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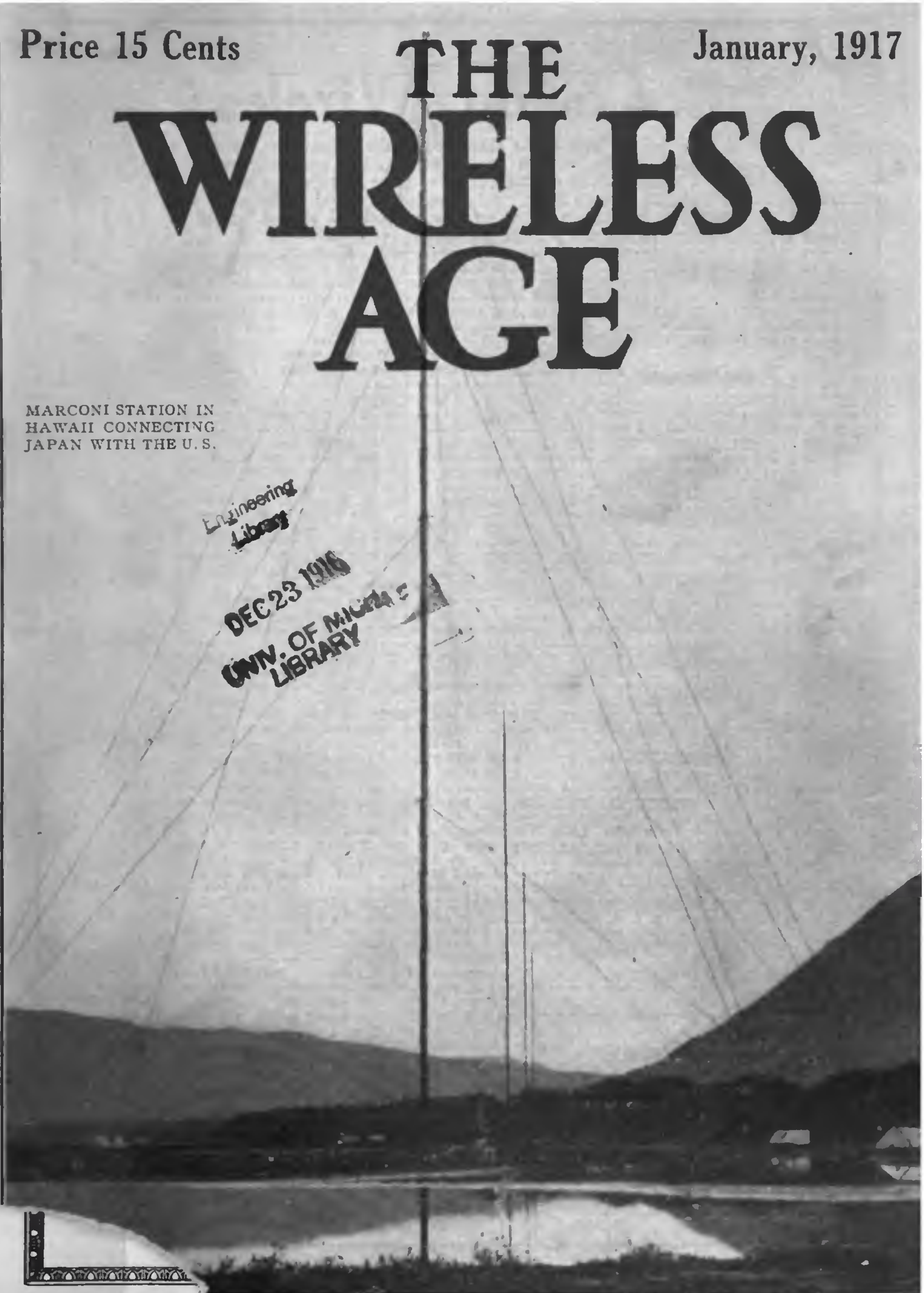

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THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

JANUARY, 1917

The New Radio Legislation

Full Details of the Bill Drafted for Presentation to Congress and a Report of the Discussion at the First Informal Conference Recently Held in Washington

IMPENDING changes in the present laws governing radio communication, which have been the subject of rumor and conjecture, were given tangible form about the middle of November, when the Inter-Departmental Committee on Radio Legislation presented for discussion the draft of a bill which it is proposed to have introduced in the present session of Congress.

An informal discussion was arranged for at the Department of Commerce building in Washington, on November 21. Among those present in person were E. J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company. John Bottomley, vice-president, secretary and treasurer, and Roy A. Weagant, chief engineer of the Marconi Company, David Sarnoff, representing the Institute of Radio Engineers, and other representatives of commercial companies and the Radio Club of America. Professor Arthur E. Kennelly, of Harvard, president of the Institute, and Professor Alfred N. Goldsmith, of the College of the City of New York, stated in communications their views of the proposed legislation, their observations being of particular interest to amateurs, as both of these men are vice-presidents of the National Amateur Wireless Association.

The general trend of the discussion disclosed the feeling that in this bill was evident a distinct spirit of hostility toward existing wireless organizations. Criticism was leveled at the proposal to confer power upon Government departments to compete with commercial stations operated by American citizens, and at the same time dictate the terms of regulation. It was asserted that the quickest way to stifle inventive effort would be to permit Government competition or confiscation to destroy the market for private enterprise; furthermore, that this was an unpatriotic action, since it is perfectly obvious that encouragement and aid should be given to promote invention and improvement in the art, so that the United States should have the best obtainable system in time of need.

Proposals to restrict the operation of commercial stations in time of peace and to impose handicaps which would prohibit profitable operation of these stations were unanimously opposed by all representatives at the meeting. The draft of the bill follows:

An Act to Regulate Radio Communication

Sec. 1. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That wherever used in this Act the term "radio communication" shall be construed to mean communication by any system or method of electrical communication without the aid of wire or other conducting connection; the word "apparatus" to mean machines, devices, and all other equipment used in radio communication; the words "transmitter" and "receiver" to mean the sending and receiving apparatus, respectively, used in radio communication; the word "radiogram" to mean any message, communication, or signal, transmitted or received in radio communication; the term "radio station" to mean a place where apparatus is used for transmitting, or for transmitting and receiving, the signals used in radio communication; the term "Government land station" to mean any radio station on land, or on a permanently moored vessel, controlled and operated by any department of the Government; the term "Government ship station" to mean a radio station on any ship of the Government controlled and operated by any department of the Government and not permanently moored; and the term "Territory of the United States" or the word "Territory" to mean any Territory, District, Zone, insular possession, water, or other place subject to the jurisdiction of the United States, and not within any State.

The word "person" as used in this Act shall be construed to import both the plural and the singular and to include a corporation, co-partnership, company, or association; and when construing and enforcing the provisions of this Act, the act, omission, or failure of any director, officer, agent, or employee of such corporation, co-partnership, company, or association acting within the scope of his employment or office shall in every case be deemed to be the act, omission, or failure of such corporation, co-partnership, company, or association, as well as that of the person acting for or on behalf thereof.

Sec. 2. Radio stations are divided for the purposes of this Act into the following classes:

1.—Coastal station, a station on land or on a permanently moored vessel used for the exchange of correspondence with ships at set. Coastal stations include (a) those open to general public correspondence, and (b) those open to limited public correspondence. Coastal stations of class (b) transmit and receive public messages to and from certain stations only, which are designated in the license.

2.—Station on shipboard, a station on board any vessel not permanently moored. Stations on shipboard include (a) those open to general public correspondence, and (b) those open to limited public correspondence. Ship stations of class (b) transmit and receive public messages to and from certain stations only, which are designated in the license.

3.—Commercial station, a land station used in the transaction of commercial business and not used for the exchange of correspondence with ships at sea. Commercial stations include (a) those open to limited public correspondence, (b) limited commercial stations, (c) special stations for transoceanic or transcontinental communication. Commercial stations of class (a) transmit and receive public messages to and from certain stations only, which are designated in the license. Limited commercial stations (class b) are stations of private interest, and carry on a specific commercial service or services defined in the license; they do not transmit public messages to, or receive them from, other stations. Special stations of class (c) are open to limited public correspondence or not, as stated in the license.

4.—Experimental station, a land station of private interest actually engaged in conducting experiments for the development of the science of radio communication or the apparatus pertaining thereto.

5.—Technical and training-school station, a land or ship station of private interest used for purposes of instruction in radio communication and training operators.

6.—Amateur station, a land station of private interest not covered by (3), (4) or (5) of this section, and not operated for financial profit. Amateur stations include (a) general amateur stations, (b) restricted amateur stations, which are within five nautical miles of a Government station, (c) special amateur stations, the operation of which seems likely to result in some substantial benefit to radio communication.

7.—Government station, a station controlled and operated by any department of the Government.

Sec. 3. Nothing in this Act shall be construed to apply to the transmission or exchange of radiograms or signals between points in the same State, if said transmission or exchange shall not interfere with the reception of radiograms or signals from beyond the jurisdiction of the said State, or the effect thereof shall not extend beyond said jurisdiction.

Sec. 4. No radio station other than those belonging to or operated by the United States shall be used by any person within the jurisdiction of the United States to transmit any radiogram by the apparatus and methods of radio communication, except under and in accordance with a station license issued by the Secretary of Commerce. Any person who shall operate any radio station in violation of this Section shall be punished by a fine not exceeding five hundred dollars for the first offense, and by a fine not exceeding one thousand dollars, or imprisonment for not more than one year, or both, for each offense thereafter; and any radio apparatus operated in violation of this Section shall be subject to forfeiture.

Authority to Fix Commercial Message Rates.

Sec. 5. The Secretary of Commerce shall fix the rates charged by all licensed stations open to public correspondence.

The heads of Government departments having jurisdiction over Government land stations and Government ship stations shall, in their discretion, so far as it may be consistent with the transaction of Government business, open service, to such general public business, and shall fix the rates for such service, subject to the control of such rates by Congress. Such executive heads shall arrange, each in his own department, and for stations under his own jurisdiction, for the transmission and receipt of commercial radiograms between land stations and vessels at sea, between land stations and licensed radio stations within the United States or any territory thereof, and between land stations and radio stations under foreign jurisdiction, under the provisions of the London Convention of nineteen hundred and twelve and future international conventions or treaties to which the United States may be a party. The receipts from such radiograms, less an amount not to exceed twenty-five per cent. per annum for the necessary expenses of each department for the handling of such commercial business, shall be turned into the Treasury as miscellaneous receipts.

No radio station other than that belonging to or operated by the United States, or by the Government of the Philippine Islands, shall be operated on land or on a permanently moored vessel in the Canal Zone, or in the Philippine Islands, or in any territory of the United States in the West India Islands other than Porto Rico, or in the Pacific Ocean west of the one hundred and sixty-first meridian of longitude west of Greenwich and South of the fortieth parallel of north latitude.

Every Government land station and Government ship station shall have special call letters which shall be designated and published by the Department of Commerce in a list of radio stations of the United States.

Sec. 6. After three months from the passage of this Act and at any time within five years after the expiration of said three months, but not longer, the Government through the Navy Department shall have authority to acquire by purchase at a reasonable valuation any coastal radio station now in operation in the United States which the owner may desire to sell.

Sec. 7. The station license required by Section 4 hereof shall not be granted to any alien, nor to any company, corporation, or association of which any officer or more than one-third of the directors are aliens or of which more than one-third of the capital stock is owned or controlled by aliens or by a foreign government or representative thereof or by any company, corporation, or association organized under the laws of a foreign country; and a license shall become void if ownership or management of the station or apparatus shall be transferred to any alien, or to any company, corporation, or association of which any officer or more than one-third of the directors are aliens or of which more than one-third of the capital stock is owned or controlled by aliens or by a foreign government or representative thereof or by any company, corporation, or association organized under the laws of a foreign country.

A license shall not be granted if, in the opinion of the Secretary of Commerce, the operation of the proposed station will seriously interfere with the operation of existing Government or licensed stations in the vicinity.

Government to Determine Type of Apparatus Which May Be Installed.

Sec. 8. The station license prescribed by Section 4 hereof shall be issued only in response to a written application therefor, addressed to the Secretary of Commerce, which shall set forth the following facts:

1. The name and address of the applicant, the date and place of birth, and, if naturalized, the date and place of naturalization.

2. If the applicant is a corporation, the date of incorporation and under what laws incorporated, the principal place of business of the corporation, the names and addresses of the officers and directors, a statement as to each officer specifying his place of birth and the country of which he is a citizen, and, if a naturalized citizen of the United States, the date and place of naturalization, and a statement showing what proportion of the capital stock is owned or controlled by aliens, by foreign governments or representatives thereof, and by companies, corporations, or associations organized under the laws of any foreign country.

3. The ownership of the station and apparatus.

4. The exact location of the station.

5. The stations with which it is proposed to communicate.

6. The purpose or purposes for which the station is to be used.

7. The wave-length or wave-lengths which it is proposed to use at the station and the period or periods of the day during which it is proposed to operate the station.

8. The proposed rate to be charged per word.

9. Such further information as the Secretary of Commerce may, by regulation, prescribe.

Every application shall be signed by the applicant upon oath or affirmation. If the applicant is a corporation, the application shall be signed upon oath or affirmation by at least two officers thereof.

The Secretary of Commerce may upon request determine in advance of the erection of a radio station, on the basis of an application substantially conforming to the requirements of this Section, whether the apparatus to be installed in such station will be licensed upon completion of such station, and upon what condition such license will be granted.

Whoever shall knowingly make any untrue statement in the application for a license prescribed by this Section, shall be guilty of perjury and shall be punished by a fine not exceeding two thousand dollars, or by imprisonment for not more than five years or both.

Giving the President Power of Seizure in Time of Peace.

Sec. 9. Station licenses shall be in such form as the Secretary of Commerce shall prescribe and shall contain a statement of the following conditions to which such licenses shall be subject:

1. The station shall at all times be subject to inspection by officials of the Department of Commerce; and the President of the United States, in his discretion, may cause the closing of such station and the removal of all radio apparatus, or may authorize the use of the station or apparatus by any department of the Government upon just compensation to the owners, as provided in Section 14 (b) of this Act.

2. The ownership or management of the station or apparatus therein shall not change without the consent of the Secretary of Commerce, nor be transferred to an alien or aliens, nor to any foreign government or representative thereof, nor to any company, corporation, or association organized under the laws of a foreign country, or of which any officer, or more than one-third of the directors, are aliens, or of which more than one-third of the capital stock is owned or controlled by aliens or by a foreign government or representative thereof, or by a company, corporation, or association organized under the laws of a foreign country. The ownership or control of more than one-third of the capital stock of any company, corporation, or association to which a station license has been issued shall not be transferred during the term of the license to an alien or aliens, or to a foreign government or representative thereof, or to any company, corporation, or association organized under the laws of a foreign country. No company, corporation or association to which a station license has been issued shall thereafter during the term of the license have any officer who is an alien.

3. The rates to be charged shall be

as fixed by the Secretary of Commerce, and shall be specified in the license.

4. Apparatus other than that specified in the license shall not be used for radio communication.

5. Every licensed radio station open to general public correspondence shall be bound to exchange radiograms with any other such station without distinction of the radio systems adopted.

Such license shall also show specifically the ownership and location of the station in which the apparatus is to be used and such other particulars as the Secretary of Commerce may deem necessary for the identification of the apparatus and to enable its range to be estimated, shall show the purpose of the station, the rates authorized by the license, the wave-length or wave-lengths and the decrement or decrements authorized for use by the station, and the hours for which the station is licensed to work.

Sec. 10. Any station license shall be revocable by the Secretary of Commerce, in his discretion, for violation of or failure to observe any of the restrictions and conditions mentioned in the preceding section, or other provision of this Act or regulation of the Secretary of Commerce, and the books and records of the licensee shall be open at all times to inspection by officials of the Department of Commerce to enable them to determine whether such violation or failure to observe has occurred.

Sec. 11. Every radio station for which a station license is required by this Act shall be in charge of or under the supervision of a person to whom an operator's license shall have been issued hereunder. No person shall operate any such station except under and in accordance with an operator's license issued to him by the Secretary of Commerce. The Secretary of Commerce, in his discretion, may grant special temporary licenses to operators of radio apparatus when any emergency arises requiring the prompt employment of such an operator. Whoever shall employ any unlicensed person in the operation or supervision of any licensed radio station, or whoever without an operator's license shall operate or supervise such a station, shall be punished by a fine not exceeding one hundred dollars for the first offense, and by a fine not exceeding two hundred dollars or imprisonment for not more than two years, or both, for each offense thereafter.

Sec. 12. An operator's license shall be issued only in response to a written application therefor addressed to the Secretary of Commerce, which shall set forth the name, age, and address of the applicant, date and place of birth, the country of which he is a citizen, and if a naturalized citizen of the United States the date and place of naturalization. The application shall also state the previous experience of applicant in operating radio apparatus and such further facts or information as may be required by the Secretary of Commerce. Every application shall be signed by the applicant upon oath or affirmation. An operator's license shall be issued only to a person who, in the judgment of the Secretary of Commerce, is shown to be proficient in the use and operation of radio apparatus and in the transmission and receipt of radiograms. An operator's license shall not be granted to any alien or representative of a foreign government. Whoever shall knowingly make any untrue statement in an application for an operator's license shall be guilty of perjury and shall be punished by a fine not exceeding two thousand dollars or by imprisonment for not more than five years, or both.

Suspension of Licenses

Sec. 13. An operator's license shall be in such form as the Secretary of Commerce shall prescribe, and may be suspended by the Secretary of Commerce for a period not exceeding one year, upon proof sufficient to satisfy him that the licensee has violated any provision of this Act or regulation of the Secretary of Commerce, or that he has failed to compel compliance therewith by an unlicensed person in his employ or under his supervision, or the license may be revoked by the Secretary of Commerce upon proof sufficient to satisfy him that the licensee was or is ineligible for a license.

Censorship, Interference and Disclosure of Messages

Sec. 14. (a) Radio stations licensed under the provisions of this Act shall at all times be subject to inspection by officials of the Department of Commerce. During any war in which the United States shall be a neutral nation, and in time of threatened or actual war in which the United States may be a party, and in time of public peril or disaster, the President may, by proclamation or Executive Order, issue regulations for the conduct and censorship of all radio stations and radio apparatus of every form and nature within the jurisdiction of the United States. Any person who shall knowingly violate or fail to observe any of said regulations shall be punished by a fine not exceeding ten thousand dollars or by a term of imprisonment of not more than three years or both; and in case of any such violation or failure to observe any of said regulations, the radio station, or apparatus, or both, shall be liable to forfeiture to the United States.

(b) The President, further, in his discretion, may cause the temporary closing of any radio station within the jurisdiction of the United States and the temporary removal therefrom of any radio apparatus for a period or periods of not more than five months each, or may authorize the temporary use of the station or the apparatus thereof by any department of the Government for a like period or periods upon just compensation to the owners.

Sec. 15. (a) Whoever shall maliciously or wilfully interfere with or cause any interference with radio communication carried on or sought to be carried on by any radio station or apparatus shall be punished by a fine not exceeding five hundred dollars for the first offense, and by a fine not exceeding one thousand dollars, for each offense thereafter.

(b) Whoever shall wilfully divulge or publish the contents, substance, purport, effect or meaning of any radiogram, or any part thereof, to any person other than the sender or addressee thereof, or his agent or attorney, except to a telegraph or radio station employed to forward such radiogram to its destination, or in response to a subpoena issued by a court of competent jurisdiction, or on demand of other competent authority, shall be punished by a fine not exceeding five hundred dollars for the first offense, and by a fine not exceeding one thousand dollars, or imprisonment for not more than one year, or both, for each offense thereafter; provided, that this section shall not apply to the divulging or publication of the contents of any radiogram by the sender or addressee thereof.

Sec. 16. All stations shall give priority over all other radiograms to radiograms relating to ships in distress, shall discontinue all sending on hearing a distress signal, and, except when answering or aiding a ship in distress, shall refrain from sending until all radiograms relating to the ship or ships in distress shall have been completed.

Every coastal station and every station whose operation can interfere with the exchange of messages between ship and ship, or ship and coast is required, during the hours it is in operation, to listen in at intervals of not less than 15 minutes, and for a period of not less than 3 minutes, with the receiver tuned to receive messages on a wave length of 600 meters, or such other normal wave-length as may be required by future international conventions.

Logarithmic Decrement Limitation

Sec. 17. When sending distress signals, the transmitter of a station on shipboard may be tuned to create a maximum of interference with a maximum of radiation. In all other circumstances, all stations shall use the minimum amount of energy necessary to complete any communication.

Every radio station shall use such transmitting apparatus that the energy is radiated in as pure and sharp a wave as practicable, and have a logarithmic decrement not greater than the limits which may be specified by the Department of Commerce, but the owner or operator of a station mentioned in Section 18 following shall not be liable to the penalties provided in Section 28 for a violation of the requirements of this section unless such owner or operator shall have been notified in writing that the transmitter owned or used by him has been found, upon tests conducted by the Government, to be so adjusted as to violate said requirements, and opportunity given such owner or operator to adjust such transmitter so as to conform to said requirements.

Receiving apparatus shall be of such construction and so adjusted and used as to give the greatest practicable protection against interference.

Sec. 18. General amateur stations shall not use a transmitting wave-length exceeding 200 meters or a transformer input exceeding one kilowatt.

Restricted amateur stations shall not use a transmitting wave-length exceeding 200 meters or a transformer input exceeding one-half kilowatt.

Special amateur stations are permitted to use any wave-length less than 600 meters and an amount of power not exceeding the limit which shall be specified in the license, provided the Secretary of Commerce is satisfied that such operation would not interfere with Government, commercial, coastal, or ship stations.

Sec. 19. The Secretary of Commerce may, in his discretion, grant licenses to experiment stations to permit the carrying on of tests with any amount of power or any wave-lengths, at such hours and under such conditions as will insure the least interference with the work of other stations.

Wave Length Restrictions.

Sec. 20. Commercial stations and technical and training-school stations shall not use a transmitting wave-length of 1800 meters nor any wave-length exceeding 600 meters unless it exceeds 1600 meters, except in special cases to be determined by the Secretary of Commerce. Such a station shall operate in such a manner as not to cause interference with Government stations or other commercial stations. Such a station shall not use any wave-length between 200 and 600 meters if operation at such a wave-length would, in the opinion of the Secretary of Commerce, cause interference with coastal or ship stations.

After the passage of this Act no license shall be granted to a commercial station permitting the use of a wave-length between 200 and 4000 meters, except when so far removed from Government or coastal stations that in the opinion of the Secretary of Commerce no interference can occur with Government or coastal communications.

In considering complaints of interference and in deciding whether the license of a station causing serious interference shall be revoked by the Secretary of Commerce, preference shall be given to stations communicating with ships or between points where other means of communication are not available.

Sec. 21. Every coastal station and ship station shall at all times be ready to send and receive messages and signals on such wave-lengths and of such wave character as are required by the existing or future international conventions, one of these wave-lengths to be considered as the normal sending and receiving wave-length of the station. Such stations may also use 1800 meters and such additional wave-lengths less than 600 meters as may be granted by the Secretary of Commerce. Every such station shall have its receiving apparatus so marked that the operator can quickly and conveniently adjust it to a receiving wave-length of 600 meters or other distress wave-length that may be designated by future international conventions.

Sec. 22. No licensed ship radio station when within fifteen nautical miles of a Government land station or a coastal station shall use a transformer input exceeding one kilowatt, nor when within five nautical miles of a Government land station or a coastal station, a transformer input exceeding one-half kilowatt, except for sending distress signals or signals or radiograms relating thereto.

The Secretary of Commerce may regulate or prohibit the use of the transmitters of stations on shipboard in harbors within the jurisdiction of the United States, as he may deem necesasry.

Location and Transmitting Restrictions.

Sec. 23. No licensed land station in operation on the date of the passage of this Act within fifteen nautical miles from the Government receiving stations at the following points: Boston, Mass.; Newport, R. I.; Washington, D. C.; Charleston, S. C.; Key West, Fla.; San Juan, P. R.; Point Isabel, San Antonio, Laredo, and El Paso, Texas; Fort Huachuca, Arizona; San Diego, and San Francisco, Calif.; North Head, Tatoosh Island, and Bremerton, Washington, or from any Government station in Alaska, shall be licensed to change its equipment in any manner that will increase its interference with other stations, and no land station located within fifteen nautical miles of the Government receiving stations herein named, and not in operation on the date of the passage of this Act, shall be licensed for the transmission of public or commercial business by radio communication.

Sec. 24. At all important seaports and at all other places where coastal stations operate in such close proximity to Government stations that interference with the work of the Government stations cannot be otherwise avoided by the enforcement of this Act, such coastal stations as interfere with the receipt of radiograms by the Government stations concerned shall not use their transmitters during the first fifteen minutes of each hour, local standard time. The Secretary of Commerce may, on the recommendation of the Department concerned, designate the station or stations which may be required to observe this division of time. The Government stations for which the above-mentioned division of time may be established shall transmit radiograms only during the first fifteen minutes of each hour, local standard time, except in case of radiograms relating to vessels in distress.

Sec. 25. Whoever, including any person in the service of the Government, shall knowingly transmit or publish, or knowingly cause to be transmitted or published, any false or fraudulent distress radiogram, or who, when engaged in radio communication, shall transmit or publish, or cause to be transmitted or published, any other radiogram for the purpose of defrauding or deceiving the Government, shall be punished by a fine not exceeding two thousand dollars or imprisonment for not more than five years, or both.

Sec. 26. No person shall use or operate any radio apparatus on a foreign ship when within the jurisdiction of the United States otherwise than in accordance with the provisions of Sections 14 (a), 15, 16, 17, and 22 of this Act, and all the provisions of said sections and penalties thereto attaching are hereby made applicable to such apparatus: Provided, however, that in no other respect shall anything contained in this Act apply to apparatus on foreign ships, nor shall the restrictions of this Section or of any other Sections of this Act apply to public vessels of foreign governments otherwise than by a general proclamation of the President.

Naval System of Accounting.

Sec. 27. The office of Director Naval Communications, established under the jurisdiction of the Navy Department, shall be charged with the accounting and payment of charges in connection with the settlement of international radio accounts as provided by the London Radiotelegraphic Convention of 1912, or as may be provided by future international conventions. The expenses involved in the settling of international radio accounts, not exceeding five thousand dollars per annum, shall be borne by the United States.

Sec. 28. In all cases of violation of any provision of this Act for which no penalty is otherwise prescribed, or of any regulation of the Secretary of Commerce, the Secretary of Commerce may impose a fine of one hundred dollars upon the owner of the apparatus by means of which such violation was effected, or a fine of twenty-five dollars upon the offending operator, or both, but such fines may be reduced or remitted by the Secretary of Commerce in his discretion; and in addition the Secretary of Commerce may in his discretion, revoke the station license of such owner and revoke or suspend the license of such operator as provided in Sections 10 and 13 of this Act.

Sec. 29. The Secretary of Commerce shall have power to enforce the provisions of this Act by appropriate regulations through collectors of customs and such other officers as he may designate; and said Secretary shall also enforce the provisions of such international radio conventions as have been or may hereafter be ratified or adhered to by the United States, except that provisions thereof relating to Government radio installations shall be enforced by the Departments respectively controlling such installations.

The Secretary of Commerce may, upon application therefor, remit or mitigate any fine, penalty, or forfeiture provided for in this Act with the exception of penalties including imprisonment: Provided, that the penalties not involving imprisonment incurred in the Philippine Islands, may be remitted or mitigated by the Governor General and President of the Philippine Commission, and such penalties incurred in the Panama Canal Zone may be remitted or mitigated by the Governor of the Panama Canal on application therefor being made, in such manner and under such regulations as they may deem proper.

Sec. 30. *Except as otherwise specifically provided in this Act,* the provisions of this Act shall extend to all places subject to the jurisdiction of the United States. The several Courts of First Instance in the Philippine Islands and the District Court of the Canal Zone shall have jurisdiction of offenses under this Act committed within their respective districts, and of conspiracies to commit such offenses as defined by Section Thirty-seven of the Act to codify, revise, and amend the penal laws of the United States, approved March 4, 1909, and the provisions of said section, for the purposes of this Act, are hereby extended to the Philippine Islands and to the Canal Zone.

Provision for Repeal of Present Act.

Sec. 31. The Act approved August 13, 1912, entitled "An Act to Regulate Radio Communication," is hereby repealed.

Such repeal, however, shall not affect any act done or any right accruing or accrued, or any suit or proceeding had or commenced in any civil cause prior to sail repeal, but all liabilities under said laws shall continue and may be enforced in the same manner as if said repeal or modifications had not been made; and all offenses committed, and all penalties. forfeitures or liabilities incurred prior to the taking effect hereof, under any law embraced in, changed, modified, or repealed by this Act, may be prosecuted and punished in the same manner and with the same effect as if this Act had not been passed.

Marconi's Pointed Criticisms.

The Marconi view of the proposed legislation was expressed in the following communication, read by the company's Vice-President and General Manager, Mr. Nally, and filed with Commander Todd, chairman of the meeting:

GENTLEMEN:

After reviewing the provisions of the proposed bill to regulate radio communication compiled by your Committee, and entitled "An Act to Regulate Radio Communication," the Marconi Company respectfully submits the following for your consideration:

There has not been sufficient time between the receipt of your copy of the proposed bill, and the date of this hearing to enable us to prepare a complete statement as to each of the sections provided for in the proposed bill, but we wish to go on record at this time as objecting to the sections specically referred to hereafter, because of the hardships and restrictions, the sections, if enacted into law, would place upon the commercial operation and development of the art of radio communication.

Section 5 provides that "The Secretary of Commerce shall fix the rates charged by all licensed stations open to public correspondence." This provision is objectionable, in the first place, because the same provision does not apply to Government radio stations, which it is now proposed to open for public correspondence, in competition with commercial stations. Obviously, a condition of rate competition may be thereby created, to the serious detriment of the commercial companies. Secondly, this power should not be vested in the Secretary of the Department of Commerce. If regulation of rates is necessary, it would seem that it should come under the jurisdiction of the Interstate Commerce Commission.

Section 5 also provides for the opening by the Government of its radio stations to general public business, and if this provision is enacted into law, it will create a condition of competition between Government and private interests, resulting in a heavy financial loss to commercial companies, which have spent considerable sums of money and years of labor in the development of efficient radio stations, so as to provide a satisfactory commercial wireless telegraph service to the public.

Section 6 seems to anticipate the condition referred to in the preceding paragraph, in that it provides that "The Government, through the Navy Department, shall have authority to acquire by purchase at a reasonable valuation, any coastal radio station now in operation in the United States which the owner may desire to sell." It is not stated who shall determine the reasonableness of the valuation which the Navy Department may wish to place on property belonging to commercial interests.

Section 7. The last paragraph of this section provides that "A license shall not be granted if, in the opinion of the Secretary of Commerce, the operation of the proposed station will seriously interfere with the operation of existing Government or licensed stations in the vicinity." We respectfully submit that in the present stage of development of the radio art it is highly undesirable to enact the above regulation into law. Its effect would be to stifle the growth of the radio art and such authority should not be left to the opinion of any one person.

A Check on the Development of the Art.

Section 8. The penultimate paragraph of this section seeks to vest further rights in the Secretary of Commerce concerning the granting of licenses, and actually provides that the Secretary of Commerce may determine in advance of the erection of a radio station whether the apparatus to be installed in such a station shall be licensed.

With the many different types of apparatus now employed in radio communication, and with the different lines along which certain types of apparatus are being further developed, it is in our opinion highly undesirable to have any Government Department determine what type of apparatus may be installed at a proposed radio station. The check that such a regulation, if enacted into law, would have on the further development of the art is obvious.

Making Confiscation Easy

Section 9, in paragraph 1 thereof, provides, "The President of the United States, in his discretion, may cause the closing of such station and the removal of all radio apparatus, or may authorize the use of the station or apparatus by any Department of the Government upon just compensation to the owners," etc.

The President of the United States is already empowered, under the Act of August 13th, 1912, approved by Congress, to "Cause the closing of any station for radio communication and the removal therefrom of all radio apparatus, or may authorize the use or control of such station or apparatus by any Department of the Government, upon just compensation to the owner," "in time of war or public peril or disaster."

The Marconi Company has on previous occasions voluntarily offered its stations, as well as its organization, to the United States Government, if desired for use in time of war or other national emergency, and renews this offer at present, but respectfully submits that the section above referred to would give the same power to the President of the United States in time of peace, a condition which, in our opinion, is unnecessary.

Section 10 provides that "The books and records of the licensee shall be open at all times for inspection by the officials of the Department of Commerce," etc. We submit that if such a provision is to be enacted at all, it should be confined to such books and records only as apply to the transmission of messages, and the apparatus installed at any station licensed by the Department of Commerce.

Section 11 provides, in part, that "whoever shall employ any unlicensed person in the operation or supervision of any licensed radio station . . . shall be punished by a fine," etc.

We desire to call the attention of this Committee to the fact that the supervisors or engineers in charge of important radio stations need not, necessarily, be operators, and if the provision referred to in this paragraph is enacted into law it would prevent, for example, the chief engineer of a high power radio station from being employed, unless he obtained an operator's license, a provision in our opinion unnecessary.

False Elimination of Interference.

Section 17, in paragraph 2 thereof, provides, among other things, that, "Every radio station shall . . . have a logarithmic decrement not greater than the limits which may be specified by the Department of Commerce," etc.

We respectfully submit that this provision is extremely undesirable. The existing laws already provide for a logarithmic decrement not exceeding .2 per complete oscillation, and as it is not always possible to determine in advance of installation the logarithmic decrement of a transmitter, this depending on the antenna and other conditions, a regulation leaving this matter entirely in the hands of the Department of Commerce, would give grounds for controversy.

Section 20, paragraph 2 thereof, which prohibits the use by commercial stations of wave lengths between 200 and 4,000 meters, would, in our opinion, if enacted into law, seriously retard the development of radio telegraphy and telephony for overland communication.

It is evident from this proposed regulation that the framers of this bill have attempted to solve the interference problem by limiting the number of stations that may be erected, and also the wave lengths that may be used by stations already in operation. In our opinion, this is not a solution of the interference problem. What is needed is the removal of the cause of interference, a problem that can only be solved by individual initiative and such research as commercial organizations can engage in. The provisions of this section are evidence of the limitations this bill would place on the future development of the art of radio communication.

Section 21 provides for the further restriction of the already limited number of wave lengths allowed for commercial ship and shore use, while the bill makes no provision whatsoever regarding the wavelengths to be employed by the Government stations, a condition which is manifestly unfair to commercial stations, and especially so in time of peace.

Section 23 not only further limits the number of stations that may be erected on land, but also prevents certain existing commercial stations from changing their equipment. The purpose of this regulation is apparently to limit interference, but the views expressed in the preceding paragraph concerning the solution of the interference problem, similarly apply in this case.

In general the proposed bill is evidence of a desire to limit private enterprise, and tends to discourage and suppress individual efforts to promote or advance the radio signaling art. For the reasons stated, as well as for other technical considerations, the Marconi Company desires to record its protest against the provisions of the bill under discussion.

Respectfully,
MARCONI WIRELESS TELEGRAPH CO. OF AMERICA,
By E. J. Nally,
Vice President & General Manager.

Commander Todd observed, after the reading of the statement, "Mr. Nally's paper has some things in it which point to possible changes in the Bill. I see several places where the Committee will undoubtedly take a very strong notice of his objections. It is a very fair and open statement of his company's attitude."

Prof. Kennelly's Protest.

Three communications were then read by David Sarnoff, representing the Institute of Radio Engineers. The first was from Professor A. E. Kennelly, president of the Institute, professor of electrical engineering at Harvard and Boston "Tech," and vice-president of the National Amateur Wireless Association. Professor Kennelly said:

GENTLEMEN:

I am informed that new legislation is proposed, looking towards the invasion of the existing commercial field of radio communication in the United States by certain department or departments of the Government, and that a hearing is proposed in the near future, at very short notice after the preparation and promulgation of the said proposed legislation.

The views of the Board of Directors of the Institute of Radio Engineers have recently been expressed officially upon this question, and I beg to state my endorsement of those views, which will doubtless be presented to your notice.

I am not commercially interested either directly or indirectly, in any radio communication system plant, company or organization, so that I am not actuated by any financial consideration in urging my point of view before your committee. I am deeply interested, however, in the active development of the science and art of radio communication in America as a scientist, a teacher, an operator a telegraphist and a United States citizen.

Although, in the past, the commercial field of radio communication has unfortunately been exploited by certain unscrupulous promoters, to the detriment of all interests involved, nevertheless, a large aggregate amount of capital, and the savings of United States citizens, has been honestly invested in it. I submit that it is the duty and interest of the Government to protect that investment and the American enterprise that goes with it.

If the Navy Department, or any other department of the Government, is allowed to compete in times of peace with existing industrial shore stations in the hands of American citizens, such competition is likely to degenerate into the confiscation of private property, because the Government now claims the right to regulate radio communication, under the terms of the London Convention, and it needs no argument to show that, with the Government in competition and at the same time construing the terms of regulation of their competitors, the competitors might quite easily, and very probably would be regulated out of existence, and their properties confiscated at scrap valuation prices by the Government. I do not, of course, say that such injustice is the intention of any department of the Government, but I do say that any legislation which permits any branch of the Government to compete commercially with existing stations for messages in times of peace is likely to lead to the injustice above mentioned.

Blocking Preparedness.

In times of war, or national peril, it is of course the duty of every citizen to sustain and cooperate with the Government in the general commandeering of all electric communication, radio or otherwise, but in times of peace such commandeering of private enterprises by the Government is not only fatal to the private interests, but also fatal to the Government interests. This is shown by the fact that in those countries of Europe where the telephone system is owned and operated entirely by the Government, the telephone communication of the country is in a relatively backward state, by comparison either with the United States or with countries in which the telephone is not owned and operated by the Government. Statistics on this point are so ample and accessible that I need not refer to them here. In order, therefore, that the highest development of radio communication shall constantly be obtainable for the support of the Government in time of need, it is very desirable that inventions and improvements should be open to the public and to public competition. If the radio system is a Government institution, nearly all incentive for improvement, and most of the inventive and scientific effort for development will cease. There will be no market for private enterprise. I therefore urgently contend that, for the present, there should be no legislation increasing the already great powers of the Government in the radio communication field.

Yours respectfully,

A. E. KENNELLY,
Professor of Electrical Engineering at Harvard University and Mass. Institute of Technology.

Prof. Goldsmith's Protest.

Professor Alfred N. Goldsmith, of the College of the City of New York, editor of the Institute Proceedings, and a vice-president of the National Amateur Wireless Association, was next heard from. His communication read as follows:

GENTLEMEN:

The undersigned has had the opportunity to read through the provisions of a proposed bill to regulate radio communication compiled by your Committee, and respectfully submits the following comment thereon:

In considering radio legislation, he assumes as a necessary and fundamental basis that the welfare of the country is dependent on the encouragement of commercial enterprise in legitimate directions, the fostering of determined inventive effort, and sympathetic co-operation of Government officials in the directions mentioned.

In the radio art, the need of such a friendly attitude on the part of the Government is peculiarly necessary, since it is well known to those engaged in this useful art that the commercial concerns have not yet passed out of the initial stages of development, and that they have sunk great sums of capital in the establishment of a valuable field which has not given them, up to the present, an adequate return. Whatever may have been their shortcomings in the past, it is very evident that the leading companies in the radio field in America are now very earnest in their desire to develop the field in the right directions and to bring the United States to a position of pre-eminence in character of equipment and grade of service. In this worthy task, they are entitled to every encouragement.

The radio art itself bristles today with unsolved problems which obviously demand concentrated research and commercial trial on the largest scale to facilitate their solution. The undersigned need only mention in this connection the great difficulties of elimination of atmospheric disturbances of reception ("strays"), the unsolved problem of long distance reliable radio telephony, the problem of securing adequate selectivity of choice of station in reception, the elimination of station interference in reception, the securing of a reliable and simple calling system whereby the continual attendance of a skilled operator in the receiving station may be avoided, and

can be solved only by individual initiative expressing itself through large commercial organizations which, out of a portion of their profits, maintain the necessarily elaborate research laboratories, and offer suitable remuneration to those carrying out the research work itself.

There is, indeed, a marked parallelism between the development of the radio field and that of wire telephony. The evidence is irrefutable that the telephonic field would not be today at its high state of development if the attitude of the Government after 1880 had been one of unfriendly interference and threatened confiscation.

Legislating Commercial Companies Out of the Field.

The undersigned is reluctantly forced to believe that the spirit of the legislation proposed by the Inter-Departmental Committee is one of hostility to the existing organizations. Throughout the proposed bill there is evidence of a desire to eliminate commercial enterprise and healthy competition. The suggested clauses giving the Secretary of Commerce the arbitrary power to suppress a station in which the smallest detail of the apparatus is changed without a license application (Section 9, paragraph 4, "Apparatus other than that specified in the license shall not be used for radio communication"), the even more arbitrary power vested in the Secretary whereby all wave-lengths between 200 and 4,000 meters are, in effect, closed to commercial stations except in the hearts of unpopulated wildernesses where the sensitive receivers in Government stations can not detect their existence and potential interference with Government traffic (Section 20: " . . . no license shall be granted to a commercial station permitting the use of wave lengths between 200 and 4,000 meters, except when so far removed from Government or *coastal* stations that in the *opinion* of the Secretary of Commerce, no interference can occur with the Government or coastal communication"); these clauses can only be interpreted as expression of a desire to drive the commercial companies out of the field. To clinch the matter, the undersigned need only cite the clause of ment is authorized to purchase commercial stations within five years from their (presumably bankrupt) owners.

If the commercial companies are driven out of the field in this early stage of its development, the undersigned is firmly convinced that a great wrong will have been done to the United States and that the future of radio communication and its legitimate development will be irretrievably destroyed. Against so unfortunate a policy, he begs to protest. He urges respectfully that the proposed legislation be abandoned as being contrary to the interests of the United States and prejudicial to the commercial and engineering development of the radio art.

Very truly yours,
ALFRED N. GOLDSMITH, Ph. D.,
Director, Radio Telegraphic and Telephonic Laboratory.

As secretary, Mr. Sarnoff then noted:

At the last meeting of the Board of Direction of the Institute of Radio Engineers, the following resolution was recorded in the minutes of the Institute records, and I am instructed to present the resolution to your Committee:

I. R. E. Resolution of Opposition to Bill.

Whereas: Certain unwise provisions in the London Radio Telegraphic Convention of 1912 through serious Governmental interference have retarded the engineering development of the radio art; and

Whereas: The development of new arts of electric communication has always been checked by Government interference and has always been fostered by the existence of free individual initiative as, for example, telephony, in the United States; and

Whereas: Many important problems in radio telegraphy and telephony are still unsolved, as, for example, the problems of long-range radio telephony, adequate selective reliability, call systems and the elimination of atmospheric strays; and

Whereas: The solution of these important problems calls for the highest engineering and inventive talent and research; and

Whereas: Such inventive effort and research can only exist under free institutions and under the stimulus of healthy competition; and

Whereas: Certain foreign Government have assisted and not opposed individual initiative and private enterprise in developing the radio communication systems of their countries with great success; and

Whereas: Government competition, or confiscation by the Government, would effectively stifle inventive effort; and

Whereas: The military control of radio —or any public-service communication— in times of peace, virtually constitutes a continuous military inquisition into private correspondence, an undemocratic and dangerous institution; and

Whereas: The reliability and superiority of our radio communication in times of sudden national peril is dependent upon the inventive and engineering resources of the nation, which should therefore be kept at the highest pitch and of the broadest scope; therefore, be it

Resolved: That the Board of Direction of the Institute of Radio Engineers is opposed to the competition by any Department of the Government, and particularly by any Military or Navy Department, with existing organizations founded for radio communication; and

Resolved, further: That this resolution be brought to the notice of such Congressional Committees as may have charge of any proposed legislation on the subject.

Respectfully,
Board of Direction,
THE INSTITUTE OF RADIO ENGINEERS,
By David Sarnoff,
Secretary.

In his address to the meeting Commander Todd stated that the principal reason for the Government's desire to handle commercial business was that operators in Government service at shore stations are not obtaining enough practice to make them efficient as operators.

Navy Views Government Monopoly in Thin Disguise.

"I ask," said Mr. Nally, vice-president and general manager of the Marconi Company, "if the Government has any other reason for entering into the commercial business than to give its operators practice?"

Commander Todd's reply was to the

effect that it would be necesary to take the traffic away from the commercial stations in order to give Government operators the practice needed to become efficient. He added: "The framing of sections that suggest Government monopoly is just the handwriting on the wall; it must come, unless all these beautiful dreams come true."

Two Views of Proper Preparedness

"Naturally, Mr. Chairman," said Mr. Nally, "it isn't clear to us as a question of business, why this should come true. Why a service which in itself has not been criticized, which is considered as developing from day to day, which is improving every hour and is doing really good service to the public, why it should be legislated out of business mainly for the reason that Government operators are not given sufficient practice. We might say that it is necessary for the Army and Navy to be constantly at war in order to be prepared!"

After some hesitation, Commander Todd replied: "It might be a good thing."

"It would be disastrous!" observed Mr. Nally.

The meeting adjourned shortly after Prof. E. B. Rosa, a member of the Inter-Departmental Committee, chief psysicist of the Bureau of Standards, had given his interpretation of some of the provisions and asked the members of the Institute to discuss matters with the Committee.

HOW FORT VAUX RECEIVED ELECTION NEWS

A newspaper says that news of the Presidential election in the United States was communicated by wireless telegraphy to Fort Vaux on the Verdun front and created intense interest even amid the activities of defense preparations and under a very severe German bombardment.

DR. DEGROOT'S PAPER

At a meeting of the Intsitute of Radio Engineers, held on December 6th, in Room 1201, Engineering Societies Building, New York, a paper on "The Classification and Elimination of Strays," by Dr. C. J. deGroot, was presented. Dr. deGroot, who is head of the radio service of Holland in the Dutch East Indies, has developed some remarkable methods of classifying and eliminating strays.

ALASKAN STATIONS CLOSED

The following land stations in Alaska have been closed and will not be reopened until March, 1917: Akutan (KNW), Chignik (KHC), Egegak (KMF), Hales Creek (KMT), Koggiung (KVV), Koggiung (KHB), Naknek (KHT), Naknek (KMK), Nushagak (KMG), and Snag Point (KHF).

The importance of all legislative matters concerning Government control of the radio field has led The Wireless Age to publish this full report for the benefit of its readers.

The annual report of the Secretary of the Navy, received as we go to press, makes clear the determination to make radio a Government monopoply, if possible. Secretary Daniels says: "No censorship of radio stations can be absolutely effective outside of complete Government operation and control." He adds: "The Government must . . . obtain control of all coast radio stations and operate them, in conjunction with naval stations, for commercial work in times of peace."

Before this can be done, however, laws must be passed. And in the end the law must express the will of the people of the United States.

Study the Bill and send in your comments to the Editor.

British Law to Compel Ship Installations

The following regulation has been published in the London Gazette:

"37B (1) Every British ship of three thousand gross tonnage or upwards, in respect of which a license to install wireless telegraph apparatus has been granted by the Postmaster-General, and which puts to sea from a port in the United Kingdom after a date to be specified in such a license, shall be provided with a wireless telegraph installation, and shall maintain a wireless telegraph service, and shall be provided with a certified operator, together with suitable accommodation for the apparatus and operator:

"Provided that where a license has been granted in respect of a ship before the making of this regulation, this obligation shall apply as if the twenty-first day of August, nineteen hundred and sixteen, were the date specified in the license.

"(2) Application to the Postmaster-General in a form prescribed by him for such a license shall, unless a license has before the making of this regulation been granted in respect of the ship, be made:

"(A) In the case of a ship of such tonnage as aforesaid, registered in the United Kingdom, by the owner thereof on or before the twenty-first day of August, nineteen hundred and sixteen: and

"(B) In the case of a British ship of such tonnage as aforesaid, registered elsewhere than in the United Kingdom, by the master of the ship within two days from the arrival of the ship in the United Kingdom next after the making of this regulation.

"(3) The Postmaster-General shall, as and when wireless telegraph apparatus and the service of operators becomes available for the purpose, cause licenses to be issued in respect of such ship as in the opinion of the Admiralty should in the national interests be fitted with such apparatus, and the licenses shall specify the date as from which the carrying of such apparatus under this regulation is to be compulsory, the character of the apparatus and the qualifications of the operator.

"(4) The Postmaster-General may

"(A) Extend the time mentioned in the license as the time within which any apparatus is to be provided; and

"(B) Exempt any ship from the obligations imposed by this regulation.

"(5) If the provisions of this regulation or the terms of any license granted thereunder are not complied with in the case of any ship, the master or owner of the ship shall be guilty of a summary offence against these regulations, and if any master or owner fails to make an application in accordance with this regulation he shall be guilty of a summary offence against these regulations, and in either case if the ship is at any time subsequently found at a port of or within the territorial waters adjoining the United Kingdom the ship may be seized and detained.

"(6) In this regulation expressions have the same meaning as in the Merchant Shipping Acts, 1894 to 1914."

The Operator and the Tramp

The Viewpoint of a Wireless Man Assigned to a Tramp Steamer—Facts About the Rolling Stone Which Acquires None of the Moss That Gathers on Ruins But Gains Brightness by Contact With Diversified Interests—A Journey That Afforded a Chance to Rub Elbows With Incas from the Tropic Mountains, Zulus from the Veldt, Enigmatic Japanese and Stalwart Siberians

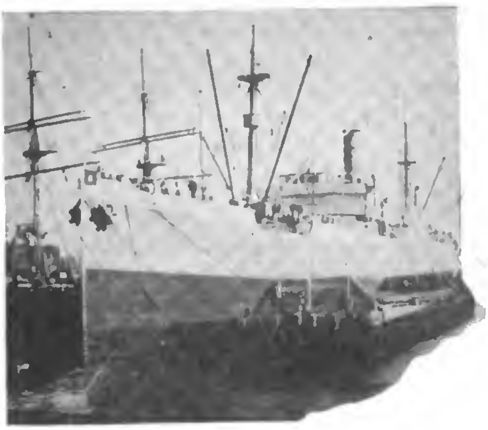
By J. Edward Jones

Marconi Operator on the San Francisco

PICTURE yourself strolling about the plazas of tropical cities to the accompaniment of tuneful music with the southern cross bright and clear overhead, and soft-eyed, dusky-skinned senoritas moving here and there with languorous grace; imagine seeing the Inca in the fastness of his mountain home, Zulus fresh from the broad veldt, high-browed Ceylonese on their own picturesque island, enigmatical Japan, the frozen wastes of dread Siberia and Egypt, with its pyramids and mighty river, its veiled maidens and perplexing atmosphere of mystery.

Sounds fascinating, doesn't it? Well, the reality is even more delightful than the description. Moreover, the opportunity to experience the thrills and tingles born of actually journeying to the interesting places referred to, to visit on an average a different country each month, is open to him who sits in the wireless cabin of a freight steamship.

In a previous issue of THE WIRELESS AGE was published an article entitled "Is the Game Worth While?" which caused considerable comment. However, it did not mention the wireless operator on the tramp and the ambition to tell the story of the radio man from the former's viewpoint was one of the reasons that prompted me to write this article. This I feel measureably qualified to do since I myself am a freight operator.



Operator Jones and his vessel, the San Francisco, on which he made the interesting voyage described

I have heard operators express much gratification upon learning that they had been assigned to passenger steamships, their satisfaction doubtless being due to visions of scenes of gayety and animation. These men could not grasp the advantages of being a freight operator. From my viewpoint the most desirable feature of a post on a passenger liner is the opportunity to handle a larger amount of traffic than falls to the lot of the man in the freighter's wireless cabin.

But the recital of my experiences rather than any argument I could present will, it seems to me, better impress the reader with the advantages which we of the tramps enjoy. Therefore I will hurry on with my story.

I was assigned in the latter part of August, 1915, to the San Francisco of the Isthmian Line, bound on a voyage to the River Plate. There were days and days of gliding over the waters, then a short stay in Montevideo and Buenos Aires and a delightful trip up the Rio Parana to Rosario. The latter has many attractions and I remember it chiefly because of the fact that we enjoyed some excellent duck shooting while the San Francisco was docked there. We steamed for New York with several thousand tons of linseed and the voyage proceeded without incident until we were four days out. Then fire was discovered on the ship and all hands were called upon to fight it. We succeeded in keeping the flames under control and ran into the harbor of Rio Janeiro, where it was extinguished. Eight days later the San Francisco resumed her voyage northward, stopping at Barbados for coal.

When the vessel arrived in New York we were informed that she had been chartered to go to Siberia with rolling stock for the Trans-Siberian Railway. The Panama Canal was closed, so we were compelled to steam towards the rising sun, instead of taking the shorter route to the west.

We cleared from New York early in December, and twelve days later San Antão, the most northwesterly island of the Cape Verde group, loomed up ahead. Soon other rocky headlands came in sight, and shortly afterwards we rounded Bird Rock and dropped anchor in St. Vincent Bay.

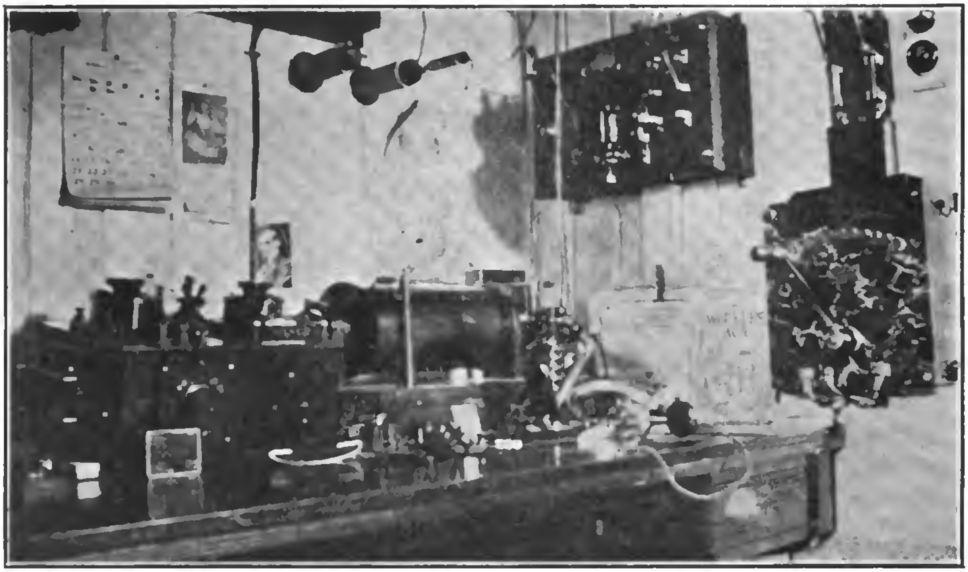
Upon leaving Durban we steamed through the Mozambique Channel, between Madagascar and Portuguese East

Cruz Grande is typical of the smaller ports along the Chilean coast, on the final leg of the return voyage

Two days' journey from the Panama Canal is Buenaventura, Colombia, of which this is the main street

Africa. We obtained a splendid view of the beautiful, fertile Comoro Isles and I communicated with the French wireless station at Dzaondzi, on Mayotta Island. Then followed two weeks of steady steaming, almost on and parallel with the equator, but we encountered fair weather and near the end of January the ship tied up in Sabang harbor.

Sabang is situated on Pulo Weh, to the extreme north of Sumatra, the island being mountainous, and covered with luxuriant vegetation. There are numerous pepper and cocoa-nut plantations, the scenery is gorgeous, and the customs of the people very odd. Sabang has about 600 inhabitants, most of whom



A corner of the wireless room on the San Francisco

are coolies employed by the coal company. The bay is very picturesque, being surrounded by high hills covered by a dense tropical growth. The water is clear, and hundreds of fishes can be seen plainly.

Leaving Sabang, we headed down the Malacca Strait, passing among the Malacca Islands, once the center of great piratical activities, and thus into the China Sea. Here the gorgeous sunsets and the large amounts of phosphorous in the water are worthy of note.

We sighted the rugged, mountainous coast of Japan, on February 14th, and through blinding snow-storms entered the Inland Sea and came to anchor be-

tween Moji and Shimonoseki. In spite of the weather, we had hardly anchored when a larger number of vendors came on board and set up their shops on the hatches, giving the ship the appearance of a bazaar. Both men and women coaled the ship, and it was difficult to distinguish one from the other, although most of the latter had children strapped to their backs. In the towns most of the buildings are low, have the same color, and are constructed on architectural lines peculiar to the country. The customs of the people are deeply interesting, mystery and strangeness pervading them. The belles, with their swaddling clothes and stilt-like sandals, seemed very odd to us of the Western world. Most engaging were the manners of the Japanese whom we met and my visit to their country was given added interest by the knowledge that in it was one of the links of the Marconi world-girdling wireless chain.

After leaving Japan we put in close to the coast of Chosen, and two days later were pushing our way through ice fields, until, preceded by a couple of ice-breakers, we entered Vladivostok harbor.

Vladivostok is built around the inner harbor, with high hills rising at the back. Some straggling streets run almost to the summits of these hills. It is of ... importance as the eastern terminus of the Trans-Siberian Railway, and as an open port during the entire year. During most of our spare time we were skating, skeeing, or sleighing, and we attended many masquerade balls, most of which were given for charity. Swetlanskaia Ulica (Light Street), was the favorite promenade in the evenings and on Sundays, but when inclement weather prevailed, Kokkana's cafe was a popular gathering place. In the midst of this pleasure-seeking throng it was difficult to realize that the dread mines of Kara were but a comparatively short distance to the west and to the north were those of Ust Yansk and others of even more terrible repute.

Thus passed four days in Vladivostok and when on March 15th we steamed slowly out of the harbor we left behind scenes that were associated with many pleasant memories. After coaling at Moji again we departed for Ilo Ilo, the second largest port in the Philippine Islands. The town itself is rather small and the streets are narrow. Most of the stores are conducted by Chinese, and many articles typical of their country can be purchased remarkably cheap. While the town is fast becoming Americanized there still remain many of the customs established by the old Spanish influence, and a considerable number of the natives speak neither Spanish nor English. Their habits proved an interesting study, for in some ways they go back to the days of slavery. The Chinese villages, along the shores of the streams which we explored by motor-boat, were very odd indeed, being built upon piles driven down into the water. No doubt this form of habitation has its advantages in a country swarming with snakes and lizards.

Manila, which arouses the expectations of sightseers, proved to be not very different from other tropical cities

Chinese and natives inhabit these houses on stilts above the water and appear to be happy in the Philippines

From Ilo Ilo to Manila the course of the stream runs in and out among numerous islands. Wireless traffic is handled easily, for stations on several of the islands maintain a good service.

It was with anticipations of an interesting sight-seeing tour that I went ashore at Manila. However, I found it not greatly different from the average Latin-American city. An automobile trip up into the hills provided a welcome diversion, for the country is attractive, being dotted here and there with villages that are extremely primitive.

At Singapore, our next port of call, I found a city with a population of 193, 000, which, because of its geographical position, on a small island at the extreme southern end of the Malay peninsula, possesses a trade and importance out of all proportion to its size. About the outskirts of the place wild animals prowl. Their number includes tigers, elephants, panthers, tapirs, wild hogs and deer, the first-named species frequently finding their way into the city. Singapore has a Coney Island, it should be chronicled, but it differs in every way from New York's famous resort.

Easter Sunday found the San Francisco churning her way into Colombo Harbor where two hospital ships and two transports filled with Australian troops reminded us of the great European war. Just outside the city are the extensive tea plantations of Sir Thomas Lipton, a visit to them providing one of the most attractive features of our stay.

An adventure with sharks in the Indian Ocean marked the next chapter of our voyage. When we were midway between Colombo and the island of Socotra, the ship sprung a leak and it was necessary to lower the carpenter over the side to make repairs. He accomplished his task successfully, but at some risk for the waters about the vessel swarmed with man-eaters and in order to protect the carpenter from attack the officers of the San Francisco directed a continuous rifle fire upon them.

Steaming close to Aden, reputed as the place in which prevail the warmest weather conditions in the world, we ran past Perim late in the evening of the same day into the Red Sea. On the morning of May 7th we sighted the peak of Mount Sinai, where those ten very brittle commandments were made. Then came our trip through the Suez Canal. on the banks of which were encamped Australian troops, and at length we arrived at Port Said.

After steaming the length of the Mediterranean we stopped at Oran, the second largest city in Algeria. It is divided into two parts, the old and the new, which are separated by a ravine and a rivulet, and joined near the beach by a tunnel. The modern part is growing rapidly, and already contains some fine buildings. Oran originally belonged to the Spaniards, but was abandoned by them after a severe earthquake, and was afterwards occupied by the French. There are some celebrated thermal baths near the place.

The ten kilowatt wireless station on top of Mount San Cristobal, a lofty eminence overlooking Lima, at the foot of the Andes

We arrived at Liverpool without mishap on May 22nd. Some of our cargo was discharged there and then we proceeded to Greenock with the remainder.

The San Francisco sailed for the west coast of South America on July 29th, passing through the Panama Canal exactly three months after we made the passage of the Suez. Two days later we entered the Buenaventura River and anchored off the town bearing that name.

Callao, our next stop, is important as the seaport of Lima, the capital of Peru. Lima is about eight miles inland from Callao, an electric train service being maintained between the two places. Lima is built on a level tract of country at the foot of the Andes. The old Cathedral, built in 1625, contains great wealth; there are pillars and other decorations of pure gold and silver. I also saw in the Cathedral the bones of General Don Francisco Pizarro, who founded Lima.

Pizarro, it should be stated for the benefit of those who are not familiar with Lima's history, was that ruthless Spanish adventurer who was sent to conquer Peru, his countrymen having heard of its great wealth. By treachery he captured Atahualpa, the Inca, who offered as his ransom to fill the room in which he was confined, as high as he could reach with vessels of gold. Pizarro accepted the offer, the value of which is estimated at $15,000,000 in gold, but as soon as the treasure was in his possession he put the Inca to death. The powerful dynasty passed away with the death of Atahualpa, but many of the latter's descendants still live in the mountains of Peru.

During my stay in Lima I climbed Mount San Cristobal and visited the Lima 10 k. w. wireless station on top of the lofty eminence. From the station I obtained an excellent panoramic view of the city.

Arica, Caleta Junin, Iquique Antofogasta, Taltal, Cruz Grande and Valparaiso on the Chilean coast were among other places the San Francisco touched at before starting on the final leg of the voyage to New York. The latter port we reached without mishap and there my story ends.

The readers of this article will notice that my recital embraces visits to many countries, showing that the freight operator's assignments may take him to points in every part of the world. And while the old saying about the rolling stone and its failure to gather moss may be recalled, it should also be borne in mind that moss is often found on ruins and the rolling stone becomes bright from contact with various kinds of substances.

Lima, the capital of Peru, as seen from the wireless station atop Mount San Cristobal.

Radio Telephony

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ARTICLE I.

WORLD ASPECTS. Before presenting to our readers something of the technical details of radio telephony, we may be pardoned for a digression based on the broader viewpoint of world growth.

Most difficult it is for a citizen of a modern state, beside whose breakfast table lies the printed sheet bearing the most recent news of widely distant happenings, to realize the elaborate and delicately adjusted mechanism which makes the entire earth his mental neighborhood. The labor of gathering accurate news, the transfer of these to the telegraph or telephone lines, the transmission of these across ocean or continent by the highly evolved radio telegraph or cable, and the huge task of editing, printing, and distributing them: all this shows but dimly in the final result. And yet, possibly the most fundamental difference between savagery and civilization and the most potent source of the latter is *communication.* The isolation of any modern state, the communication lines of which were irretrievably broken, would be truly tragic. The ties that would be broken would be not merely financial but in every field of human endeavor. Imagine a state which heard nothing of the politics, art, science, and literature of all the others. Picture the provincialism, the backward and undeveloped craving for the beautiful in art, the lack of co-ordinated scientific research and industrial development dependent thereon, and the childish literature which would result. A second "Dark Ages" of the mind and spirit would follow; and the citizens of the segregated state would be willing to pay almost any price for the restoration of communication. The evil effects of lack of communication on commerce need not be dwelt on; their magnitude and inevitability partake of the obvious. It is exceptional that money in the form of the actual gold or silver is physically transferred from one country to another to settle debts. Payment is made by the transfer of credits between the countries or their merchants, and this transfer requires nothing more than the use of the radio or cable station for a few minutes. Only the small outstanding monthly or annual balance in favor of one or the other is physically conveyed between the merchants, and even this but rarely.

2. **PERSONAL ASPECTS.** Aside from these larger aspects of communication, there are other advantages of communication which are priceless to the individual. The most obvious of these is the call for help in time of peril. We cannot gauge the value of a radio station on ship-board to the passenger or crew after collision or the breaking out of fire. The stringent laws of all nations relative to ship sets speak clearly for the opinion of the world. And marine law (and even naval law) have been altered by requiring the captain of the ship to remain directly and immediately responsible to his superiors on shore.

Modern business would, of course, be helpless except for the telegraph and telephone. Imagine our great companies in a world where all communication was by word of mouth, or by letter! The wheels of industry would turn but slowly when weighted down and clogged by slow and unreliable communication.

In the more personal matters of life, the literal extension of the personality by the telephone constitutes an inestimable privilege. The more pleasant social amenities become possible to all. And the wish of the poet, to "Annihilate but time and space, and make two lovers happy," is no longer a dream. Communication has indeed conquered tardy time and weary space.

To summarize: in its larger aspects, COMMUNICATION IS THE LIFE-BLOOD OF CIVILIZATION, OF INTERNATIONAL GOOD WILL, AND OF PROGRESS.

To the individual, IT IS AT ONCE THE CLIMAX OF CONVENIENCE AND THE ULTIMATE EXTENSION OF PERSONALITY IN TIME AND SPACE.

3. **USES OF RADIO TELEPHONY.** (a) The most natural use of radio telephony is from ship to ship and from ship to shore. Since it is the only means of telephonic communication possible under the circumstances, it would not need to compete against wire telephones or cables. By the use of amplifying relays at the receiving end (on shore), it will be possible to enable any person on the ship to communicate directly with persons on land, in part over the regular wire lines and in part by radio. The details of such communication will be explained in a subsequent article of this series. The great advantage of radio telephony over radio telegraphy on board ships is the direct personal contact between the persons corresponding and the resulting possibility of speedily settling the matters at issue, and (e.g., on freighters or tramp steamers) the freedom from the necessity of understanding the code. Of course, this last advantage is bound up with the simplification of ship radio telephone sets to the point where a skilled operator becomes unnecessary, the manipulation being simple and certain.

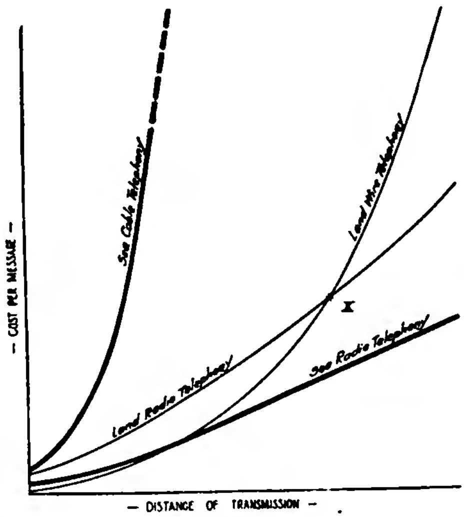


Figure 1

(b) A second important field for radio telephony is in trans-oceanic and trans-continental work. In the first of these, radio telephony is unique in meeting the requirements and is free from competition with submarine telephone cables. In the latter case, it would have to meet the competition of the long distance telephone lines. In each case, communciation between Subscriber A and Subscriber B would be through their wire lines to the nearest radio telephone high power station and thence automatically retransmitted through an amplifying relay. This will be further explained in a later paper of this series.

(c) There are certain types of regions where radio communication is the only one possible of maintenance, e.g., in the arctic regions (because of snow and ice interference with wire lines), in densely wooded tropical regions (because of the enormous difficulty of maintaining a clear right of way through rapidly growing and luxuriant vegetation), in regions or across regions occupied in part by hostile savage tribes (who are addicted to the use of copper telegraph wire for ornament), and between islands and the mainland (where precipitous rocky coasts or swift currents injure or sweep away cables). In all of these cases, radio telephony offers its usual advantages and will no doubt come into increasing use.

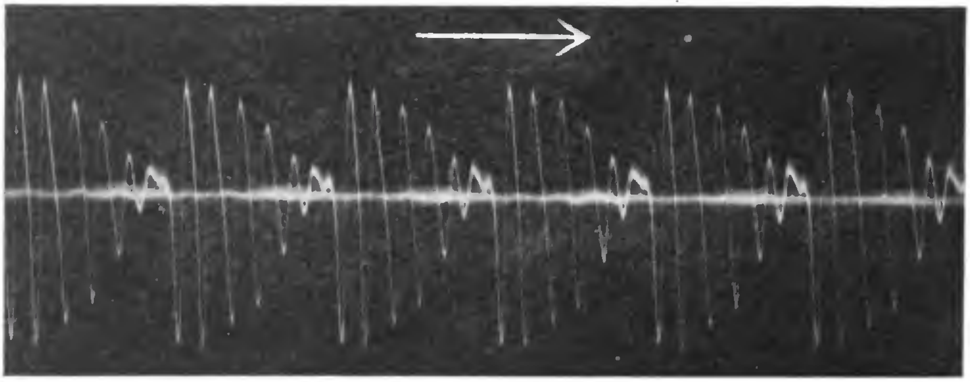


Figure 2

(d) Between two moving trains or between moving trains and fixed land stations. Here, too, we are practically restricted to radio communication. The obvious advantages of such installations in times of storm, when wire lines are almost always incapacitated, has been shown by the experiences of the officials of the Delaware, Lackawanna & Western Railroad in times of blizzards. They have kept in touch with their otherwise marooned trains, and have greatly simplified the problem of resuming normal traffic schedules. And even in fair weather, the advantage of keeping all trains in touch with each other and the control of train dispatching is obvious. Occasional failures of the block system become far less dangerous, because it is possible to warn a train regardless of its position relative to the signals. In foggy weather, this accurate moment-to-moment information as to train positions is far from being a drawback to the normally anxious passenger on certain railroads.

(e) There are a number of special applications of radio telephony which have not as yet been developed to the point at which it is possible to make any very definite statement as to their ultimate value. Among these are telephonic communication between various levels of a mine and the surface (which communication would greatly increase the chance of an early rescue in cases of cave-in, where wire lines are almost always broken), communication between government foresters, communication between aeroplanes or dirigibles and the ground, and communication between submarines and ship or shore.

4. **RADIO VERSUS WIRE TELEPHONY.** It is very difficult, if not impossible, to institute a fair comparison between these fields at the present time. Radio telephony is so far from having reached an advanced stage of development, and is so seriously threatened on the research side by government control and naval or postal administration, that our conclusions are little better than guesses. However, certain broad considerations are fairly obvious and probable.

Let us consider Figure 1. Horizontally we have laid off on an arbitrary scale the distance over which telephone transmission is being carried on, the extreme distance covered by the chart being probably of the order of magnitude of 2,000 miles. Vertically, the cost for a three-minute toll message has been laid off, the extreme cost indicated being of the rough order of magnitude of $15 for three minutes. It is understood that these values may easily be as much as fifty per cent. or more in error.

(a) **Land Telephony.** For short distances, there seems to be no ques-interference between a multiplicity of radio telephone stations, the first cost of even a low power radiophone station, the first cost of the transmitting and receiving antennas and ground, and the occasional skilled attendance required, at least, by present-day radiophones render the idea of replacing the complex network of a city's wire telephone system by radiophones highly improbable. This feature is clearly shown by the lower portions of the fine line curves of Figure 1, wherein the influence of first cost on transmission over wire telephones and radiophones is qualitatively shown. There may be occasional exceptions to the curves shown, for example, in the case of very special types of service. Thus, it might be desirable for a military or police force to maintain radiophonic rather than wire line communication, for obvious reasons. But except when such special circumstances render radio communication imperative, the radiophone would seem to be at a disadvantage for short-range communication. As we gradually increase the

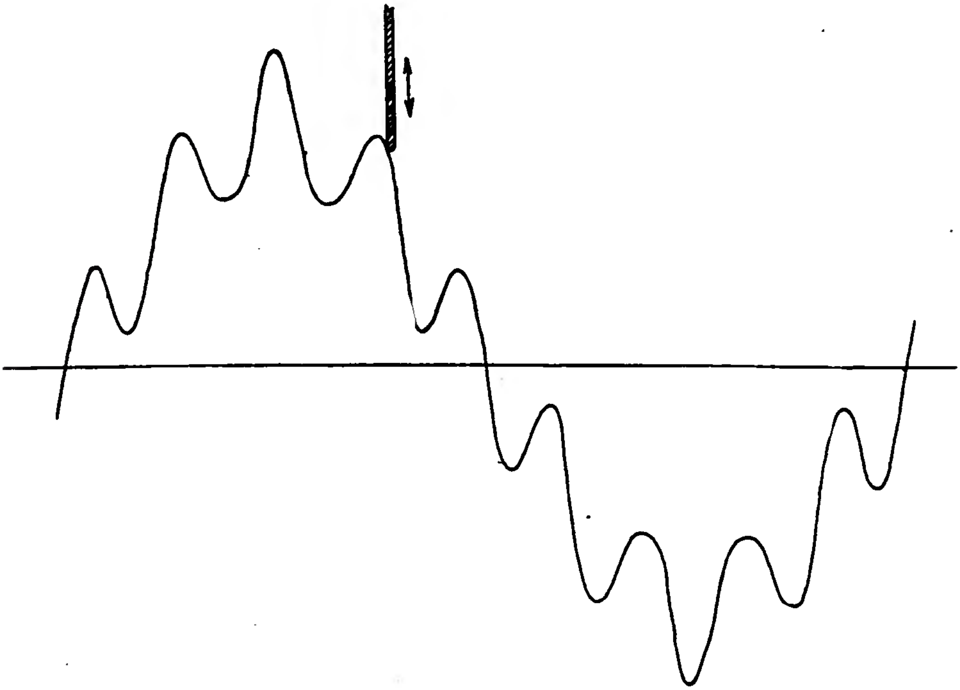


Figure 3.—Typical wave-form

range of communication, the circumstances may, however, alter. The vast expense of maintaining a two or three thousand mile long wire line, against sleet and snow, high wind, defective insulation, casual depradation, (and sometimes over-luxuriant vegetation) then come into consideration. If the wire line crosses one or more mountain chains, there are bound to be troublesome and weak points. Underground cables for wire telephony, except in the case of very high-grade and comparatively short-distance traffic, have not come into use because of their great cost. In addition, long telephone lines must be "loaded" electrically to prevent excessive speech distortion, and require the use of fairly elaborate two-way amplifiers at a number of points along the line. When it is considered that the cost of the line alone in the New York-San Francisco wire telephone transmission is in the neighborhood of two million dollars, and that this line must be constantly patrolled by hundreds of men, it will be seen that radio telephony may well come into

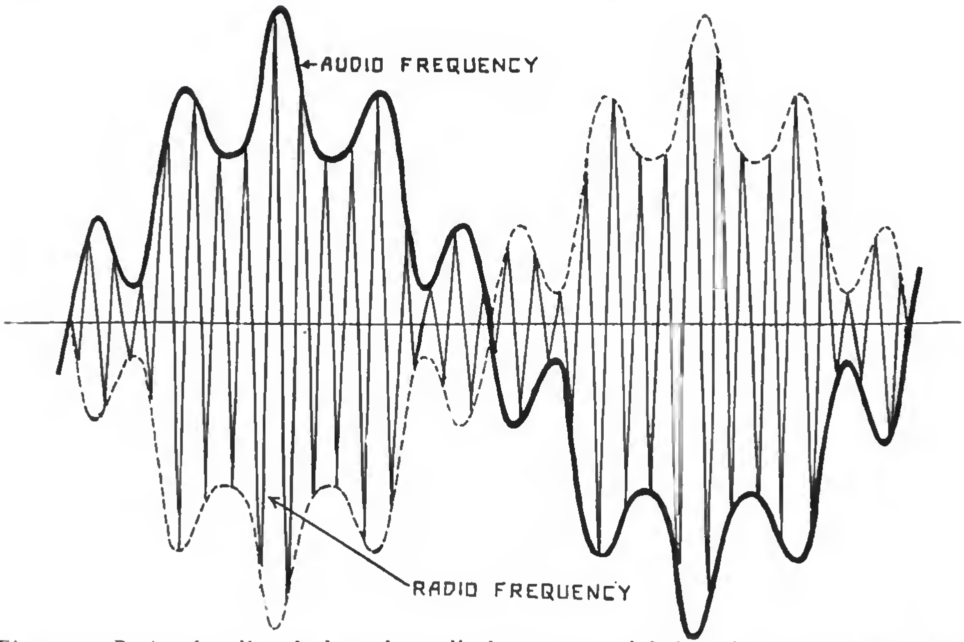


Figure 4.—Basis of radio telephony by audio frequency modulation of radio frequency energy

consideration. That is to say, at some point (e.g., *X* in Figure 1), the radiophone may become more desirable than the wire telephone. There is no question that the distance of transmission corresponding to this point *X* depends directly on the extent to which strays can be eliminated in reception. It can safely be said that so long as radio telephony over long distances is dependent on absence of serious atmospheric disturbances, it will be handicapped thereby. With the advent of apparatus which markedly reduces stray intensity, wire line telephony over very considerable distances will be at a marked disadvantage. This will result in shifting the point X far to the left of the position indicated in Figure 1.

(b) **Oversea Telephony.** As soon as we consider telephony over water, we find a different state of affairs existing. It is questionable whether radio is not always less expensive than cable telephony in this case. Certain it is that over great stretches of water radio telephony is at an enormous advantage because of the great cost of laying and maintaining the type of cable required for submarine telephony and also because radio communication over water is always accomplished with less power than for the equal distance over land. Consequently, we have tentatively indicated in Figure 1 the sea radio telephony curve as lying below the sea cable telephony curve throughout the length of each, and with the advantage of the former becoming specially marked for great distances. Of course, so far as long range overseas communication with ships is concerned, the radiophone has no rival.

Passing now to the technical aspects of radio telephony, we desire to make clear the scope of these papers. They are not in the least intended to give every practical detail of construction of a "50 mile radiophone set," or indeed to go into many practical details of construction at all. The reason for this is two-fold. First of all, the limitations of space would prevent adequately treating all existing methods of radio telephony, even were all data available, and secondly, the cost to-day of building a reliably operative radiophone over any considerable distance is beyond the reach of most experimenters. In other words, the average amateur might just as well not attempt to construct such sets in the present state of the art. Furthermore, it is not possible for us here to give due credit to all those responsible for the historical development of each device described; nor to assign with any certainty patent rights in the apparatus mentioned. Present-day litigation and confusion as to patent rights would render such a course inappropriate on our part. We cannot even cover the entire field of radio telephony exhaustively. At best, we can only describe certain interesting and *operative* methods of radio telephony, assigning them to the manufacturer or designing engineer at present concerned with them, and giving proposed changes or improvements.

5. **BROAD PROBLEMS INVOLVED IN RADIO TELEPHONY.** These problems are the following: (a) that of radiating energy at all for this purpose; (b) distortion of speech due to several causes; (c) the allied problem of amplification of speech at transmitter and receiver without distortion; (d) the obtaining of secrecy, and (e) the reduction of stray disturbances.

(a) **Radiation of Modulated Energy.** It first becomes incumbent on us to consider the nature of speech. In the back of the throat of the speaker, a sort of membrane known as the "vocal cords" is set into more or less continuous vibration by the breath. The quality of the resulting sound is modified in at least two ways: by altering the shape of the mouth with the tongue or otherwise and thus causing a degree of selective resonance, and by actually starting or stopping the stream of sound as is done with the harsher consonants, e.g., the letter "d." The extreme complexity of the resultant sound vibration of the air is illustrated in the oscillogram of Figure 2.* This is a record of the current in a telephone line (and therefore approximately of the sound in the receiver) corresponding to the sustained vowel sound "ah" (as in "bah," a clear-speaking man's voice being used for the test. The total time of the record is slightly over one-twentieth of a second. The basic vibration was of approximate frequency 800 cycles per second and the chief modification thereof occurs with a frequency of 120 cycles per second. The great complexity of speech, even for the comparatively regular vowel sounds, is well illustrated. When the comparative crudity of radio telegraphy is considered, the difficulty of radio telephony becomes obvious. On the one hand, in telegraphy as nearly as possible complete and abrupt starting and stopping of the energy flow is required and this at no very rapid rate. In radio telephony, on the other hand, the outgoing flow of energy must be moulded and modulated with close approximation to the excessively complicated wave form of the speech vibrations. The difference in degree is not far from that between ruling a dot-and-dash line and making a dry-point etching of an autumn landscape.

Given, then, the complex vibrations which constitute speech, the problem of radiating the moulded energy arises. Of course, on a small and feeble scale the problem is solved in every-day conversation between two persons. This may be termed a species of "audio telephony," the frequency of the radiated air waves being those of the speech itself, *i. e.*, of the order of 2,000 cycles per second. The same sort of solution might be attempted, using the electromagnetic "ether" waves of audio *i. e.*, audible), frequency to carry the telephone message. This solution is entirely unsatisfactory for a number of reasons. Firstly, the frequencies in speech vary considerably, and the radiating system (antenna) could not remain resonant to all these frequencies and their corresponding electromagnetic wave lengths. Secondly, the wave length would be excessively long, being 150.000 meters, or 90 miles, for the frequency of 2,000 cycles per second. This would require, for fairly effective radiation, an antenna of the length of say 10 or 20 miles, which is beyond the dreams of even the designers of the highest powered stations.

* This unusually clear record the author owes to the kindness of Mr. John B. Taylor.

Were an ordinary antenna about 300 feet (100 meters) high to be used, its radiation resistance at 2,000 cycles would be 0.0007 ohm, necessitating an antenna current of no less than 12,000 amperes to radiate even 1 kilowatt effectively. It is unpleasant to imagine the voltage at the antenna top under these conditions; its value being not far from a million and a half volts. Obviously, as a practical consideration, radio telephony by means of electromagnetic waves of the same frequency as that of speech vibrations is out of the question.

At this point, the problem of radio telephony looks sufficiently hopeless; but fortunately an ingenious alternative (and a successful one) is available. Let the rippling curve of Figure 3 represent the sound vibrations corresponding to some spoken word. If this word was recorded on a vertical-cut phonograph record, a cross section of the groove of the record would show this curve as indicated. If a needle, indicated in the figure, were to move from left to right along the groove, and were pressed against the record it would also move, up and down. If a diaphragm were fastened to the upper end of the needle, this diaphragm would set into motion the air near it, and the resulting sound vibrations would be an accurate reproduction of the original speech used in making the record. So far, we are on familiar enough ground.

But suppose that we were suddenly to encounter a difficulty of the following kind. Imagine that it were not feasible to secure a large enough diaphragm at the top of the needle to set much air into motion. We might choose to use a small diaphragm vibrating *very rapidly* instead. In fact, we might arrange that this diaphragm vibrated so rapidly that its vibrations could not be heard at all, *but only the variation in their amplitude or width of swing.* Our phonograph record would now have to assume the curious appearance of the thin-line to-and-fro curve of Figure 4. This curve has been appropriately marked "radio frequency" in the figure, as distinguished from the heavy or envelope curve marked "audio frequency." The audio frequency curve is exactly the same as before, but it is replaced for radiating purposes by the *moulded or modulated radio frequency curve. The radio frequency curve* should strictly not have sharp peaks at the extreme of each alternations but should be a rounded "sine" curve. For clearness in the figure, it has been indicated as sharply peaked. Its frequency must be over 10,000 cycles per second, corresponding to inaudible "sound."

It may seem peculiar to speak of "hearing the variations in amplitude of a super-audible vibration," yet this is entirely possible. All we should need under the simplest conditions would be a "sound rectifier"; *i. e.*, a device which only permitted one-half of the radio frequency sound to reach the ear. This would correspond, in Figure 4, to admitting to the ear only those portions of the radio frequency vibration which lie above the middle line. Although the ear could not follow each of the myriad radio frequency impulses which it would thus receive, nevertheless the ear drum would receive inward pushes of an amplitude variation corresponding to the heavy line audio frequency curve. Consequently the variations in the super-audible vibration would certainly be heard. The necessity for the "sound rectifier" is clear enough when we consider that without it extremely rapid impulses on the ear drum in opposite directions (corresponding to the entire radio frequency curve) would merely neutralise each other, causing no actual motion of the heavy ear drum. It is assumed that, though the ear drum can follow readily enough audio frequency vibrations, its inertia is so great that it could not follow the radio frequency vibrations to any appreciable extent. Hence the necessity for the "sound rectifier" producing mono-directional impulses of varying amplitude instead of bi-directional mutually neutralising pushes-and-pulls of variable amplitude.

If we substitute for the explanation in the above imaginary acoustic case. the corresponding electrical case, we find that the explanation given holds equally. Since our antennas are too small electrically to radiate effectively audio frequency electromagnetic waves (as shown in an earlier paragraph), we are compelled to telephone by means of the variation of super-audible (that is, radio frequency) electromagnetic waves. In other words, the energy actually radiated from the station must resemble the "radio frequency" curve of Figure 4, and follow in its envelope curve (the audio frequency curve) of he original sound vibrations.

The necessity for the crystal or valve *rectifier* (corresponding to the imaginary "sound rectifier" mentioned) is also evident if we substitute in the analogy already given the combination of telephone diaphragm and ear drum for the ear drum itself. Its function will be seen to be the furnishing of mono-directional mutually assisting electrical impulses which can push aside a heavy telephone diaphragm, which same diaphragm would hardly respond at all to the bi-directional mutually neutralising unrectified impulses.

From the foregoing, we can draw one very important conclusion. The radio frequency used in radio telephony must be quite inaudible and completely steady, and many times higher than the audio frequency voice vibrations. Otherwise we should hear in the receivers a continuous, high, and piercing tone corresponding to the ever-present radio frequency, which shrill tone would naturally be an objectionable interference with the conversation. Furthermore, the accurate reproduction of the delicate overtones in the voice, which are of fairly high frequency themselves, is dependent on having many radio frequency cycles available for the moulding process, so that the envelope curve will be very faithfully followed.

It is to be noted that a second method of radio telephony exists, which might be termed "modulation by change of frequency (or wave length)." Instead of altering the amplitude of the radiated waves in accordance with the envelope speech curve, we might systematically increase and diminish the radiated frequency in proportion to the envelope curve. For example, while normally radiating at 50,000 cycles per second (6,000 meters wave length), we might alter the frequency to say 48,000 cycles at points corresponding to the peaks in the audio frequency curve, to 49,000 meters for points corresponding to half-way between peak and zero in the audio frequency curve, and so on. At the receiving station, the response in the detector circuit would then be proportional (or nearly so) to the speech curve in view of the tuning and detuning effects which would occur in the receiver as the rapidly varying frequency was received. This method permits keeping appreciably full load on the radio frequency generator at all times.

It is the view of the writer that any such method is objectionable in that it distributes the radiated energy over a considerable range of wave lengths, thereby increasing the liability to interfence with other stations. Furthermore, stray reduction will probably require the reception of a single sharply defined frequency.

A third alternative method exists for radio telephony, this being a combination of the first two. That is, both the amplitude and the frequency of the radiated waves are varied in accordance with the audio frequency curve. This method, rather than the second, has been occasionally used; but it suffers from the same defects as the second method and has no great advantages over the first.

This is the first of a series of twelve articles on "Radio Telephony" by Dr. Goldsmith, an eminent authority on the subject. Causes of speech distortion, secrecy of communication and the elimination of strays are subjects which will be discussed in the second article, to appear in the February issue.

A view of the Koko Head, Hawaii, mast line, showing the hotel for engineers and oper
the Japanese mast. On top of Koko Head, an extinct volcano, is a t
The Koko Head station was planned originally as the receiving

Intangible Bond Between the Occider Wireless Linking th

BEHIND the announcement that the wireless service established between the United States and Japan by the Marconi Wireless Telegraph Company of America was inaugurated on November 15 lies a story of overcoming seemingly insurmountable difficulties; of the accomplishment of engineering feats that apparently defied the most skilled efforts; of the battling with nature in remote climes and finally the resultant triumph—the forging of another link in the world-wide radio chain and the unlocking of other gates to the commercial world of the Orient.

The history of the United States-Japan service began about four years ago, when the idea of encircling the world with radio stations was evolved. Not even a rumble of the great European war was being heard at that time, but the advantages of a wireless chain in time of war were pointed out, attention being called to the value of the system in the event of the severing of the cables. Followed an exhaustive investigation by the English Post Office authorities who at length reported that the Marconi system was the one to utilize in the project. The reason for this choice, it was explained, was that this system alone could provide the required service with proven reliability of operation.

The execution of the plan having been decided upon, the far-reaching machinery of the Marconi system was immediately set into motion. The American Marconi Company was called upon to build the following units: Trans-Atlantic stations at New Brunswick and Belmar on the New Jersey coast to send and receive messages to and from corresponding stations in Great Britain; sending and receiving stations respectively at Bolinas and Marshall, California, linking the Pacific coast with the Hawaiian stations, Kahuku and Koko Head, two similar stations in Manila, the Philippine Islands, and receiving and transmitting stations at Marion and Chatham, Massachusetts, to connect in Norway with Stavanger and Naerbo.

Extensive industrial activity marked this herculean task. From the Atlantic to the Pacific, from the Golden Gate to Hawaii, it reached. Station buildings, homes for engineers, operators, towering masts, intricate apparatus—these were built and transported until the dream of a globe-girdling wireless system began to assume tangible form.

One of the first difficulties that came up in connection with the construction of the stations was that of transportation of materials. Practically all of the structural steel and machinery for the

in the center. At the left of the hotel can be seen the San Francisco mast and at the right
and an anchorage of the aerial wires is sunk far down in the center.
in Hawaii and will be used as the demands of the service require it

and the Orient Strengthened by United States to Japan

Kahuku and Koko Head stations was conveyed by steamship from New York to the Port of Mexico, across the Isthmus of Tehuantepec, and thence by boat to Honolulu, the trip occupying about five or six weeks. The cement and lumber were shipped from California.

Koko Head, which was planned originally as the receiving station in Hawaii, and will be used as the demands of the service require it, is about ten miles east of Honolulu. There were two ways to transport the material to this point: Either by carting it by road, a plan which had many drawbacks because of the condition of the thoroughfare, or by transporting it by boat and unloading it on the beach. A trial of the latter plan was decided upon and a consignment of steel was loaded on a small steamer commanded by a Hawaiian who had earned a reputation for skill in manoeuvering his craft in and out of the numerous difficult landings. A barge and a launch accompanied the steamer, for the latter could not be navigated over a bar on the route to Koko Head and it was planned to unload the material on the barge and have the latter towed ashore by the small steam-propelled boat. All went well until the launch with the barge in tow tried to shoot through the breakers. The first line of rollers was passed in safety, but a short distance farther on two large combers submerged the barge and it sank. Thus ended the attempt to effect transportation by the sea.

Meanwhile the experiment of conveying the material by road was being tried. The caravan, laden until the wheels of the wagons creaked and groaned, started from Honolulu soon after midnight and ran into a tropical rainfall after it had proceeded, only a few miles. The road, which was built of red clay mud, softened and became so slippery that the wagons could not be driven in a straight line, the rear wheels slipping off to one side wherever the surface of the thoroughfare sloped. As a result material fell from the vehicles, parts of harness broke, wheels were put out of commission and it was finally necessary to shift most of the loads, double up on the teams and bring the material piecemeal to the site of the station. Notwithstanding this discouraging experiment, the trucking was continued by means of the road route, although the horse-drawn vehicles were discarded and automobiles substituted.

Koko Head, located on the Island of Oahu, the third in size of the Hawaiian group, is known as the dryest point on the island. The land is undeveloped and is used only for cattle grazing, even the latter getting little nourishment from the scanty surface growths. In fact, they frequently perish because of the lack of fresh water. The inadequate water supply threatened to cause considerable hardship among the engineers and station builders. It was found easy to obtain well water, but it ran about forty grains of salt to the gallon, which destroyed its value for drinking purposes, and after scouring the hills in search of a supply, it was decided to distil all water.

From the operating house as a center, the San Francisco aerial extends southwestward, carried on five 330-foot masts to an anchorage. The Japan aerial extends from the operating house almost due east. The first two masts are of the standard sectional type, 430 feet in height, the first being on level ground and the second on a hillside. From the latter point the aerial makes a span of more than 2,000 feet to the top edge of Koko Head, an extinct volcano, at an elevation of 1,194 feet above the sea level; here there was not room enough to erect a sectional mast, only about forty square feet being available for a self-supporting structural tower, 150 feet in height. The tail end anchorage is far down on the inside of the crater. The balancing aerial, which is employed in both sets of antennae, is on self-supporting towers, each of which is 100 feet in height. The difficulty in erecting these masts was largely due to the fact that two of them and the anchorage were located in a pond and it was necessary to sink caissons in order to lay the foundations.

The problems of construction at Kahuku, which is now being employed both as a sending and receiving station, were not as great as those at Koko Head, although the former is the largest wireless station in the world. From the power house the San Francisco transmitting aerial extends southwestward, supported by twelve masts, each of which is 325 feet in height; the Japanese aerial extends to the southeast supported by twelve masts, each being 475 feet in height. The subsoil at the station is made up of porous coral rock and consequently considerable difficulty was experienced in putting down foundations for the power house and masts. In all of the excavations for the mast anchorage foundations were built water tight wooden cribs into which was poured concrete. Different sections of the site required different treatment, but generally the trouble was due to the presence of water in the subsoil, a factor, however, which added to the facility of operating the station.

The task of constructing the Bolinas station involved taking into consideration the fact that most of the material for erection purposes—the mast sections and wire rope for the eight masts, each 325 feet in height, and the steel work and machinery—was manufactured in the Eastern part of the United States and in order to transport it to Bolinas, which is about fifteen miles from San Francisco, it was sent from New York by boat to the Isthmus of Panama, across the Isthmus by rail and thence by water again to San Francisco.. As there was no railroad transportation available from the latter city to Bolinas, it was necessary to ship a considerable part of the material by water route from San Francisco, unload it at the wharf at Bolinas Bay and haul it by motor trucks to the site of the station. A sand bar with a shallow opening through which the tide races, obstructs Bolinas Bay, making it impossible for craft of considerable size to reach the wharf except during high tide. In addition to these handicaps there was the necesity for rushing the work in order to make all the progress possible during the season of comparatively few storms.

As was the case at Koko Head, much difficulty was met with in obtaining a water supply. This was due to the fact that the ground is full of cracks caused by earthquakes and that the salt water from the Pacific seeped in. The solution of this vexed question was found, however, by damming a creek and installing a small pumping plant and a tank.

At Marshall, the receiving station, twelve miles north of Bolinas on Tomales Bay, there were perhaps fewer obstacles to be overcome than at the other stations. The distribution of the construction materials was carried out from two points, a railroad running from Sausalito, near San Francisco, providing transportation. Extension tracks were built on the southern boundary of the site where all material for the buildings and the first two masts nearest these structures were unloaded and hauled away by motor trucks. The material for the remainder of the masts (there are seven in all, each 330 feet in height) was unloaded at the railroad siding at Marshall and hauled through the town and up a steep incline.

One of the most interesting features of the construction work was the erection of the steel masts. The mast is made up of steel cylinders, constructed in quarter sections flanged vertically and horizontally and secured together by bolts. Stayed with steel cables, these stand in a concrete foundation. Surmounting the main steel column was a wooden topmast, the lower part of which is squared and set in square openings in the plates between the steel cylinders. The hoisting arms attached to the upper end were fitted with blocks and hoisting cables. Attached to these arms were chain hoists supporting a square wooden cage for the workmen, which was lowered or raised as the demands of the work required while the sections were being bolted together.

The wooden topmast was the key note of this novel system of construction, operating like a man who pulls himself up by his bootstraps. The lower half of this topmast is of square section and is guided by a square hole in the diaphragm plates between each section. The topmast was fitted with a set of hoisting arms which carried blocks through which reaved the material hoisting ropes. A square wooden cage was suspended from the hoisting arms by four chain hoists so that the workmen in it could move themselves up and down to bolt the sections together.

Assume that two cylinders have been bolted to the bed plate, the mast rising through the center. The sections of the third cylinder were raised by a steam winch and bolted in place by the workmen. Then a heavy flexible steel rope was temporarily anchored at the top of this last cylinder. Attached to the top of the steel section, this cable led down inside the cylinders and around a wheel in the foot of the wooden topmast; then it was carried up again on the other side and around a sheave to the top of the steel, thence to the winch. By pulling

At the left, the Marconi hotel for men of the trans-Pacific station at Marshall, California. The Marshall station is employed for receiving messages from Japan and Hawaii on this rope the topmast was raised the length of one cylinder and pinned through holes in both steel and wooden masts. With the addition of a new cylinder, the topmast was raised again, the pin supporting it until this was brought about. The stays were attached at the required points as the erection of the mast progressed.

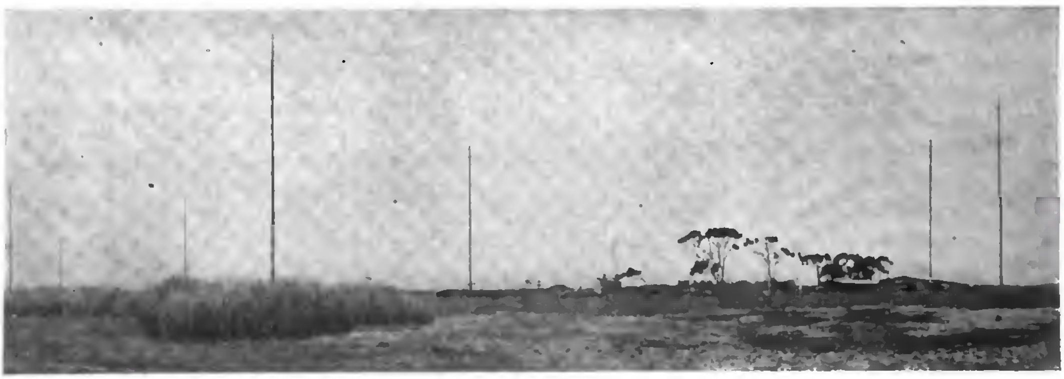
The stays, by means of which each mast is supported, are made of heavy plough steel cable, possessing great tensile strength. For each mast thousands of feet of this cable were used, great care being taken to see that the elastic extension of these stays was not so great as to result in the vibration of the mast during heavy winds. It was essential to break each stay into short lengths connected with great porcelain insulators in order that the electrical energy might not be absorbed, led to the earth by the stays and lost for purpose of wireless operation. For all connections at the masts, insulators and anchorages, special bridge sockets were designed. This did away with the necessity for splicing and permitted a perfect and straight pull, thereby developing the strength of the cable. Heavy concrete blocks were used as anchorages for the stays.

In addition to the antennae stretched between the masts, great quantities of wire were placed in the ground about the stations in order to provide an efficient earthing system or ground connection. Told in brief, a circle of zinc plates is buried in a trench, bolted together and joined to the wireless circuits of the power house by copper wires. Wires radiate from the zinc plates in the ground to a set of outer plates, from which extend another set of earth wires placed in trenches running the full length of the aerial.

The capacity of each of the generators employed in the stations of the United States-Japan circuit with the exception of that at Funabashi is 300 kilowats. These generators are driven by 500 horsepower motors, except at Kahuku. where 500 horsepower turbines are used.

A feature of these stations that stands out distinctively is the type of aerials installed. Thousands of tons of steel are required for these aerials. The distinctive feature of the aerials at the Marconi trans-Pacfiic stations is that they are directional, that is the radiation of wireless signals in the desired direction is very much stronger than in any other. This control of the signals is a long step ahead in wireless communication. All of the stations are of the duplex type and can receive and transmit signals at the same time.

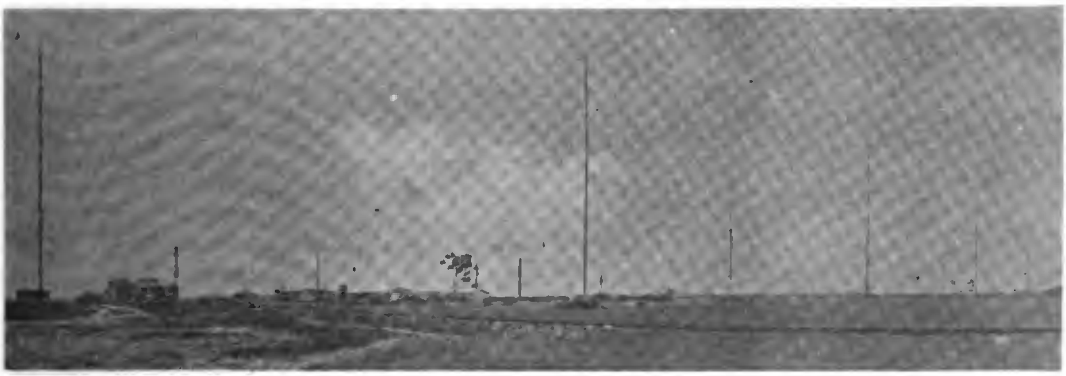
The automatic sending and receiving apparatus plays an important part in the service between the Occident and the Orient. The sending machine somewhat resembles a typewriter and will make possible the transmission of more than 100 words a minute. Under the automatic system, ten or 100 messages can be filed at the same time at the office of the Marconi Company in Honolulu. They will be distributed among the necessary number of operators and the dots and dashes punched in a paper tape by a ma-



The Kahuku, Hawaii, Marconi trans-Pacific wireless station, a general view of which is both for sending and receiving messages. In this photograph are shown the Japanese chine. This tape is fed into an automatic sender and the signals conveyed by land line to Kahuku where the dots and dashes actuate a high power sending key, automatically energizing the aerial instantaneously with the feeding of the tape in the station, thirty miles or more away. At the transmitting station the dots and dashes operate magnets of the high-power sending key in the main energy circuits and the signals are flashed to the points which the destination of the message calls for—either Marshall or Funabashi. If the message is destined for Marshall it will be received on a specially constructed dictaphone machine, each cylinder, as soon as it is filled with the dots and dashes, being handed to an operator who will transcribe it into a typewritten message by means of a dictaphone machine running at normal speed.

Such were the difficulties, the achievements and a few of the problems met with. After the stations had been completed there was a long period of tests and trials. The first results of these were marked by the opening of the service between Hawaii and the United States on September 24, 1914. On February 2, 1915, the station in Ochiishi, Japan, it was announced by newspapers of that country, had received messages from the Kahuku station. Prior to picking up the signals of the Kahuku station Ochiishi was receiving messages from a steamship 1,100 miles off the Japanese coast. The Ochiishi operators declared that the messages from Hawaii were clearer than those from the steamship, notwithstanding the fact that the distance was more than three times as great. This was only one indication of the great range of the Kahuka station, for while tests were being carried on with the station in Funabashi, near Tokio, Japan, which was selected as the Japanese unit to communicate with the Hawaiian stations, inquiries regarding the spark and wave-length of Kahuku were received from Porto Rico, the Falkland Islands, New Orleans and New Zealand, where the signals transmitted by Kahuka were easily read.

At ten o'clock in the morning, New York time, and midnight, Tokio time, of the day appointed for the opening of the service, the cumulative result of the three years of study and effort which Edward J. Nally, vice-president and general manager of the American Marconi Company, and the members of his staff had devoted to the task of establishing communication with Japan was signalized by an exchange of messages between notables in the United States and the former nation. As an illustration of the operation of the service it can be stated that a message from President Wilson to the Emperor of Japan, at Tokio began its radio flight at the Bolinas station, from which, with the speed of a lightning flash, it took an unerring course across the Pacific and was received at the Kahuku station, spanning a distance of 2,372 miles. Quickly it was copied at Kahuku, given a new impetus, and sent speeding across the space of 4,140 miles that it had to traverse before reaching Tokio. In a similar man-



pictured in this photograph, is now employed in the United States-Japan wireless service mast, at the right of the power house (center), and the San Francisco mast at the left ner the reply of the emperor was dispatched to President Wilson. The message was transmitted from Funabashi and relayed at Kahuku to Marshall, which station has direct communication with the Western Union Telegraph Company, over whose wires traffic is forwarded. In Japan, connection is made with the Japanese Imperial Telegraph system to all points in the Orient.

All of the communications between the United States and the Hawaiian and Japanese stations are transmitted in English or French. The Funabashi station is controlled by the Japanese Government and has two staffs of operators, military and civil, being employed by the Department of Posts and Telegraphs for commercial business, as well as by the Government.

A rear view of the mast line of Bolinas, the transmitting station of the Marconi trans-Pacific wireless link in California, from the ranch buildings, in the foreground, adjacent to the station property. The line of masts is a mile in length, extending to the ocean. In the background are shown the power house and the Marconi hotel for engineers and operators. Messages destined for Hawaii and Japan are flashed from this station

For the present the Marconi United States-Japanese service will be confined to San Francisco, Hawaii and Japan. There will be two classes of service between San Francisco and Japan, a full rate or expedited service at eighty cents per word, a reduction of forty-one cents per word from the existing cable rates, and a deferred half-rate service at forty cents per word, the lowest cable rate at present being $1.21 per word.

This linking of two nations by wireless is simple in the telling and in time will doubtless be accepted as a part of the scheme of general conditions in communication. But the men who brought it about, who spent days and nights in determining the solutions of vexed questions, who conducted tests regardless of time and weather, who journeyed to distant parts of the world to blaze the initial path of the project—they will long remember the romance and the difficulties of the undertaking, even though it was all a part of the day's work.

Marconigrams Interchanged by Eminent Men

Men prominent in various walks of life interchanged marconigrams on the day of the inauguration of the service. Besides President Wilson and Emperor Yoshihito of Japan, messages were sent and received by Guglielmo Marconi and Godfrey Isaacs, managing director of the English Marconi Company; Jiro Tanaka, director general of Posts and Telegraphs, the Ministry of Communications, Japan; John W. Griggs, president of the Marconi Wireless Telegraph Company of America; Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, and Frank A. Vanderlip, president of the National City Bank. Among the messages flashed to and from Japan were the following:

The White House,
WASHINGTON, November 15, 1916.

His Imperial Majesty the Emperor of Japan at Tokio:

The Government and people of the United States of America send greetings to your Imperial Majesty and to the people of Japan and rejoice in this triumph of science which enables the voice of America from the far West to cross the silent spaces of the world and speak to Japan in the far East, hailing the dawn of a new day. May this wonderful event confirm the unbroken friendship of our two nations and give assurance of a never-ending interchange of messages of good will. May the day soon come when the voice of peace, carried by these silent messengers, shall go into all the world and its words to the end of the world.

WOODROW WILSON.

TOKIO, November 15, 1916.

President of the United States,
Washington, D. C.:

It affords me much pleasure that the first use of the installation of wireless telegraphy between Japan and the United States has been to transmit your cordial message. In return I send this expression of my thanks for the good will exhibited toward me and my people, and of the hearty desire entertained throughout Japan for the continued prosperity and welfare of the United States.

JOSHIHITO.

WASHINGTON, November 15, 1916.

The American Ambassador, Tokio:

I tender your Excellency my sincere greetings on the occasion of this new conquest of space, which is not only a great triumph of science, but is another powerful addition to the bonds of friendship and good neighborhood between Japan and America.

JAPANESE AMBASSADOR,
Washington.

TOKIO, November 15, 1916.

The Japanese Ambassador,
Washington, D. C.:

Sincere thanks for your Excellency's greetings and congratulations. All true men join you in the hope that this last triumph of science will draw our two nations into still closer bonds of friendship and good neighborhood.

AMERICAN AMBASSADOR.

NEW YORK, November 15, 1916.

Hon. Jiro Tanaka,
Director General, Posts and Telegraphs, Ministry Communications, Tokio:

Accept my heartiest congratulations for your large share in the completion of the Japan link which welds two nations together by an invisible bond. I know of no more encouraging feature in the development of the world's commerce.

JOHN W. GRIGGS,
President Marconi Wireless Telegraph Company of America.

FUNABASHI, November 16, 1916.

John W. Griggs,
President Marconi Wireless Telegraph Company of America,
New York.

My best felicitations upon the successful opening of the trans-Pacific wireless service. I sincerely hope that this invisible circuit will tend to augment the amicable relations of the two countries, and that the service will be developed with rapid strides.

JIRO TANAKA,
Director General, Posts and Telegraphs.

NEW YORK, November 15, 1916.

Hon. Jiro Tanaka,
Director General, Posts and Telegraphs, Ministry Communications,
Tokio:

For three years we have worked together to commercialize this miracle of wireless. Our relations have been so harmonious and so pleasant that we have added reasons to celebrate this day and to exchange felicitations upon the happy completion of what seemed a well-nigh impossible task. Accepting this as an augury of the future character of communications which may pass between us and between those who may use our service, it brings us assurance of continued friendly relations. My congratulations and best wishes to you and to all the members of your staff.

EDWARD J. NALLY,
Vice-President and General Manager, Marconi Wireless Telegraph Company of America.

FUNABASHI, November 16, 1916.

Edward J. Nally,
Vice-President and General Manager, Marconi Wireless Telegraph Company of America, New York:

On the occasion of this happy event allow me to offer our best and cordial greetings to you and your company, coupled with the earnest wish that this new bond of communication across the Pacific, and this achievement of the modern scientific invention, will serve to enhance the political, commercial and friendly relations existing between the two countries. I avail myself of this opportunity to tender you and all your staff interested in bringing about this successful result my heartfelt thanks and warmest congratulations.

JIRO TANAKA,
Director General, Posts and Telegraphs.

LONDON, November 15, 1916.

Director General, Posts and Telegraphs of Japan, Tokio:

Our warmest congratulations upon the inauguration of a public wireless telegraph service between your country and the United States of America. The cheaper and the easier communication is made betwen two peoples the better do they learn to know and understand each other and the greater is the development of their mutual interests. May this new service contribute substantially in this direction.

GUGLIELMO MARCONI,
GODFREY ISAACS.

FUNABASHI, November 16, 1916.

Guglielmo Marconi,
Godfrey Isaacs,
London:

Accept my thanks for your telegram conveying greetings for the opening of the public service which is heartily reciprocated.

JIRO TANAKA,
Director General, Posts and Telegraphs.

NEW YORK, November 15, 1916.

Doctor Jiro Tanaka,
Japanese Minister Communications:

Heartiest congratulations on successful opening Japanese-American circuit, marking a new era in scientific achievement and closer knitting of two great nations.

JOHN BOTTOMLEY,
Vice-President, Secretary and Treasurer, Marconi Wireless Telegraph Company of America.

FUNABASHI, November 16, 1916.

John Bottomley,
Vice-President, Secretary and Treasurer, Marconi Wireless Telegraph Company of America, New York:

Your telegram conveying greetings gratefully acknowledged. May our new route uniting the far East and far West bring lasting welfare to the people of both countries.

JIRO TANAKA,
Director General, Posts and Telegraphs.

FUNABASHI, November 16, 1916.
The New York Times, New York:

Greetings heartily returned on fortunate occasion of establishment of wireless communications between America and Japan.

TERAUCHI,
Prime Minister, Tokio.

NEW YORK, November 15, 1916.
Count Seiki Terauchi,
Prime Minister, Tokio:

Greetings over the marvel of a wireless telegraph link between Japan and America.

THE NEW YORK TIMES.

SOME WIRELESS SPEED RECORDS

Although the service of the Marconi Wireless Telegraph Company of America between the United States and Japan was inaugurated only a short time ago, several speed records in sending and receiving messages, which prove wireless faster than existing cable practice, have already been made by operators in the trans-Pacific stations.

Operator "Paddy" Walsh of Honolulu recently sent to the Marconi receiving station in California, a distance of 2,372 miles, sixty-seven messages in one hour and twenty minutes. None of the messages was shorter than fifteen words and some of them contained forty words. W. H. Barsby, operator at the receiving station, copied the messages without a "break" or an error.

Operators in the Marconi office in the heart of the business section of Honolulu are today, with the aid of repeaters, transmitting direct to both the United States and Japan. Automatic transmission and reception of messages at a speed of from eighty to one hundred words a minute, will be brought into use in the near future. Duplex transmission through the ether between stations thousands of miles apart at a speed of a hundred words a minute, may appear as improbable to some persons as did wireless transmission across the Atlantic a few years ago. However, the equipment has been provided, the tests made and when conditions warrant the step, transmission at that speed in two directions simultaneously will be employed.

MORE USEFUL COMMUNICATION—MARCONI

Guglielmo Marconi, according to a dispatch from Rome, Italy, in an address on November 12 before a gathering which included the Duke of Genoa and the elite of scientific, literary, and aristocratic circles, said that wireless telegraphy had rendered magnificent services to Italy and her allies in the war.

He regretted that it was impossible, for obvious reasons, to explain as fully as he would have liked to do the progress made during the last two years in radio-telegraphy, but he described problems that are still unsolved, such as the origin, nature and means of dominating those natural disturbing waves known as "intruders," which he had been studying and experimenting with. He expressed the conviction that he would soon be able to announce means of communication more practical and economical.

WIRELESS CONVEYS RE-ELECTION NEWS TO WILSON

President Wilson was steaming up New York Bay in the yacht Mayflower when he received confirmation of his re-election. It reached him in the form of a congratulatory wireless message from his secretary, Joseph P. Tumulty, who was in Long Branch, N. J.

Mr. Tumulty had told the President he would not congratulate him until it was definitely known that he was elected. When the result was no longer in doubt, he sent the news by wireless.

THE SHARE MARKET

New York, December 6.

Bid and asked quotations in Marconi shares today:

American, 3⅛-3⅜; Canadian, 2-2⅜; English, common, 14-17½; English, preferred, 12½-15.

Famous Wireless Sets

By Blaine McLean

The Stars and Stripes and house-flag, too,
For sixty years on the ocean blue;
We'll haul them down with uncovered head
And furl away as loved ones dead.

THE transfer to the Atlantic of the former Pacific Mail trans-Pacific liners Mongolia, Manchuria, Korea and Siberia, and the disposal to foreign companies of the steamers Nile, Persia and China, recalls to mind the excellent wireless work accomplished by the sets on these vessels—work that has made them famous among radio operators the world over.

Wireless was first established on these ships in 1910, soon after the Florida-Republic disaster. During the seventeen-day voyage across the Pacific, the sets installed were practically always in communication with land, being able to send position messages to San Francisco nightly. On the last homeward-bound trip of the Mongolia communication was established in the same night with Japan, Siberia, Alaska, Hawaii and America.

An official record compiled a few years ago of the longest distances to which ships on the Pacific have communicated, shows that on February 21, 1912, the Persia established direct communication with San Francisco at a distance of 4,708 miles. This record, as far as I know, has never been exceeded by any ship station. During that year the Persia operated to distances of more than 4,000 miles at four different times.

While the Persia holds the record for long distance work the best average results have been obtained with the set on the Korea. The results accomplished have earned for this ship the reputation of having a "freak set." It is recorded that on March 3, 1912, she sent her position to San Francisco, when she was 2,193 miles west of Honolulu, or approximately 4,300 miles from San Francisco.

Most of the long distance records accomplished by the San Francisco station have been made by Operator in Charge F. W. Shaw, who has been at the station for nearly five years.

Long range work has not been so frequent recently, this condition being due perhaps to the large increase in radio traffic, which has prohibited coast stations operators from devoting as much time as formerly to this work. While messages are still being sent considerable distances, they are, in most cases, relayed.

Some wireless men are of the opinion that it is possible, with sets of equal power, to work further on the Pacific than on the Atlantic. Whether or not this is true, I do not know, but it is evident that the results obtained on the Pacific have, indeed, been most remarkable.

GERMAN ATTACK ON SEPNAVOLAK STATION

A Russian torpedo boat sank two German submarines and crippled another after the submersibles had attacked the Russian wireless station at Sepnavolak. on the Murman coast, according to information received recently in Christiana from Petrograd.

Several persons were killed by the gunfire of the submarines.

The Murman coast is the northern seaboard of Kola Peninsula, in the Arctic Ocean. It lies to the west of the entrance to the White Sea, in which is the important Russian seaport of Archangel.

RADIO ELECTION RETURNS FIRST IN

In a recent election in Maine the first town to report was the little hamlet of Criehaven, which constitutes a cluster of islands far off the mouth of the Penobscot, and commonly known as Matinicus. A few of the voters in this town are the keepers of the two granite lights on Matinicus rock, 20 miles off the mainland. The vote of Criehaven was sent to the county seat of Knox County, Rockland, by wireless, and so far as known this was the first instance of the use of wireless communication for the collection of election returns.

From and For those who help themselves

Experimenters' Experiences.

The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.

FIRST PRIZE, TEN DOLLARS

The Construction and Use of a Calibrated Receiver Shunt Box

If I were to judge solely from the conversations I have had with fellow amateur workers, I should venture to assert that a pronounced haziness regarding the subject of quantitative measurements prevails. As an example, take the case of two receiving detectors and ask the owner how much better one is than the other—generally you receive a rather vague or perhaps indefinite reply.

It is well understood that the foundation of scientific knowledge is based upon accurate measurement and unless a given device is subject to careful quantitative analysis, it has but little scientific value. To say the least we should be able to compare it with some known standard in mechanics or electrics in order that we may judge its probable cost or commercial worth.

I am certain that the average amateur gives this phase of the subject too little attention and on this account gropes more or less in the dark. In my own experience this was distinctly the case and therefore I began at an early date to study the art of scientific measurement.

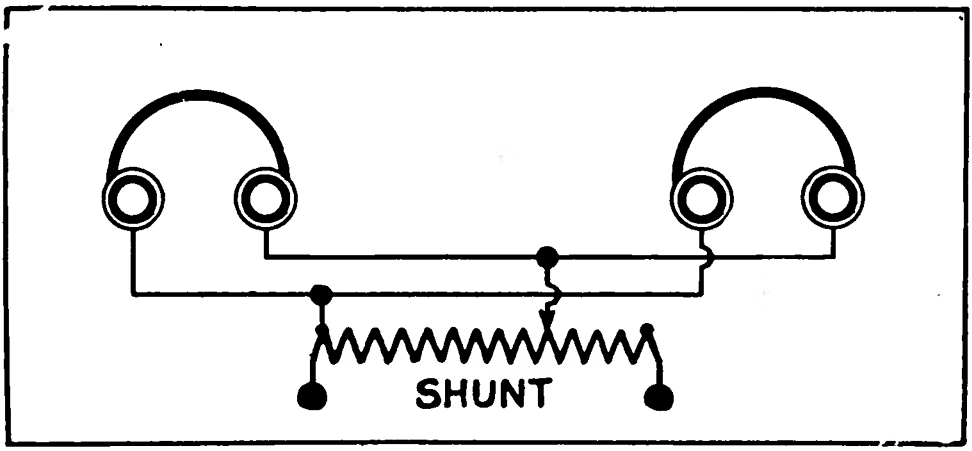


Figure 1, First Prize Article

Now it is comparatively easy to construct or purchase a wave-meter at a reasonable price which, when checked against a standard, gives a fair degree of accuracy; and although we may use such devices as the glow lamp, the hot wire milliameter, the wattmeter and the neon gas tube for determining the point of resonance, all these indicators are not as flexible and as rugged as the calibrated shunt box I am about to describe.

The telephone resistance shunt is generally termed an audibility meter because it can be used for comparing the strength of two signals in a receiving telephone. I have found a calibrated shunt box, sometimes called an "audibility meter," a valuable aid in making comparative measurements. A description of its construction will, I believe, interest readers of THE WIRELESS AGE.

The loudness of a signal in a receiving telephone is proportional to the square of the receiver current according to Dr. Austin (Manual of Wireless Télegraphy, Robison Edition of 1915, page 173) and conversely the intensity of the current is proportional to the square root of the loudness.

Thus if one sound is 100 times as loud as another the current which produced it is ten times as great.

Suppose that a signal produced by the current, I_1 comes in just at the limit of audibility, that another N times as loud produced by the current, I_2, follows, and we are required to determine the numerical value of N. If, by shunting the receivers, we reduce the receiver current down from I_2 to $\frac{1}{\sqrt{N}} I_2$ the second sound will be just at the limit of audibility and the multiplying power of the shunt will give us the measurement of the strength of it. Now this can be readily accomplished as follows: Let R be the resistance of the receiver, S the resistance of the shunt, I the incoming current in the telephone circuit and I_r the current in the receiver,

$$\text{Then } I_r = I \frac{S}{R+S} \text{ or } I = I_r \frac{R+S}{S}$$

The ratio, I/I_r, is called the multiplying power of the shunt and is represented by the letter M,

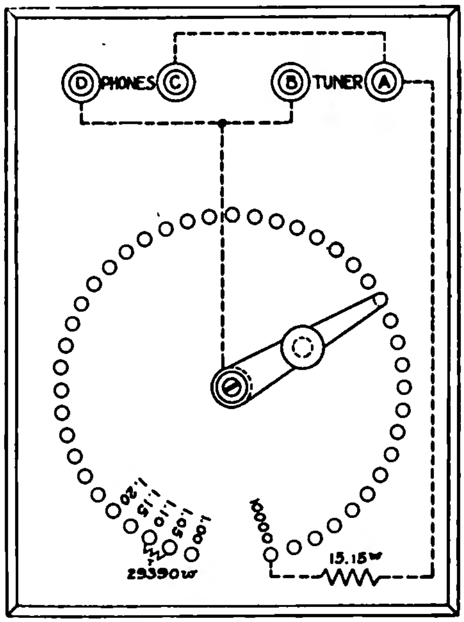
$$\text{Hence } M = \frac{R+S}{S} \quad MS = R + S$$

$$MS - S = R \text{ or } S = \frac{R}{M-1}$$

That is, in the case assumed, if we wish to reduce the receiver current to the $\sqrt{N}$ the part, we must shunt the receiver with a resistance S = Receiver resistance Sq. Root of N, — 1. Numerically, if the receiver is a 1500-ohm instrument and a current, I_1, coming in produces in the receiver when shunted with 750 ohms, a signal equal in audibility to that produced by a current, I_2, in the *unshunted* receiver, then $750 = \frac{1500}{\sqrt{N}-1}$

or $\sqrt{N} - 1 = \frac{1500}{750} = 2$ or $\sqrt{N} = 3$ and $N = 9$. That is, the audibility of the former signal was nine times that of the latter and the current of the former is three times that of the latter.

Let us apply this formula to the working out of a table of shunts for a standard 1500-ohm receiver; these values are given in the table appearing on the following page.



- TOP OF BOX -

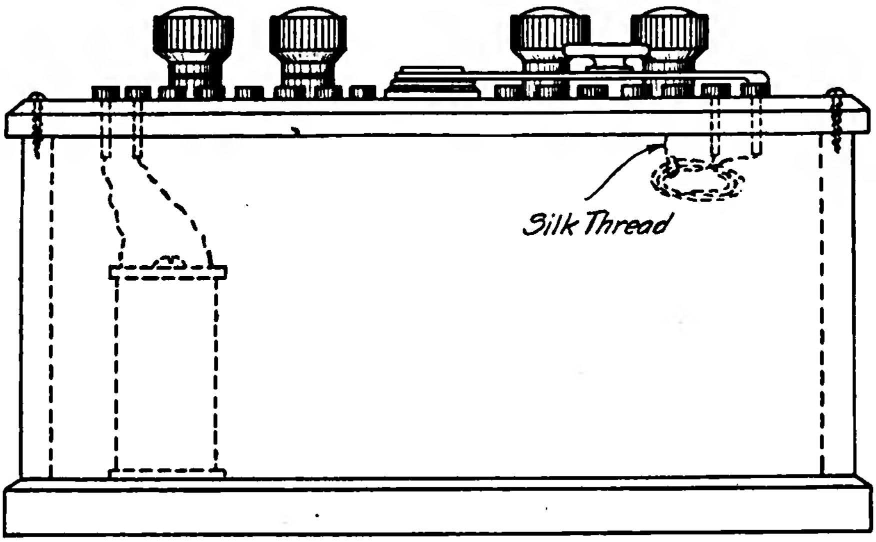
RAD. STUD ARC: 2¼"; STUDS: 5/16" SPACING.

Figure 2, First Prize Article

If a 1000-ohm receiver were employed the values of the various resistances would be two-thirds those given in the table, and if a pair of 1500-ohm instruments were used the values would be doubled. Frequently, however, a station will possess two pairs of 1500-ohm receivers, in which case they may be con-

TABLE OF RESISTANCES.

Relative Loudness	Relative Current	Shunt for 1500 w phone	Coil Res.	Meters No. 22, 18% GS	Connecting Stud	to Stud
N	$\sqrt{N}$	$\frac{1500}{\sqrt{N-1}}$				
10000	100.	15.15	—	—	A	45
9000	94.87	15.97	0.82	0.82	45	44
8000	89.44	16.95	0.98	.98	44	43
7000	83.67	18.14	1.19	1.19	43	42
6000	77.46	19.61	1.47	1.47	42	41
5000	70.71	21.52	1.91	1.91	41	40
4000	63.25	24.09	2.57	2.57	40	39
3000	54.77	27.89	3.80	3.80	39	38
2000	44.72	34.31	7.42	7.42	38	37
1000	31.62	48.97	14.66	14.66	37	36
900	30.00	51.72	2.75	2.75	36	35
800	28.28	54.99	3.27	3.27	35	34
700	26.46	58.92	3.93	3.93	34	33
600	24.50	63.83	4.91	4.91	33	32
500	22.36	70.22	6.39	6.39	32	31
400	20.00	78.95	8.73	8.73	31	30
300	17.32	91.91	12.96	12.96	30	29
				Meters No. 36, 18% GS		
200	14.14	114.1	22.20	.872	29	28
150	12.25	133.3	19.20	.754	28	27
100	10.00	161.6	28.3	1.11	27	26
75	8.66	195.8	34.2	1.34	26	25
50	7.07	247.1	51.3	2.00	25	24
25	5.00	375.1	128.0	5.02	24	23
20	4.47	432.0	56.9	2.23	23	22
15	3.87	522.0	90.0	3.53	22	21
10	3.16	693.8	171.8	6.73	21	20
9	3.00	750.0	56.2	2.20	20	19
8	2.83	820.6	70.6	2.77	19	18
7	2.65	911.3	90.7	3.56	18	17
6	2.45	1034.5	123.2	4.74	17	16
5	2.24	1213.6	179.1	7.03	16	15
4	2.00	1500.	286.4	11.21	15	14
3.5	1.87	1722.	222.	8.70	14	13
3	1.73	2049.	327.	12.81	13	12
2.5	1.58	2582.	533.	20.09	12	11
2.25	1.50	3000.	418.	16.40	11	10
2.	1.41	3623.	623.	24.43	10	9
1.75	1.32	4644.	1021.		9	8
1.50	1.23	6667.	2023.	These Coils it is best to purchase	8	7
1.25	1.12	12710.	6043.		7	6
1.20	1.09	15790.	3080.		6	5
1.15	1.07	20830.	5040.		5	4
1.10	1.05	30610.	9780.		4	3
1.05	1.03	60000.	29390.		3	2
1.00	1.00	∞	∞		2	1



– END VIEW –

Figure 3, First Prize Article

nected as in Figure 1. In this case since four equal resistances connected, two in series and the two sets in parallel, are the equivalent of a single resistance, the same set of shunts will do in this case as in that of a single 1500-ohm receiver.

It is quite true that in this case the receiver current will be halved and the audibility factor reduced to ¼, at the same time both ears are in use and the aural acuity heightened or, in other words, the two ears acting together give a more balanced and keener perception, and the effect of extraneous noises is diminished. Furthermore, if two experimenters make the test both can listen in, thus deriving the benefit of two independent estimates of audibility. These advantages seem sufficient to justify the use of two pair of receivers even if one is left idle on the table although still connected in circuit.

My audibility meter box was made of seasoned birch, mahogany stain finish, the bottom of a ⅜-inch stock, sides and ends of ¼ inch and the top of ¼ inch hard rubber. The over-all dimensions of the box were 8 inches by 6 inches by 3 inches, which gives a good dimensioned top, with a 6-inch square space for the circle of contact studs, and a 6-inch by 2-inch space for binding posts. The plan of the box and end elevation are shown in Figures 2 and 3. I have not presented the details of the construction of switch arm and stud contacts, as they differ in no way from the ordinary types.

Upon the top of the box are stamped the values of the stud ratios. There are forty-five studs in all. No. 1 stud is left blank and marked 1; between stud No. 2 (which is stamped 1.05) and No. 3 (which is stamped 1.10) is soldered a resistance coil of 29390. ohms. Between No. 3 and No. 4 (which is stamped 1.15) is connected a coil of 9,780 ohms; between No. 4 and No. 5 (which is stamped 1.20) is a coil of 5,040 ohms, and so on, till between No. 44 and No. 45 (which is stamped 10,000) is placed a coil of 0.82 ohm resistance, while stud No. 45 is connected with binding post, A, through the last shunt coil of 15.15 ohms. The binding post, A, is connected with C. The switch arm connects directly with binding post, B, and the latter with D. Then the receiving telephones connect between C and D, and the leads from the receiving transformer circuit between A and B.

As a rule, do not attempt to adjust the resistances of the various coils closer than from 1 to ½ per cent., because the latter is about the best the average man can reach and also because the coil of the telephone receiver is wound with copper which changes resistance by 0.39 per cent. per centigrade degree change in temperature. The average work is certainly not worth making the temperature correction. Neither is it advisable to attempt, unless well skilled, to wind the coils for values in excess of 1000 ohms, as they will be bulky unless made of very fine wire. I advise amateurs to purchase this half dozen large coils from the Leeds Northrup Company of Philadelphia, or a similar concern, asking to have them wound non-inductively on wooden spools to a precision of not more than 0.5 per cent. They will probably be manganin, but if other wire is cheaper they might be thus specified. The cost will rise rapidly as a higher degree of precision is required.

The remaining coils one can easily wind of 18 per cent. German silver wire either silk or double cotton covered, as preferred. Thirty per cent. German silver has a higher specific resistance, but is more brittle and not worth the difference.

No. 36 B. & S. gauge will give 25.5 ohms per meter very closely. The greatest length of this required will be twenty-four meters and forty-three centimeters for the 623-ohm coil. When getting down to the 12.96 ohm coil it will be well to change the size of wire and use No. 22 B. & S. gauge which has a resistance of 0.992 or practically 1 ohm per meter. This change may, perhaps, be made a little sooner if desired; the exact point is immaterial.

Obtain a meter stick and measure off the lengths of wire as closely as possible, double each length in the middle and wind up into a coil about the fingers, tie with silk thread in several places and dip in melted paraffine. Tag each coil as made. The coils as thus determined will be close enough for ordinary work, and will cover all requirements unless one has access to a Wheatstone bridge. Since all colleges and many high schools possess a good bridge in their physical laboratories, the amateur may be able to avail himself of one, in which event he may adjust the value of resistance considerably closer. He should keep in mind that the copper receiver coils change resistance 0.39 per cent. per degree centigrade, while the German silver shunting coils change only 0.1th as much. Furthermore, the manganin coils do not change at all. Since, however, a closer adjustment of the coils gives a more precise ratio between the various shunting values and it is not a very difficult procedure to carry out, I shall present the method.

Each coil should be cut to a length known to be a little too long and then connected into the bridge in the usual way, one end of the coil being soldered

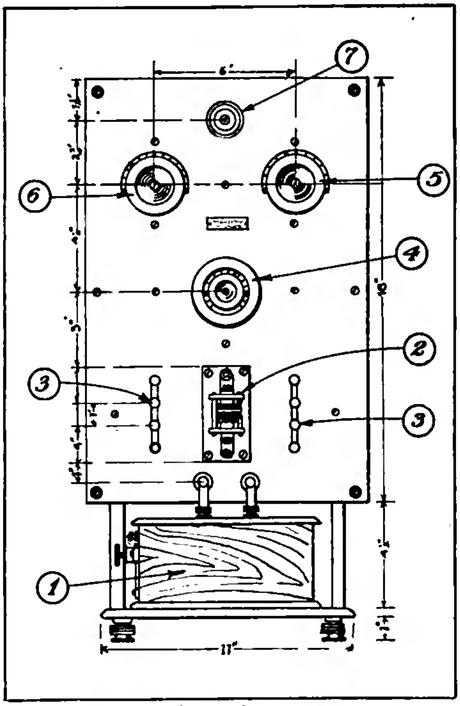


Figure 1, Second Prize Article

to a short bit of No. 20 B. & S. copper wire. A similar bit of this wire is clamped under the other binding post of the bridge and the free end of the coil twisted about it. The bridge ratio and rheostat arms are then set at the proper values, the keys depressed, and if the galvanometer shows a deflection the coil is shortened a bit by winding a little more about the copper terminal wire. It is again tested and the procedure repeated until balance is obtained; then the coil is soldered firmly to the copper lead wire, removed from the bridge and afterward soldered between the proper studs on the shunt box, the short copper leads having negligible resistance.

The work of Austin, Wein, Duddell, Hogan and others have shown the range of power necessary in modern receivers for reading a signal as well as for bare audibility and, as might be expected, it varies with the frequency over the range from about 450 microwatts at low or excessive frequencies to 7.7 at the best frequency, say, about 900. Austin states that 10 microamperes in some experiments gave a signal just audible.

If the set of phones which it is intended to use can now be tested at some standardizing laboratory (say the Bureau of Standards) and the current necessary for audible signals at several frequencies determined, the experimenter will be able to obtain very precise results. In such a case, however, it will invariably be necessary to make temperature corrections for resistances, remembering that the German silver coils in the box change 0.04 per cent. per centigrade degree, that any manganin coils remain practically constant, and that the copper coils of the receivers change 0.4 per cent per centigrade degree. This last change in temperature is not easy to determine because of the heat radiated from the head; therefore it is better to wear them for some few minutes before beginning work and measure their resistance if possible by a bridge immediately on removal. Of course if they were used only for say five minutes they might, without serious error, be assumed to have the temperature of the room.

Specific advice for mounting the coils is not given because some will be quite large and others will have but a few inches of fine wire. If the high resist-

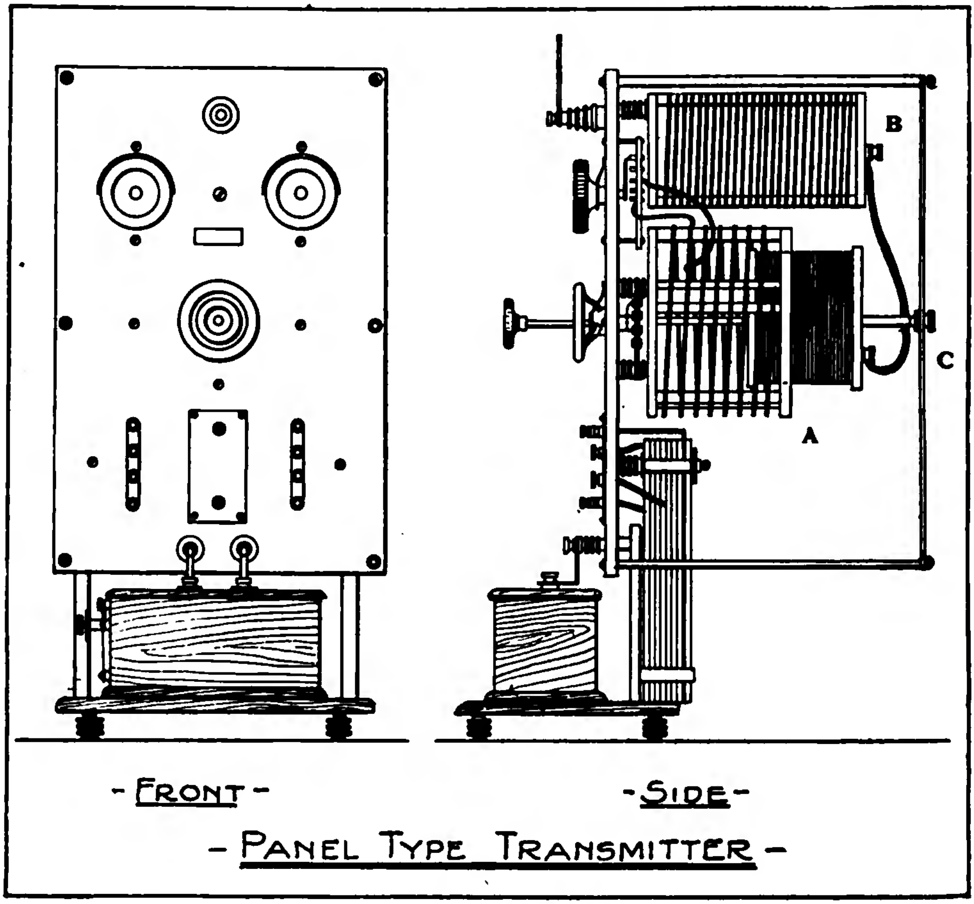


Figure 2, Second Prize Article

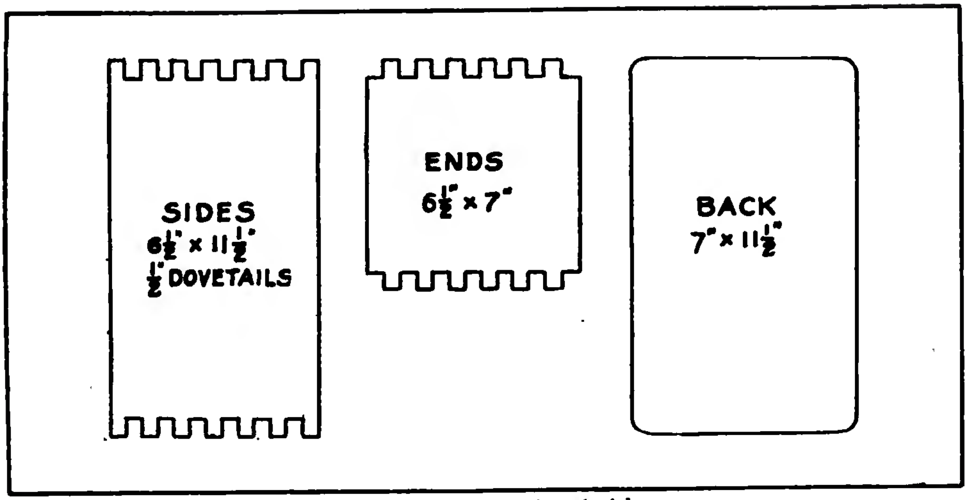


Figure 1, Third Prize Article

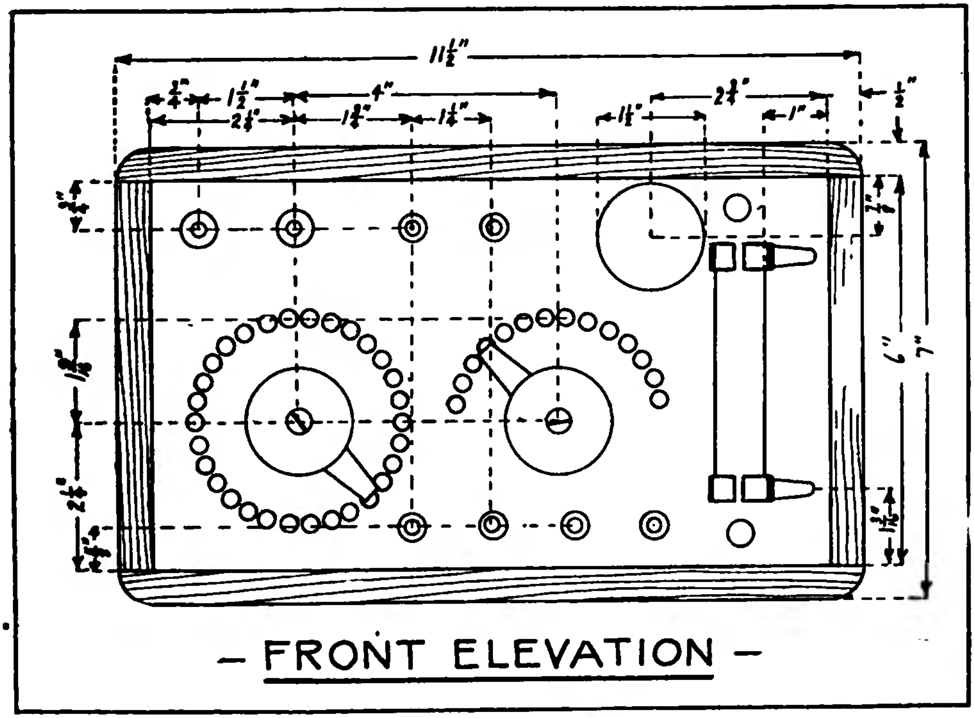


Figure 2, Third Prize Article

ance coils are purchased they will probably be wound on spools which may be fastened to the bottom of the box with a long screw passed down the center. The larger coils, if home-made, may be wound on spools in the same manner and similarly mounted, the copper leads being made long enough to reach up to the studs for soldering. A certain amount of slack should be allowed for convenience. The smallest coils will hang free supported by their own leads, and if there is any doubt as to the safety of this a loop of silk thread tied about the coil and also the end of the stud, will furnish ample support. After all the coils are in place use hot paraffine freely, as it improves insulation and stiffens the coils.

The uses to which the shunt box can be put are diversified. For instance, suppose we have a set fitted with two detectors, one being in, and we find that with the best adjustment possible a signal is just lost when the switch rests on stud 75; in the case of the other detector it is found that the signal similarly disappears when the switch rests on stud 100. It immediately follows that the latter detector is the better in the ratio (100-75)/100 = 25/100 = 25 per cent. under the conditions of this particular set.

Again, in determining wave forms produced in the closed and open oscillating circuits and radiated from the aerial, the detector and receivers shunted by the calibrated box are connected to the wave-meter as usual, the latter being adjusted by listening in on the receivers *unshunted* for the best resonant point, then the phones are shunted to the 10,000-point and the coupling between the inductances of the wave-meter and circuit under test changed till the sound is just on the edge of vanishing. Thereafter the coupling is *not changed*. The capacity of the wave-meter is slightly increased, thus throwing out the adjustment, and it will be found that the sound is lost but again returns when the shunt box is set to, say, 8,000. This then gives a point on the curve at a higher wave-length than resonance. The capacity is again changed and the process repeated. After a sufficient number of points have been thus located, a curve may be plotted in which the abscissas are either wave-lengths or condenser scale readings and the corresponding ordinates the settings of the shunt box.

These are but two of the many uses to which the box can be put and it will very certainly prove valuable in many other measurements so that the time consumed in its construction will be well spent.

W. LINCOLN SMITH, *Massachusetts*

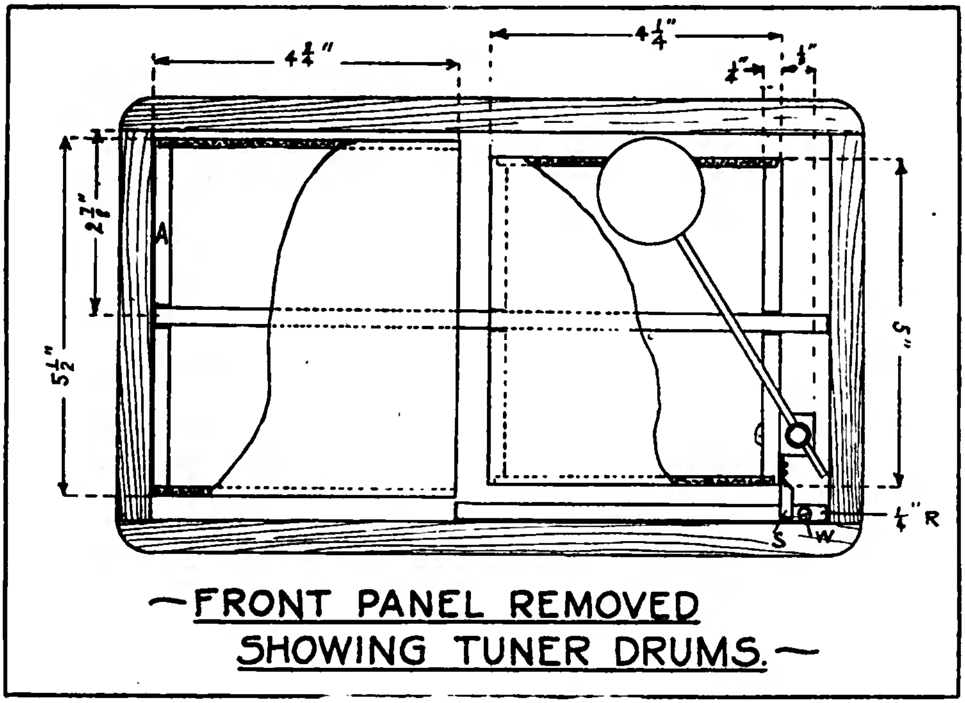


Figure 3, Third Prize Article

SECOND PRIZE, FIVE DOLLARS

A Small Panel Transmitter Which Should Be Popular

Following the adoption of the panel form of transmitter by the commercial companies, amateur experimenters have come to the realization that this arrangement of apparatus is without doubt the most efficient as well as the best appear-

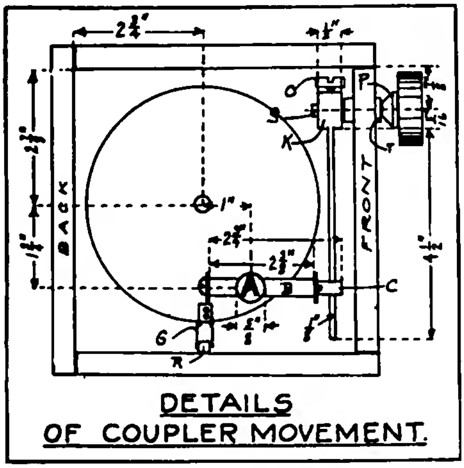


Figure 4, Third Prize Article

ing. The following is a description of a small panel transmitter which was designed by the writer, and has been in constant use for several years. There is probably nothing described which cannot be built by the average amateur at a reasonable cost. The arrangement of the various units as shown is suggested, but even this can be varied by the constructor in accordance with his own ideas.

Figure 1, which is the front view of the panel, gives an idea of the general arrangement of the controlling switches and quenched gap. The panel may be constructed of wood, bakelite or slate, and should be mounted above a small platform as shown. The platform supports the spark coil or transformer, 1. The quenched gap is represented at 2 and can either be made by the reader or purchased ready to mount on the panel for $2.50, from a well known house. Some diversity of opinion has been expressed at various times in regard to the advisability of using this form of spark gap on a small coil or transformer operated on 60 cycles. It might be well to remind those who think that the quenched gap is only fit for 500 cycle work that there is some engineering ability required to adjust the circuits and design the transformer, and this may be responsible for the poor results at first encountered. Too much work is being done with apparatus which is just thrown together without regard for theory or Government regulations. With the quenched gap shown, the decrement of a small spark coil or transformer can easily be kept below the required .2 and at the same time show a high transfer of energy to the antenna. The adjustment of condenser capacity and group frequency is sometimes necessary to obtain a pure note, but with a little patience the gap

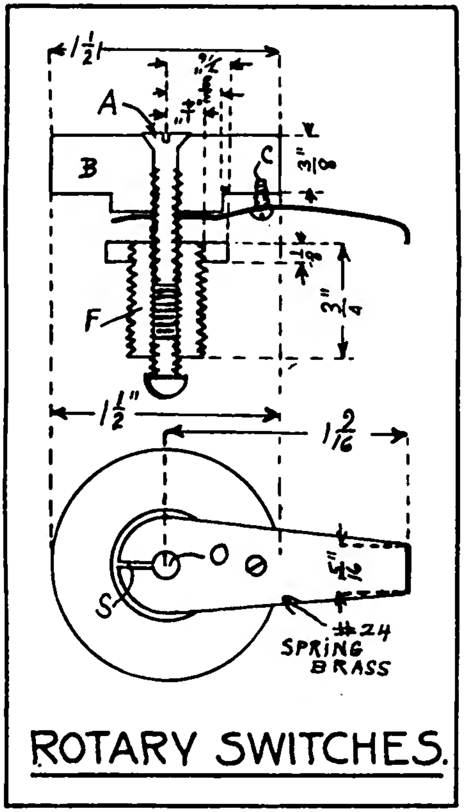


Figure 5, Third Prize Article

can be made to give surprising results. Of course a straight gap may be substituted for the form shown, but as the primary object of the design of this set is to provide a means of reducing interference from small coils due to improper tuning, it is suggested that the form referred to be adopted.

The leads from the condenser are

brought out to two rows of posts, so that the capacity adjustment previously referred to, can be readily made. The condenser used by the writer consisted of two sections of Murdock moulded condenser, each having a capacity of .0017 microfarad. These condensers are very efficient and compact. They showed a resistance to radio currents of .41° as compared to .14° and .28° of the Fessenden compressed air and Wireless Specialty leyden jar in oil. (See L. W. Austin's notes; Bulletin Bur. Standards, Vol. 9.)

The antenna change-over switch and coupling adjustment is represented at 4 (Figure 1). At 5 and 6 are shown the wave-length switches used for varying the wave-length of the closed circuit and antenna circuit. They are well insulated from the panel in order to permit these adjustments to be made with safety during operation. The adjustment of wave-length is made by means of a wave-meter in the closed circuit, and the aerial can be tuned to resonance by means of a hot wire ammeter or thermo-element and mill-voltmeter calibrated in terms of R. M. S. amperes. The antenna is connected to the post marked 7.

Figure 2 shows the front and side views of the apparatus. No dimensions are given as the amateur generally supplies these to conform with the apparatus on hand. The coupling transformer is shown at A. Some criticism of the form of coil shown is expected. A pancake form may be adopted as a means of saving space, but quantitatively no difference in results may be expected. The loading inductance for the antenna circuit is shown at B, and the ground terminal at C. This inductance may be wound with ordinary seven-strand No. 22 copper on the rubber strips. The secondary of the oscillation transformer was wound with ordinary flexible lighting cord equivalent to No. 14. The primary was wound with No. 8 copper wire.

In setting up the apparatus after the construction is completed, the following procedure may be adopted: Adjust the primary radio circuit to the three wave-lengths decided upon. Also adjust the antenna circuit to resonance at these wave-lengths and with all the gaps of the quenched gap in circuit, note the radiation with coupling loose enough to prevent the radiation of two waves. This will be shown on the wave-meter and at the same time the note and pitch of the spark may be determined. Adjust the vibrator on the coil or the captance or reactance of the primary transformer circuit until the note is cleared. If an integrating wattmeter of the indicating type is at hand, this may be placed in the primary circuit and adjustment for maximum indication made, at the same time taking care that the note remains clear.

Now change the condenser to another capacity and repeat the operations just

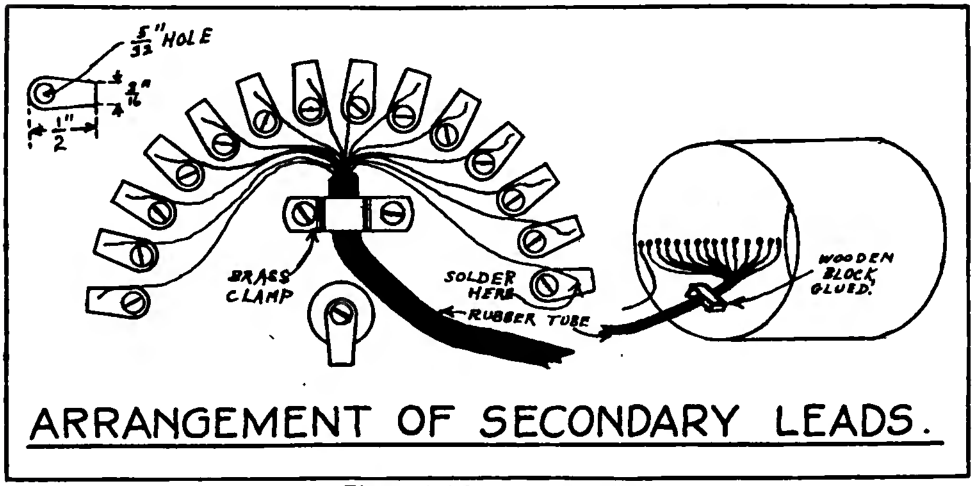


Figure 6, Third Prize Article

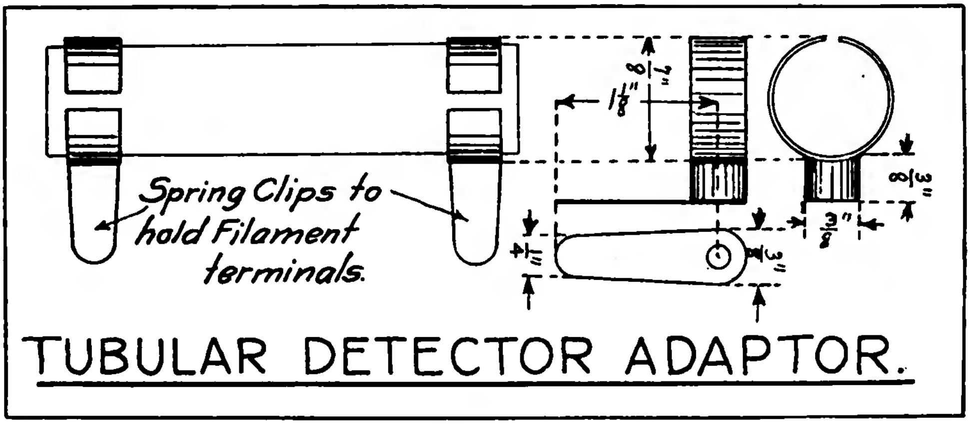


Figure 7, Third Prize Article

performed. Note the antenna current. Do this several times with various capacities and, when the antenna current is maximum and the note is clear, this is about the capacity that is best suited to the circuit used. Of course, this is not an accurate statement, but with the usual facilities of the average experimenter, it may be said to be as accurate as the adjustments themselves.

CHARLES C. BALLANTINE,
Pennsylvania.

THIRD PRIZE, THREE DOLLARS
A Portable Tubular Vacuum Valve Receiving Set

The accompanying drawings show the construction of a portable valve receiving set the writer built a year ago and which has given excellent results. This outfit is intended to be a compact sensitive tuner and detector. It consists of a good sized loose coupler, fixed condenser and any style tubular vacuum valve mounted in a small carrying case.

Some features of the set are described as follows: The case, measuring 7 inches by 7 inches by 11½ inches, outside dimensions, will fit into a handbag, which can be easily carried. The coupling knob throws the secondary drum out of the primary easily and quickly by a turn of sixty degrees of the handle. The set is designed so that without the use of variable condensers it tunes to 2,000 meters and all the switches and terminals are mounted on a hard rubber front which puts all adjustments within easy reach. The vertical position of the rubber prevents dust from collecting easily.

The case is made of any hard wood with the corners dovetailed and glued. Figure 1 shows the dimensions of the pieces to be cut out. Half inch stock is used. When joined, it can be stained, filled, shellaced and varnished to suit the builder.

Then the rubber front is cut to fit in the front of the case. A piece of ½ inch rubber, 6 inches by 12¼ inches, will allow the front to be cut 6 inches by 10½ inches. A piece left over will make all the necessary knobs. The rubber is set in flush with the edges and is held in place by six 8/32 counter-sunk-head brass machine screws passing through the sides and ends of the case. This mounting leaves the entire surface of the rubber available for the switches and so on. All the machine work for this set can be completed on a small metal-working lathe and drill press, together with the tools most amateurs have on hand. Figure 2 shows a front elevation of the set. Figures 3 and 4 show the details of the coupler movement with the dimensions.

The primary of the coupler is wound with No. 25 silk covered wire wound on a cardboard tube 5½ inches in diameter and 4¾ inches in length. Before winding, the tube is painted heavily with thick shellac and the alcohol burned out with a blow-torch which leaves the tube dry and hard. A wooden flange, A, turned from 3/8 inch stock, is bored at the center with a 1/4-inch hole to hold one end of the sliding rod. This flange is glued in one end of the drum. Two small wood screws through this will hold the primary to the inside of the case. The taps on the primary are arranged at short intervals, permitting fairly close tuning. There will be about 160 turns, all told. First wind six taps with three turns each, then six with four turns, six from the secondary at points equidistant throughout the windings.

Before attaching the terminals inside the drum, the coupler movement should be installed. This is simply constructed as shown in Figures 3 and 4. A piece of 1/8-inch brass rod draws the secondary drum in and out. This rod passes through the pin, C, which turns in the bearing, B. Pillar A supports the bearing, B. The pin is made of 1/4-inch brass rod and a 5/32-

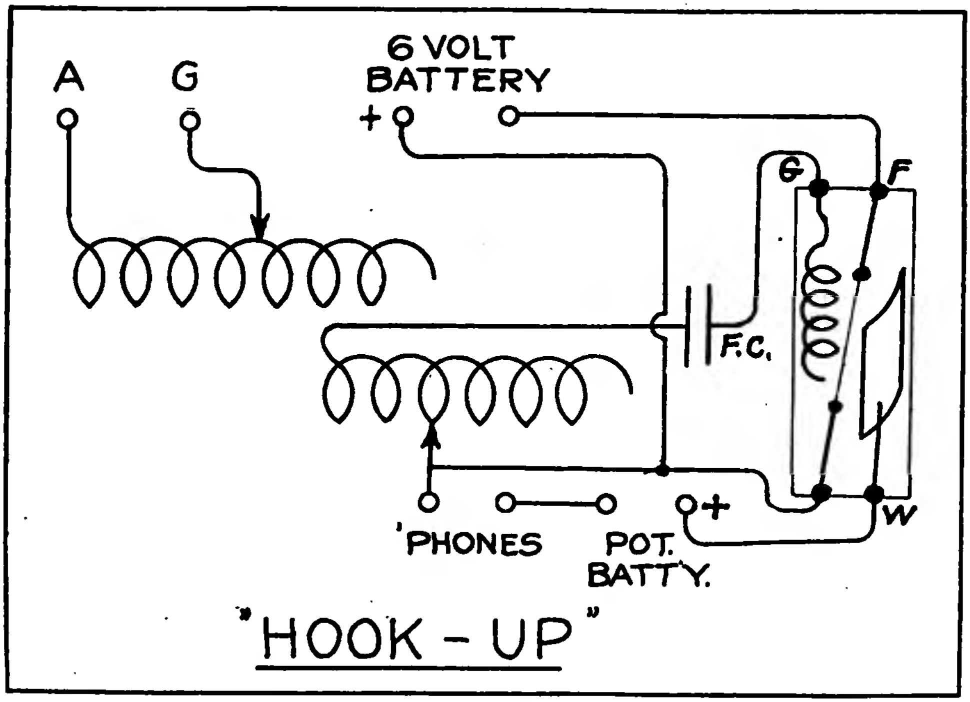


Figure 8, Third Prize Article

with five, six with six and six with eight. This arrangement can be caried to suit, but should be kept close at the beginning to tune well around 600 meters.

The secondary is wound with No. 32 double cotton covered wire. The drum in 5 inches in diameter and 4 1/4 inches long and is treated like the primary. A wooden flange is made to fit each end of the drum. A 5/16-inch hole through the center of each allows the drum to work on the slide rod which is a piece of 1/4-inch brass rod the full length inside of the case. One end is held in the 1/4-inch hole in the primary flange and the other by an 8/32 machine screw through the end of the case. Fourteen taps are taken inch hole accommodates the 1/8-inch rod. The bearing is a piece of 1/4-inch I. D. brass tube and the pillar is turned and bored from 5/8-inch rod. The position of the shaft, S, is shown in Figures 3 and 4. This is also a 1/4-inch rod, which turns in a brass bearing made of a threaded piece of 1/2-inch rod fitted into the rubber. A piece of 5/8-inch rod is made into a shoulder that holds the 1/8-inch rod and set screw, O. This should be a good size with a large head and the shaft, S, should be filed flat to allow this screw to be well tightened. The hard rubber handle is 1 1/2 inches in diameter and is threaded onto the shaft and locked tight by the threaded collar, P. A little grease on the 1/8-inch rod will make it slide easier. After the coupling adjuster is completed a piece of 1/4-inch square brass rod, R, is placed along the bottom inside the case, and under the secondary drum with a small brass guide, G, attached to the end of the drum. This prevents side play. A set screw, W, limits the lengthwise movement of the drum as shown in Figure 3.

Figure 2 shows the arrangement of the switches and Figure 5 shows a switch handle in detail which is very durable. The knife blade, D, is held to the handle by one 6/32 screw and is bored with a 3/16-inch hole, O, at the shaft and a narrow slit, S, is cut. Each side is bent to make a spring washer. The screw, A, is fitted snugly in the handle. The base, F, threads into the rubber. The spring washer effect of the knife, D, amply takes care of the 1/32-inch movement up or down, of the screw, A, when the knob is rotated one complete revolution.

The primary switch has thirty points equally spaced on a 3 1/8-inch circle. The secondary contact points are mounded on a semi-circle of 1-9/16-inch radius. 5/32-inch holes are bored to pass 6/32 screws to hold the switch points. All the points are 1/4-inch diameter and 1/4 inch in length. Forty-four little lugs are then made, as in Figure 6, by boring a row of 5/32-inch holes along the edge of a piece of sheet brass and then cutting to shape with tin shears. One of these lugs goes with each screw to the contacts and the terminals of the winding are soldered to them before the rubber front is put in place. Figure 6 also shows how the leads are brought out from the secondary drum. A fourteen-strand cable, made up of No. 28 D. C. C. wire in a 3/16-inch soft rubber tube, connects from the secondary to its switch. A wooden block glued inside the drum anchors that end of the cable and a brass strap holds the end on the rubber front. The leads are neatly fanned out and soldered. If the wires become crossed, connect a 4-volt battery across the secondary and with a low reading voltmeter you can easily distinguish every lead by the drop of voltage. A single light flexible wire runs from the beginning of the winding to the fixed condenser. This can be purchased or made as desired and

The primary terminals should be soldered last and any point on the circle can be chosen for the start. It is probably best to take the one nearest the top and solder from left to right. This complete circle arrangement on the primary allows the wave-length to be changed quickly.

Figure 7 gives the details of mounting the vacuum valve. The parts are made from tubing and rod sweated together. Figure 8 gives the hook up. All connections should be well soldered and the brass work polished and lacquered. On top of the case a leather handle is fastened for carrying. It is hardly possible to install the high potential battery in the set, and in view of the fact that a battery needs considerable attention, it is just as well to place it in a separate case. The filament rheostat can be mounted on this.

Such a set as this would be ideal for a launch or boat, where a storage bat-

A view of the portable vacuum valve receiving set described in the Third Prize Article

tery is available. For general work with all spark stations the writer has obtained excellent results and the experimenter would do well to construct a similar instrument.

GEORGE STURLEY, *California.*

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

How to Transmit Efficiently During Hours of Confusion

Since the passage of the government radio regulations all of the amateur stations have been huddled together just below the 200-meter limit. In the vicinity of large cities this has resulted in considerable confusion during the hours when

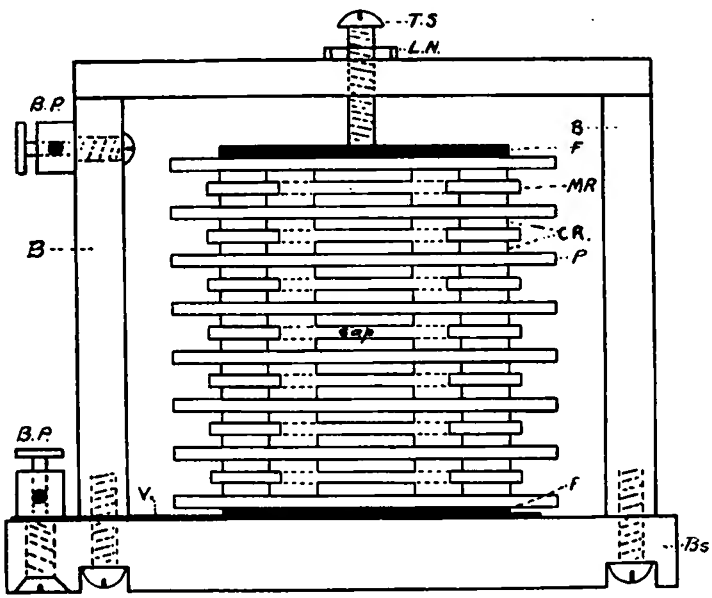


Figure 1, Fourth Prize Article

the law is not to be changed, the amateurs should do the best they can to eliminate this difficulty.

A simple remedy is to avoid the use of excessive power when transmitting. I know of amateurs who are accustomed to use as much as ½ k.w. to communicate a distance of a few blocks. The resultant roar in near-by stations satisfies the sender, but it is an unreasonable and unnecessary form of interference. Another remedy, an all-important one, is sharp tuning. This brings us to the subject of this article; the description of a highly efficient, sharply tuned "town set," which, if generally used, would do away with all unnecessary interference in congested localities.

The essence of this set is a small quenched spark gap, used in conjunction with a spark coil, condenser and oscillation transformer. Everyone being familiar with the last named instruments, we will turn our attention to the workings and construction of the spark gap. The advantages of this form of discharger are numerous. The one with which we are mostly concerned is the fact that a pure wave is emitted. That is, the energy is practically all radiated at one definite wave-length. Besides producing a pure wave, this results in greater efficiency because more energy will be picked up by the receiving station when it is concentrated on one wave-length, than would be picked up if the energy were spread over a series of wave-lengths, with perhaps two maximum points. The reason for this behavior of the quenched gap follows:

When the potential of the condenser is of a certain value, it breaks down the resistance of the gaps and the primary oscillations surge back and forth in the closed circuit. The sparking surfaces of the gaps are rounded; that is, the gaps at the center are shorter than they are at the outer edge as at X, Y, (Figure 2). The first set sparks will pass at X, because they offer the least resistance (shorter); but the electromagnetic action of the magnetic field set up about the discharging current will drive these sparks outward to the location of Y. This lengthens the gap materially and completely damps the primary oscillations and therefore the quenching effect. The high resistance of the spark gaps immediately returns. Let us consider the effect of this on the secondary of the oscillation transformer. The primary oscillations set up similar oscillations by induction in the open circuit. These secondary oscillations soon reach a maximum, and at this point, the primary oscillations are quenched, as explained. See Figure 3, B. This action allows the oscillations in the open circuit to become very persistent, and to radiate the energy at substantially the natural period of the open circuit.

Now what is the effect of these oscillations in the open circuit upon the closed circuit? There is no effect, because oscillations that may be set up in the primary circuit by the secondary are effectually blocked by the high resistance of the spark gap. The closed circuit remains inactive until the condenser has again reached the critical value. This non-return of energy by the open circuit is responsible for the production of a pure wave. It also allows the two cirsuits to be coupled a great deal closer than would otherwise be advisable, which fact alone means a greater transfer of energy and hence increased efficiency.

There are three ways in which the oscillations in the open circuit may become damped: by return of energy from the antenna circuit to the closed circuit, the resistance of the circuit itself, and by radiation. The last-named is the object of the set and is not considered a loss.

A quenched spark gap suitable for use with a 1 inch-2 inch coil, or larger, may be easily constructed. Out of spring copper No. 16-18, cut eight discs 3 inches in diameter, as in Figure 2, P. Next, out of the same material, cut fourteen rings with an outside diameter of 2 inches and an inside diameter of 2 inches. Also cut out fourteen discs 1 inch in diameter (Fig. 2, R). This work may readily be done by means of snippers and neatly finished by the aid of a file. Now solder the 1-inch discs to the centers of the 3-inch discs, placing one on each side of six and one on one side of the remaining two. With a file, shape these 1-inch discs, shown in Figure 2 at YXY, as explained during the description of the working of the gap. Care should be taken not to remove any of the surface at the center, X.

Take the metal rings that were cut and solder them to the 3-inch discs, making sure they are centered. Place them, following out the same methods pursued with the 1 inch discs, that is,

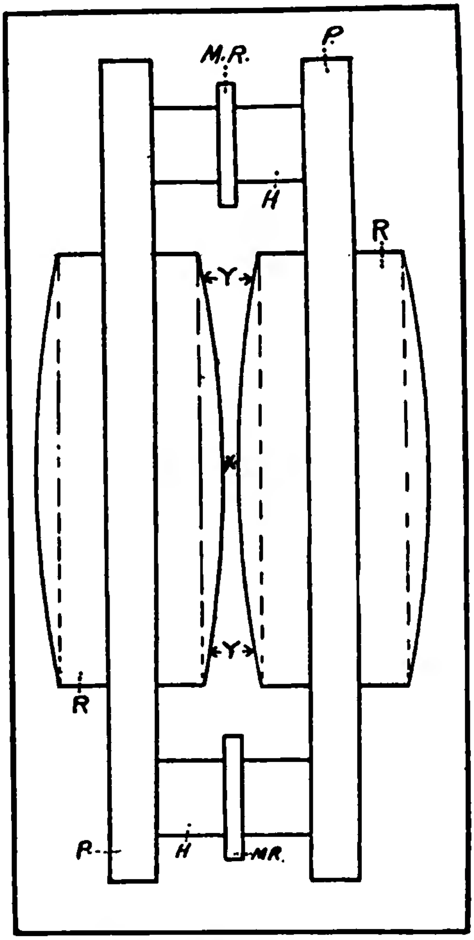


Figure 2, Fourth Prize Article

place one on each side of six and one on one side of the remaining two, selecting the same sides that hold the 1-inch discs. Cut seven rings out of some very thin mica, preferably 0.01 inch thick. The length of the gap is determined by this thickness.

The gap is now ready to assemble, as shown in Figure 1. Stack the plates up, placing a mica ring, MR, between the opposing metal rings, CR. They should be carefully centered, which is easily done by applying a little shellac to one side and sticking the ring in place before stacking. Make a simple frame, as shown in Figure 1. A convenient method is to use three pieces of ¼-inch brass rod and either screw or solder them together. Place a screw, TS, provided with a lock nut, LN, in the center on top. Mount the two binding posts as shown. Place a piece of copper under the post on the base and let it extend to the center of the base in order to make contact with the bottom gap.

Provide a heavy metal disc, F, and place on top in order to transfer the pressure from the screw, TS, to the rings, CR. This keeps the gaps from becoming closed when tightening TS. With all the discs centered and the mica rings in place, press the gaps together with the top screw, and lock with the lock nut, LN. This completes the gap. It will probably be found by tests with a hot wire meter, that the total number of gaps are not required. Any number of plates can be cut out by short-circuiting the adjacent 3-inch discs by means of clips.

The customary hook-up is shown at A in Figure 3. If the vibrator on the coil is now adjusted to give rapid makes and breaks, by means of a rubber band passed around the head of the coil holding the hammer in, or else by stiffening the hammer by introducing paper between it and the core, a high clear tone will be produced, and the wave will be pure and sharp, having the wave-length of the aerial circuit.

K. W. Nicholson, *California.*

HONORARY MENTION

An Improvement on the Average Spark Gap

I do not believe that all rotary gaps described justify the trouble and expense incurred in their construction, but the gap described in this article possesses the advantage of being easily and cheaply constructed and of producing a much clearer spark than that obtained by the usual type. This effect is mainly obtained by causing the spark to jump at one point only, thereby securing a shorter gap and a spark giving only the fundamental tone without the presence of rough over tones, which are often so noticeable when the spark takes place simultaneously at two points.

In the description of my apparatus no dimensions are given as they will depend upon the dimensions of the gap itself and the power of the transmitting set. Referring to Figure 1, D is a piece of stiff brass, about ½ an inch in width and 1/16th of an inch in thickness, bent as shown so that it will fit under two opposite plugs on the wheel. A hole is drilled in each end of this brass strip, D, the two opposite plugs A and B are removed, the brass strip is fitted over the screws, G and H, and the two plugs are again screwed into place.

Care must be taken in bending D to have it correctly balanced or the gap will not run smoothly. E is a piece of

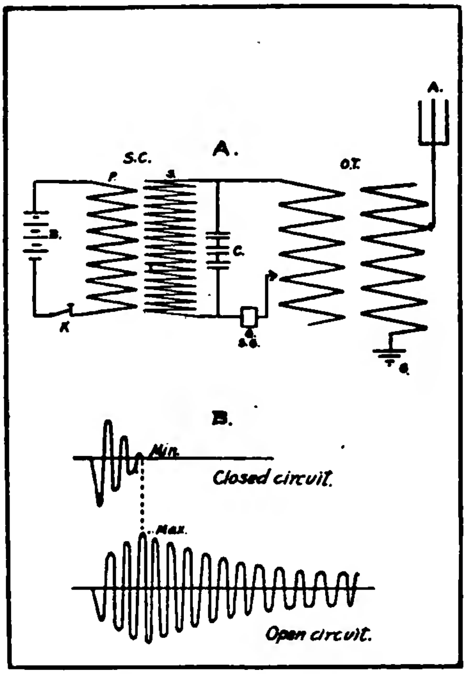


Figure 3, Fourth Prize Article

spring brass, bent as shown in the figure, with a hole drilled in the end, K. The binding post, F, which ordinarily supports one of the stationary electrodes, is removed from the base, E, and is placed over the screw which holds F to the base. Then the binding post is screwed into place over E. The contact surface, I, of E should be no longer than the width of D, namely, ½ an inch, and

(Continued on page 298)

German Portable Sets In The World's War

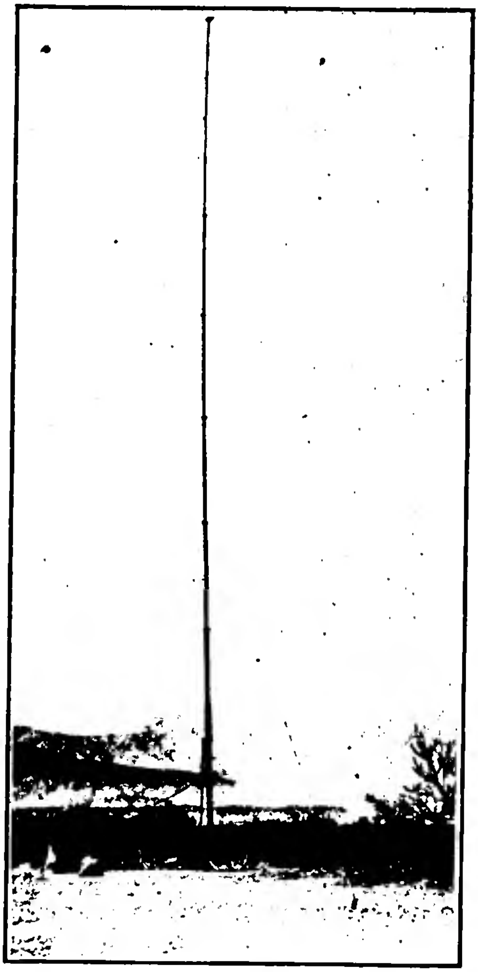
THE accompanying photograph shows a German wireless field set in actual operation on the Maccedonian front in the present war. In the background can be seen one of the Balkan mountain ranges. Owing to the mountainous nature of the country, it is necessary to have masts of considerable height. The one shown here is a sectional telescopic mast, each of the eight sections being four meters high, making the height of the mast 32 meters, or 105 feet. Field sets in the German army carry still higher masts, the limit being 45 meters, or 148 feet.

Far more numerous, however, on the Balkan war fronts are the cavalry stations, which are intended to safeguard the most advanced cavalry patrols. These are carried by pack horses, and this arrangement permits of a simple division of loads, whose weight and distribution on the pack saddle is so apportioned that the pack animal is neither overburdened or hampered.

The station is provided with a collapsible military tent, which in bad weather gives shelter to the telegraphers and the apparatus. The sides of the tent are utilized in the packed station for covering the packs. The primary alternating current used by the sender is developed by a light generator, the power being supplied by a benzine motor.

The cavalry station carries a telescopic mast. A horizontal or umbrella antenna may be employed for earthing, the wires being stretched over the ground. These wires are wound up according to a system which prevents the individual wires from being tangled, and in a few seconds they may be stretched out or drawn in.

By day, in a flat country, a distance of 100 kilometers can be obtained with large receiving antenna, and at night a distance of 150 kilometers can be obtained. The erection of the station takes from ten to fifteen minutes when four men are employed. The dismantling of the station takes from eight to twelve miutes. Two men are needed for operating the station. The packs rest tightly on the back of animals, and are subject to a minimum of disarrangement when the latter are trotting or galloping.



View of German field set

New Vice President of N. A. W. A.

Commander David Wooster Todd, U.S.N., Director Naval Communications, and successor to Captain W. H. G. Bullard, has recently accepted an appointment as a vice-president of the National Amateur Wireless Association. Commander Todd, who is one of the most prominent figures in the radio world today, was born in Round Valley, California, July 24, 1874. His sea service comprises assignments to fifteen vessels of the United States Navy. He has served ashore as instructor in ordnance at the Naval Academy, in charge of the Radio Division of the Bureau of Steam Engineering, Navy Department, and as assistant superintendent of the Radio Service. His appointment as Director Naval Communciations dates from August 3, 1916

With the Amateurs

RESULTS OF THE PRESIDENTIAL RELAY ON NOVEMBER 27th

By W. H. Kirwan (9XE),

National Chief of Relay Communications,

NATIONAL AMATEUR WIRELESS ASSOCIATION

THREE hours of real wireless fun and testing of various receiving apparatus was offered you on this night. From the great amount of interest that was shown, we are led to believe that it is the kind of work you like.

For the benefit of a few Doubting Thomases in the east, it is stated that the permission to run this relay was received from the White House, direct from the secretary of the President of the United States. The Acting Secretary of the Navy, the Hon. Mr. Benson, also gave the permission, and it was referred to him from the White House before we received the open order to go ahead.

NAA and NAJ did not send out warnings as planned, because we withdrew the request when it appeared that some were trying to make this a political move.

The relay was started by 9XE sending with a one-half inch coil, connected to a regular oscillation transformer of the pancake type. The coil was going all along, and for a sending wave we had about one-half of the O. T. short circuited by the sending key when it was pressed. This compensating wave passed through the regular telephone wires, and as the receiver was off at 9XE and also at 9XR, two miles away, the wave worked the Hall wireless relay device, which is a sound actuated relay, and automatically sent the message by working a magnetic key at 9XR.

The relay as conducted was perfectly fair, and was open to all amateurs broad enough to see the advantage of it. The main idea of the relay was to get some idea of the real range of the various sending stations under adverse conditions.

Every sending station had a copy of the MSG ahead of time, and had instructions to repeat a certain letter in a certain marked word, and all had different words marked. Not even the writer knew what word or letter would be repeated. Some of the most remarkable distances have been covered, and some good receiving records made.

A great many Government and commercial stations were working at the time of the relay, as well as numbers of amateurs who appeared to be willfully interfering. Throughout, however, the results were most gratifying and interesting.

No special interests were served in this relay, so far as the writer knows, but one or two were ignored because we did not care to have anyone get the credit for running the relay like they did the Washington's Birthday relay of last year.

Please understand that I am not trying to commercialize your interest in relay work, and there is no string tied to the prizes. Neither are you urged into a mad race for subscriptions for THE WIRELESS AGE magazine to earn this prize. It is human nature to enjoy a pat on the back for work well done, and that is what you are getting now. Bigger and better prizes will be offered later on to the best amateur station in the country for all around work, so you had better get busy. And don't forget that the writer is assuming all responsibility for giving the prizes.

INCIDENTS OF THE RELAY

P. Stover, of Marengo, Iowa, claimed to have heard 6SH and 1ATY. The first station is in California and the latter in Connecticut. Not checking the mistakes cost him his chance for a good credit. Chester Sinnett, who lives on Bailey Island, off the coast of Maine, clearly read 8AEZ and 4DI, checking their mistakes and earning two good credits. Station 5DU, in Dallas, Texas, was clearly read by the writer, and did remarkable work.

For sending, the stations are listed as follows in the order of their apparent superiority—8AEZ, 8NH, 5DU, 9ABD, 6SH, 8NF, 9IC, 8JZ, 7YS, 7ZS, 2ZB, 8SK—and we came very near forgetting 9IK, which is really fourth on the list. A look at the list will explain the game better. 9DK—O'Neill of St. Louis—volunteered to take the place of 9ACE, who was called away at the last moment. Emmerton, of Sawtelle, Calif., was listed as 6QJ through an error, his call being 6TQ. Some stations were not heard at all, probably because their sigs were not leaving their spark gap, and there appears to be lots in the country just like this. Some stations like 7YS, 7ZS and a few others, are hundreds of miles away from anyone, and the fact that they were heard shows that they work remarkable distances.

Robert Higgy, late of the Lima High School, in Ohio, was at his new home in Phœnix, Arizona, with the receivers strapped on; as usual he caught the MSG from 5DU and also heard 9NN talking about it with 5DU. This is the kind of sending, boys, you want to do, and don't let anyone tell you that this is freak work.

One good thing about these relays is that we are interesting the amateurs in the south and west where good stations are needed.

Publicity relays are the only kind of relays that are going to be any good to you until you are officially recognized by the Government as a factor in its third line of defense.

The prize winners are published in this issue. Some of them are old war horses at the game, and we are all glad to see some new faces looming up over the horizon. Keep right after these old timers, boys, and make them work.

There was the usual number of boneheads who have stations for their amusement and not for work, but the least said about them the better. But don't forget that we have their names on file. The station getting the greatest number of credits later will be given one of the largest prizes ever offered to any amateur for faithful work.

For instance, station 8NH received 6 credits for checking six stations, as did also 9MK, and all these will count in the final round-up to award the prize to the best all around station for sending and receiving.

We collected some wonderful data about aerials and fading sigs during this last relay, and all we need now is for all the stations that participated to send me all the dope on their aerial, particularly height, shape, size, wires, kind, and how the aerial bears with the compass. If you haven't a compass, better borrow one, and let me know how it runs with the compass; also state if it is level, on top, or inclined, and how much. Radiation is not important unless you have a calibrated wave-meter. If you will send this dope at once it will be turned over to the experts of the Institute of Radio Engineers and all the discussions concerning it will be published for your benefit. Before we get interested in the schedules and so forth, don't forget that the writer thanks you one and all for the interest you are taking in this work, for your most kind assistance, and for the thousands of kind letters that have been received.

Some of you wanted immediate replies and even enclosed a stamp, but it is a physical impossibility for one man who is obliged to work as hard as any of you to find the time to do so. More than 100,000 signatures were received to the relay MSG, and nearly all of them were counted by the writer.

THE PRIZE WINNERS

8YZ—Peabody High School of Pittsburgh, Pa., is awarded the second prize of one tubular audion panel, assembled with two filament bulb, rheostat, and ready to be connected up for use, for getting 1,893 signatures of American citizens. This panel has been donated by the National Electric Mfg. Co., Mallers Bldg., Chicago.

2AGJ—J. K. Hewitt, of Albany, N. Y., turned in 861 signatures and receives the 3,000-ohm pair of phones, 55 type, unconditionally donated by the Wm. B. Murdock Co., of Chelsea, Mass. This is the third prize.

The Ames Radio Club, of Ames, Iowa, turned in 777 signatures and evidently had a lucky combination of figures; to this organization is awarded the fourth prize; a pair of 2,000-ohm phones, 55 variety, made by and donated by the Wm. B. Murdock Co. This is the new club just formed by some very progressive amateurs and you will doubtless hear more from them later.

9HQ—Owen R. Terry, Stoughton, Wisconsin, gets the fifth prize for turning in 716 signatures to the MSG. This will be one two-filament tested electron relay, donated by the Pacific Research Laboratories, of San Francisco, Cal. This company would not consider any other arrangement but that the writer permit them to give ten of these prizes to the lucky winners.

The following will therefore get an electron relay from the Pacific Research Laboratories:

J. I. Greene, Rock Falls, Ill., 714 sigs. A newcomer in the game.

9RD—F. M. Bailey, Clinton, Iowa, 554 sigs. An old war horse, with a son twenty-one years old.

9NY—R. O. Strock, Polo, Ill., 502 sigs. An ardent worker. Watch him for results.

Glenn Fordyce, Anita, Iowa, 338 sigs. This little fellow is a "newsie."

9IK—R. W. G. Mathews, Chicago, Ill., 315 sigs. A pleasant fellow, hard worker and A1 amateur.

9ACM—A. E. Jeffrey, High School, Goshen, Ind., 281 sigs. A busy school teacher who finds time for a little recreation that also interests his pupils.

1IZ—Robt. T. St. James, Grt. Barrington, Mass., 279 sigs. A bright star in the east.

8ACK—Russell Blair, Norwood, Ohio, 245 sigs. Chock full of grit.

5CW—H. L. Ansley, Birmingham, Ala., 213 sigs. Our little Southern brother.

The following did well, and will get a prize of a three months' subscription to The Wireless Age. If you are already acquainted with this wonderful magazine, you will have the date for renewal of subscription advanced three months:

6SI—Leander S. Hoyt, Hayward, Cal.
9QF—C. E. Lockwood, Waterloo, Iowa.
8NH—Mrs. C. Candler, St. Marys, Ohio.
3ST—R. R. Chappell, Richmond, Va.
3GX—G. S. Robinson, Richmond, Va.
1ASI—E. W. Merrow, Worcester, Mass.
1ATY—H. Holcomb, Windsor Locks, Conn.
9MK—E. H. Gittings, Lanark, Ill.
9OM—C. P. Finley, Cedar Rapids, Iowa.
9GF—H. G. Eytt, Denver, Colo.
J. A. Goorish, Chicago, Ill.
L. P. Englund, Moline, Ill.
9ACO—E. Wittick, Moline, Ill.
E. A. Smith, Oakville, Wash.
8ALE—H. Alexander, Grove City, Pa.
D. K.—Kent Bros., Dewitt, Iowa.
W. S. Rothrock, Winston-Salem, N. C.
Eric Austin, Sacramento, Cal.
St. Martins College, Lacey, Wash.
8AEZ—M. B. West, Lima, Ohio.

The prize winners listed will please write to The Wireless Age, send their correct addresses at once, and they will get the magazine. I compliment you all.

Commercial stations that were called QRM by a great many stations who were trying to pick up the MSG; WHB, NAO, NAI, WRU, NAJ, WGO, WUF, WGV, WNU, and a few others.

Amateur and special stations that were called QRM by many amateurs: 8YO, 5AM, 2AGJ, 2DA, 4CL, 9TZ, YJ, 9XN, 6BJ, 5ZC, 1ON, 9AKH, 9KU, 9UN, 8XA. There is a possibility that a great many of these were not read correctly, and our apologies are offered to those that are not guilty.

The First Prize

The one KW, new type, Thordarson transformer, offered by the Thordarson Electric Mfg. Co., of Chicago, is still safe at last reports. Kenneth Briggs, of Rochester, N. Y., and J. N. Simpson, of the same city, were on the watch and had located Mr. Hughes at the Hotel Seneca in that city. As soon as each of them received the MSG, he went with all speed to the hotel, and Mr. Briggs evidently arrived first. He relied on the clerk to give the MSG to Mr. Hughes and the clerk forgot it. Mr. Simpson arrived soon after and the clerk told him that someone else had been there ahead of him and he left without verifying it. Both these young men had a good chance, and will probably always remember that hotel clerks are in a class by themselves. A later letter from another amateur states that a dandy fire escape outside of the building would have permitted both of them to hand the MSG to the Presidential candidate and given him the surprise of his life.

The Stations that Received the Message

Following is a list of stations that received the MSG and checked the mistakes. Each credit means that this station checked the mistake from one certain station; those with six credits, for instance, checked six different stations:

	CREDITS
8NH—Mr. and Mrs. C. Candler, St. Marys, Ohio	6
9MK—E. H. Giddings, Lanark, Ill	6
9DK—D. H. Oneill, St. Louis, Mo	5
9ADT—G. Hartman, Wauwatosa, Wis	5
8AEZ—M. B. West, Lima, Ohio	5
4DI—W. S. Rothrock, Winston-Salem, N. C	5
8ALE—Alexander Bros., Grove City, Penna	4
9IK—H. G. Mathews, Chicago, Ill	4
Chester Sinnett, Bailey Island, Me	3
9FW—K. B. Warner, Cairo, Ill	3
1IZ—R. T. St. James, Grt. Barrington, Mass.	3
DK—Kent Bros., Dewitt, Iowa	3
9WS—Coy V. Patterson, Kansas City, Mo	3
9KF—J. A. Goorisich, Chicago, Ill	3
9ACO—E. Wittick, Moline, Ill	3
7YS—St. Martin's College, Lacey, Wash	2
9RD—F. M. Bailey, Clinton, Iowa	2
8CO—H. W. Harmon, Grove City College, Pa	2
2ZB—W. L. Brooks, Schenectady, N. Y	2
5OX—D. Simmons, Shreveport, La	2
7DJ—H. W. Blagen, Hoquiam, Wash	2
3RD—R. Dimling, Baltimore, Md	2
9HQ—D. R. Terry, Stoughton, Mich	2
6SI—L. L. Hoyt, Hayward, Cal	1
3RO—W. T. Gravely, Danville, Va	1
IZF—H. C. Bowen, Fall River, Mass	1
9VS—Parker Wiggin, Kansas City, Mo	1
3ST—R. R. Chappell, Richmond, Va	1
3GX—G. C. Robinson, Richmond, Va	1
6PN—Paul Nesbitt, Acampo, Cal	1
3ZS—C. H. Stewart, St. Davids, Pa	1
9YE—W. S. Ezell, Wichita, Kan	1
6AS—Eric Austin, Sacramento, Cal	1
2AGJ—J. K. Hewitt, Albany, N. Y	1
6WS—W. Ford, San Diego, Cal	1
6SR—R. O. Shelton, San Diego, Cal	1
1UN—J. W. Peckham, Middleton, R. I	1

5DU—B. Emerson, Dallas, Texas.................................. 1
3WL—R. Davis, Washington, D. C.................................. 1
6TQ—A. Emerton, Sawtelle, Cal.................................. 1
3QZ—C. A. Service, Bala, Pa.................................. 1
9FA—L. A. Walker, St. Joseph, Mo.................................. 1
8CM—K. Briggs, Rochester, N. Y.................................. 1
7ZC—A. C. Campbell, Lewiston, Mont.................................. 1
5CQ—Ray Atkins, Groesback, Texas.................................. 1
9IC—G. A. Greenleaf, Woodstock, Ill.................................. 1

These received the MSG but forgot to check mistake:

6DM—Robt. Higgy, Phoenix, Ariz.
1EAA—T. H. Gavin, Fall River, Mass.
8AAK—C. R. Pardridge, Saginaw, Mich.
5BV—J. M. Clayton, Little Rock, Ark.
9TZ—J. A. Gardner, Eureka, S. D.
9TZ—E. R. Isaak, Eureka, S. D.
9RW—H. J. Pourhop, Sheboygan, Mich.
1DX—S. Sandreuter, Stamford, Conn.
9ZL—Cecil Bridges, Louisville, Ill.
J. T. Moorehead, Greensboro, N. C.
J. N. Simpson, Rochester, N. Y.
R. Ray, Park Rapids, Mich.
F. Jameson, Leavenworth, Kan.
B. Emerson, Monroe City, Mo.
S. D. Darley, Jacksonville, Ill.
W. L. Galloway, Xenia, Ohio.

There were hundreds of others who merely stated that they had received the MSG, and did not state from what station and did not check mistakes.

The following is the list of sending stations that worked on the relay and also the stations that read them and checked their mistakes:

9XR—Heard by: 9LP-9PY-9NY-9JT-9FW-1ZF-9RD-9WS-9VS-9ACO-9ZL-9FA-9IC-9LW-8AOZ-9IK-DK-2AGJ-9KF.

9YA—Heard by: 9LP-9MK-9YE-9NY-9JT-9FW-5DU-9RD-9DK-9WS-9ACO-9FA-9TZ-8ACK-9IC-DK-9GY.

9ZS—Heard by: 9LP-9PY-9MK-9NY-9JT-9FW-8AAK-9RD-9WS-9VS-9ACO-9ZL-9FA-8NH-9LW-9IC-9ACM-9IK-5OX-DK-2AGJ-9GY-9KF.

9IK—Heard by: 9BJ-9NY-3RO-9JT-9FW-1ZF-8NH-9DK-9ZL-1DX-8ACK-3ZS-9ADT-9LW-3RD-8ALE-9IC-9KF.

9ADT—Heard by: 9IK and 8NH. There seemed to be a fading from this station on relay night.

7ZS-7DJ-7YS—All heard each other, and if you will refer to the map you will see what great distances were covered.

9BD—Heard by: 9MK-9JT-9FW-8NH-9PD-9DK-8ACK-9LW-1IZ-9IC.

8JZ—Heard by: 4DI-9JT-9FW-8NH-9RD-8ACK-8ALE-5BU-8CM-9IK-2AGJ-9GY.

8ADE—Heard by: 8NH and 9IK, but the latter station said that his sigs were faint.

8SK—Heard by: 9BJ-9ADT-8NH-8ALE-1IZ-8ARB-2ZB-9IK-2ALI-9GY.

9ZF—Heard by: 9LP-9ADT-9MK-9JT-9FW-9RD-9VS-7ZC.

8YI—Heard by: 9BJ-9LP-8ALE.

8AEZ—Heard by: 9BJ-9LP-9FA-3RO-4DI-9JT-9FW-8NH-1ZF-9MK-9MY-9NY-9RD-9GY-9DK-8AAK-1UN-3RD-8CO-9ADT-8ALE-3ST-3GX-5BU-1IZ-9IC-2ZB-1ASI-9IK-9ACM-5CW-9LW-8ACK-2ALI-4CK-3QZ-9HQ-8QG.

2ZB—Heard by: 8YI-8NH-9RD-9IC.

9QF—Heard by: 9LP-9MK-9RD-9VS.

8NH—Heard by: 9BJ-9LP-9NY-3RO-4DI-9MK-3RD-8AAK-9RD-9DK-8ALE-

8CO-8QG-9IC-5BU-1IZ-8ACK-8AOZ-9IK-5CW-9GY.
9ABD—Heard by: 9BJ-9LP-9ADT-9MK-8NH-8ALE-4DI-9RD-9DK-8CO-9IC-8ACK-5BU-8AOZ-9IK-5OX-5CW-5AA-9GY.
5DU—Heard by: 9BJ-8NH-9JT-9FW-9ADT-5CQ-9RD-9DK-9VS-9IC-6DM-8ACK-5BU-5BV-5EK-9IK-5OX-5CW-5AA-9GY.
9FA—No one reported that they heard these sigs.
6SL—No one reported that these sigs were heard.
6SH—Heard by: 9LP-9ADT-6AS-6PN-6WF-6SR-6SL-7YS.
1ATY—Heard by: 9LP claims to have heard this station, but did not read his mistake.
9KT—Heard by: 9LP-9IC-9VS.
9IC—Heard by: 9BJ-9RD-9ADT-9DK-8CO-5BV-9IK-9LW-8ALE-8NH-8AC 8ACK-9HQ.
9RK—No one reported hearing this station.
9DK—Heard by: 9ADT-5BV.
8CO—Heard by: 9BJ-9DK-3ST-3GX-3RD-8ALE.
3RD—No one reported this station.
6TQ—Heard by: 6SH-6WF-6SR.
5OX—No one reported the sigs from this station.
4DI—Heard by: 8ALE and the station at Bailey Island, Me., as well as lots of local stations, and 3GX-3ST, in Richmond, Va., heard this station.

The writer extends his thanks to the three bureaus of information: F. B. Chambers Co., of Philadelphia; Illinois Watch Co., of Springfield, Ill.; Mr. G. S. Johnson.

6SH—Our Western friend, MacQuarrie.

This was a splendid chance to wish some hard work on them, and we feel sure they will have some excuse about serving on the next relay.

If the prize winners will write to the donees of their respective prizes and give their address they will receive the prize.

Refer in your letter to the Presidential Relay, and to the fact that your name is published in The Wireless Age.

If anyone has any trouble at all write to:

Cordially yours,

9XE,
Davenport, Iowa.

It has been announced that the San Francisco Radio Club will publish a forty-eight-page magazine, The Pacific Radio News. The first issue of the magazine, ready for distribution on December 15, will contain full details of the proceedings of the Club during the last three months and also many instructive articles, including "Capacity Tuning." The current Pacific coast news and diagrams of various systems of apparatus operated by members of the Club, will also be published. The price of the magazine will be ten cents a copy.

At a meeting of the Club held recently, C. S. Zelk, operator on the U. S. S. Raleigh, delivered a lecture, describing in detail the various types of radio systure was followed by an instructive paper on "Storage Batteries," delivered by Sergeant T. J. Ryan.

P. R. Fenner was elected manager of the Pacific Radio News to succeed H. R. Lee, who resigned because of the fact that his time was so fully occupied with his duties as secretary and treasurer of the San Francisco Radio Club.

The initiation fee for members and associates will be increased to $2.00 beginning January 1, 1917, the dues remaining at twenty-five cents per month. A membership campaign has been begun in order that the names of 100 members may appear on the directory by the end of the year. At present seventy operators are active members of the organi-

Drifting

An Actual Experience Narrative of Adventure, the Scenes of which are Laid in Tropical Seas

By Alexander Schneider

IF you follow the sea long enough you'll surely meet with adventure. That has always been my contention and fact bears it out. So when I found myself in the perils described in the following recital I was not greatly surprised.

My story has to do largely with the D. N. Luckenbach, an American freighter, which had been sent to a drydock in New York, and there refitted with oil-burning engines. I joined the ship in New York in sole charge of the wireless equipment which had just been installed. Then we left for Norfolk, where we picked up a cargo of coal, and cleared for Rio de Janeiro. The voyage to South America passed pleasantly enough.

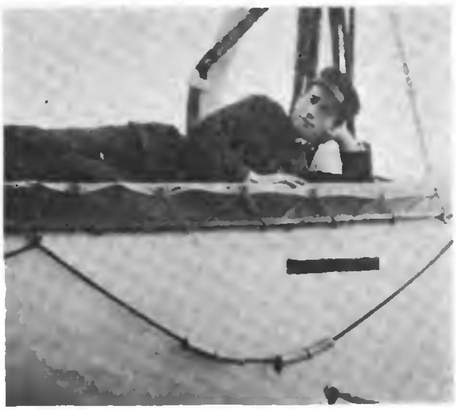
We left Rio on the northbound trip without an ounce of cargo or ballast in the holds. Abreast of Pernambuco we found a favorable current that bore to the northwest at a speed of three knots an hour, which, added to our own rate, made a snug little total each day of distance covered.

On the night of June 5th, at eleven o'clock, I rose from my set preparatory to turning in, when I was arrested by a strange tremor beneath my feet. This was followed by a crashing and jolting which drove me out on deck to seek the trouble. I peered down the engine room grating and then looked at the decks which seemed in the darkness to be heaving up and falling back like the inflation and deflation of a toy balloon. With a final rending crash that staggered me the vessel came to rest, rocking gently in the trough of the waves.

Immediately officers and crew tumbled out on deck inquiring regarding the trouble. The engineers soon found out that a propeller shaft had been broken. In fact, it was the extreme end section, the tail-shaft, which had been fractured. A scaffold was rigged over the stern and preparations were made to remove the broken shaft and replace the broken section. If this plan had been feasible, there would be but little to relate. But it was not, the chief engineer declaring that extensive repairs were impossible on the open sea.

The accident had occurred sixty miles off Cayenne in French Guiana while we were headed for Trinidad, 800 miles away to the northwest. The three-knot current continued in our favor and we drifted toward that port at rates of speed varying from twenty miles one day to 120 miles on another. The last record was made with the aid of the wind, an offshore breeze that we caught in crude sails made of the tarpaulin hatch covers. Rigged to the stays and booms, they bellied out nicely. They were a constant source of worriment, however, for sudden squalls ripped them down on more than one occasion.

Seventeen feet of water had been admitted into the forward hold in order to weight that end of the ship down and bring the after end clear of the water so that repairs might be carried out over her stern. This helped not at all, as we lacked tackle heavy enough for moving the propeller, which, with the broken section of shaft, had been pushed and jammed securely against the rudder-post. We swung about on the bow of our ship as if on a pivot, and it became plain that a strong wind might capsize us. An attempt was made to empty the hold of water, but the pumps were clogged with the residue of the coal dust that had sifted to the bottom from our southbound cargo. Then the boson and a sailor, defying the heavy timbers that washed about in the hold with each surge of the water, dove repeatedly to the bottom, and in two days succeeded in freeing the pumps. This accomplished, we were soon clear of the danger of capsizing.



The author of this article reclining on the canvas cover of a lifeboat aboard ship

All this time I was far from idle, going on watch at seven in the morning and often retiring after one o'clock the next morning. My first message was to the owners in New York. This was sent via the Barbados wireless station, 900 miles away, and ordinarily out of my communicating range. During the week that followed the captain was busy considering salvage and towing offers.

Arrangements were finally made with a firm in Trinidad and we gave our probable position for the following noon. Then we settled back and waited for the tug which, we hoped, would bring us into port two days after it arrived. But the next day dawned and passed without any signs of our tow. Meanwhile an attempt was made to attract attention by sending up columns of smoke during the day and burning colored signals at night. And still we drifted. When the island of Tobago came into sight a swift current swept us quickly sidewise toward the Grenadine Shoals, a low-lying group of coral reefs consisting for the most part of small islands.

As we drifted, the lead was heaved and when bottom was finally found at twenty fathoms, over went our anchor. Fortunately it held and, with the nose of the vessel headed out to sea, the ship's company felt that the peril was lessened. However, the dangerous current broke and swirled past the vessel, the coast of Little Martinique, seven miles distant, being in view all day.

That night the tug appeared. She had made several searches for the Luckenbach and on one occasion had put into St. George's to obtain our position by cable from the wireless station in Trinidad.

Our troubles were at an end, however, for the tug, after bucking the current for a full day, steamed off with the Luckenbach in tow, headed for Trinidad. Then life once more resumed its normal proportions and I was free to rest after my long vigil in the wireless room.

Our drifting totalled more than 760 miles and extended over a period of almost two weeks. While the stock of food had been sufficient for a longer time, the question of how long our water supply would last had begun to worry us, and, although none of the ship's company had suffered privation, all were glad when the Luckenbach was once more in a safe haven.

Vessels Recently Equipped With Marconi Apparatus.

Names.	Owners.	Call Letters.
Lackawanna	R. Lawrence Smith	KOP
Mundale	Munson Line	KUJ
Fordonian	American Star Line	(Not assigned)
Viking	Compania Navegacion Del Sureste	(Not assigned)
Samuel Mitchell	Huron Transportation Co.	WEJ
Alpena	Wyandotte Transportation Co.	WCS
Huron	Wyandotte Transportation Co.	WCH
Wyandotte	Wyandotte Transportation Co.	WCO
Car Ferry No. 6	Ann Arbor Railroad Co.	WDQ
S. Y. Nirvana	Rodman Wanamaker	(Not assigned)
Capto	B. Stolt Nielsen	LGL
Adalia	Hall Line	(Not assigned)
Chariton	George M. Embiricos	SVO

IN RECOGNITION OF OPERATOR HEBDEN'S LOYALTY

A letter expressing the regrets of the officers of the Marconi Wireless Telegraph Company of America because of the death by drowning of Percy Burdon Hebden, an operator in the Marconi service, has been sent to Miss Florence Hebden of Philadelphia, his sister. Accompanying the letter was a check for $500, sent in accordance with the Marconi Company's plan for providing life insurance for its employes. The letter follows:

November 16, 1916.

Miss Florence Hebden,
3300 D Street, Philadelphia, Pa.

Dear Miss Hebden:

It was with deep regret that the officers of the Marconi Wireless Telegraph Company of America learned of the death, by drowning at Rio Janeiro, of your brother, Percy Burdon Hebden.

His record of service, dating from September 13, 1913, shows that he had earned a name for devotion to duty, reliability and steadfastness of purpose—characteristics which will be associated with memories of him for years to come. He was one of those who kept vigil on the sea in calm and storm, facing hardship, peril and privation with unflinching eyes, in order that he might protect the lives of others. For these reasons the Marconi Company is particularly proud to have had him in its service, and it is not too much to say that he well exemplified in various ways the ideal which it seeks to maintain.

The loyalty which Marconi operators give prompted the Company to provide life insurance for them, and in accordance with this plan, you as the beneficiary named in your brother's policy, will receive $500. You will find enclosed a check for this amount.

With assurances of our sincere sympathy because of your bereavement, we are

Yours very truly,
E. J. NALLY,
Vice-President and General Manager.

Miss Hebden wrote in reply:

November 19, 1916.

Mr. E. J. Nally.

Dear Sir:

Your letter of November 16 reached me yesterday, also the check for five hundred dollars, for which please accept our sincere thanks.

As I am now the only support of my parents, this money will be very acceptable.

It has given us great pleasure to have your letter and we shall always keep it as a memorial to my dear brother.

Percy was an ideal son and brother, and his loss is keenly felt by all of us.

Again thanking you for your prompt attention in this matter and for your much appreciated letter, I am, with best wishes for the success of the Company and yourself,

Sincerely yours,
FLORENCE HEBDEN.

Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.

Positively no Questions Answered by Mail.

S. R. H., New York City, inquires:

Ques.—(1) When employing a 2 k.w. transformer operating from a sixty-cycle source of alternating current, which do you consider the better method of connection: placing the spark gap in parallel with the secondary winding, or the condenser in parallel with that winding?

Ans.—(1) Either method may be used with practically equal results. It has been stated that placing the spark gap in shunt to the secondary winding, protects the secondary pancakes or windings of the transformer from puncture which might be occasioned by the reactance voltage of the condenser. Thus during the period the condenser discharges across the spark gap, the secondary winding is practically short-circuited and is thereby protected from the oscillations of radio frequency.

Ques.—(2) What should be the capacity of a condenser to operate at 425 meters, the secondary voltage of the transformer being 16,500 volts?

Ans.—(2) A capacity of .02 microfarad is about the correct value.

Ques.—(3) On page 42 of the book "How to Conduct a Radio Club" a diagram is given of the connections for measuring the wave-length of an aerial. Should not the secondary winding of the oscillation transformer be included in the circuit to get the wave-length under operating conditions?

Ans.—(3) Yes, but the method presented was merely intended to show how the natural or fundamental wave-length of an antenna system can be obtained. The actual increase in wave-length, due to the secondary winding, must, of course, be taken into account when the set is to be operated on a stated wave-length.

Ques.—(4) On the hypothesis that the vacuum valve is operated by changes of potential and that the voltage component of the energy in the antenna system is a minimum at the earth connections, would it not be better to place the loading coils on the ground side of the tuner, rather than on the aerial side?

Ans.—(4) The correct position for this loading coil and the resulting potential depends upon other factors, such as the general over all distribution of current in the antenna system, which, of course, can only be approximately calculated. It may be that in certain cases the apparatus will give better response by connecting the loading coil in series with the earth, but examples could be cited where the statement does not apply. Several variable factors enter into this problem which would require an exceedingly lengthy discussion and a statement of facts in a particular instance. Why not satisfy yourself by carrying out the experiment?

* * *

P. B. B., Statesville, N. C., inquires:

Ques.—(1) Please state the approximate wave-length of an aerial consisting of 4 No. 14 copper clad wires, 100 feet in length with an average height of 60 feet, the wires being spaced two feet apart. The lead-ins are 50 feet in length.

Ans.—(1) The wave-length of this aerial is approximately 200 meters.

Ques.—(2) Also please state the natural wave-length of an aerial consisting of four No. 14 aluminum wires, 100 feet in length. 40 feet in height, the wires being spaced 23 inches apart. The lead-ins are approximately 25 feet in length.

Ans.—(2) The approximate wave-length of this aerial is 170 meters.

Ques.—(3) Both of these aerials are of the inverted L type. Could I hear the station at Arlington, Va., and Guantanamo, Cuba, with the small aerial?

Ans.—(3) Provided your station is equipped with the proper type of receiving apparatus, you should have no difficulty during the night hours in receiving signals from either of these stations.

* * *

O. S., Bonner Springs, inquires:

Ques.—(1) What would be the receiving range and approximate wave-length adjustment of the panel receiving set described in the Third Prize Article in the October, 1916, issue of The Wireless Age, when connected to a single wire aerial, 600 feet in length and 35 feet in height, with a lead-in 40 feet in length?

Ans.—(1) The equipment described in that issue will not respond to wave-lengths in excess of 1,600 meters, although you may be able to receive signals from Arlington by reason of forced oscillations in the tuning circuits. For example: Your aerial system may respond to wave-lengths of 2,500 meters with the variometer connected in series, but the secondary circuit would not be in resonance with the aerial circuit.

* * *

J. D. D., New Castle, Pa., inquires:

Ques.—(1) Please state the call letters of the Eiffel Tower Station in Paris.

Ans.—(1) The official call letters are FL, but we are not certain that they are being used at present.

Ques.—(2) What type of oscillation transformer is considered best for ½ k.w. transmitting set?

Ans.—(2) The inductively-coupled oscillation transformer is generally preferred because it permits the coupling between the primary and secondary windings to be easily adjusted. Practically equal results can be obtained with the auto transformer, but in order that the coupling between the primary and secondary windings may be varied over a considerable range, the helix must be fitted with 3 contact clips.

Ques.—(3) What is the approximate wave-length of an aerial 200 feet in length, comprising 4 wires spaced 2½ feet apart? The average height is 67 feet from the earth.

Ans.—(3) The fundamental wave-length of this aerial is approximately 367 meters.

Ques.—(4) Will a seventy-five-ampere fuse installed between the lightning switch and the aerial switch, affect the receiving range of a station?

Ans.—(4) No.

Ques.—(5) What is the wave-length of WCV, the Marconi station at Cape May, N. J.?

Ans.—(5) The standard wave-lengths of 300 and 600 meters are in use.

* * *

A. E., Covington, Ky., inquires:

Ques.—(1) What would be the most advantageous method of constructing an aerial to be erected between a 125-foot pole, 50 feet distant from a 15-foot pole, the latter mounted on the top of a 30-foot house, making the total height of 45 feet?

Ans.—(1) A flat top aerial comprising four wires spaced 2 or 3 feet apart, stretched from the top of the high mast to the mast atop of the house, the lead-ins being extended from the lower end to the apparatus, will give the best results.

* * *

H. E. W., Valley Station, Ky., inquires:

Ques.—(1) Could the apparatus described in the Third Prize article in the October, 1916. issue of THE WIRELESS AGE be employed to receive the time signals from Arlington? If so, what would be the dimensions of an aerial for use in connection with it and also what should be the resistance of the phones and the capacity of the fixed condenser?

Ans.—(1) This apparatus will not respond to the wave-lengths of Arlington without the addition of loading coil in the antenna circuit and a similar loading coil in the secondary circuit. The resistance of the telephones should be approximately 2,000 ohms and the fixed condenser should have a value of approximately .005 microfarad.

* * *

F. R. B., Omaha, Neb.:

By reference to page 108 of the November, 1916, issue of THE WIRELESS AGE, you will see that the natural wave-length of your aerial is slightly under 150 meters and the addition of the secondary winding of your oscillation transformer in series will not increase the wave-length beyond 200 meters. However, the capacity of the condenser in the closed circuit is excessive for this wave-length. You should cut out one section of the moulded condenser, thereby lowering the capacity to a value of .0085 microfarad. The primary winding of the oscillation transformer then requires no more than 1½ to 2½ turns to obtain the wave-length of 200 meters. In fact, we believe that the emitted wave of your station is close enough to 200 meters to escape complaint on the part of the Government Authorities.

* * *

A. P., Lawrence, Kas.:

The statement made in another publication that the secondary winding of the 3-inch spark coil should have 1½ pounds of No. 30 enameled wire, is a typographical error. The actual secondary voltage of an induction coil depends upon the action of the vibrator as well as upon the over-all design of the windings and core. On this account, different manufacturers have cores of different dimensions for given spark lengths.

The 3-inch coil to which you make reference should have from one and one-half to two pounds of No. 36 enameled wire in the secondary winding. This should be divided up into either two or three units.

The average 3-inch spark coil consumes from sixty to eighty watts direct current.

The condenser of large capacity you desire can be constructed of two sheets of tin foil, 90 feet in length, 6 inches in width. These should be separated by a thin sheet of paraffin paper placed between the two sheets of tin foil and another sheet of paraffin paper placed on the outside. The entire unit is then rolled up in circular form and the connections are brought out from the iside and outside sheeting of tin foil to the binding posts.

* * *

C. W. L., Canton, Ohio:

Possibly you may be able to cut down the flickering of the lights caused by the operation of your transmitter by readjustment of the condenser capacity at the secondary winding or by placing a reactance coil in series with the primary winding. In some sets a reactance coil is placed in shunt to the telegraph key and a portion of the load is taken by the transformer at all times, but there is not enough current to cause the spark to discharge across the gap. When the sending key is closed, full value of current flows to the primary winding and the spark functions. Transformers equipped with a magnetic leakage gap give the least trouble in this respect.

* * *

V. V. V., Lodi, Cal.:

Presuming that you intend to use a vacuum valve detector in connection with your receiving tuner for 10,000 meters, the following dimensions are applicable: The primary winding may be 10 inches in length, 7 inches in diameter, wound with No. 24 S. S. C. wire. The secondary winding should be 6 inches in diameter, 6 inches in length, wound with about 830 turns of No. 36 S. S. C. wire.

* * *

W. A. A., Louisville, Ky.:

You should keep in mind the fact that a wireless telephone transmitter like that described in the May, 1916, issue of the Monthly Service Bulletin of the National Amateur Wireless Association requires a receiving set adjustable to the wave-lengths lying between 6,000 and 8,000 meters. That is to say, you could not connect a microphone in the oscillating circuits of the vacuum valve detector and expect to receive the signals on an ordinary tuner and crystalline detector, the probable wave-length adjustment of which is no more than 2,000 or 3,000 meters. In other words, after having constructed a wireless telephone transmitter according to the design given in that issue, a similar set should be installed at the receiving station. In fact, the same battery of vacuum valves can be employed for reception as well as transmission. A hissing sound in the head telephones does not indicate that oscillations are taking place at radio frequencies. It requires considerable experience on the part of the experimenter to properly adjust a circuit of this type.

* * *

G. A. S., Mobile, Ala.:

We have no information at hand concerning the origin of the peculiar undertone you have observed in the spark of the stations referred to.

For the handling of large powers, the rotary spark gap is preferred and is always employed where a 60 cycle source of current from a city power house is available.

The 3-element vacuum valves are not supplied to the amateur market since a recent court decision. Amplifier bulbs, however, can be purchased.

* * *

L. C. R., Marlette, Mich.:

The variometer inductance described in connection with the receiving set shown in the January issue of the National Amateur Wireless Association Monthly Service Bulletin was not intended to give a large increase in the wave-length of the antenna circuit. It merely gives a fineness of adjustment between the taps of the multi-point switch connected to the secondary winding. In fact, this variometer does not increase the wave-length of the antenna system more than 125 to 150 meters Hence, you can judge for yourself approximately the dimensions of an ordinary loading coil to take its place.

* * *

J. J., Brooklyn, N. Y., inquires:

Ques.—(1) How can I construct a compact and neat fixed resistance of 1,800 ohms for the Perikon detector circuit as described on page 79 of the second edition of the book "How to Conduct a Radio Club"?

Ans.—(1) You might take a spool of No. 36 German silver wire and wind it non-inductively on a wooden core to the correct value, or you might purchase from an electrical supply house a graphite resistance rod, having approximately this value of resistance. This may be mounted on a spring clip base, such as supplied by the Marconi Company for use in its sets in the marine service.

Ques.—(2) What is the correct value of battery voltage necessary to operate this detector successfully?

Ans.—(2) Generally a single dry cell is all that is required.

Ques.—(3) What is the natural wave-length of a four-wire aerial, 60 feet in length, with an average height of 40 feet? The lead-in is 35 feet in length.

Ans.—(3) The natural wave-length is approximately 130 meters.

Ques.—(4) Please give the dimensions of an inductively-coupled transformer to be substituted for the auto transformer in a single step amplifier described on page 86 of the second edition of the book "How to Conduct a Radio Club."

Ans.—(4) The primary winding may have approximately 3½ pounds of No. 34 S. S. C. wire, which is covered with a sheet of Empire cloth, and the secondary winding may have about 4½ pounds of No. 36 S. S. C. wire.

Step-up transformers of this type can be purchased from the Manhattan Electrical Supply Company, Park Place, New York City.

* * *

J. R., Washington, D. C.:

A gas igniting coil is of no value whatever as a loading coil in the antenna circuit of a receiving set, due to the high self-inductance of the winding and the presence of the iron core.

Your aerial, 70 feet in length, 60 feet in height, has a fundamental wave-length of approximately 150 meters, and the receiving set you describe in your third query has a possible wave-length adjustment of about 3,000 meters and should permit a night range of at least 1,000 miles.

A 1½-inch spark coil connected to your transmitting aerial should give you a range of from three to ten miles in daylight.

We do not understand how you propose to operate a rotary spark gap in connection with an induction coil.

J. R. H., Winnipeg, Man., inquires:

Ques.—(1) I have constructed a receiving set like that described in Figure 70 in the second edition of "How to Conduct a Radio Club" and should like to know whether this tuner could be used for the reception of undamped waves, if loading coils of proper dimensions were constructed?

Ans.—(1) The loading coils described for the long distance receiving set on page 92 of the same publication have approximately correct dimensions for use in connection with this coupler. For waves of 10,000 meters the dimensions of both loading coils should be slightly increased.

* * *

P. E. H., Barberton, O.:

The fundamental wave-length of your aerial, described in your first query, is about 240 meters and is may be reduced to the wave-length of 200 meters by attaching the lead-in wires of the aerial to the center of the flat top or by constructing a short wave condenser of two plates of glass, 12 inches by 12 inches, covered with tin-foil, 10 inches by 10 inches. These plates should be connected in series and then in series with the antenna circuit. The better method for raising the wave-length of the antenna circuit to 600 meters is to purchase a wave-meter and to add inductance in the antenna circuit until a wave-length of 600 meters is indicated.

You will not be able to use the full power consumption of your Blitzen transformer at the wave-length of 200 meters and you should use no more than five sections of the moulded condenser. The antenna current will lie somewhere between two asd three amperes.

* * *

H. H. Sayre, Pa., inquires:

Ques.—(1) Referring to the description of a heterodyne receiving apparatus described in the February Monthly Service Bulletin of the National Amateur Wireless Association, can coils Nos. 1, 5, 8 and 10 be made of bunched windings instead of drum windings without lowering the efficiency of the apparatus?

Ans.—(1) The drum windings are preferred. Several experimenters report good results with multi-layered windings, the adjacent coils being separated by about ¼ or ½ an inch. Windings have been made up of three or four concentric coils and a very great value of inductance obtained in a minimum of space. Concerning the degree of efficiency with this winding, we have no definite data and cannot reply.

Regarding your second query: This apparatus can be mounted in a receiving cabinet provided the precaution is taken to keep the high potential ends of the coils at a distance from one another. Also place the aerial tuning inductance at right angles to the primary winding and the loading inductance in the secondary winding at right angles to the secondary proper.

Coils 3, 5, 6, 7, 11 and 12 may be fitted with multi-point switches, if desired, and the number of taps taken may vary according to the discretion of the builder. Generally for the longer range of wave-lengths a large value of inductance can be selected in all circuits and the necessary change of wave-lengths effected by means of the variable condensers only.

* * *

F. N. W., Jr., Elyria, Ohio:

Whether or not the aerial you have described will fulfil your requirements depends upon the radio stations from which you desire to receive signals. You of course understand that aerials 600 or 700 feet in length cannot be used for the reception of signals from amateur stations at the wave-length of 200 meters, but are particularly suitable for wave-lengths on the order of several thousand meters. Offhand we see no advantage in constructing an aerial after the designs you have given; in fact, if you will take careful note of your diagram you will observe that the loops of wire attached to the galvanized iron span wire are more or less non-inductive. At any rate, unless you desire to receive signals from stations at the wave-length of 6,000 or 8,000 meters, an aerial of the dimensions you have given is not necessary.

* * *

G. E. W., Kansas City, Mo.:

The troubles you experience in the lighting circuit of your house are due to electrostatic induction from the wireless aerial and the only remedy we know of is to place this aerial at right angles to the power wires or place the power wires in conduit under ground. Some part of the aerial system must be in very close inductive relation to your power circuits to cause a puncture of the insulation in the primary winding of the transformer, and the trouble can only be remedied by removing the aerial to a distance or by removal of the lighting circuit.

* * *

J. A. W., Jr., inquires:

Ques.—(1) Why does a synchronous rotary spark gap give a higher discharge frequency than that obtainable from the frequency of the current source of supply?

Ans.—(1) Because the speed of the disc and the number of electrodes is such that the charge placed in the condenser by each alternation of the charging current is discharged from two to four times per alternation depending upon the number of discharge paths presented by the disc per alternation of current.

Ques.—(2) Using the formula $C = \frac{W}{NV^2}$ I find that the required capacity for my condenser is .006 microfarad, with a transformer having a secondary voltage of 13,200 volts. Is this value correct?

Ans.—(2) This is about the correct value and should give very good results on 200 meters. The formula is only approximate, but is sufficiently accurate for preliminary determinations in any circuit.

Ques.—(3) Would four sections of Murdock moulded condenser connected in parallel withstand the voltage of this transformer?

Ans.—(3) Yes.

Ques.—(4) Where can I procure diagrams of systems using undamped waves?

Ans.—(4) Such systems are described in previous issues of the proceedings of the Institute of Radio Engineers, copies of which can be obtained from the Secretary, No. 111 Broadway, New York City.

Ques.—(5) Is there a transformer on the market by which sixty cycles alternating current can be stepped up to 500 cycles A. C.?

Ans.—(5) No such transformer exists.

* * *

S. B., Liberal, Kan., inquires:

Ques.—(1) I have an inductively coupled receiving tuner with a primary winding 4 inches outside diameter, wound with No. 24 S. C. C. wire. The secondary winding is 5½ inches in length, 3½ inches outside diameter, wound with No. 32 S. C. C. wire. It is 5 inches in length. What is the upper range of wave-length adjustment approximately?

Ans.—(1) The upper range of wave-length adjustment is about 3,000 meters.

Ques.—(2) Approximately what is the wave-length of an aerial comprising two wires, 150 feet in length, with an average height of about 35 feet? The lead-in is 25 feet in length.

Ans.—(2) About 270 meters.

Ques.—(3) Can you estimate my receiving range with an electrolytic detector, galena and silicon crystals, with the necessary associated appliances?

Ans.—(3) At nighttime you should hear commercial stations on the Atlantic Coast and in the Great Lakes District during the favorable months of the year.

Ques.—(4) Which is the more sensitive, fused silicon or crystal silicon?

Ans.—(4) Practically equal results are obtained with either grade.

Ques.—(5) With which of the receiving detectors could I obtain the best long distance results?

Ans.—(5) With the vacuum valve.

* * *

L. W., Portaupeck, N. J.:

The dimensions for a loading coil of a 10,000 meter receiving transformer cannot be furnished unless the inductance and capacity of the antenna with which it is to be employed is definitely known. There is no such thing as a 2,000-meter loading coil, because the actual effect on the wave-length of an antenna by the insertion of a given amount of inductance depends upon the capacity and inductance of the aerial system. The dimensions for a transformer of about the capacity you desire are given in the December, 1916, issue of THE WIRELESS AGE.

The receiving condenser to which you refer should have a total of 144 square inches of foil on one side and a dielectric medium of thin paraffin paper. This will give a capacitance of close to .01 microfarad.

C. W. B., Anaheim, Cal., inquires:

Ques.—(1) Why do so many commercial ship stations employ the carborundum detector exclusively?

Ans.—(1) Because it is the most practical of all crystalline detectors for commercial working due to its inherent stability and ease of adjustment.

Ques.—(2) Why are certain call letters listed in the Government Call Book with the corresponding ship's name missing?

Ans.—(2) These letters are reserved for ships under construction and since, according to the International Convention, a certain number of reservations are made for each country the permissible call letters are inserted in the Call Book and when they have been assigned to a definite vessel the owner of the book can fill in the blank space.

M. W. C., Jr., Hoboken, N. J.:

The fact that you are only fourteen years of age would not prevent your securing an amateur station license, providing you can pass the necessary Government examinations. We cannot quote the possible wave-length adjustment of your receiving apparatus without knowing the dimensions of the antenna with which it is to be employed. If you can furnish us with this data we can give you an approximate calculation.

From and For Those Who Help Themselves

(Continued from page 282.)

E should be carefully adjusted so that it makes good contact with D.

The action of the gap is as follows: Current from the condenser passes through E and G to the copper gasket, D (Figure 2), which connects all the revolving electrodes together and jumps from the moving point as they pass the single stationary electrode, D (Figure 1).

This type of spark gap can be used with transformers of almost any voltage. In the case of a low voltage transformer, the advantage lies in the short single gap obtained; with higher voltages a spark having the characteristic of both the rotary and quenched gap is secured by connecting a quenched gap of suitable dimensions in series with the rotary gap.

During the first tests of this gap many amateurs inquired as to the manner in which the spark note had been improved. The fact that an overland distance of 425 miles has been covered on several occasions with an aerial less than 60 feet in height and a transformer input of only ½ k. w., testifies to its efficiency.

BYRON B. MINNIUM, *Pennsylvania.*