Radio Call Book Magazine and Technical Review

Established 1921

25¢

February, 1932

In This Issue:

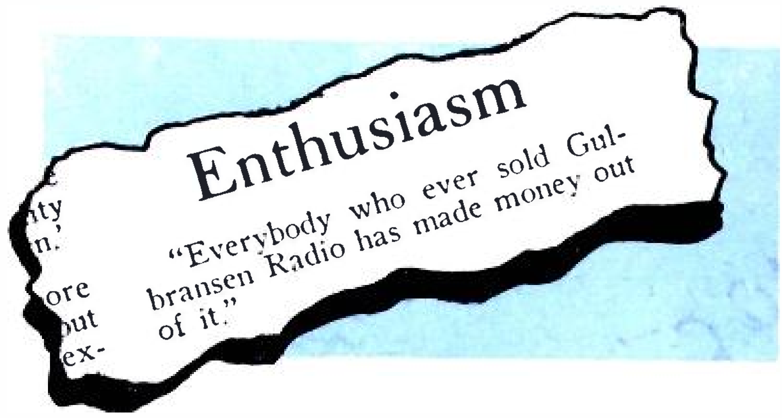
Ohmmeter with Three Ranges
When Will Television Be Reality?
Ceramics and Expansion
Short Wave Transmitter
Frequency Monitoring Station
Service Alignment of Superheterodynes
New Radio Frequency Pentode Tube
New Signal Generator
Precision Frequency Control Units

Performance Curves and Schematics of:

Audiola 13-S7, Brunswick F, General Motors S-10A, Gulbransen 10, 13, Kennedy 52A, Kolster K-90, Majestic 25, Pilot 148, Silver-Marshall A, Sparton 10

Frequency Assignments of All Broadcast, Short Wave Relay, Police, and Visual Stations

SERVICE - ENGINEERING - SALES



They say we're *enthusiastic*

. . . and we *are* . . . we caught it from GULBRANSEN Dealers and Jobbers

AN unbroken record of "no distress merchandise" . . . a service history, certified by scores of jobbers and dealers, to the effect that Gulbransen Radio very rarely requires a service call after installation . . . these are the reasons why we are "enthusiastic", as a trade magazine commented recently in quoting from a Gulbransen advertisement.

The Gulbransen line, with its background of nation-wide goodwill, is today one of the surest profit producers in the industry. These modern Superheterodynes have *everything* that is new and wanted . . . EVERYTHING

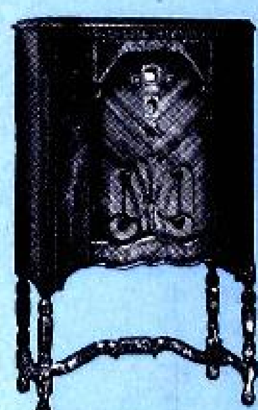
There is no *cheap* Superheterodyne, because you know and we know that a *good* Superheterodyne cannot be built and sold cheaply. The low-priced Gulbransen receiver is a time-tried TRF set of splendid performance—better than a cheap "Super" could possibly deliver.

Another fact which you know and we know, is that "most service calls start in the factory production line". Gulbransen stops 99% of them there, by the simple means of employing two inspectors for every three producing workers.

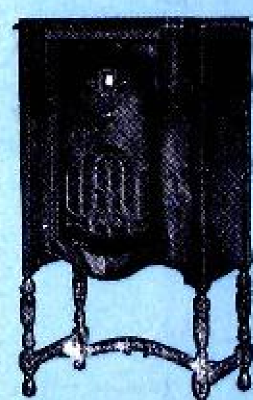
That's why Gulbransen dealers are "sitting pretty" . . . and we'd appreciate an opportunity of proving this to you. Wire or write—

GULBRANSEN COMPANY
Factory and General Offices: 816 N. Kedzie Ave.
CHICAGO, ILLINOIS

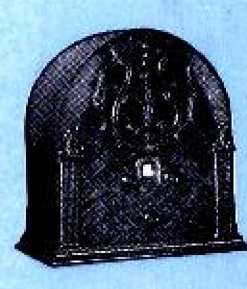
GULBRANSEN
SUPERHETERODYNE
Radio
TUNED RADIO FREQUENCY



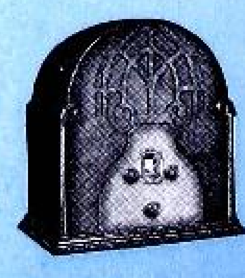
Console De Luxe Model 235. 10-tube Superheterodyne (four '35 Vari-mu, two '47 Pentode in push-pull, three '27 and one '80). Compensating Dynamic Speaker, Visual Tuning meter (simplified distance tuning), Automatic and Manual Volume Controls, Tone Control, Full-floating Tuning Condenser, Power Switch. No "blasting," no fading, no "tube" noises, no cross-talk. Price, complete with R. C. A. tubes, $113.50.



Console Receiver Model 135. Seven-tube Superheterodyne, same chassis as Model 130, in beautifully designed cabinet, 40 inches high. 2 to 5 micro-volt sensitivity (per meter). Tone Control. No tube noises or cross-talk. Price, complete with R.C.A. tubes, $79.50.



Mantel Receiver Model 130. Seven-tube Superheterodyne (two '35 Vari-mus, one '47 Pentode, two '24 screen grid, one '27 and one '80). 10-kilocycle separation. Full-floating Tuning Condenser. Completely selective, beautiful in tone. Finest cabinet work. Price, complete with R. C. A. tubes, $69.50.

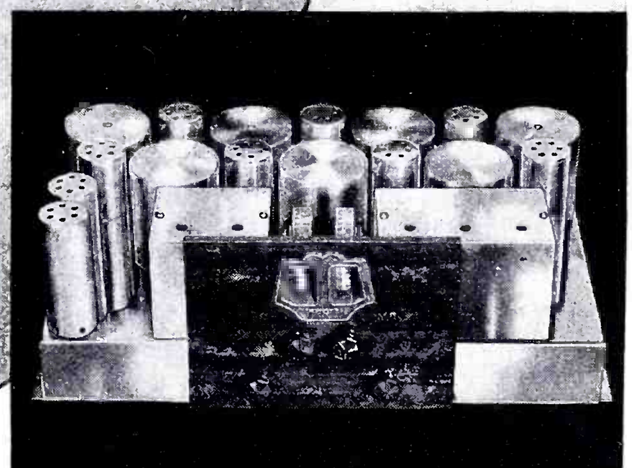


Mantel Receiver Model 330. Six-tube, tuned radio frequency, including four '24 screen grids, one '45 power tube. Powerful Dynamic Speaker. Selective, sensitive, ample volume and pleasing tone. Price, complete with R. C. A. tubes, $48.00.

63 FOREIGN COUNTRIES

get dependable 'round the world reception with SCOTT ALL-WAVE RECEIVERS

Darkened areas show the foreign countries in which Scott All-Wave Receivers are depended on for radio contact with the rest of the world.



Not only in America, is the Scott All-Wave supplying an entirely new concept of radio performance. In other lands too—in difficult spots, this receiver is doing equally sensational work. For instance, atmospheric conditions are so bad in the Canary Islands that reception there has always been considered almost impossible. Scott All-Wave Receivers located in the Canary Islands, bring in stations 9,000 and 10,000 miles away with good clarity and volume. But it is the underlying reason for such amazing performance that interests *you!*

The Scott All-Wave Receiver is so powerful and so sensitive, that when operated with the volume turned way down below the noise level, there is still more than enough sensitivity to give ample loud speaker reproduction of signals originating 9,000 and 10,000 miles away. This is one of the main reasons why Scott All-Wave Receivers are being used with complete success in 63 foreign countries today—why Scott owners in *this* country can tune 'round the world with their receivers whenever they choose—and why YOU will want a Scott!

What is the Difference that makes the Scott All-Wave so much Better?

The Scott All-Wave is not a factory product. It is built in the laboratory by experts and to laboratory exactness. Physical measurements are by the micrometer—electrical measurements are computed to the smallest fractions—each nut and bolt, each wire, and each operation, no matter how small, is performed by a man with a thorough technical understanding of radio.

The result is a precision-built receiver capable of doing things that factory-built receivers can never hope to do. The result is sensitivity so great that Chicago owners can listen to G5SW, Chelmsford, England; 12R0, Rome; VK3ME, Sydney; HRB, Honduras; and many others any day they choose. The result is also perfect 10 Kilocycle selectivity. No "cross talk." And the resulting tone is nothing short of downright *realism*—full, round and natural.

These Foreign Countries Now Served by SCOTT ALL-WAVE RECEIVERS

1. ALASKA
2. ARGENTINE
3. BARBADOS
4. BELGIUM
5. BERMUDA
6. BRAZIL
7. BRITISH GUIANA
8. BRITISH OCEANIA
9. CANADA
10. CANAL ZONE
11. CANARY ISLANDS
12. CHILE
13. CHINA
14. COLOMBIA
15. COSTA RICA
16. CUBA
17. CZECHOSLOVAKIA
18. DOMINICAN REPUBLIC
19. ECUADOR
20. EGYPT
21. ENGLAND
22. FINLAND
23. FRANCE
24. FRENCH WEST AFRICA
25. FRENCH WEST INDIES
26. GERMANY
27. GREECE
28. GUATEMALA
29. HAITI
30. HAWAII
31. HONDURAS
32. INDIA
33. ITALY
34. JAMAICA
35. JAPAN
36. MALTA
37. MEXICO
38. NETHERLANDS
39. NETHERLAND EAST INDIES
40. NETHERLAND WEST INDIES
41. NEW ZEALAND
42. NICARAGUA
43. NORTH AFRICA
44. NORWAY
45. PANAMA
46. PERU
47. PHILIPPINE ISLANDS
48. POLAND
49. PORTO RICO
50. PORTUGAL
51. SALVADOR
52. SAMOA ISLANDS
53. SCOTLAND
54. SIAM
55. SOUTHERN RODESIA
56. SPAIN
57. SWITZERLAND
58. TRINIDAD
59. UNION SOUTH AFRICA
60. URUGUAY
61. VENEZUELA
62. WALES
63. YUGOSLAVIA

Sturdy Construction Protects Precision Adjustments

The precision work, which gives the Scott All-Wave its supremacy is assured constancy by the heavy steel chassis—rigid as a bridge, and *chromium* plated to protect it from deterioration. The All-Wave chassis is so sturdily built that it is unconditionally guaranteed for five full years. Any part proving defective within that time will be replaced free of charge.

Write for Full Details

Surely, a 15-550 meter receiver that will satisfy the exacting requirements of 63 different foreign countries, will suit your needs better than any other. Surely, a receiver that is tested on reception from London and Rome before shipping is the receiver you would rather own. Mail coupon today for full particulars of the Scott All-Wave Receiver. (*Name and address of Scott owner in any foreign country, sent on request*).

CLIP

The E. H. Scott Radio Laboratories, Inc.
4450 Ravenswood Ave., Dept. CB2
Chicago, Illinois

Send me full details of the Scott All-Wave, 15-550 meter superheterodyne.

Check here if Set Builder ☐ Dealer ☐ Radio DXer ☐

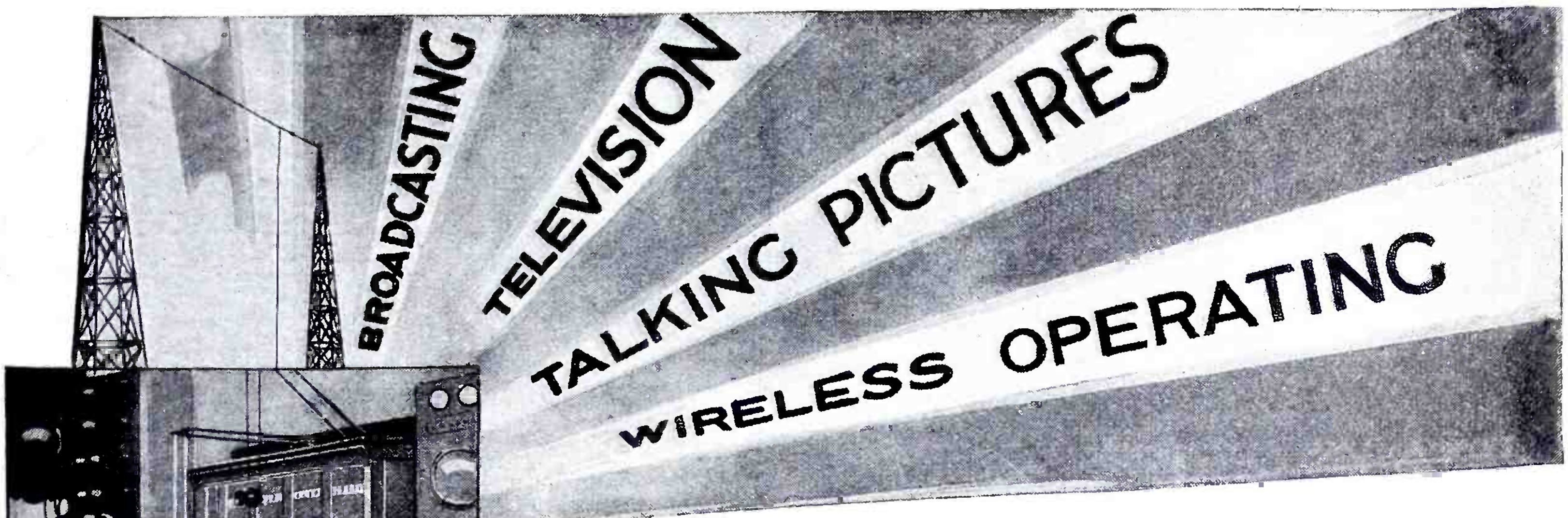
Name..

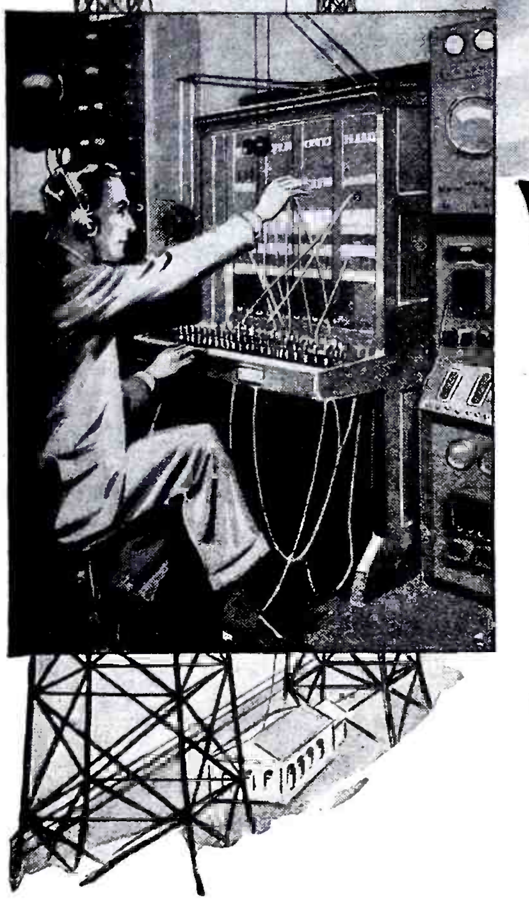
Street..

Town.......................... *State*..........

The E. H. SCOTT RADIO LABORATORIES, Inc.
FORMERLY SCOTT TRANSFORMER CO.
4450 Ravenswood Avenue, Dept. CB2, Chicago, Illinois

RADIO CALL BOOK MAGAZINE AND TECHNICAL REVIEW, February, 1932. VOL. XIII, No. 2. Published monthly at Chicago, Ill. Subscription price, $2.00 per year. 25 cents per copy. Entered as second-class matter September 3, 1931, at the Post Office of Chicago, Ill., under the Act of March 3, 1879. Citizens Radio Service Bureau, Inc., Publishers, 508 S. Dearborn St., Chicago.





WIN FAME and FORTUNE in RADIO!

Don't spend your life slaving away in some dull, hopeless job! Don't be satisfied to work for a mere $20 or $30 a week. Let me show you how to make **money in Radio—the fastest-growing, biggest field on earth!**

JOBS LEADING TO SALARIES OF $50 A WEEK AND UP!

Jobs as Designer, Inspector and Tester—as Radio Salesman and in Service and Installation Work—as operator or Manager of a Broadcasting Station—as Wireless Operator on a Ship or Airplane, as a Talking Picture or Sound Expert—HUNDREDS of OPPORTUNITIES for fascinating, well-paid Jobs!

10 Weeks of Shop Training At Coyne in Chicago

You are given a thorough training in Radio at Coyne—**in 10 short, pleasant weeks** by actual work on real Radio, Television and Sound equipment. We don't waste time on useless theory. We give you the **practical training you will need.**

All Practical Work at Coyne

You are not trained by book study at Coyne. We train you on a great outlay of Radio, Television and Sound equipment—on scores of modern Radio Receivers, huge Broadcasting equipment, the very latest Television apparatus, Talking Picture and Sound Reproduction equipment, Code Practice equipment, etc. You don't need advanced education or previous experience. We give you—**right here in the Coyne Shops**—the actual practice and experience you'll need.

TELEVISION

Is Now Here!

And TELEVISION is already here! Soon there'll be a demand for THOUSANDS of TELEVISION EXPERTS! The man who learns Television NOW can have a real future in this great new field. Get in on the ground-floor of this amazing new Radio development! Learn Television at COYNE on the very latest, newest Television equipment.

Talking Pictures

A Great Field

Talking Pictures and Public Address Systems offer thousands of golden opportunities to the Trained Radio man. Here is a great new field of Radio that has just started to grow! Prepare NOW for these marvelous opportunities! **Learn Radio Sound Work at Coyne, on actual Talking Picture and Sound Reproduction equipment.**

Coyne is 32 Years Old

You get Free Employment Help as long as you live. And if you need part-time work while at school to help pay expenses we'll gladly do all we can to get it for you if you will tell us your problems. Coyne is 32 years old! Coyne training is tested—proven beyond all doubt. You can find out everything ABSOLUTELY FREE. JUST MAIL COUPON FOR MY BIG FREE BOOK, telling all about jobs—salaries—opportunities. Mail the coupon—NOW!

H. C. Lewis, Pres. *Radio Division* **Founded 1899**

Coyne Electrical School

500 S. Paulina Street Dept. 22-5A Chicago, Illinois

H. C. LEWIS, President
Radio Division, Coyne Electrical School
500 S. Paulina St., Dept 22-5A, Chicago, Ill.

Dear Mr. Lewis:—

Send me your Big Free Radio Book and all details of your Special Offer.

Name..............................

Address..............................

City.................. *State*.........

Radio Call Book Magazine

AND TECHNICAL REVIEW
Established 1921

GEO. H. SCHEER, JR., *Editor*
E. H. PETERSON, *Service Dept.*

FEBRUARY, 1932

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Vol. 13, No. 2

Table of Contents

Editorial

F. A. Hill, our editor for the past four years, left us a short while ago to regain his health in the South. During his leadership here he won a place in the heart of everyone on the staff of this magazine. We wish him the best of luck and a speedy recovery.

Now that you have seen our new cover, how do you like it? One of its features is a complete table of contents of the major articles contained in the book. We hope that you will send us your suggestions and comments to make your magazine everything that you want it to be.

Look over the Brief Items and get the other fellows' ideas. Many questions are answered, and you may find the solution to some problems which have been bothering you recently. In answer to many requests which we have received from our service men readers, we are featuring a very helpful ohmmeter with three ranges, which may be easily built and at a very low cost. Other features which we wish to call to your attention are the articles on the nearness of Television, the Frequency Monitoring Station at Grand Island, and a complete Short Wave Transmitter.

Have you ever had difficulty in aligning a superheterodyne receiver in your service work? The answer is given on page 39. A new super control Radio Frequency Pentode is treated on page 40 and its tentative characteristics are given on page 42.

Beginning next issue we plan to publish voltage charts on all receivers. We shall catch up on the past four issues as fast as we can with charts of the receivers already published.

Editor.

Train *with* R.T.A. *for* Radio *Service* Work

Important and far-reaching developments in Radio create sudden demand for specially equipped and specially trained Radio Service Men.

This excellent set analyzer and trouble shooter included with our course of training

MANY skilled Radio Service Men are needed now to service all-electric sets. By becoming a certified R. T. A. Service Man, you can make big money full time or spare time, and fit yourself for the big-pay opportunities that Radio offers.

We will quickly give you the training you need to qualify as a Radio service man . . . certify you . . . furnish you with a marvelous Radio Set Analyzer. This wonder instrument, together with our training, will enable you to compete successfully with experts who have been in the radio business for years. With its help you can quickly diagnose any ailing Radio set. The training we give you will enable you to make necessary analysis and repairs. Serving as a "radio doctor" with this Radio Set Analyzer is but one of the many easy ways by which we help you make money out of Radio. Wiring rooms for Radio, installing and servicing sets for dealers, building and installing automobile Radio sets, constructing and installing short wave receivers . . . those are a few of the other ways in which our members are cashing in on Radio.

As a member of the Radio Training Association, you receive personal instruction from skilled Radio Engineers. Upon completion of the training, they will advise you personally on any problems which arise in your work. The Association will help you make money in your spare time, increase your pay, or start you in business. The easiest, quickest, best-paying way for you to get into Radio is by joining the Radio Training Association.

This amazing Radio Set Analyzer plus the instructions given you by the Association will transform you into an expert quickly. With it, you can locate troubles in all types of sets, test circuits, measure resistance and condenser capacities, detect defective tubes. Knowing how to make repairs is easy; knowing what the trouble is requires expert knowledge and a Radio Set Analyzer. With this Radio Set Analyzer, you will be able to give expert service and make big money. Possessing this set analyzer and knowing how to use it will be but one of the benefits that will be yours as a member of the R. T. A.

Write for No-Cost Membership Plan

We have worked out a plan whereby a membership enrollment need not cost you a cent. Our thorough training and the valuable Radio set analyzer can be yours. Write at once and find out how easily both of these can be earned.

Now is the time to prepare to be a Radio Service Man. Greater opportunities are opening up right along. For the sake of extra money in your spare time, bigger pay, a business of your own, a position with a future, get in touch with the Radio Training Association of America now.

Send for this No-Cost Membership Plan and Free Radio Handbook that will open your eyes as to what Radio has in store for the ambitious man. Don't wait. Do it now.

RADIO TRAINING ASSOCIATION OF AMERICA

Dept. RCB-2 4513 Ravenswood Ave. Chicago, Ill.

Fill Out and Mail Today!

RADIO TRAINING ASSOCIATION OF AMERICA,
Dept. RCB-2, 4513 Ravenswood Ave., Chicago, Ill.

Gentlemen: Send me details of your No-Cost Membership Enrollment Plan and information on how to learn to make real money in radio quick.

Name ....

Address ....

City ....State ....

American Broadcasting Stations

Station assignments shown in the following pages were made by the Federal Radio Commission. This list is revised from issue to issue and is therefore up-to-the-minute. Initials such as E, C, M, and P denote Eastern, Central, Mountain and Pacific time.

KABC—1420 kc, San Antonio, Texas, Alamo Broadcasting Co., 100 w, C.
KBPS—1420 kc, Portland, Ore., Benson Polytechnic School, 100 w, P.
KBTM—1200 kc, Paragould, Ark., Beard's Temple of Music, 100 w, C.
KCRC—1370 kc, Enid, Okla., Champlin Refining Co., 100 w, C.
KCRJ—1310 kc, Jerome, Ariz., C. C. Robinson, 100 w.
KDB—1500 kc, Santa Barbara, Calif., Santa Barbara Broadcasters, Ltd., 100 w, P.
KDFN—1210 kc, Casper, Wyo., D. L. Hathaway, 100 w, P.
KDKA—980 kc, Pittsburgh, Pa., Westinghouse E. & M. Co., 50,000 w, E.
KDLR—1210 kc, Devils Lake, N. D., KDLR, Inc., 100 w.
KDYL—1290 kc, Salt Lake City, Utah, Intermountain Broadcasting Corp., 1000 w, M.
KECA—1430 kc, Los Angeles, Calif., Earle C. Anthony, Inc., 1000 w, P.
KELW—780 kc, Burbank, Calif., Magnolia Park, Ltd., 500 w, P.
KEX—1180 kc, Portland, Ore., Western Broadcasting Co., 5000 w, P.
KFAB—770 kc, Lincoln, Nebr., KFAB Broadcasting Co., 5000 w, C.
KFAC—1300 kc, Los Angeles, Calif., L. A. Bdcstg. Co., 1000 w, P.
KFBB—1280 kc, Great Falls, Mont., Buttrey Broadcast, Inc., 1000 w, M.
KFBK—1310 kc, Sacramento, Calif., James McClatchy Co., 100 w, P.
KFBL—1370 kc, Everett, Wash., Leese Bros., 50 w, P.
KFDM—560 kc, Beaumont, Tex., Magnolia Petroleum Co., 500 w, C.
KFDY—550 kc, Brookings, S. D., State College, 500 w, C.
KFEL—920 kc, Denver, Colo., Eugene P. O'Fallon, Inc., 500 w, M.
KFEQ—680 kc, St. Joseph, Mo., Scroggin & Co., 2500 w, C.
GFGQ—1310 kc, Boone, Iowa, Boone Biblical College, 100 w, C.
KFH—1300 kc, Wichita, Kan., Radio Station KFH Co., 1000 w, C.
KFI—640 kc, Los Angeles, Calif., Earl C. Anthony, Inc., 50,000 w, P.
KFIO—1120 kc, Spokane, Wash., Spokane Broadcasting Corp., 100 w, P.
KFIU—1310 kc, Juneau, Alaska, Alaska Elec. Light & Power Co., 10 w.
KFIZ—1420 kc, Fond du Lac, Wis., Reporter Printing Co., 100 w, C.
KFJB—1200 kc, Marshalltown, Iowa, Marshall Electric Co., 100 w, C.
KFJF—1480 kc, Oklahoma City, Okla., National Radio Mfg. Co., 5000 w, C.
KFJI—1370 kc, Astoria, Ore., KFJI Broadcasters, Inc., 100 w, P.
KFJM—1370 kc, Grand Forks, N. D., University of North Dakota, 100 w, C.
KFJR—1300 kc, Portland, Ore., Ashley C. Dixon, KFJR, Inc., 500 w, P.
KFJY—1310 kc, Ft. Dodge, Iowa, Cedar Rapids Broadcast Co., w, C.
KFJZ—1370 kc, Ft. Worth, Texas, Henry Clay Meacham, 100 w, C.
KFKA—880 kc, Greeley, Colo., Mid-Western Radio Corp., 500 w, M.
KFKB—1050 kc, Milford, Kan., KFKB Brdcstg. Assn., 5000 w, C.
KFKU—1220 kc, Lawrence, Kan., University of Kansas, 500 w, C.
KFKX—See under KYW.
KFLV—1410 kc, Rockford, Ill., Rockford Broadcasters, Inc., 500 w, C.
KFLX—1370 kc, Galveston, Texas, Geo. Roy Clough, 100 w, C.
KFMX—1250 kc, Northfield, Minn., Carleton College, 1000 w, C.
KFNF—890 kc, Shenandoah, Iowa, Henry Field Seed Co., 500 w, C.
KFOR—1210 kc, Lincoln, Neb., Howard A. Shuman, 100 w, C.
KFOX—1250 kc, Long Beach, Calif., Nichols & Warriner, Inc., 1000 w, P.
KFPL—1310 kc, Dublin, Texas, C. C. Baxter, 100 w, C.
KFPM—1310 kc, Greenville, Texas, The New Furniture Co., 15 w, C.
KFPW—1340 kc, Ft. Smith, Ark., John Brown Schools, 50 w, C.
KFPY—1340 kc, Spokane, Wash., Symons Broadcasting Co., 1000 w, P.
KFQD—1230 kc, Anchorage, Alaska, Anchorage Radio Club, 100 w.
KFQU—1420 kc, Holy City, Calif., W. E. Riker, 100 w, P.
KFQW—1420 kc, Seattle, Wash., KFQW, Inc., 100 w, P.
KFRC—610 kc, San Francisco, Calif., Don Lee, Inc., 1000 w, P.
KFRU—630 kc, Columbia, Mo., Stephens College, 500 w, C.
KFSD—600 kc, San Diego, Calif., Airfan Radio Corp., 500 w, P.
KFSG—1120 kc, Los Angeles, Calif., Echo Park Evan. Assn., 500 w, P.
KFUL—1290 kc, Galveston, Texas, W. H. Ford, 500 w, C.
KFUO—550 kc, St. Louis, Mo., Concordia Theological Seminary, 500 w, C.
KFUP—1310 kc, Denver, Colo., Fitzsimmons General Hospital, 100 w, M.
KFVD—1000 kc, Culver City, Calif., Los Angeles Broadcasting Co., 250 w, P.
KFVS—1210 kc, Cape Girardeau, Mo., Hirsch Battery & Radio Co., 100 w, C.
KFWB—950 kc, Hollywood, Calif., Warner Bros. Broadcasting Corp., 1000 w, P.
KFWF—1200 kc, St. Louis, Mo., St. Louis Truth Center, Inc., 100 w.
KFWI—930 kc, San Francisco, Calif., Radio Entertainments, Inc., 500 w, P.
KFXD—1420 kc, Nampa, Idaho, Service Radio Co., 50 w, M.
KFXF—920 kc, Denver, Colo., Colorado Radio Co., 500 w, M.
KFXJ—1310 kc, Edgewater, Colo., Western Slope Broadcasting Co., 50 w, M.
KFXM—1210 kc, San Bernardino, Calif., Lee Bros. Broadcasting Co., 100 w, P.
KFXR—1310 kc, Oklahoma City, Okla., Exchange Avenue Baptist Church, 100 w, C.
KFXY—1420 kc, Flagstaff, Ariz., Mary M. Costigan, 100 w, M.
KFYO—1420 kc, Abilene, Texas, Kirksey Bros., 100 w, C.
KFYR—550 kc, Bismarck, N. D., Meyer Broadcasting Co., 1000 w, C.
KGA—1470 kc, Spokane, Wash, Northwest Broadcasting System, Inc., 5000 w, P.
KGAR—1370 kc, Tucson, Ariz., Tucson Motor Service Co., 100 w, M.
KGB—1330 kc, San Diego, Calif., Don Lee, Inc., 500 w, P.
KGBU—900 kc, Ketchikan, Alaska, Alaska Radio & Service Co., 500 w.
KGBX—1310 kc, St. Joseph, Mo., KGBX, Inc., 100 w.
KGBZ—930 kc, York, Nebr., Geo. R. Miller, 500 w, C.
KGCA—1270 kc, Decorah, Iowa, Chas. W. Greenley, 50 w, C.
KGCR—1210 kc, Watertown, S. D., Greater Kampeska Radio Corp., 100 w.
KGCU—1200 kc, Mandan, N. D., Mandan Radio Association, 100 w, M.
KGCX—1310 kc, Wolf Point, Mont., First State Bank of Vida, 100 w, M.
KGDA—1370 kc, Mitchell, S. D., Mitchell Broadcasting Corp., 100 w, M.
KGDE—1200 kc, Fergus Falls, Minn., Jaren Drug Co., 100 w, C.
KGDM—1100 kc, Stockton, Calif., E. F. Peffer, 250 w.
KGDY—1200 kc, Huron, S. D., J. A. Loesch, 15 w, C.
KGEF—1300 kc, Los Angeles, Calif., Trinity Methodist Church, 1000 w, P.
KGEK—1200 kc, Yuma, Colo., Beehler Elec. Equip. Co., 100 w, M.
KGER—1360 kc, Long Beach, Calif., Consolidated Bdcstg. Corp., 1000 w, P.
KGEW—1200 kc, Ft. Morgan, Colo., City of Ft. Morgan, 100 w, P.
KGEZ—1310 kc, Kalispell, Mont., Chamber of Commerce, 100 w, M.
KGFF—1420 kc, Shawnee, Okla., KGFF Bdcstg. Corp., 100 w, C.
KGFG—1370 kc, Oklahoma City, Okla., Oklahoma Broadcasting Co., Inc., 100 w, C.
KGFI—1500 kc, Corpus Christi, Texas, Eagle Broadcasting Co., 100 w, C.
KGFJ—1200 kc, Los Angeles, Calif., Ben S. McGlashan, 100 w, P.
KGFK—1500 kc, Moorhead, Minn., Red River Broadcasting Co., Inc., 50 w, C.
KGFL—1370 kc, Raton, N. Mex., KGFL, Inc., 50 w, M.
KGFW—1310 kc, Ravenna, Neb., Sothman & McConnell, 50 w.
KGFX—580 kc, Pierre, S. D., Dana McNeil, 200 w, C.
KGGC—1420 kc, San Francisco, Calif., Golden Gate Broadcasting Co., 100 w, P.
KGGF—1010 kc, South Coffeyville, Okla., Powell & Platz, 500 w.
KGGM—1230 kc, Albuquerque, N. Mex., New Mexico Broadcasting Co., 250 w.
KGHF—1320 kc, Pueblo, Colo, Ritchie & Finch, 250 w, M.
KGHI—1200 kc, Little Rock, Ark., O. A. Cook, 100 w.
KGHL—950 kc, Billings, Mont., Northwestern Auto Supply Co., 1000 w, M.
KGIQ—1320 kc, Twin Falls, Idaho, Radio Broadcasting Corp.
KGIR—1360 kc, Butte, Mont., KGIR, Inc., 500 w, M.
KGIW—1420 kc, Trinidad, Colo., Leonard E. Wilson, 100 w, M.
KGIX—1420 kc, Las Vegas, Nev., J. M. Heaton, 100 w.
KGIZ—1500 kc, Grant City, Mo., Grant City Park Corp., 100 w, C.
KGJF—890 kc, Little Rock, Ark., First Church of the Nazarene, 250 w.
KGKB—1500 kc, Tyler, Tex., Tyler Commercial College, 100 w, C.
KGKL—1370 kc, San Angelo, Tex., KGKL, Inc., 100 w, C.
KGKO—570 kc, Wichita Falls, Tex., Wichita Falls Broadcasting Co., 250 w, C.
KGKX—1420 kc, Sandpoint, Idaho, C. E. Twiss and F. H. McCann, 100 w, P.
KGKY—1500 kc, Scottsbluff, Nebr., Hilliard Co., Inc., 100 w, C.
KGMB—1320 kc, Honolulu, Hawaii, Honolulu Broadcasting Co., 250 w, P.
KGMP—1210 kc, Elk City, Okla., Bryant Radio & Elec. Co., 100 w, C.
KGNF—1430 kc, North Platte, Nebr., H. L. Spencer, 500 w, M.
KGNO—1210 kc, Dodge City, Kans., Dodge City Broadcasting Co., Inc., M.
KGO—790 kc, San Francisco, Calif., National Broadcasting Co., Inc., 7500 w, P.
KGRS—1410 kc, Amarillo, Texas, Gish Radio Service, 1000 w, C.
KGU—940 kc, Honolulu, Hawaii, Marion Mulrony, Advertising Publ. Co., 1000 w.
KGVO—1420 kc, Missoula, Mont., Mosby's, Inc.
KGW—620 kc, Portland, Ore., Oregonian Pub. Co., 1000 w, P.
KGY—1200 kc, Lacey, Wash., St. Martins College, 10 w, P.
KHJ—900 kc, Los Angeles, Calif., Don Lee, Inc., 1000 w, P.
KHQ—590 kc, Spokane, Wash., Louis Wasmer, Inc., 1000 w, P.
KICK—1420 kc, Red Oak, Iowa, Red Oak Radio Corp., 100 w.
KID—1320 kc, Idaho Falls, Ida., KID Broadcasting Co., 250 w, M.
KIDO—1350 kc, Boise, Idaho, Boise Broadcasting Station, 1000 w, P.
KIT—1310 kc, Yakima, Wash., C. E. Haymond, 100 w, P.
KJBS—1070 kc, San Francisco, Calif., Julius Brunton & Sons Co., 100 w, P.
KJR—970 kc, Seattle, Wash., Northwest Broadcasting System, Inc., 500 w, P.
KLCN—1290 kc, Blytheville, Ark., C. L. Lintzenich, 50 w, C.
KLO—1400 kc, Ogden, Utah, Peery Building Co., 500 w, M.
KLPM—1420 kc, Minot, N. D., John B. Cooley, 100 w, C.
KLRA—1390 kc, Little Rock, Ark., Arkansas Broadcasting Co., 1000 w.
KLS—1440 kc, Oakland, Calif., Warner Bros., 250 w, P.
KLX—880 kc, Oakland, Calif., Tribune Pub. Co., 500 w, P.
KLZ—560 kc, Denver, Colo., Reynolds Radio Co., Inc., 1000 w, M.
KMA—930 kc, Shenandoah, Iowa, May Seed & Nursery Co., 500 w, C.
KMAC—1370 kc, San Antonio, Texas, W. W. McAllister, 100 w, C.
KMBC—950 kc, Kansas City, Mo., Midland Broadcasting Co., 1000 w, C.
KMED—1310 kc, Medford, Ore., Mrs. W. J. Virgin, 100 w, P.
KMJ—1210 kc, Fresno, Calif., J. McClatchy Co., 100 w, P.
KMLB—1200 kc, Monroe, La., J. C. Liner, 100 w, C.

KMMJ—740 kc, Clay Center, Neb., The M. M. Johnson Co., 1000 w, C.
KMO—860 kc, Tacoma, Wash., KMO, Inc., 500 w, P.
KMOX—1090 kc, St. Louis, Mo., Voice of St. Louis, Inc., 50,000 w, C.
KMPC—710 kc, Beverly Hills, Calif., R. S. Macmillan, 500 w, P.
KMTR—570 kc, Los Angeles, Calif., KMTR Radio Corp., 500 w, P.
KNX—1050 kc, Hollywood, Calif., Western Broadcast Co., 5000 w, P.
KOA — 830 kc, Denver, Colo., National Broadcasting Co., Inc., 12,500 w, M.
KOAC—550 kc, Corvallis, Ore., Oregon State Agricultural College, 1000 w, P.
KOB—1180 kc, State College, N. M., N. M. College of Agri. & Mech. Arts, 20,000 w, M.
KOCW—1400 kc, Chickasha, Okla., Oklahoma College for Women, 250 w, C.
KOH—1370 kc, Reno, Nevada, Jay Peters, Inc., 500 w.
KOIL—1260 kc, Council Bluffs, Iowa, Mona Motor Oil Co., 1000 w, C.
KOIN—940 kc, Portland, Ore., KOIN, Inc., 100 w, P.
KOL—1270 kc, Seattle, Wash., Seattle Broadcasting Co., 1000 w, P.
KOMO—920 kc, Seattle, Wash., Fisher's Blend Station, Inc., 1000 w, P.
KONO—1370 kc, San Antonio, Tex., Mission Broadcasting Co., 100 w, C.
KOOS—1370 kc, Marshfield, Ore., H. H. Hanseth, Inc., 100 w, P.
KORE—1420 kc, Eugene, Ore., Eugene Broadcast Station, 100 w, P.
KOY—1390 kc, Phoenix, Ariz., Nielsen Radio & Sporting Goods Co., 500 w, M.
KPCB—650 kc, Seattle, Wash., Queen City Broadcasting Co., 100 w, P.
KPJM—1500 kc, Prescott, Ariz., A. P. Miller, 100 w, M.
KPO—680 kc, San Francisco, Calif., Hale Bros. & The Chronicle, 5000 w, P.
KPOF—880 kc, Denver, Colo., Pillar of Fire, Inc., 500 w, M.
KPPC—1210 kc, Pasadena, Calif., Pasadena, Presbyterian Church, 50 w, P.
KPQ—1500 kc, Wenatchee, Wash., Wescoast Broadcasting Co., 50 w, P.
KPRC—920 kc, Houston, Texas, Houston Printing Co., 1000 w, C.
KQV—1380 kc, Pittsburgh, Pa., KQV Bdcstg. Co., 500 w, E.
KQW—1010 kc, San Jose, Calif., Pacific Agric. Foundation, 500 w, P.
KRE—1370 kc, Berkeley, Calif., First Congregational Church, 100 w, P.
KREG—1500 kc, Santa Ana, Calif., Pacific-Western Broadcasting Federation. 100 w, P.
KRGV—1260 kc, Harlingen, Texas, KRGV, Inc., 500 w.
KRLD—1040 kc, Dallas, Texas, KRLD, Inc., 10,000 w, C.
KRMD—1310 kc, Shreveport, La., Robert M. Dean, 50 w, C.
KROW—930 kc, Oakland Calif., Educational Broadcasting Corp., 500 w, M.
KRSC—1120 kc, Seattle, Wash., Radio Sales Corp., 50 w, P.
KSAC—580 kc, Manhattan, Kan., Kansas State Agricultural College, 500 w, C.
KSCJ—1330 kc, Sioux City, Iowa, Perkins Bros. Co., 1000 w, C.
KSD—550 kc, St. Louis, Mo., Pulitzer Pub. Co., 500 w, C.
KSEI—900 kc, Pocatello, Idaho, Radio Service Corp., 250 w, M.
KSL—1130 kc, Salt Lake City, Utah, Radio Service Corp., 5000 w, M.
KSMR—1200 kc, Santa Maria, Calif., Santa Maria Radio Co., 100 w, P.
KSO—1380 kc, Clarinda, Iowa, Iowa Bdcstg. Co., 500 w, C.
KSOO—1110 kc, Sioux Falls, S. D., Sioux Falls Broadcasting Assn., 2000 w, C.
KSTP—1460 kc, St. Paul, Minn., National Battery Broadcasting Co., 10,000 w, C.
KTAB—560 kc, San Francisco, Calif., Associated Broadcasters, 1000 w, P.
KTAR—620 kc, Phoenix, Ariz., KTAR Broadcasting Co., 500 w, M.
KTAT—1240 kc, Ft. Worth, Tex., S. A. T. Broadcasting Co., 1000 w, C.
KTBR—1300 kc, Portland, Ore., M. E. Brown, 500 w, P.
KTBS—1450 kc, Shreveport, La., Tri-State Broadcasting Co., 1000 w, E.
KTFI—1320 kc, Twin Falls, Idaho, Radio Broadcasting Corp., 250 w, M.
KTHS—1040 kc, Hot Springs, Ark., Chamber of Commerce, 10,000 w, C.
KTLC—1310 kc, Houston, Tex., Houston Broadcasting Co., 100 w, C.
KTM—780 kc, Los Angeles, Calif., Pickwick Broadcasting Corp., 500 w, P.
KTRH—1120 kc, Houston, Tex., Rice Hotel, 500 w, C.
KTSA—1290 kc, San Antonio, Texas, Lone Star Broadcast Co., 1000 w, C.
KTSL—1310 kc, Shreveport, La., Houseman Sheet Metal Works, Inc., 100 w, C.
KTSM—1310 kc, El Paso, Tex., W. S. Bledsoe and W. T. Blackwell, 100 w, C.
KTW—1220 kc, Seattle, Wash., First Presbyterian Church, 1000 w, P.
KUJ—1370 kc, Walla Walla, Wash., Paul R. Heitmeyer, Inc., 100 w, P.
KUOA—1390 kc, Fayetteville, Ark., University of Arkansas, 1000 w, C.
KUSD—890 kc, Vermilion, S. Dak., University of South Dakota, 500 w, C.
KUT—1500 kc, Austin, Tex., KUT Bdcstg. Co., 100 w, C.
KVI—760 kc, Tacoma, Wash., Puget Sound Radio Broadcasting Co., 1000 w, P.
KVL—1370 kc, Seattle, Wash., KVL, Inc., 100 w, P.
KVOA—1260 kc, Tucson, Ariz., R. M. Riculfi, 500 w.
KVOO—1140 kc, Tulsa, Okla., Southwestern Sales Corp., 5000 w, C.
KVOR—1270 kc, Colorado Springs, Colo, W. D. Corley, 1000 w, M.
KVOS—1200 kc, Bellingham, Wash., KVOS, Inc., 100 w, M.
KWCR—1310 kc, Cedar Rapids, Iowa. Cedar Rapids Bdcst. Co., 100 w, C.
KWEA—1210 kc, Shreveport, La., Hello World Broadcasting Corp., 100 w, C.
KWG—1200 kc, Stockton, Calif., Portable Wireless Tel. Co., 100 w, P.
KWJJ—1060 kc, Portland, Ore., KWJJ Broadcasting Co., Inc., 500 w, P.
KWK—1350 kc, St. Louis, Mo., Thos. Patrick Convey, Inc., 1000 w, C.
KWKC—1370 kc, Kansas City, Mo., Wilson Duncan Broadcasting Co., 100 w.
KWKH—850 kc, Shreveport, La., Hello World Broadcasting Corp., 10,000 w, C.
KWLC—1270 kc, Decorah, Iowa, Luther College, 100 w, C.
KWSC—1220 kc, Pullman, Wash., State College of Washington, 1000 w, P.
KWWG—1260 kc, Brownsville, Texas, Brownsville Herald Publishing Co., 500 w, C.
KXA—570 kc, Seattle, Wash., American Radio Tel. Co., 500 w, P.
KXL—1420 kc, Portland, Ore., KXL Broadcasters, Inc., 100 w, P.
KXO—1500 kc, El Centro, Calif., Irey & Bowles, 100 w, P.
KXRO—1310 kc, Aberdeen, Wash., KXRO, Inc., 75 w, P.
KXYZ—1420 kc, Houston, Texas, Harris County Broadcasting Co., 100 w, C.
KYA—1230 kc, San Francisco, Calif., Pacific Broadcasting Corp., 1000 w, P.
KYW—1020 kc, Chicago, Ill., Westinghouse E. & M. Co., 10,000 w, C.
NAA—690 kc, United States Navy Department, Washington, D. C., 1000 w, E.
WAAB—1410 kc, Quincy, Mass., Bay State Bdcstg. Corp.
WAAF—920 kc, Chicago, Ill., Drovers Journal Pub. Co., 500 w daytime, C.
WAAM—1250 kc, Newark, N. J., WAAM, Inc., 1000 w, E.
WAAT—940 kc, Jersey City, N. J., Bremer Broadcasting Corp., 300 w, E.
WAAW—660 kc, Omaha, Neb., Omaha Grain Exchange, 500 w daytime, C.
WABC—860 kc, New York City, N. Y., Atlantic Broadcasting Corp., 50,000 w, E.
WABI—1200 kc, Bangor, Maine, Pine Tree Broadcasting Co., 100 w, E.
WABO—See under WHEC.
WABZ—1200 kc, New Orleans, La., Coliseum Place Baptist Church, 100 w, C.
WACO—1240 kc, Waco, Tex., Central Texas Broadcasting Co., Inc., 1000 w, C.
WADC—1320 kc, Tallmadge, Ohio, Allen T. Simmons, 1000 w, E.
WAGM—1420 kc, Mars Hill, Me., Aroostook Bdcstg. Corp., 100 w.
WAIU—640 kc, Columbus, Ohio, Associated Radiocasting Corp., 500 w, E.
WALR—1210 kc, Zanesville, O., Roy W. Waller, 100 w, E.
WAPI—1140 kc, Birmingham, Ala., Alabama Polytechnic Institute, 5000 w, C.
WASH—1270 kc, Grand Rapids, Mich., WASH Broadcasting Corp., 500 w, C.
WAWZ—1350 kc, Zarepath, N. J., Pillar of Fire, 250 w, E.
WBAA—1400 kc, Lafayette, Ind., Purdue University, 500 w, C.
WBAK—1430 kc, Harrisburg, Pa., Pennsylvania State Police, 500 w, E.
WBAL—1060 kc, Baltimore, Md., Consolidated Gas, Elec. Co., 10,000 w, E.
WBAP—800 kc, Ft. Worth, Tex., Carter Publications, Inc., 10,000 w, C.
WBAX—1210 kc, Wilkes-Barre, Pa., John H. Stenger, Jr., 100 w, E.
WBBC—1400 kc, Brooklyn, N. Y., Brooklyn Broadcasting Corp., 500 w.
WBBL—1210 kc, Richmond, Va., Grace Covenant Presbyterian Church, 100 w, E.
WBBM—770 kc, Chicago, Ill., WBBM Bdcstg. Corp., 25,000 w, C.
WBBR—1300 kc, Brooklyn, N. Y., People's Pulpit Association, 1000 w, E.
WBBZ—1200 kc, Ponca City, Okla., C. L. Carrell, 100 w, C.
WBCM—1410 kc, Bay City, Mich., James E. Davidson, 500 w, E.
WBCN—See under WENR.
WBEN—900 kc, Buffalo, N. Y., WBEN, Inc., 1000 w, E.
WBEO—1310 kc, Marquette, Mich., Lake Superior Bdcstg. Co.
WBGF—1370 kc, Glens Falls, N. Y., W. Parker & N. Metcalf, 50 w, E.
WBHS—1200 kc, Huntsville, Ala., Hutchens Co., 50 w.
WBIG—1440 kc, Greensboro, N. C., North Carolina Broadcasting Co., 500 w, E.
WBIS—See under WNAC.
WBMS—1450 kc, Hackensack, N. J., WBMS Broadcasting Corp., 250 w.
WBNX—1350 kc, New York, N. Y., Standard Cahill Co., Inc., 250 w, E.
WBOQ—See under WABC.
WBOW—1310 kc, Terre Haute, Ind., Banks of Wabash Broadcasting Assn., 100 w, C.
WBRC—930 kc, Birmingham, Ala., Birmingham Broadcasting Co., 500 w, C.
WBRE—1310 kc, Wilkes-Barre, Pa., Louis G. Baltimore, 100 w, E.
WBSO—920 kc, Needham, Mass., Babson's Statistical Org., Inc., 250 w, E.
WBT—1080 kc, Charlotte, N. C., Station WBT, Inc., 5000 w, E, shared.
WBTM—1370 kc, Danville, Va., Clarke Elec. Co., 100 w, E.
WBZ—990 kc, Boston, Mass., Westinghouse E. & M. Co., 15,000 w, E.
WBZA—990 kc, Springfield, Mass., Westinghouse E. & M. Co., 1000 w, E.
WCAC—600 kc, Storrs, Conn., Connecticut Agricultural College, 250 w, E.
WCAD—1220 kc, Canton, N. Y., St. Lawrence University, 500 w, E.
WCAE—1220 kc, Pittsburgh, Pa., WCAE, Inc., 1000 w, E.
WCAH—1430 kc, Columbus, Ohio, Commercial Radio Service Co., 500 w, E.
WCAJ—590 kc, Lincoln, Neb., Nebraska Wesleyan University, 500 w, C.
WCAL—1250 kc, Northfield, Minn., St. Olaf College, 1000 w, C.
WCAM—1280 kc, Camden, N. J., City of Camden, 500 w, E.
WCAO—600 kc, Baltimore, Md., Monumental Radio, Inc., 250 w, E.
WCAP—1280 kc, Asbury Park, N. J., Radio Industries Broadcast Co., 500 w, E.
WCAT—1200 kc, Rapid City, S. D., South Dakota State School of Mines, 100 w, M.
WCAU—1170 kc, Philadelphia, Pa., Universal Broadcasting Co., 10,000 w, E.
WCAX—1200 kc, Burlington, Vt., Burlington Daily News, 100 w, E.
WCAZ—1070 kc, Carthage, Ill., Superior Broadcasting Co., 50 w.
WCBA—1440 kc, Allentown, Pa., B. B. Musselman, 250 w, E.
WCBD—1080 kc, Zion, Ill., Wilbur Glen Voliva, 5000 w, C.
WCBM—1370 kc, Baltimore, Md., Baltimore Broadcasting Corp., 100 w, E.
WCBS—1210 kc, Springfield, Ill., Dewing & Meester, 100 w, C.
WCCO—810 kc, Minneapolis, Minn., Northwestern Broadcasting Inc., 5000 w, C.
WCDA—1350 kc, New York, N. Y., Italian Educational Broadcasting Co., 250 w, E.
WCFL—970 kc, Chicago, Ill., Chicago Federation of Labor, 150 w, C.
WCGU—1400 kc, Brooklyn, N. Y., U. S. Broadcasting Corp., 500 w, E.
WCHI—1490 kc, Chicago, Ill., People's Pulpit Association, 5000 w, C.
WCKY—1490 kc, Covington, Ky., L. B. Wilson, 500 w, E.
WCLB—1500 kc, Long Beach, N. Y., Arthur Faske, 100 w, E.
WCLO—1200 kc, Janesville, Wis., WCLO Radio Corp., 100 w, C.
WCLS—1310 kc, Joliet, Ill., WCLS, Inc., 100 w, C.
WCMA—1400 kc, Culver, Ind., General Broadcasting Co., 500 w, C.
WCOA—1340 kc, Pensacola, Fla., City of Pensacola, 500 w, E.
WCOC—880 kc, Meridian, Miss., Mississippi Broadcasting Co., 500 w, C.
WCOD—1200 kc, Harrisburg, Pa., Keystone Broadcasting Corp., 100 w, E.
WCOH—1210 kc, Yonkers, N. Y., Westchester Broadcasting Corp., 100 w, E.

WCRW—1210 kc, Chicago, Ill., Clinton R. White, 100 w, C.
WCSC—1360 kc, Charleston, S. C., Lewis Burk, 500 w, E.
WCSH—940 kc, Portland, Me., Congress Square Hotel Co., 1000 w, E.
WDAE—1220 kc, Tampa, Fla., Tampa Publishing Co., 1000 w, E.
WDAF—610 kc, Kansas City, Mo., Kansas City Star Co., 1000 w, C.
WDAG—1410 kc, Amarillo, Texas, National Radio & Broadcasting Corp., 250 w, C.
WDAH—1310 kc, El Paso, Texas, W. S. Bledsoe, 100 w, M.
WDAY—940 kc, Fargo, N. D., WDAY, Inc., 1000 w, C.
WDBJ—930 kc, Roanoke, Va., Times-World Corp., 250 w, E.
WDBO—1120 kc, Orlando, Fla., Orlando Broadcasting Co., 1000 w, E.
WDEL—1120 kc, Wilmington, Del., WDEL, Inc., 250 w, E.
WDEV—1420 kc, Waterbury, Vt., H. C. Whitehill, 50 w.
WDGY—1180 kc, Minneapolis, Minn., Dr. Geo. W. Young, 1000 w, C.
WDIX—1500 kc, Tupelo, Miss., North Mississippi Broadcasting Corp., 100 w, C.
WDOD—1280 kc, Chattanooga, Tenn., WDOD Broadcasting Co., Inc., 1000 w, C.
WDRC—1330 kc, Hartford, Conn., Doolittle Radio Corp., 500 w, E.
WDSU—1250 kc, New Orleans, La., Jos. H. Uhalt, 1000 w, C.
WDZ—1070 kc, Tuscola, Ill., James L. Bush, 100 w.
WEAF—660 kc, New York, N. Y., National Broadcasting Co., Inc., 50,000 w, E.
WEAI—1270 kc, Ithaca, N. Y., Cornell Univ., 1000 w, E.
WEAN—780 kc, Providence, R. I., Shepard Broadcasting Service, 250 w, E.
WEAO—570 kc, Columbus, Ohio, Ohio State University, 750 w, E.
WEBC—1290 kc, Superior, Wis., Head of The Lakes Broadcasting Co., 1000 w, C.
WEBQ—1210 kc, Harrisburg, Ill., First Trust & Savings Bank, 100 w, C.
WEBR—1310 kc, Buffalo, N. Y., Howell Broadcasting Co., 100 w, E.
WEDC—1210 kc, Chicago, Ill., Emil Denemark, Inc., 100 w.
WEDH—1420 kc, Erie, Pa., Erie Dispatch-Herald, 30 w, E.
WEEI—590 kc, Boston, Mass., Edison Elec. Illum. Co., 1000 w, E.
WEEU—830 kc, Reading, Pa., Berks Bdcstg. Co., 1000 w.
WEHC—1350 kc, Emory, Va., Emory and Henry College, 500 w, E.
WEHS—1420 kc, Evanston, Ill., WEHS, Inc., 100 w, C.
WELK—1370 kc, Philadelphia, Pa., WELK Broadcasting Station, Inc., 100 w, E.
WELL—1420 kc, Battle Creek, Mich., Enquirer-News Co., 100 w, E.
WENR—870 kc, Chicago, Ill., Great Lakes Radio Broadcasting Co., 50,000 w, C.
WEPS—See under WORC.
WEVD—1300 kc, New York, N. Y., Debs Memorial Radio Fund, 500 w, E.
WEW—760 kc, St. Louis, Mo., St. Louis University, 1000 w, C.
WEXL—1310 kc, Royal Oak, Mich., Royal Oak Broadcasting Co., 50 w, E.
WFAA—800 kc, Dallas, Texas, Dallas News and Journal, 50,000 w, C.
WFAM—1200 kc, La Porte, Ind., South Bend Tribune, 100 w, C.
WFAN—610 kc, Philadelphia, Pa., Keystone Broadcasting Co., Inc., 500 w, E.
WFBC—1200 kc, Knoxville, Tenn., First Baptist Church, 50 w, E.
WFBE—1200 kc, Cincinnati, Ohio, Post Publ. Co., 100 w, E.
WFBG—1310 kc, Altoona, Pa., William F. Gable Co., 100 w, E.
WFBL—1360 kc, Syracuse, N. Y., The Onondaga Co., Inc., 1000 w, E.
WFBM—1230 kc, Indianapolis, Ind., Indianapolis, Power & Light Co., 1000 w, C.
WFBR—1270 kc, Baltimore, Md., Baltimore Radio Show, Inc., 250 w, E.
WFDF—1310 kc, Flint, Mich., Frank D. Fallain, 100 w, E.
WFDV—1310 kc, Rome, Ga., Dolies Goings, 100 w, E.
WFDW—1420 kc, Talladega, Ala., R. C. Hammett, 100 w, C.
WFEA—1430 kc, Manchester, N. H., Rines Hotel Co., 500 w.
WFI—560 kc, Philadelphia, Pa., Strawbridge & Clothier, 500 w, E.
WFIW—940 kc, Hopkinsville, Ky., WFIW, Inc., 1000 w, C.
WFLA—620 kc, Clearwater, Fla., Clearwater Chamber of Commerce and St. Petersburg Chamber of Commerce, 1000 w, E.
WFOX—1400 kc, Brooklyn, N. Y., Paramount Broadcasting Corp., 500 w.
WGAL—1310 kc, Lancaster, Pa., WGAL, Inc., 100 w, E.
WGAR—1450 kc, Cleveland, Ohio, WGAR Broadcasting Co., 500 w, E.
WGBB—1210 kc, Freeport, N. Y., Harry H. Carman, 100 w, E.
WGBC—See under WNBR.
WGBF—630 kc, Evansville, Ind., Evansville on the Air, Inc., 500 w, E.
WGBI—880 kc, Scranton, Pa., Scranton Broadcasters, Inc., 250 w, E.
WGBS—1180 kc, New York, N. Y., American Radio News Corp., 500 w, E.
WGCM—1210 kc, Gulfport, Miss., Great Southern Land Co., Inc., 100 w, C.
WGCP—1250 kc, Newark, N. J., May Radio Broadcast Corp., 250 w.
WGES—1360 kc, Chicago, Ill., Oak Leaves Broadcasting Corp., 500 w, C.
WGH—1310 kc, Newport News, Va., Hampton Roads Broadcasting Corp., Inc., 100 w, E.
WGL—1370 kc, Ft. Wayne, Ind., Allen-Wayne Co., 100 w, C.
WGMS—See under WLB.
WGN—720 kc, Chicago, Ill., Tribune Co., 25,000 w, C.
WGR—550 kc, Buffalo, N. Y., Buffalo Broadcasting Corp., 1000 w, E.
WGST—890 kc, Atlanta, Ga., Georgia School of Technology, 250 w, E.
WGY—790 kc, Schenectady, N. Y., General Electric Co., 50,000 w, E.
WHA—940 kc, Madison, Wis., University of Wisconsin, 750 w, C.
WHAD—1120 kc, Milwaukee, Wis. Marquette University, 250 w, C.
WHAM—1150 kc, Rochester, N. Y., Stromberg-Carlson Tel. Mfg. Co., 5000 w, E.
WHAP—1300 kc, New York, N. Y., Defenders of Truth Society, Inc., 1000 w, E.
WHAS—820 kc, Louisville, Ky., The Courier Journal Co. & Louisville Times Co., 10,000 w, C.
WHAT—1310 kc, Philadelphia, Pa., Independence Broadcasting Co., 100 w, E.
WHAZ—1300 kc, Troy, N. Y., Rensselaer Polytechnic Institute, 500 w, E.
WHB—860 kc, Kansas City, Mo., WHB Broadcasting Co., 500 w, C.
WHBC—1200 kc, Canton, Ohio, St. John's Catholic Church, 10 w, E.
WHBD—1370 kc, Mt. Orab, Ohio, F. P. Moler, 100 w, E.
WHBF—1210 kc, Rock Island, Ill., Beardsley Specialty Co., 100 w, C.
WHBL—1410 kc, Sheboygan, Wis., Press Pub. Co., 500 w, C.
WHBQ—1370 kc, Memphis, Tenn., Station WHBQ, Inc., 100 w, C.
WHBU—1210 kc, Anderson, Ind., Anderson Bdcstg. Corp., 100 w, C.
WHBY—1200 kc, Green Bay, Wis., St. Norbert's College, 100 w, C.
WHDF—1370 kc, Calumet, Mich., Upper Michigan Brdcstg. Co., 100 w, C.
WHDH—830 kc, Boston, Mass., Matheson Radio Co., Inc., 1000 w, E.
WHDI—1180 kc, Minneapolis, Minn., Dr. G. W. Young, 500 w, C.
WHDL—1420 kc, Tupper Lake, N. Y., Tupper Lake Broadcasting Corp., 100 w, E.
WHEC—1440 kc, Rochester, N. Y., Hickson Electric Co., Inc., 500 w, E.
WHFC—1420 kc, Cicero, Ill., WHFC, Inc., 100 w, C.
WHIS—1410 kc, Bluefield, W. Va., Daily Telegraph Printing Co., 250 w, E.
WHK—1390 kc, Cleveland, Ohio, Radio Air Service Corp., 1000 w, E.
WHN—1010 kc, New York, N. Y., Marcus Loew Booking Review, 250 w, E.
WHO—1000 kc, Des Moines, Iowa, Central Broadcasting Co., 5000 w, C.
WHOM—1450 kc, Jersey City, N. J., New Jersey Broadcasting Corp., 250 w, E.
WHP—1430 kc, Harrisburg, Pa., WHP, Inc., 500 w, E.
WIAS—1420 kc, Ottumwa, Iowa, Poling Electric Co., 100 w, C.
WIBA—1280 kc, Madison, Wis., Capital Times Co., 500 w, C.
WIBG—930 kc, Elkins Park, Pa., St. Paul's Church, 25 w, E.
WIBM—1370 kc, Jackson, Mich., WIBM, Inc., 100 w.
WIBO—560 kc, Chicago, Ill., Nelson Bros. Bond and Mortgage Co., 1000 w, C.
WIBR—1420 kc, Steubenville, Ohio, G. W. Robinson, 50 w, E.
WIBU—1210 kc, Poynette, Wis., W. C. Forrest, 100 w, C.
WIBW—580 kc, Topeka, Kan., Topeka Broadcasting Assn., Inc., 1000 w, C.
WIBX—1200 kc, Utica, N. Y., WIBX, Inc., 100 w, E.
WICC—600 kc, Bridgeport, Conn., Bridgeport Broadcasting Station, Inc., 500 w, E.
WIL—1200 kc, St. Louis, Mo., Missouri Broadcasting Co., 100 w, C.
WILL—890 kc, Urbana, Ill., University of Illinois, 250 w, C.
WILM—1420 kc, Wilmington, Del., Delaware Broadcasting Co., Inc., 100 w, E.
WIOD—1300 kc, Miami, Fla., Isle of Dreams Broadcasting Co., 1000 w, E.
WIP—610 kc, Philadelphia, Pa., Gimbel Bros., Inc., 500 w, E.
WIS—1010 kc, Columbia, S. C., South Carolina Broadcasting Co., Inc., 500 w, E.
WISJ—See under WIBA.
WISN—1120 kc, Milwaukee, Wis., Evening Wisconsin Co., 250 w, C.
WJAC—1310 kc, Johnstown, Pa., Johnstown Automobile Co., 100 w, E.
WJAG—1060 kc, Norfolk, Neb., Norfolk Daily News, 1000 w, C.
WJAK—1310 kc, Elkhart, Ind., The Truth Pub. Co., Inc., 50 w.
WJAR—890 kc, Providence, R. I., The Outlet Co., 250 w, E.
WJAS—1290 kc, Pittsburgh, Pa., Pittsburgh Radio Supply House, 1000 w, E.
WJAX—900 kc, Jacksonville, Fla., City of Jacksonville, 1000 w, E.
WJAY—610 kc, Cleveland, Ohio, Cleveland Radio Broadcasting Corp., 500 w, E.
WJAZ—1490 kc, Chicago, Ill., Zenith Radio Corp., 5000 w, C.
WJBC—1200 kc, LaSalle, Ill., Kaskaskia Broadcasting Co., 100 w, C.
WJBI—1210 kc, Red Bank, N. J., Monmouth Broadcasting Co., 100 w, E.
WJBK—1370 kc, Highland Park, Mich., J. F. Hopkins, 50 w, C.
WJBL—1200 kc, Decatur, Ill., Commodore Broadcasting Co., 100 w, C.
WJBO—1420 kc, New Orleans, La., Valdemar Jensen, 100 w, C.
WJBT—See under WBBM.
WJBU—1210 kc, Lewisburg, Pa., Bucknell University, 100 w, E.
WJBW—1200 kc, New Orleans, La., C. Carlsen, Jr., 30 w, C.
WJBY—1210 kc, Gadsden, Ala., Gadsden Broadcasting Co., 100 w, C.
WJDX—1270 kc, Jackson, Miss., Lamar Life Ins. Co., 1000 w, C.
WJJD—1130 kc, Chicago, Ill., Loyal Order of Moose, 20,000 w, C.
WJKS—1360 kc, Gary, Ind., Johnson-Kennedy Radio Corp., 1000 w, C.
WJMS—1420 kc, Ironwood, Mich., Johnson Music Store, 100 w.
WJR—750 kc, Detroit, Mich., The Goodwill Station, Inc., 10,000 w, E.
WJSV—1460 kc, Alexandria, Va., Independent Publishing Co., 10,000 w.
WJTL—1370 kc, Oglethorpe University, Ga., 100 w, E.
WJW—1210 kc, Mansfield, Ohio, Mansfield Broadcasting Association, 100 w, E.
WJZ—760 kc, New York City, N. Y., National Broadcasting Co., 30,000 w, E.
WKAQ—890 kc, San Juan, Porto Rico, Radio Corp. of Porto Rico, 250 w, E.
WKAR—1040 kc, East Lansing, Mich., Michigan State College, 1000 w, E.
WKAV—1310 kc, Laconia, N. H., Laconia Radio Club, 100 w, E.
WKBB—1310 kc, Joliet, Ill., Sanders Bros., 100 w, C.
WKBC—1310 kc, Birmingham, Ala., R. B. Broyles Furniture Co., 100 w, C.
WKBF—1400 kc, Indianapolis, Ind., Indianapolis Broadcasting Corp., 500 w, C.
WKBH—1380 kc, LaCrosse, Wis., WKBH, Inc., 1000 w, C.
WKBI—1420 kc, Chicago, Ill., WKBI, Inc., 100 w, C.
WKBN—570 kc, Youngstown, Ohio, WKBN Bdcstg. Corp., 500 w, E.
WKBO—1450 kc, Jersey City, N. J., Camith Corp., 250 w, E.
WKBS—1310 kc, Galesburg, Ill., Permil N. Nelson, 100 w, C.
WKBV—1500 kc, Connersville, Ind., Knox Battery & Electric Co., 100 w, C.
WKBW—1480 kc, Buffalo, N. Y., WKBW, Inc., 5000 w, E.
WKBZ—1500 kc, Ludington, Mich., K. L. Ashbacker, 50 w.
WKJC—1200 kc, Lancaster, Pa., Lancaster Bdcstg. Service, Inc., 100 w, E.
WKRC—550 kc, Cincinnati, Ohio, WKRC, Inc., 1000 w, E.
WKY—900 kc, Oklahoma City, Okla., WKY Radiophone Co., 1000 w, C.
WKZO—590 kc, Kalamazoo, Mich., WKZO, Inc., 1000 w, C.
WLAC—1470 kc, Nashville, Tenn., Life & Casualty Ins. Co., 5000 w, C.

WLAP—1010 kc, Louisville, Ky., American Broadcasting Corp. of Kentucky, 1259 w, C.

WLB—1250 kc, Minneapolis, Minn., University of Minnesota, 1000 w, C.

WLBC—1310 kc, Muncie, Ind., Donald A. Burton, 50 w.

WLBF—1420 kc, Kansas City, Kan., WLBF Broadcasting Co., 100 w, C.

WLBG—1200 kc, Petersburg, Va., WLBG, Inc., 100 w, E.

WLBL—900 kc, Ellis, Wis., Wisconsin Department of Markets, 2000 w, daytime, C.

WLBW—1260 kc, Oil City, Pa., Radio-Wire Program Corp., 500 w, E.

WLBX—1500 kc, Long Island City, N. Y., John N. Brahy, 100 w.

WLBZ—620 kc, Bangor, Me., Maine Broadcasting Co., 500 w, E.

WLCI—1210 kc, Ithaca, N. Y., Lutheran Assn. of Ithaca, 50 w, E.

WLEY—1370 kc, Lexington, Mass., Lexington Air Station, 100 w, E.

WLIB—See under WGN.

WLIT—560 kc, Philadelphia, Pa., Lit Brothers, 500 w, E.

WLOE—1500 kc, Boston, Mass., Boston Broadcasting Co., 100 w.

WLS—870 kc, Chicago, Ill., Agricultural Broadcasting Co., 5000 w, C.

WLSI—See under WPRO.

WLTH—1400 kc, Brooklyn, N. Y., Voice of Brooklyn, Inc., 500 w, E.

WLVA—1370 kc, Lynchburg, Va., Lynchburg Broadcasting Corp., 100 w, E.

WLW—700 kc, Cincinnati, Ohio, Crosley Radio Corp., 50,000 w, E.

WLWL—1100 kc, New York, N. Y., Missionary Society of St. Paul, 5000 w, E.

WMAC—See under WSYR.

WMAK—1040 kc, Buffalo, N. Y., WMAK Broadcasting System, 1000 w, E.

WMAL—630 kc, Washington, D. C., M. A. Leese Co., 250 w, E.

WMAQ—670 kc, Chicago, Ill., National Broadcasting Co., 5000 w, C.

WMAZ—1180 kc, Macon, Ga., Southeastern Broadcasting Co., 500 w, E.

WMBA—1500 kc, Newport, R. I., LeRoy Joseph Beebe, 100 w, E.

WMBC—1420 kc, Detroit, Mich., Michigan Broadcasting Co., Inc., 100 w, E.

WMBD—1440 kc, Peoria Heights, Ill., Peoria Bdcstg. Co., 500 w.

WMBF—See under WIOD.

WMBG—1210 kc, Richmond, Va., Havens & Martin, Inc., 100 w, E.

WMBH—1420 kc, Joplin, Mo., Edwin Dudley Aber, 100 w, C.

WMBI—1080 kc, Chicago, Ill., Moody Bible Institute Radio Station, 5000 w, C, shared.

WMBJ—1500 kc, Wilkinsburg, Pa., Rev. John W. Sproul, 100 w, E.

WMBO—1310 kc, Auburn, N. Y., WMBO, Inc., 100 w, E.

WMBQ—1500 kc, Brooklyn, N. Y., Paul J. Gollhofer, 100 w.

WMBR—1370 kc, Tampa, Fla., F. J. Reynolds, 100 w, E.

WMC—780 kc, Memphis, Tenn., Memphis Commercial Appeal, Inc., 500 w, C.

WMCA—570 kc, New York, N. Y., Knickerbocker Broadcasting Co., Inc., 500 w, E.

WMIL—1500 kc, Brooklyn, N. Y., Arthur Faske, 100 w, E.

WMMN—890 kc, Fairmont, W. Va., Holt Rowe Novelty Co., 250 w, E.

WMPC—1500 kc, Lapeer, Mich., First Methodist Protestant Church, 100 w, E.

WMRJ—1210 kc, Jamaica, N. Y., Peter J. Prinz, 10 w, E.

WMSG—1350 kc, New York, N. Y., Madison Square Garden Broadcast Co., 250 w, E.

WMT—600 kc, Waterloo, Iowa, Waterloo Broadcasting Co., 500 w, C.

WNAC—1230 kc, Boston, Mass., The Shepard Broadcasting Service, 1000 w, E.

WNAD—1010 kc, Norman, Okla., University of Oklahoma, 500 w, C.

WNAX—570 kc, Yankton, S. Dak., Gurney Seed & Nursery Co., 1000 w, C.

WNBF—1500 kc, Binghamton, N. Y., Howitt-Wood Radio Co., 100 w, E.

WNBH—1310 kc, New Bedford, Mass., New Bedford Broadcasting Co., 100 w, E. shared.

WNBO—1200 kc, Silver Haven, Pa., J. B. Spriggs, 100 w, E.

WNBR—1430 kc, Memphis, Tenn., Memphis Broadcasting Co., 500 w, C.

WNBW—1200 kc, Carbondale, Pa., Home Cut Glass & China Co., 10 w, E.

WNBX—1200 kc, Springfield, Vt., First Congregational Church Corp., 10 w, E.

WNBZ—1290 kc, Saranac Lake, N. Y., Smith & Mace, 50 w, E.

WNJ—1450 kc, Newark, N. J., Radio Investment Co., 250 w, E.

WNOX—560 kc, Knoxville, Tenn., WNOX, Inc., 1000 w, C.

WNYC—570 kc, New York, N. Y. Department of Plant & Structures, 500 w, E.

WOAI—1190 kc, San Antonio, Texas, Southern Equipment Co., 50,000 w, C.

WOAN—See WREC.

WOAX—1280 kc, Trenton, N. J., WOAX, Inc., 500 w, E.

WOBU—580 kc, Charleston, W. Va., WOBU, Inc., 250 w, E.

WOC—1000 kc, Davenport, Iowa, Central Broadcasting Co., 5000 w, C.

WOCL—1210 kc, Jamestown, N. Y., A. E. Newton, 50 w, E.

WODA—1250 kc, Paterson, N. J., Richard E. O'Dea, 1000 w, E.

WODX—1410 kc, Mobile, Ala., Mobile Brdcstg. Corp., 500 w, C.

WOI—640 kc, Ames, Iowa, Iowa State College, 5000 w, C.

WOKO—1440 kc, Albany, N. Y., WOKO, Inc., 500 w, E.

WOL—1310 kc, Washington, D. C., American Broadcasting Co., 100 w, E.

WOMT—1210 kc, Manitowoc, Wis., Francis M. Kadow, 100 w.

WOOD—1270 kc, Grand Rapids, Mich., Walter B. Stiles, Inc., 500 w, C.

WOPI—1500 kc, Bristol, Tenn., Radiophone Broadcasting Co., 100 w, E.

WOQ—1300 kc, Kansas City, Mo., Unity School of Christianity, 1000 w, C.

WOR—710 kc, Newark, N. J., J. Bamberger Broadcasting Service, Inc., 5000 w, E.

WORC—1200 kc, Worcester, Mass., A. F. Kleindienst, 100 w, E.

WOS—630 kc, Jefferson City, Mo., State Marketing Bureau, 500 w, C.

WOV—1130 kc, New York, N. Y., International Broadcasting Corp., 1000 w, E.

WOW—590 kc, Omaha, Neb., Woodmen of the World, 1000 w, C.

WOWO—1160 kc, Ft. Wayne, Ind., Main Auto Supply Co., 10,000 w, C.

WPAD—1420 kc, Paducah, Ky., Paducah Broadcasting Co., 100 w, C.

WPAP—See under WQAO.

WPAW—1210 kc, Pawtucket, R. I., Shartenberg & Robinson, 100 w, E.

WPCC—560 kc, Chicago, Ill., North Shore Congregational Church, 500 w, C.

WPCH—810 kc, New York, N. Y., Eastern Broadcasters, Inc., 500 w, E.

WPEN—1500 kc, Philadelphia, Pa., Wm. Pen Broadcasting Co., 100 w, E.

WPG—1100 kc, Atlantic City, N. J., WPG Broadcasting Corp., 5000 w, E.

WPOE—1370 kc, Patchogue, N. Y., Nassau Broadcasting Corp., 100 w, E.

WPOR—See under WTAR.

WPRO—1210 kc, Providence, R. I., Cherry & Webb Bdcstg. Co., 100 w, E.

WPSC—1230 kc, State College, Pa., Pennsylvania State College, 500 w, day, E.

WPTF—680 kc, Raleigh, N. C., Durham Life Insurance Co., 1000 w, E.

WQAM—560 kc, Miami, Fla., Miami Broadcasting Co., 1000 w, E.

WQAN—880 kc, Scranton, Pa., Scranton Times, 250 w, E.

WQAO—1010 kc, New York, N. Y., Calvary Baptist Church, 250 w, E.

WQBC—1360 kc, Vicksburg, Miss., Delta Broadcasting Co., 300 w, C.

WQDM—1370 kc, St. Albans, Vt., A. J. St. Antoine, 100 w, E.

WQDX—1210 kc, Thomasville, Ga., Stevens Luke, 100 w, E.

WRAK—1370 kc, Williamsport, Pa., C. R. Cummins, 50 w, E.

WRAM—1370 kc, Wilmington, N. C., Wilmington Radio Association, 100 w, E.

WRAW—1310 kc, Reading, Pa., Reading Broadcasting Co., 50 w, E.

WRAX—1020 kc, Philadelphia, Pa., WRAX Broadcasting Co., 250 w, E.

WRBJ—1370 kc, Hattiesburg, Miss., Hattiesburg Bdcstg. Co., 10 w, C.

WRBL—1200 kc, Columbus, Ga., WRBL Radio Station, Inc., 50 w, E.

WRBQ—1210 kc, Greenville, Miss., J. Pat Scully, 250 w, C.

WRBX—1410 kc, Roanoke, Va., Richmond Development Corp., 250 w, E.

WRC—950 kc, Washington, D. C., National Broadcasting Co., 500 w, E.

WRDO—1370 kc, Augusta, Me., Albert S. Woodman, 100 w, E.

WRDW—1500 kc, Augusta, Ga., Davenport's Musicove, Inc., 100 w, E.

WREC—600 kc, Memphis, Tenn., WREC, Inc., 500 w.

WREN—1220 kc, Lawrence, Kan., Jenny Wren Co., 1000 w, C.

WRHM—1250 kc, Minneapolis, Minn., Minnesota Broadcasting Corp., 1000 w, C.

WRJN—1370 kc, Racine, Wis., Racine Broadcasting Corp., 100 w, C.

WRNY—1010 kc, New York, N. Y., Aviation Radio Station, 250 w, E.

WROL—1310 kc, Knoxville, Tenn., Stuart Broadcasting Corp., 100 w, C.

WRR—1280 kc, Dallas, Texas, City of Dallas, 500 w, C.

WRUF—830 kc, Gainesville, Fla., University of Florida, 5000 w, E.

WRVA—1110 kc, Richmond, Va., Larus Bros. & Co., Inc., 5000 w, E.

WSAI—1330 kc, Cincinnati, Ohio, Crosley Radio Corp., 500 w, E.

WSAJ—1310 kc, Grove City, Pa., Grove City College, 100 w, E.

WSAN—1440 kc, Allentown, Pa., Allentown Call Pub. Co., 250 w, E.

WSAR—1450 kc, Fall River, Mass., Doughty & Welch Electrical Co., Inc., 250 w, E.

WSAZ—580 kc, Huntington, W. Va., WSAZ, Inc., 250 w, E.

WSB—740 kc, Atlanta, Ga., Atlanta Journal Co., 5000 w, E.

WSBC—1210 kc, Chicago, Ill., World Battery Co., 100 w, C.

WSBT—1230 kc, South Bend, Ind., South Bend Tribune, 500 w, C.

WSEN—1210 kc, Columbus, Ohio, Columbus Broadcasting Corp., 100 w, E.

WSFA—1410 kc, Montgomery, Ala., Montgomery Brdcstg. Co., 500 w, C.

WSIX—1210 kc, Springfield, Tenn., 638 Tire & Vulcanizing Co., 100 w, C.

WSJS—1310 kc, Winston-Salem, N. C., The Journal Co., 100 w, E.

WSM—650 kc, Nashville, Tenn., National Life & Accident Ins. Co., 5000 w, C.

WSMB—1320 kc, New Orleans, La., WSMB, Inc., 500 w, C.

WSMK—1380 kc, Dayton, Ohio, Stanley M. Krohn, Jr., 200 w, C.

WSOC—1210 kc, Gastonia, N. C., A. J. Kirby Music Co., 100 w, E.

WSPA—1420 kc, Spartanburg, S. C., 100 w, E.

WSPD—1340 kc, Toledo, Ohio, Toledo Broadcasting Co., 1000 w, E.

WSUI—880 kc, Iowa City, Iowa, State Univ. of Iowa, 500 w, C.

WSUN—See under WFLA.

WSVS—1370 kc, Buffalo, N. Y., Seneca Vocational High School, 50 w, E.

WSYB—1500 kc, Rutland, Vt., Weiss Music Co., E.

WSYR—570 kc, Syracuse, N. Y., Clive B. Meredith, 250 w, E.

WTAD—1440 kc, Quincy, Ill., Illinois Broadcasting Corp., 500 w.

WTAG—580 kc, Worcester, Mass., Worcester Telegram Pub. Co., Inc., 250 w, E.

WTAM—1070 kc, Cleveland, Ohio, National Broadcasting Co., 50,000 w, E.

WTAQ—1330 kc, Eau Claire, Wis., Gillette Rubber Co., 1000 w, C.

WTAR—780 kc, Norfolk, Va., WTAR Radio Corp., 500 w, E.

WTAW—1120 kc, College Station, Texas, Agri. & Mech. College of Texas, 500 w, C.

WTAX—1210 kc, Springfield, Ill., WTAX, Inc., 100 w.

WTBO—1420 kc, Cumberland, Md., Associated Brdcstg. Corp., 100 w, E.

WTEL—1310 kc, Philadelphia, Pa., Foulkrod Radio Eng. Co., 50 w, E.

WTFI—1450 kc, Athens, Ga., Toccoa Falls Bdcstg. Co., 500 w, E.

WTIC—1060 kc, Hartford, Conn., Travelers Broadcasting Service Corp., 50,000 w, E.

WTJS—1310 kc, Jackson, Tenn., Sun Publishing Co., 100 w, C.

WTMJ—620 kc, Milwaukee, Wis., Milwaukee Journal, 1000 w, C.

WTNT—1470 kc, Nashville, Tenn., Life and Casualty Ins. Co. of Tenn., 5000 w, C.

WTOC—1260 kc, Savannah, Ga., Savannah Broadcasting Corp., 500 w, E.

WWAE—1200 kc, Hammond, Ind., Hammond-Calumet Broadcasting Corp., 100 w, C.

WWJ—920 kc, Detroit, Mich., Evening News Assn., 1000 w, E.

WWL—850 kc, New Orleans, La., Loyola University, 5000 w, C.

WWNC—570 kc, Asheville, N. C., Citizens Broadcasting Co., 1000 w, E.

WWRL—1500 kc, Woodside, N. Y., Long Island Broadcasting Corp., 100 w.

WWSW—1500 kc, Pittsburgh, Pa., Hotel Schenley.

WWVA—1160 kc, Wheeling, W. Va., West Virginia Broadcasting Corp., 5000 w, E.

WXYZ—1240 kc, Detroit, Mich., Kunsky Trendle Broadcasting Co., 1000 w, E.

U. S. Broadcasting Stations by Frequencies

550 Kilocycles, 545.1 Meters:
KOAC, WGR, WKRC, KFUO, KSD, KFDY, KFYR

560 Kilocycles, 535.4 Meters.
WLIT, WFI, KFDM, WNOX KTAB, KLZ, WIBO, WPCC, WQAM

570 Kilocycles, 526.0 Meters:
WNYC, WMCA, WSYR, WMAC, WKBN, WWNC, KGKO, WNAX, KXA, KMTR, WEAO

580 Kilocycles, 516.9 Meters—Canadian Shared:
WTAG, WOBU, WSAZ, KGFX, KSAC, WIBW

590 Kilocycles, 508.2 Meters:
WEEI, WCAJ, WOW, KHQ, WKZO

600 Kilocycles, 499.7 Meters—Canadian Shared:
WCAO, WREC, WOAN, KFSD, WCAC, WMT WICC

610 Kilocycles, 491.5 Meters:
WFAN, WIP, WDAF, KFRC, WJAY

620 Kilocycles, 483.6 Meters:
WLBZ, WTMJ, KGW, WFLA, WSUN, KTAR

630 Kilocycles, 475.9 Meters—Canadian Shared:
WMAL, WOS, KFRU, WGBF

640 Kilocycles, 468.5 Meters:
WAIU, KFI, WOI

650 Kilocycles, 461.3 Meters:
WSM, KPCB

660 Kilocycles, 454.3 Meters:
WEAF, WAAW

670 Kilocycles, 447.5 Meters:
WMAQ

680 Kilocycles, 440.9 Meters:
WPTF, KPO, KFEQ

690 Kilocycles, 434.5 Meters—Canadian Wave:

700 Kilocycles, 428.3 Meters:
WLW

710 Kilocycles, 422.3 Meters:
WOR, KMPC

720 Kilocycles, 416.4 Meters:
WGN, WLIB

730 Kilocycles, 410.7 Meters—Canadian Wave:

740 Kilocycles, 405.2 Meters:
WSB, KMMJ

750 Kilocycles, 399.8 Meters:
WJR

760 Kilocycles, 394.5 Meters:
WJZ, WEW, KVI

770 Kilocycles, 389.4 Meters:
KFAB, WBBM, WJBT

780 Kilocycles, 384.4 Meters—Canadian Shared:
WTAR, WPOR, KELW, KTM, WMC, WEAN

790 Kilocycles, 379.5 Meters:
WGY, KGO

800 Kilocycles, 374.8 Meters:
WBAP, WFAA

810 Kilocycles, 370.2 Meters:
WPCH, WCCO

820 Kilocycles, 365.6 Meters:
WHAS

830 Kilocycles, 361.2 Meters:
KOA, WHDH, WRUF, WEEU

840 Kilocycles, 356.9 Meters—Canadian Wave:

850 Kilocycles, 352.7 Meters:
KWKH, WWL

860 Kilocycles, 348.6 Meters:
WBOQ, WABC, KMO, WHB

870 Kilocycles, 344.6 Meters:
WLS, WENR, WBCN

880 Kilocycles, 340.7 Meters—Canadian Shared:
WQAN, WGBI, WCOC, KLX, KPOF, KFKA, WSUI

890 Kilocycles, 336.9 Meters—Canadian Shared:
WJAR, WMMN, WGST, KGJF, WILL, KUSD, KFNF, WKAQ

900 Kilocycles, 331.1 Meters:
WKY, WLBL, KHJ, KSEI, KGBU, WJAX, WBEN

910 Kilocycles, 329.5 Meters—Canadian Wave:

920 Kilocycles, 325.9 Meters:
WWJ, KPRC, WAAF, WBSO, KOMO, KFXF, KFEL

930 Kilocycles, 322.4 Meters—Canadian Shared:
WIBG, WDBJ, WBRC, KGBZ, KMA, KFWI, KROW

940 Kilocycles, 319 Meters:
WCSH, WFIW, KOIN, KGU, WHA, WDAY, WAAT

950 Kilocycles, 315.6 Meters:
WRC, KMBC, KFWB, KGHL

960 Kilocycles, 312.3 Meters—Canadian Wave:

970 Kilocycles, 309.1 Meters:
KJR, WCFL

980 Kilocycles, 305.9 Meters:
KDKA

990 Kilocycles, 302.8 Meters:
WBZ, WBZA

1000 Kilocycles, 299.8 Meters:
WHO, WOC, KFVD

1010 Kilocycles, 296.9 Meters—Canadian Shared:
WQAO, WPAP, WHN, WRNY, KGGF, WNAD, KQW, WIS, WLAP

1020 Kilocycles, 293.9 Meters:
KYW, KFKX, WRAX

1030 Kilocycles, 291.1 Meters—Canadian Wave:

1040 Kilocycles, 288.3 Meters:
WKAR, KTHS, KRLD, WMAK

1050 Kilocycles, 285.5 Meters:
KNX, KFKB

1060 Kilocycles, 282.8 Meters:
WBAL, WJAG, KWJJ, WTIC

1070 Kilocycles, 280.2 Meters:
WTAM, WCAZ, WDZ, KJBS

1080 Kilocycles, 277.6 Meters:
WBT, WCBD, WMBI

1090 Kilocycles, 275.1 Meters:
KMOX

1100 Kilocycles, 272.6 Meters:
WPG, WLWL, KGDM

1110 Kilocycles, 270.1 Meters:
WRVA, KSOO

1120 Kilocycles, 267.7 Meters—Canadian Shared:
WTAW, WISN, WHAD, KFSG, KRSC, WDEL, WDBO, KFIO, KTRH, KMSC, KMBC

1130 Kilocycles, 265.3 Meters:
WOV, KSL, WJJD

1140 Kilocycles, 263.0 Meters:
WAPI, KVOO

1150 Kilocycles, 260.7 Meters:
WHAM

1160 Kilocycles, 258.5 Meters:
WWVA, WOWO

1170 Kilocycles, 256.3 Meters:
WCAU

1180 Kilocycles, 254.1 Meters:
KEX, KOB, WHDI, WDGY, WMAZ, WGBS

1190 Kilocycles, 252.0 Meters:
WOAI

1200 Kilocycles, 249.9 Meters: Canadian Shared:
WABI, WNBX, WORC, WIBX, WHBC, WBHS, WLBG, WNBO, WKJC, WNBW, WABZ, WJBW, WBBZ, WFBC, WRBL, KGCU, WJBC, WJBL, WWAE, WFAM, KFJB, WCAT, KGDY, KFWF, KGDE, WCLO, WHBY, KSMR, WIL, KVOS, KGY, KGEK, KGEW, KGHI, WCAX, WCOD, WFBE, KBTM, WEPS, KMLB, KGFJ, KWG

1210 Kilocycles, 247.8 Meters—Canadian Shared:
WJBI, WGBB, WCOH, WOCL, WLCI, WPAW, WPRO, WLSI, WJW, WBAX, WJBU, WMBG, WSIX, WJBY, WRBQ, WGCM, KWEA, KDLR, KGCR, KFOR, WHBU, KFVS, WEBQ, WODX, WCRW, WEDC, WCBS, WTAX, WHBF, WOMT, WSBC, KDFN, KMJ, KFXM, KPPC, WALR, WRBL, WMRJ, KGMP, KGNO, WSEN, WSOC, WIBU

1220 Kilocycles, 245.6 Meters:
WCAD, WCAE, WREN, KFKU, WDAE, KWSC, KTW

1230 Kilocycles, 243.8 Meters:
WNAC, WBIS, WPSC, WSBT, WFBM, KFQD, KYA, KGGM

1240 Kilocycles, 241.8 Meters:
WACO, KTAT, WXYZ

1250 Kilocycles, 239.9 Meters:
WGCP, WODA, WAAM, WLB, WGMS, WRHM, KFMX, WCAL, KFOX, WDSU

1260 Kilocycles, 238.0 Meters:
WLBW, KWWG, KRGV, KOIL, KVOA, WTOC

1270 Kilocycles, 236.1 Meters:
WEAI, WASH, WOOD, KWLC, KGCA, KOL, KVOR, WFBR, WJDX

1280 Kilocycles, 234.2 Meters:
WCAM, WCAP, WOAX, WDOD, WRR, KFBB, WIBA, WISJ

1290 Kilocycles, 232.4 Meters:
WNBZ, WJAS, KTSA, KFUL, KLCN, KDYL, WEBC

1300 Kilocycles, 230.6 Meters:
WBBR, WHAP, WEVD, WHAZ, KFH, KGEF, KFAC, KFJR, KTBR, WIOD, WMBF, WOQ

1310 Kilocycles, 228.9 Meters:
WKAV, WEBR, WNBH, WOL, WGH, WHAT, WFBG, WRAW, WGAL, WSAJ, WBRE, WKBC, WTJS, KRMD, KFPM, WDAH, KFPL, KFXR, WKBS, WCLS, WKBB, KWCR, KFJY, KFGQ, WBOW, WJAK, WLBC, KTSL, KFUP, KFXJ, KFBK, KGEZ, KMED, KTSM, KGCX, WJAC, WSJS, KXRO, KGFW, KFIU, KGBX, KIT, WMBO, KCRJ, KTLC, WEXL, WROL, WTEL, WBEO, WFDV

1320 Kilocycles, 227.1 Meters:
WADC, WSMB, KID, KTFI, KGHF, KGMB, KGIQ

1330 Kilocycles, 225.4 Meters:
WDRC, WTAQ, KSCJ, WSAI, KGB

1340 Kilocycles, 223.7 Meters:
KFPW, WCOA, KFPY, WSPD

1350 Kilocycles, 222.1 Meters:
WMSG, WCDA, WBNX, KWK, WAWZ, WEHC KIDO

1360 Kilocycles, 220.4 Meters:
WOBC, WGES, KGIR, KGER, WFBL, WCSC WJKS

1370 Kilocycles, 218.8 Meters:
WSVS, WCBM, WHBD, WJBK, WIBM, WRAK, WELK, WHBQ, WRAM, KGFG, KFJZ, KGKL, KFLX, KGDA, KRE, WPOE, KFBL, KWKC, WRJN, KGAR, KVL, KFJI, KGFL, WHDF, KOOS, WGL, KFJM, KCRC, WMBR, WRBJ, WLEY, WBGF, WBTM, WLVA, WQDM, WRDO, KONO, KMAC, KUJ, WJTL, KOH

1380 Kilocycles, 217.3 Meters:
KQV, KSO, WKBH, WSMK

1390 Kilocycles, 215.7 Meters:
WHK, KLRA, KUOA, KOY

1400 Kilocycles, 214.2 Meters:
WCGU, WFOX, WLTH, WBBC, WCMA, WKBF, KOCW, WBAA, KLO

1410 Kilocycles, 212.6 Meters:
KGRS, WDAG, KFLV, WHBL, WBCM, WODX, WSFA, WAAB, WRBX, WHIS

1420 Kilocycles, 211.1 Meters:
WTBO, WKBI, WIBR, WEDH, WMBC, KGFF, KABC, KFYO, KICK, WIAS, KGGC WLBF, WMBH, KFIZ, KORE, WILM, KGIW, KGKX, KFQW, KLPM, KXL, WHDL, WHFC, WEHS, KFQU, KFXD, KGIX, WJBO, WELL, WFDW, WPAD, WSPA, KBPS, KFXY, KXYZ, WAGM, WDEV, KGVO, WJMS

1430 Kilocycles, 209.7 Meters:
WHP, WCAH, WGBC, WNBR, WBAK, KECA, KGNF, WFEA

1440 Kilocycles, 208.2 Meters:
WHEC, WABO, WOKO, WCBA WTAD, WMBD, KLS, WSAN, WBIG

1450 Kilocycles, 206.8 Meters:
WBMS, WNJ, WKBO, WSAR, WGAR, WTFI, KTBS, WHOM

1460 Kilocycles, 205.4 Meters:
WJSV, KSTP

1470 Kilocycles, 204.0 Meters:
KGA, WTNT, WLAC

1480 Kilocycles, 202.6 Meters:
KFJF, WKBW

1490 Kilocycles, 201.6 Meters:
WCKY, WJAZ, WCHI

1500 Kilocycles, 199.9 Meters:
WMBA, WLOE, WNBF, WMBQ, WLBX, WWRL, WKBZ, WMPC, WOPI, WPEN, KGKB, WKBV, KPJM, KDB, KGFI, WMBJ, KREG, WCLB, WRDW, KGIZ, KGKY, KPQ, KUT, WDIX, KXO, KGFK, WSYB, WWSW

LIST OF POLICE BROADCASTING STATIONS

Call	Kilocycles	Meters	Location	Call	Kilocycles	Meters	Location
WPDO	2,458	122.05	Akron, Ohio	KGPE	2,422	123.86	Kansas City, Mo.
WPDY	2,452	122.34	Atlanta, Ga.	WPDT	2,470	121.50	Kokomo, Ind.
KGPS	2,416	124.17	Bakersfield, Calif.	WPDL	2,440	123.00	Lansing, Mich.
KGPJ	1,712	175.23	Beaumont, Tex.	KGPL	1,712	175.23	Los Angeles, Calif.
KSW	2,410	124.50	Berkeley, Calif.	WPDE	2,440	123.00	Louisville, Ky.
WEY	1,596	187.97	Boston, Mass.	WPEC	2,470	121.50	Memphis, Tenn.
WRDU	1,596	187.97	Brooklyn, N. Y.	WPDK	2,452	122.34	Milwaukee, Wis.
WMJ	2,422	123.86	Buffalo, N. Y.	KGPB	2,416	124.17	Minneapolis, Minn.
WBR	257	1,165.00	Butler, Pa.	WPY	438	685.00	New York, N. Y.
KGOZ	2,470	121.50	Cedar Rapids, Iowa	WPY	500	600.00	New York, N. Y.
WPDV	2,458	122.05	Charlotte, N. C.	WCF	1,596	187.97	New York, N. Y.
WPDB	1,712	175.23	Chicago, Ill.	KGPH	2,452	122.34	Oklahoma City, Okla.
WPDC	1,712	175.23	Chicago, Ill.	KGPI	2,470	121.50	Omaha, Neb.
WPDD	1,712	175.23	Chicago, Ill.	KGJX	1,712	175.23	Pasadena, Calif.
WKDU	1,712	175.23	Cincinnati, Ohio	WPDP	2,440	123.00	Philadelphia, Pa.
WRBH	2,452	122.34	Cleveland, Ohio	WPDU	1,712	175.23	Pittsburgh, Pa.
WPDI	2,416	124.17	Columbus, Ohio	KGPP	2,416	124.17	Portland, Ore.
KVP	1,712	175.23	Dallas, Tex.	WPDH	2,416	124.17	Richmond, Ind.
KGPN	2,470	121.50	Davenport, Iowa	WPDR	1,712	175.23	Rochester, N. Y.
WPDM	2,416	124.17	Dayton, Ohio.	KGPC	1,712	175.23	St. Louis, Mo.
KGPV	1,662	180.51	Des Moines, Iowa.	WPDS	2,416	124.17	St. Paul, Minn.
WKDT	1,596	187.97	Detroit, Mich.	KGPW	2,470	121.50	Salt Lake City, Utah.
WCK	2,410	124.50	Detroit, Mich.	KGPD	1,596	187.97	San Francisco, Calif.
WPDX	2,410	124.50	Detroit, Mich.	KGPD	2,410	124.50	San Francisco, Calif.
WPDF	2,440	123.00	Flint, Mich.	KGPM	2,470	121.50	San Jose, Calif.
KGPR	1,712	175.23	Ft. Worth, Tex.	KGPA	2,416	124.17	Seattle, Wash.
WMP	1,662	180.51	Framingham, Mass.	KGPK	2,470	121.50	Sioux City, Iowa
WPEB	2,440	123.00	Grand Rapids, Mich.	WRDQ	2,470	121.50	Toledo, Ohio
WJL	257	1,165.00	Greensburg, Pa.	WPDA	2,416	124.17	Tulare, Calif.
WRDR	2,410	124.50	Grosse Point Village, Mich.	KGPG	2,410	124.50	Vallejo, Calif.
WBA	257	1,165.00	Harrisburg, Pa.	WPDW	2,410	124.50	Washington, D. C.
WMO	2,410	124.50	Highland Park, Mich.	WMB	257	1,165.00	West Reading, Pa.
KGPQ	2,452	122.35	Honolulu, T. H.	WDX	257	1,165.00	Wyoming, Pa.
WMDZ	2,440	123.00	Indianapolis, Ind.	WPDG	2,158	122.05	Youngstown, Ohio
WRDS	1,662	180.51	Ingham, Mich.				

U. S. VISUAL BROADCASTING STATIONS

Call	Kilocycles	Meters	Owner	Call	Kilocycles	Meters	Owner
1XAV	2,850	105.30	Short Wave & Television, Boston, Mass.	W3XAD	48,500	6.18	RCA-Victor, Camden, N. J.
W2XAB	2,750	109.10	Atlantic Broadcasting, New York, N. Y.	W3XAD	60,000	5.00	RCA-Victor, Camden, N. J.
W2XBC	2,750	109.10	United Research Corp., Long Island City, N. Y.	W3XAD	2,100	142.90	RCA-Victor, Camden, N. J.
W2XBU	2,000	150.00	Harold E. Smith, Beacon, N. Y.	W3XK	2,000	150.00	Jenkins Laboratories, Wheaton, Md.
W2XCD	2,000	150.00	DeForest Radio Co., Passaic, N. J.	W6X4H	2,000	150.00	Pioneer Mercantile Co., Bakersfield, Calif.
W2XCR	2,100	142.90	Jenkins Television, Jersey City, N. J.	W6XAO	43,000	6.97	Don Lee, Inc., Los Angeles, Calif.
W2XCR	2,000	150.00	Jenkins Television, Jersey City, N. J.	W6XS	2,100	142.90	Don Lee, Inc., Los Angeles, Calif.
W2XCW	2,100	142.90	General Electric, Schenectady, N. Y.	W8XAV	2,100	142.90	Westinghouse, East Pittsburgh, Pa.
W2XDA	1,544	194.30	Atlantic Broadcasting, New York, N. Y.	W9XAA	2,750	109.10	Federation of Labor, Chicago, Ill.
W2XDS	43,000	6.98	Jenkins Television, New York, N. Y.	W9XAB	1,564	191.82	Federation of Labor, Chicago, Ill.
W2XDS	48,500	6.19	Jenkins Television, New York, N. Y.	W9XAO	2,000	150.00	Western Television Corp., Chicago, Ill.
W2XDS	60,000	5.00	Jenkins Television, New York, N. Y.	W9XAP	2,100	142.90	Daily News, Chicago, Ill.
W2XF	43,000	6.97	National Broadcasting, New York, N. Y.	W9XD	43,000	6.97	Journal Company, Milwaukee, Wis.
W2XF	48,500	6.18	National Broadcasting, New York, N. Y.	W9XD	48,500	6.18	Journal Co., Milwaukee, Wis.
W2XF	60,000	5.00	National Broadcasting, New York, N. Y.	W9XD	60,000	6.00	Journal Co., Milwaukee, Wis.
W2XR	2,850	105.30	Radio Pictures, Inc., Long Island City, N. Y.	W9XG	2,750	109.10	Purdue University, W. Lafayette, Ind.
W3XAD	43,000	6.97	RCA-Victor, Camden, N. J.	W9XR	2,850	105.30	Great Lakes Broadcasting, Chicago, Ill.

U. S. RELAY BROADCASTING STATIONS

Call	Kilocycles	Meters	Owner	Call	Kilocycles	Meters	Owner
W1XAZ	9,570	31.35	Westinghouse Elec., East Springfield, Mass.	W6XAF	2,938	112.10	Dept. Agriculture, Sacramento, Calif.
W2XAD	15,340	19.56	General Electric, Schenectady, N. Y.	W6XAF	5,870	51.11	Dept. Agriculture, Sacramento, Calif.
W2XAF	9,530	31.48	General Electric, Schenectady, N. Y.	W6XAL	6,080	49.34	Pacific-Western Broadcasting, Westminster, Calif.
W2XAG	550	545.00	General Electric, Schenectady, N. Y.	W6XAL	15,250	19.67	Pacific-Western Broadcasting, Westminster, Calif.
W2XAG	660	455.00	General Electric, Schenectady, N. Y.	W6XAL	21,500	13.95	Pacific-Western Broadcasting, Westminster, Calif.
W2XAG	790	380.00	General Electric, Schenectady, N. Y.	W6XN	12,850	23.35	General Electric, Oakland, Calif.
W2XAG	1,150	260.90	General Electric, Schenectady, N. Y.	W8XAL	6,060	49.50	Crosley Radio Corp., Cincinnati, Ohio
W2XAG	1,500	200.00	General Electric, Schenectady, N. Y.	W8XK	6,140	48.86	Westinghouse, East Pittsburgh, Pa.
W2XAL	6,040	49.67	Short Wave Bdcstg. Corp., Coytesville, N. J.	W8XK	9,570	31.35	Westinghouse, East Pittsburgh, Pa.
W2XAL	11,800	25.42	Short Wave Bdcstg. Corp., Coytesville, N. J.	W8XK	11,880	25.25	Westinghouse, East Pittsburgh, Pa.
W2XAL	15,250	19.67	Short Wave Bdcstg. Corp., Coytesville, N. J.	W8XK	15,210	19.72	Westinghouse, East Pittsburgh, Pa.
W2XAL	21,460	13.97	Short Wave Bdcstg. Corp., Coytesville, N. J.	W8XK	17,780	16.87	Westinghouse, East Pittsburgh, Pa.
W2XE	6,120	49.02	Atlantic Broadcasting, Jamaica, N. Y.	W8XK	21,540	13.93	Westinghouse, East Pittsburgh, Pa.
W2XE	11,840	25.34	Atlantic Broadcasting Co., Jamaica, N. Y.	W9XAA	6,080	49.34	Federation of Labor, Chicago, Ill.
W2XE	15,280	19.63	Atlantic Broadcasting Co., Jamaica, N. Y.	W9XAA	11,840	25.34	Federation of Labor, Chicago, Ill.
W2XZ	610	491.50	National Broadcasting, Bellmore, N. Y.	W9XAA	17,780	16.87	Federation of Labor, Chicago, Ill.
W3XAL	6,100	49.18	National Broadcasting, New York, N. Y.	W9XF	6,020	49.83	Great Lakes Broadcasting, Chicago, Ill.
W3XAU	6,060	49.50	Universal Broadcasting, Philadelphia, Pa.	W9XF	11,800	25.42	Great Lakes Broadcasting, Chicago, Ill.
W3XAU	9,590	31.28	Universal Broadcasting, Philadelphia, Pa.	W9XF	21,500	13.95	Great Lakes Broadcasting, Chicago, Ill.
W3XL	6,425	46.70	National Broadcasting, New York, N. Y.	W9XU	6,060	49.50	Mona Motor Oil Co., Council Bluffs, Iowa

SIMPLE TIME CHART

(Time changes every 15 degrees of Longitude East or West)

← WEST

LONGITUDE WEST OF GREENWICH	180°	165°	150°	135°	120°	105°	90°	75°	60°	45°	30°	15°	0°
PLACES ON, OR NEARLY ON, THE MERIDIAN INDICATED.	FIJI ISLANDS	UNALASKA	SEWARD	JUNEAU	LOS ANGELES	DENVER	CHICAGO	NEW YORK	BUENOS AIRES	RIO JANEIRO	AZORES	ICELAND	LONDON (GREENWICH)
TIME	Midnight	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon

↑ International date line. When it's Monday East of 180° it is Tuesday West of 180°.

EAST → ↓

LONGITUDE EAST OF GREENWICH	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
PLACES ON, OR NEARLY ON, THE MERIDIAN INDICATED.	LONDON (GREENWICH)	BERLIN	CAIRO ODESSA	ADEN	MAURITIUS ISL.	LAHORE	CALCUTTA	BATAVIA	MANILA	KOBE	AUSTRALIA EASTERN	CALEDONIA NEW	FIJI ISLANDS
TIME	Noon	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Midnight

FOREIGN BROADCAST STATIONS

ALGERIA

Call	Location	Kc.
......	Algiers	824

ARGENTINA

Call	Location	Kc.
LP4	Buenos Aires	670
LR1	Buenos Aires	790
LR2	Buenos Aires	870
LR3	Buenos Aires	950
LR4	Buenos Aires	990
LR5	Buenos Aires	830
LR6	Buenos Aires	910
LR7	Buenos Aires	750
LR8	Buenos Aires	1150
LR9	Buenos Aires	1030
LS1	Buenos Aires	710
LS2	Buenos Aires	1190
LS3	Buenos Aires	1270
LS5	Buenos Aires	1070
LS6	Buenos Aires	1350
LS8	Buenos Aires	1230
LS9	Buenos Aires	1390
LT2	Concordia	810
J2	Concordia	1327
LV2	Cordoba	911
LT7	General Pico	...
LT2	La Plata	685
LV8	Los Molinos	...
LT4	Mendoza	759
LT5	Parana	1249
LT3	Rosario	1090
LV5	Rosario	1369
LV6	Rosario	1079
LT6	San Juan	730
LP2	Villaguay	1140

AUSTRALIA

Call	Location	Kc.
5CL	Adelaide	730
5DN	Adelaide	960
5KA	Adelaide	1200
5AD	Adelaide	1310
5AD	Adelaide	720
2AY	Albury	1320
2AY	Albury	1480
3BA	Ballarat	1300
3BO	Bendigo	1450
3BO	Bendigo	980
4QG	Brisbane	760
4BC	Brisbane	1145
4BC	Brisbane	880
4BK	Brisbane	1290
2CA	Canberra	1050
3KZ	Carlton	1350
4CH	Charleville	1170
3GL	Geelong	1400
2GN	Goulburn	1490
2MO	Gunnedah	1500
2MO	Gunnedah	1330
7ZL	Hobart	580
7HO	Hobart	890
7HO	Hobart	1160
7LA	Launceston	1080
7LA	Launceston	1100
2XN	Lismore	1340
4MK	Mackay	1190
3AR	Melbourne	610
3LO	Melbourne	800
3UZ	Melbourne	930
3DB	Melbourne	1180
3KZ	Melbourne	1350
2MV	Moss Vale	1220
2MV	Moss Vale	1460
2NC	Newcastle	1245
2HD	Newcastle	1415
2HD	Newcastle	1110
6WF	Perth	690
6ML	Perth	1010
6ML	Perth	1180
4RK	Rockhampton	930
2FC	Sydney	665
2BL	Sydney	855
2GB	Sydney	950
2UE	Sydney	1025
2KY	Sydney	1070
2UW	Sydney	1125
4GR	Toowoomba	1020
4TO	Townsville	1260
3TR	Trafalgar	1280
3WR	Wangaratta	1260

AUSTRIA

Call	Location	Kc.
......	Graz	851
......	Innsbruck	1058
......	Innsbruck	1376
......	Klagenfurt	662
......	Linz	1220
......	Vienna	581

BELGIUM

Call	Location	Kc.
EB4ED	Antwerp	1200
EB4GT	Bruxells	1150
ON4RB	Bruxells	590
EB4RC	Bruxells	1395
EB4FO	Bruxells	1305
EB4CE	Chatellneau	1365
EB4FG	Dampremy	1430
EB4RG	Gand	1090
EB4RW	Liege	1070
EB4BQ	Marchienne	1035
EB4EX	Ottomont	1335
EB4CF	Verviers	1395

BERMUDA

Call	Location	Kc.
TJW	Hamilton	1480

BOLIVIA

Call	Location	Kc.
......	La Paz	1713
CPX	La Paz	1000

BRAZIL

Call	Location	Kc.
PRAM	Amparo	1304
PRAH	Bahia	857
PRAF	Belem	1363
PRAQ	Bello Horizonte	1090
PRAN	Curvtiba	882
PRAZ	Franca	1111
PRAJ	Juiz de Fora	857
PRAY	Mogy das Cruzes	1000
PRAD	Pelotas	920
PRAG	Porto Alegre	1090
PRAP	Recife	750
PRAI	Ribeirao Preto	1153
PRAA	Rio de Janeiro	750
PRAB	Rio de Janeiro	934
PRAC	Rio de Janeiro	833
PRAX	Rio de Janeiro	1364
PRAK	Rio de Janeiro	1153
PRAS	Santos	1000
PRAE	Sao Paulo	857
PRAR	Sao Paulo	1016
PRAL	Sao Paolo	750
PRAO	Sao Paolo	934

CANADA

Call	Location	Kc.
CKGW	Bowmanville	910
CJBC	Bowmanville	910
CJSC	Bowmanville	910
CPRY	Bowmanville	910
10AE	Bowmanville	1199
10BQ	Brantford	1199
CKX	Brandon	540
CNRC	Calgary	690
CFCN	Calgary	690
CJCJ	Calgary	690
CHCA	Calgary	690
CFAC	Calgary	690
10BU	Canora	1199
CHCK	Charlottetown	960
CFCY	Charlottetown	960
CFCO	Chatham	1210
CHWK	Chilliwack	1210
CKMC	Cobalt	1210
CHMA	Edmonton	680
CKUA	Edmonton	580
CJCA	Edmonton	930
CNRE	Edmonton	930
CJRW	Fleming	600
CFNB	Fredericton	1210
CHNS	Halifax	930
CNRH	Halifax	930
CHCS	Hamilten	880
CHML	Hamilton	880
CKOC	Hamilton	880
CFJC	Kamloops	1120
10AY	Kelowna	1199
CFRC	Kingston	930
CFRB	King, York Co.	960
CNRX	King, York Co.	960
CJOC	Lethbridge	1120
10BU	Liverpool	1199
CJGC	London	910
CNRL	London	910
CKPR	Midland	930
CNRA	Moncton	630
CFCF	Montreal	1030
CJRM	Moose Jaw	600
10AB	Moose Jaw	1199
CFCH	North Bay	1200
CKCO	Ottawa	890
CNRO	Ottawa	600
CHWC	Pilot Butte	960
CFLC	Prescott	1010
CKPC	Preston	1210
10BI	Prince Albert	1199
CHRC	Quebec	880
CKCI	Quebec	880
CKCV	Quebec	880
CNRQ	Quebec	880
CNRD	Red Deer	840
CKLC	Red Deer	840
CHCT	Red Deer	840
CKCK	Regina	960
CJBR	Regina	960
CNRR	Regina	960
CFQC	Saskatoon	910
CNRS	Saskatoon	910
CJOR	Sea Island	1210
CKAC	St. Hyacinthe	730
CHYC	St. Hyacinthe	730
CNRM	St. Hyacinthe	730
CFBO	St. John	890
10AK	Stratford	1199
CHGS	Summerside	1120
CJCB	Sydney	880
CNRT	Toronto	840
CFCA	Toronto	840
CKOW	Toronto	840
CKCL	Toronto	580
CKNC	Toronto	580
CFCL	Toronto	580
CNRV	Vancouver	1030
CKCE	Vancouver	730
CHLS	Vancouver	730
CKFC	Vancouver	730
CKMO	Vancouver	730
CFCT	Victoria	630
CKCR	Waterloo	1010
10BP	Wingham	1199
CKY	Winnipeg	780
CNRW	Winnipeg	780
CKIC	Wolfville	930
CJGX	Yorkton	630

CANAL ZONE

Call	Location	Kc.
NBA	Panama	845

CANARY ISLANDS

Call	Location	Kc.
EAR5	Las Palmas	1071

CEYLON

Call	Location	Kc.
VPB	Colombo	700

CHILE

Call	Location	Kc.
......	Asuncion	...
CMAI	Concepcion	870
CMAB	Santiago	625
CMAC	Santiago	804
CMAD	Santiago	938
CMAE	Santiago	1070
CMAF	Santiago	750
CMAK	Santiago	1333
CMAO	Santiago	1016
CMAQ	Santiago	1224
CMAT	Tacna	545
CMAJ	Valparaiso	1034

CHINA

Call	Location	Kc.
CAB	Canton	689
XGY	Chekiang	977
COHB	Harbin	674
COMK	Mukden	731
XGZ	Nanking	1071
XOPP	Peiping	952
KRC	Shanghai	869
KSMS	Shanghai	1083
NKS	Shanghai	952
RSC	Shanghai	1276
XGX	Shanghai	1071
XGAH	Shanghai	937
COTN	Tientsin	625
GEC	Tientsin	1000

CHOSEN

Call	Location	Kc.
JODK	Keijo	690

COLOMBIA

Call	Location	Kc.
HJN	Bogota	684

COSTA RICA

Call	Location	Kc.
TI4NRH	Heredia	980
TIC	San Jose	882

CUBA

Call	Location	Kc.
CMHD	Caibarien	950
CMJA	Camaguey	1200
CMJC	Camaguey	1382
CMJE	Camaguey	856
CMJF	Camaguey	930
CMGE	Cardenas	1375
CMJA	Ciego de Avila	1017
CMHJ	Cienfuegos	645
CMGA	Colon	834
CMCG	Guanabacoa	1345
CMBR	Havana	1500
CMCW	Havana	1285
CMCQ	Havana	1150
CMBL	Havana	1500
CMCU	Havana	1285
CMBY	Havana	1225
CMCD	Havana	925
CMBC	Havana	965
CMBG	Havana	1070
CMQ	Havana	1150
CMCA	Havana	1225
CMK	Havana	730
CMCJ	Havana	620
CMBZ	Havana	1010
CMBI	Havana	1405
CMCB	Havana	1070
CMCH	Havana	1405
CMX	Havana	890
CMC	Havana	840
CMBT	Havana	790
CMBS	Havana	790
CMCF	Havana	890
CMCY	Havana	1345
CMW	Havana	588
CMBD	Havana	965
CMCR	Havana	1345
CMBN	Havana	1405
CMDC	Marianao	660
CMBW	Marianao	1010
CMCM	Havana	1405
CMBQ	Marianao	1500
CMCN	Marianao	925
CMCO	Marianao	660
CMGB	Matanzas	1205
CMGF	Matanzas	977
CMGH	Matanzas	1370
CMAB	Pinar del Rio	1249
CMAC	Pinar del Rio	1375
CMHI	Santa Clara	1110
CMKC	Santiago de Cuba	1034
CMHC	Tuinicu	790

CZECHOSLOVAKIA

Call	Location	Kc.
OKR	Bratislava	1075
OKB	Brunn	878
OKK	Kosice	1024
......	Moravska-Ostrava	1141
OKP	Prague	616

DANZIG

Call	Location	Kc.
PTB	Danzig	662

DENMARK

Call	Location	Kc.
......	Copenhagen	1067
OXO	Kalundborg	260

DOMINICAN REPUBLIC

Call	Location	Kc.
HIX	Santo Domingo	625

DUTCH EAST INDIES

Call	Location	Kc.
......	Bandoeng	968
PFC	Batavia	1364

EGYPT

Call	Location	Kc.
......	Cairo	869
......	Cairo	909

ESTONIA

Call	Location	Kc.
......	Tallinn	1013
......	Tallinn	747
......	Tartu	1050

FINLAND

Call	Location	Kc.
......	Abo	1219
......	Bjorenborg	1219
OFA	Helsingfors	1357
OFC	Jakobstad	1031
OFB	Lahti	167
OFD	Pori	1373
OFE	Tampere	662
OFG	Turku	1220
OFH	Viipuri	1031

FRANCE

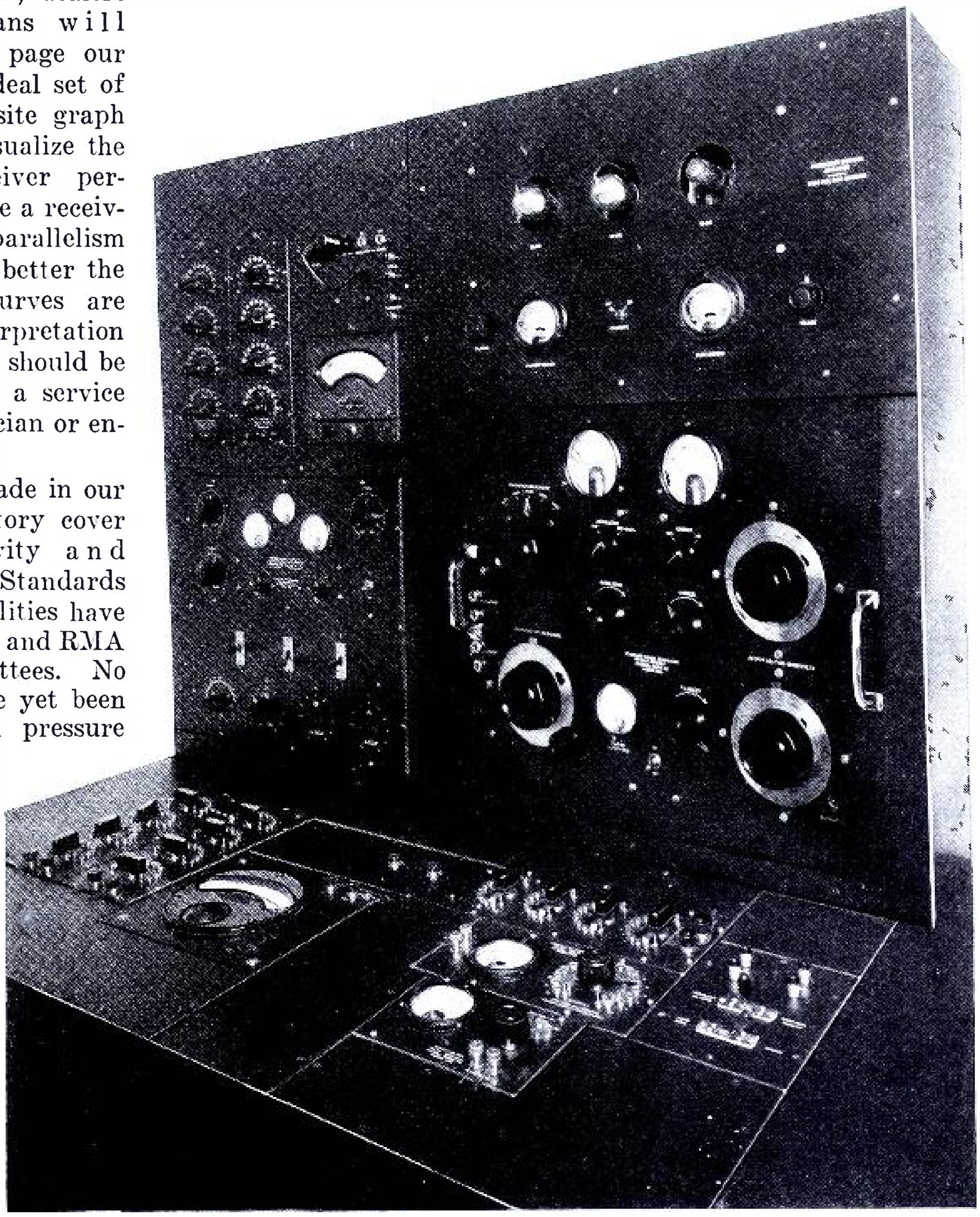
Call	Location	Kc.
F2BD	Agen	963
......	Beziers	1413
......	Bordeaux	986
......	Grenoble	915
......	Juan les Pino	1206
......	Lille	1132
......	Limoges	1020
YN	Lyon	644
YR	Lyon	1051
......	Marsan	750
......	Marseille	949
......	Montpellier	1049
......	Montpellier	1195
......	Nimes	1250
FL	Paris	207
FPTT	Paris	671
......	Paris	919
......	Paris	174
......	Paris	1265
......	Rennes	1103
MRD	Toulouse	1175
......	Toulouse	787
......	Vitus	971

Call	Location	Kc.
	GERMANY	
......	Aachen	1319
......	Aix la Chapelle	662
......	Augsburg	1112
......	Berlin I	717
......	Berlin II	1059
......	Bremen	950
......	Breslau	923
......	Cologne	1319
......	Dresden	940
......	Flensburg	1373
......	Frankfurt	769
......	Freiburg	524
......	Gleiwitz	1184
......	Hamburg	806
......	Hanover	535
......	Kassel	1220
......	Kaiserslautern	536
......	Kiel	1292
......	Konigsberg	1382
......	Langenberg	634
......	Leipzig	1158
......	Magdeburg	1060
......	Muehlacker	833
......	Munich	563
......	Munster	1319
......	Nurnberg	1255
......	Stettin	1060
......	Stuttgart	833
	GREAT BRITAIN	
2BD	Aberdeen	995
2BE	Belfast	1238
6BM	Bournemouth	1040
2LS	Bradford	1040
5WA	Cardiff	968
......	Daventry, Regional	626
......	Daventry, National	193
2DE	Dundee	1040
2EH	Edinburgh	1040
5SC	Glasgow	752
6KH	Hull	1040
2LS	Leeds	1500
6LV	Liverpool	1040
......	London, Regional	842
......	London, National	1150
2ZY	Manchester	796
5NO	Newcastle	1148
5PY	Plymouth	1040
6FL	Sheffield	1040
6ST	Stoke-on-Trent	1040
5SX	Swansea	1040
	GUATEMALA	
TGW	Guatemala City	571
	HAITI	
HHK	Port au Prince	920
	HOLLAND	
......	Bloemendaal	1220
PFBI	Hilversum	280
......	Hilversum	1004
PH9	Huizen	160
PCF	Scheveningen	280
	HONDURAS	
HRB	Tegucigalpa	1370
	HONG KONG	
ZBW	Victoria	845
	HUNGARY	
HAL	Budapest	550
	ICELAND	
......	Akureyri	1563
TFA	Reykjavik	1999
TFU	Reykjavik	250
	INDIA	
VUB	Bombay	840
VUC	Calcutta	810
VUL	Lahore	882
VUM	Madras	769
	IRISH FREE STATE	
6CK	Cork	750
2RN	Dublin	940
	ITALY	
1BA	Bari	...
1BZ	Bolzano	662
1FI	Firenze	...
1GE	Genoa	779
1MI	Milan	599
1NA	Naples	905
1PA	Palermo	1410
1RO	Rome	680
2RO	Rome	...
1TO	Torino	1094
1TR	Trieste	1211
	JAPAN	
JOLK	Fukuoka	680
JOFK	Hiroshima	850
JOJK	Kanazawa	710
JODK	Keijyo	820
JOGK	Kumamoto	790
JONK	Nagano	635
JOCK	Nagoya	810
JOKK	Okayama	700
JOBK	Osaka	750
JOIK	Sapporo	830
JOHK	Sendai	770
JOPK	Shizuoka	778
JOAK	Tokyo	870
	KENYA	
7LO	Nairobi	750
	KWANTUNG	
JQAK	Darien	759
	LATVIA	
YLZ	Riga	571
	LITHUANIA	
RYK	Kaunas	155
	LUXEMBURG	
LOAA	Luxemburg	1344
	MEXICO	
XFC	Aguascalientes	804
XFF	Chihuahua	923
XEQ	Ciudad Juarez	750
XEA	Guadalajara	1200
XEE	Linares	1000
XEY	Merida	547
XEX	Mexico City	1190
XEN	Mexico City	731
XEB	Mexico City	1030
XFG	Mexico City	638
XEG	Mexico City	910
XFI	Mexico City	591
XEO	Mexico City	940
XER	Mexico City	674
XFX	Mexico City	840
XEZ	Mexico City	588
XFZ	Mexico City	860
XEK	Mexico City	990
XEH	Mexico City	1130
XETA	Mexico City	1140
XEFA	Mexico City	1250
XET	Monterey	630
XEI	Morelia	1000
XEFE	Nuevo Laredo	980
XEP	Nuevo Laredo	1400
XEF	Oaxaca	1132
XEV	Puebla	1035
XED	Reynosa	961
XEL	Saltillo	1090
XFA	Tacubaya	500
XFA	Tacubaya	600
XEM	Tampico	841
XES	Tampico	890
XEC	Toluca	1333
XEU	Vera Cruz	800
XETF	Vera Cruz	680
XFE	Villahermosa	804
	MONACO	
......	Monaco	1266
	MOROCCO	
CNO	Casablanca	983
......	Rabat	414
	NEWFOUNDLAND	
VOGT	Bell Island	890
VONA	St. Johns	950
VOWR	St. Johns	675
VOX	St. Johns	1400
8WMC	St. Johns	682
8RA	St. Johns	550
	NEW ZEALAND	
1YA	Auckland	900
1ZR	Auckland	1090
1ZJ	Auckland	1320
1ZQ	Auckland	1188
3YA	Christchurch	980
3ZC	Christchurch	1199
2ZU	Dannevirke	1100
4YA	Dunedin	650
4ZB	Dunedin	1079
4ZO	Dunedin	1078
4ZM	Dunedin	1078
4ZL	Dunedin	1219
2ZE	Eketahuna	1210
2ZJ	Gisborne	1150
3ZR	Greymouth	820
1ZH	Hamilton	630
2ZI	Hastings	1330
2ZL	Hastings	1330
4ZP	Invercargill	1160
4ZI	Invercargill	1160
1ZM	Manurewa	1210
2ZD	Masterton	1180
2ZH	Napier	1260
2YB	New Plymouth	1230
2ZF	Palmerston North	1049
2ZO	Palmerston North	1120
2ZP	Wairoa	820
2ZK	Wanganui	600
2ZG	Wanganui	600
2ZR	Wanganui	600
2YA	Wellington	719
2ZW	Wellington	1120
	NORWAY	
LKA	Alesund	671
LKB	Bergen	824
LKD	Bodo	662
LKF	Fredriksstad	815
LKH	Hamar	527
LKK	Kristianssand	1274
LKN	Notodden	671
LKO	Oslo	280
LKP	Porsgrund	662
LKR	Rjuken	671
LKS	Stavanger	1247
LKM	Tromso	662
LKT	Trondelag	608
	PERU	
OAX	Lima	790
OA4M	Lima	1428
	PHILIPPINE ISLANDS	
KZRC	Cebu	937
KZRM	Manila	618
	POLAND	
SP3	Krakow	530
SP4	Kattowitz	710
SP7	Lodz	1229
SP6	Lwow	779
SP2	Poznan	875
SP8	Warsaw	1402
SP1	Warsaw	270
SP5	Wilno	690
	PORTUGAL	
CT1AA	Lisbon	942
	ROUMANIA	
......	Bucharest	759
	SALVADOR	
AQM	Salvador	785
RUS	Salvador	664
	SAMOA	
5ZA	Apia	940
	SIAM	
HSP1	Bangkok	857
HSP3	Bangkok	937
	SPAIN	
EAJ18	Almeria	1195
EAJ13	Barcelona	1119
EAJ1	Barcelona	860
EAJ15	Cartagena	1219
EAJ7	Madrid	708
EAJ2	Madrid	750
EAJ19	Oviedo	1119
EAJ8	San Sebastian	662
EAJ5	Seville	815
	SWEDEN	
SBE	Boden	250
SCA	Boras	1301
SCB	Eskilstuna	1220
SCC	Falum	932
SCD	Gavle	1471
SBB	Goteborg	932
SCE	Halmstad	1389
SCG	Halsingborg	1299
SBH	Horby	1167
SCF	Hudiksvall	1111
SCH	Jonkoping	1490
SCI	Kalmar	1220
SCJ	Karlskrona	1531
SCK	Karlstadt	1376
SCL	Kiruna	1220
SCM	Kristmehamm	1481
SCN	Malmberget	688
SBC	Malmo	1299
SBG	Motala	222
SCO	Norrkoping	1111
SCV	Orebro	1266
SCW	Ornskoldsvik	1376
SBF	Ostersund	389
SCP	Saffle	1220
SBA	Stockholm	688
SBD	Sundsvall	553
SCQ	Trollhattan	1112
SCR	Uddevalla	1058
SCS	Umea	1301
SCT	Uppsla	662
SCU	Varborg	1060
	SWITZERLAND	
HB3	Basel	941
......	Basel	1229
......	Berne	744
......	Berne	1220
......	Beromunster	653
......	Geneva	395
......	Lausanne	441
......	Sottens	743
HBZ	Zurich	653
	TUNISIA	
TNU	Carthage	162
TUA	Tunis	235
	TURKEY	
TAE	Angora	193
TAL	Istanbul	250
......	Osmanieh	250
	UNION OF SOVIET SOCIALIST REPUBLICS	
RW19	Achkhabad	333
RW60	Alma-Alta	310
RW36	Arkhangelsk	770
RW35	Astrakhan	435
RW8	Bakou	238
RW43	Bakou	238
RW30	Dnepropetrovsk	511
RW21	Erivan	404
RW40	Gomel	621
RW23	Groznyi	676
RW14	Irkoutsk	187
RW31	Ivanovo-Voznesensk	603
RW46	Karaganda	686
RW17	Kazan	550
RW17	Kazan	644
RW54	Khabarovsk	1052
RW54	Khabarovsk	320
RW4	Kharkov	320
RW20	Kharkov	704
RW9	Kiev	368
RW9	Kiev	290
RW33	Krasnodar	650
RW53	Leningrad	300
RW27	Makhatch Kala	795
RW10	Minsk	429
RW1	Moscow	202
RW2	Moscow	417
RW37	Moscow	792
RW39	Moscow	792
RW58	Moscow	272
RW58	Moscow	268
RW49	Moscow	230
RW51	Naltchik	748
RW42	Nijni-Novgorod	394
RW6	Novosibirsk	238
RW13	Odessa	666
RW44	Omsk	471
RW45	Orenbourg	461
RW22	Oufa	444
RW22	Oufa	617
RW67	Oukhta	354
RW56	Penza	640
RW29	Petrozavodsk	468
RW29	Petrozavodsk	779
RW24	Piatigorsk	468
RW55	Pokrovsk	730
RW12	Rostov-sur-le-Don	353
RW16	Samara	521
RW16	Samara	404
RW18	Samarkand	342
RW3	Saratov	340
RW52	Simferopol	630
RW52	Simferopol	725
RW24	Smolensk	531
RW47	Stalinabad	421
RW26	Stalino	810
RW32	Stavropol	608
RW38	Sverdlovsk	157
RW5	Sverdlovsk	363
RW11	Syktykvaz	560
RW11	Tachkent	256
RW7	Tiflis	280
RW48	Tomsk	645
RW63	Verkhneoudinsk	350
RW64	Vladikavkag	752
RW28	Vladivostok	634
RW28	Vladivostok	725
RW25	Voronej	385
RW25	Voronej	450
	URUGUAY	
CX6	Montevideo	650
CX10	Montevideo	730
CX12	Montevideo	770
CX14	Montevideo	810
CX16	Montevideo	850
CX18	Montevideo	890
CX20	Montevideo	930
CX22	Montevideo	970
CX26	Montevideo	1050
CX30	Montevideo	1130
CX32	Montevideo	1170
CX34	Montevideo	1210
CX36	Montevideo	1250
CX38	Montevideo	1290
CX40	Montevideo	1330
CX44	Montevideo	1410
CX46	Montevideo	1450
CX48	Montevideo	1490
CW40	Paysandu	1340
CW44	Paysandu	1420
CW32	Salto	1180
CW34	Salto	1220
CW36	Salto	1260
CW38	Salto	1300
CW30	Tucuarembo	1140
	UNION OF SOUTH AFRICA	
ZTC	Capetown	800
ZTD	Durban	738
ZTJ	Johannesburg	666
	VENEZUELA	
AYRE	Caracas	800
1BC	Caracas	960
	YUGOSLAVIA	
......	Belgrade	696
......	Ljubljano	527
......	Zagreb	977

FOREIGN SHORT WAVE PHONE STATIONS

Call	Location	Kc.
	ARGENTINA	
LSX	Buenos Aires	10,352
LSG	Buenos Aires	19,900
LSN	Buenos Aires	21,200
	AUSTRALIA	
VK3ME	Melbourne	9,510
VK6AG	Perth	7,194
VK2ME	Sydney	10,526
VLK	Sydney	10,526
	AUSTRIA	
....	Vienna	13,514
UOR2	Vienna	11,801
OUITH	Vienna	8,060
UOR2	Vienna	6,072
OHK2	Vienna	4,274
	BELGIUM	
	BOLIVIA	
	BRAZIL	
PPU	Rio de Janeiro	6,122
PPU	Rio de Janeiro	19,270
	BRITISH COLONIES	
VRY	Georgetown, Guiana	6,726
TJW	Hamilton, Bermuda	9,500
....	Mombras, Kenya	13,895
....	Mombras, Kenya	8,230
VQ7LO	Nairobi, Kenya	6,100
VS6WX	Singapore	7,190
	CANAL ZONE	
	CANADA	
VE9GW	Bowmanville, Ont.	6,095
VE9GW	Bowmanville, Ont.	11,810
VE9GW	Bowmanville, Ont.	24,380
VE9CG	Calgary, Alta.	6,110
VE9CA	Calgary, Alta.	6,030
VE9CA	Calgary, Alta.	11,860
VE9DR	Drummondville, Que.	11,780
VE9CF	Halifax, N. S.	6,050
VE9CL	Middlechurch, Man.	6,150
VE9DN	Montreal, Que.	6,005
VE9DN	Montreal, Que.	9,580
VE9DN	Montreal, Que.	11,895
VE9BA	Montreal, Que.	6,130
VE9BA	Montreal, Que.	11,705
VE9BA	Montreal, Que.	15,190
VE9AK	Red Deer, Alta.	2,830
VE9BJ	St. John, N. B.	6,090
VE9CS	Vancouver, B. C.	6,070
	CURACAO	
PJZ	Curacao	11,718
	CZECHOSLOVAKIA	
....	Bratislava	5,000
OK1MPT	Prague	5,119
OK1MPT	Prague	4,412
	CHILE	
	CHINA	
XCTE	Shanghai	5,000
	COLOMBIA	
HKA	Barranquilla	5,837
HKD	Barranquilla	6,993
HKF	Bogota	7,194
HKF	Bogota	7,610
HKC	Bogota	6,250
HKX	Bogota	6,977
HKX	Bogota	7,143
	COSTA RICA	
TIH	Heredia	9,734
	CUBA	
CM2LA	Havana	10,007
CM2MK	Havana	9,360
CM6XJ	Tuinucu	15,008
	DANZIG	
EK4ZZZ	Danzig	7,500
	DENMARK	
OXZ	Skamlaback	9,520
	DOMINICAN REPUBLIC	
HIX	Santo Domingo	4,610
	DUTCH EAST INDIES	
PMB	Bandoeng	20,620
PLE	Bandoeng	18,830
PLG	Bandoeng	15,957
PMY	Bandoeng, Java	5,172
PK2AF	Djocjacorta, Java	6,000
PK6KZ	Makassar	11,765
PK2AG	Semerang, Java	2,609
PK3AN	Surabaya, Java	6,036
....	Surabaya	2,143
PK1AA	Weltevreden, Java	4,000
	ECUADOR	
....	Riobamba	7,540
	EGYPT	
	ESTONIA	
	FIJI	
VPD	Suva	14,430
	FINLAND	
	FRANCE	
....	Agen	9,760
FYR	Lyons	7,463
FYR	Lyons	5,172
....	Nancy	19,350
F8AV	Nogent	3,750
FLJ	Paris	9,230
F8LH	Paris	7,317
....	Paris	6,860
F8GC	Paris	4,918
....	Pontoise-Seine-et-Oise	11,720
....	Pontoise-Seine-et-Oise	11,905
....	Pontoise-Seine-et-Oise	15,243
F8BP	Rugles	5,455
FTD	St. Assise	19,840
FRO	St. Assise	19,417
FRE	St. Assise	19,417
FTM	St. Assise	19,355
FTO	St. Assise	18,248
FTE	St. Assise	18,248
FSE	St. Assise	13,441
FQO	St. Assise	12,161
FQE	St. Assise	12,161
FTN	St. Assise	12,265
FTL	St. Assise	9,950
FTF	St. Assise	7,770
FTB	St. Assise	7,490
....	Touraine	7,500
....	Toulouse	6,122
	FRENCH COLONIES	
FM8KR	Constantine	7,009
FM8KR	Constantine	3,750
	GERMANY	
....	Elberswalde	7,407
D4AFF	Kothen	7,042
DHA	Nauen	11,760
DHC	Nauen	15,200
....	Nauen	6,020
DGW	Nauen	17,760
....	Nauen	9,560
	GREAT BRITAIN	
GBK	Bodmin	18,105
GBK	Bodmin	9,260
G5SW	Chelmsford	11,750
GBX	Rugby	16,164
GBS	Rugby	18,310
GBW	Rugby	18,138
GBW	Rugby	14,493
GBU	Rugby	12,290
GBX	Rugby	12,195
GBS	Rugby	12,195
GBS	Rugby	9,020
GBS	Rugby	6,993
G2MN	Sonning-on-Thames	14,320
	HAITI	
	GUATEMALA	
	HOLLAND	
PBF5	Hague	6,438
PCJ	Hilversum	9,590
PCJ	Hilversum	15,220
PHI	Huizen	17,775
PCK	Kootwijk	18,400
PCV	Kootwijk	17,836
	HONDURAS	
HRB	Tegucigalpa	6,170
	HUNGARY	
HAT	Szekesfehervar	9,125
	ICELAND	
	INDIA	
VUC	Calcutta	11,870
	INDO-CHINA	
F31CD	Chi-hoa	6,122
FZR	Saigon	16,216
FZR	Saigon	12,043
	IRISH FREE STATE	
	ITALY	
I2RO	Rome	11,811
I2RO	Rome	3,750
IMA	Rome	6,897
I2RO	Rome	3,750
....	Turin	3,750
HVJ	Vatican City	5,968
HVJ	Vatican City	15,120
	JAPAN	
J1AA	Kemikawa	17,391
J1AA	Kemikawa	8,000
	JUGOSLAVIA	
....	Belgrade	10,000
	LATVIA	
	LITHUANIA	
	MADAGASCAR	
....	Tananarive	6,000
	MADEIRA	
CT3AG	Funchal	6,383
	MEXICO	
XDA	Mexico City	14,634
XDA	Mexico City	9,380
XDA	Mexico City	6,818
XFD	Mexico City	6,667
XFD	Mexico City	9,091
XFD	Mexico City	11,111
XFA	Mexico City	6,977
XFA	Mexico City	7,143
XFA	Mexico City	21,249
	MONACO	
	MOROCCO	
CN8MC	Casablanca	6,881
CN8MC	Casablanca	5,882
....	Rabat	12,610
....	Rabat	9,300
....	Rabat	12,605
....	Rabat	9,300
	NEWFOUNDLAND	
VO8A	St. Johns	6,800
	NEW ZEALAND	
ZL2XX	Wellington	9,550
	NORWAY	
	PERU	
	PHILIPPINE ISLANDS	
KA1XR	Manila	12,245
KZRM	Manila	11,840
KZRM	Manila	9,570
KZRM	Manila	6,140
	POLAND	
....	Poznan	11,001
....	Poznan	8,900
	PORTUGAL	
PT1AA	Lisbon	7,143
....	Oporto	12,000
	ROUMANIA	
YO1	Bucharest	13,950
	SALVADOR	
	SHIP PHONE STATIONS	
GMJQ	SS. Belgenland	17,650
GMJQ	SS. Belgenland	13,040
GMJQ	SS. Belgenland	8,570
GMJQ	SS. Belgenland	4,762
DDDX	SS. Bremen	11,710
DDDX	SS. Bremen	7,560
IBDX	SS. Electra (Marconi's Yacht)	11,240
....	SS. Hamburg	13,040
GDLJ	SS. Homeric	12,380
GDLJ	SS. Homeric	4,754
WSBN	SS. Leviathan	8,830
WSBN	SS. Leviathan	6,637
WSBN	SS. Leviathan	4,392
WSBN	SS. Leviathan	3,429
GFWV	SS. Majestic	17,590
GFWV	SS. Majestic	13,228
GFWV	SS. Majestic	4,430
GFWV	SS. Majestic	4,180
GLSQ	SS. Olympic	12,387
GLSQ	SS. Olympic	16,456
GLSQ	SS. Olympic	8,840
	SIAM	
HS2PJ	Bangkok	10,169
HSP2	Bangkok	9,500
HSP2	Bangkok	7,300
	SPAIN	
EAJ1	Barcelona	15,789
EAR96	Barcelona	6,522
EAR25	Barcelona	6,000
EAR58	Las Palmas, Canary Islands	7,210
EAR110	Madrid	7,026
EAR125	Madrid	7,026
EAJ25	Malaga	3000
EAR113	Viscaya	6,522
	SWEDEN	
....	Motala	6,070
	SWITZERLAND	
HB9OC	Berne	9,130
HB9XD	Zurich	9,380
HB9XD	Zurich	7,229
HB9XD	Zurich	3,488
	TURKEY	
	UNION OF SOVIET SOCIALIST REPUBLICS	
RW15	Khabarovsk	4,273
RW3KAA	Leningrad	8,333
....	Leningrad	11,111
....	Leningrad	10,526
RW62	Minsk	6,420
RW61	Moscow	51,724
RW38	Moscow	5,514
RW59	Moscow	6,000
RW65	Peredvijka	3,560
RW19	Tomsk	8,111
	URUGUAY	
	UNION OF SOUTH AFRICA	
ZTJ	Johannesburg	9,380
	VENEZUELA	

Receiver Performance Curve Section



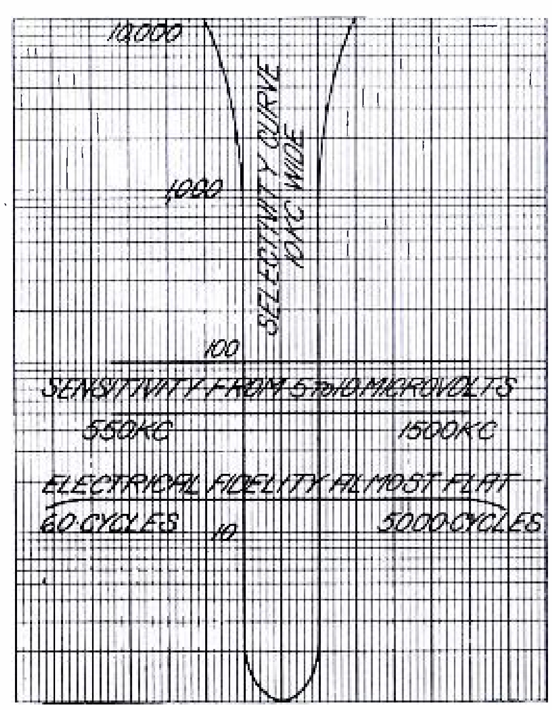
SERVICE men, dealers and technicians will find on this page our conception of an ideal set of curves. The composite graph may be used to visualize the best possible receiver performance. The more a receiver's curves near parallelism with the ideal, the better the receiver. These curves are not capable of interpretation by a layman. They should be translated only by a service man, dealer, technician or engineer.

Measurements made in our engineering laboratory cover sensitivity, selectivity and electrical fidelity. Standards for these three qualities have been set by the IRE and RMA engineering committees. No standards have yet been adopted for sound pressure measurements. Until a standard is selected, our laboratory will measure only electrical fidelity, which disregards speaker response curves. The fourth measurement appearing with the sensitivity, selectivity and electrical fidelity curves represents power overload curves, or automatic volume control curves, as the case may be.

Definitions of the three major characteristics of a receiver are:

Sensitivity is that characteristic of a receiver which determines *to how weak* a signal it is capable of responding. It is measured quantitatively in terms of the input voltage required to give standard output. The ideal sensitivity, according to the graph on this page, would fall between the two lines, ranging from 10 to 5 microvolts (absolute) or less. This is an arbitrary value.

Selectivity is the degree to which a receiver is capable of *differentiating between* the desired signal, and signals of other carrier frequencies. This characteristic is not expressible by a single numerical value, but requires one or more graphs for its expression. Best selectivity possible would be somewhat like a "chimney" whose sides would be 10 kilocycles apart nearly all the way up the graph sheet. Selectivity as measured by our laboratory only concerns itself with energy entering the receiver via the input circuit (disregarding shielding effectiveness), since no standard has as yet been adopted to simulate selectivity conditions in the field.



Ideal Composite Curve

Fidelity is the degree to which the receiver *accurately reproduces* at its output terminals, the modulated form of the received wave impressed upon it. Ideal electrical fidelity curve would be a horizontal line almost flat over the frequency range from 60 to 5000 cycles. This range is also of an arbitrary width.

The photograph illustrates the equipment used in making the measurements. It conforms to the specifications of the IRE and RMA Standardization Committees. All test frequencies are determined by zero beat of a crystal-controlled dynatron oscillator. Voltmeters and microvoltmeters are periodically checked against calibrated standards for accuracy of adjustment. Individual conditions of measurement pertaining to each receiver will be found in the text accompanying each family of curves.

Since curves of all receivers are taken under the same conditions, it may be said that such curves constitute a yardstick by which receivers of the same general class may be compared, as long as this analysis is made by those technically competent to do so.

Audiola Model 13-S7

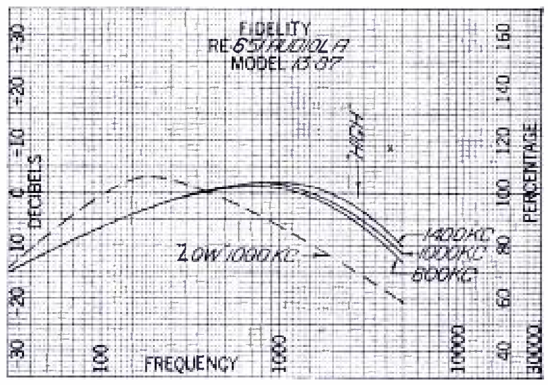
AUDIOLA'S model 13-S7 produced the included overall performance curves when recent measurements were made on it in our laboratory.

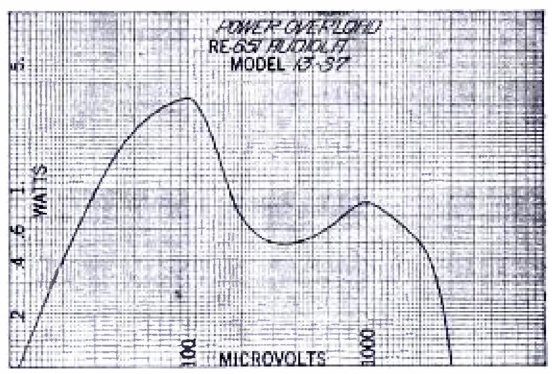
To couple the signal generator output to the input circuit of the chassis, a standard dummy antenna of 20 uh, 200 uuf and 25 ohms was used. A

noninductive load resistance of 7000 ohms was connected across the plate circuit of the single 247 pentode output tube, which in turn was capacitatively coupled to the output indicating tube voltmeter, which read the standard audio level of .05 watts, except for power overload measurements. To prevent its impedance reflection on the plate circuit of the output tube, the voice coil circuit was disconnected during measurements.

In all tests, the volume control was adjusted for maximum receiver sensitivity, the tuned circuits were not altered from factory alignment, and the tubes which were used in the chassis were of average characteristics, furnished by our laboratory because they were not shipped with the chassis. A line current of .60 amperes was drawn with an impressed voltage of 111 volts.

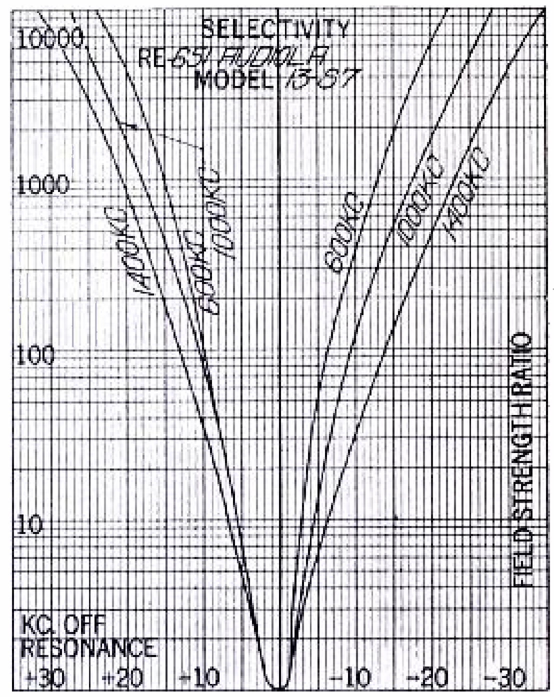
In column 1 the sensitivity curve gives an average value of 10 micro-





volts absolute, which corresponds to 2.5 microvolts per meter when a standard height antenna is employed. Maximum noise level of 24.2 per cent occurred at 1000 kc, while the minimum value of 2.8 per cent was measured at 1400 kc. At 1000 kc the measured image ratio was 2110, which was taken with an impressed signal at 1350 kc with the receiver tuned to 1000 kc. In column 2 we find the maximum power output as taken from the power overload curve to be 3.30 watts, but this figure does not take into account the distortion at this level. The selectivity curves are printed in column 3, and under them will be found the band widths in tabular form.

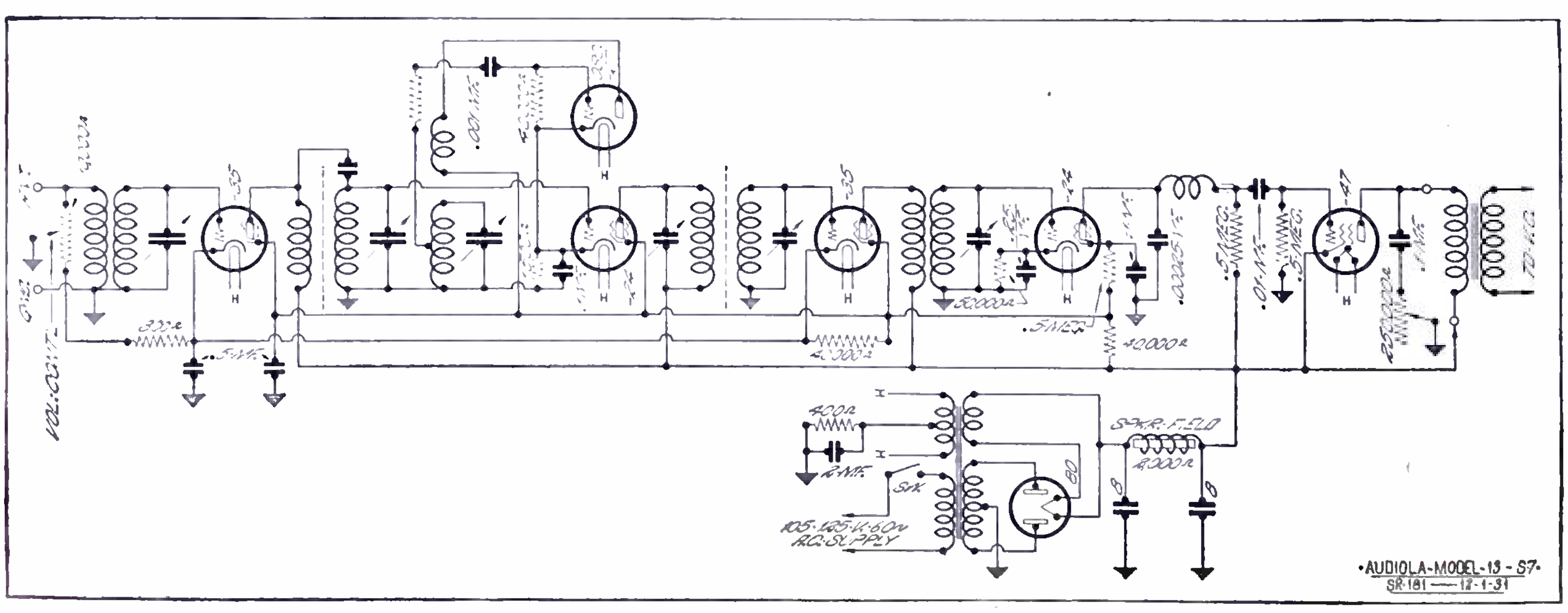
Below is a schematic wiring diagram of the Audiola superheterodyne. Tubes required for operation are a



235 r-f, 227 oscillator, 224 first detector, 235 second i-f, 224 second detector, 247 pentode output tube, and a 280 full wave rectifier. It will be noted that the only filtration is furnished by the 2000 ohm speaker field bypassed on each side with an 8 mfd electrolytic condenser.

Band Widths

Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	8	10	13.5
100	16.5	20	27
1000	28	35	44
10000	46	55.5	66.5



Brunswick Model E

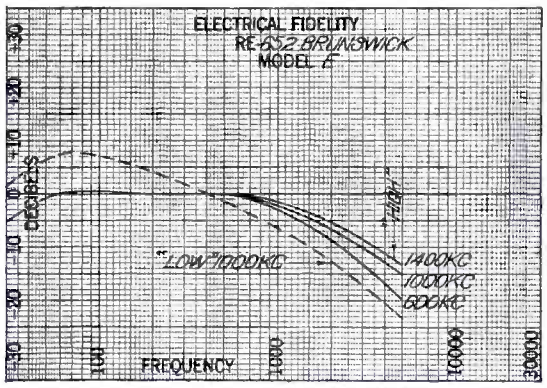
BRUNSWICK model E curves which are shown on this page were made from recent data taken in our laboratory.

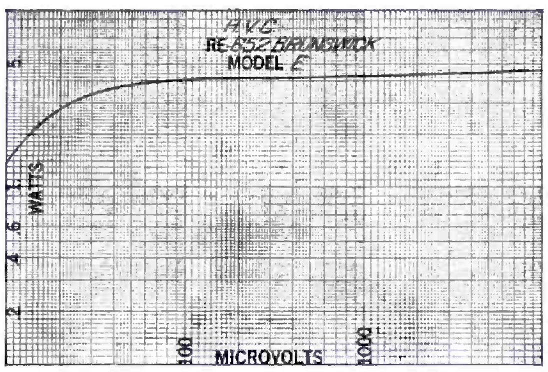
Output of the standard signal generator was fed to the input circuit of this superheterodyne by means of the standard dummy antenna of 20 uh, 200 uuf, and 25 ohms. To match the optimum plate load of the parallel 247 type pentodes, a load resistance of 3500 ohms was connected across the output circuit. To eliminate any undesired impedance being reflected from the voice coil circuit into the primary circuit, the former circuit was opened during all measurements. The plates of the 247 tubes were capacitatively coupled to the output indicating tube voltmeter, which read the equivalent voltage for a standard level of .05 watts.

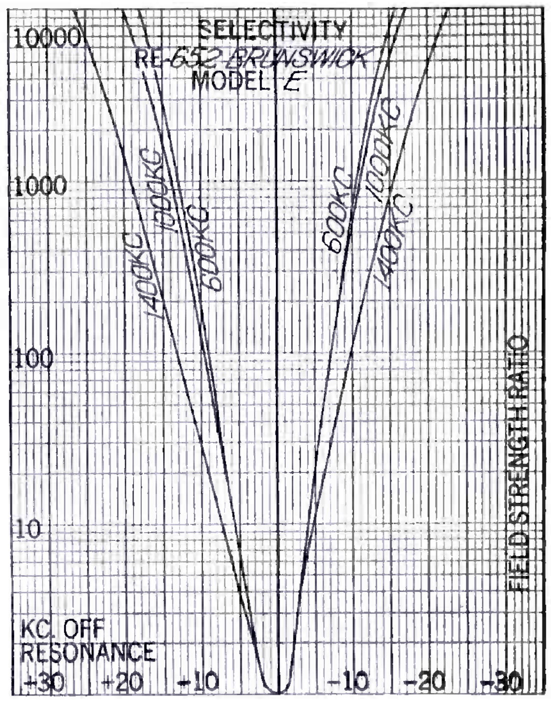
The receiver drain was .87 amperes with a line voltage of 114 volts. No changes were made in the alignment of tuned circuits from factory adjustment, the volume control was set for maximum receiver sensitivity, and the tubes employed were those furnished with the receiver as standard equipment.

From the sensitivity curve of column 1 the average is taken as 3.49 microvolts absolute, which is the equivalent of .37 microvolts per meter when a standard four-meter antenna is used. Noise level values as measured were 41.8 per cent at 1000 kc, the point of greatest sensitivity, and 8.4 per cent at 600 kc, the minimum value. An image ratio of 8910 was found with the receiver tuned to 1000 kc. In column 2 is the automatic volume control curve which gives a maximum output, at 10,000 microvolts input, of 4.57 watts. However, this figure does not take into consideration the harmonics which are present in the wave form. Under the selectivity curves of column 3 are the band widths which were taken from them.

At the bottom of the page will be found the schematic wiring diagram of this Brunswick receiver. The nine tubes required are a 551 r-f, 224 first detector, 224 oscillator, 551 second i-f, 224 second detector, 227 automatic volume control tube, parallel 247 pentodes, and a 280 rectifier. From the diagram it can also be seen that the dynamic speaker employs a "bucking" coil for the elimination of hum.

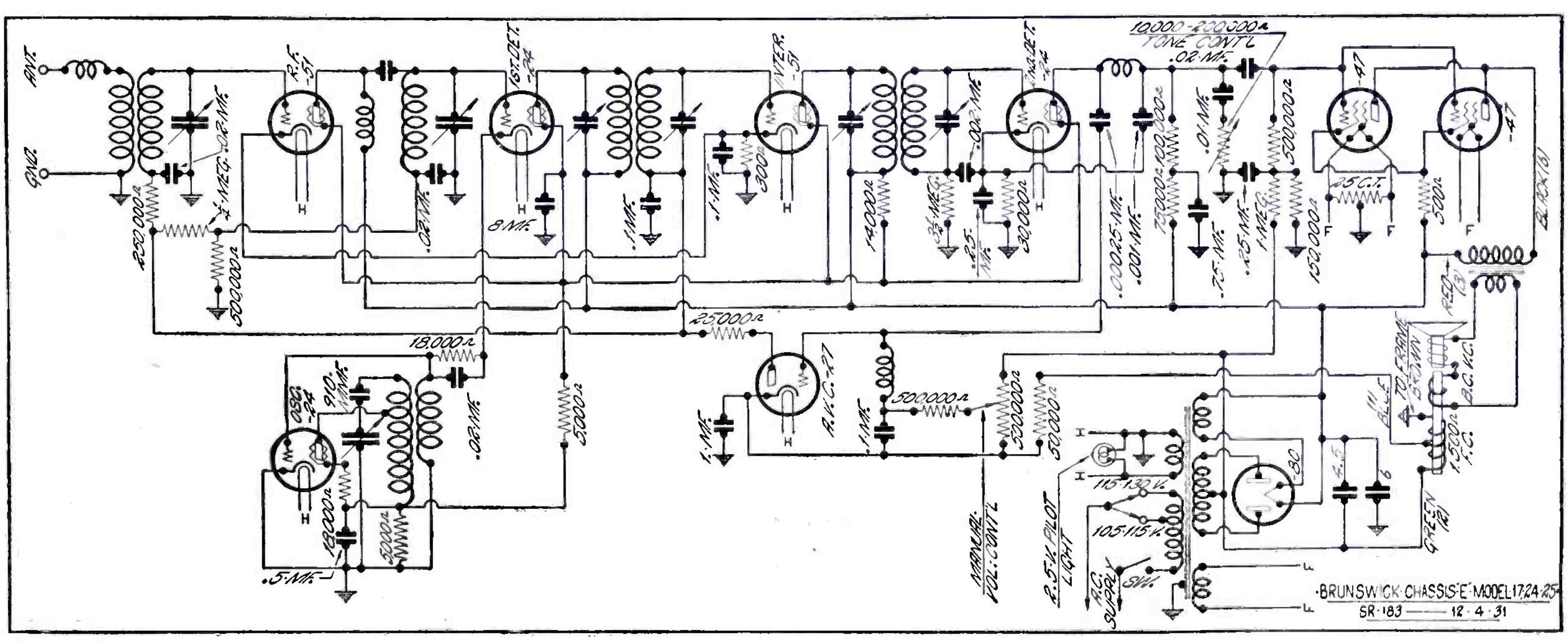






Band Widths

Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	9.5	9.5	12
100	16	16.5	23
1000	23.5	25	34.5
10000	33.5	37	49



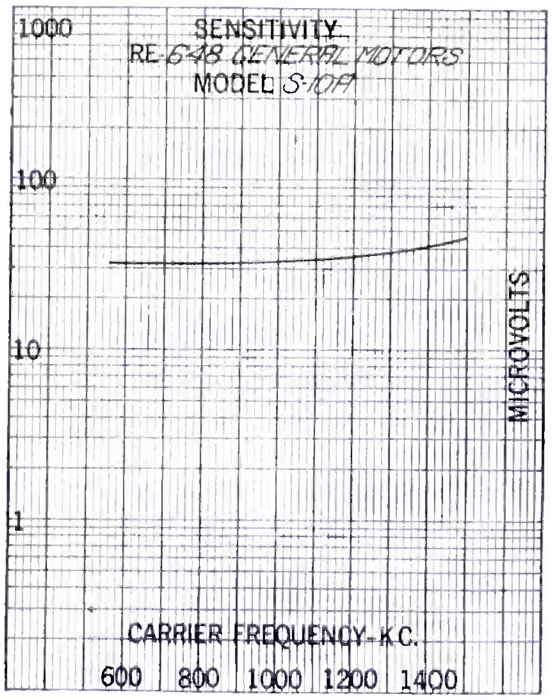
General Motors Model S-10A

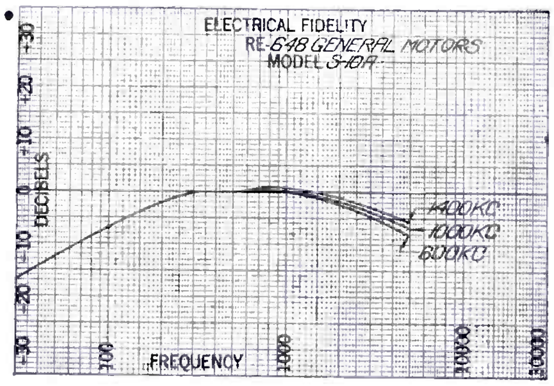
GENERAL MOTORS' model S-10A produced the included performance curves when measured in our laboratory.

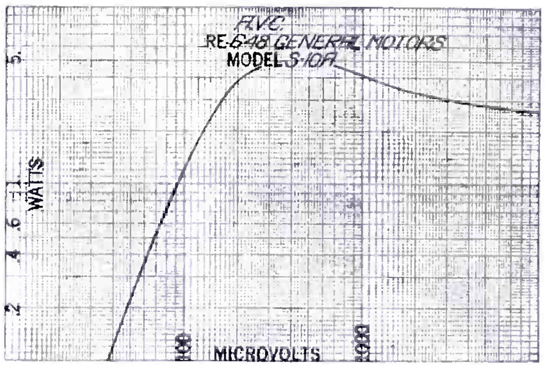
A standard dummy antenna of 20 uh, 200 uuf and 25 ohms coupled the signal generator output to the receiver input circuit. A non-inductive resistance of 7000 ohms was connected across the plate circuit of the single 247 pentode output tube to make its proper plate load, and the output meter was capacitatively coupled to the plate and indicated .05 watts as the standard audio level. The voice coil circuit was broken to eliminate any undesirable reflected impedance in the primary circuit. A line voltage of 117 volts gave the receiver a drain of .74 amperes. For test purposes the tubes furnished with the receiver were used, the volume control was turned on full, and no changes were made in the alignment of the tuned circuits.

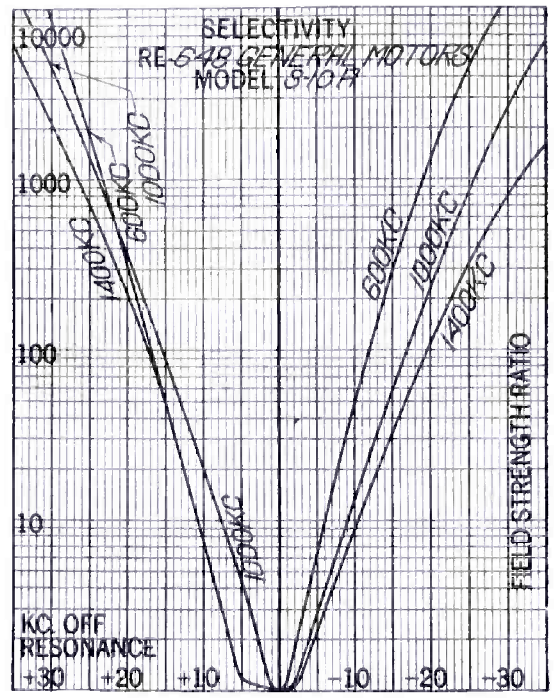
Average sensitivity is found to be 33.1 microvolts absolute from the curve of column 1, which corresponds to 8.3 microvolts per meter. A maximum noise level of 6.8 per cent was measured at 1000 kc, while the minimum of 1.1 per cent occurred at 600 kc. Measured image ratio at 1000 kc was found to be 10,000 times. From the automatic volume control curve of column 2 the maximum output is found to be 5.02 watts, but this figure does not take into account introduced harmonics in the wave form across the primary of the output transformer. In column 3 is a tabulated list of band widths under the selectivity curves from which they were taken.

Below is a schematic wiring diagram of this superheterodyne. Tubes required for operation are a 235 first detector, 235 second i-f, 227 oscillator, 224 second detector, 227 automatic volume control tube, 247 pentode, and a 280 rectifier.



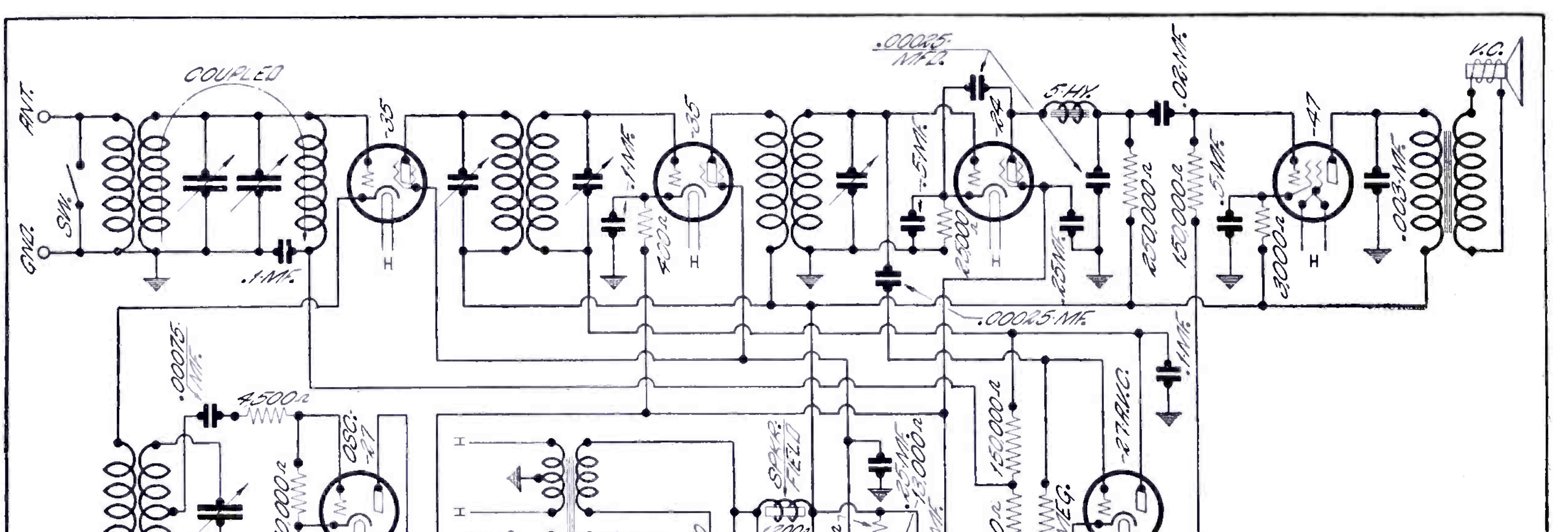






Band Widths

Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	17	17.5	21.5
100	29	32.5	37
1000	42	49.5	58
10000	59.5	72	—

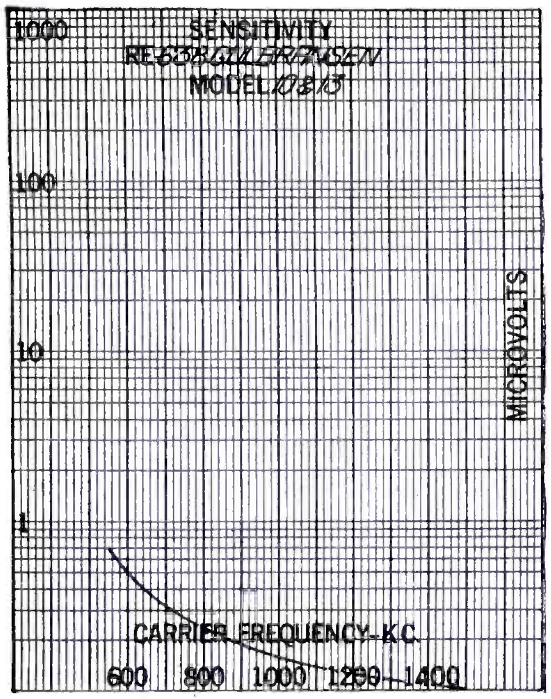


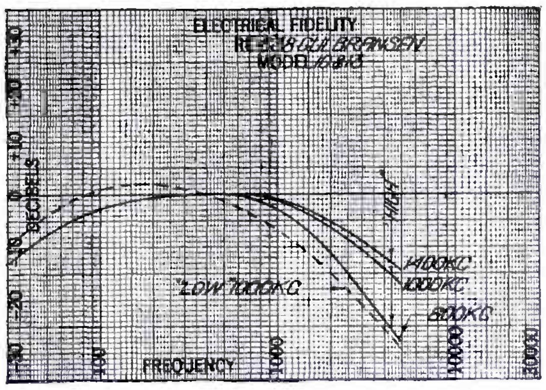
Gulbransen Models 10, 13

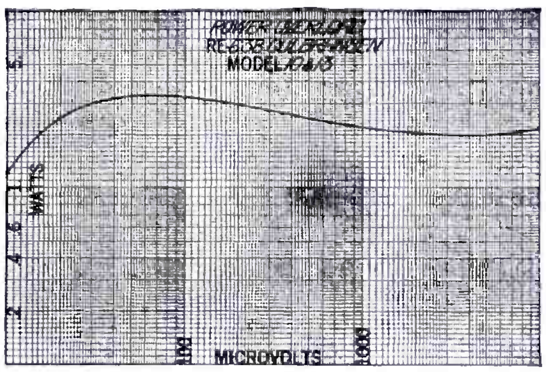
MEASUREMENTS made in our laboratory produced the included curves as being indicative of the performance of the Gulbransen models 10 and 13 superheterodynes.

Input to the receiver antenna circuit was through the dummy antenna standard of 20 uh, 200 uuf and 25 ohms, while the receiver output was maintained at the standard audio level of .05 watts. A non-inductive load resistance of 7000 ohms matched the operating impedence of the single 247 output tube employed. The plate was capacitatively coupled to the output indicating tube voltmeter, and to avoid the loading effect of the voice coil on the primary of the speaker transformer, the secondary circuit was broken.

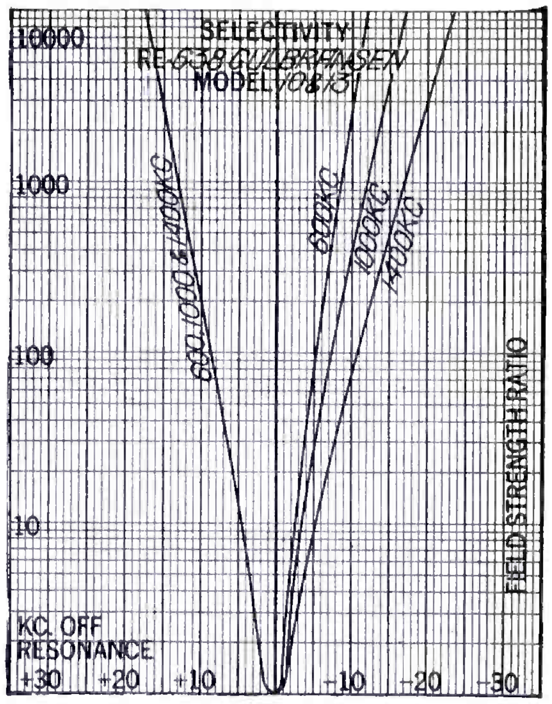
In all the receiver tests the volume control was set for maximum receiver sensitivity, and the factory alignment of the tuned circuits was not altered. Because no tubes were furnished with the chassis, those selected were of average operating characteristics. With an a-c line voltage of 112 volts, the receiver drain was .75 amperes.







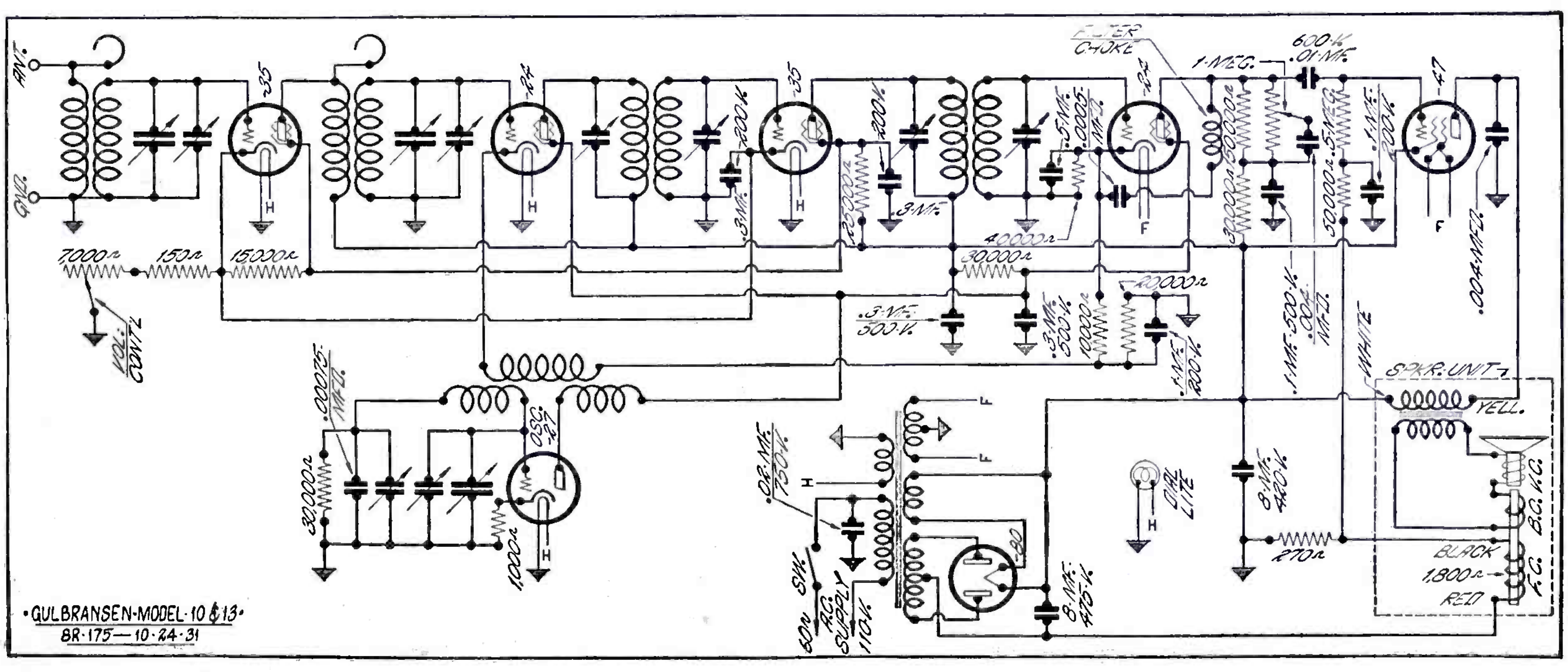
From the sensitivity curve of column 1, the average value is taken as .25 microvolts absolute or .0625 microvolts per meter, assuming a standard antenna of four meters effective height. At 600 kc the noise level is a minimum, with a value of 9 per cent, while it reaches a maximum of 38 per cent at 1400 k-c, which is the point of greatest sensitivity checked. The image ratio is calculated to be 21,500 from the input of 1350 kc, with a receiver tuned to 1000 kc. Under the selectivity curves of column 3 are the tabulated band widths from which they were measured. A maximum power output of 3.32 watts was reached, but this figure disregards the harmonics which may have been introduced into the wave form of the output.



The schematic wiring diagram is given below. Tubes required for operation are a 235 r-f, 224 first detector, 227 oscillator, 235 second r-f, 224 second detector, 247 output pentode, and a 280 rectifier.

Band Widths

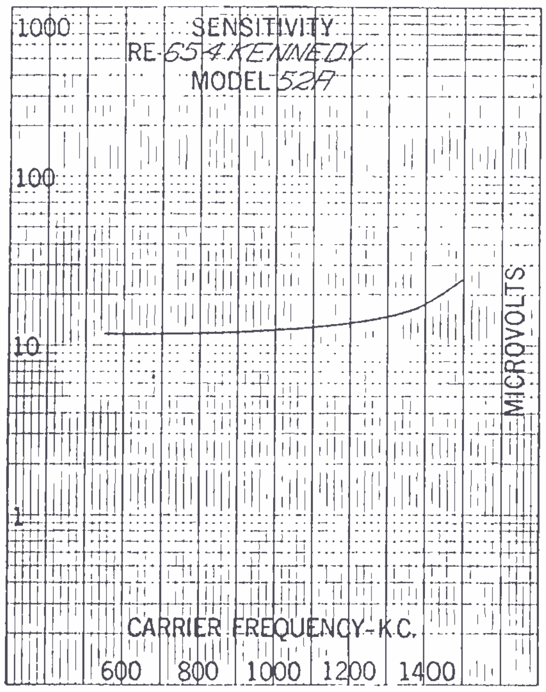
Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	7	8	10
100	14.5	16.5	20
1000	21.5	25	30.5
10000	29.5	34.5	41



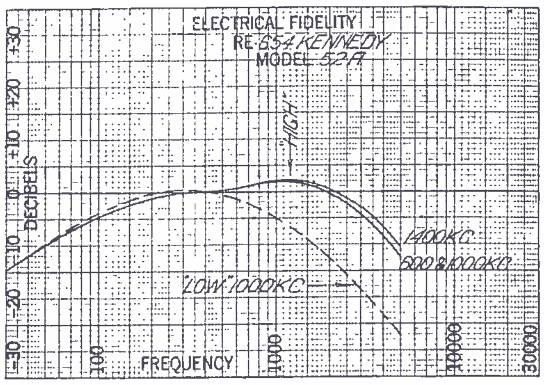
Kennedy Model 52A

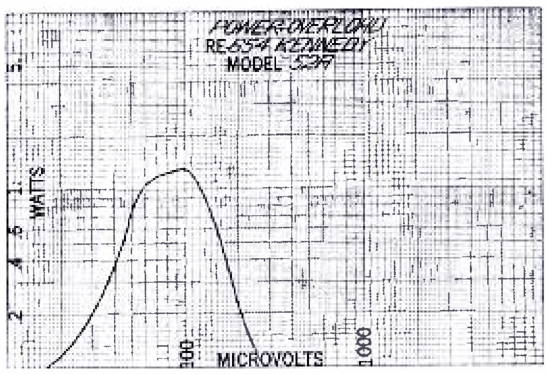
KENNEDY'S model 52-A upon measurement in our laboratory gave the included over-all response curves.

For receiver input, a standard dummy antenna of 20 uh, 200 uuf and 25 ohms was coupled between the signal generator output and the antenna circuit. A non-inductive load resistance of 7000 ohms was used to match the output impedance of the single 247 tube, the plate of which was capacitatively coupled to the output indicating voltmeter, reading a standard level of .05 watts. The voice coil circuit was opened during all measurements to prevent any undesired load being reflected on the primary circuit.

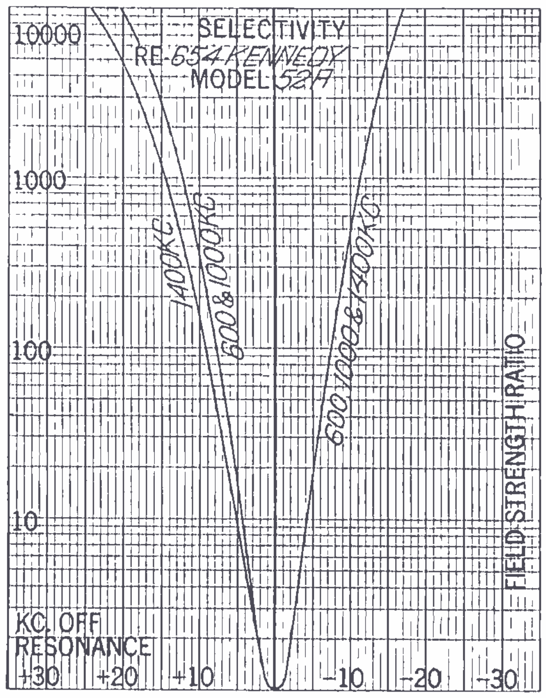


A line voltage of 117 volts made the receiver line current .66 amperes. In all tests the tubes as furnished by the manufacturer were employed, the volume control was turned on full, and no realignment of tuned circuits was made in the laboratory.





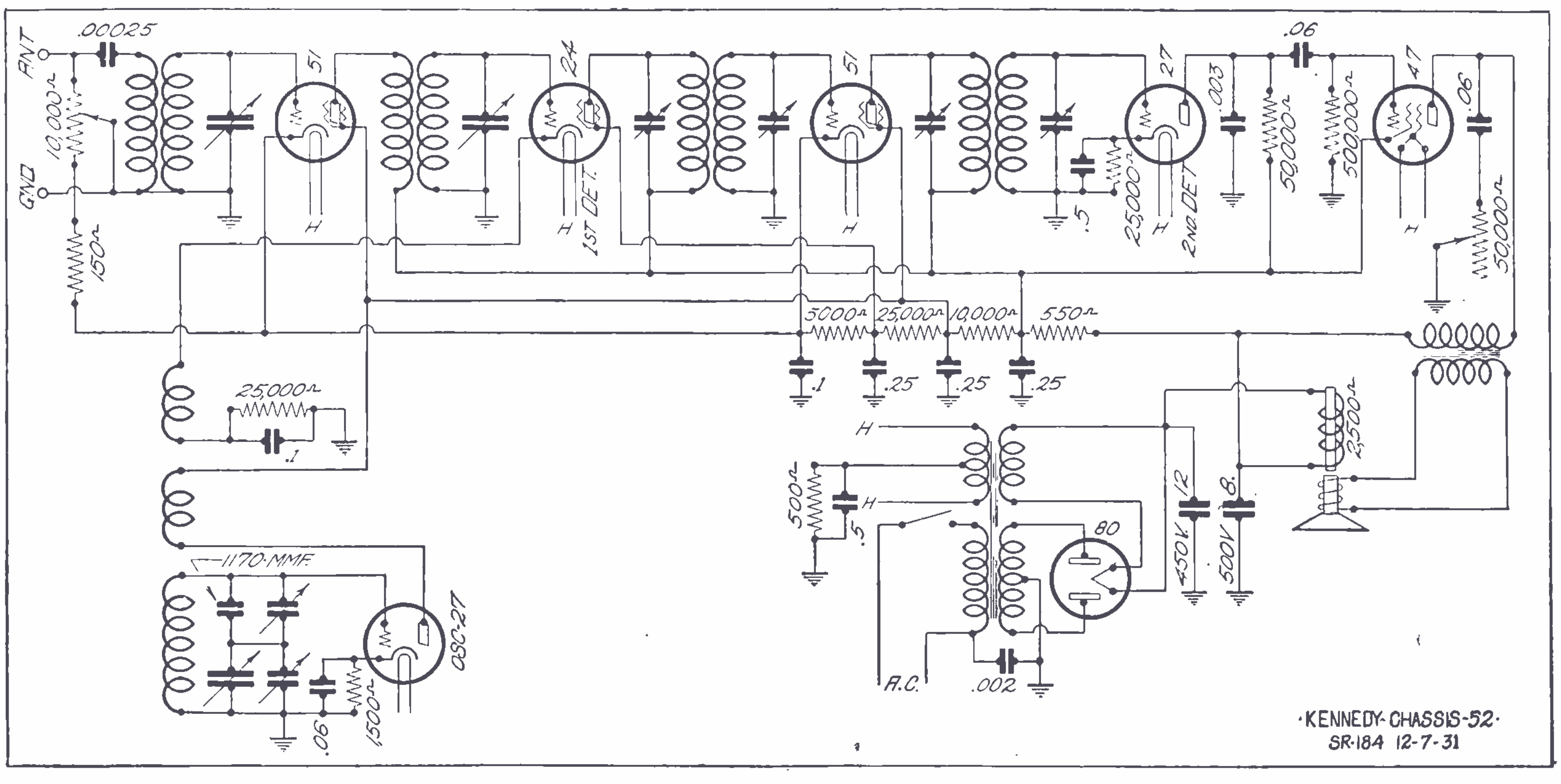
An average sensitivity of 14.5 microvolts absolute is found from the curve of column 1, which is equivalent to 3.625 microvolts per meter. At 600 kc the minimum noise level of 5.7 per cent was measured, while a maximum of 44 per cent occurred at 1400 kc. An image ratio of 3770 was found with the receiver tuned to 1000 kc. From the power overload curve of column 2, the maximum output is recorded as 1.27 watts, but no consideration was made of the harmonics in the wave form at this power level. Band widths will be found tabulated under the selectivity curves of column 3.



At the bottom of the page is the schematic wiring diagram of the receiver, from which we find the required tubes to be a 551 r-f, 224 first detector, 551 second i-f, 227 second detector, 227 oscillator, 247 pentode, and a 280 rectifier.

Band Widths

Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	9	10	10
100	15.5	17.5	17.5
1000	23.5	26.5	26.5
10000	37	41	41



Kolster Models K-90 & 92

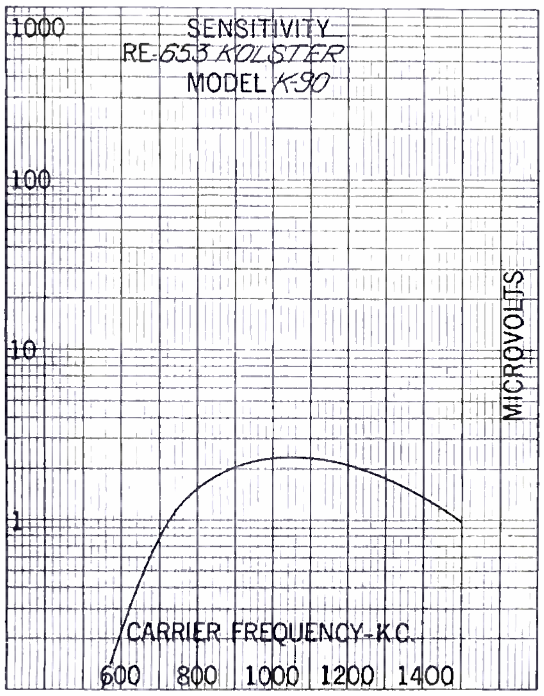
WHEN measured in our laboratory, the Kolster model K-90 superheterodyne produced the curves accompanying this article.

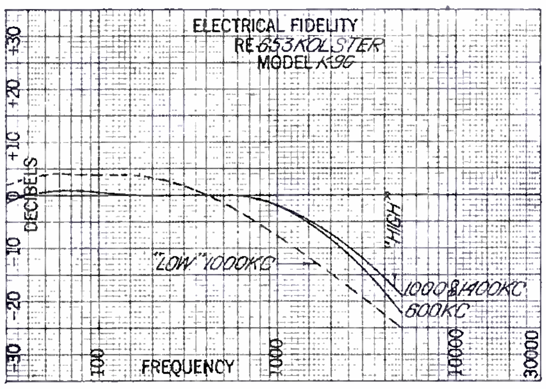
A dummy antenna standard of 20 uh, 200 uuf, and 25 ohms was employed to feed the signal generator output through the receiver input circuit. The plate circuit of the push-pull power pentodes was matched with a non-inductive resistance load of 14,000 ohms, while the voice coil was disconnected to prevent the reflection of its impedance on the primary circuit. A standard output of .05 watts of audio power was maintained with the output indicating device capacitatively coupled to the plates of the output tubes.

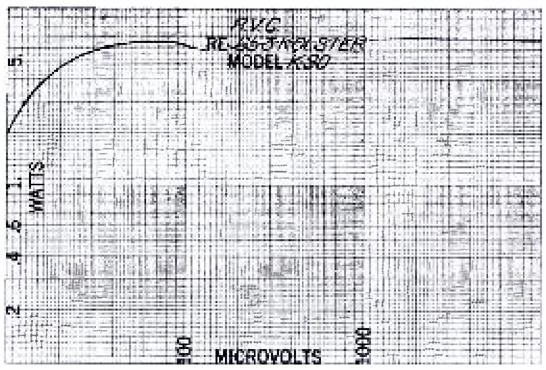
The receiver drain was 1.00 amperes, with an impressed line voltage of 111 volts. All measurements were made with the volume control turned on full, the tubes furnished as standard equipment with the receiver by the manufacturer, and with no alterations in the alignment of the tuned circuits.

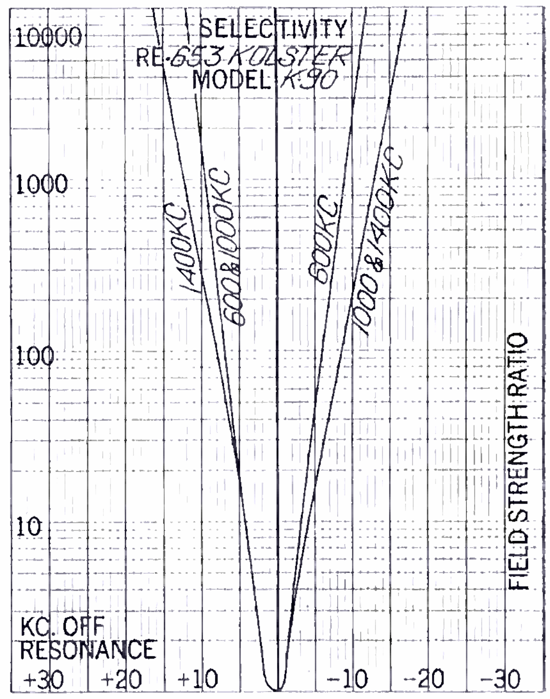
In column 1 the sensitivity curve gives an average value of sensitivity of 1.36 microvolts absolute, which corresponds to .34 microvolts per meter, with a standard height antenna. Measured noise levels were 50 per cent at 600 kc, the maximum value measured, and 10.8 per cent at 1400 kc, the minimum value. At 1000 kc the image ratio was found to be 92,800, with the signal introduced at 1350 kc and the receiver tuned to the first frequency. From the automatic volume control curve of column 3, the power output is seen to reach a maximum value of 6.80 watts, but this figure disregards the harmonics introduced in the output wave form at this level. In column 3 will be found the selectivity curves, while directly under them are the tabulated band widths.

At the bottom of the page is printed the schematic wiring diagram of the models K-90 and 92. Ten tubes are required, a 235 first r-f, 235 second r-f, 224 first detector, 235 second i-f, 227 second detector, push-pull 247 pentodes, 227 oscillator, 224 screen grid, automatic volume control tube, and a 280 type rectifier. The first detector is modulated by the local oscillator in its cathode circuit, which is connected to a pick-up coil on the oscillator coil.



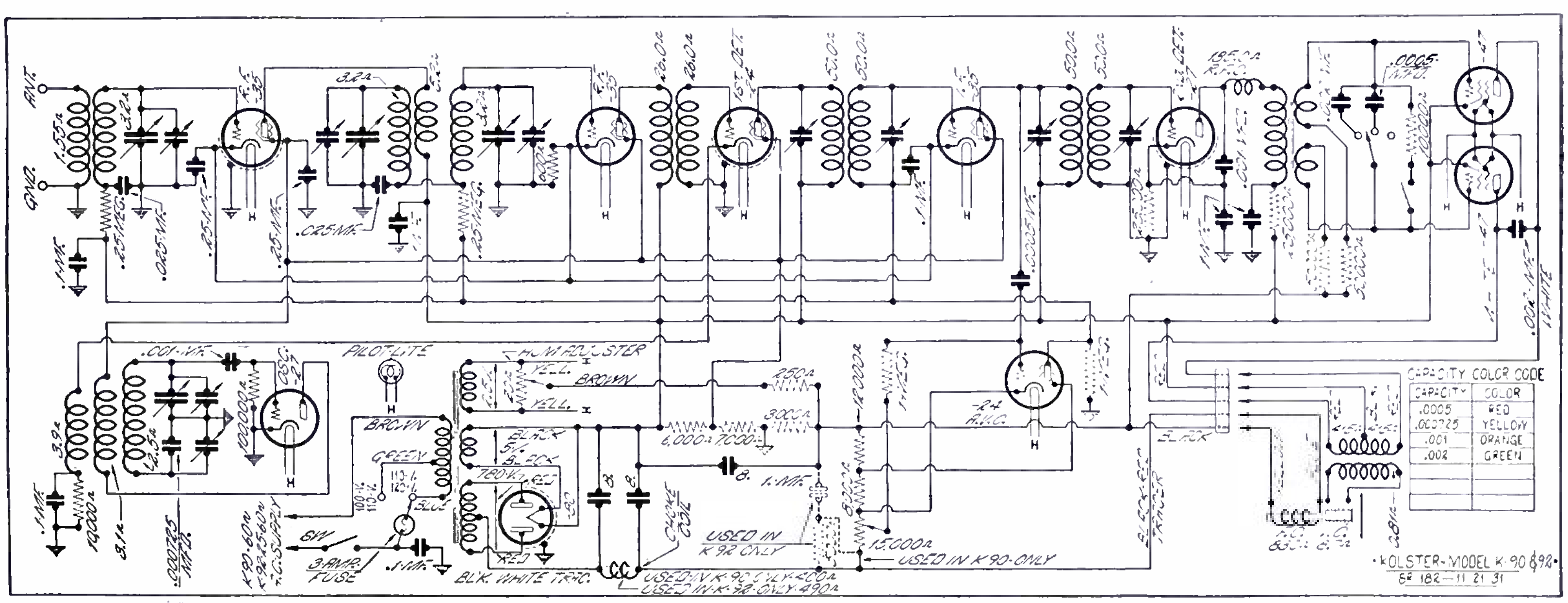






Band Widths

Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	7.5	8	8
100	13	15.5	16.5
1000	18.5	22.5	25.5
10000	23.5	29	33.5

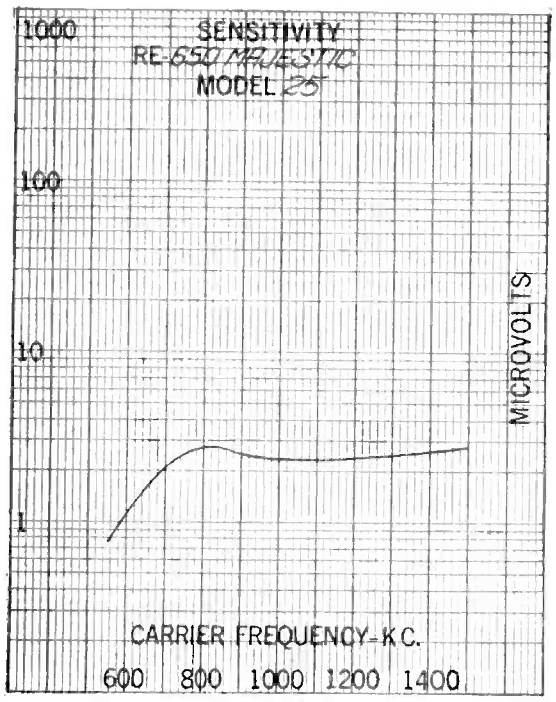


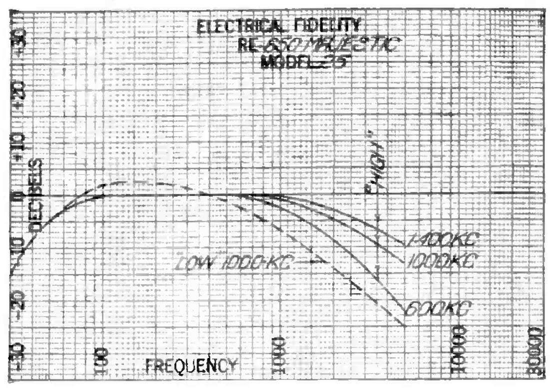
Majestic Model 25

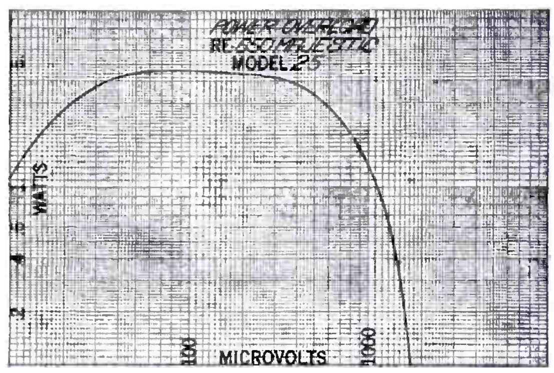
CURVES on the Majestic model 25 superheterodyne from recent measurements in our laboratory are given below.

To couple the signal generator output to the receiver input circuit, a standard dummy of 20 uh, 200 uuf and 25 ohms was employed. A standard output of .05 watts was indicated by the output meter for all measurements but that of power overload. A non-inductive load resistance of 14,000 ohms was used to match the optimum plate load of the push-pull 247 type pentodes used in the output circuit. To prevent the voice coil circuit from reflecting an undesirable load in the primary of the transformer, the former was opened for all tests. The output meter was capacitatively coupled to the plates of the output tubes.

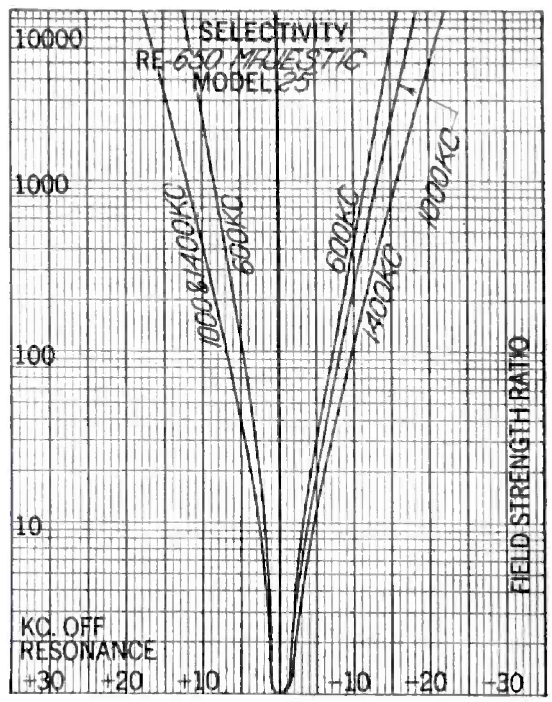
The receiver a-c line load was 1.19 amperes with a line voltage of 112 volts. No changes were made in the alignment of the receiver from factory adjustment, while the tubes employed during tests were shipped with the chassis by the manufacturer. At all times the volume control was turned to the maximum position.







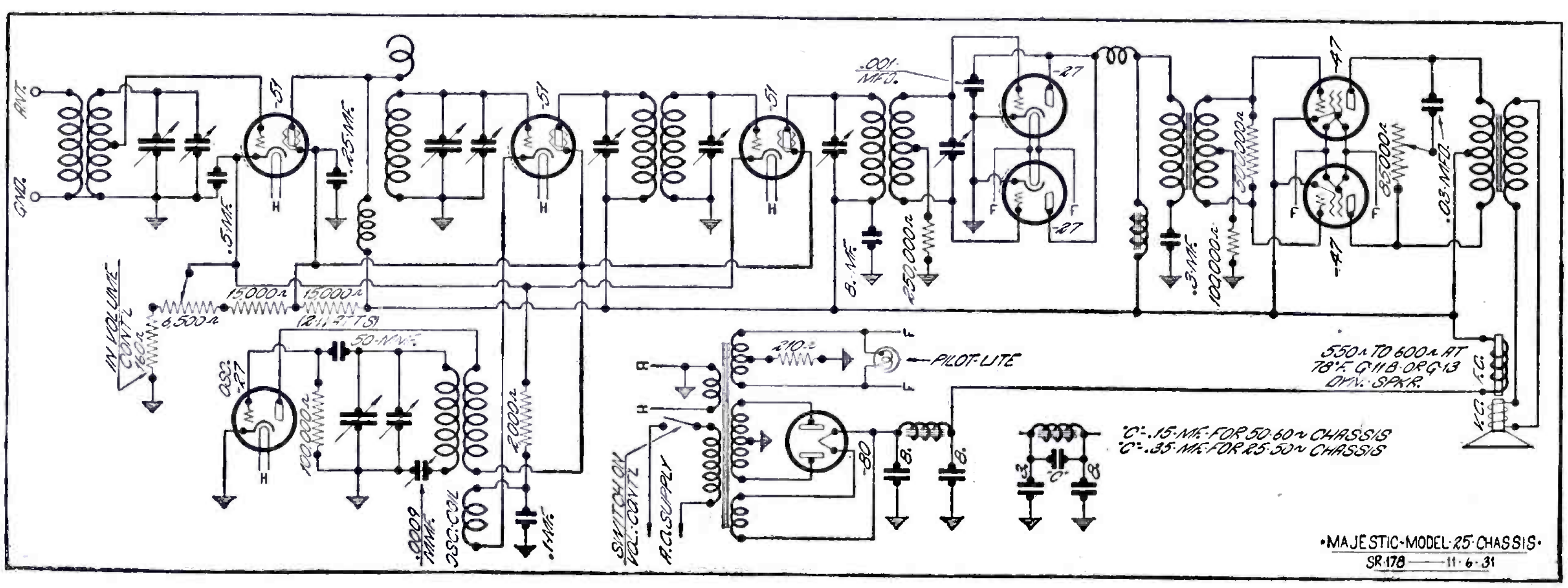
Average sensitivity measured from the curve of column 1 is found to be 2.3 microvolts absolute, which corresponds to .575 microvolts per meter with a standard antenna. At 600 kc the noise level was 16%, the minimum measured value, while the maximum of 40% occurred at 1000 kc. An image ratio of 47,700 was measured with the receiver tuned to 1000 kc. From the power overload curve of column 2 the maximum output is found to be 4.60 watts, disregarding the distortion introduced into the wave form by harmonics generated. Under the selectivity curves found in column 3 is a tabulation of band widths.



At the bottom of the page will be found the schematic diagram of this receiver. From it the tubes necessary for operation are seen to be a 551 r-f, 551 first detector, 227 local oscillator, 551 second i-f, two 227's as a full wave detector, push-pull 247 pentodes, and a 280 full wave rectifier for the power supply. A notation on the schematic wiring diagram shows the variation in the filter circuit for 50 to 60 cycle operation and 25 to 50 cycle supply.

Band Widths

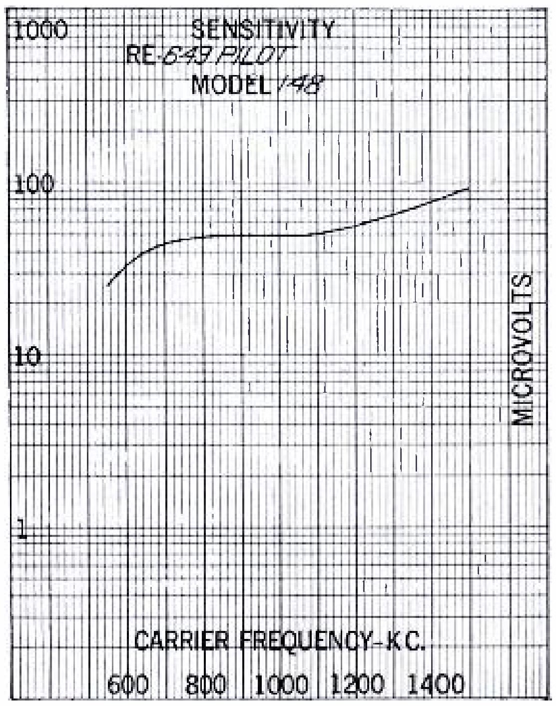
Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	5	6.5	7.5
100	12	15.5	17
1000	20	24	28
10000	28	36	39.5



Pilot Model 148

PERFORMANCE curves on the Pilot model 148 superheterodyne made from our recent laboratory measurements are included on this page.

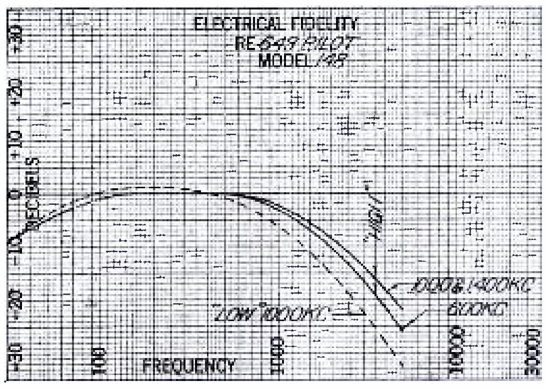
The signal generator output was coupled to the receiver input circuit

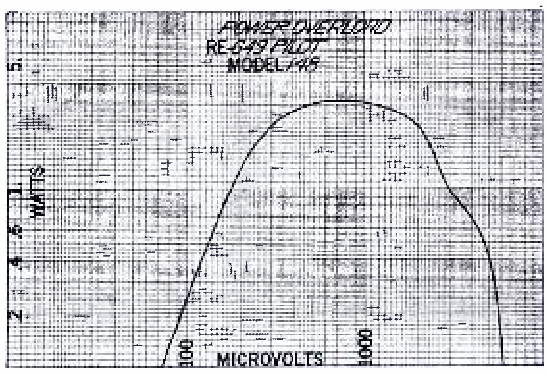


through a standard dummy antenna of 20 uh, 200 uuf and 25 ohms. To match the load impedence of the single pentode power tube, the output resistance was adjusted to a value of 7000 ohms and connected across the primary of the output transformer. Because of the loading effect of the voice coil circuit on the primary, it was open for all measurements. The output tube plate was capacitatively coupled to the output tube voltmeter, which read the value of voltage corresponding to a standard audio output of .05 watts.

In all measurements the volume control was turned to its full position, no adjustments were made to alter the factory alignment, and the tubes used were furnished by the manufacturer with the receiver. An a-c line drain of .74 amperes resulted with a voltage of 112 volts impressed across the primary of the power transformer.

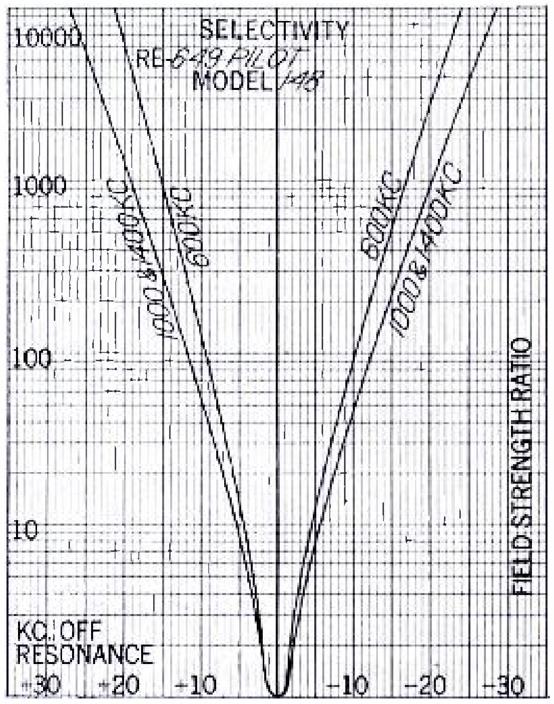
Average sensitivity over the band as taken from the curve of column 1





is 52 microvolts absolute, which is the equivalent of 13 microvolts per meter, assuming a standard height antenna. Power output reached a maximum of 3.17 watts, as shown by the power overload curve in column 2. However, this figure does not take into account the harmonics present in the voltage across the primary of the output transformer. At 1000 kc the image ratio was measured to be 540, with the input at 1350 kc. Noise levels were 1.29 per cent at 600 kc, which is the minimum, and 2.2 per cent at 1000 kc, the maximum. Under the selectivity curves of column 3 are the tabulated band widths, from which they were taken.

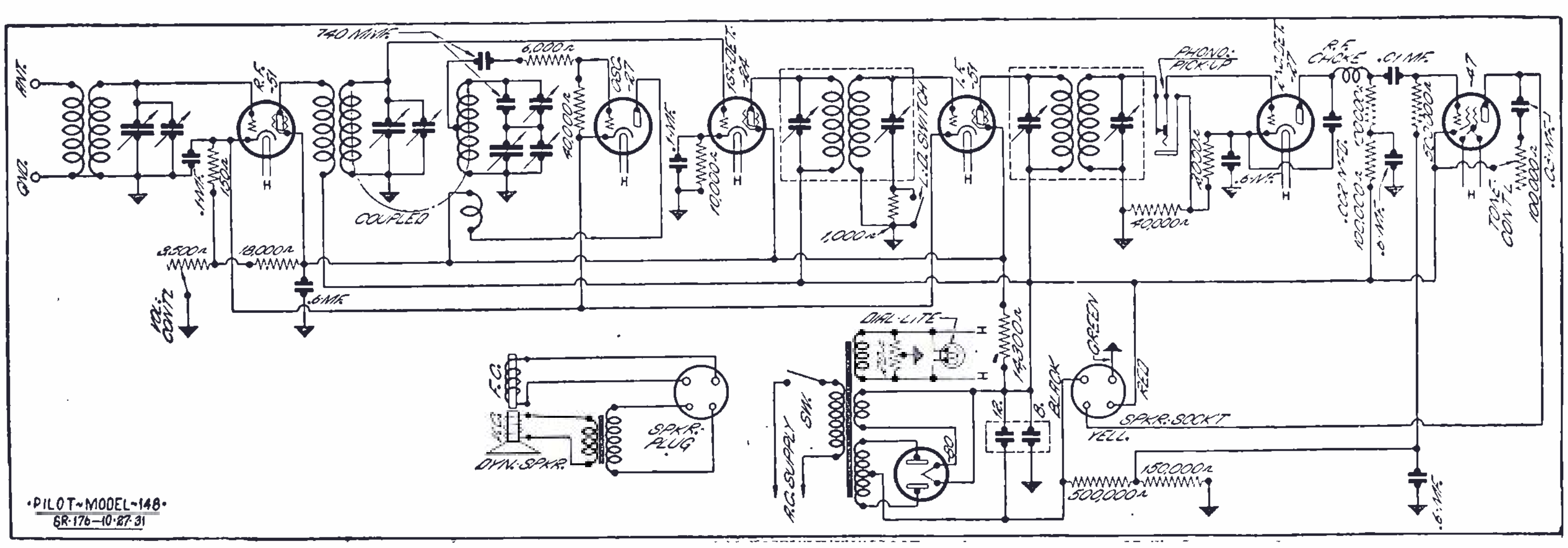
At the bottom of the page is a schematic wiring diagram of the Pilot model 148 superheterodyne. Required tubes for operation are a 551 r-f, 224 first detector, 227 oscillator, 551 sec-



ond i-f, 227 second detector, 247 power pentode, and a 280 full wave rectifier. In this circuit the speaker field is used as a filter choke in the B return lead of the power supply system. Bias for the pentode tube is obtained from a tapped resistance in parallel with the speaker field. A local-distance switch adds a series resistance in the grid circuit of the second i-f tube for the local position.

Band Widths

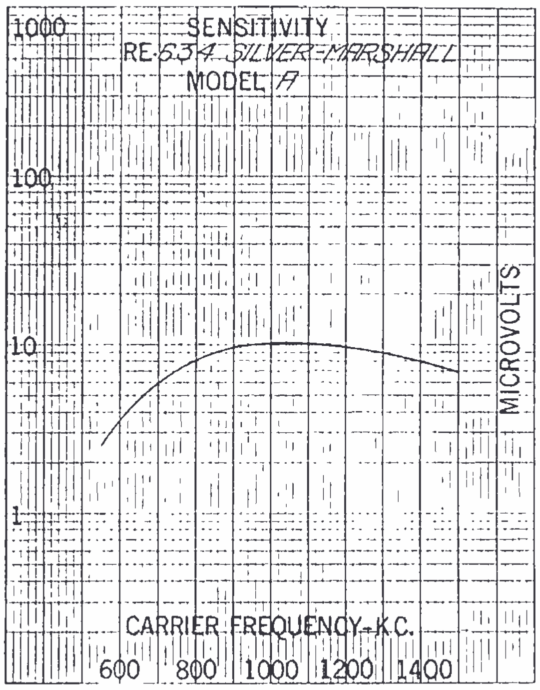
Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	9	11.5	11.5
100	20	24.5	24.5
1000	32.5	40	40
10000	45	55.5	55.5



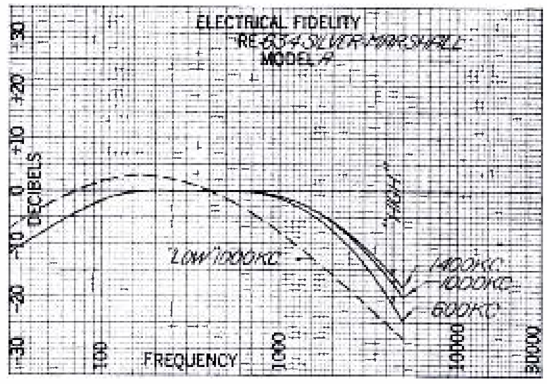
Silver-Marshall Model A

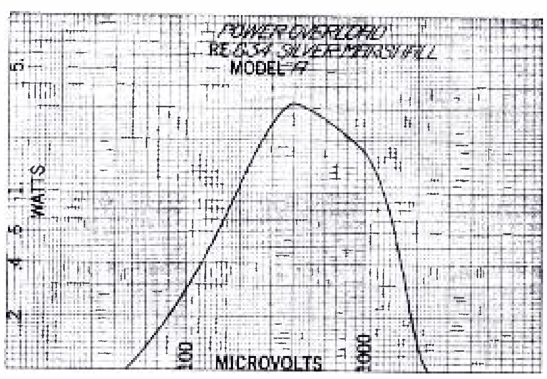
FROM recent measurements in our laboratory, the Silver-Marshall model A gave the included overall response curves.

For receiver input the signal generator output was coupled to a standard dummy antenna of 20 uh, 200 uuf and 25 ohms, connected across the chassis antenna circuit. A load resistance of 7000 ohms was connected across the plate circuit of the output pentode to match its operating load impedance. In order to prevent the loading effect of the voice coil circuit, it was opened for all measurements. The vacuum tube voltmeter was capacitatively coupled to the plate circuit, and indicated a standard output level of .05 watts, except for the power overload measurements.



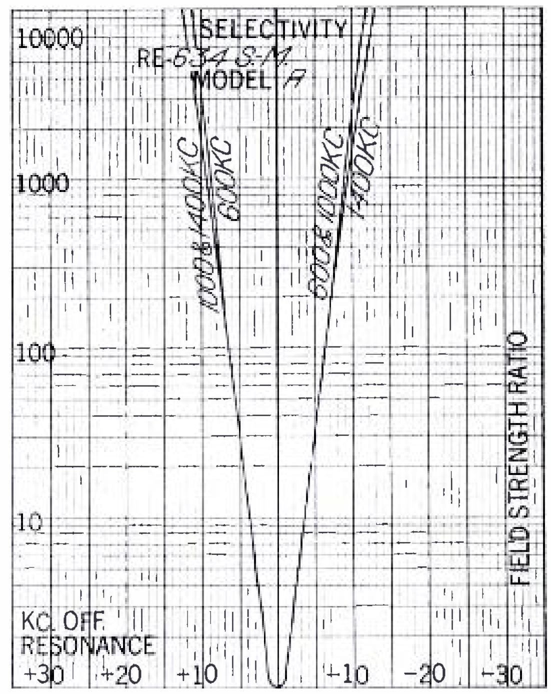
With an a-c voltage of 112 volts, the power transformer primary drew .78 amperes line current. In all tests tubes shipped with the chassis as standard equipment were used, no realignment was made on the tuned circuits from factory adjustment, and the volume control was adjusted for maximum receiver sensitivity.





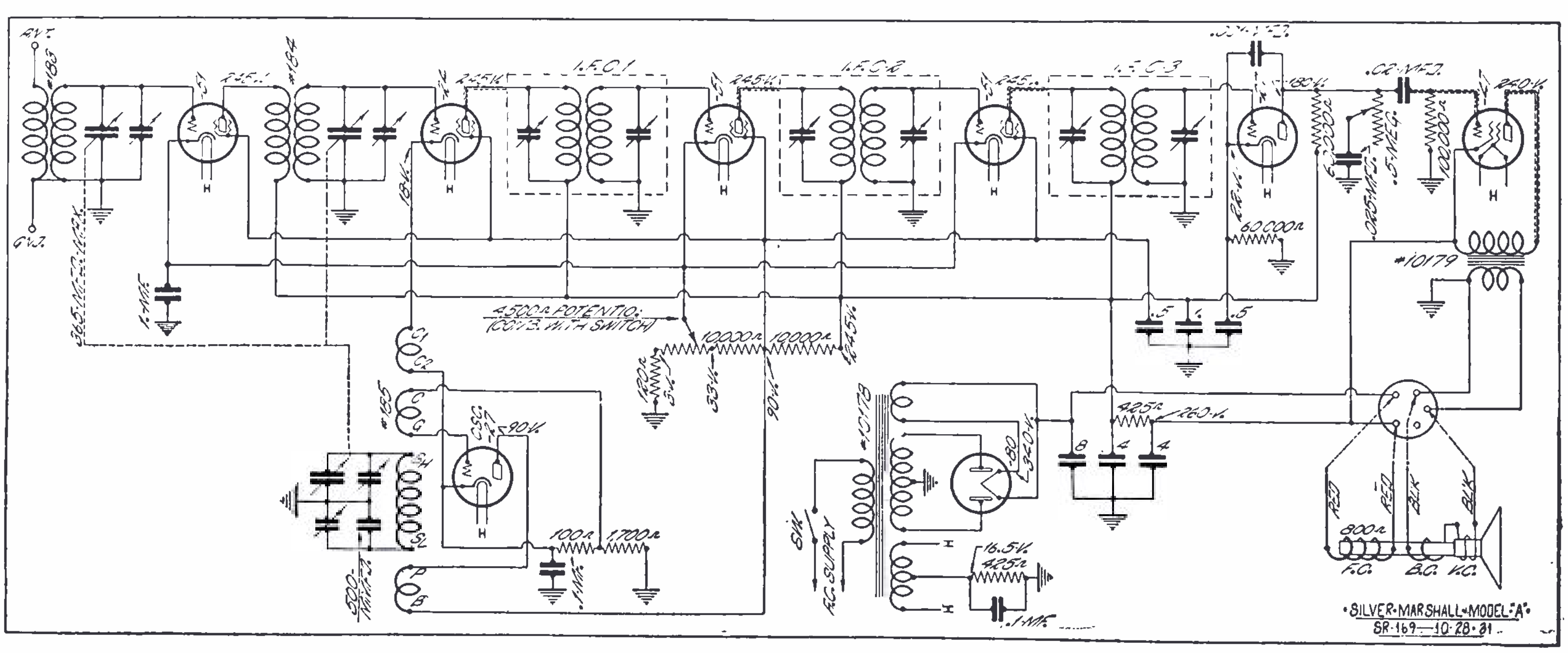
An average of 7.4 microvolts absolute was measured from the sensitivity curve of column 1, which value is equivalent to 1.85 microvolts per meter, with a standard four-meter antenna. Noise levels were 13 per cent at 600 kc and 5 per cent at 1000 kc, the maximum and minimum respectively. The power overload curve of column 2 gives the maximum power output as 3.20 watts, which does not consider the harmonics introduced in the wave form across the output transformer primary. Band widths will be found in tabular form under the selectivity curves of column 3, from which they are taken.

Below will be found the schematic wiring diagram of the model A superheterodyne receiver. Tubes required are a 551 r-f, 224 first detector, 227 local oscillator, 551 second i-f, 551 third i-f, 227 second detector, 247 power pentode and a 280 full-wave rectifier for B voltages. Bias for the 247 output tube is obtained by the drop across a 425-ohm resistance from the midpoint of the filament to ground.



Band Widths

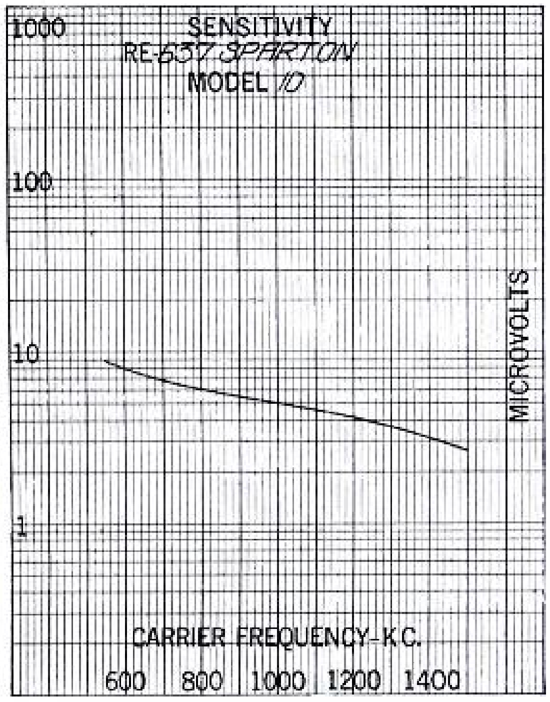
Times Field Strength	Kilocycles width 600 kc.	1000 kc.	1400 kc.
10	7	7	7
100	13	13	13
1000	18	18.5	19
10000	23	24	25.5



Sparton Model 10

AFTER measurement in our laboratory, the Sparton model 10 superheterodyne gave the following overall performance curves.

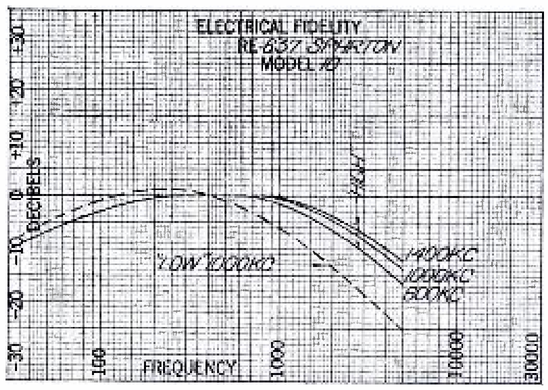
Signal generator output was coupled to the receiver antenna input circuit through a dummy antenna standard of 20 uh, 200 uuf and 25 ohms. In order to prevent a loading effect of the voice coil circuit, it was broken,

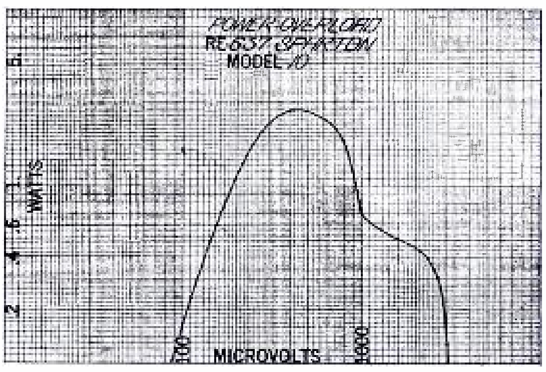


and the plate of the output power pentode was capacitatively coupled to the output indicating voltmeter, which read the voltage corresponding to a standard output of .05 watts, except for the power overload data. A non-inductive resistance load of 7000 ohms was connected in the output circuit of the 247 pentode to match its operating impedance load.

With a line voltage of 116 volts, the a-c current drain of the receiver was .93 amperes. The volume control was turned for maximum receiver sensitivity, no realignment of the tuned circuits was made from factory adjustment, and the tubes used were shipped as standard equipment for all set measurements.

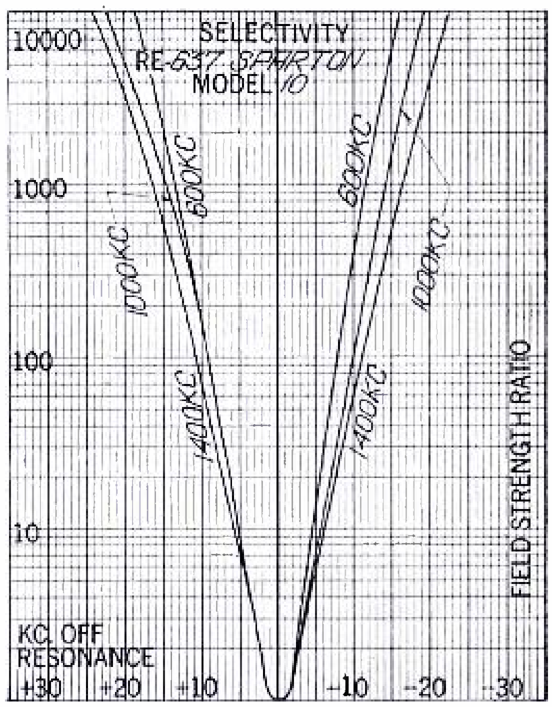
A value of 6 microvolts absolute was found for the average sensitivity, a





curve of which is given in column 1, which corresponds to 1.5 microvolts per meter using a standard four-meter antenna. Maximum noise level occurred at 1400 kc with a value of 7.6 per cent, while the minimum value of .8 per cent was measured at 600 kc. An image ratio of 134,000 was found at 1000 kc, with the signal impressed at 1350 kc. From the curve of column 2 the power overload was found to reach a maximum value of 2.65 watts. This figure does not take into account the harmonics produced. Directly below the selectivity curves of column 1 are the band widths.

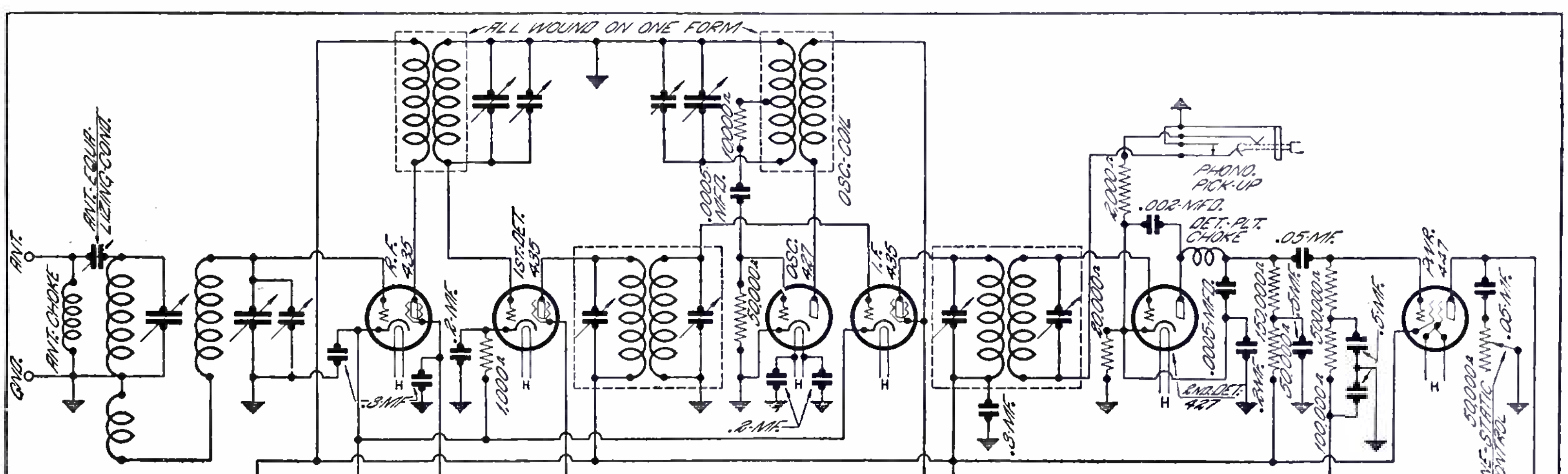
Below is the schematic wiring diagram of this receiver. The seven re-



quired tubes are a 435 r-f, 435 first detector, 427 oscillator, 435 second i-f, 427 second detector, 447 power pentode, and a 480 full wave rectifier.

Band Widths

Times Field Strength	*Kilocycles width* 600 kc.	1000 kc.	1400 kc.
10	10	11	12
100	17	19	22
1000	25	29	33
10000	34.5	41.5	46.5



SCHEMATICS PUBLISHED TO DATE

Model	Published	Drawing No.
A. C. Dayton		
Navigator	November, 1929	SR24
Acme Mfg. Co.		
AC7	March, 1929	SR3
AC4	March, 1929	SR4
All-American Mohawk		
Lyric 90	November, 1930	SR74
Lyric 6	March, 1929	SR1
Lyric 8	March, 1929	SR2
Lyric J	October, 1931	SR128
Lyric B-7	December, 1931	SR165
Lyric S-8	January, 1932	SR170
Amrad		
70	November, 1929	SR22
81	March, 1930	SR44
84	January, 1931	SR106
Apex		
48	November, 1930	SR80
31 (U. S. Radio)	January, 1931	SR108
Atwater-Kent		
38	January, 1930	SR28
55, 55C (Cap.)	September, 1930	SR51
55, 55C (Ind.)	September, 1930	SR52
66	March, 1931	SR114
H-2	December, 1931	SR131
Audiola		
Series 31 (t.r.f.)	November, 1930	SR79
Super 31	March, 1931	SR111
Junior	March, 1931	SR112
Balkeit		
A	September, 1929	SR12
Bosch		
48	November, 1930	SR73
58	January, 1931	SR109
60	March, 1931	SR117
28-29	November, 1929	SR21
Auto	November, 1930	SR94
7DC	November, 1931	SR160
Bremer-Tully		
7-70	September, 1929	SR10
81-82	November, 1930	SR75
S81-82	October, 1931	SR126
Brunswick		
3KRO	November, 1929	SR23
15, 22, 32 and 42	November, 1930	SR86
S14	November, 1930	SR71
11, 12, 16	October, 1931	SR148
17, 24	December, 1931	SR164
Colonial		
31AC	January, 1930	SR29
33 and 34 a-c	November, 1930	SR95
47-48	December, 1931	SR160
Crosley		
Roamio	September, 1930	SR67
40S, 41S, 42S, 82S	September, 1930	SR57
608 Gembox	March, 1930	SR41

Model	Published	Drawing No.
705 Showbox	March, 1929	SR6
Jewelbox 704B	March, 1929	SR5
77	November, 1930	SR83
53, 54, 57	January, 1931	SR103
120	October, 1931	SR133
121-1	November, 1931	SR149
124	December, 1931	SR150
125	January, 1932	SR174
Dayfan		
5080	September, 1929	SR11
Delco		
Auto Radio	September, 1930	SR66
Edison		
R4, R5, C4	November, 1930	SR49
R6, R7	January, 1931	SR99
Erla		
Duo Concerto R-2	January, 1930	SR33
Eveready		
50	March, 1931	SR50
Fada		
7AC	September, 1929	SR13
35-35Z	November, 1930	SR70
KW28-29	December, 1931	SR158
Federal		
H	November, 1929	SR19
Freed-Eisemann		
NR80	November, 1929	SR20
Freshman		
2-N-12	September, 1929	SR14
General Electric		
H-32	January, 1932	SR166
S-22	January, 1932	SR137
General Motors		
A	November, 1930	SR68
120-A	November, 1931	SR116
S3A	November, 1931	SR154
S9A	January, 1932	SR173
Gilfillan Bros.		
100	January, 1930	SR32
Graybar		
600	March, 1930	SR42
Grebe		
7AC	November, 1929	SR17
AH1	November, 1930	SR96
Gulbransen		
Nine-in-Line	March, 1930	SR40
161	March, 1931	SR110
Howard		
S. G. A.	September, 1930	SR56
Green Diamond 8	September, 1929	SR16
H	October, 1931	SR145
SG-B	November, 1931	SR130
O	December, 1931	SR163
Jesse French, Jr.		
G	March, 1931	SR118

Model	Published	Drawing No.
Kellogg		
523-528	November, 1930	SR77
Kennedy		
20	March, 1930	SR48
26	November, 1930	SR81
10	January, 1931	SR38
30-32	November, 1931	SR129
King		
J	January, 1930	SR31
Kolster		
K20, K22, K25 and K27	September, 1929	SR8
K21, K23, K24 and K28	March, 1930	SR45
K-43	November, 1930	SR72
K80	November, 1931	SR159
Kylectron		
70	November, 1930	SR65
Majestic		
70	September, 1929	SR7
90B	September, 1930	SR55
130-A	November, 1930	SR84
50	January, 1931	SR98
20	October, 1931	SR124
60	October, 1931	SR138
15	November, 1931	SR157
Philco		
86-82	November, 1929	SR26
95	September, 1930	SR60
90-90A	November, 1931	SR156
112	January, 1932	SR172
Radiette		
F14	January, 1931	SR104
Radiola		
60	January, 1930	SR30
66	September, 1930	SR64
44	January, 1931	SR102
18	October, 1931	SR127
RCA-Victor		
R-7	October, 1931	SR137
R50-55	December, 1931	SR166
R11	January, 1932	SR168
Sentinel		
11, 12, 15, 16	March, 1931	SR115
106B	March, 1931	SR113
108A	October, 1931	SR146
108	November, 1931	SR123
111	November, 1931	SR155
Silver		
36A	January, 1931	SR105
30B	September, 1930	SR53
30	January, 1930	SR35
35-A	November, 1930	SR82
782	October, 1931	SR120
726SW	October, 1931	SR144
D-E	November, 1931	SR152
F	December, 1931	SR140
G	January, 1932	SR153

Model	Published	Drawing No.
Slagle (Continental)		
9	January, 1930	SR27
R-20	March, 1930	SR46
Sonora		
5R	November, 1929	SR25
Sparton		
AC89	September, 1929	SR9
589	September, 1930	SR63
600, 610, 620	March, 1931	SR91
25-26	December, 1931	SR161
Splitdorf		
E175	January, 1930	SR36
Steinite		
261	September, 1929	SR15
70, 80, 95	November, 1930	SR76
600, 605, 630, 635	November, 1931	SR132
Stewart-Warner		
950	September, 1930	SR62
Series 900	January, 1930	SR34
R100	January, 1931	SR85
102A	October, 1931	SR147
Stromberg-Carlson		
846	September, 1930	SR54
635-636	November, 1929	SR18
12-14	November, 1930	SR93
10-11	November, 1931	SR134
19-20	November, 1931	SR151
Transformer Corp.		
50	November, 1930	SR78
80-81	October, 1931	SR139
Temple		
8-60, 8-80, 8-90	March, 1930	SR37
SG 8-61, 8-81, 8-91	October, 1931	SR125
Transitone		
Auto Radio	November, 1930	SR69
Trav-Ler		
C	March, 1931	SR120
U. S. Radio		
37	March, 1930	SR39
26P	October, 1931	SR143
99A	January, 1932	SR171
Victor		
R32, RE45, R52	September, 1930	SR61
R35, R39, RE57	January, 1931	SR101
Westinghouse		
WR-5	November, 1930	SR92
WR-4	January, 1931	SR107
WR10-12	November, 1931	SR137
WR15	January, 1932	SR168
Zaney-Gill		
54	March, 1931	SR119
Zenith		
52, 53, 54, 522, 532 and 542	March, 1930	SR43
71, 72, 73 and 77	November, 1930	SR97
A, B, C, D	November, 1931	SR141

Precision Frequency Control Units

By LEROY M. E. CLAUSING

Consulting and Designing Radio Engineer

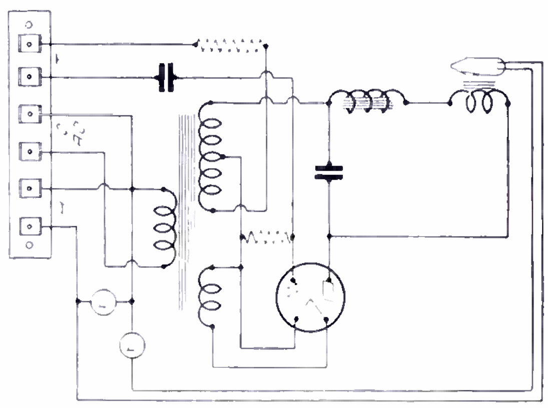
THE rapid development in the design of frequency control equipment has made it possible not only to keep within fifty cycles of an assigned broadcasting frequency, but it is now possible, with the equipment described below, to hold the frequency to within 5 cycles per million for long periods of time. One of these units has operated over a period of several weeks with a variation of less than one cycle. This extreme accuracy is of particular importance to stations operating with one or more sta-

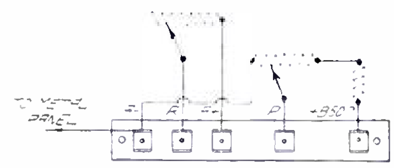
tions on the same channel, as beat note interference is reduced to a minimum and the range of the stations materially increased. To utilize this accuracy a means has been provided to shift the frequency over a few cycles to obtain zero beat for isochronous operation. This adjustment once made with a station having equally good frequency regulation, needs only an occasional check to maintain such operation.

The crystals, when furnished with the control unit are ground and adjusted to zero beat with a standard frequency unit. The accuracy of adjustment is, therefore, well within 10 cycles. The standard frequency unit used for calibrating the crystals is a type PFC control and checking unit and this is checked against standard frequency transmissions. The frequency division for the various broadcast frequency channels is obtained by means of a multivibrator and the accuracy is, therefore, equal to the accuracy of the standard unit.

The inductance, capacity and other elements entering as factors which might contribute to frequency deviations with temperature variations are maintained at a constant temperature in the heat chamber.

An even distribution of temperature is maintained at all times by means of forced circulation. The motor and fan are designed for continuous operation and this moving part was only incorporated after the reliability of this feature was demonstrated in actual use in a station for a period of over two years. The volume of the metal in the crystal holder is sufficiently large to attenuate the slight variations of temperature in the chamber to such a degree that for average temperatures outside of the chamber this variation does not exceed 0.02 deg. For temperature variations of from 41 deg. F. (5 deg. C.) to 95 deg. F. 35 deg. C.) the crystal holder temperature showed a change of 0.05 deg. C. Since the thermostat is in direct contact with the metal of the crystal holder the temperature variations of the crystal, as power is applied, are directly controlled. The bulb of the thermometer is also in contact with the crystal holder, so that the temperature shown on the front of the panel is actually an indication of the crystal tempera-





Power Control

ture. This thermometer is calibrated in tenths of degrees.

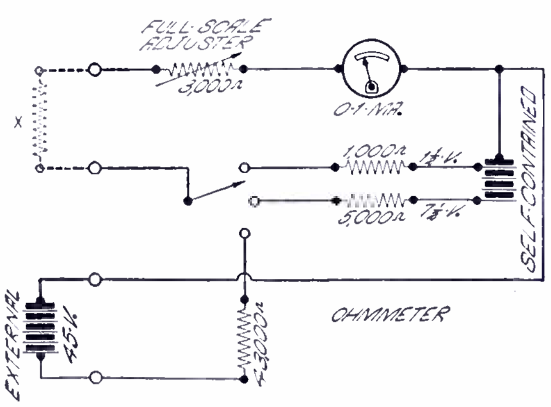
Features which contribute to the exceptional performance of these units are: frequency stability sufficiently accurate to permit common frequency broadcasting or isochronous operation with only an occasional check; a frequency shift of a few cycles can be conveniently made at any time to reach zero beat with another station; unit is equipped with buffer stage to prevent any possible reaction on oscillator; oscillator and buffer units are enclosed in metal compartment to provide thorough shielding; mercury contact relay is of the "bearingless" type, so avoids mechanical as well as electrical sticking.

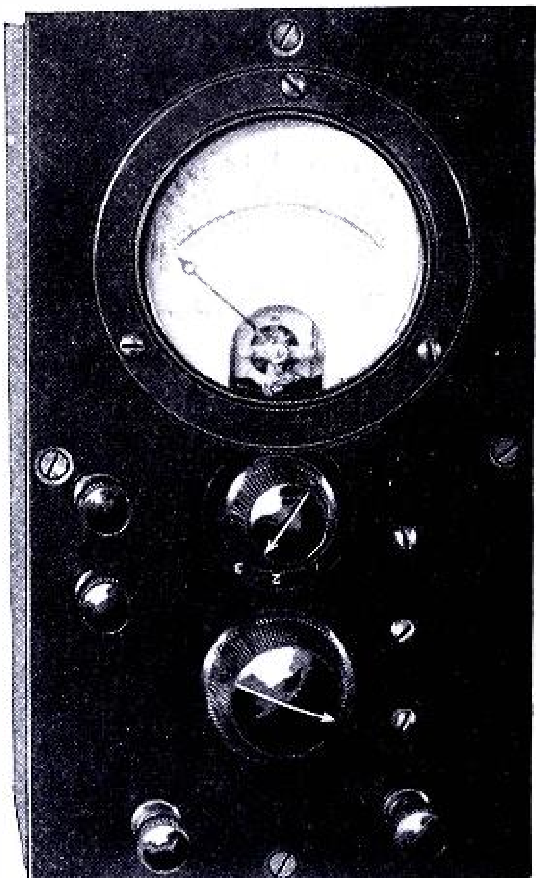
Ohmeter With Three Scale Ranges

An ohmmeter with a wide range is perhaps the second most useful piece of measuring equipment in the service field or laboratory. A bridge for measuring resistance values is in general prohibitive in price and usually such an instrument is not intended to be portable. Coding of resistors according to the new standards is a forward step, but such resistors have been in use less than a year and service work is mainly concerned with older model receivers. In addition, an ohmmeter makes an excellent and small continuity meter.

Three ranges have been calculated and calibrated for a Jewell pattern 54, 0-1 ma. d-c milliammeter. Their limits of accurate reading are approximately as follows: for the 1½ volt battery, 25 ohms to 50,000 ohms; for the 7½ volt battery, 200 ohms to 200,000; and for the external 45 volt battery, 2000 ohms to 2,000,000 ohms. Because the latter scale would be used less frequently than the first two, the size of the instrument was kept small by providing binding posts for an external 45 volt B battery. The other two ranges employ the small 7½ volt C battery, as shown in the back panel view at the bottom of column 3.

Simplicity consistent with reliability and ruggedness is the keynote of this meter, the wiring diagram of which is given at the bottom of column 1. It will be noted that the zero resistance adjusting wire-wound rheostat made by Yaxley is used for all of the ranges. Ohm's law gives the three required series resistances as 1500 ohms for the 1½ volt, 7500 ohms for the 7½ volt, and 45,000 ohms for 45 volt battery. Electrad wire-wound resistors are used and the chosen values are low enough so that the rheostat resistance, when added to them, gives the calculated value, with possible variation each side of the required value for slight changes in battery voltages. It must be remembered that the batteries must be new and up in voltage or the accuracy of the instrument is impaired. Batteries should last almost indefinitely, because at no time is the drain in excess of 1 ma. An adjustment of only one Electrad resistor is required. This is





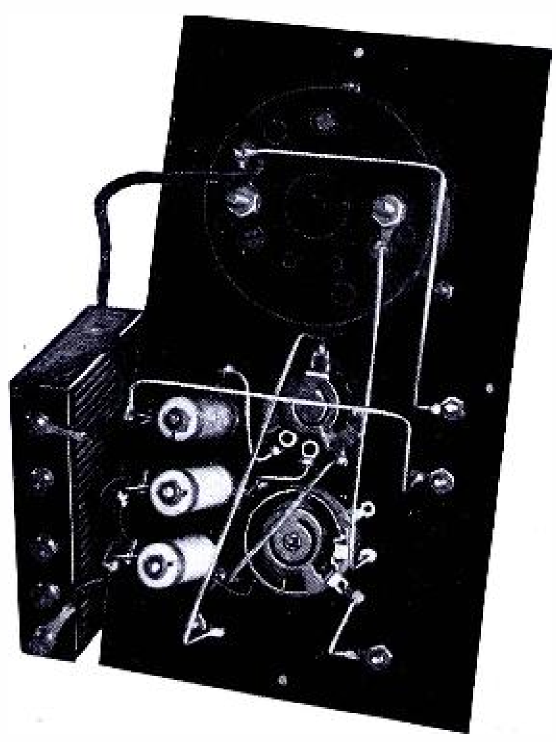
the value specified as 43,000 ohms, for which a 50,000 ohm unit was employed. To adjust this resistor the terminal at one end was loosened and moved along until, with a 45 volt battery, the terminals marked X shorted, and the rheostat set to about its middle position, the meter read just full scale, i. e., zero ohms.

A Yaxley three-point switch is used for selecting the desired meter range. The binding posts at the bottom end of the instrument are those across which the resistance to be measured is connected. Those on the left side of the front panel are for the external battery for the high range.

To operate this instrument the following procedure should be followed closely. First, with a small screwdriver, adjust the meter pointer by means of the adjusting screw to the left end of the scale marked "infinity." (This scale should be glued over the back of the original scale so that at some future time if necessary the original scale may be again used.) Then set the selector switch to point 1, which is the lowest range using 1½ volts of the battery. Short the measuring terminals with a piece of heavy copper wire and adjust the rheostat so that the meter pointer is at the right end of the ohm scale, i. e., at zero resistance. Then disconnect the shorting connection and the instrument is ready for use. Read the bottom scale directly in ohms. For the other two scales the adjustment procedure is identical except that for position 2 with a 7.5 volt battery, read the middle scale and for position 3 using the external 45 volt battery, read the top scale. If the meter pointer does not move from the left end of the scale, the resistor or circuit is open, and if it reads full scale, the resistance is very low or the circuit is closed or completed.

To remove the scale from the Jewell meter, the following procedure should be followed: First remove the three small screws which will be found equally spaced on the outside of the case, near the rear edge. One of these is probably sealed with lead or sealing wax and this material must first be removed by picking or scratching it out with a small screw-driver. Then remove the outer case. Be careful never to touch the pointer, because it is of very light construction. Remove the two screws on the face of the meter and draw the scale off by pulling it upward. Reverse this procedure in assembling the meter, taking care that the zero adjusting peg falls in its slot.

A scale with the three ranges accurately drawn, for the Jewell pattern 54, 0-1 ma. milliammeter, is available upon receipt of 50c to cover our cost of printing and handling. Overall dimensions for the instrument are 5 inches in width, 8 inches in length, and 3½ inches in depth.



Br... Items of Interest to Many

Geo. A. Hea... ...encer, Ia... I am enjoying ... me a great deal, especially ... r performance curves, bu... ... to ignore the two fields m... m most interested and in ... ink most of your readers ar... d. I refer to auto radios ... wave receivers and conv... on't you see what a service ... render by including curv... two classes of receivers be... ... are certainly others in ... et in addition to me? ... shall very shortly make m... ts on auto receivers, and we ... in the near past because ma... manufacturers are either ... their models or putting out n... which will be superior to ... the market before. Since ... the IRE-RMA standards ... g our performance curve... asurements, we are unable a... ent time to measure short w... rters, short wave receivers ... hort wave bands of the con... short wave and broadcast r... ecause there are no standards ... such measurements.

Paul J. Palm... City, Ia.: Will you please ... at size the drawings are of ... ance curves and schematics i... the Service Schematics? A... they more complete than th... own in the Call Book with ... values of specific parts on ... m. Ans.—The curves publi... *Radio Call Book Magazine a... ical Review* are those used ... dio Service Schematics and I... identical in size and data. W... ry that our diagrams are not ... complete to the very last pa... ve put into them all of the in... on which is furnished us by ... nufacturers, and, therefore, ... no further sources of informat... ou will find, however, that mos... r schematics are complete, and ... occasionally one does not hav... the values given on it.

Ora A. Kizer, ... Ind.: Does the 232 screen ... be provide greater selectivity ... igh gain r-f coils than the t... 30 using the same coils in a ... d t.r.f. set? My set tunes b... g these coils and I should lik... ge to screen grid tubes.

Your magazin... , but please don't forget us ... ds who still have to depend ... tery radios. Ans.—Other thing... es the tubes themselves enter ... e selectivity of a receiver, but from the standpoint of general efficiency we believe that you might benefit by replacing the 230 tube with a 232 type. We assume, of course, that you will take the proper precautions in the necessary shielding in making the change-over. Shielding alone would increase the selectivity noticeably.

Jas. Bohn, St. Louis, Mo.: Please send me as much information as possible on the following. 1. Explain the functions and uses of the new variable mu tube, especially the 235, the new pentode tube type 247 and screen grid type tubes of the 224, 222 and 232 types. 2. Why is not a ground connection always made on a receiver installation? Ans.—In answer to your first question, which is rather wide in its scope, we shall cover first the screen grid type tubes ordinarily encountered. This tube was designed primarily to reduce the capacity between plate and grid, which, in ordinary tubes, introduces coupling and limits the amplification because of feed-back and attendant oscillation. Placing the screen within the tube reduces the inter-electrode capacity by many times. Hence with proper shielding the gain successfully employed may be as high as 70 or 80 per stage. However, shielding is entirely necessary to have improvement over the results which are obtained with the ordinary three-element tube. The 235 type tube has a screen grid but has its control grid winding made non-uniform to give the tube combined characteristics of two typical curves. The primary reason for a tube of this type is to enable engineers to preserve good fidelity even at low volumes, which is impossible with the ordinary screen grid type tube because the latter has a very sharp cut-off as the cathode bias is increased to decrease the volume in receivers. Power pentodes, of which the 247 is probably the most common type, were developed to give high power output and high voltage amplification. Two noticeable benefits are at once apparent. Ordinary superheterodynes today employ a second detector coupled directly to the output tubes without an intermediate audio stage, which are sufficient for broadcast reception but not for phonograph reproduction, where more amplification is required. The 247 tube meets this need admirably and also gives a greater undistorted output than a 245 type tube with very little more power consumption.

In answer to your second question, almost any radio receiver will operate satisfactorily without a ground connection. Indeed, many of them operate with four or five times the sensitivity when used in this manner, but two things may occur which make advisable or necessary a ground connection. In almost every case, if a receiver is highly regenerative or actually spills over into oscillation, an earth connection is beneficial. Also it is a good means of reducing much local noise which may be carried in over the power line.

J. C. Waterson, Elkhart, Ind.: I have been a subscriber to your magazine for several years but have never used the privilege of asking for information which, I believe, is extended by you to subscribers. Back in 1926 I built a Madison-Moore battery operated superheterodyne. Recently I decided to rebuild it in a more compact form to make it easy to handle as a portable set. I find now that I am not able to tune below 1250 kc, while the upper end of the broadcast band comes in all right, WIBO coming in at 87 and 88 on the dials. In rebuilding it I found it necessary to lengthen the plate and grid leads, the combined extra length being 6½" in the plate leads and 4½" in the grid. Please advise if your data on this receiver shows that it would tune down to the lower end of the broadcast band when parts were arranged as shown in the Call Book. Can you give me any clue as to how I might remedy the trouble? Ans.—There is only one thing which will cause any receiver to fail to reach the 1500 kc point on the scale after it has once done so. This is the added capacity in the tuned circuits, which is known as parasitic or spurious. It could have entered only in your rebuilding and is due to the following things, which will be discussed briefly. Increase in length of your leads, especially plate and grid, is a very serious factor, especially if they are shielded or approach your receiver shielding closely. Also, in rebalancing your receiver you may have screwed the trimmer condensers on the variable condenser too near their maximums, thus increasing the minimum capacity of the tuned circuits. WIBO, being the next to the last channel or 560 kc, should come in at about 96 or 98, which will give you sufficient coverage at this end and you will find, however, that the change in the low end is much less than the change at the high frequency end, since at the latter point the frequency is changing very rapidly with small changes in capacity. We suggest that you rearrange your layout if you find that your padding condensers are sufficiently near their minimum values to insure that these are not causing your trouble.

S. C. Spering, New York City: Being a reader of RCBM since 34 B. C., I think you ought to include a voltage chart and socket layout on each chassis you give the works to. That would make it absolute and final, especially since the voltages are cockeyed on AVC circuits and I don't think it would entail any more trouble on the part of the engineering department. Ans.—It might be very valuable for this magazine to run the voltage chart and socket layout on each chassis, but space does not permit us to do this in view of the present valuable information which we give. Such a scheme would necessarily mean deleting some other more important feature to give this service, not to mention the added work involved. Since Weston and Jewell make such charts available to service men, using their analyzers, we cannot see any definite benefit in repetition.

Howard L. Ely, Gillespie, Ill.: I have been buying your magazine for several years and now that it is a monthly showing the performance curves of the different receivers, it certainly does appeal to me. On what day does this magazine appear on the news stands? A friend of mine has a new receiver which has quite a bit of hum and a-c background noise, and wondered if this is a characteristic of the set or what can be done to reduce it. Ans.—On the first of the month. The hum level of the receiver should not be noticeably high, and no doubt there is some small defect in the set to cause it to reach disagreeable proportions. If by background noise you mean the noise resulting when the receiver is used at maximum sensitivity, we should say that this is normal due to high amplification. If the hum of which you speak occurs only on carriers, it is due to modulation hum. Try changing tubes from the second detector on because it may be that some 227 type tubes will cause more hum than others. Also, if the audio amplification is high, there is a possibility of direct hum pick-up in the audio system from a-c wiring. Again the leakage on one or more sections of the dry electrolytic condensers may be high, and if this is the case the condenser will undoubtedly break down sooner or later. A grounding of the filament on either side would cause a very noticeable hum, and it is suggested that this be checked over carefully.

W. W. Smith, Pitsburg, Ohio: Could you tell me whether it is practical and possible to build an automatic volume control on a radio receiver which is not already furnished with one? Ans.—Since adding automatic volume control to a receiver circuit entails as much engineering as is incorporated in the entire receiver, you can plainly see that it is a job for only an experienced engineer who is familiar with that particular circuit. There are many different types of automatic volume control circuits, each one applicable to a definite receiver. We should advise you to let well enough alone, since there is no easy method of incorporating such a feature.

Jos. S. Owen, Atlanta, Ga.: Can you advise me the number of turns on each coil covering the short wave band on the Silver-Marshall 726 SW? Ans.—Regarding the number of turns on each of the short wave coils on the Silver-Marshall 726 SW, we can furnish the following information: 177 coil covers a band from 80 to 200 meters. The oscillator winding has 37 turns of No. 27 P. E. wire, wound 32 turns per inch. The tickler coil has 21½ turns of No. 30 d. s. c. close wound, and the antenna coil has 34 turns of No. 27 P. E. wound 32 turns per inch.

176 coil covers a band from 40 to 80 meters. The oscillator coil has 18 turns of No. 21 P. E., wound 16 turns per inch. The tickler coil has 10½ turns of No. 30 d. s. c. close wound, and the antenna coil has 14 turns of No. 21 P. E. wound 16 turns per inch.

181 coil covers a band from 20 to 40 meters. The oscillator coil has 13 turns of No. 17 P. E., wound 11 turns per inch. The tickler coil has 7½ turns No. 30 d. s. c. close wound, and the antenna coil has 10 turns No. 17 P. E., wound 11 turns per inch.

180 coil covers a band from 10 to 20 meters. The oscillator coil has 5 turns of No. 17 P. E., wound 8 turns per inch. The tickler coil has 4½ turns No. 30 d. s. c. close wound, and the antenna coil has four turns of 17 P. E., wound 8 turns per inch.

The following correction has been sent to us to be applied to the schematic wiring diagram of the RCA models 50 and 55 recently published in our magazine. The tone control condenser which is marked .1 mfd is to be changed to .01. This error could not have been found here because the mistake was on the original drawing sent to us.

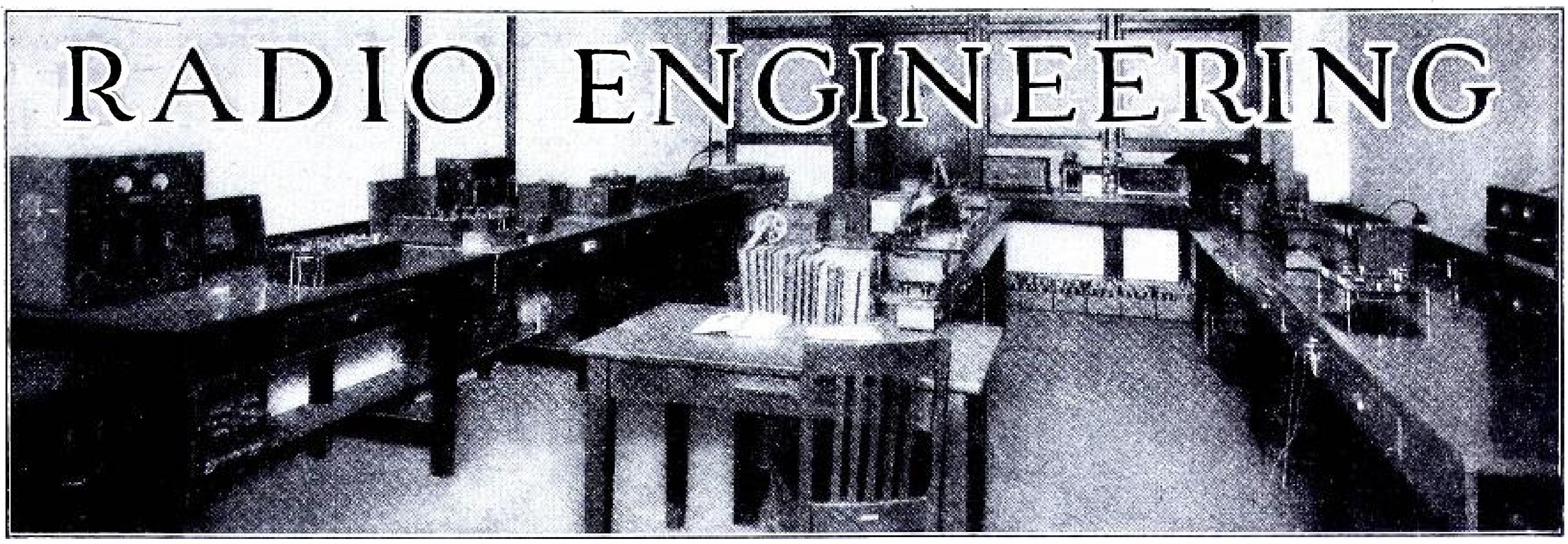
Some questions have been asked as to how to determine which tubes on a chassis is the automatic volume control tube. Ans.—Usually this is easily found by removing a tube at a time until one is found which on removal causes a very great signal increase or blasting of the receiver.

Another question which has come up frequently is the method of determining whether an electrolytic condenser has too high a leakage for use. Ans.—One method would be to connect a 0-10 or 0-50 d-c milliammeter in series with each plus lead, one at a time to determine what the d-c leakage current is in operation. Under ordinary operating voltages a 8 mfd section should not draw more than 1½ or 2 ma. It may be that some of the wet electrolytic type condensers may draw in excess of this amount. Under no circumstances should a section be used in which the direct current drain approaches 5 ma.

A reader inquired a short time ago as to the electrolyte used in the Balkite charger. Ans.—We find that such a solution consists of sulphuric acid in water to give a density reading of about 1200 on the ordinary battery testing hydrometer. Over the solution is a little paraffin oil to prevent evaporation of the water. The electrodes are lead and tantalum respectively.

A frequent request which we receive concerns the reception of police calls over broadcast receivers. Ans.—We wish to say that it is not advisable to attempt to reach these high frequencies on the ordinary superheterodyne, if they are not already available at the extreme end of the scale, but that it is not a very difficult matter to bring them in on tuned radio frequency sets. We described sometime back a method of inserting a series condenser with the tuning condenser. However, it will be probably more satisfactory to rebalance the receiver and in doing so unscrew the trimming condensers on the gang condenser as far as possible and still maintain a balance of 1300 or 1400 kc.

We note in our correspondence a letter from a reader who wishes to inquire how to align a superheterodyne which uses an automatic volume control tube. Ans.—We are of the opinion that a receiver should always be aligned with its volume control full on or as nearly full on as possible. This necessitates, especially with a sensitive receiver, a very small signal input. Hence do not attempt to align any receiver, especially one with automatic volume control, on a local or semi-local signal, but choose instead some distant signal which is not seriously affected with fading at the time.

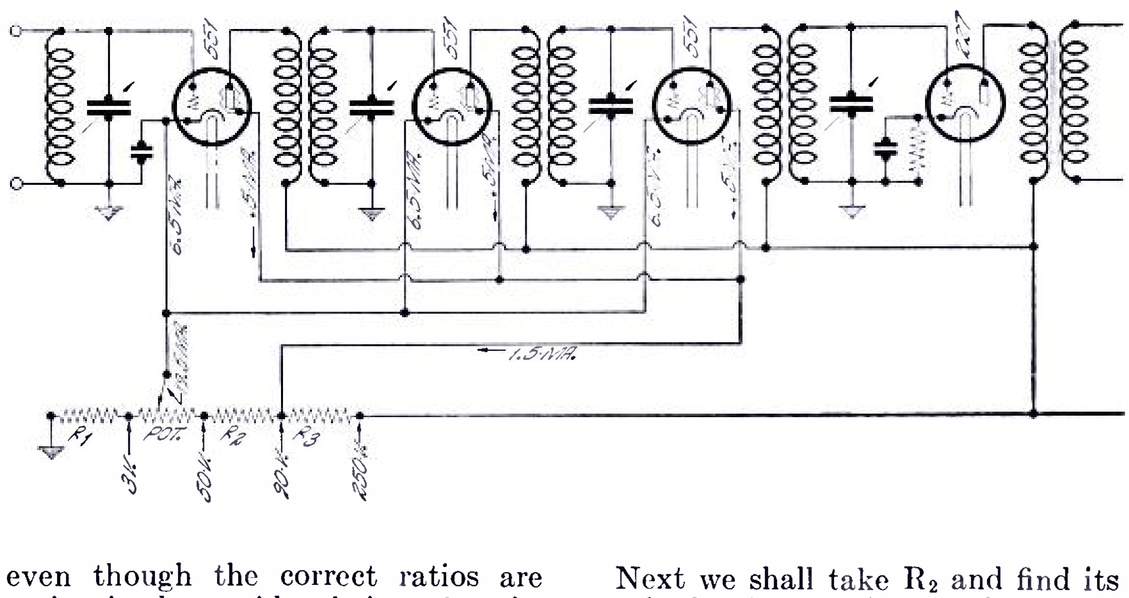


Use of Ohm's Law

PERHAPS the reader is familiar with the use of Ohm's law as applied to a simple case where only one circuit element enters into the computations. This article will demonstrate the simplicity of its applications to circuits of more than one element, and later the use of Kirchoff's rules will be shown by means of a simple problem. For d-c circuits Ohm's law may be written in three forms for convenience, each identical with the other two, $I = \frac{E}{R}$, $R = \frac{E}{I}$, and $E = IR$, where I is the current in amperes, E the voltage in volts and R the resistance in ohms. For determining the power in watts, the power formula may likewise be written in three forms, $P = I^2R$, $P = \frac{E^2}{R}$, and $P = EI$, all identical. Then if we know any two factors, the third may be found for either group of formulae. In a simple circuit consisting if a battery and a resistance, we can illustrate the methods of determining the third unknown quantity. If we assume that a 6 volt storage battery is connected to a resistance of 60 ohms, the current will be $I = \frac{6}{60} = .1$ ampere flowing in the resistor. Power expended in the resistor can be found from any of the three power equations. From the first we have $P = (.1)^2(60) = .6$ watts. From the second it is evident that $P = \frac{(6)^2}{60} = .6$ watts, and last that $P = (6)\ (.1) = .6$ watts.

For the second example, suppose that two amperes flow through a 100 ohm resistance and we wish to find the voltage across the resistance to give this current. $E = (2)\ (100) = 200$ volts, and from any of the power formulae the wattage dissipated is found to be 400 watts. The last case would be to find the resistance when the current and voltage are known. Let us take a 45 volt battery with a current drain of 9 ma, or .009 amperes. Then $R = \frac{45}{.009} = 5000$ ohms of resistance and the power utilized in heating this resistance is $P = .405$ watts.

Suppose now that I wish to calculate the resistance values for the bleeder circuit of a radio receiver, as illustrated by the diagram on this page. I know what voltage values are required, but it can be seen that 47 volts, we have $I = \frac{47}{5000} = .0094$ amperes or 9.4 ma, which must flow through the potentiometer when the sensitivity of the receiver is at a maximum. R_1, which is the resistor giving the fixed minimum bias, can now be calculated. The total current through it will be then 9.4 ma plus the current of the three r-f tubes, since the current flows from the cathodes through the arm of the potentiometer to ground. This total current will be $9.4 + (3)\ (6.5) = 9.4 + 19.5 = 28.5$ ma. Then $R = \frac{3}{.0285} = 105$ ohms.



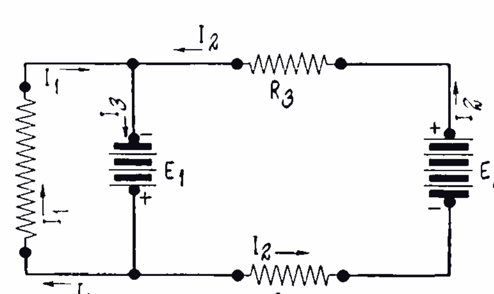
even though the correct ratios are maintained, a wide choice of resistance values was possible. Usually the current in the entire bleeder determines this factor. The current should be great enough so that the variation due to the volume control change will not lead to a serious change in other voltages. Let us start by using a 5000 ohm potentiometer for the volume control. If we calculate the current for a drop of 50-3 or

Next we shall take R_2 and find its required value. It is true that when the arm of the potentiometer is at the end toward R_2, the plate current of the tubes will have some effect, but it will be so little at this high bias value that no serious error will result if we disregard it in our calculations. Then $R_2 = \frac{90\text{-}50}{.0094} = \frac{40}{.0094} = 4270$ ohms. R_3 carries not only the bleeder current of 9.4 ma, but also the screen current for the three 551 type tubes, which is taken as .5 ma per tube as an average value. The total current through R_3 is then 9.4 ma plus 1.5 ma, or 10.9 ma. Then $R_3 = \frac{250\text{-}90}{.0109} = \frac{160}{.0109} = 14{,}700$ ohms.

We shall now determine the power rating of the resistors required. For the 105 ohm resistor we have $P = \frac{(3)^2}{105} = .0857$ watts. For the potentiometer $P = \frac{(47)^2}{5000} = .442$ watts. For R^2 we have $P = \frac{(40)^2}{4270} = .377$ watts. And finally for R_3 we have $P = \frac{(160)^2}{14700} = 1.75$ watts. It can be seen that the resistance and wattage values are odd numbers in most cases. In practice no serious results would be had if R_1 were 100 ohms and of .5 watt size, R_2 were 4500 or even 5000 ohms in resistance and ½ watt capacity, and R_3 equal to 15000 ohms and of 2 watts capacity. A slight variation of voltages from standard with the even values of resistors would be of no consequence. The above example demonstrates how an actual problem may be broken up into simple units for calculation purposes. Such applications are extremely useful to the designer and service man for his every-day needs.

Problems of slightly more complex nature require but little more calculation. We shall now discover how a simple network may be solved by means of two simple statements of Kirchoff's laws. The first is that the sum of the voltages in a closed loop is always equal to zero, and secondly that the sum of the currents approaching a point and leaving a point is also zero.

From our previous statements then, $I_1 + I_2 + I_3 = 0$. This should be obvious, because in any circuit the currents flowing to a point furnish all the current flowing from the point through as many conductors as there happen to be. In this problem there are three complete loops shown on the diagram of this page, the first of which is made up only by R_1 and E_1, the second by R_3, E_2, R_2, and E_1, and the third by R_1, R_3, E_2, and R_2, the complete outside path. An arrow direction of the current must always be assumed, and whether it is correct or not makes no difference, for if the direction happens to be wrong, the resulting current will have a negative value, but its numerical value will be correct. Never change an arrow direction once it is marked. Since we have three equations, we may solve for three unknown quantities. If we had four equations we could solve for four unknown quantities, etc. If we go in the direction from plus to minus, i. e., from the tail of the arrow towards its point, a battery furnishes a plus voltage if we go from minus to plus through the battery itself, and a resistance gives a minus voltage in the direction of the current arrow. Then for the first loop we shall start with the resistance R_1, and $-I_1R_1 + E_1 = 0$, since the product of the current and resistance gives a voltage drop. For the second loop starting with R_3 and going in a counter-clockwise direction, we have $-I_2R_3 + E_1 - I_2R_2 + E_2 = 0$ by the same rule as used in the first loop. Similarly, for the outside path or third loop, starting with R_3, we have in a counter-clockwise direction, $-I_2R_3 + I_1R_1 - I_2R_2 + E_2 = 0$. Notice that the second term is plus in this last equation, because we are going against the current arrow, whence our notation give a reversal of sign. Let us assume that we know the two battery voltages and all of the resistance values, and we wish to find the three current values. Let us make $E_1 = 45$ volts, $E_2 = 180$ volts, $R_1 = 1000$



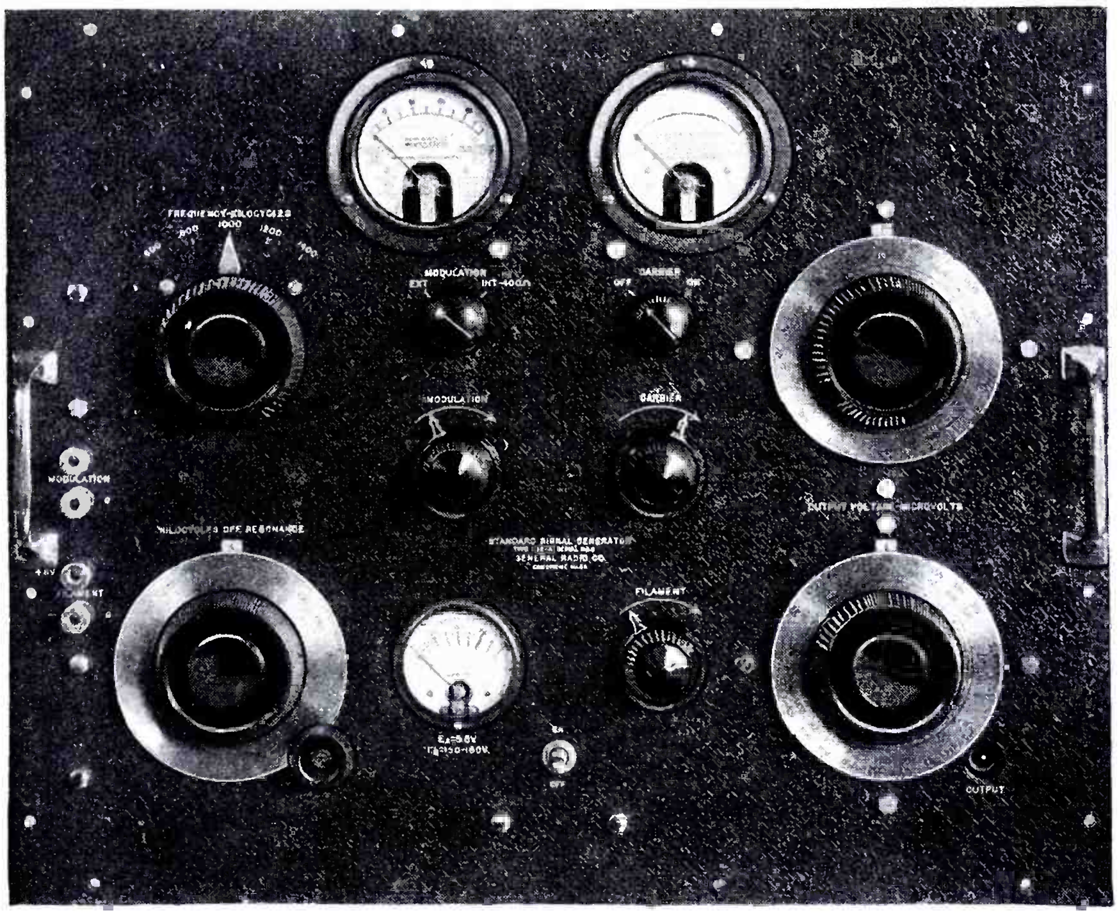
ohms, $R_2 = 10{,}000$ ohms, and $R_3 = 100{,}000$ ohms. From the first equation, $-I_1R_1 + E_1 = 0$, we can write $I_1R_1 = E_1$, and substitution gives $I_1 (10{,}000) = 45$ and $I_1 = \frac{45}{10{,}000} = .0045$ amperes. From the second equation, $-I_2R_3 + E_1 - I_2R_2 + E_2 = 0$, we can write, $I_2R_3 + I_2R_2 = E_2 + E_1$ and substitution gives $I_2 (100{,}000) + I_2 (1000) = 180 + 45$, and $I_2 (101{,}000) = 225$, or $I_2 = \frac{225}{101{,}000} = .0022277$ amperes. Finally, the third or outside loop gives, $-I_2R_3 + I_1R_1 - I_2R_2 + E_2 = 0$, and can be written $I_1R_1 + E_2 = I_2R_3 + I_2R_2$ or $I (10{,}000) + 180 = I_2 (100{,}000) + I_2 (1000)$. Substituting our known currents we have $(.0045)(10{,}000) + 180 = (.0022277)(101{,}000)$ or $45 + 180 = 225$. This identity prives our problem. It so happened that we did not need three equations, since the left loop could have been solved directly by the ordinary application of Ohm's law. This left our last equation as a check. Then to find I_3, the total current flowing through the battery E_1, we have, $I_1 + I_2 + I_3 = 0$, or $I_3 = I_1 + I_2 = .0045 + .0022277 = .0067277$ ampers or about 6.7 ma. To find the voltages across the resistors we use Ohm's law. For R_1, we know that E_1 is the voltage because it is connected directly across it. The voltage drop through R_3 is I_2R_3 or $(.0022277)(100{,}000) = 222.77$ volts. And the drop through R_2 is I_2R_2 or $(.0022277)(1000)$ and the voltage is 2.2277 volts. Let us substitute these voltages in the formula of the second loop and see if they check. From previous notations we had $-I_2R_3 + E_1 - I_2R_2 + E_2 = 0$. Substitution gives, $-222.77 + 45 - 2.2277 + 180 = 0$. and $224.9977 = 225$, which checks within one part in 100,000 or .001 of one per cent, and so effectively proves the equality and the problem.

From this simple solution it can be readily seen that the use of Kirchoff's laws is really only a modification of Ohm's law, for we merely take any closed loop and write out the potentials and voltage drops according to Ohm's law $E = IR$, and add them with correct signs. In other words, the law can be stated as; the sum of the voltage drops and voltage sources in a closed loop cancel each other, since the current flow is due to a source or sources of potential and in turn this current gives the drop through the resistors, which must equal the applied voltages. Again it can be said that; the sum of the voltage drops must equal the voltage rise or sources, since there is no other supply of voltage to the circuits. Many very complex networks may be solved in which there may be 20 or more loops and as many unknown factors. In a-c theory the use becomes more complicated, of course, but the theory remains the same.

Radio Call Book's New Generator

SPEED and accuracy—the watchwords of all industry today. Is it at all strange then that *Radio Call Book Magazine and Technical Review* should change its testing equipment to meet the demands necessary to be met by those who are leaders? After due consideration, the General Radio type 600-A Standard Signal Generator was installed a month ago to give the readers the most accurate data possible on the performance of broadcast receivers which are submitted to us for testing and publication. In every way the new generator meets the call for simplicity, ruggedness and precision. Radio frequency signals are very difficult to conduct through proper channels, but in this example, the success has been outstanding. In other words, the stray signal is so slight that it may be neglected when proper procedure is followed in making the set-up.

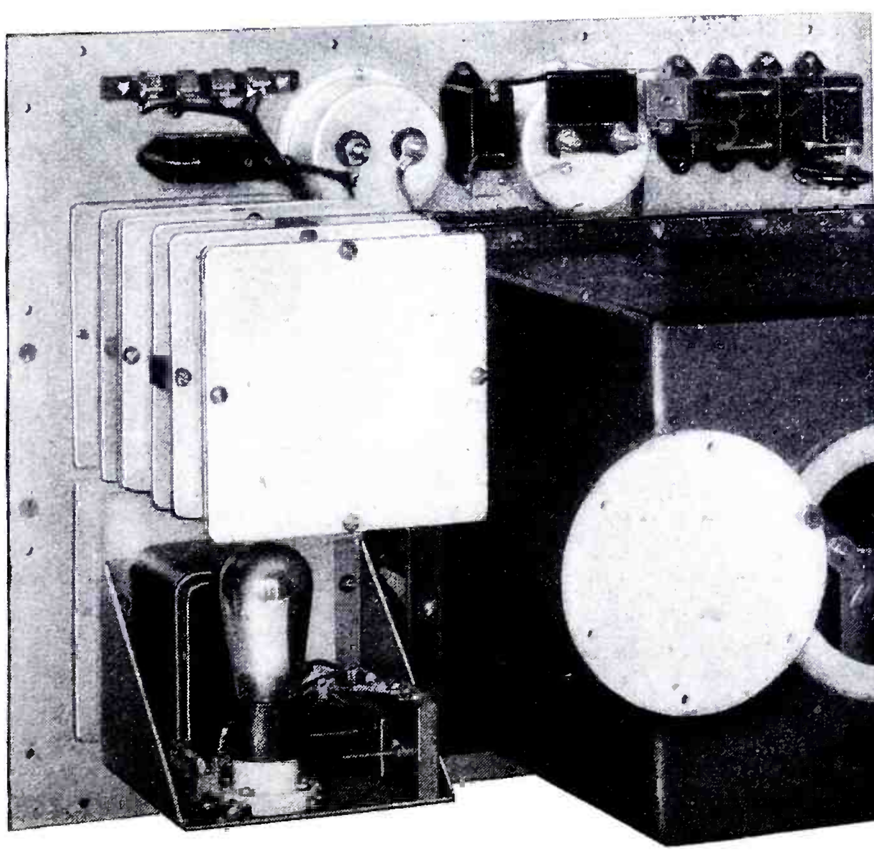
The upper illustration shows the front panel layout with all of the controls. At the upper left is the frequency control switch, which enables the operator to obtain the five standard test frequencies, namely: 600 kc, 800 kc, 1000 kc, 1200 kc, and 1400 kc. Directly below this control is the kc-off-resonance control, a true innovation to generators of this type. An ingenious arrangement of a three-gang condenser permits calibration by one kc steps to +50 or —50 kc from the frequency, on 600 kc, 1000 kc and 1400 kc. The proper gang condenser section is switched automatically when the frequency control is varied. For selectivity measurements, this feature is of inestimable value, because heretofore a dynatron oscillator was used, and every point taken on the selectivity curves was set by zero beat with the external calibrated oscillator.



To the extreme right are the attenuator controls, the upper being the ratio scale and the lower the microvolt scale. There is not a continuously variable control, since the output is adjusted to a given point on the output meter, but the points on the attenuator are taken every half decibel, which makes such a control of little added value.

Other controls are of the ordinary nature, consisting of an on-off switch, external-internal modulation, carrier frequency, on-off filament, and carrier amplitude control. A percentage modulation meter, carrier amplitude meter, and filament voltmeter are placed conveniently on the panel. All B and C batteries are within the outer shielding of the generator. A storage battery is connected externally to furnish the heater current for the two 227 type and two 112-A type tubes employed in the oscillator and rectifier circuits.

A back panel view showing the external shield and case removed is given at the bottom of the page. It can be seen that no pains have been spared to make this generator of utmost accuracy and reliability. The construction of the attenuator is noteworthy in that it, as well as the actual internal oscillator shield, is made from cast aluminum in sections which have very large bearing surfaces. An example of this is readily seen at the right-hand side of the lower illustration, which shows the cover plate partly removed. The light colored circular band on the lacquered shield represents the actual bearing surface afforded the cover plate.



Ceramics and Expansion

WHAT are the dimensions? Strange as it may seem, that simple question cannot be answered unless something is mentioned regarding temperature. Precisely speaking, a given mass of material has given dimensions only at a given temperature. As temperature changes, dimensions change. Practical proof of this assertion is to be found in the spacing between succeeding rails of track, the spacing between concrete road strips, and the considerable gaps left between structural members of bridges.

Among other minimums constantly sought by the scientific and industrial worlds is the minimum coefficient of thermal expansion, by which is meant the ratio of change in length per degree to length at 0 deg. C. In many applications it is desirable to have practically no change in the length or other dimension of a given mass of material, irrespective of temperature variations over a wide range. To meet such requirements special metal alloys have been evolved, since ceramics have not been considered practical for the purpose. The general reference for minimum thermal expansion has been Invar, an alloy largely employed for watch springs and precision instruments.

Engaged in the unique task of developing special ceramics for specific and scientific requirements, Henry L. Crowley of West Orange, N. J., took upon himself the task of evolving a material of still lower coefficient of expansion than Invar. He sought his solution in the field of ceramics rather than metals and alloys. Despite the failure of previous research, this specialist and his staff persisted in their search for many months, finally evolving an entirely new formula known as Crolite No. 7 with a coefficient but one-fourth that of Invar at 100 deg. C., and with a two-to-one advantage at 1000 deg. C.

The new material is far below the well-known ceramic Sillimanite, until now the choice for low thermal expansion applications such as spark plug cores. Porous Zircon, magnesium silicate, fused alumina, and rutile are high when compared with Crolite No. 7. At the high temperature of 1000 deg. C., the new ceramic expands considerably less than three-tenths of one per cent.

When the new material was submitted to a well-known university for test, the physicists were convinced that an error had crept into the findings. In fact, additional tests were conducted by different groups of workers, and it was only after various findings checked within close limits that the record-breaking coefficient of thermal expansion was accepted as final.

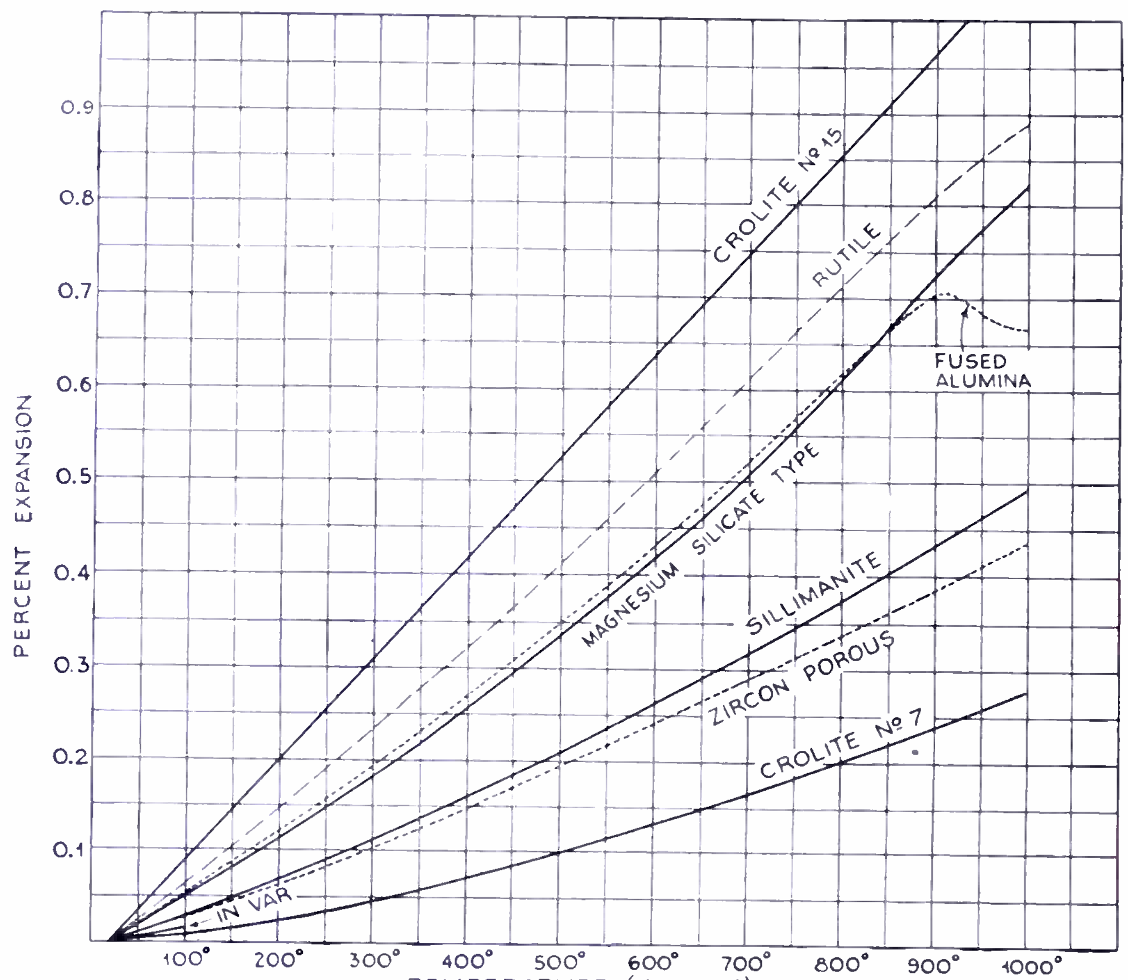
For those preferring precise comparative data, the following tables are presented, covering a low temperature and a high temperature range, and indicating coefficients for different materials:

Low Temperature Range (0-200 deg. C.)

Hermsdorf Porcelain	4.25
Sillimanite	4.19
Pyrex	3.2
Alundum	7.1-8.5
Carborundum	6.58
Invar	1.5
Crolite No. 7	.9
Crolite No. 7	1.2

temperature changes, a material of low coefficient of expansion is relatively free from internal stresses due to sudden temperature changes. Crolite No. 7 can withstand violent heat shock, such as heating to incandescence followed by plunging in water, without destruction. This characteristic makes it desirable for use in spark plug cores, especially for aviation engines where the service is extremely severe.

Were the new material but slightly in advance of Invar, it would be a notable achievement because it is a ceramic rather than an alloy. However, when it is further noted that its coefficient is between one-half and one-fourth that of the heretofore lowest coefficient known, it becomes evident that the new material has many potential uses. It is required in certain existing devices and machines where precise dimensions and spacings must be maintained despite wide temperature variations, and again where severe heat shock must be sustained without damage. Processes formerly impracticable due to the non-existence of a material of sufficiently low coefficient of expansion may now be carried on with the aid of this new ceramic.



High Temperature Range (0-1000 deg. C.)

Crolite No. 7	2.70
Sillimanite	4.98
Mullite	5.2
Magnesium Silicate Type	8.3
Rutile	8.85

It should be noted that, in addition to maintaining its dimensions within narrow limits over a wide range of

A Short Wave Transmitter

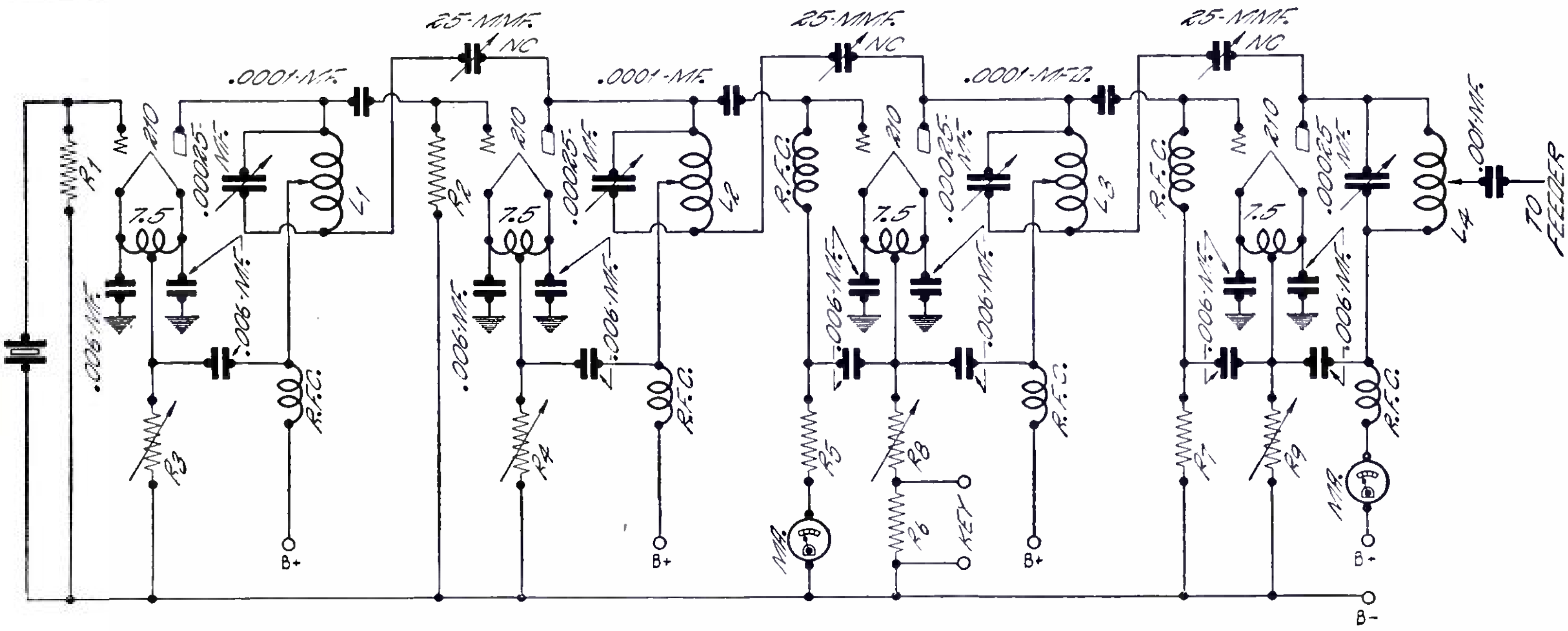
FREQUENTLY an amateur of the type that is never satisfied with his transmitter will wish to use a relatively low power set, in which almost any kind of change can be made. In the drawing shown on this page is a simplified four tube short wave transmitter, crystal controlled. The first tube at the left is the crystal stage, in which a 3530 kc crystal is employed. The tube to the right doubles that frequency to 7060 kc, which is passed along to the succeeding stage, where keying is accomplished and finally goes out into the antenna through the last tube at the same frequency, 7060 kc. On account of facility in securing tubes, 210's are employed throughout. All stages are neutralized. Separate filament supply is used in each stage, so that between a combination of grid current bias and plate current bias, there will be no necessity for any biasing batteries.

The milliammeter in the grid circuit of the third tube will depend for its size on the amount of grid current which the third grid takes. In one installation the grid current was 1 ma through an appropriate R5, and the tuning of the crystal oscillator and the doubler stage was accomplished by tuning for maximum reading on this milliammeter. This meter also indicated the cleanness of keying, especially on a bug, since with the dash side of the bug, the reading should be the maximum and with the dot side, the reading should not be less than 50 per cent of the maximum. As the reading on the dot side increases towards the maximum, there is likely to be gumminess of keying.

In the case of the milliammeter in the final stage, it is of a larger value than the total plate current used in the output. For example, in the transmitter under consideration, 550 volts was applied to the final stage and the plate current was 110 ma. Hence, a 0-200 or a 0-500 would be satisfactory. In tuning the last stage the condenser is shifted until minimum plate current is secured on the milliammeter which would indicate maximum r-f transfer to the antenna through the .001 mf coupling condenser in the feeder line. This transmitter was designed for use with a single wire untuned impedance matched feeder, coupled to a fundamental horizontal Hertz on the 40 meter band. This would permit, if desired, doubling into the 20 meter band, but would not permit its use at the crystal fundamental of 3530 kc.

The particular form of neutralization shown in the diagram is employed because it permits the greatest number of experimental changes in the plate circuit without having to reneutralize. Since neutralization is a subject well enough known to those who might be interested in this particular layout, no explanation of the process will be made.

The bypass condensers used across the 7½ volt filament windings to ground are also across the center-tap to ground resistors and consequently reduce the number of capacities required. The r-f bypass across each choke is of the same value and all such condensers are the Sangamo fixed mica type, moulded in bakelite. The coupling condensers from the plate of one tube to the grid of the next are also Sangamo of the same kind, whose values are shown in the diagram.



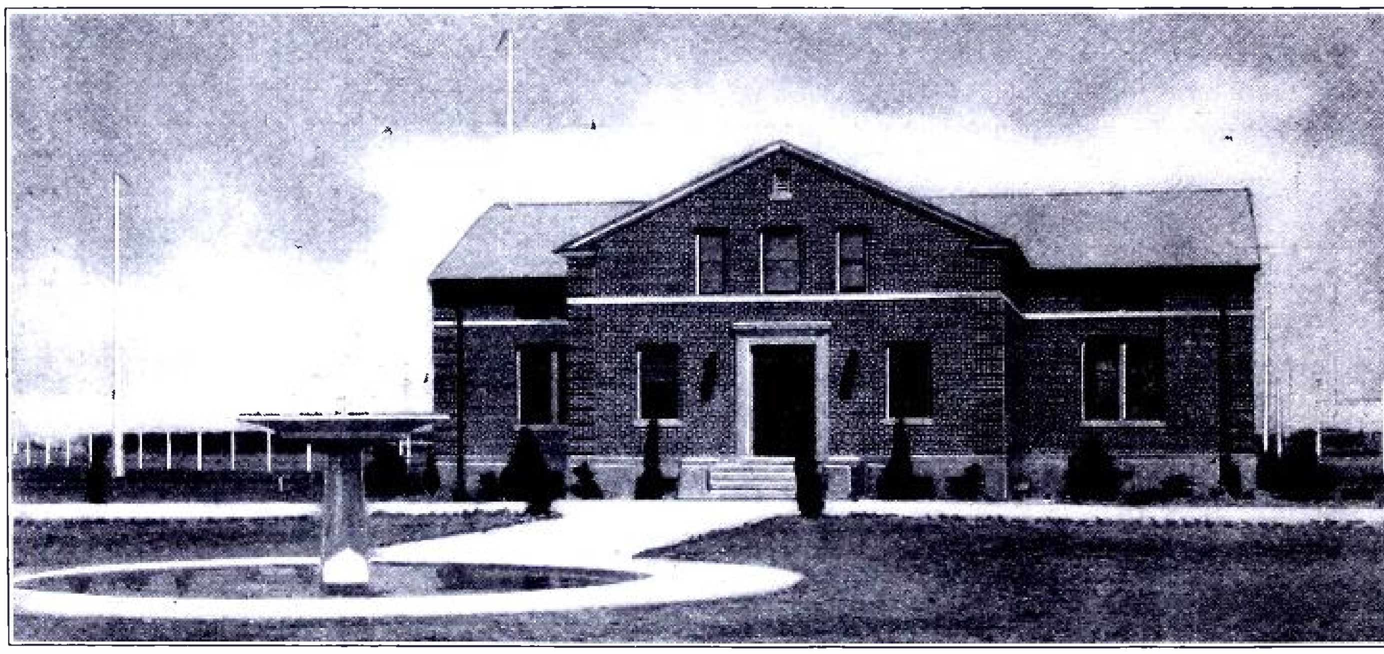
In the above drawing all of values are given excepting those involving resistance. Resistance R1 from grid to ground of the crystal tube may be anything from 50,000 to 500,000 ohms. R2, which is in the grid to ground circuit of the doubler tube, will more than likely run from 50 to 100,000 ohms. Variable resistor R3, which must carry the total plate current of the crystal oscillator, in practice worked out to be a 5,000 ohm unit. A resistor of the same general type but of 20,000 ohms value was used in R4, because the bias on the grid of the doubler was considerably higher than the bias on the grid of the oscillator tube. In both, the crystal oscillator and the doubler stage, grid current bias is very small. However, in the first class C amplifier, which is the stage that is keyed, grid current runs to a higher value and part of the bias on that grid is secured by the drop across R5, which was 100,000 ohms, while the remainder of the bias was secured through the drop across R8, which was a 0 to 5,000 ohm variable. This should also be capable of carrying the total plate current of this stage. The resistance R6, around which the key is placed, was 100,000 ohms and with the key open, ran the bias so much above cut-off, that no current occurs in the plate circuit of this tube. When the key is closed, however, that 100,000 is removed, bias drops down to normal value, and energy is passed into the succeeding class C stage, which is the power stage. In the final stage, the same condition occurs and a good deal of the bias can be utilized through the voltage drop across R7, which is 10,000 ohm fixed, while the remainder of the necessary bias (found by experiment) is secured from the plate current through R9. This resistor was also a 0 to 5,000 variable. Since the transmitter has a low power output, all of the r-f chokes were of the 80 mh kind.

Keeping Tabs on the Broadcasters

Courtesy of Good News, Oct.-Nov., 1931

CONFUSION on the air in the days of broadcasting's infancy is a painful memory to most of us. Now, with the 600-odd broadcasting stations spread intelligently and conveniently over the dial, we are inclined to give the matter little thought. To the inquiring mind, however, it must have occurred that the task of keeping stations to their allotted wavelengths is a difficult job.

Not that wilful violation of federal radio regulations is a practice common to the broadcasting stations. It's just that, with so many stations on the air, some sort of effective supervising is necessary to prevent chaos. Send 600 capable and well-meaning motorists up various lanes to a crossroads where a traffic officer is on duty and no congestion is likely to occur. But take away that officer and a snarl will result that it will take many policemen to untangle. The broadcasting situation is much the same. There has to be a traffic officer. It is the duty of this officer to set aright stations which are interfering with other stations through variations in wavelengths. In most cases, this is unintentional, due to faulty equipment, and the station is instructed to make corrections. In the event of an intentional variation, the station would in all probability be ordered off the air.



Checks U. S. Stations Regularly

The radio traffic officer is stationed near the town of Grand Island, Nebraska. His official title is Radio Frequency Monitoring Station. This station is capable of listening, and does listen, regularly, to practically all broadcasting stations in the United States, as well as a considerable number of foreign broadcasters. Aside from its routine duty of keeping a constant check on U. S. broadcasting stations, Grand Island performs numerous other special services for the Government. It is prepared, for example, to report on wireless transmission in practically any country on the globe.

To function successfully, such a station obviously must be equipped with the finest receiving apparatus and must, in addition, be extremely favorably situated. One reason for the location of the Radio Frequency Monitoring Station at Grand Island was, of course, its proximity to the geographic center of the country. But there were other determining factors. For example, the Government first considered other sites in Nebraska and neighboring states, but it was found that the soil and other factors were not as suitable as those of the site chosen. The soil under the Grand Island Station is sandy. The site, comprising 50 acres, was sold to the Government for $1.00.

Absence of man-made disturbances was an important requirement. When the Department of Commerce selected the Grand Island site, it assured itself that no power lines would be built nearer than three miles to the Frequency Monitoring Station. The station is about five miles west of the town and is set back some distance from the highway. There are no high-power broadcasting stations in the vicinity.

When completed, the Grand Island Station will have cost approximately $1,000,000. It has at present five receiving sets, which are valued at approximately $5,500 each. These sets are capable of tuning in practically every broadcasting station in the country and are probably as sensitive as any receiving sets in use today. More sets will be added as the need for them arises.

Miles of Antennae

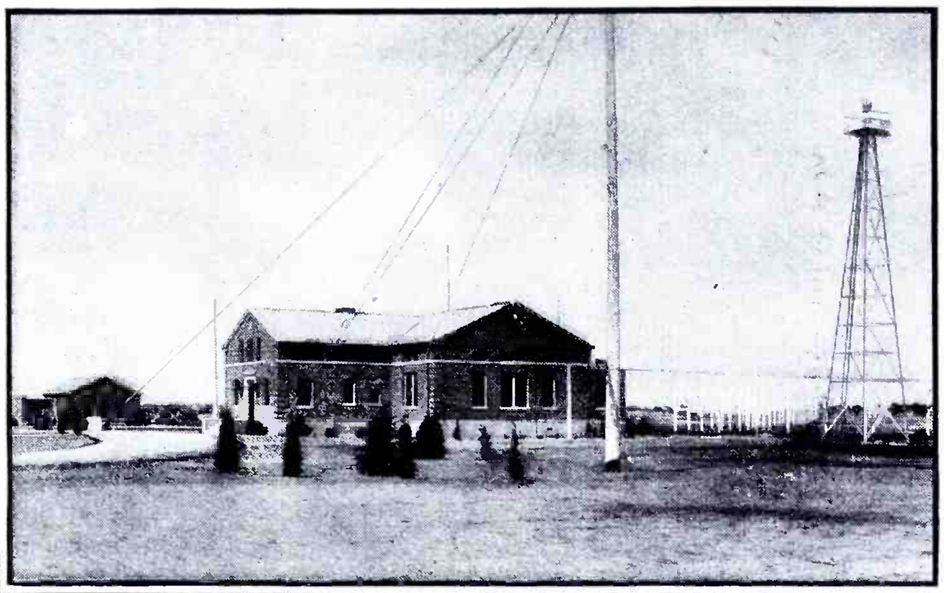
An important feature of the Grand Island Frequency Monitoring Station is the antenna system. There are many antennae, made up of many miles of wire stretched over the prairie. The control system is so arranged that the operator of any receiving set can easily switch from one antenna to another.

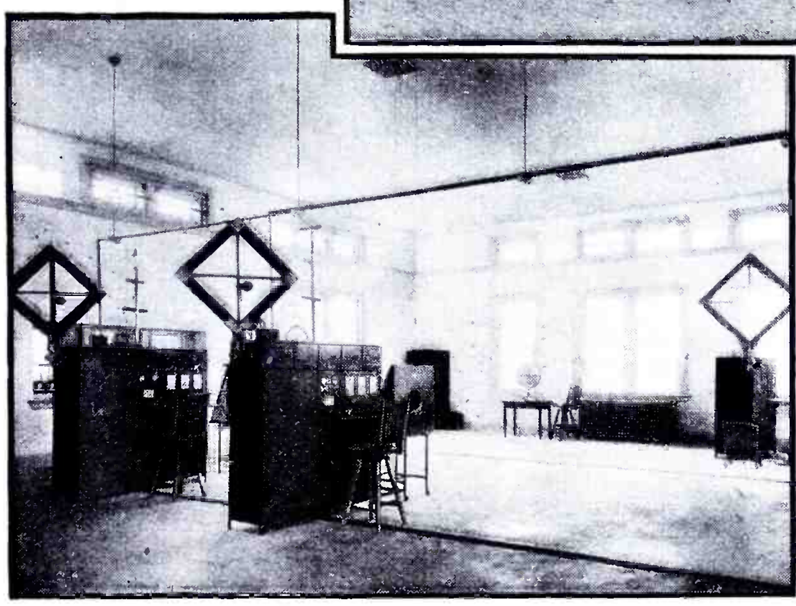
For long distance work, directional antennae are employed. One set of antennae points in the direction of London, and this is used for tuning in European stations. Another, aimed at Porto Allegro, is used to pick up South America. Four more directional systems are planned, one for Africa, one for Japan, one for Russia, and one for Australia. There are also several general-purpose antennae.

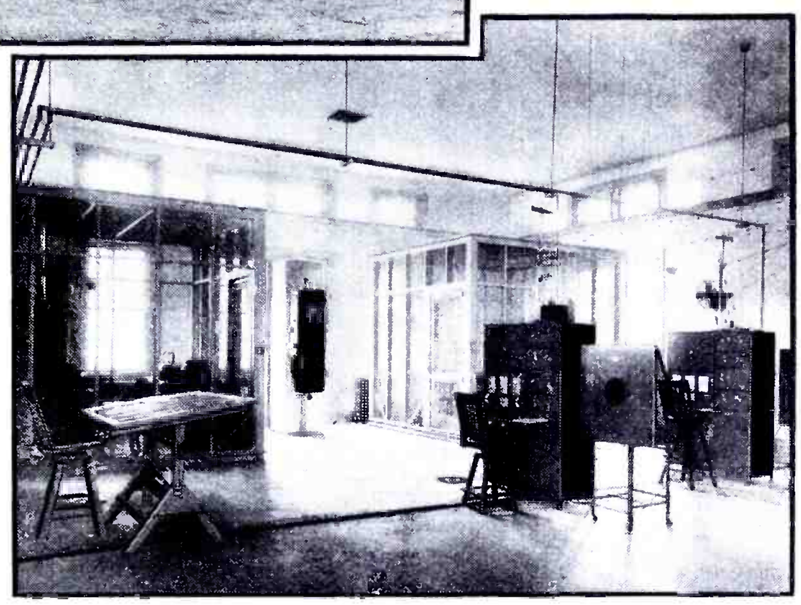
The "diversity antenna" system is sometimes used at Grand Island to minimize fading, as well as static and other natural disturbances. It has been found that signals do not fade simultaneously in different localities. Also, static is to a certain extent directional. With the diversity system, seven aerials located at reasonable distances apart are used. The signals are brought into the receiving sets, and by means of automatic selectors, only the antenna having the best and steadiest signal is connected through.

Station wavelengths are measured against the standard precision clock which is mounted in a vacuum chamber in a ten-ton concrete column. The precision clock corresponds to the standard pound, the standard foot, the standard quart, etc., in Washington, and is law to the broadcasters. Its pendulum makes one complete swing in two seconds, or one-half cycle per second. This frequency is multiplied through a tuning fork and vacuum tube amplifiers to 30,000 cycles per second, from which harmonics are produced and selected to match the lowest or highest radio frequencies in commercial use.

During the course of operations, a 24-hour watch is maintained at the station. While reception is taking place careful notes are made of weather conditions, barometrical pressure, and other items which tend to furnish information on transmitting conditions. Approximate signal strengths are noted as well as any other characteristics of the received signal. By reason of this information, it is expected that transmitting conditions under given circumstances will be predictable, and that it will be known, in a general way, what stations can be received under certain conditions and at what times reception will be at its best. The illustration on page 36 shows the external appearance of the Frequency Monitoring Station, which was erected on the flat prairie regions of central Nebraska after an extensive governmental study had revealed that this site was as nearly perfect for receiving conditions as it was possible to find in the center of the country. In the group of three photographs below, the upper illustration gives a general view of the station showing a part of the antenna system. A beacon, which is apparent, is used to warn night-flying transcontinental air mail pilots to steer clear of the aerial. At the left are the intermediate frequency receivers, and to the right can be seen the screened measuring booths, Precision Clock, and high frequency receivers. The signal energy is transmitted to the measuring apparatus within the screened booths by means of a conductor enclosed in a metal tubing, which affords the necessary shielding against stray.

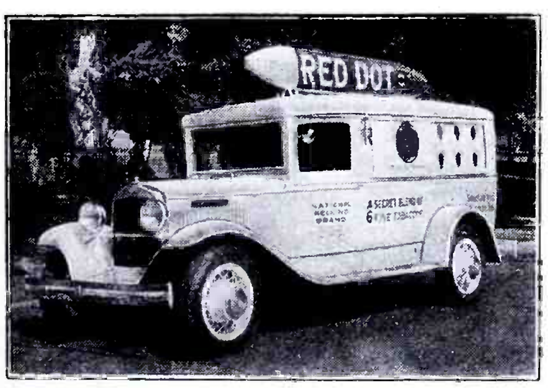




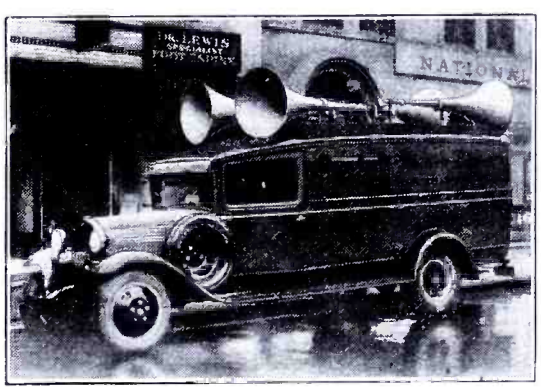


Sound on Trucks for Advertising

The R. C. A.-Victor Company is now building portable radio units equipped with Universal Electric Plants which furnish the necessary power. Either radio programs or records can be reproduced. An illustration is shown of one of the R. C. A.-Victor trucks used to advertise Red Dot Cigars. It has outlets for 12 powerful amplifying speakers.

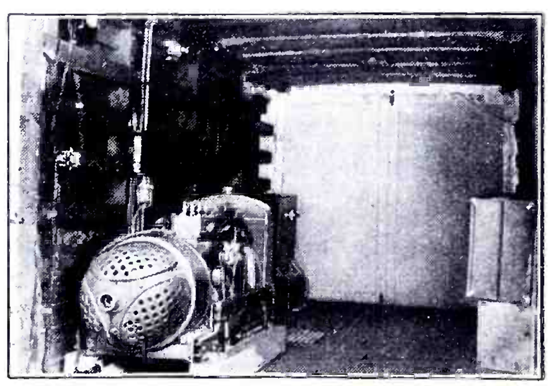


Other increasingly important adaptations are installations for amplifying public speeches, concerts, athletic



events, etc., where large crowds are gathered. A picture shows a Graybar Western Electric public address truck in which there is installed a Universal Electric Plant to run the amplifying equipment. Mr. R. C. Mulnix, Denver, Colorado, owner of this truck, recently completed a successful tour to handle the sound amplification for various public events in Colorado, Montana and Wyoming.

The possibilities in this sound truck market have barely been scratched, and the wide awake radio merchant will find splendid sales opportunities awaiting any aggressive effort in this direction on his part.



When Will Television Be Reality?

A QUESTION is often asked, "How long will it be before television will become a commercial reality?" The only answer to this is, of course, "As soon as the problems which must be overcome in the development of television can be solved." These problems are far from being impractical of solution, although many of them will require some time before they can be definitely disposed of. The principal difficulty, of course, is in obtaining enough detail so that the pictures can have real entertainment value. Anyone with a home movie projector can very soon determine for himself just how much of a problem this will be by making a rather simple little experiment.

Set the projector on a table and move it the proper distance back from the wall or screen so that the pictures measure exactly fifteen inches from top to bottom. Stop the projector on some picture which shows the edge of a door, the side of a house or some other distinct vertical line. Next throw the projector out of focus just enough so that this vertical line spreads approximately one quarter of an inch. This gives a picture with the same detail as is possible with the so-called sixty line twenty pictures per second system which is used at present.

This system requires a band width equal to that of eight of our present-day broadcasting stations. The government has allotted several channels on short waves of 100 kilocycles each, or the width of ten broadcasting channels. If these channels were increased ten times in width, the detail of the picture could improve materially. Under these conditions, it would correspond to that obtained by the movie projector when the vertical line was thrown out of focus sufficiently to cover approximately five sixty-fourths of an inch. There are, of course, several mechanical and electrical problems connected with the use of wider bands and more picture detail, but these are more or less incidental and will be readily overcome.

Another problem to be met is in the synchronizing of the receivers with the transmitter. In cases where both units are operated from the same power supply, this is readily accomplished by the use of synchronous motors. However, oftentimes within a radius of ten miles there will be as many as two or three different power supply systems. For instance, northern New Jersey power is not synchronized with that of Manhattan, and a television station in either one of these places cannot be received in the other without the use of special, and none too satisfactory synchronizing equipment.

Within the last few years, there has been considerable agitation for the continuous distribution by the Bureau of Standards of a constant frequency throughout the United States. This would presumably be at 10 kilocycles. Harmonics of such a frequency could be used by all broadcast transmitters to keep them properly on their wave, and it would very much simplify the problem of synchronization of television transmitters and receivers. However, whether the distribution of such a frequency becomes a reality or not, there will be other means for synchronization developed, such as the transmission of a synchronizing frequency along one edge of the picture.

Other annoying conditions which threaten to confine picture transmission to a local service are fading, fading distortion and echo images. These are very much more severe than in broadcast transmission. This is partly because television must of necessity be carried on at the higher frequencies where these effects are more pronounced, and partly because their effect on a picture is so much more noticeable than in speech or music.

The worst one of these is the so-called echo image phenomena. It is caused by the television impulses arriving at the receiver over two separate paths. If one of these paths is more than five or ten miles longer than the other, double overlapping images are produced. Since most of the energy received from a short wave transmitter more than fifteen to twenty miles distant is reflected energy from the Heaviside layer, there is always the possibility of unevenness and curvature in the reflecting medium giving these double images. Thus no matter how great the power of a television transmitter, its satisfactory working range will be limited to fifteen or twenty miles until these objections can be overcome.

Another limitation which is not often taken into account is the fact that only certain types of pictures can be satisfactorily transmitted and reproduced with the present type of system. As an explanation of this, we will take two extreme examples. First we will imagine that the picture is of an airplane flying overhead in a cloudless sky. In this picture, the entire background should be at maximum brilliancy. Next the scene might change to show a single spot of light in a room of otherwise total darkness; for instance, a prowler using a flashlight to locate the safe in a darkened office. These two are extreme examples but they will serve to illustrate the point.

There is this fundamental difference between the transmission of sound programs and pictures. All sounds consist of a variation in or modulation of an existing air pressure. In viewing a picture or scene, the eye receives various intensities of light, but these intensities are not variations of any existing mean intensity. In other words, if all sound ceases, we still have a fixed air pressure of 14.7 pounds per square inch, but if there is no picture in front of the eye, there may be either no light at all or a uniform amount of light from all points within the particular range of vision. Thus in broadcasting sound programs, the carrier wave is modulated exactly in accordance with the modulations of the fixed air pressure which caused the original sound, but in television not all pictures can be interpreted accurately in terms of modulation of a transmitted carrier wave.

However, the usual type of television transmitter uses a modulated carrier wave for its transmissions. In other words, the carrier wave would represent the mean intensity of the background and the modulation either increases or decreases this intensity to give the desired detail. Thus it is seen that in the two examples given above, the background of each picture would be of practically the same brilliancy. In the first, the airplane would be darker than the surrounding sky, and in the second case the spot of light would be brighter than the half lighted background. Even if it were possible to modulate the transmitted wave so completely that in the case of the second example impulses would be sent out only during the time while the light portion of the picture was being scanned, the results would still be the same. This is because of the fact that the output current of a power tube which is not distorting is constant over a given interval of time. Thus it can be seen that the sky in the first picture would be only slightly more brilliant than the background in the second picture which, of course, should be jet black.

It is due to this same condition that present television pictures often show a second, negative image outlined slightly to one side of the original.

(Continued on page 42)

Service Alignment of Supers

WHEN tuned radio frequency was in vogue, it was rather a simple matter to realign a chassis in order to bring it to the peak of performance. With superheterodyne circuits, it is much more of a problem, and unless due care and the correct procedure are used, it is almost impossible to put a superheterodyne receiver into proper operating condition once it gets out of trim. Every service man should familiarize himself with the proper procedure for superheterodyne circuit alignment before he attempts to make any adjustments.

In the first place, it is absolutely impossible to do the job right without the use of some type of instrument for indicating the peak alignment of each circuit. Tuned radio frequency receivers could be aligned by ear with a fair degree of accuracy for they had only three or four circuits at the most. This becomes practically an impossibility with superheterodynes. The reason is clear. If the receiver is tuned to a broadcasting station, a variation of ten per cent in the alignment of each circuit is not easily distinguishable. Thus in a receiver with nine tuned circuits, it would be possible to have the complete receiver only thirty-eight per cent efficient if each circuit were aligned as accurately as possible by ear.

A good type of indicating instrument and one which can be adapted to any receiver is a second detector, cathode to ground voltmeter. The readings of this instrument are affected by the carrier wave only and are practically independent of modulation. Thus variations in the intensity of the transmitted program are not a factor. If a modulated oscillator is available, an output meter across the speaker will be just as satisfactory and somewhat more sensitive.

It is first necessary to place the intermediate frequency circuits in proper adjustment. It is not only necessary to have them aligned accurately with each other, but the combined i-f amplifier must be set accurately to the frequency for which it was designed. Often it is necessary to do this job without the use of an oscillator which can be set accurately to the proper frequency. The best procedure in this case is to utilize the intermediate frequency produced by another receiver which is known to be in good operating condition.

This is accomplished by feeding some of the signal from the second detector of the good set to the grid of the first detector of the set to be aligned. Remove the second detector tube from the good set and wrap the bared end of a piece of insulated wire around the grid prong of the tube, as shown in Figure 1. Replace the tube in its socket, turn the set on and tune in a station. Be sure that the tuning is accurate and that the adjustment is not to one side or the other of the carrier wave. Now clip one terminal of a .00025 microfarad condenser to the grid prong of the first detector of the set to be aligned and connect the wire from the grid of the second detector of the other set to the other terminal of this condenser. Both receivers must be well grounded. With this connection, alignment of the i-f circuits can proceed in the normal fashion. The signal from the good receiver can be adjusted to suit the requirements by regulating its own volume control.

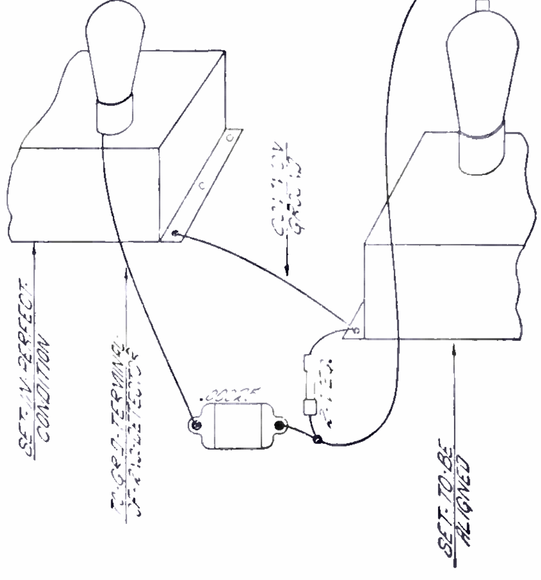
With the i-f's properly aligned, the next adjustment is that of the oscillator trimmer condenser. The oscillator circuit tuning is one of the most important adjustments in the receiver because of the fact that it alone determines the dial setting. Selectivity in the i-f end is great enough in the average super so that misalignment of the r-f circuits will not change the calibration, but will merely decrease the sensitivity. In some cases, it may happen that the dial pointer has been moved in relation to the setting of the variable condensers. At any rate, this should be checked when making the adjustment of the oscillator circuit.

It is well to make use of a calibrated oscillator, if one is available. If not, the signals from broadcasting stations of known frequency must be used. Here, as in all cases of alignment of circuits which include a variable condenser, the first adjustment should be made at the high frequency end of the dial. Turn the knob until the pointer indicates the frequency of the station or oscillator which is to be used for the check, and adjust the trimming condenser on the side of the variable for maximum response. Now turn the knob through the tuning range and check the frequency of any other stations which can be heard. A slight preliminary adjustment of the r-f circuits may be necessary in order to obtain any reception at all.

When checking at the low frequency end of the dial, it may be found that the dial calibration is inaccurate. This is caused by either one of two things: the plates of the variable condenser may be sprung, or the pointer may have shifted with respect to the rotors. In case the plates are sprung, it is necessary to bend them. It should be remembered that any bending which brings them closer together raises the dial reading at which a particular station is received.

If it is a case of the pointer or dial having slipped on the drive shaft, loosen the set screws after having tuned in a low frequency station, and turn the knob without allowing the rotor plates to move until there is a slight error in the opposite sense. For instance, suppose that after having adjusted to a high frequency station, we check against a 600 kilocycle signal and find that the pointer has to be moved to 590 kilocycles for proper reception. In this case, the set screws would be loosened, the rotor plates held so that they could not move and the knob turned until the pointer read approximately 603 kilocycles. After tightening the set screws, it is then necessary to repeat the high frequency alignment and again check on the low frequency signal.

The other two or three variable tuned circuits which comprise the r-f end of the superheterodyne receiver are trimmed in much the same manner as with tuned radio frequency. The only noticeable difference will be that the dial reading of a particular signal can not be changed with changes in alignment of these circuits. Trim them first at the high frequencies and then check them on the low end of the dial. This check can be made by slightly moving the stator plates with a bakelite rod. If the response increases when the outside stator plate is moved either toward or away from the rotor plates, it will be necessary to bend the stator plates slightly. Needless to say, this should not be carried to a point where there is danger of contact.

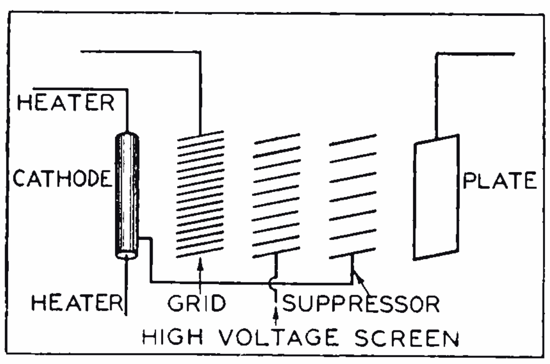


A New Super-Control R. F. Pentode

RCA Radiotron Company, Inc., and E. T. Cunningham, Inc., have announced a new tube called the Super-Control Radio Frequency Amplifier Pentode. The type designation is Radiotron RCA-239 and Cunningham C-239.

This new tube is an addition to the automobile tube series and incorporates a number of new design features which make it particularly suitable for use in new designs of automobile receivers and radio sets intended for use on 110 volt direct current lines.

The '39 is recommended for use as a radio frequency amplifier, intermediate frequency amplifier, and superheterodyne first detector. It is very effective in reducing cross modulation and modulation distortion over the usual range of received signals. Its design, like that of the '35, is such as to permit easy control of a large range of signal voltages without the use of special local-distance controls. This super-control characteristic makes the tube uniquely suitable for use in receivers designed for automatic volume control.



Above illustration gives a pictorial diagram of the arrangement of the elements in the new 239 type super-control tube. Tentative characteristics will be found on page 42

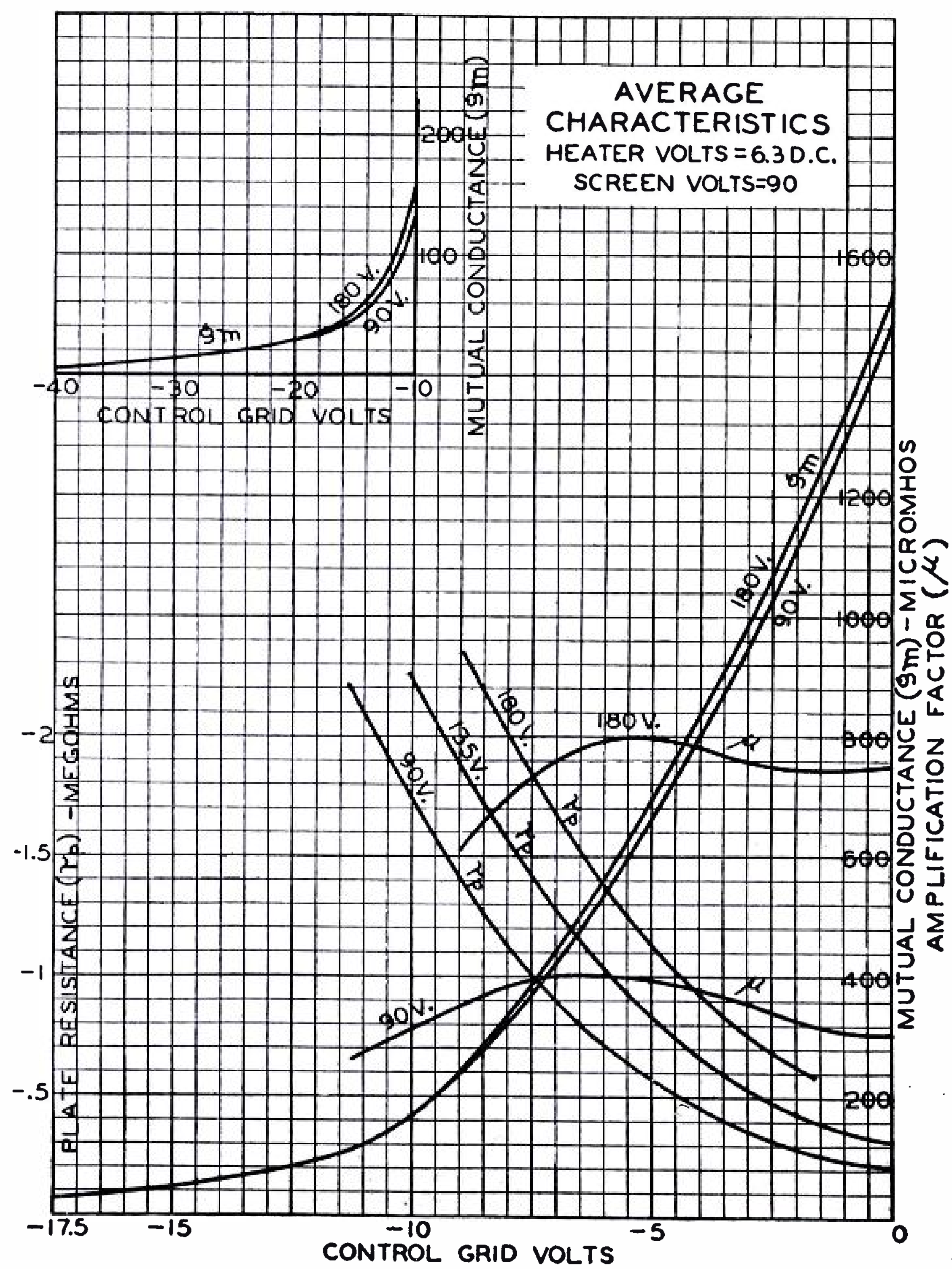
This new tube is a five electrode design, hence the name, pentode. In addition to the usual cathode, grid, screen, and plate elements, a fifth element called the suppressor is placed between the screen and the plate. This suppressor is connected within the tube to the cathode and effectively eliminates the secondary emission effects which otherwise limit the voltage swing permissible in screen grid tubes if operated with a low plate voltage, that is, at a plate voltage approximately equal to the screen voltage. The suppressor in this new radio-frequency pentode therefore makes possible the operation of this new type of tube with excellent results where the plate voltage available is limited, as for example in sets designed for operation on 110 volt direct current.

The use of the suppressor makes possible further advantages tending toward better set performance, since the fifth element permits of greater flexibility in securing a high mutual conductance and a high plate resistance, even though the tube may be operated at a low supply voltage.

The '39 utilizes a coated cathode of the heater type designed for direct current operation. Owing to the special cathode construction, the heater voltage may vary during the charge and discharge cycles of the automobile storage battery, without affecting seriously the performance or serviceableness of this tube. No resistor in the heater circuit is required for operation from a six volt battery.

For operation in receivers designed for direct current power lines, the heaters of two or more of these tubes may be connected in series. Since the current rating of this tube is the same as the '36, '37, and '38, that is 0.3 amperes, any heater combination of these tubes in series is practical, provided that the current is adjusted to the proper value.

This new tube is not interchangeable with any other type of Radiotron or Cunningham vacuum tube.



Set Manufacturers and Brand Names

Manufacturer	Address	Brand
Acme Mfg. & Elec. Co.	1440 Hamilton Ave., Cleveland, Ohio	Acme
Advance Elec. Co.	1260 W. 2nd St., Los Angeles, Calif.	Falck
All-American Mohawk Corp.	North Tonawanda, N. Y.	Lyric
Amrad Division	Crosley Radio Corp., Cincinnati, Ohio	Amrad
Andrea, F. A. D., Inc.	Long Island City, N. Y.	Fada
Atchison Radio Mfg. Co.	125 N. 6th St., Atchison, Kans.	Atchison
Atwater-Kent Mfg. Co.	4700 Wissahickon Ave., Philadelphia	Atwater-Kent
Audiola Radio Co.	430 S. Green St., Chicago	Audiola
Automatic Radio Mfg. Co.	332 A St., Boston, Mass.	Tom-Thumb
Brown & Manhart	6219 S. Hoover St., Los Angeles, Calif.	Ranger
Browning-Drake Corp.	224 Calvary, Waltham, Mass.	Browning-Drake
Brunswick Radio Corp.	120 W. 42nd St., New York City	Brunswick
Cardinal Radio Mfg. Co.	2812 S. Main St., Los Angeles, Calif.	Cardinal
Cardon-Phonocraft Corp.	E. Michigan & Horton, Jackson, Mich.	Cardon-Sparks
Carteret Radio Lab.	254 W. 18th St., New York City	Carteret
Champion Radio Mfg. Corp.	1865 W. Gage Ave., Los Angeles, Calif.	Champion
Cleartone Division	Cincinnati Time Recorder Co., 1731 Central Ave., Cincinnati, Ohio	Cleartone
Colonial Radio Corp.	254 Rano St., Buffalo, N. Y.	Colonial
Columbia Phonograph Co.	1819 Broadway, New York City	Columbia
Continental Radio Corp.	Ft. Wayne, Ind.	Star-Raider
Crosley Radio Corp.	Cincinnati, Ohio	Crosley
Davison-Haynes Mfg. Co.	1012 W. Washington Blvd., Los Angeles	Angelus
De Forest Radio Co.	Passaic, N. J.	DeForest
Delco Radio Corp.	Dayton, Ohio	Delco
Echophone Radio Mfg. Co.	104 Lake View Ave., Waukegan, Ill.	Echophone
Edison, Thos. A., Inc.	Orange, N. J.	Edison
Electrical Research Lab.	1731 W. 22nd St., Chicago	Erla
Elmore-Lambing Radio Co.	1205 S. Olive St., Los Angeles, Calif.	Singer
Flint Radio Co., Inc.	3446 S. Hill St., Los Angeles, Calif.	Flint
French, Jesse, & Sons Co.	New Castle, Ind.	Jesse-French
General Electric Co.	Bridgeport, Conn.	General Electric
General Motors Radio Corp.	Dayton, Ohio	General Motors
Gilfillan Bros., Inc.	1815 Venice Blvd., Los Angeles, Calif.	Gilfillan
Gray & Danielson Mfg. Co.	2101 Bryant St., San Francisco, Calif.	Remler
Graybar Elec. Co.	Graybar Bldg., New York City	Graybar
Grebe, A. H., & Co., Inc.	70 Van Wyck Blvd., Richmond Hill, N. Y.	Grebe
Griffin Smith Mfg. Co.	1224 Wall St., Los Angeles, Calif.	Royale
Grigsby-Grunow Co.	5801 Dickens Ave., Chicago	Majestic
Gulbransen Co.	3232 W. Chicago Ave., Chicago	Gulbransen
Herbert H. Horn	1629 S. Hill St., Los Angeles, Calif.	Tiffany Tone
High Frequency Laboratories	3900 N. Claremont Ave., Chicago	Minuet
Howard Radio Co.	South Haven, Mich.	Howard
Howard, Austin A., Corp.	1725 Diversey Pkwy., Chicago	Austin
Hyatt Elec. Corp.	406 N. Madison St., Woodstock, Ill.	Hyatt
Jackson-Bell Co.	1682 W. Washington St., Los Angeles, Calif.	Jackson-Bell
Jewel Mfg. Co.	222 S. West Temple St., Salt Lake City	Jewel
Keller-Fuller Mfg. Co.	1573 W. Jefferson, Los Angeles, Calif.	Radiette
Kellogg Switchboard & Supply Co.	1066 W. Adams St., Chicago	Kellogg
Kemper Radio Corp., Ltd.	1236 Santee St., Los Angeles, Calif.	Kemper-Kompak
Kennedy, Colin B., Corp.	South Bend, Ind.	Kennedy
King Mfg. Co.	254 R St., Buffalo, N. Y.	King
Kolster Radio Corp.	360 Thomas St., Newark, N. J.	Kolster
Long Radio Co.	2810-12 S. Main St., Los Angeles	Cardinal
Marti Radio Corp.	Ampere, N. J.	Marti
Mid West Radio Corp.	Cincinnati, Ohio (410 E. 8th St.)	Miraco
Mission Bell Radio Mfg. & Distr. Co.	1125 Wall St., Los Angeles, Calif.	Mission
National Transformer Mfg. Co.	5100 Ravenswood Ave., Chicago	Balkeit
National Transformer Mfg. Co.	5100 Ravenswood Ave., Chicago	National
Patterson Radio Corp.	239 S. Los Angeles St., Los Angeles	Patterson
Philadelphia Storage Battery Co.	Ontario & C Sts., Philadelphia, Pa.	Philco
Pierce-Airo, Inc.	510—6th Ave., New York City	Pierce-Airo
Pierce-Airo, Inc.	510—6th Ave., New York City	De Wald
Pilot Radio & Tube Co.	Lawrence, Mass.	Pilot
Pioneer Radio Co.	Plano, Ill.	Pioneer
Plymouth Radio Corp.	2625 N. Main St., Los Angeles, Calif.	Plymouth
Powell Mfg. Co.	6121 S. Western Ave., Los Angeles, Calif.	Powell
Premier Elec. Co.	Grace & Ravenswood Ave., Chicago	Premier
RCA Victor Co., Inc.	Camden, N. J.	Radiola
RCA Victor Co., Inc.	Camden, N. J.	Victor
Republic Radio Co.	3940-46 Grand Ave., Chicago	Republic
Roth-Downs Mfg. Co.	2512 University Ave., St. Paul, Minn.	Orpheus
Seeley Elec. Co.	1818 West 9th St., Los Angeles, Calif.	Lark
Silver-Marshall, Inc.	6401 W. 65th St., Chicago	Silver
Simplex Radio Co.	Monroe & King Sts., Sandusky, Ohio	Simplex
Sparks-Withington Co.	Jackson, Mich.	Sparton
Stein, Fred W.	1200 Main St., Atchison, Kans.	Aztec
Steinite Mfg. Co.	Ft. Wayne, Ind.	Steinite
Sterling Mfg. Co.	2831 Prospect Ave., Cleveland, Ohio	Sterling
Stewart-Warner Corp.	1826 Diversey Pkwy., Chicago	Stewart-Warner
Story & Clark Radio Corp.	173 N. Michigan Ave., Chicago	Story & Clark
Stromberg-Carlson Tel. Mfg. Co.	Rochester, N. Y.	Stromberg-Carlson
Transformer Corp. of America	Keeler & Ogden Ave., Chicago	Clarion
Trav-Ler Mfg. Co.	1818 Washington Blvd., St. Louis	Trav-Ler
United Air Cleaner Corp.	9705 Cottage Grove Ave., Chicago	Sentinel
United American Bosch Corp.	Springfield, Mass.	Bosch
U. S. Radio & Television Co.	Marion, Ind.	Apex
Vaga Mfg. Corp.	718 Atlantic Ave., Brooklyn, N. Y.	Vagabond
Waltham Radio Corp., Ltd.	4228 S. Vermont Ave., Los Angeles	Waltham
Ware Mfg. Corp.	Trenton, N. J.	Ware
Westinghouse Elec. & Mfg.	Mansfield, Ohio	Westinghouse
Zenith Radio Corp.	3620 Iron St., Chicago	Zenith

When Will Television Be Reality?

(Continued from page 38)

For instance, one program which is broadcast nightly shows the image of "Felix the Cat" being slowly revolved in front of the television camera. This picture, when reproduced, always shows a second outline of the cat displaced to the right which is light instead of dark. Likewise, some dark image at the top of the picture will cause the background near that image to be lighter than in the lower half of the picture, even though the two should be of the same intensity.

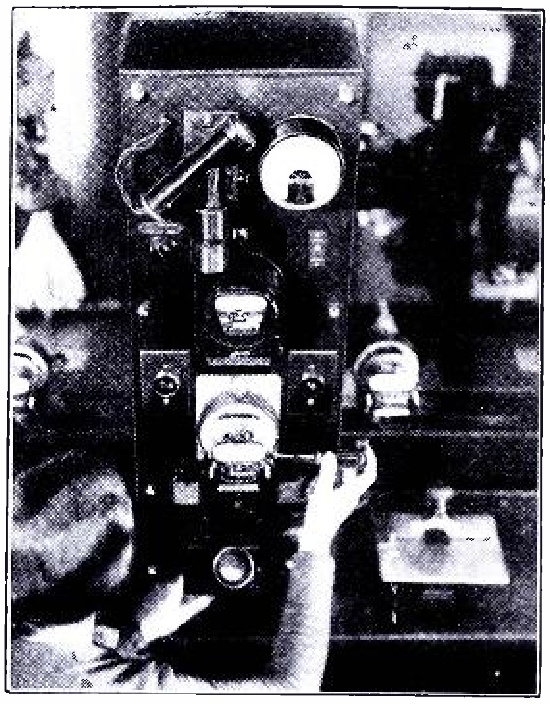
In spite of these difficulties and many others which must be satisfactorily solved before television will be accepted commercially, the problems are gradually being overcome and it will not be many months before we will witness the erection of several powerful television transmitters and can say that television is fairly on its way.

The public in general will not accept television until it has advanced far beyond the embryonic state in which radio broadcasting first became popular. In all fairness, it can be said that at the present time television has advanced at least to this stage. Nightly television programs are being broadcast in several of the larger metropolitan areas, and when these increase their band widths to enable them to transmit greater detail, they will be able to put out exceedingly interesting programs of judiciously chosen scenes and subjects. Television, because of its greater complicity, is bound to go through a longer period of development even after it does become commercial than has been the case with radio broadcasting, but the results will be of that much greater value. This will be particularly so because the two services will be combined for the transmission of talking pictures.

CALIBRATIONS

A STROBOSCOPE is a simple mechanical device used to compare speeds. Stroboscopes have been in common use in physical laboratories for a great many years. By their means not only can speeds be compared but motions can be made to appear real slow and even to stop. A rotating airplane propeller observed through a rotating disk, having holes in it, will appear to be stationary when the disk is rotated at the same speed as the propeller, or appear to turn over slowly when the disk is rotated at a slightly slower speed.

In this picture, the girl is calibrating a house type electricity meter by the stroboscopic method—a very good example of a very ancient idea put to a modern use. A sharp beam of light shines through openings in the rotating disk of the upper or "standard meter," which is known to be 100% correct. This interrupted light beam falls upon the disk of the meter being calibrated. It takes a girl only a few minutes to calibrate a new meter by this means because she merely moves an adjusting screw until the disk appears to stop.



Thus, one girl, requiring no special knowledge, can do the work better and quicker than the trained laboratory operators could do it previously.

The viewing opening near the girl's left hand is arranged to magnify the marks on the edge of the tested meter disk, and is located to give the maximum convenience and repose, and thus the least fatigue to the operator.

NEW USES FOR TELEVISION

NEW YORK CITY, Dec. 2nd.—At 9:15 this evening the solar eclipse which is to take place next August was duplicated with mechanical studio models, televised, and the television image of the demonstration picked up at the American Museum of Natural History in New York, where O. H. Caldwell was delivering a lecture on eclipses before a group of eminent scientists. The television image was projected by means of a Jenkins radiovisor on a large screen in full view of the assembled scientists.

Mr. Caldwell, former member of the Federal Radio Commission, scientist and editor, addressed the group, in front of which was the Jenkins television screen, approximately 8 feet square. Behind the screen stood the Jenkins television receiving equipment, the image from which was projected on the screen from behind in much the manner of the translux motion picture method of projection.

During the lecture the mechanical eclipse was manipulated in the television broadcasting studio and transmitted, the image being received at the Museum of Natural History and projected on the screen, a visual example of Mr. Caldwell's remarks. This marks the first time that an astronomical lecture has been demonstrated by television.

239 SUPER CONTROL R-F PENTODE

Tentative Rating and Characteristics

Heater Voltage			6.3	Volts D. C.
Heater Current			0.3	Amperes
Plate Voltage	90*	135	180	Volts Maximum
Screen Voltage, Maximum	90*	90	90	Volts
Grid Voltage, Variable	–3*	–3	–3	Volts Minimum
Plate Current	4.4	4.4	4.5	Milliamperes
Screen Current	1.3	1.2	1.2	Milliamperes
Plate Resistance	375000	540000	750000	Ohms
Amplification Factor	360	530	750	
Mutual Conductance	960	980	1000	Micromhos
Mutual Conductance at –30 volts bias	10	10	10	Micromhos
Mutual Conductance at –40 volts bias	very small, but not zero			
Interelectrode Capacitances				
Effective Grid-Plate Capacitance	0.007 uuf. Maximum			
Input Capacitance	4 uuf.			
Output Capacitance	10 uuf.			
Overall Dimensions				
Length	4$\frac{3}{16}$"—4$\frac{11}{16}$"			
Diameter	1$\frac{9}{16}$"			
Cap	0.346"—0.369"			
Bulb	S-12			
Base	Small 5 Prong			

*Recommended values for use in receivers designed for 110 volt d-c operation

NEW PRODUCTS FOR THE TRADE

Ward Leonard Issues New Circular

Ward Leonard Electric Co., Mt. Vernon, N. Y., announces a new circular No. 514, listing a complete line of voltage dividers for various radio receivers on the market.

This circular lists the trade name and model number of each receiver for which this company can supply voltage dividers. The resistance in ohms, dimensions, catalog number, code word and prices are also shown.

The manufacturers state that this circular can be obtained upon request.

Drake Publishes New Book

Frederick J. Drake & Co., 179 N. Michigan Ave., Chicago, Ill., announce the publication of "Radio and Electronic Dictionary," by H. P. Manly.

This book is designed to show various terms in the radio field and fully explains 3800 words used in the electronic field. It contains 300 pages, 550 illustrations, and the list price is $2.50.

Aerovox Makes Replacement Blocks

So great has been the demand by dealers, jobbers and service men everywhere for replacement condenser blocks, that the Aerovox Wireless Corp., Brooklyn, N. Y., has recently announced that replacement units for the Majestic 9-P-6 and 7B-P-6 and Atwater-Kent models 37 and 38 power supply units are now available.

The replacement unit for the Majestic 9-P-6 power supply consists of three 2 mfd sections of 400, 500 and 600 d-c working voltages and one mfd section of 300 d-c working voltage with a choke connected in series with the latter.

The replacement unit for the Majestic 7B-P-6 power supply consists of two 2 mfd sections of 300 and 600 d-c working voltages, and two 3 mfd sections of 300 and 400 d-c working voltages.

The condenser sections used in the construction of these blocks are non-inductively wound, impregnated and dehydrated using high grade materials throughout. They are mounted in metal casings, sealed with moisture-proof filling compound and provided with convenient soldering terminals on an insulating strip through the top of the unit.

The replacement units for Atwater-Kent models 37 and 38 power supply units consist of two .5 mfd sections, two 1 mfd sections, two filter chokes and a speaker choke. The condenser sections and chokes are mounted in heavy metal containers filled with sealing compound and provided with colored wire leads.

Lynch Announces New Resistor Manual

Lynch Mfg. Co., 1775 Broadway, New York City, announces the publication of the Lynch Resistor Replacement Manual for the service man. This book is pocket size and gives the value and code of each resistor and shows its position in the circuit of over 200 popular makes of receivers. The book contains 60 pages and may be purchased direct from the above named concern.

Burnt-Out Transformers Duplicated

The Standard Transformer Corp., 850 Blackhawk St., Chicago, Ill., announce a new service. This company will furnish replacement transformers which have the same physical and electrical characteristics of various transformers when new.

An exact reproduction of the burnt out transformer as originally furnished in the set can be obtained from this company. The manufacturer states that no refitting or redrilling of the panel is necessary and that the new transformer can be placed in exactly the same location as the burnt out transformer and will not require any special brackets or refitting.

IRC Announces New Prices on Resistors

The International Resistance Co., 2006 Chestnut St., Philadelphia, Pa., announces that increased production has enabled them to reduce prices approximately 40% on all types of metallized resistors, one watt resistors that formerly sold for 50c list can be bought for 30c list; 2 watt resistors that formerly sold for 75c list can be purchased for 40c and three watt resistors that formerly sold for 80c list are now reduced to 50c list. Increased service helps are given to the dealer and service man free of charge. The same dealers' and serviceman's discount of 40% from the list price still applies.

Gloritone Table Model

Gloritone model 99A has recently been announced by U. S. Radio & Television Corp., Marion, Ind.

NEW PRODUCTS ITEMS

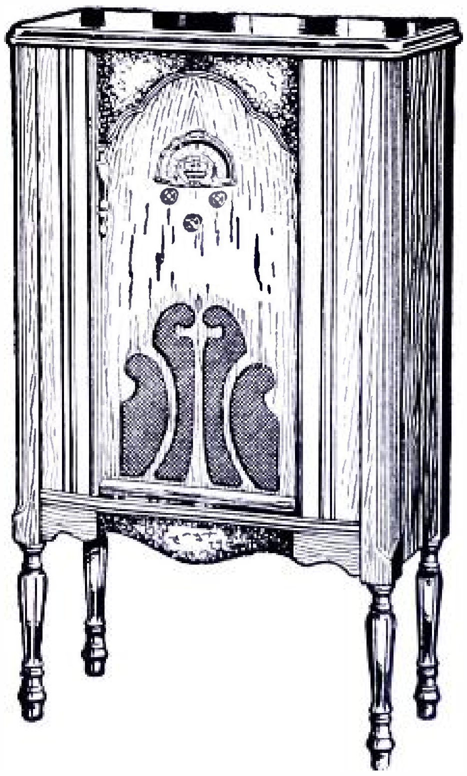
Manufacturers who have items that come within the scope of this department will find it of advantage to keep our name on their mailing list for announcements of new products. Halftones or electros should not exceed 2¼ inches in width. Address—New Products Editor, care this magazine.

This table model has a front panel of matched burl walnut. Speaker openings, scrolls and escutcheons balance in appearance. The chassis with superheterodyne circuit, using the new full range mu and pentode tubes, is balanced by an electro-dynamic speaker.

The physical characteristics measure 16⅝″ high, 14¾″ wide and 9¼″ deep.

Gloritone Console Model

Gloritone model 99B has recently been announced by U. S. Radio & Television Corp., Marion, Ind.

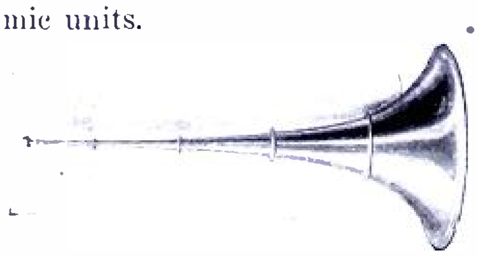


This console model has a front of matched grain woods with side decorated panel. Speaker openings, scrolls and escutcheons balance in appearance. The chassis with superheterodyne circuit, using the new full range mu and pentode tubes, is balanced by an electro-dynamic speaker.

The physical characteristics measure 38¼″ high, 22″ wide and 10⅜″ deep.

Fox Engineering Announces New Horn

The first size in a full series of all-metal trumpet horns has just been offered the sound projection trade by the Fox Engineering Co., Toledo manufacturers of horns and electro-dynamic units.



The manufacturers submit the following information:

"While the tone characteristics and physical requirements of the perfect amplifying horn have long been recognized by sound engineers, the actual attainment of these characteristics has been a matter of slow and painstaking development. All-metal horns are not new, but an all-metal horn that is entirely free from rasping and vibration noises is an achievement that will be welcomed by every sound engineer in the country.

"These horns are 6 ft. long and have a bell diameter of 32 inches, are of spun aluminum and free from lateral joints or seams. This construction makes possible a definite radial uniformity that accounts for its fine tone. Aluminum is not only an ideal medium from the standpoint of resonance and purity of tone, but its light weight is an appreciated factor in many instances. It is easy to set up and take down for temporary use, and when knocked-down into its integral parts, is extremely easy to store and ship.

"These horns are entirely free from the influence of atmospheric and moisture conditions and are almost indestructible in normal use. Weight is only 12 pounds.

"The outstanding application is for exterior use where weather conditions are bad, but their compactness, light weight, and fine tone quality meet every condition of auditorium and theatre work.

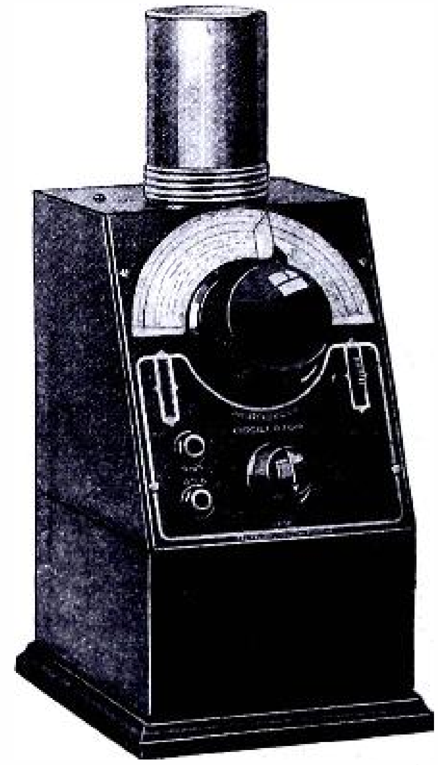
"The horn is available in the standard, straight style and can be furnished with a special curved adapter with an integral bracket for installing on wood or steel poles. This bracket construction is an appreciated feature for many jobs."

DayraD Display Tube Tester

The Radio Products Co., Dayton, Ohio, have recently placed on the market their type 360 display tube tester, with large meter calibrated in layman's language. This meter mainly designates whether a tube is good or bad. The manufacturers of this tube tester state that the set owner does not understand the technical terms which are applied to radio tubes, but he is interested in knowing whether his tubes are good or bad.

J-M-P Makes New Oscillator

J-M-P Mfg. Co., Milwaukee, Wis., announces an accurately calibrated signal generator, known as the Acrocycle oscillator.

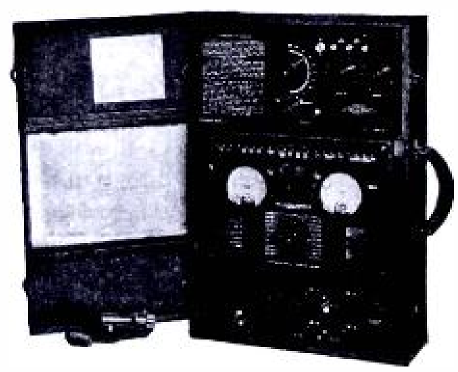


The manufacturer states that this instrument produces fundamental frequencies from 115 to 280 kc and harmonics from 230 to 1680 kc and higher. This equals approximately 175 to 2600 meters. The tuning dial is operated by a slow motion non-backlash vernier with a ratio of 68 to 1, permitting the setting of the dial pointer to hair line accuracy.

A convenient carrying case can be obtained from the manufacturer, overall measurements 6 in. by 7 in. by 12½ in.

The Jewell Professional Combination

There is a rapidly growing percentage of radio servicemen who consider their work in the light of a profession. The whole industry is indebted to them for the superior service methods they have evolved.



These men demand complete radio service equipment that is adequate for making all tests and adjustments on any receiver. To meet their needs most conveniently, the Jewell Elec. Instrument Co., 1650 Walnut St., Chicago, has developed a single compact unit that provides all necessary servicing functions.

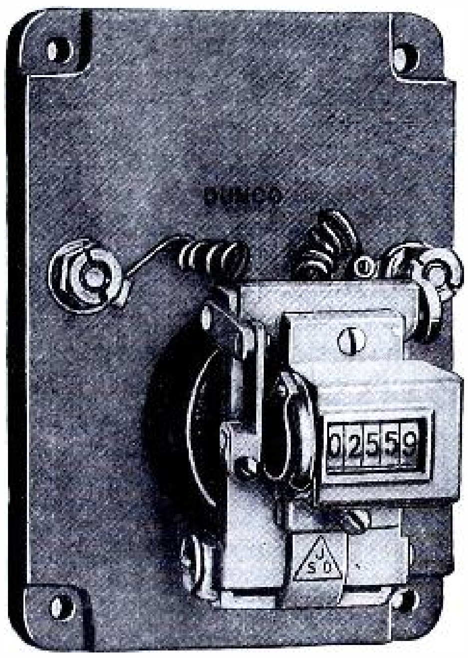
The pattern 531 professional combination includes a Jewell pattern

444 set analyzer, the new Jewell compact oscillator similar to the pattern 563 and a power unit that supplies power for testing all tubes independently of a receiving set.

The analyzer and oscillator may be removed from the carrying case for convenient use in the shop or in the customer's home.

New Electric Magnetic Counter

Struthers Dunn, Inc., 144 N. Juniper St., Philadelphia, Pa., have recently placed on the market the Dunco electric magnetic ground.

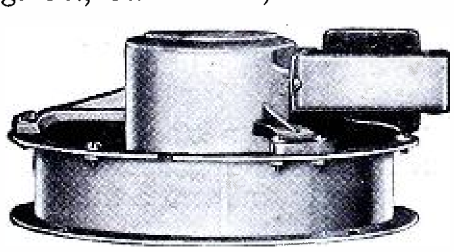


The manufacturer states that this device has a wide opening in the radio field and can be used with photo-electric cells for industrial purposes.

The unit is compact, mounted on a base 3 in. by 4½ in., overall dimension 3½ in. The non-resetting type is designed to operate up to 75 impulses per minute; the resetting type can be actuated to a speed of 350 impulses per minute, according to application.

Operadio Makes Midget Speaker

A new extremely small dynamic speaker for use with very small midget sets has just been added to the line of speakers built by the Operadio Mfg. Co., St. Charles, Ill.

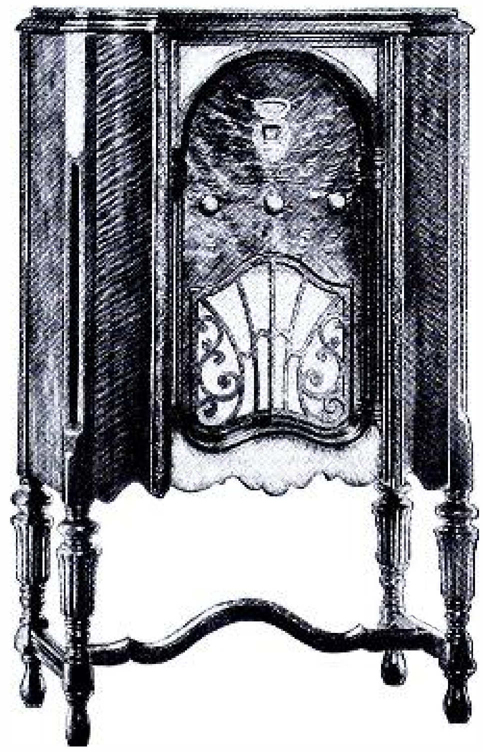


Though it is but 6 inches in diameter and 3⅜ inches overall including the speaker transformer, the manufacturer states it has an excellent response curve, high efficiency, and is capable of handling exceptional volume for a unit of these physical dimensions.

Operadio patented inverted construction that places the field coil within the conical diaphragm allows excellent structure of the magnetic path and the use of a larger field coil than customary in small speakers of ordinary design.

Sentinel Announces Two Supers with Automatic Volume Control

The United Air Cleaner Corp., 9705 Cottage Grove Ave., Chicago, recently announced to the trade their models Sentinel 118 ten tube and Sentinel 114 nine tube superheterodyne radio receiving sets.



The Sentinel model 118 uses two 224 screen grid, two 235 variable mu, three 227 triode, two 247 pentode, and one 280 rectifier tubes.

The Sentinel model 114 uses two 224 screen grid, two 235 variable mu, two 227 triode, two 247 pentode, and one 280 full wave rectifier tubes.

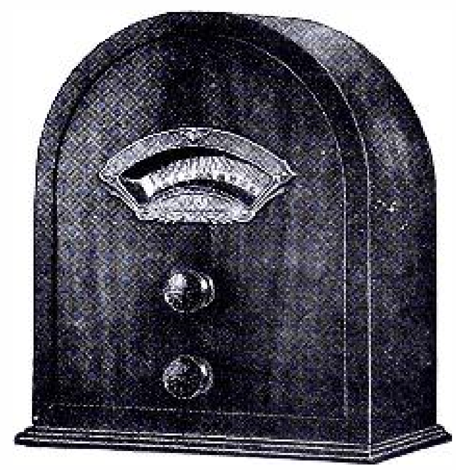
Dubilier High Frequency Condensers

A new line of high frequency capacitors, type PL-341-62, is announced by the Dubilier Condenser Corp., New York City. This type comprises a special dielectric section encased in a cylindrical aluminum shell with insulated top terminal and mounting base. The metal is reduced to a minimum in limiting Eddy current losses so prevalent at extreme frequencies; in fact, the extremely low losses in this type capacitor approach the efficiency attained in air condensers.

Type PL-341-62 Dubilier capacitors are available in .000025 and .00001 mfd values. They can be employed as neutralizing condensers because of their low capacity. Also they may be employed in parallel with the variable condenser in a tank circuit for increased capacity values, or again alone as a tank condenser. These capacitors are especially applicable to frequencies over 10 megacycles.

Franklin Makes Short Wave Converter

Following a recent complete reorganization of the former Van Horne Tube Co. of Franklin, Ohio, their engineering organization has produced a short wave converter.



This converter is known as the Rembert and is illustrated above. The manufacturers claim that it will receive police calls, ship to shore, short wave phones and all short wave stations from 15 to 200 meters.

RCA Radiolette

RCA Victor Co. announces the model R-5, a four-tube two-tuned circuit. This receiver, illustrated above, is housed in a Cathedral type midget cabinet of walnut veneer.

NEW PATENTS

Conducted by BEN J. CHROMY

National Press Building, Washington, D. C.

1,834,416. ELECTRIC CONTROLLING APPARATUS. Victor L. Osgood, New York, N. Y., assignor to Ward Leonard Electric Company, a Corporation of New York. Filed Mar. 20, 1928. Serial No. 263,142. 15 Claims. (Cl. 175—363.)

5. The combination of an alternating current supply circuit, a rectifier for supplying a load with direct current, a controlling reactor having a winding supplied with energy from the alternating current supply circuit, and a controlling rectifier supplied with energy from the alternating current supply circuit, said reactor having another winding supplied with direct current from said controlling rectifier, and a winding in the supply circuit subjected to load energy, said first-named winding being in series with said last-named winding.

1,834,571. RADIO FREQUENCY TRANSFORMER. George R. Binder, Riverside, Ill. Filed Apr. 29, 1929. Serial No. 358,802. 4 Claims. (Cl. 175—359.)

1. A radio frequency transformer having its primary and secondary interwoven on substantially a single cylindrical surface with certain coils running in a clockwise direction and certain others in a counter-clockwise direction.

1,834,778. ELECTRICAL SYSTEM. Walter E. Holland and William H. Grimditch, Philadelphia, Pa., assignors to Philadelphia Storage Battery Company, Philadelphia, Pa., a Corporation of Pennsylvania. Filed May 26, 1927. Serial No. 194,401. 1 Claim. (Cl. 250—27.)

In an electrical power supply system for radio receiving systems, the combination of a source of uni-directional current having a plurality of positive output terminals and a negative terminal for supplying potentials to the amplifier and detector stages of said receiving systems and means for simultaneously adjusting said potentials comprising a variable resistance connected between the terminals of the amplifier stages, a fixed resistance connected between one of the detector stage whereby the detector potential may be varied in accordance with the amplifier potential, and a condenser connected from one of the amplifier terminals to said negative terminal and another condenser connected from the detector terminal to said negative terminal for substantially reducing any variations in said uni-directional current which may be present and to provide a low impedance return for the signal currents of said receiving systems.

1,834,072. GLOW LAMP. Fritz Schröeter, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telegraphie m. b. H., Berlin, Germany, a Corporation of Germany. Filed June 26, 1929, Serial No. 373,-744, and in Germany July 4, 1928. 4 Claims. (Cl. 176—122.)

1. In a glow lamp construction, a cathode member, a plurality of anode members cooperating with said cathode member and spaced apart therefrom, and a tubular member surrounding said cathode member and extending outwardly therefrom toward said anode members.

1,834,113. DISCHARGE TUBE. Balthasar van der Pol, Eindhoven, Netherlands, assignor, by mesne assignments, to Radio Corporation of America, New York, N. Y., a Corporation. Filed Oct. 19, 1925, Serial No. 63,401, and in the Netherlands Jan. 23, 1925. 3 Claims. (Cl. 250—27.5.)

(Continued on next page)

(Continued from preceding page)

2. An electron discharge device comprising a heatable straight cathode for emitting electrons, and two cooperating electrodes in the form of two helices of the same diameter and pitch coaxially disposed to lie in the same cylindrical surface about said cathods with each turn of one helix lying between two adjacent turns of the other helix and the turns of one of said helices being so spaced that a substantially uniform electrostatic field exists between the adjacent turns of said helix when said helix is at normal operating potential.

1,834,129. PENDULUM-TYPE INTERRUPTER. SIEGMUND LOEWE, Berlin, Friedenau, Germany, assignor to Radio Corporation of America, a Corporation of Delaware. Filed Apr. 29, 1927, Serial No. 187,679, and in Germany July 19, 1926. 8 Claims. (Cl. 200—90.)

1. In combination, in a circuit interrupter, an evacuated vessel, a vibratory member in said vessel, one or more contacts mounted within yieldable extensions of said evacuated vessel, said extensions depending into said vessel, means for vibrating said member, and means for adjusting one or more of said contacts.

1,834,131. ELECTRON DISCHARGE APPARATUS. BENJAMIN F. MIESSNER, South Orange, N. J., assignor, by mesne assignments, to Radio Corporation of America, New York, N. Y., a Corporation of Delaware. Filed June 8, 1927. Serial No. 197,314. 2 Claims. (Cl. 250—27.5.)

1. In an electron discharge tube, a plate, a V-shaped filament, a grid comprising a coil of wire surrounding said filament, and a flat strip secured at points along its side to the turns of said coil, said strip extending laterally between the two legs of said filament.

1,834,251. ELECTRICAL DISCHARGE DEVICE. DANIEL MCFARLAN MOORE, East Orange, N. J., assignor to General Electric Company, a Corporation of New York. Filed Sept. 2, 1930. Serial No. 479,171. 7 Claims. (Cl. 176—122.)

1. A gaseous conduction device comprising a sealed elongated envelope having a stem at one end thereof, an attenuated gas content for said envelope, juxtaposed electrodes extending from wall to wall in said envelope transverse to its major axis, and having exposed end surfaces remote from said stem, a plate of insulation extending over end surfaces of said electrodes adjacent said stem and electrical conducting and mechanical supporting means for said electrodes extending from said stem through said plate.

1,834,443. CATHODE SYSTEM FOR VACUUM TUBES. STUART BALLANTINE, Mountain Lakes, N. J. Filed Aug. 6, 1928. Serial No. 297,746. 7 Claims. (Cl. 250—27.)

1. An electrical network comprising a vacuum tube having a cathode system comprising a pair of filamentary elements, means for supplying said elements with alternating currents having a substantially quadrature relation, and a terminal conductively connected to the electrical mid-points of each of said elements, said terminal serving as a common terminal for the input and output circuits of said tube.

1,834,761. ELECTRIC DISCHARGE VESSEL. RUDOLF G. BERTHOLD, Berlin-Siemensstadt, Germany, assignor to Siemens-Schuckertwerke Aktiengesellschaft, Berlin-Siemensstadt, Germany, a Corporation of Germany. Filed Dec. 23, 1927, Serial No. 242,243, and in Germany Dec. 15, 1926. 3 Claims. (Cl. 250—27.5.)

1. A seal for an electric tube having an envelope of insulating material comprising in combination, metal sleeves sealed at their ends to the insulating envelope of the tube and forming part thereof, internal and external electrode

(Continued on page 49)

(*Continued from page 47*)

connections on said electric tube joined to the inside and outside of said metal sleeves, said external electrode connections being tubular, and one being disposed within the other to permit the supply and discharge of a cooling medium flowing along said sleeves.

1,834,781. METHOD FOR TREATING FILAMENTS. GEORGE E. INMAN, East Cleveland and WILLIAM P. ZABEL, Cleveland Heights, Ohio, assignors to General Electric Company, a Corporation of New York. Filed Dec. 31, 1926. Serial No. 158,374. 2 Claims. (Cl. 148—8.)

1. The method of treating coiled filaments for electric incandescent lamps and similar articles which consists in packing a quantity of straight lengths of said filaments in a container having openings therein and confining them so as to prevent endwise movement thereof, and then inserting said container in a cleaning solution to remove impurities from said filaments.

1,834,408. ELECTRIC SIGNALING. MARIUS LATOUR, New York, N. Y., assignor to Latour Corporation, Jersey City, N. J., a Corporation of Delaware. Filed Mar. 9, 1925. Serial No. 14,221. 17 Claims. (Cl. 179—171.)

17. A signal receiving system including a plurality of electron tubes each having grid, filament and plate electrodes, input and output circuits interconnecting said electrodes with the output circuit of one electron tube interlinked with the input circuit of a succeeding electron tube, and a pair of parallel branch circuits connected in the input circuits of said electron tubes, said parallel branch circuits having an effective resistance variable at a predetermined rate in accordance with changes in frequency and operating to prevent the flow back of undesired oscillatory current in said circuits while permitting the free transfer of signaling energy of a selected frequency characteristic.

1,834,414. ELECTRICAL AMPLIFYING SYSTEM. BENJAMIN F. MIESSNER, South Orange, N. J., assignor, by mesne assignments, to Radio Corporation of America, New York, N. Y., a Corporation of Delaware. Filed June 19, 1926. Serial No. 117,076. 10 Claims. (Cl. 250—27.)

1. In a system of the character described, a source of alternating current, a rectifier connected thereto and adapted to deliver a pulsating unidirectional current, a pair of condensers across the output circuit of said rectifier, a reactance in one side of the output circuit and between the condensers, a plurality of cascaded amplifier tubes having plates and filaments and said tubes being adapted to be operated at different plate voltages, parallel connections between said plates and the one side of said output circuit, one of said connections including a resistance, and a connection between a point of common potential in the filaments of said tubes and the other side of said output circuit.

1,834,229. AMPLIFYING SYSTEM. ALBERT H. TAYLOR, Washington, D. C., assignor, by mesne assignments, to Federal Telegraph Company, a Corporation of California. Filed Nov. 7, 1927. Serial No. 231,591. 4 Claims. (Cl. 179—171.)

3. An amplification system comprising a plurality of electron tubes each having grid, filament and plate circuits, the output circuit of one electron tube having two parallel branches, one of said branches comprising a capacity and the other branch comprising an inductance and capacity in series, said last named capacity providing a nodal point of voltage intermediate the ends of said inductance, a connection from said inductance on one side of said nodal point to the grid of a succeeding electron tube and a connection from said inductance on the opposite side of said nodal point through a capacity to the plate circuit of said succeeding electron tube.

1932 NATIONAL DOUBLE SCREEN GRID
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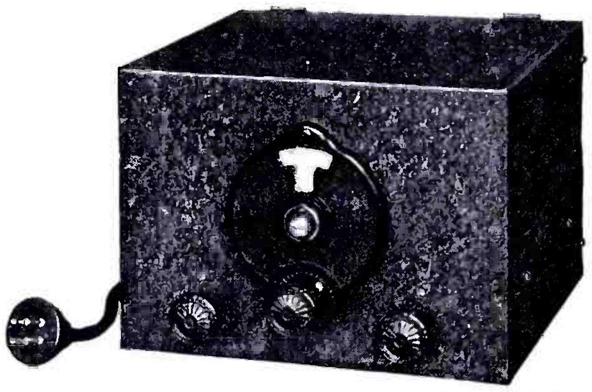
A C and 6 Volt D C Models



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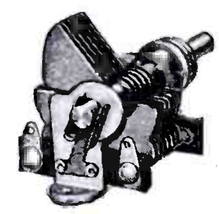

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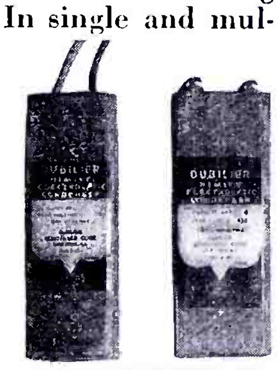

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1/100, 1/32, 1/16, 1/8, 1/4, 3/8, 1/2, 1, 2 amps. for galvanometers, millimeters, etc.	1/8 amp. for "B" circuits; also 1, 1 1/4, 2 and 3 amps. for radio replacement. WRITE FOR DETAILS	1,000, 5,000 and 10,000 volt ranges, in 1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1 1/2, 2 amps. for transmitters, rectifiers, etc.

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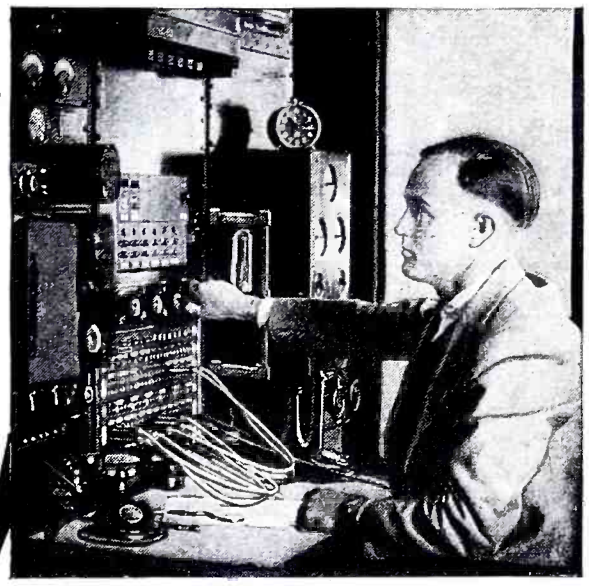

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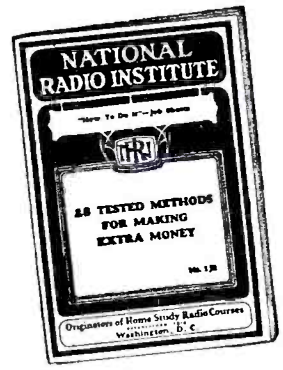

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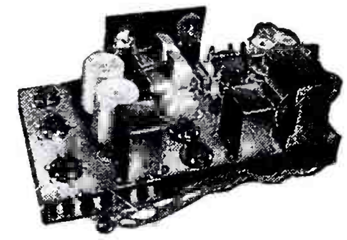

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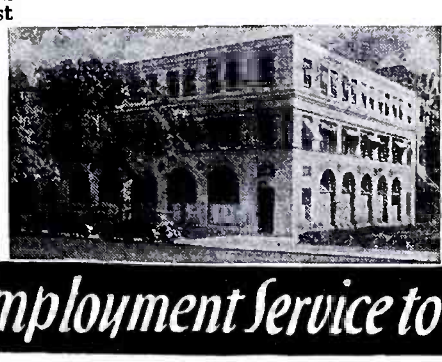

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

OF RADIO CALL BOOK MAGAZINE AND TECHNICAL REVIEW, published monthly at Chicago, Illinois, for October 1, 1931. State of Illinois, County of Cook, ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared F. A. Hill, who, having been duly sworn according to law, deposes and says that he is the Editor of the RADIO CALL BOOK MAGAZINE AND TECHNICAL REVIEW and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Citizens Radio Service Bureau, Chicago, Ill.; Editor and Managing Editor, Fred A. Hill, Chicago, Ill.; Business Manager, H. Anheiser, Chicago, Ill.

2. That the owner is (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given): Citizens Radio Service Bureau, Chicago, Ill.; Chas. O. Stimpson, Chicago, Ill.; H. Anheiser, Chicago, Ill.; F. A. Hill, Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state): There are none.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (this information is required from daily publications only).

F. A. HILL,
Editor.

Sworn to and subscribed before me this 25th day of September, 1931.

FRANK W. McVICKER, Notary Public.

(My commission expires December 1st, 1931.)

INDEX TO ADVERTISERS

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with its 10 Years of Solid, Substantial, and Continuous Growth Now Offers You the Finest Sales Opportunity in Howard History

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A SHORT AND LONG WAVE RECEIVER the snap of a switch changes the tuning from one band to another—it works!

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New Superheterodyne circuit with Special Howard Dynamic 12-inch Speaker and Tone Control. Exquisite Walnut Console Cabinet 39½ in. high, 22½ in. wide and 16¾ in. deep. Tubes employed: 2—27's; 1—80; 3—51's Variable Mu; and 2—47's Pentodes.

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No. 35, Console Model, Superheterodyne, with 8 tubes, complete	99.50
No. 40, Console Model, Superheterodyne, with 8 tubes, complete	119.50
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No. 60, Combination Model, Superheterodyne, with Automatic Volume Control, Automatic Record Changing Device, and 9 tubes, complete	259.50

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Triple Variable-Mu and Double Pentode

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100 Feet—RCA Cabloy—Model RF-5050
100—RCA Cabloy Clamps—Model RF-5055
10—RCA Taplets—Model RF-5031
10—RCA Radio Outlet Flush Plates—Model RF-5634
1—RCA Terminet—Model RF-5091

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☐ The RCA Antenaplex System
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