The Boston Evening Transcript's

Directory of Radio Broadcasting Stations

of the

United States, Canada and Cuba

Hook-ups and Trouble-Shooting Chart

By JAMES KILTON CLAPP

Compiled by
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Stations
Arranged
Alphabetically
by
Call Signals

The Boston Transcript's

DIRECTORY OF RADIO BROADCASTING STATIONS

Call Signal	Owner of Station	Location of Station	Your Adjustment
KDKA	Westinghouse Electric & Mfg. Co..........	East Pittsburgh	....
KDPM	Westinghouse Electric & Mfg. Co..........	Cleveland, O	....
KDPT	Southern Electrical Co	San Diego, Calif......	....
KDYL	Telegram Publishing Co....................	Salt Lake City, Utah..	....
KDYM	Savoy Theatre	San Diego, Calif......	....
KDYQ	Portland, Ore	Oregon Institute of Tech	....
KDYW	Smith, Hughes & Co........................	Phoenix, Ariz.........	....
KDYX	Star Bulletin	Honolulu, Hawaii......	....
KDZB	Frank E. Siefert..........................	Bakersfield, Calif......	....
KDZE	The Rhodes Co.............................	Seattle, Wash	....
KDZF	Automobile Club of Southern California.....	Los Angeles, Calif....	....
KDZI	Electric Supply Co........................	Wenatchee, Wash	....
KDZQ	Nichols Academy of Music..................	Denver, Colo	....
KDZR	Bellingham Publishing Co..................	Bellingham, Wash.....	....
KFAD	McArthur Bros. Mercantile Co..............	Phoenix, Ariz.........	....
KFAE	State College of Washington	Pullman, Wash........	....
KFAF	Western Radio Corporation	Denver, Colo..........	....
KFAJ	University of Colorado....................	Boulder, Colo.........	....
KFAN	The Electric Shop.........................	Moscow, Idaho........	....
KFAR	Studio Lighting Service Company...........	Hollywood, Calif......	....
KFAU	In. School Dist. of Boise City, Boise H. School	Boise, Idaho..........	....
KFAV	Kinney Company	Venice, Calif..........	....
KFAW	The Radio Den	Santa Ana, Calif......	....
KFAY	Virgin's Radio Service....................	Medford, Ore..........	....
KFBB	Havre, Buttrey & Co.......................	Havre, Mont..........	....
KFBC	W. K. Azbill..............................	San Diego, Calif......	....
KFBE	Reuben H. Horn	San Luis Obispo, Calif.	....
KFBG	First Presbyterian Church.................	Tacoma, Wash........	....
KFBK	Kimball-Upson Company	Sacramento, Calif......	....
KFBL	Lucas Bros	Everett, Wash	....
KFBS	Trinidad G. & E. Sup. Co & Chronicle News	Trinidad, Colo........	....
KFBU	The Cathedral	Laramie, Wyo........	....
KFCB	Neilson Radio Supply Co...................	Phoenix, Ariz.........	....
KFCD	Salem Electric Company....................	Salem, Ore...........	....
KFCF	Frank A. Moore............................	Walla Walla, Wash....	....
KFCH	Electric Service Station Inc..............	Billings, Mont	....
KFCK	Colorado Springs Radio Company...........	Colorado Springs, Colo.	....
KFCM	Richmond Radio Shop.......................	Richmond, Calif.......	....
KFCP	Ralph W. Flygare..........................	Ogden, Utah...........	....
KFCV	Fred Mahaffey, Jr.........................	Houston, Tex	....
KFCY	Western Union College.....................	Le Mars, Iowa	....
KFCZ	Omaha Central High School.................	Omaha, Neb	....
KFDA	Adler's Music Store.......................	Baker, Ore	....
KFDD	St. Michael's Cathedral...................	Boise, Idaho..........	....
KFDH	University of Arizona	Tucson, Ariz	....
KFDJ	Oregon Agricultural College...............	Corvallis, Ore.	....
KFDL	Knight-Campbell Music Company............	Denver, Colo	....
KFDO	H. Everett Cutting	Bozeman, Mont	....
KFDR	Bullock's Hardware & Sporting Goods......	York, Nebr...........	....
KFDU	Nebraska Radio Electric Company..........	Lincoln, Neb	....
KFDV	Gilbreth & Stinson........................	Fayetteville, Ark......	....
KFDX	First Baptist Church......................	Shreveport, La........	....
KFDY	Brookins College of Agr. and Mechanic Arts.	Brookings, So. Da....	....
KFDZ	Harry O. Iverson	Minneapolis, Minn......	....
KFEC	Meier & Frank Company	Portland, Ore..........	....
KFEJ	Guy Greason	Tacoma, Wash	....
KFEL	Winner Radio Corp.........................	Denver Col.	....

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Call Signal	Owner of Station	Location of Station	Your Adjustment
KFEQ	J. L. Scroggin	Oak, Neb	
KFER	Auto Electric Service Co	Fort Dodge, Ia	
KFEV	Radio Electric Shop	Douglas, Wyo	
KFEX	Augsburg Seminary	Minneapolis, Minn	
KFEY	Bunker Hill & Sullivan Mining & Concen. Co.	Kellogg, Idaho	
KFEZ	American Society of Mechanical Engineers	St. Louis, Mo	
KFFB	Jenkins Furniture Company	Boise, Idaho	
KFFE	Eastern Oregon Radio Company	Pendleton, Ore	
KFFO	Dr. E. H. Smith	Hillsboro, Ore	
KFFQ	Markehoffel Motor Company	Colorado Springs Col	
KFFR	Nevada State Journal	Sparks, Nev	
KFFV	Graceland College	Lamoni, Iowa	
KFFX	McCray Company	Omaha, Neb	
KFFY	Pinous & Murphy	Alexandria, La	
KFFZ	Al. G. Barnes Amusement Company	Dallas, Tex	
KFGC	Louisiana State University	Baton Rouge, La	
KFGD	Chickasha, Okla	Chickasha, Okla	
KFGH	Leland Stanford University	Stanford Univ., Calif	
KFGJ	Missouri National Guard, 138th Infantry	St. Louis, Mo	
KFGL	Arlington Garage	Arlington, Ore	
KFGQ	Crary Hardware Company	Boone, Io	
KFGV	Heidbreder Radio Supply Co	Utica, Neb	
KFGX	First Presbyterian Church	Orange, Tex	
KFGZ	Emmanuel Missionary College	Berrien Springs, Mich	
KFHA	Western State College	Gunnison, Col	
KFHB	Rialto Theatre	Hood River, Ore	
KFHD	Utz Electric Shop Company	St. Joseph, Mo	
KFHF	Central Christian Church	Shreveport, La	
KFHH	Ambrose A. McCue	Neah Bay, Wash	
KFHJ	Fallon & Co	Santa Barbara, Calif	
KFHR	Star Electric & Radio Company	Seattle, Wash	
KFHS	Clifford J. Dow	Lihue, Hawaii	
KFHX	Robert W. Nelson	Hutchinson, Ks	
KFI	Earle C. Anthony, Inc	Los Angeles, Calif	
KFIB	Franklin W. Jenkins	St. Louis, Mo	
KFID	Ross Arbuckle's Garage	Iola, Ks	
KFIF	Benson Polytechnic Institute	Portland, Ore	
KFIK	Gladbrook Electrical Company	Gladbrook, Io	
KFIL	Windisch Electric Farm Equipment Company	Louisburg, Ks	
KFIO	North Central High School	Spokane, Wash	
KFIQ	Yakima Valley Radio Broadcasting Association	Yakima, Wash	
KFIU	Alaska Electric Light & Power Company	Juneau, Alaska	
KFIX	Reor. Ch of Jesus Christ of Lat. Day Saints	Independence, Mo	
KFIY	Brott Laboratories	Seattle, Wash	
KFIZ	Daily Commonwealth and Oscar A. Heulsman	Fond du Lac, Wis	
KFJB	Marshall Electrical Company	Marshalltown, Iowa	
KFJC	Seattle Post Intelligencer	Seattle, Wash	
KFJD	Weld County Printing and Publishing Co	Greeley, Col	
KFJF	National Radio Manufacturing Co	Oklahoma City, Okla	
KFJI	Liberty Theatre	Astoria, Ore	
KFJK	Delano Radio and Electric Co	Bristow, Okla	
KFJL	Hardsacg Manufacturing Co	Ottumwa, Iowa	
KFJM	University of North Dakota	Grand Forks, N. Dak	
KFJR	Ashley C. Dixon & Son	Stevensville, Mont	
KFJV	Thomas H. Warren	Dexter, Iowa	
KFJW	Le Grand Radio Co	Towanda, Ks	
KFJX	Iowa State Teachers' College	Cedar Falls, Iowa	

DIRECTORY OF RADIO BROADCASTING STATIONS

Call Signal	Owner of Station	Location of Station	Your Adjustment
KFJY	Tunwall Radio Co	Fort Dodge, Iowa	....
KFJZ	Texas National Guard, 112th Cavalry	Fort Worth, Tex	....
KFKA	Colorado State Teachers College	Greeley, Col	....
KFKB	Brinkley-Jones Hospital Association	Milford, Ks	....
KFKH	Denver Park & Amusement Company	Lakeside, Col	....
KFKQ	Conway Radio Laboratories	Conway, Ark	....
KFKV	F. F. Gray	Butte, Mont	....
KFKX	Westinghouse Electric & Manufacturing Co	Hastings, Neb	....
KFKZ	Nassour Bros. Radio Co	Colorado Springs, Colo.	....
KFLA	Abner R. Wilson	Butte, Mont	....
KFLB	Signal Electric Manufacturing Co	Menominee, Mich	....
KFLD	Paul E. Greenlaw	Franklinton, La	....
KFLE	National Educational Service	Denver, Col	....
KFLH	Erickson Radio Co	Salt Lake City, Utah	....
KFLP	Everette M. Foster	Cedar Rapids, Io	....
KFLQ	Bizzell Radio Shop	Little Rock, Ark	....
KFLR	University of New Mexico	Albuquerque, N. M.	....
KFLU	Rio Grande Radio Supply House	San Benito, Tex	....
KFLV	A. T. Frykman	Rockford, Ill	....
KFLW	Missoula Electric Supply Co	Missoula, Mont	....
KFLX	George R. Clough	Galveston, Tex	....
KFLY	Fargo Radio Supply Co	Fargo, N. Dak	....
KFLZ	Atlantic Automobile Co	Atlantic, Iowa	....
KFMB	Christian Churches of Little Rock	Little Rock, Ark	....
KFMQ	University of Arkansas	Fayetteville, Ark	....
KFMR	Morningside College	Sioux City, Iowa	....
KFMS	Freimuth Department Store	Duluth, Minn	....
KFMT	George W. Young	Minneapolis, Minn	....
KFMU	Stevens Bros	San Marcos, Tex	....
KFMW	M. G. Sateren	Houghton, Mich	....
KFMX	Carleton College	Northfield, Minn	....
KGB	Tacoma Daily Ledger	Tacoma, Wash	....
KGG	Hallock & Watson Radio Service	Portland, Ore	....
KGN	Northwestern Radio Mfg. Co	Portland, Ore	....
KGU	Marion A. Mulreny	Honolulu, Hawaii	....
KGW	Portland Morning Oregonian	Portland, Ore	....
KGY	St. Martins College	Lacey, Wash	....
KHJ	Times-Mirror Co.	Los Angeles, Calif	....
KHQ	Louis Wasmer	Seattle, Wash	....
KJQ	C. O. Gould	Stockton, Calif	....
KJR	Northwest Radio Service Co	Seattle, Wash	....
KJS	Bible Institute of Los Angeles	Los Angeles, Calif	....
KLS	Warner Brothers	Oakland, Calif	....
KLX	Tribune Publishing Co	Oakland, Calif	....
KLZ	Reynolds Radio Co.	Denver, Colo	....
KMJ	San Joaquin Light & Power Corp	Fresno, Calif	....
KMO	Love Electric Co	Tacoma, Wash	....
KNT	Grays Harbor Radio Co	Aberdeen, Wash	....
KNV	Radio Supply Co	Los Angeles, Calif	....
KNX	Electric Lighting Supply Co	Los Angeles, Calif	....
KOB	New Mexico Col. of Agri. & Mechanic Arts	State College, N. Mex.	....
KOP	Detroit Police Dept	Detroit, Mich	....
KPO	Hale Bros.	San Francisco, Calif	....
KQP	Apple City Radio Club	Hood River, Ore	....
KQV	Doubleday-Hill Electric Co	Pittsburgh, Pa	....
KQW	Charles D. Herrold	San Jose, Calif	....
KRR	Berkeley Daily Gazette	Berkeley, Calif	....

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Call Signal	Owner of Station	Location of Station	Your Adjustment
KSD	Post Dispatch	St. Louis, Mo	
KSS	Prest & Dean Radio Co. and Research Society	Long Beach, Calif	
KTW	First Presbyterian Church	Seattle, Wash	
KUO	Examiner Printing Co	San Francisco, Calif	
KUS	City Dye Works & Laundry Co	Los Angeles, Calif	
KUY	Coast Radio Co	El Monte, Calif	
KWG	Portable Wireless Telephone Co	Stockton, Calif	
KWH	Los Angeles Examiner	Los Angeles, Calif	
KXD	Modesto Herald Publishing Co	Modesto, Calif	
KYQ	Electric Shop	Honolulu, Hawaii	
KYW	Westinghouse Electric & Mfg. Co	Chicago, Ill	
KZM	Preston D. Allen	Oakland, Calif	
KZN	The Deseret News	Salt Lake City, Utah	
KZV	Wenatchee Battery & Motor Co	Wenatchee, Wash	
NAA	U. S. Navy	Arlington, Va	
WAAB	Valdemar Jensen	New Orleans, La	
WAAC	Tulane University	New Orleans, La	
WAAD	Ohio Mechanics Institute	Cincinnati, Ohio	
WAAF	Chicago Daily Drovers Journal	Chicago, Ill	
WAAM	I. R. Nelson Co	Newark, N. J	
WAAN	University of Missouri	Columbia, Mo	
WAAW	Omaha Grain Exchange	Omaha, Neb	
WAAZ	Hollister-Miller Motor Co	Emporia, Ks	
WABA	Lake Forest College	Lake Forest, Ill	
WABB	Dr. John B. Lawrence	Harrisburg, Pa	
WABC	Fulwider Grimes Battery Co	Anderson, Ind	
WABD	Parker High School	Dayton, O	
WABE	Young Men's Christian Association	Washington, D. C	
WABG	Arnold Edwards Piano Co	Jacksonville, Fla	
WABH	Lake Shore Tire Co	Sandusky, O	
WABI	Bangor Railway & Electric Co	Bangor, Me	
WABJ	The Radio Laboratories	South Bend, Ind	
WABK	First Baptist Church	Worcester, Mass	
WABL	Connecticut Agricultural College	Storrs, Conn	
WABM	F. E. Doherty Automotive & Radio Equip. Co.	Saginaw, Mich	
WABN	Waldo C. Grover	La Crosse, Wis	
WABO	Lake Avenue Baptist Church	Rochester, N. Y	
WABP	Robert F. Weinig	Dover, O	
WABQ	Haverford College Radio Club	Haverford, Pa	
WABR	Scott High School	Toledo, O	
WABS	Essex Manufacturing Co	Newark, N. J	
WABT	Holliday-Hall	Washington, Pa	
WABU	Victor Talking Machine Co	Camden, N. J	
WABV	John H. De Witt	Nashville, Tenn	
WABW	College of Wooster	Wooster, O	
WABX	Henry B. Joy	Mount Clemens, Mich	
WBAA	Purdue University	West Lafayette, Ind	
WBAD	Sterling Electric Co	Minneapolis, Minn	
WBAH	The Dayton Co	Minneapolis, Minn	
WBAN	Wireless Phone Corp	Paterson, N. J	
WBAO	James Millikin University	Decatur, Ill	
WBAP	Wortham-Carter Publishing Co	Fort Worth, Tex	
WBAV	Erner & Hopkins Co	Columbus, O	
WBAW	Marietta College	Marietta, O.	
WBAX	John H. Stenger, Jr	Wilkes-Barre, Pa	
WBAY	American Telephone & Telegraph Co	New York, N. Y	
WBBA	Newark Radio Laboratories	Newark, Ohio	
WBBD	Barbey Battery Service	Reading, Pa	

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Call Signal	Owner of Station	Location of Station	Your Adjustment
WBL	T. & H. Radio Co	Anthony, Kan.	....
WBS	D. W. May. Inc	Newark, N. J.	....
WBT	Southern Radio Corp	Charlotte, N. C.	....
WBZ	Westinghouse Elec. & Mfg. Co	Springfield, Mass	....
WCAD	St. Lawrence University	Canton, N. Y.	....
WCAE	Kaufmann & Baer Co	Pittsburgh, Pa.	....
WCAG	Clyde R. Randall	New Orleans, La.	....
WCAH	Entrekin Electric Co	Columbus, Ohio	....
WCAJ	Nebraska Wesleyan University	University Place, Nebr.	....
WCAK	Alfred P. Daniel	Houston, Tex.	....
WCAL	St. Olaf College	Northfield, Minn.	....
WCAM	Villanova College	Villanova, Pa.	....
WCAO	Baldiman & Stayman Co	Baltimore, Md.	....
WCAP	Chesapeake & Potomac Telephone Co.	Washington, D. C.	....
WCAR	Alamo Radio Electric Co	San Antonio, Tex.	....
WCAS	William Hood Dunwoody Industrial Institute	Minneapolis, Minn.	....
WCAT	South Dakota State School of Mines	Rapid City, S. D.	....
WCAU	Durham & Co	Philadelphia, Pa.	....
WCAV	D. C. Dice Electric Co	Little Rock, Ark.	....
WCAX	University of Vermont	Burlington, Vt.	....
WCAY	Kesselman O'Driscoll Co	Milwaukee, Wis.	....
WCAZ	Carthage College	Carthage, Ill.	....
WCBA	Charles W. Heimbach	Allentown, Pa.	....
WCBD	Wilbur G. Voliva	Zion, Ill.	....
WCK	Stix, Baer & Fuller Dry Goods Co	St. Louis, Mo.	....
WCM	University of Texas	Austin, Tex.	....
WCX	Detroit Free Press	Detroit, Mich.	....
WDAE	Tampa Daily Times	Tampa, Fla.	....
WDAF	Kansas City Star	Kansas City, Mo.	....
WDAG	J. Laurance Martin	Amarillo, Tex.	....
WDAH	Trinity Methodist Church (South)	El Paso, Tex.	....
WDAK	The Courant	Hartford, Conn.	....
WDAO	Automotive Electric Co	Dallas, Tex.	....
WDAP	Board of Trade	Chicago, Ill.	....
WDAR	Lit Brothers	Philadelphia, Pa.	....
WDAS	Samuel A. Waite	Worcester, Mass.	....
WDAU	Slocum & Kilburn	New Bedford, Mass.	....
WDAX	First National Bank	Centerville, Iowa	....
WDAY	Radio Equipment Corp	Fargo, N. Dak.	....
WDBC	Kirk, Johnson & Co	Lancaster, Pa.	....
WDZ	James L. Bush	Tuscola, Ill.	....
WEAA	Frank D. Fallain	Flint, Mich.	....
WEAF	American Telephone & Telegraph Co	New York, N. Y.	....
WEAH	Wichita Board of Trade and Lander Radio Co.	Wichita, Kans.	....
WEAI	Cornell University	Ithaca, N. Y.	....
WEAJ	University of South Dakota	Vermillion, S. Dak.	....
WEAM	Borough of North Plainfield	North Plainfield, N. J.	....
WEAN	Shepard Co.	Providence, R. I.	....
WEAO	Ohio State University	Columbus, Ohio	....
WEAP	Mobile Radio Co	Mobile, Ala.	....
WEAR	Baltimore American & News Publishing Co.	Baltimore, Md.	....
WEAS	Hecht Company	Washington, D. C.	....
WEAU	Davidson Bros. Co	Sioux City, Iowa	....
WEAY	Iris Theatre	Houston, Tex	....
WEB	Benwood Co	St. Louis, Mo	....
WEV	Hurlburt-Still Electrical Co	Houston, Tex	....
WEW	St. Louis University	St. Louis, Mo.	....
WFAA	Dallas News & Dallas Journal	Dallas, Tex.	....

DIRECTORY OF RADIO BROADCASTING STATIONS

Call Signal	Owner of Station	Location of Station	Your Adjustment
WFAB	Carl F. Woese	Syracuse, N. Y.	
WFAF	H. C. Spratley Radio Co	Poughkeepsie, N. Y.	
WFAH	Electric Supply Co	Port Arthur, Tex.	
WFAJ	Hi-Grade Wireless Instrument Co	Asheville, N. C.	
WFAM	Times Publishing Co	St. Cloud, Minn.	
WFAN	Hutchinson Electric Service Co	Hutchinson, Minn.	
WFAQ	Missouri Wesleyan College	Cameron, Mo.	
WFAT	New Columbus College	Sioux Falls, S. Dak.	
WFAV	University of Nebraska, Dept. of Elec. Eng.	Lincoln, Nebr.	
WFI	Strawbridge & Clothier	Philadelphia, Pa.	
WGAL	Lancaster Electric Supply & Construction Co.	Lancaster, Pa.	
WGAN	Cecil E. Lloyd	Pensacola, Fla.	
WGAQ	Glenwood Radio Corp	Shreveport, La.	
WGAW	Ernest C. Albright	Altoona, Pa.	
WGAY	Northwestern Radio Co	Madison, Wis.	
WGAZ	South Bend Tribune	South Bend, Ind.	
WGI	American Radio & Research Corp	Medford Hillside, Mass.	
WGL	Thomas F. J. Rowlett	Philadelphia, Pa.	
WGR	Federal Telep. & Teleg. Co	Buffalo, N. Y.	
WGV	Interstate Eelctric Co	New Orleans, La.	
WGY	General Electric Co	Schenectady, N. Y.	
WHA	University of Wisconsin	Madison, Wis.	
WHAA	State University of Iowa	Iowa City, Iowa	
WHAB	Clark W. Thompson	Galveston, Texas	
WHAD	Marquette Universtiy	Milwaukee, Wis.	
WHAG	University of Cincinnati	Cincinnati, Ohio	
WHAH	Rafer Supply Co.	Joplin, Mo.	
WHAK	Roberts Hardware Co.	Clarksburg, W. Va.	
WHAM	University of Rochester	Rochester, N. Y.	
WHAP	Otta & Kuhns	Decatur, Ill.	
WHAR	Paramount Radio & Electric Co.	Atlantic City, N. J.	
WHAS	Courier-Journal & Louisville Times	Louisville, Ky.	
WHAV	Wilmington Electric Specialty Co.	Wilmington, Del.	
WHAZ	Rensselaer Polytechnic Institute	Troy, N. Y.	
WHB	Sweeney School Co.	Kansas City, Mo.	
WHK	Radiovex Co.	Cleveland, Ohio	
WHN	George Schubel	New York, N. Y.	
WIAB	Joslyn Automobile Co.	Rockford, Ill.	
WIAC	Galveston Tribune	Galveston, Texas	
WIAD	Howard R. Miller	Ocean City, N. J.	
WIAF	Gustav A. DeCortin	New Orleans, La.	
WIAI	Heer Stores Co.	Springfield, Mo.	
WIAJ	Fox River Valley Radio Supply Co.	Neenah, Wis.	
WIAK	Journal-Stockman Co.	Omaha, Nebr.	
WIAO	School of Engineering of Milwaukee	Milwaukee, Wis.	
WIAQ	Chronicle Publishing Co.	Marion, Ind.	
WIAR	Paducah Evening Sun	Paducah, Ky.	
WIAS	Home Electric Co	Burlington, Iowa	
WIAU	American Trust & Savings Bank	Le Mars, Iowa	
WIK	K. & L. Electric Co.	McKeesport, Pa.	
WIL	Continental Electrical Supply Co.	Washington, D. C.	
WIP	Gimbel Brothers	Philadelphia, Pa.	
WJAB	American Electric Co.	Lincoln, Nebr.	
WJAD	Jackson's Radio Engineering Laboratories	Waco, Texas	
WJAF	Press Publishing Co.	Muncie, Ind.	
WJAG	Norfolk Daily News	Norfolk, Nebr.	
WJAK	Clifford L. White	Greentown, Ind.	
WJAM	D. M. Perham	Cedar Rapids, Io.	

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Call Signal	Owner of Station	Location of Station	Your Adjustment
WJAN	Peoria Star	Peoria, Ill.	
WJAQ	Capper Publications	Topeka, Ks.	
WJAR	The Outlet Company	Providence, R. I.	
WJAS	Pittsburgh Radio Supply House	Pittsburgh, Pa.	
WJAT	Kelly-Vawter Jewelry Co.	Marshall, Mo.	
WJAX	Union Trust Company	Cleveland, O.	
WJAZ	Chicago Radio Laboratory	Chicago, Ill.	
WJD	Richard H. Howe	Granville, O.	
WJH	William P. Boyer Co.	Washington, D. C.	
WJX	Deforest Radio Tel. & Tel. Co.	New York, N. Y.	
WJY	R. C. A.	New York, N. Y.	
WJZ	New York, N. Y.	New York, N. Y.	
WKAA	H. F. Paar	Cedar Rapids, Io.	
WKAD	Charles Looff	East Providence, R. I.	
WKAF	W. S. Radio Supply Company	Wichita Falls, Tex.	
WKAN	United Battery Service Company	Montgomery, Ala.	
WKAP	Dukes W. Flint	Cranston, R. I.	
WKAQ	Radio Corp. of Porto Rico	San Juan, P. R.	
WKAR	Michigan Agriculture College	East Lansing, Mich.	
WKAV	Laconia Radio Club	Laconia, N. H.	
WKAW	Turner Cycle Company	Beloit, Wis.	
WKAY	Brenau College	Gainesville, Ga	
WKY	WKY Radio Shop	Oklahoma, Okla.	
WLAG	Cutting & Washington Radio Corp.	Minneapolis, Minn	
WLAH	Samuel Woodworth	Syracuse, N. Y.	
WLAJ	Waco Electrical Supply Company	Waco, Tex.	
WLAK	Vermont Farm Machine Corporation	Bellows Falls, Vt.	
WLAL	Naylor Electrical Co.	Tulsa, Okla.	
WLAN	Putnam Hardware Company	Houlton, Me.	
WLAP	W. V. Jordan	Louisville, Ky.	
WLAQ	Arthur E. Schilling	Kalamazoo, Mich.	
WLAT	Radio & Specialty Company	Burlington, Io.	
WLAV	Electric Shop	Pensacola, Fla.	
WLAW	Police Department, city of New York	New York, N. Y.	
WLAX	Putnam Electric Company	Greencastle, Ind.	
WLB	University of Minnesota	Minneapolis, Minn.	
WLW	Crosley Manufacturing Company	Cincinnati, O.	
WMAB	Radio Supply Company	Oklahoma, Ok.	
WMAC	J. Edward Page	Fernwood, N. Y.	
WMAF	Round Hills Radio Corp	Dartmouth, Mass.	
WMAH	General Supply Co.	Lincoln, Neb.	
WMAJ	Drovers Telegram Co.	Kansas City, Mo.	
WMAK	Norton Laboratories	Lockport, N. Y.	
WMAL	Trenton Hardware Co.	Trenton, N. J.	
WMAN	First Baptist Church	Columbus, Ohio	
WMAP	Utility Battery Service	Easton, Pa.	
WMAQ	Chicago Daily News	Chicago, Ill.	
WMAV	Alabama Polytechnic Institute	Auburn, Ala.	
WMAY	Kingshighway Presbyterian Church	St. Louis, Mo.	
WMAZ	Mercer University	Macon, Ga.	
WMC	"Commercial Appeal"	Memphis, Tenn.	
WMU	Doubleday-Hill Electric Co.	Washington, D. C.	
WNAC	Shepard Stores	Boston, Mass.	
WNAD	University of Oklahoma	Norman, Okla.	
WNAL	R. J. Rockwell	Omaha, Neb.	
WNAN	Syracuse Radio Telephone Co.	Syracuse, N. Y.	
WNAP	Wittenberg College	Springfield, Ohio.	
WNAQ	Charleston Radio Electric Co.	Charleston, S. C.	

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Call Signal	Owner of Station	Location of Station	Your Adjustment
WNAR	C. C. Rhodes	Butler, Mo	....
WNAS	Texas Radio Corp. and Austin Statesman	Austin, Tex	....
WNAT	Lennig Brothers Co	Philadelphia, Pa	....
WNAV	Peoples Telephone & Telegraph Co	Knoxville, Tenn	....
WNAW	Peninsular Radio Club	Fort Monroe, Va	....
WNAX	Dakota Radio Apparatus Co	Yankton, S. Dak	....
WNJ	Shotton Radio Manufacturing Co	Albany, N. Y	....
WOAC	Maus Radio Co	Lima, Ohio	....
WOAD	Friday Battery & Electric Corp	Sigourney, Iowa	....
WOAE	Midland College	Fremont, Neb	....
WOAF	Tyler Commercial College	Tyler, Tex	....
WOAG	Apollo Theatre	Belvidere, Ill	....
WOAH	Palmetto Radio Corp	Charleston, S. C	....
WOAI	Southern Equipment Co	San Antonio, Tex	....
WOAJ	Ervins Electrical Co	Parsons, Kans	....
WOAL	William E. Woods	Webster Groves, Mo	....
WOAN	Vaughn Conservatory of Music	Lawrenceburg, Tenn	....
WOAO	Lyradion Mfg. Co	Mishawaka, Ind	....
WOAP	Kalamazoo College	Kalamazoo, Mich	....
WOAR	Henry P. Lundskow	Kenosha, Wis	....
WOAT	Boyd M. Hamp	Wilmington, Del	....
WOAV	Pennsylvania Nat'l Guard, 2d Bat. 112th Inf.	Erie, Pa	....
WOAW	Woodmen of the World	Omaha, Neb	....
WOAX	Franklyn J. Wolff	Trenton, N. J	....
WOC	Palmer School of Chiropractic	Davenport, Iowa	....
WOI	Iowa State College	Ames, Iowa	....
WOK	Pine Bluff Co	Pine Bluff, Ark	....
WOO	John Wanamaker	Philadelphia, Pa	....
WOQ	Western Radio Co	Kansas City, Mo	....
WOR	L. Bamberger & Co	Newark, N. J	....
WOS	Missouri State Marketing Bureau	Jefferson City, Mo	....
WPAB	Pennsylvania State College	State College, Pa	....
WPAC	Donaldson Radio Co	Okmulgee, Okla	....
WPAH	Wisconsin Department of Markets	Waupaca, Wis	....
WPAJ	Doolittle Radio Corp	New Haven, Conn	....
WPAK	North Dakota Agricultural College	Agric. College, N. D	....
WPAL	Superior Radio & Telep. Equipment Co	Columbus, Ohio	....
WPAM	Auerbach & Guettel	Topeka, Kans	....
WPAP	Theodore D. Phillips	Winchester, Ky	....
WPAQ	General Sales & Engineering Co	Frostburg, Md	....
WPAT	St. Patrick's Cathedral	El Paso, Tex	....
WPAU	Concordia College	Moorhead, Minn	....
WPAZ	John R. Koch (Dr.)	Charleston, W. Va	....
WPG	Nushawg Poultry Farm	New Lebanon, Ohio	....
WQAA	Horace A. Beale, Jr	Parkesburg, Pa	....
WQAC	E. B. Gish	Amarillo, Tex	....
WQAD	Whitall Electric Co	Waterbury, Conn	....
WQAE	Moore Radio News Station	Springfield, Vt	....
WQAF	Sandusky Register	Sandusky, Ohio	....
WQAH	Brock-Anderson Electrical Engineering Co	Lexington, Ky	....
WQAL	Coles County Telephone and Teleg. Co	Mattoon, Ill	....
WQAM	Electrical Equipment Co	Miami, Fla	....
WQAN	Scranton Times	Scranton, Pa	....
WQAO	Calvary Baptist Church	New York, N. Y	....
WQAQ	Abilene Daily Reporter	Abilene, Tex	....
WQAS	Prince-alter Co.	Lowell, Mass	....
WQAV	Huntington & Guerry, Inc	Greenville, S. C	....
WQAW	Catholic University	Washington, D. C	....

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Call Signal	Owner of Station	Location of Station	Your Adjustment
WQAX	Radio Equipment Co.	Peoria, Ill.	
WRAA	Rice Institute	Houston, Tex.	
WRAD	Taylor Radio Shop	Marion, Mass.	
WRAF	The Radio Club, Inc.	Laport, Ind.	
WRAH	Stanley N. Read	Providence, R. I.	
WRAL	Northern States Power Co.	St. Croix Falls, Wis.	
WRAM	Lombard College	Galesburg, Ill.	
WRAN	Black Hawk Electrical Co.	Waterloo, Iowa	
WRAO	Radio Service Co.	St. Louis, Mo.	
WRAV	Antioch College	Yellow Springs, Ohio	
WRAW	Avenue Radio Shop	Reading, Pa.	
WRAX	Flaxon's Garage	Gloucester City, N. J.	
WRAY	Radio Sales Corp.	Scranton, Pa.	
WRAZ	Radio Shop of Newark	Newark, N. J.	
WRC	Radio Corporation of America	Washington, D. C.	
WRK	Doren Bros. Electric Co.	Hamilton, Ohio	
WRL	Union College	Schenectady, N. Y.	
WRM	University of Illinois	Urbana, Ill.	
WRR	City of Dallas	Dallas, Tex.	
WRW	Tarrytown Radio Research Laboratory	Tarrytown, N. Y.	
WSAB	Southeast Missouri State Teachers College	Cape Girardeau, Mo.	
WSAC	Clemson Agricultural College	Clemson College, S. C.	
WSAD	J. A. Poster Company	Providence, R. I.	
WSAU	Camp Marienfeld	Chesham, N. H.	
WSAG	City of St. Petersburg	St. Petersburg, Fla.	
WSAH	A. J. Leonard Jr.	Chicago, Ill.	
WSAI	United States Playing Card Co.	Cincinnati, Ohio	
WSAJ	Grove City College	Grove City, Pa.	
WSAL	Franklin Electric Co.	Brookville, Ind.	
WSAN	Allentown Radio Club	Allentown, Pa.	
WSAR	Doughty & Welch Electrical Co.	Fall River, Mass.	
WSAT	Donohoo Ware Hardware Co.	Plainview, Tex.	
WSAW	John D. Long, Jr.	Canandaigua, N. Y.	
WSAX	Chicago Radio Laboratory	Chicago, Ill.	
WSAY	Irving Austin	Port Chester, N. Y.	
WSAZ	Chase Electric Shop	Pomeroy, O.	
WSB	Atlanta Journal	Atlanta, Ga.	
WSL	J. & M. Electric Co	Utica, N. Y.	
WSY	Alabama Power Co.	Birmingham, Ala.	
WTAB	Fall River Daily Herald Publishing Co.	Fall River, Mass.	
WTAC	Penn Traffic Co.	Johnston, Pa.	
WTAF	Louis J. Gallo	New Orleans, La.	
WTAG	Horn Music Co	Providence, R. I.	
WTAH	Carmen Ferro	Belvidere, Ill.	
WTAJ	The Radio Shop	Portland, Me.	
WTAL	Toledo Radio & Electric Co.	Toledo, Ohio	
WTAM	Willard Storage Battery	Cleveland, Ohio	
WTAN	Orndorff Radio Shop	Mattoon, Ill.	
WTAP	Cambridge Radio & Electric Co.	Cambridge, Ill.	
WTAQ	S. H. Van Gorden & Son	Osseo, Wis	
WTAR	Reliance Electric Co.	Norfolk, Va.	
WTAS	Charles E. Erbstein	Elgin, Ill. (near)	
WTAT	Edison Electric Illuminating Co.	Boston, Mass.	
WTAU	Ruegg Battery & Electric Co.	Tecumseh, Neb.	
WTAW	Agricultural & Mechanical College of Texas	College Station, Tex.	
WTAX	Williams Hardware Co.	Streator, Ill.	
WTAY	Iodar-Oak Leaves Broadcasting Station	Oak Park, Ill.	
WTAZ	Thomas J. McGuire	Lambertville, N. J.	

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Call Signal	Owner of Station	Location of Station	Your Adjustment
WTG	Kansas State Agricultural College	Manhattan, Kan.	....
WWAB	Hoenig, Swern & Co.	Trenton, N. J.	....
WWAC	Sanger Bros.	Waco, Tex.	....
WWAD	Wright & Wright, Inc.	Philadelphia, Pa.	....
WWAE	Alamo Dance Hall (L. J. Crowley)	Joliet, Ill.	....
WWAF	Galvin Radio Supply Co.	Camden, N. J.	....
WWAO	Michigan College of Mines	Houghton, Mich.	....
WWI	Ford Motor Co.	Dearborn, Mich.	....
WWJ	Detroit News	Detroit, Mich.	....
WWL	Deyels University	New Orleans, La.	....

Government Daily Market Reports

Call Signal	Owner of Station	Location of Station	Your Adjustment
NAA	U. S. Navy	Arlington, Va.	....

Wave Length 435 Metres
(Eastern Time)

9.45 A.M.	Weather.
10.05 A.M.	Weather Forecasts.
10.25 A.M.	Fruit and Vegetable Shipping Reports.
12.25 P.M.	Livestock Market Reports.
1.45 P.M.	Fruit and Vegetable Market Reports.
3.25 P.M.	Complete Livestock Market Quotations and Comment.
3.45 P.M.	Special Weather Forecasts.
4.05 P.M.	(except Saturday, when time will be 4.25 P.M.) Crop Reports and Special News Items.
5.05 P.M.	Market Reports, covering Grain, Livestock, Meats, etc.
10.05 P.M.	Weather Forecasts.

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CANADA

Call Signal	Owner of Station	Location of Station	Your Adjustment
CFAC	The Calgary Herald	Calgary, Alb	....
CFCA	Star Publishing & Printing Co	Toronto, Ont	....
CFCF	Marconi Wireless Tel. Co. of Canada, Ltd	Montreal, Que	....
CFCH	Abitibi Power & Paper Co., Ltd	Iroquois Falls, Ont	....
CFCJ	La Cie de L'Evenement	Quebec, Que	....
CFCK	Radio Supply Co., Ltd	Edmonton, Alb	....
CFCL	Continental Methodist Church	Vancouver, B. C	....
CFCN	W. W. Grant Radio, Ltd	Calgary, Alb	....
CFCO	Semmelhaack, Ltd	Bellevue, Que	....
CFCQ	Radio Specialties, Ltd	Vancouver, B. C	....
CFCR	Laurentide Air Service Ltd	Sudbury, Ont	....
CFCW	The Radio Shop	London, Ont	....
CFDO	Sparks Co	Nanaimo, B. C	....
CFQC	The Electric Shop, Ltd	Saskatoon, Sask	....
CFRC	Queen's University	Kingston, Ont	....
CFUC	University of Montreal	Montreal, Que	....
CHAC	Radio Engineers	Halifax, N. S	....
CHBC	The Albertan Publishing Co	Calgary, Alb	....
CHCD	Canadian Wireless & Electric Co	Quebec, Que	....
CHCE	Western Canada Radio Supply, Ltd	Victoria, B. C	....
CHCL	The Vancouver Merchants Exchange, Ltd	Vancouver, B. C	....
CHYC	Northern Electric Co	Montreal, Que	....
CICI	Maritime Radio Corporation, Ltd	St. John, N. B	....
CJCA	The Edmonton Journal, Ltd	Edmonton, Alb	....
CJCD	T. Eaton Co., Ltd	Toronto, Ont	....
CJCE	Sprott-Shaw Radio Co	Vancouver, B. C	....
CJCN	Simons Agnew & Co	Toronto, Ont	....
CJCX	Percival Wesley Shackleton	Olds, Alb	....
CJSC	The Evening Telegram	Toronto, Ont	....
CKAC	La Presse Publishing Co	Montreal, Que	....
CKCD	Vancouver Daily Province	Vancouver, B. C	....
CKCE	Canadian Independent Telephone Co., Ltd	Toronto, Ont	....
CKCK	Leader Publishing Co., Ltd	Regina, Sask	....
CKOC	The Wentworth Radio Supply Co	Hamilton, Ont	....
CKY	Manitoba Telephone System	Winnipeg, Man	....
CPGC	London Free Press Printing Co., Ltd	London, Ont	....
OA	Dept. of Marine and Fisheries, Radio Branch Test Room	Ottawa, Ont	....

CUBA

Call Signal	Owner of Station	Location of Station	Your Adjustment
2AB	Alberto S. de Bustamante	Havana	....
8AZ	Alfredo Brocks	Caibarien	....
6AZ	Valentin Ullivarry	Cienfuegos	....
2BY	Frederick W. Borton	Havana	....
6BY	Jose Ganduxe Margarit	Cienfuegos	....
8BY	Alberto Ravelo	Santiago de Cuba	....
2CX	Frederick W. Borton	Havana	....
6CX	Dr. Antonio Tomas Figueroa	Cienfuegos	....
8CX	Baltazar Moas	Santiago de Cuba	....
2DW	Lorenzo Zayas	Havana	....
6DW	Eduardo Terry	Cienfuegos	....
2EV	Westinghouse Elec. Co	Havana	....
5EV	Leopoldo Valdes Figueroa	Colon	....
6EV	Josefa Alvarez Alvarez	Cienfuegos	....
2HC	Heraldo de Cuba	Havana	....
2HS	Julio Power	Havana	....
2JQ	Raul Perez Falcon	Havana	....
2KD	Eduardo S. de Fuentes	Havana	....
2KP	Alvaro Daza	Havana	....
6KW	Frank H. Jones	C. Tuinicu	....
2LC	Luis Casas	Havana	....
2MG	Manuel G. Salas	Havana	....
2MN	Fausto Simon	Havana	....
2OK	Mario Garcia Velez	Havana	....
2TW	Roberto E. Ramirez	Havana	....
PWX	Cuban Telephone Co	Havana	....
6XJ	Frank H. Jones	C. Tuinicu	....

Broadcasting Stations Arranged Alphabetically by States

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ALABAMA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Auburn	Alabama Polytechnic Institute	WMAV	500	250	1070
Birmingham	Alabama Power Co	WSY	500	360	833
Mobile	Mobile Radio Co	WEAP	100	360	*....
Montgomery	United Battery Service Co	WKAN	15	226	1330

ARIZONA

Phoenix	McArthur Bros. Mercantile Co	KFAD	100	360	....
	Nielsen Radio Supply Co	KFCB	10	278	1080
	Smith, Hughes & Co	KDYW	20	360	....
Tucson	University of Arizona	KFDH	150	360	....

ARKANSAS

Conway	Conway Radio Laboratories	KFKQ	150	224	1340
Fayetteville	Gilbreth & Stinson	KFDV	200	360	....
Little Rock	Bizzell Radio Shop	KFLQ	20	261	1150
	Christian Churches of Little Rock	KFMB	...	254	1180
	J. C. Dice Electric Co	WCAV	20	360	....
	University of Arkansas	KFMQ	100	263	1140
Pine Bluff	Pine Bluff Co	WOK	500	360	....

CALIFORNIA

Bakersfield	Frank E. Siefert	KDZB	100	240	....
Berkeley	Berkeley Daily Gazette	KRR	50	278	1080
El Monte	Coast Radio Co	KUY	50	256	1170
Fresno	San Joaquin Light & Power Corp	KMJ	50	273	1100
Hollywood	Studio Lighting Service Co	KFAR	200	280	1070
Long Beach	Prest & Dean Radio Co.; Radio Research Soc.	KSS	20	360	....
Los Angeles	Automobile Club of Southern California	KDZF	500	278	1080
	Bible Institute of Los Angeles	KJS	750	360	....
	City Dye Works & Laundry Co	KUS	100	360	....
	Earle C. Anthony, Inc	KFI	500	469	640
	Electric Lighting Supply Co	KNX	100	360	....
	Los Angeles Examiner	KWH	500	360	....
	Radio Supply Co	KNV	100	256	1179
	Times-Mirror Co	KHJ	500	395	760
Modesto	Modesto Herald Publishing Co	KXD	5	252	1190
Oakland	Preston D. Allen	KZM	50	360	....
	Tribune Publishing Co	KLX	250	360	....
	Warner Brothers	KLS	250	360	....
Richmond	Richmond Radio Shop	KFCM	100	360	....
Sacramento	Kimball-Upson Co	KFBK	100	283	1060
Salem'	Salem Electric Co	KFCD	20	...	....
Santa Ana	The Radio Den	KFAW	10	280	1070
Santa Barbara	Fallon & Company	KFHJ	100	360	....
San Diego	Savoy Theatre	KDYM	100	280	1070
	Southern Electrical Co	KDPT	50	244	1230
	W. K. Azbill	KFBC	10	278	1080
San Jose	City of San Jose	KFAQ	250	360	....
	Charles D. Herrold	KQW	50	360	....
San Francisco	Examiner Printing Co	KUO	150	360	....
	Hale Brothers	KPO	500	423	710
San Luis Obispo	Reuben H. Horn	KFBE	10	360	833

* Where the frequency (kilocycles) is desired it can be found by dividing 300,000 by the wave length. In each case where dots are used the figure for frequency or kilocycles is 833.

CALIFORNIA (Continued)

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Stanford Univ...	Leland Stanford University	KFGH	500	360	....
Stockton	C. O. Gould	KJQ	5	360	....
	Portable Wireless Telephone Co	KWG	100	360	....
Venice	White Kinney Co	KFAV	5	224	1340

COLORADO

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Boulder	University of Colorado	KFAJ	100	360	....
Colorado Springs.	Colorado Springs Radio Co	KFCK	10	258	1160
	Marke Hoffel Motor Co	KFFQ.	100	360	....
	Nassour Bros. Radio Co	KFKZ	10	234	1280
Greeley	Colorado State Teachers College	KFKA	50	248	1210
	Weld County Printing and Pub. Co	KFJD	50	236	1270
Denver	Knight-Campbell Music Co	KFDL	5	360	....
	National Educational Service	KFLE	25	268	1120
	Nichols Academy of Music	KDZQ	10	360	....
	Reynolds Radio Co	KLZ	500	360	....
	Western Radio Corp	KFAF	50	360	....
	Winner Radio Corp	KFEL	50	360	....
Gunnison	Colorado State Normal School	KFHA	50	252	1190
Lakeside	Denver Park & Amusement Co	KFKH	10	226	1330
Trinidad	Trinidad Gas & El. Sup. Co. and Chron. News	KFBS	10	360	....

CONNECTICUT

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Hartford	The Courant	WDAK	100	261	1150
New Haven	Doolittle Radio Corp	WPAJ	10	268	1120
Storrs	Connecticut Agricultural College	WABL	100	283	1060
Waterbury	Whitall Electric Co	WQAD	50	242	1240

DELAWARE

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Wilmington	Boyd M. Hamp	WOAT	50	360	833
	Wilmington Electrical Specialty Co	WHAV	50	360	833

DISTRICT OF COLUMBIA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Washington	Catholic University	WQAW	5	236	1270
	Chesapeake & Potomac Telephone Co	WCAP	500	469	640
	Continental Electric Supply Co	WIL	10	360	833
	Doubleday-Hill Electric Co	WMU	50	261	1150
	Hecht Co	WEAS	100	360	....
	Radio Corp. of America	WRC	500	469	640
	William P. Boyer Co	WJH	50	273	1100
	Y. M. C. A.	WABE	100	283	1060

FLORIDA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Jacksonville	Arnold Edwards Piano Co	WABG	10	275	1090
Miami	Electrical Equipment Co	WQAM	100	360	833
Pensacola	Electric Shop	WLAV	15	254	1180
	Cecil E. Lloyd	WGAN	50	360	833
St. Petersburg	Loren V. Davis and George Prestman, Sr.	WSAG	10	244	1230
Tampa	Tampa Daily Times	WDAE	250	360	....

GEORGIA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Atlanta	Atlanta Journal	WSB	500	429	700
Gainesville	Brenau College	WKAY	10	280	1070
Macon	Mercer University	WMAZ	50	268	1120

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IDAHO

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Boise	Ind. School Dist. of Boise City. Boise High	KFAU	150	360	1110
	Jenkins Furniture Co.	KFFB	10	240	1250
	St. Michael's Cathedral	KFDD	10	252	1190
Kellogg	Bunker Hill & Sullivan Min. & Concen. Co.	KFEY	10	360	....
Moscow	The Electric Shop	KFAN	50	360	....

ILLINOIS

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Belvidere	Apollo Theatre	WOAG	100	224	1340
	Carmen Ferro	WTAH	10	236	1270
Cambridge	Cambridge Radio & Electric Co.	WTAP	50	242	1240
Carthage	Carthage College	WCAZ	50	246	1220
Chicago	Board of Trade	WDAP	500	360	....
	Chicago Daily Drovers Journal	WAAF	200	286	1050
	Chicago Daily News	WMAQ	500	448	670
	Chicago Radio Laboratory	WSAX	20	268	1120
	Chicago Radio Laboratory	WJAZ	1000	448	670
	A. G. Leonard. Jr.	WSAH	500	248	1210
	Westinghouse Elec. & Manf. Co.	KYW	1000	536	560
Decatur	James Milliken University	WBAO	50	360	....
	Otta & Kuhns	WHAP	50	360	833
Elgin	Charles E. Erbstein	WTAS	500	286	1050
Galesburg	Lombard College	WRAM	250	244	1230
Joliet	Alamo Dance Hall (L. J. Crowley)	WWAE	500	227	1320
Lake Forest	Lake Forest College	WABA	100	266	1130
Mattoon	Coles County Tel. & Tel. Co.	WQAL	10	258	1160
	Orndorff Radio Shop	WTAN	100	240	1250
Oak Park	Iodar-Oak Leaves Broadcasting Station	WTAY	15	226	1330
Peoria	Peoria Star	WJAN	100	280	1070
	Radio Equipment Co.	WQAX	100	360	833
Rockford	Joslyn Automobile Co.	WIAB	50	252	1190
	A. T. Frykman	KFLV	10	229	1310
Streator	Williams Hardware Co.	WTAX	20	231	1300
Tuscola	James L. Bush	WDZ	10	278	1080
Urbana	University of Illinois	WRM	500	360	833
Zion	Wilbur G. Voliva	WCBD	500	345	870

INDIANA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Anderson	Fulwider-Grimes Battery Co.	WABC	10	229	1310
Brookville	Franklin Electric Co.	WSAL	10	246	1220
Greencastle	Putnam Electric Co.	WLAX	10	231	1300
Greentown	Clifford L. White	WJAK	30	254	1180
Laporte	Radio Club, Inc.	WRAF	20	224	1340
Marion	Chronicle Publishing Co.	WIAQ	10	226	1330
Mishawkawa	Lyradion Manufacturing Co.	WOAO	50	360	833
Muncie	Muncie Press & Publishing Co	WJAF	10	360	833
South Bend	South Bend Tribune	WGAZ	50	360	833
	The Radio Laboratories	WABJ	10	240	1250
West Lafayette	Purdue University	WBAA	250	360	....

IOWA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Ames	Iowa State College	WOI	100	360	833
Atlantic	Atlantic Automobile Co.	KFLZ	10	273	1100
Boone	Crary Hardware Co.	KFGQ	10	226	1330
Burlington	Radio & Specialty Co.	WLAT	10	360	833
Cedar Falls	Iowa State Teachers' College	KFJX	50	229	1310
	Home Electric Co.	WIAS	100	360	833

IOWA (Continued)

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Cedar Rapids	D. M. Perham	WJAM	20	258	1120
	Everette M. Foster	KFLP	20	240	1250
	H. F. Paar	WKAA	100	268	1160
Centerville	First National Bank	WDAX	100	360	....
Davenport	Palmer School of Chiropractic	WOC	500	484	620
Dexter	Thomas H. Warren	KFJV	10	224	1340
Fort Dodge	Auto Electric Service Co	KFER	20	231	1300
	Tunwall Radio Co	KFJY	50	246	1220
Gladbrook	Gladbrook Electrical Co	KFIK	20	234	1280
Iowa City	State University of Iowa	WHAA	100	283	1060
Lamoni	Graceland College	KFFV	10	360	....
Le Mars	American Trust & Savings Bank	WIAU	20	360	833
	Western Union College	KFCY	50	252	1190
Marshalltown	Marshall Electrical Co	KFJB	10	248	1210
Oskaloosa	Penn College	KFHL	10	227	1320
Ottumwa	Hardsacg Manufacturing Co	KFJL	10	242	1240
Sigourney	Friday Battery and Electric Corp	WOAD	20	360	833
Sioux City	Davidson Bros. Co	WEAU	100	360	....
	Morningside College	KFMR	10	261	1150
Waterloo	Black Hawk Electrical Co	WRAN	10	236	1270

KANSAS

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Anthony	T. & H. Radio Co	WBL	100	261	1150
Emporia	Hollister-Miller Motor Co	WAAZ	100	360	....
Hutchinson	Robert W. Nelson	KFHX	150	229	1310
Iola	Ross Arbuckle's Garage	KFID	20	246	1220
Louisburg	Windisch Electric Farm Equipment Co	KFIL	30	234	1280
Manhattan	Kansas State Agricultural College	WTG	1000	485	....
Milford	Brinkley-Jones Hospital Association	KFKB	500	286	1050
Parsons	Ervins Electrical Co	WOAJ	15	258	1160
Topeka	Auerbach & Guettel	WPAM	100	360	833
	Capper Publications	WJAQ	100	360	833
Towanda	Le Grand Radio Co	KFJW	10	226	1330
Wichita	Wichita Board of Trade & Lander Radio Co.	WEAH	50	280	1070

KENTUCKY

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Lexington	Brock-Anderson Electric Eng. Co	WQAH	10	254	1180
Louisville	Courier-Journal & Louisville Times	WHAS	500	400	750
	W. V. Jordan	WLAP	15	360	833
Paducah	Paducah Evening Sun	WIAR	100	360	833
Winchester	Theodore D. Phillips	WPAP	35	360	833

LOUISIANA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Alexandria	Pinous & Murphey	KFFY	100	275	1090
Baton Rouge	Louisiana State University	KFGC	100	254	1180
Franklinton	Paul E. Greenlaw	KFLD	20	234	1280
New Orleans	Gustav A. De Cortin	WIAF	10	234	1280
	Louis J. Gallo	WTAF	20	268	1120
	Interstate Electric Co.	WGV	100	360	833
	Valdemar Jensen	WAAB	100	268	1120
	Loyola University	WWL	100	280	1070
	Clyde R. Randall, 2813 Calhoun	WCAG	50	268	1120
	Tulane University	WAAC	400	360	....
Shreveport	Central Christian Church	KFHF	150	266	1130
	First Baptist Church	KFDX	100	360	....
	Glenwood Radio Corp	WGAQ	150	360	833

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MAINE

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilo-cycles
Bangor	Bangor Railway & Electric Co.	WABI	50	240	1250
Houlton	Putnam Hardware Co.	WLAN	250	283	1060
Portland	The Radio Shop	WTAJ	10	236	1270

MARYLAND

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilo-cycles
Baltimore	Baltimore American & News Pub. Co.	WEAR	50	360	....
	Sanders & Stayman Co.	WCAO	50	360	....
Frostburg	General Sales and Eng. Co.	WPAQ	10	360	....

MASSACHUSETTS

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilo-cycles
Boston	Edison Electric Illuminating Co.	WTAT	100	244	1228
	Shepard Stores	WNAC	100	278	1080
Dartmouth	Round Hills Radio Corp.	WMAF	100 to 500	360	833
Fall River	Doughty & Welsh Elec. Co.	WSAR	10	254	1180
	Fall River Daily Herald Publishing Co.	WTAB	10	248	1210
Lowell	Brines-Walter Co.	WQAS	100	266	1130
Marion	Taylor Radio Shop	WRAD	10	248	1210
Medford Hillside	American Radio & Research Corp.	WGI	500	360	833
New Bedford	Slocum & Kilburn	WDAU	100	360	....
Springfield	Westinghouse Electric & Mfg. Co.	WBZ	1000	337	890
Worcester	First Baptist Church	WABK	10	252	1190
	Samuel A. Waite	WDAS	5	360	....

MICHIGAN

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilo-cycles
Berrien Springs	Emmanuel Missionary College	KFGZ	10	268	1120
Dearborn	Ford Motor Co.	WWI	50	273	1100
Detroit	Detroit Free Press	WCX	500	517	580
	Detroit News	WWJ	500	517	580
	Police Department	KOP	500	286	1050
East Lansing	Michigan Agriculture College	WKAR	250	280	1070
Flint	Fallain & Lathrop	WEAA	10	280	1070
Houghton	M. G. Sateren	KFMW	50	266	1130
	Michigan College of Mines	WWAO	250	244	1230
Kalamazoo	Arthur E. Schilling	WLAQ	20	283	1060
	Kalamazoo College	WOAP	50	240	1250
Menominee	Signal Electric Manufacturing Co.	KFLB	20	248	1210
Mount Clemens	Henry B. Joy	WABX	150	270	1110
Saginaw	F. L. Doherty Auto. & Radio Supply Co.	WABM	100	254	1180

MINNESOTA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilo-cycles
Duluth	Paramount Radio Corp.	WMAT	250	266	1130
	Freimuth Department Store	KFMS	100	275	1090
Hutchinson	Hutchinson Electric Service Co.	WFAN	300	360	833
Minneapolis	Augsburg Seminary	KFEX	100	261	1150
	Cutting & Washington Radio Corp.	WLAG	500	417	720
	The Dayton Co.	WBAH	500	417	720
	William Hood Dunwoody Industrial Institute	WCAS	100	246	1050
	Harry O. Iverson	KFDZ	5	231	1300
	Sterling Electric Co.	WBAD	100	360	....
	University of Minnesota	WLB	5	360	833
	George W. Young	KFMT	5	231	1300
Moorhead	Concordia College	WPAU	20	360	833
Northfield	St. Olaf College	WCAL	500	360	....
	Carleton College	KFMX	500	283	1060
St. Cloud	Times Publishing Co.	WFAM	20	360	833

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MISSOURI

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Butler	C. C. Rhodes	WNAR	20	231	1300
Cameron	Missouri Wesleyan College	WFAQ	10	360	833
Cape Girardeau	Southeast Missouri State Teachers College	WSAB	100	360	833
Columbia	University of Missouri	WAAN	50	254	1180
Independence	Reorg. Ch'ch of Jesus Christ of Lat. Day Sts.	KFIX	250	240	1250
Jefferson City	Missouri State Marketing Bureau	WOS	500	441	680
Joplin	Rafer Supply Co.	WHAH	250	283	1060
Kansas City	Drovers Telegram Co.	WMAJ	250	275	1090
	Kansas City Star	WDAF	500	411	730
	Sweeney School Co.	WHB	500	411	730
	Western Radio Co.	WOQ	500	360	833
Marshall	Kelley-Vawter Jewelry Co	WJAT	10	360	833
St. Joseph	Utz Electric Shop Co.	KFHD	100	226	1330
St. Louis	American Society of Mechanical Engineers	KFEZ	100	360	....
	Benwood Company	WEB	500	360	....
	Franklin W. Jenkins	KFIB	10	244	1230
	Kingshighway Presbyterian Church	WMAY	100	280	1070
	Missouri Nat'l Guard, 138th Infantry	KFGJ	250	266	1130
	Post Dispatch	KSD	500	546	550
	Radio Service Co.	WRAO	10	360	833
	St. Louis University	WEW	100	261	1150
	Stix, Baer & Fuller Dry Goods Co.	WCK	100	360	....
Springfield	Heer Stores Co.	WIAI	20	252	1190
Webster Groves	William E. Woods	WOAL	500	229	1310

MONTANA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Billings	Electric Service Station, Inc.	KFCH	10	360	....
Bozeman	H. Everett Cutting	KFDO	50	248	1210
Butte	Abner R. Willson	KFLA	5	283	1060
	F. F. Gray	KFKV	50	283	1060
Havre	Havre, Buttrey & Co.	KFBB	50	360	....
Missoula	Missoula Electric Supply Co.	KFLW	10	234	1280
Stevensville	Ashley C. Dixon & Son	KFJR	5	258	1160

NEBRASKA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Fremont	Midland College	WOAE	20	360	833
Hastings	Westinghouse Electric & Manufacturing Co.	KFKX	500	286	1050
Kearney	Radio-Bug Products Co.	KFHP	10	246	1220
Lincoln	American Electric Co.	WJAB	500	360	833
	General Supply Co.	WMAH	100	254	1180
	Nebraska Radio Electric Co.	KFDU	20	240	1250
	University of Nebraska, Dept. of Elec. Eng.	WFAV	500	275	1090
Norfolk	Norfolk Daily News	WJAG	250	283	1060
Oak	J. L. Scroggin	KFEQ	150	360	....
Omaha	Journal-Stockman Co.	WIAK	200	273	1080
	McGray Co	KFFX	100	278	1080
	Omaha Central High School	KFCZ	100	258	1160
	Omaha Grain Exchange	WAAW	200	360	....
	R. J. Rockwell	WNAL	20	242	1240
	Woodmen of the World	WOAW	500	526	570
Tecumseh	Ruegg Battery & Elec. Co	WTAU	10	360	833
University Place	Nebraska Wesleyan University	WCAJ	500	360	....
Utica	Heidbreder Radio Supply Co.	KFGV	10	224	1340
York	Bullock's Hardware & Sporting Goods	KFDR	10	360	....

NEVADA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Sparks	Nevada State Journal	KFFR	10	226	....

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NEW HAMPSHIRE

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Laconia	Laconia Radio Club	WKAV	50	254	1180

NEW JERSEY

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Atlantic City	Paramount Radio & Electric Co	WHAR	10	231	1300
Camden	Galvin Radio Supply Co	WWAF	100	236	1270
	Victor Talking Machine Co	WABU	100	226	1330
Gloucester City	Flexon's Garage	WRAX	100	268	1120
Lambertville	Thomas J. McGuire	WTAZ	15	283	1060
Newark	L. Bamberger & Co	WOR	500	405	740
	Essex Manufacturing Co	WABS	50	244	1230
	D. W. May, Inc	WBS	20	360	....
	I. R. Nelson Co	WAAM	250	263	1140
	Radio Shop of Newark	WRAZ	50	233	1290
North Plainfield	Borough of North Plainfield	WEAM	100	252	1190
Ocean City	Ocean City Yacht Club	WIAD	10	254	1180
Paterson	Wireless Phone Corporation	WBAN	100	244	1230
Trenton	Franklyn J. Wolff	WOAX	500	240	1250
	Hoenig, Swern & Co	WWAB	10	226	1330
	Trenton Hardware Co	WMAL	50	256	1170

NEW MEXICO

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Albuquerque	University of New Mexico	KFLR	100	254	1180
State College	New Mexico College of Agri. and Mech. Arts	KOB	500	360	....

NEW YORK

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Albany	Shotton Radio Mfg. Co	WNJ	55	360	833
Buffalo	Federal Tel. & Tel. Co	WGR	500	319	940
Canandaigua	Curtice & McElwee	WSAW	100	275	1090
Canton	St. Lawrence University	WCAD	250	280	1070
Cazenovia	Clive B. Meredith	WMAC	200	261	1150
Ithaca	Cornell University	WEAI	500	286	1050
Lockport	Norton Laboratory	WMAK	500	360	833
New York	American Tel. & Tel. Co	WBAY	500	492	610
	Calvary Baptist Church	WQAO	100	360	833
	De Forest Radio Tel. & Tel. Co	WJX	500	360	833
	New York	WJZ	500	455	660
	Police Dept., City of New York	WLAW	500	360	833
	R. C. A.	WJY	500	405	740
	Geo. Schubel, 1540 Broadway	WHN	100	360	833
	Western Electric Co	WEAF	500	492	610
Port Chester	Irving Austin	WSAY	100	233	1290
Poughkeepsie	H. C. Spratley Radio Co	WFAF	20	360	833
Rochester	Lake Ave. Baptist Church	WABO	10	252	1190
	University of Rochester	WHAM	100	283	1060
Schenectady	General Electric Co	WGY	1000	380	790
	Union College	WRL	500	360	833
Syracuse	Syracuse Radio Telephone Co	WNAN	100	286	1050
	Carl F. Woese	WFAB	100	234	1280
	Samuel Woodworth	WLAH	100	234	1280
Tarrytown	Tarrytown Radio Research Laboratory	WRW	150	273	1100
Troy	Rensselaer Polytechnic Institute	WHAZ	500	380	790
Utica	J. & M. Electric Co	WSL	100	273	1100

NORTH CAROLINA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Asheville	Hi-Grade Wireless Instrument Co	WFAJ	50	360	833
Charlotte	Southern Radio Corp	WBT	500	360	....

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NORTH DAKOTA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Agri. College....	North Dakota Agricultural College..........	WPAK	250	360	833
Fargo	Fargo Radio-Electric Co.....................	WDAY	50	244	1230
	Fargo Radio Supply Co.....................	KFLY	20	231	1300
Grand Forks.....	University of North Dakota.......	KFJM	100	280	1070

OHIO

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Cincinnati.......	Crosley Mfg. Co...........................	WLW	500	309	970
	Ohio Mechanics Institute....................	WAAD	25	360	....
	United States Playing Card Co.......... ...	WSAI	500	309	970
	University of Cincinnati....................	WHAG	100	222	1350
Cleveland	Radiovex Co................................	WHK	100	263	1060
	Westinghouse Elec. & Mfg. Co..............	WDPM	250	270	1110
	Willard Storage Battery Co.................	WTAM	1000	390	770
	Union Trust Co............................	WJAX	500	390	770
Columbus	Entrekin Electric Co.......................	WCAH	100	286	1050
	Erner & Hopkins Co........................	WBAV	500	390	770
	First Baptist Church	WMAN	10	286	1050
	Ohio State University	WEAO	500	360	....
	Avery & Leob Electric Co...................	WPAL	100	286	1050
Dayton	Parker High School.........................	WABD	10	283	1060
Dover	Robert F. Weinig..........................	WABP	100	266	1130
Granville	Denison University	WJD	50	229	1310
Hamilton	Doren Bros. Elec. Co	WRK	200	360	833
Lima	Mans Radio Co	WOAC	50	266	1130
Marietta	Marietta College	WBAW	250	246	1220
Newark	Newark Radio Laboratories	WBBA	20	240	1250
New Lebanon ..	Nushawg Poultry Farm.....................	WPG	50	234	1280
Pomeroy	Chase Electric Shop	WSAZ	50	258	1160
Sandusky	Lake Shore Tire Co........................	WABH	20	240	1250
	Sandusky Register	WQAF	5	240	1250
Springfield	Whittenberg College	WNAP	100	231	1300
Toledo	Toledo Radio & Electric Co................	WTAL	10	252	1190
	Scott High School.........................	WABR	50	270	1110
Wooster	College of Wooster........................	WABW	20	234	1280
Yellow Springs ..	Antioch College	WRAV	100	360	833

OKLAHOMA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Bristow	Delano Radio & Electric Co...............	KFJK	100	233	1290
Chickasha	Chickasha	KFGD	20	248	1210
Norman	University of Oklahoma	WNAD	100	360	833
Oklahoma	National Radio Mfg Co.....................	KFJF	20	252	1190
	Radio Supply Co...........................	WMAB	100	360	833
	WKY Radio Shop...........................	WKY	100	360	833
Okmulgee	Donaldson Radio Co........................	WPAC	200	360	833
Tulsa	Naylor Electrical Co.......................	WLAL	100	360	833

OREGON

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Arlington	Arlington Garage..........................	KFGL	5	234	1280
Astoria	Liberty Theatre...........................	KFJI	10	252	1190
Baker	Adler's Music Store.......................	KFDA	5	360	....
Corvallis	Oregon Agricultural College................	KFDJ	50	360	....
Hillsboro	Dr. E. H. Smith..........................	KFFO	5	229	1310
Hood River......	Apple City Radio Club.....................	KOP	10	360	....
	Rialto Theatre............................	KFHB	5	280	1070
Medford	Virgin's Radio Service.....................	KFAY	50	283	1060
Pendleton	Eastern Oregon Radio Co..................	KFEC	50	360	....

OREGON (Continued)

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Portland	Benson Polytechnic Institute	KFIF	100	360	....
	Hollock & Watson Radio Service	KGG	50	360	....
	Meier & Frank Co	KFFE	10	360	....
	Northwestern Radio Mfg. Co	KGN	100	360	....
	Oregon Institute of Technology	KDYQ	100	360	....
	Portland Morning Oregonian	KGW	500	492	610
Salem	Salem Electric Co	KFCD	20	360	....

PENNSYLVANIA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Allentown	Allentown Radio Club	WSAN	10	229	1310
	Charles W. Heinbach	WCBA	10	280	1070
Altoona	Ernest C. Albright	WGAW	100	261	1150
East Pittsburgh	Westinghouse Elec. & Mfg. Co	KDKA	1000	326	920
Easton	Utility Battery Service	WMAP	150	246	1220
Erie	Pennsylvania National Guard	WOAV	100	242	1240
Grove City	Grove City College	WSAJ	250	360	833
Harrisburg	Dr. John B. Lawrence	WABB	10	266	1130
Haverford	Haverford College Radio Club	WABQ	50	261	1150
Johnstown	Penn. Traffic Club	WTAC	150	360	833
Lancaster	Kirk, Johnson & Co	WDBC	50	258	1160
	Lancaster Elec. Supply & Construction Co	WGAL	10	248	1210
McKeesport	K. & L. Electric Co	WIK	500	234	1280
Parkesburg	Horace A. Beale, Jr	WQAA	500	360	833
Philadelphia	Durham & Co	WCAU	100	286	1050
	Gimbel Brothers	WIP	500	509	590
	Lennig Brothers Co	WNAT	100	360	833
	Lit Brothers	WDAR	500	395	760
	Thomas F. J. Rowlett	WGL	500	360	833
	Strawbridge & Clothier	WFI	500	395	760
	John Wanamaker	WOO	500	509	590
	Wright & Wright, Inc	WWAD	100	360	833
Pittsburgh	Doubleday-Hill Electric Co	KQV	250	360	....
	Kaufmann & Bayer Co	WCAE	500	462	650
	Pittsburgh Radio Supply House	WJAS	500	360	833
Reading	Avenue Radio Shop	WRAW	10	238	1260
	Barbey Battery Service	WBBD	50	234	1280
Scranton	Radio Sales Corp	WRAY	100	280	1070
	Scranton Times	WQAN	100	280	1070
State College	Pennsylvania State College	WPAB	500	283	1060
Villanova	Villanova College	WCAM	150	360	....
Washington	Holliday-Hall	WABT	100	252	1190
Wilkes-Barre	John H. Stenger, Jr	WBAX	20	360	....

RHODE ISLAND

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Cranston	Dukes W. Flint	WKAP	200	360	833
East Providence	Charles Looff	WKAD	10	240	1250
Providence	J. A. Foster Co	WSAD	100	261	1150
	The Outlet Co	WJAR	500	360	833
	Shepard Co	WEAN	100	273	1100
	Stanley N. Read	WRAH	10	231	1300

SOUTH CAROLINA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Charleston	Charleston Radio Electric Co	WNAQ	10	360	833
	Palmetto Radio Corp	WOAH	100	360	833
Clemson College	Clemson Agricultural College	WSAC	500	360	833
Greenville	Huntington & Guerry, Inc	WQAV	15	258	1160

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SOUTH DAKOTA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Brookings	Brookings Dakota State College	KFDY	100	360	....
Rapid City	South Dakota State School of Mines	WCAT	100	240	1250
Sioux Falls	New Columbus College	WFAT	50	258	1160
Vermilion	University of South Dakota	WEAJ	200	283	1060
Yankton	Dakota Radio Apparatus Co	WNAX	100	244	1230

TENNESSEE

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Knoxville	People's Telephone & Telegraph Co	WNAV	500	236	1270
Lawrenceburg	Vaughn Conservatory of Music	WOAN	150	360	833
Memphis	Commercial Appeal	WMC	500	500	600
Nashville	John H. DeWitt	WABV	20	263	1140

TEXAS

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Abilene	West Texas Radio Co	WQAQ	100	360	833
Amarillo	J. Laurence Martin	WDAG	100	263	1140
	E. B. Gish	WQAC	100	360	833
Austin	Texas Radio Corp. & Austin Statesman	WNAS	100	360	833
	University of Texas	WCM	500	360	....
College Station	Agricultural & Mechanical College of Texas	WTAW	50	280	1070
Dallas	Automotive Electric Co	WDAO	50	360	....
	Al. G. Barnes Amusement Co. (Portable)	KFFZ	20	226	1330
	City of Dallas (Police & Fire Sig. Dept.)	WRR	20	360	833
	Dallas News and Dallas Journal	WFAA	500	476	630
El Paso	St. Patrick's Cathedral	WPAT	20	360	833
	Trinity Methodist Church (South)	WDAH	50	268	1120
Fort Worth	Texas National Guard, 112th Cavalry	KFJZ	20	254	1180
	Wortham-Carter Publishing Co	WBAP	750	476	630
Galveston	Galveston Tribune	WIAC	100	360	833
	George R. Clough	KFLX	10	240	1250
	Clark W. Thompson	WHAB	200	360	833
Houston	Alfred P. Daniel	WCAK	50	369	....
	Hurlburt-Still Electrical Co	WEV	50	360	....
	Iris Theatre	WEAY	250	360	....
	Fred Mahaffey, Jr	KFCV	10	360	....
	Rice Institute	WRAA	200	360	833
Orange	First Presbyterian Church	KFGX	500	250	1200
Plainview	Plainview Electric Co	WSAT	20	268	1120
Port Arthur	Electrical Supply Co	WFAH	150	236	1270
San Antonio	Alamo Radio Electric Co	WCAR	150	360	....
	Southern Equipment Co	WOAI	500	385	780
San Benito	Rio Grande Radio Supply House	KFLU	20	236	1270
San Marcos	Stevens Bros	KFMU	20	240	1250
Tyler	Tyler Commercial College	WOAF	10	360	833
Waco	Jackson's Radio Eng. Laboratories	WJAD	150	360	833
	Sanger Bros	WWAC	50	360	833
	Waco Electrical Supply Co	WLAJ	150	360	833
Wichita Falls	W. S. Radio Supply Co	WKAF	100	360	833

UTAH

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Ogden	Ralph W. Flygare	KFCP	25	360	....
Salt Lake City	Erickson Radio Co	KFLH	50	261	1150
	The Deseret News	KZN	500	360	....
	Telegram Publishing Co	KDYL	50	360	....

DIRECTORY OF RADIO BROADCASTING STATIONS

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
VERMONT					
Bellows Falls	Vermont Farm Machine Corp.	WLAK	100	360	....
Burlington	University of Vermont	WCAX	50	360	....
Springfield	Moore Radio News Station	WQAE	50	275	1090
VIRGINIA					
Arlington	U. S. Navy	NAA	..	435	....
Fort Monroe	Peninsular Radio Club	WNAW	5	360	833
Norfolk	Reliance Electric Co.	WTAR	100	280	1070
WASHINGTON					
Aberdeen	Grays Harbor Radio Co.	KNT	250	263	1140
Bellingham	Bellingham Publishing Co.	KDZR	50	261	1150
Everett	Lucas Brothers	KFBL	10	224	1340
Lacey	St. Martin's College	KGY	5	258	1160
Neah Bay	Ambrose A. McCue	KFHH	50	261	1150
Pullman	State College of Washington	KFAE	500	360	....
Seattle	Brott Laboratories	KFIY	15	231	1300
	First Presbyterian Church	KTW	750	360	....
	Northwest Radio Service Co.	KJR	100	270	1110
	Rhodes Co.	KDZE	500	455	660
	Seattle Post Intelligencer	KFJC	100	233	1290
	Star Elec. & Radio Co.	KFHR	50	283	1060
	Louis Wasmer	KHQ	100	360	....
Spokane	North Central High School	KFIO	50	252	1190
Tacoma	First Presbyterian Church	KFBG	50	360	....
	Guy Greason	KFEJ	10	360	....
	Love Electric Co.	KMO	10	360	....
	Tacoma Daily Ledger	KGB	50	252	1190
Walla Walla	Frank A. Moore	KFCF	50	360	....
Wenatchee	Electric Supply Co.	KDZI	50	360	....
	Wenatchee Battery & Motor Co.	KZV	50	360	....
Yakima	Yakima Valley Radio Broadcasting Assoc'n	KFIQ	50	242	1240
WEST VIRGINIA					
Charleston	John R. Koch (Dr.)	WPAZ	10	273	1100
Clarksburg	Roberts Hardware Co.	WHAK	15	258	1160
WISCONSIN					
Beloit	Turner Cycle Co.	WKAW	10	242	1240
Fond du Lac	Daily Commonwealth and Oscar A. Heulsman	KFIZ	100	273	1100
Kenosha	Henry P. Lundskow	WOAR	50	229	1310
La Crosse	Ott Radio, Inc.	WABN	250	244	1320
Madison	Northwestern Radio Co.	WGAY	100	360	833
	University of Wisconsin	WHA	500	360	833
Milwaukee	Kesselman O'Driscoll Co.	WCAY	250	261	1150
	Marquette University	WHAD	100	280	1070
	School of Eng. of Milwaukee	WIAO	100	360	833
Neenah	Fox River Val. Rad. Supply Co.	WIAJ	100	224	1340
Osseo	S. H. Van Gorden & Son	WTAQ	100	226	1330
St. Croix Falls	Northern States Power Co.	WRAL	100	248	1210
Waupaca	Wisconsin Department of Markets	WPAH	250	360	833
WYOMING					
Casper	Felix Thompson Radio Shop	KFEV	250	263	1140
Laramie	The Cathedral	KFBU	50	283	1060

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ALASKA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Juneau	Alaska Electric Light & Power Co.	KFIU	10	226	1330

HAWAII

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Honolulu	Electric Shop	KYQ	20	360	....
	Marion A. Mulreny, Waikiki Beach	KGU	500	360	..
	Star Bulletin	KDYX	100	360	....
Lihue	Clifford J. Dow	KFHS	30	275	1090

PORTO RICO

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
San Juan	Radio Corporation of Porto Rico	WKAQ	100	360	833

CUBA

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
Havana	Cuban Telephone Co.	PWX	500	400	750
	Lorenzo Zayas	2DW	100	300	999
	Alberto S. de Bustamante	2AB	20	240	1249
	Mario Garcia Velez	2OK	100	360	833
	Frederick W. Borton	2BY	100	260	1153
	Frederick W. Borton	2CX	10	320	935
	Westinghouse Elec. Co.	2EV	50	220	1363
	Roberto E. Ramirez	2TW	20	230	1304
	Heraldo de Cuba	2HC	500	275	1090
	Luis Casas	2LC	30	330	909
	Eduardo S. de Fuentes	2KD	100	350	857
	Fausto Simon	2MN	300	270	1110
	Manuel G. Salas	2MG	20	280	1071
	Raul Perez Falcon	2JQ	10	150	1999
	Alvaro Daza	2KP	10	200	1499
	Julio Power	2HS	20	180	1666
Colon	Leopoldo Valdes Figueroa	5EV	100	360	833
C. Tuinicu	Frank H. Jones	6KW	100	340	882
	Frank H. Jones	6XJ	100	275	1090
Cienfuegos	Dr. Antonio Tomas Figueroa	6CX	20	170	1764
	Eduardo Terry	6DW	10	225	1332
	Jose Ganduxe Margarit	6BY	100	300	999
	Valentin Ullivarry	6AZ	10	200	1499
Caibarien	Josefa Alvarez Alvarez	6EV	20	225	1332
Santiago de Cuba	Alfredo Brocks	8AZ	20	200	1499
	Alberto Ravelo	8BY	100	250	1190
	Baltazar Meas	8CX	10	275	1090

The Boston Transcript's

DIRECTORY OF RADIO BROADCASTING STATIONS

CANADA

Alphabetically by Provinces (East to West)

Location of Station	Owner of Station	Call Signal	Wave Length	Range	Power Anode input in watts
	NOVA SCOTIA				
Halifax	Radio Engineers	CHAC	400	100	20
	NEW BRUNSWICK				
St. John	Maritime Radio Corporation, Ltd.	CICI	400	75	200
	QUEBEC				
Bellevue	Semmelhaack, Ltd.	CFCO	450	40	20
Montreal	La Presse Publishing Co.	CKAC	430	250	2000
	Marconi Wireless Tel. Co. of Canada, Ltd.	CFCF	440	150	2000
	Northern Electric Co.	CHYC	410	250	2000
	University of Montreal	CFUC	400	250	2000
Quebec	Canadian Wireless and Electric Co.	CHCD	410	25	10
	La Cie de L'Evenement	CFCJ	410	25	10
	ONTARIO				
Hamilton	The Wentworth Radio Supply Co.	CKOC	410	15	20
Iroquois Falls	Abitibi Power & Paper Co., Ltd.	CFCH	400	250	500
Kingston	Queen's University	CFRC	450	500	1500
London	London Free Press Printing Co., Ltd.	CPGC	430	75	200
	The Radio Shop	CFCW	420	75	20
Ottawa	Dept. of Marine and Fisheries, Radio Branch Test Room	OA	510	75	300
Sudbury	Laurentide Air Service, Ltd.	CFCR	410	75	200
Toronto	Canadian Independent Telephone Co., Ltd.	CKCE	450	250	2000
	Simons Agnew & Co.	CJCN	410	250	2000
	Star Publishing and Printing Co.	CFCA	400	250	2000
	T. Eaton Co., Ltd.	CJCD	410	50	100
	The Evening Telegram	CJSC	430	150	500
	MANITOBA				
Winnipeg	Manitoba Telephone System	CKY	450	250	2000
	SASKATCHEWAN				
Regina	Leader Publishing Co., Ltd.	CKCK	420	200	2000
Saskatoon	The Electric Shop, Ltd.	CFQC	400	100	200
	ALBERTA				
Calgary	The Albertan Publishing Co.	CHBC	410	200	500
	The Calgary Herald	CFAC	420	200	2000
	W. W. Grant Radio, Ltd.	CFCN	440	250	1000
Edmonton	Radio Supply Co., Ltd.	CFCK	410	100	250
	The Edmonton Journal, Ltd.	CJCA	450	150	500
Olds	Percival Wesley Shackleton	CJCX	400	100	200
	BRITISH COLUMBIA				
Nanaimo	Sparks Co.	CFDC	430	15	50
Vancouver	Sprott-Shaw Radio Co.	CJCE	420	150	150
	Vancouver Daily Province	CKCD	410	150	2000
	The Vancouver Merchants Exchange, Ltd.	CHCL	440	200	2000
	Radio Specialties, Ltd.	CFCQ	450	10	40
Victoria	Continental Methodist Church	CFCL	400	...	500
	Western Canada Radio Supply, Ltd.	CHCE	400	100	20

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Supplementary

Call Signal	Owner of Station	Location of Station	Your Adjustment
WCBD	—31 —32 —33		
WSAI	— 24 — 24½ — 25¾		
~~WTAS~~	~~[illegible] 22 23+~~		
KFKB	19¼ 20¾ 21		
WEBH	17 17½ 17½ [illegible]	[illegible]	N.Y.
W	36 37 38		
WJAR	31 -33 35		
WTAS	20+ 20 21-		
W T[illegible]	44		
[illegible]	44½ 46 4+	Newark	
WEB[illegible]	-15 15 16¼ 17	[illegible]	
	22½ 22 [illegible]		
W[illegible]	36- 37- 39+		
W[illegible]	37+ 3 34		
	55½ 55¾ 59½	[illegible]	
W[illegible]	39 40¼ 41½		
	47 48 51+		
WJZ	59 59 63½		
WCAE	61+ 61+ 67	Pittsburgh	Pa 462
	19½ 19 21½		
[illegible]	40 [illegible]		
[illegible]BH	[illegible]		
WL[illegible]	49 49 53		
WGY	38½ 40 41½		

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Supplementary

Call Signal	Owner of Station	Location of Station	Your Adjustment
WFI	[illegible] 43½ 45		
WJY	45 45 -48	N.Y.	
WCAD	18 -19 19³	Canton	N.Y.
WHAZ	-39 [illegible] 41	Troy	N.Y.
	43 44 46	Phila.	
[illegible]	25 [illegible] 27	B	
[illegible]	44 [illegible] 47	[illegible]	
WGY	39 40 [illegible]	[illegible]	
WGBS	27² 28³ 30	[illegible]	
KFKX	21 22 23+	[illegible]	Nebr.
[illegible]	[illegible] 15		
WJAS	19 20 21+	Pitts.	
WAHG	24 25³ 27	[illegible]	
[illegible]	-9 9 10+	[illegible]	[illegible]
WCAE	[illegible] 61-	[illegible]	
WGBS	24 25¼ 27	N.Y.C.	
WGAR	[illegible] 43¼	[illegible]	
WCAD	13 13½ 13½	Canton	N.Y.
WSEL	-13 13+ 14²	[illegible]	
[illegible]	11 [illegible] 13	[illegible]	N.Y.
WAHG	24¼ 25 27+	Brooklyn	
WWAD	12¼ 13 13	Philadelphia	
WOAI	41 42 45	[illegible]	

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Supplementary

Call Signal	Owner of Station			Location of Station	Your Adjustment
WHAS	43 /	44 1/4	47 1/2	[illegible]	Ky
WREO	19+	20	21-	Lansing Michigan	
WOS	53+	54-	59-	Jefferson City, Mo	
2XZ WA[illegible]D	71-	71	77 1/2	" " 400 m	
WOC	76-	7[illegible]-	81+	Davenport	
WEEL	22	22+	23-	[illegible]	
WMBF	27 1/2	29	30-	Miami Beach Fla	
280 WEAA	[illegible]	[illegible]	[illegible]	Flint Mich.	
WUAS	18-	8+	19-	Pitts.	
W[illegible]R	17-	17-	17	N.Y. City	
[illegible]CAU	18	19	20	[illegible]	
[illegible]CAE	22	22-	24	[illegible]	
WC[illegible]D	30	31+	33+	[illegible]	
[illegible]IIT	40	[illegible]	44	[illegible]	
	40	[illegible]	44	Miami	Fla
~~WGBS~~	~~36-~~	~~36 1/2~~	~~[illegible]9~~	~~[illegible]~~	
WCAP	[illegible]	4	8	Wash D C	
[illegible]WU	32	33	35	[illegible]	
WJY	44	45	48	[illegible]	
C[illegible]	46	47-	51	[illegible]	
WKAR	-21	-21	-21	E Lansing Mich	
WEA[illegible]	-21	21	21+	Flint Mich	
C[illegible]RA	24+	25	25-	New Brunswick	Can

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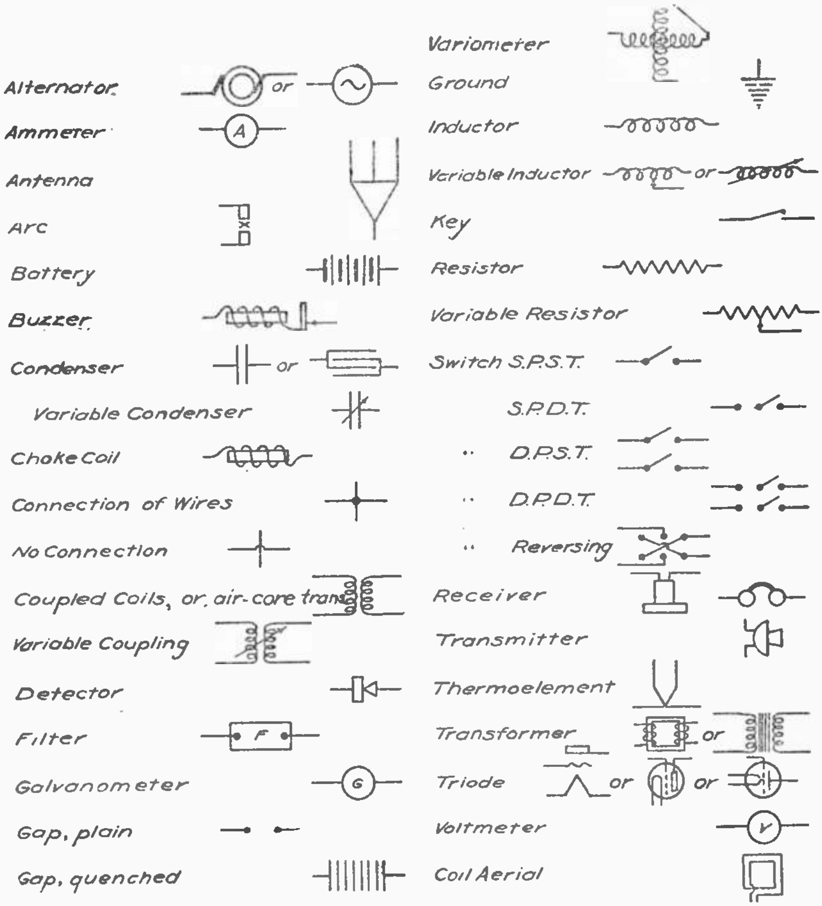
Supplementary

Call Signal	Owner of Station	Location of Station	Your Adjustment
	80 80 87	Detroit	
WEAF	70½ 72½ 77	NY	
	67+ 70 74–		
WTIC	65 68 71–	Hartford	Conn
WJZ	58 61 63	N.Y.	
	40½ 43½ 45½		
~~WEAR~~	39½ 42 44	Cleveland	[illegible] Fires
W3BD	32 32+ 33	[illegible]	
[illegible]	3 4 4+	[illegible]	
WMBF	39½ 41½ 42	Miami B. Fla	
	43 44+ 47+		N. Car [illegible]
[illegible]	34 35 37	N. Y. City	
W1Y	14+ 15 15+	Radio News	

KEY TO SYMBOLS OF APPARATUS

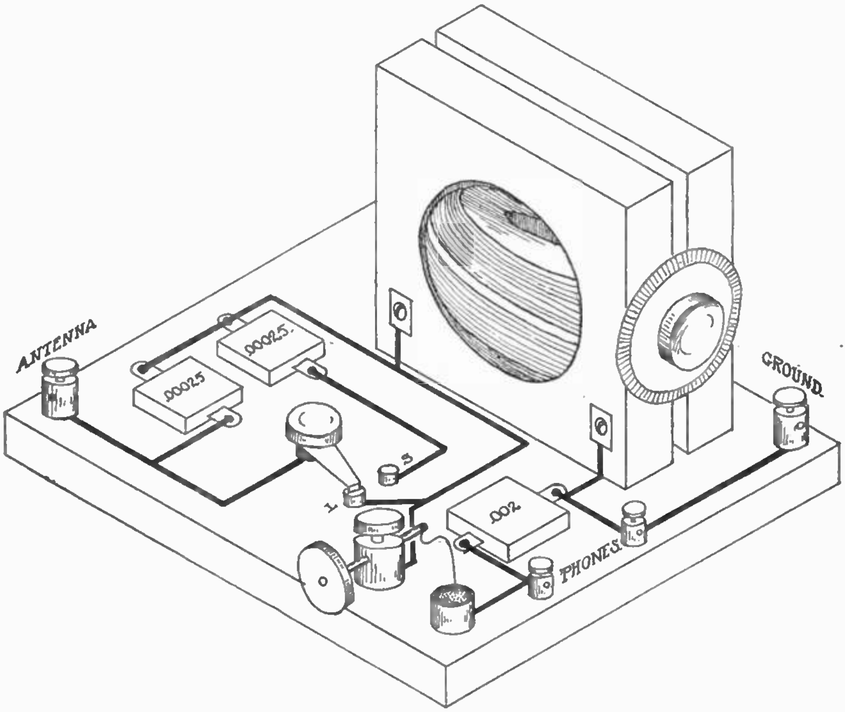


TIME AND DISTANCE CHART FOR RADIO OPERATORS

Some Successful Hookups Described and Illustrated

By
J. K. CLAPP

THE CRYSTAL RECEIVER



One of the advantages of this particular construction is that the apparatus may be used with very good results in a receiver employing a vacuum tube detector. The experimenter is thus able to make use of the apparatus in a simple receiver which may be later expanded into a more elaborate affair without the necessity of discarding any of the equipment. This receiver will cost a dollar or two more than a two-slide tuner set if the variometer is purchased ready made. The parts for a variometer may, however, be obtained on the open market at a cost considerably below that of an assembled instrument. If the parts are purchased and the variometer assembled by the experimenter the cost of this receiver will not be any greater than that of a two-slide tuner. The range of this receiver is about the same as that of the two-slide tuner—about twenty-five miles under ordinary conditions for the reception of broadcast programmes.

THE CRYSTAL RECEIVER

Simple Set Employing a Variometer or Vario-Coupler

HERE is a type of simple crystal set, employing a variometer or vario-coupler as the main tuning unit. While the use of either of these two instruments necessitates, in general, the purchase of one or the other, thereby making this crystal set more expensive than the simplest type, it is well to remember that such an instrument may be employed to advantage at any time it is desired to expand the set into a tube receiver.

The material required for this receiver is as follows: A variometer, or vario-coupler, a crystal detector, a telephone condenser of 0.002 microfarads capacity and a pair of high-resistance telephone receivers (2000 ohms). Some other small fixed condensers, or a small variable condenser will be required, depending upon the particular hook-up to be employed, as outlined below.

The telephone condenser and the detector stand may be constructed if desired. The condensers had best be purchased, although they may be costructed, and the proper value of capacity found by trial, varying the size and number of the sheets of tinfoil until the best results are obtained.

In Figure 2 are shown the connections of the receiver employing a vario-coupler.

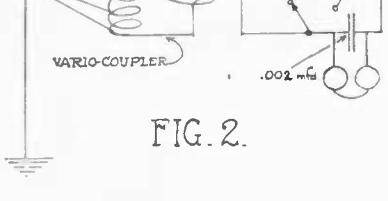


FIG. 2.

It is to be noticed that the detector circuit is so connected as to include the whole of the winding, while the antenna circuit includes only the portion between one end of the stator (stationary winding) and the point tapped off by means of the switch.

Across the leads to the detector are placed three fixed condensers of 0.000025, 0.000050 and 0.0001 microfarads capacity respectively, which are connected to a three-point switch as shown. With the switch set so as to include the smallest of the condensers, the shortest range of wave lengths will be obtained, and with the switch set so as to include the largest of them, the longest range of wave lengths will be obtained.

Operation

In tuning this receiver the proper amount of inductance is inserted in the antenna circuit by varying the position of the switch connected to the taps on the stator winding. The detector circuit is then tuned by rotating the rotor winding inside of the stator winding until the best signal is obtained.

A second circuit which requires somewhat less apparatus is shown in Figure 3. Here either a variometer or a vario-coupler may be employed. If the vario-coupler is employed, it will not be necessary to make use of the taps on the stator winding. The two windings of the instrument are connected in series, as shown, and the detector circuit is placed across its terminals. A small fixed condenser of approximately 0.00025 mfd. is inserted in series with the antenna. This condenser is essential if the antenna be very large, but even with a small antenna its use is to be recommended, as it greatly improves the operation of the set, both as regards sensitivity and selectivity. Changing the value of this condenser will change the range in wavelength which may be covered by the receiver to some extent. If it is

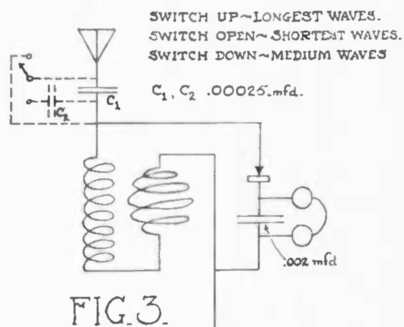


FIG. 3.

desired to have as great a range in wavelength as is feasible, it becomes necessary to employ another condenser of about the same capacity, which may be placed in shunt with the first, by means of a switch. This second condenser and its connections are shown in dotted lines on the diagram.

In tuning this type of receiver it is only necessary to adjust the value of inductance in the circuit by rotating the rotor winding inside the stator winding, until the best response is obtained. The circuit shown in Figure 3 is simpler to operate and is somewhat more selective than the circuit shown in Figure 2.

If a vario-coupler be purchased. a combination arrangement may be adopted. employing a tuning coil in addition to the vario-coupler. The circuit diagram for such a combination is shown in Figure 4. Here the rotor and stator windings are employed separately, thereby utilizing only inductive coupling with the antenna. As this coupling may be varied by turning the rotor

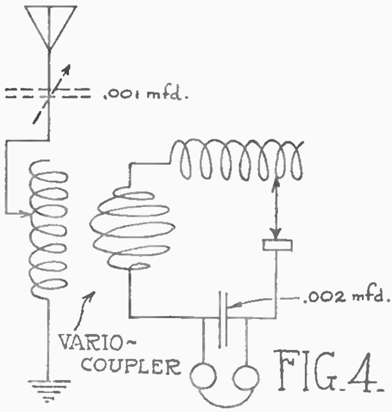


FIG. 4.

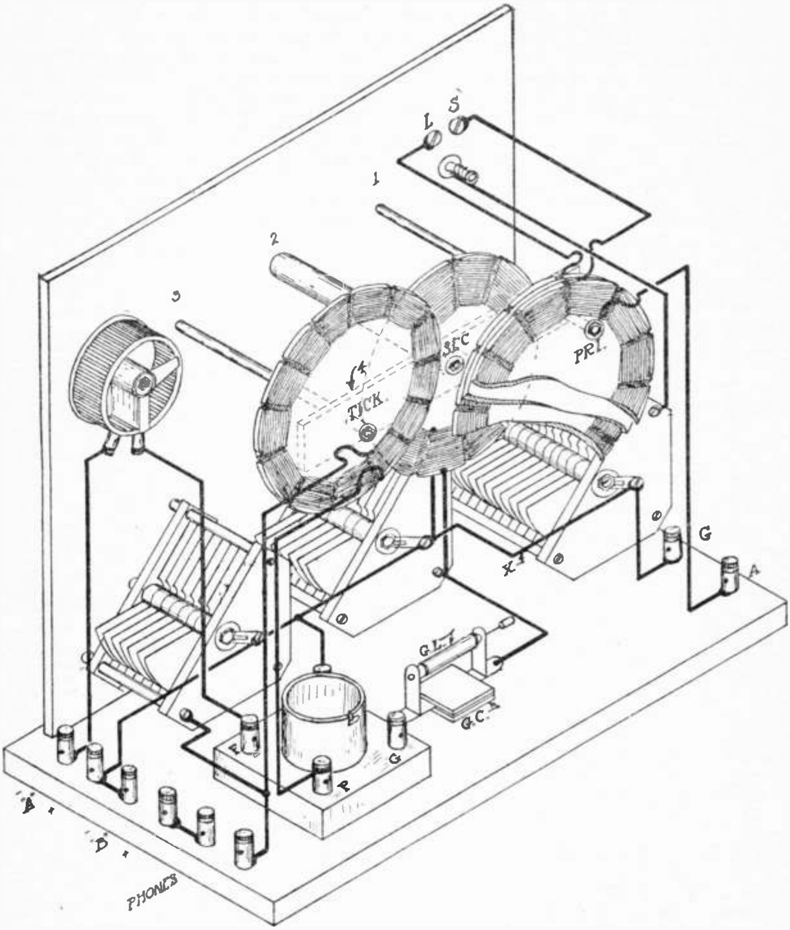
within the stator, quite a high degree of selectivity can be obtained, as compared with any of the circuits previously described.

The antenna circuit contains only the stator winding of the vario-coupler, though the use of a series variable condenser as shown by the dotted lines is to be recommended. The detector circuit is composed of the secondary of the vario-coupler (rotor), the one-slide tuning coil, the detector, phone condenser and telephone receivers.

In tuning this receiver the position of the antenna switch and the position of the slider on the tuning coil is varied until the loudest signal is obtained. If now the rotor of the vario-coupler be turned so that the plane of the rotor winding approaches right angles with the plane of the stator winding, the coupling between the antenna circuit and the detector circuit is loosened. A decrease of signal will usually result, but if the positions of the switch and of the slider be changed slightly, the signal may be brought back to practically its original strength. In many cases the signal is actually louder when loose coupling is employed than when the coupling is very close. In any event, it is best to operate with as loose coupling as is compatible with good signal strength. as when this is done the amount of interference from stations on other than the desired wavelength is greatly reduced. If the variable condenser is employed. the tuning of the antenna circuit should be so carried out that the number of turns in the coil is as large as possible, while the condenser is set at fairly low values. This results in what is termed a "stiff" circuit, that is, it responds only very feebly to oscillations of a wavelength other than that to which it is tuned.

Single Tube Receiver

A THREE CIRCUIT SINGLE TUBE RECEIVER



This figure shows a good method of mounting a three-coil tuner and a tube detector. While this receiver is slightly more complicated than the usual broadcast receiver, the greater selectivity obtainable with this type more than overcomes the disadvantage of the additional controls. The coils for this set are easily made by the experimenter. A receiver of this type should bring in broadcasting stations 200 or 250 miles away with good regularity. Under very good conditions reception has been accomplished over distances as great as 1000 miles, using head phones. If it is desired to operate a loud-speaker, it will be necessary to employ one or two stages of audio-frequency amplification for satisfactory results.

A THREE CIRCUIT SINGLE TUBE RECEIVER

A Satisfactory Hook-Up Designed to Eliminate Interference

THE circuit which is used is given in Figure 5, and is popularly spoken of as a "three circuit" receiver. Under this classification the various tuned circuits are (1) The primary, or antenna circuit, L1, C1 and the aerial. (2) The secondary circuit, L2, C2. (3) The plate circuit, L3, C3. This latter circuit is not rigorously a tuned circuit, in the sense that it is brought into resonance with the incoming signal.

A loose-coupled circuit has been recommended, for such a circuit is much more satisfactory in eliminating interference than the ordinary "single-circuit" set, but it is not so complicated that the various adjustments required in tuning cannot be easily mastered.

The constants for the circuit, as here presented, are applicable for use with any

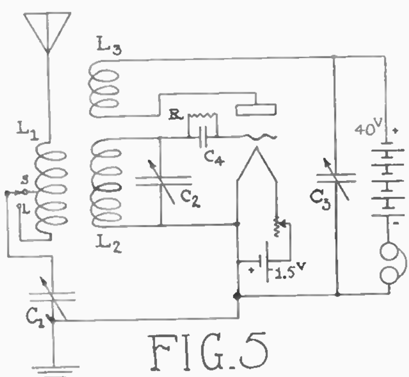


FIG.5

of the dry-cell tubes, such as the WD-11, UV-199, etc. If larger tubes, such as the UV-200 or VT-1, are used, the size of the secondary coil may have to be slightly reduced.

Coil Forms

In Figure 6 are given the dimensions of the forms for the coils, which forms may be cut from heavy cardboard, about one-sixteenth of an inch in thickness. An odd number of radial slots is then cut in the circular piece of cardboard, the width of the slots being approximately equal to the thickness of the cardboard. The sides of the slots should be parallel, so that the slots are not any wider at the edge of the form than they are at the centre.

In winding these coils the wire is started at the inner edge of one of the slots and woven in and out through the slots. After going around the form once, the next turn will lie on the opposite sides of all of the teeth of the form from the first turn. The third will occupy the same sides as the first, and so on. In this way the turns are practically spaced a distance equal to the diameter of one wire throughout their length, except at the points where they go through the slots. In

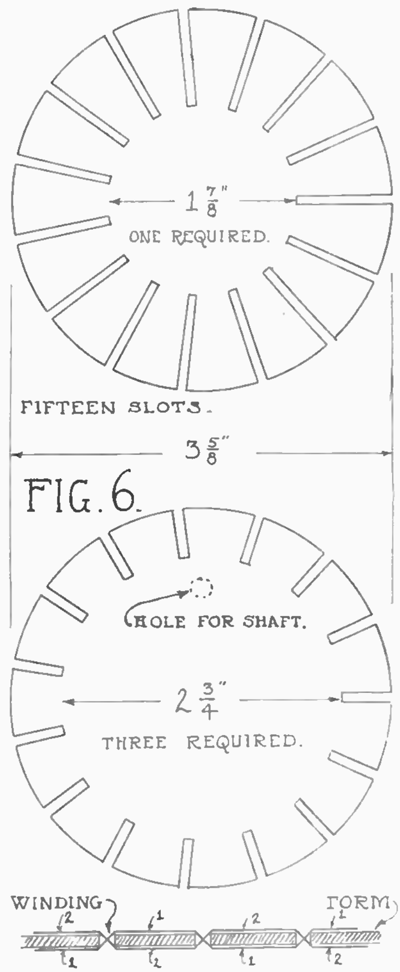


FIG. 6.

the lower part of Figure 6 there is shown a developed view of the edge of the winding of one of the coils. At the points where the successive turns cross each other it is desirable to have them cross at as rear right angles as possible. This form of winding has a number of advantages—it stays "put" without the use of any binder on the winding; the turns are comparatively far apart, which results in a very low self-capacity for the coil; it is compact and easy to handle in mounting.

The coils should be wound with No. 28 double cotton covered copper wire, the form with the deep slots having an even sixty turns, while the other three coils have twenty-five turns each. The sixty-turn coil will be used for the secondary; one of the twenty-five-turn coils for the "tickler," L3, and the remaining two of the twenty-five-turn coils will be used together for the primary, L1. These two coils should be placed one upon the other, with a disc of the cardboard from which they were made placed between them. The two coils should then be connected in series, care being taken that the connections are so made that the current will flow in the same direction around both coils. A lead should be brought out from the junction point between the two coils for connection to the switch.

Having constructed the coils, we require the following material to complete the set: 1 variable condenser, 0.001 mfd. maximum; 1 variable condenser, 0.00025 mfd. maximum; 1 fixed condenser, 0.00025 mfd; 1 grid leak resistance 2 megohms; 1 vacuum tube, with its filament heating battery, rheostat, and "B" battery. A dry-cell tube is very convenient, and requires no expensive storage battery for its operation.

Wavelength Range

Placing the 0.001 mfd. variable condenser in the ground lead, with the movable plates connected to ground, will reduce body capacity effects considerably. With the switch placed so that only one of the sections of the primary coil is in the circuit, the variation in the antenna circuit wavelength will be somewhat as indicated by the lower dashed curve of Figure 7. By varying the condenser throughout its range, we are enabled to tune the antenna circuit from approximately 170 metres to 325 metres. Placing the switch so as to include both sections of the primary winding enables us to tune from approximately 300 metres to about 525 metres, as shown by the upper dashed curve in the figure. The numerical values of the wavelength given will be only approximate, as the values will change with different aerials. If a large antenna is used, the primary coils may be reduced to fifteen or twenty turns each, instead of the twenty-five turns given above.

Placing the 0.00025 mfd. variable condenser across the secondary coil (sixty turns) we are enabled to adjust the secondary wavelength from approximately 200 to 525 metres, thereby covering practically the entire new allotment of wavelengths for broadcasting stations. If the coil has been carefully made as indicated above, and the condenser has a maximum capacity close to the value mentioned, the curve of wavelengths given in Figure 7 will come within a few per cent of the values actually obtained with the set. Owing to changes in the wiring of the set, differences in the tubes used, and differences in the capacities of the condensers

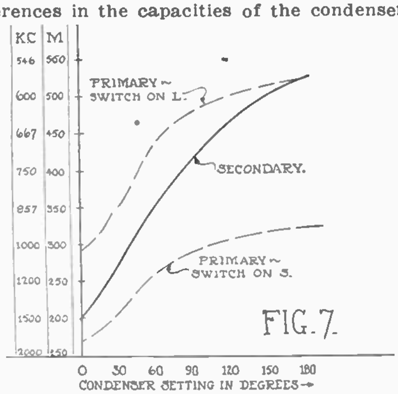


FIG. 7.

used, an accurate prediction of the wavelength range which may be obtained on the secondary condenser cannot be made. The particular condenser used in obtaining these curves was of 0.000257 mfd. capacity, maximum, and had thirteen plates, but there are wide variations in capacity of condensers having "thirteen plates," so that to recommend a specific capacity in terms of "plates" is meaningless.

The condenser C3 may be a variable condenser of the same capacity as C2, or it may be a fixed condenser of approximately the same capacity. However, it is usually possible to operate the set without any condenser at all in this part of the circuit, since the capacity of the telephone cords will serve as a by-pass, for the radio frequency currents, around the telephone receivers. In general, it will be found that the smaller the value of C3, or its equivalent, the better the quality of the speech and music received.

Mounting the Apparatus

The apparatus for this set may be conveniently mounted on a panel eight by twelve inches in size, with a supporting base behind it as indicated in the diagram. The three variable condensers are mounted in a line at the bottom of the panel. The coils are supported from a frame consisting of the rod (2) which is fastened to the panel by a machine screw and a piece of insulating material (4) which is fastened to the end of the rod (2) by means of a machine screw. This latter screw is also used to fasten the secondary coil in place. The primary coil and the tickler coil are mounted on the ends of small shafts which pass freely through the insulating strip (4). Between the backs of these coils and the face of the supporting strip there should be placed a small piece of brass tubing, over the shafts (2 and 3). The tube for the ticker coil shaft should be about 3-16 inch long, while that for the primary coil shaft should be about three-eighth inch long. These tubes serve to keep the coils at the proper distance apart, so that they will not rub against one another as they are being turned. The shafts (2 and 3) should be passed through holes in the supporting strip which are bored through at a distance from the edge of the secondary winding of from one-eighth to one-quarter inch. The lengths of the shafts should be made such that when the knobs are screwed on, the knob will bear firmly against the front of the panel. There is sufficient friction then to hold the primary or tickler coils in any position, without making the knobs turn too hard.

The primary winding is in two sections, of twenty-five turns each, which are connected together in such a manner that a current will flow around the two coils in the same direction. The junction point between the two sections is brought out for connection to the switch. From the inside winding terminal of one coil a lead is taken to the antenna post (A). From the junction point between the two windings a lead is taken to the switch point "S" and from the outside end of the primary section a lead is taken to the switch point "L." From the centre of the switch run a wire to the stationary plates of the 0.001 variable condenser (lefthand condenser, viewed from the front of the panel). From the rotor plates of this condenser a lead is taken to the ground binding post (G). This completes the antenna circuit.

For connections of the secondary winding, take a lead from the outside terminal of the spider-web to the stationary plates of the middle variable condenser and then on to the grid leak and grid condenser. The inside terminal of the secondary coil should be connected to the rotor plates of this variable condenser and thence to the positive filament terminal of the socket. This completes the secondary circuit.

From the plate terminal of the socket a connection should be made to one end of the tickler winding. The other tickler connection is run to one of the telephone receiver binding posts and also to the stationary plates of the third variable condenser. The rotor plates of this condenser are connected to the positive filament terminal of the socket.

The filament circuit of the tube consists simply in the connections between the negative "A" battery terminal, the filament rheostat, the negative filament socket terminal and from the positive socket terminal to the positive terminal of the "A" battery. The short connections between the various binding posts are clearly shown in the diagram.

It will be observed that all of the rotor plates of the three variable condensers are connected to the positive filament terminal of the "A" battery, and that this point is also connected to ground. This arrangement is chosen as it materially reduces the effects of the operator's hands upon the strength of the signals.

In assembling such a receiver, keep the drawing at hand as you make the connections, and the process will automatically be followed through without difficulty. The mounting shown in the drawing has everything supported from the panel but the socket and the binding posts. If it is desired to mount all of the instruments on the panel, so that the panel could be removed from a containing cabinet without any trouble, it is a simple matter to fasten the socket and binding posts in position on the panel and change the wiring to correspond with the new arrangement.

Adjustments

Let us now consider the adjustments necessary to bring in a desired signal on the receiver described in the last article. Having the connections made as in the diagram, the batteries giving full voltage, the first step is to light the filament of the tube. The rheostat is adjusted until the filament is a dull red (for oxide coated filaments, as in the WD-11, which was mentioned for this set). Next, turn the right-hand knob on the top of the panel so that the tickler coil partially covers the secondary coil. If a variable condenser is used at C3, it should be set near maximum. If the set is properly connected, the tube should now oscillate. A test for oscillation is to place the finger-tip on the grid connection of L2. If the tube is oscillating a sharp click will be heard when the finger touches the connection, and another click will also be heard when the finger is removed. If both clicks are not heard, the connections to the tickler coil L3 should be reversed. If the set has been constructed as directed, we may now set the secondary condenser, C2, at approximately sixty degrees and know that the secondary circuit is tuned approximately to 360 metres. Now bring the primary coil near to the secondary coil by turning the left-hand knob on top of the panel. Place the switch on the point marked "S" and vary the condenser rather quickly over its entire range. If the antenna circuit tunes to 360 metres at any setting of the condenser, a sharp click will be heard in the telephones when the antenna circuit is tuned to the secondary circuit. If no such click is obtained, place the switch on the point marked "L" and repeat the procedure.

If the primary condenser, C1, is now moved slowly past the point where the click was heard, it will usually be found that a click is heard at one point on the condenser scale and a second click heard at some other point, a few degrees away. If the primary coupling is now loosened, these two clicks will move closer and closer together, until they finally merge into one. If the coupling is still further loosened, the click gets weaker and weaker and finally disappears. The proper point to operate the set is at that value of coupling where the clicks have just merged together.

Now, if the secondary condenser setting is changed to some other value, it will be found that the setting of the primary condenser, where the click occurs, will have moved correspondingly, on the scale. Now, if we know the wavelength corresponding to any setting of the secondary condenser we can immediately tune the primary circuit to it by hunting for the point where the click occurs on the primary condenser scale. This is very handy, for we may mark down the settings of the secondary for the different stations heard, and return to them at will, it being unnecessary to keep any record of the primary condenser settings.

If a telephone station is transmitting, a note will be heard in the telephones when the secondary condenser is moved past the point of resonance for that particular station. This note will at first be of very high pitch, but as the condenser is moved toward the exact setting of the condenser for the best reception of this station, the tone will drop lower and lower, and at the point where the circuit is tuned to the station, it will disappear altogether. If the condenser is moved past this point, the note will rise again to very high pitch. At the point where the note is of low pitch the voice or music may be heard, but will probably be distorted and unpleasant. The next step is to "clear up" the signals.

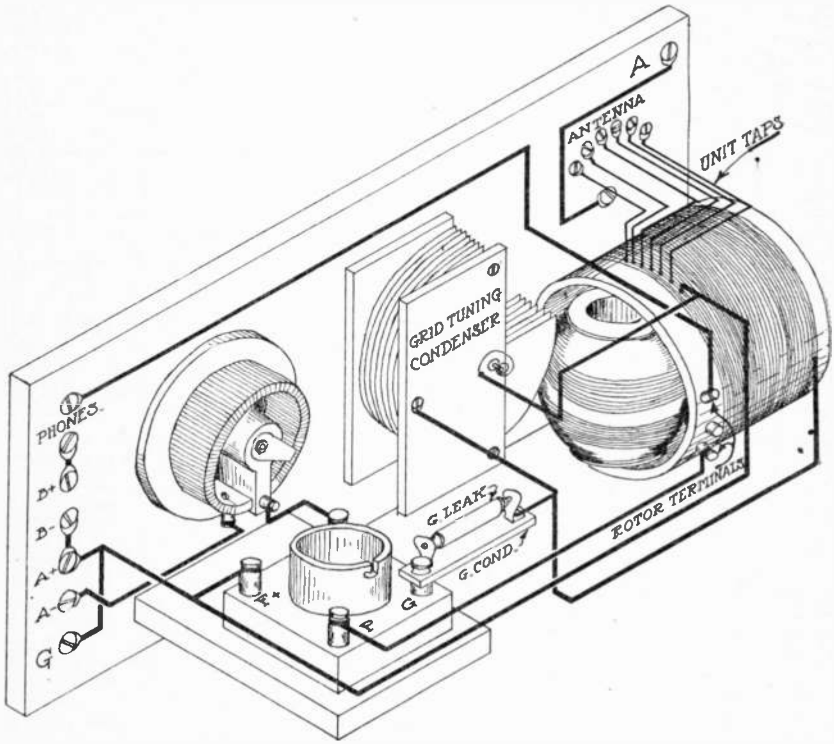
The tickler coil should be moved away from the secondary coil a small amount. The note mentioned above will now appear again, and the condenser C2 should be reset to the point where the note is lowest in pitch. The primary condenser should be varied slightly, and set at the point where the sounds from the distant transmitter are heard loudest. The tickler coupling should thus be reduced in small steps, the secondary condenser being changed each time so as to keep the steady tone from reappearing. When the tickler coupling has been reduced sufficiently the tube will stop oscillating and the signals will come through clear and strong. The tuning on the primary and secondary condensers will now be very sharp, and little trouble should be experienced from interference.

The quickest method of tuning in a station has been outlined above: First, make the tube oscillate, and listen for the beat note with its carrier frequency; second, adjust the set until this beat note is loud, and low in tone; third, "clear up" the signal by slowly reducing the tickler coupling until the regenerative action is no longer sufficient to maintain the tube in the oscillating condition. This procedure is practically the only one which may be used for quickly picking up very weak signals. If continuous wave telegraph signals are being received, the procedure is exactly the same, except that the note heard is left at a good musical pitch and the process of "clearing up" is omitted.

Remember that when the note is heard in the receivers, other listeners in your vicinity will also hear it. Therefore, operate your receiver in this condition just as little as possible.

The Haynes Receiver

THE HAYNES SINGLE CIRCUIT RECEIVER



In this figure the assembly of the Haynes receiver is clearly shown. A vario-coupler is used for the tuning element and for obtaining regeneration. From four to ten single turn taps are brought out from the stationary winding for connection to the antenna tuning switch. The remainder of the stationary winding is used for the grid tuning coil. The stationary winding of the vario-coupler should have 65 or 70 turns. The rotor winding should have approximately 35 turns, the exact number depending somewhat upon the type of tube which is used as the detector. The grid tuning condenser should be of approximately 0.0003 mfd. maximum capacity, and should be of the best grade obtainable. The efficiency of the receiver depends to a large extent upon the quality of this condenser. All of the instruments may be mounted directly upon the panel, facilitating construction and repair. The fewer the number of turns which are included in the antenna circuit the sharper is the tuning on the grid condenser. All tuning is done with the grid condenser. Regeneration is controlled by rotating the movable coil of the vario-coupler. A "one-hundred and eighty degree" vario-coupler may be used to advantage, as the regeneration may be more smoothly controlled.

THE HAYNES SINGLE CIRCUIT RECEIVER

How the Hook-Up Differs from Other Single Circuit Types

WE will now consider some simple single-circuit receivers which are preferable to the single-circuit type which is ordinarily employed. In the usual form of this circuit the grid circuit of the tube is bridged across the antenna tuning inductance. This arrangement, while quite simple to operate and of good sensitivity, has little immunity from interference when used with the average antenna. Furthermore, if operated in an oscillating condition, it radiates strongly, causing much interference to nearby listeners.

If the antenna circuit is coupled to the grid circuit through a coil of a very few turns, or through a small condenser, these objections are in a large measure overcome without any decrease in the ease of tuning. Some writers have described this form of antenna circuit as an "aperiodic" circuit, i. e., a circuit which has no "natural period." Strictly speaking, an aperiodic circuit is one which contains so much resistance that it is incapable of sustaining an oscillation. In the Reinartz and Haynes receivers the antenna circuit contains from one to ten turns of wire. Such a circuit has resistance, of course, but the value of resistance is far below that which is necessary to make the circuit non-oscillatory. The circuit is a tuned circuit, but it is not tuned to the desired wavelength. It is tuned to some wavelength so much below the desired one that for all receiving purposes the antenna circuit adjustments are not at all critical. The function of such a circuit is a simple collector for the desired signals.

The special point of interest in this contest is the method by which regeneration is obtained and controlled. The winding which is used as a tickler is stationary, and the amount of regeneration is controlled by means of taps brought out from this winding. As the taps do not offer a smooth control, a variable condenser is used to obtain gradual variations in the amount of regeneration. The advantage of this method is that all of the windings are stationary.

The Haynes Receiver

In Figure 44 is shown the circuit for the "Haynes" receiver. In this circuit a vario-coupler may be employed, provided that certain modifications of the windings are made. The stator winding is used for the grid circuit winding and should have about sixty turns of wire in it. No taps are used on this part of the winding. If the vario-coupler has taps brought out for a number of single turns, anywhere from six

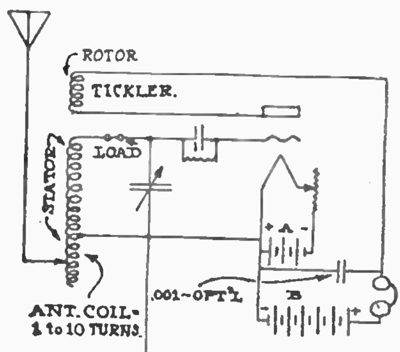


FIG. 44.

to ten, this portion of the winding may be used for the antenna coil. If no single turn taps are brought out it will be necessary to tap off a portion of the winding. While single turn adjustments are desirable here, they are not absolutely necessary. Taps may be brought out so that the antenna circuit may be made to include two, four, seven or ten turns and good results may be had. The rotor of the vario-coupler is used as the tickler winding. The ordinary vario-coupler rotor has far too many turns, so that some will have to be taken off. About thirty-five turns on the rotor is satisfactory for nearly all tubes. No. 24 or No. 26 double cotton covered wire is suitable for all the windings. The circuit will operate with either a "ninety degree" or "180 degree" vario-coupler, but the "180 degree" coupler is to be preferred, as it affords a smoother control of regeneration. In this circuit regeneration is controlled entirely by varying the coupling between the rotor and stator windings. It is important that the grid circuit tuning condenser have low losses and a low "zero" capacity. A condenser having a maximum capacity of not more than 0.0003 mfd. should be used. If the condenser is any larger the tuning will be so coarse that it will be very difficult to tune the set carefully to any weak stations. With such a condenser the receiver may be made to respond to all wavelengths in the broadcast band between 220 and 550 metres. The range of the set may be increased to include the longer wavelengths by inserting a small loading coil as shown in the diagram. While not absolutely necessary, a small fixed condenser of 0.0005 or 0.001 mfd. capacity shunted across the telephone receivers and the "B" battery will usually help in controlling the regeneration. A grid condenser of 0.00025 mfd. and a grid leak resistance of from 1 to 2.5 megohms will give very satisfactory results with most tubes. It often happens that the capacity afforded by the telephone cords is sufficient to give good results; in such a case the fixed condenser may be omitted.

Another Type of Receiver

Another type of single circuit receiver is shown in Figure 45. In this receiver the

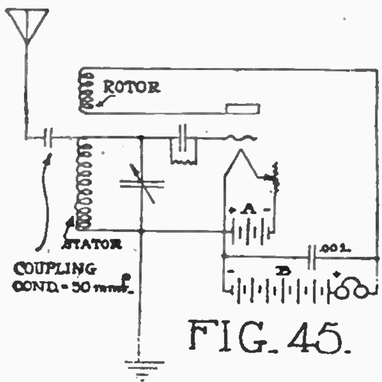


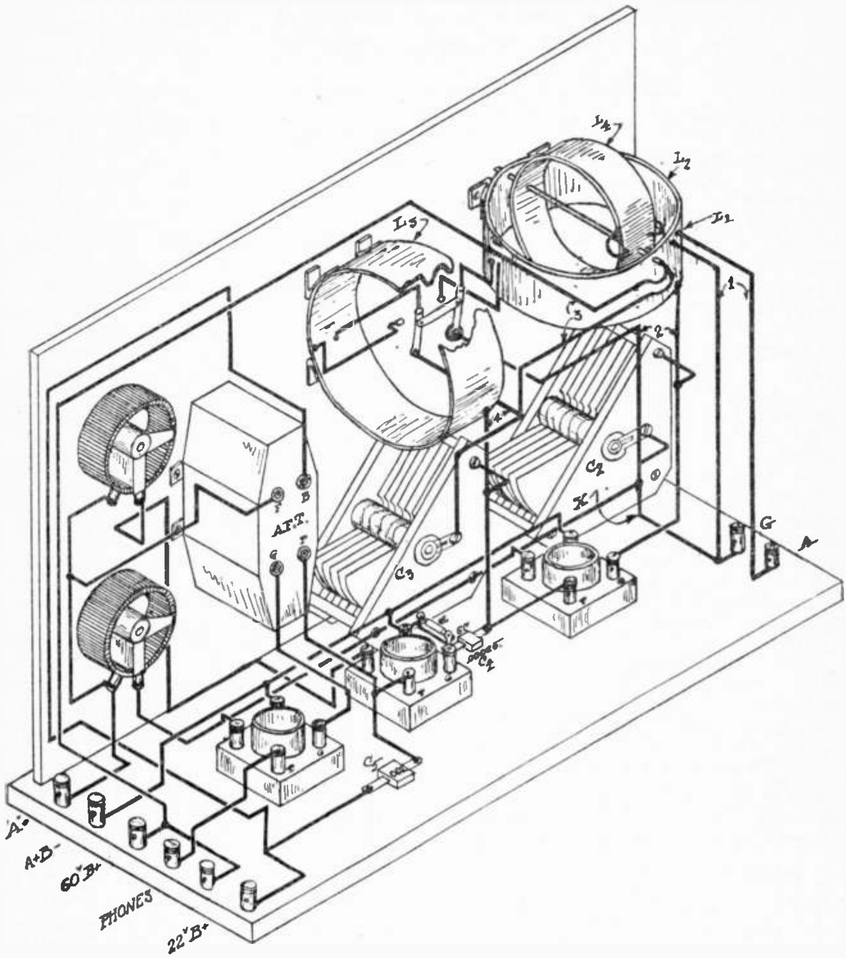
FIG. 45.

antenna circuit is connected to the grid circuit of the tube through a very small coupling condenser. The capacity of this condenser should not be greater than 30 or 40 mmfd. (0.000030 or 0.000040 mfd.). A 13-plate condenser set at zero, or at very low values is suitable, or this condenser may be made by placing two plates one inch square about 1-16 inch apart. The remainder of the circuit is exactly the same as for the other circuits. If the antenna capacity is made too large the circuit degenerates into the familiar single circuit receiver, and possesses all its faults. With the small capacity which should be used, the secondary or grid circuit tunes very much as if the antenna circuit were not present, the tuning being very sharp. A vario-coupler may be conveniently employed for this circuit, just as described above.

Many of the single circuit receivers which were placed on the market in the early days of popular broadcasting may be easily converted into receivers of the type described here. Such a change cannot be too highly recommended. For example, a Clapp-Eastham "HR" set may be converted to the type shown in Figure 45 by the addition of the 0.0003 variable condenser. This condenser should be connected across the inductance as shown. The antenna condenser in the set should then be set at some low value, around twenty on the scale. The tuning may then be done by the added condenser and the inductance switch. The regeneration is controlled entirely by means of the tickler coupling, as before. Other arrangements may be made for all of the single circuit receivers on the market.

The Superdyne

THE SUPERDYNE RECEIVER



This drawing shows a convenient and straightforward method for mounting one stage of tuned radio frequency amplification, tube detector, and one stage of audio frequency amplification. The radio frequency amplifier grid and plate circuits are sharply tuned by means of the coils and condensers, L-2, C-2 and L-3, C-3, respectively. With such a circuit the amplifier would ordinarily be useless because of the generation of oscillations within the amplifier itself. The tendency of the amplifier to oscillate is controlled by means of the small rotating winding, L-4, by means of which the amplifier may be held at a very sensitive adjustment. With a large outside antenna, the antenna and ground wires are connected to a four-turn winding, L-1, which avoids all difficulties and controls in the antenna circuit. For use with a small antenna, such as may be strung up inside a room, the receiver has generally been found to give best results when the antenna is connected directly to the grid of the radio frequency amplifier tube. In such cases the winding L-1 is not used. This receiver is not difficult to construct and is capable of giving truly remarkable results. It is extremely selective—in fact its selectivity approaches that of the super-heterodyne. The settings of the condenser C-3 are practically constant, so that once a station has been picked up the settings may be recorded for future use. This condenser should be set at the desired point and then the controls of the condenser C-2 and of the coil L-4 should be operated together, balancing one against the other, for the loudest signal.

THE SUPERDYNE RECEIVER

A Set with One Stage of Magnetically Neutralized Radio Frequency Amplification

THE greatest difficulty to be overcome in the design and operation of a radio frequency amplifier is the regenerative feedback which takes place through the capacity existing between the elements of the vacuum tube itself. The small condenser formed by the grid and the plate of the tube, with the leads to these elements, allows energy to flow from the plate circuit of the tube back into the grid circuit. This energy enters the grid circuit in such a manner as to build up the signal already present in that circuit. This amplified signal then is passed through the tube, whereupon some of the plate circuit energy is again fed back into the grid circuit, tending to build up the signal in the grid circuit to still larger values. This process continues until it is found that the tube will maintain this interchange of energy between the two circuits, without the presence of a signal. In this condition the tube is a generator of high frequency oscillations, the energy for the oscillations being supplied by the "B" battery. Nearly everyone interested in radio has read descriptions of the "Neutrodyne" receiver, in which the interchange of energy between the plate and grid circuits is annulled by means of a small condenser, called the "neutralizing condenser."

Magnetic Neutralization

In the receiver about to be described, the same effect is produced by means of a coil connected in the plate circuit of the tube, the coil being placed near the grid circuit coil. An interchange of energy between the two circuits then takes place through the inter-electrode capacity of the tube, as before, and also through the magnetic field set up by the plate circuit coil. If the direction of the winding of the plate coil is properly chosen, the energy fed back into the grid circuit, through the coil, may be made to oppose the energy fed back through the tube capacity. No attempt is made in this receiver to "neutralize" once and for all, as is done in the "Neutrodyne." Instead, the process of neutralization is carried out as a tuning adjustment, which permits of a very accurate neutralization at each adjustment of the receiving set.

The circuit could theoretically be operated with only two tubes, the radio frequency amplifier and detector. In practice it has been found, however, that such operation is not very satisfactory, as the presence of the telephones directly in the detector plate circuit leads to capacity effects which materially reduce the effectiveness of the receiver. A second stage of audio frequency amplification may of course be added to the circuit shown, if greater volume of signals is desired.

Circuit Diagram

The circuit diagram is shown in Figure 60. To simplify the necessary tuning adjustments, the antenna circuit has been only approximately tuned. The antenna

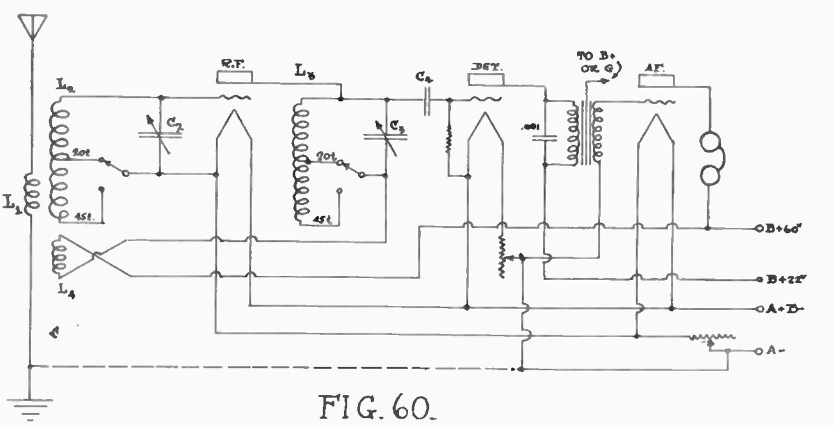


FIG. 60.

winding, L-1, consists of four turns of wire wound over the coil L-2. The pair of wires, marked (1), on the assembly drawing connect with this four-turn coil.

The grid circuit of the amplifier consists of the coil L-2 and the variable condenser C-2. [Pair marked (2)]. The coil is tapped at one point, at approximately one half of the winding, in order to provide good efficiency at all broadcasting wavelengths. It has been found that a certain ratio of inductance to capacity is rather essential in this circuit, so that this ratio is approximately maintained over the entire broadcast band by means of the tap on the winding. The coil L-2 may be made by winding 45 turns of number 22 double cotton covered wire on a form four inches in diameter. The form will only have to be about two inches long, to provide space for the winding and for any mounting screws. The winding should be tapped at the twentieth turn. The length of the winding will be about one and one-quarter inches. The coil L-3, which is used in the plate circuit (pair 4) of the radio frequency amplifier is of exactly the same construction as the coil L-2. The condensers C-2 and C-3, should be of good quality, with a maximum capacity of 0.0005 mfd.

Neutralizer

The reversed feed-back coil, or neutralizer, L-4, may be wound on a wooden rotor ball three and one-half inches in diameter. If a form of this size cannot be obtained, use one smaller than the size given. Do not use a form larger than the given size. A very good mounting for this form is indicated on the drawing where the coil is wound on a piece of cylindrical tubing three inches in diameter. This provides a space of one-half inch between the two windings. It must be borne in mind that if the winding L-2 and the winding L-4 are too close together, the capacity existing between the windings will be so large as to cause a large amount of trouble in the operation of the set. If this capacity is sufficiently large, no satisfactory results will be obtainable. The shaft for the rotor form should be mounted at the upper end of coil L-2, which will be connected to filament, thereby reducing the effect of any capacity between the windings L-2, L-4. The winding of the rotor form should have from eight to thirty-six turns. The exact number will depend upon several things, the stray capacities of the circuit and the resistance of the plate tuning circuit L-3, C-3. If the resistance of this circuit is very low (good quality condenser and good coil) a larger number of turns will be required on L-4 than when the resistance of the tuning circuit is high (poor quality condenser or high resistance coil). It is necessary to actually try the set to find out if the number of turns has been properly chosen. If the set operates best with the coil L-4 almost at right angles to L-2, there are too many turns on the rotor and some should be removed. If the set has squeals and whistles accompanying the signals, no matter what the position of L-4, then there are too few turns and some should be added. A good starting point is with from twenty-four to thirty-six turns, which in practically every case is more than enough. A few may then be easily removed for the smoother operation of the receiver. The coil L-4 (pair 3) is connected between the tuned plate circuit of the amplifier and the "B" battery.

Grid Condenser, Grid Leak, and By-pass Condenser

The condenser C-4 may be a standard grid condenser of from 0.00025 to 0.0005 mfds. capacity. The value of this condenser is not particularly critical, so that a considerable latitude is allowable. The grid leak should be connected as shown on the diagrams, i. e., between the grid of the detector tube and the positive filament terminal of that tube. The value of the leak resistance has a material bearing upon the results which will be obtained. For UV 201-A tubes a leak of 2.5 megohms has been found quite satisfactory. If a good variable leak is available, it may well be employed here. It is evident that it is not possible to connect the grid leak resistance across the terminals of the condenser C-4, as is often done in single tube outfits, for if it is done here, there is a direct connection between the positive terminal of the "B" battery and the grid of the detector tube through the grid leak resistance. This means that the grid of the detector will be driven to a high positive potential by the "B" battery and the detector tube will not work properly. With UV-200 tubes it is sometimes possible to obtain satisfactory results without any grid leak, but this procedure is not to be recommended.

The by-pass condenser, C-5, in the detector plate circuit is quite important. A mica condenser, of from 0.001 to 0.002 mfd., has been found most satisfactory with a UV-201-A tube as the detector. This size of by-pass is also suitable for use with other types of tubes.

It will be noticed that unless the filament circuit of the tubes is grounded, the whole circuit is "floating" as regards its potential to earth. It is sometimes advisable to ground the negative terminal of the "A" battery, especially so if the receiver is to be used on a small indoor antenna. This ground connection is indicated on the wiring diagram by a dotted line, and is shown by the connection marked "X" on the assembly drawing. It is often very advantageous to connect the core of the audio frequency amplifying transformer to the ground or to the positive terminal of the "B" battery. An improvement in results cannot be definitely predicted, but an improvement is so often obtained that this is a kink which is well worth a trial.

Operation

It will be found that in operation the condensers C-2 and C-3 will be placed at approximately equal values. As the coupling between L-4 and L-2 is changed, by rotating L-4, it will be found that the setting of C-2 will be materially affected. The setting of C-3 will only need very slight readjustment. In fact, this condenser may be calibrated to read in wavelengths and the settings may be duplicated without difficulty. In operating the receiver C-3 is set at the proper value and then C-2 and L-4 are operated together, balancing one against the other for the best signal, in much the same manner that an ordinary regenerative receiver is operated.

When first placing the set in operation, place C-3 at about half scale and rotate L-4 until a click is heard in the receivers. Now move C-2 up or down, past the corresponding setting of C-3, until a click is heard. With a little trial it will be found that the condensers and neutralizer may be set so that the receiver will oscillate only over a very narrow range on either of the condensers. If the coupling of L-4 with the coil L-2 is now increased, by turning L-4 more nearly parallel to L-2, it will be found that the condensers may be turned back and forth past the resonant setting without the tube breaking into oscillation. When this condition has been obtained, the receiver is in good working order. Some practice is necessary to obtain the best results with this circuit, even if it is in perfect working order, especially in picking up weak signals. The tuning process should always be carried out by setting the condenser C-3 and balancing C-2 and L-4 against each other for that setting of C-3. After a few stations have been picked up, so that the wavelength corresponding to various settings of C-3 is known quite closely, it is a fairly simple process to pick up even a weak signal on any desired wavelength.

The tuning on both C-3 and C-2 will be found very sharp, even on local signals. It is so much more sharp than the usual types of circuits that the inexperienced operator will many times miss even a fairly loud signal, by moving the condenser too far at a step. A good gear vernier on the condensers is very handy in obtaining a good adjustment.

Constructional Hints

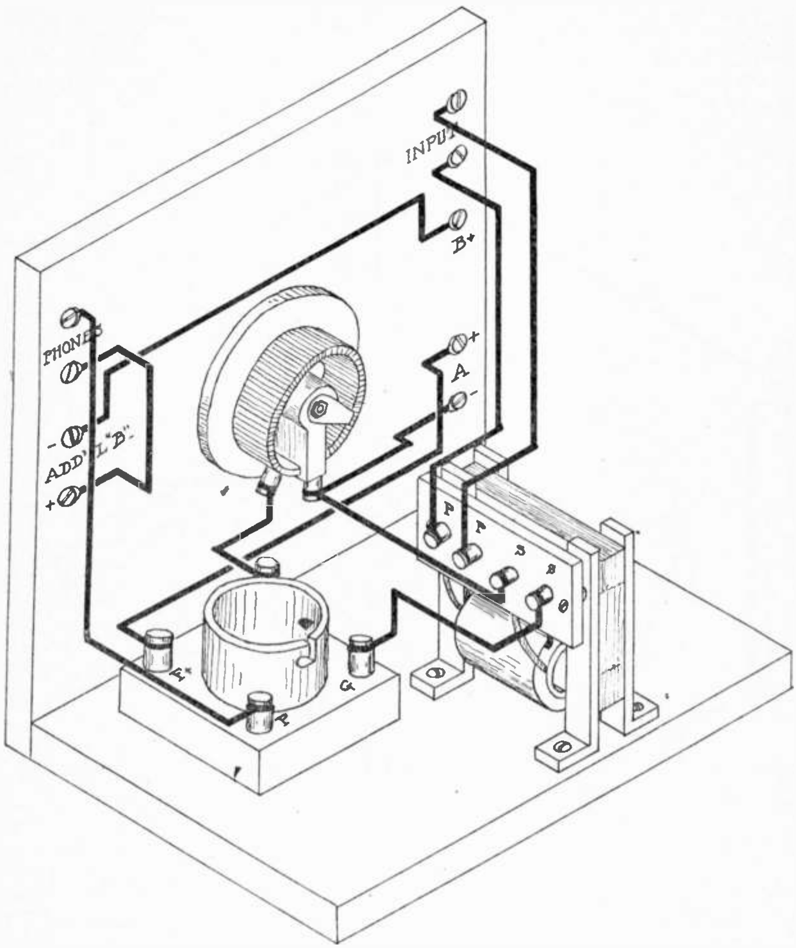
The arrangement of the apparatus should be such that the grid and plate leads of the radio frequency amplifier tube are well separated. If these leads are run too close together trouble will be experienced. The coils L-2 and L-3 should be placed on the same centre line, at right angles, so that there is little coupling between them. If there is much coupling between the coils it will be found that the circuit will either oscillate at all positions of L-4 or will not bring in any signals with very good intensity.

For operation of an indoor antenna it has been found very satisfactory to connect the antenna directly to the grid end of the coil L-2, grounding the filaments as explained above. The antenna winding, L-1, is not used in this case. Under the worst conditions this circuit will give as good results as any one-stage radio frequency outfit, but under the best conditions it will give results which are really remarkable. It is a circuit which will well repay one for considerable time spent in the construction of the set and in mastering the operation. The values of "B" battery voltage and filament current materially affect the operation of the radio frequency amplifier. A little experimenting is necessary to determine the best values for the particular tube used. Voltages from 22.5 to 50 seem to give the best results with 201-A tubes.

Also the best results seem to be obtained when the same "B" voltage is applied to all three tubes. In other words the binding posts "plus 60 v" and " plus 22 v" are connected together and to the positive terminal of the "B" battery. If a UV-200 tube is used for the detector, it will be necessary to use the two "B" battery connections, as indicated in the drawing and wiring diagram, since this type of tube does not operate well with voltages higher than 22 volts.

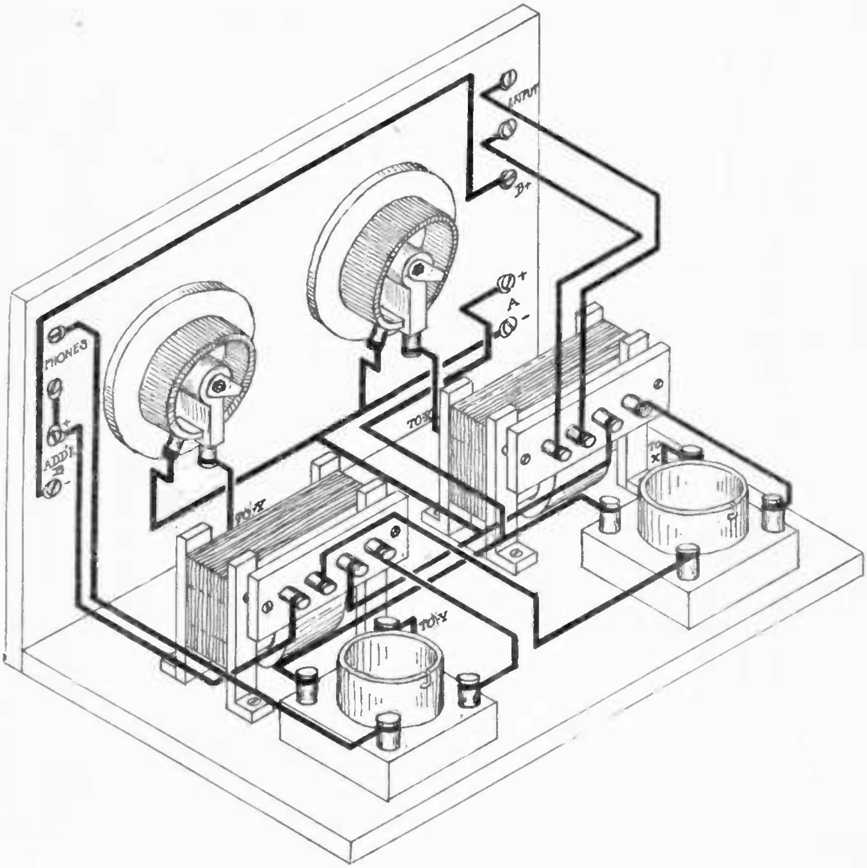
While it is desirable to operate this circuit with three UV-201-A tubes, fairly satisfactory results may be obtained with other types of tubes such as the WD-11 or WD-12, UV-199, etc.

SINGLE STAGE OF AUDIO-FREQUENCY AMPLIFICATION



Many listeners believe that a special connection must be employed with each type of receiver when audio-amplification is to be used. This is not the case. An audio frequency amplifier may be built which may be added to any type of receiving apparatus to increase the volume of the signals. Here there is shown a simple method of assembling a one-step amplifier. The binding posts have been arranged to fit in with the previous assemblies, but they do not have to be arranged in the order shown. The posts shown at the left hand end of the panel (looking at the front) may be connected by short jumpers to the corresponding posts on any of the tube receivers which have been described. The posts marked "Additional B" are for the amplifier "B" battery. A higher voltage may be advantageously used on the plates of the amplifier tubes than is used on the detector tube. These binding posts have been shown as a convenient means for adding the required "B" battery for the amplifier. If the same battery is to be used for both amplifier and detector, these two binding posts should be connected together. It is often convenient to make up the amplifier in a separate assembly, for then it may be used with any receiving apparatus without any change in construction. If at a later time a second stage of amplification is desired another assembly, similar to this one, may be made and added with the least amount of constructional effort.

DOUBLE STAGE OF AUDIO-FREQUENCY AMPLIFICATION



If two stages of audio frequency amplification are desired and may be constructed at the same time, the assembly above will serve as a guide in laying out the apparatus. As in the one stage amplifier, the posts on the left hand of the panel (from the front) are fitted to conform with the posts on the receiving sets so far described. Short connections may be made between the two sets, presenting a uniform and neat appearance This amplifier may be used with any type of receiving set. The special points considered in the accompanying article should be carefully followed in placing this amplifier in an operative condition.

AUDIO-FREQUENCY AMPLIFICATION

A Two-Stage Type Which May Be Used with Any Receiver

WE will now discuss the assembly of a two-stage audio-frequency amplifier, which may be used with any of the regular types of receiving equipment. Two diagrams of connections for this amplifier are given; one with a complete system of filament lighting jacks, the other with binding post connections only.

No particular dimensions are given, because everyone has their own ideas as to the type of cabinet which they desire to use. It may be said, however, that the "long and skinny" type of panel is very desirable. The apparatus should be mounted so that the connections will appear very much as they do in the diagram, that is, the signal progresses from one end of the amplifier directly through to the other end, without doubling back. Generous spacing should be allowed between the component parts of the amplifier. The transformers and tubes should be separated by at least an inch and a half, which will bring the tubes about six or seven inches apart, centre to centre.

The best plan to follow in the assembly is to arrange the apparatus in position and secure it permanently in place before beginning any wiring.

Special Points

Certain of the leads should be run in as short and direct a manner as possible between the two points which they connect. These leads are shown in the diagram and labelled with the letter "S." These leads are the connections between the tubes and transformers, in both the plate and grid circuits.

There are several points of special importance which should be followed carefully. The return leads in the grid circuit of each tube should be run from the transformer secondary to the negative terminal of the "A" battery. This mode of connection places a small biasing voltage on the grid of the tube, due to the drop in voltage in the resistance of the rheostat. This voltage is usually sufficient to permit the use of fairly high plate voltages on the tubes, which results in good amplification and consequent volume of signal, without the necessity of employing a separate biasing or "C" battery.

If the cores of the audio-frequency transformers are grounded, or are connected to the positive terminal of the "B" battery, a great improvement in signal strength is often obtained. The effectiveness of this connection depends upon the type of transformers used, and to some extent upon the type of tube, so that an increase of signal strength cannot be definitely predicted. This is a "kink" that is well worth trying, however.

For tubes it is recommended that the UV 201-A tube be used, though considerable amplification may be obtained with al-

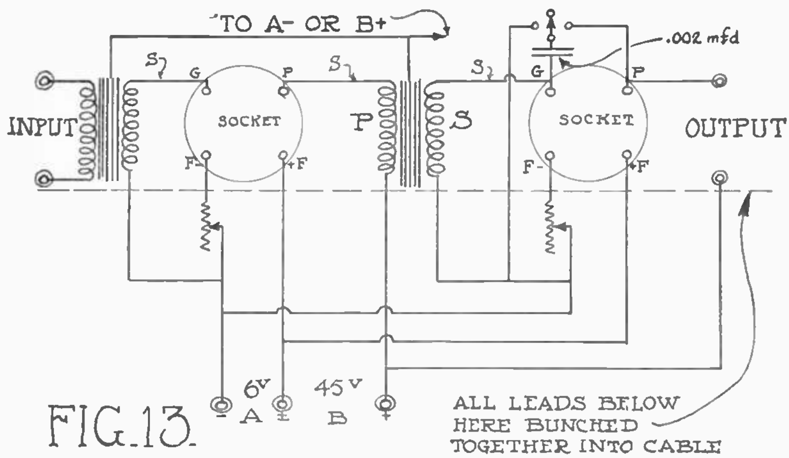


FIG. 13.

most any of the standard tubes on the market. The UV 201-A tube has a good amplification factor, and at the same time possesses a low plate circuit resistance. This latter quality permits a greater current to flow in the plate circuit, with a consequent greater volume of signal, than is obtainable with most of the other tubes under similar conditions. The low filament current required by this tube makes the amplifier very economical to run. Any of the standard audio-frequency transformers made by reputable manufacturers will give satisfactory results with these tubes.

A small fixed condenser, connected with a switch, in the plate circuit of the last tube, sometimes improves the amplification considerably. The connections for this condenser are plainly indicated in the diagrams.

HOW A RADIO RECEIVER WORKS

Explanation, in Simple Language, of How Wireless Signals Are Received

LET us first consider a simple hydraulic analogy, which will make clear the essential principles of reception in radio telephony without the complication due to the varied electrical phenomena which take place in the actual receiver.

Analogy

Suppose that we have a long trough, running from the transmitter to the receiver. Let our transmitter be a faucet which is capable of supplying water to the trough, so that it will flow smoothly along to the receiver. At the receiving end of the trough we will place our receiving equipment, which consists of a cork or a chip of wood. In order that the receiver will not be carried away by the flow of water, let the chip be secured to the sides of the trough by means of two threads as indicated in the diagram. These conditions are represented in Figure 1, and represent the conditions

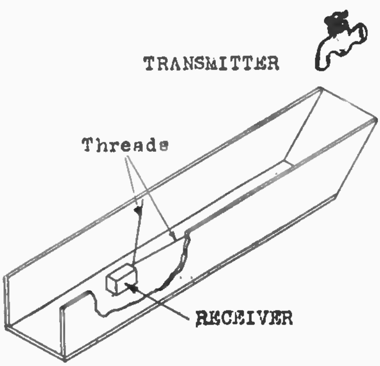


FIGURE 1.

when the transmitter is closed down. We are waiting for the broadcast station to start its programme.

Now when the transmitter is placed into operation, a steady supply of water is let into the trough, and this water flows smoothly down toward the receiving end as long as the supply is constant. At the receiving station the chip rides upon the surface of the water, but quietly, as long as there are no ripples. This condition is shown in Figure 2, which represents the conditions after the transmitting station has been placed in operation, ready to start the programme. The speaker has not yet begun to make his announcement.

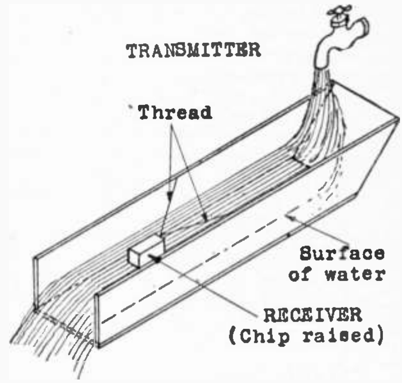


FIGURE 2.

Now let us vary the amount of water which is let into the trough, by turning the handle of the faucet back and forth, never shutting the supply entirely off. The result will be that a series of waves, or ripples, will move down the trough, in accordance with the manner in which the supply is varied. At the receiver the chip will move up and down on the surface of the water, its motions corresponding to the ripples. Thus the signals, transmitted by varying the supply of water to the trough,

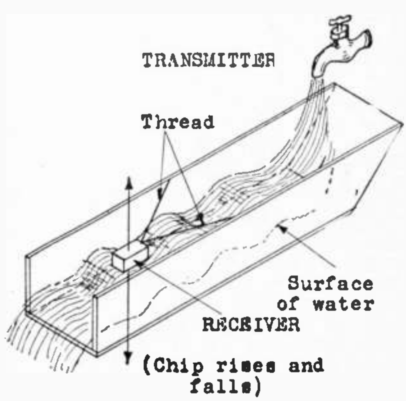


FIGURE 3.

are recorded by the motion of the chip. These conditions are indicated in Figure 3. The programme is now being transmitted.

Radio Reception—The Receiving Equipment

Now let us consider the actual radio apparatus. At the transmitting station we have apparatus which sends out electric energy into space. At the receiving station we have an elevated wire, called the antenna, which serves to collect some of the energy. In order that the energy thus collected may be led to the apparatus which makes known the presence of the signal, we have a wire connected to the elevated wire, and brought down to the instruments. This is called the lead-in. The exterior conditions at the receiving station may now be shown as follows (Figure 4):

Now inside of our receiving station we may have any one of a large number of types of equipment. For the purposes of this article we will choose a type which has been very widely used; but, in general, the

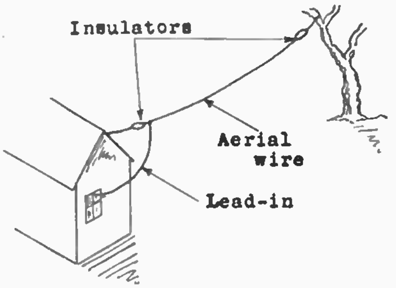


FIGURE 4.

discussion applies to any type. The exterior appearance of such an equipment is indicated in Figure 5. Such a set would be called a single-circuit vacuum tube receiver. The lead-in from the outside aerial wire is brought to the antenna binding post, marked "A." The antenna circuit is completed, externally to the receiving set, by the connection which goes from the post marked "G" to a water-pipe, or to a metal plate buried in moist earth. The remainder of the external connections are those to the filament lighting battery ("A" battery), from which power is taken to light the filament of the vacuum tube, within the cabinet. This "A" battery may consist of from one to three of the familiar dry cells, or may be a storage battery, such as is used for lighting and starting in automobiles. The other battery shown, the "B" battery, consists of a number of small flashlight cells made up in a single container, and is necessary for the operation of the vacuum tube, as will be described. The signals are made audible in the telephones (telephone receivers), which are similar to the

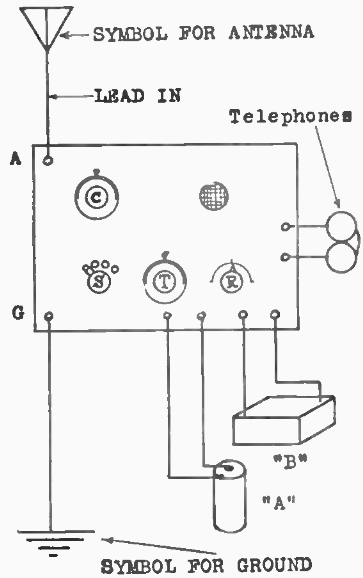


FIGURE 5

usual telephone receiver used for wire telephony. So much for the outside of the receiver.

Inside the Cabinet—the Condenser

Let us now take a look at the interior of the cabinet and see where the signal goes. From the antenna binding post we find that a wire connects with an instrument called a variable condenser, (which is shown in the various assembly drawings).

It consists of two sets of parallel metal plates; one set fixed in position—the other movable on a shaft, so that these plates may be made to enter into the spaces between the fixed plates. There is no metallic connection between the two sets of plates. The size of the condenser depends upon the size and number of the plates and upon the distance between the fixed and movable plates. A condenser is rated by its ability to store electric energy—a large condenser being one which can store a large amount of energy. The condensers used in radio reception are generally quite small, that is, their capacity is small. (The unit of capacity is the farad. The farad is much too large a unit for practical purposes, so that a microfarad, or one one-millionth of a farad is commonly used. Even this unit is large for radio work, so that a micro-micro-farad is often employed, which is one one-trillionth of a farad.) The symbol for the condenser consists of two parallel lines, separated by a small distance, representing the two sets of plates as they are separated in the condenser. A variable condenser is represented by the same symbol, with an arrow drawn through it, to indicate that the condenser is variable. These symbols are shown in the Key to Symbols of Apparatus.

The Vario-Coupler

From the condenser we find that there is a connection taken to one end of the stationary winding of an instrument which is called a vario-coupler—a drawing of this may be seen in the Haynes assembly. The stationary winding is called the stator and the rotatable winding, the rotor. From a number of points on the stationary winding, taps are taken off to the points of the switch "S." The taps are simply connections which are made at various points, to the continuous winding on the stationary form. By means of this switch it is possible to vary the number of turns which are included between the end of the coil and the arm of the switch. A coil is rated by its ability to store magnetic energy, and this is given the name inductance. The inductance of a coil depends upon the number of turns of wire, the size of the wire, the spacing between the turns, and the area enclosed by the turns. (The unit of inductance is the henry, but this unit is too large for general work in radio, so that the milli-henry, one one-thousandth of a henry, or the micro-henry, one one-millionth of a henry is commonly employed.) The symbol for a coil ("inductor" and "variable inductor") is shown in the Key to Symbols of Apparatus.

Now we find that the center of the arm of the switch is connected to the ground binding post on the panel, and we have seen that this post is connected to the water pipe or to a buried plate. We may now show the complete antenna circuit of this receiver as in Fig. 8.

Electrical Pitch; Tuning

We are all familiar with the fact that a stretched string may be made to give out notes of different pitch as the length of the string is changed, as is done on stringed instruments. In a similar manner, the electrical circuit of Figure 8 may be adjusted to different electrical pitches or frequencies by adjusting its electrical length. This electrical length may be changed by changing the position of the movable plates of the variable condenser, or by changing the position of the switch "S." When the condenser is set so that the movable plates are all within the stationary plates, and the switch is set so that all of the turns of the coil are included in the circuit, then the electrical pitch or frequency of the circuit is lowest. As the movable plates of the condenser are withdrawn from within the stationary plates, or the number of active turns of the coil are reduced, the electrical pitch, or frequency, of the circuit is raised. Thus we have means of tuning this circuit to various electrical frequencies.

When energy is collected by the antenna, a current is caused to flow back and forth through the circuit of Figure 8, between the antenna and ground, and then between the ground and antenna, and so on, as long as the energy is supplied. When the electrical pitch of the circuit is made exactly equal to the electrical pitch of the distant transmitter, then the receiver circuit is said to be in resonance, or tuned, with the distant transmitter. Under this

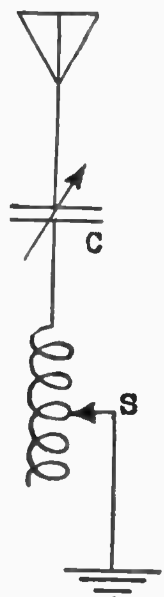


FIGURE 8.

condition a maximum current will flow in the antenna circuit, for a given amount of energy radiated from the transmitting station.

We now have a receiving equipment which can be adjusted to receive certain radio frequencies, but we have no means of making these frequencies apparent to our senses. We must now attach to the circuit of Figure 8 some device which will convert electrical frequencies into some form of vibration which is detected by our five senses. Generally, although not necessarily, the electrical vibrations are converted into vibrations in the air so that we may detect the signal by our sense of hearing. The apparatus which thus converts the electrical vibrations into audible vibrations is called the detector and reproducing apparatus. The purpose of the detector is to convert the electrical radio frequency vibrations into electrical vibrations which are so slow that their pitch is within the range of response of the ear. The reproducing apparatus takes these slow electrical or audio frequency vibrations and creates vibrations in the air, of the same frequency. These air vibrations then affect our sense of hearing.

The Vacuum Tube Detector

The most commonly used detection device is the three electrode vacuum tube. This device is one of the most complicated and useful of all modern inventions, so that it will be possible to give but the briefest outline of its action and uses here. The tube consists of an evacuated glass container, having within it a filament somewhat after the manner of the filament of an ordinary incandescent light; a plate, which is simply a plate of metal and a grid, which is a ladder-like structure of fine wire, placed between the filament and plate of the tube. The filament is connected to a battery, through a variable resistor, or rheostat, as indicated in Figure 9. The purpose of the battery is to heat the filament, as at high temperatures the filament may be made to give off small particles of negative electricity, called electrons. These electrons are boiled out of the filament in much the same manner that water particles are shot out from the surface of boiling water. If the plate of the tube is connected to the positive terminal of a high voltage battery, "B," as indicated in Figure 9, and the negative terminal of this battery is connected to the filament circuit, the small particles, or electrons which are shot out of the filament will be attracted to the positively charged plate. If the battery is left connected, this attraction will cause a large number of these small particles to cross over the space between the filament and plate, which is equivalent to a current flowing in the plate circuit. If the plate were charged negatively, by reversing the connections to the high voltage battery, then no electrons would go to the plate, since they are repelled by a negative charge.

Action of the Grid

Now in the modern tube, the ladder-like grid is most important. When the grid is

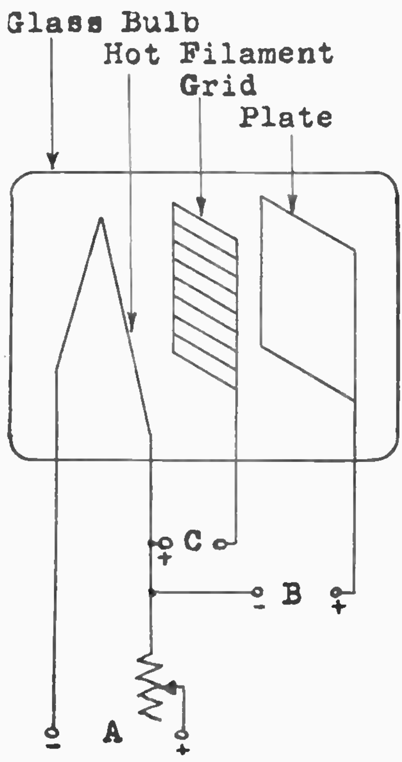


FIGURE 9.

charged negatively, as by the battery "C," it repells electrons which are attempting to pass through it and get to the positively charged plate. However, some of the electrons have their right-of-way signals up and shoot right through the spaces of the grid and finally arrive at the plate. The total number of such electrons is less, however, than when the grid was not charged. If the grid is charged positively (as by reversing the battery "C", figure 9) it tends to attract electrons to itself, but it also gives all of the electrons coming out of the filament a higher speed, so that a large number of electrons still slip through the meshes of the grid and go to the plate. The number of electrons which thus reaches the plate is greater than that when the grid was uncharged.

Thus the grid is seen to act as a control of the number of electrons reaching the plate, or in other words, a control of the plate current. It is further found that the charge on the grid is much more effective in controlling the plate current, than is the charge on the plate. That is, if we vary the voltage of the battery "C" by one volt, we will produce a much greater change in the plate current, than we would obtain by varying the battery "B" by one volt. Thus we obtain an amplifying action in the tube, a feature which is most important in its practical application.

Connection of Tube to Receiver

If now we supplant the battery "C" by a portion of the antenna circuit of Figure 8, as between the points "A" and "B," we can charge the grid by means of the incoming signal, as shown in Figure 10. This

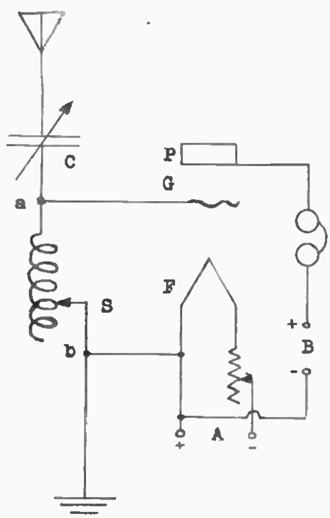


FIGURE 10.

means that the signal itself may be used to control the plate current of the tube. If we should insert a pair of telephone receivers in the plate circuit, as shown in the diagram, to make the signal audible, we would find that we could hear nothing. This is because the tube is acting to vary the plate current at the same frequency at which the antenna circuit is vibrating. If it were possible for the telephone receiver diaphragms to vibrate this fast, we still would hear nothing because our ears will not respond to such tremendously high frequencies. (The frequencies used in broadcast work range from 540,000 to 1,330,000 vibrations per second. The highest note that an average person can hear is about 15,000 vibrations per second.) If we can slow up the high frequency, or make several vibrations of the high frequency produce a single vibration, then we have a means of reducing these tremendously high vibrations to lower ones, which our ears can hear.

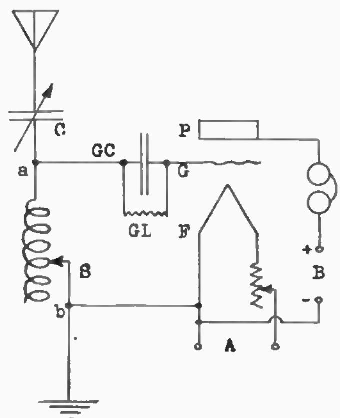


FIGURE 11.

If we make use of a small condenser and a high resistance, connected in the grid circuit of the tube, as shown in Figure 11, then we have the effect mentioned above. These instruments are known as the grid condenser GC, and the grid leak resistance, GL.

Action of the Circuit

Now let us consider the action of the circuit when signals are being received. When no signals are being sent out from the transmitting station, the grid of the tube will have practically a zero charge upon it. The plate current is then steady and at a certain value. These conditions correspond to the conditions outlined for Figure 1, of our analogy. Now let the transmitting station prepare to send signals, though no words are yet spoken. Energy, in an unvarying amount, will then be radiated from the transmitting station, some of this energy being collected by the receiving antenna. This results in a voltage being impressed upon the grid of the tube, and this voltage is steady in value. The plate current of the tube will then change to a new value, and will remain at this value as long as the charge on the grid remains constant. When this change in plate current takes place, we hear a single click in the telephone receivers, but we hear nothing more, under these conditions, until the apparatus at the transmitting station is shut down. If this is done, the voltage applied to the grid is removed, and the plate current will return to its original value. When this occurs another click will be heard in the telephone receivers. This corresponds to the rise and fall of the block, when the water is turned on, or shut off completely, in the analogy. (Figure 2.)

Now let the transmitter apparatus be placed in operation, and words be spoken into the microphone. The energy radiated from the transmitter will no longer be constant, but will vary in amount with the control effected by the voice. On the steady flow of energy, which takes place when no words are being spoken, are superimposed various ripples, these ripples being in accordance with the voice. This corresponds to the analogy pertaining to Figure 3. Now at the receiver, the amount of energy collected by the antenna will vary, according as the amount sent out by the transmitter is large or small. The current flowing in the antenna circuit will then vary in accordance with these changes, and the changes in current will be reproduced as changes in the voltage or charge applied to the grid of the tube. These changes in the charge on the grid of the tube cause corresponding changes in the plate current. As these changes take place at audio frequency the diaphragms of the telephone receivers will respond to the changes, and as they move in and out, they set up air waves, which, striking our ears, produce the sensation of sound. In this connection it should be noticed that it is not the energy of the signal which operates the telephones, but energy supplied by the "B" battery. The signal simply acts through the tube to control the flow of this energy through the telephone receivers.

Regeneration

Since the vacuum tube is an amplifying device, we have a greater amount of energy flowing in the plate circuit than came in through the antenna circuit. Some of this energy may be taken out of the plate circuit to be led back to the grid circuit, where it can be made to amplify or regenerate the signal present there. If this is done, the receiving set is said to be regenerative.

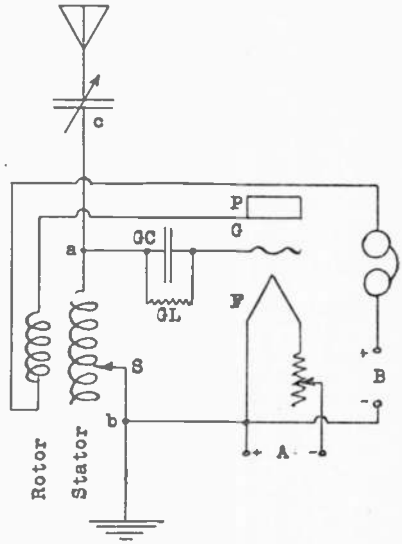


FIGURE 12.

One method for accomplishing this result is indicated in Figure 12. The rotor winding of the variocoupler is connected in the plate circuit of the tube in such a manner that part of the radio frequency energy present in the plate circuit may be fed back into the grid circuit, through the magnetic transfer between the rotor coil and the stator coil. (In the diagram the rotor winding is indicated as being placed beside the stator winding for greater clearness in the drawing.) The effect of a signal is thus increased very greatly, so that it is possible to hear signals clearly that would be entirely too weak to hear with the arrangement of Figure 11.

This is but a brief, and far from rigorous, explanation of the operation of a radio receiving set. However, if it serves to make clearer the mysteries of the why of radio, its purpose is accomplished.

International Morse Code and Conventional Signals

[To be used for all general public-service radio communication. (1) A dash is equal to three dots; (2) the space between parts of the same letter is equal to one dot; (3) the space between two letters is equal to three dots; (4) the space between two words is equal to five dots.]

A	· —
B	— · · ·
C	— · — ·
D	— · ·
E	·
F	· · — ·
G	— — ·
H	· · · ·
I	· ·
J	· — — —
K	— · —
L	· — · ·
M	— —
N	— ·
O	— — —
P	· — — ·
Q	— — · —
R	· — ·
S	· · ·
T	—
U	· · —
V	· · · —
W	· — —
X	— · · —
Y	— · — —
Z	— — · ·

Ä (German)	· — · —
Á or Å (Spanish-Scandinavian)	· — — · —
CH (German-Spanish)	— — — —
É (French)	· · — · ·
Ñ (Spanish)	— — · — —
Ö (German)	— — — ·
Ü (German)	· · — —

1	· — — — —
2	· · — — —
3	· · · — —
4	· · · · —
5	· · · · ·
6	— · · · ·
7	— — · · ·
8	— — — · ·
9	— — — — ·
0	— — — — —

Period	· · · · · ·
Semicolon	— · — · — ·
Comma	· — · — · —
Colon	— — — · · ·
Interrogation	· · — — · ·
Exclamation point	— — · · — —
Apostrophe	· — — — — ·
Hyphen	— · · · · —
Bar indicating fraction	— · · — ·
Parenthesis	— · — — · —
Inverted commas	· — · · — ·
Underline	· · — — · —
Double dash	— · · · —
Distress call	· · · — — — · · ·
Attention call to precede every transmission	— · — · —
General inquiry call	— · — · — — · —
From (de)	— · · ·
Invitation to transmit (go ahead)	— · —
Warning—high power	— — · · — —
Question (please repeat after ......)—interrupting long messages	· · — — · ·
Wait	· — · · ·
Break (Bk.) (double dash)	— · · · —
Understand	· · · — ·
Error	· · · · · · · ·
Received (O. K.)	· — ·
Position report (to precede all position messages)	— · — ·
End of each message (cross)	· — · — ·
Transmission finished (end of work) (conclusion of correspondence)	· · · — · —

List of Abbreviations to be Used in Radio Communications[1]

Abbreviation.	Question.	Answer or notice.
CQ	—·—· ——·—	Signal of inquiry made by a station desiring to communicate.
TR	— ·—·	Signal announcing the sending of particulars concerning a station on shipboard (Art. XXII).
(1)	——·——	Signal indicating that a station is about to send at high power.
PRB	Do you wish to communicate by means of the International Signal Code?	I wish to communicate by means of the International Signal Code.
QRA	What ship or coast station is that?............	This is ......
QRB	What is your distance?........................	My distance is ......
QRC	What is your true bearing?....................	My true bearing is ...... degrees.
QRD	Where are you bound for?......................	I am bound for ......
QRF	Where are you bound from?....................	I am bound from ......
QRG	What line do you belong to?..................	I belong to the . . . .. Line.
QRH	What is your wave length in meters?..........	My wave length is ..... meters.
QRJ	How many words have you to send?..........	I have ...... words to send.
QRK	How do you receive me?.................... ..	I am receiving well.
QRL	Are you receiving badly? Shall I send 20...... ···—· for adjustment?	I am receiving badly. Please send 20. ···—· for adjustment.
QRM	Are you being interfered with?................	I am being interfered with.
QRN	Are the atmospherics strong?..................	Atmospherics are very strong.
QRO	Shall I increase power?........................	Increase power.
QRP	Shall I decrease power?.......................	Decrease power.
QRQ	Shall I send faster?...........................	Send faster.
QRS	Shall I send slower?..........................	Send slower.
QRT	Shall I stop sending?..........................	Stop sending.
QRU	....	I have nothing to transmit. I have nothing for you.
QRV	Are you ready?	I am ready. All right now.
QRW	Are you busy?..................................	I am busy (or, I am busy with ...... Please do not interfere).
QRX	Shall I stand by?..............................	Stand by. I will call you when required.
QRY	When will be my turn?........................	Your turn will be No. ......
QRZ	Are my signals weak?.........................	Your signals are weak.
QSA	Are my signals strong?........................	Your signals are strong.
QSB	Is my tone bad?.............................. Is my spark bad?............................	The tone is bad. The spark is bad.
QSC	Is my spacing bad?...........................	Your spacing is bad.
QSD	What is your time?...........................	My time is ......
QSF	Is transmission to be in alternate order or in series?	Transmission will be in alternate order.
QSG	....	Transmission will be in series of 5 messages.
QSH	....	Transmission will be in series of 10 messages.
QSJ	What rate shall I collect for?................	Collect . ....
QSK	Is the last radiogram canceled?...............	The last radiogram is canceled.
QSL	Did you get my receipt?......................	Please acknowledge.

[1] When an abbreviation is followed by a mark of interrogation, it refers to the question indicated for that abbreviation.

List of Abbreviations to be Used in Radio Communications

Abbreviation.	Question.	Answer or notice.
QSM	What is your true course?	My true course is ...... degrees.
QSN	Are you in communication with land?	I am not in communication with land.
QSO	Are you in communication with any ship or station (or: with ......)?	I am in communication with ...... (through ......).
QSP	Shall I inform ...... that you are calling him?	Inform ...... that I am calling him.
QSQ	Is ...... calling me?	You are being called by ......
QSR	Will you forward the radiogram?	I will forward the radiogram.
QST	Have you received the general call?	General call to all stations.
QSU	Please call me when you have finished (or: at .. o'clock).	Will call when I have finished.
QSV [1]	Is public correspondence being handled?	Public correspondence is being handled. Please do not interfere.
QSW	Shall I increase my spark frequency?	Increase your spark frequency.
QSX	Shall I decrease my spark frequency?	Decrease your spark frequency.
QSY	Shall I send on a wave length of ...... meters?	Let us change to the wave length of ...... meters.
QSZ	....	Send each word twice. I have difficulty in receiving you.
QTA	....	Repeat the last radiogram.
QTC	Have you anything to transmit?	I have something to transmit. I have one or more radiograms for ......
QTE	What is my true bearing?	Your true bearing is ...... degrees from ......
QTF	What is my position?	Your position is ...... latitude ...... longitude.

[1] Public correspondence is any radio work, official or private, handled on commercial wave lengths.

Insurance Rules for Installing Radio Apparatus

RADIO AND INSURANCE

FOLLOWING are the insurance regulations covering the installation of radio apparatus as recommended by the National Fire Protection Association and accepted recently for the National Electric Code. A new set of specifications has now been evolved which will interest every amateur in the land. It is still believed by insurance engineers that an outdoor antenna may be slightly hazardous through becoming a conductor for lightning. However, it is now recognized that when properly installed, it may become a protection rather than otherwise.

General

A. The requirements of this article shall not apply to equipment installed on shipboard, but shall be deemed to be additional to, or amendatory of, those prescribed in articles 1 to 19, inclusive, of this code.

B. Transformers, voltage reducers, keys and other devices employed shall be of types expressly approved for radio operation.

For Receiving Stations Only

A. Antenna and counterpoise outside buildings shall be kept well away from all electric light or power wires of any circuit of more than 600 volts, and from railway, trolley or feeder wires, so as to avoid the possibility of contact between the antenna or counterpoise and such wires under accidental conditions.

B. Antenna and counterpoise where placed in proximity to electric light or power wires of less than 600 volts, or signal wires, shall be constructed and installed in a strong and durable manner, and shall be so located and provided with suitable clearances as to prevent accidental contact with such wires by sagging or swinging.

C. Splices and joints in the antenna span shall be soldered unless made with approved splicing devices.

D. The preceding paragraphs, a, b, and c, shall not apply to light and power circuits used as receiving antenna, but the devices used to connect the light and power wires to radio receiving sets shall be of approved type.

E. Lead-in conductors shall be of copper, approved copper-clad steel or other metal which will not corrode excessively, and in no case shall they be smaller than No. 14 except that bronze or copper-clad steel not less than No. 17 may be used.

F. Lead-in conductors on the outside of buildings shall not come nearer than 4 inches to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-conductor which will maintain permanent separation. The non-conductor shall be in addition to any insulating covering on the wire.

G. Lead-in conductors shall enter the building through a non-combustible, non-absorptive insulating bushing slanting upward toward the inside.

H. Each lead-in conductor shall be provided with an approved protective device (lightning arrester) which will operate at a voltage of 500 volts or less, properly connected and located either inside the building at some point between the entrance and the set which is convenient to a ground, or outside the building as near as practicable to the point of entrance. The protector shall not be placed in the immediate vicinity of easily ignitible stuff, or where exposed to inflammable gases or dust or flyings of combustible materials.

I. If an antenna grounding switch is employed, it shall in its closed position form a shunt around the protective device. Such a switch shall not be used as a substitute for the protective device.

It is recommended that an antenna grounding switch be employed, and that in addition a switch rated at not less than 30 amperes, 250 volts, be located between the lead-in conductor and the receiver set.

J. If fuses are used, they shall not be placed in the circuit from the antenna through the protective device to ground.

Fuses are not required.

K. The protective grounding conductor may be bare and shall be of copper, bronze or approved copper-clad steel. The grounding conductor shall be not smaller than the lead-in conductor, and in no case shall be smaller than No. 14 if copper nor smaller than No. 17 if of bronze or copper-clad steel. The grounding conductor shall be run in as straight a line as possible from the protective device to a good permanent ground. Preference shall be given to water piping. Other permissible grounds are grounded steel frames of buildings or other grounded metal work in the building, and artificial grounds such as driven pipes, rods, plates, cones, etc. Gas piping shall not be used for the ground.

L. The protective grounding conductor shall be guarded where exposed to mechanical injury. An approved ground clamp shall be used where the grounding conductor is connected to pipes or piping.

M. The grounding conductor may be run either inside or outside the building. The protective grounding conductor and ground, installed as prescribed in the preceding paragraphs K and L, may be used as the operating ground.

It is recommended that in this case the operating grounding conductor be connected to the ground terminal of the protective device.

If desired, a separate operating grounding connection and ground may be used, the grounding conductor being either bare or provided with an insulating covering.

N. Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than 2 inches to any electric light or power wire not in conduit unless separated therefrom by some continuous and firmly fixed non-conductor, such as porcelain tubes or approved flexible tubing, making a permanent separation. This non-conductor shall be in addition to any regular insulating covering on the wire. Storage battery leads shall consist of conductors having approved rubber insulation.

It is recommended that the circuit from the storage battery be properly protected by fuses as near as possible to the battery.

For Transmitting Stations Only

A. Antenna and counterpoise outside buildings shall be kept well away from all electric light or power wires of any circuit of more than 600 volts, and from railway trolley or feeder wires, so as to avoid the possibility of contact between the antenna or counterpoise and such wires under accidental conditions.

B. Antenna and counterpoise where placed in proximity to electric light or power wires of less than 600 volts, or signal wires, shall be constructed and installed in a strong and durable manner, and shall be so located and provided with suitable clearances as to prevent accidental contact with such wires by sagging or swinging.

C. Splices and joints in the antenna and counterpoise span shall be soldered unless made with approved splicing devices.

D. Lead-in conductors shall be of copper, bronze, approved copper-clad steel or other metal which will not corrode excessively and in no case shall be smaller than No. 14.

E. Antenna and counterpoise conductors and wires leading therefrom to ground switch, where attached to buildings, shall be firmly mounted 5 inches clear of the surface of the building, on non-absorptive insulating supports such as treated pins or brackets, equipped with insulators having not less than 5 inches creepage and air-gap distance to inflammable or conducting material. Suspension type insulators may be used.

F. In passing the antenna or counterpoise lead-in into the building a tube or bushing of non-absorptive insulating material, slanting upward toward the inside, shall be used and shall be so insulated as to have a creepage and air-gap distance of at least 5 inches to any extraneous body. If procelain or other fragile material is used it shall be protected where exposed to mechanical injury. A drilled window pane may be used in place of a bushing provided 5 inches creepage and air-gap distance is maintained.

G. A double throw knife switch having a break distance of at least 4 inches and a blade not less than ⅛ inch by ½ inch shall be used to join the antenna and counterpoise lead-in to the grounding conductor. The switch may be located inside or outside the building. The base of the switch shall be of non-absorptive insulating material. This switch shall be so mounted that its current-carrying parts will be at least 5 inches clear of the building wall or other conductors. The conductor from grounding switch to ground shall be securely supported.

It is recommended that the switch be located in the most direct line between the lead-in conductors and the point where grounding connection is made.

H. Antenna and counterpoise conductors shall be effectively and permanently grounded at all times when station is not in actual operation and unattended, bv a conductor at least as large as the lead-in and in no case smaller than No. 14 copper, bronze, or approved copper-clad steel. This grounding conductor need not have an insulated covering or be mounted on insulating supports. The grounding conductor shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Other permissible grounds are the grounded steel frames of buildings and other grounded metal work in buildings and artificial grounding devices such as driven pipes, rods, plates, cones, etc. The grounding conductor shall be protected where exposed to mechanical injury. A suitable approved ground clamp shall be used where the ground conductor is connected to pipes or piping. Gas piping shall not be used for the ground.

It is recommended that the protective grounding conductor be run outside the building.

I. The radio-operating grounding conductor shall be of copper strip not less than ⅝ inch wide by 1/32 inch thick, or of copper, bronze, or approved copper-clad steel having a periphery, or girth, of at least ¾ inch, such as a No. 2 wire, and shall be firmly secured in place throughout its length.

J. The operating grounding conductor shall be connected to a good permanent ground. Preference shall be given to water piping. Other permissible grounds are grounded steel frames of buildings or other grounded metal work in the building, and artificial grounding devices such as driven pipes, rods, plates, cones, etc. Gas piping shall not be used for the ground.

K. When the current supply is obtained directly from lighting or power circuits, the conductors whether or not lead covered shall be installed in approved metal conduit, armored cable or metal raceways.

L. In order to protect the supply system from high-potential surges and kick-backs there shall be installed in the supply line as near as possible to each radio-transformer, rotary spark gap, motor and generator in motor generator sets and other auxiliary apparatus one of the following:

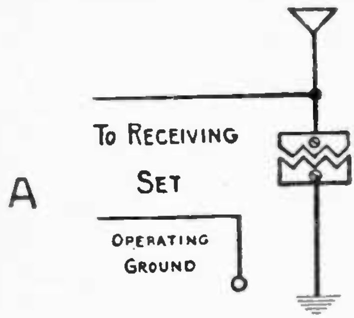
1. Two condensers (each of not less than ½ microfarad capacity and capable of withstanding 600 volt test) in series across the line with mid-point between condensers grounded; across (in parallel with) each of these condensers shall be connected a shunting fixed spark-gap capable of not more than 1/32 inch separation.

2. Two vacuum tube type protectors in series across the line with the mid-point grounded.

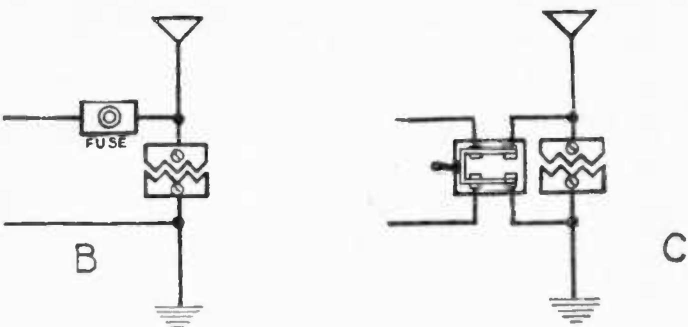
3. Resistors having practically zero inductance connected across the line with mid-point grounded.

It is recommended that this third method be not employed where there is a circulation of power current between the mid-point of the resistors and the protective ground of the power circuit.

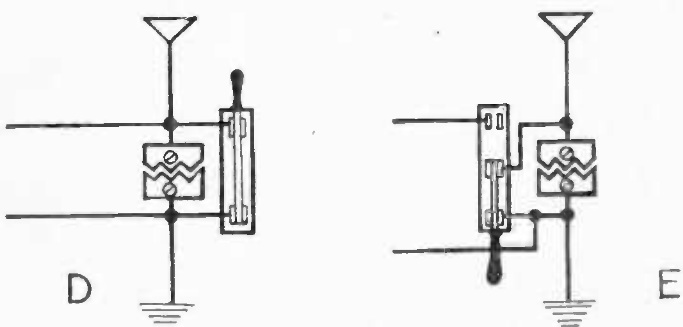
4. Electrolytic lightning arresters such as the aluminum cell type.



Required Protection
For Radio
Receiving Sets



Illustrative Permissible
Additions To Protection For
Radio Receiving Sets



TROUBLE SHOOTING

The Purpose of the Detailed Chart Is a Short Cut Remedy for Defects

THE purpose of this chart is to aid in the elimination of troubles which are experienced in the operation of radio receiving equipment. Owing to the large variety of equipments, and the varied names which have been given to them, it has been necessary to classify the different circuits by type, and not by name. The first table lists a large number of the popular names beside the type name, so that no difficulty will be experienced in classifying the receiving equipment according to the chart. First pick out the designating letter for the particular type of receiver which you are using. Single tube sets are given separate letters; multi-tube sets are classified according to the tuning equipment and given the same letter as the corresponding single tube set, with separate letters to cover the amplifiers as a distinct unit. Special circuits are given distinctive letters.

List of Receivers

For example, suppose the receiver to be a "single circuit," with tube detector and two stages of audio frequency amplification. The tuning equipment and detector are covered by the designating letter "C"; the two-stage amplifier by the designating letter "K." To look up the possible causes for troubles which may be experienced in the operation of this receiver, we would then enter the large table under the heading of the particular trouble experienced and in the portion of the column sub-headed "C" we would find the sources which migнt exist in the receiver and detector; in the portion sub-headed "K" we would find the possible sources which might exist in the amplifier. Complete information for the receiver as a whole is thus available.

Numbers 1 to 5

Troubles are due to certain causes, some of which occur rather frequently. Those which are most likely to occur are checked in the small squares with numbers from 1 to 5. As far as possible these numbers have been assigned in the order in which the troubles are most frequently experienced. This could not be rigidly adhered to, however, so that in first looking up the source of trouble, run down the column, checking off all causes which are designated by a number of 5 or less.

Numbers 6 to 9

Troubles of secondary frequency are given numbers from 6 to 9, and, as before, these have been arranged as far as possible in the order in which they are most likely to occur. If the first search through the column did not reveal the cause of the trouble, the column should again be run through, checking all sources which are designated by numbers from 6 to 9.

In some instances it will be found that the same number appears more than once. This just means that the sources opposite these numbers have about equal chances of being the cause of the trouble in question.

Letter "P"

There are certain possibilities which are rarely experienced as sources of trouble, but which are nevertheless of a type which is very elusive and sometimes very difficult of solution. Wherever possible, these sources have been designated by a letter "P," which indicates that such sources are "Possibilities." The column should be checked through, if the first two trials have not located the trouble, and each source designated by a letter "P" considered.

Letter "X"

As a final resort extremely unlikely sources, but those which are at least theoretically possible, have been given the designating letter "X." This designation holds throughout the table, except in section "K-GENERAL," in which an X is also used to designate informative, or suggestive entries which may apply to the various troubles experienced.

TABLE OF RECEIVERS

Code Letter	General Type	Popular Name
	Crystal Receivers	
A	Direct coupled	One, two or three slide tuners, variometers, with crystal detector.
B	Loose Coupled	Loose couplers, variocouplers with crystal detector.
	Single Tube Receivers	
C	Direct Coupled	One, two or three slide tuners, "single circuit," Green circuit, Westinghouse RC, Aeriola, Maclite, AceV, Jacobs, two-coil honey-comb and spider-web sets, and variations.
D	Semi-tuned, directly coupled, or closely coupled.	Haynes, Reinartz, Sodion DR6, Tuning equipment of Radiodyne, Superdyne, etc., and variations.
E	Loose Coupled	"Two circuit" non-regenerative; "three-circuit" regenerative; ultra-audion, four circuit, Zenith, Federal, Amrad, Sodion DR9, Variocoupler-two-variometer, Variocoupler-condenser-variometer; three coil honey-comb or spider-web sets, and variations.
F	Loop Receivers	
	Direct Coupled	See "C"
	Loose Coupled	See "E"
G	Reflex	Acme, Erla, etc., with crystal detector. Tuning equipment as in C, D, E or F.
	Radio Frequency Amplifiers with Detector	
H	One to three stages tuned radio frequency	Tuning equipment as in C to F, or special with amplifier as in Radiodyne, Neutrodyne, Ballentine, XYZ, Cabot, etc.
I	One to three stages transformer-coupled radio frequency	Acme, Erla, Amrad, Federal, composite, and others.
J	Magnetically neutralized tuned radio frequency amplifier	Superdyne, home-made variations.
	Audio Frequency Amplifiers	
K	One to three stages transformer coupled audio frequency	Standard circuits used in general practice.
L	One to three stages choke coil coupled audio frequency (Resistance coupled amplifiers behave very nearly the same)	Not generally used.
	Reflex, Multistage	
M	Several stages of combined radio and audio frequency amplification using the same tubes for both	Acme, DeForest, Erla, Fada Neutrodyne, etc. Tuning equipment as in C to F.
	Super Heterodyne	
	Composite	Tuning equipment as in C to F; radio frequency amplifier as in H, I or J; audio frequency amplifier as in K.

TROUBLE SHOOTING CHART

TROUBLE: NO SIGNALS; FRYING, CLICKING NOISES; SCRATCHY SIGNALS; MUFFLED SIGNALS; LOW HUMMING; BROAD TUNING; SQUEALS, HOWLS, TOO MUCH REGENERATION; WEAK SIGNALS, NO "; NO AMPLIFICATION; MARKED DISTORTION; LOUD CONTINUOUS HOWLING; SIGNALS, TUBE OUT OF SOCKET; BODY CAPACITY; DOES NOT TUNE TO LONG WAVES; DOES NOT TUNE TO SHORT WAVES; DOES NOT REFLEX; TUBE DOES NOT LIGHT; FADING, CAUSE IN SET

TYPE OF RECEIVER: A B C D E F G H I J K L M (No signals); ALL TYPES; A B C D E F G H I J K L M; A B K; C D E F G H I J K L M; A B; C D E F G H I J K L M; ALL TYPES; C D E F G H I J M; C D E F G; H I J K L; ALL TYPES; C D E F G M; H I J K L; G H I J M; C D E F G H I J K M; A C D F G; B E H I J M; A C D F G; B E H I J M; G M; C D E F G H I J K L M; ALL TYPES

CAUSE

A DEFECTIVE:

1 Aerial; Aerial connections	P P P P P · P 8 · X X X X · P
2 Ground, ground connections	P P P P P · 3 8 8 · X X X X · P
3 Inductance coils	3 3 2 2 2 P · X X · 8 6 4 · P · X X X X · X
4 Sliders or switches	4 4 3 3 3 · X X · 4 4 4 · P · X X X X · P
5 Primary condenser	4 4 4 4 4 · X · 3 · X · X X X X · X
6 Secondary condenser	P 5 P 5 5 P X · X · 6 · P P X X · X X X X · X
7 Grid variometer	7 5 · X X · 8 6 · P X X X · X X X X · 8
8 Crystal	P P P P · P X 2 3 3 8 P P 3 · X X 4 P · 2
9 Grid leak	P P X X P 3 8 4 8 3 6 4 7 · P X P 3 P · X
10 Grid Condenser	P P X 9 8 3 8 4 8 2 7 4 8 · P P 3 P · X
11 Socket connections	6 6 8 P P P 8 6 7 5 X · 7 P P · 8 9 · P · 2 3
12 Filament lighting contacts on first jack	P P P X X 5 · X · 2 3 P
13 Filament rheostat	P P P P P P 8 8 8 X · 2 3 P
14 "A" battery	P P P P P P 8 9 8 X · P P 1
15 Vacuum tube	X X X X X P P P P P · P 4 X
16 Phone condenser	5 5 P P P · P P P P 8 · 7 · P P P · 8 X X · P 3 X
17 Phones; phone cords	P P P P P · P P P P 8 4 4 2 · 4 X X · X · 3 P
18 "B" battery	P P P P P P 4 4 3 3 · X X P · 7
19 Potentiometer	7 7 2 2 2 3 4 3 1 · 3 X · 7 6 8 8 8 8 · 7 2
20 Plate variometer	P P P 2 1 · P 3 · X · X 3 P 5 8 3 4 · P X 9
21 Radio frequency transformer	2 8 · X · 6 · 3 · P
22 Audio frequency transformer	X P 8 3 P X · 8 · X X · 5 X X P · X
23 Choke coil	X P P P X · 5 X · 8 · 5 7 X P · X
24 First jack	P P P P P · X 8 X X 3 · 8 · 5 X · X P
25 Second jack	X 8 · X X · X · X P
26 Third jack	8 · X · X · P
27 "C" battery	8 · 3 · X · P
28 Insulation	X X X X X P X 6 X X X 3 X X 2 5 5 · X 7 X X X X X · 7 8 7 7 · X P

B OPEN CIRCUIT IN

1 Antenna or ground circuits	P P P P P · X X · 3 8 X · X X X X
2 Primary coil	2 2 2 2 2 · X X · 4 8
3 Primary condenser	3 3 4 4 4 · X X · X P X
4 Secondary coil	3 P 2 2 2 · 7 · X X · 4 6 · 4
5 Secondary condenser	P 5 P 5 5 · P · X X · P
6 Grid leak resistance	P P P X · X X · X X · 4
7 Grid condenser	P P P X · P · P · 7 1 P X
8 Socket contacts	6 8 8 P P 9 8 8 7 P · P · 7 X P X
9 Filament rheostat	P P X P P 8 8 8 P · 8 X P 5 P · 2 3
10 "A" battery connections	P P P X P P 8 8 7 · X · 3 3
11 First jack	P P P P P P · 8 P · X X · X · X X · 2
12 Second jack	8 P · X · X · X P
13 Third jack	8 P · X · X · P
14 Plate circuit	2 8 7 P P 8 6 5 P · X · 9 8 · P
15 Tickler coil	2 8 · X · 3
16 Radio frequency transformer	X P 8 8 · P X · X · X · 9 P P P · P
17 Audio frequency transformer	X · P X · X · X · 9 P P P · P
18 Choke coil	X 3 · X · X · X 9 · X
19 "B" battery connections	7 7 7 6 2 6 5 4 4 · X · X 9 · X
20 Between plug and jack	P P P P P P P P P P · P P · X · X 6 · X

C SHORT CIRCUIT IN

1 Antenna (to ground)	P P P P P · P
2 Antenna coil	2 3 2 2 · 4 · P
3 Antenna condenser	4 4 2 4 2 · X X · X · X
4 Primary coil	2 3 2 2 2 · X · 4 · 8 X
5 Secondary coil	3 P 2 3 8 6 · X · 3 · 3 X
6 Secondary condenser	P 5 P 5 P X · X · P
7 Between elements of tubes	X X X X X X X X X · X · X X · X X
8 Between springs of socket	X X X X X X X X X · X · X X · X X
9 Tickler coil	2 2 · X
10 Feed back condenser	2 2 · X
11 Phone condenser	6 6 P P X X P X X 4 X · 7 · X
12 Phones; phone cords	P P P P P P P P P P X · X
13 First jack	P P P P X X X 8 8 X X · X · P
14 Second jack	8 8 · P
15 Third jack	8 8 · P
16 Wiring	X X 8 9 9 3 9 9 P P P X X X · X · X 9 X · 8
17 Wiring to shield	X X X X X 9 X P X X · X · X 9
18 Apparatus, to shield	X X X X X 9 X X X X · X · X 9
19 Wiring, to apparatus	X X X X X 9 X X X X · X · X 9

D REVERSED

1 Primary condenser connections	4
2 Secondary condenser connections	P · P X · 4
3 Secondary coil connections	P 6 · X 8 · X 3
4 "C" battery	X · 9 6
5 "A" battery	X X X X P P 6 X P · X · X · 8 9 · 9
6 "B" battery	7 7 1 2 8 3 4 4 7 · X · X · 8 9 · 4
7 Tickler connections	1 1 · X · 2
8 Compensator coil connections	3 · P
9 AFT secondary connections	3 3 3 · 8 X · 2 · 6 8 X · 2
10 AFT primary connections	5 3 5 · 4 X · 2 · X X X · 8

E RUN DOWN

1 "A" battery	P P P X P P 8 6 7 5 · P · X · P X X X X · 8 5 P
2 "B" battery	P P P P P 3 7 4 5 1 · 2 · P · 4 P P P P · 2 4
3 "C" battery	9 6 8 1 · 3 · P · P 5

F TOO LOW, OR TOO SMALL

1 Antenna length	P P P X X · X · P P
2 Number of turns on primary coil	6 2 2 X X · 4 X · 5 5
3 Primary condenser	7 3 P X X · X · 9 9
4 Number of turns on secondary coil	3 2 X X · X · P · 5 5
5 Secondary condenser	5 P X X · X · X · 8 8
6 Grid condenser	4 · 6 · X · P P
7 Grid leak	P P P · 4 · 6 1 · 8 · 7
8 Grid variometer	P P X · X · 6 · 8 · 8 8
9 "A" battery voltage	P P P X P P P 8 P · 9 · X P X P P · 4 7 P
10 "B" battery voltage	7 7 P X 9 X X 3 8 · 8 · 6 8 8 · 3
11 Number of turns on tickler coil	2 P X · 8 · 9 9
12 Feed-back condenser	2 P · 3
13 Plate variometer	P P · 3 · 9 9
14 Phone condenser	X · P 1 3 · 3
15 Turns on compensator coil	6 · X · P
16 Filament current	P P P P P P X P P · P · X P X P P · 4 7

G TOO HIGH, OR TOO LARGE

1 Antenna length	P P P X · 3 · 3 3
2 Number of turns on primary coil	8 2 2 X X · 2 2
3 Antenna condenser	8 3 P X X · 3 3
4 Number of turns on secondary coil	3 2 X X · X · P · 3
5 Secondary condenser	5 P X X · X · 3
6 Grid variometer	P X · X
7 Grid leak	P X · 2 8 · 1 3 · 3 2
8 Grid condenser	X · 3 P 4 · X X
9 "A" battery voltage	P P · X · X · P · P X 7
10 "B" battery voltage	X X X P · 8 P 6 · 7 1 · 2 3 2
11 "C" battery voltage	2 X · 1 2
12 Number of turns on tickler coil	1 1 · X 4 · P
13 Feed-back condenser	3 1 · X 4 · P
14 Plate variometer	3 2 · X 4 · P
15 Number of turns on compensator coil	9 · X
16 Condenser across AFT secondary	P P 3 · 1 · 8
17 High ratio AFT	8 7 7 · 1
18 Filament current	X X P P 5 X X · 1 · X
19 Length of Grid leads	P 6 2 X · X · 6 4 6 3 · P P 3 2
20 Phone condenser	1 1 · X

H TOO CLOSE

1 Plate and grid leads	P 4 X 2 X X · P 6 2 2 · 8 8 8 2 · X X
2 Apparatus	X 8 3 X X · 3 5 6 · 9 8 9 8 · X X
3 AF tranformers	X 5 P X · P · 1 2
4 RF transformers	P 7 X 5 X · 3 P · P P P · P
5 Coil and panel	P · 3
6 Tickler and grid windings; (capacity feed-back between windings)	X · 5 5 · X

I OUT OF ADJUSTMENT

1 Receiver	1 1 1 1 P 1 2 1 3 3 3 5 4 · 5 X · 4 4 X P P · 3 3 3 3
2 Crystal detector	1 P 5 2 2 2 8 8 P P · X 6 · 3
3 Telephone receivers	X X X X X X X X X X X X X X · X X X
4 Neutralizing condensers	2 · 2 · X 4 3
5 Radio frequency transformers	X 2 X · 3 X · X 4

J INCORRECT

1 Tap on secondary winding	X P X · X X
2 Grid return connection	P X P 3 5 5 3 X 4 X 4 4 · 5 6 7 9 3 2 P · 6
3 Number of turns on secondary of transformer	P P P · P X · 6 · X X
4 "C" battery voltage	P P 7 P · 2 X · 2 X · 6 P · X
5 Grid leak resistance	X X 7 1 · 1 3 · 4 P
6 Grid condenser capacity	X X 5 P · 6 2 · P 5 4 · 4 P
7 Wiring	9 7 1 1 1 1 2 2 5 2 2 X X X · P P P X · 3 8 · X X · 2

K GENERAL

1 Aerial near high voltage lines	9 9
2 High resistance antenna or ground circuits	X X X · 3 · X X X X · P
3 Outside sources; Static, X-rays arc-lights, grounds on power lines	1 · 8 8
4 Loose connections	3 3 3 3 3 4 5 5 6 4 4 1 X X · X X X X P · 8 X · 3
5 Shield panel; connect shield to minus "A" and ground.	X X · X
6 Rotary plates to ground or minus "A".	X · X
7 Loose connections on, or in, transformer	P P P X · X X · X
8 Ground cores of AF transformers to minus "A" or plus "B"	X X X X · X X X X
9 Use "C" battery	X X X · X
10 Use ½ or 3 megohm leak across AFT secondary	X X · X
11 Use leak on amplifier tubes	2 X · X X
12 Use power tube and high "B" voltage	X · X X · X X
13 Use potentiometer	P X X · X X · X
14 Microphonic noises from tube	2 · 2
15 Noisy detector tube	P · 1 1 · X X
16 Receiver oscillating	X X X X
17 Interference between carrier waves of two transmitting radiophone stations	X X X X · 2 2 · X X
18 Radiation from nearby receivers	X · 2 2 · X X
19 Clocking at audio frequency	X · X X X
20 AF oscillations in amplifier	X X · X X
21 Mechanical coupling between phones and loud speaker	X X · X
22 Leakage in apparatus	X X X 8 8 X X X X X · 6 · P P X · 9
23 Use loose coupled receiver or wave-trap	X
24 Filaments burned out	X X X X X X X X X X
25 Shielded by steel in building or surroundings	X
26 Put transformers at rightangles	

Supplement to Transcript's Radio Book

Published Feb. 1

New Broadcasting Stations, Stations Discontinued and Alterations in Stations

New Stations Arranged Alphabetically by Call Signals

Call Signal	Owner of Station	Location of Station	Your Adjustment
KDZE	Rhodes Co	Seattle, Wash	
KFJQ	Electric Construction Co, valley radio division	Grand Forks, N. Dak	
KFMY	Boy Scouts of America	Long Beach, Calif	
KFMZ	Roswell Broadcasting Club	Roswell, N. Mex	
KFNC	First Methodist Church, Alonzon Monk, Jr.	Corsicana, Tex	
KFNF	Henry Field Seed Co	Shenandoah, Iowa	
KFNG	Wooten's Radio Shop	Coldwater, Miss	
KFNH	State Teachers College	Springfield, Mo	
KFNJ	Warrensburg Electric Shop	Warrensburg, Mo	
KFNL	Radio Broadcast Association	Paso Robles, Calif	
KFNV	L. A. Drake	Santa Rosa, Calif	
KFNX	Peabody Radio Service	Peabody, Kans	
KFNY	Montana Phonograph Co	Helena, Mont	
KFNZ	Royal Radio Co	Burlingame, Calif	
KFOB	Glenwood Technical Association	Minneapolis, Minn	
KFOC	First Christian Church	Whittier, Calif	
KFOD	The Radio Shop	Wallace, Idaho	
KFOF	Rohrer Electric Co	Marshfield, Oreg	
KFOH	Radio Bungalow	Portland, Oreg	
KFOJ	Moberly High School Radio Club	Moberly, Mo	
KFOL	Leslie M. Schafbuch	Marengo, Iowa	
KFON	Echophone Radio Shop	Long Beach, Calif	
KFOP	Willson Construction Co	Dallas, Texas	
KFPB	Edwin J. Brown	Seattle, Wash	
KFSG	Echo Park Evangelistic Association	Los Angeles, Calif	
KGO	General Electric Co	Oakland, Calif	
WABY	John Magaldi, Jr	Philadelphia, Pa	
WABZ	Coliseum Place Baptist Church	New Orleans, La	
WBBE	Alfred R. Marcy	Syracuse, N. Y	
WBBF	Georgia School of Technology	Atlanta, Ga	
WBBG	Irving Vermilya	Mattapoisett, Mass	
WBBH	J. Irving Bell	Port Huron, Mich	
WBBI	Indianapolis Radio Club	Indianapolis, Ind	
WBBJ	Neel Electric Co	West Palm Beach, Fla	
WBBK	Kaufmann & Baer Co	Pittsburgh, Pa	
WBBL	Grace Covenant Church	Richmond, Va	
WBBM	Frank Atlass Produce Co	Lincoln, Ill	
WBBN	A. B. Blake	Wilmington, N. C	
WBBO	Michigan Limestone & Chemical Co	Rogers, Mich	
WBBP	Petoskey High School	Petoskey, Mich	
WBBQ	Frank Crook	Pawtucket, R. I	
WBBR	Peoples Pulpit Association	Rossville, N. Y	
WBBS	First Baptist Church	New Orleans, La	
WBBT	Lloyd Brothers	Philadelphia, Pa	
WBBU	Jenks Motor Sales Co	Monmouth, Ill	
WBBV	Johnstown Radio Co	Johnstown, Pa	
WBBW	Ruffner Junior High School	Norfolk, Va	
WBBY	Washington Light Infantry	Charleston, S. C	
WBBZ	Noble B. Watson	Indianapolis, Ind	
WCBC	University of Michigan	Ann Arbor, Mich	
WCBE	Uhalt Radio Co	New Orleans, La	
WCBG	Howard S. Williams	Pascagoula, Miss	
WCBH	University of Mississippi	Oxford, Miss	
WDM	Church of the Covenant	Washington, D. C	
WMAW	Wahpeton Electric Co	Wahpeton, N. Dak	

New Stations Arranged Alphabetically by States

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
	CALIFORNIA				
Burlingame	Royal Radio Co.	KFNZ	10	231	1294
Long Beach	Boy Scouts of America	KFMY	20	229	1310
	Echophone Radio Shop	KFON	100	234	1282
Los Angeles	Echo Park Evangelistic Association	KFSG	500	278	1080
Paso Robles	Radio Broadcast Association	KFNL	10	240	1250
Oakland	General Electric Co.	KGO	1000	312	960
Santa Rosa	L. A. Drake	KFNV	5	234	1282
Whittier	First Christian Church	KFOC	100	236	1271
	DISTRICT OF COLUMBIA				
Washington	Church of the Covenant	WDM	50	234	1280
	FLORIDA				
West Palm Beach	Neel Electric Co.	WBBJ	50	258	1160
	GEORGIA				
Atlanta	Georgia School of Technology	WBBF	500	270	1110
	IDAHO				
Wallace	The Radio Shop	KFOD	10	224	1339
	ILLINOIS				
Lincoln	Frank Atlass Produce Co.	WBBM	200	226	1330
Monmouth	Jenks Motor Sales Co.	WBBU	10	224	1339
	INDIANA				
Indianapolis	Indianapolis Radio Club	WBBI	20	234	1280
	Noble B. Watson	WBBZ	50	227	1321
	IOWA				
Marengo	Leslie M. Schafbuch	KFOL	10	234	1282
Shenandoah	Henry Field Seed Co.	KFNF	500	266	1128
	KANSAS				
Peabody	Peabody Radio Service	KFNX	10	240	1250
	LOUISIANA				
New Orleans	Coliseum Place Baptist Church	WABZ	50	263	1140
	First Baptist Church	WBBS	100	250	1200
	Uhalt Radio Co.	WCBE	5	263	1140
	MASSACHUSETTS				
Mattapoisett	Irving Vermilya	WBBG	100	240	1250
	MICHIGAN				
Ann Arbor	University of Michigan	WCBC	200	280	1070
Port Huron	J. Irving Bell	WBBH	50	246	1220
Petoskey	Petoskey High School	WBBP	10	246	120
Rogers	Michigan Limestone & Chemical Co.	WBBO	500	250	1200
	MINNESOTA				
Minneapolis	Glenwood Technical Association	KFOB	5	224	1339
	MISSISSIPPI				
Coldwater	Wooten's Radio Shop	KFNG	10	254	1180
Oxford	University of Mississippi	WCBH	20	242	1239
Pascagoula	Howard S. Williams	WCBG	10	254	1181
	MISSOURI				
Moberly	Moberly High School Radio Club	KFOJ	5	246	1215
Springfield	State Teachers College	KFNH	20	236	1270
Warrensburg	Warrensburg Electric Shop	KFNJ	50	234	1280
	MONTANA				
Helena	Montana Phonograph Co.	KFNY	5	261	1145
	NEW MEXICO				
Roswell	Roswell Broadcasting Club	KFMZ	500	250	1200

New Stations Arranged Alphabetically by States

Location of Station	Owner of Station	Call Signal	Power	Wave Length	Frequency in Kilocycles
	NEW YORK				
Rossville	Peoples Pulpit Association	WBBR	500	244	1230
Syracuse	Alfred R. Marcy	WBBE	10	246	1220
	NORTH CAROLINA				
Wilmington	A. B. Blake	WBBN	10	275	1090
	NORTH DAKOTA				
Grand Forks	Electric Construction Co., valley radio division	KFJQ	5	280	1070
Wahpeton	Wahpeton Electric Co	WMAW	50	254	1180
	OREGON				
Marshfield	Rohrer Electric Co	KFOF	10	240	1250
Portland	Radio Bungalow	KFOH	15	283	1060
	PENNSYLVANIA				
Johnstown	Johnstown Radio Co	WBBV	5	248	1209
Philadelphia	Lloyd Brothers	WBBT	5	234	1282
	John Magaldi, Jr	WABY	50	242	1240
Pittsburgh	Kaufmann & Baer Co	WBBK	10	254	1180
	RHODE ISLAND				
Pawtucket	Frank Crook	WBBQ	50	252	1190
	SOUTH CAROLINA				
Charleston	Washington Light Infantry	WBBY	20	268	1119
	TEXAS				
Corsicana	First Methodist Church, Alonzon, Monk, Jr.	KFNC	20	234	1282
Dallas	Willson Construction Co	KFOP	100	268	1119
	VIRGINIA				
Norfolk	Ruffner Junior High School	WBBW	50	222	1351
Richmond	Grace Covenant Church	WBBL	10	283	1060
	WASHINGTON				
Seattle	Edwin J. Brown	KFPB	..	224	1339
	Rhodes Co	KDZE	100	270	1110

Stations Taken Off the List

KFAV	Venice, Calif.	**WBAW**	Marietta, O.
KFCD	Salem, Ore.	**WBBK**	Pittsburgh, Pa.
KFCK	Colorado Springs, Colo.	**WDAX**	Centerville, Iowa
KFDU	Lincoln, Neb.	**WGAY**	Madison, Wis.
KFGJ	St. Louis, Mo.	**WJAB**	Lincoln, Neb.
KFIB	St. Louis, Mo.	**WKAW**	Beloit, Wis.
KFIK	Gladbrook, Iowa	**WLAN**	Houlton, Me.
KFIY	Seattle, Wash.	**WLAT**	Burlington, Iowa
KFJD	Greeley, Colo.	**WOAJ**	Parsons, Ks.
KFKH	Lakeside, Colo.	**WOAL**	Webster Groves, Mo.
WAAZ	Emporia, Ks.	**WQAH**	Lexington, Ky.
KABC	Anderson, Ind.	**WTAN**	Mattoon, Ill.
WABJ	South Bend, Ind.	**WPG**	New Lebanon, O.

Alterations in Stations

KDPM	Cleveland, Ohio. Power, 500.
KDYL	Salt Lake City, Utah. Station operated and controlled by Newhouse Hotel. Power, 100.
KDZE	Seattle, Wash. Call signal changed to KFOA.
KFAE	Pullman, Wash. W. l., 330. frequency, kc. 908.
KFBC	San Diego, Calif. Power, 20.
KFCB	Phoenix, Ariz. W. l., 238; frequency, kc. 1260.
KFCF	Walla Walla, Wash. Power, 100.
KFEC	Portland, Oreg. W. l., 248; frequency, kc. 1210.
KFER	Fort Dodge, Iowa. Power, 10.
KFFV	Lamoni, Iowa. Power, 100.
KFGD	Chickasha, Okla. Power, 200.
KFGZ	Berrien Springs, Mich. Power, 250.
KFHD	St. Joseph, Mo. Station operated and controlled by Utz Radio & Electric Co.

Alterations in Stations

KFHR	Seattle, Wash. Power, 50; w. l., 283. frequency, kc. 1060.
KFJC	Seattle, Wash. W. l., 270, frequency, kc. 1110.
KFKX	Hastings, Nebr. Power. 1000; w. l., 341; frequency, kc. 880.
KFLZ	Atlantic, Iowa. Power, 100.
KFLB	Menominee, Mich. Power, 5.
KFLV	Rockford, Ill. Power, 100.
KFNH	Springfield, Mo. Power, 20.
KLX	Oakland, Calif. W. l., 509; frequency, kc. 590.
KRE	Berkeley, Calif. W. l., 275; frequency, kc. 1090.
KYQ	Honolulu, Hawaii. Power, 100; w. l., 270; frequency. kc. 1110.
WABH	Sandusky, Ohio. Power, 10.
WABI	Bangor, Me. Power, 100.
WBAP	Fort Worth, Tex. Power, 500.
WBAY	Western Electric Co.
WBBA	Newark, Ohio. Power, 10.
WBBL	Richmond, Va. Power, 50.
WBS	Newark, N. J. Power, 10.
WCAK	Houston, Tex. W. l., 263; frequency, kc. 1140.
WCAR	San Antonio, Tex. Power, 100; station operated and controlled by Southern Radio Corp. of Texas, 120 E. Travis street.
WCAS	Minneapolis, Minn. W. l., 280; frequency, kc. 1070.
WDAP	Chicago, Ill. Power, 1000.
WEAF	American Tel. & Tel Co.
WEAJ	Vermillon, S. D. Power, 100.
WEAY	Houston, Tex. Power, 500.
WEB	St. Louis, Mo. W. l., 273; frequency, kc. 1110.
WGAQ	Shreveport, La. W. l., 252; frequency, kc. 1190.
WGAZ	South Bend, Ind. Power. 250.
WGV	New Orleans, La. W. l.. 242; frequency, kc. 1240.
WHAA	Iowa City. Iowa. W. l., 484; frequency, kc. 620.
WHAR	Atlantic City, N. J. Address 1215 Atlantic avenue.
WHN	New York, N. Y. Power, 100-500.
WIAD	Ocean City, N. J. Changed to Philadelphia, Pa., 6318 North Park avenue. Power, 100.
WIAJ	Neenah. Wis. Power, 20.
WIK	McKeesport, Pa. Power, 100.
WJAF	Muncie, Ind. Station operated and controlled by Muncie Press and Smith Electric Co.
WJAS	Pittsburgh, Pa. W. l., 250; frequency, kc. 1200.
WJZ	Radio Corporation of America.
WKAA	Cedar Rapids, Iowa. W. l., 268; frequency, kc. 1120.
WKAR	East Lansing, Mich. Power, 500.
WKY	Oklahoma, Okla. Power, 500.
WLB	Minneapolis, Minn. Power, 25.
WMAH	Lincoln, Nebr. Power, 50.
WMAV	Auburn, Ala. Power, 250.
WNAD	Norman, Okla. Power, 50.
WNAL	Omaha. Nebr. W. l., 266; frequency, kc. 1130.
WNAP	Springfield, Ohio. W. l., 275; frequency, kc. 1090.
WNAT	Philadelphia, Pa. Power, 250.
WNAW	Fort Monroe, Va. Station operated and controlled by Henry Kunzman. Box 167.
WOAC	Lima, Ohio. Station operated and controlled by Page Organ Co. (H. P. Maus).
WOAG	Belvidere, Ill. W. l., 273; frequency, kc. 1100.
WOAP	Kalamazoo, Mich. W. l., 283; frequency, kc. 1060.
WOAV	Erie, Pa. Power, 50.
WPAH	Waupaca, Wis. Power, 500.
WPAK	Agricultural College, N. Dak. Power, 50.
WQAM	Miami, Fla. W. l., 283; frequency, kc. 1060.
WQAN	Scranton, Pa. Power, 50.
WRAH	Providence, R. I. Power, 15.
WRAM	Galesburg, Ill. Power, 100.
WRAO	St. Louis, Mo. Power, 20.
WRAV	Yellow Springs, Ohio. W. l., 242; frequency, kc. 1240.
WRAY	Scranton, Pa. Power, 10.
WSAL	Brookville, Ind. Power. 50.
WSAD	Providence, R. I. Power, 150.
WSAW	Canandaigua, N. Y. Power, 5.
WTAQ	Osseo, Wis. W. l., 254; frequency, kc. 1180.
WTAY	Oak Park, Ill. W. l., 283; frequency, kc. 1060; power, 500.
WTAX	Streator. Ill. Power, 50.
WWAE	Joliet, Ill. Station operated and controlled by Lawrence J. Crowley.