling for perfect reproduction* #	√	
10.	Adjustable Antennae Coupling to adapt set to all various types and sizes of broadcast antennae* #	√	
11.	Antennae Series Condenser for Extreme Selectivity in congested districts* #	√	
12.	Sealed Chassis to exclude moisture and dust* #	√	
13.	Last stage, power audio, adaptable to 201A, 112,171 or 210 tubes, 550 volts maximum capacity for great volume* #	√	
14.	Separate B Voltage Taps for Detector, Radio Amplifiers, Audio Amplifiers and Power Amplifiers*	√	
15.	Separate Bias Voltage Taps for Radio Amplifier, Audio Amplifiers and Power Amplifiers*	√	
16.	Power Audio Tube Filament arranged for heating by either battery or alternative current*	√	
17.	No rivets to corrode, all connections soldered in accordance with Navy Specifications*	√	
18.	Only piece of steel used is in condenser shafts, detrimental steel supports purposely omitted	√	
19.	Metallized heavy current carrying, permanent value grid leaks and resistors	√	
20.	Direct Disc Vernier Adjustments	√	
21.	Indicating rotors upon which calibrations can be recorded for reference	√	
22.	All insulating material Genuine Bakelite include sub-panels—coil bases—coilforms—sockets	√	
23.	All Screws, Bolts and Nuts securely fastened by bronze lock washers* #	√	
24.	Most Compact Multiple Tube Sets made, 9 tube less than 2 cubic feet; 7 tube less than 1 cubic foot	√	
25.	Scientifically determined distance between transformers and shield, not detrimentally close* #	√	
26.	Volume Control device to regulate volume to any desired value without affecting quality	√	
27.	Can be used with "B" and "C" Eliminators, special Golden-Leutz Eliminator made to match	√	
28.	Practically all parts, except the meter and a few small parts, are manufactured in our factory	√	
29.	Each receiver tested at night and calibrated to a station at least 2000 miles distant	√	
30.	Designed by Charles R. Leutz.	√	

Universal Transoceanic "Phantom"

Item	Quan.	DESCRIPTION	Price
1	1	Universal Transoceanic "Phantom" Broadcast Receiver, 9 tubes, 4 tuned radio, detector, three audio and power audio amplifier. Including "A" Transformers for 200 to 560 meters tuning range. (No accessories included.)	$250.00
		EXTRAS	
2	1	Set selected tubes including detector and 210 power amplifier	25.50
3	1	Set "B" Transformers for tuning 80 to 210 meters	25.00
4	1	Set "C" Transformers for tuning 35 to 90 meters	25.00
5	1	Set "AA" Transformers for tuning 500 to 1500 meters	25.00
6	1	Set "BB" Transformers for tuning 1200 to 3600 meters	25.00
7	1	6 volt 120 A.H. Storage Battery	24.00
8	1	New Type Farrand Senior Loud Speaker, Cone Type	32.50
9	1	Golden-Leutz Special Current Supply for 110 volts 50/60 cycle A.C.	135.00
10	1	Antennae Equipment	4.00
		Total all accessories	$571.00
11	1	Complete Knocked down Kit of all Transoceanic "Phantom" Parts, ready for assembly including constructional drawings (no accessories). "A" Transformers for 200 to 560 meters included	$220.00
12	1	Complete set of Constructional Drawings and Operating Data for Transoceanic "Phantom" only	2.00

Special Quotation for Dry "B" Battery Operation Will Be Made on Request

GOLDEN-LEUTZ, Inc.

"Manufacturers of the Highest Class Radio Apparatus in the World"

MAIN OFFICE AND WORKS:

SIXTH and WASHINGTON AVENUES, LONG ISLAND CITY, NEW YORK, U. S. A.

Cables: "Experinfo" New York—All Codes

DEALERS OR JOBBERS WIRE ORDER FOR SAMPLE TODAY. CUSTOMERS MAY ORDER DIRECT IF DESIRED.

Station KOA—Denver, Colo.
Mona Frazier, pretty co-ed singing college and fraternity songs.

Station WCFL—Chicago, Ill.
Hazel Nyman, The Girl Wonder Accordionist.

Station WCFL—Chicago, Ill.
Franklin C. E. Lundquist, Musical Director.

Station WLWL—
New York, N. Y.
Paulist Choristers.

Station WHK—Cleveland, Ohio
Banjo Boys, Eddie Mosier and Mike Lash.

Station KFOA—Seattle, Wash.
Luther J. Jensen, Studio Director and Chief Announcer

Station WHK—Cleveland, Ohio.
Dr. Geo. S. Blodgett, Popular Lecturer and Entertainer.

Station WHK—Cleveland, Ohio.
Phyllis Street, Pianist.

Radio Listeners Choose *EXCELLO* Consoles for Best and Latest Radio Sets

Excello Radio Console, Style R-16 with desk drop closed. Dimensions, 37 inches wide, 16 inches deep, 55 inches high. Finest cabinet work of American Walnut with 5-ply Walnut veneer top, walnut end panels and matched butt walnut doors. Finished two-tone-piano finish.

MR. JOSEPH CALCATERRA has selected the Excello Hyboy Console as the appropriate housing for the Hyboy Super-Heterodyne described in Radio Listeners' Guide. This is the Console illustrated to the left—a wall Console of the latest type with tone chamber above the receiver panel space. The tone chamber is constructed of wood with metal throat and is shaped for reproduction of the full tonal range.

By means of adjustable filler pieces, the receiver compartment will accommodate any set with panel not exceeding 9 by 32 inches. The battery compartment below is ample for A Battery and B Batteries and charger. Two cabinet compartments are provided at either side of the tone chamber for tools, head-set, log, etc.

EXCELLO Radio Consoles

Style R-24
Bench to Match

At your dealer or write for catalog. Dealers and distributors write for interesting proposition on open territory.

EXCELLO PRODUCTS CORPORATION

4821-29 West 16th Street, Cicero, Illinois. (Suburb of Chicago)

Station WCAU—
Philadelphia, Pa.
Sam J. Gold, baritone

Station WKAF
Milwaukee, Wis.
Badger State Quartette.

Station KFON—
Long Beach, Calif.
Hal G. Nichols, announcer

Station WKAF—
Milwaukee, Wis.
Antoinette A. Sigwalt,

Station KFON—
Long Beach, Calif.
Solo cellist.

Station WEAF—
New York, N. Y.
Phillips Carlin, announcer.

Station WKAF—
Milwaukee, Wis.
Kathleen Clar, pianist.

Station WOR—
Newark, N. J.
H.B. Glover, announcer.

Station WLW—
The Crosley Pups in Night Howls.

Insist on hearing RGS this receiver

42 Stations in 30 Minutes—

Miami Beach at 5:30 in the afternoon from within one half mile of Station WBBR, New York City—Chicago on the same afternoon without an antenna—

These are just a few recent feats performed by an assembled R. G. S. Receiver. The R. G. S. Receiver, built by David Grimes for modern broadcast conditions and employing a new application of the Inverse Duplex System, is a development that will leave an indelible impression upon all receiver design.

The R. G. S. is offered complete in kit form in order to keep the price down to "rock bottom," thus allowing more people to take immediate advantage of this new principle of construction that establishes new standards for selectivity, distance, sensitivity and tone quality. Price $69.70, without accessories or cabinet.

Authorities in the radio field, such as Arthur H. Lynch, Robert S. Kruse, R. W. Cotton, Volney Hurd, Willis Kingsley Wing and Zeh Bouck, have greeted the R. G. S. Receiver with unprecedented enthusiasm. They are as amazed by its performance as you will be.

Write today giving us your name and address and the name and address of your dealer. We will then arrange for a demonstration of an assembled R. G. S. Receiver in your territory and you can determine for yourself just what is behind our claims. No obligation.

Write

R. G. S. Sales Division

Grimes Radio Engineering Co., Inc.
285 Madison Ave., New York City

DEALERS: Write for complete merchandising information

BUILT FOR MODERN THESE TOOLS ONLY BROADCAST CONDITIONS

Station KFWB—Hollywood, Calif.
Nell Larson, studio accompanist.

Station KFWB—Hollywood, Calif.
Charlie Wellman, announcer and manager.

Station KFWB—Hollywood, Calif.
Dolores Costello, famous screen star.

Station WRVA—Richmond, Va.
Ernest H. Crosby of All Saints Church.

Station KFSD—San Diego, Calif.
Tom Sexton, announcer.

Station WLAC—Nashville, Tenn.
Mrs. William A. Dunn, colorra tura soprano.

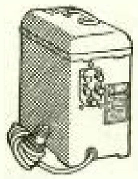
Station WRVA—Richmond, Va.
Arthur Perkins "And he plays his own Ukelele."

Station WRVA—Richmond, Va.
Juvenile Performers.

Add the new Balkite Combination *to your radio set now*

U.S. PAT., OCT. 12, 1926

with your "A" battery it supplies all radio power automatically from the light socket



Three New Balkite "B"s

Including Balkite "B"-X for sets of 8 tubes or less

Eliminates "B" batteries and supplies "B" current from the light socket. Three new models. Balkite "B"-W at $27.50 for sets of 5 tubes or less requiring 67 to 90 volts. Balkite "B"-X (illustrated) for sets of 8 tubes or less; capacity 30 milliamperes at 135 volts — $42. Balkite "B"-Y for any radio set; capacity 40 milliamperes at 150 volts—$69. (In Canada: "B"-W $39; "B"-X $59.50; "B"-Y $96.)

The Balkite Trickle and High-Rate Charger

MODEL J. Has two rates. A low trickle charge rate and a high rate for rapid charging. Can thus be used either as a trickle or as a high rate charger. Noiseless. Rates: with 6-volt battery, 2.5 and .5 amperes; with 4-volt battery, .8 and .2 ampere. Price $19.50. (West of Rockies $20. In Canada $27.50.)

Balkite Trickle Charger, $10

MODEL K. For those who require a charger of limited capacity only. Rate .5 ampere. Price $10. (West of Rockies $10.50. In Canada $15.)

All Balkite Units operate from 110-120 volt, 50-60 cycle AC. The Balkite Charger is also made in 25-40 cycle models.

Now you can operate your radio set from the light socket. Merely by adding the new Balkite Combination Radio Power Unit. Once connected to your "A" battery and set and plugged into the light socket, it *supplies automatic power to both circuits.* You need not even turn it off and on, for it is controlled by the filament switch already on your set and is entirely automatic in operation. It will give you a constant quality of reception that cannot be secured in any other way.

Balkite Combination can be installed in a few minutes, either near the set or in a remote location. Like all Balkite Radio Power Units it has no tubes, nothing to replace or renew, is a permanent piece of equipment, and is built to conform with the standards of the Underwriters' Laboratories. It is noiseless in operation. It will serve any set now using either 4 or 6-volt "A" batteries and requiring up to 30 milliamperes at 135 volts of "B" current—any set of 8 tubes or less, including power tubes.

Add Balkite Combination now and know the pleasure of owning a receiver always ready to operate at full power not only this season but for years to come. Price $59.50. [In Canada $83.] Ask your dealer.

FANSTEEL PRODUCTS COMPANY, INC.
North Chicago, Illinois

Balkite
Radio Power Units

THE BALKITE LINE OF ELECTROLYTIC DEVICES IS PROTECTED BY EDGAR W. ENGLE U. S. REISSUE PATENT NO. 16.438. DATED OCT. 12, 1926

Station KWSC—Pullman, Wash.
Gladys Anderson, violinist.

Station KLX—Oakland, Calif.
Charles H. Gabriel, Jr., program director and chief announcer.

Station KLX—Oakland, Calif.
Preston D. Allen, studio director, chief engineer and relief announcer.

Station KWSC—Pullman, Wash.
Prof. H. Nasmyth, baritone.

Station KWSC—Pullman, Wash.
Raymond Howell, violinist.

Station KWSC—Pullman, Wash.
Bernice Metz, pianist.

Station WPG—Atlantic City, N. J.
John R. George, chief operator.

Station WPG—Atlantic City, N. J.
Alice Warren Sachse, program director.

Station WPG—Atlantic City, N. J.
Male Quartette.

Station WSWS—Wooddale, Ill.
Zola Haynes, pianist and organist.

Station WSWS—Wooddale, Ill.
Ethyl Gray, concert violinist.

Station WSWS—Wooddale, Ill.
John L. Clark, chief announcer.

Station KTAB—Oakland, Calif.
Ada Morgan O'Brien, program director.

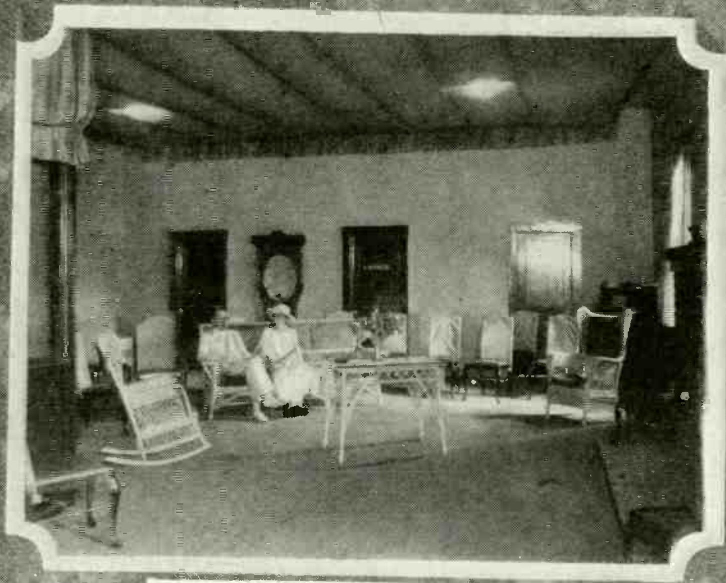
Station KMOX—St. Louis, Mo.
String Quartette.

Station KTAB—Oakland, Calif.
L. R. Tucker, "Brother Bob."

Station KMOX—St. Louis, Mo.
David Bittner, Jr., conducting Jazz Orchestra.

Station KMOX—St. Louis, Mo.
KMOX Radio Players.

Station KFKB—Milford, Kans.
Mrs. T. [illegible]. Jones, popular vocalist.



Station KFKB—Milford, Kans.
Dr. and Mrs. J. R. Brinkley in Reception Room.

Station WBCN—Chicago, Ill
The WBCN Studio Ensemble.

Station KGW—Portland, Ore.
Stephen Gaylord, chief announcer.

Station KGW—Portland, Ore.
Gladys Johnson, cellist

Station KGW—Portland, Ore.
Hugh Walton, announcer and tenor.

Station WBCN—Chicago, Ill.
A scene from the Pirate Ship, broadcast from this station.

Station WBCN—Chicago, Ill.
J. R. Foster, studio manager.

Station WFI—Philadelphia, Pa.
Harold Simonds, member of Philadelphia Male Quartette.

Station WFI—Philadelphia, Pa.
John Vandersloot, announcer.

Station WFI—Philadelphia Pa.
Mabel Swint Ewer, program director.

Station KSMR—Santa Maria, Calif.
Sydney Peck, announcer.

Station KFH—Wichita, Kans.
Leslie Fox, chief announcer and assistant program director.

Station KSMR—Santa Maria, Calif.
Kess B. Holeman, general manager.

Station KSMR—
Santa Maria, Calif.
"Charlie and Mamie" Trio.

Station KFH—Wichita, Kans.
Jimmie White and Howard Fordham, Singing Serenaders.

Station KFH—Wichita, Kans.
Gage Brewer's Hawaiians.

Radio Listeners' Guide and Call Book

Combined With

Radio Review

Sidney Gernsback, Editor *W. G. Many, Managing Editor*

RADIO BROADCAST STATIONS OF THE UNITED STATES

Indexed Alphabetically by Call Letters

The following list of stations has been so arranged that it can be readily referred to in finding the location, name, power, wave length, frequency and time of a station, providing the call letters are known.

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
KD	**KDKA—Pittsburgh, Pa.** (Transmitter is in East Pittsburgh)—Westinghouse Elec. & Mfg. Co.	Var.	309.1	970	Eastern
	KDLR—Devils Lake, N. D.—Radio Elec. Co.	5	231	1300	Central
	KDYL—Salt Lake City, Utah—Intermountain Broadcasting Corp., 1009 Ezra Thompson Bldg.	200	246	1220	Pacific
KF	**KFAB—Lincoln, Nebr.**—Nebraska Buick Auto Co.	5000	340.7	880	Central
	KFAD—Phoenix, Ariz.—Electrical Equipment Co.	100	272.6	1100	Mountain
	KFAF—San Jose, Calif.—Alfred E. Fowler, Montgomery Hotel	50	217.3	1380	Pacific
	KFAU—Boise, Idaho—Independent School District of Boise	2000	280	1070	Mountain
	KFBB—Havre, Mont.—F. A. Buttrey Co., F. A. Buttrey Co. Bldg.	50	275	1090	Mountain
	KFBC—San Diego, Calif.—W. K. Azbill and Union League Club, 5038 Cliff Place	50	215.7	1390	Pacific
	KFBK—Sacramento, Calif.—Bee-Kimball Upson Co., 610 California St.	100	248	1210	Pacific
	KFBL—Everett, Wash.—Leese Bros., 2814 Rucker Ave.	100	223.7	1340	Pacific
	KFBS—Trinidad, Colo.—School Dist. No. 1	15	238	1260	Mountain
	KFBU—Laramie, Wyo.—Bishop N. S. Thomas	500	374.8	800	Mountain
	KFCB—Phoenix, Ariz.—Nielsen Radio Supply Co., 311 N. Central Ave	125	238	1260	Mountain
	KFCR—Santa Barbara, Calif.—Santa Barbara Broadcasting Co	15	413	726	Pacific
	KFDD—Boise, Idaho—St. Michaels Episcopal Church	50	275	1090	Mountain
	KFDM—Beaumont, Tex.—Magnolia Petroleum Co.	500	315.6	950	Central
	KFDX—Shreveport, La.—1st Baptist Church	100	250	1200	Central
	KFDY—Brookings, S. Dakota—South Dakota State College	100	305.9	980	Central

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
KF	**KFDZ—Minneapolis, Minn.**—H. O. Iverson, 2510 Thomas Ave. South	10	231	1300	Central
	KFEC—Portland, Oregon—Meier & Frank Co.	50	248	1210	Pacific
	KFEL—Denver, Colo.—Eugene P. O. Fallon, Argonaut Hotel	250	254	1180	Mountain
	KFEQ—St. Joseph, Mo.—John L. Scroggin	500	268	1120	Central
	KFEY—Kellogg, Idaho—Bunker Hill & Sullivan Mining & Concentrating Co., 834 McKinley Ave.	10	233	1290	Pacific
	KFFP—Moberly, Mo.—First Baptist Church	50	242	1240	Central
	KFH—Wichita, Kans.—Rigby-Gray Hotel Co., Hotel Lassen	500	267.7	1120	Central
	KFHA—Gunnison, Colo.—Western State College of Colo.	50	252	1190	Mountain
	KFHL—Oskaloosa, Iowa—Penn College	10	240	1250	Central
	KFI—Los Angeles, Calif.—Earle C. Anthony, Inc., Packard Motor Car Bldg., 1000 S. Hope St.	5000	467	640	Pacific
	KFIF—Portland, Ore.—Benson Polytechnic School	100	248	1210	Pacific
	KFIO—Spokane, Wash.—North Central High School	250	265.3	1130	Pacific
	KFIQ—Yakima, Wash.—Dr. I. M. Miller	500	256	1170	Pacific
	KFIZ—Fond du Lac, Wis.—Fond du Lac Commonwealth Reporter, 22 Forest Ave.	100	273	1100	Central
	KFJB—Marshalltown, Iowa—Marshall Electric Co.	10	248	1210	Central
	KFJF—Oklahoma, Okla.—National Radio Mfg. Co.	500	261	1150	Central
	KFJI—Astoria, Ore.—Liberty Theatre (E. E. Marsh)	10	246	1220	Pacific
	KFJM—Grand Forks, N. D.—University of N. D.	100	278	1080	Central
	KFJR—Portland, Ore.—Ashley C. Dixon & Son., associated with Ralph Schneeloch Co., 1350 E. 36th St.	120	263	1140	Pacific
	KFJY—Fort Dodge, Iowa—Tunwall Radio Co., 1004 Central	100	246	1220	Central
	KFJZ—Fort Worth, Tex.—W. E. Branch, 3rd and Main	50	254.1	1180	Central
	KFKA—Greeley, Colo.—Colorado State Teachers College	50	273	1100	Mountain
	KFKB—Milford, Kans.—J. R. Brinkley, MD	1000	434.5	690	Central
	KFKU—Lawrence, Kans.—University of Kansas	500	275	1090	Central
	KFKX—Hastings, Neb.—National Broadcasting Co.	5000	288.3	1040	Central
	KFKZ—Kirksville, Mo.—State Teachers College	75	226	1330	Central
	KFLR—Albuquerque, N. Mex.—University of New Mexico	100	254	1180	Mountain
	KFLU—San Benito, Tex.—San Benito Radio Club	20	236	1270	Central
	KFLV—Rockford, Ill.—Swedish Evangelical Mission Church	100	229	1310	Central
	KFLX—Galveston, Tex.—Geo. R. Clough, 3327 Ave. P.	250	240	1250	Central
	KFMR—Sioux City, Iowa—Morningside College	100	261	1150	Central
	KFMX—Northfield, Minn.—Carleton College	500	336.9	890	Central
	KFNF—Shenandoah, Iowa.—Henry Field Seed & Nursery Co.	1000-2500	461.3	650	Central
	KFOA—Seattle Wash.—Rhodes Department Store, 6144 Arcade Bldg.	1000	454.3	660	Pacific
	KFOB—Burlingame, Calif.—KFOB Inc.	50	226	1330	Pacific
	KFON—Long Beach, Calif.—Nichols & Warinner, Inc., Jergins Trust Bldg.	500	233	1290	Pacific
	KFOR—David City, Neb.—David City Tire & Elec. Co.	100	226	1330	Central
	KFOT—Wichita, Kans.—College Hill Radio Club (College Hill Methodist Church)	50	231	1300	Central

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
KF	KFOX—**Omaha, Neb.**—Technical High School (Board of Education)	100	248	1210	Central
	KFOY—**St. Paul, Minn.**—Beacon Radio Service (M. G. Goldberg), 376 Robert St	50	252	1190	Central
	KFPL—**Dublin, Tex.**—C. C. Baxter, 205 Grafton St	20	252	1190	Central
	KFPM—**Greenville, Tex.**—The New Furniture Co	10	242	1240	Central
	KFPR—**Los Angeles, Calif.**—Los Angeles County Forestry Dept	500	231	1300	Pacific
	KFPW—**Carterville, Mo.**—St. Johns M. E. Church, South. (L. E. Stewart)	20	258	1160	Central
	KFPY—**Spokane, Wash.**—Symons Investment Co	100	266	1130	Pacific
	KFQA—**St. Louis, Mo.**—Transmitter in Kirkwood—The Principia, 5539 Page Ave	5000	280.2	1070	Central
	KFQB—**Fort Worth, Tex.**—Lone Star Broadcast Co., 205 Worth Bldg	2500	508.2	590	Central
	KFQP—**Iowa City, Iowa.**—Geo. S. Carson, Jr., 906 E. College St	10	223.7	1340	Central
	KFQU—**Alma (Holy City), Calif.**—W. E. Riker	250	230.6	1300	Pacific
	KFQW—**Seattle, Wash.**—Carl F. Knierim	50	215.7	1390	Pacific
	KFQX—**Seattle, Wash.**—Alfred M. Hubbard	15	210	1428	Pacific
	KFQZ—**Hollywood, Calif.**—Taft Radio & Broadcasting Co., Inc., 1641 N. Argyle	500	226	1330	Pacific
	KFRB—**Beeville, Tex.**—Hall Bros	250	248	1210	Central
	KFRC—**San Francisco, Calif.**—Don Lee (Inc)	50	267.7	1120	Pacific
	KFRU—**Columbia, Mo.**—Stephens College, Administration Bldg	500	499.7	600	Central
	KFSD—**San Diego, Calif.**—Airfan Radio Corp., 402 B. St.	1000	245.8	1220	Pacific
	KFSG—**Los Angeles, Calif.**—Echo Park Evangelistic Assn., Angelus Temple	500	275	1090	Pacific
	KFUL—**Galveston, Texas**—Thos. Groggan and Bros. Music Co., 2126 Market St	500	258	1160	Central
	KFUM—**Colorado Springs, Colo.**—Corley Mountain Highway, Ford Vollmer Bldg	100	239.9	1250	Mountain
	KFUO—**St. Louis, Mo.**—Lutheran Church of the Missouri Synod, Concordia Theological Seminary	500	545.1	550	Central
	KFUP—**Denver, Colo.**—Fitzsimons General Hospital, Red Cross Bldg	50	234	1280	Mountain
	KFUR—**Ogden, Utah**—Peery Building Co., 420 Twenty-fifth St	50	224	1340	Pacific
	KFUS—**Oakland, Calif.**—Louis L. Sherman, 529 Twenty-eighth St	50	256	1170	Pacific
	KFUT—**Salt Lake City, Utah**—University of Utah	100	261	1150	Pacific
	KFVD—**Venice, Calif.** — McWhinnie Elec. Co., 1825 So. Pacific Ave	50	208	1440	Pacific
	KFVE—**St. Louis, Mo.**— Benson Broadcasting Corp., 1111 Olive St	5000	240	1250	Central
	KFVG—**Independence, Kans.**—First Methodist Episcopal Church	15	236	1270	Central
	KFVI—**Houston, Texas**—Dunlap, Wilkes, Hills & Hjorth	50	240	1250	Central
	KFVN—**Fairmont, Minn.**—Carl E. Bagley	50	227	1320	Central
	KFVR—**Denver, Colo.** (near)—The Olinger Corp., 1075 Penn St	50	244	1230	Mountain
	KFVS—**Cape Girardeau, Mo.**—Hirsch Battery and Radio Co., 312 S. Fred. St	50	224	1340	Central

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
KF	**KFVY—Albuquerque, N. Mexico**—Radio Supply Co., 407 West Central Ave	10	250	1200	Mountain
	KFWB—Hollywood, Calif.—Warner Bros. Pictures (Inc.), 5842 Sunset Blvd	500	252	1190	Pacific
	KFWC—San Bernardino, Calif.—L. E. Wall	200	211.1	1420	Pacific
	KFWF—St. Louis, Mo.—St. Louis Truth Center, Rev. Emil C. Hartmann, 4030 Lindell Blvd	500	214.2	1400	Central
	KFWH—Eureka, Calif.—F. Wellington Morse, Jr., Hotel Vance	100	254	1180	Pacific
	KFWI—San Francisco, Calif.—(Transmitter is in So. San Francisco.)—Tom Catton, Radio Entertainments, Inc	500	250	1200	Pacific
	KFWM—Oakland, Calif.—Oakland Educational Society, 1520 8th Ave	500	315.6	950	Pacific
	KFWO—Avalon, Catalina Island, Calif.—Major Lawrence Mott, Signal Corps, U. S. Army	250	211.1	1420	Pacific
	KFWU—Pineville, La.—Louisiana College	100	238	1260	Central
	KFWV—Portland, Ore.—KFWV Broadcast Studios (Inc.), 385 East Fifty-eighth St., So	500	212.6	1410	Pacific
	KFXB—Big Bear Lake, Calif.—Bertram O. Heller	500	202.6	1480	Pacific
	KFXD—Logan, Utah—Service Radio Company	10	205.4	1460	Mountain
	KFXF—Denver, Colo.—Colorado Radio Corp., The Brown Palace Hotel	1000	422	710	Mountain
	KFXH—El Paso, Texas—Bledsoe Radio Co., 115 S. El Paso St	50	242	1240	Central
	KFXJ—Edgewater, Colo.—R. G. Howell	15	215.7	1390	Mountain
	KFXR—Oklahoma, Okla.—Classen Film Finishing Co., 132½ W. Main Street	15	214.2	1400	Central
	KFXY—Flagstaff, Ariz.—Mary M. Costigan (Orpheum Theatre)	50	205.4	1460	Mountain
	KFYF—Oxnard, Calif.—Carl's Radio Den, 207—5th St.	10	205.4	1460	Pacific
	KFYJ—Houston, Texas—(Portable) Houston Chronicle Pub. Co	10	238	1260	
	KFYO—Texarkana, Texas—Buchanan-Vaughan Co.	10	209.7	1430	Central
	KFYR—Bismark, N. D.—Hoskins Meyer, In., 200 Fourth St.	10	248	1210	Central
KG	**KGAR—Tucson, Ariz.**—Tucson Citizen, 80 South Stone St	100	243.8	1230	Mountain
	KGBS—Seattle, Wash.—A. C. Dailey, 844 E. 58 St.	100	227	1320	Pacific
	KGBX—St. Joseph, Mo.—Foster-Hall Tire Co., 1221 Fred. Ave	50	347.8	862	Central
	KGBY—Shelby, Nebr.—Albert C. Dunning	50	202.6	1480	Central
	KGBZ—York, Nebr.—Federal Live Stock Remedy Co., 303 W. Fifth St	100	333.1	900	Central
	KGCA—Decorah, Iowa—Chas. W. Greenley	15	280.2	1070	Central
	KGCB—Oklahoma, Okla.—Wallace Radio Inst., 105 W. 13 St	100	331	905	Central
	KGCG—Newark, Ark.—Moore Motor Co	100	239.9	1250	Central
	KGCH—Wayne, Nebr.—Wayne Hospital (S. A. Lutgen)	500	434	690	Central
	KGCI—San Antonio, Tex.—Searcy M. Rhodes, 716 Gramercy St	15	239.9	1250	Central
	KGCL—Seattle, Wash.—Louis Wasmer and Archie Taft, 609 Washington Blvd	10	238	1260	Pacific
	KGCN—Concordia, Kans.—Alva E. Smith, 1117 So. Hill St	50	210	1428	Central
	KGCR—Brookings, S. Dak.—Cutler's Radio Broadcasting Service (Inc.), 415 Main St	10	252	1190	Central

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
KG	**KGCU—Mandan, N. Dak.**—Mandan Chamber of Commerce	250	290	1035	Central
	KGCX—Vida, Mont.—First State Bank of Vida	10	240	1250	Mountain
	KGDA—Dell Rapids, S. Dak.—Home Auto Co. (J. R. Nelson)	10	254.1	1180	Central
	KGDE—Barrett, Minn.—Jaren Drug. Co	50	232.4	1290	Central
	KGDI—Seattle, Wash.—Northwest Radio Service Co., 614 Terminal Sales Bldg		461.4	650	Pacific
	KGDJ—Cresco, Iowa—R. Rathert, 316 Fifth Ave		202.6	1480	Central
	KGDM—Stockton, Calif.—Victor G. Koping, 332 E. Channel St		217.3	1380	Pacific
	KGDO—Dallas, Tex.—C. H. and Henry Garret, 2012 Main St	100	285	1050	Central
	KGDP—Pueblo, Colo.—Pueblo Council, Boy Scouts of America	10	260.7	1150	Mountain
	KGDR—San Antonio, Tex.—Radio Engineers	15	240	1250	Central
	KGDW—Humboldt, Neb.—Frank J. Rist	100	241.8	1240	Central
	KGDX—Shreveport, La.—Wm. Erwin Anthony	500	291.1	1030	Central
	KGDY—Oldham, S. D.—J. Albert Loesch	15	210	1428	Central
	KGDZ—Decorah, Iowa—Norwegian Luthern College	50	431	695	Central
	KGEF—Los Angeles, Calif.—Trinity Methodist Church	1000	516.9	580	Pacific
	KGEH—Eugene, Ore.—Eugene Broadcasting Station	50	236.1	1270	Pacific
	KGEK—Yuma, Colo.—Beehler Elec. Equipment Co.	10	252	1190	Mountain
	KGEL—Jamestown, N. Dak.—Ernest W. Ellison	50	225	1330	Central
	KGEN—El Centro, Calif.—E. R. Irey & F. M. Bowels	15	281	1070	Pacific
	KGEQ—Minneapolis, Minn.—Fred W. Herrmann	50	330	910	Central
	KGER—Long Beach, Calif.—C. Merwin Dobyns	100	325.9	920	Pacific
	KGES—Central City, Nebr.—Central Radio Electric Co.	10	205.4	1460	Central
	KGO—Oakland, Calif.—General Electric Co	5000	361.2	830	Pacific
	KGRS—Amarillo, Tex.—Gish Radio Service, 108 E. 8th Street	100	234	1280	Central
	KGTT—San Francisco, Calif.—Glad Tidings Temple and Bible Inst	50	207	1450	Pacific
	KGW—Portland, Ore.—The Oregonian Pub. Co	1000	491.5	610	Pacific
	KGY—Lacey, Wash.—St. Martins College	50	278	1080	Pacific
KH	**KHJ—Los Angeles, Calif.**—The Times Mirror Co	500	405.2	740	Pacific
	KHQ—Spokane, Wash.—Louis Wasmer, Davenport Hotel	1000	394.5	760	Pacific
KI	**KICK—Anita, Iowa**—Walnut Grove Co	100	273	1100	Central
KJ	**KJBS—San Francisco, Calif.**—Julius Brunton and Sons Co., 1380 Bush St	5	220	1360	Pacific
	KJR—Seattle, Wash.—Northwest Radio Service Co., Vincent I. Kraft, Mgr., 614 Terminal Sales Bldg	20000	384.4	780	Pacific
KK	**KKP—Seattle, Wash.**—City of Seattle, Harbor Dept.	15	260	1153	Pacific
KL	**KLDS—Kansas City, Mo.**—Reorganized Church of Jesus Christ of Latter Day Saints	1000	440.9	680	Central
	KLS—Oakland, Calif.—Warner Bros. Radio Supplies Co., 2201 Telegraph Ave	250	250	1200	Pacific
	KLX—Oakland, Calif.—The Oakland Tribune	500	508.2	590	Pacific
	KLZ—Denver, Colo.—Reynolds Radio Co., 1534 Glenarm Street	500	384.4	780	Mountain
KM	**KMA—Shenandoah, Iowa**—May Seed and Nursery Co.	500	461.3	650	Central
	KMED—Medford, Ore.—W. J. Virgin	50	250	1200	Pacific

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
KM	**KMJ—Fresno, Calif.**—Fresno Bee	50	234	1280	Pacific
	KMJP—Kansas City, Mo.—Kansas City Journal-Post	1000	440.9	680	Central
	KMMJ—Clay Center, Nebr.—M. M. Johnson Co.	1000	229	1310	Central
	KMO—Tacoma, Wash.—KMO, Inc., Hotel Winthrop	500	250	1200	Pacific
	KMOX—St. Louis, Mo. (Transmitter is in Kirkwood.) The Voice of St. Louis, Inc., Mayfair Hotel	5000	280.2	1070	Central
	KMTR—Hollywood, Calif.—Echophone Mfg. Co., 1025 N. Highland Ave	500	370.2	810	Pacific
KN	**KNRC—Los Angeles, Calif.**—Kierulff and Ravenscroft, Co. 1630 So. Los Angeles St	500	208	1440	Pacific
	KNX—Los Angeles, Calif.—Los Angeles Evening Express, 6116 Hollywood Blvd	1000	336.9	890	Pacific
KO	**KOA—Denver, Colo.**—General Electric Co.	5000	322.4	930	Mountain
	KOAC—Corvallis, Ore.—Oregon Agricultural College	500	280.2	1070	Pacific
	KOB—State College, N. Mex.—New Mexico College of Agriculture and Mechanic Arts	5000	348.6	860	Mountain
	KOCH—Omaha, Neb.—Central High School, 22nd and Dodge	500	258	1160	Central
	KOCW—Chickasha, Okla.—Oklahoma College for Women	200	252	1190	Central
	KOIL—Council Bluffs, Iowa—Mona Motor Oil Co.	500	305.9	980	Central
	KOIN—Sylvan, Ore. (Transmitter is 6 miles west of City.)—KOIN, Inc.	1000	319	940	Pacific
	KOMO—Seattle, Wash.—Bert F. Fisher, 604 Home Savings Bldg	1000	305.9	980	Pacific
	KOWW—Walla Walla, Wash.—Blue Mountain Radio Association. (Frank A. Moore)	500	285	1050	Pacific
KP	**KPJM—Prescott, Ariz.**—Wilburn Radio Service, Journal Miner Bldg	15	215	1390	Mountain
	KPO—San Francisco, Calif.—Hale Bros. and the San Francisco Chronicle	1000	428.3	700	Pacific
	KPPC—Pasadena, Calif. — Pasadena Presbyterian Church	50	229	1310	Pacific
	KPRC—Houston, Texas—Houston Post Dispatch	500	296.9	1010	Central
	KPSN—Pasadena, Calif.—The Star-News	1000	315.6	950	Pacific
KQ	**KQV—Pittsburgh, Pa.**—Doubleday-Hill Electric Co., 719 Liberty Ave	500	275	1090	Eastern
	KQW—San Jose, Calif.—First Baptist Church of San Jose, Montevina Ave	500	333.1	900	Pacific
KR	**KRAC—Shreveport, La.**—Caddo Radio Club—Fair Grounds	50	220	1360	Central
	KRE—Berkeley, Calif.—Berkeley Daily Gazette (C. E. Dunscomb)	100	256	1170	Pacific
	KRLD—Dallas, Tex.—Dallas Radio Laboratories, 208 North St. Paul St	500	357.1	840	Central
	KROW—Portland, Ore.—Oregon Broadcast Co.	50	231	1300	Pacific
	KRSC—Seattle, Wash.—Radio Sales Corporation, 1202 Fifth Avenue	250	499.6	600	Pacific
KS	**KSAC—Manhattan, Kans.**—Kansas State Agricultural College	500	340.7	880	Central
	KSBA—Shreveport, La.—Shreveport Broadcasting Co., W. G. Paterson	1000	312.6	960	Central
	KSD—St. Louis, Mo.—Pulitzer Publishing Co.—The St. Louis Post Dispatch	500	545.1	550	Central
	KSEI—Pocatello Idaho—KSEI Broadcasting Association	500	260.7	1150	Mountain
	KSL—Salt Lake City, Utah—Radio Service Corp. of Utah, 505 Templeton Bldg	1000	299.8	1000	Mountain

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KS	KSMR	KSMR—Santa Maria, Calif.—Santa Maria Valley R. R. Co.	100	282.8	1060	Pacific
	KSO	KSO—Clarinda, Iowa—A. A. Berry Seed Co	500	405.2	740	Central
	KSOO	KSOO—Sioux Falls, S. D.—Sioux Falls Broadcast Association, 609 Minnehaha Bldg	100	360	833	Mountain
KT	KTAB	KTAB—Oakland, Calif.—The Associated Broadcasters, Inc., 1410 10th Ave	1000	302.8	990	Pacific
	KTAP	KTAP—San Antonio, Tex.—Robert B. Bridge, Radio Service Shop, 2412 Main Ave	10	263	1140	Central
	KTBI	KTBI—Los Angeles, Calif.—Bible Institute of Los Angeles	750	293.9	1020	Pacific
	KTBR	KTBR—Portland, Ore.—Brown's Radio Shop, 172 Tenth St	50	263	1140	Pacific
	KTHS	KTHS—Hot Springs Nat'l Park, Ark.—New Arlington Hotel Co	750	375	800	Central
	KTNT	KTNT—Muscatine, Iowa—Norman Baker	1000	333.1	900	Central
	KTUE	KTUE—Houston, Texas—Uhalt Electric, W. J. Uhult 614 Fannin St	5	263	1140	Central
	KTW	KTW—Seattle, Wash.—The First Presbyterian Church of Seattle, Wash	1500	454.3	660	Pacific
KU	KUJ	KUJ—Seattle, Wash.—Puget Sound Radio Broadcasting Co., 5811 Fifth Ave., N. E	15	352.5	850	Pacific
	KUOA	KUOA—Fayetteville, Ark.—University of Arkansas	750	299.8	1000	Central
	KUOM	KUOM—Missoula, Mont.—State University of Montana	500	244	1230	Mountain
	KUSD	KUSD—Vermillion, S. D.—University of South Dakota	100	278	1080	Central
	KUT	KUT—Austin, Texas—University of Texas	500	231	1300	Central
KV	KVI	KVI—Tacoma, Wash.—Puget Sound Radio Broadcasting Co., Ninth and A Sts	15	342.5	875	Pacific
	KVOO	KVOO—Bristow, Okla.—Southwestern Sales Corp., Tulsa and Bristow, Okla	500	375	800	Central
	KVOS	KVOS—Seattle, Wash.—L. L. Jackson and L. Kessler, 1208 Tenth Ave	500	333.1	900	Pacific
KW	KWCR	KWCR—Cedar Rapids, Ia.—H. F. Paar, Cedar Rapids Broadcasting Corp., 1444 Second Ave., E	500	296	1013	Central
	KWG	KWG—Stockton, Calif.—Portable Wireless Telephone Co., 530 East Market St	50	248	1210	Pacific
	KWKC	KWKC—Kansas City, Mo.—Wilson Duncan Broadcasting Studios, Werby Building	100	236	1270	Central
	KWSC	KWSC—Pullman, Wash.—State College of Washington, Mechanic Arts Bldg	500	348.6	860	Pacific
	KWTC	KWTC—Santa Ana, Calif.—Dr. John W. Hancock, 1101 North Ross Street		263	1140	Pacific
	KWUC	KWUC—Le Mars, Iowa—Western Union College, Dubs Bldg	1500	252	1190	Central
	KWWG	KWWG—Brownsville, Texas—Chamber of Commerce	500	278	1080	Central
KX	KXL	KXL—Portland, Ore.—KXL Broadcasters (Love Elec. Co.), 501 Pantages Bldg	50	400	750	Pacific
	KXRO	KXRO—Seattle, Wash.—Brott Laboratories, 609 Washington Boulevard	85	240	1250	Pacific
KY	KYA	KYA—San Francisco, Calif.—Pacific Broadcasting Co.	1000	399.8	750	Pacific
	KYW	KYW—Chicago, Ill.—Westinghouse Electric and Mfg. Co., Congress Hotel	3500	535.4	560	Central
KZ	KZM	KZM—Oakland, Calif.—Preston D. Allen, 13th and Harrison Streets	100	240	1250	Pacific
NA	NAA	NAA—Arlington, Va.—United States Navy	1000	434.5	690	Eastern
WA	WAAD	WAAD—Cincinnati, Ohio—Ohio Mechanics Institute	25	258	1160	Central
	WAAF	WAAF—Chicago, Ill.—Chicago Daily Drovers Journal	500	278	1080	Central
	WAAM	WAAM—Newark, N. J.—I. R. Nelson, 1 Bond St	500	263	1140	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WA	**WAAT—Jersey City, N. J.**—Bremer Broadcasting Corp., 210 Jackson Ave	500	235	1280	Eastern
	WAAW—Omaha Neb.—Omaha Grain Exchange	500	384.4	780	Central
	WABB—Harrisburg, Pa.—Harrisburg Radio Co	10	204	1470	Eastern
	WABC—Richmond Hill, N. Y.—Atlantic Broadcasting Corp	500	315.6	950	Eastern
	WABF—Kingston, Pa.—Markle Broadcasting Corp., 294 Wyoming Ave	500	410.7	730	Eastern
	WABI—Bangor, Me.—First Universalist Church, Park St.	100	239.9	1250	Eastern
	WABO—Rochester, N. Y.—Lake Ave. Baptist Church	100	258	1160	Eastern
	WABQ—Philadelphia, Pa.—U. S. Broadcasting Co	500	260.7	1150	Eastern
	WABR—Toledo, Ohio—Scott High School	50	263	1140	Eastern
	WABW—Wooster, Ohio—College of Wooster	50	206.8	1450	Eastern
	WABX—Mount Clemens, Mich.(near)—Henry B. Joy, 1830 Penobscot Bldg., Detroit, Mich	500	246	1220	Central
	WABY—Philadelphia, Pa.—John Magaldi, Jr., 815 Kimball St	50	242	1240	Eastern
	WABZ—New Orleans, La.—Coliseum Place Baptist Church	50	275	1090	Central
	WADC—Akron, Ohio—Allen T. Simmons	500	258	1160	Eastern
	WAFD—Detroit, Mich.—Albert B. Parfet Co., 1432 Military Road	500	312.3	960	Eastern
	WAGM—Royal Oak, Mich.—Robert L. Miller, 309 So. Main St	50	225.4	1330	Eastern
	WAGS—Somerville, Mass.—Willow Garages (Inc.) (W. E. Hartwell and J. Smith Dodge), 131 Willow Avenue	5	250	1200	Eastern
	WAIT—Taunton, Mass.—A. H. Waite and Co., Inc., 32 Weir St	10	229	1310	Eastern
	WAIU—Columbus, Ohio—Elk Country Club	750	293.9	1020	Eastern
	WAMD—Minneapolis, Minn.—Hubbard and Company and Radisson Radio Corp	5000	243.8	1230	Central
	WAOK—Ozone Park, N. Y.—A. H. Andreasen	100	247.8	1210	Eastern
	WAPI—Auburn, Ala.—Extension Service Alabama Polytechnic Institute	1000	461	650	Central
	WARC—Medford Hillside, Mass.—The Amrad Corp	100	261	1150	Eastern
	WARS—Brooklyn, N. Y.— Ameteur Radio Specialty Co., 77 Cortlandt St., N. Y	500	295	1016	Eastern
	WASH—Grand Rapids, Mich.—The Baxter Launderers and Cleaners	500	256.4	1170	Eastern
	WATT—Boston, Mass. (Portable)—Edison Electric Illuminating Company of Boston	100	243.8	1230	
WB	**WBAA—Lafayette, Ind.**—Purdue University	500	273	1100	Central
	WBAK—Harrisburg, Pa.—Pennsylvania State Police	500	275	1090	Eastern
	WBAL—Baltimore, Md. (Transmitter is in Glen Morris.) Consolidated Gas, Electric Light and Power Co	5000	246	1220	Eastern
	WBAO—Decatur, Ill.—James Millikin University	100	270	1110	Central
	WBAP—Fort Worth, Texas—Carter Publishing Co., Inc.	1500	475.9	630	Central
	WBAW—Nashville, Tenn.—Braid Elec. Co. and Waldrum Drug Co	100	236.1	1270	Central
	WBAX—Wilkes-Barre, Pa.—John H. Stenger, Jr., 66 Gildersleeve St	100	256	1170	Eastern
	WBBC—Brooklyn, N. Y.—Peter J. Testan, 2123 Troy Ave	500	249.9	1200	Eastern
	WBBL—Richmond, Va.—Grace-Covenant Presbyterian Church, 1627 Monument Ave	100	228.9	1310	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WB	**WBBM—Chicago, Ill.**—Atlass Investment Co., 1554 Howard St.	10000	225.4	1330	Central
	WBBP—Petoskey, Mich.—Petoskey High School	200	238	1260	Central
	WBBR—Rossville, N. Y.—People's Pulpit Assn., 124 Columbia Heights, Brooklyn, N. Y.	1000	416.4	720	Eastern
	WBBW—Norfolk, Va.—Ruffner Junior High School	50	222	1350	Eastern
	WBBY—Charleston, S. C.—Washington Light Infantry	10	267.9	1120	Eastern
	WBBZ—Chicago, Ill. (Portable)—C. L. Carrell, 1506 No. American Building	50	215.7	1390	
	WBCN—Chicago, Ill.—Foster and McDonnell, 728 West Sixty-fifth St.	500	266	1130	Central
	WBES—Takoma Park, Md.—Bliss Electrical School	100	222	1350	Eastern
	WBET—Boston, Mass.—Boston Transcript	100	384.4	780	Eastern
	WBKN—Brooklyn, N. Y.—Arthur Faske, 1515 Eastern Parkway	100	291.1	1030	Eastern
	WBMC—Woodside, N. Y.—Malbrook Co.	500	293.9	1020	Eastern
	WBMH—Detroit, Mich.—Braun's Music House	100	352.7	850	Central
	WBMS—Union City, N. J.—George J. Schowerer, 837 34th St.	100	223.7	1340	Eastern
	WBNY—New York, N. Y.—Baruchrome Corp., 145 W. 45th St.	1000	322	930	Eastern
	WBOQ—Richmond Hill, N. Y.—A. H. Grebe & Co., 70 Van Wyck Boulevard	100	236	1270	Eastern
	WBRC—Birmingham, Ala.—Birmingham Broadcasting Corp., Age-Herald Bldg.	50	248	1210	Central
	WBRE—Wilkes-Barre, Pa.—Baltimore Radio Exchange, 17 West Northampton St.	100	231	1300	Eastern
	WBRL—Tilton, N. H.—Booth Radio Laboratories, 23 Summer St.	500	420	715	Eastern
	WBRS—Brooklyn, N. Y.—Universal Radio Mfg. Co., 1062 Broadway	100	394	760	Eastern
	WBSO—Wellesley Hills, Mass.—Babson's Statistical Organization	100	242	1240	Eastern
	WBT—Charlotte, N. C.—Charlotte Chamber of Commerce	250	275	1090	Eastern
	WBZ—Springfield, Mass. (Transmitter is in East Springfield, Mass.)—Westinghouse Electric and Mfg. Co., Hotel Kimball	5000	331.1	905	Eastern
	WBZA, Boston, Mass.—Westinghouse Electric and Mfg. Co., Hotel Brunswick	250	333.1	900	Eastern
WC	**WCAC—Storrs, Conn.**—Connecticut Agricultural College	500	275.1	1090	Eastern
	WCAD—Canton, N. Y.—St. Lawrence University	500	263	1140	Eastern
	WCAE—Pittsburgh, Pa.—Pittsburgh Press and Kaufmann and Baer Co., 6th and Smithfield Streets	500	461.3	650	Eastern
	WCAH—Columbus, Ohio—Entrekin Electric Co., 321 W. Tenth Ave.	500	265.3	1130	Eastern
	WCAJ—University Place, Neb.—Nebraska Wesleyan University	500	254	1180	Central
	WCAL—Northfield, Minn.—St. Olaf College	500	336.9	890	Central
	WCAM—Camden, N. J.—City of Camden, Civic Centre	1000	336.9	890	Eastern
	WCAO—Baltimore, Md.—Monumental Radio (Inc.), 848 N. Howard St.	100	275	1090	Eastern
	WCAR—San Antonio, Texas—Southern Radio Corp. of Texas, 101 West Pecan St.	2000	263	1140	Central
	WCAT—Rapid City, S. D.—South Dakota State School of Mines	50	240	1250	Mountain
	WCAU—Philadelphia, Pa.—Universal Broadcasting Co. (Durham and Co.)	500	278	1080	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WC	**WCAX—Burlington, Vt.**—Extension Service, University of Vermont	100	252	1190	Eastern
	WCAZ—Carthage, Ill.—Carthage College	50	246	1220	Central
	WCBA—Allentown, Pa.—Charles W. Heimbach 1015 Allen St	150	254	1180	Eastern
	WCBD—Zion, Ill.—Wilbur G. Voliva	5000	344.6	870	Central
	WCBE—New Orleans, La.—Uhalt Bros., 1219 No. Rampart St	5	263	1140	Central
	WCBH—Oxford, Miss. (near)—University of Mississippi	50	242	1240	Central
	WCBM—Baltimore, Md.—Hotel Chateau, Charles St. and North Ave	100	229	1310	Eastern
	WCBR—Providence, R. I. (portable)—Chas. H. Messter, 42 Doyle Ave	100	209.7	1430	
	WCBS—Providence, R. I.—(portable) Harold L. Dewing and Chas. H. Messter, 6 N. Main St	250	242.5	1240	
	WCCO—St. Paul - Minneapolis, Minn.—Washburn - Crosby Co	5000	416.4	720	Central
	WCFL—Chicago, Ill.—Chicago Federation of Labor 166 W. Washington St	500	491.5	610	Central
	WCFT—Tullahoma, Tenn. (Ovaca)—Knights of Pythias Home (Orphanage)	10	252	1190	Central
	WCGU—Lakewood, N. J.—Charles G. Unger, New Perl House	500	350.6	855	Eastern
	WCLO—Camp Lake, Wis.—C. E. Whitmore	50	230.6	1300	Central
	WCLS—Joliet, Ill.—WCLS (Inc.), 301 East Jefferson St.	150	214.2	1400	Central
	WCMA—Culver, Ind.—Culver Military Academy	500	258.5	1160	Central
	WCOA—Pensacola, Fla.—City of Pensacola	500	252	1190	Central
	WCOM—Manchester, N. Y.—172nd Field Artillery, N.H.N.G.	100	252	1190	Eastern
	WCOT—Olneyville, R. I.—Jacob Conn	100	265.3	1130	Eastern
	WCRW—Chicago, Ill.—Clinton R. White, 650 Waveland Ave	50	416.4	720	Central
	WCSH—Portland, Me.—Henry P. Rines, Congress Square Hotel Co	500	500	600	Eastern
	WCSO—Springfield, Ohio—Wittenberg College	100	248	1210	Central
	WCWK—Fort Wayne, Ind.—Chester W. Keen, 1729 Lafayette St	250	234	1280	Central
	WCX—Pontiac, Mich.—Detroit Free Press	5000	516.9	580	Eastern
WD	**WDAD—Nashville, Tenn.**—Dad's Auto Accessory and Radio Store, 171 Eighth Ave., North	1000	226	1330	Central
	WDAE—Tampa, Fla.—Tampa Daily Times	1000	273	1100	Eastern
	WDAF—Kansas City, Mo.—The Kansas City Star	1000	365.6	820	Central
	WDAG—Amarillo, Tex.—J. Laurance Martin, 655 E. 4th St	100	263	1140	Central
	WDAH—El Paso, Tex.—Trinity Methodist Church, Cor. Boulevard and Mesa Ave	100	267.7	1120	Mountain
	WDAY—Fargo, N. D.—Radio Equipment Corp., 119 Broadway	500	261	1150	Central
	WDBE—Atlanta, Ga.—Gilham Electric Co., 35 Cone St	100	270	1110	Central
	WDBJ—Roanoke, Va.—Richardson-Wayland Electric Corp., 106 Church Ave., S. W	50	229	1310	Eastern
	WDBK—Cleveland, Ohio—S. J. Broz, Furniture, Hardware and Radio Store, 13920 Union Ave	50	327	917	Eastern
	WDBO—Winter Park, Fla.—Central Florida Broadcast Station, Inc	500	240	1250	Eastern
	WDBZ—Kingston, N. Y.—Kingston Radio Club (Boy Scouts of America, Ulster County Council)	10	233	1290	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WD WDEL	**Wilmington, Del.** (Transmitter at 6th and Market Sts.)—Willard S. Wilson, Wilmington Electric Specialty Co., 405 Delaware Ave......	100	266	1130	Eastern
WDGY	**Minneapolis, Minn.**—Geo. W. Young, 909 West Broadway...........................	500	263	1140	Central
WDOD	**Chattanooga, Tenn.**—Chattanooga Radio Co., Inc., 615 Market St.......................,	500	256	1170	Central
WDRC	**New Haven, Conn.**—Doolittle Radio Corporation, 115 Crown St.........................	100	268	1120	Eastern
WDWF	**Cranston, R. I.**—Dutee W. Flint and Lincoln Studios, Inc.	500	440.9	680	Eastern
WDWM	**Newark, N. J.**—Radio Industries Broadcast Co., 20 Central Ave........................	500	280.2	1070	Eastern
WDXL	**Detroit, Mich.**—DXL Radio Corporation, 5769 Stanton Ave..........................	250	296.9	1010	Eastern
WDZ	**Tuscola, Ill.**—Jas. L. Bush....................	100	278	1080	Central
WE WEAF	**New York, N. Y.** (Transmitter at 463 West St.)—National Broadcasting Co., Inc., 195 Broadway......................................	5000	491.5	610	Eastern
WEAI	**Ithaca, N. Y.**—Cornell University............	500	254	1180	Eastern
WEAM	**North Plainfield, N. J.**—Borough of North Plainfield (W. G. Buttfield)..................	250	261	1150	Eastern
WEAN	**Providence, R. I.**—The Shepard Co., 122 Mathewson St............................	500	367	817	Eastern
WEAO	**Columbus, Ohio**—The Ohio State University..	750	293.9	1020	Eastern
WEAR	**Cleveland, Ohio**—Willard Storage Battery Co.	1000	389.4	770	Eastern
WEAU	**Sioux City, Iowa**—Davidson Bros. Co........	150	275	1090	Central
WEBC	**Superior, Wis.**—Superior Telegram-Ross Elec. Co., 1225 Tower St.......................	100	242	1240	Central
WEBH	**Chicago, Ill.**—Edgewater Beach Hotel Co., 5300 Sheridan Road.......................	2000	370	810	Central
WEBJ	**New York, N. Y.**—Third Ave. Railway Co., 2396 Third Ave...........................	500	272.6	1100	Eastern
WEBL	United States (Portable) Radio Corp. of America	100	226	1330	
WEBQ	**Harrisburg, Ill.**—Tate Radio Co., 700 West Robinson St.............................	100	225.4	1330	Central
WEBR	**Buffalo, N. Y.**—Howell Broadcasting Co., Inc., 54 Niagara St...........................	100	244	1230	Eastern
WEBW	**Beloit, Wis.**—Beloit College.................	700	268	1120	Central
WEDC	**Chicago, Ill.**—Emil Denemark Broadcasting Station, 3860 Ogden Avenue................	1000	250	1200	Central
WEEI	**Boston, Mass.**—The Edison Electric Illuminating Co. of Boston.........................	500	348.6	860	Eastern
WEHS	**Evanston, Ill.**—Robert E. Hughes, Oliver G. Fordham.................................	10	202.6	1480	Central
WEMC	**Berrien Springs, Mich.**—Emmanuel College..	4000	315.6	950	Central
WENR	**Chicago, Ill.**—All American Radio Corporation, 4201 Belmont Ave.......................	1000	266	1130	Central
WEPS	**Gloucester, Mass.**—Ralph G. Matheson, 282 Washington St............................	100	295	1016	Eastern
WEW	**St. Louis, Mo.**—St. Louis University..........	1000	360	833	Central
WF WFAA	**Dallas, Tex.**—Dallas News and Dallas Journal, Baker Hotel.............................	500	475.9	630	Central
WFAM	**St. Cloud, Minn.**—Times Publishing Co., Inc..	10	273	1100	Central
WFAV	**Lincoln, Neb.**—University of Nebraska, Dept. of Electrical Engineering....................	500	275	1090	Central
WFBC	**Knoxville, Tenn.**—First Baptist Church.......	50	250	1200	Central
WFBE	**Cincinnati, Ohio**—Garfield Place Hotel Co. (Robert A. Casey).........................	10	226	1330	Central

	Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WF	WFBG	**Altoona, Pa.**—The William F. Gable Co.	100	277.8	1080	Eastern
	WFBJ	**Collegeville, Minn.**—St. John's University	100	236	1270	Central
	WFBL	**Syracuse, N. Y.**—Onondaga Co.	500	252	1190	Eastern
	WFBM	**Indianapolis, Ind.**—Merchants Heat and Light Co.	250	268	1120	Central
	WFBR	**Baltimore, Md.**—Fifth Infantry Maryland National Guard, Fifth Regt. Armory	100	254	1180	Eastern
	WFBZ	**Galesburg, Ill.**—Knox College	20	254	1180	Central
	WFCI	**Pawtucket, R. I.**—Frank Crook, Inc., 103 Exchange St.	100	258.5	1160	Eastern
	WFDF	**Flint, Mich.**—Frank D. Fallain, Police Building	100	234	1280	Eastern
	WFI	**Philadelphia, Pa.**—Strawbridge & Clothier	500	394.5	760	Eastern
	WFKB	**Chicago, Ill.**—Francis K. Bridgman, 4536 Woodlawn Ave.	500	217.3	1380	Central
	WFKD	**Philadelphia, Pa.**—Foulkrod Radio Engineering Co.	10	249.9	1200	Eastern
	WFRL	**Brooklyn, N. Y.**—Robt. M. Lacey and Jas. A. Bergner (Flatbush Radio Labs.), 1421 E. 10th St.	100	205.4	1460	Eastern
WG	WGAL	**Lancaster, Pa.**—Lancaster Elec. Supply & Construction Co., 23 East Orange St.	10	248	1210	Eastern
	WGBB	**Freeport, N. Y.**,—Harry H. Carman, 217 Bedell St.	100	244	1230	Eastern
	WGBC	**Memphis, Tenn.**—Radio Bible Class, First Baptist Church	10	278	1080	Central
	WGBF	**Evansville, Ind.**—Finke Furniture Co., 307 South Seventh St.	500	236.1	1270	Central
	WGBI	**Scranton, Pa.**—Scranton Broadcasters, Inc., 608 Linden St.	100	240	1250	Eastern
	WGBR	**Marshfield, Wis.**—Geo. S. Ives, 731 West Fifth St.	50	229	1310	Central
	WGBS	**New York, N. Y.** (Transmitter is in Astoria, L. I.)—Gimbel Bros., 33d St. and Broadway	500	315.6	950	Eastern
	WGBU	**Fulford-by-the-Sea, Fla.**—Florida Cities Finance Co.	500	278	1080	Eastern
	WGBX	**Orono, Me.**—University of Maine	500	234.2	1280	Eastern
	WGCP	**Newark, N. J.**—May Radio Broadcast Corp. 380 Central Ave.	500	252	1190	Eastern
	WGES	**Chicago, Ill.** (Transmitter is in Oak Park, Ill.), Oakleaves Broadcasting Station, Coyne Electrical School, 128 North Crawford Ave.	500	250	1200	Central
	WGHB	**Clearwater, Fla.** (Transmitter is in Dunedin.) —Fort Harrison Hotel (Ed. A. Haley)	500	266	1130	Eastern
	WGHP	**Mount Clemens, Mich.**—Geo. H. Phelps, 110 Rowena St.	1500	270	1110	Central
	WGL	**New York, N. Y.**—International Broadcast Corp.	1000	442.4	678	Eastern
	WGM	**Jeanette, Pa.**—Verne & Elton Spencer, 501 Cowan Ave.	150	372	806	Eastern
	WGMU	**Richmond Hill, N. Y.** (Portable),—A. H. Grebe & Co.	100	236	1270	
	WGN	**Chicago, Ill.**—The Chicago Tribune (Drake Hotel)	1000	303	990	Central
	WGR	**Buffalo, N. Y.**—Federal Radio Corp., Hotel Statler	750	319	940	Eastern
	WGST	**Atlanta, Ga.**—Georgia School of Technology	500	270	1110	Central
	WGWB	**Milwaukee, Wis.**—Geo. W. Brocone, Inc., Radiocast Corporation of Wisconsin, 144 Broadway	1000	384.4	780	Central
	WGY	**Schenectady, N. Y.**—General Electric Co.	50000	379.5	790	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WH	WHA—Madison, Wis.—University of Wisconsin	1000	535.4	560	Central
	WHAD—Milwaukee, Wis.—Marquette University and Milwaukee Journal	500	275	1090	Central
	WHAM—Rochester, N. Y.—University of Rochester (Eastman School of Music)	100	278	1080	Eastern
	WHAP—New York, N. Y.—W.H. Taylor Finance Corp., 9 West 96th St	1000	431	695	Eastern
	WHAR—Atlantic City, N. J.—F. B. Cook's Sons, Owners, Seaside Hotel	500	275	1090	Eastern
	WHAS—Louisville, Ky.—Courier-Journal and Louisville Times	500	399.8	750	Central
	WHAZ—Troy, N. Y.—Rensselaer Polytechnic Institute	500	379.5	790	Eastern
	WHB—Kansas City, Mo.—Sweeney Automotive and Elec. School, Sweeney Building	500	365.6	820	Central
	WHBA—Oil City, Pa.—Shaffer Music House	10	250	1200	Eastern
	WHBC—Canton, Ohio—Rev. E. P. Graham, 627 McKinley Ave., N. W	10	254	1180	Eastern
	WHBD—Bellefontaine, Ohio—Chamber of Commerce	100	222	1350	Central
	WHBF—Rock Island, Ill.—Beardsley Specialty Co., 217 Eighteenth St	100	222	1350	Central
	WHBL—Chicago, Ill. (Portable),—C. L. Carrell	50	215.7	1390	
	WHBM—Chicago, Ill. (Portable),—C. L. Carrell, 1536 South State St	20	215.7	1390	
	WHBN—St. Petersburg, Fla.—First Ave. Methodist Church	10	238	1260	Eastern
	WHBP—Johnstown, Pa.—Johnstown Automobile Co., 101 Main St	100	256	1170	Eastern
	WHBQ—Memphis, Tenn.—Men's Fellowship Class of St. Johns Methodist Episcopal Church, South 805 Central Bank Bldg	50	233	1290	Central
	WHBR—Cincinnati, Ohio—United Research Lab., 2317 Gilbert Ave., P. O. Box 618	300	215.7	1390	Central
	WHBU—Anderson, Ind.—Rivera Theatre and Bing's Clothing Store, 1002 Meridian St	10	218.8	1370	Central
	WHBW—Philadelphia, Pa.—D. R. Kienzle, 4916 Chestnut St	100	216	1390	Eastern
	WHBY—West De Pere, Wis.—St. Norbert's College	50	250	1200	Central
	WHDI—Minneapolis, Minn.—Wm. Hood Dunwoody Industrial Institute, 818 Superior Blvd	500	278	1080	Central
	WHEC—Rochester, N. Y.—Hickson Electric Co., 36 South Ave	100	258	1160	Eastern
	WHFC—Chicago, Ill.—Triangle Broadcasters, Hotel Flanders (Stanley Ehrmann), 4145 Broadway	150	258.5	1160	Central
	WHK—Cleveland, Ohio—Radio Air Service Corp., 1116 Carnegie Hall	1000	272.6	1100	Eastern
	WHN—New York, N. Y.—George Schubel, 1540 B'way	1000	361.2	830	Eastern
	WHO—Des Moines, Ia.—Bankers Life Co., 1110 Liberty Building	5000	526	570	Central
	WHOG—Huntington, Ind.—Huntington Broadcasters' Association, 409 N. Jefferson St	15	241.8	1240	Central
	WHT—Chicago, Ill.—(Transmitter is in Deerfield, Ill.) Radiophone Broadcasting Corp., 410 North Michigan Blvd	3500	400	750	Central
WI	WIAD—Philadelphia, Pa.—Howard R. Miller, 6318 North Park Ave	100	250	1200	Eastern
	WIAS—Burlington, Iowa—Home Electric Co., 315 North 3rd St	100	254	1180	Central
	WIBA—Madison, Wis.—Capital Times Studio, and Strand Theatre Corp., 14 E. Mifflin St	100	236.1	1270	Central
	WIBG—Elkins Park, Pa.—St. Paul's Protestant Episcopal Church	50	222	1350	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WI	**WIBI—Flushing, N. Y.**—Frederick B. Zittell, Jr., 49 Boerum Ave	50	218.8	1370	Eastern
	WIBJ—Chicago, Ill.—(Portable), C. L. Carrell, 1506 N. American Bldg	50	215.7	1390	
	WIBM—Chicago, Ill.—(Portable), C. L. Carrell, 1506 N. American Bldg	10	215.7	1390	
	WIBO—Chicago, Ill.—Nelson Bros. Russo & Fiorito	1000	226	1330	Central
	WIBR—Steubenville, Ohio—Thurman A. Owings	50	246	1220	Eastern
	WIBS—Elizabeth, N. J.—(Portable), Lieut. Thos. F. Hunter	10	202.6	1480	
	WIBU—Poynette, Wis.—The Electric Farm	20	222	1350	Central
	WIBW—Chicago, Ill. (Portable) C. L. Carrel, 1056 N. American Bldg	100	220	1360	
	WIBX—Utica, N. Y.—WIBX (Inc.), Hotel Utica	150	234.2	1280	Eastern
	WIBZ—Montgomery, Ala.—A. D. Trum, 217 Catoma St	10	230.6	1300	Central
	WICC—Bidgeport, Conn.—Chas. W. Selen and Harold D. Feuer, 1188 Main St	500	285	1050	Eastern
	WIL—St. Louis, Mo.—St. Louis Star & Benson Radio Co	250	273	1100	Central
	WILL—Urbana, Ill.—University of Illinois	1000	272.6	1100	Central
	WIOD—Miami Beach, Fla.—Carl G. Fisher Co	1000	247.8	1210	Eastern
	WIP—Philadelphia, Pa.—Gimbel Bros., Market St. Bldg	500	508.2	590	Eastern
WJ	**WJAD—Waco, Tex.**—Frank P. Jackson	500	352.7	850	Central
	WJAG—Norfolk, Neb.—Norfolk Daily News	200	270	1110	Central
	WJAK—Kokomo, Ind.—J. A. Kautz, Kokomo Tribune, 1531 Washington St	50	254	1180	Central
	WJAM—Cedar Rapids, Ia.—D. M. Perham, 322 Third Ave. W	100	268	1120	Central
	WJAR—Providence, R. I.—The Outlet Co	500	483.6	620	Eastern
	WJAS—Pittsburgh, Pa.—Pittsburgh Radio Supply House, 963 Liberty Ave	500	275	1090	Eastern
	WJAX—Jacksonville, Fla.—City of Jacksonville	1000	336.9	890	Eastern
	WJAY—Cleveland, Ohio—Cleveland Radio Broadcasting Corp	1000	435.7	688	Eastern
	WJAZ—Chicago, Ill.—(Transmitter is in Mount Prospect, Ill.), Zenith Radio Corp., 312 South Michigan Ave	10000	329.8	910	Central
	WJBA—Joliet, Ill.—D. H. Lentz, Jr., 301 Whitley Ave	50	206.8	1450	Central
	WJBB—St. Petersburg, Fla.—Financial Journal, J. E. Dadsure, Publisher, 126 13th St. N	250	254	1180	Eastern
	WJBC—LaSalle, Ill.—Hummer Furniture Co., 2nd & Joliet Sts	100	234.2	1280	Central
	WJBI—Red Bank, N. J.—Robt. S. Johnson, 63 Broad St.	250	218.8	1370	Eastern
	WJBK—Ypsilanti, Mich.—Ernest F. Goodwin, 803 Congress St	10	233	1290	Central
	WJBL—Decatur, Ill.—Wm. Gushard Dry Goods Co., 301 N. Water St	500	270	1110	Central
	WJBO—New Orleans, La.—Valdemar Jensen, 119 S. St. Patrick St	100	268	1120	Central
	WJBR—Omro, Wis.—Gensch & Stearns	100	227.1	1320	Central
	WJBT—Chicago, Ill.—John S. Boyd, 7421 Sheridan St.	500	238	1260	Central
	WJBU—Lewisburg, Pa.—Bucknell University, Engineering Bldg	100	211.1	1420	Eastern
	WJBW—New Orleans, La.—C. Carlson, Jr., 2743 Dumaine St	20	270	1110	Central

Radio Call Letzers	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WJ	**WJBY—Gadsden, Ala.**—Electric Const. Co. (T. G. Erwin), 517 Broad St	150	270.1	1110	Central
	WJBZ—Chicago Heights, Ill.—Roland G. Pamler and A. Coppotelli, 144 East Sixteenth St	100	419.3	715	Central
	WJJD—Mooseheart, Ill.—Supreme Lodge, Loyal Order of Moose	1000	370.2	810	Central
	WJR—Detroit, Mich. (Transmitter is in Pontiac, Mich.)—Station WJR, Inc., Book-Cadillac Hotel	5000	516.9	580	Central
	WJUG—New York, N. Y.—Uda Benjamin Ross, 30 Park Place	250	516.9	580	Eastern
	WJZ—New York, N. Y.—(Taanrsmitter is in Bound Brook, N. J.), Radio Corp. of America	50000	455	660	Eastern
WK	**WKAF—Milwaukee, Wis.**—Radio Service Corporation, 4 Plankinton Arcade Bldg	750	261	1150	Central
	WKAR—East Lansing, Mich.—Michigan State College	1000	285.5	1050	Central
	WKAV—Laconia, N. H.—Laconia Radio Club, 533 Main St	100	223.8	1340	Eastern
	WKBA—Chicago, Ill.—Arrow Battery Co. (Jos. Silverstein), 1217 Wabash Ave	200	209.7	1430	Central
	WKBB—Joliet, Ill.—Sanders Bros., 607 Jefferson St	100	282.8	1060	Central
	WKBC—Birmingham, Ala.—H. L. Ansley, 1428 North Twelfth Ave	10	225	1330	Central
	WKBE—Webster, Mass—K. & B. Electric Co., 59 Emerald Ave	100	270.1	1110	Eastern
	WKBF—Indianapolis, Ind.—Noble B. Watson, 233 Iowa St	100	244	1230	Central
	WKBG—Chicago, Ill.—(Portable), C. L. Carrell, 36 So. State St	100	215.7	1390	
	WKBH—La Crosse, Wis.—Callaway Music Co., 221 Main St	500	249.9	1200	Central
	WKBI—Chicago, Ill.—Fred L. Schoenwolf, 1917 Warner Ave	50	220.6	1360	Central
	WKBJ—St. Petersburg, Fla.—Gospel Tabernacle, Inc., 5th Ave. and 10th St. South	250	280	1070	Eastern
	WKBL—Monroe, Mich.—Monrona Radio Mfg. Co., 16 S. Monroe St	15	252	1190	Eastern
	WKBM—Newburgh, N. Y.—WKBM Radio Broadcasting Co., John W. Jones, Mgr., 130 Broadway	100	285.5	1050	Eastern
	WKBN—Youngstown, Ohio—Radio Electric Service Co. (W. P. Williamson, Jr.), 26 Auburndale Ave.	50	360	833	Eastern
	WKBO—Jersey City, N. J.—Camith Corporation, 118 Concourse Bldg		220.4	1360	Eastern
	WKBP—Battle Creek, Mich.—Battle Creek Enquirer & News		265	1130	Eastern
	WKBQ—New York, N. Y.—Starlight Amusement Park, Inc., 1100 E. 177 St	8	285	1050	Eastern
	WKBS—Galesburg, Ill.—Pernil N. Nelson, 227 Duffield Ave	200	361.2	830	Central
	WKBT—New Orleans, La.—First Baptist Church	50	252	1190	Central
	WKBU—New Castle, Pa.—(Portable.) Harry K. Armstrong	50	238	1260	
	WKBV—Brookville, Ind.—Knox Battery & Electric Co., 1058 Main St	250	236.1	1270	Central
	WKBW—Buffalo, N. Y.—Churchill Evangelistic Assn.	1000	362.5	827	Eastern
	WKBY—Danville, Pa. (Portable.)—Fernwood Quick	100	220	1360	
	WKBZ—Ludington, Mich.—Karl L. Ashbacker, First National Bank Bldg	15	256	1170	Eastern
	WKDR—Kenosha, Wis.—Edward A. Dato, 936 N. Michigan Ave., Chicago, Ill	10	428.3	700	Central
	WKJC—Lancaster, Pa.—Kirk Johnson Co., 16 West King St	50	258	1160	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WK	**WKRC—Cincinnati, Ohio**—Kodel Radio Corp., 507 E. Pearl St.	1500	325.9 422.3	920 710	Central
	W K Y—Oklahoma, Okla.—W K Y Radiophone Co. (Huckins Hotel)	100	352.7	850	Central
WL	**WLAC—Nashville, Tenn.**—Life & Casualty Ins. Co.	1000	225.4	1330	Central
	WLAL—Tulsa, Okla.—W. & E. Radio Service Co.	100	250	1200	Central
	WLAP—Louisville, Ky.—Virginia Avenue Baptist Church, 2600 Virginia Ave.	20	275	1090	Central
	WLB—Minneapolis, Minn.—University of Minnesota	500	278	1080	Central
	WLBA—Philadelphia, Pa.—J. C. Van Horn	50	236.1	1270	Eastern
	WLBC—Muncie, Ind.—D. A. Burton, 2224 S. Jefferson St.		223.7	1340	Central
	WLBE—Brooklyn, N. Y.—J. Henri Fruitman, 2029 Sixty-fifth St.		230.6	1300	Eastern
	WLBF—Kansas City, Mo.—Everett L. Dillard, 300a E. 33rd St.	25	211.1	1420	Central
	WLBG—Petersburg, Va.—R. A. Gamble	100	332.3	905	Eastern
	WLBH—Farmingdale, N. Y.—Joseph J. Lombardi	30	230	1304	Eastern
	WLBI—East Wenona, Ill.—Alovsius Yarc	250	296.9	1010	Central
	WLBJ—Cleveland, Ohio—Henry Grossman	100	300	1000	Eastern
	WLBL—Madison, Wis.—(Transmitter is in Stevens Point, Wis.), Wisconsin Department of Markets	750	278	1080	Central
	WLBO—Galesburg, Ill.—Frederick Trebbe, Jr.	100	243	1230	Central
	WLBP—Ashland, Ohio—Robert A. Fox	15	220.4	1360	Eastern
	WLBQ—Atwood, Ill.—E. Dale Trout	25	230.6	1300	Central
	WLBR—Belvedere, Ill.—Alford Radio Co.	15	335	895	Central
	WLBT—Crown Point, Ind.—Harold Wendell	100	230	1304	Central
	WLBU—Canastota, N. Y.—Matthew B. Greiner	5	220	1360	Eastern
	WLBV—Mansfield, Ohio—J. F. Weimer and D. A. Snick	50	230.6	1300	Central
	WLBW—Oil City, Pa.—Petroleum Telephone Co.	250	321	934	Eastern
	WLBX—Long Island City, N. Y.—John B. Brahy	250	230.6	1300	Eastern
	WLBY—Iron Mountain, Mich.—Aimone Electric	50	249.9	1200	Central
	WLBZ—Dover-Foxcroft, Me.—Thompson L. Guernsey	250	299	1000	Eastern
	WLCI—Ithaca, N. Y.—Lutheran Assoc. of Ithaca, N. Y.	50	266	1130	Eastern
	WLIB—Chicago, Ill.—Liberty Weekly	4000	303	990	Central
	WLIT—Philadelphia, Pa.—Lit Bros.	500	394.5	760	Eastern
	WLS—Chicago, Ill.—(Transmitter is in Crete, Ill.), Sears Roebuck & Co.	5000	345	870	Central
	WLSI—Cranston, R. I.—Dutee W. Flint & Lincoln Studios, Inc.	500	440.9	680	Eastern
	WLTS—Chicago, Ill.—Lane Technical High School, Hotel Flanders	100	258.5	1160	Central
	WLW—Cincinnati, Ohio—(Transmitter is in Harrison, Ohio), Crosley Radio Corp.	5000	422.3	710	Central
	WLWL—New York, N. Y.—Paulist Fathers, 415 W. 59th St.	5000	384.4	780	Eastern
WM	**WMAC—Cazenovia, N. Y.**—Clive B. Meredith	100	275	1090	Eastern
	WMAF—Dartmouth, Mass.—Round Hills Radio Corp.	1000	440.9	680	Eastern
	WMAK—Lockport, N. Y.—Norton Laboratories	1000	266	1130	Eastern
	WMAL—Washington, D. C.—M. A. Leese Radio Co., 720 Eleventh St., N. W.	100	290	1030	Eastern
	WMAN—Columbus, Ohio—W. E. Heskett, 507 North High St.	50	286	1050	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WM	WMAQ—Chicago, Ill.—Chicago Daily News	1000	447.5	670	Central
	WMAY—St. Louis, Mo.—Kingshighway Presbyterian Church	100	248	1210	Central
	WMAZ—Macon, Ga.—Mercer University	500	261	1150	Eastern
	WMBA—Newport, R. I. (Portable.)—LeRoy Joseph Beebe	100	249.9	1200	
	WMBB—Chicago, Ill.—American Bond & Mortgage Co., 6201 Cottage Grove Ave	500	250	1200	Central
	WMBC—Detroit, Mich.—Mich. Broadcasting Co	100	256.4	1170	Eastern
	WMBD—Peoria Heights, Ill.—Peoria Heights Radio Laboratory	250	279	1075	Central
	WMBE—St. Paul, Minn.—Dr. C. S. Stevens	5	220	1360	Central
	WMBF—Miami Beach, Fla.—Fleetwood Hotel Corp.	500	384.4	780	Eastern
	WMBG—Richmond, Va.—Havens & Martin	10	220	1360	Eastern
	WMBH—Chicago, Ill. (Portable)—Edwin Dudley Aber	100	280	1070	
	WMBI—Chicago, Ill.—Moody Bible Institute of Chicago 153 Institute Place	500	288.3	1040	Central
	WMBJ—Monessen, Pa.—Wm. Roy McShaffrey	50	277.6	1080	Eastern
	WMBK—Hamilton, Ohio—John C. Slade	10	360	833	Central
	WMBS—Harrisburg, Pa.—Mack's Battery Co	500	360	833	Eastern
	WMC—Memphis, Tenn.—The Commercial Publishing Co., Commercial Appeal Bldg	500	499.7	600	Central
	WMCA—New York, N. Y. (Transmitter is in Hoboken, N. J.)—Associated Broadcasters, Inc	500	340.7	880	Eastern
	WMHA—New York, N. Y.—YMHA and Boy Scouts Troop No. 707, Washington Heights	30	230	1304	Eastern
	WMPC—Lapeer, Mich.—First Methodist Protestant Church	30	222	1350	Eastern
	WMRJ—Jamaica, L. I., N. Y.—Peter J. Prinz, 10 New York Blvd	10	227.1	1320	Eastern
	WMSG—New York, N. Y.—Madison Square Garden Broadcasting Corp	500	302.8	990	Eastern
	WMVM—Newark, N. J.—Edward J. Malone, Jr	500	475.9	630	Eastern
WN	WNAB—Boston, Mass.—The Shepard Stores	100	280.2	1070	Eastern
	WNAC—Boston, Mass.—The Shepard Stores	500	430.1	697	Eastern
	WNAD—Norman, Okla.—University of Oklahoma	500	254	1180	Central
	WNAL—Omaha, Neb.—R. J. Rockwell, 5019 Capital Ave.	50	258	1160	Central
	WNAT—Philadelphia, Pa.—Lennig Bros. Co., Spring Garden and 9th Sts	500	250	1200	Eastern
	WNAX—Yankton, S. D.—Dakota Radio Apparatus Co.	100	244	1230	Central
	WNBH—New Bedford, Mass.—New Bedford Hotel, (Irving J. Vermilya and A. J. Lopez)	250	248	1210	Eastern
	WNJ—Newark, N. J.—Radio Shop of Newark (Herman Lubinsky), 89 Lehigh Ave	150	348.6	860	Eastern
	WNOX—Knoxville, Tenn.—People's Telephone & Telegraph Co., 313 Commerce Ave	500	267.7	1120	Central
	WNRC—Greensboro, N. C.—Wayne M. Nelson	10	224	1340	Eastern
	WNYC—New York, N. Y.—City of New York, Dept. of Plants and Structures, Municipal Bldg	1000	526	570	Eastern
WO	WOAI—San Antonio, Texas—Southern Equipment Co.	5000	394.5	760	Central
	WOAN—Lawrenceburg, Tenn.—Jas. D. Vaughn	500	356.4	842	Central
	WOAX—Trenton, N. J.—Franklyn J. Wolff, Top of the Monument Pottery Co	500	240	1250	Eastern
	WOBB—Chicago, Ill.—Longacre Engineering & Construction Co., 127 North Dearborn St	5	555.2	540	Central
	WOC—Davenport, Iowa—The Palmer School of Chiropractic	5000	483.6	620	Central

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WO	**WOCB—Orlando, Fla.**—Orlando Broadcasting Co., 19 South Main Street	50	213	1408	Eastern
	WOCL—Jamestown, N. Y.—A. E. Newton, for the Jamestown Furniture Market Assn	15	275.2	1090	Eastern
	WODA—Paterson, N. J.—O'Dea Temple of Music	500	391.5	765	Eastern
	WOI—Ames, Iowa—Iowa State College	750	270	1110	Central
	WOK—Chicago, Ill. (Transmitter is in Homewood, Ill.) Neutrowound Radio Mfg. Co., 1721 Prairie Ave	20000	217.3	1380	Central
	WOKO—Peekskill, N. Y.—Harold E. Smith	50	233	1290	Eastern
	WOKT—Rochester, N. Y.—Titus-Ets. Corp	1000	340	880	Eastern
	WOMT—Manitowoc, Wis.—Mikadow Theatre (Francis M. Kadow)	50	254.1	1180	Central
	WOO—Philadelphia, Pa.—John Wanamaker	500	508.2	590	Eastern
	WOOD—Grand Rapids, Mich. (Transmitter in Furnwood, Mich.)—Don Gildersleeve, Leo Robinson and Maurice Wetzel, Hotel Rowe	1000	241.8	1240	Central
	WOQ—Kansas City, Mo.—Unity School of Christianity	1000	278	1080	Central
	WOR—Newark, N. J.—L. Bamberger and Co	500	405	740	Eastern
	WORD—Batavia, Ill.—People's Pulpit Assn., 124 Columbia Heights, Brooklyn, N. Y	5000	275	1090	Central
	WOS—Jefferson City, Mo.—Missouri State Marketing Bureau	500	440.9	680	Central
	WOW—Omaha, Neb.—Woodmen of the World Life Insurance Assn	1000	526	570	Central
	WOWO—Fort Wayne, Ind.—The Main Auto Supply Co., 213 West Main St	500	227	1320	Central
WP	**WPAB—Norfolk, Va.**—Radio Corp. of Virginia	100	319	940	Eastern
	WPAK—Fargo, N. D.—North Dakota Agricultural College	50	275	1090	Central
	WPAP—Cliffside, N. J.—Palisades Amusement Park	100	361.2	830	Eastern
	WPCC—Chicago, Ill.—North Shore Congregational Church	500	258	1160	Central
	WPCH—New York, N. Y.—Concourse Radio Corporation, Park Central Hotel	500	272.6	1100	Eastern
	WPDQ—Buffalo, N. Y.—WPDQ, Inc., 121 Norwood Ave	100	205.4	1460	Eastern
	WPEP—Waukegan, Ill.—Maurice Mayer	500	212.6	1410	Central
	WPG—Atlantic City, N. J.—Municipality of Atlantic City	5000	299.8	1000	Eastern
	WPRC—Harrisburg, Pa.—W. Arthur Wilson, Prop., Wilson Printing and Radio Co., Fifth and Kelker Streets	100	215.6	1390	Eastern
	WPSC—State College, Pa.—Pennsylvania State College, Dept. of Elec. Engineering	500	282.8	1060	Eastern
WQ	**WQAA—Parkersburg, Pa.**—Horace A. Beale, Jr	500	220	1360	Eastern
	WQAE—Springfield, Vt.—Moore Radio News Station	50	246	1220	Eastern
	WQAM—Miami, Fla.—Electrical Equipment Co., 42 Northwest Fourth St	750	285.5	1050	Eastern
	WQAN—Scranton, Pa.—Scranton Times	100	250	1200	Eastern
	WQAO—Cliffside, N. J.—Calvary Baptist Church	100	361.2	830	Eastern
	WQJ—Chicago, Ill.—Calumet Baking Powder Co. and Rainbo Gardens	1000	447.5	670	Central
WR	**WRAF—Laport, Ind.**—The Radio Club, Inc., 719 Michigan Ave	100	223.8	1340	Central
	WRAH—Providence, R. I.—Stanley N. Read, 191 Alabama Ave	450	235	1280	Eastern
	WRAK—Escanaba, Mich.—Economy Light Co., 1105 Ludington St	100	256.3	1170	Central

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WR	**WRAL—Ithaca, N. Y.**—Ralph Edwin Parry, Eclipse Studio, 317 Elm St	25	365	820	Eastern
	WRAM—Galesburg, Ill.—Lombard College	100	243.8	1230	Central
	WRAV—Yellow Springs, Ohio—Antioch College	100	263	1140	Central
	WRAW—Reading, Pa.—Avenue Radio and Electric Shop, 460 Schuylkill Ave	10	238	1260	Eastern
	WRAX—Philadelphia, Pa.—Berachach Church, Inc., 1608 Alleghany Ave	500	268	1120	Eastern
	WRBC—Valparaiso, Ind.—Immanuel Lutheran Church	500	278	1080	Central
	WRC—Washington, D. C.—Radio Corporation of America	1000	468.5	640	Eastern
	WRCO—Raleigh, N. C.—Wynne Radio Co., 226½ Fayetteville St	100	252	1190	Eastern
	WREA—Shellington, Pa.—Paul Kenneth Musselman, 54 S. Miller St	100	300	1000	Eastern
	WREC—Whitehaven, Tenn.—Wooten's Radio and Electric Co	10	254	1180	Central
	WREO—Lansing, Mich.—Reo Motor Car Co	500	286	1050	Eastern
	WRES—Wollaston, Mass.—Harry L. Sawyer, 335A Newport Avenue	50	295	1016	Eastern
	WRHFWashington, D. C.—Washington Radio Hospital Fund, 525 Eleventh St., N. W	50	256	1170	Eastern
	WRHM—Minneapolis, Minn.—Rosedale Hospital Co., Inc., Andrews Hotel	3000	252	1190	Central
	WRK—Hamilton, Ohio—Doron Bros. Electrical Co	100	270	1110	Central
	WRMU—Richmond Hill, N. Y. MU-1 (Yacht)—A. H. Grebe and Co., Inc	100	236	1270	
	WRNY—New York, N. Y. (Transmitter is in Coytesville, N. J.)—Experimenter Publishing Co., 53 Park Place	500	374	802	Eastern
	WRR—Dallas, Tex.—City of Dallas, Police and Fire Signal Department	500	246	1220	Central
	WRRS—Racine, Wis.—Racine Radio Co	10	360	833	Central
	WRSC—Chelsea, Mass., The Radio Shop	15	270.1	1110	Eastern
	WRST—Bay Shore, N. Y.—Radiotel Mfg. Co., Carleton Theatre	150	215.7	1390	Eastern
	WRVA—Richmond, Va.—Larus & Brother Co., Inc., 22nd and Cary Sts	1000	256	1170	Eastern
WS	**WSAI—Cincinnati, Ohio**—(Transmitter is in Mason, Ohio), United States Playing Card Co	5000	325.9	920	Central
	WSAJ—Grove City, Pa.—Grove City College	250	229	1310	Eastern
	WSAN—Allentown, Pa.—Allentown Call Publishing Co.	100	229	1310	Eastern
	WSAR—Fall River, Mass.—Doughty & Welch Electric Co., Inc., 46 N. Main St	100	322	930	Eastern
	WSAX—Chicago, Ill.—(Portable), Zenith Radio Corp., 332 South Michigan Ave	100	268	1120	
	WSAZ—Pomeroy, Ohio—Chase Electric Shop	50	244	1230	Eastern
	WSB—Atlanta, Ga.—The Atlanta Journal	1000	428.3	700	Central
	WSBC—Chicago, Ill.—World Battery Co., 1219 South Wabash Ave	1500	288.3	1040	Central
	WSBF—St. Louis, Mo.—Stix, Baer & Fuller Dept. Store	250	273	1100	Central
	WSBT—South Bend, Ind.—South Bend Tribune	500	315.6	950	Central
	WSDA—New York, N. Y.—The City Temple (Seventh Day Adventist Church, 120th St. Lenox)	250	263	1140	Eastern
	WSEA—Virginia Beach, Va.—Virginia Beach Broadcasting Co	500	516.9	580	Eastern
	WSIX—Springfield, Tenn.—Tire & Vulc. Co	150	250	1200	Central
	WSKC—Bay City, Mich.—World's Star Knitting Co	500	260.7	1150	Eastern

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
WS	**WSM—Nashville, Tenn.**—The National Life & Accident Ins. Co.	5000	282.8	1060	Central
	WSMB—New Orleans, La.—Saenger Theatres, Inc. & Maison Blanche Co.	500	319	940	Central
	WSMH—Owosso, Mich.—Shattuck Music House, 207 Washington St.	20	240	1250	Eastern
	WSMK—Dayton, Ohio—S. M. K. Radio Corporation, 39 East Third St.	500*	275	1090	Eastern
	WSOE—Milwaukee, Wis.—School of Engineering of Milwaukee, 415 Marshall St.	500	246	1220	Central
	WSOM—Woodhaven, N. Y.—Union Course Laboratories, 9024-78th St.	500	288.3	1040	Eastern
	WSRO—Hamilton, Ohio—The Radio Co., 421 High St.	100	252	1190	Central
	WSSH—Boston, Mass.—Tremont Temple Baptist Church	100	261	1150	Eastern
	WSUI—Iowa City, Iowa—State University of Iowa	500	484	620	Central
	WSVS—Buffalo, N. Y.—Seneca Vocational School, 666 E. Delavan Ave.	50	219	1370	Eastern
	WSWS—Batavia, Ill.—Richmond Harris & Co. (Illinois Broadcasting Co.)	5000	275	1090	Central
	WSYR—Syracuse, N. Y.—Clive B. Meredith, Hotel Syracuse	500	352.7	850	Eastern
WT	**WTAD—Quincy, Ill.**—Illinois Stock Medicine Broadcasting Corp.	50	236	1270	Central
	WTAG—Worcester, Mass.—Worcester Telegram Pub. Co., 18 Franklin St.	500	545.1	550	Eastern
	WTAL—Toledo, Ohio—Toledo Broadcasting Co. (Hotel Waldorf)	100	252	1190	Eastern
	WTAM—Cleveland, Ohio—Willard Storage Battery Co.	1000	389.4	770	Eastern
	WTAQ—Eau Claire, Wis.—S. H. Van Gorden & Son	1000	254	1180	Central
	WTAR—Norfolk, Va.—Reliance Electric Co., 519 West 21st St.	100	261	1150	Eastern
	WTAW—College Station, Tex.—Agricultural & Mechanical College of Texas	500	270	1110	Central
	WTAX—Streator, Ill.—Williams Hardware Co., 115 So. Vermillion St.	50	231	1300	Central
	WTAZ—Lambertville, N. J.—Thos. J. McGuire	15	261	1150	Eastern
	WTHO—Ferndale, Mich.—W. T. Thomas Radio Co. 187 East Woodland Ave.	500	407	737	Eastern
	WTIC—Hartford, Conn.—Travelers Insurance Co.	500	475.9	630	Eastern
	WTRC—Brooklyn, N. Y.—Twentieth Assembly District Regular Republican Club, Inc., 62 Woodbine St.	100	239.9	1250	Eastern
	WTRL—Midland Park, N. J.—Technical Radio Labs.	15	280.2	1070	Eastern
WW	**WWAE—Plainfield, Ill.**—Lawrence J. Crowley	500	241.8	1240	Central
	WWJ—Detroit, Mich.—Detroit News	1000	352.7	850	Eastern
	WWL—New Orleans, La.—Loyola University	100	275	1090	Central
	WWNC—Asheville, N. C.—Asheville Chamber of Commerce, 101 Patton Ave.	100	254	1180	Central
	WWPR—Detroit, Mich.—Detroit Police Dept.	500	300	1000	Eastern
	WWRL—Woodside, N. Y.—Woodside Radio Labs., 41-30 Fifth-Eighth Street	100	258.5	1160	Eastern
	WWVA—Wheeling, West Va.—John C. Stroebel	100	348.6	860	Eastern

This list has been corrected up to and including January 31st, 1927.

RADIO BROADCAST STATIONS OF THE UNITED STATES

By Wavelengths and Frequencies

Meters	Kilocycles	Power	Call Letters	Location
202.6	1480	500	KFXB	Big Bear Lake, Cal.
202.6	1480	50	KGBY	Shelby, Neb.
202.6	1480	...	KGDJ	Cresco, Iowa
202.6	1480	10	WEHS	Evanston, Ill.
202.6	1480	10	WIBS	Elizabeth, N. J.
204	1470	10	WABB	Harrisburg, Pa.
205.4	1460	10	KFXD	Logan, Utah
205.4	1460	50	KFXY	Flagstaff, Ariz.
205.4	1460	10	KFYF	Oxnard, Cal.
205.4	1460	10	KGES	Central City, Neb.
205.4	1460	100	WFRL	Brooklyn, N. Y.
205.4	1460	100	WPDQ	Buffalo, N. Y.
206.8	1450	50	WABW	Wooster, Ohio
206.8	1450	50	WJBA	Joliet, Ill.
207	1450	50	KGTT	San Francisco, Cal.
208	1440	50	KFVD	Venice, Cal.
208	1440	500	KNRC	Los Angeles, Cal.
209.7	1430	10	KFYO	Texarkana, Tex.
209.7	1430	100	WCBR	Providence, R. I.
209.7	1430	200	WKBA	Chicago, Ill.
210	1428	15	KFQX	Seattle, Wash.
210	1428	50	KGCN	Concordia, Kans.
210	1428	15	KGDY	Oldham, S. Dak.
211.1	1420	200	KFWC	San Bernardino, Cal.
211.1	1420	250	KFWO	Avalon, Catalina Is., Cal.
211.1	1420	100	WJBU	Lewisburg, Pa.
211.1	1420	25	WLBF	Kansas City, Mo.
212.6	1410	500	KFWV	Portland, Ore.
212.6	1410	500	WPEP	Waukegan, Ill.
213	1408	50	WOCB	Orlando, Fla.
214.2	1400	500	KFWF	St. Louis, Mo.
214.2	1400	15	KFXR	Oklahoma, Okla.
214.2	1400	150	WCLS	Joliet, Ill.
215	1395	15	KPJM	Prescott, Ariz.
215.6	1390	100	WPRC	Harrisburg, Pa.
215.7	1390	50	KFBC	San Diego, Cal.
215.7	1390	50	KFQW	Seattle, Wash.
215.7	1390	15	KFXJ	Edgewater, Colo.
215.7	1390	50	WBBZ	Chicago, Ill.
215.7	1390	50	WHBL	Chicago, Ill.
215.7	1390	20	WHBM	Chicago, Ill.
215.7	1390	300	WHBR	Cincinnati, Ohio
215.7	1390	50	WIBJ	Chicago, Ill.
215.7	1390	10	WIBM	Chicago, Ill.
215.7	1390	100	WKBG	Chicago, Ill.
215.7	1390	150	WRST	Bay Shore, N. Y.
216	1390	100	WHBW	Philadelphia, Pa.
217.3	1380	50	KFAF	San Jose, Cal.
217.3	1380	...	KGDM	Stockton, Calif.
217.3	1380	500	WFKB	Chicago, Ill.
217.3	1380	20,000	WOK	Chicago, Ill.
218.8	1370	10	WHBU	Anderson, Ind.
218.8	1370	50	WIBI	Flushing, N. Y.
218.8	1370	250	WJBI	Red Bank, N. J.
219	1370	50	WSVS	Buffalo, N. Y.
220	1360	5	KJBS	San Francisco, Cal.
220	1360	50	KRAC	Shreveport, La.
220	1360	100	WIBW	Chicago, Ill.
220	1360	100	WKBY	Danville, Pa.
220	1360	5	WLBU	Canastota, N. Y.
220	1360	5	WMBE	St. Paul, Minn.
220	1360	10	WMBG	Richmond, Va.
220	1360	500	WQAA	Parkersburg, Pa.
220.4	1360	...	WKBO	Jersey City, N. J.
220.4	1360	15	WLBP	Ashland, Ohio
220.6	1360	50	WKBI	Chicago, Ill.
222	1350	50	WBBW	Norfolk, Va.
222	1350	100	WBES	Takoma Park, Md.
222	1350	100	WHBD	Bellefontaine, Ohio
222	1350	100	WHBF	Rock Island, Ill.
222	1350	50	WIBG	Elkins Park, Pa.
222	1350	20	WIBU	Poynette, Wis.
222	1350	30	WMPC	Lapeer, Mich.
223.7	1340	100	KFBL	Everett, Wash.
223.7	1340	10	KFQP	Iowa City, Ia.
223.7	1340	100	WBMS	Union City, N. J.
223.7	1340	...	WLBC	Muncie, Ind.
223.8	1340	100	WKAV	Laconia, N. H.
223.8	1340	100	WRAF	Laport, Ind.
224	1340	50	KFUR	Ogden, Utah
224	1340	50	KFVS	Cape Girardeau, Mo.
224	1340	10	WNRC	Greensboro, N. C.
225	1330	50	KGEL	Jamestown, N. Dak.
225	1330	10	WKBC	Birmingham, Ala.
225.4	1330	50	WAGM	Royal Oak, Mich.
225.4	1330	10,000	WBBM	Chicago, Ill.
225.4	1330	100	WEBQ	Harrsiburg, Ill.
225.4	1330	1000	WLAC	Nashville, Tenn.
226	1330	75	KFKZ	Kirksville, Mo.
226	1330	50	KFOB	Burlingame, Cal.
226	1330	100	KFOR	David City, Neb.
226	1330	500	KFQZ	Hollywood, Cal.
226	1330	1000	WDAD	Nashville, Tenn.
226	1330	100	WEBL	U. S. (Portable)
226	1330	10	WFBE	Cincinnati, Ohio
226	1330	1000	WIBO	Chicago, Ill.
227	1320	50	KFVN	Fairmont, Minn.
227	1320	100	KGBS	Seattle, Wash.

Meters	Kilocycles	Power	Call Letters	Location
227	1320	500	WOWO	Ft. Wayne, Ind.
227.1	1320	100	WJBR	Omro, Wis.
227.1	1320	10	WMRJ	Jamaica, N. Y.
228.9	1310	100	WBBL	Richmond, Va.
229	1310	100	KFLV	Rockford, Ill.
229	1310	1000	KMMJ	Clay Center, Nebr.
229	1310	50	KPPC	Pasadena, Cal.
229	1310	10	WAIT	Taunton, Mass.
229	1310	100	WCBM	Baltimore, Md.
229	1310	50	WDBJ	Roanoke, Va.
229	1310	50	WGBR	Marshfield, Wis.
229	1310	250	WSAJ	Grove City, Pa.
229	1310	100	WSAN	Allentown, Pa.
230	1304	30	WLBH	Farmingdale, N. Y.
230	1304	100	WLBT	Crown Point, Ind.
230	1304	30	WMHA	New York, N. Y.
230.6	1300	250	KFQU	Alma (Holy City), Cal.
230.6	1300	50	WCLO	Camp Lake, Wis.
230.6	1300	10	WIBZ	Montgomery, Ala.
230.6	1300	...	WLBE	Brooklyn, N. Y.
230.6	1300	25	WLBQ	Atwood, Ill.
230.6	1300	50	WLBV	Mansfield, Ohio
230.6	1300	250	WLBX	Long Island City, N. Y.
231	1300	5	KDLR	Devils Lake, N. D.
231	1300	10	KFDZ	Minneapolis, Minn.
231	1300	50	KFOT	Wichita, Kans.
231	1300	500	KFPR	Los Angeles, Cal.
231	1300	50	KROW	Portland, Ore.
231	1300	500	KUT	Austin, Tex.
231	1300	100	WBRE	Wilkes-Barre, Pa.
231	1300	50	WTAX	Streator, Ill.
232.4	1290	50	KGDE	Barrett, Minn.
233	1290	10	KFEY	Kellogg, Idaho
233	1290	500	KFON	Long Beach, Cal.
233	1290	10	WDBZ	Kingston, N. Y.
233	1290	50	WHBQ	Memphis, Tenn.
233	1290	10	WJBK	Ypsilanti, Mich.
233	1290	50	WOKO	Peekskill, N. Y.
234	1280	50	KFUP	Denver, Colo.
234	1280	100	KGRS	Amarillo, Tex.
234	1280	50	KMJ	Fresno, Cal.
234	1280	100	WFDF	Flint, Mich.
234	1280	250	WCWK	Fort Wayne, Ind.
234.2	1280	500	WGBX	Orono, Me.
234.2	1280	150	WIBX	Utica, N. Y.
234.2	1280	100	WJBC	La Salle, Ill.
235	1276	500	WAAT	Jersey City, N. J.
235	1276	450	WRAH	Providence, R. I.
236	1270	20	KFLU	San Benito, Tex.
236	1270	15	KFVG	Independence, Kans.
236	1270	100	KWKC	Kansas City, Mo.
236	1270	100	WBOQ	Richmond Hill, N. Y.
236	1270	100	WFBJ	Collegeville, Minn.
236	1270	100	WGMU	Richmond Hill, N. Y.
236	1270	100	WRMU	Rich. Hill, N.Y. Yacht
236	1270	50	WTAD	Quincy, Ill.
236.1	1270	50	KGEH	Eugene, Ore.
236.1	1270	100	WBAW	Nashville, Tenn.
236.1	1270	500	WGBF	Evansville, Ind.
236.1	1270	100	WIBA	Madison, Wis.
236.1	1270	250	WKBV	Brookville, Ind.
236.1	1270	50	WLBA	Philadelphia, Pa.
238	1260	15	KFBS	Trinidad, Colo.
238	1260	125	KFCB	Phoenix, Ariz.
238	1260	100	KFWU	Pineville, La.
238	1260	10	KFYJ	Houston, Tex.
238	1260	10	KGCL	Seattle, Wash.
238	1260	200	WBBP	Petoskey, Mich.
238	1260	10	WHBN	St. Petersburg, Fla.
238	1260	500	WJBT	Chicago, Ill.
238	1260	50	WKBU	New Castle, Pa.
238	1260	10	WRAW	Reading, Pa.
239.9	1250	100	KFUM	Colorado Springs, Colo.
239.9	1250	100	KGCG	Newark, Ark.
239.9	1250	15	KGCI	San Antonio, Tex.
239.9	1250	100	WABI	Bangor, Me.
239.9	1250	100	WTRC	Brooklyn, N. Y.
240	1250	10	KFHL	Oskaloosa, Iowa
240	1250	250	KFLX	Galveston, Tex.
240	1250	5000	KFVE	St. Louis, Mo.
240	1250	50	KFVI	Houston, Tex.
240	1250	10	KGCX	Vida, Mont.
240	1250	15	KGDR	San Antonio, Tex.
240	1250	85	KXRO	Seattle, Wash.
240	1250	100	KZM	Oakland, Cal.
240	1250	50	WCAT	Rapid City, S. D.
240	1250	500	WDBO	Winter Park, Fla.
240	1250	100	WGBI	Scranton, Pa.
240	1250	500	WOAX	Trenton, N. J.
240	1250	20	WSMH	Owosso, Mich.
241.8	1240	100	KGDW	Humboldt, Nebr.
241.8	1240	15	WHOG	Huntington, Ind.
241.8	1240	1000	WOOD	Grand Rapids, Mich.
241.8	1240	500	WWAE	Plainfield, Ill.
242	1240	50	KFFP	Moberly, Mo.
242	1240	10	KFPM	Greenville, Tex.
242	1240	50	KFXH	El Paso, Tex.
242	1240	50	WABY	Philadelphia, Pa.
242	1240	100	WBSO	Wellesley Hills, Mass.
242	1240	50	WCBH	Oxford, Miss.
242	1240	100	WEBC	Superior, Wis.
242.5	1240	250	WCBS	Providence, R. I.
243	1230	100	WLBO	Galesburg, Ill.
243.8	1230	100	KGAR	Tucson, Ariz.
243.8	1230	5000	WAMD	Minneapolis, Minn.
243.8	1230	100	WATT	Boston, Mass.
243.8	1230	100	WRAM	Galesburg, Ill.
244	1230	50	KFVR	Denver, Colo.
244	1230	500	KUOM	Missoula, Mont.
244	1230	100	WEBR	Buffalo, N. Y.
244	1230	100	WGBB	Freeport, N. Y.
244	1230	100	WKBF	Indianapolis, Ind.
244	1230	100	WNAX	Yankton, S. D.
244	1230	50	WSAZ	Pomeroy, Ohio
245.8	1220	1000	KFSD	San Diego, Calif.
246	1220	100	KDYL	Salt Lake City, Utah

Meters	Kilocycles	Power	Call Letters	Location	Meters	Kilocycles	Power	Call Letters	Location
246	1220	10	KFJI	Astoria, Ore.	252	1190	500	WGCP	Newark, N. J.
246	1220	100	KFJY	Fort Dodge, Ia.	252	1190	500	WFBL	Syracuse, N. Y.
246	1220	500	WABX	Mount Clemens, Mich.	252	1190	15	WKBL	Monroe, Mich.
246	1200	5000	WBAL	Baltimore, Md.	252	1190	50	WKBT	New Orleans, La.
246	1220	50	WCAZ	Carthage, Ill.	252	1190	100	WRCO	Raleigh, N. C.
246	1220	50	WIBR	Steubenville, Ohio	252	1190	3000	WRHM	Minneapolis, Minn.
246	1220	50	WQAE	Springfield, Vt.	252	1190	100	WSRO	Hamilton, Ohio
246	1220	500	WRR	Dallas, Tex.	252	1190	100	WTAL	Toledo, Ohio
246	1220	500	WSOE	Milwaukee, Wis.	254	1180	250	KFEL	Denver, Colo.
247.8	1210	100	WAOK	Ozone Park, N. Y.	254	1180	100	KFLR	Albuquerque, N. M.
247.8	1210	1000	WIOD	Miami Beach, Fla.	254	1180	100	KFWH	Eureka, Cal.
248	1210	100	KFBK	Sacramento, Cal.	254	1180	500	WCAJ	University Place, Neb.
248	1210	50	KFEC	Portland, Oregon	254	1180	150	WCBA	Allentown, Pa.
248	1210	100	KFIF	Portland, Oregon	254	1180	500	WEAI	Ithaca, N. Y.
248	1210	10	KFJB	Marshalltown, Ia.	254	1180	100	WFBR	Baltimore, Md.
248	1210	100	KFOX	Omaha, Neb.	254	1180	20	WFBZ	Galesburg, Ill.
248	1210	250	KFRB	Beeville, Tex.	254	1180	10	WHBC	Canton, Ohio
248	1210	10	KFYR	Bismark, N. D.	254	1180	100	WIAS	Burlington, Ia.
248	1210	50	KWG	Stockton, Cal.	254	1180	50	WJAK	Kokomo, Ind.
248	1210	50	WBRC	Birmingham, Ala.	254	1180	250	WJBB	St. Petersburg, Fla.
248	1210	100	WCSO	Springfield, Ohio	254	1180	500	WNAD	Norman, Okla.
248	1210	10	WGAL	Lancaster, Pa.	254	1180	10	WREC	Whitehaven, Tenn.
248	1210	100	WMAY	St. Louis, Mo.	254	1180	1000	WTAQ	Eau Claire, Wis.
248	1210	250	WNBH	New Bedford, Mass.	254	1180	100	WWNC	Asheville, N. C.
249.9	1200	500	WBBC	Brooklyn, N. Y.	254.1	1180	50	KFJZ	Fort Worth, Tex.
249.9	1200	10	WFKD	Philadelphia, Pa.	254.1	1180	10	KGDA	Dell Rapids, S. Dak.
249.9	1200	500	WKBH	LaCrosse, Wis.	254.1	1180	50	WOMT	Manitowoc, Wis.
249.9	1200	50	WLBY	Iron Mountain, Mich.	256	1170	500	KFIQ	Yakima, Wash.
249.9	1200	100	WMBA	Newport, R. I.	256	1170	50	KFUS	Oakland, Cal.
250	1200	100	KFDX	Shreveport, La.	256	1170	100	KRE	Berkeley, Cal.
250	1200	10	KFVY	Alburquerque, N. Mex.	256	1170	100	WBAX	Wilkes-Barre, Pa.
250	1200	500	KFWI	San Francisco, Calif.	256	1170	500	WDOD	Chattanooga, Tenn.
250	1200	250	KLS	Oakland, Cal.	256	1170	100	WHBP	Johnstown, Pa.
250	1200	50	KMED	Medford, Ore.	256	1170	15	WKBZ	Ludington, Mich.
250	1200	500	KMO	Tacoma, Wash.	256	1170	50	WRHF	Washington, D. C.
250	1200	5	WAGS	Somerville, Mass.	256	1170	1000	WRVA	Richmond, Va.
250	1200	1000	WEDC	Chicago, Ill.	256.3	1170	100	WRAK	Escanaba, Mich.
250	1200	50	WFBC	Knoxville, Tenn.	256.4	1170	500	WASH	Grand Rapids, Mich.
250	1200	500	WGES	Chicago, Ill.	256.4	1170	100	WMBC	Detroit, Mich.
250	1200	10	WHBA	Oil City, Pa.	258	1160	20	KFPW	Carterville, Mo.
250	1200	50	WHBY	West De Pere, Wis.	258	1160	500	KFUL	Galveston, Tex.
250	1200	100	WIAD	Philadelphia, Pa.	258	1160	500	KOCH	Omaha, Neb.
250	1200	100	WLAL	Tulsa, Okla.	258	1160	25	WAAD	Cincinnati, Ohio
250	1200	500	WMBB	Chicago, Ill.	258	1160	100	WABO	Rochester, N. Y.
250	1200	500	WNAT	Philadelphia, Pa.	258	1160	500	WADC	Akron, Ohio
250	1200	100	WQAN	Scranton, Pa.	258	1160	100	WHEC	Rochester, N. Y.
250	1200	150	WSIX	Springfield, Tenn.	258	1160	50	WKJC	Lancaster, Pa.
252	1190	50	KFHA	Gunnison, Colo.	258	1160	50	WNAL	Omaha, Neb.
252	1190	50	KFOY	St. Paul, Minn.	258	1160	500	WPCC	Chicago, Ill.
252	1190	20	KFPL	Dublin, Tex.	258.5	1160	500	WCMA	Culver, Ind.
252	1190	500	KFWB	Hollywood, Cal.	258.5	1160	100	WFCI	Pawtucket, R. I.
252	1190	10	KGCR	Brookings, S. Dak.	258.5	1160	150	WHFC	Chicago, Ill.
252	1190	10	KGEK	Yuma, Colo.	258.5	1160	100	WLTS	Chicago, Ill.
252	1190	200	KOCW	Chickasha, Okla.	258.5	1160	100	WWRL	Woodside, N. Y.
252	1190	1500	KWUC	Le Mars, Iowa	260	1153	15	KKP	Seattle, Wash.
252	1190	100	WCAX	Burlington, Vt.	260.7	1150	10	KGDP	Pueblo, Colo.
252	1190	10	WCFT	Tullahoma, Tenn.	260.7	1150	500	KSEI	Pocatello, Idaho
252	1190	500	WCOA	Pensacola, Fla.	260.7	1150	500	WABQ	Philadelphia, Pa.
252	1190	100	WCOM	Manchester, N. Y.	260.7	1150	500	WSKC	Bay City, Mich.

Meters	Kilocycles	Power	Call Letters	Location	Meters	Kilocycles	Power	Call Letters	Location
261	1150	500	KFJF	Oklahoma, Okla.	270.1	1110	150	WJBY	Gadsden, Ala.
261	1150	100	KFMR	Sioux City, Ia.	270.1	1110	100	WKBE	Webster, Mass.
261	1150	100	KFUT	Salt Lake City, Utah	270.1	1110	15	WRSC	Chelsea, Mass.
261	1150	100	WARC	Medford Hillside, Mass.	272.6	1100	100	KFAD	Phoenix, Ariz.
261	1150	500	WDAY	Fargo, N. D.	272.6	1100	500	WEBJ	New York, N. Y.
261	1150	250	WEAM	No. Plainfield, N. J.	272.6	1100	1000	WHK	Cleveland, Ohio
261	1150	750	WKAF	Milwaukee, Wis.	272.6	1100	1000	WILL	Urbana, Ill.
261	1150	500	WMAZ	Macon, Ga.	272.6	1100	500	WPCH	New York, N. Y.
261	1150	100	WSSH	Boston, Mass.	273	1100	100	KFIZ	Fond du lac, Wis.
261	1150	100	WTAR	Norfolk, Va.	273	1100	50	KFKA	Greeley, Colo.
261	1150	15	WTAZ	Lambertville, N. J.	273	1100	100	KICK	Anita, Ia.
263	1140	120	KFJR	Portland, Oregon	273	1100	500	WBAA	Lafayette, Ind.
263	1140	10	KTAP	San Antonio, Tex.	273	1100	1000	WDAE	Tampa, Fla.
263	1140	50	KTBR	Portland, Oregon	273	1100	10	WFAM	St. Cloud, Minn.
263	1140	5	KTUE	Houston, Tex.	273	1100	250	WIL	St. Louis, Mo.
263	1140	Exper.	KWTC	Santa Ana, Cal.	273	1100	250	WSBF	St. Louis, Mo.
263	1140	500	WAAM	Newark, N. J.	275	1090	50	KFBB	Havre, Mont.
263	1140	50	WABR	Toledo, Ohio	275	1090	50	KFDD	Boise, Idaho
263	1140	500	WCAD	Canton, N. Y.	275	1090	500	KFKU	Lawrence, Kans.
263	1140	2000	WCAR	San Antonio, Texas	275	1090	500	KFSG	Los Angeles, Cal.
263	1140	5	WCBE	New Orleans, La.	275	1090	500	KQV	Pittsburgh, Pa.
263	1140	100	WDAG	Amarillo, Tex.	275	1090	50	WABZ	New Orleans, La.
263	1140	500	WDGY	Minneapolis, Minn.	275	1090	500	WBAK	Harrisburg, Pa.
263	1140	100	WRAV	Yellow Springs, Ohio	275	1090	250	WBT	Charlotte, N. C.
263	1140	250	WSDA	New York, N. Y.	275	1090	100	WCAO	Baltimore, Md.
265	1130	...	WKBP	Battle Creek, Mich.	275	1090	150	WEAU	Sioux City, Ia.
265.3	1130	250	KFIO	Spokane, Wash.	275	1090	500	WFAV	Lincoln, Neb.
265.3	1130	500	WCAH	Columbus, Ohio	275	1090	500	WHAD	Milwaukee, Wis.
265.3	1130	100	WCOT	Olneyville, R. I.	275	1090	500	WHAR	Atlantic City, N. J.
266	1127	100	KFPY	Spokane, Wash.	275	1090	500	WJAS	Pittsburgh, Pa.
266	1127	500	WBCN	Chicago, Ill.	275	1090	20	WLAP	Louisville, Ky.
266	1127	100	WDEL	Wilmington, Del.	275	1090	100	WMAC	Cazenovia, N. Y.
266	1127	1000	WENR	Chicago, Ill.	275	1090	5000	WORD	Batavia, Ill.
266	1127	500	WGHB	Clearwater, Fla.	275	1090	50	WPAK	Fargo, N. D.
266	1127	50	WLCI	Ithaca, N. Y.	275	1090	500	WSMK	Dayton, Ohio
266	1127	1000	WMAK	Lockport, N. Y.	275	1090	5000	WSWS	Batavia, Ill.
267.7	1120	500	KFH	Wichita, Kans.	275	1090	100	WWL	New Orleans, La.
267.7	1120	50	KFRC	San Francisco, Cal.	275.1	1090	500	WCAC	Storrs, Conn.
267.7	1120	100	WDAH	El Paso, Texas	275.2	1090	15	WOCL	Jamestown, N. Y.
267.7	1120	500	WNOX	Knoxville, Tenn.	277.6	1080	50	WMBJ	Monessen, Pa.
267.9	1120	10	WBBY	Charleston, S. C.	277.8	1080	100	WFBG	Altoona, Pa.
268	1120	500	KFEQ	St. Joseph, Mo.	278	1080	100	KFJM	Grand Forks, N. D.
268	1120	100	WDRC	New Haven, Conn.	278	1080	50	KGY	Lacey, Wash.
268	1120	700	WEBW	Beloit, Wis.	278	1080	100	KUSD	Vermillion, S. D.
268	1120	250	WFBM	Indianapolis, Ind.	278	1080	500	KWWG	Brownsville, Tex.
268	1120	100	WJAM	Cedar Rapids, Ia.	278	1080	500	WAAF	Chicago, Ill.
268	1120	100	WJBO	New Orleans, La.	278	1080	500	WCAU	Philadelphia, Pa.
268	1120	500	WRAX	Philadelphia, Pa.	278	1080	100	WDZ	Tuscola, Ill.
268	1120	100	WSAX	Chicago, Ill.	278	1080	10	WGBC	Memphis, Tenn.
270	1110	100	WBAO	Decatur, Ill.	278	1080	500	WGBU	Fulford-by-the-Sea, Fla.
270	1110	100	WDBE	Atlanta, Ga.	278	1080	100	WHAM	Rochester, N. Y.
270	1110	1500	WGHP	Mt. Clemens, Mich.	278	1080	500	WHDI	Minneapolis, Minn.
270	1110	500	WGST	Atlanta, Ga.	278	1080	500	WLB	Minneapolis, Minn.
270	1110	200	WJAG	Norfolk, Nebr.	278	1080	750	WLBL	Madison, Wis.
270	1110	500	WJBL	Decatur, Ill.	278	1080	1000	WOQ	Kansas City, Mo.
270	1110	20	WJBW	New Orleans, La.	278	1080	500	WRBC	Valparaiso, Ind.
270	1110	750	WOI	Ames, Ia.	279	1075	250	WMBD	Peoria Heights, Ill.
270	1110	100	WRK	Hamilton, Ohio	280	1070	2000	KFAU	Boise, Idaho
270	1110	500	WTAW	College Station, Tex.	280	1070	250	WKBJ	St. Petersburg, Fla.

Meters	Kilocycles	Power	Call Letters	Location
280	1070	100	WMBH	Chicago, Ill.
280.2	1070	5000	KFQA	St. Louis, Mo.
280.2	1070	15	KGCA	Decorah, Iowa
280.2	1070	5000	KMOX	St. Louis, Mo.
280.2	1070	500	KOAC	Corvallis, Oregon
280.2	1070	500	WDWM	Newark, N. J.
280.2	1070	100	WNAB	Boston, Mass.
280.2	1070	15	WTRL	Midland Park, N. J.
281	1067	15	KGEN	El Centro, Calif.
282.8	1060	100	KSMR	Santa Maria, Cal.
282.8	1060	100	WKBB	Joliet, Ill.
282.8	1060	500	WPSC	State College, Pa.
282.8	1060	5000	WSM	Nashville, Tenn.
285	1050	100	KGDO	Dallas, Tex.
285	1050	500	KOWW	Walla Walla, Wash.
285	1050	500	WICC	Bridgeport, Conn.
285	1050	8	WKBQ	New York, N. Y.
285.5	1050	1000	WKAR	East Lansing, Mich.
285.5	1050	100	WKBM	Newburgh, N. Y.
285.5	1050	750	WQAM	Miami, Fla.
286	1050	50	WMAN	Columbus, Ohio
286	1050	500	WREO	Lansing, Mich.
288.3	1040	5000	KFKX	Hastings, Neb.
288.3	1040	500	WMBI	Chicago, Ill.
288.3	1040	1500	WSBC	Chicago, Ill.
288.3	1040	500	WSOM	Woodhaven, N. Y.
290	1035	250	KGCU	Mandan, N. Dak.
290	1035	100	WMAL	Washington, D. C.
291.1	1030	500	KGDX	Shreveport, La.
291.1	1030	100	WBKN	Brooklyn, N. Y.
293.9	1020	750	KTBI	Los Angeles, Cal.
293.9	1020	750	WAIU	Columbus, Ohio
293.9	1020	500	WBMC	Woodside, N. Y.
293.9	1020	750	WEAO	Columbus, Ohio
295	1016	500	WARS	Brooklyn, N. Y.
295	1016	100	WEPS	Gloucester, Mass.
295	1016	50	WRES	Wollaston, Mass.
296	1013	500	KWCR	Cedar Rapids, Ia.
296.9	1010	500	KPRC	Houston, Tex.
296.9	1010	250	WDXL	Detroit, Mich.
296.9	1010	250	WLBI	East Wenona, Ill.
299	1000	250	WLBZ	Dover-Foxcroft, Me.
299.8	1000	1000	KSL	Salt Lake City, Utah
299.8	1000	750	KUOA	Fayetteville, Ark.
299.8	1000	5000	WPG	Atlantic City, N. J.
300	1000	100	WLBJ	Cleveland, Ohio
300	1000	100	WREA	Shellington, Pa.
300	1000	500	WWPR	Detroit, Mich.
302.8	990	1000	KTAB	Oakland, Cal.
302.8	990	500	WMSG	New York, N. Y.
303	990	1000	WGN	Chicago, Ill.
303	990	4000	WLIB	Chicago, Ill.
305.9	980	100	KFDY	Brookings, S. Dak.
305.9	980	500	KOIL	Council Bluffs, Ia.
305.9	980	1000	KOMO	Seattle, Wash.
309.1	970	Var.	KDKA	Pittsburgh, Pa.
312.3	960	500	WAFD	Detroit, Mich.
312.6	960	1000	KSBA	Shreveport, La.
315.6	950	500	KFDM	Beaumont, Tex.

Meters	Kilocycles	Power	Call Letters	Location
315.6	950	500	KFWM	Oakland, Cal.
315.6	950	1000	KPSN	Pasadena, Cal.
315.6	950	500	WABC	Richmond Hill, N. Y.
315.6	950	4000	WEMC	Berrien Springs, Mich.
315.6	950	500	WGBS	New York, N. Y.
315.6	950	500	WSBT	South Bend, Ind.
319	940	1000	KOIN	Sylvan, Oregon
319	940	750	WGR	Buffalo, N. Y.
319	940	100	WPAB	Norfolk, Va.
319	940	500	WSMB	New Orleans, La.
321	934	250	WLBW	Oil City, Pa.
322	930	1000	WBNY	New York, N. Y.
322	930	100	WSAR	Fall River, Mass.
322.4	930	5000	KOA	Denver, Colo.
325.9	920	100	KGER	Long Beach, Calif.
325.9	920	1500	WKRC	Cincinnati, Ohio
325.9	920	5000	WSAI	Cincinnati, Ohio
327	917	50	WDBK	Cleveland, Ohio
329.8	910	10,000	WJAZ	Chicago, Ill.
330	910	50	KGEQ	Minneapolis, Minn.
331	905	100	KGCB	Oklahoma, Okla.
331.1	905	5000	WBZ	Springfield, Mass.
332.3	903	100	WLBG	Petersburg, Va.
333.1	900	100	KGBZ	York, Nebr.
333.1	900	500	KQW	San Jose, Cal.
333.1	900	1000	KTNT	Muscatine, Iowa
333.1	900	500	KVOS	Seattle, Wash.
333.1	900	250	WBZA	Boston, Mass.
335	895	15	WLBR	Belvedere, Ill.
336.9	890	500	KFMX	Northfield, Minn.
336.9	890	1000	KNX	Los Angeles, Cal.
336.9	890	500	WCAL	Northfield, Minn.
336.9	890	1000	WCAM	Camden, N. J.
336.9	890	1000	WJAX	Jacksonville, Fla.
340	880	1000	WOKT	Rochester, N. Y.
340.7	880	5000	KFAB	Lincoln, Nebr.
340.7	880	500	KSAC	Manhattan, Kans.
340.7	880	500	WMCA	New York, N. Y.
342.5	875	15	KVI	Tacoma, Wash.
344.6	870	5000	WCBD	Zion, Ill.
345	870	5000	WLS	Chicago, Ill.
347.8	862	50	KGBX	St. Joseph, Mo.
348.6	860	5000	KOB	State College, N. Mex.
348.6	860	500	KWSC	Pullman, Wash.
348.6	860	500	WEEI	Boston, Mass.
348.6	860	150	WNJ	Newark, N. J.
348.6	860	100	WWVA	Wheeling, W. Va.
350.6	855	500	WCGU	Lakewood, N. J.
352.5	850	15	KUJ	Seattle, Wash.
352.7	850	100	WBMH	Detroit, Mich.
352.7	850	500	WJAD	Waco, Tex.
352.7	850	100	WKY	Oklahoma, Okla.
352.7	850	1000	WWJ	Detroit, Mich.
356.4	842	500	WOAN	Lawrenceburg, Tenn.
357.1	840	500	KRLD	Dallas, Tex.
360	833	100	KSOO	Sioux Falls, S. D.
360	833	1000	WEW	St. Louis, Mo.
360	833	50	WKBN	Youngstown, Ohio
360	833	10	WMBK	Hamilton, Ohio

Meters	Kilocycles	Power	Call Letters	Location
360	833	500	WMBS	Harrisburg, Pa.
360	833	10	WRRS	Racine, Wis.
361.2	830	5000	KGO	Oakland, Cal.
361.2	830	1000	WHN	New York, N. Y.
361.2	830	200	WKBS	Galesburg, Ill.
361.2	830	100	WPAP	Cliffside, N.J.
361.2	830	100	WQAO	Cliffside, N. J.
362.5	827	1000	WKBW	Buffalo, N. Y.
365	820	25	WRAL	Ithaca, N. Y.
365.6	820	1000	WDAF	Kansas City, Mo.
365.6	820	500	WHB	Kansas City, Mo.
367	817	500	WEAN	Providence, R. I.
370	810	2000	WEBH	Chicago, Ill.
370.2	810	500	KMTR	Hollywood, Calif.
370.2	810	1000	WJJD	Mooseheart, Ill.
372	806	150	WGM	Jeanette, Pa.
374	802	500	WRNY	New York, N. Y.
374.8	800	500	KFBU	Laramie, Wyo.
375	800	750	KTHS	Hot Springs Nat. Pk., Ark
375	800	500	KVOO	Bristow, Okla.
379.5	790	50,000	WGY	Schenectady, N. Y.
379.5	790	500	WHAZ	Troy, N. Y.
384.4	780	20,000	KJR	Seattle, Wash.
384.4	780	500	KLZ	Denver, Colo.
384.4	780	500	WAAW	Omaha, Neb.
384.4	780	100	WBET	Boston, Mass.
384.4	780	1000	WGWB	Milwaukee, Wis.
384.4	780	5000	WLWL	New York, N. Y.
384.4	780	500	WMBF	Miami Beach, Fla.
389.4	770	1000	WEAR	Cleveland, Ohio
389.4	770	1000	WTAM	Cleveland, Ohio
391.5	765	500	WODA	Paterson, N. J.
394	760	100	WBRS	Brooklyn, N. Y.
394.5	760	1000	KHQ	Spokane, Wash.
394.5	760	500	WFI	Philadelphia, Pa.
394.5	760	500	WLIT	Philadelphia, Pa.
394.5	760	5000	WOAI	San Antonio, Tex.
399.8	750	1000	KYA	San Francisco, Cal.
399.8	750	500	WHAS	Louisville, Ky.
400	750	50	KXL	Portland, Ore.
400	750	3500	WHT	Chicago, Ill.
405	740	500	WOR	Newark, N. J.
405.2	740	500	KHJ	Los Angeles, Cal.
405.2	740	500	KSO	Clarinda, Iowa
407	737	500	WTHO	Ferndale, Mich.
410.7	730	500	WABF	Kingston, Pa.
413	726	15	KFCR	Santa Barbara, Cal.
416.4	720	1000	WBBR	Rossville, N. Y.
416.4	720	5000	WCCO	St. Paul, Minn., Minn.
416.4	720	50	WCRW	Chicago, Ill.
419.3	715	100	WJBZ	Chicago Heights, Ill.
420	715	500	WBRL	Tilton, N. H.
422	710	1000	KFXF	Denver, Colo.
422.3	710	1500	WKRC	Cincinnati, Ohio
422.3	710	5000	WLW	Cincinnati, Ohio
428.3	700	1000	KPO	San Francisco, Cal.
428.3	700	10	WKDR	Kenosha, Wis
428.3	700	1000	WSB	Atlanta, Ga.
430.1	697	500	WNAC	Boston, Mass.
431	695	50	KGDZ	Decorah, Ia.
431	695	1000	WHAP	New York, N. Y.
434	690	500	KGCH	Wayne, Nebr.
434.5	690	1000	KFKB	Milford, Kans.
434.5	690	1000	NAA	Arlington, Va.
435.7	688	1000	WJAY	Cleveland, Ohio
440.9	680	1000	KLDS	Kansas City, Mo.
440.9	680	1000	KMJP	Kansas City, Mo.
440.9	680	500	WDWF-WLSI	Cranston, R. I.
440.9	680	1000	WMAF	Dartmouth, Mass.
440.9	680	500	WOS	Jefferson City, Mo.
442.4	678	1000	WGL	New York, N. Y.
447.5	670	1000	WMAQ	Chicago, Ill.
447.5	670	1000	WQJ	Chicago, Ill.
454.3	660	1000	KFOA	Seattle, Wash.
454.3	660	1500	KTW	Seattle, Wash.
455	660	50,000	WJZ	New York, N. Y.
461	650	1000	WAPI	Auburn, Ala.
461.3	650	1000-2500	KFNF	Shenandoah, Ia.
461.3	650	500	KMA	Shenandoah, Ia.
461.3	650	500	WCAE	Pittsburgh, Pa.
461.4	650	...	KGDI	Seattle, Wash.
467	640	5000	KFI	Los Angeles, Cal.
468.5	640	1000	WRC	Washington, D. C.
475.9	630	1500	WBAP	Fort Worth, Tex.
475.9	630	500	WFAA	Dallas, Tex.
475.9	630	500	WMVM	Newark, N. J.
475.9	630	500	WTIC	Hartford, Conn.
483.6	620	500	WJAR	Providence, R. I.
483.6	620	5000	WOC	Davenport, Ia.
484	620	500	WSUI	Iowa City, Ia.
491.5	610	1000	KGW	Portland, Oregon
491.5	610	500	WCFL	Chicago, Ill.
491.5	610	5000	WEAF	New York, N. Y.
499.6	600	250	KRSC	Seattle, Wash.
499.7	600	500	KFRU	Columbia, Mo.
499.7	600	500	WMC	Memphis, Tenn.
500	600	500	WCSH	Portland, Me.
508.2	590	2500	KFQB	Fort Worth, Tex.
508.2	590	500	KLX	Oakland, Cal.
508.2	590	500	WIP	Philadelphia, Pa.
508.2	590	500	WOO	Philadelphia, Pa.
516.9	580	1000	KGEF	Los Angeles, Cal.
516.9	580	5000	WCX	Pontiac, Mich.
516.9	580	5000	WJR	Detroit, Mich.
516.9	580	250	WJUG	New York, N. Y.
516.9	580	500	WSEA	Virginia Beach, Va.
526	570	5000	WHO	Des Moines, Iowa
526	570	1000	WNYC	New York, N. Y.
526	570	1000	WOW	Omaha, Nebr.
535.4	560	1000	WHA	Madison, Wis.
535.4	560	3500	KYW	Chicago, Ill.
545.1	550	500	KFUO	St. Louis, Mo.
545.1	550	500	KSD	St. Louis, Mo.
545.1	550	500	WTAG	Worcester, Mass.
555.2	540	5	WOBB	Chicago, Ill.

This list has been corrected up to and including January 31st, 1927

RADIO BROADCAST STATIONS OF THE UNITED STATES

By States and Cities

State and City	Call Letters	Wave Length	Power
ALABAMA			
Auburn	WAPI	461	1000
Birmingham	WBRC	248	50
Birmingham	WKBC	225	10
Gadsden	WJBY	270.1	150
Montgomery	WIBZ	230.6	10
ARIZONA			
Flagstaff	KFXY	205.4	50
Phoenix	KFAD	272.6	100
Phoenix	KFCB	238	125
Prescott	KPJM	215	15
Tucson	KGAR	243.8	100
ARKANSAS			
Fayetteville	KUOA	299.8	750
Hot Springs National Park	KTHS	375	750
Newark	KGCG	239.9	100
CALIFORNIA			
Alma (Holy City)	KFQU	230.6	250
Avalon, Catalina Island	KFWO	211.1	250
Berkeley	KRE	256	100
Big Bear Lake	KFXB	202.6	500
Burlingame	KFOB	226	50
El Centro	KGEN	281	15
Eureka	KFWH	254	100
Fresno	KMJ	234	50
Hollywood	KFQZ	226	500
Hollywood	KFWB	252	500
Hollywood	KMTR	370.2	500
Long Beach	KFON	233	500
Long Beach	KGER	325.9	100
Los Angeles	KFI	467	5000
Los Angeles	KFPR	231	500
Los Angeles	KFSG	275	500
Los Angeles	KGEF	516.9	1000
Los Angeles	KHJ	405.2	500
Los Angeles	KNRC	208	500
Los Angeles	KNX	336.9	1000
Los Angeles	KTBI	293.9	750
Oakland	KFUS	256	50
Oakland	KFUU	220	100
Oakland	KFWM	315.6	500
Oakland	KGO	361.2	5000
Oakland	KLS	250	250
Oakland	KLX	508.2	500
Oakland	KTAB	302.8	1000
Oakland	KZM	240	100
Oxnard	KFYF	205.4	10
Pasadena	KPPC	229	50
Pasadena	KPSN	315.6	1000
Sacramento	KFBK	248	100
San Bernardino	KFWC	211.1	200
San Diego	KFBC	215.7	50
San Diego	KFSD	245.8	1000
San Francisco	KFRC	267.7	50
San Francisco	KGTT	207	50
San Francisco	KFWI	250	500
San Francisco	KJBS	220	5
San Francisco	KPO	428.3	1000
San Francisco	KYA	399.8	1000
San Jose	KFAF	217.3	50
San Jose	KQW	333.1	500
Santa Ana	KWTC	263	Exper.
Santa Barbara	KFCR	413	15
Santa Maria	KSMR	282.8	100
Stockton	KGDM	217.3	...
Stockton	KWG	248	50
Venice	KFVD	208	50
COLORADO			
Colorado Springs	KFUM	239.9	100
Denver	KFEL	254	250
Denver	KFUP	234	50
Denver	KFVR	244	50
Denver	KFXF	422	1000
Denver	KLZ	384.4	500
Denver	KOA	322.4	5000
Edgewater	KFXJ	215.7	15
Greeley	KFKA	273	50
Gunnison	KFHA	252	50
Pueblo	KGDP	260.7	10
Trinidad	KFBS	238	15
Yuma	KGEK	252	10
CONNECTICUT			
Bridgeport	WICC	285	500
Hartford	WTIC	475.9	500
New Haven	WDRC	268	100
Storrs	WCAC	275.1	500
DELAWARE			
Wilmington	WDEL	266	100
DISTRICT OF COLUMBIA			
Washington	WMAL	290	100
Washington	WRC	468.5	1000
Washington	WRHF	256	50
FLORIDA			
Clearwater	WGHB	266	500
Fulford-by-the-Sea	WGBU	278	500
Jacksonville	WJAX	336.9	1000
Miami Beach	WIOD	247.8	1000
Miami Beach	WMBF	384.4	500
Miami	WQAM	285.5	750
Orlando	WOCB	213	50

State and City	Call Letters	Wave Length	Power
FLORIDA—Con.			
Pensacola	WCOA	252	500
St. Petersburg	WHBN	238	10
St. Petersburg	WJBB	254	250
St. Petersburg	WKBJ	280	250
Tampa	WDAE	273	1000
Winter Park	WDBO	240	500
GEORGIA			
Atlanta	WDBE	270	100
Atlanta	WGST	270	500
Atlanta	WSB	428.3	1000
Macon	WMAZ	261	500
IDAHO			
Boise	KFAU	280	2000
Boise	KFDD	275	50
Kellogg	KFEY	233	10
Pocatello	KSEI	260.7	500
ILLINOIS			
Atwood	WLBQ	230.6	25
Batavia	WORD	275	5000
Batavia	WSWS	275	5000
Belvedere	WLBR	335	15
Carthage	WCAZ	246	50
Chicago	KYW	535.4	3500
Chicago	WAAF	278	500
Chicago	WBBM	225.4	10,000
Chicago	WBBZ	215.7	50
Chicago	WBCN	266	500
Chicago	WCFL	491.5	500
Chicago	WCRW	416.4	50
Chicago	WEBH	370	2000
Chicago	WEDC	250	1000
Chicago	WENR	266	1000
Chicago	WFKB	217.3	500
Chicago	WGES	250	500
Chicago	WGN	303	1000
Chicago	WHBL	215.7	50
Chicago	WHBM	215.7	20
Chicago	WHFC	258.5	150
Chicago	WHT	400	3500
Chicago	WIBJ	215.7	50
Chicago	WIBM	215.7	10
Chicago	WIBO	226	1000
Chicago	WIBW	220	100
Chicago	WJAZ	329.8	10,000
Chicago	WJBT	238	500
Chicago	WKBA	209.7	200
Chicago	WKBG	215.7	100
Chicago	WKBI	220.6	50
Chicago	WLIB	303	4000
Chicago	WLS	345	5000
Chicago	WLTS	258.5	100
Chicago	WMAQ	447.5	1000
Chicago	WMBB	250	500
Chicago	WMBH	280	100
Chicago	WMBI	288.3	500
Chicago	WOBB	555.2	5
Chicago	WOK	217.3	20,000
Chicago	WPCC	258	500
Chicago	WQJ	447.5	1000
Chicago	WSAX	268	100
Chicago	WSBC	288.3	1500
Chicago Heights	WJBZ	419.3	100
Decatur	WBAO	270	100
Decatur	WJBL	270	500
East Wenona	WLBI	296.9	250
Evanston	WEHS	202.6	10
Galesburg	WFBZ	254	20
Galesburg	WKBS	361.2	200
Galesburg	WLBO	243	100
Galesburg	WRAM	243.8	100
Harrisburg	WEBQ	225.4	100
Joliet	WCLS	214.2	150
Joliet	WJBA	206.8	50
Joliet	WKBB	282.8	100
LaSalle	WJBC	234.2	100
Mooseheart	WJJD	370.2	1000
Peoria Heights	WMBD	279	250
Plainfield	WWAE	241.8	500
Quincy	WTAD	236	50
Rockford	KFLV	229	100
Rock Island	WHBF	222	100
Streator	WTAX	231	50
Tuscola	WDZ	278	100
Urbana	WILL	272.6	1000
Waukegan	WPEP	212.6	500
Zion	WCBD	344.6	5000
INDIANA			
Anderson	WHBU	218.8	10
Brookville	WKBV	236.1	250
Crown Point	WLBT	230	100
Culver	WCMA	258.5	500
Evansville	WGBF	236.1	500
Fort Wayne	WCWK	234	250
Fort Wayne	WOWO	227	500
Huntington	WHOG	241.8	15
Indianapolis	WFBM	268	250
Indianapolis	WKBF	244	100
Kokomo	WJAK	254	50
Lafayette	WBAA	273	500
Laport	WRAF	223.8	100
Muncie	WLBC	223.7	. . .
South Bend	WSBT	315.6	500
Valparaiso	WRBC	278	500
IOWA			
Ames	WOI	270	750
Anita	KICK	273	100
Burlington	WIAS	254	100
Cedar Rapids	KWCR	296	500
Cedar Rapids	WJAM	268	100
Clarinda	KSO	405.2	500
Council Bluffs	KOIL	305.9	500
Cresco	KGDJ	202.6	. . .
Davenport	WOC	483.6	5000
Decorah	KGCA	280.2	15
Decorah	KGDZ	431	50

State and City	Call Letters	Wave Length	Power
IOWA—Con.			
Des Moines	WHO	526	5000
Fort Dodge	KFJY	246	100
Iowa City	KFQP	223.7	10
Iowa City	WSUI	484	500
Le Mars	KWUC	252	1500
Marshalltown	KFJB	248	10
Muscatine	KTNT	333.1	1000
Oskaloosa	KFHL	240	10
Shenandoah	KFNF	461.3	1000–2500
Shenandoah	KMA	461.3	500
Sioux City	KFMR	261	100
Sioux City	WEAU	275	150
KANSAS			
Concordia	KGCN	210	50
Independence	KFVG	236	15
Lawrence	KFKU	275	500
Manhattan	KSAC	340.7	500
Milford	KFKB	434.5	1000
Wichita	KFH	267.7	500
Wichita	KFOT	231	50
KENTUCKY			
Louisville	WHAS	399.8	500
Louisville	WLAP	275	20
LOUISIANA			
New Orleans	WABZ	275	50
New Orleans	WCBE	263	5
New Orleans	WJBO	268	100
New Orleans	WJBW	270	20
New Orleans	WKBT	252	50
New Orleans	WSMB	319	500
New Orleans	WWL	275	100
Pineville	KFWU	238	100
Shreveport	KFDX	250	100
Shreveport	KGDX	291.1	500
Shreveport	KRAC	220	50
Shreveport	KSBA	312.6	1000
MAINE			
Bangor	WABI	239.9	100
Dover-Foxcroft	WLBZ	299	250
Orono	WGBX	234.2	500
Portland	WCSH	500	500
MARYLAND			
Baltimore	WBAL	246	5000
Baltimore	WCAO	275	100
Baltimore	WCBM	229	100
Baltimore	WFBR	254	100
Tokoma Park	WBES	222	100
MASSACHUSETTS			
Boston	WATT	243.8	100
Boston	WBET	384.4	100
Boston	WBZA	333.1	250
Boston	WEEI	348.6	500
Boston	WNAB	280.2	100
Boston	WNAC	430.1	500
Boston	WSSH	261	100
Chelsea	WRSC	270.1	15
Dartmouth	WMAF	440.9	1000
Fall River	WSAR	322	100
Gloucester	WEPS	295	100
Medford Hillside	WARC	261	100
New Bedford	WNBH	248	250
Somerville	WAGS	250	5
Springfield	WBZ	331.1	5000
Taunton	WAIT	229	10
Webster	WKBE	270.1	100
Wellesley Hills	WBSO	242	100
Wollaston	WRES	295	50
Worcester	WTAG	545.1	500
MICHIGAN			
Battle Creek	WKBP	265	...
Bay City	WSKC	260.7	500
Berrien Springs	WEMC	315.6	4000
Detroit	WAFD	312.3	500
Detroit	WBMH	352.7	100
Detroit	WDXL	296.9	250
Detroit	WJR	516.9	5000
Detroit	WMBC	256.4	100
Detroit	WWJ	352.7	1000
Detroit	WWPR	300	500
East Lansing	WKAR	285.5	1000
Escanaba	WRAK	256.3	100
Ferndale	WTHO	407	500
Flint	WFDF	234	100
Grand Rapids	WASH	256.4	500
Grand Rapids	WOOD	241.8	1000
Iron Mountain	WLBY	249.9	50
Lansing	WREO	286	500
Lapeer	WMPC	222	30
Ludington	WKBZ	256	15
Monroe	WKBL	252	15
Mount Clemens	WABX	246	500
Mount Clemens	WGHP	270	1500
Owosso	WSMH	240	20
Petoskey	WBBP	238	200
Pontiac	WCX	516.9	5000
Royal Oak	WAGM	225.4	50
Ypsilanti	WJBK	233	10
MINNESOTA			
Barrett	KGDE	232.4	50
Collegeville	WFBJ	236	100
Fairmont	KFVN	227	50
Minneapolis	KFDZ	231	10
Minneapolis	KGEQ	330	50
Minneapolis	WAMD	243.8	5000
Minneapolis	WDGY	263	500
Minneapolis	WHDI	278	500
Minneapolis	WLB	278	500
Minneapolis	WRHM	252	3000
Northfield	KFMX	336.9	500
Northfield	WCAL	336.9	500
St. Cloud	WFAM	273	10
St. Paul	KFOY	252	50
St. Paul	WMBE	220	5
St. Paul-Minneapolis	WCCO	416.4	5000

State and City	Call Letters	Wave Length	Power
MISSISSIPPI			
Oxford (near)	WCBH	242	50
MISSOURI			
Cape Girardeau	KFVS	224	50
Carterville	KFPW	258	20
Columbia	KFRU	499.7	500
Jefferson City	WOS	440.9	500
Kansas City	KLDS	440.9	1000
Kansas City	KMJP	440.9	1000
Kansas City	KWKC	236	100
Kansas City	WDAF	365.6	1000
Kansas City	WHB	365.6	500
Kansas City	WLBF	211.1	25
Kansas City	WOQ	278	1000
Kirksville	KFKZ	226	75
Moberly	KFFP	242	50
St. Joseph	KFEQ	268	500
St. Joseph	KGBX	347.8	50
St. Louis	KFQA	280.2	5000
St. Louis	KFUO	545.1	500
St. Louis	KFVE	240	5000
St. Louis	KFWF	214.2	500
St. Louis	KMOX	280.2	5000
St. Louis	KSD	545.1	500
St. Louis	WEW	360	1000
St. Louis	WIL	273	250
St. Louis	WMAY	248	100
St. Louis	WSBF	273	250
MONTANA			
Havre	KFBB	275	50
Missoula	KUOM	244	500
Vida	KGCX	240	10
NEBRASKA			
Central City	KGES	205.4	10
Clay Center	KMMJ	229	1000
David City	KFOR	226	100
Hastings	KFKX	288.3	5000
Humboldt	KGDW	241.8	100
Lincoln	KFAB	340.7	5000
Lincoln	WFAV	275	500
Norfolk	WJAG	270	200
Omaha	KFOX	248	100
Omaha	KOCH	258	500
Omaha	WAAW	384.4	500
Omaha	WNAL	258	50
Omaha	WOW	526	1000
Shelby	KGBY	202.6	50
University Place	WCAJ	254	500
Wayne	KGCH	434	500
York	KGBZ	333.1	100
NEW HAMPSHIRE			
Laconia	WKAV	223.8	100
Tilton	WBRL	420	500
NEW JERSEY			
Atlantic City	WHAR	275	500
Atlantic City	WPG	299.8	5000
Camden	WCAM	336.9	1000
Cliffside	WPAP	361.2	100
Cliffside	WQAO	361.2	100
Elizabeth	WIBS	202.6	10
Jersey City	WAAT	235	500
Jersey City	WKBO	220.4	...
Lakewood	WCGU	350.6	500
Lambertville	WTAZ	261	15
Midland Park	WTRL	280.2	15
Newark	WAAM	263	500
Newark	WDWM	280.2	500
Newark	WGCP	252	500
Newark	WMVM	475.9	500
Newark	WNJ	348.6	150
Newark	WOR	405	500
North Plainfield	WEAM	261	250
Paterson	WODA	391.5	500
Red Bank	WJBI	218.8	250
Trenton	WOAX	240	500
Union City	WBMS	223.7	100
NEW MEXICO			
Albuquerque	KFLR	254	100
Albuquerque	KFVY	250	10
State College	KOB	348.6	5000
NEW YORK			
Bay Shore	WRST	215.7	150
Brooklyn	WARS	295	500
Brooklyn	WBBC	249.9	500
Brooklyn	WBKN	291.1	100
Brooklyn	WBRS	394	100
Brooklyn	WFRL	205.4	100
Brooklyn	WLBE	230.6	...
Brooklyn	WTRC	239.9	100
Buffalo	WEBR	244	100
Buffalo	WGR	319	750
Buffalo	WKBW	362.5	1000
Buffalo	WPDQ	205.4	100
Buffalo	WSVS	219	50
Canastota	WLBU	220	5
Canton	WCAD	263	500
Cazenovia	WMAC	275	100
Farmingdale	WLBH	230	30
Flushing	WIBI	218.8	50
Freeport	WGBB	244	100
Ithaca	WEAI	254	500
Ithaca	WLCI	266	50
Ithaca	WRAL	365	25
Jamaica	WMRJ	227.1	10
Jamestown	WOCL	275.2	15
Kingston	WDBZ	233	10
Lockport	WMAK	266	1000
Long Island City	WLBX	230.6	250
Manchester	WCOM	252	100
Newburgh	WKBM	285.5	100
New York	WBNY	322	1000
New York	WEAF	491.5	5000
New York	WEBJ	272.6	500
New York	WGBS	315.6	500
New York	WGL	442.4	1000
New York	WHAP	431	1000

State and City	Call Letters	Wave Length	Power
NEW YORK—Con.			
New York	WHN	361.2	1000
New York	WJUG	516.9	250
New York	WJZ	455	50,000
New York	WKBQ	285	8
New York	WLWL	384.4	5000
New York	WMCA	340.7	500
New York	WMHA	230	30
New York	WMSG	302.8	500
New York	WNYC	526	1000
New York	WPCH	272.6	500
New York	WRNY	374	500
New York	WSDA	263	250
Ozone Park	WAOK	247.8	100
Peekskill	WOKO	233	50
Richmond Hill	WABC	315.6	500
Richmond Hill	WBOQ	236	100
Richmond Hill	WGMU	236	100
Richmond Hill	WRMU	236	100
Rochester	WABO	258	100
Rochester	WHAM	278	100
Rochester	WHEC	258	100
Rochester	WOKT	340	1000
Rossville	WBBR	416.4	1000
Schenectady	WGY	379.5	50,000
Syracuse	WFBL	252	500
Troy	WHAZ	379.5	500
Utica	WIBX	234.2	150
Woodhaven	WSOM	288.3	500
Woodside	WBMC	293.9	500
Woodside	WWRL	258.5	100
NORTH CAROLINA			
Asheville	WWNC	254	100
Charlotte	WBT	275	250
Greensboro	WNRC	224	10
Raleigh	WRCO	252	100
NORTH DAKOTA			
Bismark	KFYR	248	10
Devils Lake	KDLR	231	5
Fargo	WDAY	261	500
Fargo	WPAK	275	50
Grand Forks	KFJM	278	100
Jamestown	KGEL	225	50
Mandan	KGCU	290	250
OHIO			
Akron	WADC	258	500
Ashland	WLBP	220.4	15
Bellefontaine	WHBD	222	100
Canton	WHBC	254	10
Cincinnati	WAAD	258	25
Cincinnati	WFBE	226	10
Cincinnati	WHBR	215.7	300
Cincinnati	WKRC	325.9 422.3	1500
Cincinnati	WLW	422.3	5000
Cincinnati	WSAI	325.9	5000
Cleveland	WDBK	327	50
Cleveland	WEAR	389.4	1000
Cleveland	WHK	272.6	1000
Cleveland	WJAY	435.7	1000
Cleveland	WLBJ	300	100
Cleveland	WTAM	389.4	1000
Columbus	WAIU	293.9	750
Columbus	WCAH	265.3	500
Columbus	WEAO	293.9	750
Columbus	WMAN	286	50
Dayton	WSMK	275	500
Hamilton	WMBK	360	10
Hamilton	WRK	270	100
Hamilton	WSRO	252	100
Mansfield	WLBV	230.6	50
Pomeroy	WSAZ	244	50
Springfield	WCSO	248	100
Steubenville	WIBR	246	50
Toledo	WABR	263	50
Toledo	WTAL	252	100
Wooster	WABW	206.8	50
Yellow Springs	WRAV	263	100
Youngstown	WKBN	360	50
OKLAHOMA			
Bristow	KVOO	375	500
Chickasha	KOCW	252	200
Norman	WNAD	254	500
Oklahoma	KFJF	261	500
Oklahoma	KFXR	214.2	15
Oklahoma	KGCB	331	100
Oklahoma	WKY	352.7	100
Tulsa	WLAL	250	100
OREGON			
Astoria	KFJI	246	10
Corvallis	KOAC	280.2	500
Eugene	KGEH	236.1	50
Medford	KMED	250	50
Portland	KFEC	248	50
Portland	KFIF	248	100
Portland	KFJR	263	120
Portland	KFWV	212.6	500
Portland	KGW	491.5	1000
Portland	KROW	231	50
Portland	KTBR	263	50
Portland	KXL	400	50
Sylvan	KOIN	319	1000
PENNSYLVANIA			
Allentown	WCBA	254	150
Allentown	WSAN	229	100
Altoona	WFBG	277.8	100
Danville	WKBY	220	100
Elkins Park	WIBG	222	50
Grove City	WSAJ	229	250
Harrisburg	WABB	204	10
Harrisburg	WBAK	275	500
Harrisburg	WMBS	360	500
Harrisburg	WPRC	215.6	100
Jeanette	WGM	372	150
Johnstown	WHBP	256	100
Kingston	WABF	410.7	500

State and City	Call Letters	Wave Length	Power
PENNSYLVANIA—Con.			
Lancaster	WGAL	248	10
Lancaster	WKJC	258	50
Lewisburg	WJBU	211.1	100
Monessen	WMBJ	277.6	50
New Castle	WKBU	238	50
Oil City	WHBA	250	10
Oil City	WLBW	321	250
Parkersburg	WQAA	220	500
Philadelphia	WABQ	260.7	500
Philadelphia	WABY	242	50
Philadelphia	WCAU	278	500
Philadelphia	WFI	394.5	500
Philadelphia	WFKD	249.9	10
Philadelphia	WHBW	216	100
Philadelphia	WIAD	250	100
Philadelphia	WIP	508.2	500
Philadelphia	WLBA	236.1	50
Philadelphia	WLIT	394.5	500
Philadelphia	WNAT	250	500
Philadelphia	WOO	508.2	500
Philadelphia	WRAX	268	500
Pittsburgh	KDKA	309.1	Var.
Pittsburgh	KQV	275	500
Pittsburgh	WCAE	461.3	500
Pittsburgh	WJAS	275	500
Reading	WRAW	238	10
Scranton	WGBI	240	100
Scranton	WQAN	250	100
Shellington	WREA	300	100
State College	WPSC	282.8	500
Wilkes-Barre	WBAX	256	100
Wilkes-Barre	WBRE	231	100
RHODE ISLAND			
Cranston	WLSI-WDWF	440.9	500
Newport	WMBA	249.9	100
Olneyville	WCOT	265.3	100
Pawtucket	WFCI	258.5	100
Providence	WCBR	209.7	100
Providence	WCBS	242.5	250
Providence	WEAN	367	500
Providence	WJAR	483.6	500
Providence	WRAH	235	450
SOUTH CAROLINA			
Charleston	WBBY	267.9	10
SOUTH DAKOTA			
Brookings	KFDY	305.9	100
Brookings	KGCR	252	10
Dell Rapids	KGDA	254.1	10
Oldham	KGDY	210	15
Rapid City	WCAT	240	50
Sioux Falls	KSOO	360	100
Vermillion	KUSD	278	100
Yankton	WNAX	244	100
TENNESSEE			
Chattanooga	WDOD	256	500
Knoxville	WFBC	250	50
Knoxville	WNOX	267.7	500
Lawrenceburg	WOAN	356.4	500
Memphis	WGBC	278	10
Memphis	WHBQ	233	50
Memphis	WMC	499.7	500
Nashville	WBAW	236.1	100
Nashville	WDAD	226	1000
Nashville	WLAC	225.4	1000
Nashville	WSM	282.8	5000
Springfield	WSIX	250	150
Tullahoma	WCFT	252	10
Whitehaven	WREC	254	10
TEXAS			
Amarillo	WDAG	263	100
Amarillo	KGRS	234	100
Austin	KUT	231	500
Beaumont	KFDM	315.6	500
Beeville	KFRB	248	250
Brownsville	KWWG	278	500
College Station	WTAW	270	500
Dallas	KGDO	285	100
Dallas	KRLD	357.1	500
Dallas	WFAA	475.9	500
Dallas	WRR	246	500
Dublin	KFPL	252	20
El Paso	KFXH	242	50
El Paso	WDAH	267.7	100
Fort Worth	KFJZ	254.1	50
Fort Worth	KFQB	508.2	2500
Fort Worth	WBAP	475.9	1500
Galveston	KFLX	240	250
Galveston	KFUL	258	500
Greenville	KFPM	242	10
Houston	KFVI	240	50
Houston	KFYJ	238	10
Houston	KPRC	296.9	500
Houston	KTUE	263	5
San Antonio	KGCI	239.9	15
San Antonio	KGDR	240	15
San Antonio	KTAP	263	10
San Antonio	WCAR	263	2000
San Antonio	WOAI	394.5	5000
San Benito	KFLU	236	20
Texarkana	KFYO	209.7	10
Waco	WJAD	352.7	500
UTAH			
Logan	KFXD	205.4	10
Ogden	KFUR	224	50
Salt Lake City	KDYL	246	100
Salt Lake City	KFUT	261	100
Salt Lake City	KSL	299.8	1000
U. S. (Portable)			
Portable	WEBL	226	100
VERMONT			
Burlington	WCAX	252	100
Springfield	WQAE	246	50
VIRGINIA			
Arlington	NAA	434.5	1000
Norfolk	WBBW	222	50

State and City	Call Letters	Wave Length	Power
VIRGINIA—Con.			
Norfolk	**WPAB**	319	100
Norfolk	**WTAR**	261	100
Petersburg	**WLBG**	332.3	100
Richmond	**WBBL**	228.9	100
Richmond	**WMBG**	220	10
Richmond	**WRVA**	256	1000
Roanoke	**WDBJ**	229	50
Virginia Beach	**WSEA**	516.9	500
Wheeling	**WWVA**	348.6	100
WASHINGTON			
Everett	**KFBL**	223.7	100
Lacey	**KGY**	278	50
Pullman	**KWSC**	348.6	500
Seattle	**KFOA**	454.3	1000
Seattle	**KFQW**	215.7	50
Seattle	**KFQX**	210	15
Seattle	**KGBS**	227	100
Seattle	**KGCL**	238	10
Seattle	**KGDI**	461.4	...
Seattle	**KJR**	384.4	20,000
Seattle	**KKP**	260	15
Seattle	**KOMO**	305.9	1000
Seattle	**KRSC**	499.6	250
Seattle	**KTW**	454.3	1500
Seattle	**KUJ**	352.5	15
Seattle	**KVOS**	333.1	500
Seattle	**KXRO**	240	85
Spokane	**KFIO**	265.3	250
Spokane	**KFPY**	266	100
Spokane	**KHQ**	394.5	1000
Tacoma	**KMO**	250	500
Tacoma	**KVI**	342.5	15
Walla Walla	**KOWW**	285	500
Yakima	**KFIQ**	256	500
WISCONSIN			
Beloit	**WEBW**	268	700
Camp Lake	**WCLO**	230.6	50
Eau Claire	**WTAQ**	254	1000
Fond du Lac	**KFIZ**	273	100
Kenosha	**WKDR**	428.3	10
La Crosse	**WKBH**	249.9	500
Madison	**WHA**	535.4	1000
Madison	**WIBA**	236.1	100
Madison	**WLBL**	278	750
Manitowoc	**WOMT**	254.1	50
Marshfield	**WGBR**	229	50
Milwaukee	**WGWB**	384.4	1000
Milwaukee	**WHAD**	275	500
Milwaukee	**WKAF**	261	750
Milwaukee	**WSOE**	246	500
Omro	**WJBR**	227.1	100
Poynette	**WIBU**	222	20
Racine	**WRRS**	360	10
Superior	**WEBC**	242	100
West De Pere	**WHBY**	250	50
WYOMING			
Laramie	**KFBU**	374.8	500

This list has been corrected up to and including January 31st 1927

Radio Station WCBA—Allentown, Pa.

Clarence I. Dreisbach, studio manager and announcer.

John A. K. Lichty, announcer.

Mrs. Harrison Fleming, soprano soloist.

Radio Station KFUO—St. Louis, Mo.

Miss Edith Kiesling, pianist.

Rev. Adolph Behnke, baritone soloist.

Station CHUC—Saskatoon, Sask.
Edwin S. Esson, engineer.

Station CHUC—Saskatoon, Sask.
C. Roberts, general manager and announcer.

Station CHUC—Saskatoon, Sask.
Winnie Esson, Ethel Esson, and Hilda Esson.

Station 2RN—Dublin, Irish Free State.
Seamus Clanndiolum, station director.

Station KFWB—Hollywood, Calif.
Charlie Wellman, announcer.

Station WLAC—Nashville, Tenn.
Dr. F. M. Shepherd, medical director.

Station WGY—Schenectady, N. Y.
Harmony Twins.

Station WLAC—Nashville, Tenn.
Mrs. Eva Thompson Jones, soprano.

Station WLAC—Nashville, Tenn.
The Municipal Five.

Canadian Radio Broadcast Stations

Indexed Alphabetically by Call Letters

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
CF	**CFAC—Calgary, Alberta**—The Calgary Herald, Herald Bldg	500	434.5	690	Mountain
	CFCA—Toronto, Ont.—Star Publishing & Printing Co., S. W. Cor. Yonge St. and St. Clair Ave	500	356.9	840	Eastern
	CFCF—Montreal, Que.—Canadian Marconi Co., Canada Cement Bldg., Philipps Sq	1650	410.7	730	Eastern
	CFCH—Iroquois Falls, Ont.—Abitibi Power & Paper Co., Ltd	250	499.7	600	Eastern
	CFCK—Edmonton, Alberta—Radio Supply Co., Ltd., Royal George Hotel	50	516.9	580	Mountain
	CFCN—Calgary, Alberta—W. W. Grant (Ltd.), 708 Crescent Rd., N. W	1800	434.5	690	Mountain
	CFCQ—Vancouver, B. C.—Sprott-Shaw Radio Co., 153 Pender St., W	10	410.7	730	Pacific
	CFCT—Victoria, B. C.—G. W. Deaville, 1405 Douglas St	500	329.5	910	Pacific
	CFCY—Charlottetown, P. E. Island—Island Radio Co., Upper Hillsboro St	50	312.3	960	Atlantic
	CFDC—Vancouver, B. C.—Sparks Co., 1220 Seymour St.	100	410.7	730	Pacific
	CFGC—Brantford, Ont.—The Brant Radio Supply Co., 90 Colborne St	50	296.9	1010	Eastern
	CFJC—Kamloops, B. C.—N. S. Dalgleish & Sons, and Weller & Weller, 186 Victoria St	15	267.7	1120	Pacific
	CFLC—Prescott, Ont.—Radio Assoc. of Prescott, Victoria Hall	50	296.9	1010	Eastern
	CFMC—Kingston, Ont.—Monarch Battery Co., Montreal St	20	267.7	1120	Eastern
	CFQC—Saskatoon, Sask.—The Electric Shop, Ltd., 1322 Osler St	500	329.5	910	Mountain
	CFRC—Kingston, Ont.—Queen's University, Dept. of Electrical Engineering, Fleming Hall, Queen's University	500	267.7	1120	Eastern
	CFYC—Burnaby, B. C.—International Bible Students Assoc., 2243 Royal Oak Ave	500	410.7	730	Pacific

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
CH	**CHCO—Huntsville, Ont.**—A. Staples, Ginsburg Blk., Main St	5	247.8	1210	Eastern
	CHCS—Hamilton, Ont.—The Hamilton Spectator, Spectator Bldg	10	340.7	880	Eastern
	CHCY—Edmonton, Alberta—Int'l Bible Students Assoc., King Edward Park	250	516.9	580	Mountain
	CHIC—Toronto, Ontario—Northern Electric Co., Ltd., Hillcrest Park. (Uses Station CKNC, Canadian Nat'l Carbon Co., Toronto, Ontario)	500	367	817	Eastern
	CHLC—Summerside, P. E. I.—R. L. Holman, Ltd., Holman Bldg	25	267.7	1120	Atlantic
	CHNC—Toronto, Ont.—Toronto Radio Research Soc., Hillcrest Park. (Uses Station CKNC, Canadian Nat'l Carbon Co., Toronto, Ont)	750	356.9	840	Eastern
	CHNS—Halifax, N. S.—Northern Elec. Co., Carleton Hotel, Cor. Prince and Argyle Sts	100	322.4	930	Atlantic
	CHRC—Quebec, Que.—E. Fountaine, 11 Fifth St	5	340.7	880	Eastern
	CHUC—Saskatoon, Sask.—The International Bible Students Assoc., Cor. Ave. D and 36th St	500	329.5	910	Mountain
	CHWC—Regina, Sask.—R. H. Williams & Sons, Ltd., Cor. Hamilton St. and 11th Ave	15	312.3	960	Mountain
	CHXC—Ottawa, Ont.—J. R. Booth, 28 Range Rd	250	434.5	690	Eastern
	CHYC—Montreal, Que.—Northern Electric Co., Ltd., 121 Shearer St	750	410.7	730	Eastern
CJ	**CJBC—Toronto, Ont.**—Jarvis St. Baptist Church. (Uses one of the stations in Toronto City or District.)	500	291.1 356.9	1030 840	Eastern
	CJCA—Edmonton, Alberta—The Edmonton Journal, Ltd., Journal Bldg	500	516.9	580	Mountain
	CJCF—Kitchener, Ont.—O. Rumpel, 39 S. Cameron St.	25	247.8	1210	Eastern
	CJCI—Toronto, Ont.—Loyal Order of Moose		291.1	1030	Eastern
	CJCQ—York Co., Ont.—Standard Radio Mfg. Corp., Ltd., Township of King	1000	291.1	1030	Eastern
	CJGC—London, Ont.—London Free Press Printing Co., Ltd. 430 Richmond St	500	329.5	910	Eastern
	CJOC—Lethbridge, Alberta—J. E. Palmer, 1235 Fifth Avenue A, South	50	267.7	1120	Mountain
	CJOR—Sea Island, B. C.—Geo. C. Chandler	100	291.1	1030	Pacific
	CJRM—Moose Jaw, Sask.—Jas. Richardson & Sons, Ltd., 337 Coteau St. W	100	296.9	1010	Mountain
	CJSC—Toronto, Ont.—The Evening Telegram. (Uses station CKCL, the Dominion Battery Co., 20 Trinity St., Toronto, Ont.)	500	356.9	840	Eastern
	CJTC—Calgary, Alta.—Radio Service & Repair Shop, 18th Ave. and 7th St. E	250	434.5	690	Mountain
	CJWC—Saskatoon, Sask.—The Wheaton Electric Co., Ltd., 33rd St. and Ave. C, North	250	329.5	910	Mountain
	CJYC—Scarboro Station, Ont.—Universal Radio of Canada, Ltd	500	291.1	1030	Eastern
KC	**CKAC—Montreal, Que.**—La Presse Publishing Co., Ltd., Cor. St. James St. & St. Lawrence Blvd.	7500	410.7	730	Eastern
	CKCD—Vancouver, B. C.—Vancouver Daily Province, 142 Hastings St. W	1000	410.7	730	Pacific
	CKCI—Quebec, Que.—Le "Soleil," Ltd., 120 Dolbeau St.	22½	340.7	880	Eastern
	CKCK—Regina, Sask.—Leader Publishing Co., Ltd	500	312.3	960	Mountain

Radio Call Letters	BROADCAST STATIONS Location and Owner	Power Watts	Wave Length (Meters)	Frequency (Kilocycles)	Time at Station
CK	**CKCL—Toronto, Ont.**—Dominion Battery Co., Ltd., 20 Trinity Street	800	356.9	840	Eastern
	CKCO—Ottawa, Ont.—Dr. G. M. Geldert (for Ottawa Radio Assn.), 282 Somerset St. W	100	434.5	690	Eastern
	CKCR—St. George, Ont.—John Patterson, Main St	25	267.7	1120	Eastern
	CKCV—Quebec, Que.—G. A. Vandry, 66 St. Joseph St.	100	340.7	880	Eastern
	CKCW—Burketon Jct., Durham Co., Ont.—Canadian Broadcasting Corp	5000	329.5	910	Eastern
	CKCX—Toronto, Ont.—International Bible Students Assoc. (Uses station CJYC, Universal Radio Co. of Canada, Ltd., Scarboro Station, Ont.)	500	291.1	1030	Eastern
	CKFC—Vancouver, B. C.—United Church of Canada, Cor. Thurlow and Pendrell Sts.	50	410.7	730	Pacific
	CKMC—Cobalt, Ont.—R. L. Mac Adam	5	247.8	1210	Eastern
	CKNC—Toronto, Ont.—Canadian National Carbon Co., Ltd., Hillcrest Park	750	357	840	Eastern
	CKOC—Hamilton, Ont.—Wentworth Radio Supply Co., Ltd., Royal Connaught Hotel	50	340.7	880	Eastern
	CKPC—Preston, Ont.—Wallace Russ, 40 Russ Ave.	7½	247.8	1210	Eastern
	CKSH—St. Hyacinthe, Que.—City of St. Hyacinthe, Que., Mondor and Cascades Sts.	50	312.3	960	Eastern
	CKY—Winnipeg, Manitoba—Manitoba Telephone System, Sherbrooke St	500	384.4	780	Central
CN	**CNRA—Moncton, N. B.**—Canadian National Railways.	500	322.4	930	Atlantic
	CNRC—Calgary, Alberta—Canadian National Railways (Uses station CFAC, Calgary Herald, Calgary, or station CFCN, W. W. Grant, Ltd., Calgary).	500	434.5	690	Mountain
	CNRE—Edmonton, Alberta—Canadian National Railways. (Uses station CJCA, Edmonton Journal Ltd., Edmonton, Alberta)	500	516.9	580	Mountain
	CNRM—Montreal, Que.—Canadian National Railways. (Uses station CHYC, Northern Elec. Co., Ltd., Montreal; CKAC, LaPresse Pub. Co., Ltd., Montreal; CFCF, Canadian Marconi Co., Montreal, P. Q.)	1000-1650	410.7	730	Eastern
	CNRO—Ottawa, Ont.—Canadian National Railways	500	434.5	690	Eastern
	CNRR—Regina, Sask.—Canadian National Railways. (Uses station CKCK, Leader Pub. Co., Ltd., Regina, Sask	500	312.3	960	Mountain
	CNRS—Saskatoon, Sask.—Canadian National Railways. (Uses station CFQC, Elec. Shop, Ltd., Saskatoon, Sask.)	500	329.5	910	Mountain
	CNRT—Toronto, Ont.—Canadian National Railways. (Uses station CFCA, Star Printing & Pub. Co., Toronto, Ont.)	500	356.9	840	Eastern
	CNRV—Vancouver, B. C.—Canadian National Railways, (Transmitter is on Lulu Island, B. C.)	500	291.1	1030	Pacific
	CNRW—Winnipeg, Manitoba—Canadian National Railways. (Uses station CKY, Manitoba Tel. System, Winnipeg, Manitoba.)	500	384.4	780	Central

Station WENR—Chicago, Ill.
Vin Lindhe.

Station WENR—Chicago, Ill.
The All-American Pioneers.

Station WENR—Chicago, Ill.
Everett Mitchell, director.

Station WSBF—St. Louis, Mo.
Jack Coleman, tenor.

Station WSBF—St. Louis, Mo.
Tom Terry, organist,

Station WSBF—St. Louis, Mo.
Helen G. Hatfield, announcer.

Station KNX—Los Angeles, Calif.
Wm. Gibb McAdoo.

Station KNX—Los Angeles, Calif.
Mr. and Mrs. Lew Cody.

Station KNX—Los Angeles, Calif.
Farina of the "Our Gang" comedy with sister.

Canadian Radio Broadcast Stations

By Provinces and Cities

Provinces	Cities	Call Letters	Wave Length (Meters)	Power (Watts)
ALBERTA	Calgary	CFAC	434.5	500
“	Calgary	CFCN	434.5	1800
“	Calgary	CJTC	434.5	250
“	Calgary	CNRC	434.5	500
“	Edmonton	CFCK	516.9	50
“	Edmonton	CHCY	516.9	250
“	Edmonton	CJCA	516.9	500
“	Edmonton	CNRE	516.9	500
“	Lethbridge	CJOC	267.7	50
BRITISH COLUMBIA	Burnaby	CFYC	410.7	500
“	Kamloops	CFJC	267.7	15
“	Sea Island	CJOR	291.1	100
“	Vancouver	CFCQ	410.7	10
“	Vancouver	CFDC	410.7	10
“	Vancouver	CKCD	410.7	1000
“	Vancouver	CKFC	410.7	50
“	Vancouver	CNRV	291.1	500
“	Victoria	CFCT	329.5	500
MANITOBA	Winnipeg	CKY	384.4	500
“	Winnipeg	CNRW	384.4	500
NEW BRUNSWICK	Moncton	CNRA	322.4	500
NOVA SCOTIA	Halifax	CHNS	322.4	100
ONTARIO	Brantford	CFGC	296.9	50
“	Burketon Jct., Durham Co.	CKCW	329.5	5000
“	Cobalt	CKMC	247.8	5
“	Hamilton	CHCS	340.7	10
“	Hamilton	CKOC	340.7	50
“	Huntsville	CHCO	247.8	5
“	Iroquois Falls	CFCH	499.7	250
“	Kingston	CFMC	267.7	20
“	Kingston	CFRC	267.7	500
“	Kitchener	CJCF	247.8	25
“	London	CJGC	329.5	500
“	Ottawa	CHXC	434.5	250
“	Ottawa	CKCO	434.5	100
“	Ottawa	CNRO	434.5	500
“	Prescott	CFLC	296.9	50
“	Preston	CKPC	247.8	7½
“	St. George	CKCP	267.7	25
“	Scarboro Station	CJYC	291.1	500
“	Toronto	CFCA	356.9	500
“	Toronto	CHIC	367	500
“	Toronto	CHNC	356.9	750
“	Toronto	CJBC	291.1–356.9	500
“	Toronto	CJCI	291.1	
“	Toronto	CJSC	356.9	500
“	Toronto	CKCL	356.9	800
“	Toronto	CKCX	291.1	500
“	Toronto	CKNC	357	750
“	Toronto	CNRT	356.9	500
“	York Co.	CJCQ	291.1	1000

Provinces	Cities	Call Letters	Wave Length (Meters)	Power (Watts)
P. E. ISLAND	Charlottetown	CFCY	312.3	50
"	Summerside	CHLC	267.7	25
QUEBEC	Montreal	CFCF	410.7	1650
"	Montreal	CHYC	410.7	750
"	Montreal	CKAC	410.7	7500
"	Montreal	CNRM	410.7	1000-1650
"	Quebec	CHRC	340.7	5
"	Quebec	CKCI	340.7	22½
"	Quebec	CKCV	340.7	100
"	St. Hyacinthe	CKSH	312.3	50
SASKATCHEWAN	Moose Jaw	CJRM	296.9	100
"	Regina	CHWC	312.3	50
"	Regina	CKCK	312.3	500
"	Regina	CNRR	312.3	500
"	Saskatoon	CFQC	329.5	500
"	Saskatoon	CHUC	329.5	500
"	Saskatoon	CJWC	329.5	250
"	Saskatoon	CNRS	329.5	500

Licenses Required for Both Transmitters and Receivers in Canada

All radio stations, whether used for transmitting or receiving purposes are required to be licensed in Canada. The penalty on summary conviction for operating an unlicensed radio station is a fine not exceeding $50.00, and on conviction or indictment a fine not exceeding $500.00, with imprisonment for a term not exceeding 12 months. in addition to forfeiture of all unlicensed apparatus. The different classes of stations for which licenses are issued and their license fees vary from $1.00 for a private receiving set to $50.00] for a public commercial station.

The issue of licenses for transmitting stations is limited to British subjects or to companies incorporated under the laws of the Dominion of Canada or its provinces. Licenses for private receiving sets are issued to any person irrespective of nationality. Licenses for receiving sets are obtained from the Postmaster of the larger towns and cities in the Dominion, radio dealers, Royal Canadian Mounted Police, Department of Radio Inspectors, Departmental Agencies or from the Department of Marine and Fisheries. Licenses for all other classes of stations are obtained from the Department of Marine and Fisheries at Ottawa.

All About Standard Time

The United States adopted standard time in 1883, on the initiative of the American Railway Association, and at noon of November 18th, 1883 the telegraphic time signals sent out daily from the Naval Observatory at Washington were changed to the new system, according to which the meridians of 75°, 90°, 105°, and 120° west from Greenwich became the time meridians of Eastern, Central, Mountain, and Pacific standard time respectively.

United States standard Eastern time is used from the Atlantic Ocean to a line through Toledo, Monroeville, Mansfield and Newark, O.; thence through Huntington, W. Va.; Norton, Va.; Johnson City, Tenn.; Asheville, N. C.; Atlanta and Macon, Ga.; and Apalachicola, Fla. U. S. standard Central time is used from this first line to a line through Mandan, N. D.; Pierre, S. D.; McCook, Neb.; Dodge City, Kans., and along west line of Okla., and Tex.; standard Mountain time is used from the second ine to a line that forms the western boundary of Mont,. thence follows the Salmon River westward, the western boundary of Idaho southward, the southern boundary of Idaho eastward, and thence passes southward through Ogden and Salt Lake City, Utah; Parker and Yuma, Ariz. U. S. standard Pacific time is used from the third line to the Pacific Ocean.

Almost all countries throughout the world use standard time that differs from Greenwich time by a whole number of hours or half-hours; a few countries, however, use standard time based on the longitude of their national observatories.

Table for Making Time Transitions

Eastern Standard Time..............	1	2	3	4	5	6	7	8	9	10	11	12
Central Standard Time..............	12	1	2	3	4	5	6	7	8	9	10	11
Mountain Standard Time.............	11	12	1	2	3	4	5	6	7	8	9	10
Pacific Standard Time..............	10	11	12	1	2	3	4	5	6	7	8	9

HOW TO USE TIME TRANSITION TABLE

If a station is giving a program at 8 o'clock Mountain time and you wish to find what this is equivalent to in Central time, find 8 o'clock in the third or Mountain time row. Then immediately above it in the same vertical column will be found the figure 9 in the Central time row. This indicates that the program would be heard at 9 o'clock Central time.

Foreign Radio Broadcast Stations

Including U. S. Possessions

Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
ALASKA				
Anchorage	Anchorage Radio Club			
Juneau	Alaska Elec. Light & Power Co.	**KFIU**	226	10
Ketchikan	Alaska Radio & Service Co.	**KGBU**	229	500
ALGERIA				
Algiers	Colin & Fils	**8DB**	180	100
ARGENTINE				
Buenos Aires	Radio Titanic	**LON**	206.9	500
" "	Radio Prieto	**LOO**	250	1000
" "	Tomas Torres	**LOQ**	206.8	1000
" "	Diario "Critica"	**LOR**	222	1000
" "	Municipality of Buenos Aires	**LOS**	285.7	5000
" "	Francisco J. Brusa	**LOV**	352.9	1000
" "	Grand Splendid	**LOW**	300	1000
" "	Radio Cultura	**LOX**	375	500
" "	Sociedad Radio Nacional	**LOY**	315.8	1000
" "	"La Nacion" Soc. A. B. C.	**LOZ**	333.3	1000
" "	Gino Bocci Hnos.	**B2**	275	100
" "	Gino Bocci Hnos.	**A11**		
" "	Sociedad Radiotelefonica	**A1**		
" "	Francisco J. Brusa	**B1**		1000
" "	Facultad de Ciencias Medicas	**C1**		
" "	Departmento Nacional de Higiene	**C2**		
Cordoba	Antonio Vanelli	**H4**	275	20
"	Sociedad Radio Comercial de Cordoba		381	100
"	Jorge Coen	**HA8**	255	50
"	Diario "Los Principios"	**H6**	250	20
Hurlingham, FCP.	Felix Gunther	**DA-1**		
La Plata, FCS.	Universidad Nacional	**LOP**	425	1000
Mendoza	Ministerio de Obras Publicas	**LOU**	380	500
"	Pedro B. Baldasarre	**M6**	348	100
Monte Grande, FCS.	Argentine Broadcasting Assn.			
Olivos, FCCA.	Eugenio A. Vautier	**LOT**	272.7	1000
Rio Cuarto	Arturo Rodriguez	**H5**	275	100
Rosario	Manuel Fugardo	**F4**	260	100
San Fernando, FCCA.	Americo Liberti	**D3**	235.3	100
Santa Fe	Jose Roca Soler	**F1**	279	20
" "	Sociedad Rural de Cerealistas	**F2**	270	100
AUSTRALIA				
Adelaide	Central Broadcasters Ltd.	**5CL**	395	5000
"	F. J. Hume	**5DN**	313	500
"	Millswood Auto & Radio Co.	**5MA**		
"	Marshall & Co.	**5MC**	273	500
Bathurst		**2MK**		
Brighton		**3PB**		
Brisbane	Dr. V. McDowell	**4CM**	278	250
"	Radio Manufacturers Ltd.	**3MB**	337	250
"	Queensland Radio Service	**4QG**	385	5000
Hobart	Tasmanian Broadcasting Pty.	**7ZL**	535	1500
Melbourne	Associated Radio Co.	**3AR**	484	1600
"	Broadcasting Co. of Australia	**3LO**	371	5000

Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
AUSTRALIA				
Melbourne	O. J. Nilson & Co.	3UZ	319	100
"	L. J. Hellier	3WR	303	100
Mildura	R. J. Egge	3EO	286	100
Newcastle	H. A. Douglas	2HD	288	100
Northbridge	Otto Sandel	2UW	263	500
Perth	Westralian Farmers, Ltd.	6WF	1250	5000
Rockhampton	Queensland Government	4RN	323	500
Sydney	The Electrical Utilities Supply Co.	2UE	297	250
"	Burgin Electric Co.	2BE	316	100
"	Farmer & Co., Ltd.	2FC	442	10000
"	Broadcasters Ltd., Sydney	2BL	353	5000
Toowoomba	Gold Radio Elec. Service	4GR	294	100
AUSTRIA				
Graz	Oesterreichische Radio-verkehrs Gesellschaft		404	500
Vienna	Oesterreichische Radio-verkehrs Gesellschaft	ORV	530	1500
BELGIUM				
Brussels	Radio Belgique Co.	BAV	265	1500
BOLIVIA				
Oruro	Radio Club Boliviano	CPM	50—200	50
BRAZIL				
Bahia	Radio Sociedade de Bahia		250—450	500
Bello Horizonte	Radio Sociedade de Mina Geraes		400	500
Ceare	Radio Club Cearense			50
Curytiba	Livio Moreira			
Fortaleza	Radio Club			300
Goyanna	Benedicto Ravello			
Matto Grosso	Radio Club de Campo Grande			
Minas Geraes	Juiz de Fora			100
Para	Radio Club de Para			100
Parana			370	300
Parahyba	Radio Sociedade de Parahyba			
Pelotas	Radio Sociedade Pelotense			
Penedo	A. G. Oliveira			
Pernambuco	Radio Club de Pernambuco		310	1000
"	Cia Radiotelegrafica Brasileira		250—380	500
"	Radio Sociedade de Jader de Andrada			
"	Radio Sociedade de Garanhuns			
Petropolis	Radio Club de Petropolis			
Porto Alegre	Radio Sociedade Riograndense	RSR	381	80
Praia Vermelha	Radio Club do Brasil	SQIB	320	500
Rio de Janeiro	Radio Sociedade de Rio de Janeiro		381	1000
" " "	Radio Club do Brasil	SPE	312	500
" " "	National Telegraph Service		450	500
Sao Paulo	Sociedade Radio Educadora		310	1000
" "	Sociedade Radio Educadora Paulista	SQIG	450	1000
" "	Radio Club de Sao Paulo		350	100
" "	Radio Bandeirantes		370	50
" "	Dias Carneiro & Cia.		380—420	100
CANARY ISLANDS				
La Laguna	Servando Ortoll Delmotte	EAJ5	280	50
Las Palmas	Canary Islands Radio Club		300	6
CHILE				
Antofagasta	Oficina Jose Santos Ossa	CLAC		50
"	Oficina Jose Francisco Vergara	CLAD		50
Iquique	Gildemeister & Cia.	CLAE		100
"	Oficina San Pedro	CLAF		100
"	Oficina Pena Chica	CLAG		100

Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
CHILE				
San Eugenio	Rene Doneaud		230	25
Santiago	Radio Corporation of Chile	**CBC**	400—600	250
"	Chilean Radiophone Club	**CHAC**	300	200
"	Ferrocarril Transandino Chileno	**CLAA**		200
"	Carlos Buin Walsen	**CMAA**	240	20
"	Sociedad Radio Chileana	**CMAB**	480	1500
"	Castagneto Felli	**CMAD**	320	100
"	Ministerio de Higiene	**CMAF**	400	1350
"	Sociedad Broadcasting de Chile	**CRC**	385	350
"	"El Mercurio"	**CMAC**	360	1000
"	Radio Comercial	**CMAE**	280	500
"	Pedro Arroyo	**CMAG**	250	250
"	Cia Radio Transandino	**CMAI**	260	100
"	Universidad de Chile	**CMAU**	440	100
"		**ORC**	430	
"		**RC**	350	50
"	Harvey Diamond	**CNAA**		
"	Jose Bellalta	**CNAC**		
Tacna	Ministerio de Relaciones Exteriores	**CMAT**	365	1000
Valparaiso	Cia Radio Transandina	**CNAD**	265	500
"	Cia de Salitres de Antofagasta	**CLAB**		50
Vilna del Mar	Antonio Cornish Besa	**ACB**	400	50
" " "	Antonio Cornish Besa	**CNAB**		
CHINA				
Shanghai	Kellogg Switchboard & Supply Co.	**KRC**	335	500
"	Radio Supply Co. of Nanking Road	**RSC**	235	10
Tientsin	Gisho Electrc Co.	**GEC**	288	50
Victoria (Hongkong)	Hongkong Radio Society	**5HK**	475	150
COSTA RICA				
San Jose	Government			
CUBA				
Caibarien	Maria J. Alvarez	**6EV**	250	50
Camaguey	Antonio Sarasola	**7AZ**	275	50
"	Salvador Rionda	**7SR**	350	500
Camajuani	Diego Ibarra	**6YR**	200	20
Central Tuinicu	Frank H. Jones	**6KW**	340	100
" "	Frank H. Jones	**6KJ**	275	100
Ciego de Avila	Eduardo V. Figueroa	**7BY**	320	10
Cienfuegos	Jose Ganduxe	**6BY**	260	200
"	Antonio T. Figueroa	**6CX**	170	20
"	Eduardo Terry	**6DW**	225	10
"	Luis Del Castillo	**6GR**	250	10
"	Juan Pablo Ros	**6GF**	190	50
"	Eligio Cobelo Ramirez	**6JQ**	275	10
"	Valentin Ullivarri	**16AZ**	200	20
Elia				300
Havana	Credito y Construcciones Cia.	**2HP**	295	100
"	Julio Power	**2JP**	270	20
"	Frederick W. Borton	**2CX**	320	10
"	Alberto S. Bustamante	**2AB**	235	10
"	Cuban Telephone Co.	**PWX**	400	650
"	Jose Leiro	**2JL**	275	50
"	Alvara Daza	**2K**	200	20
"	E. Sanchez de Fuentes	**2KD**	350	50
"	Fausto Simon	**2MN**	270	30
"	"El Pais"	**2EP**	355	400
"	Humberto Giquel	**2CG**	350	15
"	Bernardo Barrie	**2BB**	255	15

Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
CUBA				
Havana	Frederick W. Borton	**2BY**	315	100
"	Luis Casas	**2LC**	250	30
"	Julio Power	**2HS**	180	50
"	Jose Lara	**2LR**	235	50
"	Manuel y Guillermo Salas	**2MG**	280	20
"	R. B. Waters	**2MK**	85	20
"	Maria Garcia Velez	**2OK**	360	100
"	Oscar Collar Orta	**2OL**	300	100
"	Roberto E. Ramirez	**2TW**	230	20
"	Roberto E. Ramirez	**2UF**	265	10
"	Roberto Karman	**2RK**	315	100
"	Raul Karman	**2RY**	275	10
"	Homero Sanchez	**2SZ**	180	10
"	Amadeo Saenz	**2WW**	210	20
"	Antonio A. Ginard	**2XX**	150	50
"	Raul Perez Falcon	**2JD**	105	20
"	Heraldo de Cuba	**2HC**	275	500
Matanzas	Leopoldo T. Figueroa	**5EV**	360	10
"	Ernesto V. Figueroa	**5AZ**	200	50
"	Leon Gonzalez Velez	**5BY**	190	10
Nueva Gerona	Isle of Pines Telephone Co.	**8JQ**	225	20
Puerto del Rio	Antonio Sarasola	**1AZ**	275	50
Sagua la Grande	Santiago Ventura	**6HS**	200	10
Santiago	Alfredo Vinnet	**8FU**	225	15
"	Pedro C. Anduz	**8DW**	275	50
"	Alfredo Brooks	**8AZ**	240	20
"	Ceferino Ramos	**8IR**	190	20
"	Alberto Ravelo	**8BY**	250	100
"	Guillermo Polanco	**8HS**	200	20
Tuinicu	Frank H. Jones	**6KW**	368	1000
"	Short Wave Experimental Station	**6XJ**		
CZECHOSLOVAKIA				
Brunn	Radio Journal	**OKB**	750	1000
Prague	Radio Journal	**OKP**	513	5000
DENMARK				
Copenhagen	Copenhagen Radio Broadcasting Station		337	500
Soro	Ministry of War		1150—2400	1000
EQUADOR				
Guayaquil	J. Puig Verdaguer			
FINLAND				
Hango	Nuoren Voiman Liiton Radiohydistys		259.6	200
Helsingfors	Civil Guards of Finland		522	500
Jyvaskyla	Nuoren Voiman Liiton Radiohydistys		301.5	100
Mikkeli	Nuoren Voiman Liiton Radiohydistys		561	100
Pori	Nuoren Voiman Liiton Radiohydistys		255.3	100
Skatudden	Military Station Radio Div.		318	750
St. Michel	Nuoren Voiman Liiton Radioyhdistys		561	500
Tammerfors	Nuoren Voiman Liiton Radiohydistys	3NB	393	250
Tampere			373	250
Uleaborg			233	100
FRANCE				
Agen	Dept. of Lot et Garonne	**2BD**	318	250
Grenoble	Ministry of P. T. T.		380	150
Issy-les-Moulineaux	Ministry of War	**QGA**	1800	500
Lyon	Ministry of P. T. T.	**YN**	476.2	1200
"	Radio Lyon		280	2000
Marseilles	Ministry of P. T. T.		340.1	300
Mont-de-Marsen			366	300

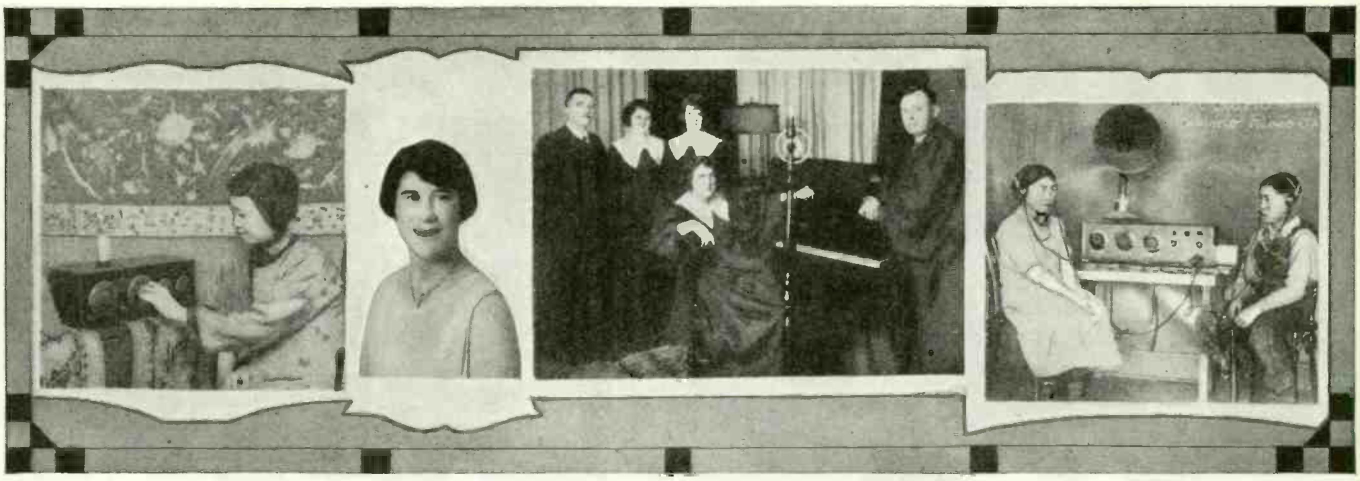
Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
FRANCE				
Montpellier	Societe Languedocienne de T. S. F.		168	100
Paris	Ecole Superieure de P. T. T.	**FPTT**	459.4	500
"	Eiffel Tower, Army	**FL**	2200	4000
"	Societe Francaise Radioelectrique	**8AJ**	1780	100
"	Petit Parisien		345	500
"	Cie. Francaise de Radiophone		1750	4000
Pic du Midi			350	
St. Etienne	Radio Club Forezien		220	50
Toulouse	Aerodrome	**MRD**	315	2000
"	La Radio		435.1	2000
GERMANY				
Berlin	Koenigswusterhausen Deutsche Welle A. G.	**AFP**	1300	5000
"	Vox Haus Funkstunde	**AB**	571	2250
"	Witzleben Funkstunde A. G.		504	
Bremen	Nordischer Rundfunk	**BMN**	400	1500
Breslau	Schlessische Funkstunde		418	4000
Dortmund	Westdeutsche Funkstunde		283	
Dresden	Mitteldeutscher Rundfunk		294	750
Elberfeld	Westdeutsche Funkstunde		259	
Frankfort-on-the-Main	Sudwestdeutscher Rundfunkdienst	**LP**	470.4	750
Freiburg-Brsg.	Suddeutscher Rundfunk		446	
Gleiwitz	Schlesischer Funkstunde		251	1500
Hamburg	Nordischer Rundfunk	**EG**	392	750
Hanover	Nordischer Rundfunk		297	1500
Kassel	Sudwestdeutsche Rundfunk		272.5	1500
Kiel	Nordicher Rundfunk		233	
Koenigsberg	Ostmarken Rundfunk		462	750
Leipzig	Mitteldeutscher Rundfunk	**MR**	452	750
Munich	Deutsche Stunde in Bayern	**WM**	488	750
Munster	Westdeutsche Funkstunde		412	750
Nuremberg	Deutsche Stunde in Bayern		340	750
Stettin	Funkstunde A. G.		241	
Stuttgart	Suddeutscher Rundfunk	**OKP**	446	1500
HAWAII				
Honolulu	Honolulu Advertiser	**KGU**	270	500
HUNGARY				
Budapest	Hungarian States' Post and Telegraph	**MTI**	546	1000
"	Magyar Tavirati Iroda		1050	2000
ICELAND				
Reykjavik			430	500
INDIA				
Bangalore	Indian Broadcasting Co.			
Bombay	Walter Rogers & Co.	**2AX**	226	
"	Bombay Presidency Radio Club	**2FV**	387	220
Calcutta	Indian States & Eastern Agency	**5AF**	425	1500
Karachi	Karachi Radio Club		425	40
Madras	Crampton Elec. Co.		220	120
Rangoon	Radio & Wireless Club of Burma		450	40
IRISH FREE STATE				
Dublin	Government	**2RN**	319.1	1500
ITALY				
Milan	Unione Radiofonica Italiana	**IMT**	308	1280
Rome	Unione Radiofonica Italiana	**IRO**	434	1200
JAPAN				
Nagoya	Nagoya Radio Broadcasting Co.	**JOCK**	365	1500
Osaka	Osaka Radio Broadcasting Co.	**JOBK**	385	1500
Tokyo	Tokyo Radio Broadcasting Co.	**JOAK**	375	1500
LATVIA				
Riga			480	2000
LUXEMBOURG				
Luxembourg		**LOAA**	217.4	1500

Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
MEXICO				
Chihuahua	Federal Government	CZF	325	250
"	Telefonos Del Gobierno del Estado de Chihuahua	ZCF	310	250
"	Compania Telefonica	XICE	500	500
Guadelajara	Radio Club—Degollado Theatre		280	10
"	Federal Military Command	FAM	490	1000
Mazatlan	Castulo Llamas	CYR	475	250
Merida	Partido Socialista del Surestan	CYY	549	100
Mexico City	Efran R. Gomez	CYA	300	500
" "	Jose J. Reynosa (El Buen Tono)	CYB	275	500
" "	Miguel S. Castro (La High Life)	CYH	375	100
" "	General Electric Co.	CYJ	410	1000
" "	"El Universal"	CYL	400	500
" "	Martinez y Zetina	CYO	425	100
" "	Excelsior Compania Editorial	CYX	260	750
" "	La Liga del Radio	CYZ	400	100
" "	Departmento de Educacion	CZE	350	500
" "	Secretaria de Industria, Comercio y Trabajo	CZI	450–550	750
" "	Fabrica Nacional de Vestuario	IJ		500
" "	F. C. Stephenex	IR	250	100
Oaxaca	Federico Zonilla	CYF	265	100
Puebla	Augustin del P. Saenz	CYU	312	100
Saltillo	Colegio Ateneo Fuente		450	135
Tampico		CYE	360	100
"	Alberto Isaak	CYQ	322	100
Vera Cruz	Ministerio de Communicaciones	CYC	300	500
" "		CYD	250	500
MOROCCO				
Casablanca	Radio Club de Moroc	CNO	250	500
NETHERLANDS				
Hilversum	Nederlandische Seintoellen Fabriek	PFBI	1000	10,000
NETHERLANDS EAST INDIES				
Soerabaya	Radiotelegraph Club		90	
NEW ZEALAND				
Auckland	Newcomb (Ltd.)	1YL	260	500
"	The Radio Broadcasting Co. of New Zealand	1YA	420	200
"	La Gloria Gramophone Co.	1YB	275	50
"	L. R. Keith	1YD	330	50
Christchurch	Radio Broadcasting Co.	3AC	240	10
Dunedin	Otago University	4XO	140	
"	British Electrical & Engineering Co.	4YA	310	500
"	Radio Supply Co.	4YO	370	500
"	Radio Broadcasting Co.	VLDN	380	750
Gisborne	Gisborne Radio Co.	2YM	260	500
Napier	B. C. Spackman	2YL	190	100
Wellington	Broadcastings Ltd.	2YB	275	15
"	Radio Broadcasting Co.	2YK	295	120
Whangarei	N. C. Shepherd	1YC	250	15
NORWAY				
Bergen	Bergen Broadcasters		358	500
Oslo	Broadcasting Co. A. S.	OSLO	381.2	1500
PERU				
Lima	Peruvian Broadcasting Co.	OAX	380	1500
"	German Gallo	5OA	250	20
"	Enrique Perez	4OA	250	20
"	Augusto Gilardi	3OA	250	20
PHILIPPINE ISLANDS				
Iloilo		KPM	400	500
Manila	I. Beck, Inc.	KZIB	260	10

Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
PHILIPPINE ISLANDS				
Manila	Radio Corp. of the Philippines	KZKZ	270	500
"	Far Eastern Radio, Inc.	KZRQ	385	500
POLAND				
Warsaw	Government	PTR	380	700
PORTO RICO				
San Juan	Radio Corp. of Porto Rico	WKAQ	340	500
PORTUGAL				
Lisboa	Grandes Armazeins do Chiado	PIAA	320	500
Montesanto	Government Wireless Station	CTV	2450	1500
RUSSIA				
Moscow	Sokolniki		1010	2000
"	Trade Union		450	2000
"	Lubovitch		365	
"	Union of Soviet Workers		675	
"	Comintern	RDW	1450	12000
"	Radio-Peredatcha		400	2000
Leningrad			310–240	2000
Niji-Novgorod			253	1000
Kiev			1000	2500
SAN SALVADOR				
San Salvador	Government of Salvador	AQM	452	500
SENEGAL				
St. Louis	Senegal Radio Club		300	100
SPAIN				
Barcelona	Radio Barcelona (Hotel Colon)	EAJ1	325	1000
"	Radio Catalana	EAJ13	460	1000
Bilbao	Radio Club Vizcaina	EAJ9	415	200
"	Radio Vizcaya	EAJ11	418	2000
"	Armando de Otera		383	200
Cadiz	Radio Cadiz	EAJ3	360	200
"	Juan Iaborra-Iahera	EAJ10	330	1000
Cartagena	Enrique de Orbe	EAJ16	335	1000
"		EBX	1200	1000
Madrid	Radio Espana	EAJ2	334	300
"	Escuela Superior	PTT	458	1000
"	Antonio Castilla	EAJ4	375	4000
"	Radio Iberica	EAJ6	392	1000
"	Union Radio	EAJ7	372.4	1000
"	Radio Espanola	EAJ15	490	1000
"		EGC	1650–2200	2000
Malaga	Spanish Telecommunication Co.	EAJ25	325	2000
"	Alfonso Villota		325	200
Oviedo (Cima)	Arturo Cima	EAJ19	340	1000
"		EAJ12	345	1000
Salamanca		EAJ22	290	1000
San Sebastian	Sabino Ucelayeta	EAJ8	344.6	500
Sevilla	Manuel Garcia Ballesta	EAJ17	330	100
"	Jorge la Riva	EAJ21	300	1000
"	Radio Club Sevillano	EAJ5	350	150
Valencia		EAJ24	360	1000
"	Jose Lopes Azcar	EAJ14	400	500
Zaragoza		EAJ23	325	1000
STRAIGHTS SETTLEMENTS				
Singapore	Malaya Amateur Wireless Society		330	150
SWEDEN				
Boden	Radiotjanst	SASE	1350	500
Eskilstuna	Radio Club	SMUC	243	150

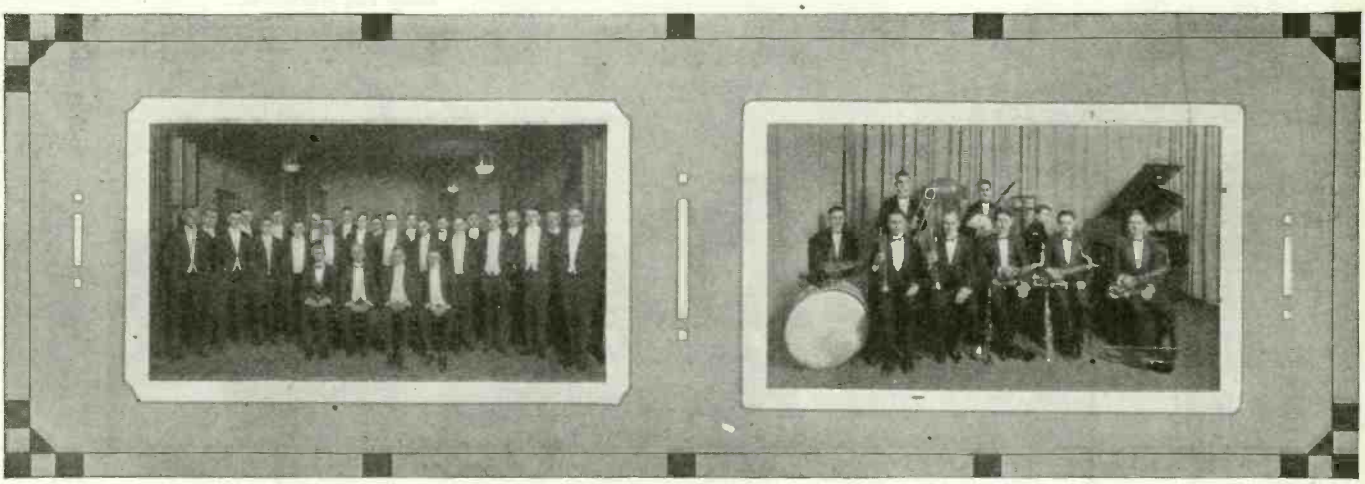
Countries and Cities	Owner	Call Letters	Wave Length (Meters)	Power (Watts)
SWEDEN				
Falun	Radiotjanst	**SMZK**	370	40
Gaevle	Radio Club	**SMXF**	325	200
Goteborg	Radiotjanst	**SASB**	290	500
Jonkopings	Jonkopings Rundradiostation	**SMZD**	265	200
Karlsborg	Radiotjanst	**SASF**	1350	50
Karlskrona			196	200
Karlstad	Radio Club of Karlstad	**SMXG**	221	1000
Linkoeping	Radio Club	**SMUV**	467	25
Malmo	Radiotjanst	**SASC**	270	500
Norrkoeping	Radio Club	**SMVV**	260	175
Stockholm	Radiotjanst	**SASA**	454.5	1500
Sundsvall	Radiotjanst	**SASD**	545	500
Trollhattan	Trollhattans Rundradiostation	**SMXQ**	345	50
SWITZERLAND				
Berne	Radio—Genossenschaft		411	1500
Geneva	Radio Broadcasting Soc. of Geneva		760	500
Lausanne	Lausanne Radio Society	**HB-2**	318	500
Zurich	Zurich University	**RGZ**	515–650	500
"	Zurich Radio Genossenschaft		514.1	500
TUNISIA				
Tunis	French Army	**OCTU—TUA**	1450--45	500
UNION OF SO. AFRICA				
Cape Town	Cape Publicity Assn.	**WAMG**	375	1200
Durban	Town Council		400	1200
Johannesburg	Associated Scientific & Technical Societies	**JB**	438	1000
UNITED KINGDOM				
Aberdeen	British Broadcasting Co.	**2BD**	500	1500
Belfast	British Broadcasting Co.	**2BE**	306.1	1500
Birmingham	British Broadcasting Co.	**5IT**	491.8	1500
Bournemouth	British Broadcasting Co.	**6BM**	326.1	1500
Cardiff	British Broadcasting Co.	**5WA**	353	1500
Daventry	British Broadcasting Co.	**5XX**	1600	25000
Dundee	British Broadcasting Co.	**2DE**	288.5	200
Edinburgh	British Broadcasting Co.	**2EH**	294.1	200
Glasgow	British Broadcasting Co.	**5SC**	405.4	1500
Hull	British Broadcasting Co.	**6KH**	288.5	200
Leeds-Bradford	British Broadcasting Co.	**2LS**	277.8—254.2	200
Liverpool	British Broadcasting Co.	**6LV**	297	200
London	British Broadcasting Co.	**2LO**	361.4	3000
Manchester	British Broadcasting Co.	**2ZY**	384.6	1500
Newcastle	British Broadcasting Co.	**5NO**	312.5	1500
Nottingham	British Broadcasting Co.	**5NG**	275.2	200
Plymouth	British Broadcasting Co.	**5PY**	400	200
Sheffield	British Broadcasting Co.	**6FL**	272.7	200
Stoke-on-Trent	British Broadcasting Co.	**6ST**	288.5	200
Swansea	British Broadcasting Co.	**5SX**	288.5	200
URUGUAY				
Montevideo	Radio Sudamericano	**CWOZ**	320	500
"	Diario "El Dia"	**CWOR**	375	500
"	Danree & Cia	**CWOF**	300	200
"	Templo Metodista	**CWOG**	325	100
"	Instituto Metereologico	**CWOB**	240	500
"	General Electric Co. of Uruguay	**CWOS**		500
VENEZUELA				
Caracas	Empresa Venezolana de Radiotelefonia	**AYRE**	374	1000
YUGOSLAVIA				
Belgrade	Cie. Generalle De T. S. F.	**HFF**	1650	2000

Station KGO—Oakland, Calif.



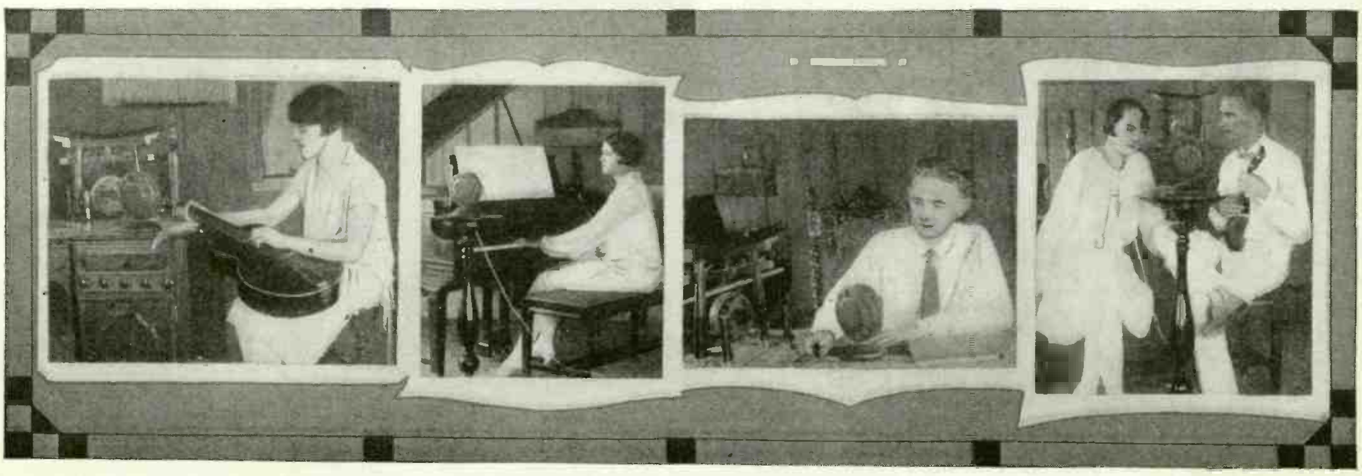
Mrs. Con San Mue tuning in KGO. Margaret Avery, cellist. The First Methodist Church Quartette. Eskimo children in the Pilot Station Government School.

Station WHAZ—Troy, N. Y.



Students' Glee Club. Campus Serenaders.

Station WGHB—Clearwater, Fla.



Caroline Lee, "Miss Radio of the South." Miss Blanche Cloyd, coloratura soprano. W. Walter Tison, directing announcer. Mrs. Carl Stephen and Ticket Holmes.

Station WRNY—New York, N. Y.

Grant Mitchell, star of "One of the Family" at the Eltinge Theatre.

Julia Hoyt broadcasting from the unfinished French Building.

Life saving lessons through WRNY.

The New York Edison Ensemble.

Sol Rothschild, injured four years ago is shown broadcasting.

Judson House tenor

Madge de Bries, Spanish dancer.

Our 1927 Broadcast Station Popularity Contest

WITH this announcement of the first nation-wide radio listeners' "broadcast station popularity contest," RADIO LISTENERS' GUIDE AND CALL BOOK inaugurates a new and unique effort to promote closer relations of mutual understanding and co-operation between the public and the broadcasters.

Year in and year out, the various broadcast stations throughout the country concentrate their utmost effort to please and entertain *you*, their audience. Here is your opportunity to show the exact measure of your appreciation—and incidentally to obtain still *better* programs by indicating to the managers of the various stations just what programs among those offered are most to your liking. This is to be done by registering your individual vote in favor of those stations whose programs most uniformly win your interest and approval.

In this 1927 broadcast station popularity contest, the editors of RADIO LISTENERS' GUIDE AND CALL BOOK will present to each of the ten most popular broadcast stations in the country, as elected by the votes of all our readers, a handsome silver loving cup, ten trophies in all, to the ten stations winning the largest number of ballots of approval from this picked coast-to-coast radio audience.

We believe that this contest, the first of its kind, will have a stimulating constructive effect on broadcasting, and help to raise to still higher levels the standards of merit and interest already established.

More than this, however, for the furtherance of radio as a popular public institution, the awards are intended as tokens of your appreciation—*your* award of honor to an institution whose usefulness is measured in terms of its service to *you*.

Size of cup 17½" high.

Each cup will be presented as a gift from the readers of RADIO LISTENERS' GUIDE AND CALL BOOK, to the most popular stations, and will be engraved with an inscription to this effect. They will be displayed in the studios of the prize-winning stations as permanent reminders of the fact that their programs have won this definite popular recognition as most widely enjoyed and appreciated in the whole line-up of broadcast effort.

In the event of ties in the number of votes, a prize cup identical to those offered will be awarded to each tying contestant.

This contest closes at 12 o'clock noon, April 16, 1927. The list of winning stations will be announced in the Summer issue of RADIO LISTENERS' GUIDE AND CALL BOOK.

As Station WRNY in New York is operated by the owners of this publication, it is to be regarded as excluded absolutely from this contest. We ask our readers not to include WRNY in their votes, as for obvious reasons we cannot give our own station a place in an impartial voting contest conducted among our readers.

It is a simple matter to cast your vote. Just fill in the designated spaces on the voting form with the call letters of the ten stations you like best, with your choices in order as indicated on the ballot. This places you under no obligation of any kind. You need not even sign your vote, if you do not care to do so. If you do sign your name and address on the voting blank, however, we shall send you a contest souvenir of value to every radio listener, in appreciation of your co-operation for the encouragement and recognition of the efforts of the broadcast stations.

Use the form printed below. We suggest that you clip and fill it out now, and mail it at once before it slips your mind.

RADIO LISTENERS' GUIDE AND CALL BOOK
53 PARK PLACE, NEW YORK CITY
BROADCAST STATION POPULARITY CONTEST

I hereby cast my vote for the ten following Broadcast Stations by their call letters:

1st Choice	2nd Choice	3rd Choice	4th Choice	5th Choice	6th Choice	7th Choice	8th Choice	9th Choice	10th Choice

(Indicate call letters of favorite stations in spaces above according to your choice.)

I would also like to have you send me free of charge the souvenir of interest to every radio listener.

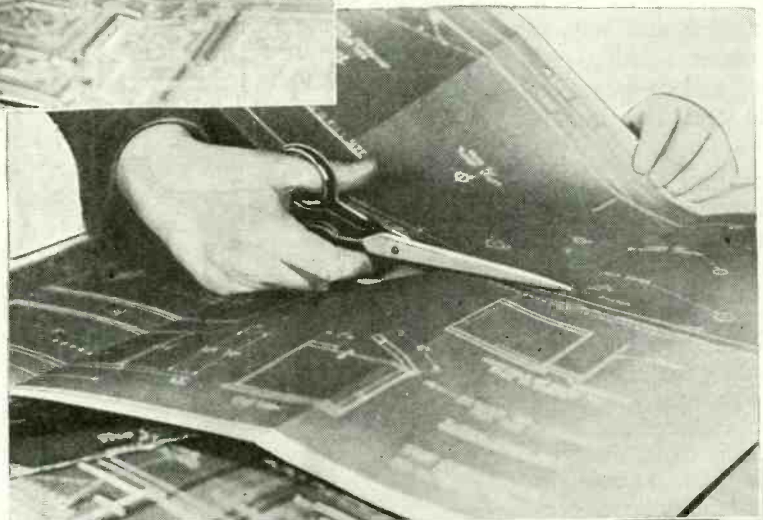
NAME

STREET

CITY

STATE

How to Use
This Method Makes



Blue print patterns used to drill panels for various sets are usually furnished in envelopes as shown in the upper left hand photo. The blue print panel drilling pattern is removed from the envelope and placed flat on a table, and the pattern is cut out with a shears along the dotted lines as shown at the left.

ONE of the easiest ways to build your own radio set is that of employing radio set patterns. These are usually contained in envelopes along with picture diagrams and instructions, etc., for building various sets.

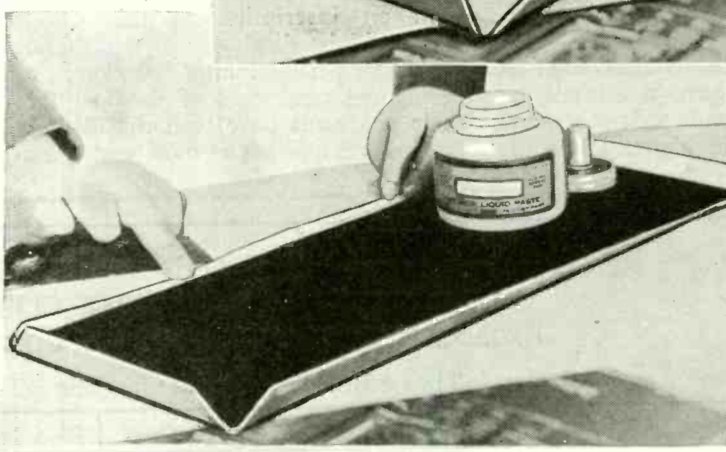
Cutting Out Panel Drilling Pattern

The blueprint panel drilling pattern is removed from the envelope and unfolded. Laying the pattern face up on a flat surface, the panel is cut out along the dotted lines. The pattern is then reversed or placed face down and the flaps are creased back along the heavy edges as shown in the accompanying photo.

After the pattern has been cut out the flaps on all four sides are folded back along the heavy lines or edge of the panel. Care should be exercised in doing this as the pattern should fit snug around all four edges when placed on the panel.

Paste the Pattern on Panel

After all four sides have been carefully creased, the panel itself is placed front side down on the back of the pattern, and ordinary photo paste is applied to the underneath edges of the flaps. These are bent over on the back of the panel and pasted securely. Care should be taken in doing this to see that the pattern fits snugly around all four edges. When this is done, the pattern should lay absolutely flat on the front surface of the panel as pictured in the accompanying photo.

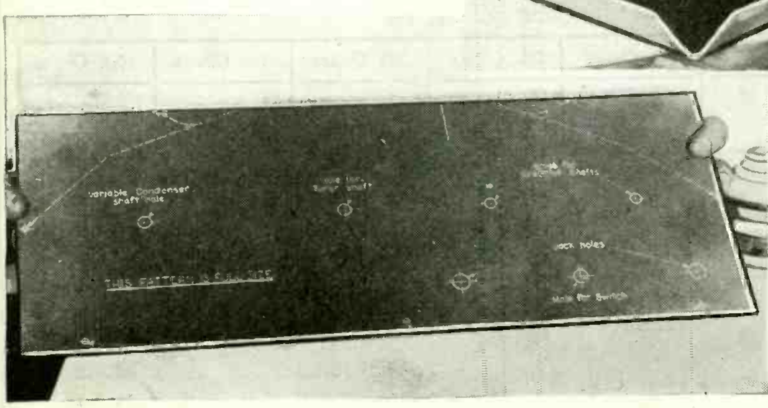


The panel is placed on the pattern face down, and with ordinary photo paste on the underside of the flaps they are pasted on the back of the panel as shown in the photo at the left.

Using Templates with Pattern

Condenser dial, rheostat or other templates of parts to be mounted on the panel can easily be employed in conjunction with the panel drilling pattern. These templates are usually furnished with parts by the various manufacturers.

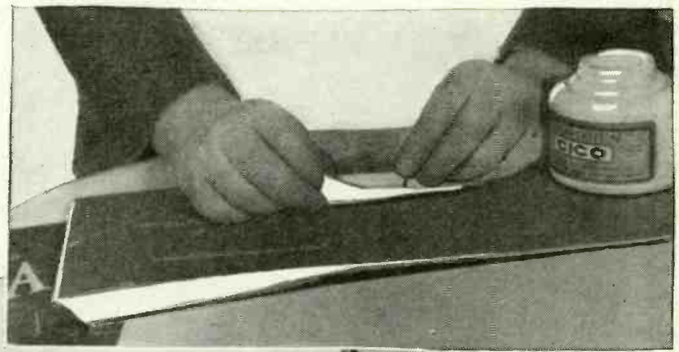
The point of a pin is pierced through the center of the shaft hole in the template and located exactly in the center of the cross lines on the pattern, the method of doing this is clearly shown in the upper right-hand photo. Holding the point of the pin on the center of the cross lines of the pattern, the template is turned until the desired angle of the mounting screw holes is

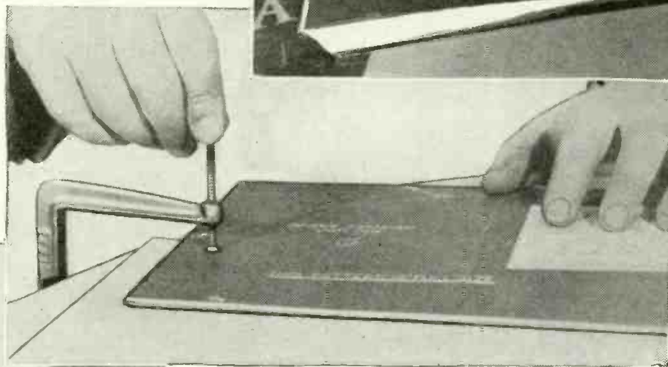


How the panel drilling pattern appears when pasted on panel.

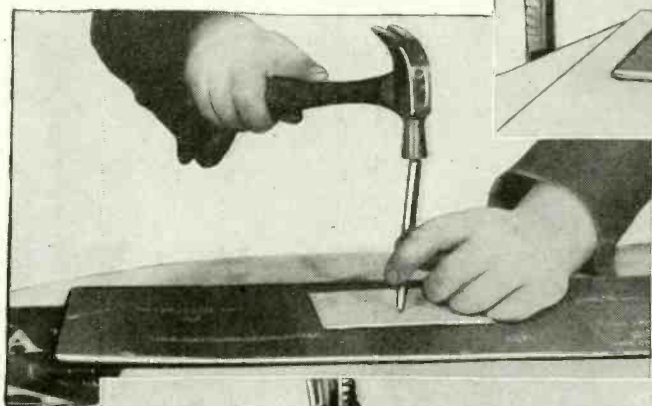
Radio Patterns

Panel Drilling Simple

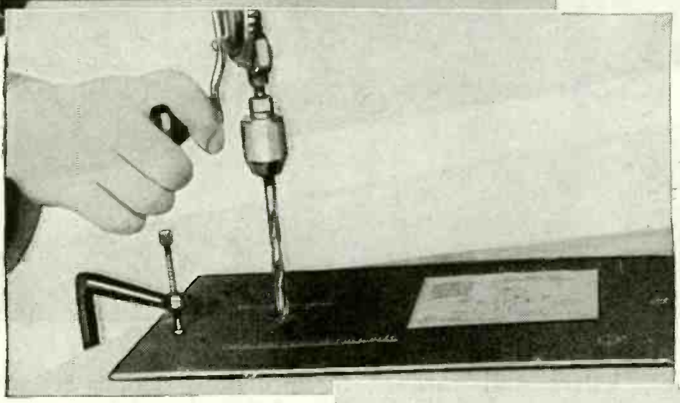




Inasmuch as only the holes for shafts of parts are indicated on the patterns, the mounting screw holes can be located with templates furnished with various parts. These are pasted directly on the panel and the shaft hole center is located with the point of a pin.



The photos directly above and at the left show how the panel is held secure to the work bench with a clamp and the method of centerpunching holes.



determined. The pin is removed and the template is held firm against the panel, and then pasted down directly on the surface of the pattern exactly in the position wanted. The hole centers for the shafts and mounting screw holes of the various parts can then be center punched.

Drilling the Panel

In order to prevent the panel from turning while the holes are being drilled, it is a good plan to hold the panel securely to the work bench with small C-clamps as shown. First begin drilling all holes with a $\frac{1}{16}''$ diameter drill, afterwards using the larger size drill, thus preventing the holes from being drilled off center which might possibly occur when using the larger drill first.

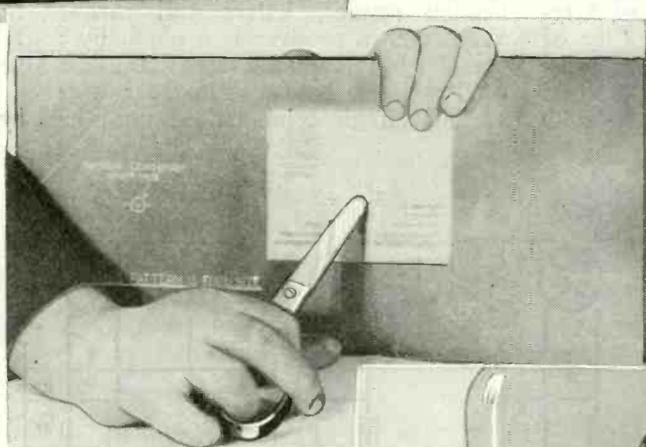
An Improvised Reamer for Shaft Holes

Should the constructor not have larger size drills on hand for making holes such as those for jacks, switches, etc., the ordinary household shears can be used for reaming these holes to their proper size. When all holes have been drilled, the pattern can be removed from the panel by immersing it under the kitchen faucet. Attention is called here that cool water should be used in doing this, because if warm water is run over a hard rubber panel there may be a possibility of the panel bending in the process of removing the pattern.

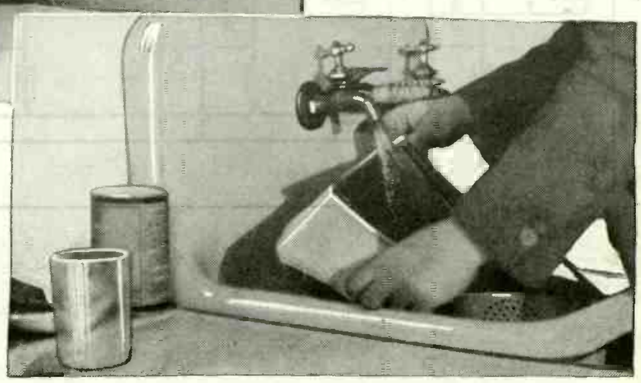
The burrs around the edges of the holes can afterwards be removed by turning the blunt point of an ordinary table knife in each hole.

Assembly and Wiring from Patterns

In proceeding with the construction of the set, the next step usually is to mount the various parts on the baseboard, wiring these according to the picture wiring diagram or schematic diagram furnished. The parts used on the panel are mounted next, the panel is fastened to the baseboard and the wiring is completed.



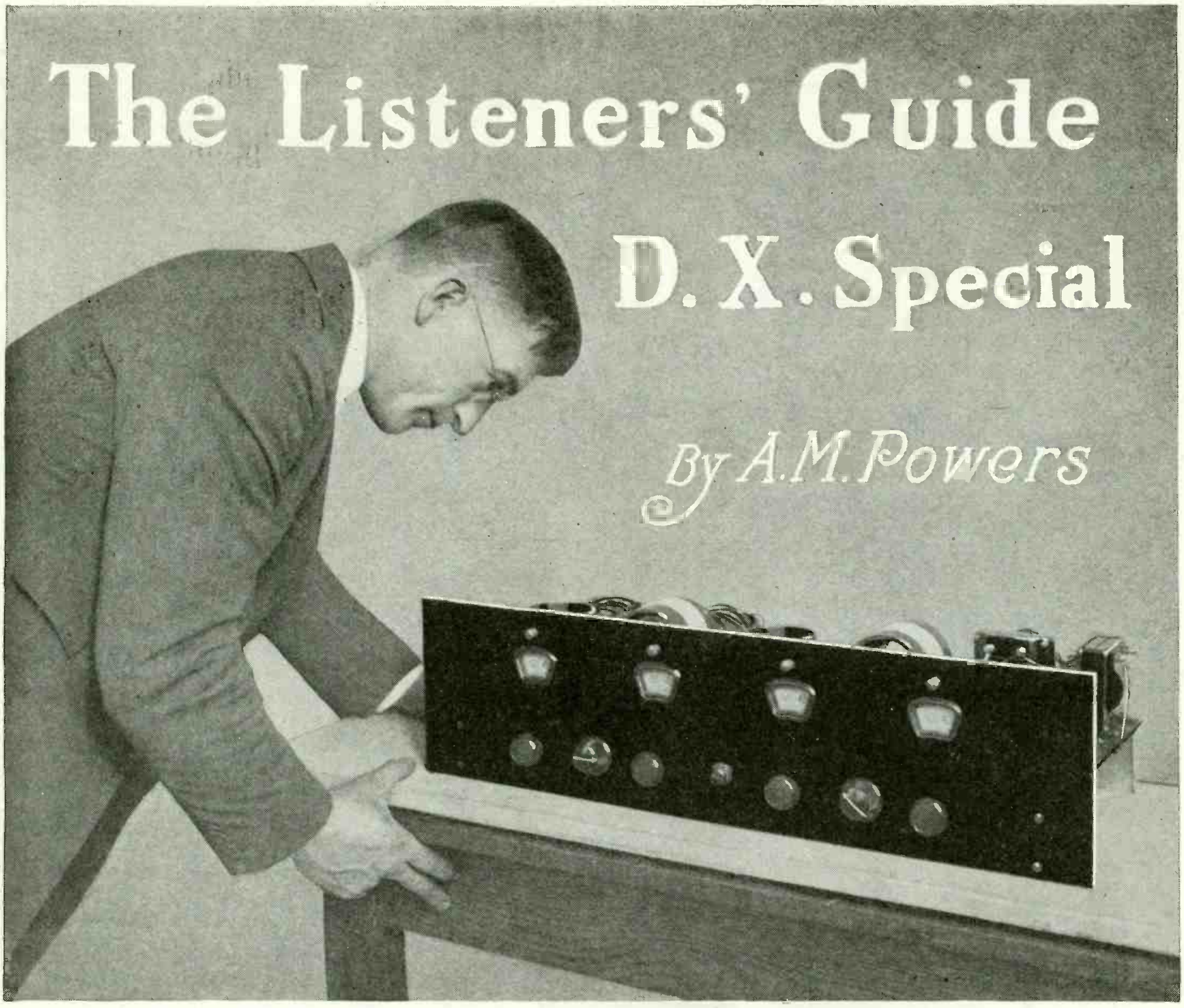
The two photos directly above show how the panel is drilled and shaft hole reamed out to a larger size with an ordinary pair of household shears. In drilling holes it is good practice to start holes with a small size drill and afterward using a larger one.



When the panel is completely drilled it is washed off under the faucet.

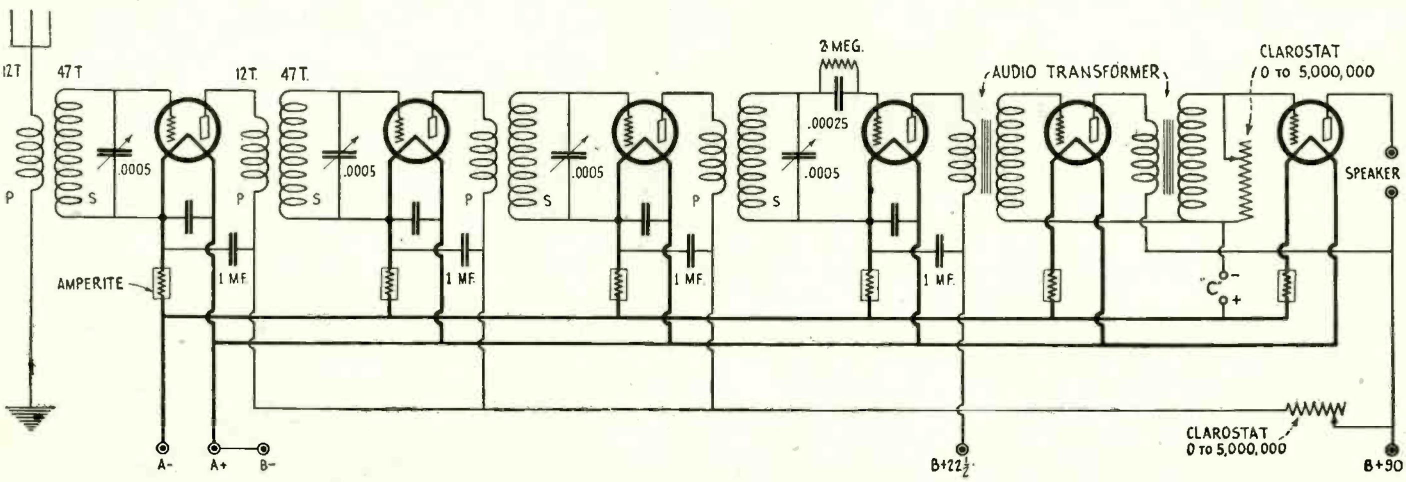
The Listeners' Guide D. X. Special

By A. M. Powers

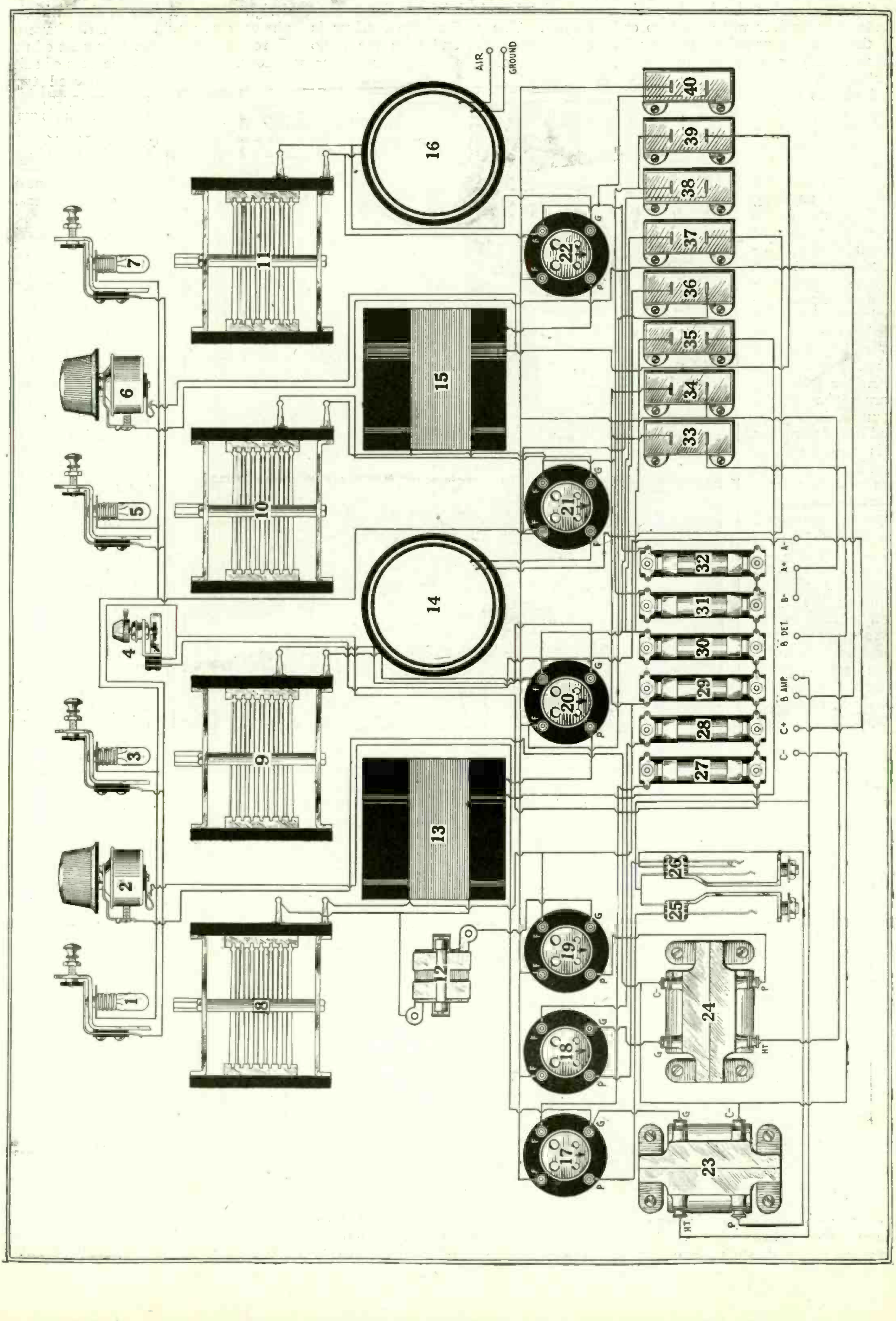


WHAT would you think of a receiver installed in the City of Brooklyn, New York, that is capable of bringing in OAK of Peru, EAJ of Madrid, KPO of San Francisco, KGO of Oakland, KQP of Portland and many other distant stations, the undeniable proof of which exists in verification stamps, letters and cards? Well, such a receiver is a possibility; for Mr. John White, a radio enthusiast of Brooklyn, has experimented with various circuit combinations until he struck upon the arrangement as shown in the accompanying photos and diagrams; and the result has been that the forementioned stations are only but a few of those heard from which he has received verifications of reception.

The set may be readily constructed by the average handyman, and successfully operated by anyone. Furthermore, with the rapid spread of broadcasting, not only from coast to coast



Schematic wiring diagram of the Listeners' Guide D. X. Special as described in this article.


AIR
GROUND
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A+
B-
B DET
B AMP
C+
C-
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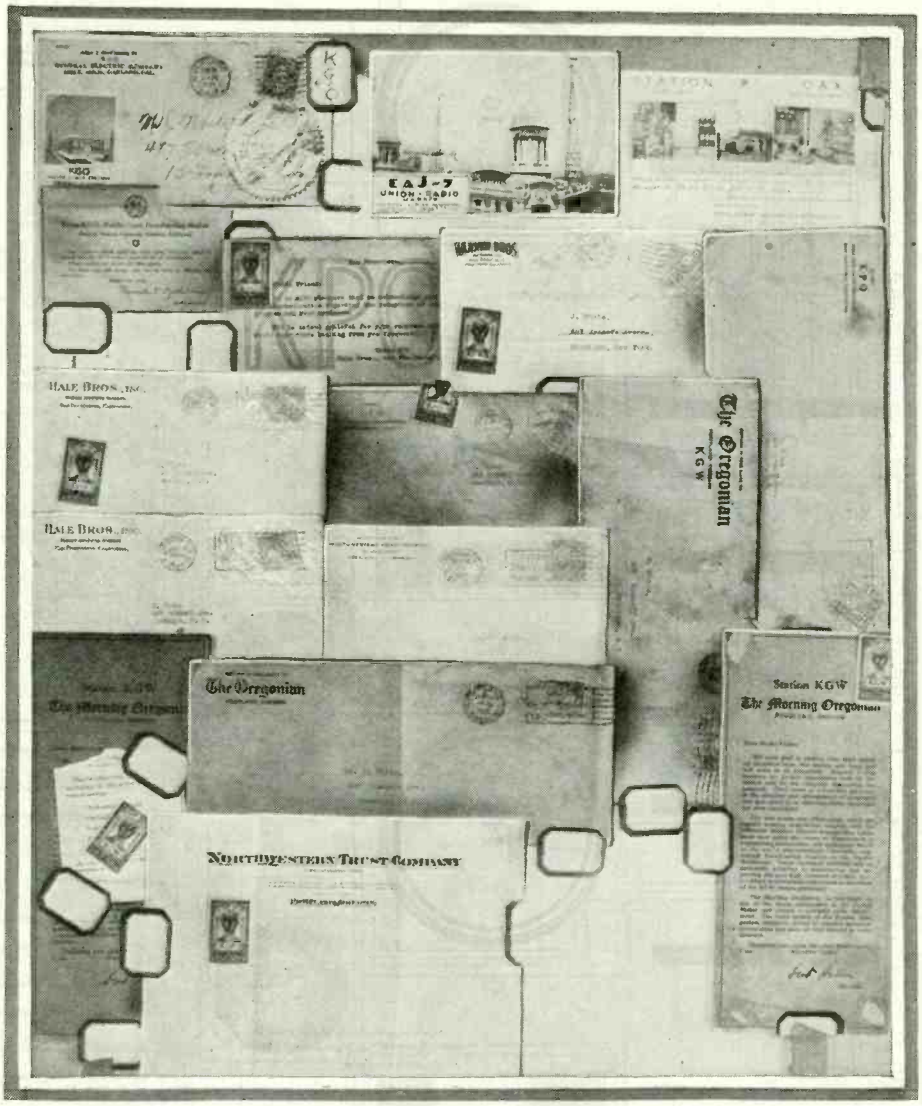
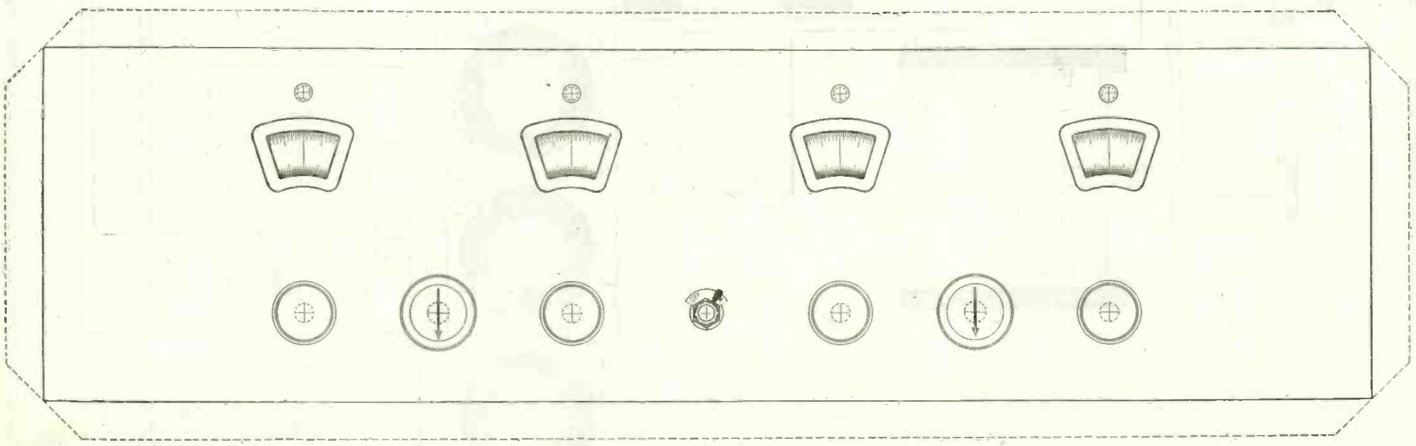
in this country, but also in many other lands, this receiver will afford no end of thrill to the proud possessor who tunes his way from country to country, section to section and city to city in search of something different in the way of radio programs. While this receiver does not introduce anything radically new in the way of a fundamental circuit, it indeed presents an efficient combination of circuit principles which will enable the DX fan to satisfy his desires.



Mr. White's collection of verifications received from distant stations. These include Madrid, Peru, Portland, San Francisco, etc.

In the following paragraphs will be found a description and list of parts for this new receiver, and by referring to the picture wiring diagram, photos, and layouts, there should be no difficulty in assembling this set from standard parts. Details for winding the radio frequency coils are also given later in this article. The set employs four stages of tuned radio frequency amplification and is so designed as to incorporate the least resistance in the radio frequency stages, thus making for maximum sensitivity and selectivity so essential in ultra-distant reception. A study of the accompanying circuit diagram will show what use is made of resistance control in the positive side of the B battery lead going to the plates of the radio frequency tubes so as minutely to regulate the plate potential for obtaining maximum sensitivity. The cost of the receiver is quite reasonable, and with the radio frequency coils of the home-made type, the other parts are quite standard in every way. There are four tuning dials for this receiver controlling four radio frequency tuning condensers. If the constructor desires to make the set more compact, gang or tandem condensers can be used. However, this of course would mean that the layout design of the receiver as shown in the photos, etc., would necessarily have to be re-arranged to the judgment of the builder. If tandem condensers of suitable matched type are employed, the tuning controls may be reduced to two, but by so doing, there is a possibility of losing some of the extreme sensitivity of the receiver. Moreover, for the best results, it would be necessary to use vernier or supplementary tuning controls so as to obtain the exact resonance in tandem condensers. Six tubes are used with Amperite automatic filament control for each so as to eliminate the rheostats. There are special by-pass condensers of 1 mfd. across the filament of each radio frequency amplifier and detector tube, and another from the "B" end of the radio frequency coil to the negative filament. This somewhat increases the efficiency of the receiver, and is just one more of the little touches that make remarkable sensitivity. Besides, the Clarostat variable resistance is used to control the plate current of all the radio frequency tubes, another is employed across the secondary of the second audio transformer in order to improve the tone of quality.



Front panel layout of the Listeners' Guide D. X. Special with all hole centers indicated at the cross sections of small circles.

Inasmuch as the coils are home-made, it is well to describe them at this point. These are wound on a three inch diameter bakelite or hard rubber tube, which should measure about 3½ inches long. The primary winding in. gap, comprises of 47 turns of the same size wire, all the turns being in the same direction. The primary coil is wound on the smaller size tubing, by means of small brass machine screws with Hexagon nuts. The coils when located in the set should be placed with their axis at right angles, and with

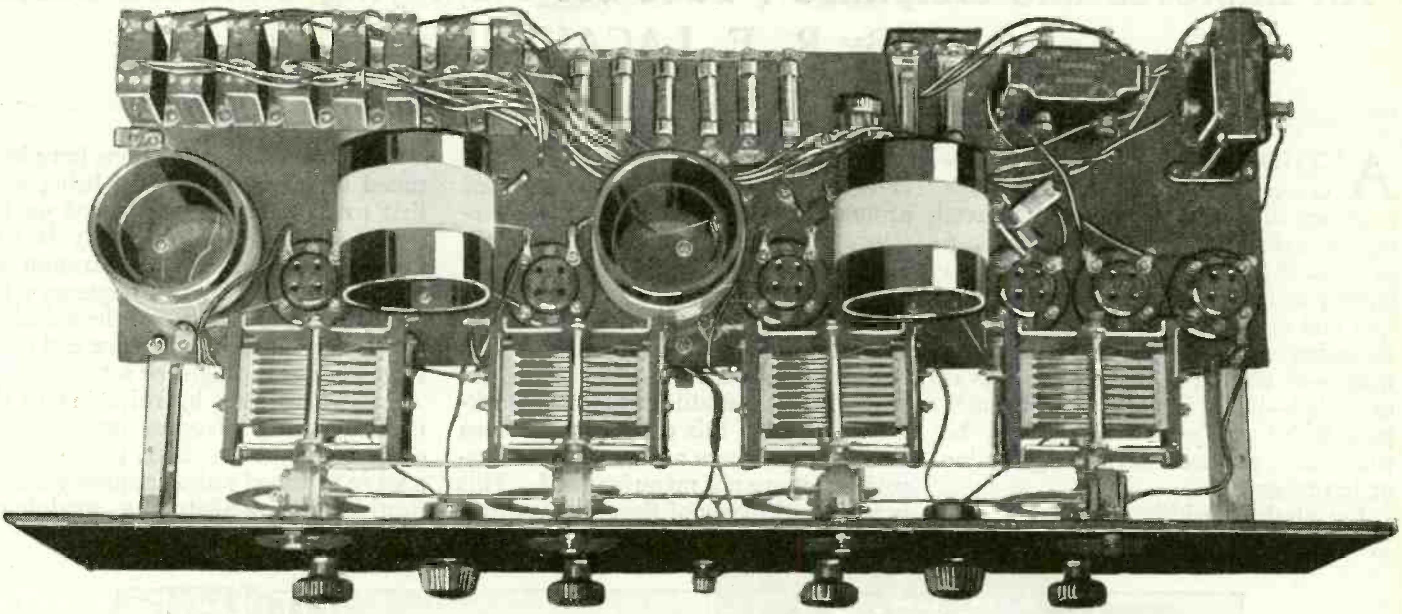
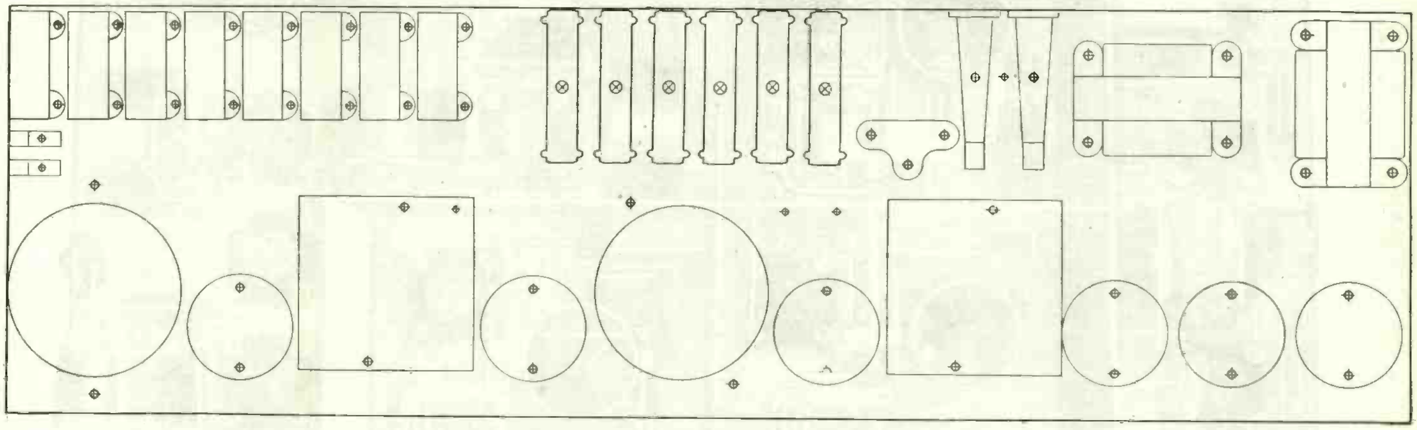
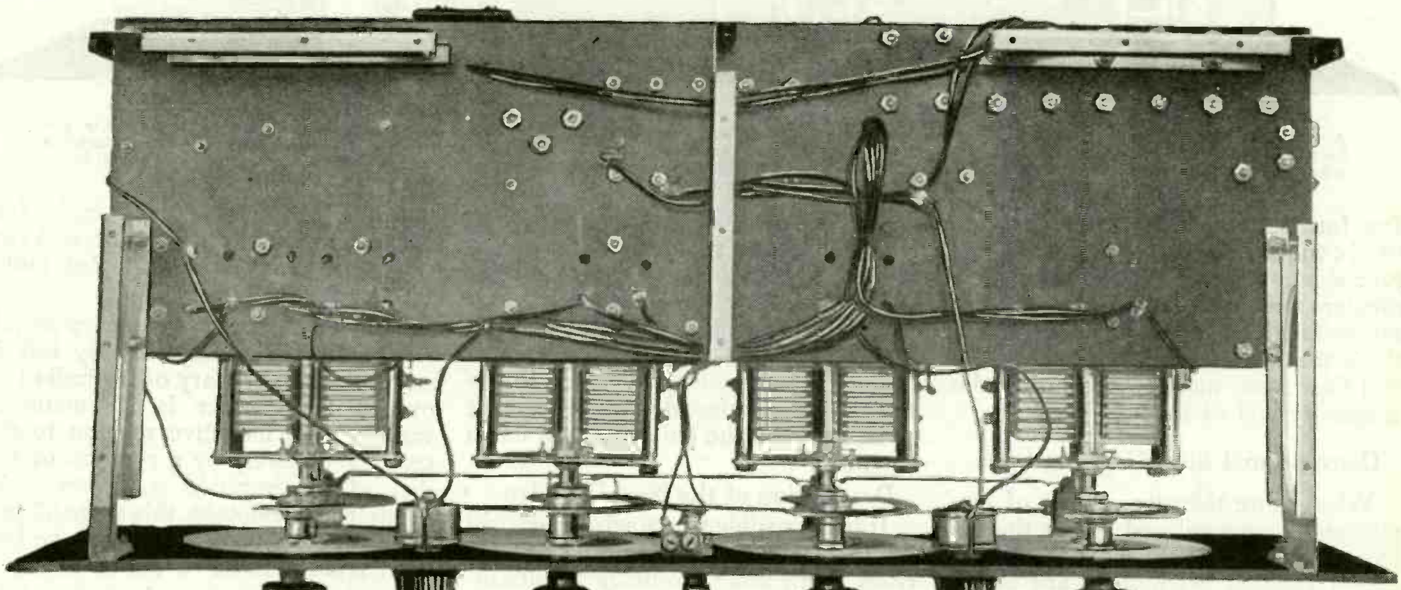


Photo showing a top view of the completed set. Note that the R.F. coils are placed at right angles.



Sub-panel layout of parts with all mounting holes indicated.



A bottom view of the set. Two panel brackets are attached to the back of the panel to give additional support.

comprises twelve turns of No. 24 D. C. C. wire, while the secondary, separated from the primary by a ¼ and placed inside of the secondary coil at the grid end of the winding, and is fastened to the secondary coil tubing a spacing of at least 5 in. between coils. Thus one may be mounted standing up;

(*Continued on page* 153)

The New Shielded Ultradyne

An Improved and Simplified 9-Tube Set Employing Standard Parts

By R. E. LACAULT

ALTHOUGH the majority of receivers that have made their appearance in the past few months have, on an average, six tubes, there is a great deal of interest displayed in sets having many more. It is true that the five and six tube receiver is good for reception up to about one thousand miles—of course, in some cases this is exceeded—but when the experimenter goes after really distant stations he turns to a receiver having eight, nine or ten tubes.

On stations within the radius of a few hundred miles, the set having five or six tubes will give every bit as good reproduction as will a receiver having a greater number; but as pointed out numerous times, if distance is wanted, there must be sufficient amplification; and this means more tubes in the radio frequency end of the set.

Conventional Shielding Available

When more than two stages of amplification are employed before the detector tube, there is likely to be trouble unless suitable precautions are taken. In the past year radio engineers have incorporated in set design shielding about the radio frequency stages to reduce interstage coupling, finding that reception is to be improved. In the new Shielded Ultradyne receiver which is described herewith, shielding is used around the stage of tuned radio frequency amplification, the modulator and the oscillator circuits.

In the "old" days of radio—four or five years ago—when the experimenter wanted to build a new receiver, it was necessary for him to make the greater part of the apparatus at his own workbench. Today this condition has been changed, for there are very few accessories that are not manufactured. This is true particularly of the shields, which formerly had to be laboriously cut from sheet metal, but which now can be obtained all ready to install in a receiver.

The new Ultradyne is one designed for assembly with minimum effort on the part of the builder. By this is meant that everything installed in the set may be purchased; nothing having to be made by the builder unless he so chooses.

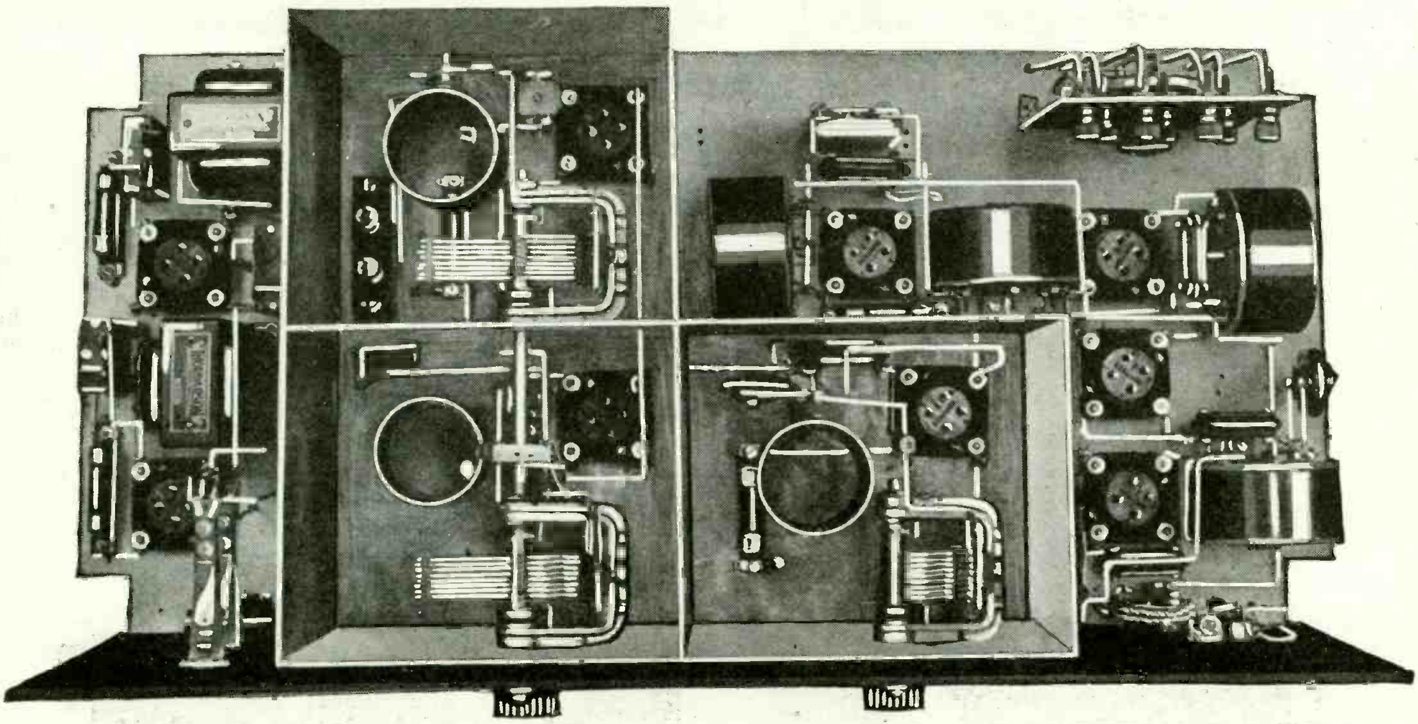
Description of the New Ultradyne

It is impossible to say what a set will do in a given location, especially in cities, there being too many factors involved to permit any broad and sweeping claims to be made. However, if a set such as described in this article is properly assembled and adjusted, it will give excellent results. On a short indoor antenna many stations have been tuned in, the amplification being such that most of them were heard on the loud speaker. The selectivity is sufficient to permit the separation of stations very close in frequency; the radio frequency stage and the shielding preventing much interference and noise from getting through the set.

As can be seen by referring to the picture wiring diagram or schematic diagram of this receiver, it consists of a stage of tuned radio frequency amplification, an oscillator, a modulator, three stages of long wave radio frequency amplification, detector, and two stages of transformer coupled audio frequency amplification.

The stage of radio frequency amplification is audio coupled. By this is meant that the primary of the radio frequency transformer is automatically varied in its inductive relation to the secondary merely by a rotation of the dial of the variable condenser. As mentioned previously, this stage of amplification is shielded and is to be isolated from the rest of the receiver.

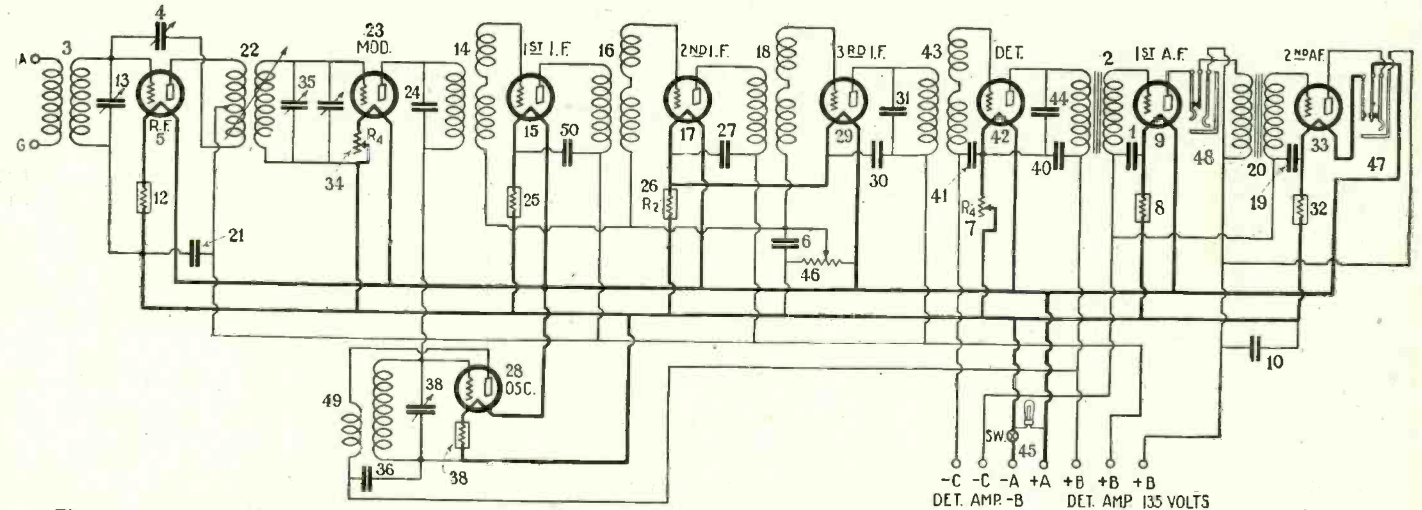
The audio amplifier is designed to produce volume and good quality and, when used with a good loud speaker will produce all audio frequencies with fidelity.



A top view of the new shielded Ultradyne receiver, which is very compact in form. The two-stage transformer-coupled audio amplifier can be seen at the extreme left of the base. The left rear shield contains the single stage of constant-coupled tuned-radio-frequency amplification which precedes the modulator circuit contained in the left front shield. The right-hand shield encloses the oscillator circuit. The three intermediate-frequency amplifier stages and the detector are grouped around the oscillator shield.

The detector circuit is so wired that it may be employed with a "C" battery, if use is made of the bend in the "characteristic curve" of the tube. The grid return is connected to a binding post, which, in turn, may be connected to the the shielded stages which are the most delicate parts of the receiver, may be built with standard parts which are all ready for assembling and designed to fit without further adjustment. The panel drilling template and layout is 7, and binding posts mounted, as shown in the photo of the back panel view.

The partitions of the shields should also be drilled for the connections running from one shielded compartment into the other. The drilling of the



The complete circuit diagram of the new nine-tube Ultradyne. Note that the last or power stage of audio-frequency amplification employs a filament-control jack; so that this stage is in operation only when the loud-speaker plug is inserted in the jack referred to.

"C" battery or the positive or minus of the "A", as the case may be.

A rheostat also is provided to control the detector filament; it is mounted on the binding post panel inside of the set; because, once adjusted for the particular tube used it need not be re-set.

In order to produce the results of which it is capable, this receiver should be build with the best parts obtainable. This has been said and repeated a great many times by designers of good sets, and can never be emphasized too strongly. The amount of energy received from distant stations is so small that it is of the utmost importance to avoid bad contacts and high-loss parts shown in the accompanying drawing, as well as the layout for parts to be mounted on the baseboard. The radio frequency coils and auto-couple coil are designed to be mounted directly on the condenser or on small brackets. The shields are all drilled for the mounting of the condensers and sockets, so that a screw driver is all that is necessary for the work of assembling these units.

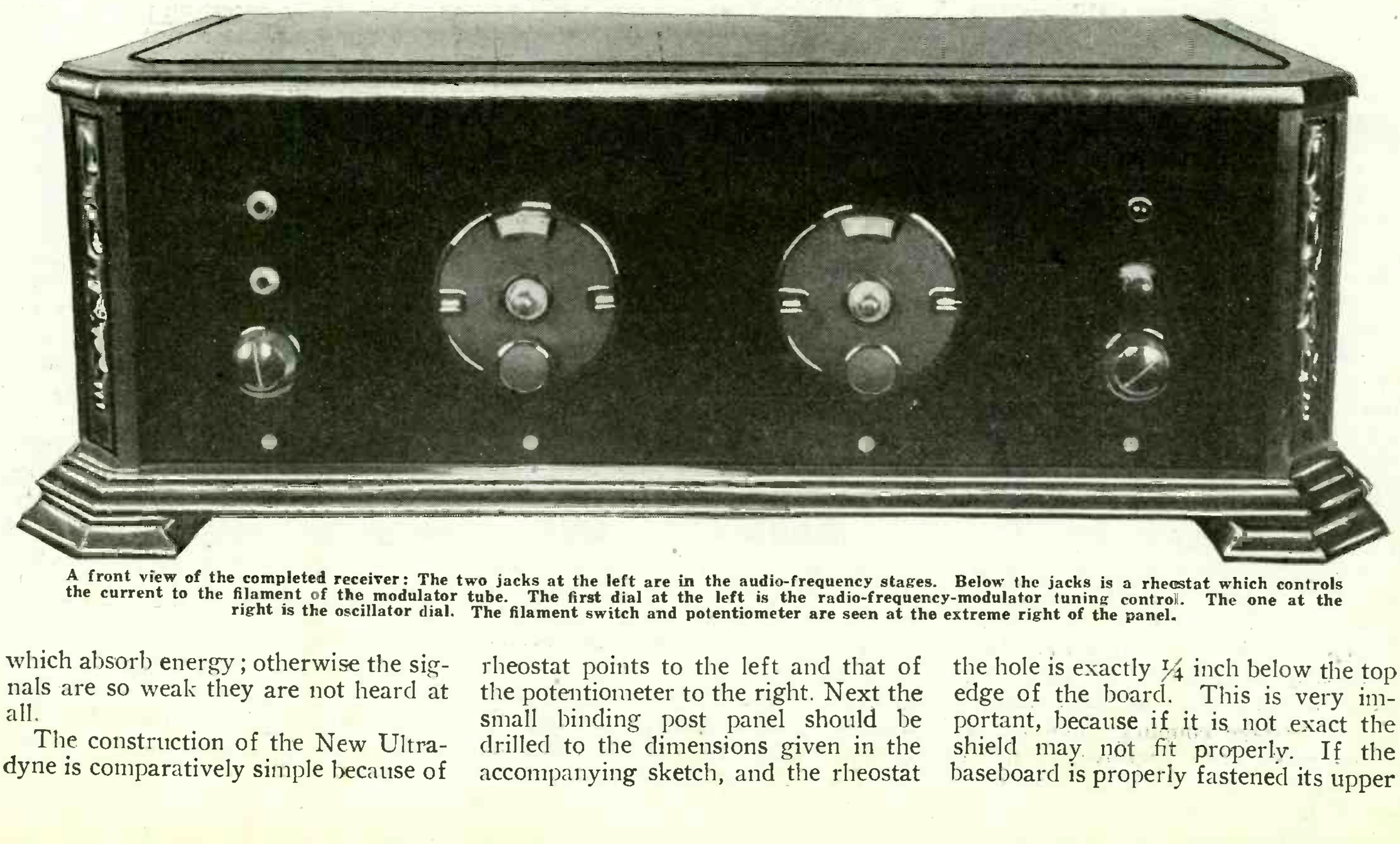
Assembling the Set

After the panel is completely drilled, the switch 45, rheostat 34, and potentiometer 46, may be mounted on it. Turn them so that when you look at the front of the panel the center lug of the left baseboard for the wiring is done after the parts are mounted on the board.

Before mounting the parts, it is necessary to place the bottom of the shields and in order to do this accurately and properly line up the condenser mounted on the same shaft, one should proceed as follows:

First place the baseboard in the cabinet so that the clearance is even all around and mount the panel against it by means of four wood screws.

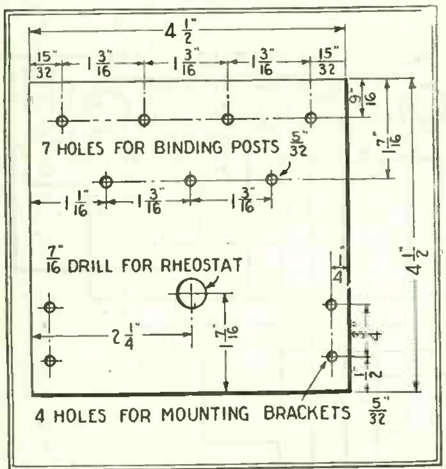
In order to prevent the board from splitting, first mark the spots for the screws through the panel holes with a sharp point. Then drill, but before doing so, make sure that the center of



A front view of the completed receiver: The two jacks at the left are in the audio-frequency stages. Below the jacks is a rheostat which controls the current to the filament of the modulator tube. The first dial at the left is the radio-frequency-modulator tuning control. The one at the right is the oscillator dial. The filament switch and potentiometer are seen at the extreme right of the panel.

which absorb energy; otherwise the signals are so weak they are not heard at all.

The construction of the New Ultradyne is comparatively simple because of rheostat points to the left and that of the potentiometer to the right. Next the small binding post panel should be drilled to the dimensions given in the accompanying sketch, and the rheostat the hole is exactly ¼ inch below the top edge of the board. This is very important, because if it is not exact the shield may not fit properly. If the baseboard is properly fastened its upper face should be exactly 7¼ inches from the upper edge of the panel. After the panel has been fixed against the edge of the board, the left .00035 mfd. condensers 35, should be mounted against



Constructional details of the small binding-post panel on which is also mounted the detector rheostat.

the shield and panel so that the screws pass through both of them. Next, the bottom of the shielded compartment should be placed under the bent edge of the front section of the shield; so that the holes come just under those punched in the bent lower edge of the shield mounted against the panel.

Take care in placing this bottom section to have the two holes punched for the socket mounting screws on the right and back of the condenser when you look from above. Two wood screws may then be inserted through the holes to fasten the bottom of the front compartment on the baseboard, and the socket may also be screwed down.

The next step is the mounting of the other variable condenser, 13, on the front section of the back shield and back partition of the front shield. These two sections are mounted back to back, as shown, and maintained by the mounting screws of the condenser. This ensemble should then be placed on the baseboard, and the double-length shaft pushed through both condensers after the individual shafts have been removed.

The long shaft provides the proper alignment for the condensers, which should both turn freely without binding at any point. The double partition supporting the back condenser may then be screwed down on the board. The holes on the lower edge should correspond exactly with those in the bottom of the front shield.

The bottom of the back shield is screwed down exactly with those in the bottom of the front shield.

The bottom of the back shield is screwed down exactly like the front one. Turn it so that the mounting holes for the sockets are on the right of t[illegible] ndenser.

The other partitions of the shield are mounted later and held in the corners by means of the slides provided for this purpose.

The other variable condenser is mounted in the other shield and fastened against the panel and baseboard in the same manner. After the condensers are properly aligned, and the shield screwed down, the condensers should be removed, automatic-filament-control base, coils, binding post and by-pass condensers mounted upon the bottom of the shields, and the holes for wiring drilled as shown, through both shield and baseboard. Then screw down all the sockets, bases, audio-frequency transformers, multichokes, by-pass condensers and the binding post panel. Mount also the auto-couple coil on the left forward condenser and remount the three variable condensers.

PARTS REQUIRED FOR ULTRADYNE SET

3 Hammarlund variable condensers, .00035 mfd.; 13, 35, 38.
2 Hammarlund equalizing condensers, 3-50 mmf.; 4, and one mounted directly on variable condenser 35.
6 Sangamo fixed by-pass condensers, .5 mfd.; 1, 6, 19, 21, 40, 41.
1 Sangamo fixed by-pass condenser; 1.0 mfd., 10.
3 Sangamo fixed by-pass condensers; .005 mfd.; 30, 31, 50.
2 Sangamo fixed by-pass condensers; .001 mfd.; 36, 44.
1 Sangamo fixed condenser; .00025 mfd., 24.
2 Hammarlund R.F. transformers; 3, 49.
2 Thordarson audio transformers, 3 to 1 ratio; 2, 20.
1 Hammarlund R.F. auto variable coupler; 22.
9 Benjamin sockets, 5, 9, 15, 17, 23, 28, 29, 33, 42.
2 Marco vernier dials.
2 Yaxley rheostats; 20 ohms, 7, 34.
1 Potentiometer, 400 ohms; 46.
4 Amperites, No. 1-A; 8, 12, 25, 39.
2 Amperites, No. 112; 26, 32.
9 Eby binding posts.
4 Madison Choke transformers; 14, 16, 18, 43.
1 Yaxley double circuit jack, 47.
1 Yaxley single circuit jack, filament control, 48.
1 Yaxley filament switch and pilot light; 45.
1 Formica panel 8 x 24 x 3/16 inches.
1 Cabinet, 8 x 25½ x 12⅛ inches (inside diameter).
1 Wood baseboard, 12 x 25¼ x ½ inches.
3 Hammarlund aluminum shields.

Wiring the Set

The wiring operation, which might be called "golf wiring," because the underboard wires run directly from one hole to the next, is very easily done. One may use wires of different colors for each circuit, although this is not essential. Pliable wire such as cornish hook-up wire, rather than bus bar is recommended for the underboard wiring.

If this type of wire is used it may be bent double where it passes through a hole in the board and a loop left long enough to reach the soldering lug. The loop is then cut, the two ends scraped clean and soldered to the lug. The wiring can be followed either from the picture or schematic diagrams given herewith.

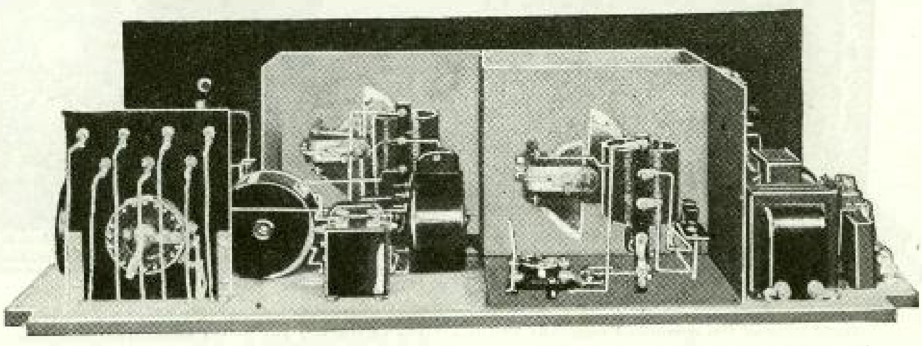
After all the connections are made and soldered, the jacks may be mounted and the wiring above the baseboard done with either the same wire or bus bar. Care should be taken, when wiring the parts inside the shields, not to run the grid and plate leads too close to the shield. Insulate all the wires or bus bars passing through the partitions with spaghetti tubing, even if insulated wire is used. During the wiring operation check each lead often. Be sure to make good soldered joints as this operation is very important. Use a properly-tinned soldering iron and a rosin core solder wire. Also be sure to have the wires or lugs clean before you try to solder them.

The wiring diagrams given here show all the connections, which should be carefully checked after the wiring is completed.

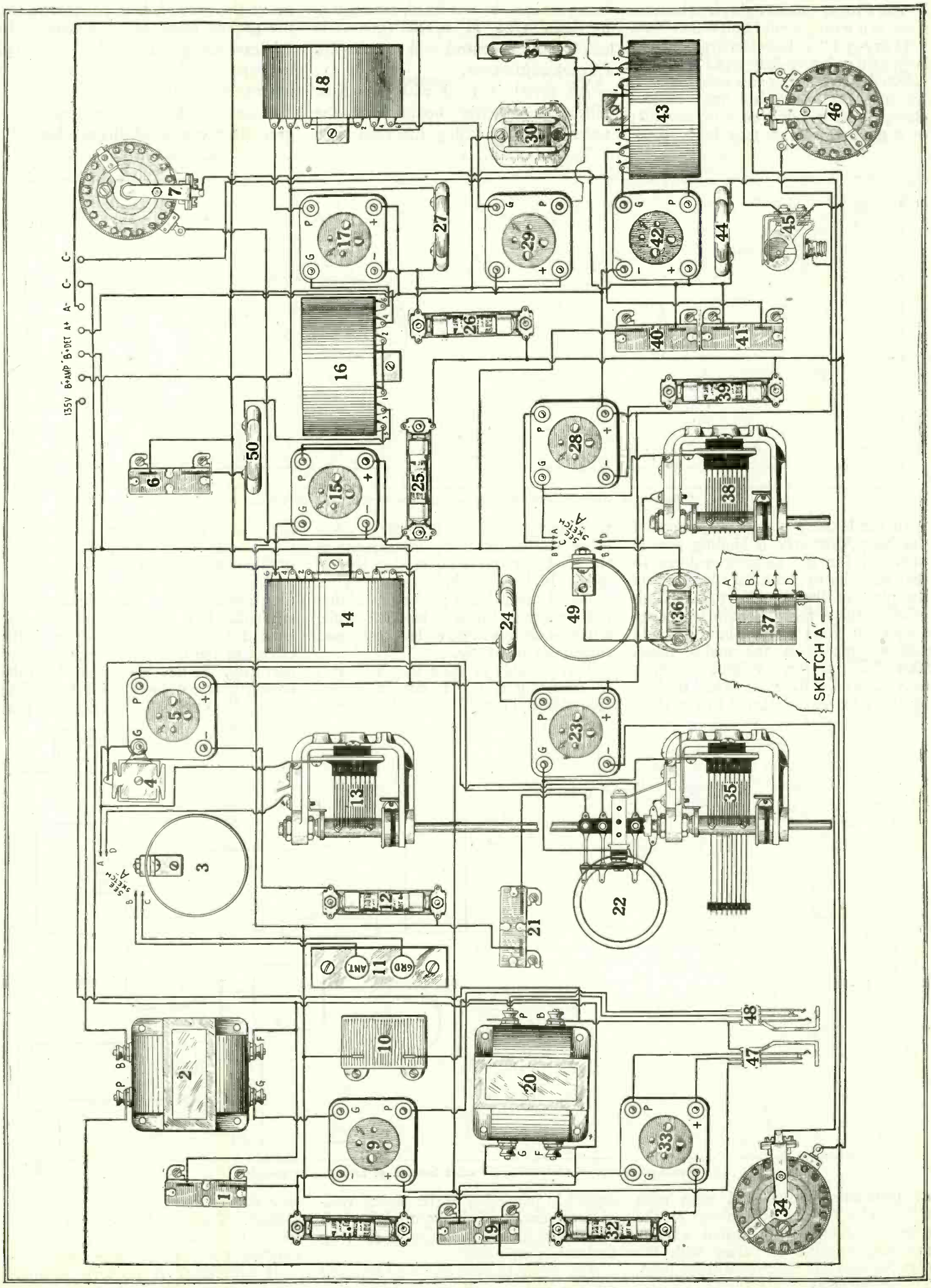
To make sure that everything is connected correctly, insert all the tubes in the sockets, turn the rheostats up full and connect the "A" battery only to the "A+" and "A—" posts. If the filament wiring is correct, all the tubes will light.

To check the "B" battery circuits, leave the "A—" connected as before; but connect the plus terminal of the 6-volt storage battery to the "B+ Det" binding post. If this circuit is O.K., none of the tubes should light.

Repeat the test by connecting the "A+" lead to the "B+ Amp" and the



The receiver as seen from the rear, with part of the shielding removed to give a clear view of the placement of the parts. Note the rheostat mounted on the binding-post panel; this controls the filament current to the detector tube.


135V B+AMP B+DET A+ A- C- C-
SKETCH A
SEE SKETCH A
ANT
GRD

"B+ 135v." If during these tests one or more tubes should light, it is because there is a wrong connection somewhere.

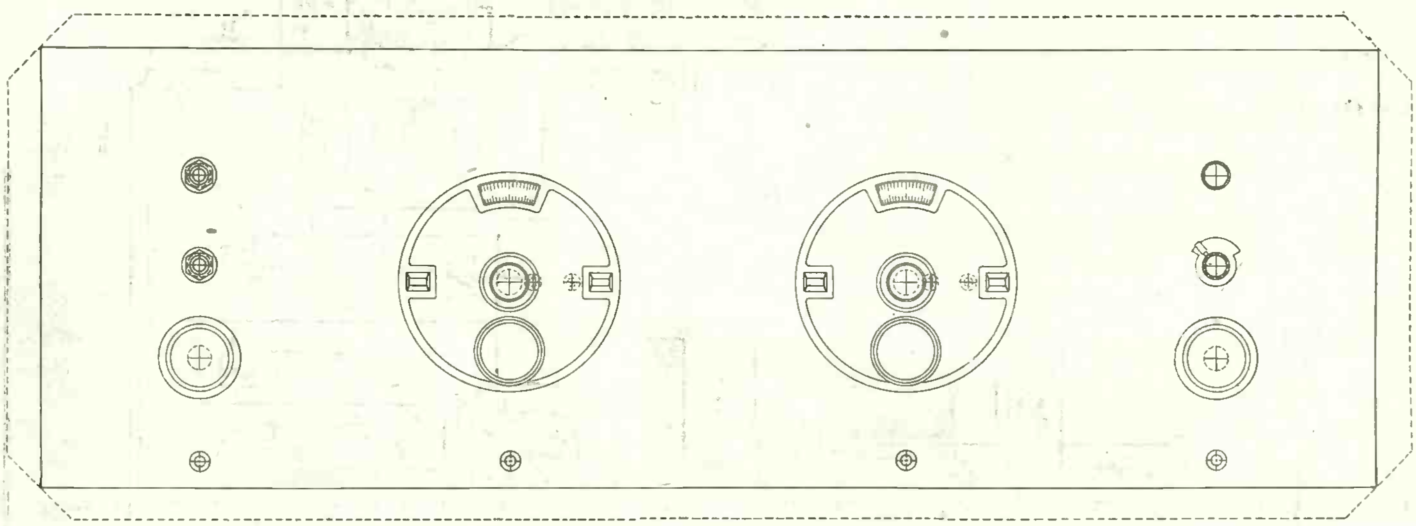
If dry-cell "B" batteries are used, the large size or heavy-duty types should be selected because they last much longer. Storage "B" batteries may be re-charged and can deliver more current; or a good eliminator may be used.

of various types of tubes, and after being set may be left fixed, although if a "CeCo" type "H" special detector is employed the control will not require careful adjustment.

An aerial is used with the New Ultradyne receiver because of the necessity of matching the input and

tions, where the set is installed high above the ground, it is possible to use the ground alone as an antenna. In this case the ground lead is connected to the antenna binding post and nothing is connected to the ground post.

Once the batteries, antenna and ground are connected, the set should be



Layout of parts mounted on panel showing the location of hole centers.

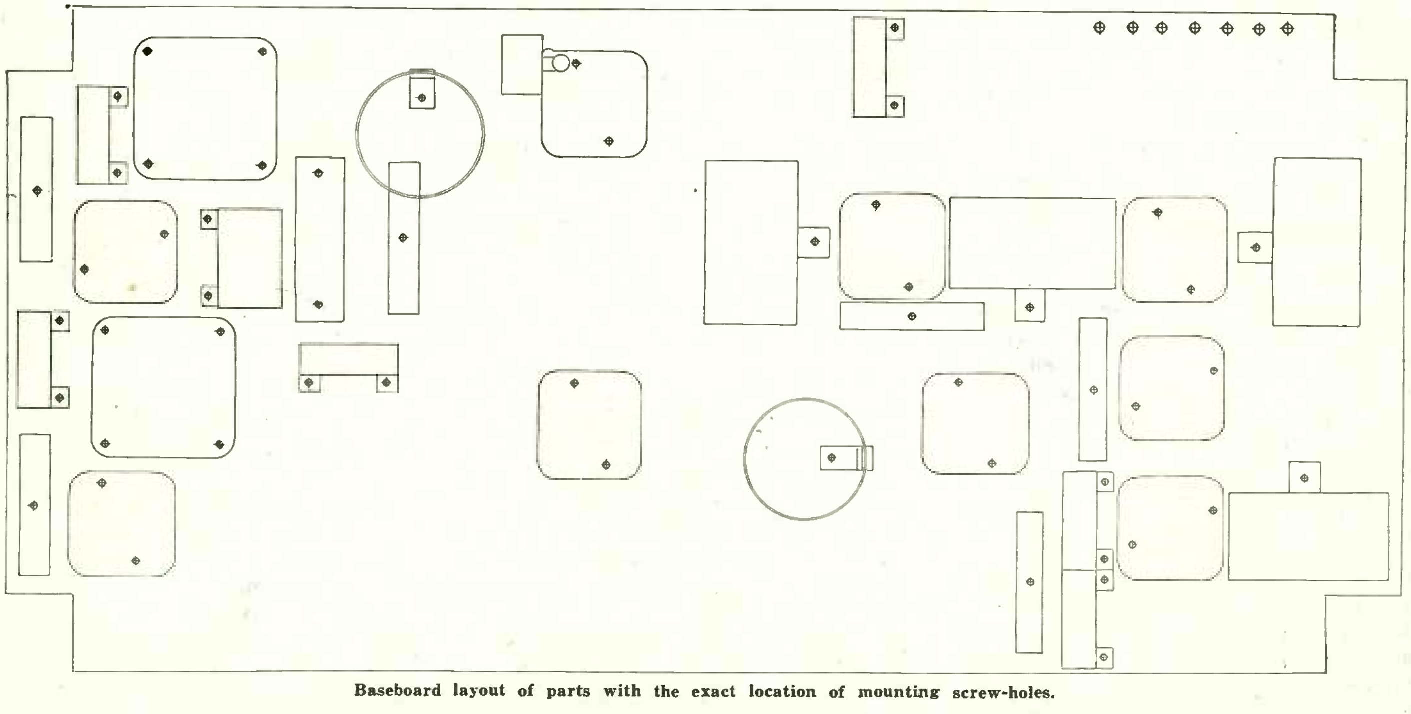
In the binding post arrangement of the New Ultradyne a binding post is provided for the detector voltage so that 45 volts or more may be used on the plate of the detector tube. With "CeCo" tubes for the radio frequency stages 90 volts should be used and 135 or more on the audio tubes. The "C" battery voltage depends upon the audio "B" voltage and is given by the tube manufacturer in the sheet

radio frequency stage accurately. Another reason for using an antenna is that it picks up more energy than a loop. If installed indoors it may be fastened around the picture moulding in the room and thus be invisible, while a loop is always more or less bulky and sometimes unsightly.

It is possible to use a loop with this receiver, but if this is done a second Hammarlund equalizing condenser con-

adjusted as follows: Turn the rheostats on almost full; then turn the dials until some station is heard.

Once a signal is tuned in, adjust the potentiometer for maximum signal strength. If a whistle is heard, it may be that the balancing condenser in the circuit of the first tube is not adjusted correctly. If this is the case, turn the adjusting screw slowly until the whistle stops. To check this adjustment, tune



Baseboard layout of parts with the exact location of mounting screw-holes.

of instructions furnished with each tube. The "C" battery voltage on the detector should be adjusted experimentally, because it varies with the plate voltage and the type of tube used. The rheostat provided for the control of the detector filament permits the use

nected in parallel with the second variable condenser 35, is required for balancing the inductance between the loop and auto-couple coil.

The ground connection may be taken on the radiator of water pipe, previously scraped clean. In some loca-

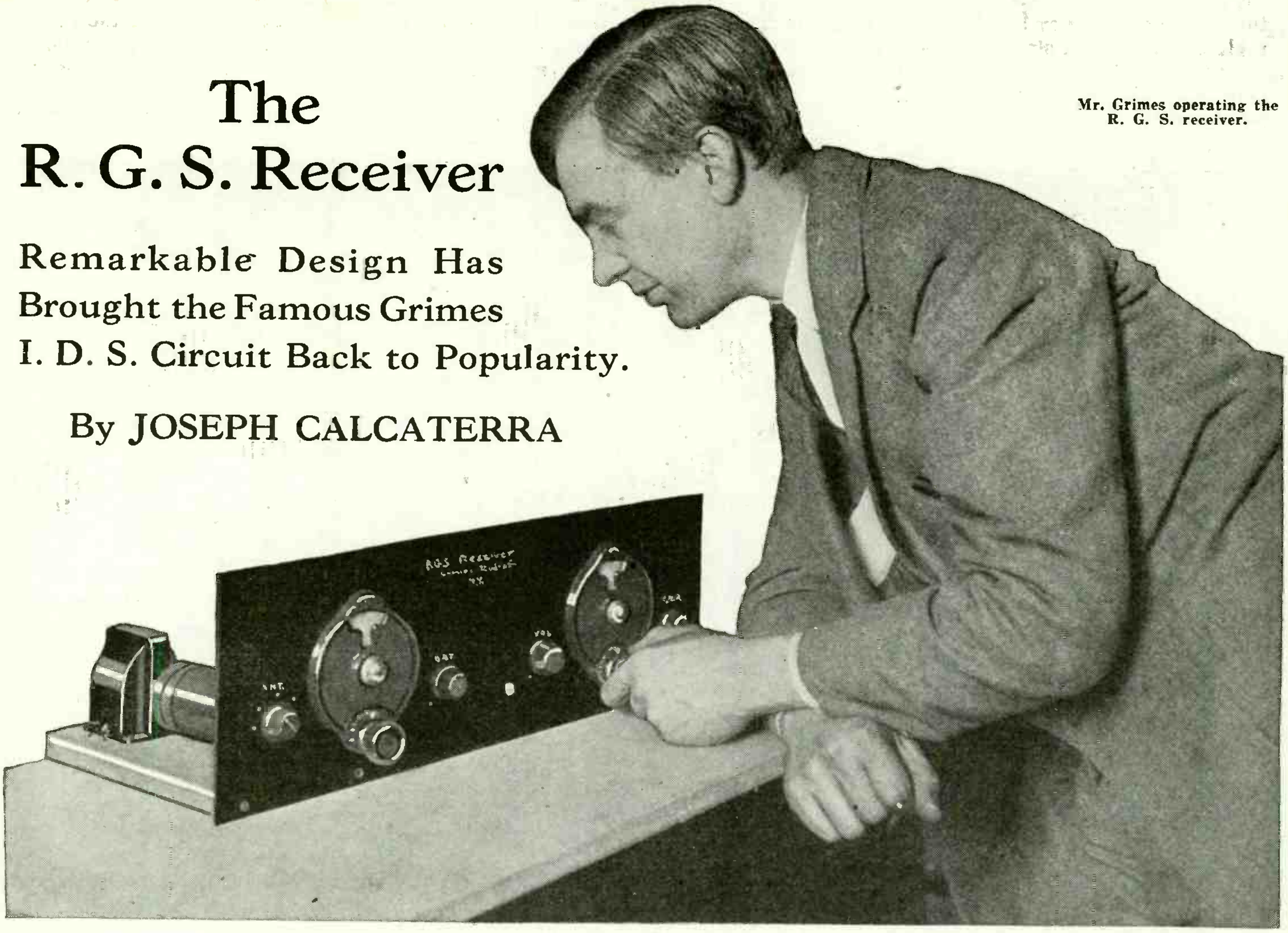
in a short-wave and then a long-wave station. The first tube should not oscillate in either case if the balancing condenser is properly adjusted.

If everything is properly adjusted the set is now ready to tune on any broadcast frequency.

The R. G. S. Receiver

Remarkable Design Has Brought the Famous Grimes I. D. S. Circuit Back to Popularity.

By JOSEPH CALCATERRA



Mr. Grimes operating the R. G. S. receiver.

THERE is nothing so thrilling as to witness a real "comeback" by a champion who was thought to be done in his particular line of endeavor.

Just such a thing has happened in radio in the remarkable comeback staged by the new and improved Inverse Duplex System of combined radio and audio frequency amplification, popularly known as the Grimes I. D. S. circuit.

The Grimes I. D. S. circuit had its beginnings with the old reflex circuits, but there the similarity ceases. It grew out of the reflex system; and then supplanted the reflex system in every one of its best points and added a few for good measure that were possible only with the I. D. S.

The original I. D. S. was an outgrowth of a long series of experiments conducted by David Grimes during the war at considerable expense to the government to develop a really simple but very efficient circuit, that would meet the exacting conditions of aeroplane transmission and reception. The object was to develop a circuit, so fundamentally sound that it could be adapted to changing conditions.

Doubles Efficiency

Fundamentally the I. D. S. is a system designed to make two blades of grass grow where only one grew before. In this respect it is like the old reflex circuits which had for their aim, the idea of utilizing each tube to its maximum efficiency, by using each tube both as a radio and audio frequency amplifier at the same time.

The original Grimes I. D. S. circuit made its appearance in 1922 and its popularity was widespread. At that time broadcasting conditions were totally different from the conditions which exist today. The I. D. S. circuit was designed to fulfill the requirements desired in a receiver to tune to the broadcasting stations then in existence and operating on a comparatively narrow wavelength band of from 360 to 400 meters. No one prophesied at that time that conditions would ever be what they are today with hundreds of stations jamming the ether on wavelengths from 200 to nearly 600 meters and separated from each other only by very small margins.

The tuning system of the old I. D. S. therefore was designed to cover the then existing wavelength bands from 360 to 400 meters and the only wavelength control necessary was a single tuning condenser to tune the loop aerial, used as an energy collector. The radio frequency transformers used in the various stages were of the fixed type, limiting the effective wavelength range of the receiver. Under such conditions, reception was obtained on a one-foot loop of stations over 1,300 miles away, and that with only 3 tubes.

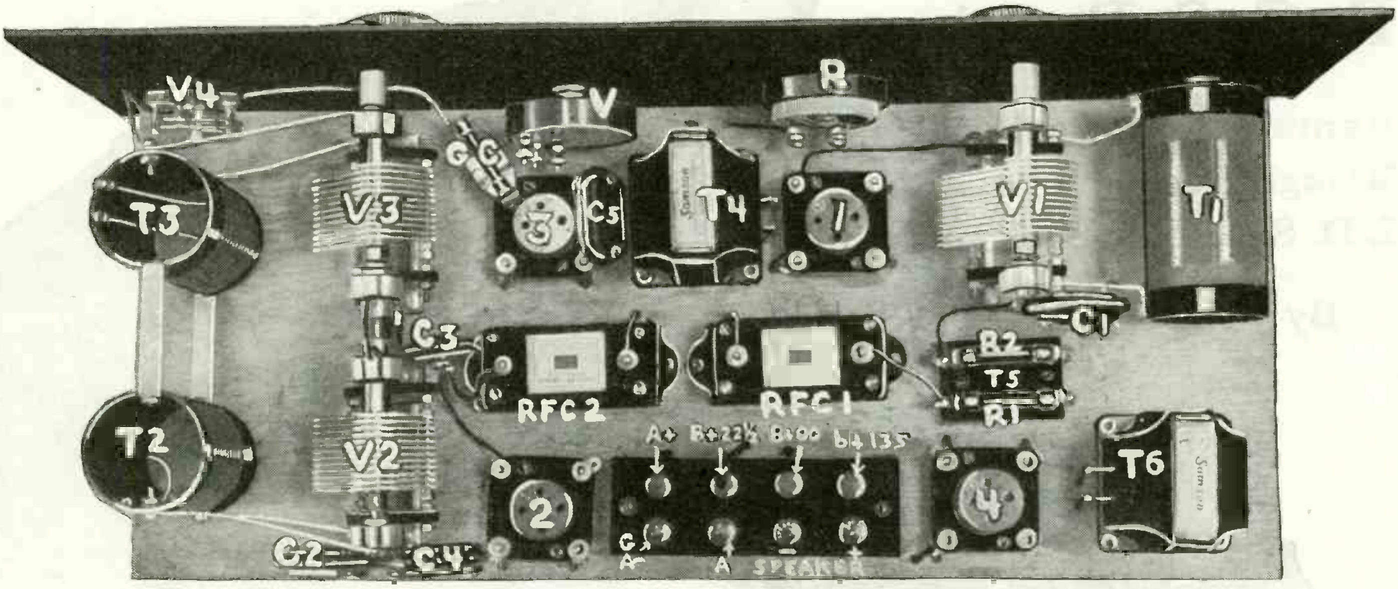
As broadcast conditions changed, new tubes and apparatus were developed and made their appearance on the market. It became evident that circuits would have to change to adapt themselves to the new conditions. Accordingly tuned radio frequency amplification and its variations began to come to the fore as a means of obtaining greater selectivity and distance ranges.

Multitube Operation

With the rapid downward revision of tube prices, came a disregard of the number of tubes that was used in a receiver and the demand for more and more tubes in a receiver resulted in the ten-tube monstrosities that became so popular for a while.

Needless to say, the use of more tubes than are necessary to obtain the required results is not only a waste of money for the tubes but a waste of battery juice to boot. It is just as ridiculous a procedure as buying and eating more food than you can properly digest simply because food is cheap and you have the price.

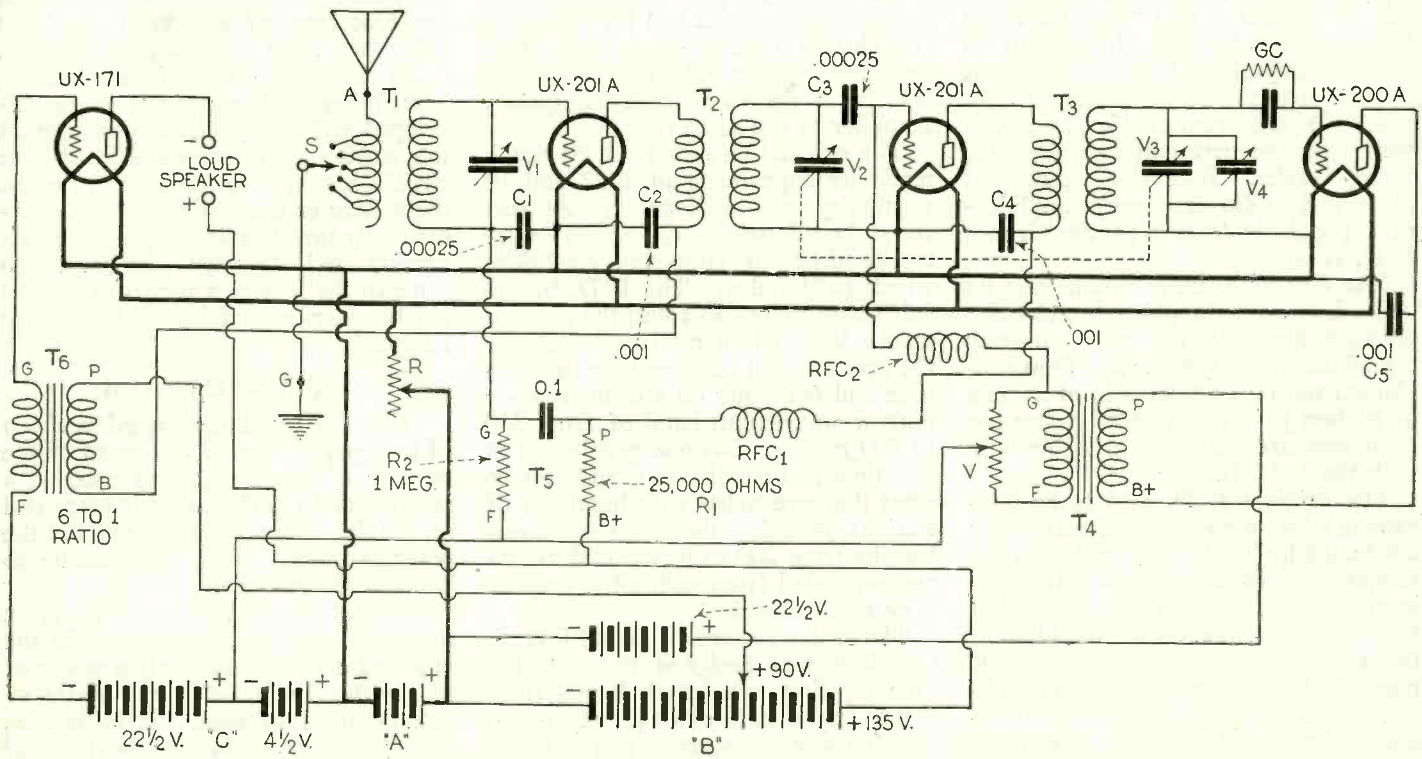
The development of the I. D. S. circuit did not stop merely at the change of the circuit to incorporate tuned radio frequency amplification to replace the untuned stages used in the old receiver. The search for the ultimate in efficient tuned radio frequency amplification resulted in the discovery



A top view of the R. G. S. set as it appears when completely assembled.

of a principle which has been the goal of all experimenters in tuned radio frequency amplification; equal amplification and selectivity over the entire broadcast wavelength range.

A glance at the schematic diagram of the receiver will serve to refresh the memory of many fans who have not looked at a circuit of the duplex type for some time back. You will



Wiring diagram of the receiver. All reference numbers indicated correspond with those on the various parts in the photos.

recognize at a glance the purpose of the .00025 mfd. fixed condensers in the grid circuits and the .001 mfd. fixed condensers in the plate circuits as bypasses for the radio frequency currents in those circuits.

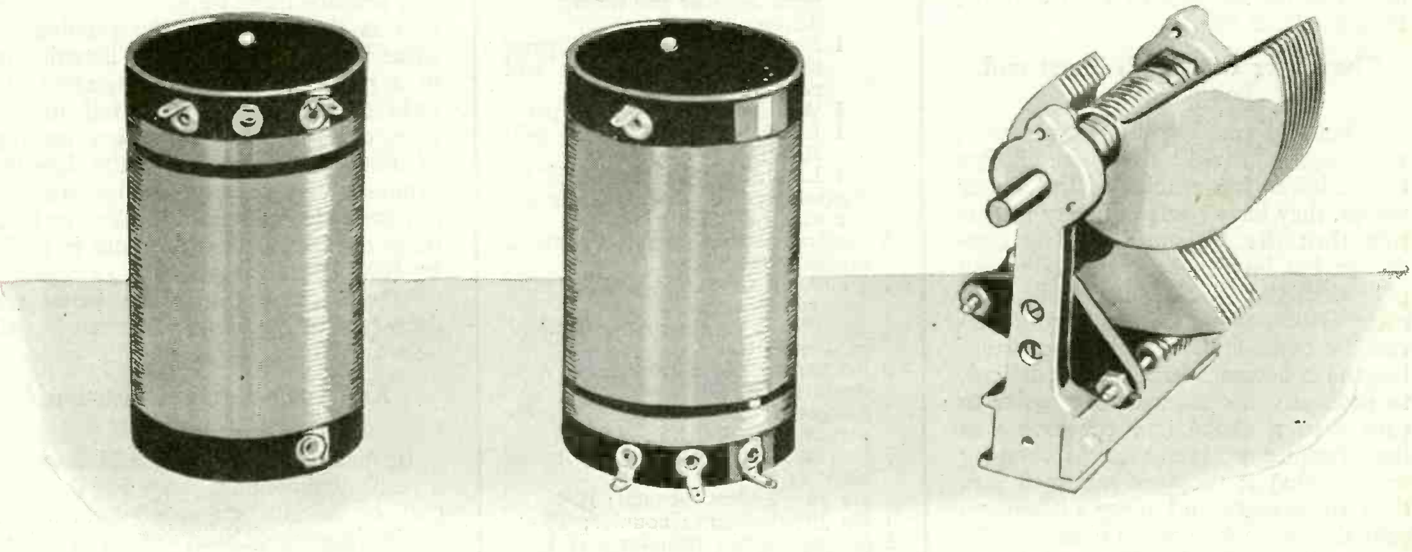
In the ordinary tuned radio frequency circuits, these condensers are not absolutely necessary but in circuits based on the duplex principle, these bypass condensers must be used because of the audio circuits which also enter and leave the same tubes.

The Path of the Signal in I. D. S.

In this new I. D. S. circuit, the radio energy collected by the antenna and ground circuit passes into the receiver thru the antenna coupling transformer "T1". It passes on thru the tuned secondary of transformer "T1" and is amplified by tube No. 1. The amplified radio frequency energy passes thru the primary of the second tuned transformer "T2" and is amplified by tube No. 2. As far as the radio frequency energy is concerned, the circuits of the audio transformers, "T4" and "T5", included in the grid and plate circuits of tubes No. 1 and No. 2 do not exist since the bypass condensers in the grid and plate circuits of these tubes bypass the radio frequency energy across the rest of the circuits, according to the old principles of duplex operation.

The amplified R. F. currents in the plate circuit of tube No. 2 then repeat the cycle being passed on into the grid circuit of the detector tube No. 3, there to be rectified and changed into audio frequency currents.

From there on the path of the audio currents is from the plate circuit of detector tube No. 3, thence into the grid circuit of tube No. 2 thru the thru to the 6 to 1 ratio audio frequency transformer "T6" and are fed into the grid circuit of the last stage audio tube, No. 4. reduce the efficiency of the circuit while aiding feedback currents would ordinarily, throw the circuit into oscillation.



A close-up of the coils and variable condenser used in the R. G. S. set described in this article.

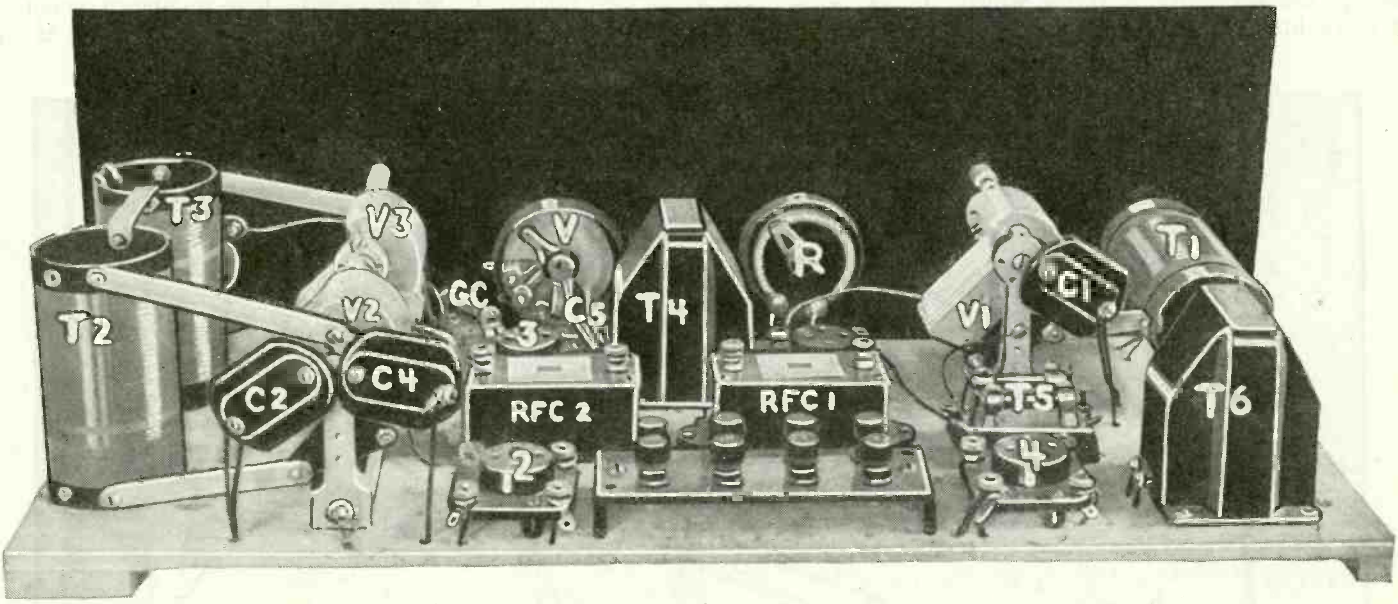
action of the 2 to 1 ratio audio transformer "T4". Tube No. 2 thus acts as the first audio frequency amplifier tube in addition to its function as the second radio frequency amplifier tube.

The audio frequency current is amplified by tube No. 2. The audio frequency current in the plate circuit of this tube then passes thru the primary coil of radio frequency transformer "T3"; thru the coil, RFC1 and the

There are several features of this circuit which are not so easily apparent from a general inspection of the circuit.

The seemingly innocent looking radio frequency filter coil connected between the "P" terminal of resistance coupler "T5" and the primary coil of R. F. transformer "T3" plays a very important part in the unusual efficiency of the circuit.

The remarkable sensitivity and selectivity of the new I. D. S. centers around this little radio frequency filter coil. By properly poling the phase of the Primary of the tuned radio frequency transformer "T3", the tendency toward radio frequency feedback was made aiding thru the resistance coupled stage. This itself was not enough because the tendency to oscillate would make reception impossible. By carrying



A rear panel view of the set showing the location of the parts on the panel and baseboard.

primary resistor "R1" of the resistance coupled transformer "T5" and thru the coupling condenser, it passes into the grid circuit of tube No. 1. It is then amplified by tube No. 1 which performs the double function of first radio frequency amplifier and second audio frequency amplifier.

From the plate circuit of tube No. 1, the audio frequency currents pass

If it were not for this radio frequency filter coil, the presence of the coupling condenser in the resistance-coupler, "T5" would cause serious difficulties thru the introduction of a feedback circuit from the plate circuit of the second radio frequency tube No. 2 to the grid circuit of the first radio frequency tube No. 1.

Opposing feedback currents would

development possibilities a step further it dawned on Grimes that by properly proportioning the constants of the filter coil, which is a special RF choke, and the bypass condenser "C4" in the plate circuit of the No. 2 tube, (.001 mfd.), the aiding feedback could be prevented at the short waves (high frequencies) and aided at the long waves (low frequencies). The idea worked beyond his wildest expectations. The short waves tended to pass readily thru the bypass condenser while the special choke further aided their passage thru this condenser by offering a blocking action to the passage of such currents thru the filter coil.

The Filter Coil With Short and Long Waves

When we consider the long waves, we have a totally different action. Due to the lower frequencies of the longer waves, they have some difficulty in getting thru the .001 mfd. bypass condenser but have a comparatively easy path thru the R. F. Filter Coil. Remember that as the frequency of a current becomes lower (increasing wavelength) it becomes increasingly difficult to pass thru a condenser but easier to pass thru a choke and conversely as the frequency increases, (lowering wavelength) it becomes easier to pass thru condensers and more difficult to pass thru a choke coil. Of course the size of the choke and the capacity of the condenser are important. In this particular case best results are obtained by using a .001 mfd. condenser and a .75 milhenry filter coil having a resistance of approximately 1,000 ohms.

The proper design of the tuning coils, filter coil and condenser is very important.

Equal Amplification and Selectivity

The astonishing part of this arrangement is that while it increases the amplification at long waves, it also increases the selectivity, a factor which is more important than it appears at first glance. Several methods have been evolved which serve the purpose of increasing amplification at the long waves but in each instance, the selectivity of the receiver at these long waves is sacrificed. In the I. D. S. high amplification comparable to that obtained at short waves is obtained without sacrificing selectivity.

The tapped primary on the antenna coil is highly desirable from several standpoints. In the first place it serves to provide a means equivalent to shortening or lengthening the antenna for nearby or distance reception. Another and perhaps more important consideration is that reducing the number of turns in the primary, when listening in to a powerful local station, serves to reduce the radio energy fed to the detector tube and prevents overloading of this tube. Overloading the detector produces very poor quality because under such circumstances the low or bass notes are lost. The difference in quality because of the presence or absence of these low notes as the turns are decreased or increased respectively will be a revelation to you.

Audio Howl and Interaction Eliminated

In the audio end, the combination of a resistance coupled stage for the second or middle stage, eliminates the audio frequency howl which is often present when two or more stages of transformer-coupled audio frequency amplification are cascaded. The use of audio transformers with a rising characteristic curve such as the Samson HW-A3 type must be used in the audio stages, to compensate for the tendency of the fixed bypass condensers, which are in effect connected across the transformer windings, and discriminate against the high pitched sounds and the pronunciation of words in which the letters "S", "T" and "C" are present.

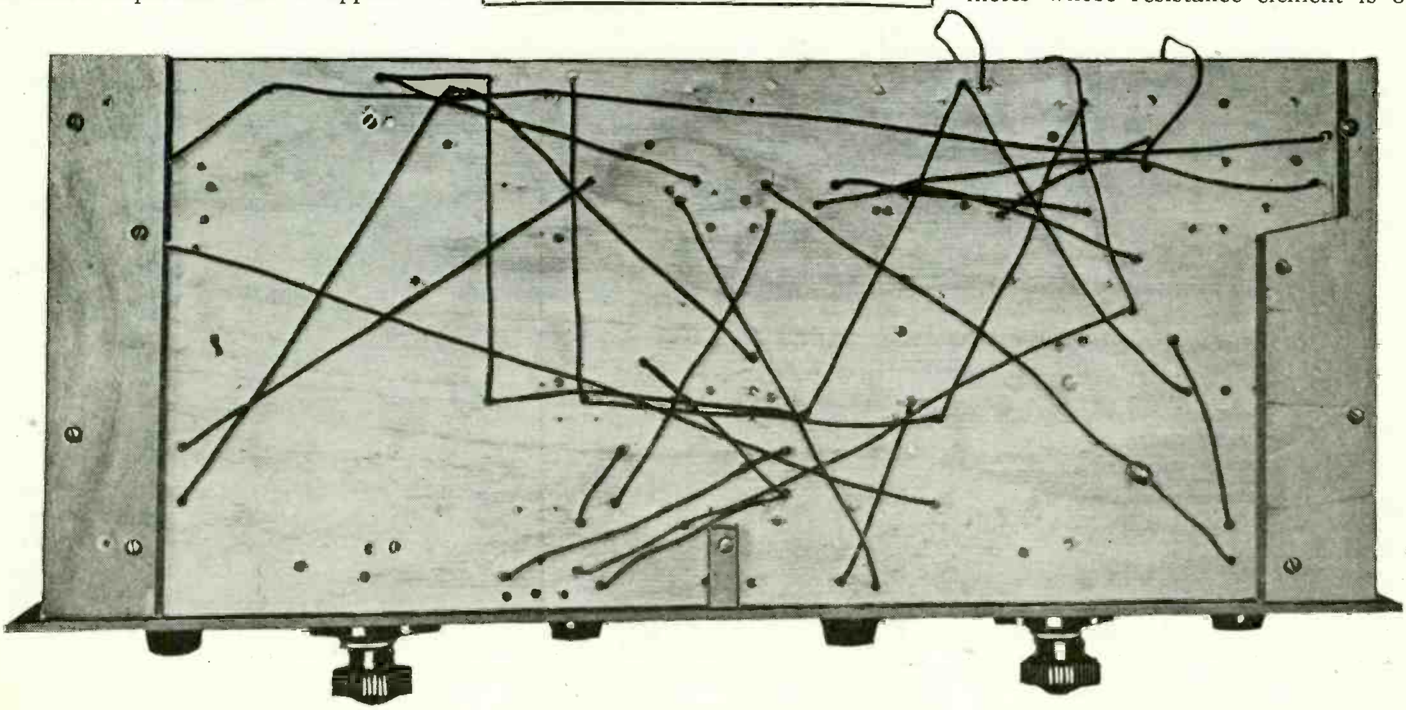
Smooth volume control is obtained by the use of a high resistance potentiometer whose resistance element is of the order of 250,000 ohms. This method of volume control with the resistance element connected as shown across the secondary winding of transformer "T4" is much better than fila-

PARTS REQUIRED FOR THE R.G.S. RECEIVER

1 Grimes Essential kit consisting of:
- 1 National-Grimes tapped antenna coupler and tuning condenser; T1
- 1 National-Grimes, 2 gang tuned RF transformer and condenser unit; T2, T3
- 1 Westinghouse engraved panel
- 1 I.D.S. grid RF choke coil; RFC1
- 1 I.D.S. filter FR coil; RFC2

4 Benjamin; No. 9040 UX spring sockets; 1, 2, 3, 4
1 General radio type 368, 15 mmfd. midget condenser
1 Dubilier; type 642, .00025 mfd. grid condenser; GC
1 Lynch; 2 megohm metallized grid leak; GC
2 Sangamo; .00025 mfd. fixed condensers; C1, C3
3 Sangamo; .001 mfd. fixed condensers; C2, C4, C5
1 Centralab; 250,000 ohm. potentiometer; V
1 De Jur; 2-ohm rheostat; R
1 De Jur resistance coupler; T5
1 Samson audio transformer; type HW-A3, 2 to 1 ratio; T4
1 Samson; type HW-A3, 6 to 1 ratio audio transformer; T6
1 Special set of Acme Celatsite colored wires
1 Lynch; 25,000 ohm metallized resistors; R1
1 Lynch; 1 megohm metallized resistor; R2
2 National vernier dials
1 9" x 20" x ½" baseboard
8 Eby; Ensign type, engraved binding posts marked respectively; "ANT"; "GND"; "Speaker+"; "Speaker—"; "A B-Bat."; "22½ Volts+"; "90 Volts+"; "135 Volts+."

The "GND" also serves as the "A—" terminal.



The bottom of the baseboard. Most all wiring is made through holes in the baseboard and connections made direct from one point to another.

ment rheostat or detuning control of volume because it does not cause distortion as is so often the case when rheostat or detuning control of volume is employed.

No Shielding Required on Improved Model

A further improvement which is of vital interest to the home builder lies in the elimination of all shielding on this RGS Receiver. There is no question of course regarding the advantages to be ordinarily derived from total shielding but thru the use of a new development it has been possible to eliminate shielding entirely without sacrificing selectivity, provided the receiver is to be used beyond a half mile of a local broadcasting station. Under these conditions, the unshielded RGS Receiver with its two stages of radio, detector and three stages of audio will give results that will surpass most shielded models.

The use of the receiver without fussy shielding brought up another problem which was solved in a very simple and effective manner. In a shielded model it would be possible to connect the "G" terminal of audio transformer "T2", because the shielding isolated the operator's hand from the critical points of the circuit.

In an unshielded I. D. S., it was found that bringing the hand to the second tuning condenser caused a whistle because of the capacity effect between the hand and the audio transformer "G" terminal which amounted to touching the audio transformer grid terminal with the consequent howl which takes place when this is done.

This effect was overcome by changing the grid circuit of the second tube slightly, placing the .00025 mfd. condenser in the grid lead instead of in the grid return lead and placing a radio frequency choke coil RFC2 between the grid of the tube and the grid terminal of the audio transformer "T4" as shown to keep the radio frequency currents in the tuned radio frequency circuit and out of the audio frequency circuits.

Front panel layout. The two large dials are the tuning controls while the knobs located on either side of both dials are clearly labeled for their use.

Simplified Control

To simplify control, reducing the usual three controls of most two stage and detector radio frequency circuits to the logical and popular two controls, the second radio frequency and the detector tuning condensers have been ganged. These two condensers move very closely in step with each other so that there is no sacrifice in efficiency by ganging them. As an added feature for distance tuning when all circuits must be on the hairline for efficient tuning, a separate small capacity variable condenser has been provided to compensate for any slight irregularity

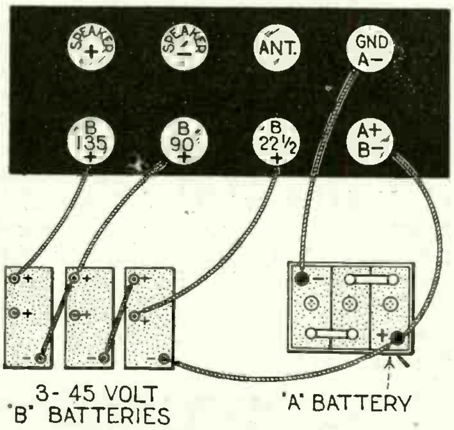


Diagram of connections to the binding post panel which is mounted on the rear of the baseboard.

in the coordination of the ganged tuning condensers. This need not be used except for very fine tuning.

The connections for the various elements of the receiver have been worked out very carefully and are the result of careful calculation and a great number of experiments.

A phase reversal in any of the circuits will mean the difference between remarkably efficient operation and absolutely rotten results. It is recommended therefore, that the specifications and especially the directions for connecting the parts as regards polarity of the coils of the tuned radio frequency transformers and the audio frequency transformers be followed implicity.

The use of a separate 22½-volt battery for the detector circuit is absolutely necessary for best results. The use of a common "B" battery for all stages will result in noises and howling just as soon as the detector "B" battery unit of the entire battery runs down, thereby increasing the resistance of the battery and causing resistance coupling and the howling which usually results from this cause.

Construction of the Receiver

The construction of the receiver and wiring is a very simple matter. It is not necessary to follow the layout shown since the placing of the parts is not very important as long as care is taken to place the coils in the relative positions shown.

After the parts are mounted on the panel and on the wood baseboard, the connections can be made by running the flexible wire from one terminal to the other, running the long leads thru the baseboard and along the bottom of the baseboard until they are directly below the other terminal and then threading the wires thru the baseboard again to terminate at the desired terminal. The grid connections however, should be run as directly as possible and in such cases it is best to make the connections from terminal to terminal on the top of the baseboard.

Batteries Required

The "A" battery required depends on whether you are going to use a trickle charger or not. The circuit and apparatus as designed is suited for storage battery tube. The use of dry cell tubes demands different constants which have not as yet been fully worked out.

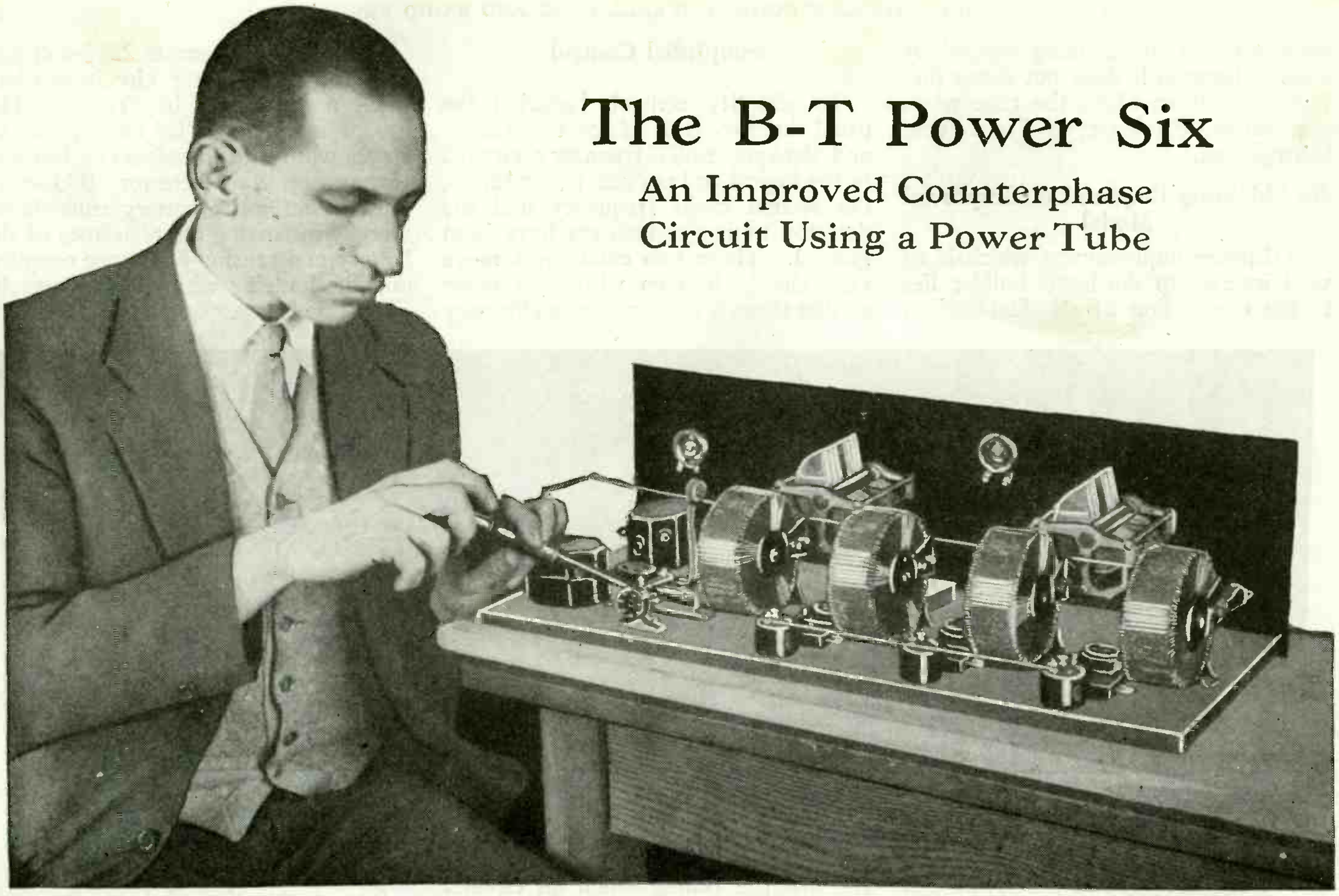
Due to the slightly higher impedance of the dry cell tubes at radio frequencies, the number of turns on the primary windings of the transformers "T2" and "T3" should be increased about three turns more.

The detector circuit is especially designed so that the new, highly efficient detector tube, UX 200A may be used.

(*Continued on page* 168)

The B-T Power Six

An Improved Counterphase Circuit Using a Power Tube



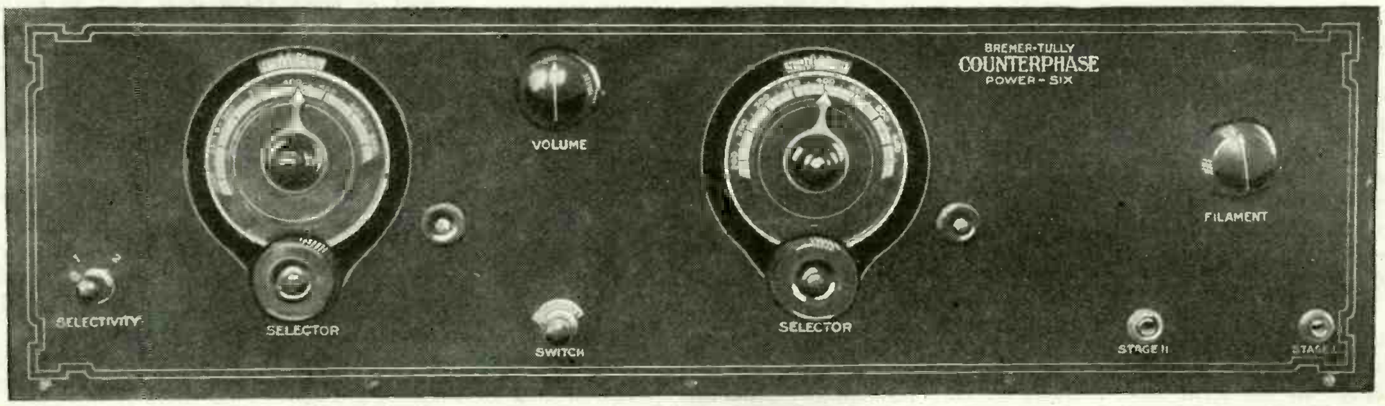
THIS receiver employs three stages of tuned radio frequency amplification, a detector and two stages of audio frequency amplification. The detector tube is the fundamental unit of all receivers. If the antenna were connected to the detector coil and the phones placed in the plate circuit, signals could be tuned in, just as in a standard one-tube set. In order to make these signals louder two stages of audio frequency amplification are added. A jack is inserted in each stage to permit use of either one or two stages of audio amplification. To still further strengthen the signal and secure sharper selection, three stages of tuned radio frequency amplification are employed ahead of the detector. Each radio frequency stage and the detector requires a tuning condenser and coil; in all, four coils and four condensers. However; two condensers are attached to each shaft in order to simplify the tuning and eliminate controls.

Preventing Oscillation

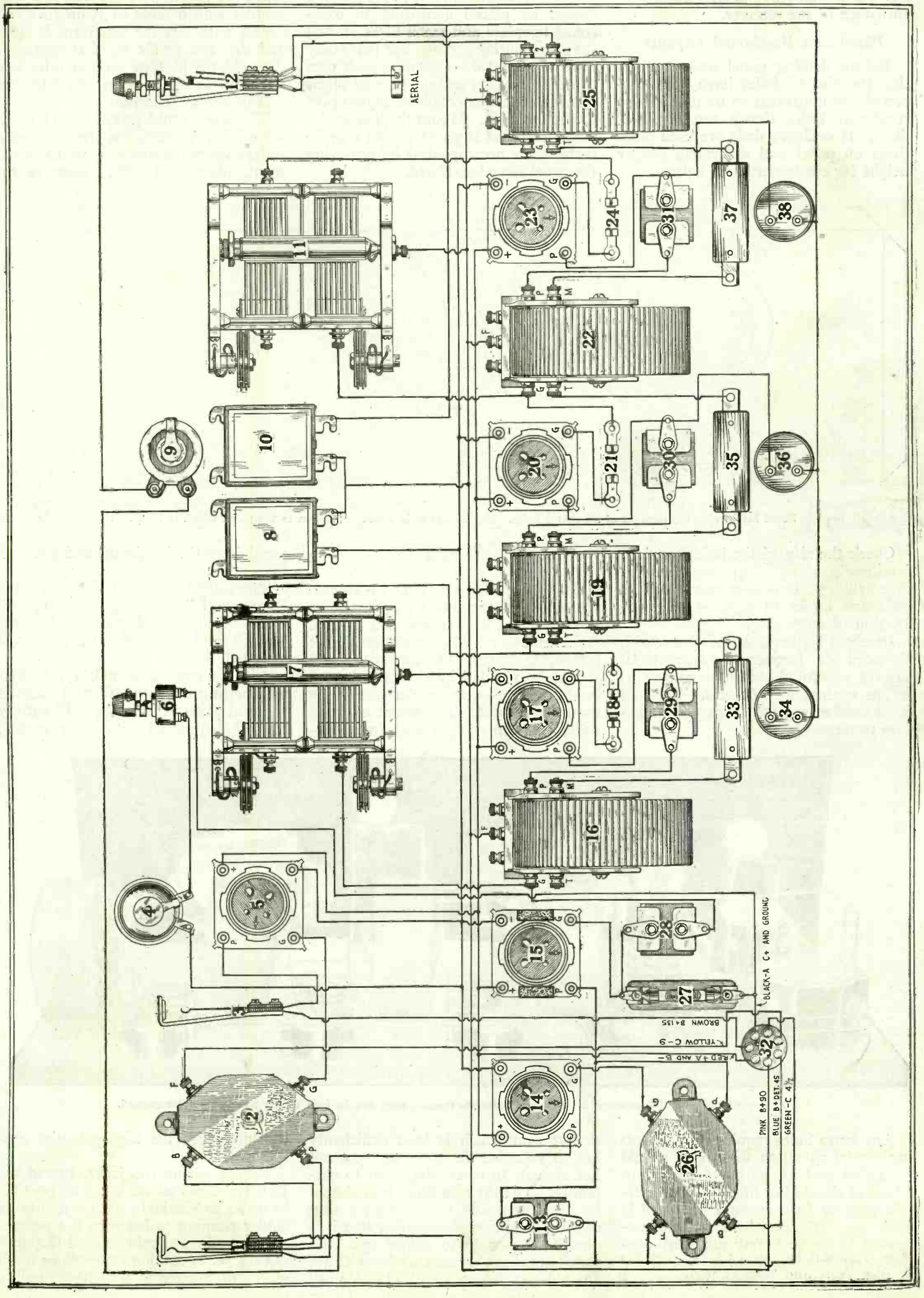
When the tuned radio frequency stages of a receiver are tuned to the same frequency, there is a tendency to oscillate. This is prevented by a separate counterphase circuit in each stage. Each is permanently adjusted by means of a Vario Denser "33," "35" and "37" to suit the tube used. The 1500-ohm resistances "18," "21" and "24" in series with the grid of each tube are used to keep the set equally sensitive over the broadcast band. Normally with the ordinary connection for transformer-coupled radio frequency amplification there is a marked variation in the sensitivity of the set from the lower to the higher wavelengths. This is due mainly to the fact that the set tends to oscillate most readily at the higher frequencies (lower wavelengths). The 1500-ohm resistances in combination with the series-variable resistance of 500,000 ohms "9" in the B Battery lead tend to hold the amplification practically constant over the range of this receiver. The 500,000 ohm variable resistance is used to control volume.

Two degrees of antenna coupling are provided in order that the operator may adjust his set to the selectivity and sensitivity requirements of his own individual locality and antenna. This switch controls the amount of energy fed from the antenna into the set.

"C" batteries are used on both the radio frequency and audio frequency stages of this receiver. This "B" materially lengthens the life of the bat-



A panel view of the B-T power six. The two selectors control the four tuning condensers. The small knob at the right of each selector controls the small vernier or "trimmer" condenser.


AERIAL
BLACK-A C+ AND GROUND
BROWN B+135
YELLOW C-9
RED +A AND B-
PINK B+90
BLUE B+DET.45
GREEN-C 4½

teries and improves the all-around performance of the receiver.

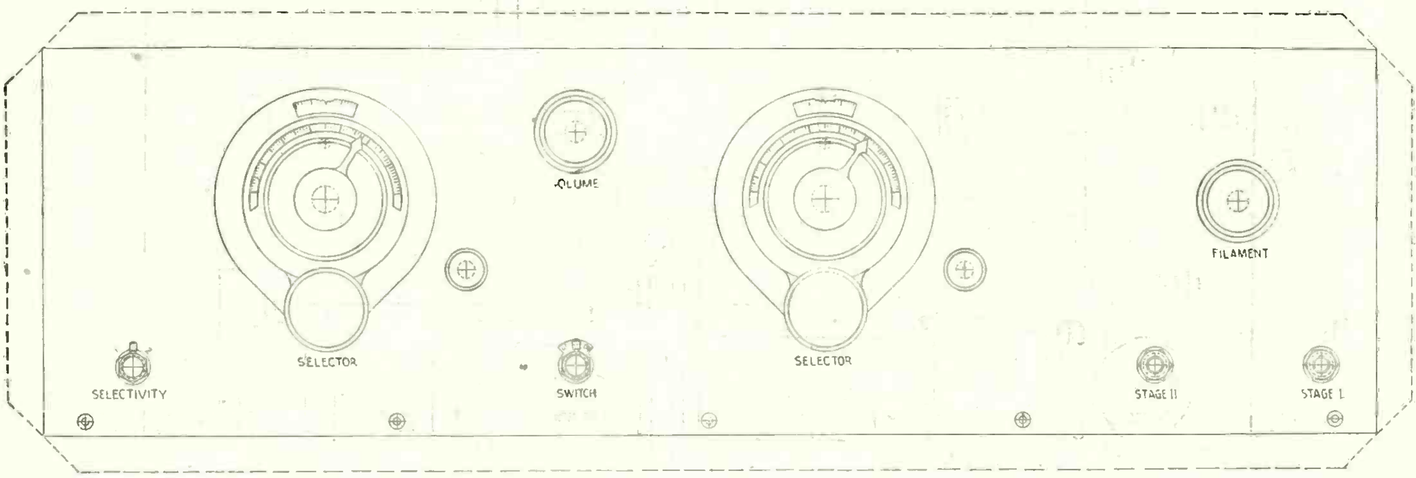
Panel and Baseboard Layouts

Before drilling panel make certain that the size of holes have been corrected for apparatus to be used. The condenser holes shown are for B-T dials. If ordinary dials are used place them on panel and determine proper height for condenser shaft holes.

Parts which mount on the baseboard should be placed according to baseboard template and small holes started for all mounting screws. All parts may now be mounted. Examine each part carefully making certain that all apparatus is in perfect condition before proceeding to wire. Mount the Torostyles last. The first steps of wiring may be more easily accomplished by removing the panel from baseboard.

touch the junction of the iron and connection with a piece of rosin core soldering wire. If the apparatus is clean and the iron at the right temperature the solder will flow on the joint and the rosin will pass off as vapor leaving a neat, clean connection.

The most rapid progress will result by wiring circuits in the following order: negative filament, positive filament, plate, and grid. Remove the panel from the baseboard and make all filament connections.



Panel layout showing location of all center holes. This layout is in exact proportion to the panel which is 7" x 24".

Check the size of the holes required for the rheostat jack and switches before drilling. Before engraving, place dials and knobs in position to check location of engraving.

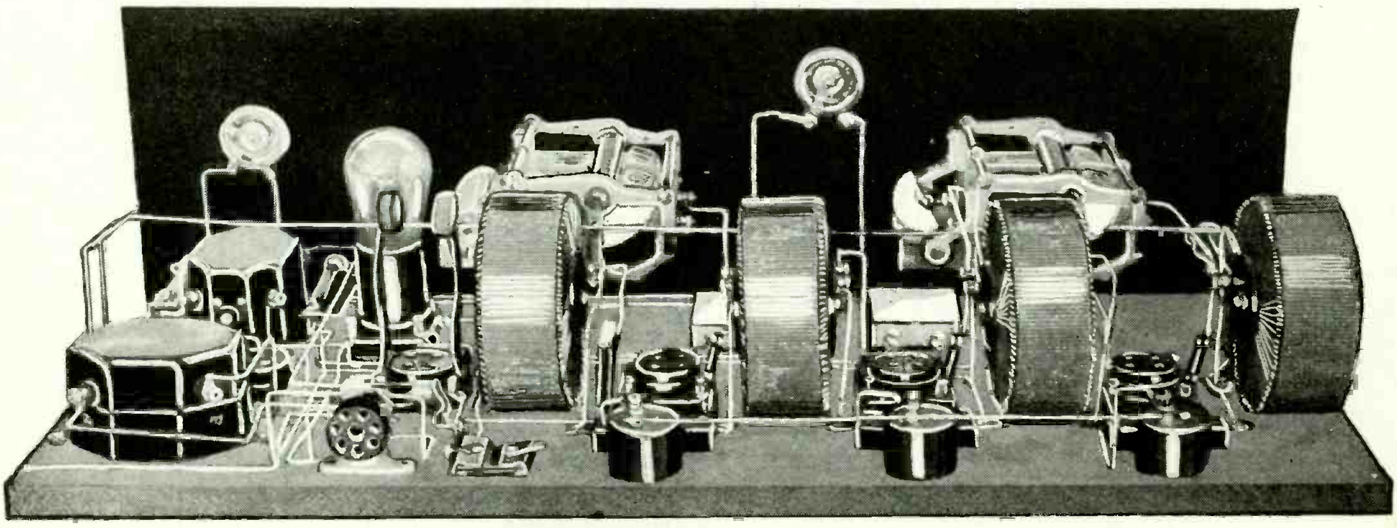
Baseboard should be of dry wood, shellaced or lacquered. Inspect all sockets carefully before mounting to insure against any defects. Test all fixed condensers for short circuit before connecting.

Wiring

In wiring the set No. 14 tinned, round or square bus wire should be used for best appearance and results. Acid fluxes or acid-core solder almost invariably result in corrosion and should be avoided by the amateur set builder. Rosin-core solder should be used throughout. The secret of good soldering is in using a well-tinned soldering iron which is kept sufficiently hot to vaporize the rosin and yet not hot enough to cause the rosin to carbonize. The tip of a dirty iron should be filed clean and tinned with a thin coating of solder. Remember that it is almost impossible to solder two corroded surfaces—scrape surfaces clean. In soldering first touch the hot iron to the connection to be soldered and then

The leads to switch "6" and 3 Ohm Rheostat "4," should be made after all other negative and positive filament leads have been made and the panel mounted.

After mounting panel, finish filament wiring to switch "6" and rheostat "4" and proceed with the "B" battery lead, then proceed with other wiring, finishing with the high-potential connections.



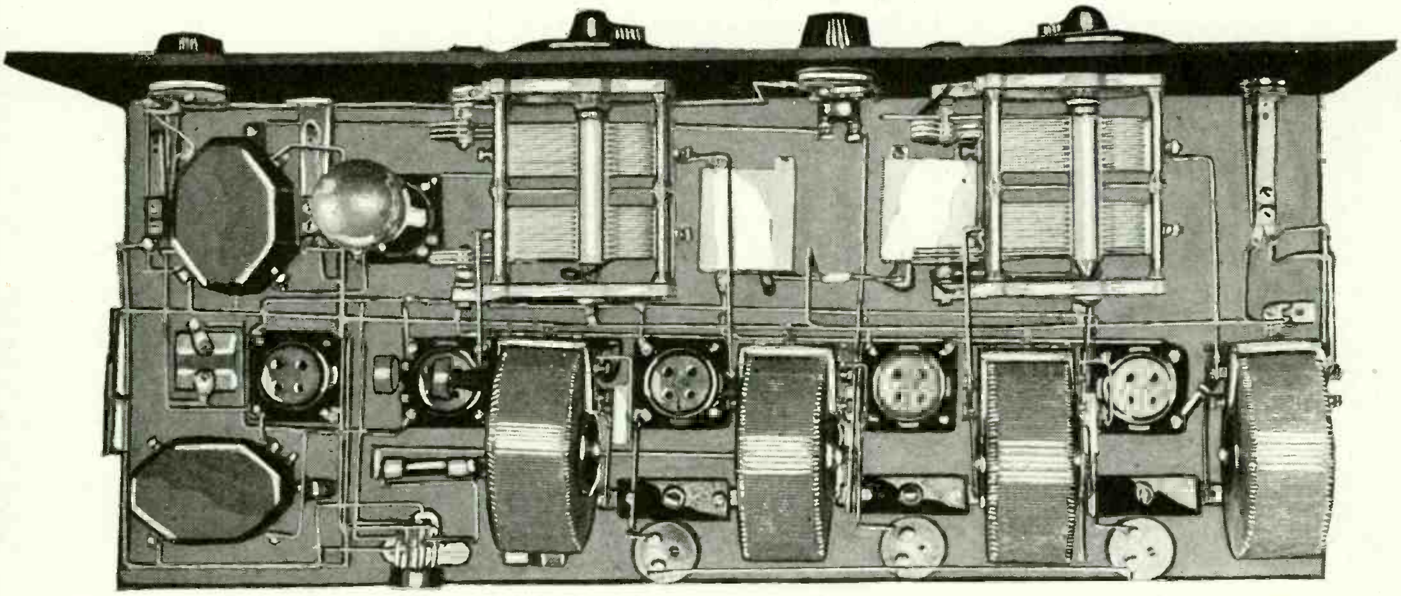
A rear view of the B-T power six. The four Torostyle transformers can be seen clearly in the right foreground.

Any extra holes required for mounting special rheostats, dials, etc., should be added and all parts which mount on panel should be fitted to make certain that no further work on panel is necessary. The panel may then be engraved if desired and mounted centrally on baseboard with No. 6 by ¾-inch Countersunk wood screws and fitted to the cabinet.

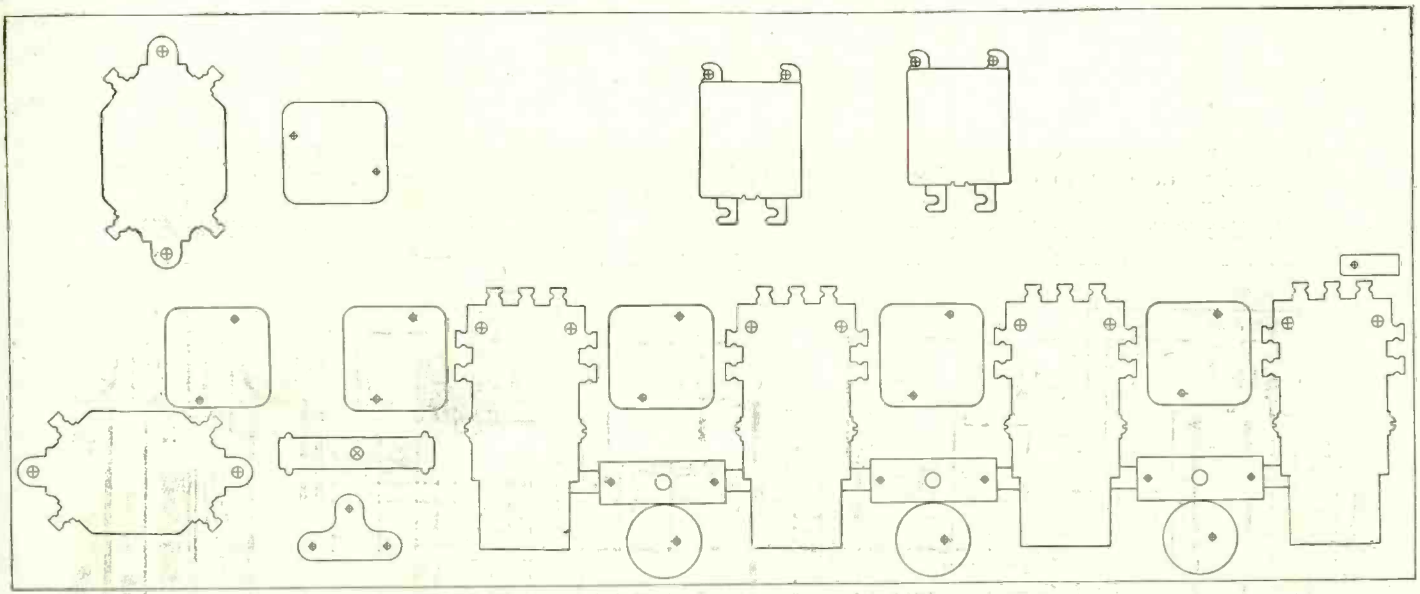
Before wiring the jacks, spread the jack terminals as far apart as possible in order to eliminate the possibility of solder running in between the prongs. Soldering lugs should be used throughout the set in making connections to all pieces of apparatus on which binding posts are used. This makes possible a much neater appearance and eliminates the possibility of heating the terminals too hot and thereby disconnecting wires which may be soldered to them from the inside.

Either binding posts or some type of plug-in connections may be used to provide the battery connections. In the set constructed in our laboratories, a Jones Multi-plug "32" was used.

It is preferable to place the "C" battery inside the cabinet or immediately outside if there is not sufficient room. Either flexible leads or separate posts may be used to provide for these connections.



Top view of the power six. It can be seen that the wiring is simple and straightforward.



Plan of baseboard. This gives the exact layout of each piece of apparatus and also location of mounting holes.

Check Wiring Carefully

Before connecting the batteries to the completed set, carefully check over all connections and then in order to be sure that no mistake has been made which would burn out the tubes, make the following test. Connect one side of the "A" battery to the terminal minus "B" and then with the tubes in their sockets and the filament switch turned on, connect the other side of the "A" battery to each of the plus "B" binding posts or connections, one at a time. The tubes should not light: if by any chance they do light carefully check over the circuit and locate the short or wrong connection between the "A" and "B" circuit, before going any further.

The set is now ready for preliminary tests and adjustment of the Vario Densers "33," "35" and "37." Connect all the batteries properly and insert one of the tubes. Turn switch on—if tube lights properly insert all tubes. With the tubes turned on, and the antenna and speaker connected, you should be able to tune in stations provided all connections have been properly made and no defective apparatus has been used.

Soldering Suggestions

Do not use acids for soldering. Use rosin core solder or dissolve a small amount of powdered rosin in alcohol to the consistency of a paste, and apply light coating to joint. Clean all parts thoroughly by scraping if they are not already tinned.

Clean the point of soldering copper by filing. Rub point with solder and sal-amoniac or soldering acid to secure a clean coating of solder. Soldering copper must always be hot enough to melt solder instantly. Solder connections by picking up a drop of solder on the point of copper and touching the copper to point of contact just sufficiently long to flow the solder thoroughly into point.

The essentials of soldering are: First, a clean thoroughly tinned point; second, a clean or tinned contact, with a small amount of rosin flux, and third, a hot copper. The copper must not be hot enough to burn the solder coating of the point.

Do not attempt to rush or hurry wiring. Careful and thorough work will insure immediate results, while hurried or slip-shod work will destroy your apparatus, and make best results impossible. Cleanliness is of utmost importance. Do not permit soldering pastes or flux to spread on posts, or you may melt the soldered connections from inside of post; a hot iron quickly applied will avoid this danger.

Tuning the Set

With the tuning controls, the approximate position for each wavelength is indicated directly. In tuning, rotate the two dials together, keeping them both at approximately the same reading as the setting may not be exactly the same as each dial; the best method is to rotate one dial slowly across the wavelength desired and in rotating the other dial cause it to alternately lag behind and then lead the first dial, or turn it rapidly back and forth across the signal while rotating the other dial slowly.

The capacity between circuits will vary in different sets due to variations in individual wiring as well as any slight differences in individual coils and condensers, no matter how closely matched. Therefore with each condenser unit ("7" and "11") there is a small variable "trimmer" condenser. When once adjusted the rear trimmers are not changed and the front trimmers only for very fine work in tuning. The trimmers are used to bring the circuits into resonance. The setting of front trimmer and to a certain extent the dial reading is affected by the position of the rear trimmer.

To begin adjustment set the rear "trimmer" on the left hand condenser full in.

Then rotate panel "trimmer" back and forth rapidly as the main dial is moved slowly a few degrees to each side of the approximate setting for the station desired. Set dial at point where greatest volume results, then adjust "trimmer" for greatest volume. Next do this same thing with the other dial and trimmer.

Try to get the point of greatest volume with the front trimmer near its central position, and for fine tuning you may then turn either way without going beyond the range of the front trimmer. If this point of maximum volume does not come with the front trimmer near the central position, change the rear "trimmer" slightly and try again. You will find this easier than it sounds.

When searching for weak, distant stations, it is necessary that all tuned circuits be kept in resonance—otherwise the station may not be heard; that is, it may be passed by. To keep the circuits resonant, in other words, tuned to the same wavelength when the tuning controls are rotated, is difficult unless you are systematic.

A simple rule is simply to follow the outside sounds or noises. There is always a certain amount of static present. If your tuning controls are kept together these sounds can be heard as you turn the dials, although there may be no station signal heard, as you go up or down the scale and you will locate practically all stations within range.

The two selectors are used to tune the receiver to the same frequency as the signal to be received. For strong signals close tuning is not necessary and it may even be desirable to rotate selector to slightly out of resonance to prevent over-loading. However, weak signals require very close adjustment of selectors for maximum volume and volume may be considerably increased by means of the "trimmer" knobs. Always operate at lowest volume consistent with size of room.

Volume or sensitivity may be increased by rotating the volume control "9." Increasing the sensitivity beyond a certain degree may cause the circuit to go into oscillation. This is indicated by a "click," oscillation beats, whistles or distorted signals. Always reduce senstivity below this point.

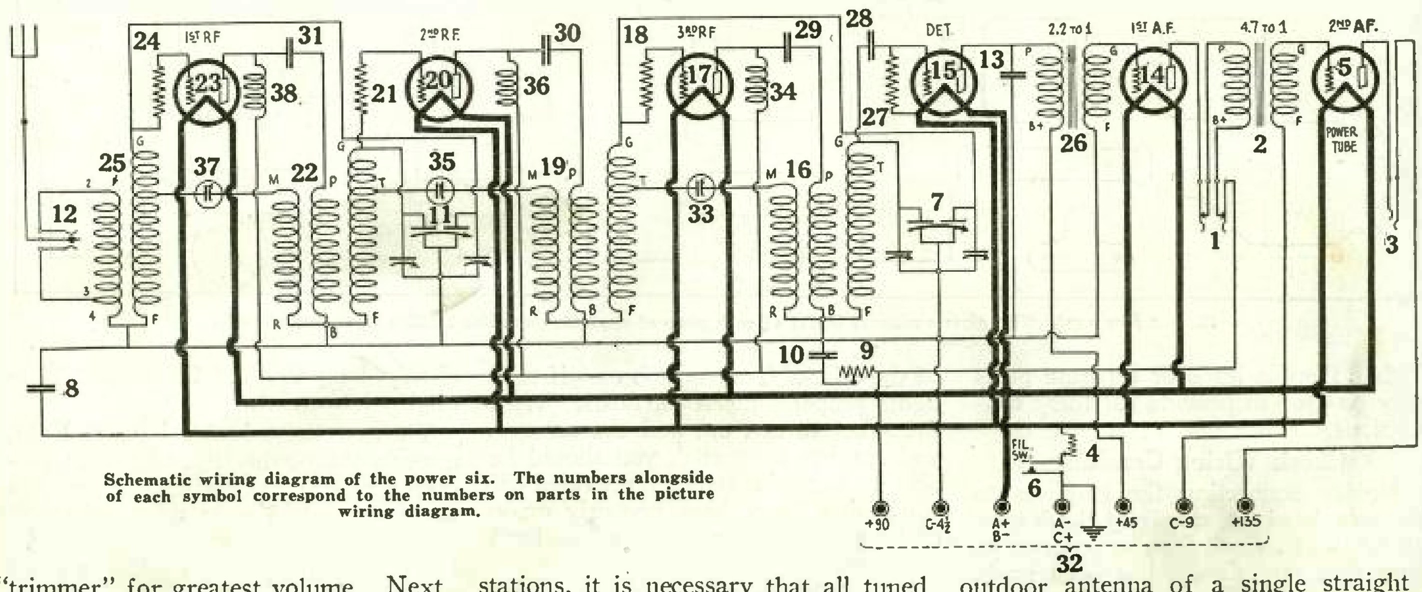
When tuning weak signals use both hands, tuning each control and its trimmer carefully. Then adjust sensitivity control carefully for loudest clear signal.

This circuit is designed for the use of 201-A or 301-A tubes or their equivalent in the three radio frequency stages and first audio. The 200-A or similar tube is recommended as a detector and the UX-112 or its equivalent in the last stage of audio frequency amplification. Type 199 may be used, but volume will be less than with standard 201-A tubes. Use either an indoor or outdoor antenna of a single straight wire 20 to 60 feet in length. A loop antenna is not recommended. Use water pipe as ground if possible.

PARTS REQUIRED FOR B-T POWER SIX

- 1 Type TA Bremer-Tully Torostyle Transformer (25)
- 3 Type TC Bremer-Tully Torostyle Transformers (16, 19, 22)
- 2 Type LD-17 Bremer-Tully Tandem Condenser (7, 11)
- 3 Model N, X-L Vario Densers, 1.8 to 20 mmf. (33, 35, 37)
- 1 Bremer-Tully 500,000 ohm resistance (9)
- 3 Bremer-Tully R. F. choke coils (34, 36, 38)
- 3 Bremer-Tully 1500 ohm fixed resistances (18, 21, 24)
- 1 Micarta or Radion Panel 7" x 24"
- 1 Wood Baseboard 9¾" x 23½"
- 1 Bremer-Tully Euphonic Audio Transformer, 2.2 to 1 (26)
- 1 Bremer-Tully Euphonic Audio Transformer, 4.7 to 1 (2)
- 2 Bremer-Tully Tuning Controls
- 1 Aerovox .001 mfd. fixed condenser (13)
- 1 Aerovox .00025 mfd. fixed condensers (28)
- 3 Aerovox .006 mfd. fixed condensers (29, 30, 31)
- 2 Aerovox 1 mfd. fixed condensers (8, 10)
- 1 Durham 2 megohm grid leak (27)
- 5 Bremer-Tully type UXA (5, 14, 17, 20, 23) and one UXD Socket (15)
- 1 Carter Double Circuit Jack (1)
- 1 Carter Single Circuit Jack (3)
- 1 Carter Filament Switch (6)
- 1 Carter 3-ohm Rheostat (4)
- 1 Carter Single Pole Double Throw Jack Switch or equivalent (12)
- 1 Jones Multi-plug (32)
- 2 C-Batteries, 4½ volts each

Cornish Bus-bar or flexible hook-up wire



Schematic wiring diagram of the power six. The numbers alongside of each symbol correspond to the numbers on parts in the picture wiring diagram.

The Regenatrol Receiver

A Circuit Combining Tuned R. F. Amplification and Regeneration with Automatic Antenna Adjustment

ASIDE from the time and effort spent in improving the electrical efficiency of the circuits used in present-day receivers, more thought has been given to the problem of simplified, unified control than to any other phase of radio development work. Of course the idea of improving the appearance of the front panel has been given its due share of attention.

For a long time, it was thought absolutely necessary to use three controls on receivers using the standard two stages of radio frequency amplification, a detector and two stages of transformer coupled audio frequency amplifiction.

The idea persisted that anything less than these three controls in the form of tuning condensers across each tuned radio frequency condenser would result in a considerable loss of efficiency that would overbalance any advantages resulting from single or simplified control.

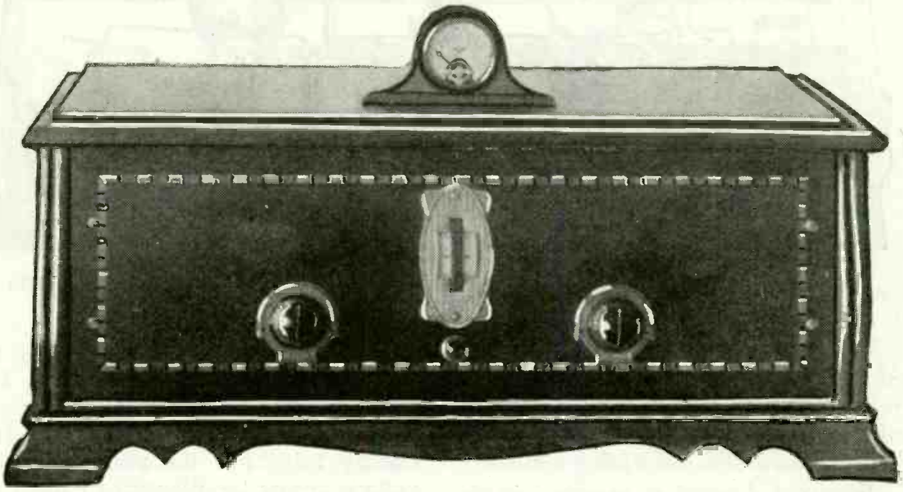
This idea has persisted for such a long time that it would seem as though it had become a recognized principle of receiver design and construction that three tuning controls are absolutely necessary for efficient operation.

Three Controls Not Logical

For the average person, a set with three controls is impractical because three controls are difficult to co-orinate, even when the dial settings move along pretty well in step with each other. The idea of using two controls has gained considerable ground and it would seem that two controls is really the logical number of controls for a two-fisted individual.

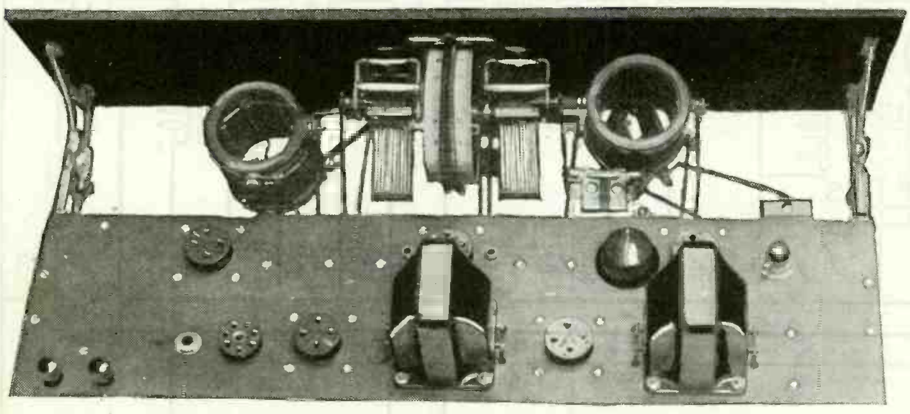
Some designers have gone a step further and tried to reduce the controls to one wavelength adjusting control. While the single control method is probably the most desirable from the standpoint of ease of operation, it does not lend itself very readily to mass production because of the care which must be exercised in balancing the units to produce exact co-ordination For practically the same reason such controls are often inadvisable for the home set builder because of the difficulty of getting matched parts or making the necessary adjustments to get them into step with each other.

In the average five tube set of the two stages of radio frequency, detector and two stages of audio frequency type, the detector stage and the radio frequency stage preceding it are usually pretty well in step with each other, provided good condensers and coils having the same characteristics are used. Most of the trouble in getting single control receivers to operate properly usually results from the fact that antennae and antennae characteristics vary considerably with different installations and tend to get the first radio frequency stage out of step with the other two tuned stages.



A view of the completed Regenatrol receiver. Note the simplicity of controls on this well-balanced panel. The voltmeter placed on top of the set also adds to the appearance as well as being useful.

Any attempt to couple the detector and the radio frequency stage before it together will result in some loss of efficiency unless some compensating method is used, so that the idea of using a separate control for the antenna stage and a double control for the detector stage and the radio frequency stage preceding it, is not as good as it may seem at first because of the compensating means which must be used to keep the two stages in step.



A back panel view of the Regenatrol. All wiring is concealed beneath the sub-panel. This set is made with a sloping panel, although the panel can be made perpendicular by means of the adjustable panel brackets.

Antenna Compensation

One of the best methods of accomplishing practically single control, with the alternative of double control is by use of a fixed radio frequency transformer for the antenna coupler of the first radio stage and tuned stages for the next radio frequency stage and detector stage. By using a double drum control unit such as the Bruno Unitune, in which the drums which control both tuning condensers are placed closely adjacent to each other, it is possible to adjust both condensers at the same time by pressing on both drums at the same time.

However, it is possible to adjust each condenser independently of the other by simply pressing on one drum at a time. This makes it possible to adjust the second radio frequency stage and the detector stage to maximum efficiency, making up for the slight loss which results from the use of an untuned antenna coupler. The loss which takes place in the untuned antenna coupler is further made up by the use of a regenerative feature in the detector stage, a feature which brings the circuit up to the standard of a really efficient three-control tuned radio frequency receiver.

The Tuning Unit

The Bruno "TK" Unitune, used as tuning unit simplifies the construction of the receiver by concentrating the coils and condensers in one unit.

Provision has been made for using a Jewell Portable voltmeter to check

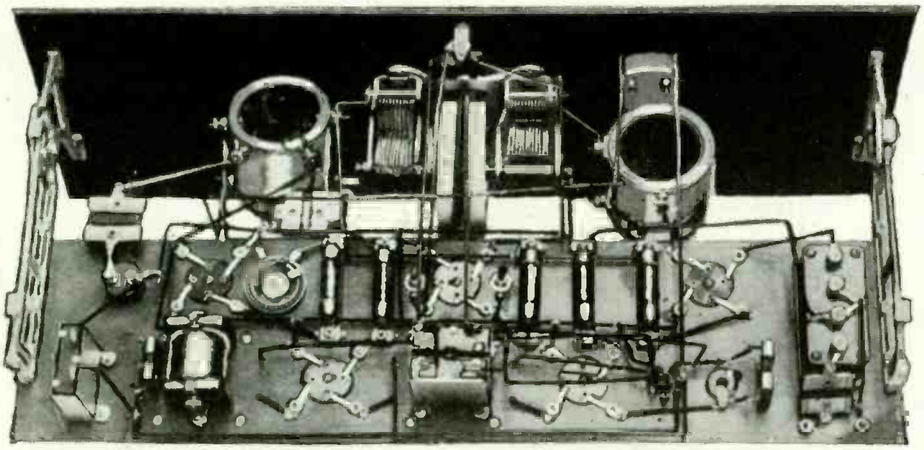


Photo showing an underneath view of the sub-panel with its parts and wiring arranged in compact fashion.

The regenerative control in the form of a variable tickler placed in inductive relationship to the secondary winding of the detector tuner is much less critical than an additional tuning control.

Separate Amperites are used in the filament circuit of each tube to give maximum efficiency of operation where no adjustment of the filament rheostat is desired. In that case the rheostat is placed at the full-on position cutting off all resistance and leaving the regulation of filament current to the Amperites.

the operating characteristics of the radio frequency tubes, and detector. The tip jacks connect the voltmeter across the filament of the second radio frequency tube, but the reading of the voltage across the filament of this tube serves as a good indicator of the conditions in the other tubes because the radio frequency and detector tubes are controlled from the same rheostat.

The fixed radio frequency transformer, used as the antenna coupler is connected as an autotransformer, thus giving maximum energy transfer and

denser is connected in series with the tickler to prevent shortcircuiting the battery. A battery switch is also provided in this circuit so that the regenerative feature may be used or disconnected, depending on whether the switch is "On" or "Off."

A radio frequency choke coil, "24," is used to prevent radio frequency currents from flowing through the tickler coil circuit instead.

Fixed Condensers Improve Quality

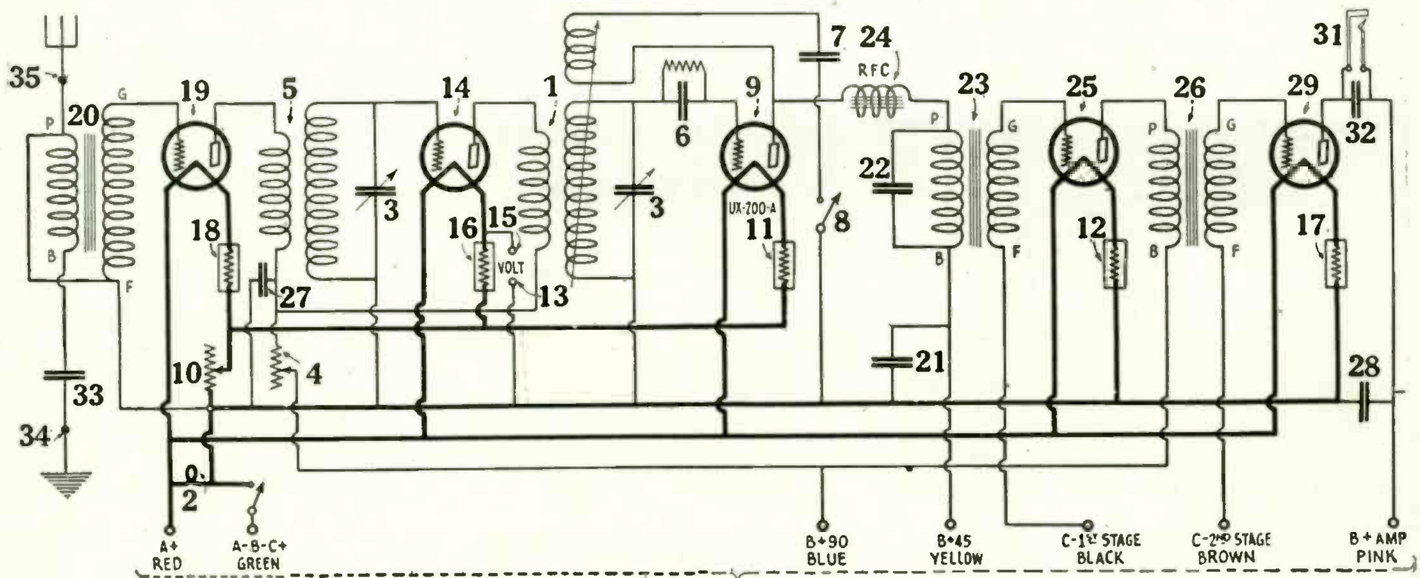
Fixed condensers of proper sizes are used in the various circuits to insure maximum efficiency.

A .0005 mfd. condenser in the ground circuit sharpens the tuning. A .006 mfd. fixed condenser across the loudspeaker terminals eliminates hissing and deepens the tone of the speaker.

Bypass condensers of 1 mfd. capacity across the "B" battery leads eliminate noises through any possible fluctuations through rundown "B" batteries and also serve to bypass radio frequency currents across the high resistance of the "B" batteries.

The drilling layouts for the panel and subpanel will show you the locations of the holes for mounting the parts. After you have located the hole centers with a center punch, you can proceed to drill the holes. Before drilling the holes with the proper size, enlarge the spot hole made with centerpunch by using a small drill about No. 41. This will enlarge the holes and give the larger sizes a better start.

In drilling the panel and subpanel, back them up with a piece of wood so as to avoid chipping.



Schematic wiring diagram of the set with numbers indicating the corresponding parts shown in picture wiring diagram and given in the list of parts required for this set.

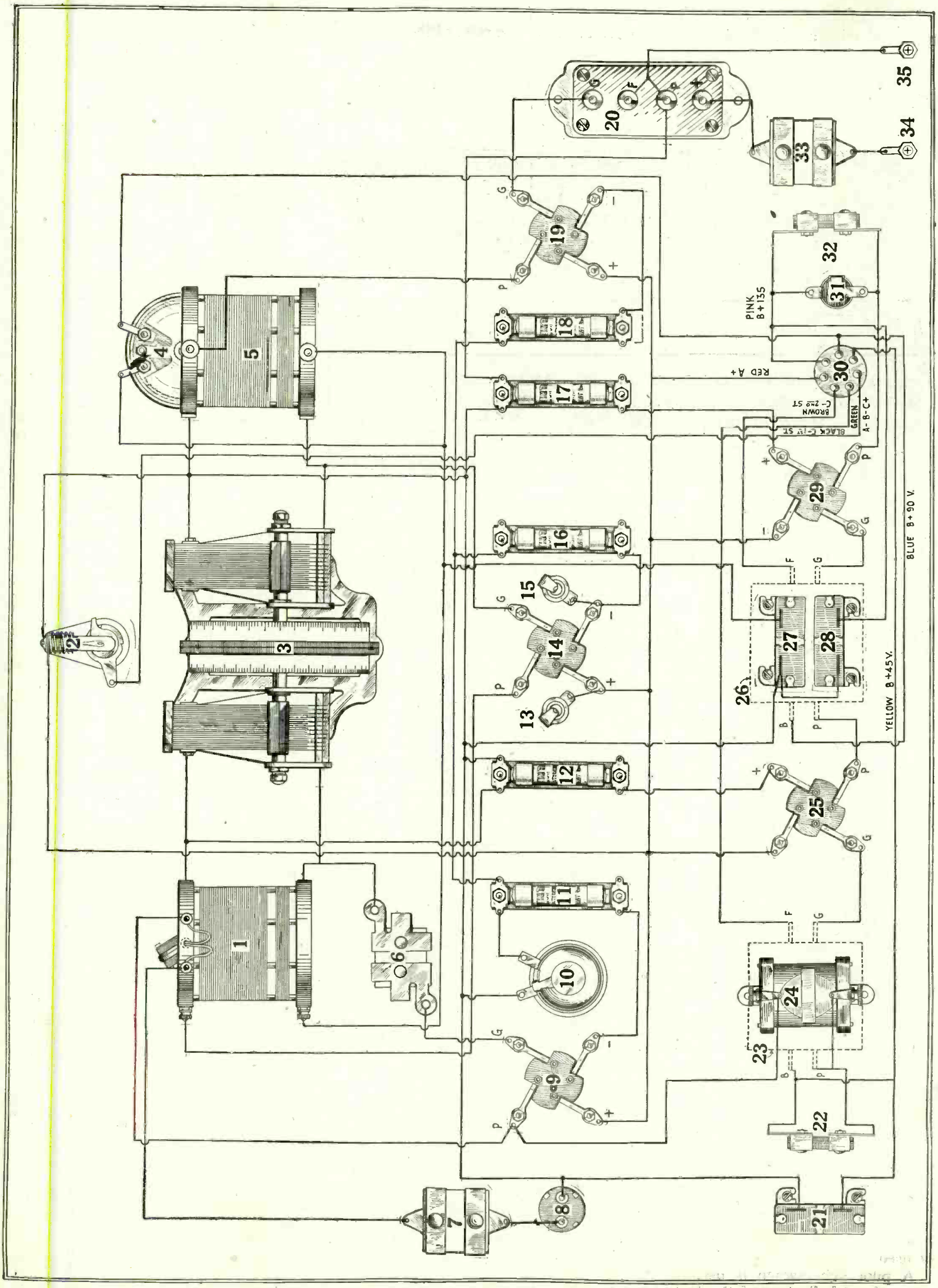
For tuning in distant stations where a rather critical adjustment of tube filaments is desired, the rheostat may be used.

A pilot light switch is used which gives visual indication of the fact that the "A" battery is "ON" or "OFF."

feeding a strong signal to be amplified by the first radio frequency tube.

Instead of being connected in series in the plate circuit of the detector tube, the tickler coil is connected as shown between the plate and the filament of the detector circuit. A .006 mfd. con-

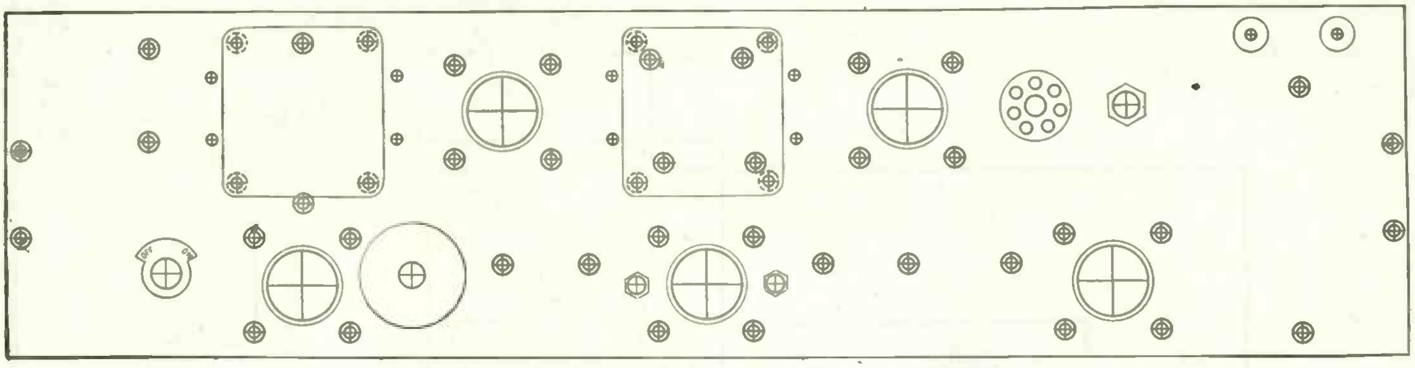
You can now drill every hole you have spotted, with a No. 18 drill. This will serve as a clearance hole for the parts which are mounted with 6/32 screws and will serve to start the larger drills for the larger holes.


PINK B+135
RED A+
BROWN C-2nd ST
BLACK C-1st ST
GREEN A-B-C+
BLUE B+90 V.
YELLOW B+45V.

Sizes

All holes for mounting screws should be drilled with a No. 10 drill; those for jacks, etc., should be drilled with a ¼" drill. **Holes** for the tube sockets should be drilled with a 1" drill. In cutting out the 1" holes, you will find it necessary to first drill a smaller hole to accommodate the pilot of the panel cutter, thus insuring centering the 1" holes.

Some holes shown on the layouts have a solid-line outer circle while others have a dotted-line outer circle. These outer circles indicate that those holes should be countersunk for 6/32" screws. Those shown with a solid line outer circle should be countersunk on the top side of the sub-panel, while those shown with a dotted-line-outer circle should be countersunk on the under side of the sub-panel.



Mounting layout showing all holes to be drilled in the sub-panel.

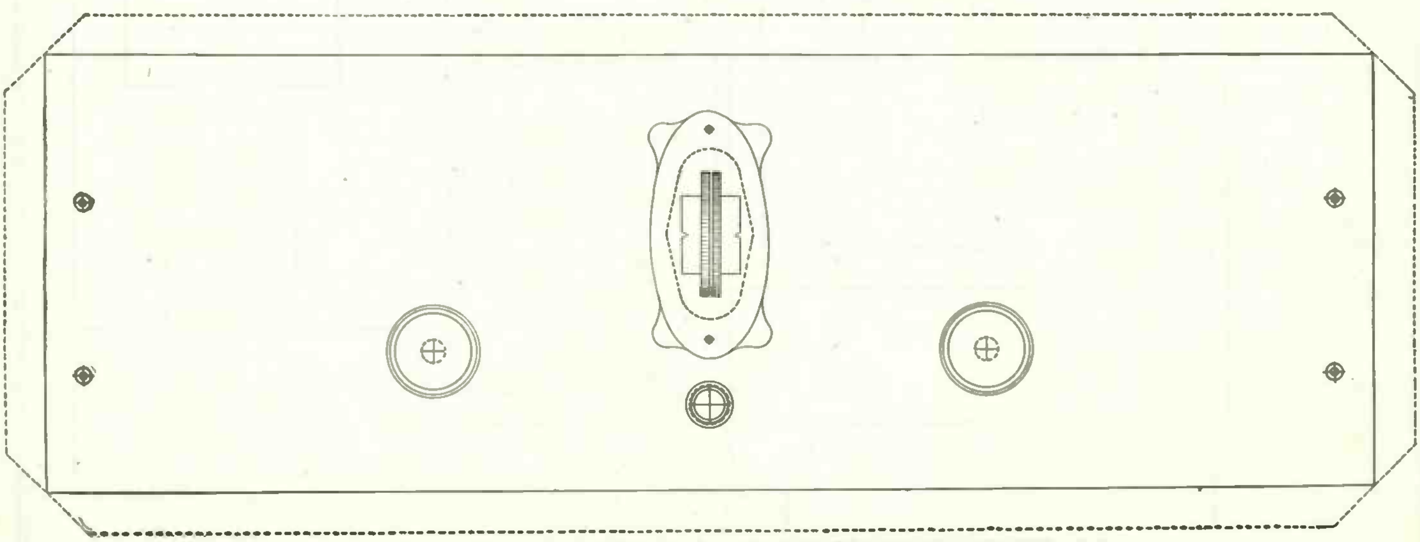
PARTS REQUIRED FOR THE REGENATROL RECEIVER

1 Bruno "TK" Unitune, consisting of
  1 three-circuit tuner; 1
  1 2C condenser unit; 3
  1 tuned R. F. transformer; 5
1 Bruno pilot light switch; 2
1 Centralab, No. 200M, 200,000 ohm Radiohm; 4
1 Electrad, Type GS, .00025 mfd. grid condenser; 6
1 Durham, 2 megohm metallized grid leak; 6
2 Electrad, Type S, .006 mfd. fixed condensers; 7, 32
1 Carter "Imp" battery switch; 8
5 Benjamin, No. 9044 UX spring sockets; 9, 14, 19, 25, 29
1 Carter, No. M6, 6 ohm midget rheostat; 10
4 Amperites, No. 1A; 11, 12, 16, 18
1 Amperite, No. 1A for UX 201A; No. 112 for UX 112 or UX 171 type tubes; 17
2 Carter, No. 10 tip jacks; 13, 15
1 Acme, R3 untuned R.F. transformer; 20
3 Tobe, 1 mfd. precision condensers; 21, 27, 28 (use a 1 mfd. filter condenser in place of No. 28 if more than 135 volts is used in last stage)
2 Electrad, Type S, .0005 mfd. fixed condensers; 22, 33
1 Samson, type HW-A3, 2 to 1 ratio audio transformer; 23
1 Samson, No. 85, 85 milhy. R.F. choke coil; 24
1 Samson, type HW-A3, 6 to 1 ratio audio transformer; 26
1 Jones, type PM Multiplug, 4 or 8-ft. cable as desired; 30
1 Carter, No. 1, open circuit "Short" jack; 31
1 Eby, Ensign type, engraved binding post with "GND" marking; 34
1 Eby, Ensign type, engraved binding post with "ANT" marking; 35
1 Lignole, No. 1D, 7" x 21" front panel
1 Formica, No. 1D, 5" x 20" x 3/16" subpanel
1 Pair, Bruno adjustable brackets
10 Lengths, Acme Celatsite, black covered wire
1 Package, Kester Radio Solder
1 Corbett, Type TS, 7" x 21", 10" deep sloping front cabinet
  1 Jewell, type 135 C portable voltmeter

You will find it worth your while to test out all the parts before mounting them on the panel and sub-panel. No matter how much care may be exercised in manufacturing and shipping each individual part there is always a chance that a defective part may slip thru the regular inspections of the manufacturers or may be damaged in transit.

The radio frequency coils should be tested to make sure that there are no open circuits in the windings and that there is no connection between the primary and secondary windings.

The untuned radio transformer and the audio transformers and choke coil should also be tested to make sure that the windings are intact and properly separated.

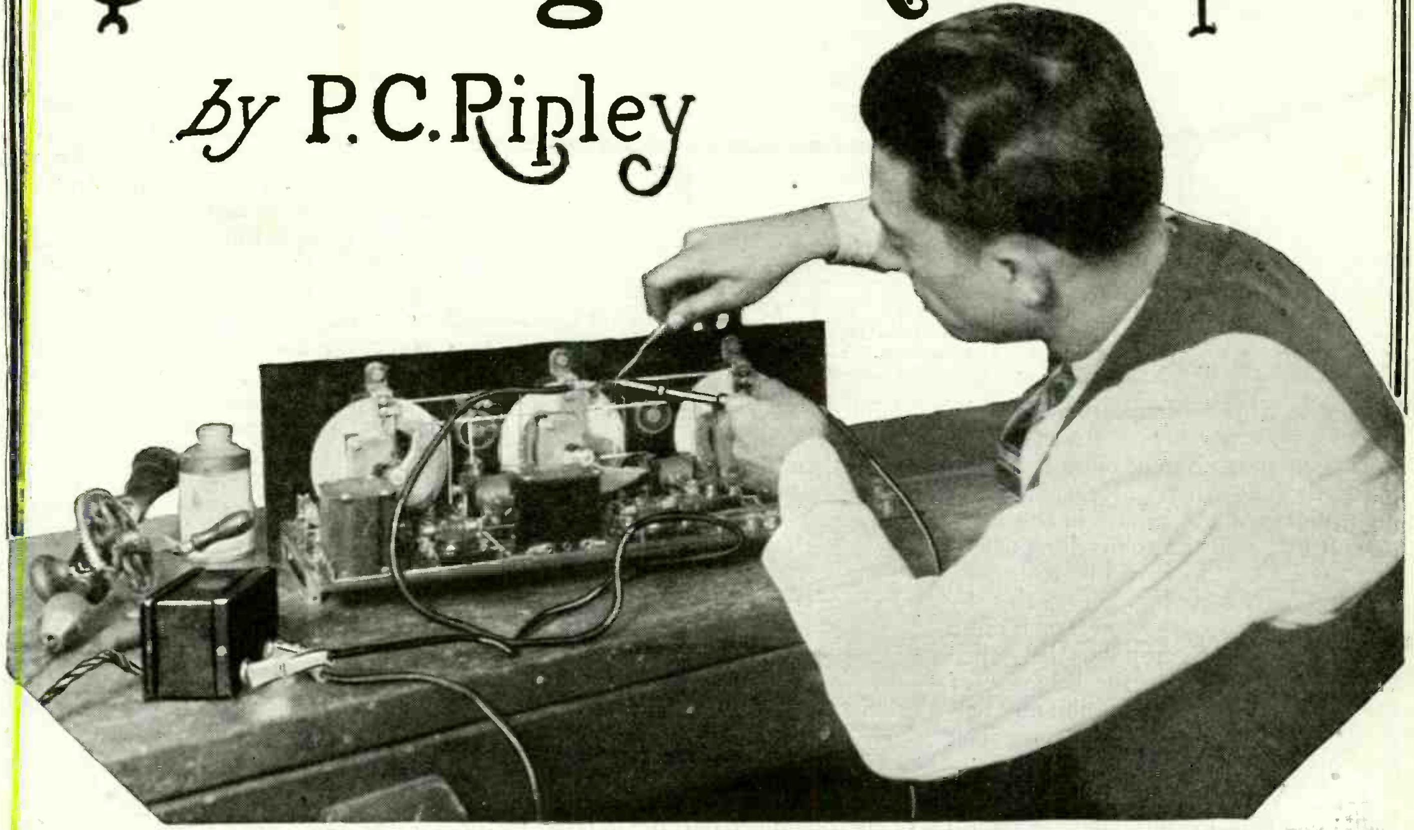


Hole drilling layout for the front panel of the Regenatrol receiver.

(*Continued on page* 160)

The Gentle Art of Soldering the Radio Set

by P. C. Ripley



THE lack of knowledge concerning the basic fundamentals which control the successful use of rosin core solder in radio construction has been responsible for many constructors gaining the impression that the material is of little practical value. Other fans of a more observing nature have mastered these essential factors and are its staunchest defenders as the only suitable material for the protection of vital connections in a radio receiver. The leading radio engineers and manufacturers after long and exhaustive research covering the entire field of fluxing agents have placed their endorsement on rosin as the only suitable flux for radio or delicate electrical use. To the home constructors of radio apparatus who have attempted the use of rosin core solder with disappointing results this article is submitted, endeavoring to bring to their attention the probable cause of failure.

One who attempts the use of solder in the construction of as delicate an instrument as a radio receiver should possess at least a fundamental knowledge of why the material is employed, an elementary knowledge of solders and fluxes and the proper tools to make the correct application. When he has assimilated this he will be in a position to realize that soldering is far from the least important part of radio construction.

The use of solder on the mechanical joints of our conductors gives us a tenacious, flexible bonding medium of great endurance which protects the connection against the attack of atmospheric oxygen. Oxides are usually very poor conductors of electrical energy and in unprotected joints may accumulate to such extent that they retard or defeat entirely the flow of current. Suppose we constructed a radio receiver without the protection of solder on these vital connections; with increase in age its efficiency would decrease until it became entirely inoperative.

All metals expand or contract under the influence of temperature change. Unsoldered connections are likely to loosen unless restrained with this yielding bond, solder. This presumably would be aggravated by the unequal expansion and contraction of dissimilar metals should these be used. Vibration of conductors tend to loosen contacts but if these are soldered they will remain secure indefinitely. So in solder we have the best solution to these undermining factors that would serve to make radio reception a failure.

In comparing the resistance of the alloy solder to the common conductor metal, copper, we find that solder offers a resistance nearly ten times greater than that of the copper. But in practical application, we can so form our joints and connections that they will show a 40% greater conductivity than the normal value of the conductors so joined, even after solder bonding. To secure joints of such low resistance means that we must execute joints, splices or connections in such a manner that they be *mechanically secure* and *electrically conductive* without the use of solder. Then *solder bond* for the reasons already stated.

The formation of abutted joints or connections is to be discouraged for several reasons. The constructor who attempts to hold a part in position, while soldering, with his hand as the supporting medium is certain to produce a good many unsatisfactory joints. It is a physical impossibility to support a part or conductor abutted to another absolutely motionless for the necessary period required for solder to pass from molten fluidity to solid state. The slightest tremor of the hand at this critical stage is likely to induce fracture which may be only partial and will pass unobserved. At some later date while under strain from expansion, contraction, vibration or shock this weakness will manifest itself in a most mystifying manner. Joints mechanically secure may be soldered without the burning of fingers from conducted heat in the part that so frequently happens when a constructor attempts the formation of an abutted joint.

Another grave danger to be encountered through the use of abutted joining of conductors will come in the formation of close connections. While soldering one, the heat is apt to be conducted to another joint close by and it promptly falls apart. Mechanically secure joints will not behave in this manner, neither will the solder flow out of the connections, as it will be restrained by capillary adhesion. Try this by forming two close connections on a conductor, using scrap bus bar, then solder them and note the behavior of the solder. It does not exhibit any tendency to run out of the joint unless an excessive amount of solder is used.

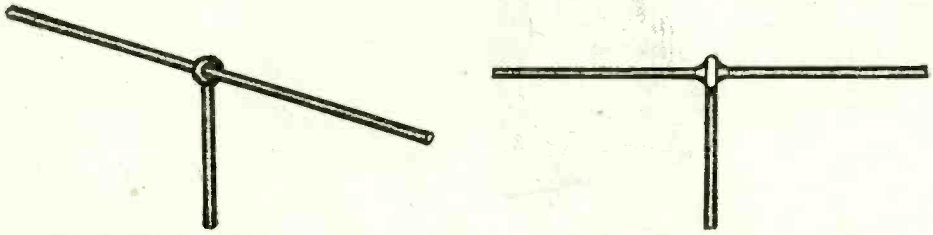


Fig. 1. Well formed joints. A—at the left is a joint made mechanically secure and electrically conductive without solder. B—at the right shows the same connection as it should appear when protected with solder.

Fig. 1A illustrates a well formed joint; one which is mechanically secure and electrically conductive before soldering. Fig. 1B shows the same joint as it will appear when correctly soldered. Fig. 2 offers an idea of what may occur when attempting the soldering of abutted conductors. You can observe that while we have been successful in establishing contact between the two conductors with solder, a considerable body of this material separates the two. As previously stated, solder possesses only a fraction of the conductivity of copper so if we desire joints of low resistance we either have to make our connections mechanically secure and electrically conductive or employ a webbing of solder ten times as large as the diameter of the conductor. To make use of such a quantity of solder in bonding joints would detract from the general good appearance of our wiring and still leave us with weak connections. Let us make up our minds not to make use of abutted joints but to make them the correct way; secure mechanically, electrically conductive, then solder protect.

Our alloy solder composed of the two metals, tin and lead, presents a manifestation of one of nature's queer vagaries. The mystery of this alloy is that it possesses a lower melting point than either of its component metals. By combining these two metals in varying proportions we secure certain well defined behaviors in the resultant alloys. These characteristic behaviors are the determining factors in solder selection for specific use. In your selection of solder, unless you are qualified to judge solder, it will be a wise plan to purchase an article which carries the endorsement of the manufacturer as being suitable for radio use. The ordinary commercial grades of solder are frequently made from reclaimed or scrap metals and are likely to contain small quantities of metals other than tin and lead. These have the effect of raising the melting point or detracting from the strength and working quality of the solder. Solder may be procured in a variety of forms but the home constructor of radio has largely adopted the wire or ribbon form of rosin core solder. This material is tubular in form and restrained within this wall of solder is the flux, rosin. The item offers the radio fan a material and labor saving combination of the two essential elements for successful set construction.

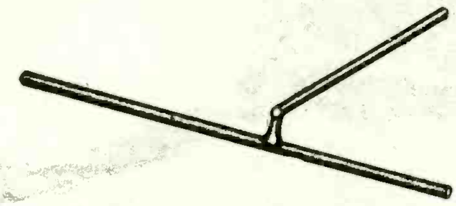


Fig. 2. What may occur in forming abutted connections. The joint is seen separated by the solder.

The matter of a correct flux for radio assembly will next occupy our attention for this substance may determine the difference between success or failure in solder construction. Likewise it controls the quality and durability of the receiver. Radio demands the use of a flux whose residual be neither corrosive nor conductive. That means that we must employ rosin; but to cover the subject in a comprehensive manner it will be well to offer some information on the other types of fluxes and what may be expected if they are utilized.

The prime duty of a flux is to dissolve or remove the oxides which occur on the surfaces of all metals. When this is accomplished the solder while in a molten condition penetrates the minute pits which these oxides formerly occupied and can alloy with the clean, heated metal surfaces. Fluxes range in character from very strong acids to very mild acid bearing substances. To use acid, chloride salt solutions, or chloride salt solution emulsified to paste form in radio construction is beyond the practice of good engineering principles. The corrosive and conductive properties of such fluxes condemn them for use in the construction of delicate electrical control apparatus. The pastes or semi-viscous fluxes are formed by emulsifying acid or chloride salt solutions with some organic grease or wax. The popular idea seems to be that the presence of this grease will prevent corrosive action. Unfortunately this is not the case as the inorganic acids or salts do not require atmospheric contact to attack the metal. Neither do they undergo any great amount of chemical change in the soldering operation. The average fan usually looks for some startling green substance as the evidence of corrosive action. If such a material is not seen he concludes that there is no corrosive action. Such snap conclusions may lead him astray as often the compounds formed by corrosive action are other than green in color. Many constructors purchase chloride pastes under the assumption that they are formed from rosin. As a matter of

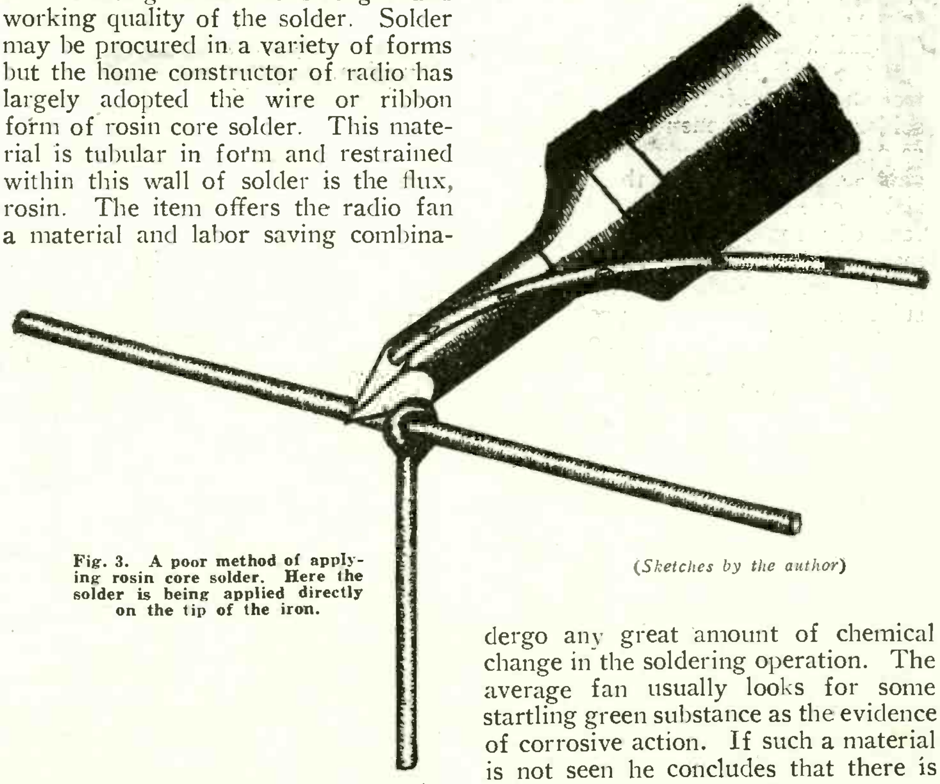
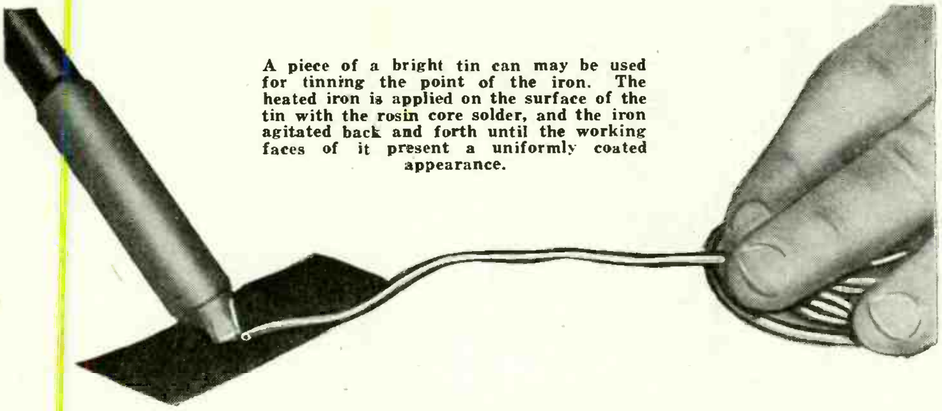


Fig. 3. A poor method of applying rosin core solder. Here the solder is being applied directly on the tip of the iron.

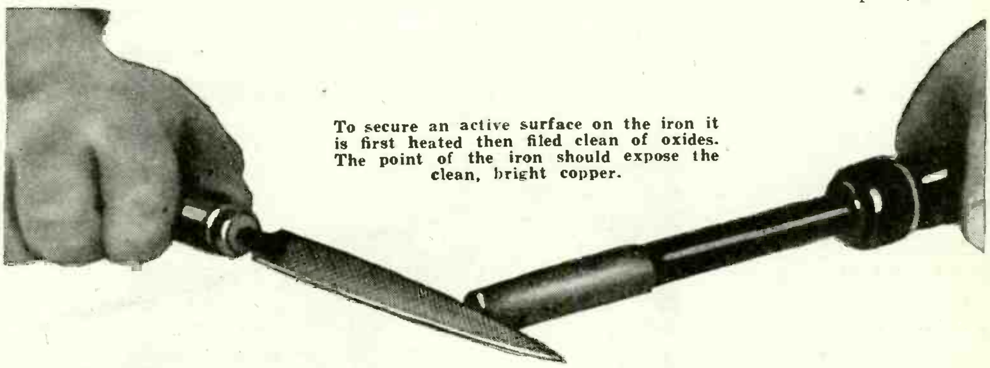
(Sketches by the author)

fact the majority of the commercial pastes contain no rosin whatever and are often fraudulently labeled NON-CORROSIVE or carry names designed to misinform the purchaser.

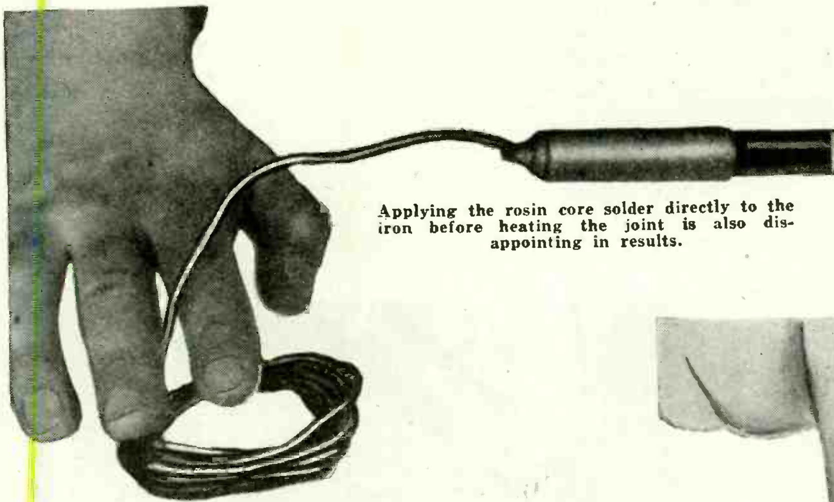


A piece of a bright tin can may be used for tinning the point of the iron. The heated iron is applied on the surface of the tin with the rosin core solder, and the iron agitated back and forth until the working faces of it present a uniformly coated appearance.

Here is what actually happens when paste is employed as a flux. When heat is applied to the paste the organic grease melts and becomes less viscous, allowing a certain amount of the chloride solution to settle to the surface of the work where it serves as the deoxidizing agent. The remainder of the chloride solution still suspended in the grease which was more remote from the heat is swept on by this grease and is often carried into insulations or inaccessible places by this over-running of the vehicle. The chloride or acid solution, or will we say the active element of the paste is highly conductive, and being distributed over a considerable area, forms a conductive path which may defeat the best insulating materials that can be secured.



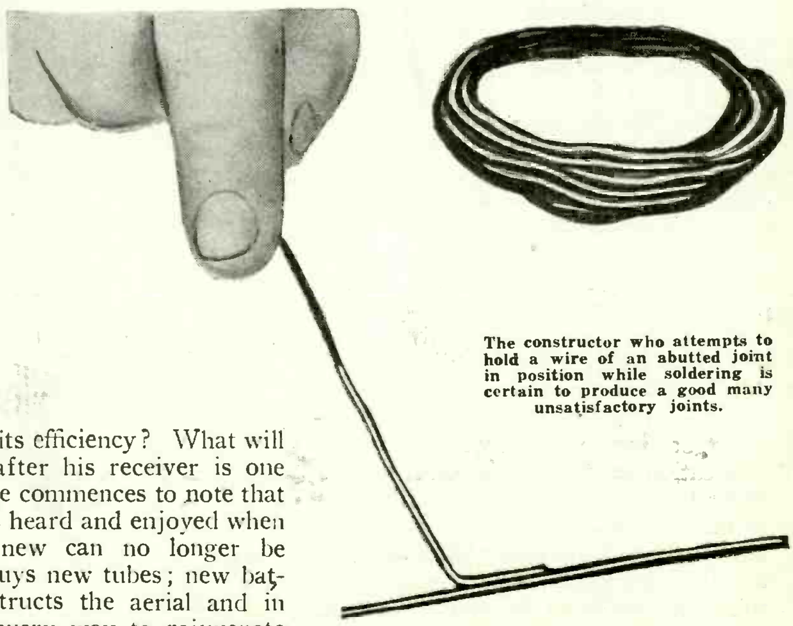
To secure an active surface on the iron it is first heated then filed clean of oxides. The point of the iron should expose the clean, bright copper.



Applying the rosin core solder directly to the iron before heating the joint is also disappointing in results.

Frequently we hear the boastful fan tell of his experiences and the great success that has attended his use of paste. That he washes his joints with alcohol or wipes them clean with a rag. That he never has had any trouble from the use of paste. But, does he know that the surface adhesion of these chlorides is very high and that by diluting them with a solvent such as alcohol he has probably been successful in spreading these destructive elements over a greater surface? Does he know that their detrimental features are not always immediately discernible? Has he any assurance that the conductive residual of the chlorides which he dilutes or smears over an increased area is not robbing his set of a definite percentage of its efficiency? What will be his boast after his receiver is one year old and he commences to note that stations he has heard and enjoyed when the set was new can no longer be heard? He buys new tubes; new batteries; reconstructs the aerial and in fact tries in every way to rejuvenate the set. Now if he were to make a truly scientific investigation of the set he would find that conductors once amply large have been reduced in size at vital points under the attack of the chlorides and that this has resulted in increased resistance. He would find that insulating materials of original high di-electric resistance have been bridged with a conductive substance that becomes more and more active with age, in defeating the purpose of the insulators. Just let us suppose that the receiver as he has constructed it shows a range of a thousand miles under normal conditions. The question is, what would have been the range if these leakages had not been introduced by the use of a flux whose residual produces and supports leakage. Here is a subject for grave thought on the part of the home constructor who desires the best.

Rosin, on the other hand, is neither corrosive nor conductive and can do no harm to the most delicate part, insulation or wire. It exhibits no tendency to gather moisture as will the residuals of chloride or acid fluxes. The hard, dense and glasslike surfaces of rosin residuals do not trap dust or particles of foreign matter as will the residuals of the inorganic chlorides and organic greases employed in pastes. These particles often aid in the establishment of a conductive path over the surface of an insulating material.

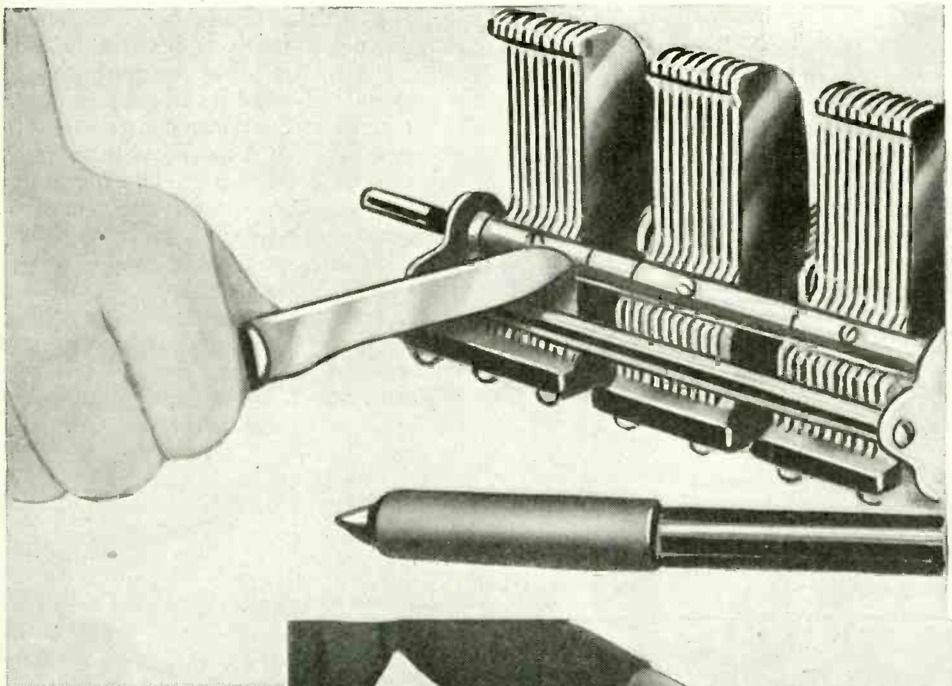


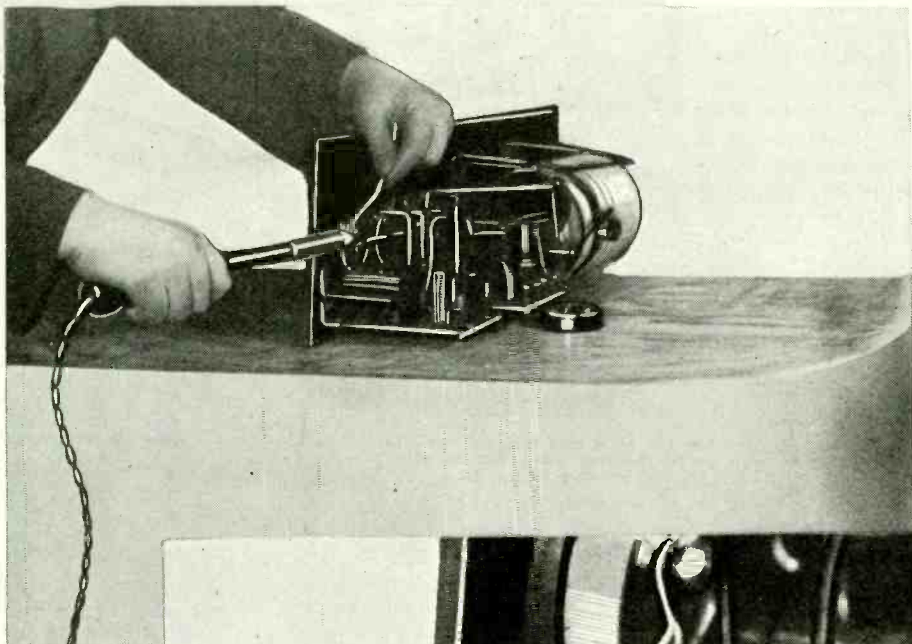
The constructor who attempts to hold a wire of an abutted joint in position while soldering is certain to produce a good many unsatisfactory joints.

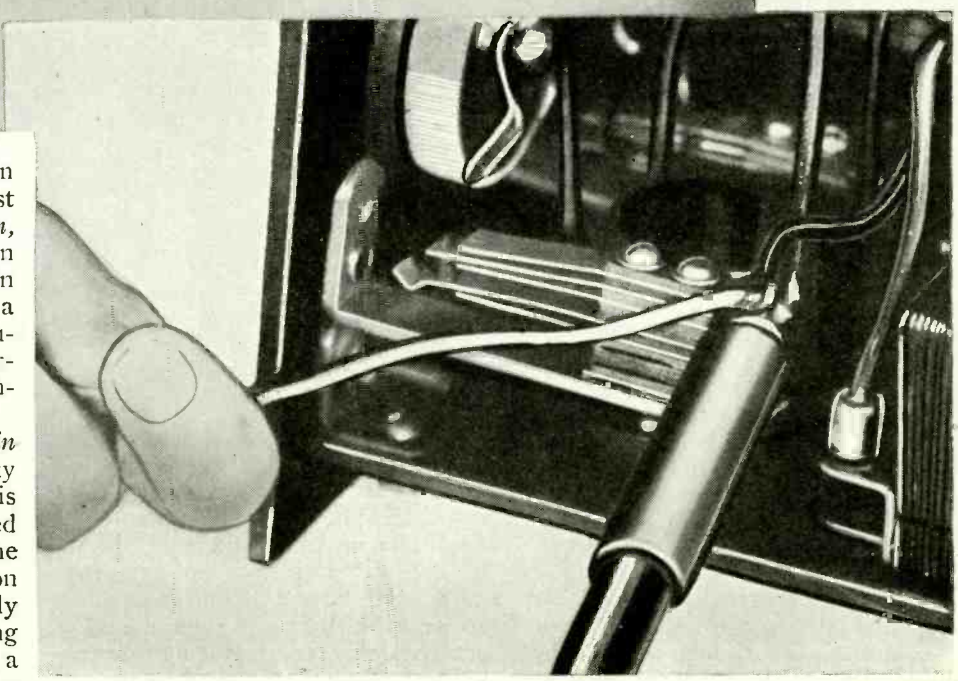
Many complaints have been heard regarding the activity of rosin as a fluxing agent. We hear about rosin joints and the unsightly dark residuals that some constructors experience. Now the greatest causes for such complaints usually have their origin from the attempted use of rosin on metals that do not respond to its capacity as a de-oxidizing agent, or failure of the user to apply it in such a manner that it can serve us as a flux. Any attempt at using rosin core solder on nickel-plated parts or soldering contacts is pretty sure to result in a failure. *Rosin has no capacity to dissolve the oxides of nickel.* Should it be compulsory to use nickel-plated contacts file away the plating and the base metal, usually brass, can be soldered. Rosin shows its greatest capacity as a flux on *tin, cadmium, silver* and *gold* plated metals and on clean *copper, brass* or *zinc*. Electro tin plated metals frequently show such a poor plating and resultant heavy accumulation of oxides that speedy soldering is defeated. *Hot tin dipped* contacts will be found to be the best.

The formation of the so-called *rosin joint* goes hand in hand with the faulty application of rosin core solder and is likely to be the direct result of burned rosin. It is a common sight to see the user of rosin core solder place his iron on the connection and immediately touch the solder to the iron, liberating the flux on the highly heated iron at a considerable distance from the surface of the connection where the flux is required. He does this long before the part has reached a solder melting temperature and the result is that the active part of the rosin that can clean our surface of oxides is passed into the air in the form of a blue-white smoke. The darker matter or the burned residual of the rosin that remains on the iron or work cannot serve as a flux and actually hinders and retards soldering. Not realizing wherein the fault lies he tries again and again until he either gives up in despair, having filled the connection so full of the dark brown matter that soldering is impossible, or he succeeds in forming some sort of a soldered connection. Usually a very poor one. He then concludes that rosin is a very inefficient flux.

If you will note Fig. 3 you can see that to apply rosin core solder in this manner is sure to lead to grief. The active element of the rosin is liberated into the atmosphere from the uppermost face of the iron and very little if any of the de-oxidizing material will ever reach the joint we are attempting to solder. The darker brown matter will get to the joint and that means trouble. Instead, if the operator will apply the iron to the connection, permit the joint to reach a solder melting temperature, *then apply the solder,* not to the iron, but to the heated work, he will discover a very different behavior in the performance of rosin as a flux. Consult Fig. 4 for the correct application of the solder to the heated part, then Fig. 1B, showing the same type







Any attempt to use rosin core solder on nickel plated parts is sure to result in a failure. Points of contact where connections are to be made to such places should be scraped or filed away, as shown in the upper photo, until the base metal is reached. Special care should be taken in soldering connections to rheostats. Lugs should be used and connections soldered to them as in the center photo. Connections to jacks, as in the lower photo, should also be carefully soldered. If an excess of flux is allowed to run between the insulated separators of a jack losses will be present in the set. Exercise care in soldering rubber insulated hook-up wire as this may melt and run into the joint.

of connection as it will appear when properly soldered. Experimentally form a few connections from scrap bus bar and solder them in the manner suggested to test the merit of this procedure.

Some of the other contributing factors in securing rosin joints are, the poor application of the iron, the use of an incorrectly shaped tool or one lacking capacity for the work attempted. In the selection of a soldering iron we have two types to consider: the conventional copper which absorbs heat from one source and acts as the conveying agent to the object to be soldered; and the electrically heated iron that derives its heat from the resistance offered to the flow of electrical energy. Then there is a carbon pencil implement which can be used with either an ordinary radio storage "A" battery or toy transformer in connection with the house current as may be seen in the photo at the beginning of this article. The method of using this device with a 6 volt storage battery is clearly seen in the sketch, Fig. 7. When the pencil is applied to the wire as shown, the electric flow of energy combined with the arcing at the carbon pencil tip causes the joint to become heated to a temperature which will melt the solder. The pencil is removed immediately after a sufficient amount of solder has been flowed on the joint and allowed to cool until it becomes perfectly solid. Each type have advantages that recommend them, but the electrically heated iron possesses the distinct advantage of maintaining a more or less constant heat, eliminating the consumption of time required in reheating the conventional copper. On very heavy work this is of considerable importance as the ordinary copper will soon spend its energy. The purchaser of electric irons should exercise caution, as there are electric irons on the market today at very attractive prices which will only generate heat sufficient for the lightest soldering operations. These will be found to be totally inadequate for the heavier soldering you will have in constructing your receiver. Lack of capacity in your electric iron, or for that matter in the conventional copper, will be disastrous to good soldering. Rosin joints and insecurely soldered connections are

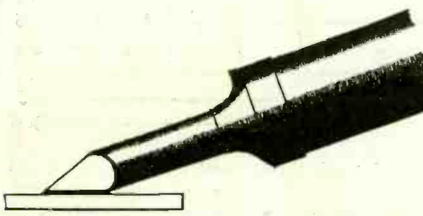


Fig. 5 A well shaped iron point. The working face is held parallel with the work surface.

often traced to this source. The only motive in the employment of a soldering iron is to convey heat to the parts to be soldered, and not until these reach a solder melting temperature can they be successfully soldered.

Long and slender points on our soldering tool may carry a great appeal as having a very efficient appearance to the uninitiated but the use of such

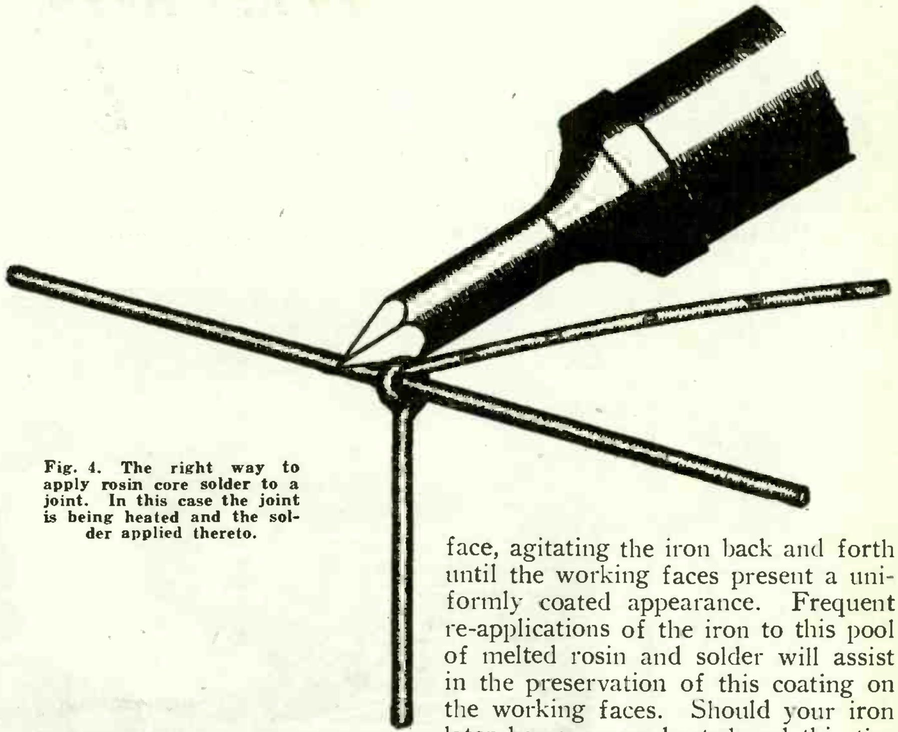


Fig. 4. The right way to apply rosin core solder to a joint. In this case the joint is being heated and the solder applied thereto.

points will likely lead to trouble. Conduction and radiation in the parts to be soldered may be so rapid that we cannot deliver heat speedily enough

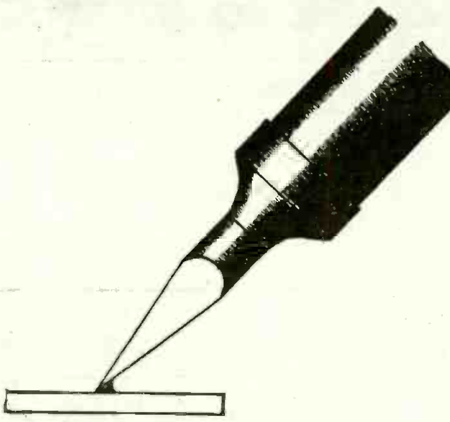


Fig. 6. The above illustration shows an iron point filed too slender, therefore making limited contact with the work.

through the slender point to defeat these forces. Fig. 5 shows a very good point while the one pictured in Fig. 6 is apt to cause trouble.

Before any effort is made to use the iron we must solder coat the working faces. This solder coating is commonly referred to as "tinning" and affords a means of utilizing the force of capillary adhesion, which is of material assistance in heat conduction. This tinning of the iron retards the formation of oxides on the iron's working faces and as oxides are poor conductors of heat the value of this coating is apparent. Molten solder is by nature cohesive but by preparing a metal surface that is attractive it loses this cohesiveness and becomes adhesive. To secure this attractive surface on the iron we first heat it; then file away the oxides exposing the clean, bright copper. Take a piece of a bright tin can and with the clean and heated iron melt some rosin core solder on to its surface, agitating the iron back and forth until the working faces present a uniformly coated appearance. Frequent re-applications of the iron to this pool of melted rosin and solder will assist in the preservation of this coating on the working faces. Should your iron later become over-heated and this tinning destroyed, it immediately loses its efficiency in heat transmission. Before any success will reward our efforts at soldering this coating must be restored in the manner outlined above.

Poor handling of our iron, even though it be of sufficient capacity, properly shaped, well tinned and correctly heated may be the cause of solder failures or rosin joints. Obviously we must bring the working face in contact with the work in such a manner that a maximum of surface is presented to expedite the transmission of the heat to the object to be soldered. Fig. 5, with the working face flat on the part, has a far greater chance to deliver its heat than the same iron as positioned in Fig. 6 where the extreme point only has contact. An iron used as pictured in Fig. 6 will fail because conduction and radiation of heat will be so rapid that we will fail to secure a temperature sufficiently high for soldering. That may mean another rosin joint.

Insulated wires of the enameled type must be cleaned free from all enamel before any effort is made at soldering. This is best done mechanically, either by sand papering or scraping with an edged tool until the metal shows bright in its entirety where you desire solder adhesion. Cotton, rubber or shellac covered conductors must also be mechanically cleaned before soldering and in the case of some rubber covered wire you will find that a sulphate has formed that has practically destroyed the tinning on the strands. It is then best to clean down to the raw copper

(*Continued on page* 166)

The Haynes DX-2 "Multivalve" Set

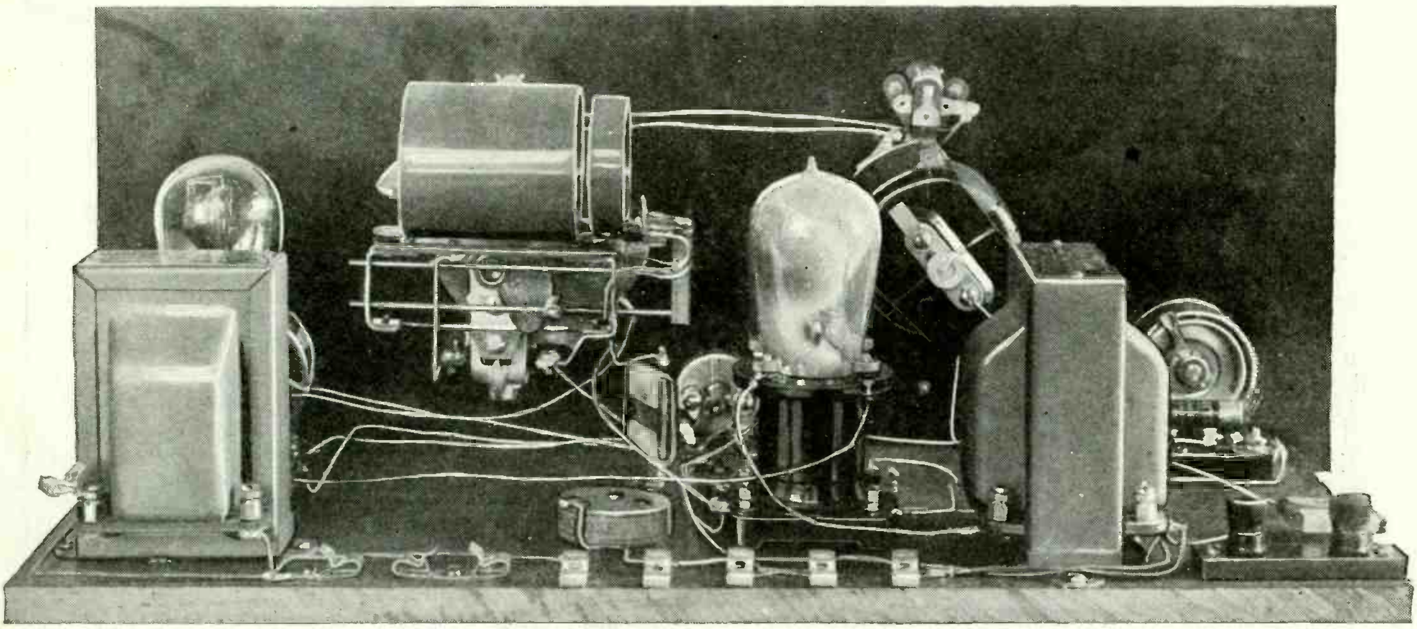
A Highly Efficient Circuit Designed for the New Three-In-One Tube

By A. J. HAYNES

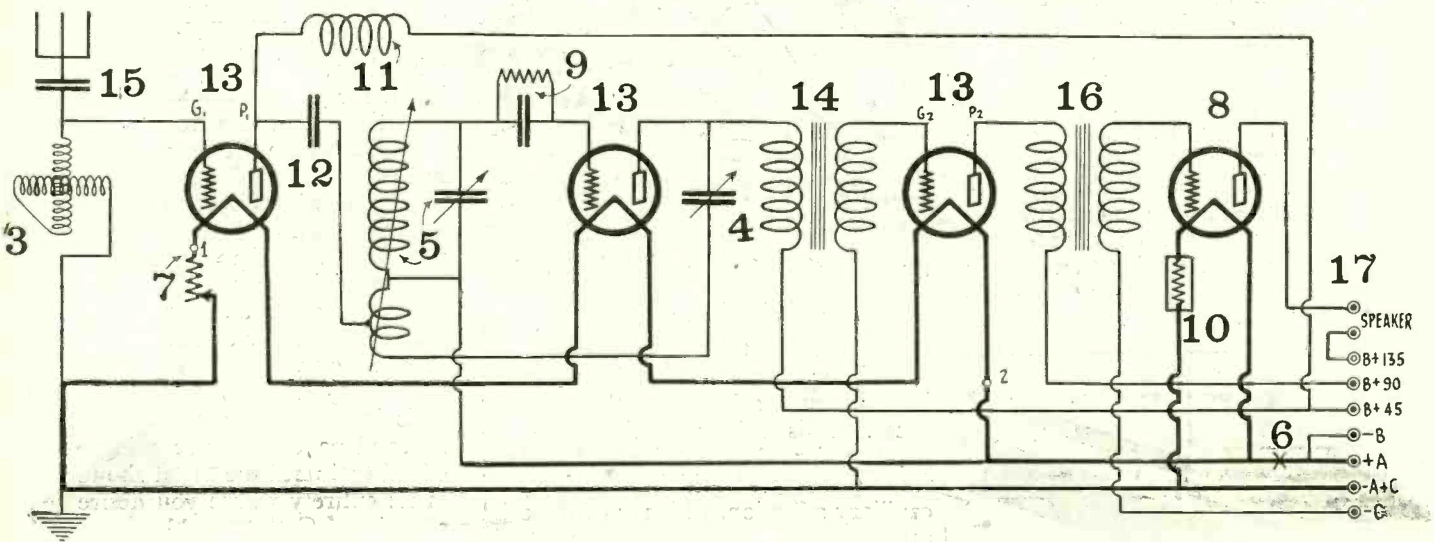
A NEW vacuum tube, known as the Emerson "Multivalve", has recently been placed on the radio market. Considerable mystery seems to surround this tube, in the minds of many radio fans, concerning exactly what it is and how it can be used to advantage in standard circuits; although many advanced radio experimenters have been wanting something of this kind for a long time and wondering why the vacuum-tube laboratories had not produced it. It is, of course, a logical development; but the difficulties lay chiefly in the design and production of such a tube on a commercial basis and at a reasonable price.

Essentially, the Multivalve is *three tubes in one*. The accompanying illustration shows the various elements in this tube, and their connections to the contact pins and binding posts on the base. It will be noted that there are three separate grids and plates; whereas the filament is one filament, of the 201A type, in three sections. Thus, the filament characteristics of the Multivalve are practically the same as those of one 201A tube.

On the other hand, it may be used in any radio circuit to take the place of three tubes of the latter type, with a very worth-while saving in battery consumption and space.



A rear view of the DX-2 Multivalve receiver. The new vacuum tube, clearly seen on the baseboard, is actually three tubes in one, with a single 5-volt ¼-ampere filament. B is the semi-power amplifier tube.

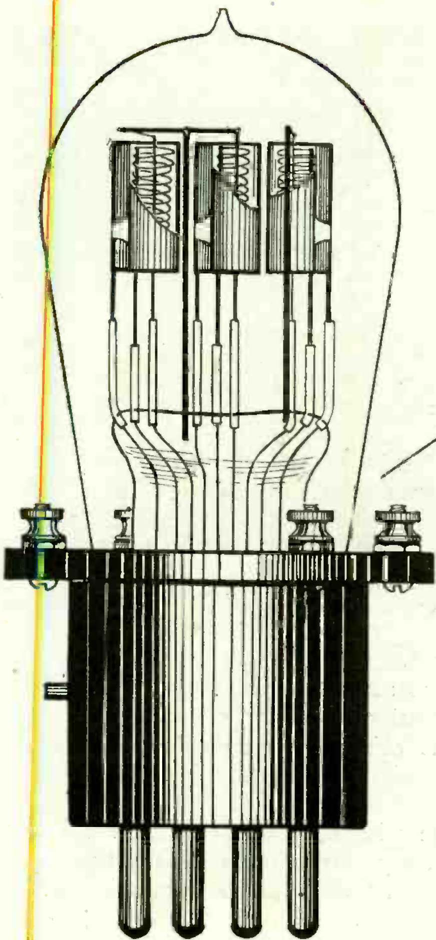


The schematic wiring diagram of the DX-2 receiver. The three tubes 13 are contained in one. 1 and 2 mark the filament terminals.

The DX-2 Circuit

While the Multivalve may be used to advantage with any radio circuit, the writer has designed around it a new set which makes full use of its unique features.

The DX-2 circuit, as it is called, incorporates unusual sensitivity and



distance-getting ability with superb tone quality, a combination which, unfortunately, is found only too seldom in the same receiver, particularly when simple construction and reasonable cost are involved.

The DX-2 receiver makes use of one Multivalve and a power output tube of the 112 or 171 type. If the latter is used, it is preferable to place an output transformer between the last tube and the loud speaker.

The radio frequency choke coil, 11, which is used in the plate circuit of

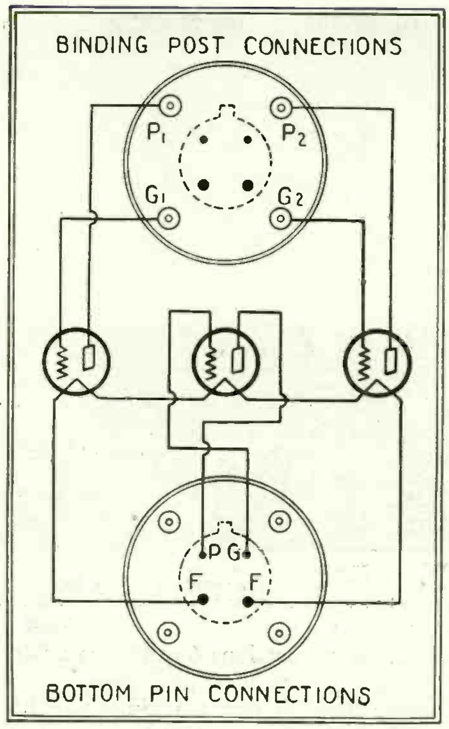


Illustration by courtesy of The Emerson Radval Corp.

Details of the three-in-one "Multivalve" tube, showing its internal construction and, at the right, the connections to the tube-base prongs and to the special binding posts.

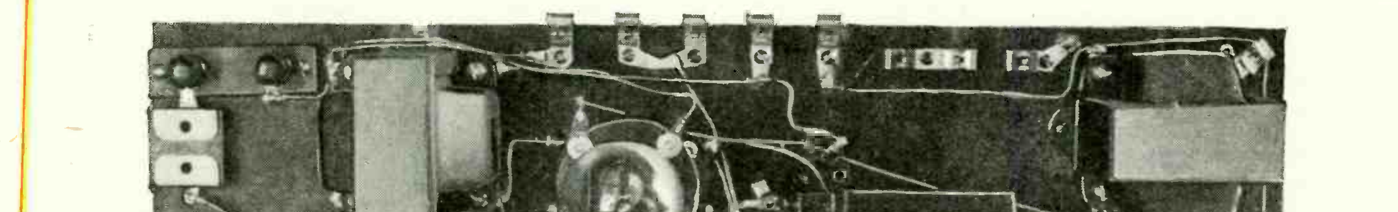
the detector, is not critical and can be built very easily if desired. This can be done by winding approximately 300 turns of No. 28 or 30 wire (double silk insulation is preferred) on an ordinary sewing-silk spool. The turns should be bunch-wound in the middle of the spool, and need not be put on evenly. The spool may then be secured to the baseboard with a brass screw through its center.

Operation

One of the unique features of the DX-2 circuit is the double use of the primary winding, which couples the radio frequency and detector units. This winding, which is the movable coil on the variable condenser at 5, is used as both a primary coupling coil and a tickler for the detector regeneration. The position of this coil is automatically varied as the tuning condenser is turned, the coupling being loosened on the short wavelengths and increased to maximum as the condenser capacity increases, when tuning to the higher waves. As a result of this action, not only is the coupling between the radio frequency and detector tubes varied progressively with the wavelength, but at the same time the amount of feed-

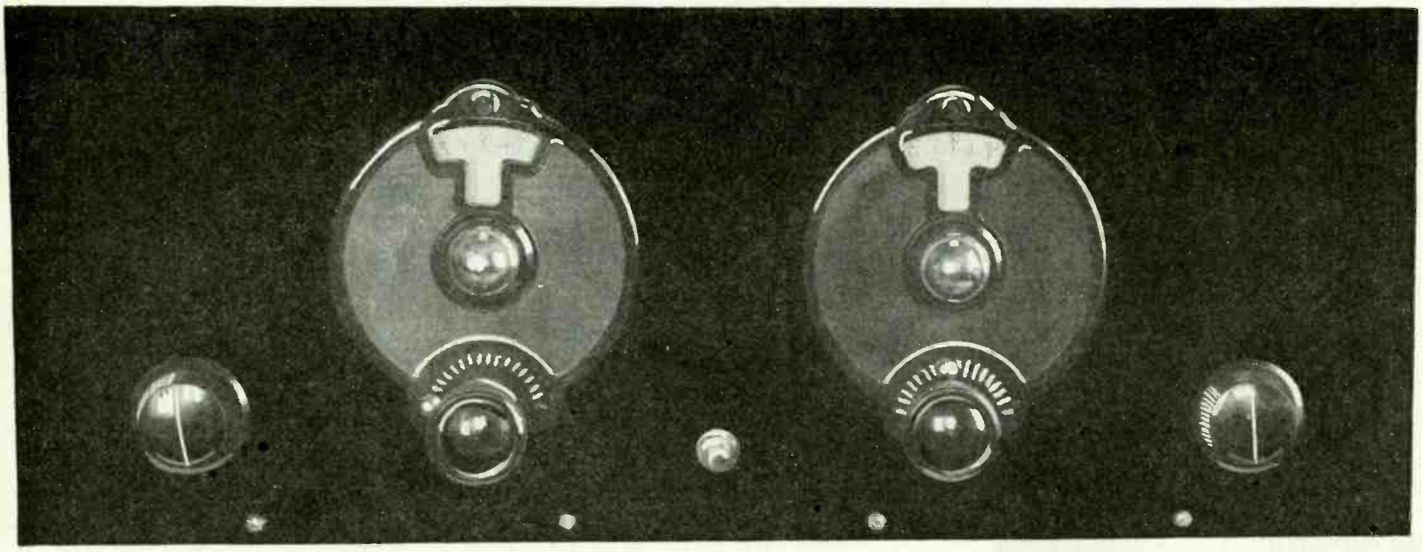
PARTS FOR HAYNES DX-2 MULTIVALVE SET

1 Hammarlund variable coupling, R. F. Transformer and one Hammarlund .00035 mfd. variable condenser; 5
1 General Radio Co., variometer; 3
1 Haynes-Griffen, R. F. choke coil; 11
1 Connecticut Tel. & Tel. Co., .00035 mfd. variable condenser; 4
1 Dubilier, .00025 mfd. grid condenser; 9
1 Dubilier, .0001 mfd. fixed condenser; 15
1 Dubilier, .002 mfd. fixed condenser; 12
1 Carter 20 ohm rheostat; 7
1 Amperite, 1-A automatic filament control; 10
1 Electrad or Durham, 5 meg. grid leak with mounting; 9
2 Pacent, Karas or Thorardson 3 to 1 audio transformers; 14, 16
2 Benjamin sockets, 8, 13
1 Frost or Carter filament switch; 6
2 Eby or X-L binding posts; 18
7 Fahnestock single spring clip binding posts, and 1 double spring clip post; 17
2 National vernier dials
1 Formica or Radion panel 7 x 17 x 3/16 ins.
1 Wood baseboard 7 x 17 x 3/16 ins.
1 Emerson Multivalve tube
1 Cleartron semi-power tube



A top view of the set showing photographically how the parts are assembled and wired.

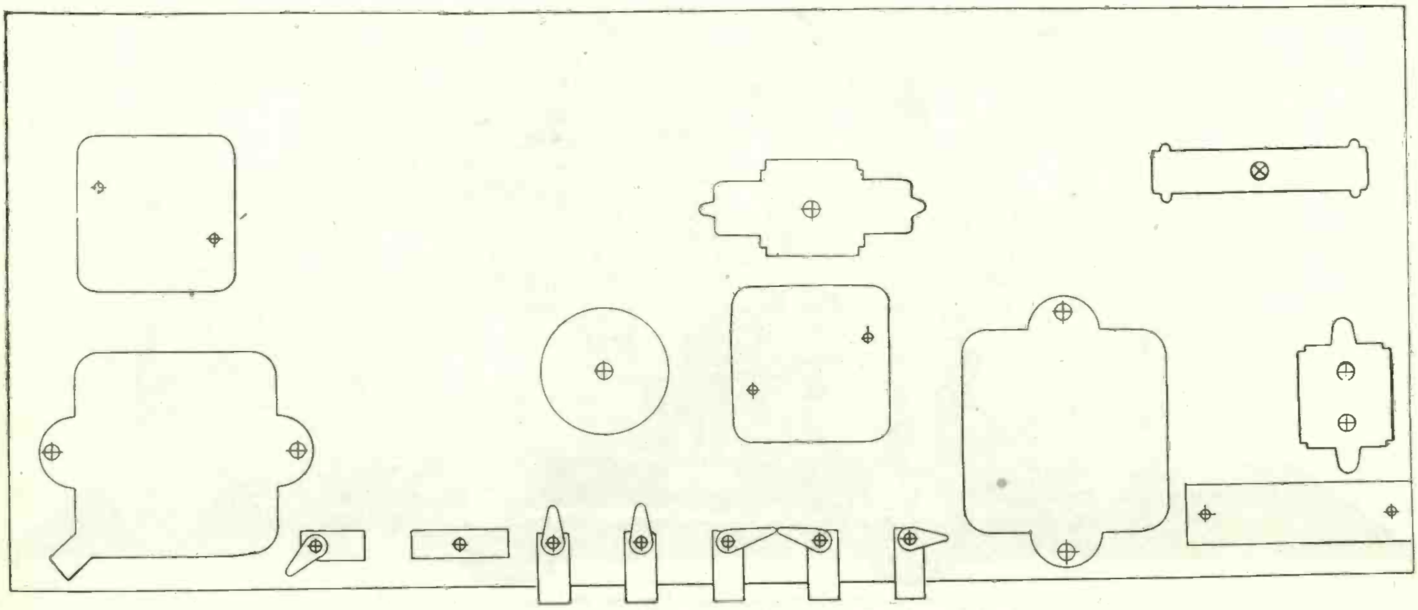
back in the detector circuit is varied so that the regeneration is held practically constant over the tuning range of the circuit. The degree of regeneration is controlled by the small variable condenser between plate of detector tube and its coil, this being shown at 4. As the capacity of this condenser is increased, the regeneration increases, and vice versa.



A panel view of the DX-2 showing the main tuning control dials, the regeneration control knob at the right, the filament switch in the center and rheostat knob at the extreme left which controls the filament current of the three-in-one tube.

On all ordinary reception, this regenerative control need not be touched. It can be left either at zero or with a slight amount of regeneration if the receiving location is a poor one. However, if distant stations are being sought, the regenerative condenser should be advanced until the detector tube is just below the point of oscillation: this will increase the sensitivity of the set many times. The small compression-type variable condenser specified for the set is ideal for this purpose, as it is compact and provides a very smooth adjustment. It will be noted that this condenser has three capacity ranges. When using this particular type condenser in the DX-2 circuit, remove the jumper from the terminals and make connections on the two posts marked "A" and "B," leaving "G" unconnected. These markings will be found on the condenser itself, but are not indicated on the diagrams. If desired, the usual type of rotary plate condenser may be used here. It should be a compact one, however, and of approximately .00035 mfd. capacity.

A large antenna is not necessary but, on the contrary, undesirable with the DX-2. An average overall length, from the end of the antenna to the receiver, of 75 to 100 feet is satisfactory. This includes antenna and lead-in. If it is desired to use this set with an extremely long antenna, it is usually necessary to place a series fixed condenser (15), of .0001 mfd. capacity, between the antenna and the antenna binding post on the receiver.



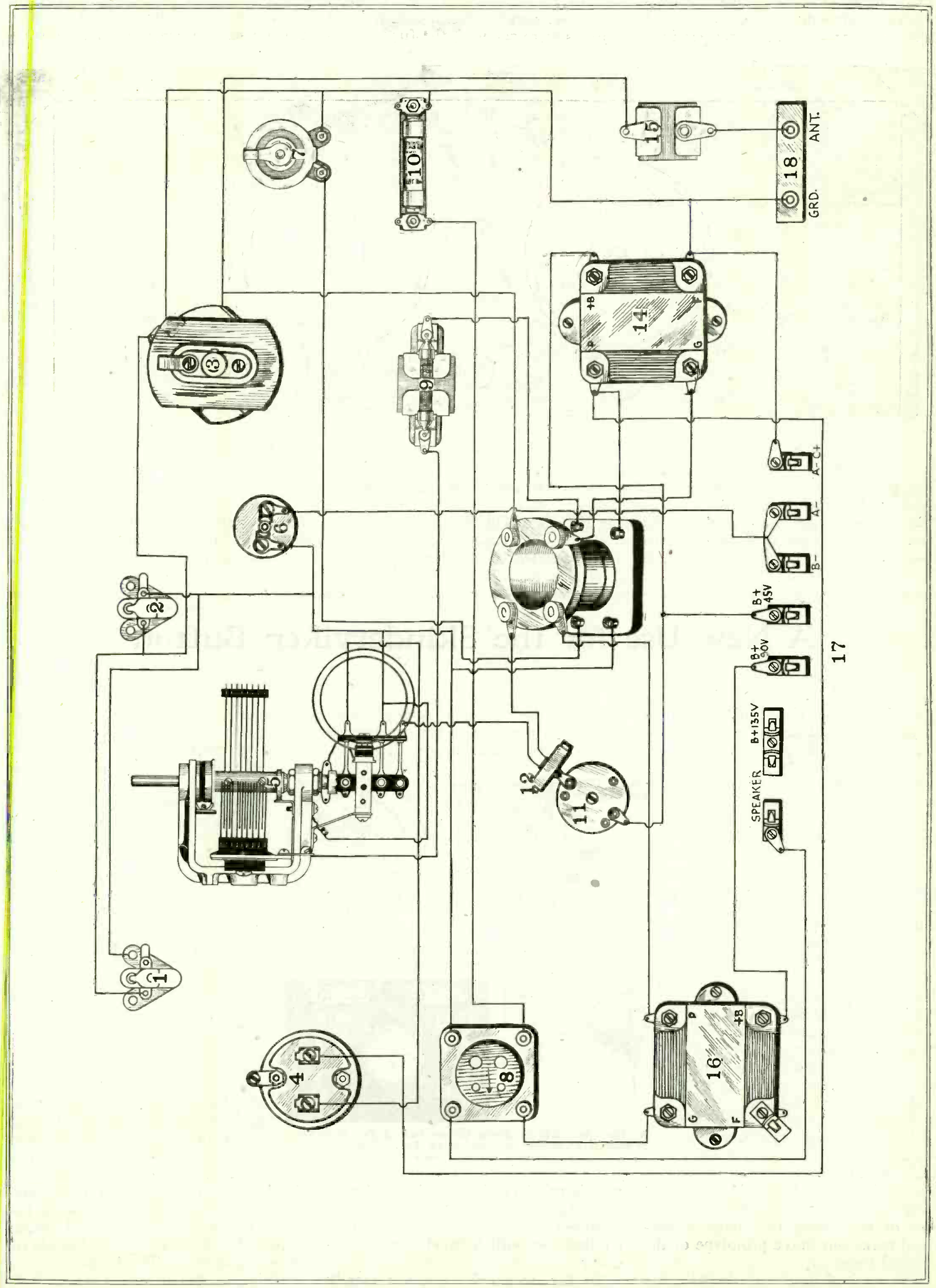
Layout of apparatus on the baseboard and all mounting holes indicated.

The secret of the sensitivity of this receiver on an aerial lies in the fact that it does not make use of a semi-aperiodic antenna circuit, such as found in most sets in service today. The antenna system of the circuit is actually tuned by a variometer. As the effective capacity in the antenna circuit is comparatively small, a large potential difference is built up across the grid and filament of the radio frequency unit, which results in unusually high amplification of weak signals.

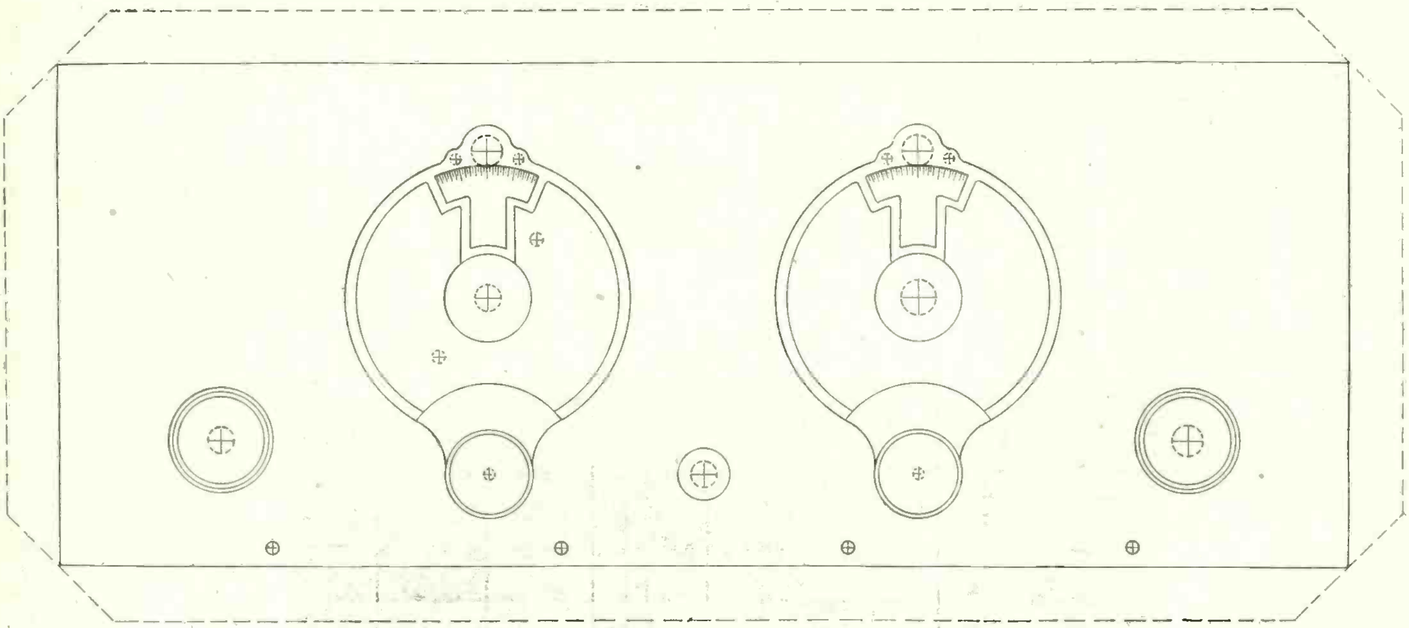
The design of this circuit is such that, even though the detector tube is made to oscillate, it will not cause bad interference in your neighbors' receivers. This is due to the fact that, even with the detector tube oscillating, the radio frequency circuit will not oscillate.

Results

The writer always hesitates to predict actual results which can be ob-


ANT.
18
GRD.
15
10
7
14
+B
G
13
9
A-C+
A-
B-
B+45V
B+90V
17
B+135V
SPEAKER
6
2
12
11
5
1
4
8
16
P
+B
G
F

tained from any set, as so much depends upon location and local conditions. Good long-distance work has been done on the DX-2 receiver in a comparatively poor location in the heart of New York City, with an antenna consisting of only a 20 foot length of wire dropped from the window of an apartment house. On this makeshift aerial, several mid-western stations were received, the furthest being KFKX of Hastings, Nebraska. As a matter of comparison, a good five-tubed tuned-R.F. receiver was tried on the same antenna, and failed very badly on the distance reception, because of the inefficiency of its untuned primary when used on such a poor antenna system. It can therefore be seen that the DX-2 is remarkably sensitive to weak signals.



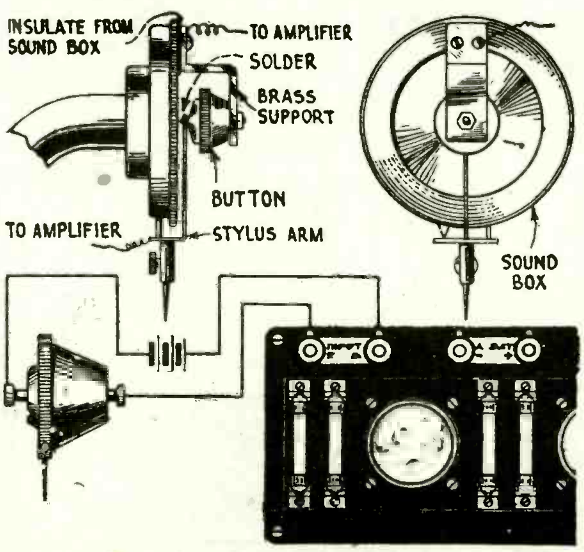
Hole drilling layout for the front panel of the Haynes DX-2 Multivalve receiver.

A New Use for the Skinderviken Button

With a relatively small investment of money, plus a liberal investment of ingenuity, the old phonograph can be brought back into the good graces of the family. The marvelous advances scored in phonographic reproduction can be enjoyed side by side with the best radio has to offer.

The essentials of modern phonographic reproduction are, first of all, the new electrically-cut records which contain the wealth of tone and the full depth of the original studio rendition. The old-time records simply have not the necessary ingredients for quality reproduction, and it is a waste of time and effort to use them for quality reproduction. Secondly, we must have a device to translate the record groove wiggles into corresponding wiggles of an electric current. Thirdly, we must have a means of amplifying the delicate electrical wiggles many times, without distortion. Fourthly, we must have a loud-speaker device fully capable of translating the complex electrical variations into a prototype of the original music.

The simplest means of obtaining the desired volume and quality of amplification is by means of a good audio amplifier such as a resistance coupled unit. A resistance coupled amplifier unit is relatively inexpensive and provides faithful amplification and ample volume for the largest living room, in conjunction with a good cone reproducer.



At the upper left is shown the method of fastening the Skinderviken button to the sound box. The electrical circuit is shown below.

So far, so good. We are merely following radio practice. But there still remains the problem of the pick-up, or device for converting the needle vibration into electrical variations. Here the simplest method is to take the standard phonograph sound box and attach a Skinderviken button, as shown in the sketch. The results will prove a revelation. The electrical circuit is shown in the lower part of the accompanying illustration. At the upper left, the method of fastening the Skinderviken button to the phonograph sound box is clearly illustrated.

At the lower left of the illustration, a Skinderviken transmitter button is shown practically full size.

For the information of those who have not as yet experimented with the Skinderviken button, this interesting device is a small carbon grain microphone button, less than an inch in diameter and about a half an inch high, containing a polished metallic button affixed to a mica diaphragm and a surrounding case of brass. The space between the case and the polished button is partially filled with a good grade of carbon granules. The button is very sensitive to sound waves when it is attached to any form of diaphragm.

The Samson "RFC" Receiver

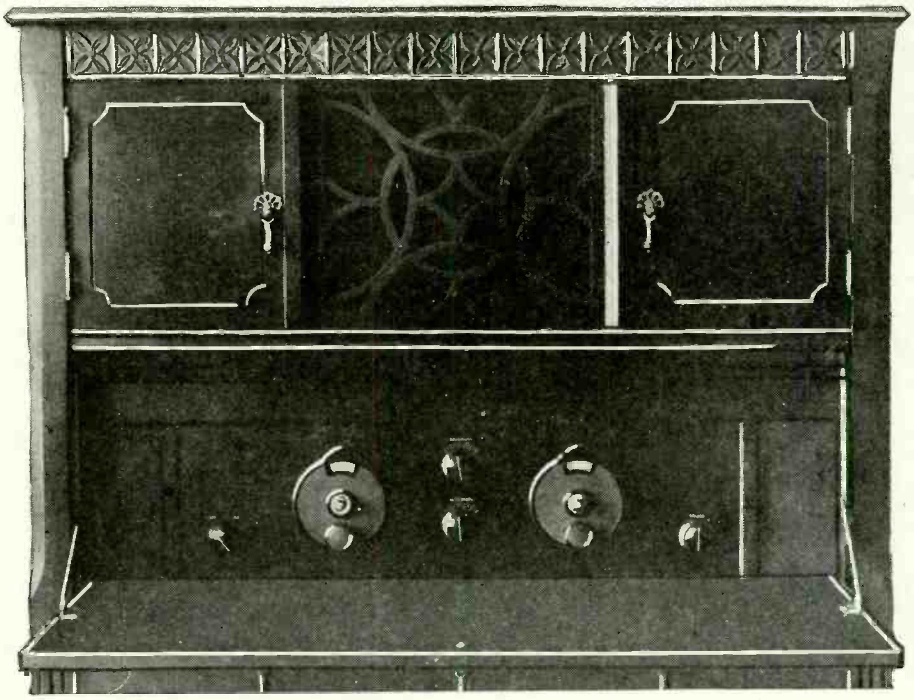
Description of a Receiver, Inherently Stable and which Combines Equal Amplification and Selectivity Over Entire Wavelength Range

THE writer believes it was Thomas Edison who once said something to the effect that if he is working on a problem and comes up against a stone wall in the form of a missing link in his chain of developments, he merely puts the job aside for the time being and pretty soon someone discovers the missing principle or invents a mechanism which just fits into his scheme of things.

The development of great enterprises has seemed to follow along those lines. Industries are built up on the foundation of a revolutionary idea but the steps that lead up to the final development are the result of the combined efforts of many minds laboring along that particular line towards a common goal. In many cases, insurmountable obstacles seem to doom an enterprise to failure and in some cases really worthwhile ideas have been discarded simply because one link of the chain was missing.

The automobile of today is what it is simply because the various phases which enter into the proper functioning of the entire organism have been well thought out. Ideas have been shelved for a time, only to be brought out when processes and auxillary mechanisms which fit into the general scheme have been developed.

Long before tuned radio frequency amplification came into vogue, the possibilities of using impedance coupled or choke coil radio frequency amplification were tried out and were found to work satsfactorily on long waves. With the growing popularity of comparatively short waves such as those included in the 200 to 550 meter waveband used for broadcasting, the choke coil coupled radio frequency circuits fell into disfavor because of the seeming inefficiency of these circuits for wavelengths of this type.



The completed "RFC" receiver installed in a console cabinet.

The real cause behind the failure of the choke coils then used, to measure up to the requirements of this type of amplification was due not to any inherent fault of this type of amplification but to the types of choke coils then available. The ordinary type of choke coil has an extremely high distributed capacity. At long wavelengths (low frequencies) the effect of this capacity is comparatively small, since the coil offers comparatively little opposition to the flow of low frequency current, while the capacity offers comparatively greater opposition to the flow of low frequency current. At the shorter wavelengths (high frequencies) however, the conditions are reversed. Then we find that the choke coil unit acts practically as a condenser connected in the plate lead of the tube so that the impedance obtained is merely that of a condenser of a capacity equal to the distributed capacity of the coil plus the equivalent shunt tube capacity. Obviously since the choke coil unit acts as a condenser rather than as a coil we cannot get efficient choke coil amplification.

For this reason choke coil impedance-coupled radio frequency amplification was discarded as being unsuited for use on broadcast wavelengths.

With the development of helical wound coils however, the complexion of the problem changed. The difficulty experienced with the old types of chokes was eliminated and a choke was produced whose distributed capacity is so low that it may be used with excellent results in radio frequency circuits.

The helical type of winding makes it possible to produce choke coils for impedance-coupled radio frequency amplification with distributed capacities of the coils held down to the remarkably small values of 2 to 3 micro-microfarads at broadcast frequencies.

Tuned radio frequency amplification has the advantage of permitting very sharp tuning for obtaining maximum selectivity. Where it falls down is in its inability to give equal amplification and selectivity over the whole wavelength range, without resorting to special and tricky circuits such as those incorporating automatic variable coupling between the primary and secondary winding of radio frequency transformers. Even such expedients fail to solve the problem because they produce equal amplification over the wavelength range at the expense of selectivity, broadening tuning on the longer wavelengths.

Circuit arrangements which combine circuits having rising characteristics with others having drooping characteristics produce excellent results when properly designed, but the delicacy with which the parts must be matched and the receiver constructed take them out of the class of the home builder.

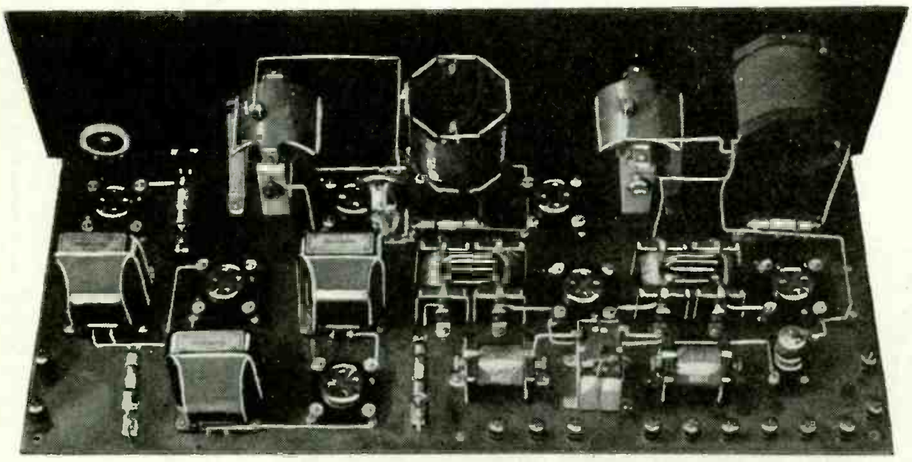
The nearest approach to ideal conditions of that type without the disadvantages of critical adjustment and construction has been attained by combining tuned radio frequency with choke coil impedance coupled radio frequency amplification.

This combination has been attained

without complicating the controls. As a matter of fact the receiver resulting from this combination has only two major controls although three stages of radio frequency amplification are employed.

The antenna tuning unit consists of a single coil with a tap provided for antenna connection as shown in the schematic wiring diagram. This auto-transformer action gives maximum energy transfer from the antenna circuit to the grid circuit of the first radio frequency tube, No. 1.

The grid return leads of all the radio frequency tubes go to the negative 4½-volt terminal of the "C" battery. This negative bias on the grids



A back panel view of the new Samson "RFC" set.

of the tubes reduces "B" battery consumption and also stabilizes operation. A radio frequency choke coil, "L5" is connected into the lead as shown to prevent radio frequency currents from finding their way into the "C" battery lead common to both radio and audio frequency circuits. This eliminates coupling between the circuits and avoids howling and distorted reproduction. A 1 mfd. condenser, "C8" bypasses the radio frequency currents from the grid return leads to the filament lead thereby completing the path for the radio frequency currents in the antenna to ground circuit and the grid to filament circuits. This capacity does not affect tuning.

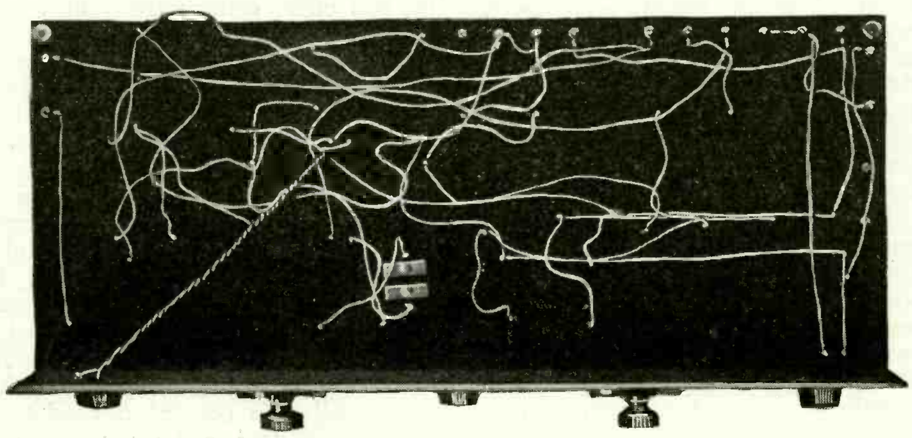
A similar plan is followed to isolate the plate circuits of the radio frequency circuits from the coupling that usually results thru the common resistance provided by the "B" batteries. In this case the plate returns are connected together and connected to the positive 90-volt "B" battery terminal thru another Radio frequency choke coil, "L6." The radio frequency path for these currents back to the filament lead is completed by another 1 mfd. fixed condenser "C9".

Samson, No. 125, 125 millihenry radio frequency choke coils are used for this purpose. The coupling impedances, "L1"; "L2"; "L3" and "L4" are also No. 125 Samson helical wound, 125 millihenry radio frequency choke coils.

The signal is passed from tube to tube being amplified at each step by tubes 1, 2 and 3 of the radio frequency amplifier system. So far the only tuned stage for selecting the wavelength desired has been the antenna stage. The impedance-coupled stages are untuned.

With a capacitative plate load, the feedback thru the inter-electrode capacitance of the tube is of such a phase as to cause anti-regeneration. This makes the amplifier inherently stable. The radio frequency amplifier portion of this receiver is far more stable than the conventional types of tuned radio frequency amplifiers, but since it has many of the characteristics of the conventional types, it is capable of oscillating under certain conditions. A small variable neutralizing condenser is therefore connected as shown, between the grid of the first radio frequency tube, No. 1 and the plate of the second radio frequency tube, No. 2. This arrangement is not the same as that used in most neutralizing schemes and cannot be applied to tuned radio frequency circuits. By its use in this circuit, it is possible to neutralize the negative feedback, or by overneutralizing, to introduce regeneration into the first tuned circuit. In the latter case, the adjustment is set at the long waves and will then require no further adjustment.

After the signal is amplified by tube No. 3, it is passed into the detector stage by a special tuning unit consisting of a secondary tuned by a variable condenser, "C2". The coupling between the primary and secondary coils of the detector stage coupler is

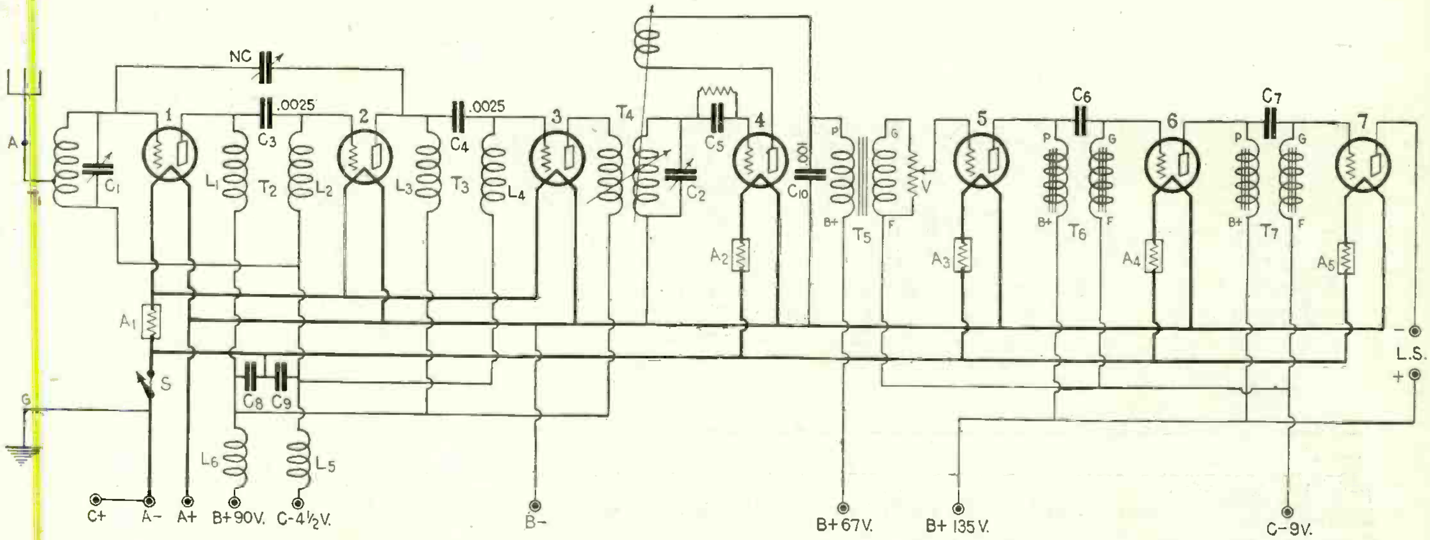


All wiring is done with flexible hook-up wire beneath the sub-panel.

LIST OF PARTS FOR SAMSON "RFC" RECEIVER

- 1 Formica Drilled and Engraved front panel
- 1 Formica Drilled sub-panel
- 1 Samson, Type 41, antenna coupler; T1
- 1 Samson, Type 31, double rotor tuner; T4
- 1 Samson, Type HW-A3, 2 to 1 ratio audio frequency transformer; T5
- 2 Samson, Type 4, Dual impedance units; T6, T7
- 6 Samson, Type 125, 125 millihenry radio frequency choke coils; L1, L2, L3, L4, L5, L6
- 2 Samson, .0005 mfd. variable condensers; C1, C2
- 1 No. 3A Amperite; A1
- 3 No. 1A Amperites; A2, A3, A4
- 1 No. 112 Amperite; A5
- 2 Sangamo, .0025 mfd. fixed condensers; C3, C4
- 1 Sangamo, .00025 mfd. grid condenser with grid leak mounting clips; C5
- 1 Tobe, 2 megohm, Tipon grid leak; C5
- 2 Tobe, 1 mfd. bypass condensers; C8, C9
- 1 Bremer-Tully neutralizing condenser; NC
- 7 Benjamin, No. 9040, UX spring sockets; 1, 2, 3, 4, 5, 6, 7
- 1 Carter, No. 2, 200,000 ohm Hi-ohm volume control; V
- 1 Dubilier; .001 mfd. fixed condenser; C10
- 11 Eby, Ensign type, engraved binding posts marked respectively, "ANT"; "GND"; "A" Battery+; "A" Battery—; "B" Battery—; "C" Battery+; 4 Volts "C—"; 9 Volts "C—"; 45 Volts+; 90 Volts+; 135 Volts+; Speaker—; Speaker+
- 1 Carter, "Imp" battery switch
- 1 Extra Carter rheostat knob for use on battery switch to match Hi-ohm knob
- 2 Samson, Vernier dials
- 15 Lengths Acme flexible Celatsite wire
- 1 Excello cabinet or Console

variable to provide for different coupling to give varying degrees of selectivity and sensitivity. With close coupling maximum sensitivity can be obtained for tuning in distant stations in uncon-



Schematic wiring diagram of the receiver with all parts marked to correspond with front and sub-panel layouts given herewith.

gested districts or when local stations have left the ether clear for real distance work.

With very loose coupling, obtained by turning the primary coil at right angles to the secondary coil, maximum selectivity is obtained for cutting thru local interference.

Regeneration control in the detector stage, giving increased signal strength and selectivity control is provided by another variable coil at the other end of the secondary winding.

The output of the detector stage feeds into a stage of transformer-coupled audio frequency amplification, using a high grade 2 to 1 ratio audio transformer.

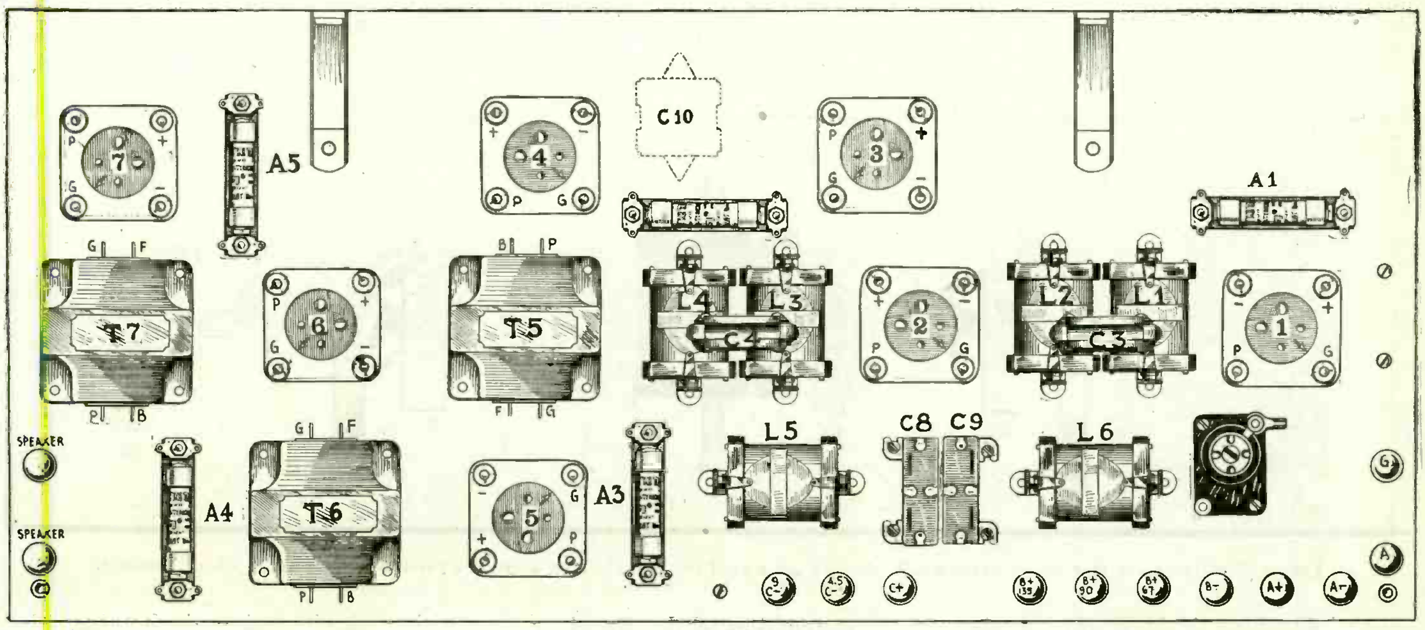
A .001 mfd. fixed condenser connected between the "P" terminal of the transformer and the positive filament terminal of the tube serves to bypass the radio frequency currents in the plate circuit of the detector tube across the high resistance of the transformer winding and "B" batteries.

A variable resistance of the order of 200,000 ohms connected across the secondary winding of the first stage audio transformer serves as an efficient means of controlling the volume of the receiver from a whisper to full volume. In this case, due to the use of dual impedance amplification for the last two stages, the variable high resistance is used only as a volume control and not to "tone" the amplifier.

A dual impedance audio amplifier should not be confused with the ordinary type of impedance coupled amplifier in which a choke is used as the plate element and a resistance is used as the grid element of the unit. The latter can be overloaded very easily and unless careful precautions are taken distortion will result. On the other hand, the dual impedance amplifier unit is very hard to overload and will give excellent reproduction even when the input energy is high enough to overload the ordinary type of impedance coupled amplifier using a grid resistance element.

The stopping or coupling condensers, "C6" and "C7" are part of the dual impedance units and need not be connected externally.

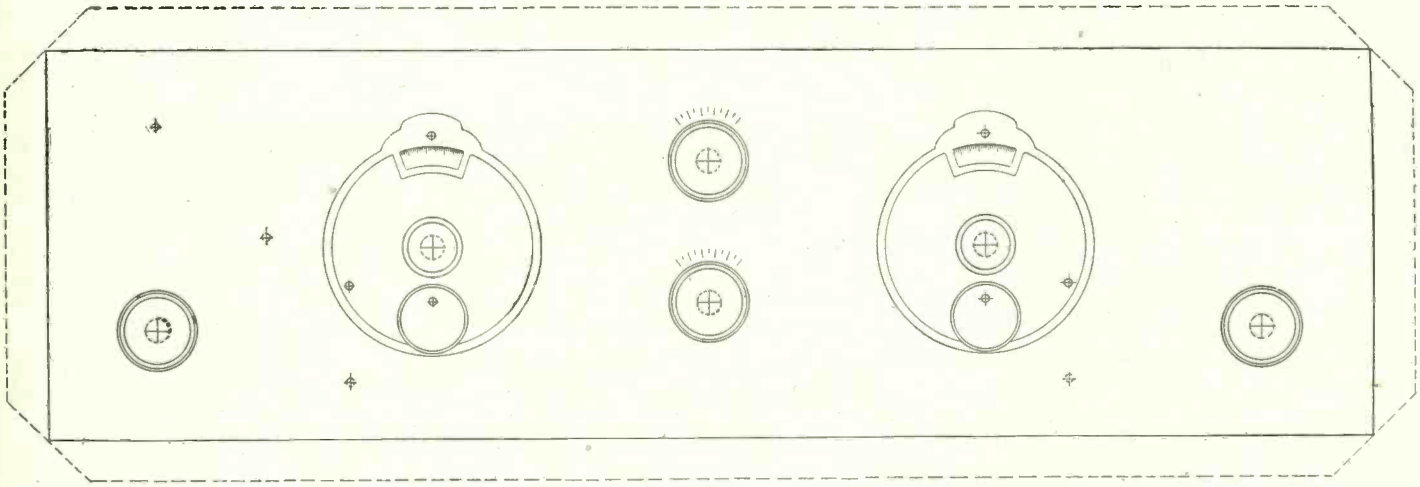
With the precautions taken to avoid coupling thru the common "B" and "C" batteries and with the provisions made for close adjustment of the circuit thru the variable coupling feature between the primary and secondary circuits in the detector and the regenerative control, the use of automatic filament control is practical for all tubes,



Sub-panel layout of parts marked according to their respective symbol in the wiring diagram given above on this page.

thus eliminating rheostat controls entirely.

The three radio frequency tubes are grouped together and controlled by a single No. 3 Amperite designed to take radio frequency tube and the plate of the second radio frequency tube. It is sensitive because of the three stages of radio frequency amplification; regeneration and variable coupling in the cate measuring and positioning. All that must be watched is to place the parts so as to reduce the length of the high-potential grid and plate leads as much as possible.



Hole drilling layout for the RFC receiver. All hole centers are shown at the cross sectioned lines.

care of three UX 201A tubes. A separate Amperite is used for each of the other tubes. The use of the Amperites eliminates the danger of heating the filaments above or below their rated temperature and in this way increases the useful life of the tubes.

In most present-day receivers the tendency has been to improve either the radio frequency end of the receiver or the audio frequency end. It is seldom that a really complete job has been done for both sections of the receiver.

In this receiver we have the ultimate both in a radio frequency unit and audio frequency unit, not neglecting of course the high efficiency of the detector.

To sum up we have a radio frequency unit that is inherently stable, because of the inherent stability of choke coil impedance coupled radio frequency stages. The tendency to oscillate thru overneutralization is under absolute control by means of the neutralizing condenser "NC" connected as shown between the grid of the first detector stage added to which are three stages of highly efficient audio frequency amplification.

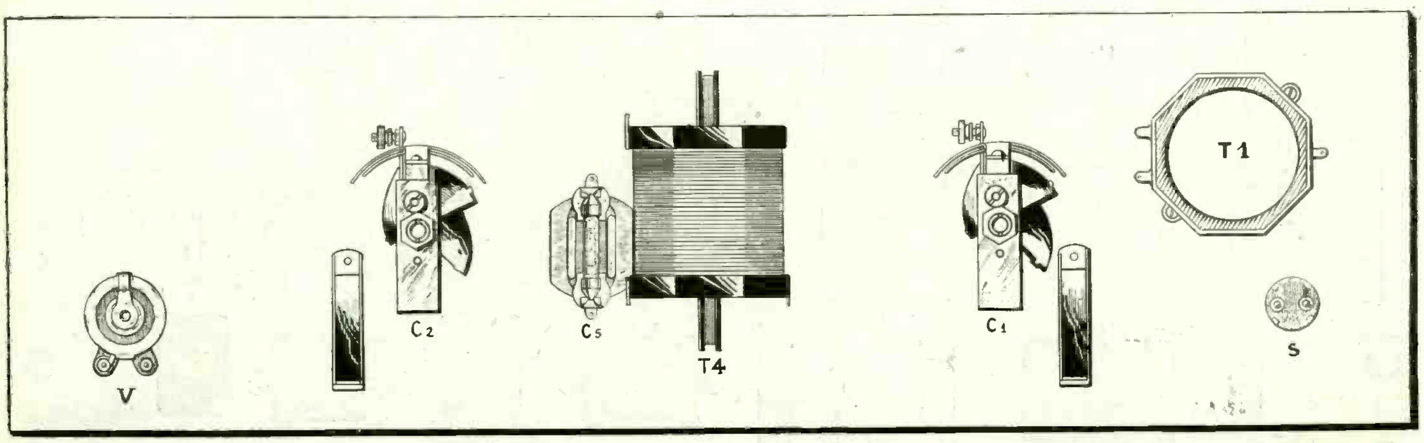
It is very selective because of the two tuned stages, the variable coupling in the detector stage that gives hairline selectivity and the additional selectivity control obtained with regeneration.

It is simple to operate. There are only two actual tuning controls; the first stage tuning condenser and the detector stage tuning condenser, while sharpness of tuning can be added thru the use of the variable coupling and regeneration..

The volume control is to adjust the set to the desired volume and cannot be numbered as an adjusting control. The battery switch of course does not rate as a control.

All the parts, with the exception of the .001 mfd. fixed condenser in the plate circuit of the detector are mounted on top of the panel. Some of the connections can be made very easily on the top side of the subpanel. The majority of the connections however are made very easily by threading the connecting wires thru the subpanel and running them under the subpanel to their terminals on the top side of the subpanel.

An easy method of making these connections is to drop bus bar wire connections from the terminals of the parts thru the holes in the subpanel so that they project slightly on the under side of the subpanel, forming terminals for further connections. The rest of the wiring can then be done by using flexible, insulated wire, thus avoiding bending of wires.



Layout of parts on the rear of the front panel. Letters correspond to those given on respective parts in the schematic wiring diagram.

Construction of the Receiver

Although the "RFC" receiver is a comparatively large set, it is far from being a difficult set to construct. The circuit is very easy to follow; the parts do not have to be placed in any hard and fast position requiring deli-

The "RFC" receiver is comparatively simple in operation as there are only two main tuning controls. It is important however that several considerations be kept in mind while performing

(*Continued on page* 158)

The Shielded Hyboy Superheterodyne

Special Design of Transformer and Circuit Eliminates Reception of Stations on More Than One Dial Setting

By JOSEPH CALCATERRA

MAN is the kingpin of the animal universe; the Rolls-Royce is the goal of every car owner; there is nothing quite like Broadway, N. Y. C., in any other city in the world;—when it comes to Radio; the Superheterodyne reigns supreme.

The proudest boast of any other receiver is that it ranks next to the Superheterodyne.

There is no receiver that can compare to the superheterodyne in point of selectivity; no receiver that can match it for sensitivity and when properly constructed with due regard to the quality of parts used in the audio end of the circuit, the quality of reproduction obtainable with this type of receiver is unbeatable.

The tuning operation in a superheterodyne receiver is comparatively simple in spite of the high amplification obtainable by the use of a large number of tubes. The actual tuning controls are limited to two in number, just the right number for a man who has two hands to use.

The only objection which has been lodged on the superheterodyne has been its peculiarity of receiving stations on more than one setting of the dials, a factor which spoiled selectivity in some cases and made logging of the stations a nuisance in others.

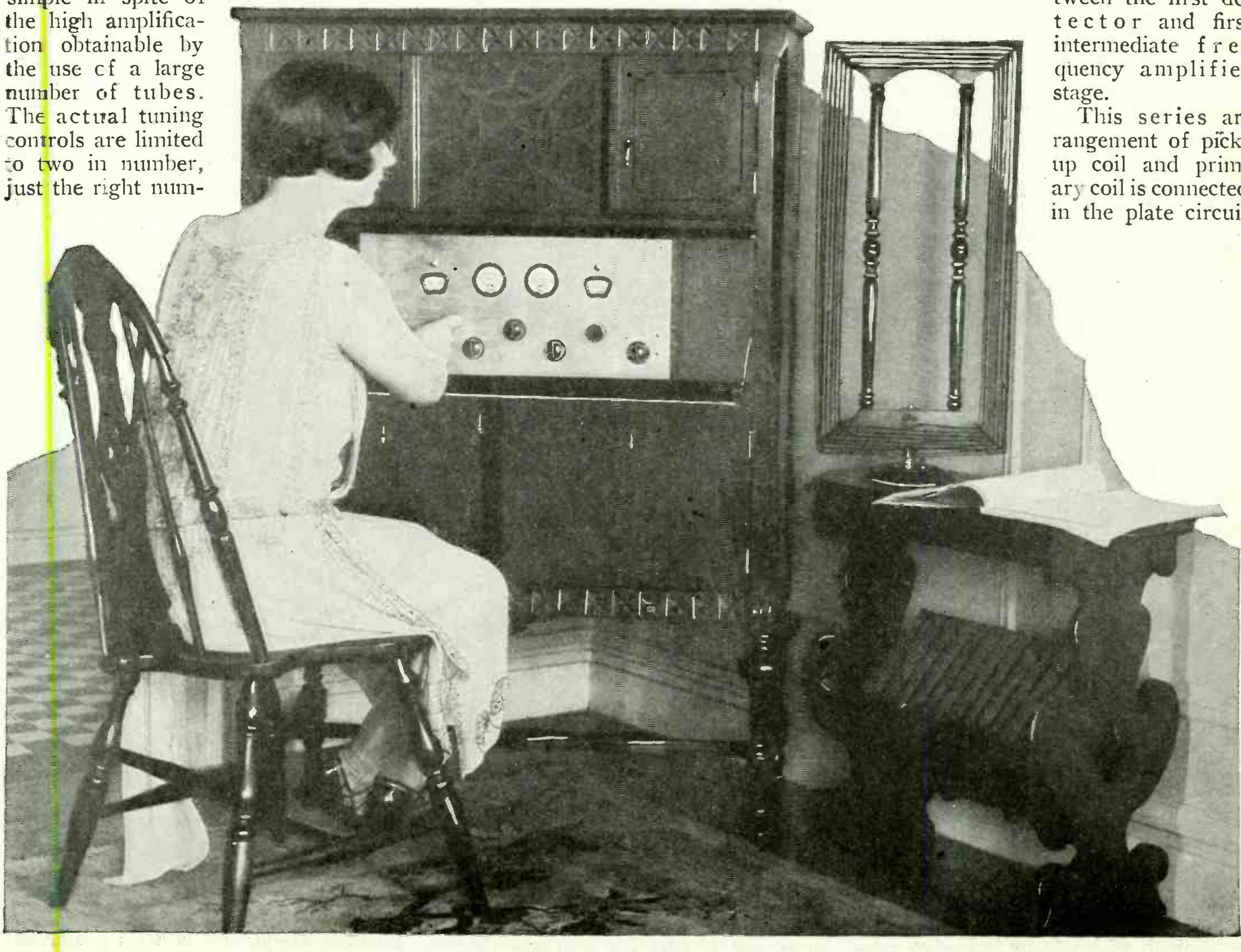
At last a superheterodyne circuit and necessary parts have been perfected to eliminate this difficulty. In the new Madison-Moore "One-Spot" superheterodyne receiver, both the circuit and the transformers have been developed with the primary idea of eliminating the bad feature of tuning in stations on more than one setting of the tuning controls. It must be borne in mind, however, that the elimination of this nuisance of receiving stations on more than one setting depends not only on the use of this circuit and parts but also to some extent on the proper manipulation of the tuning controls.

The method used to provide the heterodyne action in this receiver is very much different than that used in other superheterodyne circuits.

The incoming signal is amplified in the regular way after being brought into the grid circuit of the first detector tube by means of the tuned loop circuit. From then on the course of the signal energy is different than in the ordinary type of superheterodyne circuits.

In the average superheterodyne, a pickup coil in the oscillator coupler is connected in series with the primary coil of the input coupler. The input coupler is the coupling transformer between the first detector and first intermediate frequency amplifier stage.

This series arrangement of pickup coil and primary coil is connected in the plate circuit

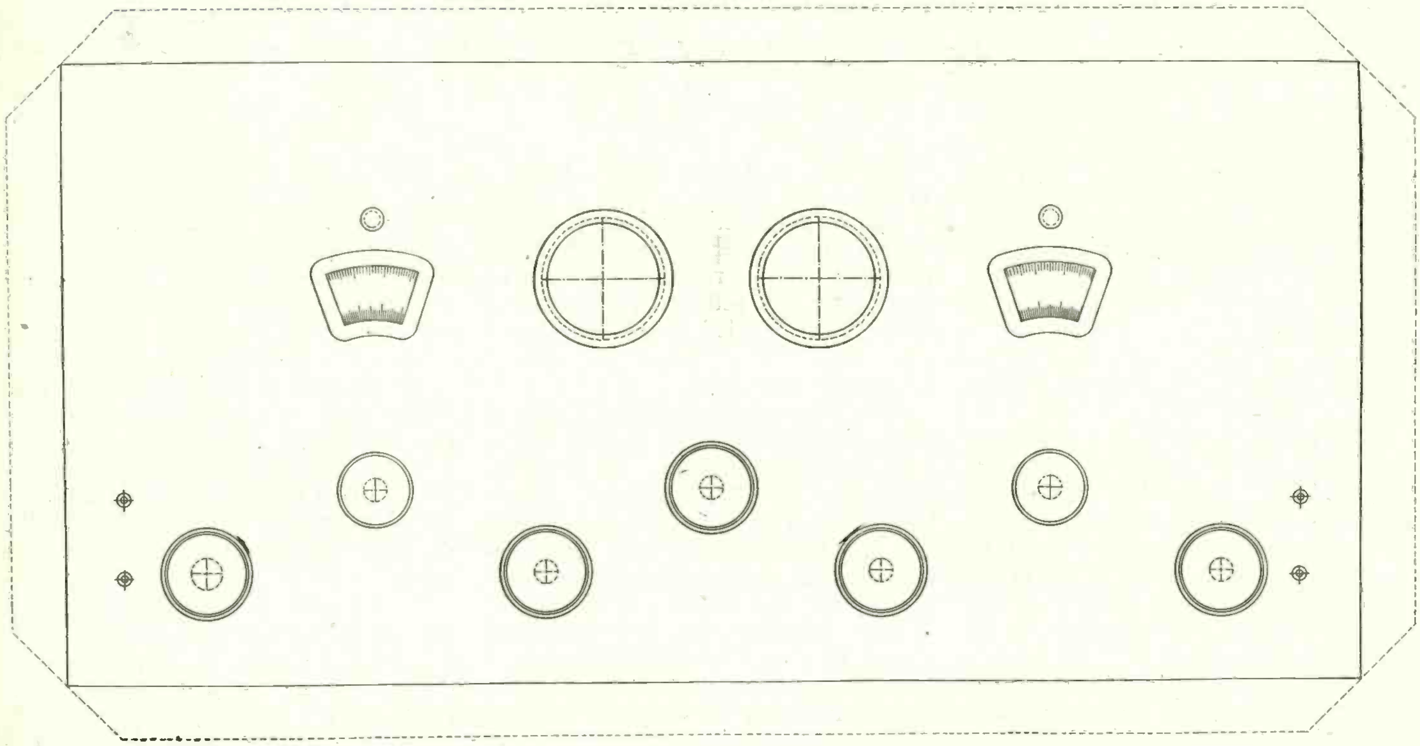


The completed receiver installed in the hyboy cabinet operating on the loop at the right.

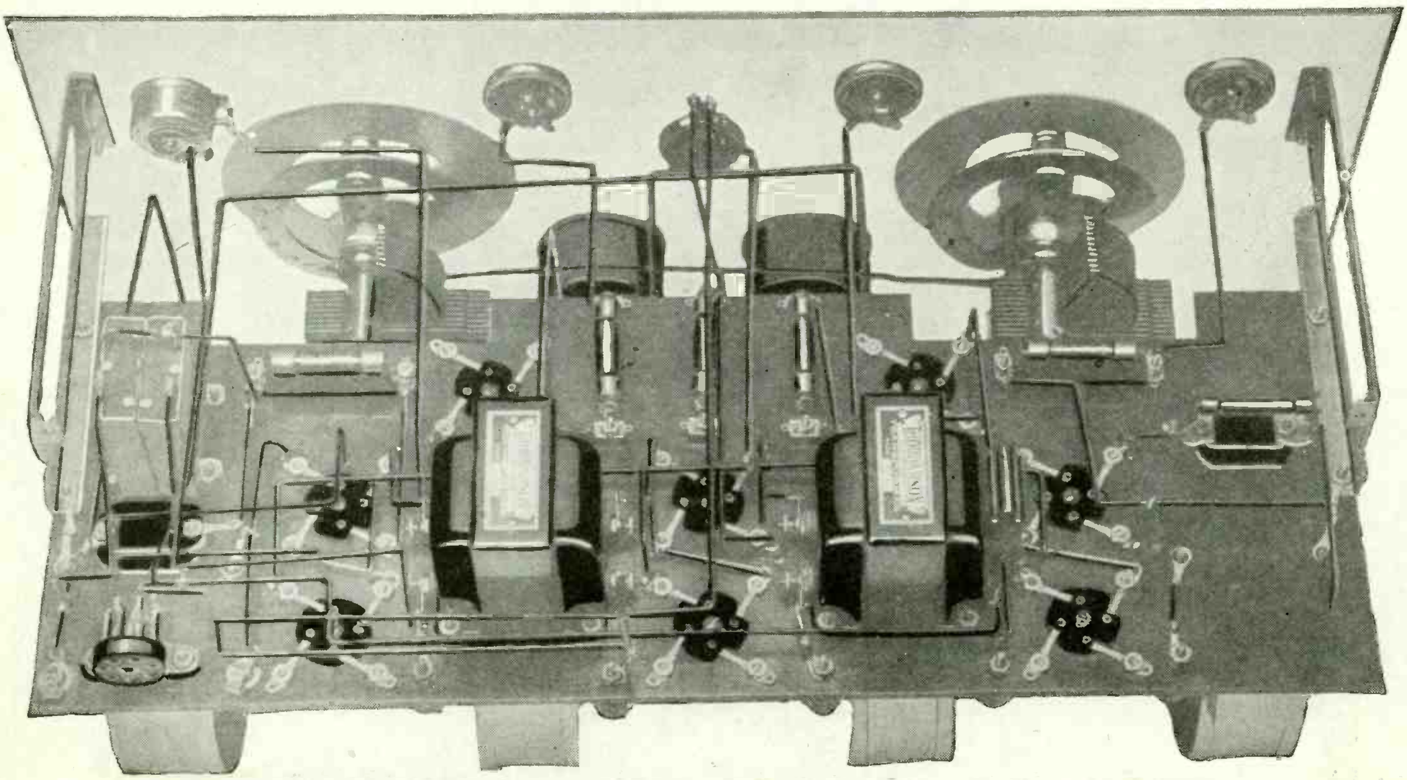
of the first detector tube. As the signal is received, a radio frequency current of the frequency of the incoming signal is produced in the plate circuit of the first detector tube. A locally generated oscillation in the oscillator circuit is transferred into the plate circuit of the first detector tube by means of the pickup coil already mentioned, which is in inductive relationship to the grid coil of the oscillator circuit.

The "mixing" of the two frequencies to produce the intermediate frequency takes place in the plate circuit of the first detector tube and this resulting frequency, passing through the primary of the input coupler is transferred to the grid circuit of the first intermediate frequency amplifier tube through the input transformer, the primary coil of which is connected in the plate circuit of the first detector tube.

In this new arrangement, a different and simplified action takes place. The primary of the input transformer, "T2," is connected in series with the plate coil of the oscillator coupler "T1." The locally generated oscillation in the plate circuit of the oscillator circuit combines with the incoming oscillation in the plate circuit of the first detector tube and the intermediate frequency is thus generated directly in the plate circuit of the first detector tube and passed on to the first



The layout of the front panel showing the location of holes to be drilled.



A bottom view of the sub-panel showing how the audio transformers, amperites, and condensers are mounted.

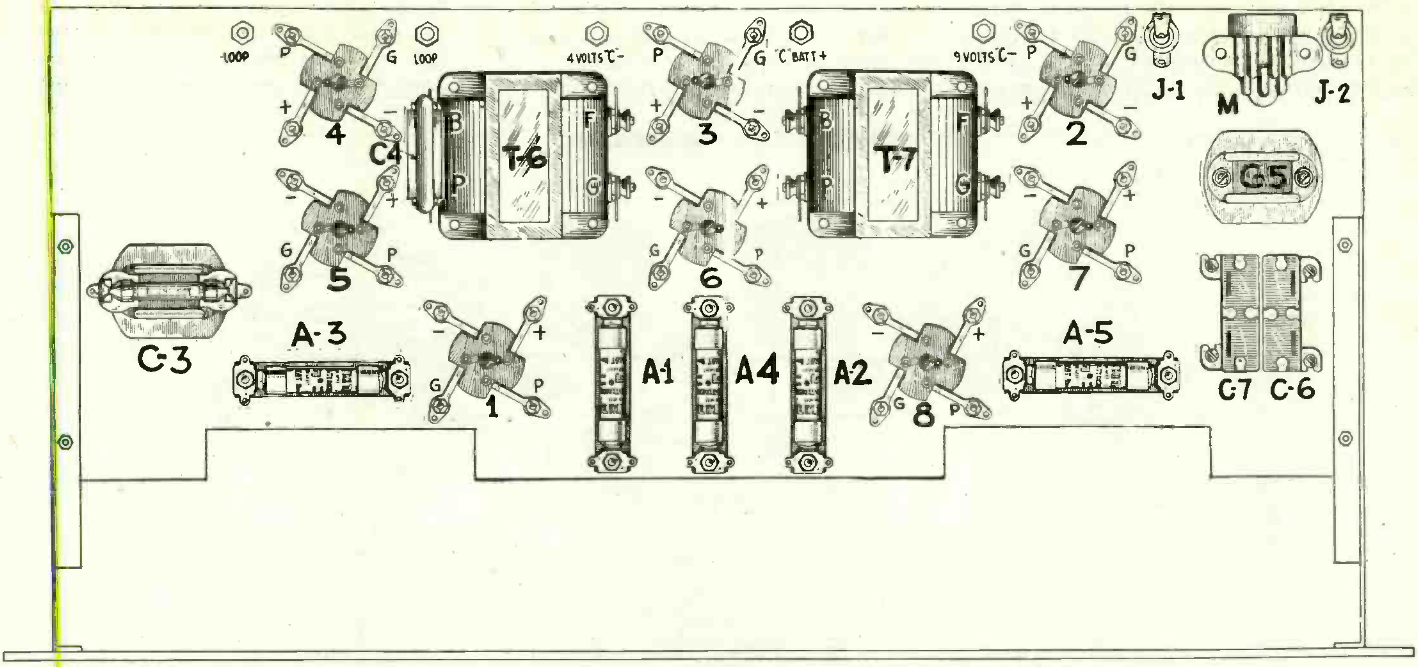
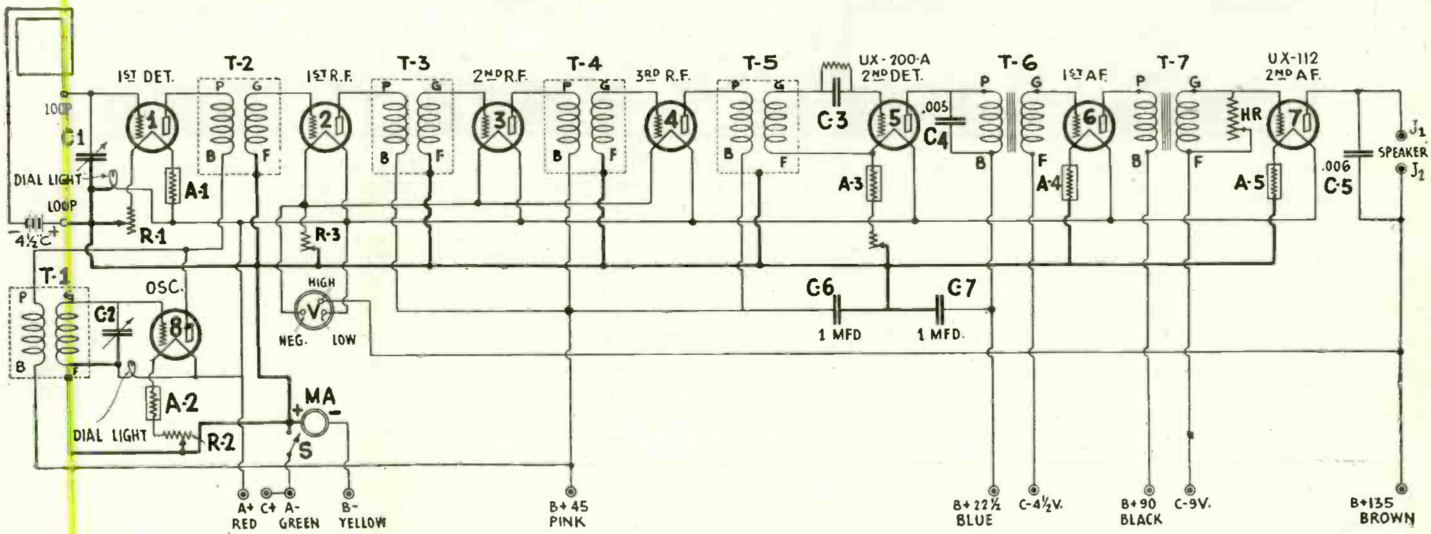
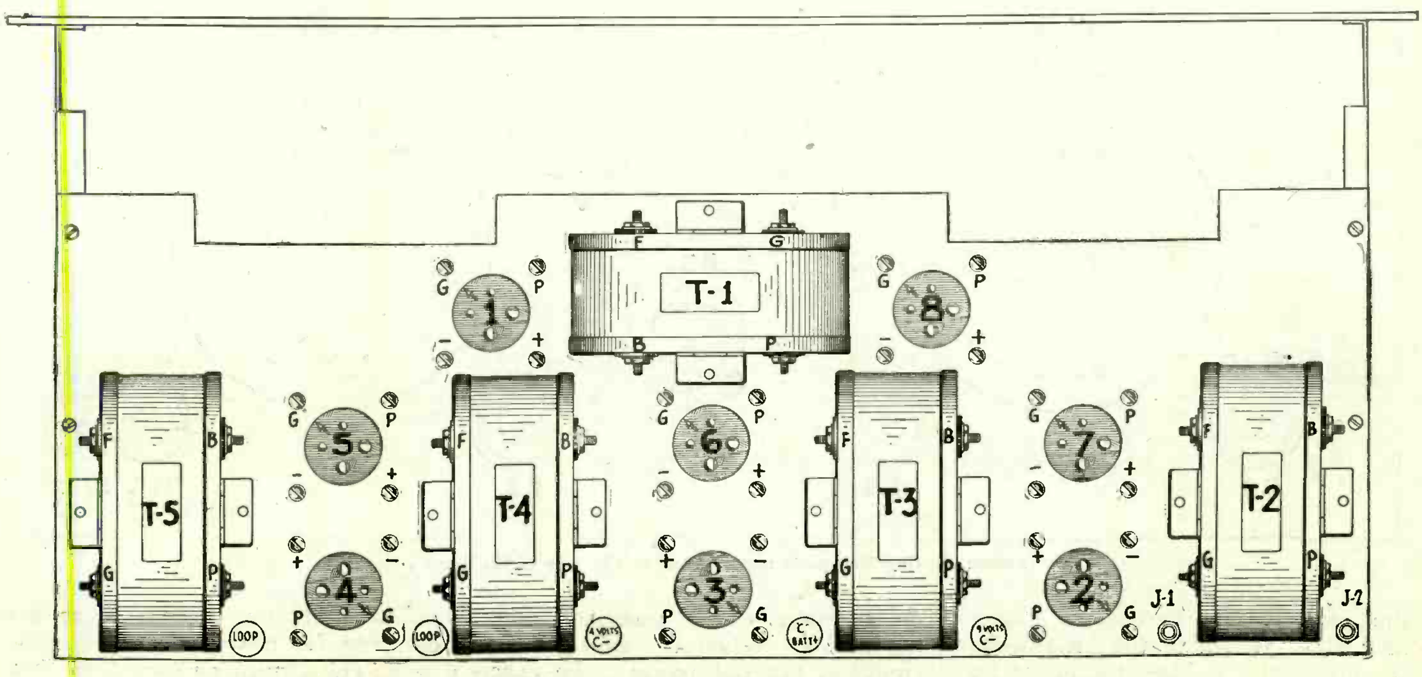


Diagram layout of the parts mounted on the bottom of sub-panel.



Schematic wiring diagram of the Shielded Hyboy Superheterodyne. All letters correspond to those as shown in the front and sub-panel layouts.

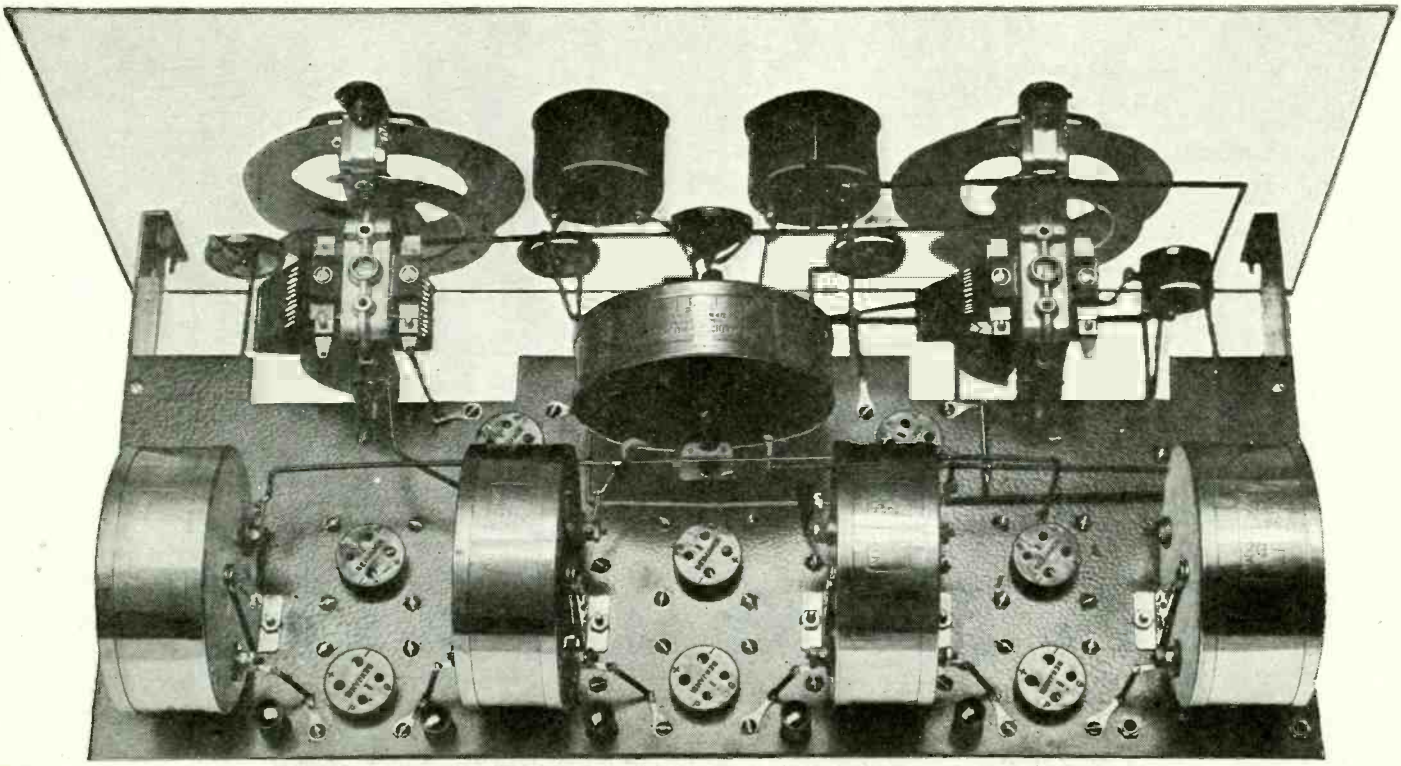


A top sub-panel layout of the set giving the location of the five transformers, sockets and binding posts.

intermediate frequency amplifier tube.

The input coupler "T2" is adjusted to the desired intermediate frequency and responds only to that frequency, extra connections required when the pickup coil type of circuit arrangement is used.

The feature which makes possible ness with which the individual circuits have been designed and worked out makes it possible to bring the circuit up to just below the point of

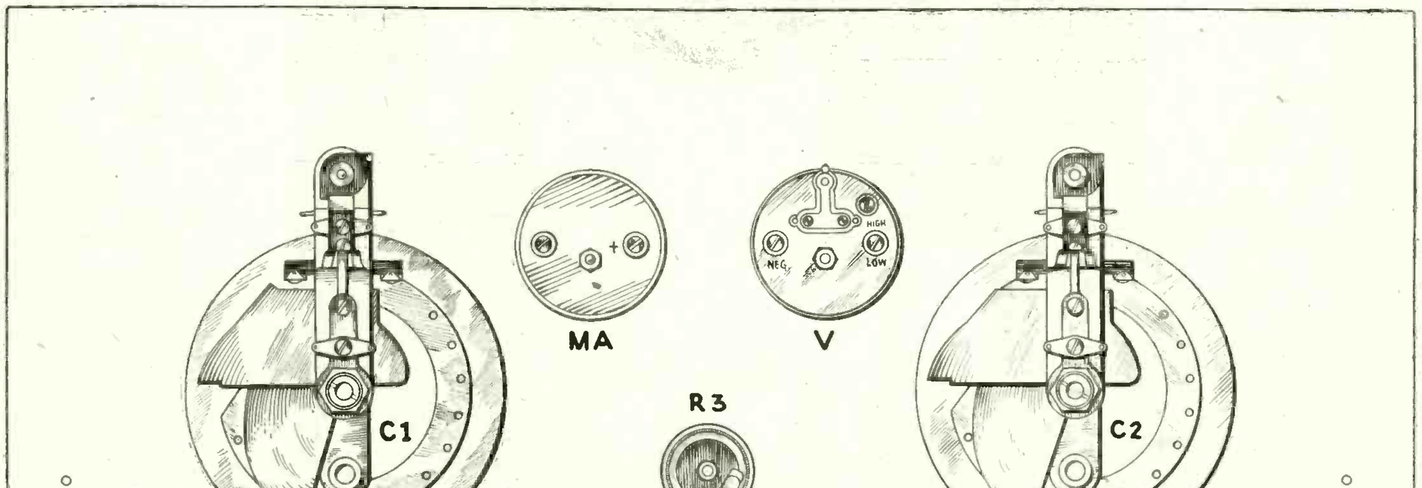


A rear panel view of the Shielded Hyboy Superheterodyne. The Madison-Moore transformers, HW1; HW2; HW3; HW4 and HW5 are shown mounted on the sub-panel. The binding posts mounted on the rear of the sub-panel are connected as follows (from left to right): First two to loop; Third to 4 volts C—; Fourth C Battery+ and Fifth 9 volts C—. The two tip jacks at the extreme right are for the loud speaker.

so that no signal is passed on to the radio frequency amplifiers until the oscillator is adjusted to produce the required frequency when the oscillation it produces is combined with the incoming frequency.

This circuit arrangement eliminates the elimination of the double settings on which a station can be tuned in hinges on the high value of the intermediate frequency used. To get the required efficiency, the units must be carefully designed, assembled and matched because a slight difference in oscillation, giving maximum response without introducing distortion.

This in brief is the main difference between this circuit and other superheterodyne circuits. There are other features however, which are not so readily apparent.



Layout showing how parts are mounted on the rear of the front panel.

the pickup coil; permits a simpler method of obtaining the intermediate frequency and reduces the losses and the constants of the units will result in failure. While the first detector circuit is not regenerative, the exact-

The parts and circuits have been designed for use with storage battery

(*Continued on page* 178)

A Practical A and B—D. C. Eliminator

A Direct Current Eliminator Having Low Operating Cost

IN many of the larger cities there are sections supplied with direct current rather than alternating current. There is no reason in the world why radio fans in these localities should not enjoy the benefits of battery elimination. In fact, direct current has the advantage in that it does not need to be rectified. Hitherto the chief drawback to the design of direct current eliminators has been the fact that a certain amount of waste has been necessary on the "A" side to cut the voltage down to the required 6 volts. A means has been devised which will be described herewith, by which the surplus current may be utilized. In other words, the waste or by-product of current obtained in cutting down the voltage is utilized in a novel manner; namely, to supply a reading or floor lamp placed near the set. The eliminator described below can be used on any type of set and gives unusually quiet operation. As regards current consumption, this is practically negligible, since the "B" section uses so little current that it would not be recorded on the electric light meter, while the "A" side utilizes the by-product to light the reading lamp.

The schematic diagram in Fig. 1 shows the separate "A" hook-up. Fig. 2 shows the separate "B" hook-up. The eliminator built in the Radio Listeners' Guide laboratories was made for a ten tube Super Zenith. In this set there are separate compartments for "A" and "B" eliminators and hence the device was made in two sections. There is no reason at all, however, why the two parts could not be combined on one baseboard if desired.

The eliminator is connected to the lighting circuit through an ordinary lamp cord connected to an outlet. It may be necessary to reverse this connection since the plate current of the vacuum tubes must be on the positive side in order to operate the set.

On the "A" side a current-carrying choke is used as a filter. The choke used was the Amertran 418. This has a low resistance and can carry currents up to 2½ amperes without heating. In case the fan wishes to build his own choke, this should be made with about 500 turns of number 20 enamelled wire on the conventional iron core. A 2 mfd. filter condenser is connected at each end of the choke, that is, between the choke and the negative side. This is all the filtering required for the "A" current. The reading lamp is connected in series with the choke using the binding posts as indicated in the picture wiring diagram.

Since the reading lamp is in series in the circuit it acts as a valve to control the amount of current going to the filaments of the tubes. It may be desired to use more or less tubes in a given set as for instance when one stage of audio is cut out, therefore a reversed rheostat is included in the circuit, thus obviating the necessity of changing the size of the reading lamp. Stops are necessary at both ends of the rheostat so that it cannot be turned completely off, thus allowing too high a voltage to be placed on the tube filaments. The reversed rheostat acts as a by-pass to keep the excess current out of the filaments. As the rheostat is turned up or down, the voltage is varied and can be read directly on the voltmeter. The value of the rheostat should be 30 ohms or more. However, it should allow a current of at least one-quarter of an ampere to flow without heating.

This shows the direct current eliminator installed in a De Luxe Super Zenith. The "A" section is at the right and the "B" eliminator is at the left.

The "B" section of the eliminator is just as simple as the "A" side. The filtering is taken care of by an Amertran 854 choke with a 2 mfd. condenser connected between the output and B minus. A one-half mfd. condenser is used between the detector output and B minus. Bradleyohms are connected as shown to regulate the output and detector voltage, and these were found to give exceedingly fine control. A jewell voltmeter is included in the output circuit. A cheap voltmeter should not be used since in this case the voltmeter will actually consume more current than the "B" eliminator can carry.

In the circuits illustrated, a 45 volt "B" battery has been placed in series on the positive side of the line, so as to raise the voltage up to that of 135, as required by the Zenith set. Small batteries are illustrated, but it was found desirable to use a medium size battery such as Eveready 767 or 772. In case an average five tube set is used with standard 201-A tubes, the battery may be eliminated.

The size of the reading lamp used will depend upon the number of tubes in the set. For example, with 201-A type tubes drawing ¼ amp. each, a 100 watt lamp can take care of up to three tubes. Of course, it will be necessary to reduce the voltage slightly by using the reversed rheostat. In like manner a 150 watt lamp will allow sufficient current to flow to supply up to five tubes and a 250 watt lamp up to eight tubes. Where 99 type tubes are used, the reading lamp should be correspondingly smaller. In case the eliminator is used with a set having 10 or more tubes, it may be found desirable to do away with the reading lamp and use a Nichrone ribbon resistance wound on asbestos boards and suitably mounted so as to permit heat radiation. The length of the resistance ribbon should be such as to permit the desired current to flow, while a large enough ribbon should be used to allow this current to flow without overheating.

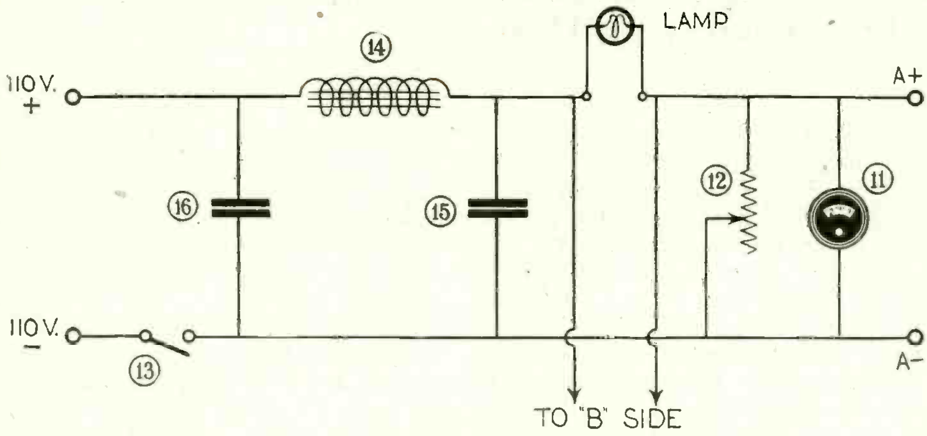


Fig. 1. Schematic wiring diagram of the "A" eliminator. Note reversed rheostat No. 12.

The ground lead should not be connected directly to the set. A ½ to 1 mfd. fixed condenser should be used in series with the ground and the set in order to prevent the possibility of a short circuit with consequent blowing of the fuses.

When the eliminator is in use, the rheostats on the set should be turned on full, and left in that position, using the reversed rheostat for filament regulation.

A final word of precaution regarding connections. In a great many sets, B minus is connected to A plus within the set. Therefore, try using the eliminator without connecting the B minus to it. If it works without making this connection, this shows that the connection is already made within the set and in this case the B minus lead from the set should be taped up and not used.

A small outlet box contains the fuses for each side of the line, and also a double pole, double throw knife switch for use in switching the lamp directly onto the line, where it is to be used without the set.

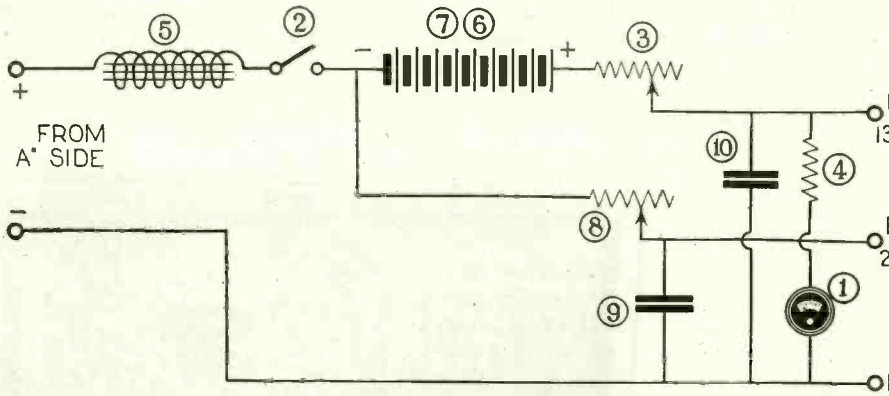


Fig. 2. Schematic wiring diagram of "B" eliminator. Exact voltages wanted are obtained by manipulating Bradleyohms 3 and 8.

Construction

The parts were first mounted on the baseboard, testing the fixed condensers (9, 10, 15 and 16) before mounting them. Center holes were then drilled for snap switches (2 & 13), rheostat (12) and Bradleyohm (3). The holes for the voltmeters (1 & 11) were drilled out next. The best method of doing this is to locate the exact center, scribe a drilling circumference and drill a large number of ⅛-inch holes,

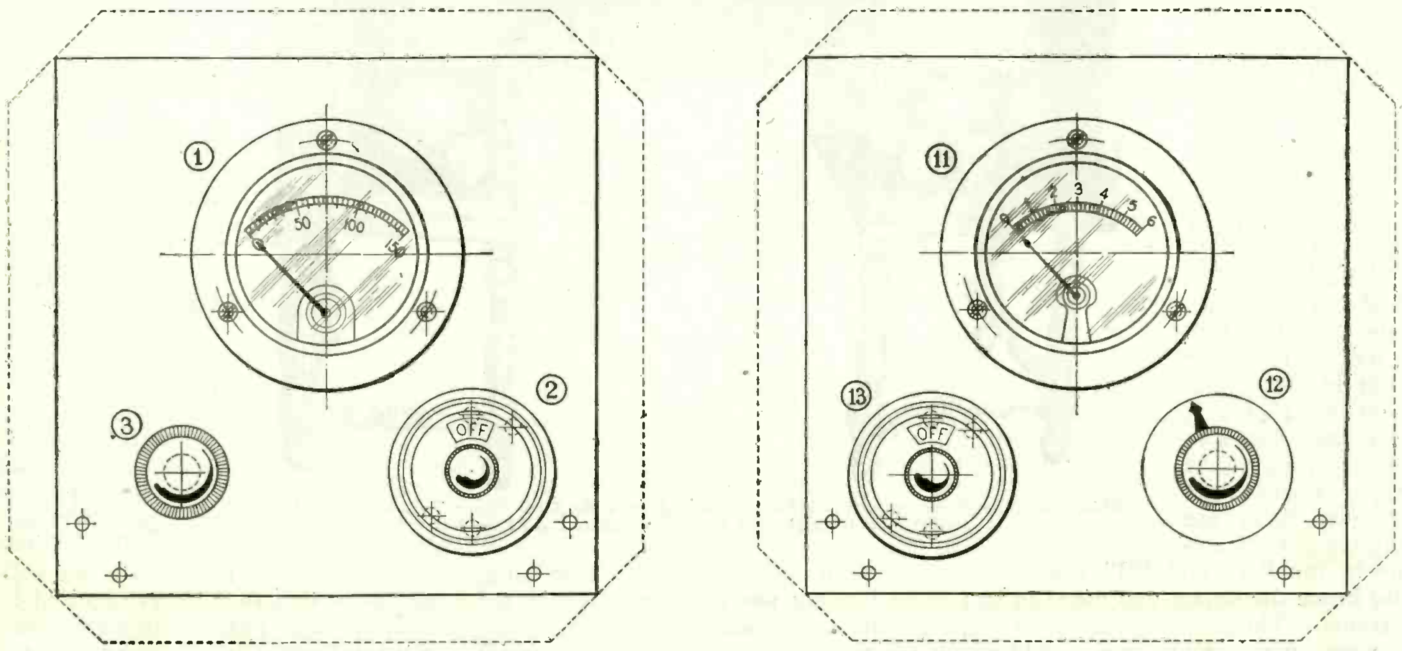
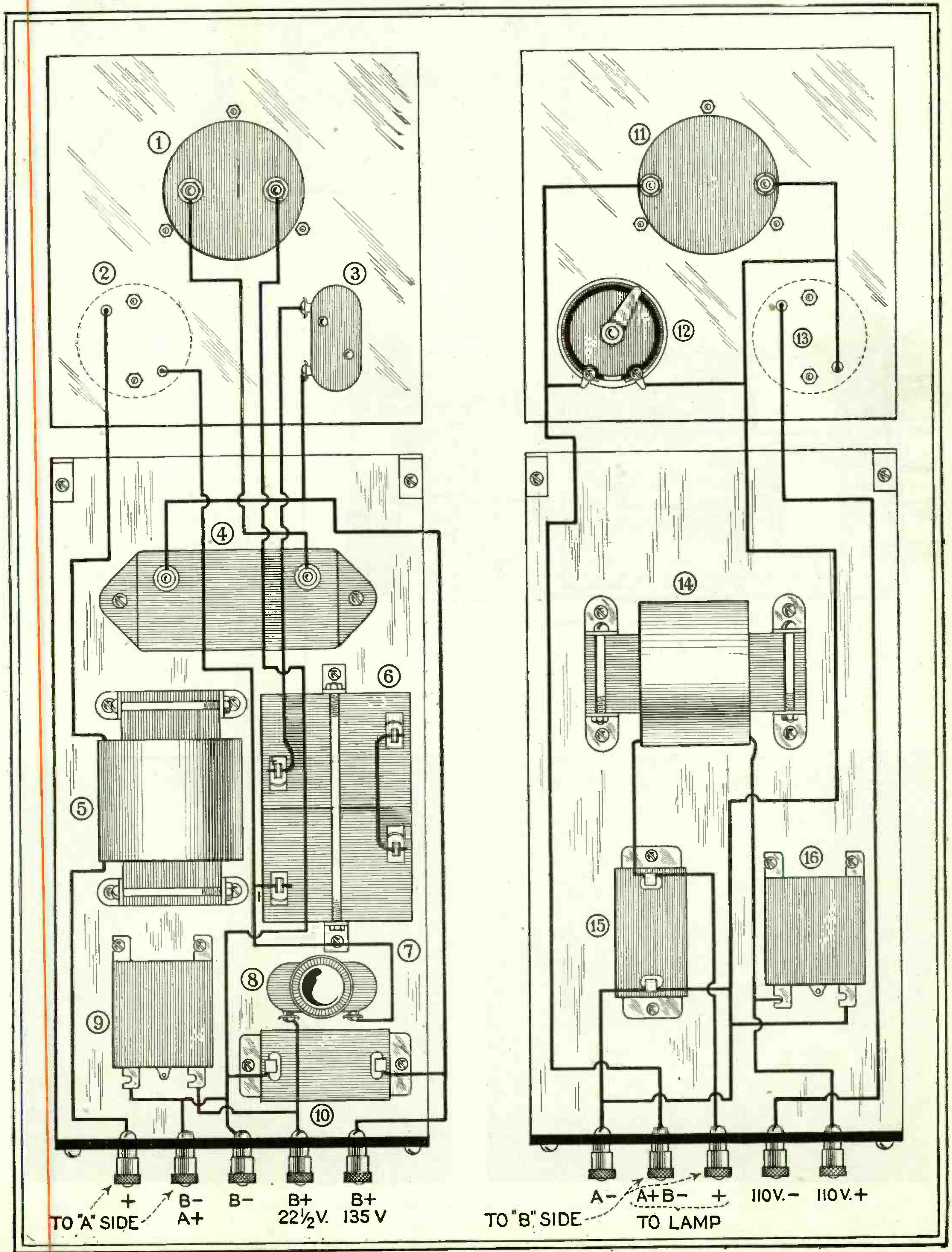


Fig. 3. At the left is shown the panel layout of the "B" section of the eliminator; at the right is the panel layout of the "A" side.

Picture Wiring Diagram of the Practical "A" and "B"—D. C. Eliminator



The diagram at the left shows baseboard and rear panel view of the "B" eliminator. That at the right shows same views of the "A" eliminator.

finishing up the large hole with a file. Of course a quicker job may be done, using a "fly cutter." In this case it is

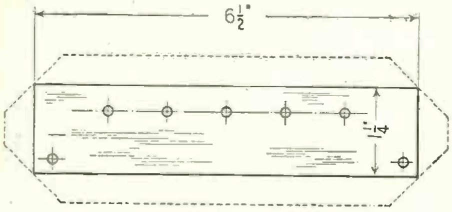
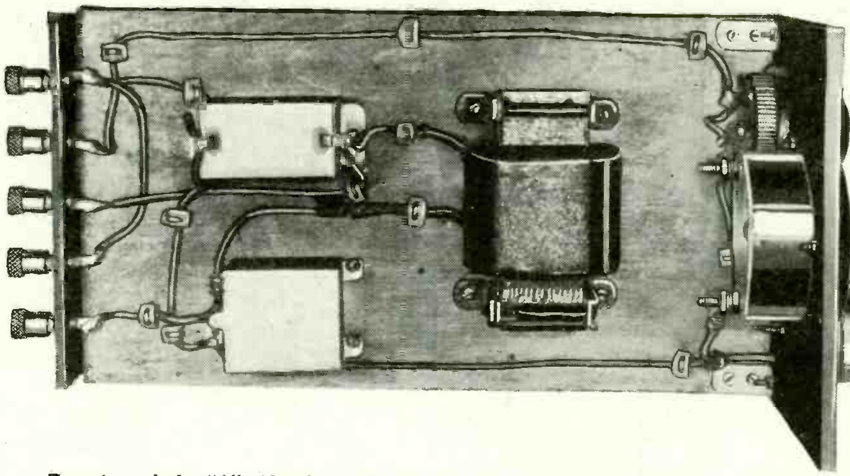
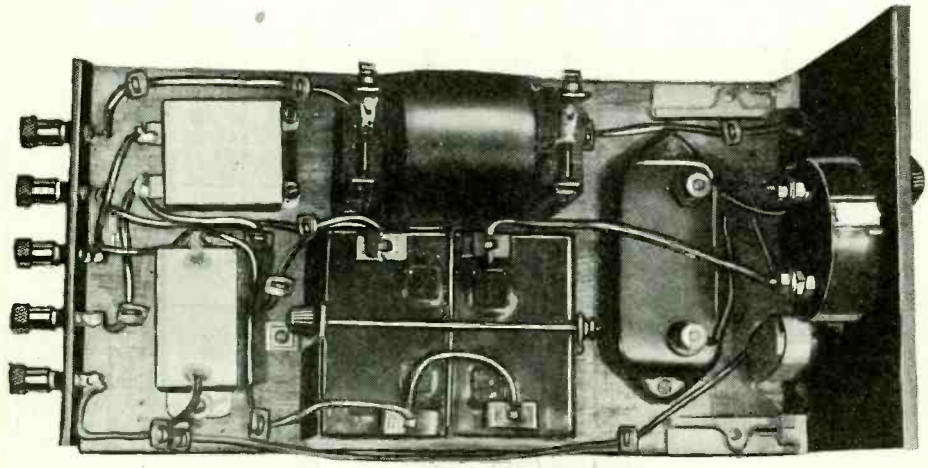


Fig. 4 Layout of binding-post strips, showing center holes for posts.

merely necessary to drill one small center hole and locate the large-circle drilling tool in this. Care should be taken to measure the outside diameter accurately so that a good fit will be obtained when the voltmeters are inserted.



Top view of the "A" side of the direct current eliminator. Note the extreme simplicity.

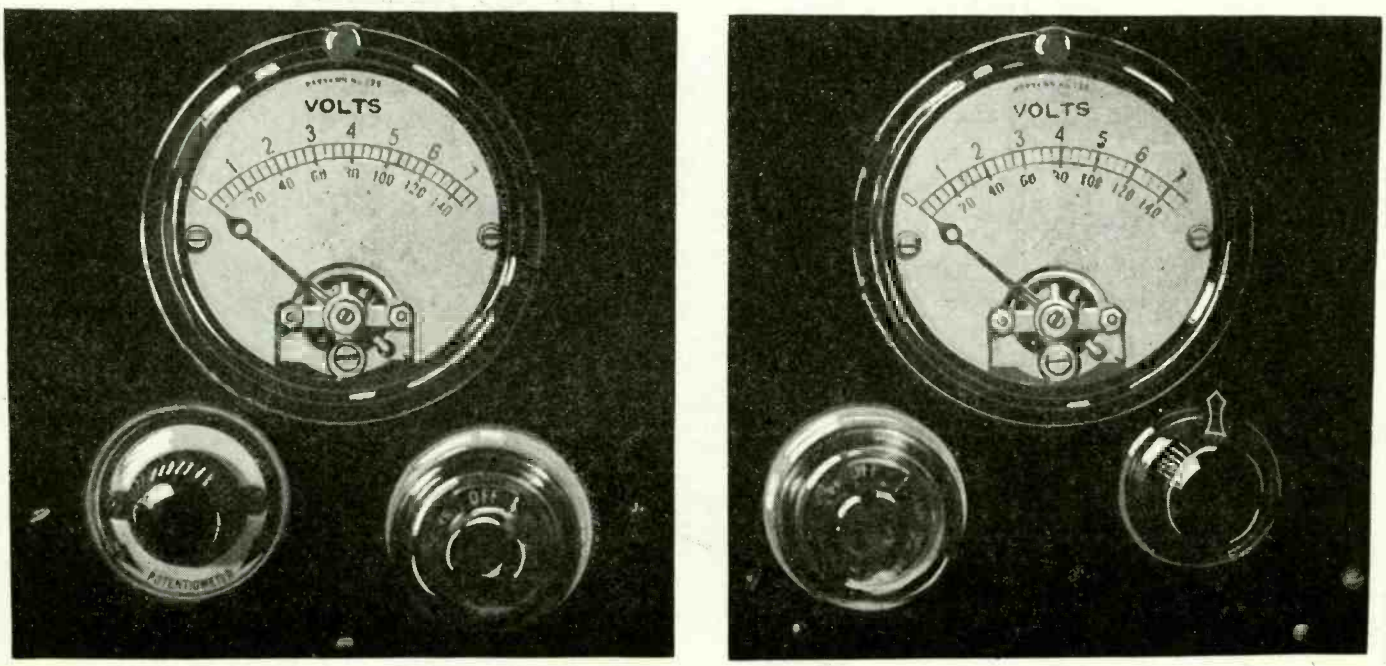


A top view of the "B" eliminator.

The various parts are next mounted on the panels and these are fastened to the baseboards, using brackets as shown in the illustrations. The binding post strips are also fastened to the baseboards at this time. The parts are now connected up as per the picture wiring diagram or the schematic hook-up. The wiring is extremely simple and no fixed procedure is necessary. Number 18 rubber covered stranded wire was used. This was fastened to the baseboard at the necessary intervals by small rubber-insulated cleats.

PARTS REQUIRED FOR "A" & "B" D.C. ELIMINATOR

1 Amertran Choke, 418 (14)
1 Amertran Choke, 854 (5)
1 Dubilier Fixed Condenser, 2 mfd. (10)
2 Tobe Fixed Condensers, 2 mfd. (15, 16)
1 Tobe Fixed Condenser, ½ mfd. (9)
1 Jewell Voltmeter with res. 0 to 150 volts (1, 4)
1 Jewell Voltmeter, 0 to 6 volts (11)
2 Snap Switches (2 & 13)
1 Electrad Rheostat, 30 ohms (12)
2 Bradleyohms, 5000 to 500,000 ohms (3, 8)
2 Eveready 22½ volt 772 (6, 7)
2 Formica or Radion Panels ¼" x 6½" x 6½"
2 Formica or Radion Binding Post Strips, 3/16" x 6½" x 1¼"
2 Wood Baseboards, 6½" x 12" x ½"
10 X-L Binding Posts



The panel at the left is that of the "B" side of the practical direct current eliminator; that shown at the right is the "A" eliminator panel.

A Simple Wave Trap and Clarifier

A Useful Accessory for the Non-Selective Set

THERE is an insistent demand for a good wave trap, and this increases in urgency as the broadcasting stations continue to multiply. An efficient wave trap is almost indispensable in localities where there are a great many broadcasting stations, except where the radio receiving set is extremely selective. Even in rural districts remote from powerful broadcasting stations a wave trap often comes in handy. For instance, a radio listener living at a point equi-distant from New York and Pittsburgh may have trouble in separating WGBS on 315.6 meters and KDKA on 309.1. The wave trap described below will solve his difficulties

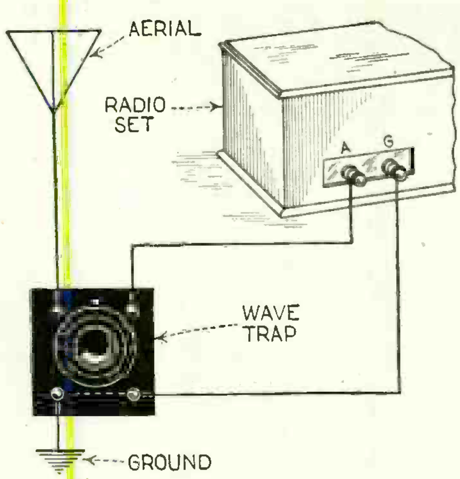


Fig. 1. Method of connecting wave trap in series with set.

The construction of the wave trap shown is extremely simple. It consists essentially of a good variable condenser, a radio frequency coil, a low capacity variable condenser, a vernier dial and four binding posts.

The schematic wiring diagram is shown in Figure 2. The photographs show the neat appearance of the completed wave trap. The parts used in this device consist of a Karas Orthometric condenser, of .00037 mfd. capacity, controlled by a Karas Micrometric dial, a Karas Equamatic coil, an X-L Variodenser .0003 to .001 mfd., and four X-L binding posts.

To put the wave trap into operation, the aerial is connected to the left top binding post and the ground to the left bottom binding post. The aerial terminal of the radio set is connected to the right top terminal and the ground terminal of the set is connected to the right bottom terminal. Since the two ground binding posts are connected together, one could be omitted. However, the use of two gives the wave trap a better appearance.

It will be noticed that the use of the Equamatic coil gives a very wide variation of adjustments. The primary is attached to the condenser shaft and its coupling changes as the condenser is rotated. A further hand adjustment is also provided. In addition the secondary can be adjusted as can be seen by an inspection of the photographs. These adjustments provide a wide range, so that almost any station may be tuned out, no matter how close, nor how powerful.

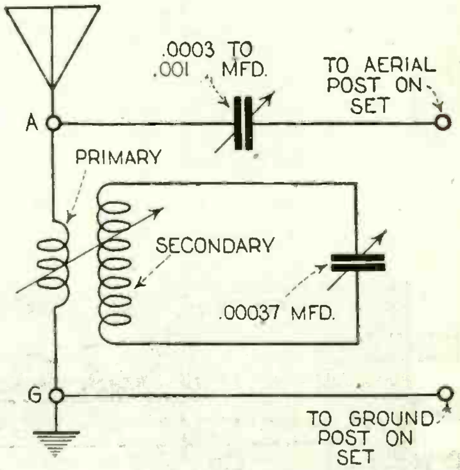
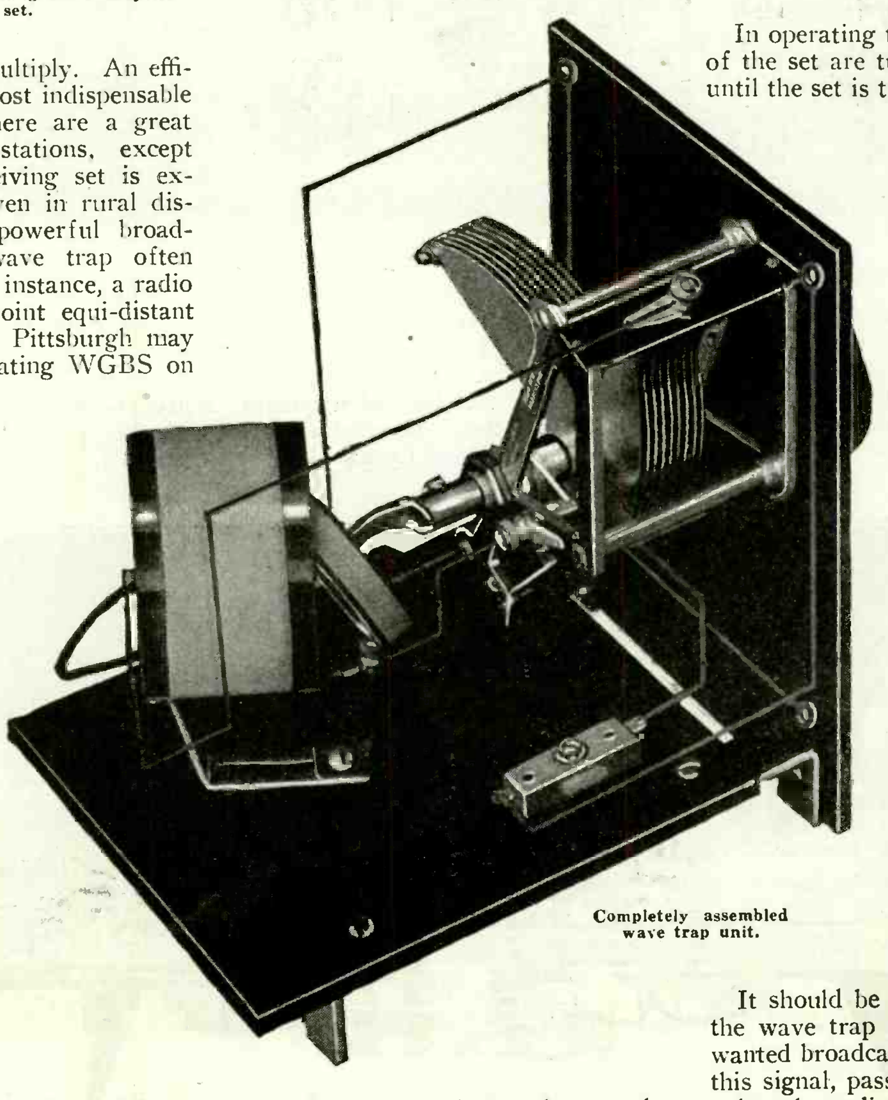


Fig. 2. Schematic wiring diagram of wave trap.



Completely assembled wave trap unit.

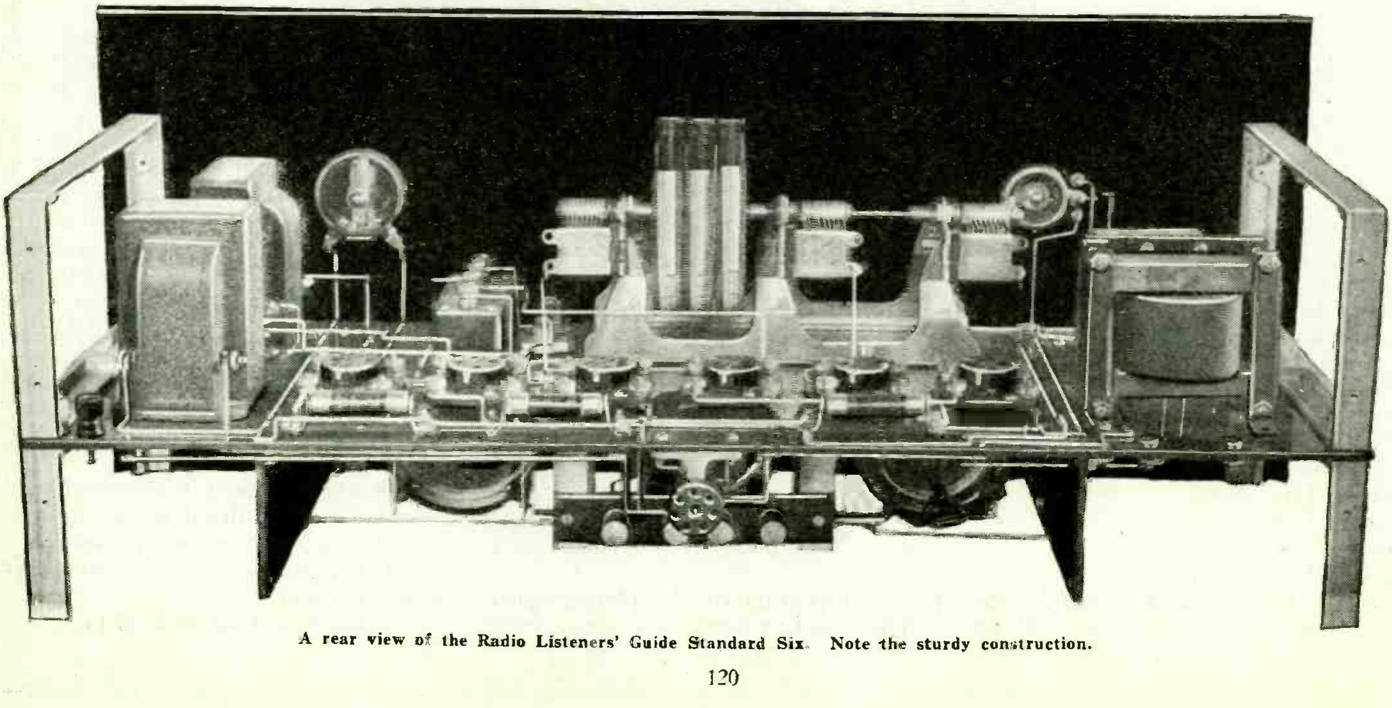
In operating the wave trap, the dials of the set are turned in the usual way until the set is tuned to the desired station. This should be done before connecting the wave trap in the circuit. After the desired station has been tuned in, attach the wave trap and tune it by means of the condenser dial to the wave length of the interfering station. Finally detune the receiving set. The unwanted broadcasting or other signal will be tuned out in this way and the desired station may then be tuned in on the set. If a very powerful station is to be tuned out, it may be necessary to alter the coupling between the primary and the secondary of the wave trap coil. This can be done by manipulating the primary or by changing the positions of both the primary and the secondary.

It should be clearly understood that the wave trap is tuned in on the unwanted broadcast station. It "accepts" this signal, passing on the desired signal to the radio set.

(*Continued on page* 174)

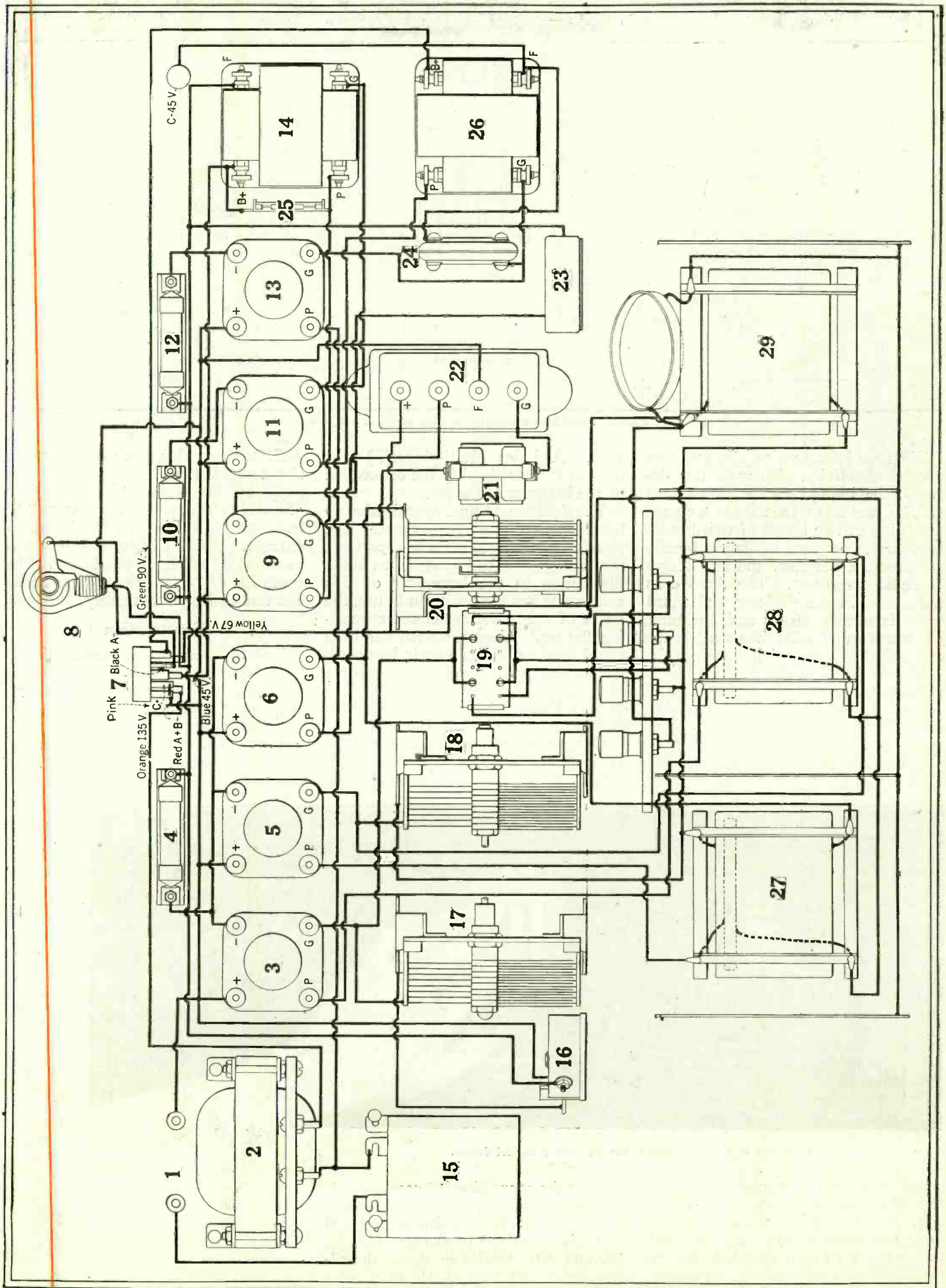
THE R. L. G. (Radio Listeners' Guide) Standard Six might be described as a custom built set. In other words, this set was built to fit certain fixed specifications and the parts were chosen with the requirements in mind.

The first and most important requirement was that of beautiful, true and clear tone quality. This immediately necessitated the selection of a quality transformer for the audio amplification stages and the Rauland Lyrics (14 and 26) were finally decided upon. As further aids to obtaining the finest tone qualities possible, it was decided to use a new power tube in the last audio stage with the correct "C" battery for grid bias. The ouput filter consisting of a



A rear view of the Radio Listeners' Guide Standard Six. Note the sturdy construction.

Picture Wiring Diagram of the R. L. G. Standard Six



Jacobs choke (2) of 30 henries, known as the Molliformer, and a 4 mfd. Tobe condenser (15) completed the specifications insofar as tone quality was concerned.

A Carter 400 ohm potentiometer (16) was included as a volume control. The set was designed for loop or antenna operation, a simple Federal Anti-Capacity change-over switch (19) being

Fiat loop. A type UX-200-A CeCo tube was used as a detector tube, and one of the new type UX-171 CeCo power tubes was used in the last audio stage. The other tubes were type 201-

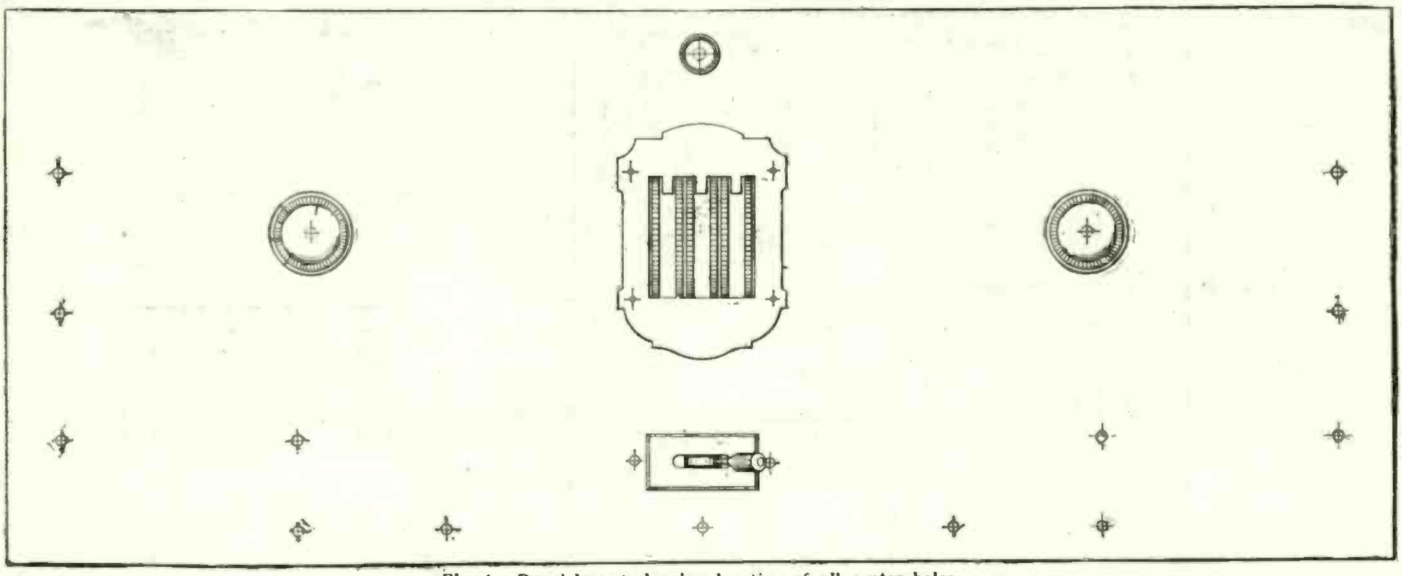


Fig. 1. Panel layout showing location of all center holes.

The next important requirement was that of selectivity. To meet this demand, the highly efficient Aero coils (27, 28, and 29) were used in a circuit consisting of two stages of tuned radio frequency, one stage of untuned radio frequency, a detector, and two stages of audio frequency. The Aero coils were used in the detector and tuned radio frequency stages and an Acme r.f. transformer (23) was used in the untuned stage, this being shown in the schematic diagram, Fig. 3. To add still further to the selectivity, shielding consisting of copper sheets was used between the coils.

A third specification was that of simplified control. This was attained by the use of the Alden three gang

used. A Jones Multi-plug (7) was used to further simplify the connection of the batteries to the set.

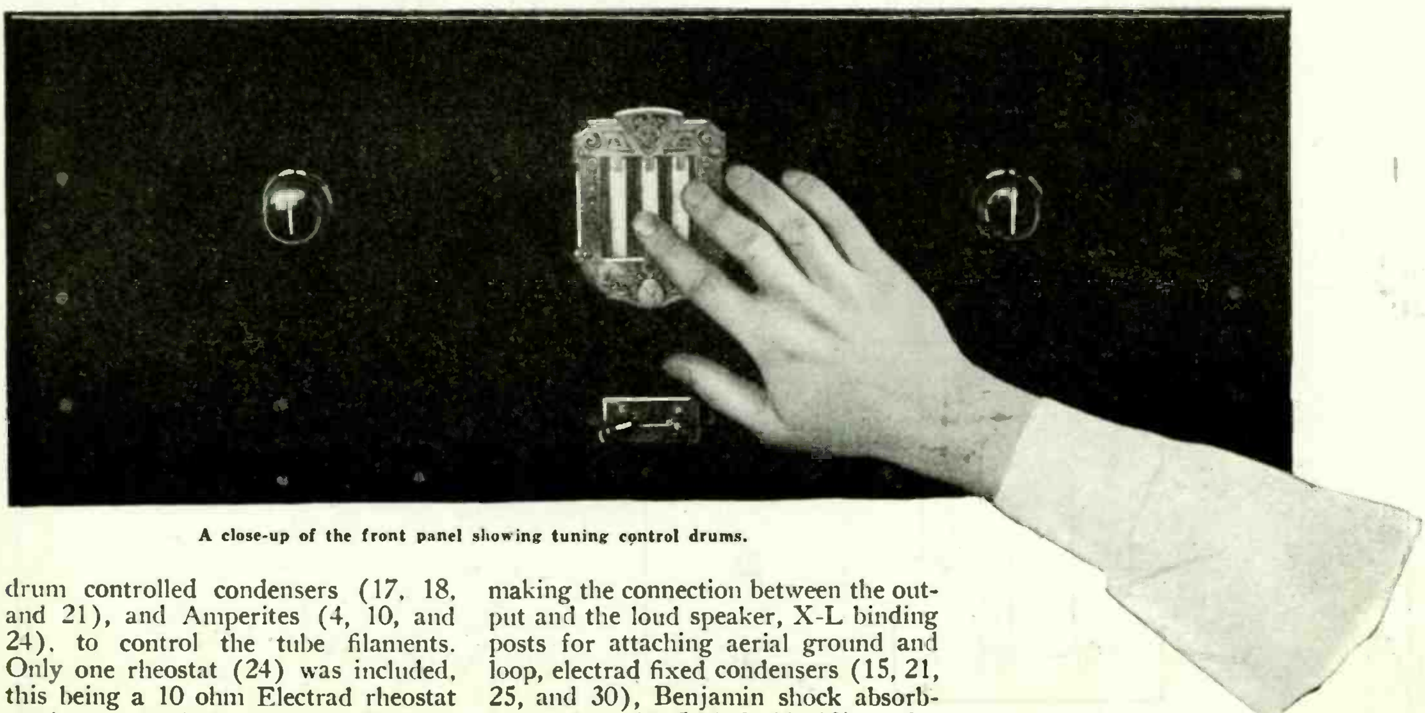
The fourth and final specification to be met was that of appearance. The panel was measured and cut so as to fit in a dining room buffet, as shown in the illustration at the beginning of this article. When the set is not in use, the doors of the buffet are closed concealing the set. After a station has been tuned in, the doors can again be closed, so that the set, although its front panel presents an appearance of unobtrusiveness and quiet simplicity, still may be entirely out of view if desired.

Other parts selected for use with this set included a Bruno filament switch (8), Yaxley phone tip jacks (1) for

A CeCo tubes. The energy supply consisted of a Balkite "BX" eliminator for supplying the various "B" voltages, a 45-volt "C" battery and a storage "A" battery hooked up with a Balkite trickle charger. The trickle charger was switched off when set was in use. The operation of "B" eliminator was noiseless and entirely satisfactory.

Construction

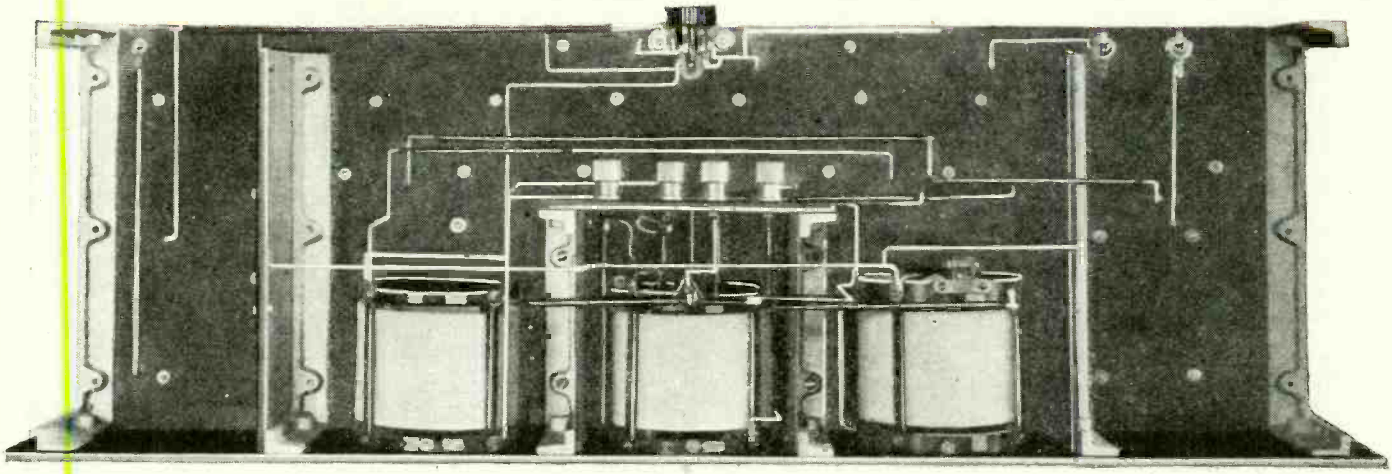
The first step in the construction is to fit the brackets to the panel and sub-base. While aluminum brackets have been used as shown, any good strong bracket may be used instead. The next step is to cut the holes in the panel for the Alden unit (17, 18, and 20) using the metal plate furnished as



A close-up of the front panel showing tuning control drums.

drum controlled condensers (17, 18, and 21), and Amperites (4, 10, and 24), to control the tube filaments. Only one rheostat (24) was included, this being a 10 ohm Electrad rheostat used to control the detector filament.

making the connection between the output and the loud speaker, X-L binding posts for attaching aerial ground and loop, electrad fixed condensers (15, 21, 25, and 30), Benjamin shock absorbing sockets (3, 5, 6, 9, 11, 13), and a a template, scribing this inside. The other center holes are cut next including the centers for potentiometer (16), rheostat (23) and the Anti-Capacity



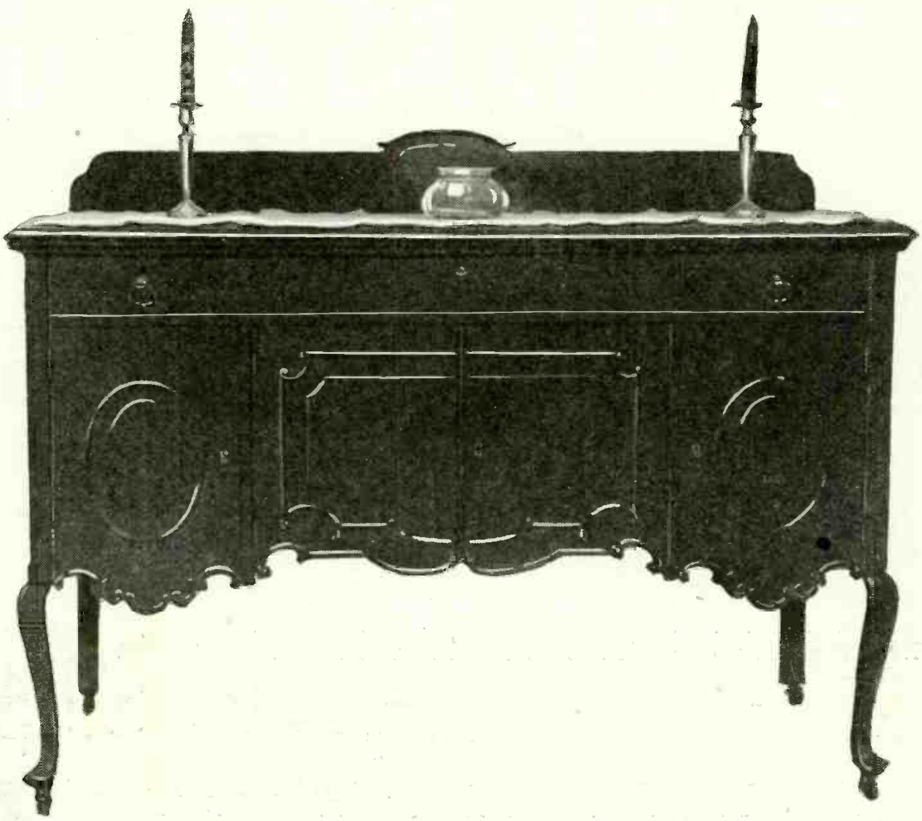
Bottom view of R. L. G. Standard Six. Shielding can be seen between the coils.

switch (17). The various parts are then mounted on top of the sub-base. The shielding coils should then be put on the bottom. The sheet copper is reinforced with Bakelite. Finally, the Aero coils (27, 28 and 29) are mounted on the bottom of the sub-panel.

The wiring should be started before the panel is attached to the sub-panel. The filament circuits are wired first, then the plate and grid circuits, doing as much of the wiring as possible before attaching the panel and the shields.

The parts going on the panel are now mounted and the panel is attached and the wiring completed.

Be sure to carefully check and recheck the wiring throughout before making any tests with the current on. The first test is for the purpose of determining that there is no short-circuit between the filament and the high potential lines. Place a tube in one of



When the doors of the buffet are closed the set is no longer visible.

the sockets and connect one side of the "A" battery to each of the plus "B" terminals. Have the filament switch turned on and connect the other side of the "A" battery to each of the plus "B" connections, one at a time. If the tube lights up, this shows that there is a short between the "A" and the "B" circuits. This fault should be located immediately before going any further. Next connect the A battery to the A minus and B minus terminals of the Multi-plug (7) connector and the tube should light up. Now connect all other connections and place all other tubes in their sockets.

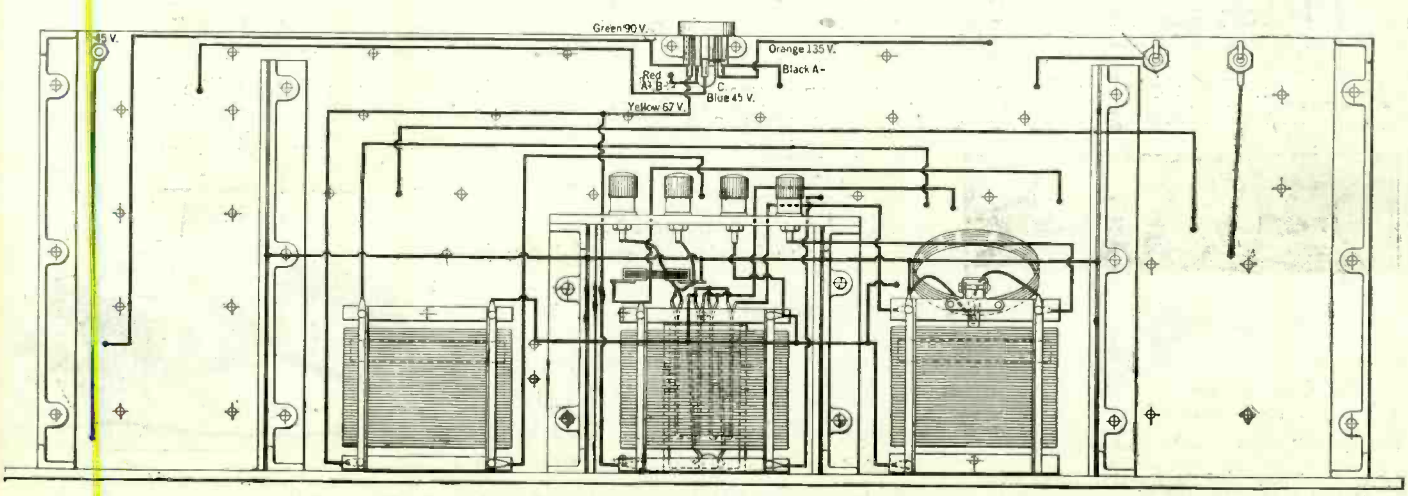


Fig. 2. Bottom view of set showing location of center holes in sub-base.

Operating the Set

A home constructed Engineers' Service 3 ft. loud speaker was used. It was found that the impedance of this speaker closely matched that of the set. When the set was first connected up and tuned in, the voice of an announcer was the first thing to be heard. The reproduction of the voice was so natural, that the writer received a shock, although he has been listening to radio sets for the last five years. The next station to be tuned in was broadcasting the performance of a jazz band. The tone quality was little short of perfection. Everything came through with remarkable fidelity from the moan of the saxophone to the boom of the kettle drums. The sound range seemed to include at least an octave more on the lower range than that of the ordinary set. With regard to selectivity, the set was equally as efficient, in fact many might find this extreme selectivity objectionable since even powerful nearby stations could be tuned out on a hairs-breadth turn of the tuning controls. The set had one objectionable feature which was a tendency to go into oscillation on the lower wavelengths. The 400 ohm potentiometer (16) controlled this however, and the writer expects to experiment further along these lines using resistances in the grid leads.

It should be kept in mind that this set is not recommended for the first-time set builder, but rather for the experienced radio fan who will be able to get the most out of the fine tuning required.

PARTS FOR R. L. G. STANDARD SIX

2 Yaxley Phone Tip Jacks; 1
1 Jacobs 30 Henry Molliformer; 2
1 Benjamin Socket; 3
1 Amperite, ¾ amp.; 4
1 Benjamin Socket; 5
1 Benjamin Socket; 6
1 Jones Multiplug; 7
1 Bruno Pilot Light Filament Switch; 8
1 Benjamin Detector Socket; 9
1 Amperite, ¼ amp.; 10
1 Benjamin Socket; 11
1 Amperite, ¼ amp.; 12
1 Benjamin Socket; 13
1 Rauland Lyric Audio Transformer; 14
1 Tobe Fixed Condenser, 4 mfd.; 15
1 Carter 400 Ohm Potentiometer; 16
1 Alden Condenser, .00035 mfd.; 17
1 Alden localized control Condenser, .00035 mfd.; 18
1 Federal Anti-Capacity Switch; 19
1 Alden Condenser .00035 mfd.; 20
1 Electrad Grid Condenser, .00025 mfd., and 1 Electrad Grid Leak 3 meg.; 21
1 Acme R. F. Transformer; 22
1 Electrad Detector Filament Rheostat, 10 ohm; 23
1 Electrad .0001 mfd. By-pass Condenser; 24
1 Electrad, .002 mfd. Fixed Condenser; 25
1 Rauland Lyric Audio Transformer; 26
1 Aero R. F. Coil; 27
1 Aero R. F. Coil; 28
1 Aero Coil Antenna Coupler; 29

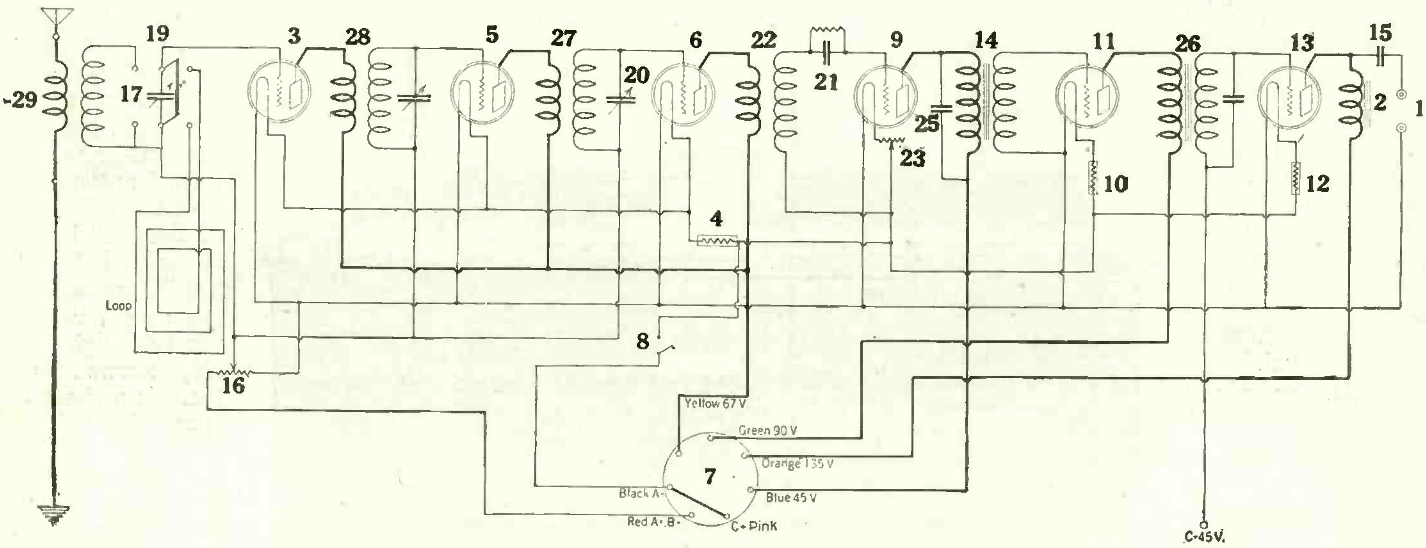


Fig. 3. Schematic wiring diagram of Radio Listeners' Guide Standard Six.

Testing for Broken Phone Cords

Grasping a phone cord as shown in Fig. 1 when withdrawing it from the plug often causes scoring of the delicate wire with consequent breakage. The resulting open circuit is often hard to locate.

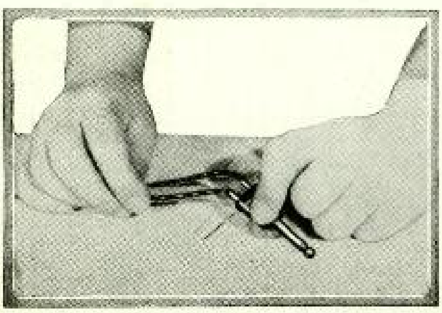


Fig. 1. Phone and loudspeaker cords often become broken through careless handling.

Fig. 2 shows a method of testing the cord for the break. A small lamp is placed in series with the head-set or loud speaker and with a small dry cell. Flickering of the light will occur when the phone cord terminal is moved around, in case the wire strands are broken. This method of locating a trouble of this nature is positive and rapid. Very often defective phone cords are responsible for clicks and other noises for which the radio receiving set is unjustly blamed.

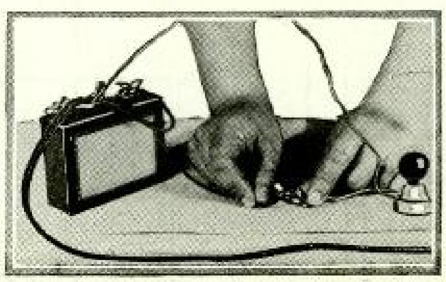


Fig. 2. A method of testing phone cord for a hidden break or "open."

A New Standardized Browning-Drake

Author Describes Standardization of This Popular Receiver with Changes in Design

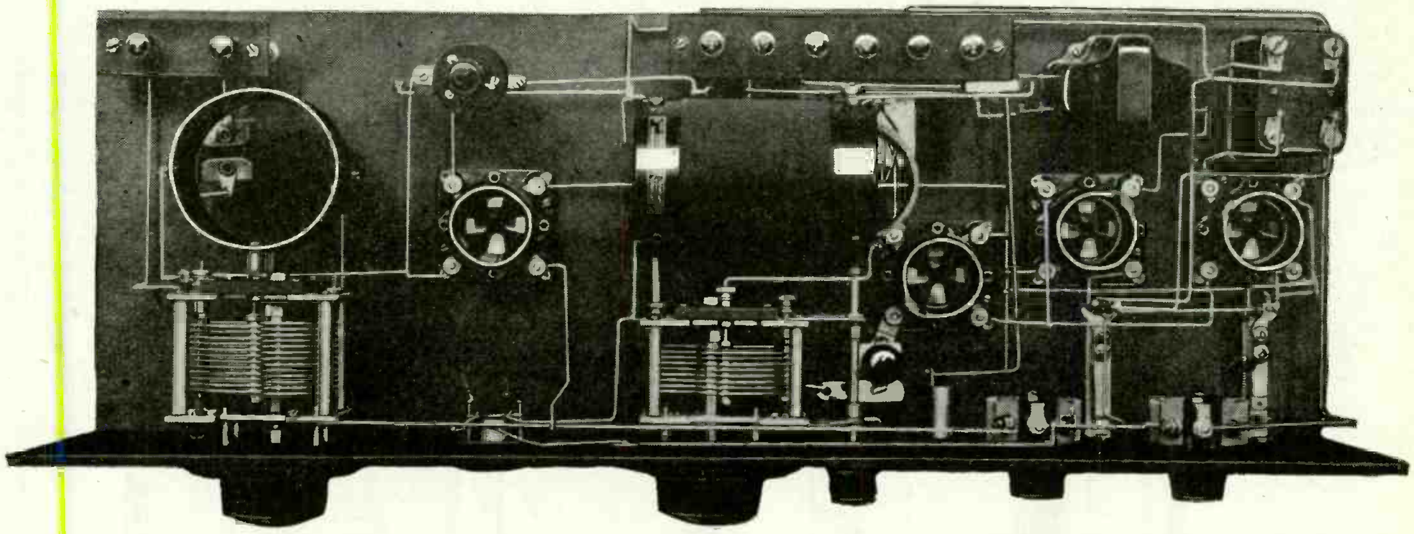
By GLENN H. BROWNING

SINCE June, 1924, when the Browning-Drake slot wound radio frequency transformer was first introduced by Volney D. Hurd, Radio Editor of the *Christian Science Monitor*, many developments have progressed, built up around the research instituted by F. H. Drake and the writer at Harvard University. The popularity which has attended Browning-Drake has, of course, been very gratifying, and we have a deep appreciation for the good will of the 150,000 fans who use sets built up around this research. Both Dr. Drake and the writer also feel a keen personal obligation to see to it so far as we can that accurate information shall have been given out, so that the construction work of the fans will be to the best advantage.

When the set was originally written up in the radio publications, a four tube outfit was recommended, involving a circuit consisting of one stage of tuned radio frequency, followed by tickler feed-back detector, and two stages of transformer-coupled audio. Soundness of electrical design, rather than symmetrical mechanical assembly, was the major interest. The efficiency of the newly designed radio frequency transformer was fully realized when used in this assembly and the results proved quite a surprise to the designers, although a very pleasant one. The audio transformers, on which the tone quality largely depended, were believed to be the best on the market in those days.

Since 1924 many changes have taken place. Improved apparatus, now standard on the market, has replaced that formerly offered. Details of mechanical assembly and design have been greatly improved all through the radio industry. As all fans know, no fundamental changes have been brought about in circuit design or in mathematical principles. Progress has rather been along the lines of increased efficiency in the component parts which go toward making up the complete set.

Tone quality very near to perfection is now available through the use



Illustrations by courtesy of Browning-Drake Corp.

Fig. 1. The original four-tube Browning-Drake, designed in 1924. Transformer-coupled amplification was used in this assembly.

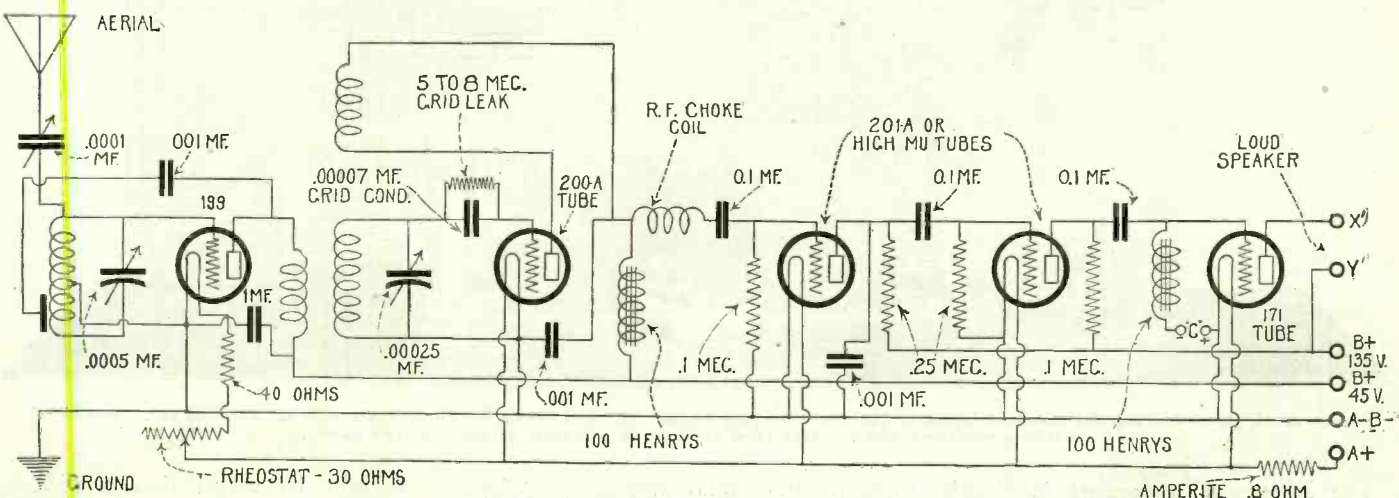


Fig. 2. A schematic wiring diagram of the new standardized Browning-Drake set as shown in the assembly Fig. 3.

of resistance and impedance coupled audio amplification. Semi-power tubes, high grade cone type loud speakers, and more sensitive detector tubes have made it possible to receive results far in advance of those of former days.

This article is an attempt to indicate a Browning-Drake assembly involving standard apparatus, and making use of the research of the past two years. Within the past six months or more, many articles on this set have appeared under the names of various writers. The assemblies set forth in some cases have been excellent but unfortunately some have not. Designs have been set forth which do not represent sound electrical principles. Confusion has arisen in the minds of the fans as to which Browning-Drake should be considered standard. A new assembly has therefore been designed, which Dr. Drake and the writer believe will prove satisfactory as well as being easy to construct.

The new form of coils designed some months ago make use of space winding for the antenna and the secondary of the regenaformer (radio frequency transformer). This form of winding was adopted after considerable research showed mathematically that both the sensitivity and selectivity of the circuit would be improved in their use.

believed to be most advantageous in the position of certain important parts of the wiring.

The most important feature to be observed in the circuit diagram is the

PARTS FOR STANDARDIZED BROWNING-DRAKE

1 Browning-Drake kit (Browning-Drake Corporation) or 1 set National-B-D tuning units.
1 front panel 7 x 21 x 1/8
1 base panel 12 x 18 x 1/8
(Distributed by the Browning-Drake Corporation as part of a foundation unit.)
2 National impedaformers (1 first stage, 1 second or third stage)
3 Resistances (two 1/4 Meg., one 8. Meg.) (Electrad or Tobe)
1 Precise Midget .0001 variable condenser
8 Eby binding posts
2 Yaxley pup jacks
1 Yaxley fil. switch
1 Yaxley 30 ohm rheostat
1 40 ohm B-D resistance cartridge
1 0.1 Mf. Tobe by-pass condenser
3 .001 Mf. fixed condensers (Electrad)
1 .00007 Mf. grid condenser (Electrad)
1 B-D balancing or neutralizing device
1 Amperite (Type will depend on tubes used in detector and audio stages.)
1 1Mf. Tobe condenser (optional)
1 National tone filter (optional)

ception. The combination shown herein, consisting of one impedance, one resistance and with one impedance leak in the last stage, is believed to avoid this difficulty. The use of a radio frequency choke (incorporated in the National Company first stage impedaformer) as well as the extra .001 fixed condenser after the first audio tube, also assists in correcting the difficulty,

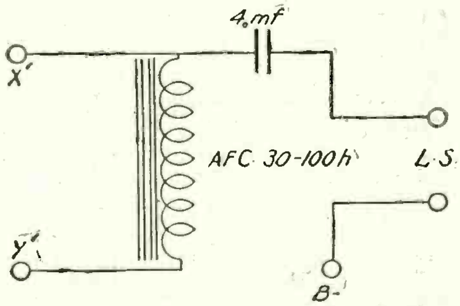


Fig. 4. The output filter circuit.

by preventing radio frequency currents getting into the audio amplifier. An output filter system, (circuit as shown in Fig. 4) is pictured in the layout of the set. This is optional, but assists the operation of the loud speaker when considerable volume is being received. A high grade cone speaker, such as the Farrand or Western Electric, is recommended.

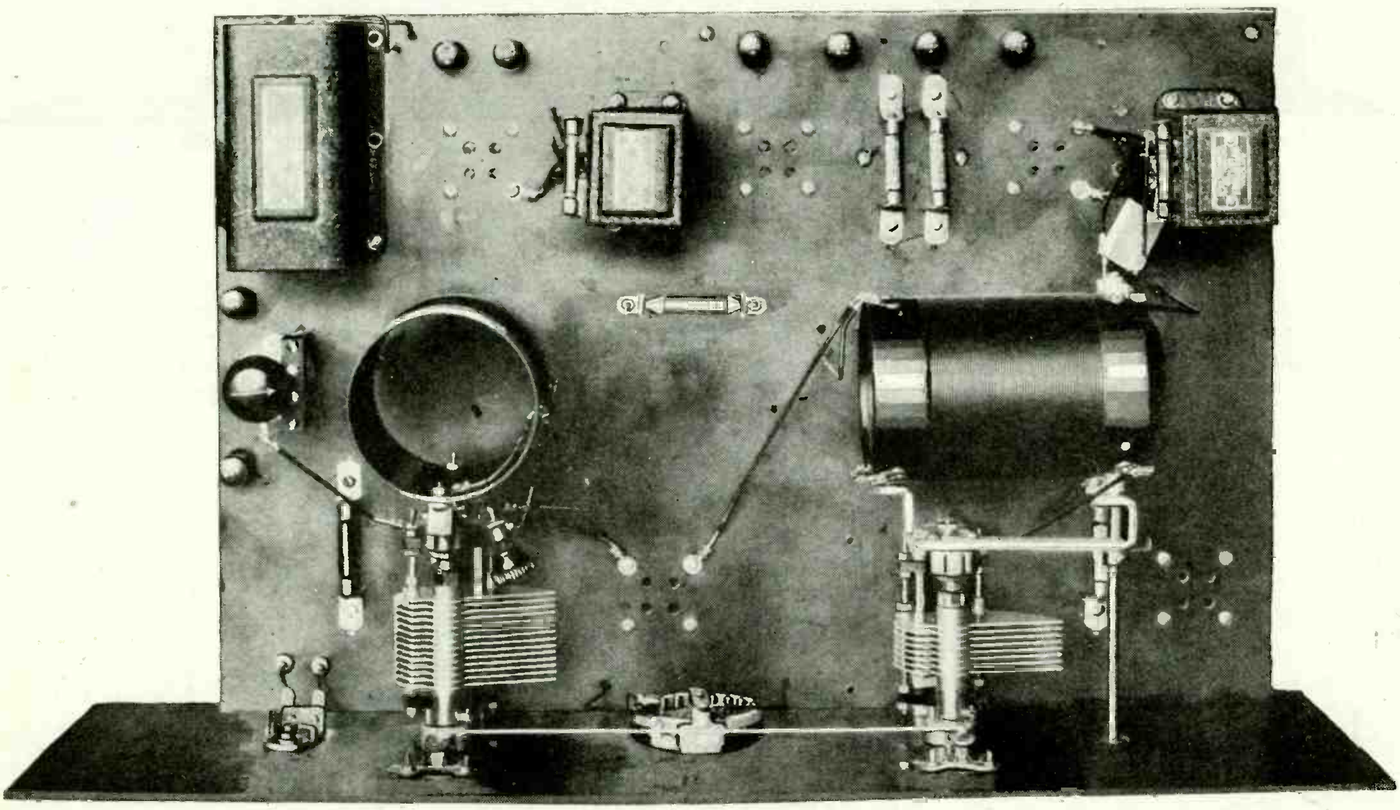


Fig. 3. A photo showing the sub-panel layout of the new Browning-Drake. The well known Browning-Drake coils are mounted on the new type National condenser which is very rigid and acts as a support between the two panels.

The necessary apparatus is listed herewith. Substitution may be made in some cases but best results will very likely be obtained by using the apparatus suggested. A base panel assembly is shown, Fig. 2, which may be varied in minor details but which is form of the audio amplifier. Much difficulty has hitherto been experienced in using "B" eliminators with resistance or impedance coupled amplifiers. A continuous chirping or chugging sound, sometimes referred to as "motor-boating", has impaired distant re-

It will be noted that a different method of balancing than employed in the original Browning-Drake, is pictured. If it be preferred to balance according to the original system, this may be done by means of the tap provided on the regenaformer coil. Any one of several systems may be used satisfactorily.

Lamp Socket Operation

This outfit, as well as many others, may be operated from the 110 volts A.C. line by the use of the following accessories:

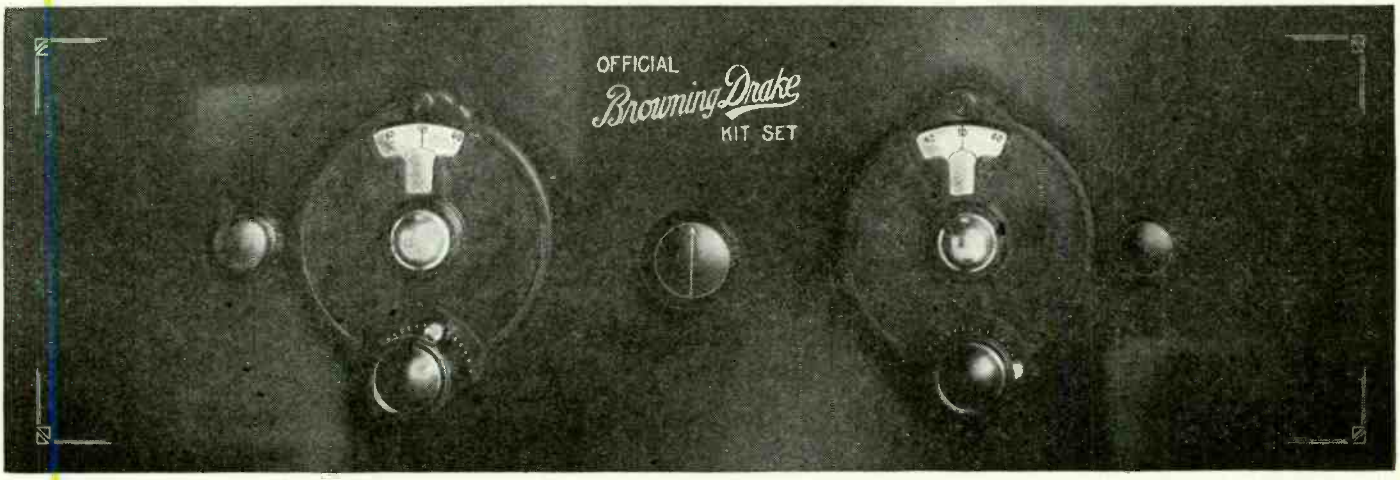


Fig. 5. A front panel view of the new Browning-Drake set.

1 "B" eliminator, National or Farrand.
1 "A" battery with trickle charger (Tungar suggested).
1 automatic relay switch (Yaxley recommended).

The connections for these devices are shown in diagrams furnished with the automatic switch and, if a high grade "B" eliminator is used, the results should be equal to those obtainable by the use of ordinary batteries; in fact, this assembly has been designed with this in mind.

Operation of Set

A few notes may be helpful to those not familiar with the older models on choice of tubes and the operation of the set. Tubes should be as follows:

Radio Frequency	199
Detector	200A
First and Second Audio	201A or High Mu
Third Audio	171, 112 or 201A

The tubes listed first in each case are recommended. Great care should be exercised in the selection of tubes, especially the 199 tube in the radio frequency socket.

It will be found that the new type CX 300A or UX 200A detector tube will be more sensitive to weak signals especially. The only change necessary in any set for its use is to connect the grid return to the negative side of the filament. This has been done in the present circuit.

The 171 tube will be found superior to the 112 or 201A. The drain on the "B" supply is such, however, that the use of an eliminator is almost obligatory. The value of "C" battery, recommended by the tube manufacturer should, in every case, be used.

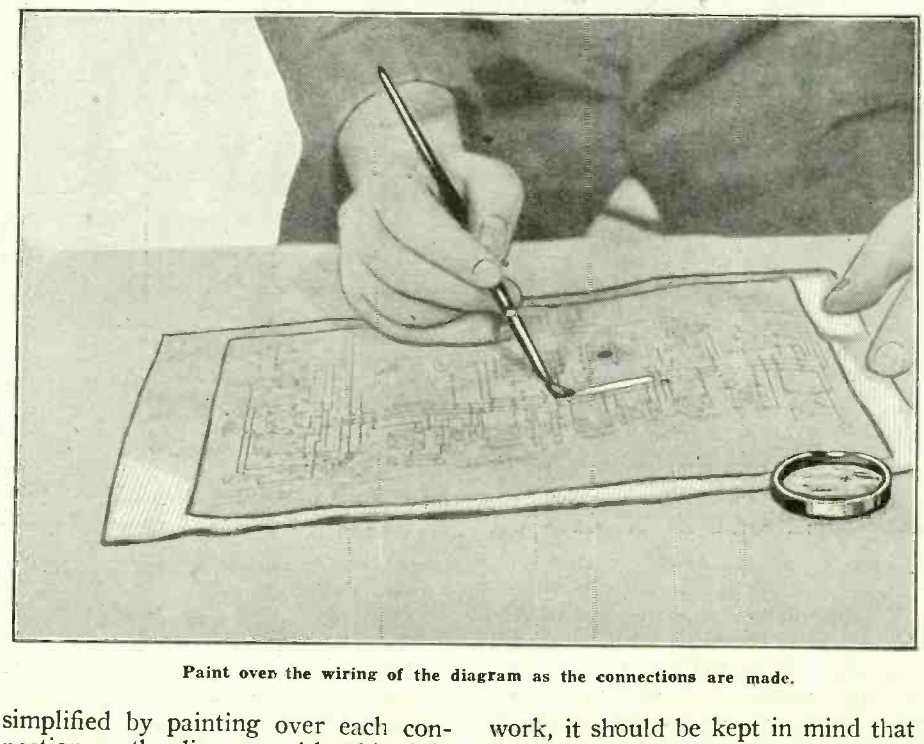
When placing the set in operation, two important points to observe are the oscillation of the detector circuit and the neutralization or balancing of the radio frequency tube. This latter may be done by the usual method of tuning in a strong local station and then turning off the filament of the radio frequency tube. The neutralizer should then be turned until no signal is heard.

When the rotary (tickler) coil is turned a distinct "plop" should be heard. One evening with the set is better than a whole book on its operation. It will be found by turning the tickler coil to a position of oscillation, that distant stations can be picked up by their beat-notes, and this is a distinct aid in tuning. Many fans in Boston are able to set for California stations consistently on a particular setting of the regenaformer condenser dial by this method.

In writing this article, the object has been to clear up some of the confusion arising from several Browning-Drake designs being prevalent, as well as to incorporate several minor changes.

Checking Set Wiring

When working from a picture wiring diagram, such as one of those appearing in the Radio Listeners' Guide and Call Book, the procedure may be simplified by painting over each connection on the diagram with white ink, as the actual wiring is put on the set. In this way the diagram becomes easier to follow as the work progresses. The method is shown clearly in the accompanying illustration. While it might seem that this would slow up the work, it should be kept in mind that a few extra minutes spent in building may mean the difference between success and disappointment.



Paint over the wiring of the diagram as the connections are made.

The Universal Transoceanic "New Phantom" Model

A Wonderfully Selective Nine-Tube Receiver

By CHARLES R. LEUTZ

THE original Universal Transoceanic is a nine-tube receiver having four stages of tuned radio frequency amplification, detector and four stages of audio frequency amplification. In order to secure maximum efficiency from the radio frequency stages, each stage was built in a separate metallic shielded case and had its own set of individual "B" and "C" batteries.

The result was a very efficient receiver, and considered one of the most powerful radio receivers ever built; but it was very large mechanically, being over 7 feet long, 20 inches deep and 10½ inches high (over 9 cubic feet).

To make the design smaller and less expensive was the design problem and the result is the New Phantom Universal Transoceanic.

This set is only 27⅞ inches long, 13 1/16 inches deep and 8 inches high, less than 2 cubic feet and the cost reduced. The electrical efficiency has only been reduced about 15 per cent, yet the space occupied and the cost has been reduced nearly 75 per cent.

The accompanying photos illustrate the front view of the receiver, the special high power "B" and "C" eliminator made to match the receiver, and on the opposite page is a schematic wiring diagram of the entire receiver with diagrams for making battery connections, etc.

The design is divided into six sections and they will be described successively.

The receiver has the following outstanding features, many of which are original in design by the writer, viz.:

1. Four stages of tuned radio frequency amplification.
2. 100% shielding between radio frequency stages.
3. Single, double or individual dial control.
4. Wavelength range of 35 meters to 3600 meters through the use of interchangeable tuned radio frequency transformers.
5. Entirely shielded variable condensers, shielding condenser field from transformer shield.
6. Power audio amplifier incorporated within receiver capable of taking up to 550 volts direct current.
7. Audio amplifier adaptable to any voltages and power tubes such as types 112, 171, and 210.
8. Twenty binding post terminals allowing separate plate voltage adjustments for the radio frequency amplifier, detector, audio frequency amplifier and power audio amplifier, also separate adjustable bias voltages for the radio frequency amplifier, audio frequency amplifier and power audio amplifier.
9. A high resistance three scale voltmeter and eight reading switch give all "A," "B," and "C" voltage readings including power amplifier "B" voltages up to 560 volts.

Antenna Tuning Circuit

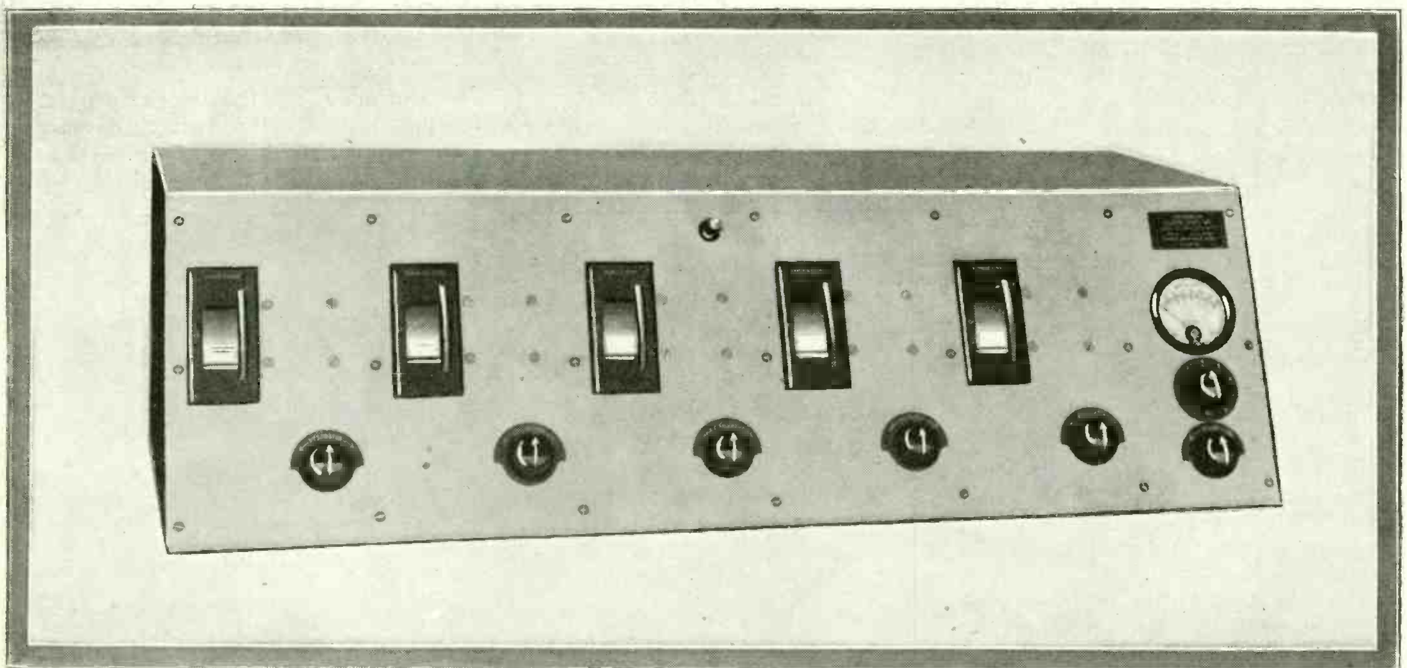
Provision is made to use either a loop or outdoor antenna. As the wavelength range is 35 to 3600 meters, this is quite important.

An antenna series condenser is provided and is used in series with a long antenna when receiving short wavelengths, otherwise it is short circuited by a shunting switch.

A 1 MF by-pass condenser is in series with the ground lead. This condenser readily allows the received signals to pass through to ground but prevents short circuiting the "B" voltages through the filaments in case antenna is grounded, or when connecting two different kinds of receivers to the same batteries.

To use a loop, the first radio frequency transformer is removed from its socket and the Loop Adapter is in-

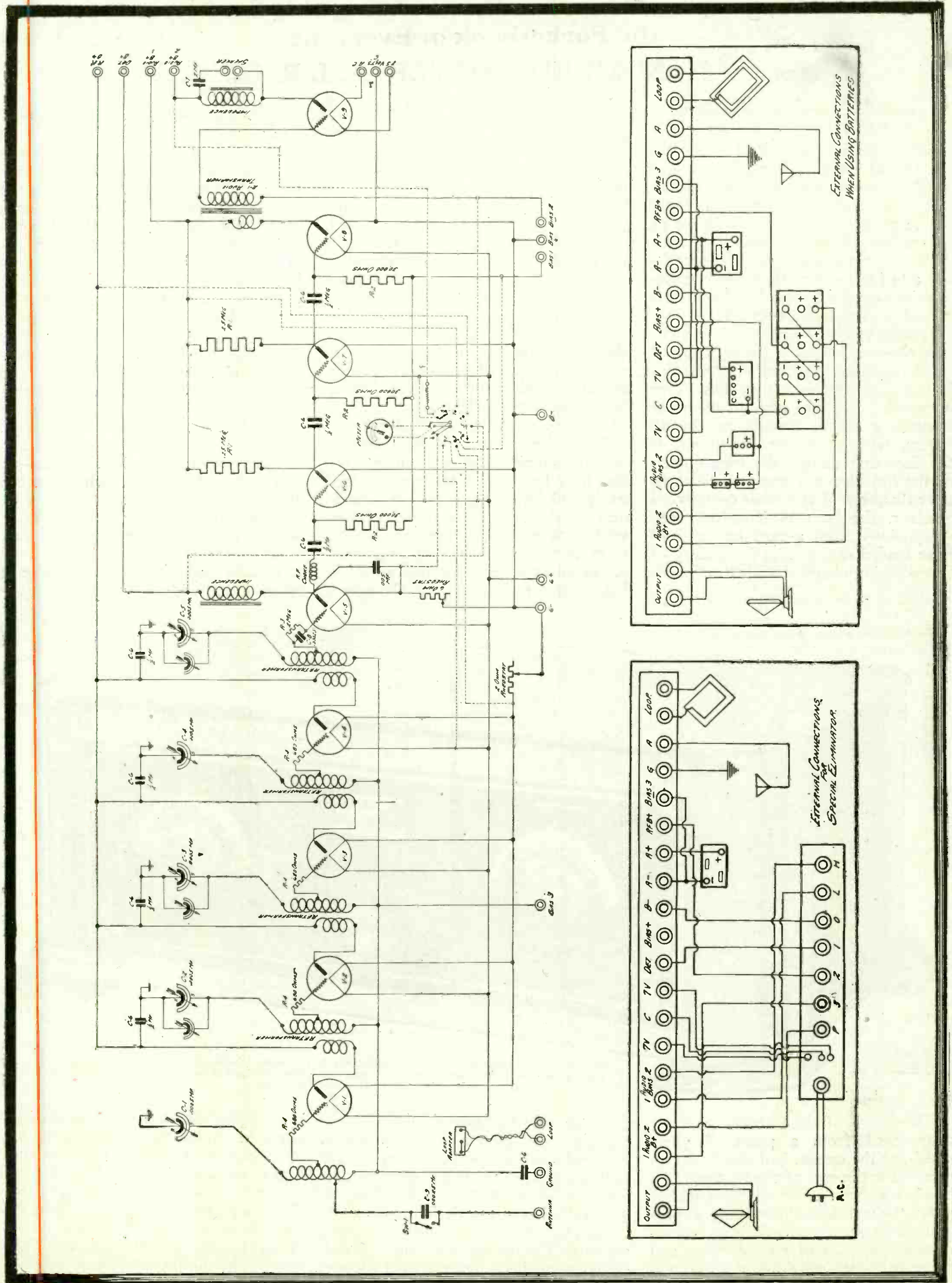
(*Continued on page* 156)



Illustrations by courtesy of Golden-Leutz, Inc.

Front view of the completed Universal Transoceanic "New Phantom" receiver.

Diagrams of Universal Transoceanic Receiver



Installment Building of the Shielded Six

Progressive Method of Constructing this Set Meets the Pocketbook of Everyone

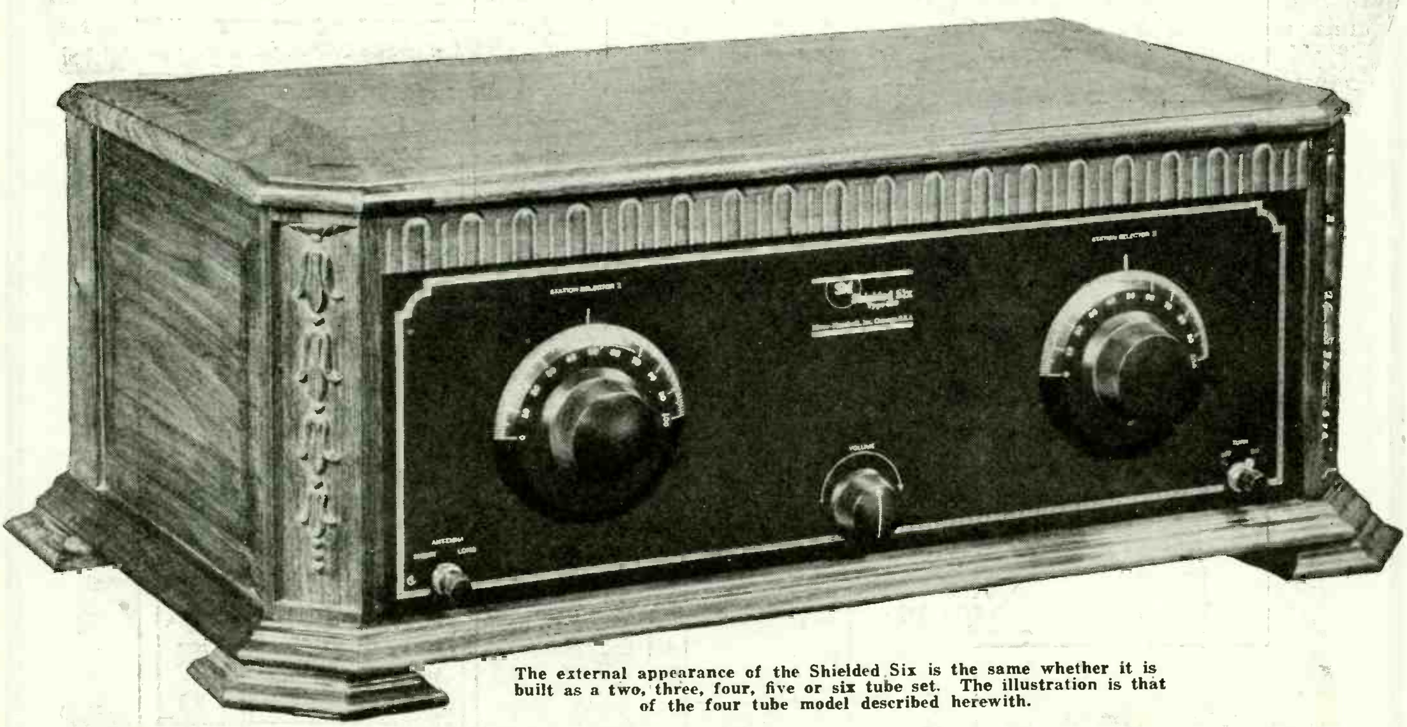
By McMURDO SILVER, A. I. R. E.

THE receiver described under the title of "How to Build the Shielded Six" in the last issue of Radio Listeners' Guide and Call Book has brought to the author a very large number of letters from interested fans. It is indeed gratifying to observe that practically all of the several thousand communications received from builders of the Shielded Six have commented very favorably upon the performance of the receiver—the letters of the majority of builders state unreservedly that the Six is the finest receiver they have ever operated. Possibly one of the most interesting points brought out by all letters, with very few exceptions, is the fact that though the tone quality of the Shielded Six was claimed to be finer than that of any other commercial receiver, the builders have not been disappointed, and almost one and all have lauded to the skies the quality of reproduction obtained with the Shielded Six.

The design of the Shielded Six was approached from a point of view, which, at the outset, had absolutely no regard for the cost of the receiver. In brief, cost was a secondary consideration, the principal object being to provide a receiver capable of producing remarkable quality of reproduction, and at the same time providing extreme sensitivity together with a satisfactory degree of selectivity. After the electrical design of the receiver had been completed and it was ascertained that the performance left little to be desired, consideration was given to the cost of the complete kit and it was reduced to the lowest figure commensurate with high quality of merchandise—and even though in the annals of complete kits the price is high—falling just below the $100.00 mark—the receiver which can be constructed from this kit represents a value, in complete factory built receivers, of from two to three times the cost of the Shielded Six.

The price of the complete kit has been the stumbling block for many fans that have heard their friends' Shielded Six's and have expressed a desire to own one themselves, but found it inconvenient to make the necessary investment in the Shielded Six and accessories all at once. For this reason it has seemed fitting that data be gotten together on what might be termed as "installment building" of the Shielded Six , whereby the receiver itself can be built progressively with an initial investment as low as $27.00; and yet, after the first initial purchase, may be put in operating condition and provide entertainment throughout the entire period of what might be termed its "adolescence". As an example, using the brass subpanel and steel chassis, a one tube set receiver can be built as a starter at the cost of about $27.00; whereas a second tube can be added by the additional expenditure of about $7.00. If preferred, a three tube set can be built at an initial cost of $41.00—or a four tube set for, roughly, $53.00.

This progressive method of assembly should be of extreme value to fans in general, for it means that the absolute novice just coming into the game and desiring to experiment can build economically a one-tube receiver and thereby test his own ability as a constructor. He may then easily add—as his pocketbook and inclination allow him to—up to the four tube stage, where he can stop, providing he is satisfied with local reception. This statement is made advisedly; for the Shielded Six built with four tubes will give more than satisfactory local reception and the cost is on a par with that of the average four or five tube sets not capable of expansion. What fan will question the advantage of this plan which enables him to start, say with four tubes— and if, then, he wishes, continue progressively building until he has the complete six tube receiver and is satisfied that he is the owner of one of the finest modern broadcast receivers?



The external appearance of the Shielded Six is the same whether it is built as a two, three, four, five or six tube set. The illustration is that of the four tube model described herewith.

Throughout the progressive building of the receiver, it is almost unnecessary to repeat any work if it is done carefully, and it is absolutely unnecessary to buy a single item which is not used in the finished outfit. Thus, no waste purchases are made, and, instead of the builder starting with a three or four tube set which he would later discard in favor of the Shielded Six, with consequent loss, he will start his first receiver upon the Six chassis, confident that his investment will not decrease, but, on the contrary, will increase in value with each addition.

This plan is certainly the most practical, for it is far more satisfactory than the construction of, let's say, a three-tube set followed by the almost certain addition of stage after stage of external radio or audio frequency amplification. Needless to say, such an assembled outfit would, aside from probably being inefficient, present a decidedly undesirable appearance and would have practically no resale value, for it would be, in automobile parlance, an "orphan."

The photographs and drawings herewith show the four tube stage of the Shielded Six, which is probably the most satisfactory step, for the material cost is in the neighborhood of $53.00 and the four tube assembly is capable of giving more than ample volume on local reception, adequate selectivity, and, in rural locations, possesses decided distance-getting proclivities.

In addition to the parts listed below, hook-up wire, machine screws, nuts and lugs will be necessary.

If this list be compared with that in the previous issue of Radio Listeners' Guide, it will be noticed that, among other things, the shields, radio frequency choke coil, 1. mf. bypass condensers, output transformer, antenna switch, stabilizing resistances, and certain other items have been left out—reducing the price of the finished receiver by over $40.00.

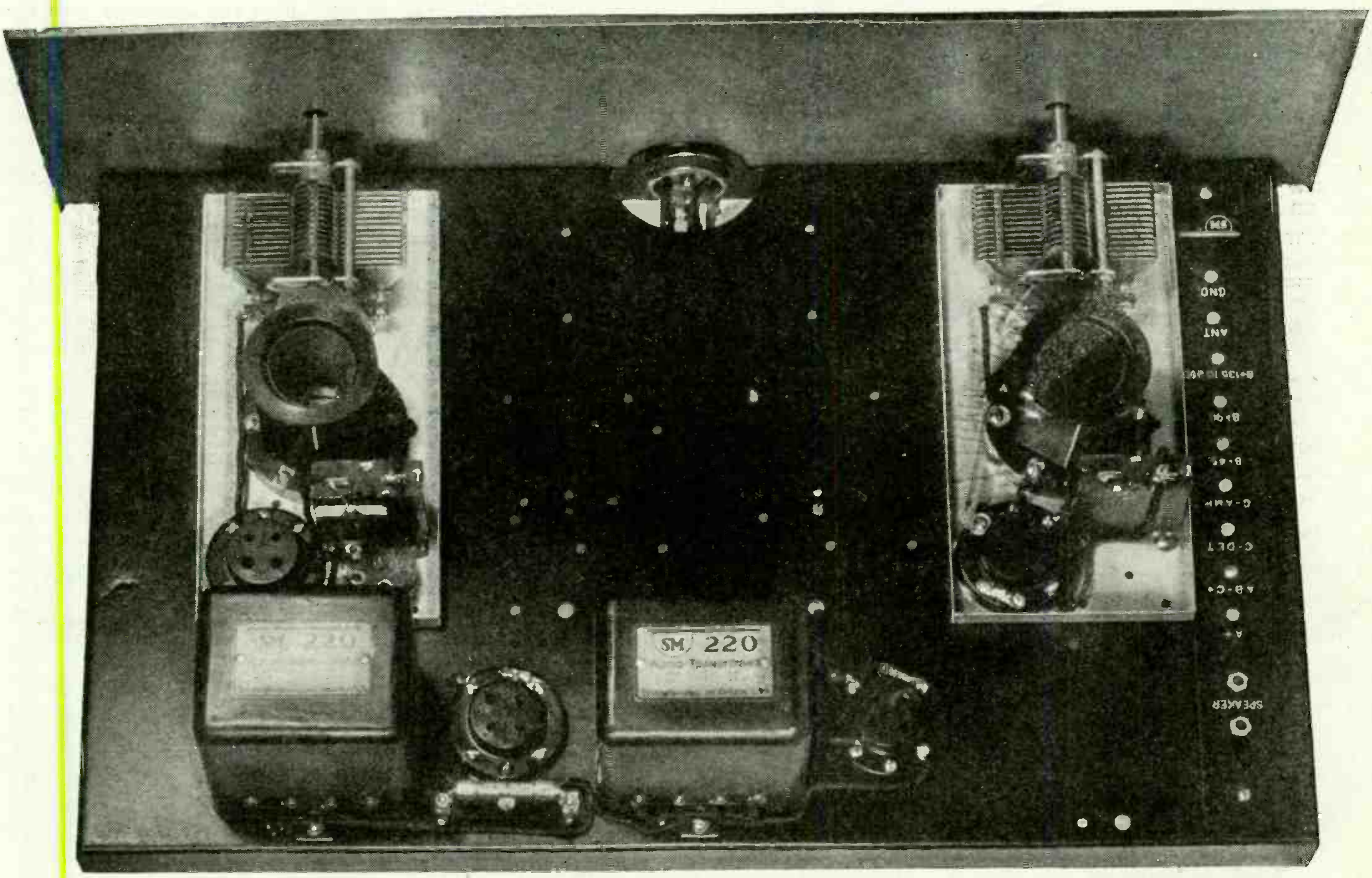
PARTS REQUIRED FOR FOUR TUBE ASSEMBLY

2—S-M 316B condensers
2—S-M 515 coil sockets
1—S-M 115A coil
1—S-M 116A coil
4—S-M 511 sockets
2—S-M 220 transformers
1—Polymet .002 mfd. condenser
2—Carter tip jacks
1—Carter 25,000 ohm Hi-pot
1—Carter ½ ohm resistor
2—Kurz-Kash 0-100 4" dials
1—Terminal strip with terminals
1—Crowe metal panel—pierced
1—Formed steel chassis—pierced
1—Yaxley No. 10 battery switch

The actual photograph of the four tube assembly shows the Polymet ¼ meg. lug and mount in place; whereas these are not actually necessary in the four tube assembly. This same condition applies to the 200 ohm stabilizing resistances, the 1. mf. bypass condensers, the type 275 choke coil, and the stage shields visible in the photograph. These items were pictured simply to show how the assembly would appear toward the final stage, but they need not be incorporated in building the four tube receiver as they will only all be necessary in the six tube assembly. Thus, in the diagram of the four tube assembly, the Polymet grid leak is shown across the secondary of the audio transformer; whereas it may be omitted in the four tube assembly with safety. Likewise, the type 275 choke, the antenna switch, and the three 1. mfd. condensers may be dropped with safety.

There is little point in giving herewith details of the assembly of the four tube receiver, for the previous article in this publication, or the instruction booklet on the type 630 kit, will give full data upon the various assembly steps. Suffice it to say, if the various steps are carried out as explained in the article referred to, and the wiring arranged as suggested, that very few connections will be made that need be done over as the assembly progresses. This is not altogether true if the shields are left off, for it will then be necessary to remount the stage assemblies to get the shields under them when the sixth tube is finally being added.

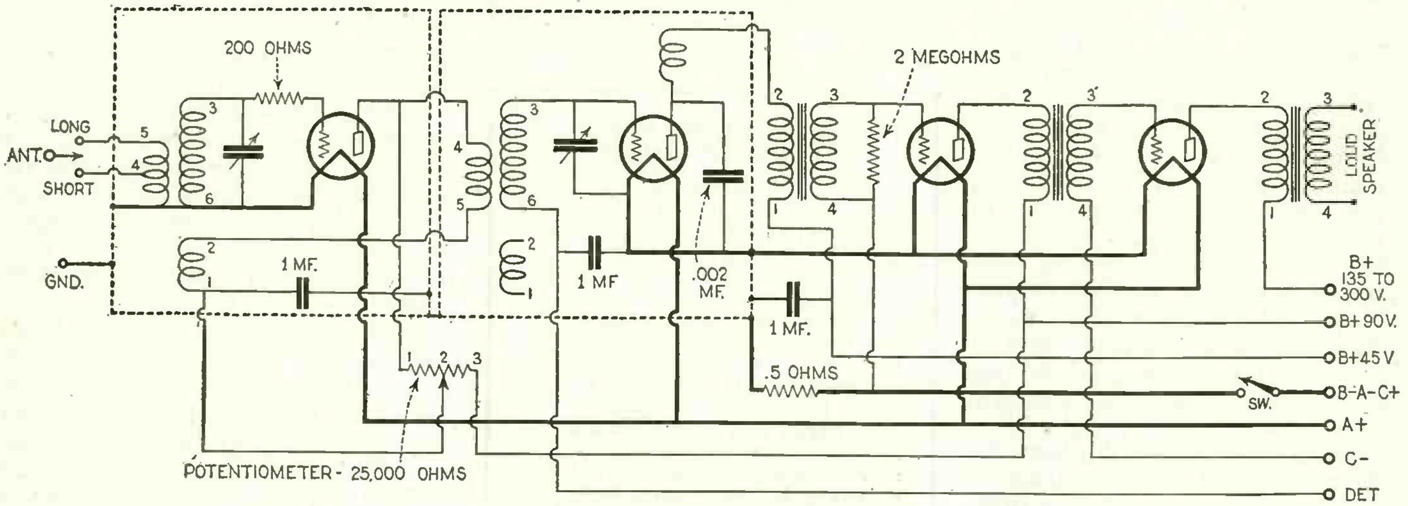
If the builder wishes to go a little further and assemble the five tube receiver, an additional RF stage would



The Silver Shielded Six at the four tube stage. The two middle (second and third) r.f. stages have been left out. This four tube outfit costing about $53.00 will give excellent local reception with marvelous tone quality.

simply be included in the diagram herewith between the stage compartments "A" and "D." Thus, in the original 6 tube diagram this additional stage would represent unit "C." When the until the addition of the sixth tube later.

The whole receiver can be built to the final stage without the output transformer—for the purpose of the output audio stage, which would afford ample volume on local stations and quite fair volume on out-of-town stations; for it has been the experience of thousands of builders that the volume of the Shielded



Schematic wiring diagram showing the installment building of the Shielded Six receiver.

sixth tube was to be added it would be in the form of unit marked "B." These additions should be quite clear, for the circuit of each one of the units is essentially similar—and very similar to that of the "A" or "D" units on the diagram herewith.

In the five tube assembly it would be preferable to use at least two stage shields, say on "C" and "D" units; while the "A" unit can be left unshielded. The link motion used to link "C" and "D" condensers would simply have an idle hole for the "B" condenser which would hang loose in the assembly transformer is simply to prevent loud speaker damage if a UX 171 or other large tube is used, and, at the same time, to compensate for the deficiencies in loud speaker low note reproduction. Thus, if the output transformer were left out, the performance of the receiver from a quality standpoint would not be quite as good as with the transformer; but it would be decidedly superior to that of the average tuned RF outfit.

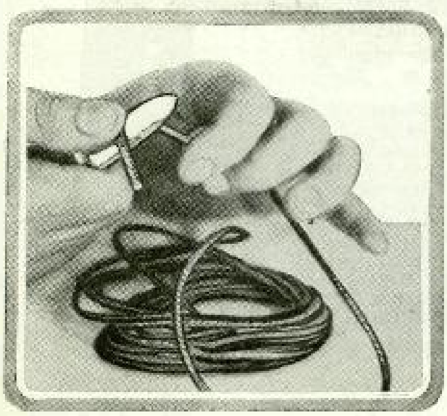
Another possible alteration would be the construction of the receiver as a five tube set leaving out the second Six is in many cases in excess of that required for satisfactory reception.

There is one change that cannot be satisfactorily made in the operation of the receiver, and that is the use of dry cell tubes. The UX201A tube must be used in the RF stage; although a UX-112 will make a most excellent detector.

Should any points come to the minds of prospective builders in connection with the "installment building" of the Shielded Six, or matters pertaining to its operation, it is to be hoped that there will be no hesitancy in calling upon the writer, for he is ready and willing at all times to assist fans in every way possible.

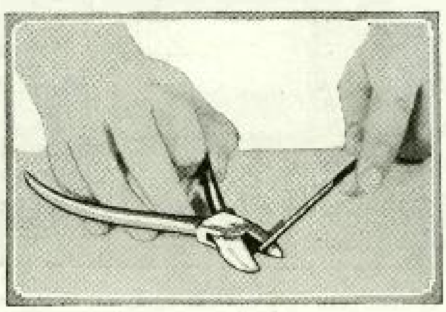
Stripping Insulation from Wire

Many radio workers have formed the bad habit of using a sharp knife to strip off the insulation from wire.



A sharp knife often cuts wire as well as insulation.

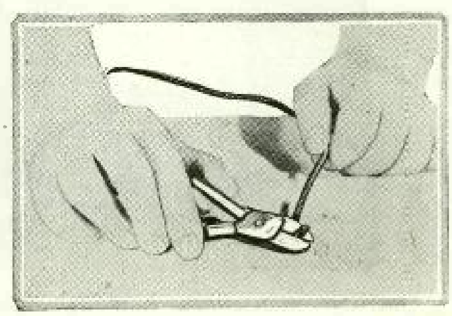
While this seems to accomplish the desired results more rapidly than any other way, it is a dangerous practice since the sharp blade of the knife almost invariably cuts, not only the insulation, but also the fine strands of the wire. In the case of a solid wire, the knife very often nicks this, weakening



A rat-tail file is used to notch the pliers.

it and usually results in a break at a most inopportune time.

Good practice calls for the use of a pair of pliers for scoring the insulation which can then be removed with a blunt edge. One of the accompanying illustrations shows clearly what happens when a knife is used to strip insulation. The tension which must be placed on



The wire is placed in the notch and the insulation is quickly removed.

the wire is bound to result in damage to the copper. The other illustrations show the correct use of notched pliers for removing insulation.

How to Make an "A" Battery Supply Unit

A Compact and Useful Device for Sets Employing Dry-Cell Tubes

By HERBERT E. HAYDEN

THERE is no getting away from it, what we really like in our radio these days is QUALITY. Of course most of us know that the new power tubes will give this much, but whether the tubes are 4 or 6 volts, the consumption of power is a considerably greater drain on the "A" battery, since one UX 120 type power tube consumes twice as much as the UX 199 type.

This comparison is made with special reference to tubes of one particular make, while others draw more in order to give the same result, with the same "B" battery voltage.

This brings up a very important question and that is of proper "A" battery supply. Of course it is a simple matter to use a standard 6 volt storage battery, charging it at intervals, or suffer the annoyance of having the battery service man in the neighborhood come in and remove it from the house, with the always frightful danger of leaving a few drops of acid where it is least wanted—on the parlor rug. The writer is aware of the many excellent types of "A" power units on the market, some very good, and others—well, its a matter of opinion, more or less. The popularity of the console set makes it necessary to secure units that will fit in nicely with the other apparatus as regards dimensional requirements, since the standard product, due to space limitations, will not fit in well in many instances.

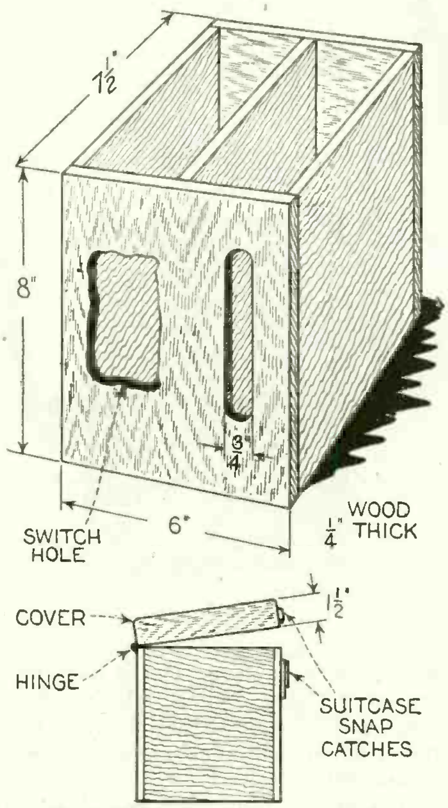


Fig. 4 gives details of box construction.

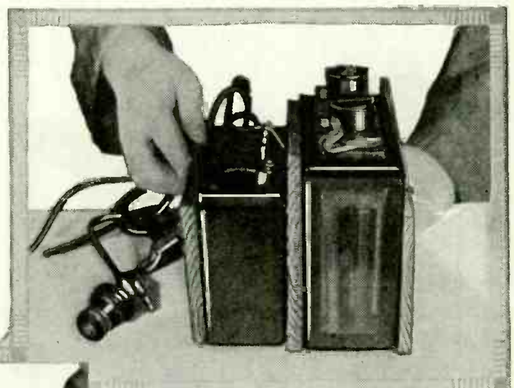
The purpose of this article is to show how a small storage battery, together with a bulb type trickle charger can be housed together in one neat unit, so small that it should fit in small space, or the arrangement of the parts can be changed to meet certain conditions if necessary.

Figure 1 gives us an idea how to start things. The 1/4 inch boards may be placed as close as shown, making a rather snug fit, but the center separator is not wood, but a piece of 1/4 inch asbestos sheet, used to cut off the slight amount of heat developed by the charger. Actually, the dimensions of the box are as follows: Length, 7 1/2 inches; Width, 6 inches; Height, 8 inches. See sketch for cabinet dimensions. It is perhaps easiest to make up this box completely, nailing down all sides, etc., so as to make a cube, then saw off, or rather saw right through this completed box, the cover, as shown in Figure 5, making this cover about 1 1/2 inches high. The cover is made fast to the main box by two small hinges, and kept closed by two suit case snap catches, on the opposite side.

After the work has progressed thus far, it is a good idea to paint the box, inside and out, with an acid proof paint, although if properly handled, this unit will probably never throw off any acid or spray of any kind. Also place four rubber feet on the bottom of the box, as shown in Figure 6.

Now the best way to determine the condition of any storage battery, is to use a hydrometer, which is the syringe-like instrument that sucks up a little of the battery acid, and with its enclosed float, resembling in appearance the conventional thermometer, gives us a specific gravity reading on a printed scale enclosed in this float.

Fig. 1, at the right, shows how to start the construction of the "A" supply unit. Fig. 2, in center, shows slots cut in box, to show specific gravity. Fig. 3, at left, shows completed unit.



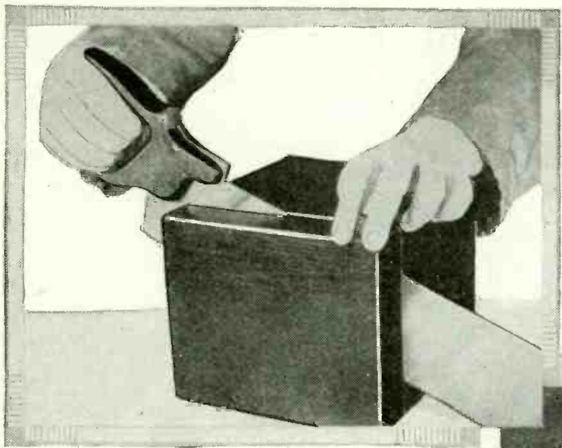
This condition can also be arrived at by placing little wax balls in the solution of a certain predetermined weight, and when the specific gravity of the electrolyte solution falls below the wanted value, the little wax balls will fall also, that is instead of floating on the surface, as they do normally, they will drop down in the battery solution.

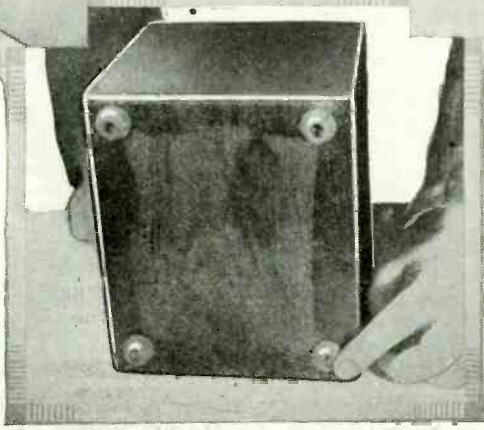
This is the manner in which the reading is taken with the little battery referred to in this article. The builder will notice that the jar of the particular battery used in this unit is made of special hard glass, which is of course transparent, and in one end of the jar, two of the little wax balls described, will be found, one colored red, the other white. These little pellets remain in the solution, and when your battery is up to full charge, both balls will remain floating on the surface of the electrolyte, and when the charge has dropped 25%, the white ball will drop, and when 75% discharged, the red ball, in addition, will drop. Realizing this, it will be easy to understand that a slot will have to be cut in the box, so that the wax balls will be visible at all times.

It will be noticed in Figure 2 that this is exactly what we do. Cut the slot as shown in the photo Figure 3.

Note that the other larger hole to the left of the hydrometer slot is to accommodate a toggle switch, which will be connected later into the 110 volt line, and used to turn the charging current on and off.

In Figure 3 the switch has also been inserted, the face plate removed, to make the construction clear. The face plate is easily secured by two machine screws, furnished with the tumbler switch.





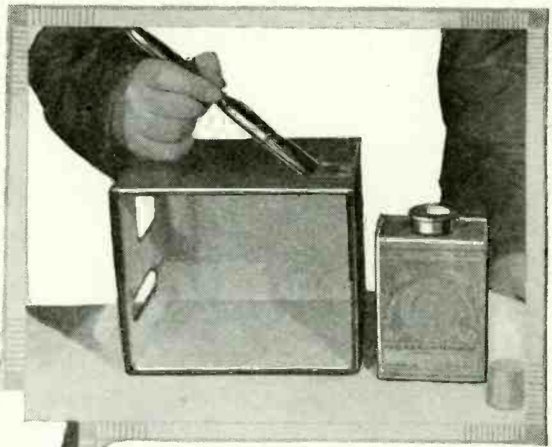


Fig. 5, at the left, shows how cover is sawed out. Rubber feet are placed on the bottom of the box as shown in Fig. 6, at the center. The box should be painted inside and out with an acid-proof paint as shown in Fig. 7 at the right.

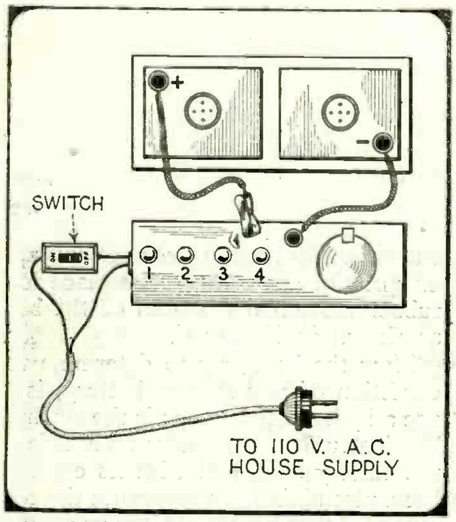
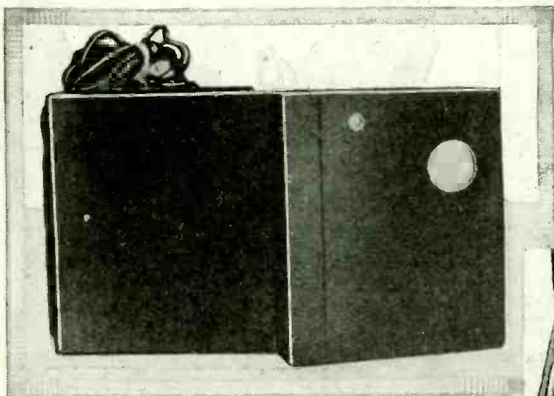
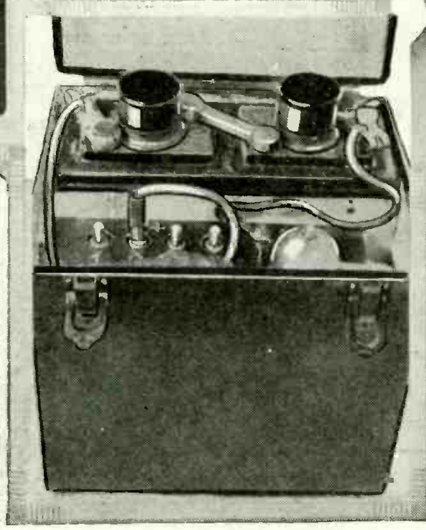


Fig. 11. Picture wiring diagram of the "A" supply unit.

The bulb type charger used in the unit shown in photos herewith is supplied with four little posts on the top of the metal case enclosing the charging elements, and the purpose of these posts, with the corresponding connecting clip, which is snapped off and on these posts, is to regulate the charge, according to the use to which the radio is put, that is, the amount of "A" battery drain. The number one post gives a charging rate of .110 amp., and can be left on this post indefinitely, and the line current, 110 volts, also left connected to the charger. No. 2 post gives .220 amp., No. 3 .385, No. 4 .550 amp., although the last two posts will only be used with 6-volt storage batteries, since the No. 1 and 2 posts will take care of all ordinary needs when the 4-volt battery is used.

Figure 8 gives us a close-up of the top of the battery and the charger, showing clearly the posts on the charger, and the bulb inserted, while the accompanying sketch Figure 11 shows connections of the unit. All that remains, is to connect the line circuit switch in series with the charger, place the cover on, and screw the plug in the nearest baseboard oulet, after the charger has been suitably installed in the radio console or cabinet. Figure 9 shows how a small hole has been cut in the top of the box, covered on the inside with a piece of screen wire to allow ventilation. This arrangement makes a most satisfactory unit for your radio, since it is not necessary to remove the unit from the set for any purpose.





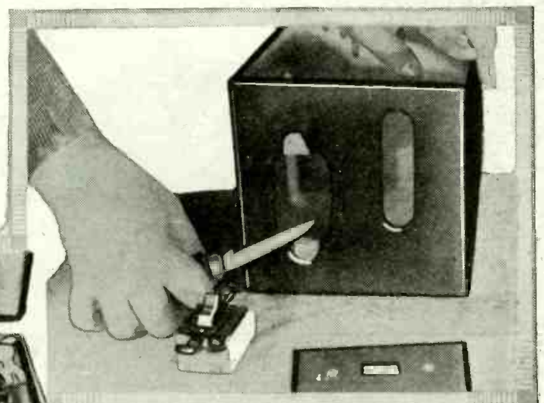


Fig. 8, center, gives a close-up of the top of the battery and the charger. Fig. 9, at left, shows small hole cut in top of the box. Fig. 10, at the right, shows how hole is cut for the switch.

Quality Reproduction and How to Obtain It

By CLYDE J. FITCH

IF the history of radio in broadcast reception is accurately portrayed in the advertising pages of the various radio magazines, a brief review shows a distinctive yearly trend, but the general direction has always been towards better quality of reproduction.

First it was volume. Not many years ago advertisements of *a six stage audio frequency amplifier* appeared in the various radio publications. Such an amplifier would be out of the question today. Two stages are the practical limit for good quality reception with normal volume.

To obtain the enormous volume demanded in those days, audio transformers were made with ratios as high as 20:1. The better makes of transformers now have ratios of two or three to one or less.

After the demand for volume subsided, distance was all the rage. Everyone was tuning in DX. This brought about multi-tube sets of the superheterodyne class. And with distance and the increasing number of broadcasting stations came the demand for selectivity. This started the low-loss craze.

Finally the demand for better quality of reproduction forced manufacturers to turn their entire attention to the making of better loud speakers to replace the high pitched metallic sounding horns then in vogue; hence, the advent of the cone type loud speaker. See fig. 1.

With quality came beauty. The radio set is no longer an electrical device for the workshop or laboratory; it is a musical instrument of the highest type designed to harmonize with the most beautiful home interiors.

From the foregoing we can safely say that radio has finally settled down to a solid basis. Simplified tuning, selectivity, high quality reproduction and beauty are here at last.

Locating Distortion

Good reproduction is the antipodes of distortion, and to obtain one we

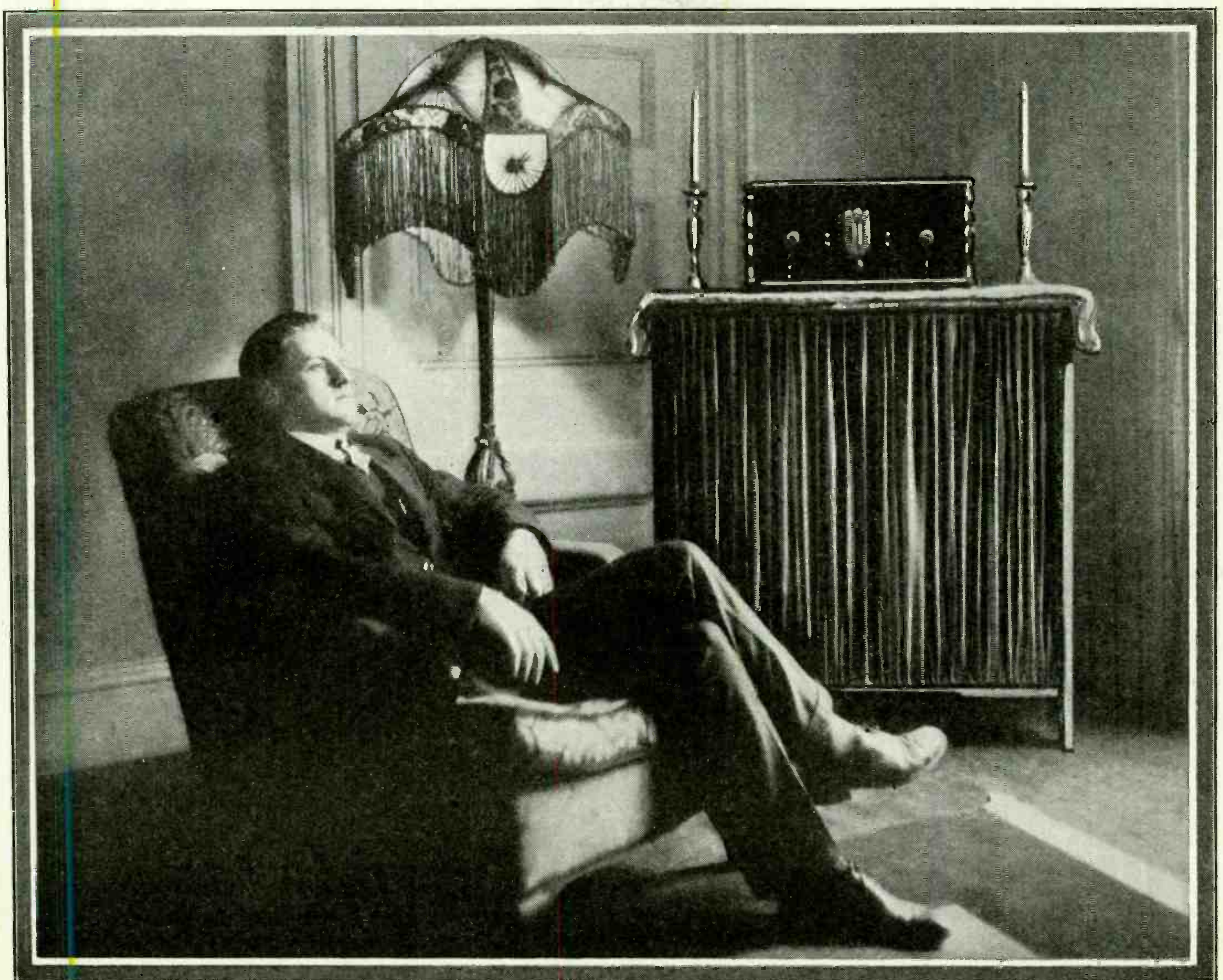


Illustration by courtesy of Engineers' Service Co.

A 36-inch diameter cone speaker built into a cabinet which also houses the "A" and "B" batteries. Note the pleasing appearance of the ensemble.

must analyze the other; therefore, we shall now talk about distortion.

There are many forms of distortion incurred in radio programs in their journey from the broadcasting studio to their final reproduction by the loud

Photo by courtesy of Empire Electrical Products Co.

Fig. 1. A typical cone-type loud speaker.

speaker at the receiving end. The most harmful forms are fortunately at the receiving end.

There are two general types of distortion, namely, frequency distortion, and wave shape distortion. Frequency distortion is present when notes of certain frequencies are very weak or entirely eliminated. This is very noticeable in broadcasting reception on poor

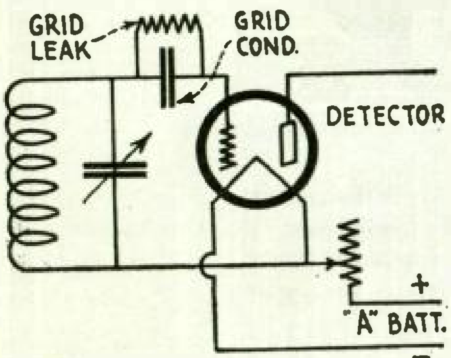


FIG. 2

Connections of grid condenser and leak in an average set.

sets and speakers. The lower tones are usually missing or are not reproduced with their proportionate intensity. This type of distortion is caused by faulty audio frequency transformers and loud speakers.

Wave shape distortion is present when the actual wave shape of the audio frequency currents is changed. One can get a clear idea of what is meant by wave shape by looking at the wavy grooves in a phonograph record through a magnifying glass. Wave shape distortion causes a piano to sound like a tin pan. It changes the timbre of the various musical instruments. Timbre is the quality of tone distinguishing voices or instruments. Wave shape distortion may be caused by the detector, the tuned R.F. circuits, the audio frequency amplifier, and the loud speaker.

Analyzing the wave shape of musical tones, we find that each tone is composed of a fundamental frequency, giving it pitch, and several harmonics of higher frequencies, giving it timbre. In many receivers the fundamental frequencies of the lower tones are blocked and only the high frequency harmonics pass. The listener, therefore, hears the harmonics and the rhythm of the bass tones of a musical concert, but the musical quality is missing. This is the most objectionable feature of the average radio receiving set, but fortunately it can be eliminated by using modern transformers and speakers.

The most serious forms of distortion are found in the detector, audio amplifier, and loud speaker. Distortion caused by sharply tuned R.F. circuits, which cuts off the side bands of the carrier wave and weakens the higher tones is not very serious in the

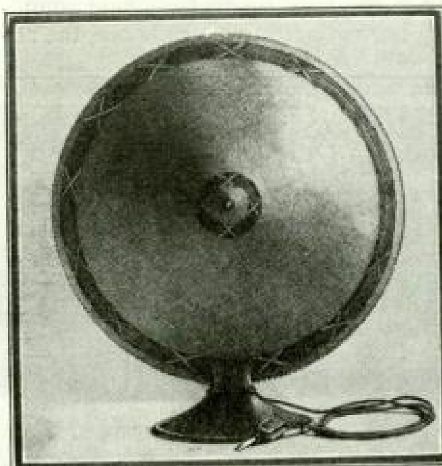


Photo by courtesy of Pacent Radio Corp.

This double cone loud speaker is capable of reproducing faithfully the output of a small set or of a multi-tube receiver.

average receiver. We shall first discuss.

Detector Distortion

Those who have listened with "earphones" and a crystal detector to a radio program and then changed over to a vacuum tube detector, noted that the quality was much better when using the crystal. But a crystal detector is not practical in the modern receiver. So without going into technicalities, we shall point out a few changes in the usual connections of the vacuum tube detector that will improve the quality.

Before the conventional grid leak and grid condenser was invented by DeForest, vacuum tube detectors were operated in connection with a "C" battery. This was before the days of

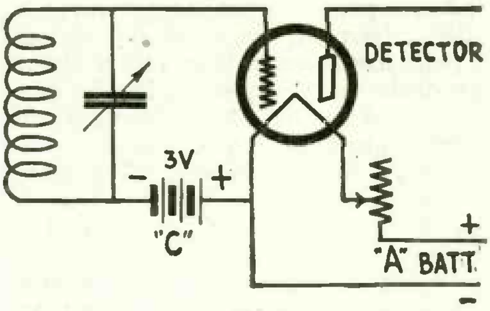


FIG. 3

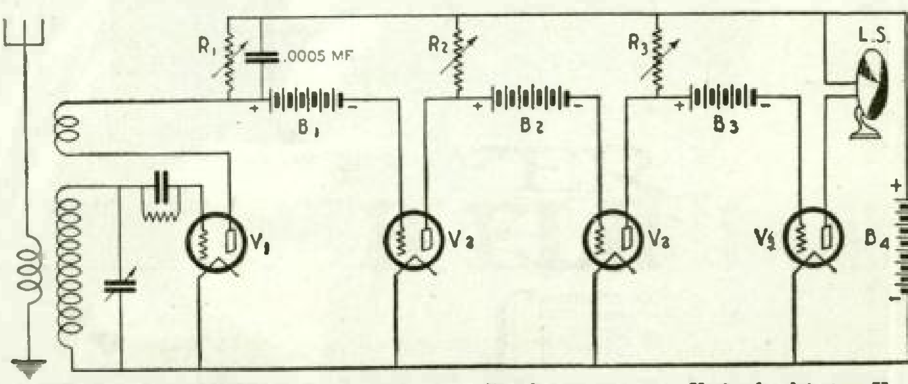
Detector connections where "C" battery is used.

broadcasting, when radio was used for spark or code reception only and distortion was of no consideration. The advent of the grid condenser and leak did away with the "C" battery and it has seldom been used for detectors since.

The grid condenser and leak cause a distorting effect on the wave shape unless they have the proper characteristics for each particular station being received. For broadcast reception, the "C" battery gives better results.

Figure 2 shows the connections of a grid condenser and leak as used in the average radio set. Figure 3 shows the detector connections when using a "C" battery instead of the grid condenser and leak. A "C" battery of 3 to 4½ volts and a "B" battery voltage of 45 gives very good results when using 201-A type tube.

You can easily try a "C" battery on the detector of your set by removing the grid leak and connecting the battery across the grid condenser, as shown in figure 4. Be sure that the *negative* terminal of the battery is connected to the grid side of the condenser. You will note that the battery



A distortionless amplifier employing battery coupling between stages. V_1 is the detector, V_2 are "high mu" tubes and V_3 is the power tube. The adjustments of this receiver are very critical.

adds electrostatic capacity to the circuit and the condenser dial setting will be changed. Therefore it is best to insert the battery in the filament side of the circuit as shown in figure 3. The use of a detector "C" battery may decrease

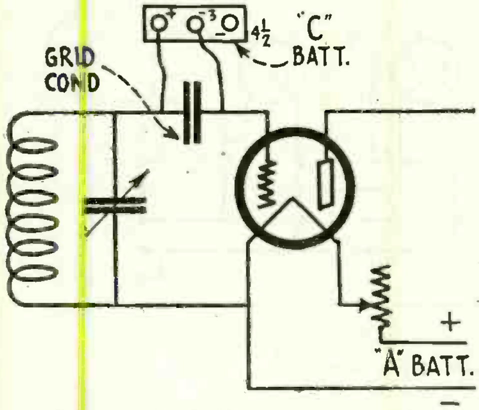


FIG.4

A "C" battery is used here instead of the conventional grid leak.

the sensitivity of the set slightly but the quality of reproduction will be much improved.

Audio Amplifier Distortion

A number of radio fans have told me that they get excellent quality when using a headset plugged in on the detector jack, but when they plug the loud speaker in second stage amplifier the excellent quality disappears. The distortion, of course, lies in the audio amplifier or loud speaker.

The amplification obtained in a vacuum tube amplifier is analogous to the magnification obtained in a lens when enlarging a picture. A small picture may look very clear and natural; when enlarged to several times its diameter, each little defect stands out like a sore thumb. If the lens is not mathematically perfect the enlarged picture is distorted. This distortion is analogous to wave shape distortion in

Several years ago audio transformers were made with very high ratios so as to obtain great volume of sound. Now the better makes of audio transformers have low ratios. Volume was sacrificed for quality. Instead of enormous amplification over a narrow band of frequencies, we get low amplification over a wide band of frequencies.

Types of Amplifiers

There are three general types of audio amplifiers in use today from which good tone quality may be obtained. They are as follows:

Transformer coupled amplifier

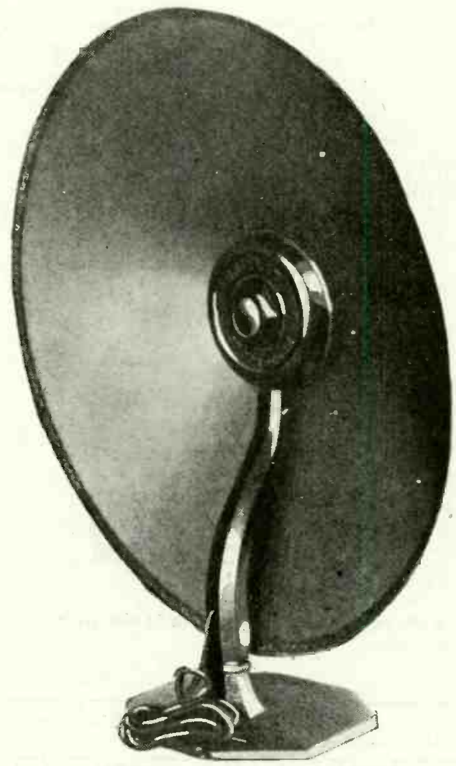


Photo by courtesy of Wheelan Mfg. Co.

As can be seen, the cone speaker shown above has but a single sheet of specially prepared paper as a diaphragm.

employing a detector "C" battery and a two stage audio amplifier.

There is nothing unusual about this circuit. The only precaution is to make sure that good audio transformers are used. Low ratio ones in both stages are preferable. A good trans-

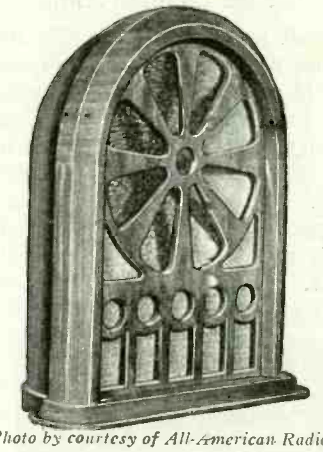


Photo by courtesy of All-American Radio Corp.

This cone type speaker is enclosed in a handsome metal casing which is designed to give the best tonal effects.

former can usually be determined by its physical size and weight. A glance at figure 6 will show the relative proportions of an old and a new type transformer of a well known make. As a general rule, the more iron and wire used and hence the heavier the transformer, the better it is.

If your set employs small high ratio audio transformers of poor construction it would certainly pay to change them. Unfortunately the keen competition in the set manufacturing business formerly forced almost all set manufacturers to employ cheap transformers, but this condition is fortunately changing.

Choke Coil Coupled Amplifier

A choke coil coupled amplifier circuit is shown in figure 7. The choke

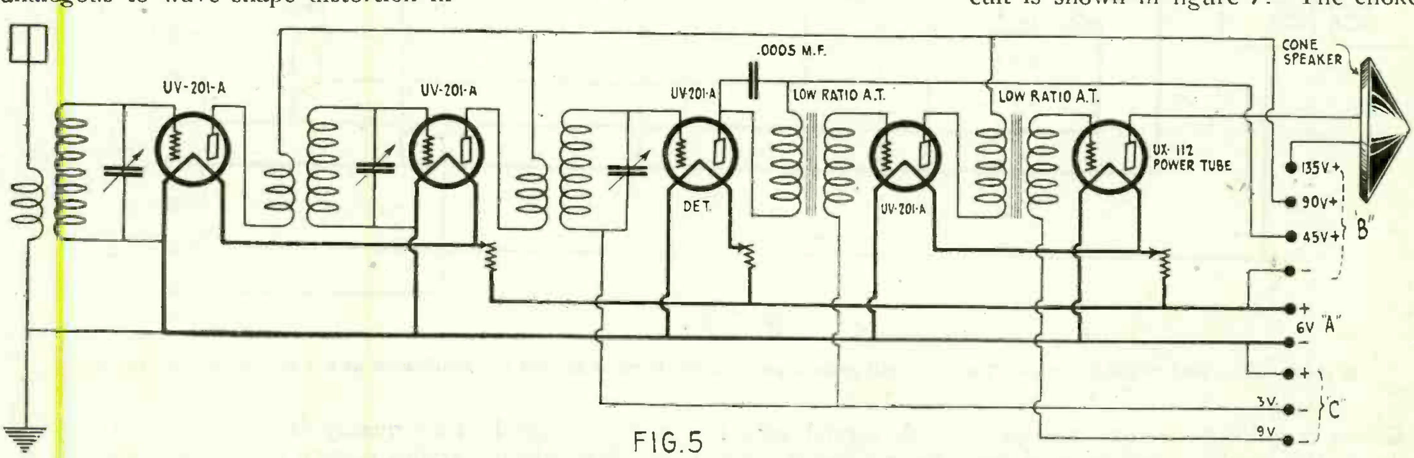


FIG.5

A five-tube circuit employing transformer coupled amplification. A detector "C" battery is used.

our amplifier. If the screen on which the picture is projected is too small, part of the picture will be missing. This is analogous to frequency distortion, in which notes at the upper and lower limits of the musical scale are missing.

Choke coil coupled amplifier, and
Resistance coupled amplifier

The Transformer Coupled Amplifier

The diagram of a transformer coupled amplifier is shown in figure 5. This diagram shows a five tube circuit

coil will give about the same amount of amplification as a 1:1 ratio transformer, with perhaps a little better efficiency. Good results may be obtained by using the secondary winding of an ordinary transformer for a choke coil.

The connections of the choke coil amplifier are the same as those of the resistance coupled amplifier shown in figure 8. The choke coil amplifier has the advantage that good quality may be obtained with low "B" battery voltages.

Resistance Coupled Amplifier

Almost perfect tone quality may be obtained with a resistance coupled amplifier if the necessary precautions are taken in constructing it. Figure 8 shows a diagram of this type of amplifier. Three stages are usually employed. There are many three-stage resistance coupled units now on the market ready wired for installing in the set. It may be necessary to try different coupling resistances and grid leaks in the amplifier before good results can be obtained.

Considerable distortion — sometimes called amplitude distortion—may result in a resistance coupled amplifier unless a very high "B" battery voltage is used. At least 180 volts should be used. This requires about double the number of "B" batteries ordinarily employed, and on this account the resistance coupled amplifier is not widely used. While twice as many batteries are necessary, the current consumption is proportionately lower, due to the fact that the high resistances limit the current flow, and the batteries consequently last about twice as long.

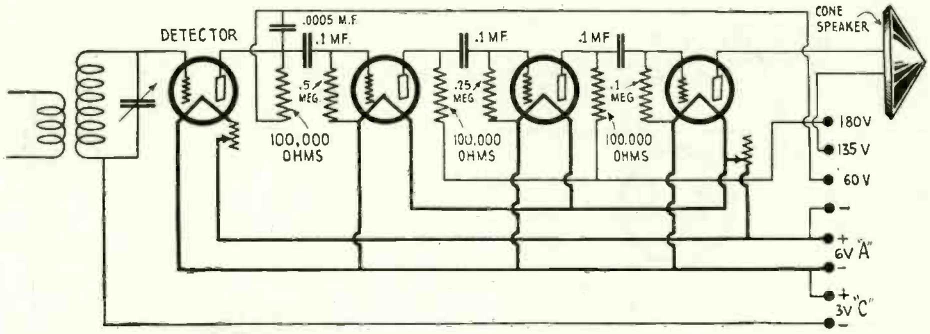
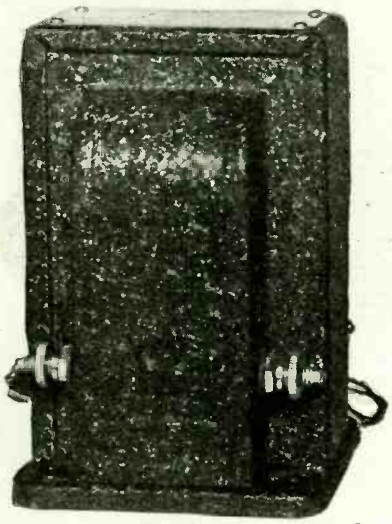


FIG. 8

Circuit diagram of a resistance coupled amplifier.



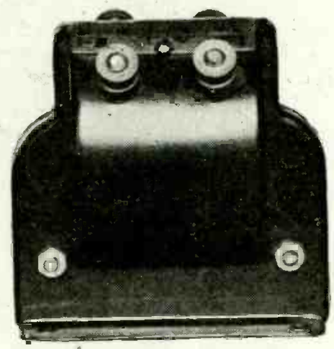


Photo by courtesy of All-American Radio Corp.

Fig. 6. The new type audio transformer at the left is shown in relative proportion to size with its brother at the right.

A special tube has been developed for resistance coupled amplifiers which considerably improves the tone quality and volume. These tubes are designed to have a much higher plate-to-filament impedance than the ordinary 201-A type tube. While the 201-A type tube gives excellent results, the special "high mu" tubes are recommended.

Some radio fans prefer a combination transformer and resistance coupled amplifier. Usually a good low ratio transformer is employed in the first stage and resistance coupled units in the second and third stages. For all ordinary requirements, however, very good results may be obtained with the standard two-stage transformer coupled amplifier, shown in figure 5, with good low ratio transformers.

Loud Speaker Distortion

Until the advent of the better makes of transformers, the horn type speaker was perfectly satisfactory, because it operated over the frequency range covered by the early high ratio transformers. The arrival of the better made low ratio transformers however, made it necessary to reconstruct the loud speakers in order to obtain the full advantage of the transformers. Thus the cone type speaker was produced.

You may ask why it is that very good tone quality is obtained from phonographs using a small diaphragm and an amplifying horn. As an explanation, the needle of the phonograph follows a well-defined groove in the record, and frequencies over the entire audio range are *forced* upon it. Therefore the needle is forced to vibrate on the lower notes as well as it does on the higher,

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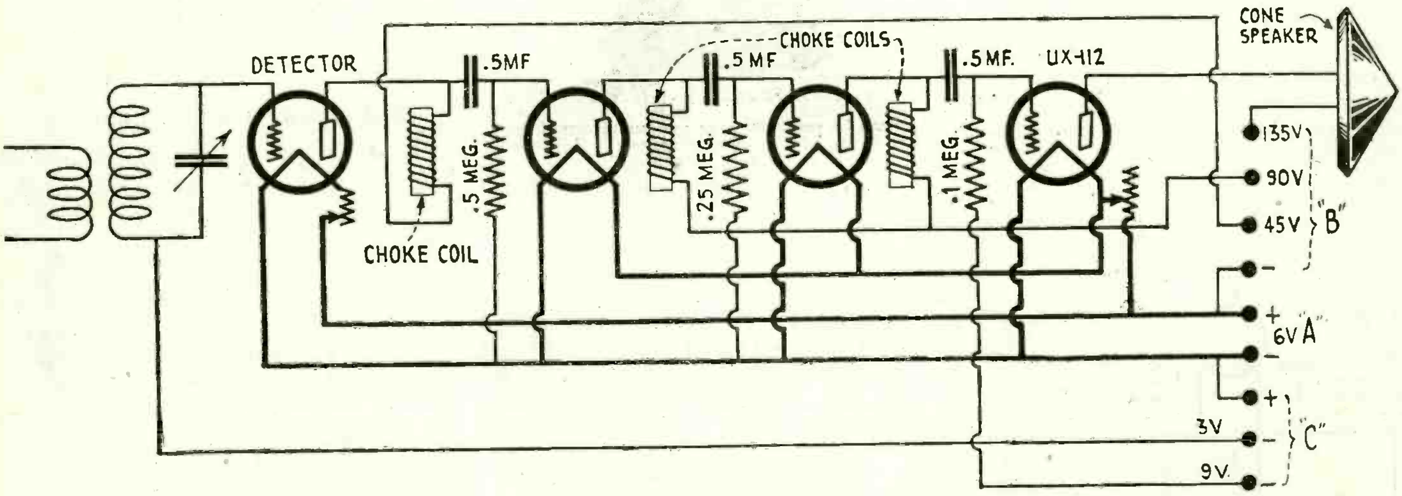


FIG. 7

A choke coil coupled amplifier circuit. The choke coil gives approximately the same amount of amplification as a 1 to 1 ratio transformer.

Current-Indicating Devices Used in Radio Receiving Sets

By S. R. WINTERS

AMMETERS, voltmeters, or other current-indicating devices may be as common on radio receiving sets of the future as on the automobiles of to-day, according to the opinion of Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards. Dr. Dellinger pointed to a newly designed radio receiver, in his office, which contained two slots for plugging in an ammeter, and then directing the writer to a large cabinet in the laboratory, the nation's technical radio advisor pointed out thirty-five old receiving sets, only one of which made any provision for indicating the filament current of the vacuum tubes.

In this matter of equipping automobiles and radio sets with current-indicating devices, there is a distinct analogy. In both cases, the types of devices used at first lacked ruggedness and proved expensive in operation. For example, the moving-coil type of ammeter on automobiles fifteen years ago was apt to short-circuit the wiring of the motor vehicles and thus inflict damages. The old fashioned design of ammeter was expensive, as well. Similarly, previous usage of ammeters and voltmeters on radio receiving sets, for the most part, has resulted in the consumption of so much current in the operation of these devices as to nullify their advantages.

Quite recently, however, manufacturers of radio receiving sets, as well as the builders of home-made equipment, had their attention called to inexpensive and simple ammeters and voltmeters, which require little consumption of current in their functioning and which are able to demonstrate their own economic value. These new instruments vary in makeup from a vest-pocket edition—only two inches in outside diameter and less than one-half inch thick—to a more pretentious push-switch arrangement where the filament current, "B" battery and "C" battery voltages are indicated.

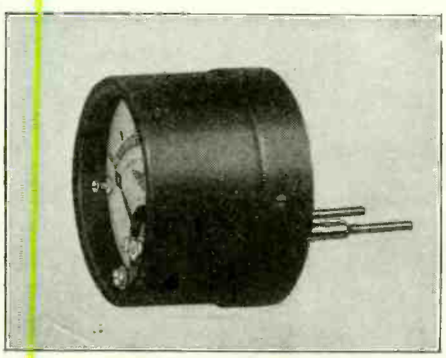


Photo by courtesy of Jewell Electrical Instrument Co.

Voltmeter which plugs into pin jacks provided in the panel of the receiving set.

Meters are standard equipment on many receiving sets.

Judging from the almost universal use of ammeters on automobiles to-day, the time will probably come when a good radio set cannot be sold without an instrument to indicate the correct supply for the vacuum-tube circuits."

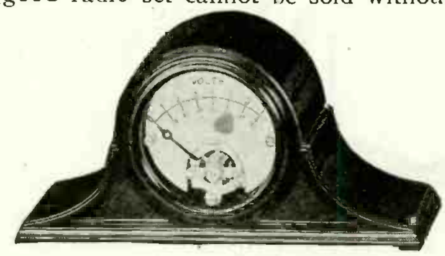


Photo by courtesy of Jewell Electrical Instrument Co.

A portable model double range direct current voltmeter for testing "A," "B" and "C" batteries.

The 25,000,000 users of radio receiving sets may be classified as "color blind," if they attempted to qualify as experts in defining "cherry red," "straw color," "right signal-strength," and other superficial and haphazard signs of indicating when the filament current of vacuum tubes is safe within the zone which insures their long life. "Inexperienced and even experienced operators of radio sets do not agree on these points," contends an eminent radio engineer. "They cannot guess very close on the average, and many guess so high that the vacuum tubes are ruined. Guessing is eliminated by a suitable instrument." The wisdom of this advice is analogous to the warning of traffic officials in Washington, D.C., in a campaign to lessen fatalities to pedestrians, by use of placards cautioning motorists to blow their horns less and use their brakes more. Similarly, owners of radio receivers may well be advised to use ammeters and voltmeters more and gamble less on "cherry red" and "straw color" and other superficial standards set up for eye detection of the proper vacuum-tube filament current.

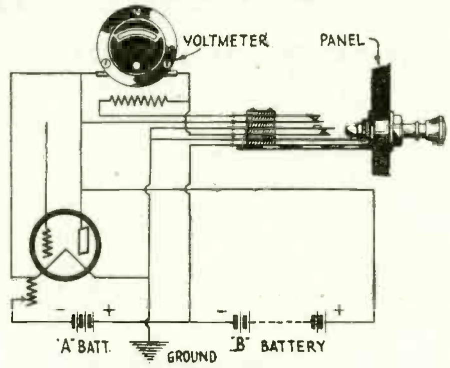
Several switching schemes have been developed for use by broadcast listeners and radio amateurs for the operation of voltmeters in performing a number of functions in radio receiving sets. The accompanying diagrams illustrate how a standard jack may be employed with a metal plug and a double-range voltmeter to control the "On" and "Off" of a radio receiver, as well as the indication of filament and "B" battery voltages. This switching arrangement is well adapted to receiving sets relying upon dry-cell batteries to supply the filament current. The common of the voltmeter is connected to the minus bus-bar of the main filaments. If one vacuum tube is used with an individual filament rheostat, the extra filament and rheostat should be in series with each other across the positive and negative bus-bars of the main filaments. Then the voltage of the individually controlled filament would never be greater than that applied to the main lot, and this is shown by the voltmeter.

The switch shown in this diagram is a standard radio jack, plus a metal plug whose shank is one-quarter inch in diameter, approximately one inch long and has a hemispherical end. The main frame of the jack is connected to +A and —B. The two prongs which usually receive the plug are connected together and to the plus bus-bar of all filaments, +F. The common of the voltmeter is connected to the minus bus-bar of the main filaments. The ground G may be connected either to +A or to +F. The contact between the main prongs is connected to the plus terminal of the low range of the voltmeter. The two upper contacts are connected in the high voltage, B circuit with the multiplier resistance somewhere between +B and the plus of the low range of the voltmeter.

In operation, when the metal plug is inserted in the jack, the vacuum-tube filaments immediately light up, if the rheostat is on, and the voltmeter shows the potential applied to the filaments. The filament rheostat is advanced as the dry-cell batteries are progressively drained of their energy, so as to keep the proper voltage on the filaments. When the metal plug is pressed in so as to lift one prong and break the circuit between the voltmeter and the plus of the filament, the pointer returns to the zero of the scale. As the pressure on the head of the plug is increased, the upper contacts close and the voltmeter indicates "B" battery potential. When the operator's finger is withdrawn, the plug returns to its natural position with the instrument indicating the filament voltage. The jack will not remain in the "B" battery position. Thus all danger of accidentally exhausting the latter is avoided. When the plug is removed, the filament current is open and hence all flow of current is stopped.

If the "A" battery is of the storage-cell type, the rheostat may be turned off when the plug is removed, so that both sides of the storage battery are disconnected from the radio receiver. In this case, —B should be connected to G and to + F and not to + A. With such an arrangement, the storage battery may be charged with a rectifier or battery charger, even though the latter does not have a transformer with an insulated secondary winding.

Radio experimenters and broadcast listeners using storage "A" batteries as sources of energy for operating their receivers, will find the following scheme versatile and efficient in performance. It is especially designed for use with multi-tube radio receiving



Voltmeter and tube control with a standard jack.

sets—for example, the super-heterodyne. It is capable of operating in a combination of circuits and of yielding every combination of voltmeter, readings desired. The switch is similar to that just described in conjunction with the standard radio jack. There is, however, an additional top contact for indicating the "C" battery current. A full description of this scheme follows:

The contact below the top contact for the "C" battery goes to the plus of the low range of the triple-scale voltmeter. The contact below this one goes through the multiplier resistance to +B. Also +F, —B and G are together. The plus of the "C" battery goes to —A or to —F. In this case the minus common of the high-resistance voltmeter goes to the "Off" end of the main (low-resistance) rheostat. When the rheostat is off this is equivalent to —F since the drop in the rheostat due to the small current of the voltmeter is negligible, but the drop in the rheostat due to the filament current is not negligible.

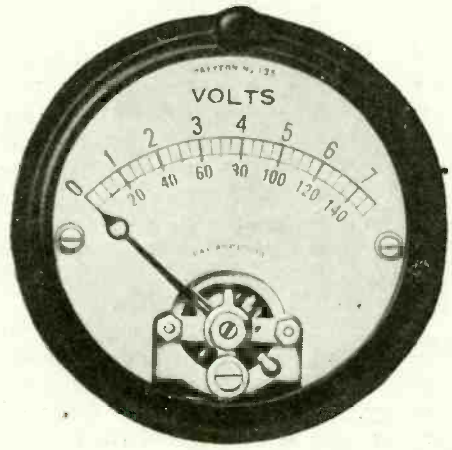


Photo by courtesy of Jewell Electrical Instrument Co.

A double-scale voltmeter, particularly useful for measuring the voltage of "A," "B" and "C" batteries. The switch at the top of the meter is used for changing from the low- to the high-scale reading.

A storage "A" battery charger, employing an ammeter as an indicator of current flow. The ammeter registers five amperes after the battery has been partly charged, although the charge is started at a higher rate.

Photo by courtesy of Niles Mfg. Co.

The functioning of this switch is as follows: As the plug is pressed in, it first disconnects the positive terminal of the voltmeter from the filament circuit, then connects it through the multiplier resistance to the "B" battery circuit. Then, with further pressure, the plug forces the upper contacts together and the minus of the "C" battery is connected to the normally plus terminal of the voltmeter. This causes the voltmeter pointer to deflect

(*Continued on page* 150)

Photos by courtesy of the Cellokay Mfg. Co., Hoyt Electrical Instrument Works, Weston Electrical Instrument Company.

Voltmeters and ammeters, such as the recent designs shown above, have many uses. At the left, a panel voltmeter; right, a panel ammeter which, at a touch of the button, will register the condition of the storage battery. The largest meter is a five-in-one combination voltmeter and ammeter.

Listeners' Guide to Accessories for the Radio Set

New Tone Clarifier Protects Speaker

A new tone clarifier recently introduced on the market, as shown in the accompanying illustration, is designed to prevent the high voltage "B" battery current from reaching the loud speaker, and at the same time assist the output energy of your radio set to build up and operate the speaker unit to the fullest advantage. This is accomplished by a specially constructed dual choke coil and a large capacity by-pass condenser which blocks the high voltage "B" battery current, keeping it out of the speaker circuit.

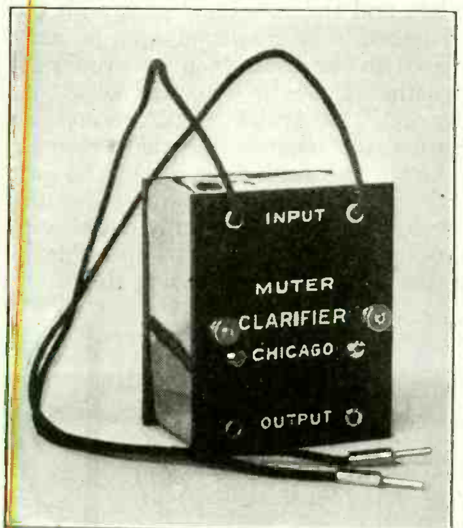


Photo by courtesy of Leslie F. Muter Co.

This tone clarifier protects loudspeaker and improves reception.

A majority of the present day speakers are partially paralyzed as the result of high voltage "B" battery current preventing them from proper response to the output of the set. Thus, when this current is prevented from reaching the speaker unit, the tone quality and volume are somewhat improved, and in addition, the life of the speaker coils and permanent magnet are greatly lengthened.

The new type high voltage amplifier and power tubes which are becoming more popular every day due to their greater output should have a device of this type connected from the output of the set to prevent destruction of the loud speaker coil windings. Such a device will also give greater depth of tone quality and volume.

The unit is provided with four terminal connections for the input and output.

The phone tips from the loud speaker are inserted in the two phone tip jacks marked "output" on the unit, and the phone plug is connected to the two short input cords. The device is then ready for operation when the plug is inserted in the set.

"A" Battery Current from Charger

There is something radically new in the way of obtaining the "A" battery current supply for lighting the vacuum tubes of the receiving set from the usual chemical or bulb type charger. The unit shown in the accompanying illustration known as the Abox, is essentially a filter device for smoothing out the rectified current as it leaves the charger and passes on to the set, thus giving a smooth direct current free from hum or noise. The unit consists of a large size choke coil with an electrolytic condenser of new design. This condenser according to the measurements of the manufacturers has a capacity of ¼ of a farad, this capacity being equivalent to 250,000 microfarads. Despite its large size electrically, this condenser is surprisingly small in mechanical dimensions, occupying only about 3″ wide, 6″ long, and 5″ deep. The principle of operation is that of gas concentration on the iron and nickel plates which are immersed in a strong solution of potassium hydroxide. The plates of this electrolytic condenser are sealed into a tank in the upper part of the unit, while the bottom of the unit holds the large size choke coil. The filter can be used with various types of bulb and chemical chargers to supply either 199 or 201-A type tubes, in any number up to 15. However, a combination of 2½ ampere type electrolytic charger and Abox filter furnishes the "A" power supply for sets using six tubes or less. This filter unit is also adaptable for direct current service as well as alternating and may be used with a trickle charger to supply the "A" battery current for sets having 199 type tubes. Where more than six tubes are used, it is advised to use a 5 ampere bulb type charger in connection with the filter. The size and weight of the unit is less than ½ of the ordinary storage battery, and can be installed along side of the charger in the radio cabinet with very little or no care.

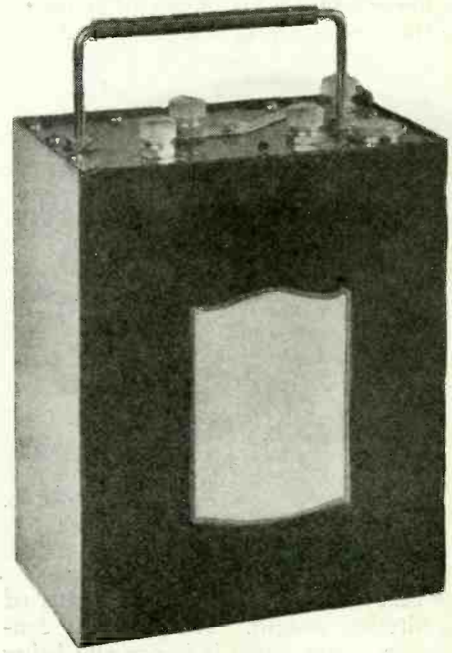
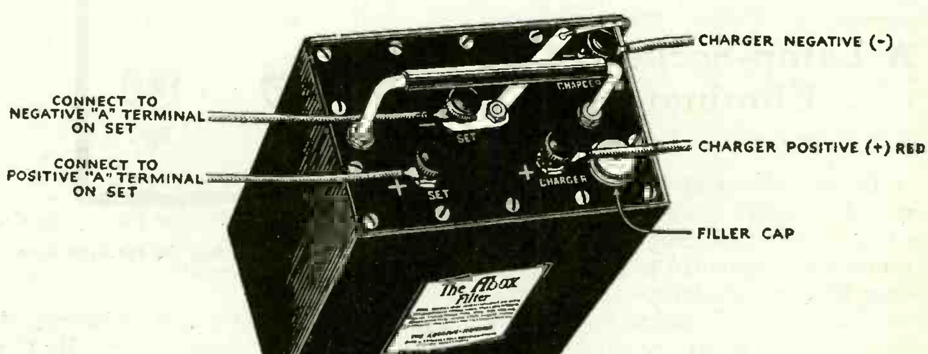


Photo by courtesy of The Abox Company

The "A" eliminator presents a neat and compact appearance.



This shows how the Abox is connected between the charger and the receiving set.

A New "A" Battery Eliminator

Another "A" battery supply unit for eliminating the storage "A" battery or converting the alternating house current into direct current for lighting a standard six volt type tube is shown in the accompanying illustration. The system employed in this unit is a transformer, choke and dual vacuum tube method of rectification. The 110 volt alternating current is stepped down to a lower voltage by means of a transformer rectified by the tube and the

Photo by courtesy of The Cooper Corp.
A powerful and well-constructed "A" eliminator.

pulsations smoothed out by means of a filtering system. The unit only consumes power when it is actually being used and then at a rate of about 2 cents per hour. Once installed, it requires no care as the parts contained in it are fixed and adjusted at the factory. The maximum output at six volts is about 2½ amperes, the eliminator therefore being capable of operating any receiver employing up to ten tubes of the 201-A type or their equivalent. The casing of the unit is made of steel, the over-all size being 9″ wide, 9½″ high, and 13¾″ in length. The unit weighs about 52 lbs. complete.

A Lamp-Socket "C" Eliminator

With the advent of higher "C" battery voltages, the Acme "C" eliminator shown in the accompanying photo has recently been presented to the radio set owner who prefers lamp-socket operation for the "C" source of current supply. This is a battery eliminator as it substitutes for the "C" battery without any change in the circuit arrangement. A UX-199 type tube is employed as the rectifier, the filament being heated by the alternating current through the tertiary winding on a transformer contained in the unit. The use of the small tube is made possible by the fact that only voltage and no current is required from the "C" supply. The unit is provided with an output cable containing three conductors, one positive "C" lead and two negatives. The voltages are controlled by two potentiometers, the knobs of which are on either side of the tube socket on top of the unit. The scales

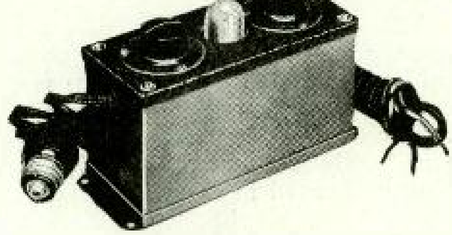


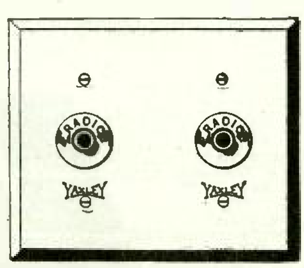
Photo by courtesy of Acme Apparatus Co.
A device which eliminates the "C" battery.

of these potentiometers are calibrated directly in volts and marked for the voltage output of each of the two "C" negative leads. A lamp socket plug is provided on a separate input cord of the eliminator to be inserted in a lamp socket or baseboard receptacle. The eliminator is especially valuable when power amplifying tubes requiring comparatively high negative voltages are used. The size and weight of the unit is comparatively small and can be readily installed in a small space in a radio cabinet.

Radio Convenience Outlets

Much interest has been manifested in the new convenience outlets, especially designed for radio work. These are made for many useful purposes.

One outlet is made for use where a number of loud speakers are to operate on the same circuit at the same time. This outlet is equipped with an impedance coil wound to 2200 ohms,

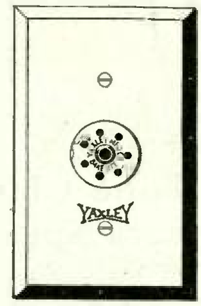


Illustrations by courtesy of Yaxley Mfg. Co.

Several loud speakers may be operated from this outlet.

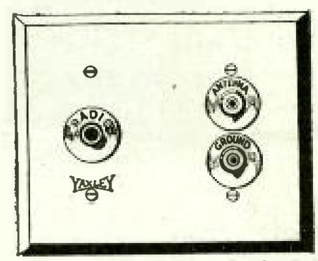
which is equivalent to the resistance of the average loud speaker unit. By the use of the impedance coil, an equal volume for one or several loud speakers may be had on the same circuit.

A new and very neat convenience outlet is also available for battery connections. The receptacle and plate fit any standard outlet box or may be fastened direct to the baseboard or in the floor. The batteries may then be placed on a shelf in the basement, in a closet, or out of the way and lead-in wires



This outlet brings all battery connections within convenient reach. It is impossible to connect the plug incorrectly.

brought to the convenience outlet. This device consists of the receptacle and plate and the connector plug with pin contacts. The connector plug is easily wired to the leads from the radio set whether cable or separate wires are used. The battery connections are then made by inserting the connector plug in the flush-type receptacle, just like plugging in an ordinary heating device plug. There is only one way to insert the plug, so it is impossible to make a mistake when using this.



An outlet for loud speaker or headset and aerial and ground. These latter connections may be made using either phone tips or No. 14 solid wire.

A convenience outlet is also available for loud speaker and phone connections. This device makes it practical to place the radio set in one location and to enjoy the reception in another part of the home. It is of great utility in hotels, hospitals, apartments, etc.

Another convenience outlet provides for aerial and ground connections. The aerial and ground wires are brought to the outlet behind the sash and are then available for connection to the set by means of phone tips or phone tip jacks or No. 14 solid wire.

A combination outlet, shown above, provides connections for loudspeaker or headset and also for aerial and ground. Other combinations can be obtained such as a plate which provides for aerial and ground and battery connections or another outlet which provides for loud speaker, aerial and ground, and battery connections. The receptacle which connects with the batteries is provided with a cable containing a number of marked, differently colored leads which are permanently attached to the battery terminals. The plug fitting into this receptacle also has a cable, with leads connected to the binding posts of the radio set.

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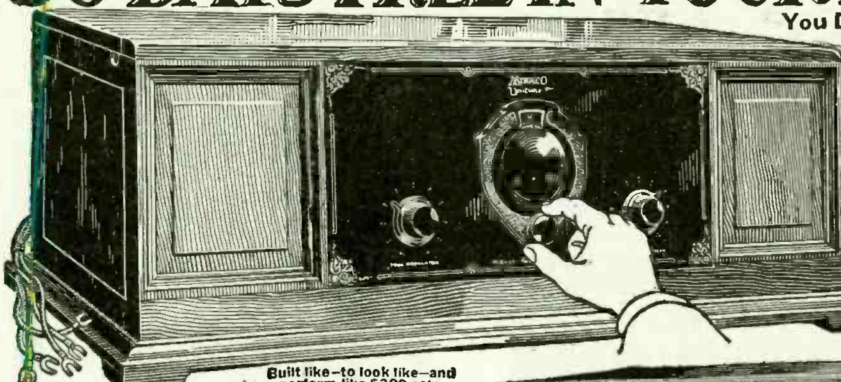

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Notice! Enormous sales of the celebrated Miraco big fine Receivers (resulting from delighted users so highly endorsing them to friends) again enable us to add hosts of costly new features, latest refinements and up-to-the-minute improvements such as you might expect to find only on much higher priced sets. Miraco's this year are still better—more beautiful—more selective—more powerful for less money than ever before.

USER-AGENTS WANTED . . WRITE!

Reports from users everywhere leave little for us to add. These are only a few of the many in our files and which we receive daily. Send coupon for plenty of additional proof and testimony of nearby users.

Coast to Coast With One Dial First Evening

I set up the Miraco Unitune about 5 P.M. and heard 35 stations, New York to California, the first evening. The fifth station I heard was Schenectady, N.Y. about 2,000 miles from here. The eighth was Pittsburgh. Heard other stations in Illinois, Nebraska, Missouri, Oklahoma, Colorado, Iowa, Texas, Kansas, California, Catalina Island, Utah. C. D. KRAKEL, Sterling, Colo.

Has Tried 50 Makes—Finds Miracos Best

Having owned and operated over 50 radio receivers, some of the most expensive, well-known makes, including superheterodyne, I believe I know what standards a radio must meet to be absolutely satisfactory. In my estimation the Miraco Ultra and Unitune are the most beautiful, efficient and selective receivers I have ever used. They are as good as the best and better than most at any price. H. P. AEBERLI, Orchlee St., N. S., Pittsburgh, Pa.

Cuts Thru Chicago Locals—Gets Coast to Coast on Single Dial

I live in a part of Chicago surrounded by powerful broadcasting stations, where costliest sets have failed to prevent interference. With my single dial Miraco Unitune, however, I have repeatedly astonished neighbors and friends by cutting through all the 17 or 18 Chicago stations and pulling in programs from Florida to California and up to Canada, clear and loud on the speaker. Every night is "silent night" for us so far as getting coast to coast. KFI, Los Angeles, and other California stations come in so loud I have to turn down the counterbalancer. I also separate the many Chicago locals. The Unitune is the most selective set I have ever heard of, and the tone quality is marvelous. And so big, handsome and easy to work—we just turn one dial and sweep the continent for programs. S. E. GUINTER, Addison St., Chicago.

Tunes Out Nearby Local With One Dial

Unitune One Dial set highly satisfactory. Find no difficulty in picking up and separating stations from 226 to 526 meters. Logged about 40 in ten days. I successfully tune out WCWS, Bridgeport—only 4 miles from my home—in 2½ points on the single dial. EDGAR R. THOMAS, Stratford, Conn.

Gets Distance Easy With 1 Dial

Unitune sure brings in far distant stations and is easy to tune. It is a marvelous set. LOUIS ULLSPERGER, Sterling, Neb.

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Guaranteed UNBEATABLE Among the Big, Fine Multi-Tube Sets

UNLESS 30 DAYS of actual enjoyment, use and comparison **in your home proves** your Miraco the **most selective, clearest toned** and **most powerful distance getter** among ANY sets using up to 8 tubes—**don't buy it!** Be thoroughly convinced **entirely at our risk. Your verdict final**—absolutely **no** strings to **OUR** offer. Satisfaction UNCONDITIONALLY guaranteed by America's big, old, reliable makers of FINE sets—Midwest Radio Corporation—7th successful year. Many, many thousands of **enthusiastic** users throughout U. S. A. and Canada. Get their testimony. **Get the amazing new low wholesale prices and Special Offer! Mail coupon or postal.**

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Miracos are latest, up-to-minute, models with newest features. Unsurpassed for quiet, low-cost operation with A and B light socket power supply units or batteries. Power tubes and more than 90 volts of "B" can be used, although the amazing power built INTO a Miraco makes this unnecessary. Coupon brings full information, users' testimony, Amazing Special Offer!

Reduced Factory Prices—Save Lots of $$$

Tremendously greater sales this season have made possible BIG reductions on our sets and accessories. Save MORE THAN EVER by dealing direct with Midwest. Or make big profits selling your friends. Get User-Agents' AMAZING Special Offer on Free Demonstrating Outfit (no red-tape, no contract to sign). Our offer will ASTONISH you. Clip coupon NOW.

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Installing Your Radio in a Console

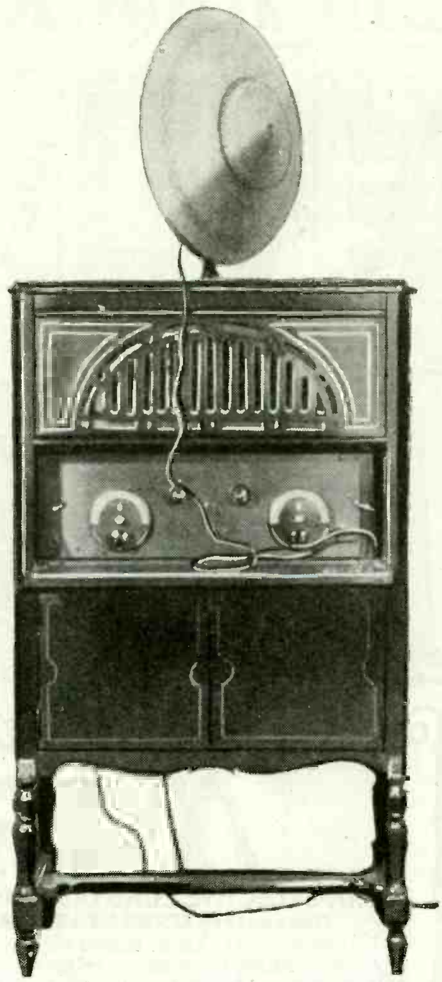

Fig. 1. Installing the set in the console improves the appearance.

MANY a radio set purchased several years ago is still giving faithful and satisfactory service. In some cases the tone quality has been improved by the use of a new power tube and various other improvements have been added from time to time but still the set looks out-of-date and the batteries and other accessories hardly add to the beauty of the surroundings. One owner has solved the problem of appearance by putting his set in a well-built mahogany console as shown in the accompanying illustrations. Some of the special features of this installation are clearly shown in the various photographs. Figure 1 shows the appearance of the set after installation in the console. In this instance a jack has been attached to the panel of the set so that a loud speaker can be plugged in, in the conventional fashion. In this way a cone type speaker can be used if the horn is not entirely satisfactory on certain kinds of programs. Figure 2 shows how the set is mounted on the sliding panel of the console. In order to make adjustments it is simply necessary to pull the set out. This is just as easy as opening a drawer. The rear of the set is shown in Figure 3. This shows how the apparatus appears when mounted on the baseboard, after having been slid into the cabinet. It is interesting to note how the wires forming the battery leads have been "cabled" together. The built-in horn is located directly above and the leads from this are connected to the output jack on the inside of the set. This makes a very handy arrangement. The lower compartment is arranged for holding the batteries or power supply devices or both. A front view of the battery space is clearly shown in Figure 4. It can be seen that the batteries are easily accessible for changing connections, testing or for replacements In the set illustrated dry cells are used. Twelve cells are shown, connected in series-parallel and heavy duty "B" batteries are also employed. This arrangement is necessary when using

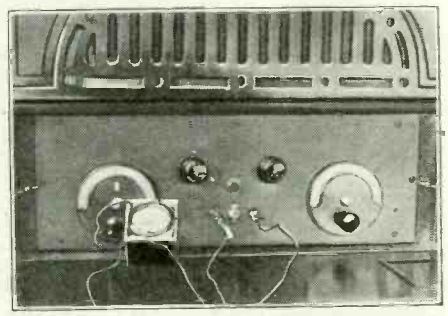

Fig. 5. Pin jacks are used for taking voltmeter readings. These can be seen in the center of the panel.

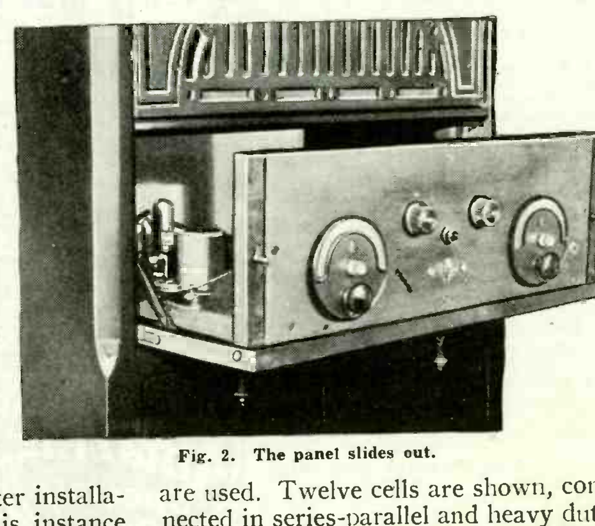

Fig. 2. The panel slides out.

multi-tube sets such as the Super-Heterodyne, as there is a considerable drain on the batteries. Figure 5 shows

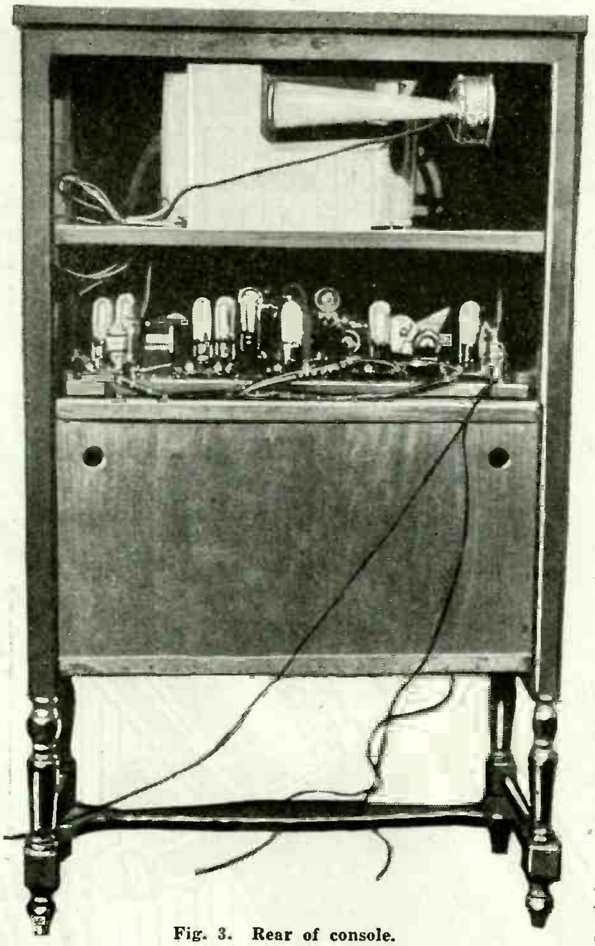

Fig. 3. Rear of console.

the use of two pin jacks on the front panel which, by means of suitable connections to the "A" battery leads, give the correct reading of the filament voltage when the leads from the small voltmeter are plugged in. Two telephone tips may be soldered on the ends of the wires leading from the meter, these in turn being fitted into the jacks. If desired, two small clips may be substituted for the pins.

In making an installation such as this, various modifications may be worked out to suit individual needs and tastes. In any event, it will readily be conceded that the addition of the console means a distinct improvement in the appearance of the set.

The use of a cable connector plug such as the Yaxley or the Jones Multi-plug will add greatly to the convenience with which changes and adjustments may be made. For example, it may be desired to remove the set from the console for the purpose of making a slight alteration. With a cable connector plug, it is unnecessary to remove any connections from the batteries or eliminators.

It is merely necessary to pull the plug out. When the time comes to reconnect the set, the plug is inserted just as an electric floor lamp would be connected to a wall outlet.

All the connections are made simultaneously and it is a physical impossibility to make a wrong connection since a groove in the plug permits it to be inserted in one particular position only. This feature alone, aside from the matter of convenience, may pay for the plug many times over, in preventing burnt out tubes, due to wrong connections.

It should be understood that the console shown in the accompanying photographs is merely for the purpose of illustrating the text.

Any good cabinet, such as those to be found advertised in this publication, will do. Consoles are available in various models, some of which have room for a cone speaker in the lower compartment.

A wide range of choice is obtainable in the finish of the exteriors and many of the consoles are obtainable in beautiful two-tone effects. Cabinets can also be had in various period models.

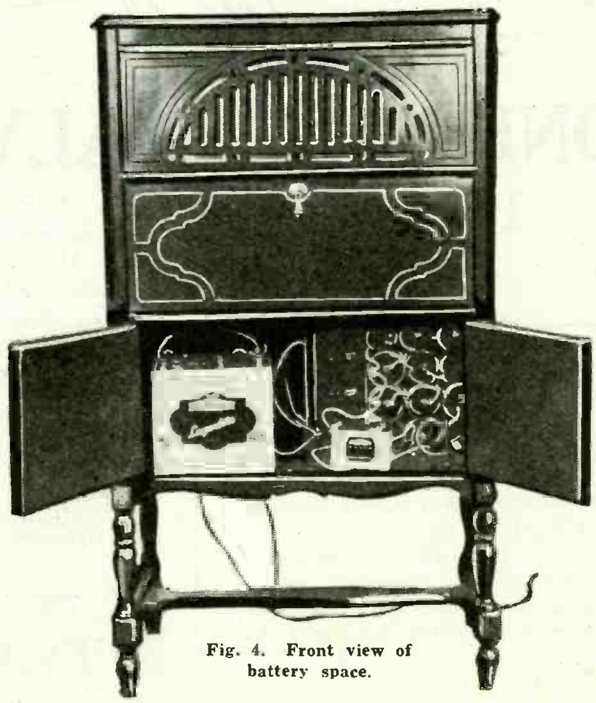

Fig. 4. Front view of battery space.

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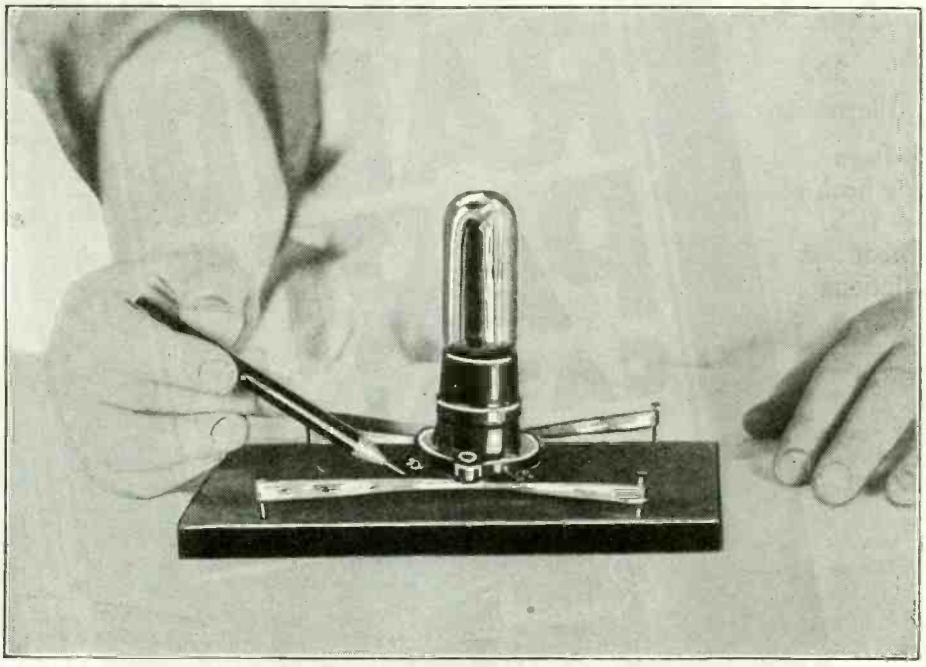
A Home-Made Shock Absorbing Socket for Experimental Work

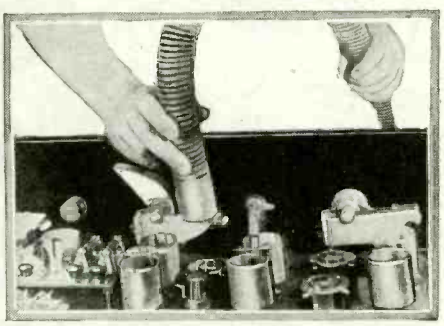
Very often a shock absorbing socket is wanted in a hurry for experimental purposes and one is not available from the usual sources. In such cases it is possible to construct one using an ordinary socket, a few nails and some rubber bands as shown. The nails are driven into a wooden baseboard and the rubber bands are stretched between them, with the socket held at the center, as indicated in the photograph. While such a device would not be desirable as a permanent socket for a radio set, it will serve the purpose exceedingly well for use in home laboratory or experimental work.



The above photo shows how the socket is held in position with rubber bands.

Removing Dust From the Radio Set

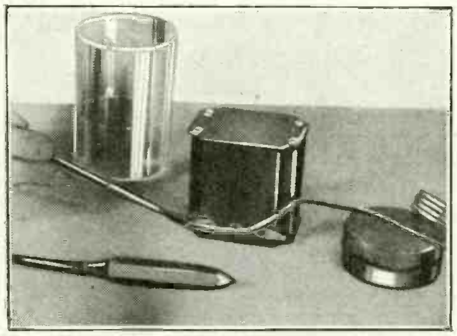
Dust between the plates of condensers and in other parts of the radio set causes losses and also may be the source of noises. The use of an ordinary duster may injure the delicate coils and do more harm than good. A vacuum cleaner can be used for this purpose to much better advantage, utilizing one of the attachments provided for working in small spaces.



The household vacuum cleaner is used to clean out the dust collected between plates of the variable condensers, coils and other parts of the set.

Preventing Open Circuits in Transformers

Correct soldering requires skill, and the knack of doing the work right usually is acquired only after considerable practice. Beginners often experience trouble in soldering connections on the transformer lugs due to overheating of the lugs. This causes the connections on the inside of the transformers to become unsoldered,

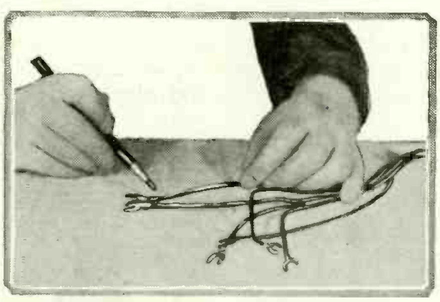


Immediately after soldering, the connection is doused with cold water on a small brush.

thus resulting in open circuits. A method of preventing this trouble is to keep a glass of cold water near the work and to douse the lug with water using a brush as shown immediately after soldering has been completed. This cools the lug off rapidly and in addition helps to set the solder.

Obtaining an Extra "B" Battery Connection from Set Cables

Most cable connectors for radio sets have six or less wires whereas the sets using power tubes require an extra high voltage connection. In a great



After making use of one lead for both the "A" battery plus and "B" negative terminals, the extra lead can be used for the "B" battery positive connection of the added battery.

many receiving sets, however, the A plus and B minus connections are interconnected. If this is the case, one cable lead may be used for both these connections, thus leaving an extra cable lead for the 135-volt binding post.

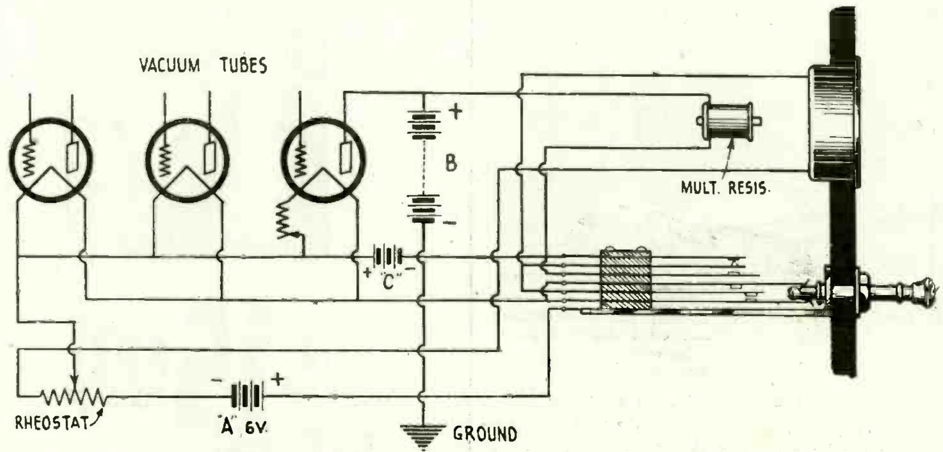
Current-Indicating Devices Used in Radio Receiving Sets

(*Continued from page* 140)

to the left of zero on the C scale. Meanwhile the multiplier-resistance current, from +B, is shunted through the low resistance of the "C" battery, and thence to —B without passing through the voltmeter. Thus it is seen that the voltmeter indicates "C" battery voltage without any appreciable error due to the current through the multiplier.

With this arrangement every operation is logical. No harm can be done the voltmeter or the batteries. The scale readings cannot be mistaken, for the normal position of plug always shows filament voltage if set is operating; pressure with deflection to right always indicates "B" volts; greater pressure and deflection to left always shows "C" voltage; release always results in return to normal. Thus one switch unit and one voltmeter serve for all desired functions and do away with all guesswork as to condition of "A," "B," or "C" batteries, and filament potential. Removal of the plug protects the filaments from being harmed by children through turning on the rheostat to the extreme position.

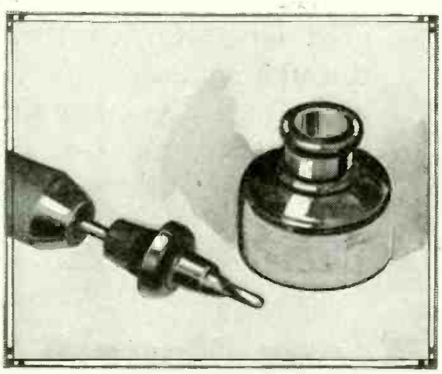
Extreme accuracy in an indicating instrument for vacuum tube service, is unnecessary. However, the relatively great inaccuracies and variable calibration of many other moving-vane instruments, and their high consumption, make them undesirable for radio-set application."



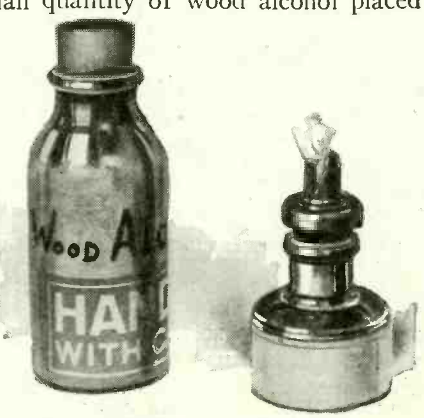
Voltmeter control switch and lock with special jack.

An Emergency Soldering Lamp

Sometimes an emergency alcohol lamp is needed where gas or electricity cannot be obtained for heating purposes. Such a lamp can be made out of an old India ink bottle. The cork and molded cover should be drilled as shown, and a lamp wick inserted. A small quantity of wood alcohol placed in the bottle then furnishes a satisfactory emergency lamp.



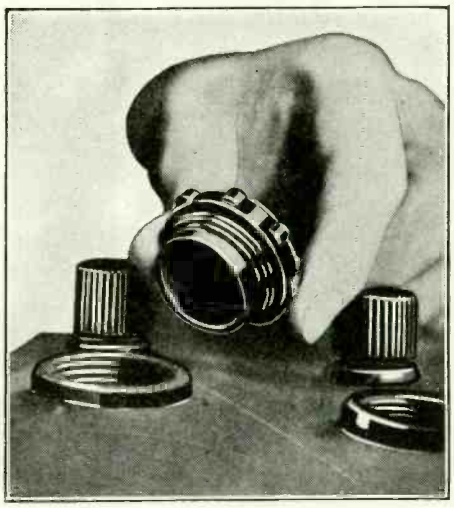
The cork and stopper is drilled.



The completed lamp ready for use.

Remove Vent Caps When Charging Battery

When charging storage batteries, always remove the caps which are at the top of the vents. These caps help to keep the air away from the electrolyte in the battery, thus preventing evaporation during the battery use. During the recharging process, especially where a high charging rate is used, the solution evaporates more rapidly and the caps should be removed so that this vapor can be diffused readily. In some instances, the vapor when mixed with air would be inflammable and if the cap is suddenly removed after charging and an open flame happened to be nearby an explosion might take place. For this reason a match should never be used to examine the level of the electrolyte, especially during or immediately after charge. A small flash light should be used for this purpose.

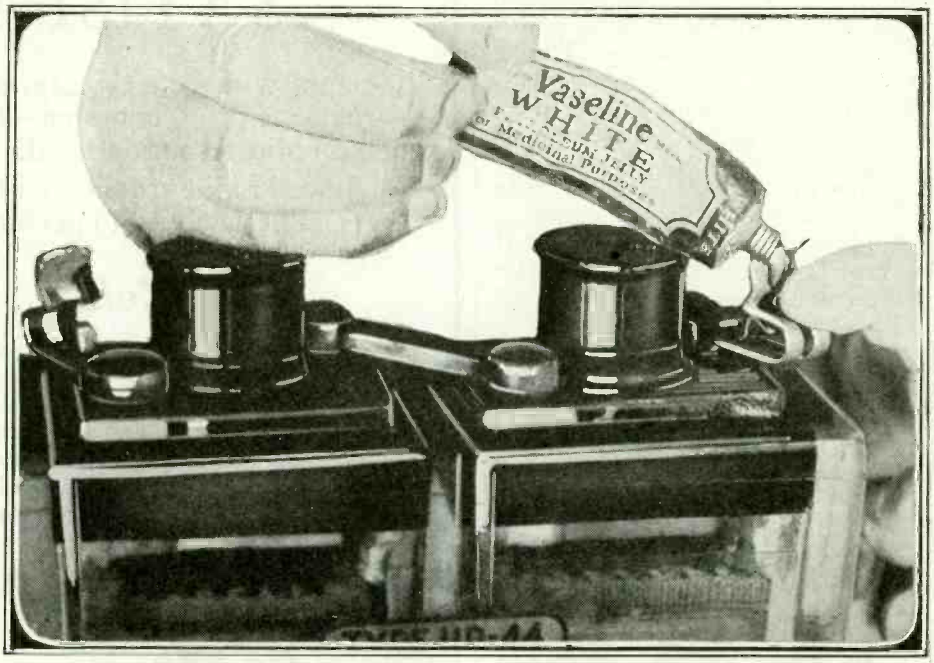


Before leaving the storage battery on charge remove all vent caps.

A BIG DROP IN VOLTAGE

Protecting Storage Battery Terminals from Corrosion

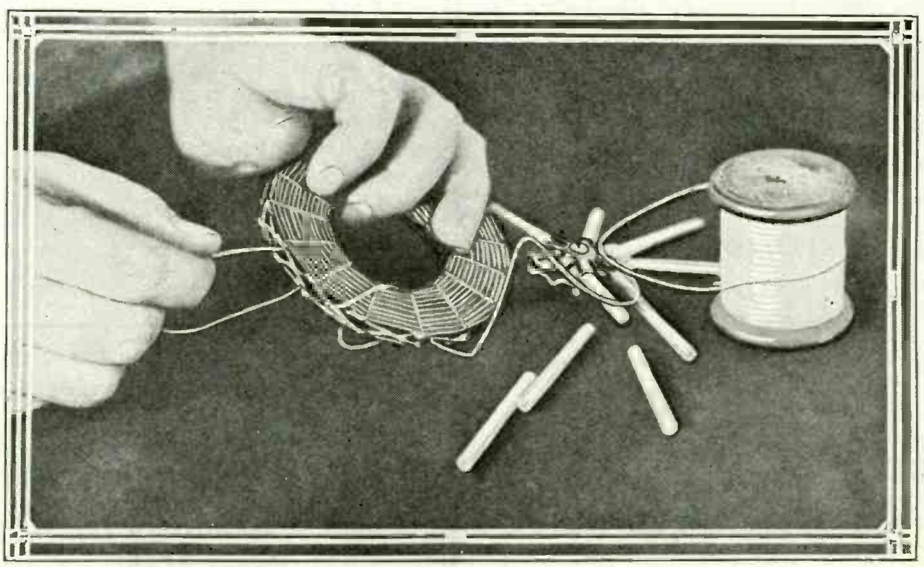
Many radio fans find that after their storage battery has been in use for a short period, a greenish substance gathers about the positive terminal, coming this trouble is to coat the terminals of the battery with vaseline. It is well to put vaseline on the battery clips also as shown in the accompany-



while a smaller quantity of a gray substance forms at the negative terminal. This coating prevents the obtaining of a good contact and must be thoroughly scraped off. The best way of over- ing illustration. The vaseline protects the terminals from the action of the electrolyte and thus prevents the formation of the unwanted substances which make poor electrical contacts.

Bind Basket-Weave Coils With Heavy Thread

In winding a coil of the Lorenz type, it is better to dispense with the use of way to make the coil rigid is to use a heavy grade of ordinary sewing



Lacing a basket-weave pancake coil with thread.

shellac or other compounds which add to the dielectric losses. The simple thread, interlacing it as shown in the accompanying illustration.

The Listeners' Guide D. X. Special

(*Continued from page 77*)

the next lying down, parallel with the panel; the next, at right angles with the panel, and lying down; and the further at an angle of 45 degrees to the panel, lying down. The exact arrangement can be seen in the accompanying photos and picture wiring diagram. As for connections, the outside terminal of the primary of each coil is connected to the plate of the proceeding tube, while the inside terminal goes to the "B" supply through the variable resistance. The outside terminal of the secondary is connected without grid while the inside is brought to the negative terminal.

PARTS FOR LISTENERS' GUIDE DX SPECIAL

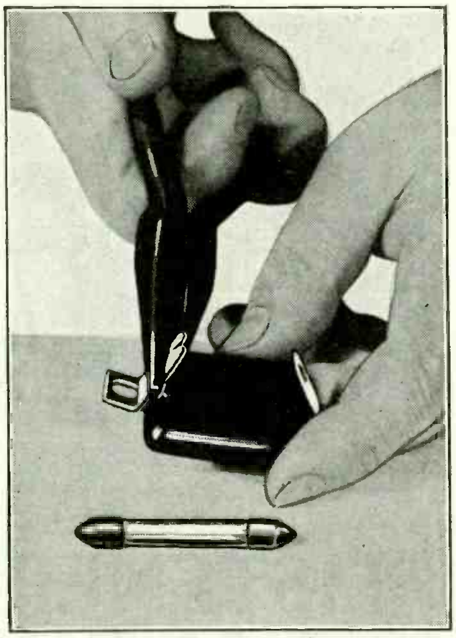
- 4 Special R.F. Transformers, 13, 14, 15, 16; (See text for construction)
- 4 Cardwell, .0005 mfd. variable condensers, 8, 9, 10, 11
- 6 Na-Ald spring sockets, 17, 18, 19, 20, 21, 22
- 2 Ferranti Audio Transformers, 23, 24
- 2 Clarostat variable resistances, 2, 6
- 6 Amperites, type 1-A; 27, 28, 29, 30, 31, 32
- 1 Formica or Radion panel 7 x 30 ins.
- 1 Formica or Radion sub-panel 7 x 29 ins.
- 1 Jones Multi-plug
- 8 Electrad 1 mfd. By-pass condensers, 33, 34, 35, 36, 37, 38, 39, 40
- 1 Yaxley filament switch, 4
- 1 Yaxley single circuit jack, 25
- 1 Yaxley double circuit, filament control jack, 26
- 1 Electrad Grid condenser .00025 mfd. with resistor clips, 12
- 1 Lynch 2 meg. grid leak, 12
- 4 American sub-panel brackets
- 4 Marco illuminated dials
- 100 ft. of Cornish hook-up wire

Other parts used in the construction of this set as shown in the photos are given herewith. All wiring is made with Cornish flexible hook-up wire.

Once completed and installed, the receiver is simple to operate. The four tuning dials should tune to about the same setting for a given signal, and the stations can be logged in the usual manner. However, extreme long distance reception will depend upon the skill and care exercised in tuning the four dials to the exact wavelength, in marked contrast with the tuning of local stations, which will not require such minute settings. The Clarostat controlled in the radio frequency tubes will be found of prime importance in raising the sensitivity of the tubes to the highest point without oscillations. Much of the long distance capability of this receiver depends upon the careful regulation of these controls with positive settings. Thus care must be taken and the process of tuning should be a careful one.

Loose Contact at Grid Leak May Cause Noises

A loose contact at the grid leak may be the origin of troublesome and mysterious noises, often hard to locate. To prevent such troubles, the best plan

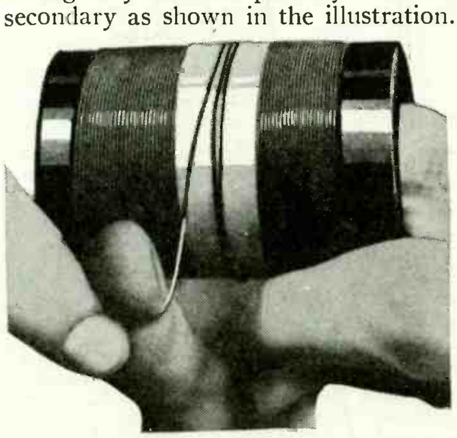


The clips which hold the grid leak should be bent so as to make the leak terminals fit secure.

is to bend the clips of the grid leak holder inward with a pair of pliers, as shown in the accompanying illustration. This will insure a tight grip and positive contact and hence there will be no chance of noises originating at this point.

Winding Radio Frequency Coils

A small coil wound on bakelite tubing may have its primary over the secondary as shown in the illustration.



By winding the primary coil directly over the secondary affords maximum coupling.

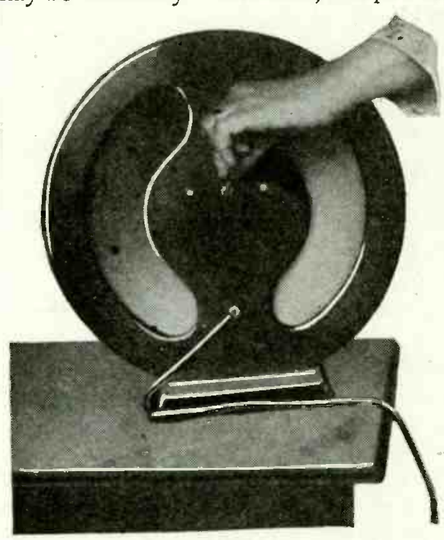
Empire cloth should be used as a separator between primary and secondary to improve selectivity. The photograph shows the primary located about three-quarters of the way from the grid end of the secondary. This position affords maximum coupling.

The ends of both primary and secondary coils can be connected to terminals located at the ends of the tubing. Brass eyelets such as used for fastening papers can be used for this purpose.

It has been found that the solenoid type of coil is extremely efficient in operation and, as a matter of fact, it very often outperforms many of the so-called low-loss type.

Adjusting the Loud Speaker Often Improves Tone

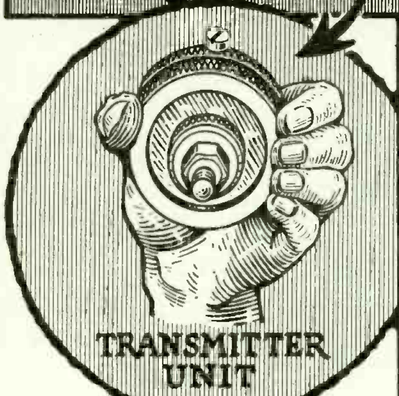
Many speakers have units which require adjustment for best results. Units should be adjusted while nearby powerful stations are being heard. This affords the correct impedance for the heaviest loads, while at the same time the adjustment takes care of the other stations which do not come in with so much volume. When the plate voltage is altered or the grid bias, or both, a readjustment of the loud speaker unit may be necessary. Likewise, if a power



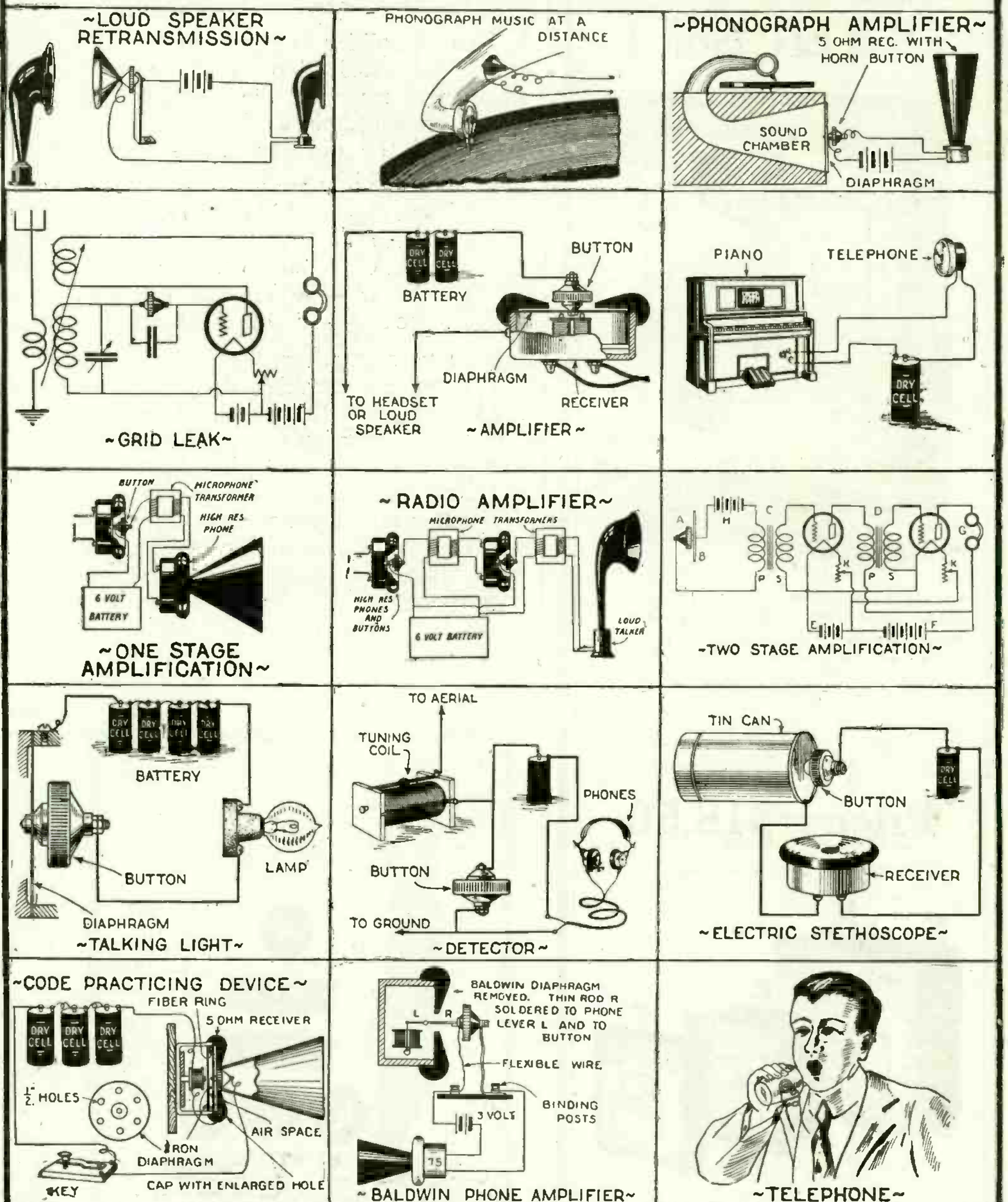
Many types of speakers have an adjusting screw which should be regulated for best results.

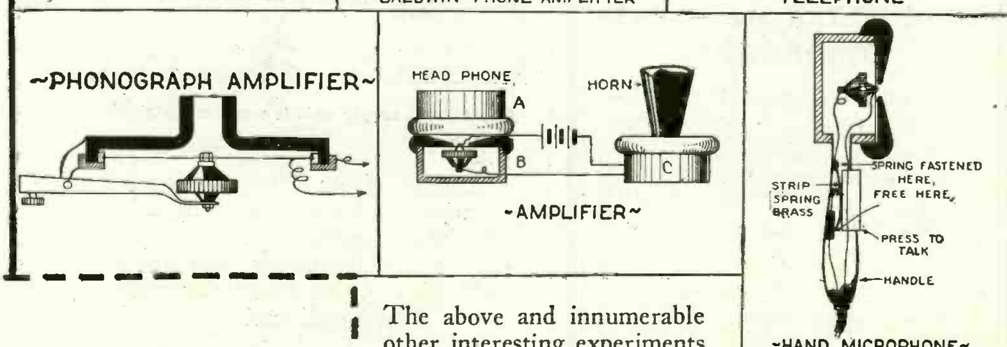
tube is used in place of a non-power tube, it would be necessary to make an adjustment. It should be kept in mind that many units operate better when connected in the circuit with the positive of the unit to the positive output connection. The best way to determine the right connection, is to try reversing the leads until best results are obtained. This trial should be made while a weak or distant station is being heard. Once a speaker is connected and set properly, it need not be altered thereafter, except as tube or voltage changes are made.

Thousands of Radio Fans use these Ingenious TRANSMITTER UNITS!



HERE ARE A FEW OF THE USES FOR THESE UNITS





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R-R-1-'27

The Universal Trans-oceanic "New Phantom" Model

(*Continued from page* 128)

serted in the socket which connects the loop properly in place of the antenna.

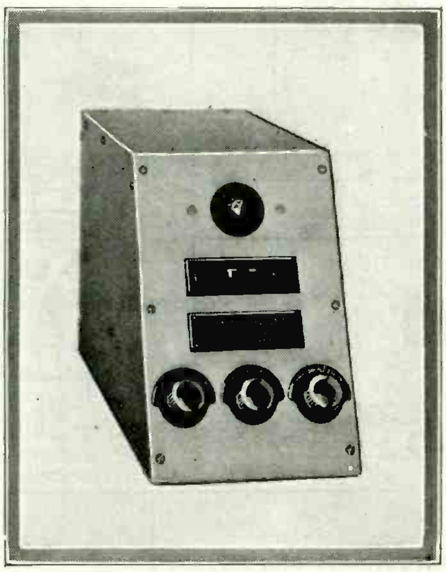
Radio Frequency Amplifier

This amplifier consists of four stages, all tuned. To cover the wide wavelength range all the transformers are interchangeable. The wavelength ranges of the different transformers are as follows:

1 Type C — 50 to 150 meters
2 Type B — 80 to 210 meters
3 Type A — 200 to 550 meters
4 Type AA— 400 to 1200 meters
5 Type BB—1000 to 3000 meters

This wavelength range includes all the broadcast wavelengths regularly used throughout the world, and makes this receiver particularly suited for use in any part of the world.

Using four stages of tuned radio frequency amplification over 16 times the degree of selectivity is obtained than with two stages of tuned radio frequency amplification in addition to giving still greater receiving range and loud signals particularly on distant signals.



The current supply unit is made to match the receiver.

Freedom from regeneration and oscillation is obtained by using a loose grid plate coupling and specially designed radio frequency transformers which give great selectivity without loss of total amplification.

The variable condensers have special shape plates, partly straight line wavelength and partly straight line frequency to give an ideal separation of station over the entire wavelength range. The rotor plates are brass and all soldered together as a solid mass. The stator plates are of similar construction. The entire condenser is contained within a complete metallic shield to retain the condenser field from interacting with the field of the transformers. Each condenser has a maximum capacity of .00045 MF.

A mechanical Universal Joint is provided between each two condensers so that the condensers can be connected together or operated individually as desired. This feature is licensed under Hogan Patent No. 1,014,002.

Special attention is given to the position of the grid and plate leads so they are not located in detrimental positions near the metallic shield.

Detector Circuit

As this receiver has a very powerful audio amplifier special attention must be given to the detector circuit.

If the detector tube is noisy or microphonic, these noises will be greatly amplified and found objectionable.

The UV200 detector has a Tungsten filament which is thick and rigid and not subject to vibration and accordingly will give quiet operation in the receiver. The new UV200A detector has a thin filament, easily vibrated and usually noisy. So called cushion sockets are not to advantage if the audio amplifier is powerful. However the UV200A detector can be used if desired, although the UV200 is preferred. The detector tuning stage is practically the same as the radio frequency stages.

Audio Frequency Amplifier

The audio frequency amplifier is designed to give absolutely distortionless amplification as its output is further amplified by the power amplifier and any distortion present would be immediately noticeable.

Power Audio Amplifier

The output of the audio amplifier is fed into a power audio transformer, and from there to the power audio tube. To secure maximum volume obtainable a UX210 power tube should be used in this power stage with 400 volts plate and 37 volts bias.

To prevent damage to the loud speaker, the high voltage current is isolated from the loud speaker by using an impedance and blocking condenser.

The current supply unit is made in two types, full wave and half wave, both in the same size cabinet and in a cabinet to match the receiver.

One UX216B Rectron is used in the half wave unit and two of these tubes in the full wave unit.

A large power transformer steps the primary voltage of 100 to 125 volts A.C. to approximately 525 volts A.C. where it is applied to the Rectron tube for rectification to pulsating direct current. This pulsating direct current is sent through a filter circuit consisting of condensers and chokes to smooth the pulsating current to a pure direct current so that the pulsations cannot be heard when supplying the receiver.

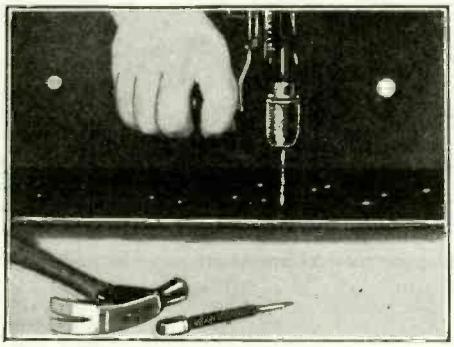
The total voltage of 400 volts direct current is supplied to the power audio amplifier and variable voltages of 100 to 350 volts supplied for the radio frequency amplifier and first audio frequency amplifiers.

A red pilot lamp is lit when the unit is in operation to warn against changing wires without turning the unit off.

In the next issue, the complete constructional drawings, technical details, and all information pertaining to assembling one of these receivers and current supply units will be given.

Use Center Punch Before Drilling Bakelite

The use of a center punch is highly desirable preparatory to drilling bakelite or similar smooth substances. The exact location of the hole to be drilled is first determined and the center punch should then be held carefully in place



Before attempting to drill bakelite use a center punch to mark the hole centers on the surface of the panel.

and tapped with a hammer so that the drill can be placed easily in the dent. This practice insures accurate location of the hole and moreover prevents scratching of the panel often caused by slipping of the drill on the slippery surface where no center punch is used.

"Oh, Gerald! Why don't you tune in some of those lower harmonics that this article mentions? I just love to hear good mouth organ music on the radio!

The Samson "R F C" Receiver

(*Continued from page* 110)

the tuning operations. Since the detector is regenerative and controlled by a variable tickler, the circuit can be made to oscillate very readily if the top center knob, controlling regeneration, is advanced too far. It is best therefore to keep the coupling loose at all times while tuning and to advance the coupling after tuning in a station to bring it in to best advantage. When tuning in distant stations of course the coupling can be tightened (made closer) to a greater extent. A little experimenting with the controls will help you to find the setting best suited under your particular conditions.

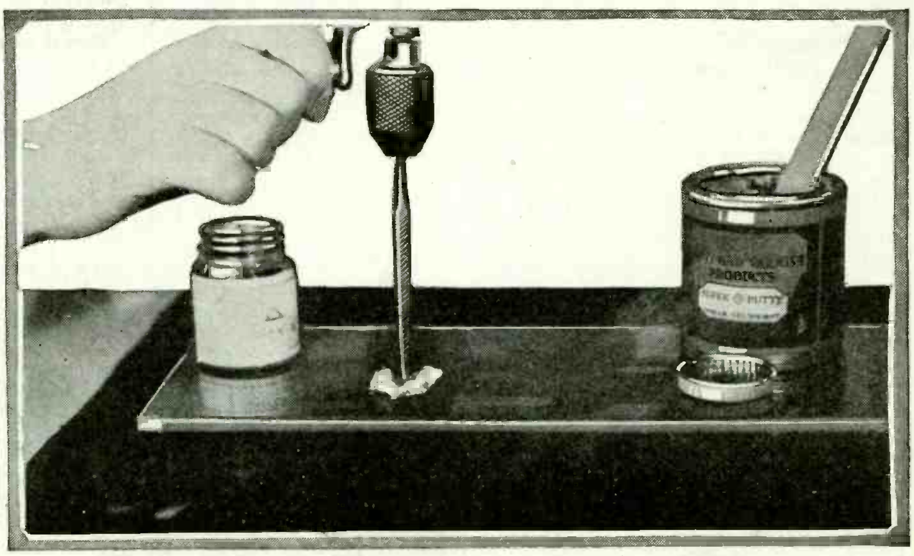
In the second place, the selectivity of the receiver can be controlled by adjustment of the coupling between the primary and secondary winding of the tuned radio frequency transformer tuner of the detector stage. For extreme selectivity, as for instance in cutting thru locals, very loose coupling should be employed. For maximum response when selectivity is not an important factor, coupling can be increased or tightened.

It is well to remember however, that while the coupling can be used as a volume control, it should not be used for that purpose. You will find that it can be used to improve quality of reproduction considerably. If you cut down the energy transfer from the radio frequency stages to the detector by loosening coupling so as to keep the detector from being overloaded and at the same time cut down regeneration you will notice that the low notes come booming in to greater advantage but if you overload the detector, by increasing coupling, you will lose the low notes and lose quality of reproduction.

It is important that the set be properly neutralized, by adjusting the neutralizing condenser, "NC". All that is necessary to adjust this condenser is to first loosen coupling on the regenerative tickler coil so that any oscillation that takes place will be due to the radio frequency circuits of the receiver. Then adjust the tuning condensers thruout their whole range. The neutralizing condenser should be adjusted so that the set oscillates and picks up heterodyne whistles. Then increase the capacity of the neutralizing condenser step by step until the set is at a point just below oscillation at all broadcast wavelengths.

Drilling Glass Panels With Three-Cornered File

A three-cornered file can be used to drill a hole in a glass panel by locking it in the chuck of a hand drill and using it as shown in the accompanying illustration. Putty is placed around the hole so as to form a circular cup. A small quantity of turpentine is poured into this, serving to keep the drilling point of the file well lubricated. This methods insures clean-cut holes.



By forming a small cup of putty for turpentine around the hole, the file will thus be well lubricated while the panel is being drilled.

Correct Microphone Placement is Important

THE proper placement of the microphone in the radio broadcasting studio, is a matter of great importance in the reproduction of musical programs. A considerable amount of experimentation has been carried on and the accumulated data has been carefully compiled. Trials have been made with various musical instruments, placing the microphone at different heights and distances. It has been determined that a microphone placed three and a half feet away from the base of a 'cello and raised to a height of from two to four feet will render excellent reproduction of that instrument. For best reproduction of a violin solo, the microphone should be raised to a height of about two feet above the shoulders of the artist. In the case where a violin and 'cello are playing together, in ensemble, the latter position of the microphone would be unfavorable to the 'cello, which itself may be considered as a solo instrument. It would be practically impossible for a listener to sit near an orchestra and hear all the instruments played with equal volume and audibility. Still the microphone must be placed in an endeavor to do this very thing.

A person seated directly in front of an orchestra, watches the various instruments and has no difficulty in associating a particular sound with the instrument from which the sound is coming. In this case the eye is indirectly aiding the ear. The microphone, however, cannot depend upon the assistance of the sense of sight. The listener at the loud speaker receives no mental stimulation by looking at the horn, although it is a common occurrence for people to gaze into the speaker in an effort to hear better.

It should be kept in mind that it is impossible to reproduce the original sounds exactly and faithfully, no matter how perfect the transmission or the radio set. What the radio listener actually hears depends almost as much on the proper placing of the microphone as on the sounds being emitted before that instrument. In some cases, this works out to the disadvantage of the artist, while in others it operates as a distinct advantage. To illustrate the latter case, the radio by proper placing of the microphone, can be made to amplify and "bring out" a voice pure in tonal qualities but weak and lacking in power. In such a case the reproduction will be superior to the original. An ordinary conversational tone can be made to sound loud and deep chested.

From the foregoing it can be understood, that the study of microphone, placement is important and is worth further investigation and research.

The Regenatrol Receiver

(Continued from page 96)

The condensers should be inspected, preferably with a voltmeter and battery to make sure that there are no short-circuits thruout their ranges.

Rheostats, fixed condensers and Amperites should also be tested.

Mounting the Parts

After all the parts have been tested you can proceed to mount the parts on the panel and subpanel. It will be necessary to mount the bypass condensers and the choke coil before mounting the audio transformers. It is also a good idea to mount the Radiohm before mounting the Unitune.

The rest of the parts can be mounted in any convenient order.

After all the parts have been mounted you can proceed with the wiring of the receiver. The wiring of the receiver can be traced out very easily by referring to the pictorial wiring diagram which shows the relative location of the parts and the general routes followed by the wires in connecting the terminals together.

In wiring the receiver you will find it a good general plan to wire up the positive "A" battery lead first. Then connect the Amperites with their respective filament terminals of the sockets as shown in the diagram. Next connect in the voltmeter tip jacks. Next connect the "G" and "P" terminals of the sockets with the terminals of their associated pieces of apparatus. Then connect the negative "A" battery leads from the multiplug to the switch and thence to the rheostat and Amperites.

Next connect the Multiplug terminals with the proper terminals of the other apparatus and finally fill in the rest of the connections that remain.

The connections are best made by following the pictorial wiring diagram. It is a good plan to fill in, in ink or colored pencil, each connection shown on the drawing as the connection is made on the set. In this way you will be able to tell at a glance which connections have been made and which still remain to be made.

After all the connections have been made the receiver is ready to be put into operation.

Operating the Receiver

The connections of the Antenna, ground and batteries is shown clearly in the schematic and pictorial wiring diagrams. Be sure to follow the color code shown in making the connections to the multiplug terminals and not the color code that comes with the Multiplug itself.

Provision has been made for the use of a UX 201A or UX 112 tube in the last stage by providing additional "B" battery and "C" battery leads to take care of the higher "B" battery and "C" battery voltages required by the UX 112. It is not advisable to use more than 135 volts on the plate of the last tube unless a choke coil output circuit is added to the receiver. The use of higher voltages such as are required for the UX 171 type tube would result in danger to the loudspeaker windings and would also produce distortion.

A UX 200-A Should Be Used As the Detector

Maximum volume can be obtained by using 45 volts on the plate of the detector tube but best results from the standpoint of quality will be obtained by keeping the detector plate voltage down to 22½ vols. A separate "B" battery for the detector stage is advisable but not absolutely necessary.

Best quality is obtained by keeping the energy delivered to the detector at the minimum possible consistent with good reception so use the volume control resistance, No. 4 and the regenerative control to reduce this volume as much as possible without impairing its operation.

The rheostat control should not be used for tuning or as a volume control. It is accordingly placed inside the cabinet on the subpanel where it can be adjusted at the beginning of the program and then left at that setting for the rest of the program.

The wavelength adjustment in tuning from station to station is obtained by adjustment of the two variable tuning condensers of the two condenser tuning unit, No. 3. Adjustment for volume and clarity of reproduction is made by means of the Radiohm No. 4 and the tickler coil of tuning unit No. 1.

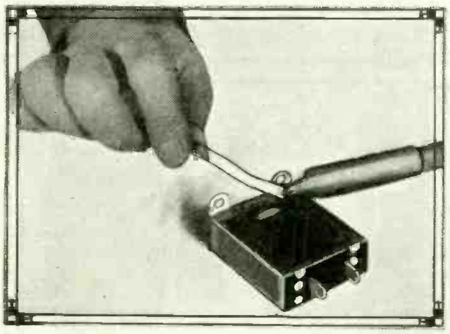
Simplified Control

The tuning condensers can be moved one at a time or together depending on whether pressure is exerted on the individual drums or on both at the same time. You can get a rough adjustment by moving them together and then clear up the signal by individual adjustment of each condenser to the best point of operation.

The tuning is so simple that a few minutes at the controls are all that are necessary to give you the necessary experience in tuning the set.

Care in Soldering Condensers

Very few people seem to realize what a delicate piece of apparatus a fixed condenser is. Those who have taken this useful little device apart know that it contains layer upon layer of very thin waxed tissue paper coated on either side with tin foil. Naturally,

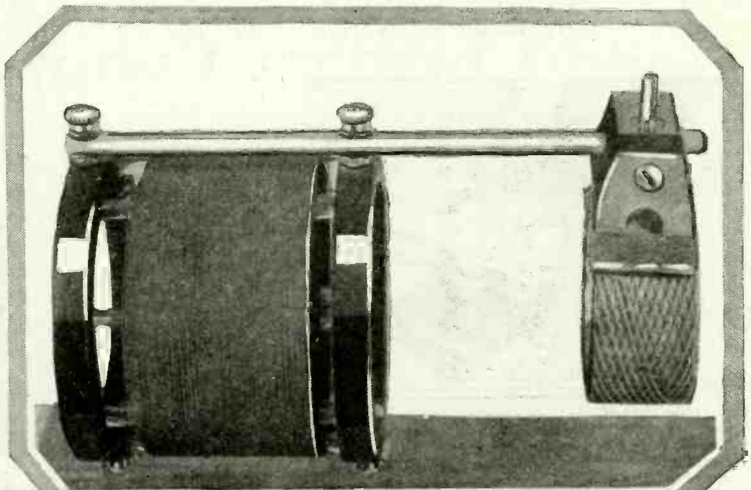


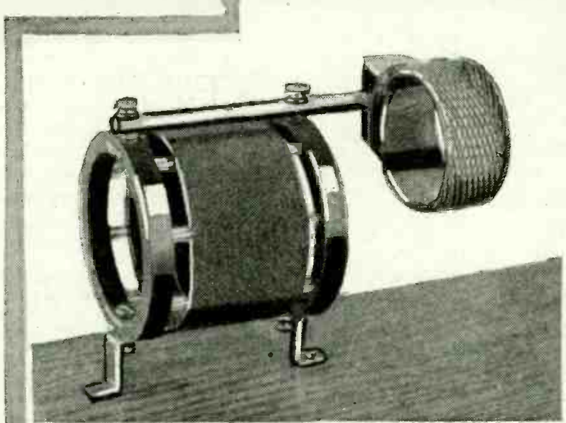
Great care should be taken in soldering connections to fixed condensers, especially to the metal casing. The condenser contained in the metal casing consists of layers of tin foil and wax which is apt to melt if too much heat is applied.

it would be a very foolish thing to lay a red-hot soldering iron on such a piece of apparatus as the constructor is shown doing in the accompanying illustration. The heat of the iron would undoubtedly go through the tin case, melt the wax on the tissue paper and thus lead to a breakdown in the dielectric of the condenser.

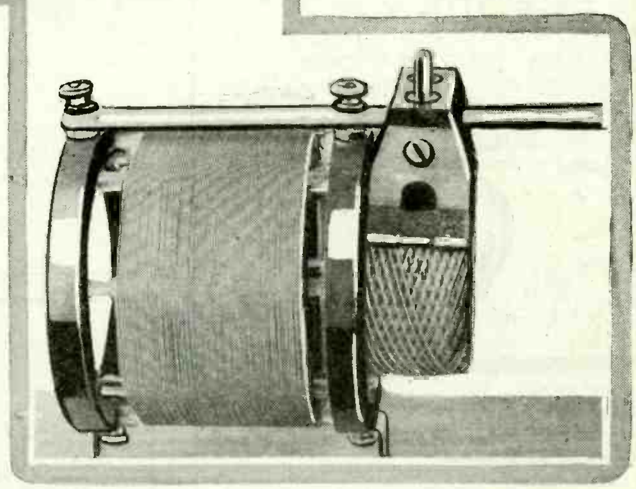
A Home-Made Aerial Coupler

A very efficient coupler suitable for use as an aerial coupler or in a wave trap may be constructed from an old coil form and a twenty turn honeycomb coil. The form itself is made of two bakelite end rings and eight glass rods supported between the end rings. About sixty turns of No. 26 D. C. C. wire are wound on the form to serve as the secondary. This is illustrated in Fig. 4. A dowel pin is fastened to the top of the coil by small bolts as shown in Fig. 5. The method of mounting on small brackets, is also shown in this illustration. Fig. 1 shows the way in which the honeycomb coil is mounted. Figures 1, 2 and 3 show various ways in which the coupling between primary and secondary may be varied from closest coupling, shown in Fig. 3 to loose coupling in Fig. 2.





Above, Fig. 1, is shown the home-made aerial coupler with a primary at the far end of the dowel pin but in the same plane. At the left, Fig. 2 the primary coil is shown swung away from the other coil so as to make the coupling very loose. Below, Fig. 3, tight coupling is obtained by bringing the primary close to the other coil.

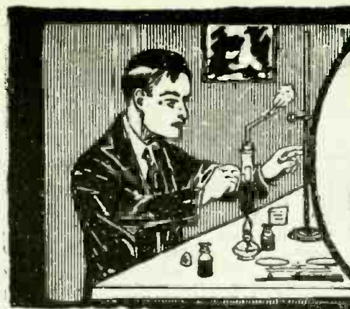


There are several features connected with this aerial coupler which recommend it to the radio builder or experimenter.

First of all, it is easy to construct. Second, it is made out of old apparatus and hence is cheap. Third, it has a very wide range of coupling, as can be noted by referring to Figures 1, 2 and 3.

Another feature of especial interest to the experimenter is the fact that the honeycomb coil may be removed very easily and replaced with one having a greater or a lesser number of turns.

In using the home-made aerial coupler as a wave trap wind sixty turns of No. 24 D.C.C. wire on a 2½ inch form. Use a ten turn honeycomb coil as the primary and connect this in series with the aerial and ground leads



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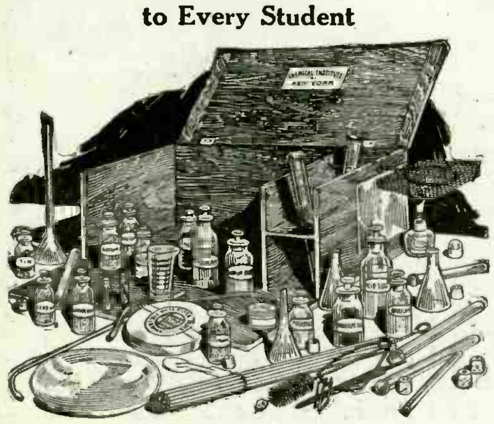

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RLG-Mch. 27

and in parallel with the "Aerial" and "Ground" binding posts of the set. Connect the secondary, that is to say, the 60 turn coil, in series with a .0005 mfd. variable condenser. The undesired signal is tuned in on the wave

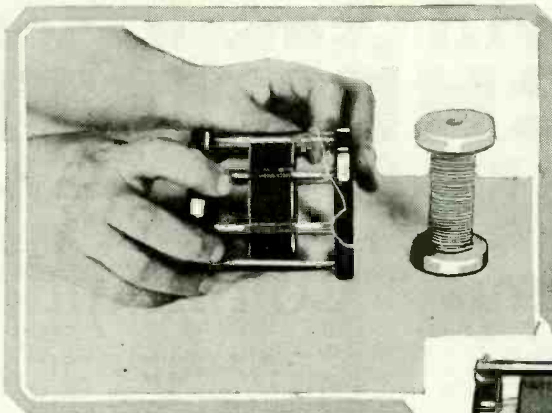


Fig. 4, at the left, shows how the secondary coil is wound. The form used consists of two bakelite end rings and eight glass rods supported between the end rings. About 60 turns of No. 26 D.C.C. wire are wound on the form to serve as a secondary.

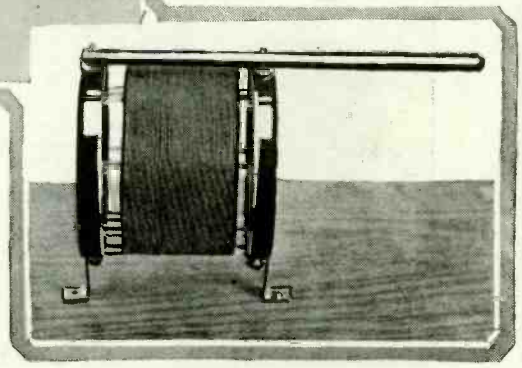
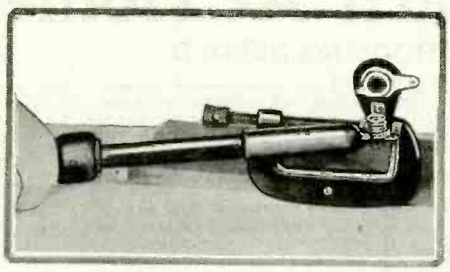


Fig. 5, at right, shows how the dowel pin is fastened to the top of the coil by small bolts. This photograph also shows the method of mounting the coil on small brackets.

trap and thus prevented from reaching the input of the receiving set.

Using a Small "C" Clamp as a Vise

A "C" clamp comes in handy as a vise, especially where very small work is to be handled. The clamp is fastened to the bench by a wood screw and

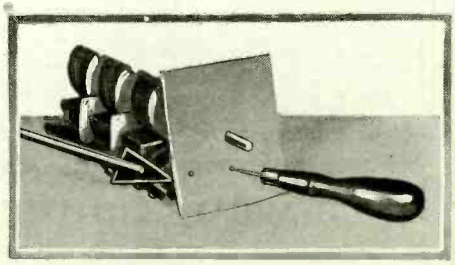


"C" clamp used as a vise for small work.

then can be used just like an ordinary vise. The illustration shows a "C" clamp used in this way while a panel light socket is being soldered.

Making Your Own Condenser Template

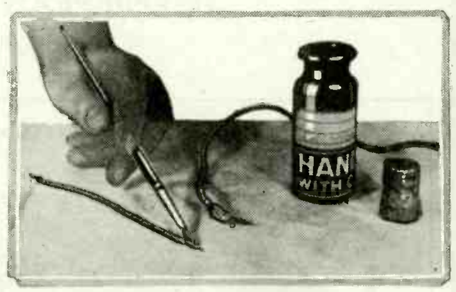
In case the condenser manufacturer has failed to furnish a template for mounting on the panel or where the template has been lost, it is an easy matter to make another one out of a piece of cardboard. A hole is punched or cut in the cardboard for the shaft and other mounting holes are marked as shown in the photograph with an awl.



Home-made condenser template.

Preventing Frayed Wire Ends

Where cotton-covered wiring is used, the ends of the wire usually present a frayed appearance as shown by the wire at the right of the photograph. A

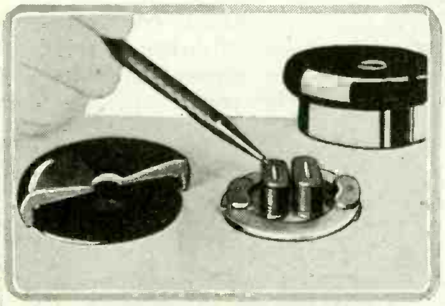


Collodion may be used to prevent fraying of cotton insulation.

few drops of collodion painted over the ends of the wire, immediately after the insulation has been stripped off will give the end a neat appearance and prevent the objectionable fraying. This can be seen by referring to the wire shown at the left directly below the brush.

Repairing Bent Diaphragm

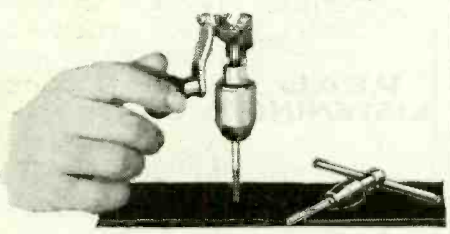
Many loud speakers and head sets are not designed to handle the high voltages used with the new power tubes. In some cases the increased magnetism exerts such a strong pull on the loud speaker diaphragm, that the diaphragm is permanently bent into a concave form. This may be repaired by a simple remedy. Take the cap off the unit and reverse it and the magnetism will draw it back into its original position.



The diaphragm is bent concave and touches the magnet poles when overloaded. This causes rattling. The diaphragm is given new life by reversing as described herewith.

Tapping Holes for the Rush Job

The illustration shows a method of speeding up the work of tapping a hole in a piece of bakelite. The tap has been removed from its customary holder and placed in the chuck of a breast drill.



The tap is placed in the drill chuck in order to speed up the work.

ANNOUNCEMENT

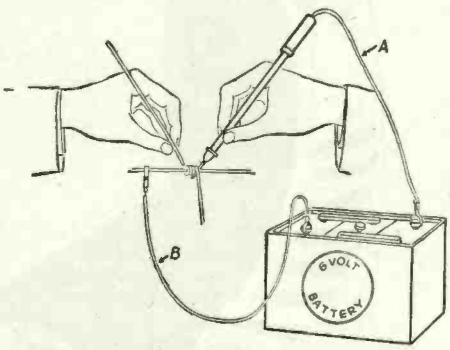
$200 Set Building Contest

Due to the multitude of entries received from contestants just before going to press with this issue, and in order to give due consideration to all entries up to the closing hour of this contest, photos and descriptions of the prize-winning sets will be published in the Summer edition of Radio Listeners' Guide & Call Book.

The Gentle Art of Soldering the Radio Set

(*Continued from page* 101)

as rosin cannot remove this material in the quantities that will be experienced. Exercise care in soldering rubber insulated hook-up wire as this insulation may melt and run into your joint. Soldering will be very difficult if it does. Heavily oxidized or dirty metal surfaces should be cleaned thoroughly with a file, sand paper, or scraper before any attempt be made at soldering. This is done to prevent the overburdening of the de-oxidizing agent of rosin.

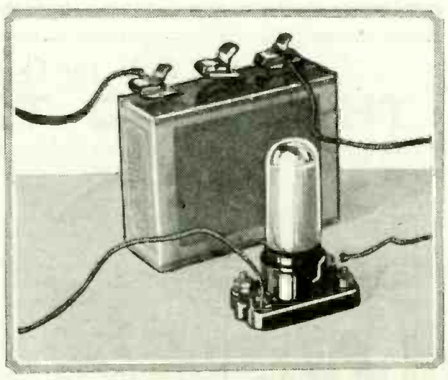


The method of using the welding soldering iron as shown in the photo at the heading of this article. Connect wire A to one battery terminal. Connect one end of separate wire B to other battery terminal. Connect other end of wire B to part being soldered, as shown in illustration. Apply solder and point of iron to part you wish to solder. The point of the iron will become red hot immediately. As soon as enough solder is on part being soldered take away solder and iron.

By following these simple instructions on the use of rosin core solder you will eliminate all possibility of rosin joints and you will be agreeably surprised at the ease with which solder protected connections are formed on your receiver.

A Tube Rejuvenator

A "C" battery may be used as a tube rejuvenator for a dry cell tube by connecting the filament of the tube to the

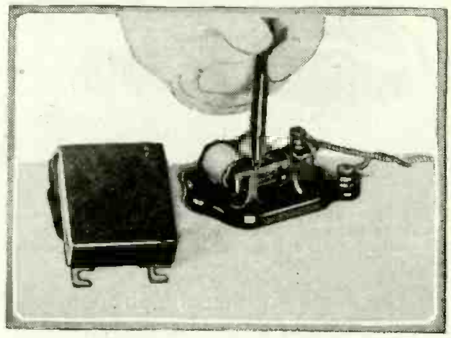


Connect the filament terminals to a "C" battery and leave on for several hours.

battery and leaving this on for several hours. No plate battery should be used. It is claimed that this method of rejuvenation has the effect of bringing the thorium to the surface of the tungsten filament, thus resulting in much greater and more rapid emission of the electrons from the filament.

Small Condenser Prevents Buzzer Sparking

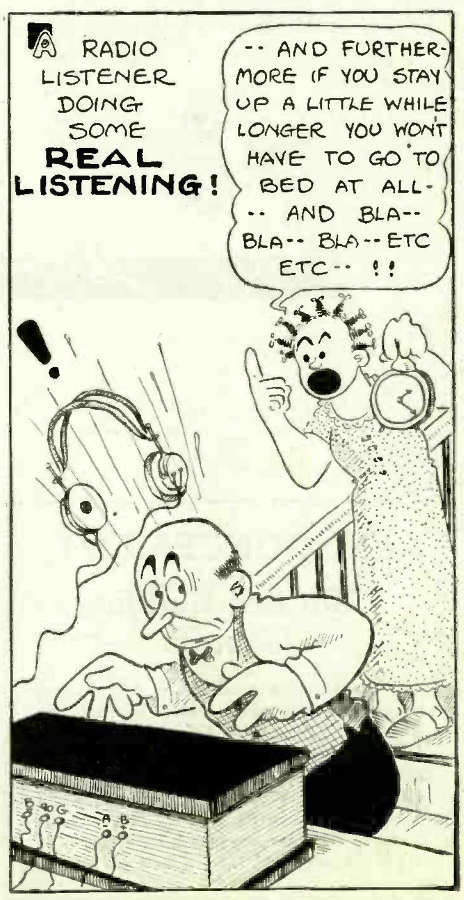
A small condenser connected between the make and break of the ordinary electric bell prevents sparking and thus keeps the contact points from



When a spark occurs at the contact points of the house buzzer a 0.1 mfd. condenser is connected across them.

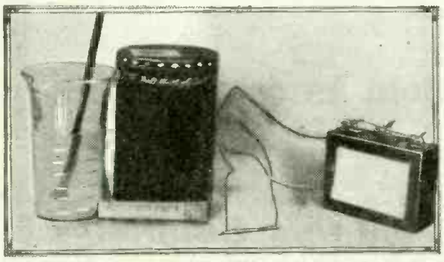
burning out. The condenser shown has a capacity of 0.1 mfd., although almost any small capacity condenser may be used for this purpose.

The noise in many radio sets can frequently be traced to the sparking of the door buzzer, and by connecting the condenser as explained above, this noise can be eliminated.



A Simple Chemical Polarity Indicator

A piece of red litmus paper moistened in a solution of salt and water makes an excellent polarity indicator. The two ends of the wire leading from the battery to be tested are held upon the ends of the strip of litmus paper

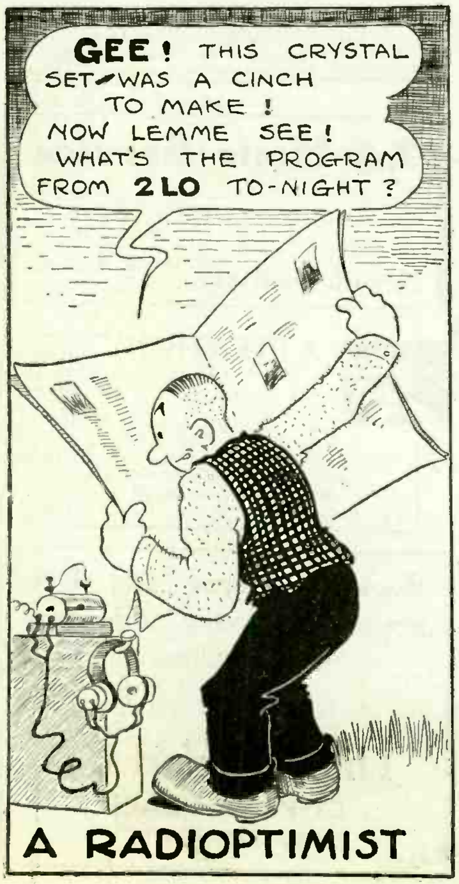


By immersing a strip of red litmus paper in a solution of salt water and touching the leads from a battery to it, the polarity of the leads will be indicated as explained.

as shown. The end of the litmus paper upon which the negative terminal rests will turn from red to dark lavender.

This test is a very positive one, and it is impossible to make a mistake such as might be the case where the polarity was determined by the observing bubbles around a negative terminal in a liquid solution.

This polarity indicator comes in very useful in determining the positive and negative terminals of batteries, etc., where there are no means of distinguishing their markings.



The R. G. S. Receiver

(*Continued from page 87*)

This tube requires that the grid return be connected direct to the negative filament terminal of the tube, thus giving greater sensitivity with less noise. When using tubes of the UX 199 or UX 201A type as detectors, it is important that the grid return be connected with the positive "A" battery lead.

The Batteries

For storage battery tubes, a 6-volt storage battery should be used. With dry cell tubes, the filament supply source should be a 4-volt storage battery or three dry cells giving a voltage source of 4½ volts. A eight ohm rheostat should be used with the dry cell tubes.

A separate 22½-volt battery should be connected as shown for the detector. Three 45-volt "B" batteries giving a total block of 135 volts should be used for the amplifier stages and connected as shown in the wiring diagram.

A negative "C" bias of 4½-volts should be connected as shown for tubes Nos. 1 and 2. When using 135 volts direct on the plate of the power tube, an additional 22½-volt "C" battery should be connected in series with the 4½-volt "C" battery to bias the grid of the power tube, thus making a total of 27 volts on the grid of the last tube. Greater distance and even sharper tuning can sometimes be had by reducing the—4½ C tap to—3 volts and increasing the 90 volt "B" Battery tap to 112 or aonther. Slight additional adjustment to compensate for any difference between the two condensers which are even 135 volts. Instability and a tendency toward oscillation may make these changes undesirable in certain cases.

Operation of the Receiver

After the batteries, loudspeaker, antenna and ground have been connected and the tubes inserted into their proper sockets, the set is ready for operation.

The antenna tap switch should be set on the third switch point. This can be varied later one way or the other to make due allowance for size of aerial. Set the "Intensity" knob which controls volume about 1/3 the way on and the battery knob about three-quarters on near the full-on position.

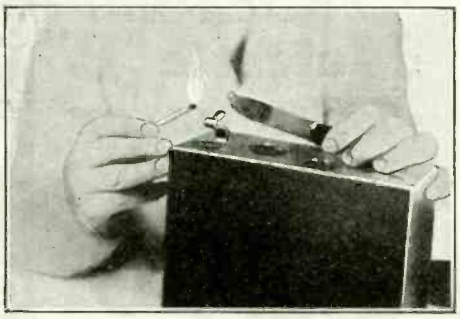
Set both tuning condensers at zero and the midget condenser half way in, and then begin varying the tuning condensers in step with each other up the scale tuning in the stations one after another. Slight additional adjustment to compensate for any difference between the two condensers which are connected together may be made by means of the midget condenser. It will be found that in congested districts, best results will be obtained by setting the antenna knob on position 2 or even 1, thus shortening the antenna and sharpening tuning. For the more distant stations higher wavelength stations however, more volume and distance range will be obtained by increasing the length of the antenna by setting the knob on the higher numbers and thus increasing the number of turns of the primary winding of transformer "T1" in the antenna circuit. When set on the higher numbers, the selectivity will suffer somewhat, especially at the low wavelengths.

When the antenna switch is varied, a slight readjustment of the first stage tuning condenser is necessary to compensate for the difference in the characteristics of the antenna circuit caused by varying the number of turns in the circuit. The higher the antenna tap, the lower the setting will be on the single tuning condenser below the proper setting given by the double tuning condenser.

If the "Intensity" or volume control adjustment is left too high, a moderately strong station will choke up the tubes and produce a "buzzing" sound. This causes no damage and can be overcome by merely turning down the "Intensity" knob to the left, i. e. counterclockwise.

Repairing "B" Batteries with Sealing Wax

Very often the top of a "B" Battery will be received in a cracked condition or it may be so damaged at home by



Sealing wax is applied to repair "B" battery.

being dropped. In any event, this permits rapid drying out of the battery with consequent rapid drop of voltage and loss of power. The remedy is to seal up the battery as soon as possible, using sealing wax as shown in the illustration. A neat and effective job can be performed very readily.

It is important to keep chemicals within the cells of dry batteries moist if long life is desired. The batteries themselves should be located in a cool, dry place so that external conditions will have as little effect upon the chemical action within the cells, as possible.

ASLEEP AT THE SWITCH!

"Hard" and "Soft" Types of Detector Tubes

By Roger Williams

THE gas-filled, or "soft," tube, used as a detector, is undoubtedly the most sensitive for this purpose; but, for ordinary receiver operation, this sensitivity is more than outweighed by the following serious disadvantages:

The gas-filled detector tube is always more or less critical in the adjustment of filament current and plate voltage. The older types were extremely critical in these respects; so much so that only a well-trained radio technician was able to employ them to advantage. The later types, developed from these earlier tubes, while doubtless constituting a great improvement, have by no means overcome this defect. Filament adjustment will be found more critical than with the "hard," or high-vacuum, type of tube. The plate battery adjustment, likewise, will be found quite critical, especially with regard to the residual, or "background" noise.

Test By Reproduced Speech

All soft detector tubes have a "background," which is extremely noisy compared with that of a hard tube. This background is not usually disturbing during the reception of rather loud speech or music, but shows its disagreeable effect as the received signal grows weaker. This is just the time when we wish the detector tube to function at its best, as we do not need an especially sensitive detector for *local* reception. A careful comparison of a hard tube with a soft one, made when one is listening to a voice which is just understandable, will show that it is much easier to follow the speech when the hard tube is used. Since what we desire is to understand and enjoy our broadcast reception, it is of no avail to make an extremely loud noise in our receiver or loud speaker, if this noise does not consist of intelligible speech or music.

All gas-filled tubes are unstable in operation. They require a considerable period of time to reach a comparatively stable operating condition. That is to say, when the tube is first lighted, it will be found necessary to make frequent adjustment of the rheostat until the tube has thoroughly "warmed up." This "warming" of the tube usually means the vaporization of certain alkaline metals which do not aid the operation of the tube until they are changed into a gaseous state by the heat of the filament; and this operation takes time. Furthermore, any changes of battery voltage, made while the set is operating, will upset the so-called "condition of equilibrium," which had been previously reached, and thus necessitate readjustment of the filament rheostat to restore this condition. This lack of *stability* is also shown during the reception of strong local signals, which frequently disturb the balanced condition of the soft tube and result in distortion of the signals.

Effect of Reduced Impedance

The gaseous tube has a rather low input impedance; that is, it acts like *a low resistance in shunt* with the circuit connected to it. With the untuned-radio-frequency circuits used in older types of receivers, this effect was not a serious drawback, since these circuits were already of high resistance; but with the modern receiver, employing tuned-radio-frequency amplification, it constitutes one of the most serious disadvantages of the soft tube.

Today, with the multiplication of broadcast stations, an extremely high degree of selectivity is demanded, and anything which tends to lessen a receiver's selectivity constitutes a serious disadvantage for the user. When a gaseous tube is placed in the detector socket of the modern tuned-radio-frequency set, it will be found that a moderately strong station, which perhaps had been heard over only 5 degrees of the tuning dials before the insertion of this tube, will now cover 10 to 20 divisions. The reason is that the connection of the soft tube to the preceding tuning circuit has been equivalent to the introduction of a resistance in shunt with it. This causes the circuit to change from a "low-loss" to a comparatively "high-loss" circuit, and accordingly broadens the tuning of the receiver. Therefore, the mere possession of increased sensitivity, by the use of a soft tube, by no means implies superior performance when it is placed in the type of receiver which is most common today. The above explanation gives an idea why the hard tube will usually out-perform the soft type, when used as a detector.

A New Hard Detector

There is a tube which not only is free from the above-mentioned disadvantages, which are inherent in the soft tubes, but also possesses distinct improvements over the regular all-purpose type of hard tube; namely, a special internal construction to prevent mechanical vibration of the elements, and a mutual conductance 25% greater.

In this tube we have a special detector built for its task, with the following features: non-microphonic, high input impedance, non-critical, sharp-tuning, quiet background, high mutual conductance, perfect stability, and maximum sensitivity consistent with these requirements.

This special tube may be substituted in *any* set which uses a 201-A-type tube as a detector, without change in

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connections. The "B" battery lead marked "B+Det" should be connected to give from 67 to 90 volts, when this tube is used with transformer- or impedance-coupled amplifiers, and from 90 to 135 volts for use with resistance-coupled amplifiers.

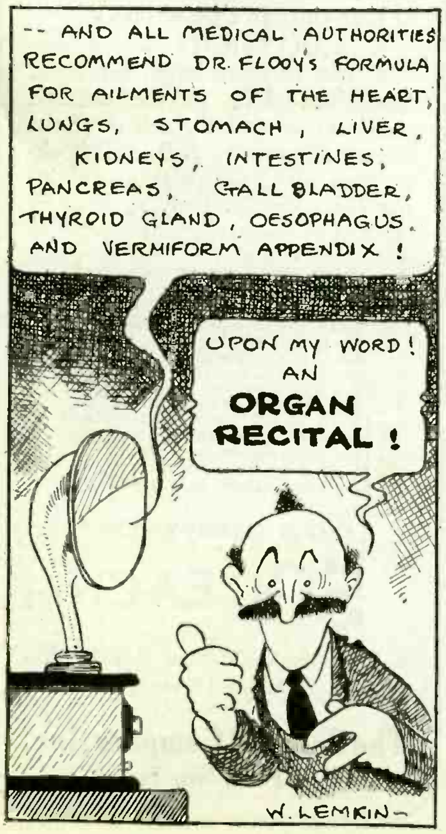
The degree of improvement to be expected from a substitution of the new tube for the all-around type will depend upon:

The type of circuit used—Especially good results are to be noted with non-regenerative types, such as the standard superheterodyne, tuned-radio-frequency, and various older circuits of this type.

The transformer used to couple the tube to the succeeding audio-frequency stage—The higher its primary impedance the greater the gain noticed. As this same feature (high primary impedance) is to be found in all good modern transformers, because it is one of the qualities necessary to reduce distortion, the better the transformer used, as a rule, the greater will be the gain noticed on substitution of the new tube; with impedance and resistance couplings, it is very marked.

The plate voltage used—Rarely will less than 67 be needed, and values from this upwards should be tried out. With resistance coupling, values from 90 up will usually be found best. *The tube cannot be damaged* by voltages below 150.

The strength of signal received—The weaker the signal, the more improvement will be noticed with this tube. Strong local signals should not be used to determine the sensitivity of a tube, as they may be powerful enough to overload it.



A Simple Wave Trap and Clarifier

(*Continued from page* 119)

The wave trap may be connected in series with the set as shown in Figure 1 or it may be connected in parallel as shown in Figure 3. Figure 4 shows a third method of connecting it. In

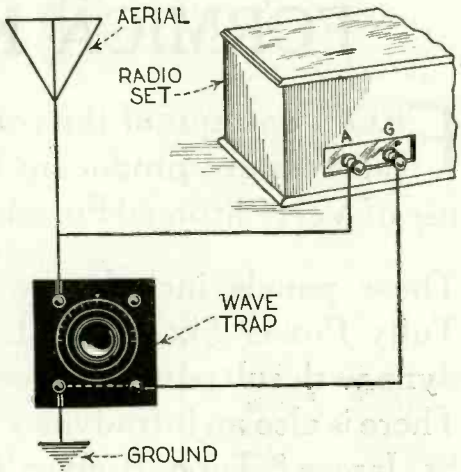


Fig. 3. Diagram showing wave trap connected in parallel with set.

this latter, the Variocondenser is cut out of the circuit. The builder may experiment with these various circuits, choosing the one which seems to give him the best results.

The use of this wave trap in many cases seems to give the radio set a clearer tone. This may be due to the tuning out of the heterodyning effect on stations which are operating on closely adjacent wave lengths.

The radio fan will find the wave trap very easy to build and still easier to

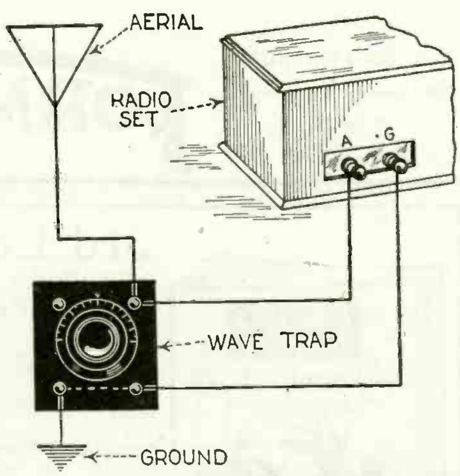
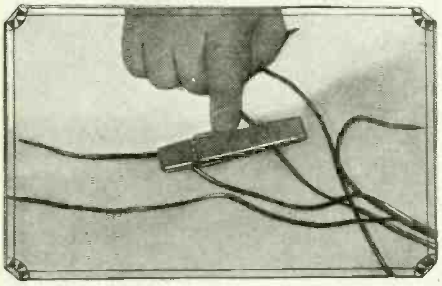


Fig. 4. A third method of connecting wave trap to the set.

operate. It will help him to get distant stations while local broadcasting is going on and when it comes to the separation of interfering local stations, the wave trap will be found to be a source of never-ending satisfaction.

Wooden Clothes Clips for Wire Markers

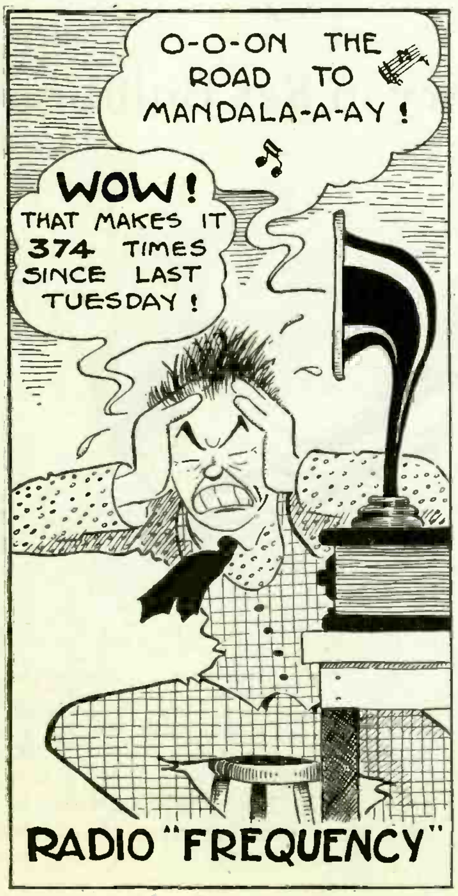
The worker in the home laboratory is often called upon to mark battery leads or leads coming from the radio set. The practice of using pieces of paper for this purpose is a poor one since the papers tear easily and thus



The clothes clip is marked and attached to the wire in order to identify it.

become removed from the wire. A much better plan is to purchase a supply of wooden clips such as used for hanging coats or trousers and clip these on the ends of the wires as shown in the photograph. As the clip is fastened on the wire, it may be marked either directly with a lead pencil or a small marked sticker may be pasted to it.

While this suggestion may seem a crude one since the clips on wires would be somewhat clumsy, nevertheless they also provide a means of changing the markings of wires quickly.



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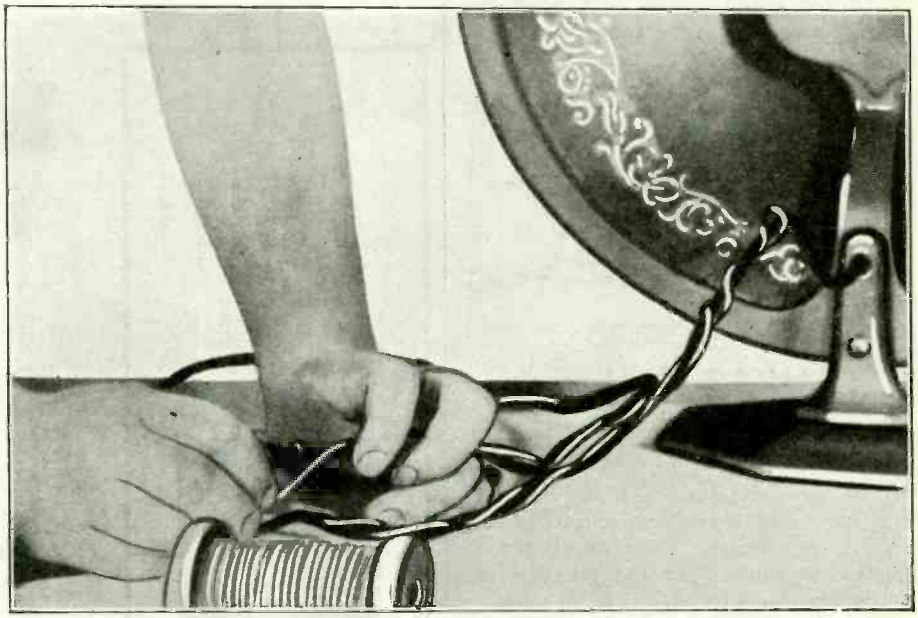
See page 188.

Eliminating Loud Speaker Noises

Noises are often caused in the loud speaker due to induction between the loud speaker cord and the circuits in the radio receiving set. This interference can often be reduced or entirely eliminated by winding a piece of magnet wire about the outside of the cord as shown. The copper wire acts as a radio frequency shield thus protecting the speaker from the stray currents likely to set up extraneous noises.

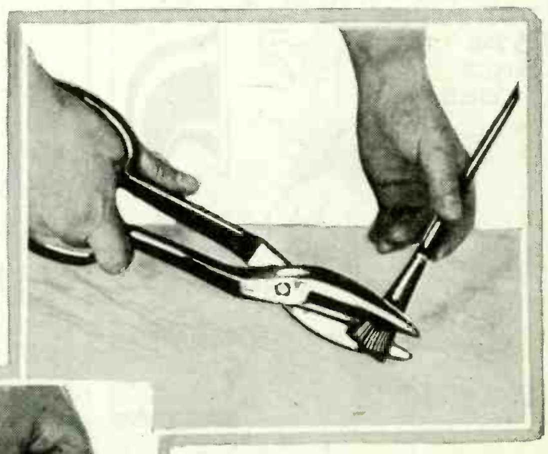


Magnet wire wound around outside of speaker cord helps to reduce noises.

Sometimes a noise will be noticed in the speaker, due to placing it in a certain position relative to the set. The remedy for this is to move the speaker until the noise disappears.

Clean Parts Necessary in Set Building

The parts that go into the home constructed radio set should be free of dust and dirt before being installed. An ordinary paint brush, clipped off about half-way as shown in Fig. 1 makes a good stiff brush to clean out dust and other foreign matter. The ordinary brush is not stiff enough and simply slides over the work without accomplishing the real purpose. Fig. 2 illustrates the process of cleaning a rheostat before installation on the panel.



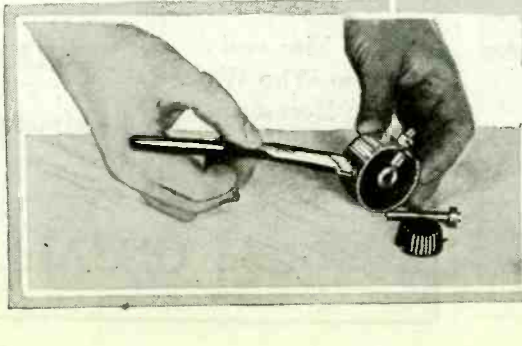
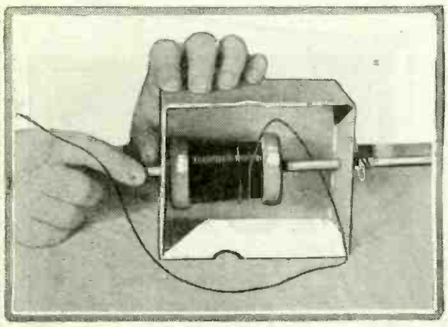


Fig. 1. The bristles of a brush are clipped off as shown above.
Fig. 2. A wire type rheostat being cleaned at the left.

Holder for Wire Bobbin

In winding coils with fine wire, it is best to mount the bobbin as shown in the illustration. A cardboard box and a rounded piece of wood to serve as a shaft complete the outfit. The wood used may be a dowel pin. The two

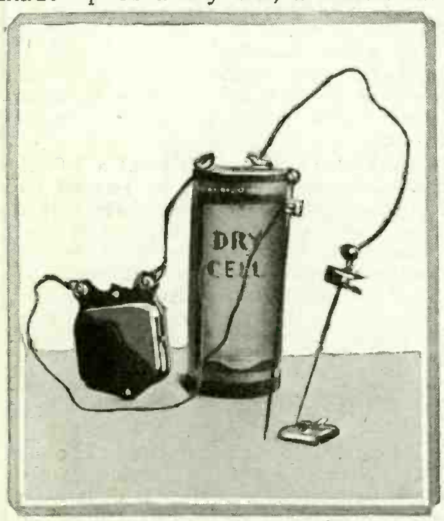


A stand for mounting the bobbin of magnet wire.

sides of the box serve as the bearings. Wire pins are used to prevent the shaft from slipping at either end. The use of such a bobbin prevents the fine wire from becoming tangled while being wound.

A Simple Test Set for Locating Troubles

A testing set of simple construction is shown in the photograph. This is made up of a dry cell, a buzzer and



The above photo shows the complete test set consisting of an ordinary electric buzzer, dry cell, hat pins, clips and flexible wire.

two hat pins. The wiring is connected to the hat pins by wire clips. The long pins enable one to reach hard-to-get-at places, while the pointed ends afford a means of piercing through insulation where this is necessary. A head-set may be substituted for the buzzer, if so desired. A short-circuited fixed condenser will produce a click in the head set everytime the terminals are touched with the hat pin. If the condenser is O.K. only one loud click will be heard and thereafter clicks become weaker as condenser is charged.

The Shielded Hyboy Superheterodyne

(*Continued from page* 114)

tubes, thus producing maximum results at a minimum operating cost. The circuits are designed to reduce the number of connections required to an absolute minimum. Wherever possible the grounded parts of the circuits have been connected to the shielding, thus placing those parts at ground potential and providing a means of making the connections between the parts through the shielding rather than through the use of wire connectors.

The parts on the wiring and terminals that are connected to the shield have been indicated on the wiring diagram by heavy lines. UX 201A or CX 301A tubes may be used throughout with the exception of the second detector tube and the last audio tube. The detector tube should be a UX 200A or CX 300A and the grid return connections have been arranged for that type of tube. If a UX 201A or CX 301A type of tube is used as the second detector, the grid return should be made to the positive "A" battery lead instead of to the negative filament terminal of the tube. A UX 112 or CX 112 type of tube can be used in the last audio stage to properly handle, without distortion, the current delivered to the last tube. A UX 171 or CX 371 will give even better results provided the recommended "B" and "C" battery voltages are used. More than 135 volts should not be used on the last stage unless proper means are employed to prevent the current from going through the loudspeaker windings. A choke coil and condenser output unit can be used when higher plate voltages are desired.

The "F" terminals of the number 1, 2, 3, and 4 transformer and coupler units are connected with the shields of the units and these are automatically grounded when the "F" terminals are connected into the circuit as shown.

The shield of the output coupler, "T5," is not connected with the "F" terminal so in that case, the shield may be grounded by connecting the shield with the negative filament lead as shown. This can be done by making the connection to one of the mounting screws used to fasten the coupler to the subpanel.

A double-reading voltmeter has been provided to check up on the voltage of the filaments of the three intermediate frequency tubes, Nos. 2, 3 and 4, and on the total voltage of the "B" batteries. The voltage applied across the filaments of the three intermediate amplifying tubes can be controlled by means of rheostat "R3." By pressing the button at the top of the voltmeter, the total "B" battery voltage can be read and a check obtained on the condition of the "B" batteries.

A milliammeter with a zero to 50 scale has been provided in the "B" battery circuit to check up on the current consumption of the receiver and to provide a means of enabling the operator to adjust the receiver for most economical operation. The proper values of the "C" batteries required in the circuit can be obtained by trying varous taps on the "C" batteries until the lowest reading is obtained on the milliammeter. The milliammeter will also serve as a check on the condition of the tubes in the receiver. Any sudden dropping in the reading, when the batteries are all in good condition indicates a falling off in the efficiency of one or more of the tubes.

Rheostats or Amperites alone or in combinations have been used to assure maximum efficiency and economy of operation. A rheostat alone is used in the filament circuits of the intermediate amplifier tubes because the voltage across the filaments of these tubes can be checked by means of the voltmeter. In the other circuits, where no means are available to check up on the voltage being applied to the filaments, Amperites have been inserted in the leads to insure against operation of the filaments at more than their rated values.

Amperites alone are used in the two audio stages. Where slight additional control is desired, both Amperites and rheostats have been used, as for instance in the oscillator circuit and in the two detector circuits. This allows adjustment of the tube below its rated voltage but prevents operation of the tubes at higher temperatures that would result in decreased life of the tubes.

A Carter combination battery switch and Hi-Ohm volume control, "VS" is used to perform the double function of battery switch and high resistance across the secondary winding of the last stage audio transformer.

A .005 mfd. fixed condenser is connected across the primary winding of the first stage audio transformer, "T6" to serve as a bypass across the transformer winding for any radio frequency currents which pass into the plate circuit of the second detector stage.

A .006 mfd. fixed condenser is used across the loudspeaker terminals to deepen the tone of the speaker and to eliminate hissing in the loudspeaker.

Two "Loop" terminals are provided in the set itself for the loop connections, although a 4½-volt "C" battery should be connected in the loop circuit as shown in the schematic wiring diagram. This "C" battery can be connected in externally by connecting the positive terminal of the "C" battery with the low potential side of the circuit and connecting one of the loop

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terminals with the negative 4½-volt terminal of the "C" battery.

You will notice that in the first detector filament circuits, the rheostat is placed in the negative filament lead, while the Amperite is placed in the positive filament lead. This brings the grid return back very close to the negative filament terminal of the tube without necessitating the use of an insulating bushing on the rheostat.

The negative terminal of the two-reading voltmeter is connected directly across the filament terminals of the intermediate frequency tubes. This gives a slight drop in voltage when reading the "B" battery voltage, but this does not matter in that type of reading. It is more important to stick to the wiring scheme shown to simplify wiring.

The milliammeter should be connected as shown with the positive terminal of the milliammeter to the negative filament lead and the other terminal of the milliammeter to the negative "B" battery terminal.

The Multiplug provides connections for the "A" and "B" batteries but because of the extra number of "B" battery leads necessary, it is impossible to use the color code recommended by the manufacturer, except for both "A" battery leads and for the negative "B" battery leads. When using a UX-200A type of detector, best results in quality are obtainable with low "B" battery. It is therefore recommended that not more than 22½ volts be used in the plate circuit of the second detector tube. The Blue lead can be used for this connection. The Pink lead can be used for the 45 volts required for the oscillator and radio frequency stages. The Black lead can be used for the 90-volt terminal and the Brown lead for the 135-volt terminal.

Three separate leads must be provided for the "C" battery connections for the audio frequency stages.

Tip jacks are used for the speaker.

Volume control is obtained by means of the Clarostat HR across the secondary winding of the last stage transformer.

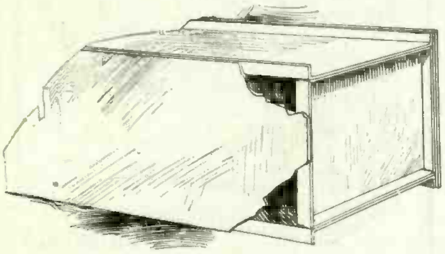
Construction of the Receiver

The first step in the construction of the receiver is to lay out and drill the panel and subpanel. All the parts with the exception of the Clarostat are mounted directly on the panel, thus connecting one terminal of each instrument to the shield, formed by the alluminum panel. This method of course saves making the individual connections. The Clarostat is mounted by using an insulating bushing to insulate the frame of the Clarostat from the panel.

Notches ½" deep and 4" long should be cut in the subpanel to allow for movement of the variable condenser plates as shown in the layout of the subpanel.

The proper sizes of the parts used on panel and subpanel and the correct positions for mounting them can be obtained by consulting the panel and subpanel layouts and the reference numbers in the list of parts, corresponding to the numbers of the parts on the layouts.

The connections between the transformers and coupler "G" and "P" terminals and the "G" and "P" terminals



The above illustration shows how the aluminum is bent to form the shielded casing of the set.

of their associated sockets should be done on the top side of the subpanel to keep the leads as short as possible and far away from the filament and battery leads. Practically all the rest of the wiring can be done on the under side of the subpanel.

Since some of the parts are mounted on directly opposite sides of the subpanel, care must be taken to mount them in the proper order so as to avoid covering up mounting holes of other instruments.

The fixed condensers should be mounted first. Mount condensers "C3"; "C5"; "C6" and "C7" first. Condenser "C5" should be mounted with flat head screws and the holes should be countersunk rather deeply to avoid any possible shorting of the condenser leads by the case of the transformer that is mounted on the other side of the subpanel.

Transformers "T3" and "T4" should be mounted before the audio transformers "T6" and "T7." Flat head screws should be used to mount the radio transformers.

An insulating bushing should be used in mounting the Clarostat on the metal panel.

To get best possible results in selectivity, the whole set should be enclosed with bottom, top, back and sides of 3/32" aluminum sheet metal. The sketch shows the method used in constructing the shielding compartment for this receiver.

For best results, it is absolutely necessary to connect and tune the set properly. The connections for the various terminals can be obtained by consulting the wiring diagram and the layout diagram. Remember the 4½-volt "C" battery which should be connected in the external circuit of the loop.

In tuning the receiver, care must be exercised and a certain amount of practice will be necessary to get best results. The filament voltage on the intermediate frequency tubes, con-

LIST OF PARTS REQUIRED

1 Excello, No. R 16 Console
1 Aluminum panel, 21" x 10" x 3/32"
1 Set of aluminum plates, sizes depending on manner in which remainder of metal shielding is constructed.
1 Radion or Formica Sub-panel, 19½" x 7" x 3/16"
1 Set of Madison-Moore, Type HW, "One-Spot" transformers, consisting of:
  1 HW1 unit; T1
  1 HW2 unit; T2
  1 HW3 unit; T3
  1 HW4 unit; T4
  1 HW5 unit; T5
2 Thordarson, Type R 200 Audio Transformers; T6, T7
8 Benjamin, No. 9044 UX spring sockets; 1, 2, 3, 4, 5, 6, 7, 8
2 Hammarlund, ML 23, .0005 mfd. Midlin Variable Condensers; C1, C2
2 Marco Illuminated Control Dials
3 Carter, No. M20, 20-ohm midget rheostats; R1, R2, R4
1 Carter, No. M10-S combination midget rheostat and filament switch; R3
4 No. 1A Amperites; A1, A2, A3, A4
1 No. 112 Amperite, A5
1 Sangamo, .00025 mfd. fixed condenser with grid leak mounting clips, C3
1 Durham, 2 meg. metallized grid leak; C3
1 Sangamo, .005 mfd. fixed condenser; C4
1 Sangamo, .006 mfd. fixed condenser; C5
2 Tobe, 1 mfd. bypass condensers; C6, C7
1 Universal Range Clarostat Volume Control; HR
1 Jewell, 135B Voltmeter, 0-7.5, 150 volt ranges; V
1 Jewell, No. 135, 0-50 milliameter; MA
1 Jones Multiplug, Type BM; M
2 Carter, No. 10 tip jacks; J1, J2
2 Eby "Loop" binding posts
3 Eby binding posts marked "C Battery +"; "4 Volts —" and "9 Volts —" respectively
1 Pair Benjamin, No. 8629 shelf-supporting brackets
15 Lengths, Acme Celatsite wire
1 Package Kester Radio Solder
1 Bodine, Model L 500 De Luxe Loop

trolled by rheostat "R3" depends on receiving conditions. A lower voltage must be used for nearby stations than is necessary when distant stations are to be tuned in.

The adjustment of the rheostat "R1" which controls the first detector tube is very important. It is only by properly adjusting this control that reception on only one point on the dials is possible. By setting this rheostat so that the first detector tube is just under the oscillating point, the tuning on the detector tuning condenser will be very sharp and stations will not be heard unless both the detector tuning condenser "C1" and the oscillator tuning condenser "C2" are in resonance. If these two tuning controls are not tuned exactly, even local stations will not be heard. If the setting of the rheostat "R1" is turned up so that the first detector tube which it controls is allowed to oscillate, the receiver loses its characteristic "one-spot" feature and stations will be heard on more than one setting, the same as on ordinary superheterodynes.

The sharpness with which it tunes makes it a little difficult to get the knack of tuning it properly at first, but a little practice will more than repay you for the preliminary annoyance.

Adhesive Tape Prevents Tube Vibration

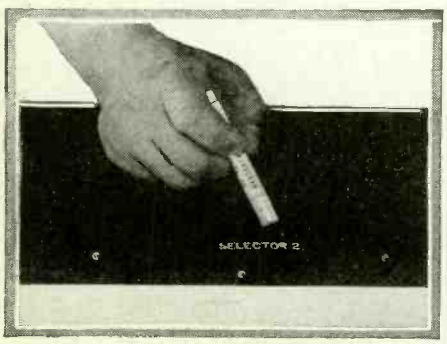
A piece of adhesive tape wound about a vacuum tube so as to cover the junction between glass and base will help to prevent tube vibration and also

Adhesive tape is wrapped around the tube and the tube base as shown in the above photo.

prevents the glass from becoming loose from the base. The illustration shows how the tape is applied. Only a single turn is necessary.

White Crayon Used for Marking Panels

Where markings are required on the panel of a home-built radio set, these

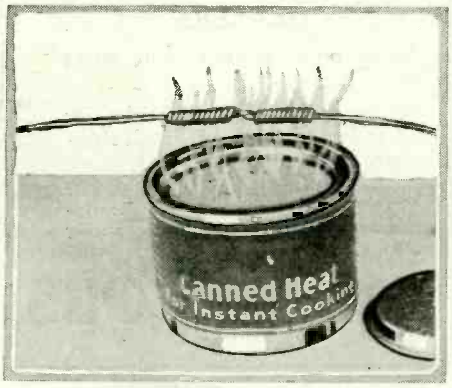


White crayon is used to fill in the markings on the panel.

are easily made by scratching the panel with a scriber or other sharp instrument and filling the scratch with white chalk. The crayon is simply rubbed over the surface, enough adhering to the scratch to make a clear marking. A marker, such as described, is shown in the accompanying photograph. This shows the use of a white crayon in connection with an engraved panel which has lost its filler. Of course, gold crayon can also be used and this can be rubbed directly over the white where it is desired to convert the markings from white to gold.

Canned Heat for Emergency Soldering

In case a small soldering job has to be performed at a place where electricity or gas are inaccessible, a can of solidified alcohol often comes in handy

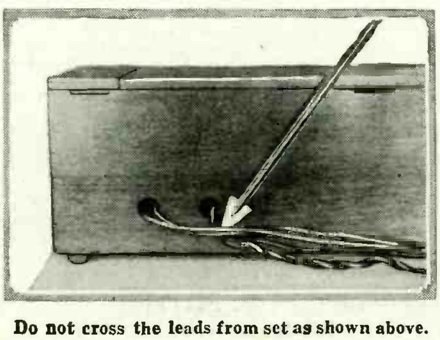


The joint is treated over a can of solidified alcohol preparatory to being soldered.

for supplying the necessary heat. It is always desirable to solder the lead-in to the aerial wire, this being only one of the places where the use of canned heat will be advantageous.

Noises Due to 110-Volt Connections

Where power operated or electrified sets have the eliminators contained in the same cabinets as the set itself, care is necessary in bringing the 110-volt

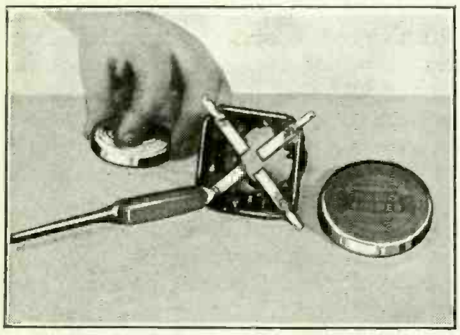


Do not cross the leads from set as shown above.

leads into the set. If these run parallel to aerial or ground leads, an objectionable hum may result. The best plan is to separate the 110-volt line as far as possible from all the other set wiring.

Solder Used to Insure Socket Contacts

The connections between socket prongs and bakelite base usually made by means of rivets or small machine screws and nuts, can be made even



Soldering the contact prongs to the terminal screws beneath the socket.

more secure with solder. A bit of solder applied at the end of the screw between the screw and the nut serves to strengthen the construction and also does away with the possibility of the nut working loose. This is an important point, since if the prong does not make good contact, the filament may not light up or plate or grid contacts may be uncertain.

Measuring "B" Battery Voltages

The cheaper types of "moving iron" voltmeters take a fairly heavy current for their operation and in many cases are not suitable for measuring the voltage of a dry "B" battery. Indeed, very serious harm may be done to the cells if such a meter is applied across the battery for any length of time.

Users of this type of instrument would be well advised to measure the voltages of their battery in comparatively small sections, making a note of the readings between the various tapping points, and then adding together those voltages to obtain a total. Although the meter may read up to 120 volts, it is best to measure the potential across a section only large enough to give a clear reading. By this method the current taken from the battery will be considerably reduced.

Many people attempt to test "B" battery eliminators with a cheap voltmeter. In such cases, the voltmeter moves slightly but fails to show a reading. This is because the meter draws more current than the eliminator is able to supply. The best way to judge an eliminator is by its performance, but if a voltage reading must be taken, an expensive, high-resistance voltmeter is an absolute necessity.

Quality Reproduction And How to Obtain It

(*Continued from page* 138)

and consequently both low notes and high notes are reproduced.

In the radio loud speaker the diaphragm is not mechanically forced to vibrate. It is magnetically connected to the electromagnets in the unit. Hence it is caused to vibrate magnetically, and vibrates more efficiently at frequencies near its own mechanical period of vibration than at other frequencies. The small diaphragm having a high mechanical period, cannot be made to operate well on the lower register. A large diaphragm must be used, and this was made in the form of a paper cone.

There is a distortion found in some cone speakers, a wave-shape distortion, caused by vibrations in the paper cone that continue longer than they should. In other words, the vibrations in the paper do not follow the electrical impulses exactly, but continue slightly beyond, giving the same effect as obtained when playing a piano with the loud pedal down. This causes the speaker to sound "drummy," and is very noticeable in inclosed type cone speakers.

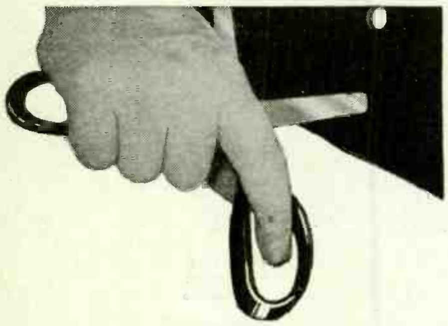
Some of the smaller type cone speakers are no better than horn speakers; and many horn speakers are far superior to some cone speakers. As a rule, the larger the cone, the better the quality. It responds to the low tones better. And contrary to the general opinion, the large cones reproduce the high tones just as well as the small cones do. After all, a small cone is merely the apex of a large one, and if this reproduces the high tones, there is no reason why the apex of a large one will not reproduce them also. In fact it does. This is an instance where theory and practice jibe, as those who have heard the large type cones in operation know. The high pitched flute and the boom of the bass drum come through with equal naturalness. Fully 50 per cent more music is obtained.

The superiority and increasing popularity of the large three foot cone speakers is evidenced by the large number of manufacturers now making this type of speaker. We can safely predict that by next year the majority of speakers in use will be of the large size, of over 30" in diameter, and it does not take up much room, when built into a cabinet like the one illustrated at beginning of this article. In this instance the cabinet houses the A and B batteries—placed on the lower shelf behind the cone—and the entire outfit occupies no more space than the average console type radio set.

So far the reason why the large cone is slow in making its debut is because of its cost. A factory made three foot cone is a very expensive proposition to pack and ship, but you can get around this disadvantage by building it yourself. The one illustrated in the photo at the beginning of this article was built from a three-foot cone speaker kit.

Scissors Used as Hole Reamer

Where a reamer is required but not available, a pair of scissors comes in handy, as shown in the accompanying illustration. If the hole in a piece of

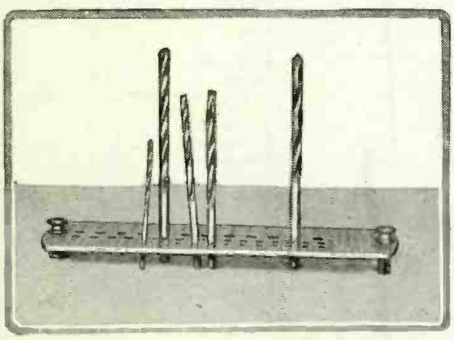


An ordinary pair of household shears used as a reamer.

wood or bakelite is just a little too small, one of the blades of the scissors should be inserted and turned from side to side, so that the sharp edge will enlarge the circle evenly.

Combination Drill Stand and Gauge

A useful drill stand can be made from a drill gauge by cutting suitable lengths of small diameter bakelite



The drill stand made with a gauge.

tubing for use as legs, holding these in place with binding posts as shown. This stand serves a double purpose, the drills are available for use when wanted, but in addition each one is labeled by the gauge so that the exact size wanted may be instantly located.

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to Z

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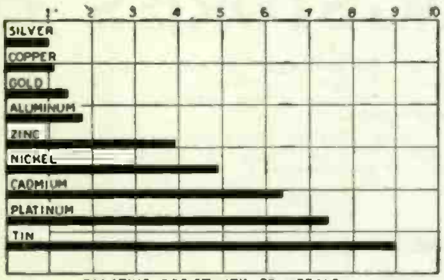
Conductivity of Shielding Materials in Radio Sets

COPPER, because of its low resistivity, is a very efficient shielding material. It follows naturally that the better conductor will dissipate more easily, in the form of eddy-current losses, the undesired electro- magnetic lines of force between certain portions of radio receiver. Experiments have shown that these fields will pass through sheet metal if it is of insufficient thickness.

The efficiency of perfect shielding has been shown by enclosing receivers in copper boxes and testing them in the vicinity of transmitting stations. It has been found that the smallest crack in the shielding is enough to ruin entirely the effect of the shielding material. Several years ago it was thought that copper screening would give enough shielding effect, and experiments have been made by the manufacturers of panels within which copper screening has been cast. Present-day broadcasting, however, with its numerous and



RELATIVE RESISTIVITY OF METALS

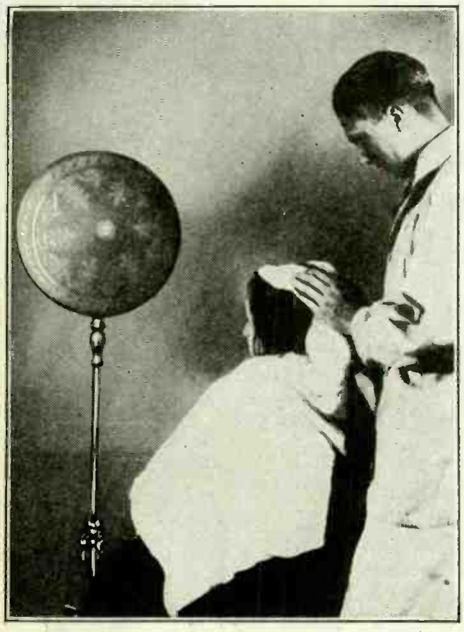
A glance shows the comparative resistance, which means current loss, in equal-sized pieces of various metals. The resistivity of pure iron is six times (disregarding the added effects of its magnetism), and that of commercial grades up to 60 times, that of copper.

powerful stations in a limited metropolitan area, demands something better than this; and the all-metal cabinet of appreciable thickness will be, we think, the ultimate solution in the attempt to confine the desired radio-frequency energy to its proper channel.

The shielding problem is still in its development stage, and is by no means solved. At the present time the development of broadcasting, however, is forcing manufacturers and engineers to study the problem, and it will not be long before we will have a practical method of shielding that will confine the energy in a radio receiver within the desired limits without absorbing an appreciable amount of it. The loss due to partial shielding at the present time makes for inefficiency and will not be tolerated in the future receiver.

Radio as an Aid to Beauty

A number of hair dressing establishments, beauty parlors and barber shops are installing radio sets for the entertainment of their customers, while the latter are undergoing the beautify-



The cone speaker mounted on a floor lamp stand is installed in the beauty parlor.

ing processes. It is asserted that the snappy strains of a jazz band will do much to relieve the agony of obtaining a permanent wave, while an opera selection is particularly efficacious in whiling away the time during the receipt of a facial treatment or massage. The accompanying photo shows how an ingenious hair dresser mounted a cone type loud speaker on a floor-lamp stand which made it practical for portable purposes about his shop.

Absorbing Moisture in Damp Places

Where a receiver has to be worked in a damp atmosphere the interior of the cabinet may be kept free from moisture by a few lumps of calcium chloride placed in a suitable receptacle inside of the cabinet . A small bottle clamped vertically to the side of the cabinet will be found best, as the narrow neck will prevent the chemical from being spilled.

The calcium chloride should be examined from time to time and renewed when necessary. The need for the renewal will be indicated by the fact that the solid lumps have entirely gone into solution with the moisture absorbed from the air.

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