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No. 698.

RADIO COMMUNICATION.

MAY 2 (calendar day May 6), 1912.—Ordered to be printed.

Mr. BOURNE, from the Committee on Commerce, submitted the following

R E P O R T .

[To accompany S. 6412.]

The Committee on Commerce, to whom was referred Senate bills 3620, 5334, and 5630, to regulate radio communication, having considered same, deemed it best not to report any of said bills but to draft and introduce a new bill (S. 6412), which the committee recommends do pass.

The main facts about the nature of radio communication and the outline of its history since 1895, when Marconi employed its principles in the successful transmission of messages a distance of 2 miles, are known generally to the Senate. The general purposes and principles of the pending bill are probably even better known. The elementary scientific facts which must be considered are briefly as follows:

In this system of communication electrical energy, converted into dots and dashes, is transmitted through the ether in waves which travel with the rapidity of light. These waves travel with equal force in all directions from the center or sending station just as ripples extend equally in all directions on the surface of a pond into which a pebble has been dropped. Thus far science has not devised a satisfactory method of forcing the energy in one given direction to the exclusion of all other directions. Consequently when several radio stations are working simultaneously each sends out its waves instantly in all directions, and instantly the waves of one station may come into contact with the waves of another. The situation presents no particular difficulties to the senders of the messages, but the various listening or receiving stations each may receive a confused blur of dots and dashes of varying clearness, and instead of a distinct intelligible message, each auditor may receive composite unintelligible messages of all or nearly all the dots and dashes composing the several messages. The cause is technically known as "interference." It can, of course, be created willfully by sending operators who begin to put out their messages, when with the receiver at the ear they know another operator is at work.

The principal means of preventing interference is through the use of varying wave lengths. The range of a station is determined in part by the electrical energy, expressed in kilowatts, and in part by the height of the aerial, while the wave length is determined by the adjustment of the apparatus, changeable at will within limits determined by the power. Subject to qualifications, a station sending a message for example on a 300-meter wave length, will not interfere with the hearing of another message by another station using a 600-wave length. The assignment of various wave lengths for various purposes runs throughout this bill. Interference can be caused by imperfect apparatus, which has not yet been brought up to the standards of efficiency thus far devised by science, even when different wave lengths are used, unless such wave lengths are purely and sharply defined. Unquestionably, in time, invention will carry the art to a high degree of perfection, but in the meantime it is incumbent upon Congress to secure for the present use of the people of the United States the advantages of radio communication, as far as developed.

HISTORY OF LEGISLATION.

The regulation of radio communication has been before the Senate for over two years in the form of legislation and for a longer period it was before the Committee on Foreign Relations in the Berlin Radiotelegraphic Convention of 1906. The Senate ratified that convention on April 3 of the current year and it is now referred to only in so far as the pending bill is designed to give effect to its provisions, particularly to carry out the obligation in the nineteenth article by which the United States with other high contracting parties is bound to take the necessary measures for insuring the execution of the convention, and in so far as the measure supplements and extends the provisions of the treaty.

A bill to regulate radio communication (S. 7243, 61st Cong., 2d sess.) was introduced on March 17, 1910, and after hearings before this committee on April 28, 1910, which have been printed, the measure was favorably reported and passed the Senate on June 16, 1910. That measure known as the Depew bill was recommended by the several departments particularly concerned, the Treasury Department, War Department, Navy Department, and Department of Commerce and Labor, but it was not acted upon by the House of Representatives although a similar House bill was favorably reported April 1, 1910. Its general features have been followed in the pending bill, particularly the first section, which defines the scope of the measure within the clause of the Constitution prescribing that Congress shall have the power "to regulate commerce with foreign nations, and among the several States," the provisions for the license of all stations and all operators (secs. 1, 2, and 3), the definition of radio communication (sec. 6), the prohibition under penalty of false or fraudulent distress calls, etc., (sec. 7), the application to foreign ships (sec. 8), and (sec. 9), providing for jurisdiction.

The pending bill in its original form (S. 3620), following almost identically the measure already referred to was introduced on December 11, 1911, and referred to a subcommittee, consisting of Senator Bourne, chairman, and Senators William Alden Smith, Burton, Simmons, and Fletcher. The subcommittee gave extended

hearings to all concerned, including officers of the departments, the scientific, legal, and commercial advisers and representatives of corporations engaged in the business of radio communication and representatives of amateur associations. The subcommittee became convinced that the bill bestowed too great powers upon the departments of Government and gave too great privileges to military and naval stations, while it did not accurately define the limitations and conditions under which commercial enterprises could be conducted. Accordingly a substitute bill (S. 5334) was introduced in behalf of the subcommittee on February 15, 1912. The subcommittee on March 1, 1912, devoted the entire day to a second hearing of all those concerned and extended to all the privilege of filing briefs. This hearing and the papers submitted have been printed. Beside this hearing the members of the subcommittee individually and as a subcommittee have consulted those able to furnish any information. The bill as reported accordingly represents the deliberate judgment of the committee after affording all concerned the opportunity to present their views orally and in writing.

The measure is the committee's effort to reconcile so far as practicable conflicting interests and in the main this effort, it is believed, has been successful. Where the conflict was irreconcilable the committee has shaped the bill so that it should insure to the people of the United States a complete and satisfactory wireless system on all our coasts free so far as possible from interruption and available for the public service 24 hours a day every day in the year.

DEFINITE POWERS AND OBLIGATIONS.

This bill differs radically in its method of regulation from the earlier measures and establishes a principle which it is believed can be followed with advantage to all concerned in legislation on other subjects. At all events the committee is determined that legislation for the regulation of radio communication at the outset shall be based upon what its members believe to be sound principle. The former bills delegated to the President of the United States in the first instance and subsequently to the Secretary of Commerce and Labor the power to make regulations governing radio communication which should have the force of law. That amounted practically, at least in the judgment of some members of this committee, to the surrender by Congress of its powers and the bestowal of legislative power to all intents and purposes upon administrative officers. This feature of former bills, for which there has been too frequently precedent in legislation, not only admitted of the arbitrary exercise of power but left those who should be subject to its exercise entirely in the dark as to what they could or could not do without thwarting the purpose of Congress. The committee is not unmindful of the fact that in the case of *Buttfield v. Stranahan* (192 U. S., 496) the Supreme Court held:

Congress legislated on the subject as far as was reasonably practicable, and from the necessities of the case was compelled to leave to executive officials the duty of bringing about the result pointed out by the statute.

There is always danger, however, that this decision may be invoked either for the purpose of seeking opportunity to exercise power unrestricted by the will and purpose of Congress or that it may be invoked

in behalf of hasty legislation. It is easy for administrative officers who are too indolent to frame for the consideration of Congress a statement of the precise purposes which they have in view, or who are not sufficiently informed as to the methods by which those purposes may be attained, to ask Congress to bestow upon them the general power of regulation. Congress is asked to act upon the spur of the moment while administrative officers reserve to themselves indefinite time in which to obtain the knowledge for intelligent action under the grant of arbitrary power. It is perhaps worth the consideration of the Senate that when the British Parliament bestows such general powers of regulation the bestowal is frequently accompanied by the statutory requirement that such regulations must be laid before Parliament for a reasonable time before taking effect.

The committee hastens to say, however, that it does not believe that in this matter of the regulation of radio communication any such motives inspired or were contemplated by the departments which have joined in recommending the passage of the bill. The subject matter is one involving considerable scientific knowledge, and the regulations necessarily must in part be expressed in scientific terms which would not be understood by many Senators or Representatives in Congress without long explanation almost impossible in terms ordinarily intelligible. We refer particularly to the third and fourth regulations at pages 6 and 7.

COMPULSORY INTERCHANGE.

The first step toward the regulation of radio communication was taken to endeavor to forestall an effort on the part of the allied companies operating under the Marconi patents to obtain a world-wide monopoly in the use of radio communication. These companies sought to make exclusive contracts with foreign Governments—and to an extent succeeded—that Marconi apparatus and operators should be exclusively employed for purposes of government. They also obtained an exclusive contract with Lloyd's maritime reporting stations throughout the world which keep British shipowners, marine insurance companies, and other associations and individuals interested in shipping in touch with the happenings of the sea. Besides these contracts the Marconi companies established the rule that their operators and apparatus must not communicate with stations using any other of the several systems at that time fairly well developed. No one nation could meet the extraordinary situation thus threatened, and a preliminary international conference was accordingly called at Berlin in 1903 in which the United States participated. This preliminary conference was followed by a second conference at Berlin in 1906, which framed the convention ratified by the Senate on April 3, 1912. In the framing of that international convention the delegates of the United States took an important part. One of the foundation principles of regulated radio communication is found in article 3 of the Berlin convention, which reads:

The coastal stations and the stations on shipboard shall be bound to exchange wireless telegrams without distinction of the wireless-telegraph system adopted by such stations.

The delegates of the United States insisted upon an even more rigid regulation, to be found in article 1 of the supplementary agree-

ment which has been accepted by some, though not all, nations. It reads as follows:

Each station on shipboard referred to in article 1 of the convention shall be bound to correspond with any other station on shipboard without distinction of the wireless telegraph system adopted by such stations, respectively.

In section 2 of the wireless ship act of June 24, 1910, Congress affirmed this principle as far as at the time was practicable in these words:

That for the purpose of this act apparatus for radio communication shall not be deemed to be efficient unless the company installing it shall contract in writing to exchange, and shall, in fact, exchange, as far as may be physically practicable, to be determined by the master of the vessel, messages with shore or ship stations using other systems of radio communication.

The eleventh regulation (p. 8 of the pending bill) establishes the principle in the most comprehensive form. The committee recognizes that there is room for difference of opinion as to the necessity of the obligation that one shore station shall be bound to exchange messages with another shore station without distinction of system, but on the whole it has been disposed to believe that the fullest enunciation of the principle will be for the general good. It will be noted that the eleventh regulation does not apply to stations used exclusively in scientific experiments, nor, of course, does it apply to amateur stations. Frequency in communication is not to be encouraged there. The regulation also does not apply in the few cases where companies have established stations exclusively for the transaction of their own business, such as the ship and shore stations of some vessels in the fruit trade, which are maintained almost exclusively for the purpose of directing ships owned by one company where and when to proceed to load and unload. The regulation does apply to all ship stations and to any Government station or any shore station which undertakes to carry on general public business or is, so to speak, a common carrier.

DISTRESS CALLS.

Radio communication has already demonstrated its value as an agency for promoting the security of life and property at sea, and under proper supervision and regulation that value can be greatly increased. The most important purpose of this bill is to regulate that agency so as to attain that end so far as the committee by past experience has been able to judge situations which have arisen and provide for situations which may arise calling for its use.

The fifth, sixth, seventh, eighth, and ninth regulations on pages 7 and 8 relate exclusively to distress signals. Of these the most comprehensive is the ninth regulation, reading:

All stations are required to give absolute priority to signals and radiograms relating to ships in distress; to cease sending on hearing a distress signal; and, except when engaged in answering or aiding the ship in distress, to refrain from sending until all signals and radio grams relating thereto are completed.

This regulation is absolutely binding on all kinds of stations afloat and ashore, which are described in another paragraph of this report (p. 6). It is enforceable under the penalties prescribed on page 13, including the fifth section, and also on page 4, lines 14 to 18. This regulation also gives effect to and reinforces under penalties article 9 of the Berlin convention, and service Regulation

XVI attached to that convention. The committee, however, has thought best not to include in the bill the closing paragraph of service Regulation XVI, which reads:

In case the ship in distress adds at the end of the series of her calls the call letters of a particular station the answer to the call shall be incumbent upon that station alone. If the call for assistance does not specify any particular station, every station perceiving such call shall be bound to answer it.

The fifth regulation provides that the apparatus on shipboard shall be so adjusted that the distress call may be sent out with a wave length of approximately 300 meters. The purpose of this section is to provide a uniform wave length to which the operators on other ships from time to time may adjust their apparatus with the knowledge that on that wave length distress calls will usually be sent. The wave length of 300 meters is the usual wave length of the apparatus now in use on the great majority of foreign ships, so that an operator sending out a distress call on the 300-meter wave length has the assurance that his call will be received by the greatest number of other ships within reach. Thus far most American ships have no standard distress-wave length. It is as necessary to have some such generally accepted standard wave length for the distress signal as it is to have a distinctive call itself. It is, of course, possible that in view of the improvement of apparatus the coming London International Radiotelegraphic Conference may provide that at some time in the future a longer wave length shall be the standard for the distress call of ships of all nations, and in that event it will, of course, be necessary for Congress to readjust our system to the international system which may hereafter be prescribed. The regulation is obligatory upon all vessels except those of very small tonnage, such as harbor tugs equipped with apparatus of short range directing them where and when to report to tow a vessel into port, etc.

The sixth regulation (taken from Berlin service Regulation XVI) puts into the statute the international signal of distress—3 dots, 3 dashes, 3 dots—which signify the letters S O S in Continental Morse. The Berlin Radiotelegraphic Convention prescribes the use of the Morse International Code or "Continental Morse," is it is known to operators in this country, as distinguished from American Morse.

The combinations of dots and dashes for 11 letters in the Continental Morse differ from the American Morse. In the opinion of experts the Continental Morse is more accurate than the American Morse because in shaping some of the letters of the alphabet the American Morse prescribes long spaces and short spaces between the dots and dashes. The difference in time between a long space and a short space will vary with the "personal equation" of both the sending and the receiving operator and leads to confusion, so that while American Morse seems to be somewhat more rapid the best opinion is that it is less trustworthy, especially at critical moments. The dots and dashes indicating numerals, important in fixing latitude and longitude, differ radically. For obvious reasons the recognition of Continental Morse, used by the world's shipping, is a necessity for us.

The seventh regulation provides that in sending out distress calls an operator may adjust his instrument so as to create the maximum of interference, and thus attract the attention of the largest possible number of listening operators on other ships or ashore. The reasons for this regulation are patent.

The eighth regulation prescribes that the apparatus on all ships shall be capable of sending distress calls which may be received by day (when ordinarily the range is materially less than by night) over a distance of at least 100 nautical miles. The act of June 24, 1910, already prescribes that apparatus on ocean passenger steamers must be capable of transmitting and receiving messages over a distance of at least 100 miles night or day. In the case of such ships, accordingly, the regulation merely affirms existing law. There are, however, other American vessels equipped with apparatus, but not subject to the law, such as yachts and occasional cargo boats. This regulation will bring the apparatus on such vessels in this respect up to the standard of the statute of 1910. The committee does not regard this as a hardship; it can foresee the time after the number of trained operators has sufficiently increased and the voluntary use of radio apparatus shall be more general when the laws of the United States and other nations will extend the statutory obligation to carry such apparatus and operators.

SCIENTIFIC PROGRESS.

The claim has been made that any precise regulation of radio communication, in view of the undeveloped stage of the art, will necessarily retard the progress of science and diminish the usefulness to mankind of the invention. The same claim was made before the Berlin conference and rejected, and in rejecting it this committee has taken the same action which other legislative bodies, after examination, have taken. The development of the art has been at least as rapid abroad under the Berlin convention as it has been in the United States, where there have been thus far no regulations whatever. The history of the objection shows that in effect it is raised to the principle of any regulation whatever and with almost equal force to any particular form of regulation. The need of regulation being conceded, as it must be, the objection of course has to be dismissed. The bill, however, is drawn to allow ample opportunity for every form of improvement by which new inventions may be used without interfering with others. At page 5, lines 15 to 18, the Secretary of Commerce and Labor is given authority to waive any or all of the regulations when no interference will ensue. These lines are not a departure from the principle of the bill which fixes maximum requirements. They simply bestow the power to reduce the requirements to meet progress in the art. For the same purpose the paragraph beginning at page 5, line 19, gives the Secretary of Commerce and Labor the power to grant special licenses for scientific experiments on condition that those experiments shall be so conducted as not to impair radio communication for ordinary purposes. Many experiments may be conducted in the laboratory, and in the few instances where the actual use of the ether may be necessary this paragraph authorizes that privilege under proper restrictions.

The term "radio communication," instead of "radio telegraphy," is used throughout the bill so that its provisions will cover the possibility of the commercial development of radio telephony. (Sec. 6, p. 14.) Experiments have been made here and abroad for some years in carrying the human voice on Hertzian waves, but with only limited and occasional results. Radio telephony involves the application of the same principles as are involved in inventions to enable apparatus

to select and record accurately one message on a given wave length out of a mass of messages on various lengths. When this latter result has been attained—an unfulfilled promise of some years standing—radio telephony will quickly follow. The bill is framed to be adjustable to that improvement when it comes, but in the meantime it deals with the art as it exists to-day.

KINDS OF RADIO STATIONS.

Radio stations may be divided according to the general nature of their operations into the following divisions and subdivisions:

I. Ship stations:

- A. Merchant vessels and yachts—
 1. American.
 2. Foreign.
- B. Government vessels—
 1. Naval vessels.
 2. Army transports, cable ships, and harbor tugs.
 3. Revenue cutters.
 4. Light ships.
 5. Miscellaneous (Coast and Geodetic Survey, Fisheries, etc.).

II. Shore stations:

- A. Commercial—
 1. Public service.
 2. Special service.
- B. Scientific experimental.
- C. Amateur.
- D. Government—
 1. Naval, some of which also do commercial business gratis.
 2. Seacoast defenses.
 3. Interior Army posts, including Alaska stations doing also commercial business for pay.

COMPLETE AND CONTINUOUS SEACOAST SYSTEM.

The eighteenth regulation (pp. 11 and 12) will secure for the United States a complete chain of radio stations on all its coasts at suitable intervals open for the receipt and transmission of radiograms at all hours of the day and night throughout the entire year. With the appropriations of Congress, the Navy Department has already established a chain of 45 stations, at intervals of 200 miles or thereabouts, along our coast with apparatus and operators, which it is the constant aim of that department to improve. In addition to these stations, is a considerable number of coast stations established by private enterprises for the transaction of commercial business. These stations are of various degrees of efficiency and are open for varying periods during the day or night, and in some instances are manned for continuous service during 24 hours. The bill interferes in no way with the transaction of business by such commercial stations, but it does provide at page 12, lines 5-21, that wherever and whenever such commercial stations are not prepared at all hours of the day or night to receive and transmit messages, then the naval stations shall conduct commercial business. Congress has appropriated money to pay for these naval stations and to pay the salaries of their operators as a defensive measure in time of war, but the committee believes that the people of the United States are entitled to a larger and more frequent use of these stations and to some return for the large investment which they have made in them. The committee is equally firm in its

belief that the Government should not conduct any form of commercial activity which is satisfactorily conducted by private enterprises. The regulation mentioned is consistent with both of these principles of legislative action. From the necessities of the case at several places, notably Key West, the naval stations already conduct commercial business in the absence of commercial shore stations, but Congress has not hitherto given to the Navy Department the authority to make a fair charge for the service thus rendered. The bill empowers the Secretary of the Navy to fix rates for such service by naval stations, subject to the control of Congress, and directs that the receipts shall be covered into the Treasury as miscellaneous receipts.

From this general system the bill departs in the case of several special naval stations named at page 11. These stations are at Arlington, Va., in fact at the National Capital; and the center of naval direction by radio communication, at Key West, Fla., and San Juan, P. R., important strategic points on the Atlantic coast; and on the Pacific coast at North Head, at the mouth of the Columbia River, and Tatoosh Island, close to the northwest frontier, whence communication is maintained with Alaska: and at San Diego, Cal., on the Mexican boundary. At all of these points commercial stations not in actual operation at the date of the passage of the act are not hereafter to be licensed. The same rule is established for Alaska, where communication is now maintained effectively throughout the interior by military stations of the Signal Corps of the Army and by Army and Navy stations on the seaboard. For obvious reasons the same rule is made for the Canal Zone. At these points it is made the duty of the Secretary of War and the Secretary of the Navy, respectively, to provide for the conduct of commercial business in accord with the prescriptions of the Berlin convention.

The committee has felt that it was the more incumbent upon it to provide a series of shore stations open continuously during 24 hours, if necessary at Government expense, because it has just reported a bill requiring ocean steamships to carry two operators, so that such ships may have a continuous service at all hours of the day or night.

RESERVATION OF WAVE LENGTHS.

The first and second regulations, for convenience, may be considered together. Every station is required to designate a definite wave length. This regulation is more important than the designation of each station by its individual call letters. The fact that a station on ship or shore is prepared to transact business on a given wave length will be communicated to all concerned in the United States by the list of stations provided for on page 2, at lines 14 to 17, and page 3, lines 14 to 17, and for the information of the world at large is now provided for in the publications of the radiotelegraphic service of the International Bureau of the Telegraphic Union at Berne, which issues periodically a list of the world's radiotelegraphic stations afloat and ashore. The wave length to be designated, however, shall not exceed 600 wave meters, which is the maximum wave length ordinarily used for communication between ships and between ships and the shore. It may, however, exceed 1,600 meters, in practice extending to 6,600 meters, within which range are the wave lengths used for sending trans-Atlantic messages from Clifden, Ireland (4,500), to Glace Bay,

Nova Scotia, or from Poldhu, Wales, or South Wellfleet, Cape Cod, respectively, to ships halfway across the Atlantic.

The intervening wave lengths from 600 to 1,600 meters are reserved for stations of the Government. This reservation, prescribed in service Regulation II of the Berlin convention, was the unanimous agreement of foreign nations. It rests on the fact that the wider the range reserved for the Government the more chance Government installations have, not only to increase the number of communications between its units in a given area, but to avoid commercial interference by choosing wave lengths far removed from those being used by neighboring commercial installations. At present the Navy standard calling wave length is 1,000 meters, which is practically in the middle of the Government's range. It is a little nearer 600 than 1,600, because it is easier to cut out a short wave than a long wave. In other words, a ship of the Navy at a given place would need only 400 meters difference of wave length to cut out an interfering commercial message near the lower half of the Navy's reservation of wave lengths and might need 600 meters to cut out such a message if the interfering signal were sent on a long wave. The ability of Government stations to use wave lengths far removed from those in use by commercial stations protects mutually both classes of stations from each other and the advantage is equal.

PURE AND SHARP WAVES.

The first service regulation of the Berlin convention prescribes that apparatus on ship or shore "shall, as far as possible, keep pace with scientific and technical progress." This generalization the third and fourth regulations of the bill (pp. 6-7) reduce to precise form, so that a Government inspector by test instruments can decide at once whether the apparatus is up to standard. Modern apparatus does comply with the requirements proposed, and all the companies using such apparatus favor the regulation. It is opposed by the owners of obsolete or imperfect apparatus. This inferior apparatus now interrupts the workings of modern apparatus, and impairs the usefulness of the country's general system of radio communication. In principle these two regulations are similar to the automatic-coupler section of the railroad safety appliance act of March 2, 1893, safety to life being the basis of the pending measure. An outlay of about \$25 a set will bring old apparatus up to the standards fixed by these regulations.

The subcommittee hearings contain diagrams at pages 43 and 44 illustrating the imperfections which the third regulation will correct, and at page 45 an illustration of the result to be effected by the two regulations. A sending station ought to send out its messages on a given wave length, which will be received by the desired station, adjusted to listen on that wave length. An ordinary apparatus in this country, however, sends out messages simultaneously not only on its appropriate wave length, say 600 meters, but also on a band of wave lengths above and below that standard. The appropriate wave length alone performs the desired purpose; the other wave lengths interfere with the hearing of other messages by other stations from other stations.

Those acquainted with music will recall that when a given note is struck and prolonged on the piano or violin the attentive ear catches simultaneously other faint higher notes, called "harmonics," though they sometimes produce discord. In a fine old violin age and usage have toned down the discordant so-called "harmonics," and the instrument responds to the artist's will to produce a given mellow note, while the cheap and harsh instrument produces that note with noisy overtones. The tuning fork has no "harmonics," while the harshness of the cymbals or triangle is caused by these higher discordant overtones. In radio communication the endeavor should be to send a message from one station to another as the rifle sends the bullet to the bull's-eye. One may imagine a man aiming at a target, with two or three rifles strapped loosely together at his shoulder, and firing them simultaneously. One bullet might hit the bull's-eye, but the other bullets certainly would not and probably would hit adjacent targets to the discomfort of both sportsmen and markers at those targets. The "pure wave" is a single bullet sent straight to the mark. To apply the figure to the "sharp wave," the difference between it and its opposite is like the difference between the rifle which sends through its grooves directly to the mark its accurately shaped bullet, and the smooth-bore shotgun scattering a charge of buckshot and slugs.

REDUCED POWER FOR SHIPS.

Separate wave lengths thus defined are not alone sufficient under all circumstances to prevent one radio station from virtually putting another station temporarily out of communication. A station sending out messages with small power in close proximity to a much larger and more important station may prevent that larger station from receiving messages at sea. The existing naval and military stations (as will be seen from the list of all shore stations in the United States in Appendix A) are established near all the important seaports.

The tenth regulation provides for the use of moderate energy on all ships when they are within 15 miles of important seaports and of still less energy when within 5 nautical miles of such port, exception being made in all cases of distress calls. The use of the words "naval or military station" is in fact descriptive of ports, and the regulation is designed to protect the radio communication of commercial stations at such ports as well as the business of the Government stations. Berlin Service Regulation VI (c) provides:

The power transmitted to the wireless-telegraph apparatus shall not, under normal conditions, exceed 1 kilowatt. Power exceeding 1 kilowatt may be employed when the vessel finds it necessary to correspond while more than 300 kilometers distant from the nearest coastal station or when, owing to obstructions, communication can be established only by means of an increase of power.

The tenth regulation, accordingly, is in harmony with the international convention, and at the same time protects the lines of communication through the ether between our principal seaports and ships at sea.

DIVISION OF TIME.

The twelfth and thirteenth regulations are one in effect, and provide that in the rare cases where other means of preventing interference do not suffice there shall be a division of time, the Government

stations being restricted to the first 15 minutes of each hour and commercial stations having the use of the remaining 45 minutes. The authority to make this division of time is delegated to the Secretary of Commerce and Labor, who, presumably, will be a fair arbiter between commercial interests and real or apparent military exigency.

Interference can not be prevented by using different wave lengths alone. The power used by the stations in sending and their relative distances from one another are factors. For example, two stations are trying to communicate with each other on a certain wave length. They can do so without interference from other pairs of stations trying to communicate with each other on other wave lengths differing by at least 10 per cent from that used by the first-mentioned stations except when other stations use high power in sending or send out signals when very close to one or both of the two stations first mentioned. The interference with the receiving of one station caused by the sending of another near-by station is the most common, and at all large cities where there are two or more stations operating for governmental or commercial purposes within a few miles of one another, a division of time is necessary. The interference can be avoided sometimes by a very great difference in wave length, sometimes by a difference of wave length and the use of low power by all stations concerned. Otherwise by a division of time. Examples of the necessity of a division of time are afforded by the experience of the navy yards at New York and Philadelphia. These have, within a few miles in each of the cities mentioned, radio apparatus on the department stores of John Wanamaker, and when these stations are communicating with each other on a wave length of about 1,400 meters neither New York nor Philadelphia can receive from ships of the Navy sending on 600 meters; that is, the near-by interfering stations force oscillations on the receiving aerials of the navy-yard stations, and the more powerful interfering signals drown out the signals desired. It should be noticed that this division of time may be established only when all other means for preventing interference fail. When interference-prevention devices are perfected, it will not be necessary to enforce this regulation.

UNNECESSARY POWER.

The fourteenth regulation, prescribing the use of the minimum amount of energy, carries out service Regulation XXVIII of the Berlin convention and requires no explanation.

The seventeenth regulation, embodying Berlin service Regulation XXX, provides that on ordinary business matters a ship shall communicate with the nearest shore station, thus securing the most economical use of nature's resources as thus far available through invention.

ADMINISTRATION.

The first three sections of the bill vest in the Secretary of Commerce and Labor the general administration of the act, as he is the officer already charged by Congress with the duty of administering the laws relating to shipping and foreign and domestic commerce. The system of licenses for stations and operators is similar to the system for

registering and licensing about 25,000 merchant vessels of the United States and licensing about 40,000 officers of steam vessels, both of which systems are now administered by the Secretary of Commerce and Labor. Like the laws which require the owners and officers of American vessels to be American citizens, this bill provides that the owners and operators of American radio stations shall owe allegiance to the United States. The administration of the fourth section, covering the main provisions of the Berlin convention and its service regulations, is also intrusted to the Secretary of Commerce and Labor, who administers now the law prescribing radio apparatus and operators on ocean steamships. The system of penalties for lesser infractions of the law, provided on page 13, lines 4-17, is similar to the system of penalties provided for violations of the navigation laws under the direction of the Secretary of Commerce and Labor. The bill also provides for the suspension or revocation of licenses of operators or stations for graver offenses. Malicious interference is made a misdemeanor punishable by fine or imprisonment or both (sec. 5, p. 13), and the crime of knowingly transmitting a fraudulent distress call is punishable by a fine of not over \$2,500 or imprisonment for not over five years or both. (Sec. 7, p. 14.)

The jurisdiction provided in section 9, page 15, is similar to the jurisdiction for the trial of offenses on the high seas provided at the beginning of our Government. (Act of Apr. 30, 1790, incorporated in sec. 730 of the Revised Statutes.)

FOREIGN SHIPS.

Foreign ships on the high seas are, broadly speaking, subject to the laws of their own Governments, respectively. Most of these Governments have ratified and carried into effect the Berlin Radiotelegraphic Convention. Service Regulation VII of that convention provides:

If the management of the wireless telegraph service of a country has knowledge of any infraction of the convention or of the regulations committed in any of the stations authorized by it, it shall ascertain the facts and fix the responsibility.

In the case of stations on shipboard, if the operator is responsible for such infraction, the management of the wireless telegraph service shall take the necessary measures and, if the necessity should arise, withdraw the certificate. If it is ascertained that the infraction is the result of the condition of the apparatus or of instructions given the operator, the same method shall be pursued with regard to the license issued to the vessel.

2. In cases of repeated infractions chargeable to the same vessel, if the representations made to the wireless telegraph management of the country to which the vessel is subject by that of another country remain without effect, the latter shall be at liberty after giving due notice, to authorize its coastal stations not to accept communications proceeding from the vessel at fault. In case of disagreement between the managements of the wireless telegraph service of two countries, the question shall be submitted to arbitration at the request of either of the two Governments at issue. The procedure in such case shall be the same as indicated in article 18 of the convention.

As each nation has thus assumed the duty of punishing its own offenders, it is necessary in the present bill to provide in the case of foreign ships within our jurisdiction only for the violation of a few of the regulations in section 4, based upon international requirements, but somewhat more rigid, such as the eighth regulation fixing the minimum range for ship's apparatus at 100 miles—in effect an amendment of the radio ship act of 1910, and the use of reduced power,

one-half kilowatt, within 5 miles of our principal seaports. For the utterance of fraudulent distress calls within our jurisdiction, foreign ships, of course, should be subject to the severe penalties of section 7, but such cases can scarcely arise. Section 8, on pages 14-15, applies the act to foreign ships within these limitations.

AMATEURS.

The bill requires all amateur operators and amateur stations, of which there are some thousands in the United States, to be licensed whenever they employ power for the transmission of messages which cross State lines or go beyond the territorial limits of the United States, or whenever the power they employ interferes with the hearing by a neighboring Government or commercial station of messages which have crossed State lines or come from the sea. The committee regrets the necessity for such a regulation for several reasons, but it can see no alternative. It is an indisputable fact that on many occasions amateurs have seriously interfered with important business messages and on some occasions they have been guilty, doubtless unwittingly, of interference with the transmission of messages relative to vessels in distress. The bill does not interfere in any way with the hearing of messages by amateurs at all times and places as they may elect. It does, however, require them to use electrical energy for the transmission of messages for their own entertainment in such a manner as not to interfere with the serious work of radio communication. The paragraph on page 5, line 15, providing "that the Secretary of Commerce and Labor may, in his discretion, waive the provisions of any or all of these regulations when no interference can ensue" will enable amateurs in the interior of the country where there are really no commercial stations to carry on their communication with one another with comparative freedom.

The fifteenth and sixteenth regulations (p. 10) relate exclusively to amateur stations and are applicable mainly along the seaboard. The fifteenth regulation restricts the power of amateurs to 1 kilowatt, which is the power allowed ordinarily to ships under the Berlin convention. Their stations are limited to wave lengths of 200 meters or less, the ordinary commercial wave length being 300 meters. The sixteenth regulation provides that at the principal seaports where there are naval or military stations the power to be used shall not exceed one-half kilowatt. Under this restriction amateurs may operate their stations within a city over a distance of about 5 miles and in the suburbs over about double that distance, while over the water a considerably greater distance may be covered. The Secretary of Commerce and Labor is vested with the authority to extend somewhat in deserving cases where no harm would ensue the power and wave length which may be used.

The committee expresses appreciation of the assistance rendered by Commissioner E. T. Chamberlain, of the Bureau of Navigation, in the Department of Commerce and Labor, and by Lieut. Commander D. W. Todd, of the Bureau of Steam Engineering, in the Department of the Navy, in the preparation of this report.

APPENDIX A.—List of wireless stations in the United States and possessions.

| Name and location of station. | Character of station. | Name and location of station. | Character of station. |
|---|--|--|-----------------------|
| UNITED STATES. | | UNITED STATES—continued. | |
| <i>Atlantic and Gulf coast.</i> | | <i>Atlantic and Gulf coast—Con.</i> | |
| Eastport, Me. | Commercial. | Frying Pan Shoals Lightship. | U. S. Navy. |
| Portland, Me. | U. S. Navy. | St. Augustine, Fla. | Do. |
| Fort Levitt, Me. | U. S. Army. | Jupiter, Fla. | Do. |
| Portsmouth, N. H. (navy yard). | U. S. Navy. | Jacksonville, Fla. | Commercial. |
| Amesbury, Mass. | Experimental (Pickard). | Knights Key, Fla. | Do. |
| Cambridge, Mass., Harvard University. | Experimental (Pierce). | Key West, Fla. (naval station). | U. S. Navy. |
| Fort Andrews, Mass. | U. S. Army. | Tampa, Fla. | Commercial. |
| Brant Rock, Mass. | Experimental (trans-Atlantic). | Fernandina, Fla. | Do. |
| Chatham, Mass. | Commercial. | Pensacola, Fla. (navy yard). | U. S. Navy. |
| Chelsea, Mass. | Experimental. | Mobile, Ala. | Commercial. |
| Boston, Mass.: Board of Trade. | Do. | Fort Morgan, Ala. | Do. |
| Navy yard. | U. S. Navy. | New Orleans, La. | Do. |
| Cape Cod, Mass. (2 stations): South Wellfleet. | Commercial (trans-Atlantic and local). | Naval station. | U. S. Navy. |
| Highland Light. | U. S. Navy. | United Fruit Co. | Private. |
| Siasconset, Mass. | Commercial. | Southwest Pass, La. (United Fruit Co.). | Do. |
| Quincy, Mass. | Do. | Grand Island, La. | Commercial. |
| Nantucket Shoals Lightship. | U. S. Navy. | Port Arthur, Tex. | Do. |
| Newport, R. I. (torpedo station). | Do. | Galveston, Tex. | Do. |
| Point Judith, R. I. | Commercial. | <i>Porto Rico.</i> | |
| Providence, R. I. | Do. | San Juan. | U. S. Navy. |
| Wilsons Point, Conn. | Do. | <i>Cuba.</i> | |
| New London, Conn. | Do. | Guantanamo. | U. S. Navy. |
| Sea Gate, N. Y. | Do. | <i>Panama.</i> | |
| Sagaponack, N. Y. | Do. | Colon (Canal Zone) | U. S. Navy. |
| Fire Island, N. Y. | U. S. Navy. | Porto Bello. | Do. |
| New York, N. Y. | Commercial. | Boca del Toro. | Commercial. |
| 111 Broadway. | Do. | <i>Pacific coast.</i> | |
| Hotel Plaza. | Do. | Tatoosh Island, Wash. | U. S. Navy. |
| Herald ship news office, the Battery. | Private. | Friday Harbor, Wash. | Commercial. |
| Wanamaker's. | Do. | Seattle, Wash. | Do. |
| 42 Broadway. | Commercial. | Seattle Gas Engine Machine Co. | Private. |
| New York. | Experimental. | University grounds. | Commercial. |
| Brooklyn, N. Y. (navy yard). | U. S. Navy. | Roche Harbor, Seattle Gas Engine Machine Co. | Private. |
| Coney Island, N. Y. | Commercial. | Port Townsend, Wash. | Commercial. |
| Fort H. G. Wright, N. Y. | U. S. Army. | Bremerton, Wash. (Puget Sound Navy Yard). | U. S. Navy. |
| Fort Totten, N. Y. | Do. | Tacoma, Wash. | Commercial. |
| Fort Wood, N. Y. | Do. | North Head, Wash. | U. S. Navy. |
| Fort Hancock, N. J. | Do. | Fort Worden, Wash. | U. S. Army. |
| Bayonne, N. J. | Commercial. | Astoria, Oreg. | Commercial. |
| Atlantic City, N. J. | Do. | Marshfield, Oreg. | Do. |
| Cape May, N. J. | Do. | Cape Blanco, Oreg. | U. S. Navy. |
| Camden, N. J. | Do. | Fort Stevens, Oreg. | U. S. Army. |
| Philadelphia, Pa. (2 stations): Bellevue-Stratford. | Do. | Eureka, Cal. | Commercial. |
| Navy yard. | U. S. Navy. | Do. | U. S. Navy. |
| Wanamaker's. | Private. | San Francisco, Cal. (2 stations). | Commercial. |
| Cape Henlopen, Del. | U. S. Navy. | The Presidio. | U. S. Army. |
| Sparrows Point, Md. | Experimental. | Yerba Buena Island (naval training station). | U. S. Navy. |
| Annapolis, Md. (Naval Academy). | U. S. Navy. | Vallejo, Cal. (Mare Island Navy Yard). | Do. |
| Washington, D. C. | Do. | Farallon Islands, Cal. | Do. |
| Capitol. | Experimental (El-Hott Woods). | San Luis Obispo, Cal. | Commercial. |
| Mills Building. | U. S. Army. | Point Arguello, Cal. | U. S. Navy. |
| Bureau of Standards. | Do. | Santa Barbara, Cal. (Hotel Potter). | Commercial. |
| Arlington, Va. | U. S. Navy. | Sacramento, Cal. | Do. |
| Tangier Island, Va. | Commercial. | Los Angeles, Cal. | Do. |
| Fort Monroe, Va. | U. S. Army. | Examiner. | Do. |
| Fort Monroe, Va. 1. | Do. | San Pedro, Cal. | Do. |
| Coast Artillery School. | Do. | Avalon, Catalina Island, Cal. (2 stations). | Do. |
| Norfolk, Va. | Commercial. | San Diego, Cal. | U. S. Navy. |
| Norfolk, Va. (navy yard).... | U. S. Navy. | | |
| Virginia Beach, Va. | Commercial. | | |
| Beaufort, N. C. | U. S. Navy. | | |
| Diamond Shoals Lightship. | Do. | | |
| Cape Hatteras, N. C. | Commercial. | | |
| Charleston, S. C. (navy yard). | U. S. Navy. | | |
| Savannah, Ga. | Commercial. | | |

1 Under construction.

APPENDIX A.—List of wireless stations in the United States and possessions—Continued.

| Name and location of station. | Character of station. | Name and location of station. | Character of station. |
|-------------------------------|-----------------------|--|-----------------------------|
| UNITED STATES—continued. | | UNITED STATES—continued. | |
| <i>Alaska.</i> | | <i>Philippine Islands—Contd.</i> | |
| Cordova..... | U. S. Navy. | Fort Wint..... | U. S. Army. |
| Dutch Harbor..... | Do. | Fort William McKinley..... | Do. |
| Unalga ¹ | Do. | <i>Great Lakes.</i> | |
| Pribilof Islands..... | Do. | Buffalo, N. Y..... | Commercial. |
| Kodiak..... | Do. | News Building..... | Do. |
| Sitka..... | Do. | Erie, Pa..... | Do. |
| Ketchikan..... | Commercial. | Ashtabula, Ohio..... | Do. |
| Juneau..... | Do. | Cleveland, Ohio (2 stations)..... | Do. |
| Nak Nek..... | Do. | Toledo, Ohio..... | Do. |
| Karluk..... | Do. | Detroit, Mich. (2 stations)..... | Do. |
| Kogginung..... | Do. | Detroit, Mich. (1 station)..... | Experimental. |
| Chignik..... | Do. | Detroit Journal..... | Commercial. |
| Nushagak..... | Do. | Port Huron, Mich..... | Do. |
| Clarks Point..... | Do. | Bay City, Mich..... | Do. |
| Circle City..... | U. S. Army. | Saginaw, Mich..... | Do. |
| Fort Egbert..... | Do. | Mackinac Island, Mich..... | Do. |
| Fairbanks..... | Do. | Harbor Beach, Mich..... | Do. |
| Fort Gibbon..... | Do. | Ludington, Mich..... | Do. |
| Kotlik..... | Do. | Isle Royal, Mich..... | Do. |
| Nome..... | Do. | Grand Haven, Mich..... | Do. |
| Nulato..... | Do. | Benton Harbor, Mich..... | Do. |
| Petersburg..... | Do. | Chicago, Ill..... | Do. |
| Fort St. Michael..... | Do. | Congress Hotel..... | Do. |
| Wrangell..... | Do. | Milwaukee, Wis. (2 stations)..... | Do. |
| <i>Hawaiian Islands.</i> | | Wapuca, Wis..... | Private and com mercial. |
| Honolulu..... | U. S. Navy. | Manitowoc, Wis..... | Commercial. |
| Nawaliwili, Kauai..... | Commercial. | Scandinavia, Wis..... | Private and com mercial. |
| Lahaina, Maui..... | Do. | Sault Ste. Marie, Mich. (2 stations)..... | Commercial. |
| Kawaikae..... | Do. | Marquette, Mich..... | Do. |
| Kuanakakai..... | Do. | Frankfort, Mich..... | Do. |
| <i>Guam.</i> | | Manistique, Mich..... | Do. |
| Guam..... | U. S. Navy. | Calumet, Mich..... | Do. |
| <i>Philippine Islands.</i> | | Duluth, Minn. (2 stations)..... | Do. |
| Cavite..... | U. S. Navy. | Grand Marais, Minn..... | Do. |
| Olongapo ² | Do. | <i>Interior.</i> | |
| Jolo..... | Insular government. | Fort Leavenworth, Kans..... | U. S. Army. |
| Zamboanga..... | Do. | Fort Riley, Kans..... | Do. |
| Malabang..... | Do. | Fort Omaha, Nebr..... | Do. |
| Manila..... | U. S. Army. | Fort Sam Houston, Tex..... | Do. |
| Corregidor Island..... | Do. | | |
| Fort Frank..... | Do. | | |
| Fort Drum..... | Do. | | |

¹ Projected.² Under construction.