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SOURCES OF ELEMENTARY RADIO INFORMATION

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SOURCES OF ELEMENTARY RADIO INFORMATION.

ABSTRACT.

The developments in radio communication have been so rapid that much important radio information has not yet been collected in books, but must be sought in periodicals and other sources. A number of important books have appeared recently and are not generally known. The Bureau of Standards is constantly receiving requests for radio information. Many of the inquiries call for the same information, and in order to facilitate the handling of such inquiries this circular has been prepared. This circular gives information concerning radio periodicals, radio books issued by various publishers, Government radio publications issued by various bureaus, including the publications of the Bureau of Standards, radio laws and regulations, and call letters, and answers a few of the most usual elementary questions concerning radio communication which are asked by the novice.

CONTENTS.

1. INTRODUCTION.

A very considerable number of persons are interested in the operation of radio stations who are not directly concerned with the operation of either Government or regular commercial radio stations. Some are interested in maintaining a private system of radio communication over comparatively short distances. Many are interested in radio because it offers a very fascinating experimental field. Different kinds of useful information, such as

weather reports, market reports, time signals, and music and other entertainment, are transmitted broadcast daily by radio, and are received by many persons in all parts of the United States. This radio broadcasting has recently grown very rapidly and has become very popular and has resulted in the installation of receiving sets by persons who previously had never had any interest in radio.

2. PERIODICALS.

Persons interested in radio communication along the lines mentioned above can keep in touch with radio developments which will be of value to them by arranging to see regularly the issues of one or more of various periodicals.

The United States Department of Commerce, Bureau of Navigation, issues a monthly periodical called the Radio Service Bulletin, which will be found of considerable interest by every person engaged in radio communication. This periodical contains information regarding changes in the radio regulations, traffic information, and lists additions to or changes in the list of Commercial and Government Radio Stations, and brief items regarding new developments in radio. Publications of radio interest issued by various Government departments, including the Bureau of Standards, are announced as soon as issued. The Radio Service Bulletin also publishes each month a list of references to the more important radio articles appearing in the technical radio periodicals. These references are classified and furnish a means of keeping in touch with the material appearing on a particular subject. Subscriptions for the Radio Service Bulletin may be placed with the Superintendent of Documents, Government Printing Office, Washington, D. C. The subscription price is 25 cents per year for subscribers in the United States and its possessions, Canada, Cuba, and Mexico. For other countries the subscription price is 40 cents per year.

Persons who have had technical training in electricity and radio communication will be interested in the Proceedings of the Institute of Radio Engineers, One hundred and fortieth Street and Convent Avenue, New York, N. Y. Articles of radio interest frequently appear also in the Journal of the American Institute of Electrical Engineers, 29 West Thirty-ninth Street, New York, N.Y., and in the Journal of the Franklin Institute, 15 South Seventh Street, Philadelphia, Pa. Most of the general periodicals and the

popular scientific periodicals now devote considerable space to radio.

The following is a partial list of periodicals (monthly, except as stated) which cover the general and elementary phases of radio communication. Some of them are of a popular rather than a technical nature.

QST.—Published by the American Radio Relay League, Hartford, Conn.
Wireless Age, 326 Broadway, New York, N. Y.
Radio Telegrapher, 44 Broad Street, New York, N. Y.
Radio, Pacific Building, San Francisco, Calif.
Radio and Model Engineering, 88 Park Place, New York, N. Y.
Telegraph and Telephone Age (semimonthly), 253 Broadway, New York, N. Y.
Radio News, 235 Fulton Street, New York, N. Y.
Radio (formerly Aviation and Wireless News), 60 East Adelaide Street, Toronto, Ontario.
Wireless World and Radio Review (weekly), 12 Henrietta Street, London, England.
Radio News of Canada, 257 West Adelaide St., Toronto, Ontario.
Modern Wireless, Devereux Buildings, Strand, W. C. 2, London, England.
Radio Broadcast, Doubleday, Page & Co., Garden City, N. Y.
Popular Radio, 9 East Fortieth Street, New York, N. Y.
Radio World, 1493 Broadway, New York, N. Y.
Radio Digest, Illustrated, 123 West Madison Street, Chicago, Ill.
Radio Dealer, 1133 Broadway, New York, N. Y.
Radio Merchandising, 342 Madison Avenue, New York, N. Y.
Radio Journal, 113 Stimson Building, Los Angeles, Calif.
American Radio Journal, 116 West Thirty-ninth Street, New York, N. Y.

The New York Evening Mail each Saturday issues a radio magazine supplement which contains articles of popular radio interest.

3. GOVERNMENT RADIO PUBLICATIONS.

The Superintendent of Documents, Government Printing Office, Washington, D. C., will send without charge, on request, a copy of his Price List No. 64, which lists Government publications of radio interest.

A considerable number of papers on radio subjects have been issued by the radio laboratory of the Bureau of Standards. Some of these have been published by the Government Printing Office and some in various periodicals. Most of these papers are primarily of interest to the radio engineer and scientist. Bureau of Standards Letter Circular No. 40, Radio Publications of the Bureau of Standards, which lists these publications, may be secured by addressing a request to the Bureau of Standards, Washington, D. C. The bureau's publications issued by the Government Printing Office, which are of most general radio interest, are listed below. The Bureau of Standards can not undertake to send its

new radio publications as they are issued nor to send individual notices announcing their issue. Prompt notices of such publications appear in the Radio Service Bulletin described above. The notices state the price at which such publications may be purchased from the Superintendent of Documents. Announcements of new radio publications of the Bureau of Standards also appear in various periodicals.

The publications of the Bureau of Standards cover many subjects besides radio communication, including varied fields of investigation in electricity, light, sound, heat, chemistry, metallurgy, engineering materials, clay products, standards of weight and measure, and various other scientific and technical problems. Circular No. 24, of the Bureau of Standards, lists all of the publications of the Bureau on all subjects and gives a brief abstract of each.

The Principles Underlying Radio Communication, Signal Corps Radio Communication Pamphlet No. 40, is an elementary book prepared by the Bureau of Standards. It contains over 600 pages and more than 300 illustrations, and is durably bound in fabrikoid. It was prepared primarily as a textbook for use in the instruction of Signal Corps men, but has also been used in schools and colleges. It is assumed that the reader has had at least the major part of a high-school course, but no knowledge of mathematics beyond algebra is assumed. The first 200 pages are devoted to an introductory general discussion of electricity and electrical machinery, and the rest of the book to the fundamental principles of radio communication. The construction and operation of the important types of radio transmitting and receiving apparatus are discussed. There are numerous circuit diagrams and useful tables. The operation of electron tube transmitting and receiving sets, including radio telephone sets, is discussed. A copy of the 1922 edition of this book can be purchased for $1 from the Superintendent of Documents. This price includes postage in the United States and its possessions, Canada, Cuba, and Mexico. For other countries, 15 cents additional for postage.

Radio Instruments and Measurements, Bureau of Standards Circular No. 74, will be found of interest by any one who is interested in technical radio theory or who wishes to make radio measurements of any kind. It is a book of 341 pages and covers thoroughly a wide variety of radio measurements. A copy may be purchased for 60 cents from the Superintendent of Documents. Foreign postage, 15 cents extra.

Construction and Operation of a Simple Home-Made Radio Receiving Outfit, Bureau of Standards Circular No. 120, describes a very simple single-circuit crystal detector set which can be made in the home. Price, 5 cents.

Construction and Operation of a Two-Circuit Radio Receiving Equipment with Crystal Detector, Bureau of Standards Circular No. 121, describes another type of receiving set which can be made in the home, which is not quite as simple and will give more selective reception than the set described in Circular No. 120. Price, 5 cents.

Description and Operation of an Electron-Tube Detector Unit for Simple Radio Receiving Outfits, Bureau of Standards Circular No. 133, describes an electron-tube detector unit which may be used as a detector in connection with the tuning coil described in Circular No. 120, or the two-circuit coupler and condenser described in Circular No. 121, or any available regenerative or non-regenerative tuners. Price, 10 cents.

Auxiliary Condensers and Loading Coil Used with Simple Home-made Radio Receiving Outfits, Bureau of Standards Circular No. 137, describes auxiliary apparatus which can be used in connection with the apparatus described in Circulars Nos. 120 and 121. The loading coil is primarily for use in connection with the single-circuit set described in Circular No. 120, and makes it possible to receive longer wave lengths on that set, up to 3,000 meters. A telephone-shunt condenser and a series-antenna condenser are also described. Price, 10 cents.

Description and Operation of an Audio-frequency Amplifier Unit for Simple Radio Receiving Outfits, Bureau of Standards Circular No. 141, describes an amplifier unit, of which the most essential parts are an audio-frequency transformer and an electron tube. One or two such audio-frequency amplifier units can be used with any tuning device equipped with a crystal or electron-tube detector, including the sets described in Circulars Nos. 120 and 121. The use of the audio-frequency amplifier unit considerably increases the strength of a received signal. Price, 10 cents.

A Decimal Classification of Radio Subjects—An Extension of the Dewey System, Bureau of Standards Circular No. 138, gives in decimal form a detailed classification of upward of 1,000 radio subjects, which has been found useful for classifying radio publications, specifications, and other radio material. This classification is used in classifying the references to current radio periodical literature which appear each month in the Radio Service Bulletin (see p. 2). Price, 10 cents.

The Bureau of Standards also issues letter circulars, in mimeographed form, of which only a limited number are available. A copy of any of these may be secured by any person having actual use for it on application to the bureau so long as a supply is available. Those on radio subjects are the following:

B. S. Letter Circular No. 40, Radio publications of the Bureau of Standards. May 1, 1923.

B. S. Letter Circular No. 50, Bibliography of books and periodicals on tests, properties, and uses of electrical insulating materials. November 4, 1922.

B. S. Letter Circular No. 51, List of the more important United States patents covering the materials and methods of manufacture of insulating materials. November 4, 1922.

B. S. Letter Circular No. 56, Methods of radio-direction finding as an aid to navigation: The relative advantages of locating the direction finder on shore and on shipboard. March 27, 1922.

B. S. Letter Circular No. 73, Fees for testing radio apparatus. August 1, 1922.

B. S. Letter Circular No. 75, The secondary standardization of radio wavemeters. August 21, 1922.

B. S. Letter Circular No. 76, The standardization of inductors at radio frequencies. August 21, 1922.

B. S. Letter Circular No. 77, The comparison of condensers at radio frequencies. August 21, 1922.

B. S. Letter Circular No. 78, Design of a portable short-wave radio wavemeter. August 23, 1922.

B. S. Letter Circular No. 86, Methods of measuring voltage amplification of amplifiers. January 26, 1923.

B. S. Letter Circular No. 87, Methods of measuring properties of electron tubes. January 27, 1923.

B. S. Letter Circular No. 90, Tests of radio receiving sets. I. March 10, 1923.

B. S. Letter Circular No. 92, Radio signals of standard frequency and their utilization. April 25, 1923.

Papers by members of the staff of the bureau describing radio work performed at the bureau have appeared in various periodicals from time to time, including: Proceedings of the Institute of Radio Engineers, Journal of the American Institute of Electrical Engineers, QST, Wireless Age, Physical Review, Journal Washington Academy Sciences, Radio News, and Scientific American. These papers are listed in Bureau of Standards Letter Circular No. 40, which is mentioned above. Copies of these papers published in outside periodicals can not be furnished by the bureau, but must be consulted in the periodicals in which they are printed.

The following Scientific Papers of the Bureau of Standards are of radio interest, and may be purchased from the Superintendent of Documents, at the prices stated:

S169. Formulas and tables for the calculation of mutual and self inductance; by Rosa and Grover. 3d ed. 1916. 20 cents. (See also S320.)

S206. High frequency ammeters; by J. H. Dellinger. 1913. 10 cents.

S234. Insulating properties of solid dielectrics; by H. L. Curtis. 1914. 15 cents.
S235. A direct reading instrument for measuring the logarithmic decrement and wave length of electromagnetic waves; by F. A. Kolster. 1914. 10 cents.
S269. Effect of imperfect dielectrics in the field of a radiotelegraphic antenna; by J. M. Miller. 1916. 5 cents.
S320. Additions to the formulas for the calculation of mutual and self inductance; by F. W. Grover. 10 cents. (Supplementing S169.)
S326. Electrical oscillations in antennas and inductance coils; by J. M. Miller. 1918. 5 cents.
S341. Airplane antenna constants; by J. M. Cork. 1919. 5 cents.
S351. Dependence of the input impedance of a three-electrode vacuum tube upon the load in the plate circuit; by J. M. Miller. 1919. 5 cents.
S353. Variation in direction of propagation of long electromagnetic waves; by A. H. Taylor. 1919. 5 cents.
S354. Principles of radio transmission and reception with antenna and coil aerials; by J. H. Dellinger. 1919. 10 cents.
S355. Determination of the output characteristics of electron tube generators; by L. M. Hull. 1919. 5 cents.
S381. An electron tube transmitter of completely modulated waves; by L. M. Hull. 1920. 5 cents.
S423. Operation of the modulator tube in radio telephone sets; by E. S. Purington. 1921. 10 cents.
S427. Some effects of the distributed capacity between inductance coils and the ground; by G. Breit. 1921. 5 cents.
S428. The radio direction finder and its application to navigation; by F. A. Kolster and F. W. Dunmore. 1922. 15 cents.
S430. The high-frequency resistance of inductance coils; by G. Breit. 1922. 5 cents.
S431. The field radiated from two horizontal coils; by G. Breit. 1922. 5 cents.
S449. Radio-frequency amplifiers; by P. D. Lowell. 1922. 5 cents.
S450. An electron-tube amplifier using sixty-cycle alternating current to supply power for the filaments and plates; by P. D. Lowell. 1922. 5 cents.
S455. Tables for the calculation of the inductance of circular coils of rectangular cross section; by F. W. Grover. 1922. 10 cents.
S468. Formulas and tables for the calculation of the inductance of coils of polygonal form; by F. W. Grover. 1923. 10 cents.
S469. Directive radio transmission on a wave length of 10 meters; by F. W. Dunmore and F. H. Engel. 1923. 10 cents.
S471. Methods of measurement of properties of electrical insulating materials; by J. H. Dellinger and J. L. Preston. 1923. 15 cents.

Bureau of Standards Technologic Paper No. 216, Properties of electrical insulating materials of the laminated phenol-methylene type; by J. H. Dellinger and J. L. Preston (1922); may be purchased from the Superintendent of Documents for 30 cents.

The following two Signal Corps publications are useful to the beginner and may be purchased from the Superintendent of Documents at the prices stated:

Elementary principles of radiotelephony. Signal Corps Radio Communication Pamphlet No. 1. 1921. 79 p. 10 cents.
Elementary electricity. Signal Corps Training Pamphlet No. 1. 1921. 52 p. 15 cents.

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The following Signal Corps publications, which cover their respective subjects in some detail, can also be purchased from the Superintendent of Documents:

Amplifiers and heterodynes. Signal Corps Radio Communication Pamphlet No. 9. 1922. 37 p. 10 cents.

Wavemeters and decremeters. Signal Corps Radio Communication Pamphlet No. 28. 1922. 58 p. 10 cents.

Primary batteries. Signal Corps Training Pamphlet No. 7. 1923. 10 cents.

4. BOOKS.

In the past few years a considerable number of books have been published to meet the needs of the various classes of readers interested in radio. Below are listed some of the more important books which are particularly likely to be of interest to the elementary student. No effort has been made to list all of the radio books published. The division into classes according to difficulty is more or less arbitrary, and is simply intended as a general guide to help the person who has no familiarity with the literature.

Very recently there have appeared a considerable number of inexpensive books and pamphlets of a very elementary nature issued by various publishers, which offer explanations of radio phenomena and give instructions for construction and operation of radio sets. The accuracy and value of these publications varies widely, and no attempt has been made to list them here.

(a) BOOKS SUITABLE FOR THE BEGINNER.

E. E. Bucher. Practical wireless telegraphy. New York, 1918. Wireless Press (Inc.).

*E. E. Bucher. Wireless experimenter's manual. New York, 1920. Wireless Press (Inc.).

Charles B. Hayward. How to become a wireless operator. Chicago, 1918. American Technical Society.

Robison's manual of radio telegraphy and telephony. Annapolis, Md., 1920. United States Naval Institute.

The Admiralty manual of wireless telegraphy. London, 1920. Published by His Majesty's Stationery Office.

*M. B. Sleeper. Design data for radio transmitters and receivers. New York, 1920. Norman W. Henley Publishing Co.

*M. B. Sleeper. Construction of radio phone and telegraph receivers for beginners. New York, 1922. Norman W. Henley Publishing Co.

*M. B. Sleeper. How to make commercial type radio apparatus. New York, 1922. Norman W. Henley Publishing Co.

*M. B. Sleeper. Design of modern radio receiving sets. New York, 1922. Sleeper Radio Corp.

*M. B. Sleeper. Radio experimenter's handbook. New York, 1922. Norman W. Henley Publishing Co.

*M. B. Sleeper. 101 receiving circuits. New York, 1922. Sleeper Radio Corp.

J. E. Cameron. Radio for beginners. New York, 1922. Technical Book Co.

J. E. Cameron. Textbook on wireless. New York, 1922. Technical Book Co.

A. F. Collins. Radio amateur's handbook. New York, 1922. Thomas Y. Crowell Co.

P. E. Edleman. Experimental wireless stations. New York, 1920. Norman W. Henley Publishing Co.

Morecroft, Hazeltine, Goldsmith, Pupin, and others. Radiophone receiving. New York, 1922. D. Van Nostrand Co.

W. C. Ballard. Elements of radio telephony. New York, 1922. McGraw-Hill Book Co.

(b) BOOKS OF A POPULAR NATURE.

A. C. Lescarboura. Radio for everybody. New York, 1922. Scientific American Publishing Co.

Dellinger and Whittemore. Radio handbook. Philadelphia, Pa., 1922. Lefax (Inc.).

The easy course in home radio. New York, 1922. Review of Review Co.

Yates and Pacent. The complete radio book. New York, 1922. Century Co.

Snodgrass and Camp. Radio receiving for beginners. New York, 1922. The Macmillan Co.

L. M. Cockaday. Radio telephony for everyone. New York, 1922. Frederick A. Stokes Co.

F. E. Drinker. Radio miracle of the 20th century. Philadelphia, Pa., 1922. National Publishing Co.

An introduction to radio. New York, 1922. Wireless Press (Inc.).

H. J. Marx. Radio reception. New York, 1922. G. P. Putnam's Sons.

C. W. Taussig. The book of radio. New York, 1922. D. Appleton & Co.

(c) ELEMENTARY TEXTS OF STUDY.

The principles underlying radio communication. Signal Corps Radio Communication Pamphlet No. 40 (revised edition). Washington, 1922. Government Printing Office. Price $1. (See more extended notice on page 4.)

*S. Ballantine. Radio telephony for amateurs. Philadelphia, Pa., 1922. David McKay Co.

G. D. Robinson. Modern theory and practice in radio communication. Annapolis, Md., 1920. United States Naval Institute.

E. W. Stone. Elements of radio telegraphy. New York, 1919. D. Van Nostrand Co.

J. C. Hawkhead and H. M. Dowsett. Handbook of technical instruction for wireless telegraphists. London, 1918. Wireless Press (Ltd.).

A. N. Goldsmith. Radio telephony. New York, 1918. Wireless Press (Inc.).

R. D. Bangay. The oscillation valve. London, 1919. Wireless Press (Ltd.).

Lauer and Brown. Radio engineering principles. New York, 1920. McGraw-Hill Book Co.

John Scott-Taggart. Elementary textbook on wireless vacuum tubes. London, 1922. Radio Press, (Ltd.).

*J. B. Dow. The c. w. manual. San Francisco, 1922. Pacific Radio Publishing Co.

*J. O. Smith. Modern radio operation. New York, 1922. Wireless Press (Inc.).

*A. H. Verrill. Radio for amateurs. New York, 1922. Dodd, Mead & Co.

(d) MORE ADVANCED TEXTS SUITABLE FOR REFERENCE.

Bureau of Standards Circular No. 74. Radio instruments and measurements. Washington, 1918. Government Printing Office. 60 cents. (See more extended notice on page 4.)

H. M. Dowsett. Wireless telegraphy and telephony. London, 1920. Wireless Press (Ltd.).

Rupert Stanley. Textbook of wireless telegraphy. (2 vols.) London, 1919. Longmans Green & Co.

J. H. Morecroft. Principles of radio communication. New York, 1921. John Wiley & Sons.

J. A. Fleming. The principles of electric wave telegraphy. (4th ed.) London, 1919. Longmans Green & Co.

J. A. Fleming. The wireless telegraphist's pocketbook of notes, formulae, and calculations. London, 1915. Wireless Press (Ltd.).

W. H. Eccles. Wireless telegraphy and telephony. London, 1918. Benn Bros. (Ltd.).

John Scott-Taggart. Thermionic tubes in radio telegraphy. London, 1921. Wireless Press (Ltd.).

B. Leggett. Wireless telegraphy, with special reference to the quenched spark system. London, 1921. Chapman & Hall (Ltd.).

L. B. Turner. Wireless telegraphy and telephony. Cambridge, England, 1921. Cambridge University Press.

H. J. Van der Bijl. The thermionic vacuum tube and its applications. New York, 1920. McGraw-Hill Book Co.

(e) YEARBOOK.

A valuable reference book on matters of radio interest is the Year Book of Wireless Telegraphy, published in May of each year by the Wireless Press (Ltd.), 12 Henrietta Street, London, England.

There is also issued a considerably abbreviated edition of the Year Book of Wireless Telegraphy, which is intended primarily for experimenters, amateurs, and persons interested in broadcast reception. This abbreviated edition contains the same material as the complete Year Book, except that material primarily of interest to commercial companies has been omitted.

Persons desiring to construct their own radio apparatus will find useful information in current issues of radio periodicals and in various books. The books listed on pages 8 and 9, which are marked *, are of particular interest along this line. Circulars Nos. 120, 121, 133, 137, and 141, of the Bureau of Standards, which are described on page 5, will also be found of interest in this connection.

5. CODES.

In radio telegraphy, signals are transmitted by dots and dashes arranged according to the International Morse Code, sometimes called the Continental Code. The International Morse Code is different from the American Morse Code, which is used on land lines in the United States. The International Morse Code is given in the Principles Underlying Radio Communication, in the books by Robinson, Robison, and Hayward, mentioned above, and also in the pamphlet, Radio Communication Laws of the United States,

mentioned below. The International Morse Code is also given on a small card (Form 773a) published by the Bureau of Navigation. A copy of this card may be procured without charge on application to the Bureau of Navigation, Department of Commerce, Washington, D. C., or to any of the district radio inspectors whose addresses are given below.

6. DIFFICULTIES IN TRANSMISSION.

Persons contemplating the installation of radio stations which are expected to maintain reliable radio communication at all times, particularly radio telephony, are reminded that radio communication is often subject to serious interference from atmospheric electric disturbances, which are particularly serious in the summer. Other difficulties in transmission may also exist. Information regarding the actual operating conditions in a given locality should be obtained whenever possible from the operators of radio stations in the locality in question.

7. SAFETY PRECAUTIONS.

The ordinary precautions required for the safe operation of any electrial equipment should be observed in every radio station. All high-voltage wiring should be carefully insulated and kept as far as possible from other wiring and so placed as to minimize the possibility that the operator may come in contact with it, and suitable danger tags should be displayed.

Insurance companies make certain requirements regarding electrical installations in any building on which they carry risks. Information regarding such requirements may be secured from the National Board of Fire Underwriters, 76 William Street, New York, N. Y., or from local insurance inspection offices. These requirements are summarized in a small book, the National Electrical Code, which contains a section covering special requirements for radio installations. A copy of this book may be secured for 10 cents from the National Board of Fire Underwriters. A brief discussion of safety precautions in radio installations may be found in the book, the Principles Underlying Radio Communication, mentioned above.

8. RECEPTION IN RADIO TELEPHONY.

The apparatus ordinarily required for reception in radio telephony is the same as that ordinarily used for reception in radio telegraphy. The transmitting apparatus, however, differs essentially.

9. RADIO LAWS AND REGULATIONS.

Every person engaged in the handling of radio traffic should be thoroughly familiar with the radio communication laws of the United States and the International Radiotelegraphic Convention. These are printed in a pamphlet, Radio communication laws of the United States, of which copies may be purchased for 15 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

The law provides that in order to operate a radio transmitting station, both a *station* license and an *operator* license must be secured. The law provides penalties for the operation of a transmitting station without proper licenses.

A station used only for receiving does not require a station license. Operators of stations used only for receiving do not require operators' licenses, but must maintain secrecy in regard to messages heard.

Provision is now made for eight classes of land stations:

1. Public service stations, general.
2. Public service stations, limited.
3. Limited commercial stations.
4. Experiment stations.
5. Technical and training-school stations.
6. Special amateur stations.
7. General amateur stations.
8. Restricted amateur stations.

Station licenses for classes 4, 5, and 6 are issued only under exceptional circumstances, as set forth in the pamphlet mentioned above.

General amateur stations are restricted to a transmitting wave length not exceeding 200 meters and a transformer input not exceeding 1 kilowatt.

Restricted amateur stations are amateur stations located within five nautical miles of a naval or military station and are restricted to a wave length not exceeding 200 meters and to a transformer input not exceeding one-half kilowatt.

If a transmitting station radiates more than one wave length, the energy in no one of the lesser waves shall exceed 10 per cent of the energy in the principal wave.

The logarithmic decrement per complete oscillation must not exceed two-tenths.

Operators' licenses are divided into the following classes: Commercial extra first class, commercial first class, commercial

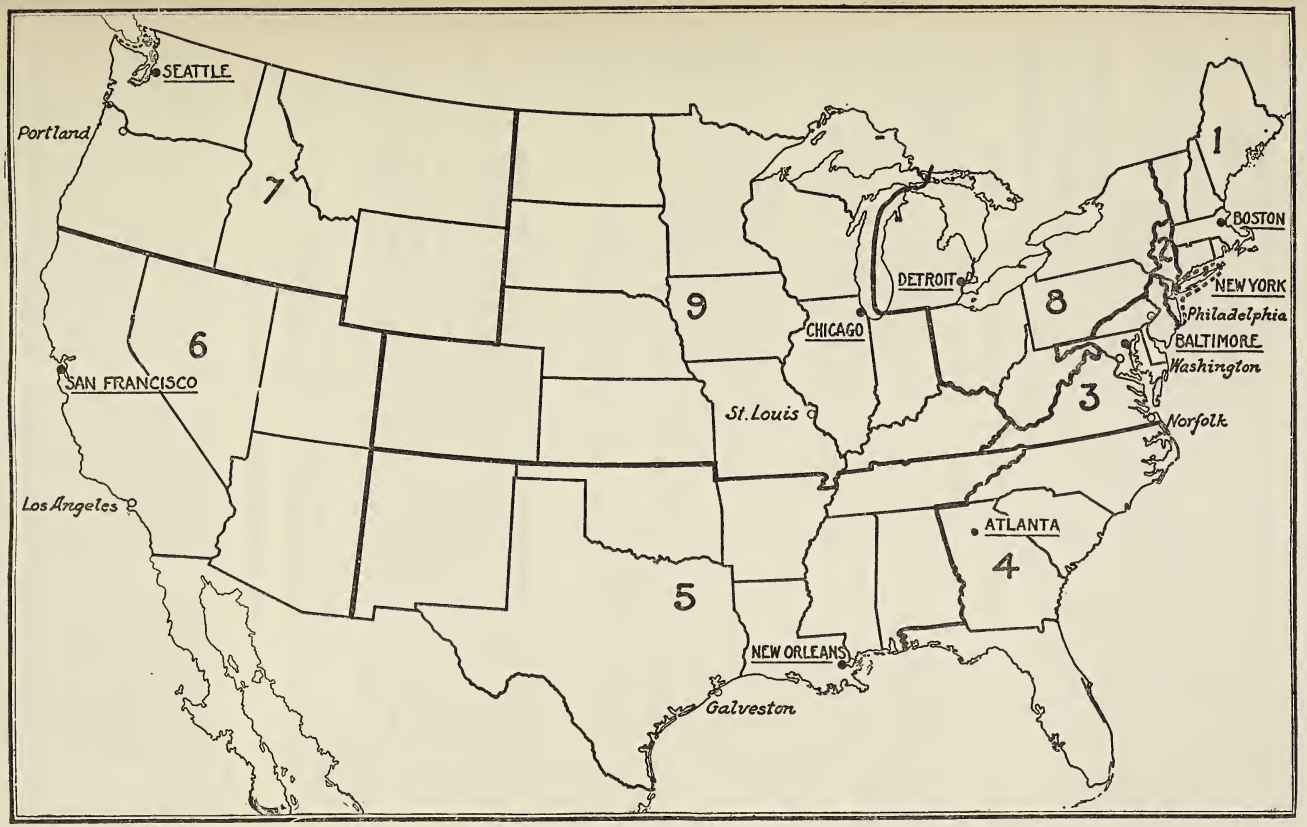

FIG. 1.—*Outline map of the United States showing division into radio inspection districts.*

Names of cities in capitals are those in which offices of District Supervisors of Radio are located.

second class, commercial cargo grade, experiment and instruction grade, amateur first grade, and amateur second grade. In order to obtain an operator's license of any grade, it is necessary to pass an examination showing certain qualifications, as set forth in the pamphlet mentioned above. For the amateur licenses an operator must be sufficiently familiar with the International Morse Code to receive at a speed of at least ten words per minute.

Both station licenses and operators' licenses are issued by the Bureau of Navigation, Department of Commerce, Washington, D. C. The United States is divided into nine radio districts. Figure 1 shows the boundaries of these districts. Each district has a supervisor of radio who has charge of the issuing of both station licenses and operators' licenses in his district. Application for either kind of license should be addressed to the U. S. Supervisor of Radio of the district in which the station is located, or, if this is not known, to the Bureau of Navigation, Department of Commerce, Washington, D. C.

There have been revisions of the regulations which were in force during 1922 covering limited commercial stations used for radio-telephone broadcasting. For information regarding current regulations applying to such stations, inquiry should be made of the Bureau of Navigation.

The offices of the district supervisors of radio are located as follows:

First District, U. S. Supervisor of Radio, Customhouse, Boston, Mass.
Second District, U. S. Supervisor of Radio, Customhouse, New York, N. Y.
Third District, U. S. Supervisor of Radio, Customhouse, Baltimore, Md.
Fourth District, U. S. Supervisor of Radio, Federal Building, Atlanta, Ga.
Fifth District, U. S. Supervisor of Radio, Customhouse, New Orleans, La.
Sixth District, U. S. Supervisor of Radio, Customhouse, San Francisco, Calif.
Seventh District, U. S. Supervisor of Radio, 2301 L. C. Smith Building, Seattle, Wash.
Eighth District, U. S. Supervisor of Radio, Federal Building, Detroit, Mich.
Ninth District, U. S. Supervisor of Radio, Federal Building, Chicago, Ill.

10. CANADIAN RADIO LAWS.

The laws regulating the operation of private radio stations in Canada are in several respects quite different from those in force in the United States. For instance, a station which is used only for receiving must have a station license, but is not restricted as to the length of its antenna. Licenses for private receiving stations are issued to any person in Canada, irrespective of nationality. Every person operating any kind of a radio station in Canada, with the exception of private receiving stations, must have a

"certificate of proficiency," or operator's license. A "certificate of proficiency" can not be issued to a person who is not a British subject. Amateur experimental stations used for transmitting are restricted to wave lengths of 175 meters for spark, and for continuous wave and radio telephone 150, 175, 200, and 225 meters. The Canadian laws and regulations are printed in the Year Book of Wireless Telegraphy. For authoritative information inquiry should be made of the Deputy Minister, Department of Marine and Fisheries, Ottawa, Ontario, who will supply for 10 cents a pamphlet containing the Canadian laws and regulations.

11. STATION CALL LETTERS.

Amateur calls.—The station license issued for the operation of an amateur transmitting station in the United States designates a call which is to be used by that station at all times. This call consists usually of a number followed by two letters, as 1AB, but may consist of a number followed by three letters, as 1ABC. The number is the number of the radio district in which the station is located. Experiment stations have calls consisting of a number followed by two or three letters of which the first one is X, as 1XA. Technical and training-school stations have calls consisting of a number followed by two or three letters of which the first one is Y, as 1YA. Special amateur stations have calls consisting of a number followed by two or three letters of which the first one is Z, as 1ZA. It is unlawful for any transmitting station at any time to sign any call except the call assigned in its station license. No station is allowed to transmit until a station license is issued. The radio regulations formerly provided that after an application for a station license had been filed and pending the issue of the station license, a provisional call could be used and the station could transmit; this provision has been repealed.

Canadian amateur calls.—Canadian amateur stations are assigned calls consisting of a number followed by two or three letters, like the calls assigned to amateur stations in the United States. The Canadian stations having calls beginning with the numbers 1, 2, and 3 are in the southeastern part of Canada, somewhat near to the United States stations having calls beginning with 1, 2, 3. Therefore it is possible for a Canadian station having a call, say 1AB, to work with a United States station having the same call 1AB. Operators who make a practice of working Canadian stations have devised various means for avoiding confusion. The Official List of Radio Stations of Canada may

be purchased for $1 from the Deputy Minister, Department of Marine and Fisheries, Ottawa, Ontario.

12. LISTS OF RADIO CALLS.

Every radio amateur should also have a copy of the pamphlets Amateur Radio Stations of the United States (price, 25 cents) and Commercial and Government Radio Stations of the United States (price, 15 cents). Orders should be sent to the Superintendent of Documents, Government Printing Office, Washington, D. C. These pamphlets contain lists of the amateur and commercial and Government transmitting stations in the United States and of the call letters assigned to the stations; a new edition of each pamphlet is published on June 30 of each year. The prices given above are for the editions dated June 30, 1922. These prices are subject to change from year to year. The monthly publication called the Radio Service Bulletin mentioned above contains information regarding changes in the radio regulations, traffic information, and lists additions to or other changes in the list of Commercial and Government Radio Stations.

A Consolidated Radio Call Book is published by the Consolidated Radio Call Book Co., 41 Park Row, New York, N. Y. This gives the calls of both United States and foreign stations.

An Amateur Radio Call Book is published by the Radio Directory Publishing Co., 14 Vesey Street, New York, N. Y. This gives the calls of amateur and broadcasting stations in both the United States and Canada.

A Citizens Radio Call Book is published by the Citizens Radio Service Bureau, 416 South Dearborn Street, Chicago, Ill., and gives the calls of amateur and broadcasting stations.

Maps of the United States, showing the location of radio stations, particularly broadcasting stations, are sold by the George F. Cram Co., Chicago, Ill.; Burgess Battery Co., Madison, Wis.; and the Radio Directory Publishing Co., 14 Vesey Street, New York, N. Y.

A list of commercial and Government stations operating in the United States and in foreign countries is given in the Year Book of Wireless Telegraphy, mentioned above.