

**INSTRUCTIONS**  
FOR THE  
**OPERATION, CARE, AND REPAIR**  
OF  
**RADIO PLANTS**

---

( Reprint of Chapter 31 of the Manual of Engineering Instructions )

---

NAVY DEPARTMENT  
BUREAU OF ENGINEERING



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1922

NAVY DEPARTMENT,  
BUREAU OF ENGINEERING,

*24 April, 1922.*

The following chapter (Chapter 31, Radio Plants) of the Manual of Engineering Instructions is for official use only. These instructions will become effective upon their receipt, and shall not be made known to persons not connected with the United States Navy. Anything contained in the Manual of Engineering Instructions in conflict with these changes is modified accordingly.

J. K. ROBISON,

*Engineer in Chief, United States Navy, Chief of Bureau.*

## CHAPTER 31.

### RADIO PLANTS.

Section I. General instructions—Articles 31-1 to 31-85, inclusive.

Part 1. Organization—Articles 31-1 to 31-26, inclusive.

Part 2. Shore communication stations—Articles 31-27 to 31-68, inclusive.

Part 3. Reports—Articles 31-69 to 31-85, inclusive.

Section II. Spark transmitters—Articles 31-100 to 31-228, inclusive.

Part 1. General—Articles 31-100 to 31-102, inclusive.

(A) The 500-cycle quenched-spark transmitter—Articles 31-103 to 31-149, inclusive.

Part 1. Theory—Articles 31-103 to 31-108, inclusive.

Part 2. Description—Articles 31-112 to 31-125, inclusive.

Part 3. Operation—Articles 31-129 to 31-133, inclusive.

Part 4. Installation—Article 31-136.

Part 5. Care and upkeep—Articles 31-138 to 31-149, inclusive.

(B) Auxiliary spark transmitters—Articles 31-150 to 31-186, inclusive.

Part 1. General—Articles 31-150 to 31-151, inclusive.

Part 2. Theory—Articles 31-152 to 31-155, inclusive.

Part 3. Description—Articles 31-160 to 31-175, inclusive.

Part 4. Operation—Articles 31-177 to 31-181, inclusive.

Part 5. Faults and remedies—Articles 31-185 to 31-186, inclusive.

(C) Motor buzzer transmitters—Articles 31-200 to 31-228, inclusive.

Part 1. General—Articles 31-200 to 31-202, inclusive.

Part 2. Theory—Articles 31-203 to 31-208, inclusive.

Part 3. Description—Articles 31-209 to 31-215, inclusive.

Part 4. Operation—Articles 31-217 to 31-221, inclusive.

Part 5. Faults and remedies—Articles 31-223 to 31-228, inclusive.

Section III. Arc transmitters—Articles 31-250 to 31-297, inclusive.

Part 1. General—Articles 31-250 to 31-253, inclusive.

Part 2. Theory—Articles 31-254 to 31-263, inclusive.

Part 3. Description—Articles 31-264 to 31-273, inclusive.

Part 4. Operation—Articles 31-274 to 31-294, inclusive.

Part 5. Faults and remedies—Articles 31-295 to 31-296, inclusive.

Part 6. Care and upkeep—Article 31-297.

- Section IV. Vacuum tube transmitters—Articles 31-325 to 31-371, inclusive.**
- (A) The vacuum tube used as a transmitter—Articles 31-325 to 31-338, inclusive.
    - Part 1. General—Articles 31-325 to 31-326, inclusive.
    - Part 2. Theory—Articles 31-327 to 31-338, inclusive.
  - (B) Model TB radio telephone equipment—Articles 31-339 to 31-348, inclusive.
    - Part 1. General—Article 31-339.
    - Part 2. Description—Articles 31-340 to 31-343, inclusive.
    - Part 3. Vacuum tubes—Articles 31-344 to 31-347, inclusive.
    - Part 4. Faults and remedies—Article 31-348.
  - (C) The model TC radio equipment—Articles 31-349 to 31-369, inclusive.
    - Part 1. General—Article 31-349.
    - Part 2.—Theory—Articles 31-350 to 31-358, inclusive.
    - Part 3. Description—Articles 31-359 to 31-362, inclusive.
    - Part 4. Operation—Articles 31-363 to 31-364, inclusive.
    - Part 5. Faults and remedies—Articles 31-365 to 31-369, inclusive.
  - (D) Transmitting vacuum tubes—Articles 31-370 to 31-371, inclusive.
- Section V. Aircraft radio equipment—Articles 31-400 to 31-435, inclusive.**
- Part 1. General—Articles 31-400 to 31-406, inclusive.
  - (A) Radio transmitters—Articles 31-407 to 31-417, inclusive.
    - Part 1. Synchronous spark type—Articles 31-407 to 31-408, inclusive.
    - Part 2. Quenched-spark and Chaffee gap types—Articles 31-409 to 31-412, inclusive.
    - Part 3. Vacuum tube type—Articles 31-413 to 31-417, inclusive.
  - (B) Receiving equipment—Articles 31-418 to 31-430, inclusive.
    - Part 1. General—Articles 31-418 to 31-423, inclusive.
    - Part 2. Radio compass—Articles 31-424 to 31-426, inclusive.
    - Part 3. Interphones—Articles 31-427 to 31-430, inclusive.
  - (C) Emergency communication—Articles 31-431 to 31-435, inclusive.
- Section VI. Receiving equipment—Articles 31-450 to 31-503, inclusive.**
- Part 1. General—Articles 31-450 to 31-451, inclusive.
  - (A) Receivers—Articles 31-452 to 31-500, inclusive.
    - Part 1. General—Articles 31-452 to 31-455, inclusive.
    - Part 2. Description—Articles 31-456 to 470, inclusive.
    - Part 3. Operation—Articles 31-471 to 31-490, inclusive.
    - Part 4. Installation—Articles 31-491 to 31-493, inclusive.

## Section VI. Receiving equipment—Continued.

Part 5. Care—Article 31-494.

Part 6. Repair—Articles 31-495 to 31-496, inclusive.

Part 7. Faults and remedies—Articles 31-497 to 31-500, inclusive.

## (B) Amplifiers—Articles 31-525 to 31-538, inclusive.

Part 1. General—Articles 31-525 to 31-526, inclusive.

Part 2. The audio-frequency amplifier—Articles 31-527 to 31-531, inclusive.

Part 3. The radio-audio-frequency amplifier—Articles 31-532 to 31-538, inclusive.

## (C) Vacuum tube detectors—Articles 31-550 to 31-566, inclusive.

Part 1. General—Articles 31-550 to 31-551, inclusive.

Part 2. Description—Articles 31-552 to 31-559, inclusive.

Part 3. Operation—Articles 31-560 to 31-564, inclusive.

Part 4. Faults and remedies—Articles 31-565 to 31-566, inclusive.

## (D) Radio-frequency drivers—Articles 31-575 to 31-594, inclusive.

Part 1. General—Articles 31-575 to 31-578, inclusive.

Part 2. Theory—Articles 31-579 to 31-581, inclusive.

Part 3. Description—Articles 31-582 to 31-589, inclusive.

Part 4. Operation—Articles 31-590 to 31-592, inclusive.

Part 5. Faults and remedies—Articles 31-593 to 31-594, inclusive.

## (E) Special equipment for increasing selectivity—Articles 31-625 to 31-737, inclusive.

(1) The Acceptor-rejector circuit—Articles 31-625 to 31-663, inclusive.

Part 1. General—Articles 31-625 to 31-626, inclusive.

Part 2. Theory—Articles 31-627 to 31-633, inclusive.

Part 3. Description—Articles 31-634 to 31-650, inclusive.

Part 4. Operation—Articles 31-652 to 31-657, inclusive.

Part 5. Faults and remedies—Articles 31-658 to 31-663, inclusive.

(2) The model RE receiving equipment—Articles 31-675 to 31-698, inclusive.

Part 1. General—Articles 31-675 to 31-677, inclusive.

Part 2. Theory—Articles 31-678 to 31-681, inclusive.

Part 3. Description—Articles 31-682 to 31-691, inclusive.

**Section VI. Receiving equipment—Continued.**

**Part 4. Operation—Articles 31-692 to 31-693, inclusive.**

**Part 5. Faults and remedies—Articles 31-694 to 31-698, inclusive.**

**(3) The tuned telephone—Articles 31-725 to 31-737, inclusive.**

**Part 1. General—Articles 31-725 to 31-726, inclusive.**

**Part 2. Theory—Article 31-727.**

**Part 3. Description—Articles 31-728 to 31-732, inclusive.**

**Part 4. Operation—Articles 31-733 to 31-734, inclusive.**

**Part 5. Faults and remedies—Articles 31-735 to 31-737, inclusive.**

**(F) Wavemeters—Articles 31-750 to 31-772, inclusive.**

**Part 1. General—Articles 31-750 to 31-757, inclusive.**

**Part 2. Description—Articles 31-759 to 31-762, inclusive.**

**Part 3. Operation—Articles 31-763 to 31-766, inclusive.**

**Part 4. Faults and remedies—Articles 31-767 to 31-772, inclusive.**

**(G) Miscellaneous apparatus—Articles 31-800 to 31-823, inclusive.**

**Part 1. Telephones—Articles 31-800 to 31-805, inclusive.**

**Part 2. Crystal detectors—Articles 31-806 to 31-810, inclusive.**

**Part 3. Vacuum tubes—Articles 31-811 to 31-815, inclusive.**

**Part 4. Condensers—Articles 31-816 to 31-820, inclusive.**

**Part 5. Inductances—Articles 31-821 to 31-823, inclusive.**

**Section VII. Batteries—Articles 31-850 to 31-864, inclusive.**

**Part 1. General—Article 31-850.**

**Part 2. The type SE 3535A dry battery—Articles 31-851 to 31-857, inclusive.**

**Part 3. The Edison "B" battery—Article 31-858.**

**Part 4. The Edison "A" battery—Articles 31-859 to 31-860, inclusive.**

**Part 5. Power storage batteries—Articles 31-861 to 31-864, inclusive.**

**Section VIII. Field sets—Articles 31-875 to 31-896, inclusive.**

**Part 1. General—Articles 31-875 to 31-877, inclusive.**

**Part 2. Description—Articles 31-878 to 31-883, inclusive.**

**Part 3. Operation—Articles 31-884 to 31-889, inclusive.**

**Part 4. Faults and remedies—Articles 31-890 to 31-896, inclusive.**

**Section IX. Radio compass equipment—Articles 31-900 to 31-998, inclusive.**

**Section IX. Radio compass equipment—Continued.**

- Part 1. General—Articles 31-900 to 31-905, inclusive.**  
**Part 2. Theory—Articles 31-906 to 31-913, inclusive.**  
**Part 3. Description—Articles 31-914 to 31-926, inclusive.**  
**Part 4. Installation of radio compass equipment on U. S. naval vessels—Articles 31-927 to 31-928, inclusive.**  
**Part 5. Installation of U. S. naval radio compass shore stations—Articles 31-929 to 31-948, inclusive.**  
**Part 6. Calibration of ship radio compass installations—Articles 31-949 to 31-967, inclusive.**  
**Part 7. Calibration of U. S. naval radio compass shore stations—Articles 31-968 to 31-980, inclusive.**  
**Part 8. Operation—Articles 31-981 to 31-983, inclusive.**  
**Part 9. Faults and remedies—Articles 31-984 to 31-986, inclusive.**  
**Part 10. Testing of circuits and apparatus—Articles 31-987 to 31-998, inclusive.**

**SECTION I.—GENERAL INSTRUCTIONS.****PART 1.—ORGANIZATION.**

31-1. The Bureau of Engineering is responsible under the law for the maintenance, material supply, and construction of the Coast Signal Service, and funds are annually appropriated to it by Congress for this purpose. Maintenance and operation of Coast Signal Service.

31-2. The Coast Signal Service comprises all mediums of rapid signaling operated by the Navy for the exchange of communications between the Navy Department, the Naval Organization on shore, and the Atlantic, Pacific, and Asiatic Fleets and their auxiliaries, including aircraft. Coast Signal Service.

31-3. The functioning of the Coast Signal Service is effected through the Naval Communication Service. The administration of the Naval Communication Service is under the cognizance of two Bureaus, namely: Administration of Naval Communication Service.

(1) Bureau of Navigation, for personnel, and of the Office of Naval Operations (Director Naval Communications), for operation and traffic.

(2) Bureau of Engineering, for maintenance, material supply, and construction.<sup>1</sup>

31-4. The instructions contained in this Manual will cover only maintenance, material supply, and construction under the cognizance of the Bureau of Engineering, which includes the establishment of new communication units and also matters pertaining to investigational, research, design, and development work, patents, requisitions for and manufacture of equipment, inspections, installation and testing, alterations and repairs, the preparation and distribution of technical instructions and data covering the care and operation of radio and sound apparatus and other communication facilities. Scope of Manual.

<sup>1</sup>The Bureau of Yards and Docks assists in connection with architecture and construction contracts.

Communication activities.

31-5. The communication activities under the Bureau's cognizance as outlined in the preceding article can be grouped under four general heads, namely:

(1) Radio—Telegraph, telephone, compass, beacon.

(2) Sound.

(3) Homing pigeons.

(4) Land lines—Telegraph, telephone, control, comprising part of shore communication stations.

Communication facilities.

31-6. These communication facilities are depended upon by the Navy, either wholly or in part, in connection with all ship, shore, and aircraft activities.

Mission of Bureau of Engineering.

31-7. The mission of the Bureau of Engineering, with respect to these communication facilities, is:

(1) To prepare, provide, and maintain in condition for continuous efficient service these mediums of communication, so as to meet the requirements of the Fleets, in order that the latter may be *efficiently and economically managed in time of peace, and efficiently maneuvered in time of war.*

(2) To aid in the preservation of life and property at sea and in the air.

(3) To serve other governmental activities and the general public within the limitations imposed by Congress.

Radio Division.

31-8. The administration and functioning of the Naval Communication Service, with respect to maintenance, material supply, and construction, is effected through the Radio Division of the Bureau, the organization of which, and the personnel engaged, under normal conditions, being indicated in Figure 31-1.

Delegation of authority at isolated stations.

31-9. Many of the units comprising the Naval Communication Service are situated in widely separated and isolated localities. Complicated machinery and apparatus are installed at these stations, and they require the attention of skilled mechanics. To meet its responsibilities under these conditions certain material and maintenance activities are delegated to the commanding officers of ships directly, or through the commander in chief, and to commandants of designated navy yards for accomplishment by the radio material officers attached to the yards.

Assignment of radio material officers. Scope of yards.

31-10. Yards at which radio material officers have been assigned and the territory to be covered by these yards for communication maintenance, material supply, and construction activities are indicated below:

Radio material officer, navy yard, Boston: First naval district excepting the navy yard, Portsmouth.

Officer detailed by engineer officer, navy yard, Portsmouth: Within the limits of the Portsmouth yard.

Radio material officer, navy yard, New York: Third naval district and, in addition, the West Indies (assistant to Radio material officer, navy yard, New York; for West Indies, San Juan).

Radio material officer, navy yard, Philadelphia: Fourth naval district.

Radio material officer, navy yard, Norfolk: Fifth naval district, excepting activities along the Severn and Potomac Rivers.

Radio material officer, navy yard, Washington: Activities along the Severn and Potomac Rivers within the fifth naval district.



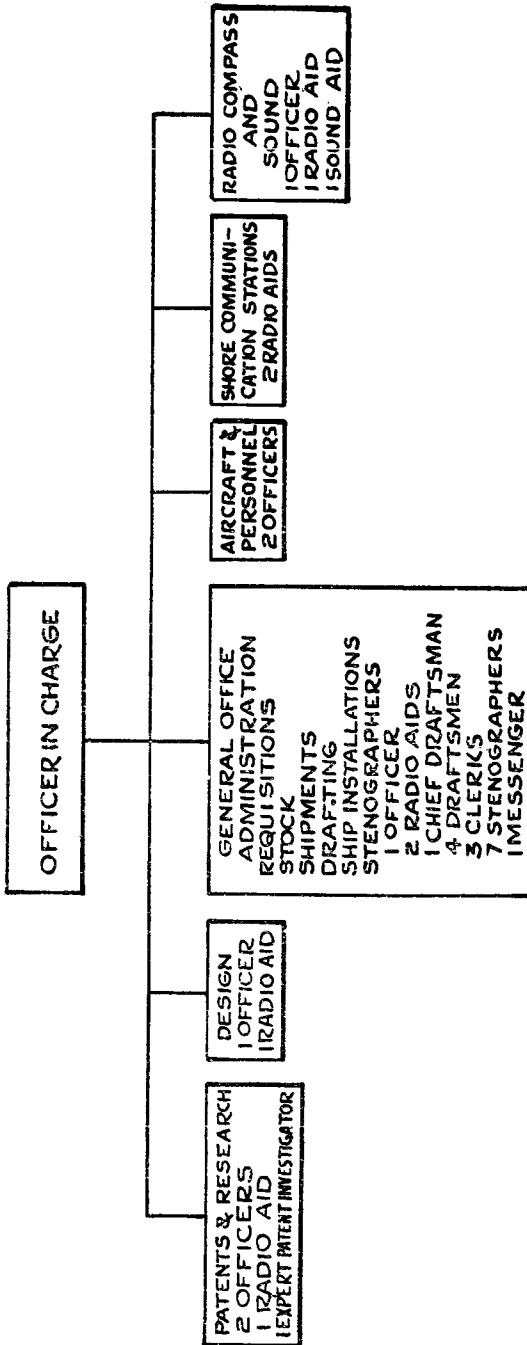


FIG. 31-1.—Organization of Radio Division, Bureau of Engineering.

Radio material officer, navy yard, Charleston: Sixth naval district.

Radio material officer, naval station, Key West: Seventh naval district.

Radio material officer, naval station, New Orleans: Eighth naval district.

Radio material officer, ninth naval district, Great Lakes: Ninth naval district.

Radio material officer, navy yard, Mare Island: Eleventh and twelfth naval districts.

Radio material officer, navy yard, Puget Sound: Thirteenth naval district.

Radio material officer, naval station, Pearl Harbor: Fourteenth naval district.

Radio material officer, fifteenth naval district, Canal Zone: Fifteenth naval district including naval radio stations in the Republic of Panama.

Radio material officer, naval station, Cavite: Sixteenth naval district, including the Peking and Vladivostok stations.

Officer detailed by engineer officer, naval station, Guam: Within the limits of the naval station, Guam.

Officer detailed by engineer officer, naval station, Tutuila: Within the limits of the naval station Tutuila.

Supervisor, Trans-Pacific high-power circuit, navy yard, Mare Island: All high-power stations within the eleventh, twelfth, fourteenth, and sixteenth naval districts comprising this circuit.

**Correspondence.**

31-11. Correspondence relating to communication maintenance, material supply, and construction will be direct between the Bureau and commandants of maintenance yards except in connection with vessels at sea. In the latter case, correspondence will be direct between the Bureau and the commanders in chief and commanding officers, copies being forwarded to the commandants of the vessels' home yards, and to the responsible unit commanders in the fleets.

**Provisions made for operation.**

31-12. The Bureau will cause to be maintained, under the industrial department, machinery division of these designated yards and stations, and at other points as may be necessary, adequate facilities for radio material officers to insure the provision, functioning, and coordination of the communication maintenance, material supply, and construction facilities of the Naval Communication Service.

**Function of radio material officers.**

31-13. The function of radio material officers is to supervise and coordinate all maintenance, material supply, and construction activities in connection with radio, sound, pigeon, and land line facilities relating to ship, shore, and aircraft communication service within the territory assigned by the Bureau to the yards to which they are detailed. It is the Bureau's desire that all personnel regularly engaged in communication maintenance, material supply, and construction work—that is, radio draftsmen, assistant radio inspectors, radio inspectors, radio laboratorians, radio aids, sound aids, pigeon experts, etc.—report directly to the radio material officer in connection with research, design, manufacturing, testing, installations, tuning; in general, all communication main-

tenance, material supply, and construction work for which the yard is made responsible by the Bureau. Manufacturing work carried on in shops by other than communication personnel should be subject to inspection and approval by the radio material officers prior to its acceptance for service.

31-14. The duties and responsibilities of radio material officers <sup>Duties of radio</sup> <sub>material officers.</sub> are:

- (1) (a) To supervise and direct the activities of the radio laboratory and the work of the radio laboratory and field personnel.
- (b) To cooperate with other departments concerning the prosecution of work for, or affecting, the communication service, which may be carried on in other departments or by other than communication technical personnel.
- (2) To maintain the shore communication stations assigned to their yards in condition for continuous efficient operation, making necessary arrangements to utilize the station personnel for this purpose as far as practicable without interfering with their operation and traffic or other duties.
- (3) To perform minor items of repair work, tuning, etc., on vessels in port upon the request of the commanding officers, and major items of alterations, repairs, etc., as directed by the Bureau.
- (4) To supervise the initial installations on vessels and aircraft at builders' yards as directed by the Bureau.
- (5) To perform minor items of repair work, tuning, etc., on aircraft as requested by the commanding officers of air stations or other proper authority, and major items of alterations, repairs, etc., as directed by the Bureau.
- (6) To supervise inspections of shore communication stations over which they have jurisdiction. Radio material officers will make at least every alternate quarterly or periodical inspection except when authorized not to do so by the Bureau of Engineering. Two or more consecutive quarterly or periodical inspections of shore communication stations will not be made by the same yard representative, other than the radio material officer, unless authorized by the Bureau.
- (7) To make recommendations as deemed necessary to maintain these stations in condition for continuous efficient operation.
- (8) To furnish estimates covering expenditures in connection with: (a) The ordinary maintenance, material supply, and construction of shore communication stations, (b) repairs, (c) alterations, (d) the establishment of new stations, which come under the jurisdiction of the industrial department, machinery division.
- (9) To obtain estimates covering expenditures in connection with shore communication stations from other departments having cognizance of work contemplated.
- (10) To maintain close supervision of all expenditures made from funds of the Bureau of Engineering in connection with the Naval Communication Service within their territory to the end that the service may be maintained as economically as possible, consistent with efficiency, and that overexpenditures of allot-

ments do not occur. This will involve cooperating with the Accounting Officer and estimating costs where actual figures are not immediately available.

(11) To cooperate with the Supply Officer as regards the stock of communication material and equipment required and on hand, to the end that sufficient material and equipment may be available to meet the requirements without involving unnecessary purchases or carrying excessive quantities of material and equipment in stock, particularly that which may become obsolete, and preventing deterioration of equipment due to improper care while in storage.

(12) To cooperate closely with the district communication superintendents to insure continuous efficient service and economy of operation in matters other than personnel and traffic.

(13) To confine expenditures in connection with communication matters, over which they have supervision, to the projects authorized annually and to the authorized expenditures under the maintenance allotments as appropriated and authorized.

(14) To cause to be carried on such research, experimental, development, test and other work as may be assigned to their yards from time to time by the Bureau of Engineering.

(15) To direct the maintenance, material supply, and construction of shore communication stations, by correspondence or otherwise, through the officers in charge and the personnel of the stations, furnishing copies of any correspondence to the district communication superintendents having jurisdiction over the stations for operation and traffic.

(16) To prepare correspondence addressed to officers in charge of shore communication stations, and others, regarding other than routine matters for the approval and signature of their immediate superior.

(17) To assign competitive marks to shore communication stations based on the condition of the station as indicated by the service rendered, the economical operation of the station in matters of material and the general condition of all material at the stations as disclosed by the inspections.

(18) To pass on all requisitions and requests for supplies or services at shore communication stations which involve expenditures under the appropriation "Engineering" and to obviate unessential expenditures.

(19) To provide instruction for the personnel of shore communication stations with reference to maintenance, material supply, and construction subjects and also for the communication personnel of ships in port when so directed.

(20) To coordinate all communication maintenance, material supply, and construction work relative to radio, sound, and pigeon facilities utilized by the Naval Communication Service in connection with ship, shore, and aircraft activities, within the territory over which they have supervision.

(21) To arrange for survey of worn out or damaged material and equipment, and for its replacement where necessary and authorized.

(22) To inaugurate methods of procedure for carrying on the detail work as regards maintenance, material supply, and construction matters between shore communication stations and their maintenance yards. This will include routine correspondence and reports, establishment of allowances of expendable supplies for the various stations, shipments and deliveries of material and supplies, inventories, records, etc.

31-15. Activities in connection with communication maintenance, material supply, and construction matters involving action on the part of other Bureaus or agencies of the Department or other governmental agencies, will be handled in conjunction with or through the agencies (or their representatives) having jurisdiction. For example, the Bureau of Construction and Repair for ship structural work, the Bureau of Yards and Docks for public works, the Bureau of Aeronautics for aircraft installations, the Major General Commandant for Marine Corps communication activities, the Bureau of Lighthouses for light vessel installations, district commandants and commanding officers of outlying activities for administrative purposes, etc.

31-16. Communication maintenance, material supply, and construction matters in connection with ships are handled in the following manner: Activities with ships.

(1) Initial installations on new ships are made at the builders' yards under the supervision of radio material officers of designated yards prior to the commissioning of the vessels.

(2) Maintenance and repair work and tuning on ships in port will be accomplished by radio material officers upon request of the commanding officer. New installations, alterations, or extensive repairs will be approved by the Bureau of Engineering prior to undertaking the work.

(3) Work on ships at sea is accomplished by radio officers, or as directed by the commanding officers, the commanders in chief, or unit commanders through the commanding officers.

31-17. Communication maintenance, material supply, and construction matters in connection with communication units on shore are supervised by radio material officers of yards to which the units have been assigned for maintenance. Activities with shore units.

31-18. Communication maintenance, material supply, and construction matters in connection with aircraft activities based on shore are supervised by radio material officers of the yards to which the activities have been assigned by the Bureau. Radio material officers, in such cases, act as the liaison officer under the yard and district commandants and the commanding officer of the air stations. Activities with aircraft shore units.

31-19. Communication maintenance, material supply, and construction matters in connection with aircraft at sea with the fleet are supervised in a manner similar to that followed for ship stations as outlined in article 31-16. Activities with aircraft at sea.

31-20. All tests and experiments in connection with communication apparatus and facilities will be conducted as directed by the Bureau of Engineering, care being exercised always to avoid any interference with operation and traffic matters under the jurisdiction of the Director Naval Communications. Tests.

**Activities afloat.** 31-21. Communication maintenance and material activities afloat are under the jurisdiction of the commanders in chief, force commanders, squadron commanders, division commanders, and commanding officers in the order named, who, in turn, may delegate the detail work to the officers assigned to radio duties.

**Coast Signal Service budget.** 31-22. The administration of the maintenance, material supply, and construction work of the Coast Signal Service, as regards expenditures, is effected under a budget system. Recommendations, with estimates, are submitted to the Bureau, periodically, from which the funds required for the annual routine maintenance, material supply, and construction of individual communication units are determined as are those required for other than routine repairs, replacements, alterations, and the establishment of new units.

**Program of expenditures.** 31-23. The annual program of expenditures, which absolutely limits the expenditures for all communication maintenance, material supply, and construction activities for a fiscal year, is made up as follows:

(a) Recommendations for the annual Alaskan Radio Expedition covering other than routine repairs, replacements, alterations, and the establishment of new shore communication units in Alaska. These recommendations should be in the Bureau not later than December 1 of each year.

(b) Recommendations for the annual routine maintenance, material supply, and construction of individual shore communication units. These recommendations should be submitted by all maintenance yards so as to reach the Bureau not later than March 15 of each year.

(c) Recommendations covering other than routine repairs, replacements, alterations, and the establishment of new shore communication units to be submitted by maintenance yards for all shore communication units (other than the Alaskan stations). These recommendations should be submitted by all maintenance yards so as to reach the Bureau not later than March 15 of each year.

(d) Recommendations by commanding officers of ships covering allowances required for expendable communication supplies for their vessels, and also aircraft which may be attached thereto, and repairs, replacements, alterations, and new installations. These recommendations should be submitted through their immediate superiors for forwarding to the Bureau through the vessels' home yards so as to reach the Bureau not later than March 15 of each year.

(e) Recommendations by commanding officers of naval air stations covering allowances required for expendable communication supplies for aircraft assigned to their stations, and repairs, replacements, alterations and new installations. These recommendations should be submitted through the yard having jurisdiction over communication maintenance, material supply, and construction activities at the air station, so as to reach the Bureau not later than March 15 of each year.

**Public works projects.** 31-24. Funds for public works projects in connection with shore communication stations are allotted to the Bureau of Yards and Docks for accomplishment under contract or by utilizing labor and material of the stations' maintenance yard.

31-25. Ordinary repair and preservation work at shore communication stations which is under the jurisdiction of the public works department will be accomplished by that department under the stations' maintenance allotment when so directed by the commandant. Repairs.

31-26. It is the Bureau's desire that close cooperation exist between the public works department and the radio material officer in connection with all public works matters pertaining to shore communication stations and particularly as regards the plans for new work and expenditures authorized from this Bureau's appropriation. Co operation  
between public  
works and radio  
material officer.

#### PART 2.—SHORE COMMUNICATION STATIONS.

31-27. Shore communication stations comprise all communication facilities established on shore and operated by the Naval Communication Service, including light vessels equipped with radio. Shore stations.

31-28. The Bureau of Engineering is responsible for all expenditures pertaining to the grounds, buildings, antenna supports, etc.; the improvements in connection with shore communication stations and the establishment of new units in the chain of stations of the Coast Signal Service. Bureau respon-  
sibility.

31-29. Maintenance, material supply, and construction activities on shore are directed by the Bureau through navy yards and naval stations designated as maintenance yards for shore communication activities to which radio material officers have been assigned as assistants to the engineer officers under the commandants. Shore activi-  
ties.

31-30. Shore radio and pigeon stations which are situated within maintenance yards will be administrated for maintenance, material supply, and construction matters in the usual manner by radio material officers under the authority of the engineer officer and commandant. Stations with-  
in maintenance  
yards.

31-31. Shore radio and pigeon stations which are situated within naval air stations will be administrated for maintenance, material supply, and construction matters by their maintenance yards. The radio material officers of the maintenance yards will act as joint liaison officers under the yard and district commandants and the commanding officer of the air station for communication material matters at these stations. Stations with-  
in naval air sta-  
tions.

31-32. Shore radio and pigeon stations which are situated outside of the limits of the yard to which they have been assigned for maintenance, and which are not within the limits of a naval air station, but are within the limits of a naval district, will be administrated for maintenance, material supply, and construction by their maintenance yards, the radio material officer acting as the radio material representative for the district commandant. Stations out-  
side yard, but  
within naval dis-  
trict.

31-33. Shore radio and pigeon stations which are situated outside the limits of maintenance yards to which they are assigned for maintenance, and which are also outside the limits of air stations, naval districts, and Marine Corps detachment areas, will be administrated for maintenance, material supply, and construction by their maintenance yards, the radio material officers in such Stations out-  
side naval dis-  
trict.

cases acting as the radio material representative for the commandant or other officer having jurisdiction over the stations in question.

**Stations part of Marine Corps detachment.**

31-34. Shore radio and pigeon stations, other than strictly portable or field stations, which are established as part of the activities of a Marine Corps detachment, and which are designated as forming part of the chain of coastal communication stations of the Naval Communication Service, are assigned maintenance yards in the usual manner. These stations will be administrated for maintenance, material supply, and construction matters by their maintenance yards in a manner similar to that followed in connection with other stations of the chain of shore communication stations, the radio material officers in such cases acting as the radio material representative for the officer in command of the Marine Corps detachment.

**Field sets of Marine Corps.**

31-35. The Naval Communication Service is not directly concerned in the portable or strictly field communication stations owned, maintained and operated by the Marine Corps at marine camps or in the field, therefore the Bureau is not responsible for maintenance, material supply, and construction matters pertaining to such stations. Communication material and equipment, including homing pigeons, required by the Marine Corps for use at such field stations, however, will be supplied by the Bureau upon request; payment for such material and equipment, excepting homing pigeons, to be made by transfer of funds. Homing pigeons furnished the Marine Corps for use at field communication stations will remain the property of the Bureau, to be returned when their services are no longer required.

**Light vessel radio stations.**

31-36. Light vessel radio stations are assigned maintenance yards in the usual manner and will be administrated for maintenance material supply, and construction matters by their maintenance yards in a manner similar to that followed in connection with other stations of the chain of shore communication stations. Radio material officers will act as the radio material representative for the district commandants and cooperate with the Bureau of Lighthouses district superintendents having jurisdiction over the light vessels.

**Repairs by shore station personnel.**

31-37. Maintenance, material supply, and construction work at shore communication stations will, when required, be performed by station personnel in accordance with orders issued by the radio material officers and in accordance with the general approval of the commandants or other officers having jurisdiction over the station personnel.

**Minor repairs.**

31-38. Care will be exercised by radio material officers with a view to having minor items of work within the capacity of the station force performed by the station personnel at all stations, without interfering with their operation and traffic or other duties, rather than incurring the expense of sending working parties from the maintenance yards or awarding contracts to local firms.

**Expenses of superintendents.**

31-39. The expenses of the offices of district communication superintendents, Pacific coast communication superintendent and Philippine communication superintendent will be paid from the



maintenance allotments of the district center station. The expenses of communication offices at navy yards and stations will be paid from the maintenance allotments of the radio station at such navy yard or station.

31-40. The radio material officer attached to the industrial department, machinery division, of the navy yard, Mare Island, will perform additional duties under the commandant, navy yard, Mare Island, as "supervisor, trans-Pacific high-power circuit." This circuit will be designated for this purpose as consisting of all high-power radio stations (100-kilowatts and above and their controlling stations) in the eleventh, twelfth, fourteenth, and sixteenth naval districts. These additional duties will consist of acting in an advisory capacity to the Bureau of Engineering and the maintenance yards and stations concerned, with a view to coordinating all material matters in connection with the maintenance in condition for continuous efficient operation of, and improvements to, the circuit. The supervisor is not authorized to make expenditures.

Supervisor  
trans - Pacific  
high-power circuit.

31-41. Officers in charge of shore communication stations are responsible for the proper care and preservation of the property comprising their stations as well as the efficient functioning of the equipment. Every endeavor must be made to operate the stations as economically as possible consistent with efficient service, cleanliness and preservation of Government property.

Responsibility  
of officer in  
charge of station.

31-42. An inventory will be kept available for inspection of all public property at each shore communication station, radio laboratory, and sound laboratory. The inventory will include descriptive data, means of identification, and cost or valuation, properly arranged by classes as land with roads and walks, fences, antenna supports, buildings and other structures, household and office furniture and furnishings, apparatus, tools, vehicles, etc. This inventory will not include expendable supplies, but a separate record of such supplies showing periodical receipts and expenditures will be kept at the stations for observation and checking.

31-43. The officer in charge of a communication station will be held accountable for all Government property belonging to his station or placed under his care by proper authority. He will receive for all articles invoiced to his station upon receiving and accepting the articles.

Accountability  
of officer in  
charge of station.

31-44. Upon assuming control of a radio station the officer in charge shall immediately report the fact to the maintenance yard in writing. He shall report any discrepancies between the items of public property on hand and those called for by the inventory, and shall call attention to any items in poor condition, the responsibility for which might be a subject of inquiry by an inspecting officer.

Report by station  
officer on  
taking charge.

31-45. Upon being relieved, the officer in charge shall inspect the station with his successor, giving the latter complete details of the condition of all property at the station, including grounds, antenna supports, buildings and other structures, furniture and furnishings, machinery and equipment; furnish full information concerning the capabilities of the station, the method of obtaining

Duties when  
being relieved.

supplies, etc., and transfer the station to his successor. The latter shall acknowledge the receipt of same, noting any discrepancies over his signature in the inventory records, and assume control of the station.

**Transfer of officers.**

31-46. Whenever practicable, it is desired that transfer of officers in charge of shore communication stations be made when the radio material officer or his representative can be present, but without involving unnecessary travel, in order that the maintenance yard may have first-hand knowledge of the actual condition of the station at the time of transfer.

**Appropriation for wire lines.**

31-47. The differentiation between wire communication facilities provided for shore communication stations for payment out of the appropriation "Engineering" and that out of "Pay miscellaneous" will be as follows:

(1) All wire, telegraph, telephone, control signaling or special traffic facilities, provided at shore communication stations for the operation of the stations and all similar facilities provided for the actual handling, relay, receipt or delivery of the radio traffic incident to the operation of the stations, are properly chargeable to the appropriation "Engineering."

(2) All wire communication facilities provided at shore communication stations exclusively for the administration of the stations or the convenience of the personnel, are properly chargeable to the appropriation "Pay miscellaneous."

(3) Wire communication facilities which have been provided to operate the stations or handle the traffic incident to the operation of the stations and which are also authorized used in connection with the administration of the stations, or for the convenience of the personnel, will be charged to the appropriation "Engineering."

**Inspection of stations.**

31-48. (1) Inspections of shore communication stations as regards maintenance, material supply, and construction will be made by radio material officers having jurisdiction over the stations at quarterly or other authorized periodical intervals, and more frequently when found advisable. This report shall be called the Material Inspection Report of the U. S. Naval Radio Station (name).

(2) Inspections of shore communication stations by radio material officers, so far as they have to do with public works and public utilities, shall not conflict with the annual inspection of public works and public utilities required of public works officers by the Bureau of Yards and Docks.

**Inspection reports of shore stations.**

31-49. Inspection reports of shore communication stations will be submitted by the commandants to the Bureau in duplicate and copies furnished for information to the district communication superintendents, Atlantic coast communication superintendent, Pacific coast communication superintendent and Philippine communication superintendent having jurisdiction over the stations.

**Inspection report of trans-Pacific high-power station.**

31-50. Inspection reports of stations of the trans-Pacific high-power circuit will be submitted in quadruplicate and forwarded via the commandant, navy yard, Mare Island, for information of the supervisor, trans-Pacific high-power circuit. One copy of report will be retained in the files of the supervisor, one copy

will be furnished the Pacific coast communication superintendent, for information, and the original report and duplicate copy with endorsements will be forwarded to the Bureau of Engineering.

31-51. Material inspection reports shall cover the following Scope of material inspection.  
points:

- (1) Condition of station grounds as regards the efficient functioning of the station.
- (2) Condition of antenna system, including antenna supports and accessories.
- (3) Ground system, in so far as it can be inspected.
- (4) Condition of buildings, tanks, and other structures other than antenna supports.
- (5) Condition of roads and walks.
- (6) Provision for preventing station going out of commission due to carrying away of antenna during storms, collection of sleet, etc., including provisions made for duplicate antenna, or antenna material, hoisting gear, etc.
- (7) Condition of power equipment on the station, including steam boilers, engines, engine-driven generators, power lines and transformers, storage batteries, etc.
- (8) Condition of transmitting equipment and accessories, including motor generators.
- (9) Condition of receiving equipment and accessories, including storage batteries.
- (10) Fire prevention facilities.
- (11) Result of check of station inventory with maintenance yard records.
- (12) Method, care, and preservation of records on station pertaining to station material.
- (13) Condition of plumbing and heating facilities.
- (14) Water supply.
- (15) Sanitation.
- (16) Neatness and cleanliness of property and material comprising the station.
- (17) Expenses in connection with maintenance, material supply, and construction of the station.
- (18) Condition of machine tools and small tools and facilities for making repairs locally.
- (19) General transportation facilities.
- (20) Condition of motor vehicles and other land transportation facilities.
- (21) Condition of motor boats and other water transportation facilities.
- (22) Surveys.
- (23) Maintenance, material supply, and construction, educational facilities and knowledge of station personnel regarding communication, technical matters, and their ability to make repairs.
- (24) Condition of control and communication land lines comprising part of the station.
- (25) Repairs, alterations, or improvements made by station personnel since last inspection.
- (26) Repairs, alterations, or improvements made by yard force since last inspection.

(27) Repairs, alterations, or improvements under way, or authorized to be made by station or yard force.

(28) Familiarity of station personnel with contents of Bureau's monthly radio report.

(29) Discrepancies, if any, in station's authorized transmitting wave lengths.

(30) Defects in material requiring immediate attention and not previously reported, and action taken or recommended.

(31) Defects in material not previously reported and which should be rectified as soon as possible with recommendations where necessary.

(32) Defects in material not previously reported and not urgent which will be given consideration in the annual recommendations.

(33) A list of outstanding recommendations which have been submitted to the Bureau and upon which no action has been taken, or upon which action by the Bureau is not complete, such as new apparatus due, etc.

(34) Condition of recreational facilities, including small arms and ammunition furnished for the protection of the station.

(35) General condition of the station as a whole as regards maintenance, material supply, and construction matters and whether or not the condition of the station appears to be due to the zeal and ability or the neglect and inefficiency of the officer in charge, giving name and rank or rating of the officer in charge.

**Items reported on.**

31-52. With the following exceptions, the inspection report as submitted need contain only such of the items enumerated in the preceding articles as the inspecting officer may desire to comment on. Reference to items which are found to be entirely satisfactory need not be made in the inspection report. The exceptions are subparagraphs (6), (16), (17), (23), (25), (26), (27), (28), (29), (30), (31), (32), (33), (34), and (35) of the preceding article.

**Efficiency of plant to be noted.**

31-53. All material inspection reports without exception, however, shall contain a paragraph stating whether the station is considered to be in condition for continuous efficient operation under all circumstances, and if not, what action is contemplated, underway, or recommended to insure its maintenance in condition for continuous efficient operation.

**Identity of inspection reports.**

31-54. Material inspection reports shall indicate which quarter of the fiscal year, or other authorized period, is covered, and by whom the inspection is made.

**Report concerning other departments.**

31-55. If material inspection reports contain comments or recommendations pertaining to activities coming under the jurisdiction of departments, other than the industrial department, machinery division, of the maintenance yards, full report of the action taken or contemplated by these departments, with estimates where necessary, shall be obtained prior to forwarding correspondence to the Bureau of Engineering.

**Means to insure efficient operation.**

31-56. Close cooperation shall be maintained with the district communication superintendents in connection with inspection reports, with a view to insuring the maintenance and operation of the station in an efficient and economical manner, within their allowances, and of insuring that the stations are satisfactory from an operation point of view. Maintenance and new constructional

work which might cause interruption to the Naval Communication Service will not be undertaken at any shore communication station without the approval of the district communication superintendent.

31-57. After an inspection of a shore communication station by a representative of the Department a copy of the report as furnished to the Bureau will be also furnished the radio material officer, via the commandant, for information. **Copy to material officer.**

31-58. Requests or requisitions by officers in charge of shore communication stations for material and supplies will be submitted to or through the radio material officer of their maintenance yards. If the radio material officer having supervision over a shore communication station is assigned to a yard or station other than the maintenance yard of the communication station, officers in charge shall submit requests or requisitions for material and supplies to their maintenance yard via the office of the radio material officer having supervision over the station. **Routing of requests and requisitions.**

31-59. Repairs, other than urgent, and alterations, are to be requested of commandants by radio material officers with recommendations. If necessary, commandants will obtain the approval of Bureau of Engineering before undertaking the work. **Request for repairs.**

31-60. Expenditures in connection with maintenance and upkeep for efficient operation of shore communication stations may be authorized by commandants of maintenance yards, under the stations' maintenance allotments, without previous reference to the Bureau of Engineering, provided the expenditures for any one project do not exceed \$200. If the expenditures for any one project are likely to exceed this figure, the approval of the Bureau of Engineering and the Department will be obtained before undertaking the work. In no case will a shore communication station's maintenance allotment be overdrawn without first obtaining the approval of the Bureau of Engineering. **Authority for expenditures.**

31-61. Correspondence which may be exchanged between officers in charge of shore communication stations and supply officers relating to bids, local contracts, open purchases, shipments, etc., should always be routed via the radio material officer having jurisdiction over matters of material at the station. **Routing bids, contracts, etc.**

31-62. Following is a list of the existing shore communication stations of the Naval Communication Service showing the names of stations, kind of service rendered, naval district in which located, if any, assigned maintenance yard, and the command having jurisdiction over the individual stations: **Shore communication stations.**

Station.	Kind.	District.	Maintenance yard.	Command.
Portsmouth.....	T-R.....	First.....	Portsmouth..	Commandant navy yard, Portsmouth.
Sea Wall.....	T-Tf.....	do.....	Boston.....	Commandant first naval district.
Bar Harbor.....	C.....	do.....	do.....	Do.
Do.....	R.....	do.....	do.....	Do.
Cape Elizabeth.....	C.....	do.....	do.....	Do.
Portland.....	T-R.....	do.....	do.....	Do.
Chelsea.....	T.....	do.....	do.....	Do.
Navy yard.....	R.....	do.....	do.....	Commandant navy yard, Boston.
Gloucester.....	C.....	do.....	do.....	Commandant first naval district.
Deer Island.....	C.....	do.....	do.....	Do.
Fourth Cliff.....	C.....	do.....	do.....	Do.
Radio Laboratory.....	Exp (R).....	do.....	do.....	Commandant navy yard, Boston.
North Truro.....	C (T) (R).....	do.....	do.....	Commandant first naval district.
Chatham.....	C.....	do.....	do.....	Do.
Do.....	T-Tf-R.....	do.....	do.....	Commanding officer naval air station, Chatham.
Surfside.....	C.....	do.....	do.....	Commandant first naval district.
Naval aviation.....	Pgn.....	do.....	do.....	Commanding officer naval air station, Chatham.
Prices Neck.....	C.....	do.....	do.....	Commandant first naval district.
Melville.....	T.....	do.....	do.....	Do.
C. Ibr. Island.....	R.....	do.....	do.....	Do.
Light Vessel No. 3.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 5.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 20.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 41.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 42.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 47.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 73.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 54.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 66.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 74.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 85.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 86.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 90.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 4.....	T-R.....	do.....	do.....	Do.
Navy yard.....	T.....	Third.....	New York.....	Commandant navy yard, New York.
Sandy Hook.....	C.....	do.....	do.....	Commandant third naval district.
Fire Island.....	C (T) (R).....	do.....	do.....	Do.
Amagansett.....	C.....	do.....	do.....	Do.
Do.....	T (R).....	do.....	do.....	Do.
South Ferry Building.....	R.....	do.....	do.....	Do.
Radio Laboratory.....	Exp (R).....	do.....	do.....	Commandant navy yard, New York.
Sayville.....	T.....	do.....	do.....	Commandant third naval district.
Buffalo.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 68.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 87.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 11.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 48.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 23.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 39.....	T-R.....	do.....	do.....	Commandant third naval district.
Light Vessel No. 79.....	T-R.....	Fourth.....	do.....	Commandant fourth naval district.
Light Vessel No. 69.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 44.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 78.....	T-R.....	Third.....	do.....	Commandant third naval district.
Light Vessel No. 16.....	T-R.....	do.....	do.....	Do.
Cayey.....	T.....	do.....	do.....	Governor Virgin Islands.
San Juan.....	R.....	do.....	do.....	Do.
Guantanamo.....	T-Tf.....	do.....	do.....	Commandant naval station, Guantanamo.
Do.....	R.....	do.....	do.....	Do.
Navassa Island.....	T-R.....	do.....	do.....	Do.
Port au Prince.....	T.....	do.....	do.....	Commanding officer Marine detachment.
Do.....	R.....	do.....	do.....	Do.

Station.	Kind.	District.	Maintenance yard.	Command.
St. Thomas.....	T-R.....	.....	New York.....	Governor Virgin Islands.
St. Croix.....	T-R.....	.....	do.....	Do.
San Domingo.....	T-R.....	.....	do.....	Military Governor San Domingo.
Marine land force.....	Pgn.....	.....	do.....	Do.
Navy yard.....	T-R.....	Fourth.....	Philadelphia.....	Commandant navy yard, Philadelphia.
Radio laboratory.....	Exp. (R).....	do.....	do.....	Do.
Marine land force.....	Pgn.....	do.....	do.....	Commanding officer Marine detachment.
Cape May.....	T-Tf-R.....	do.....	do.....	Commandant fourth naval district.
Do.....	C.....	do.....	do.....	Do.
Bethany Beech.....	C.....	do.....	do.....	Do.
Cape Henlopen.....	C.....	do.....	do.....	Do.
Lakehurst.....	T-Tf-R.....	do.....	do.....	Commanding officer Naval air station, Lakehurst.
Do.....	C.....	do.....	do.....	Do.
Naval aviation.....	Pgn.....	do.....	do.....	Do.
Mantoloking.....	C.....	do.....	do.....	Commandant fourth naval district.
Annapolis.....	T.....	.....	Naval Academy.....	Superintendent Naval Academy (R. M. O., Navy Yard, Washington).
Naval Academy.....	T-R.....	.....	do.....	Superintendent Naval Academy.
Arlington.....	T.....	.....	Washington.....	Department.
Navy yard.....	T-Tf.....	.....	do.....	Commandant navy yard, Washington.
Navy Department.....	R.....	.....	do.....	Department.
Radio laboratory.....	Exp. (R).....	.....	do.....	Commandant navy yard, Washington.
Anacostia.....	C.....	.....	do.....	Commanding officer naval air station, Anacostia.
Radio laboratory.....	Exp(T)(R).....	.....	do.....	Do.
Naval aviation.....	Pgn-Edu.....	.....	do.....	Do.
Quantico.....	T-R.....	.....	do.....	Commanding officer Marine detachment.
Marine land force.....	Pgn.....	.....	do.....	Do.
Dahlgren.....	Tf.....	.....	Washington.....	Do.
Indian Head.....	T-R.....	.....	do.....	Do.
Naval Proving Grounds.....	.....	.....	.....	Do.
Navy yard.....	T.....	Fifth.....	Norfolk.....	Commandant navy yard, Norfolk.
Hampton Roads.....	R.....	do.....	do.....	Commandant Naval Base, Hampton Roads.
Virginia Beach.....	C.....	do.....	do.....	Commandant fifth naval district.
Do.....	T-TF(R).....	do.....	do.....	Do.
Hog Island.....	C.....	do.....	do.....	Do.
Poyners Hill.....	C.....	do.....	do.....	Do.
Naval Aviation.....	Pgn.....	do.....	do.....	Commandant Naval Base, Hampton Roads.
Radio Laboratory.....	Exp(R).....	do.....	do.....	Commandant navy yard, Norfolk.
Baltimore.....	T-R.....	do.....	do.....	Commandant fifth naval district.
Cape Hatteras.....	T-R.....	do.....	do.....	Do.
Do.....	C.....	do.....	do.....	Do.
Cape Lookout.....	C.....	do.....	do.....	Do.
Morehead City.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 46.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 52.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 72.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 80.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 101.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 91.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 49.....	T-R.....	do.....	do.....	Do.
Navy yard.....	T.....	Sixth.....	Charleston.....	Commandant navy yard, Charleston.
Charleston.....	R.....	do.....	do.....	Commandant sixth naval district.
Radio Laboratory.....	Exp(R).....	do.....	do.....	Commandant navy yard, Charleston.
Folly Island.....	C(T)(R).....	do.....	do.....	Commandant sixth naval district.
North Island.....	C(T)(R).....	do.....	do.....	Do.
Tybee Island.....	C.....	do.....	do.....	Do.
Savannah.....	T-R.....	do.....	do.....	Do.

Station.	Kind.	District.	Maintenance yard.	Command.
Port Royal.....	T-R-Edu.	Sixth.....	Charleston.....	Commanding Officer, Marine detachment.
Light Vessel No. 84.	T-R	..do.....	..do.....	Commandant sixth naval district.
Light Vessel No. 94.	T-R	..do.....	..do.....	Do.
Light Vessel No. 1.	T-R	..do.....	..do.....	Do.
Light Vessel No. 34.	T-R	..do.....	..do.....	Do.
Light Vessel No. 53.	T-R	..do.....	..do.....	Do.
Naval Station.....	T-Tf	Seventh.....	Key West.....	Commandant naval station, Key West.
Key West.....	R	..do.....	..do.....	Do.
Jupiter Inlet.....	C	..do.....	..do.....	Do.
Jupiter.....	T-R	..do.....	..do.....	Do.
St. Augustine.....	T-R	..do.....	..do.....	Do.
Pensacola.....	C	Eighth.....	New Orleans.....	Commanding officer Naval air station, Pensacola.
Do.....	T-Tf-R	..do.....	..do.....	Do.
Naval Aviation.....	Pgn	..do.....	..do.....	Do.
Naval Station.....	T-R	..do.....	..do.....	Commandant naval station New Orleans.
Radio Laboratory. Pass a Loutré.....	Exp (R) T-R-C	..do..... ..do.....	..do..... ..do.....	Do. Commandant eighth Naval district.
Grand Island.....	T-R-C	..do.....	..do.....	Do.
Burrwood.....	T-R	..do.....	..do.....	Do.
Do.....	C	..do.....	..do.....	Do.
Mobile.....	T-R	..do.....	..do.....	Do.
Sabine Pass.....	C	..do.....	..do.....	Do.
Port Arthur.....	T-R	..do.....	..do.....	Do.
Galveston.....	T-R	..do.....	..do.....	Do.
Point Isabel.....	T-R	..do.....	..do.....	Do.
Light Vessel No. 81.	T-R	..do.....	..do.....	Do.
Light Vessel No. 102.	T-R	..do.....	..do.....	Do.
Great Lakes.....	T-Tf	Ninth.....	Commandant ninth naval district.	Commandant ninth naval district.
Do.....	R	..do.....	..do.....	Do.
Air Mail Field.....	L	..do.....	..do.....	Do.
Chicago.....	T-R	..do.....	..do.....	Do.
Radio School.....	Edu	..do.....	..do.....	Commanding officer Great Lakes Radio School.
Naval Training.....	Pgn	..do.....	..do.....	Commandant ninth naval district.
Radio Laboratory. Milwaukee.....	Exp (R) T-R	..do..... ..do.....	..do..... ..do.....	Do. Do.
Manistique.....	C	..do.....	..do.....	Do.
Do.....	T-R	..do.....	..do.....	Do.
Eagle Harbor.....	C	..do.....	..do.....	Do.
Do.....	T-R	..do.....	..do.....	Do.
Duluth.....	T-R	..do.....	..do.....	Do.
White Fish Point.....	T-R-C	..do.....	..do.....	Do.
Grand Marais.....	C	..do.....	..do.....	Do.
Detour Point.....	T-R-C	..do.....	..do.....	Do.
Mackinac Island.....	T-R	..do.....	..do.....	Do.
Alpena.....	T-R	..do.....	..do.....	Do.
Thunder Bay Island. Detroit.....	C T-R	..do..... ..do.....	..do..... ..do.....	Do. Do.
Cleveland.....	T	..do.....	..do.....	Do.
Air Mail Field.....	R	..do.....	..do.....	Do.
Darien.....	T	Fifteenth	Commandant fifteenth naval district.	Commandant fifteenth naval district.
Balboa.....	R	..do.....	..do.....	Do.
Colon.....	T-R	..do.....	..do.....	Do.
Coco Solo.....	T-Tf-R	..do.....	..do.....	Commanding officer Coco Solo Naval Air Station.
Naval Aviation.....	Pgn	..do.....	..do.....	Do.
Cape Mala.....	T-R	..do.....	..do.....	Commandant fifteenth naval district.
Puerto Obaldia.....	T-R	..do.....	..do.....	Do.
La Palma.....	T-R	..do.....	..do.....	Do.
Managua.....	T-R	..do.....	..do.....	Commanding Officer Marine detachment.
Chollas Heights.....	T	Eleventh	Mare Island.....	Commandant eleventh naval district.
Point Loma.....	T-Tf	..do.....	..do.....	Do.
Do.....	C	..do.....	..do.....	Do.
North Island.....	R	..do.....	..do.....	Commanding Officer Naval Air Station North Island.



Station.	Kind.	District.	Maintenance yard.	Command.
Imperial Beach....	C.....	Eleventh	Mare Island	Commandant eleventh naval district.
Naval Aviation...	Pgn.....	do.....	do.....	Commanding Officer Naval Air Station North Island.
Inglewood.....	T.....	do.....	do.....	Commandant eleventh naval district.
San Pedro.....	R.....	do.....	do.....	Commanding Officer Submarine Base San Pedro.
Point Fermin.....	C.....	do.....	do.....	Commandant eleventh naval district.
Point Hueneheme...	T-R-C...	do.....	do.....	Do.
Point Arguello....	C(T)(R) ..	do.....	do.....	Do.
Farallones.....	C(T)(R) ..	do.....	do.....	Commandant twelfth naval district.
Point Montara....	C(T)(R) ..	do.....	do.....	Do.
Bird Island.....	C(T)(R) ..	do.....	do.....	Do.
Point Reyes.....	C(T)(R) ..	do.....	do.....	Do.
Beach San Francisco.	T.....	do.....	do.....	Do.
South San Francisco.	T-Tf.....	do.....	do.....	Do.
Mare Island M. P.	T.....	do.....	do.....	Commandant navy yard Mare Island.
Mare Island H. P.	T.....	do.....	do.....	Do.
Yerba Buena.....	R.....	do.....	do.....	Commandant Naval Training Station, San Francisco.
Radio School.....	Edu.....	do.....	do.....	Do.
Radio Laboratory.	Exp (R) ..	do.....	do.....	Commandant navy yard Mare Island.
Eureka.....	C.....	do.....	do.....	Commandant twelfth naval district.
Do.....	T-R.....	do.....	do.....	Do.
Light Vessel No. 70.	T-R.....	do.....	do.....	Do.
Light Vessel No. 83.	T-R.....	do.....	do.....	Do.
Light Vessel No. 76.	T-R.....	do.....	do.....	Do.
Marshfield.....	T-R.....	Thirteenth	Puget Sound	Commandant thirteenth naval district.
Empire.....	C.....	do.....	do.....	Do.
North Head.....	T-R.....	do.....	do.....	Do.
Fort Stevens.....	C.....	do.....	do.....	Do.
Ocean Park.....	C.....	do.....	do.....	Do.
Astoria.....	T-R.....	do.....	do.....	Do.
Seattle.....	T-R.....	do.....	do.....	Do.
Keyport.....	T-Tf.....	do.....	do.....	Commandant Naval Torpedo Station.
Puget Sound.....	R.....	do.....	do.....	Commandant navy yard Puget Sound.
Radio Laboratory.	Exp (R) ..	do.....	do.....	Do.
Neau Bay.....	Tf.....	do.....	do.....	Commandant thirteenth naval district
Tatoosh.....	C.....	do.....	do.....	Do.
Do.....	T-R.....	do.....	do.....	Do.
New Dungeness....	C(T)(R) ..	do.....	do.....	Do.
Port Angeles.....	C.....	do.....	do.....	Do.
Cattle Point.....	C(T)(R) ..	do.....	do.....	Do.
Smiths Island.....	C(T)(R) ..	do.....	do.....	Do.
Light Vessel No. 67	T-R.....	do.....	do.....	Do.
Light Vessel No. 93	T-R.....	do.....	do.....	Do.
Light Vessel No. 88	T-R.....	do.....	do.....	Do.
Light Vessel No. 92	T-R.....	do.....	do.....	Do.
Sitka.....	T-R.....	do.....	do.....	Do.
Ketchikan.....	T-R.....	do.....	do.....	Do.
Juneau.....	T-R.....	do.....	do.....	Do.
Hanscom.....	T.....	do.....	do.....	Do.
Eyak.....	R.....	do.....	do.....	Do.
Seward.....	T-R.....	do.....	do.....	Do.
Soapstone Point...	T-R-C...	do.....	do.....	Do.
Hinchenbrook.....	T-R-C...	do.....	do.....	Do.
Kodiak.....	T-R.....	do.....	do.....	Do.
Dutch Harbor.....	T-R.....	do.....	do.....	Do.
Cape Barchef Light	Tf.....	do.....	do.....	Superintendent light-houses, Ketchikan.
Scotch Cap Light	Tf.....	do.....	do.....	Do.
St. George.....	T-R.....	do.....	do.....	Commandant thirteenth naval district.
St. Paul.....	T-R.....	do.....	do.....	Do.
Pearl Harbor.....	T.....	Fourteenth	Pearl Harbor.	Commandant Naval Station, Pearl Harbor.

Station.	Kind.	District.	Maintenance yard.	Command.
Air base.....	Tf.....	Fourteenth	Pearl Harbor	Commanding officer Naval Air Base, Pearl Harbor.
Heeia.....	T.....	do.....	do.....	Commandant fourteenth naval district.
Wailupe.....	R.....	do.....	do.....	Do.
Naval aviation.....	Pgn.....	do.....	do.....	Commanding officer Naval Air Base, Pearl Harbor.
Radio Laboratory.	Exp (R).....	do.....	do.....	Commandant Naval Station Pearl Harbor.
Ofu.....	T-R.....		Tutuila.....	Commandant Naval Station, Tutuila.
Tutuila.....	T-R.....		do.....	Do.
Guam.....	T.....		Guam.....	Commandant Naval Station, Guam.
Do.....	C.....		do.....	Do.
Merizo.....	R.....		do.....	Do.
Marine aviation.....	Pgn.....		do.....	Do.
Cavite.....	T.....		Cavite.....	Commandant sixteenth naval district.
Los Banos.....	R.....		do.....	Do.
Olongapo.....	T-R.....		do.....	Commandant Naval Station, Olongapo.
Vladivostok.....	T-R.....		do.....	Commander in chief Pacific Fleet.
Shanghai.....	R.....		do.....	Do.
Peking.....	C.....		do.....	Do.
Do.....	T-R.....		do.....	Do.

Kind of stations.

31-63. The key to the kind of stations is as follows:

B—Radio beacon service (no stations yet in commission).

C—Radio compass receiving stations.

Edu—Communication educational service.

Exp—Radio research and experimental station.

L—Land line communication station only.

Pgn—Homing pigeon station.

R—Receiving and control station (local or remote).

T—Radio telegraph transmitting station.

Tf—Radio telephone station.

Living quarters.

(T) (R)—Stations equipped for transmitting and receiving although nominally not traffic stations.

31-64. Living quarters will be provided for the personnel of shore communication stations which are located outside of a naval or military reservation. Married operators' quarters will be provided where possible to accommodate married personnel of the rating of chief radioman or higher, but the bureau will not authorize the construction of new married operators' quarters to accommodate married personnel holding ratings below chief radioman except in very special cases.

Standard allowance of furnishings.

31-65. Following is the standard allowance of house furnishings at shore communication stations:

OFFICER IN CHARGE QUARTERS.

(Gunner or radioman in charge.)

PAROR OR LIVING ROOM.

1 carpet, rug pattern. 5-frame body. Brussels or Wilton.

2 chairs, upholstered, hardwood frame.

2 armchairs (as above); one rocking-chair can be substituted for one of the armchairs.

- 1 sofa or davenport (as above).
- 1 library table, hardwood.
- 1 set of window shades and fixtures for each window.
- 1 stove, heating, coal, wood, or gas (when required).
- 1 bookcase, small (or bookrack).
- 1 set of scrim curtains with rod and fixtures for each window.

## DINING ROOM.

- 1 carpet, rug pattern, 5-frame body, Brussels or Wilton.
- 1 dining table (6-foot extension, 48-inch pedestal), round or square, oak, any finish.
- 1 sideboard, with or without mirror, wood to match above, not less than 54 inches long.
- 6 chairs, wood to match above.
- 1 side table.
- 1 set of window shades and fixtures for each window.
- 8 dinner plates, chinaware.
- 8 coffee cups and saucers, chinaware.
- 8 soup plates, chinaware.
- 8 tumblers, glass.
- 1 water pitcher, glass.
- 2 meat platters, chinaware.
- 2 vegetable dishes, chinaware.
- 2 salt shakers, glass.
- 2 pepper shakers, glass.
- 8 mess bowls, chinaware.
- 1 cream pitcher, chinaware.
- 1 butter dish, chinaware.
- 1 butter knife, plated ware.
- 1 sirup pitcher, glass.
- 1 sugar bowl, chinaware.
- 1 gravy ladle, plated ware.
- 8 table knives, plated ware.
- 8 table forks, plated ware.
- 8 teaspoons, plated ware.
- 8 soup spoons, plated ware.
- 3 tablecloths, cotton, white.
- 12 napkins, cotton.
- 1 carving set.
- 2 dinner platters, chinaware.
- 1 set of scrim curtains with rod and fixtures for each window.

## MAIN HALL.

- 1 carpet, 5-frame body, Brussels or Wilton.
- 1 mirror and table.
- 1 set of window shades and fixtures for each window.
- 1 set of scrim curtains with rod and fixtures for each window.

## EACH SLEEPING ROOM.

- 1 carpet, rug pattern, 5-frame body, Brussels or Wilton.
- 1 bedstead of enameled iron with one set of springs and one mattress.
- 1 dresser, bureau or chiffonier, with mirror, oak or mahoganyized birch.
- 1 table, small.
- 1 chair, as above, cane or wood seat.
- 1 rocker.
- 1 set of window shades and fixtures for each window.
- 2 pillows.
- 4 sheets, seamless, plain, white, cotton.
- 4 pillowcases, plain, white, cotton.
- 3 blankets, wool, plain.
- 2 bedspreads, cotton.
- 1 set of scrim curtains with rod and fixtures for each window.

## UPPER HALL.

- 1 carpet, 5-frame body Brussels or Wilton.
- 1 stair carpet, 5-frame body Brussels or Wilton, including pads.
- 1 set of window shades and fixtures for each window.
- 1 set of scrim curtains with rod and fixtures for each window.

## BATH.

- |                                                      |                                                                |
|------------------------------------------------------|----------------------------------------------------------------|
| 1 rug, small.                                        | 1 set of scrim curtains with rod and fixtures for each window. |
| 1 chair, white enameled.                             | 1 towel rack.                                                  |
| 1 medicine cabinet with mirror.                      | 1 soap rack.                                                   |
| 1 set of window shades and fixtures for each window. |                                                                |

## KITCHEN, PANTRY, ETC.

- |                                                                                                |                                                        |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| 1 range, cooking, coal, wood, or gas.                                                          | 1 ladle.                                               |
| 1 refrigerator, top ice, to hold about 100 pounds, white opalite glass lining.                 | 1 scoop, flour.                                        |
| 1 kitchen table (deal).                                                                        | 1 cake turner.                                         |
| 2 kitchen chairs.                                                                              | 1 pudding pan, 2-quart.                                |
| 2 door foot mats.                                                                              | 1 dairy pan, 2-quart.                                  |
| 1 egg beater.                                                                                  | 1 can opener.                                          |
| 1 broiler.                                                                                     | 1 lemon reamer.                                        |
| 1 meat fork.                                                                                   | 1 set sad irons or 1 electric iron.                    |
| 1 meat grinder.                                                                                | 1 chopping bowl.                                       |
| 1 teakettle.                                                                                   | 1 kitchen cabinet (when no built-in feature provided). |
| 1 teapot.                                                                                      | 1 shovel for coal hod.                                 |
| 1 bread knife.                                                                                 | 1 roast pan, covered.                                  |
| 1 butcher knife.                                                                               | 1 saucepan, 2-quart.                                   |
| 1 potato masher.                                                                               | 4 pie pans.                                            |
| 1 bean pot.                                                                                    | 4 bread pans, one-loaf size.                           |
| 1 dish pan.                                                                                    | 2 bread pans, two-loaf size.                           |
| 1 saucepan, 3-quart.                                                                           | 1 mixing bowl, large, earthenware.                     |
| 1 bread pan.                                                                                   | 4 cake tins.                                           |
| 2 frying pans, one 6-inch, one 9-inch covered garbage can.                                     | 1 muffin tin.                                          |
| 1 wash boiler.                                                                                 | 1 sugar can.                                           |
| 2 washtubs, galvanized iron, when stationary tubs not provided.                                | 1 tea can.                                             |
| 1 wringer and stand.                                                                           | 1 double boiler, 2-quart.                              |
| 1 washboard.                                                                                   | 1 hot-cake griddle.                                    |
| 1 washing machine (one only to be supplied each station and to be for general use at station). | 1 grater.                                              |
| 1 bucket, galvanized iron.                                                                     | 1 coffee pot or percolator.                            |
| 1 paring knife.                                                                                | 1 rolling-pin.                                         |
| 1 waffle iron.                                                                                 | 1 steel.                                               |
| 1 bread box.                                                                                   | 1 freezer, ice-cream, 2-quart.                         |
| 1 colander.                                                                                    | 1 mixing spoon, cook's, perforated.                    |
|                                                                                                | 1 mixing spoon, 12 inches long.                        |
|                                                                                                | 1 flour sifter.                                        |
|                                                                                                | 1 coal hod, galvanized iron, small.                    |
|                                                                                                | 1 coffee grinder.                                      |

## OPERATOR'S BARRACKS.

(Sleeping quarters, per man.)

- 1 bedstead, single, of enameled iron, with one set of springs and one mattress.
- 3 blankets.
- 2 bedspreads, cotton.
- 4 sheets, seamless, plain, white, cotton.
- 1 pillow.
- 2 pillow slips, plain, white, cotton.
- 1 metal locker.
- 1 chair, plain, wood or cane seat.
- 1 set window shades and fittings for each window.
- 1 set of scrim curtains with rod and fixtures for each window.

DINING ROOM.

(Based on complements of approximately 10 men.)

- 1 set window shades and fittings for each window.
- 1 dining table, 8-foot, extension, square, heavy, plain legs, oak.
- 12 chairs, wood, to match above.
- 3 tablecloths, plain, white, cotton.
- 12 mess bowls, chinaware.
- 12 cups and saucers, chinaware.
- 3 vegetable dishes, chinaware or glass.
- 2 cream pitchers, chinaware or glass.
- 2 salt shakers, glass.
- 2 pepper shakers, glass.
- 12 tumblers, glass.
- 2 butter dishes, chinaware or glass.
- 1 carving set.
- 12 table knives, steel, bone handle.
- 12 table forks, steel, bone handle.
- 12 soup spoons, plated ware.
- 12 teaspoons, plated ware.
- 12 dinner plates, chinaware.
- 3 dinner platters, chinaware.
- 2 sirup pitchers, glass.
- 2 sugar bowls, chinaware or glass.
- 2 dinner platters, chinaware.
- 12 soup plates.

KITCHEN.

(Based on complement of approximately 10 men.)

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1 kitchen cabinet (when no built-in features provided).</li> <li>1 covered garbage can.</li> <li>1 bucket, galvanized iron.</li> <li>1 paring knife.</li> <li>1 waffle iron.</li> <li>1 bread box.</li> <li>1 colander.</li> <li>1 ladle.</li> <li>1 meat fork.</li> <li>1 bread-mixing pan.</li> <li>1 tea can.</li> <li>1 steel.</li> <li>1 coffee grinder.</li> <li>1 refrigerator, suitable size.</li> <li>1 egg beater.</li> <li>1 broiler.</li> <li>1 meat grinder.</li> <li>1 teakettle.</li> <li>1 bread knife.</li> <li>1 potato masher.</li> <li>1 bean pot, 2-quart.</li> <li>1 dish pan.</li> <li>2 saucepans, 6-quart.</li> <li>1 meat saw, 18-inch.</li> <li>6 bread pans, 2-loaf size.</li> <li>1 mixing bowl, large.</li> <li>4 cake tins.</li> <li>1 cleaver.</li> <li>1 sugar can.</li> </ul> | <ul style="list-style-type: none"> <li>1 scoop, flour.</li> <li>1 cake turner.</li> <li>1 pudding pan, 2-quart.</li> <li>1 dairy pan, 2-quart.</li> <li>1 can opener.</li> <li>1 lemon reamer, glass.</li> <li>1 set sad irons or 1 electric iron.</li> <li>1 chopping bowl.</li> <li>1 shovel for coal hod.</li> <li>1 double boiler, 2-quart.</li> <li>3 frying pans, 6-inch, 9-inch and 13-inch.</li> <li>1 hot-cake griddle.</li> <li>1 grater.</li> <li>1 butcher knife, 9-inch.</li> <li>1 muffin tin.</li> <li>1 coffeepot.</li> <li>1 teapot.</li> <li>2 roast pans, covered.</li> <li>2 saucepans, 4-quart.</li> <li>6 pie tins.</li> <li>1 rolling pin.</li> <li>1 freezer, ice-cream.</li> <li>1 mixing spoon, 12 inches long.</li> <li>1 mixing spoon, cook's, perforated.</li> <li>1 flour sifter.</li> <li>1 coal hod, galvanized-iron, large.</li> <li>1 kitchen table (deal).</li> <li>1 range, cooking, coal, wood, or gas.</li> <li>2 kitchen chairs.</li> </ul> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

BATH.

- |                                                                                                                                                                             |                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1 chair, white enameled.</li> <li>1 medicine cabinet, with mirror.</li> <li>1 set of shades and fixtures for each window.</li> </ul> | <ul style="list-style-type: none"> <li>1 set of scrim curtains with rod and fixtures for each window.</li> <li>1 towel rack.</li> <li>1 soap rack.</li> </ul> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|

## LIVING ROOM.

(Based on complement of approximately 10 men.)

- 1 library table, plain, suitable size.
- 1 bookcase, sectional.
- 6 chairs, oak or mahoganyed birch, wood or cane seats.
- 4 rockers, oak or mahoganyed birch, wood or cane seats.
- 1 set of window shades and fixtures for each window.
- 1 stove, heating, coal or wood (when required).
- 1 set of scrim curtains with rod and fixtures for each window.

## MARRIED OPERATORS' QUARTERS.

## LIVING ROOM.

- 1 carpet, rug pattern, 5-frame body Brussels or Wilton.
- 2 chairs, hardwood, saddle seats.
- 1 chair, upholstered, hardwood frame.
- 1 armchair or rocking-chair, as above.
- 1 sofa or davenport, as above.
- 1 library table, hardwood.
- 1 set of window shades and fixtures for each window.
- 1 stove, heater type, coal, wood, or gas (when required).
- 1 bookcase, small (or book rack).
- 1 set of scrim curtains with rod and fixtures for each window.

## DINING ROOM.

- 1 carpet, rug pattern, 5-frame body Brussels or Wilton.
- 1 dining table, 6-foot extension, round or square, heavy plain legs, oak, any finish.
- 1 sideboard, without mirror, wood to match above.
- 6 chairs, wood to match above.
- 1 set of window shades and fixtures for each window.
- 3 tablecloths, plain, white, cotton.
- 12 napkins, plain, white, cotton.
- 6 mess bowls, chinaware.
- 6 saucers and cups, chinaware.
- 3 vegetable dishes, chinaware or glass.
- 1 cream pitcher, chinaware or glass.
- 1 salt shaker, glass.
- 1 pepper shaker, glass.
- 6 tumblers, glass.
- 1 cream pitcher, chinaware or glass.
- 6 table knives, plated.
- 6 table forks, plated.
- 6 soup spoons, plated.
- 6 teaspoons, plated.
- 6 dinner plates, chinaware.
- 1 water pitcher, glass.
- 6 soup plates, chinaware.
- 1 gravy ladle, plated ware.
- 1 butter knife, plated ware.
- 2 meat platters, chinaware.
- 1 sirup pitcher, glass.
- 1 sugar bowl, chinaware or glass.
- 1 carving set.
- 1 set of scrim curtains with rod and fixtures for each window.

## MAIN HALL.

- |                                                                                                                                |                                                                                                                                                                                                                                                                                                        |                                                   |                                                                |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1 carpet, 5-frame body Brussels or Wilton.</li> <li>1 hall mirror and table.</li> </ul> | <table border="0"> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">1 set window shades and fixtures for each window.</td> </tr> <tr> <td style="border-left: 1px solid black; padding-left: 5px;">1 set of scrim curtains with rod and fixtures for each window.</td> </tr> </table> | 1 set window shades and fixtures for each window. | 1 set of scrim curtains with rod and fixtures for each window. |
| 1 set window shades and fixtures for each window.                                                                              |                                                                                                                                                                                                                                                                                                        |                                                   |                                                                |
| 1 set of scrim curtains with rod and fixtures for each window.                                                                 |                                                                                                                                                                                                                                                                                                        |                                                   |                                                                |

## EACH SLEEPING ROOM.

1 carpet, rug pattern, 5-frame body.	1 set of window shades and fixtures for each window.
1 bedstead of enameled iron with one set of springs and one mattress.	2 pillows.
1 dresser, bureau, or chiffonier, with mirror, oak or mahogany-birch.	4 sheets, seamless, plain, white, cotton.
1 chair, as above, cane or wood seat.	4 pillowcases, plain, white, cotton.
1 set of scrim curtains with rod and fixtures for each window.	3 blankets, wool, plain.
	2 bedspreads, cotton.

## UPPER HALL.

1 carpet, 5-frame body, Brussels or Wilton.	1 set window shades and fixtures for each window.
1 stair carpet, 5-frame body Brussels or Wilton, including pads.	1 set of scrim curtains with rod and fixtures for each window.

## KITCHEN.

1 refrigerator, top ice, to hold about 100 pounds.	1 potato masher.
1 egg beater.	1 bean pot.
1 broiler.	1 bread pan.
1 meat fork.	1 sugar can.
1 meat grinder.	1 tea can.
1 teakettle.	1 steel.
1 bread knife.	1 flour sifter.
1 dish pan.	1 coal hod, galvanized-iron, small.
1 saucepan, 3-quart.	1 coffee grinder.
1 saucepan, 2-quart.	1 covered garbage can.
4 bread pans, one-loaf size.	1 wash boiler.
2 bread pans, two-loaf size.	2 washtubs, galvanized iron (when stationary tubs not provided).
1 mixing bowl, large, earthenware.	1 kitchen cabinet (when no built-in features provided).
4 cake ints.	1 wringer and stand.
1 muffin tin.	1 washboard.
1 double boiler, 2-quart.	1 bucket, galvanized iron.
2 frying pans, 6 and 9 inch.	1 shovel for coal hod.
1 hot-cake griddle.	1 paring knife.
1 grater.	1 waffle iron.
1 butcher knife.	1 bread box.
1 coffeepot or percolator.	1 colander.
1 teapot.	1 ladle.
1 roast pan, covered.	1 scoop, flour.
4 pie tins.	1 cake turner.
1 rolling pin.	1 dairy pan, 2-quart.
1 freezer, ice-cream, 2-quart.	1 pudding pan, 2-quart.
1 mixing spoon, cook's, perforated.	1 can opener.
1 mixing spoon, 12 inches long.	1 lemon reamer, glass.
1 range, cooking, coal, wood, or gas.	1 set sad irons or 1 electric iron.
1 kitchen table (deal).	
2 kitchen chairs.	

## BATH.

1 set of shades and fixtures for each window.	1 towel rack.
1 chair, white enameled.	1 soap rack.
1 medicine cabinet, with mirror.	1 rug, small.
	1 set of scrim curtains with rod and fixtures for each window.

The limit of expenditures to furnish completely officer in charge quarters is \$1,000 maximum; for married operators' quarters, \$850 maximum; and for operators' barracks, \$100 per man of the authorized complement for complements of 10 men and under

and \$75 per man of the authorized complement for complements in excess of 10 men. Subsequent replacements or repairs are to be absorbed by the station's annual maintenance allotment.

**Floor covering.** 31-66. Carpets, rugs, linoleum, or matting will be used to cover floors of rooms, at the discretion of the commandants of the maintenance yards, depending on which is considered most suitable with respect to climatic or other conditions prevailing at the stations, costs, etc.

**Type of furniture.** 31-67. There will be no objections to type of furniture best suited for climatic and other conditions prevailing at the stations being selected at the discretion of the commandants of the stations' maintenance yards, nor to electric ranges or heaters being furnished in place of coal, wood, or gas stoves, provided the initial cost in conjunction with the cost of operation is less for the electrical equipment.

**Nettings for beds.** 31-68. When considered necessary by the commandants of the maintenance yards for the health and comfort of station personnel, the allowances may be increased to provide for top frames to carry netting and two nettings assigned to the standard allowance for each bed.

#### PART 3—REPORTS.

**Reports.** 31-69. The following reports, in addition to those in letter form mentioned in previous articles, will be rendered in connection with communication maintenance, material supply, and construction matters. These do not include such routine reports as the radio material officer may require to be made to his office by officers in charge of shore communications stations.

**Annual on April 1.** 31-70. On April 1, by commanders in chief to the Secretary of the Navy, with copies to the Director Naval Communications and the Bureau of Engineering, a report outlining the radio, sound, and pigeon communication activities of the fleets, during the preceding fiscal year, and recommendations for the ensuing fiscal year.

**Annual on January 1.** 31-71. On January 1, by officers in charge of shore communication stations to Bureau of Engineering via their maintenance yard (radio material office), a description of their stations on Form N. Eng. 25A. One copy of this report will be furnished the district communication superintendent and one copy retained for file. Two copies will be forwarded to the radio material officer, who shall retain one copy and forward the other to the Bureau of Engineering.

**Annual July 1 and when important changes are made.** 31-72. On July 1, and at such times as important changes are made, by commanding officers of vessels, including aircraft in commission, in reserve, and naval auxiliaries, to Bureau of Engineering via official channels of fleet, if attached to fleet, a description of ship's communication installation on Forms N. Eng. 25 B. Report shall be prepared in sextuplicate, one copy furnished to division commander, one to squadron commander, one to commander in chief, one to vessel's home yard, one to the Bureau of Engineering, and one retained in the vessel's files. Vessels not attached to a fleet or to naval districts will forward this report to the Bureau of Engineering, furnishing a copy to the vessel's home yard. (Small ships use Form N. Eng. 269 for radio.)



31-73. On January 1 by commanding officers of district craft, including aircraft, a description of radio installation, on Form N. Eng. 25B. (In case of similar installations on several aircraft at the same station, one report for all aircraft named in the report will suffice.) The number of the copies and official channels for forwarding the report shall be the same as for shore communication stations. (Small ships use Form N. Eng. 260 for radio.) Annual January 1.

31-74. (1) On January 1 by commanding officers of vessels in commission (including vessels in reserve and naval auxiliaries) to Bureau of Engineering annually and at such other times as important changes are made in the sound installation, on Form N. Eng. 71. One copy to be furnished the commander in chief and one copy furnished the vessel's home yard. Annual January 1 or upon extensive alterations.

(2) When there is no sound installation on board, a letter to that effect will be submitted in lieu of Form N. Eng. 71.

31-75. By maintenance yards to Bureau of Engineering at end of each quarter a report of expenditures in connection with shore communication stations during the quarter, on Form N. Eng. 74. Quarterly.

31-76. At end of each quarter, by industrial department, machinery division (radio material officer) of maintenance yards to the Bureau of Engineering, a report reviewing briefly all communication maintenance, material supply, and construction activities coming under their jurisdiction. This report will review the activities within the territory covered as a whole, and will show the personnel employed or engaged in the material branch of the Naval Communication Service at each maintenance yard and outlying points; the nature of the work involved; the conditions in general as regards material within the territory covered; the status of projects underway as regards shore stations, ship stations, sound apparatus, etc., the status of allowances and expenditures; the number and nature of interruptions to the service during the quarter due to troubles with material; meritorious or unsatisfactory service, as regards material, on the part of the personnel concerned; shore communication station marks, etc. This report will be submitted to the Bureau of Engineering in quadruplicate promptly after the end of each quarter.

31-77. Radio material officers quarterly or periodical inspection reports of shore communication stations, to be submitted to the Bureau in duplicate, copies to be furnished to communication supervisory personnel interested.

31-78. At the end of each quarter by supervisor, trans-Pacific high-power circuit to Bureau of Engineering, with copies to commandants of maintenance yards interested, Pacific coast communication superintendent, Philippine communication superintendent, a quarterly review of the trans-Pacific high-power circuit as a whole.

31-79. On the first day of each month by all maintenance yards and the Bureau of Engineering; a report containing all data of interest pertaining to the radio, sound and pigeon activities of the preceding month. Reports of the maintenance yards shall be forwarded to the Bureau of Engineering and to all other navy yards and naval stations, to the commanders in chief, to naval air Monthly.

stations, and to such shore communication stations as may be desirable for instructional purposes. Bureau of Engineering reports will be forwarded to all navy yards, naval stations, air stations, shore communication stations, commanders in chief, squadron and train commanders of the Atlantic, Pacific, and Asiatic Fleets. These reports will comprise a monthly review of all communication maintenance, material supply, and construction activities of the Naval Communication Service.

31-80. By commanding officers of air stations and air detachments, via the yard having supervision over communication maintenance, material supply, and construction matters, to the Bureau of Engineering, a report of aircraft communication material on hand, apparatus installed in planes, and items of interest in regard to radio and pigeon communications.

Special re-  
ports, when to  
be made. 31-81. By officer in charge shore radio stations to Bureau of Engineering, when important changes are made in apparatus. This report shall be forwarded on Form N. Eng. 25A in the same manner as the annual description of shore radio installations.

31-82. By officer in charge of shore radio stations to their maintenance yard (district radio material officer), whenever a casualty occurs to apparatus which necessitates closing down of the station. Also whenever repairs of apparatus due to casualty are beyond the capacity of the station force.

31-83. After each calibration of ships' radio compasses by commanding officers of vessels in commission, in reserve, and naval auxiliaries to Bureau of Engineering, a radio-compass deviation curve on Form N. Eng. 29. One copy to be furnished the commander in chief and one copy to the vessel's home yard.

31-84. After each calibration of radio compass by officers in charge of shore radio-compass stations to Bureau of Engineering, via maintenance yard, in duplicate, one copy to be retained at maintenance yard, radio-compass deviation curve on Form N. Eng. 29.

Forms.

31-85. The following forms should be obtained from the Bureau of Engineering:

N. Eng. 25A. Description of radio shore station -----	By requisition on Form N. Eng. 52C.
N. Eng. 25B. Description of ship radio installation--	Do.
N. Eng. 29. Radio-compass calibration report-----	Do.
N. Eng. 74. Quarterly report of expenditures -----	Do.
N. Eng. 269. Description of radio installation for small ships-----	Do.
N. Eng. 71. Description of sound apparatus-----	Do.

## SEC. II—SPARK TRANSMITTERS.

### PART 1—GENERAL.

CLASS OF 31-100. (1) Spark transmitters come under the general class of spark transmitters. damped wave apparatus and are found in three forms in the Naval Service:

- (a) 500-cycle quenched-spark transmitters.
- (b) Auxiliary transmitters.
- (c) Motor buzzer transmitters.

(2) The first two types are generally considered quite similar in operation, the main difference being in the frequency and the type of spark gap employed.

(3) The operation of the third type is similar to that of a buzzer excited circuit and uses a direct current supply. A description of each type is given in the following:

31-101. All spark transmitters supply power to the antenna circuit at intervals, not continuously. The antenna circuit is then permitted to oscillate at its own period, more or less independently of the exciting circuit, depending upon the type of gap employed in the latter circuit. Because the antenna circuit has resistance and, further, because power is not supplied continuously to this circuit, the oscillations set up in the antenna increase in amplitude to a maximum value and then decrease, the rate of decrease or decrement being dependent upon the resistance, and the capacity to inductance ratio of the circuit. The decrement is usually measured by means of a decremeter. Antenna oscillations.

31-102. The 500-cycle transmitter, when adjusted properly, has a spark frequency of 1,000 per second. This spark frequency is dependent upon several factors, viz, the frequency and voltage of the alternating current supply, the size of the capacity to be charged, the length of the gap, and the resistance and reactance of the charging circuit. A train of oscillations is set up in the antenna circuit by each recurring spark. Thus there are 1,000 wave trains per second. The oscillations in the wave train occur at a radio-frequency rate (the frequency of oscillations depends on the constants of the circuit), the number of oscillations in each wave train being determined by the decrement. The duration of each wave train is extremely short. The wave trains occur at intervals of one one-thousandth of a second (one per spark) and are separated by relatively long periods in which no action takes place. The distinctive note of a transmitter, as heard in the telephones, corresponds to the spark frequency. Group frequency.

#### (A) THE 500-CYCLE QUENCHED-SPARK TRANSMITTER.

##### PART I.—THEORY.

31-103. The Navy standard 500-cycle quenched-spark transmitter, figure 31-2, consists essentially of three circuits, namely: Circuits.

(1) 500-cycle circuit including the armature of the alternator leads and primary coils of the 500-cycle step-up transformer, secondary coils of the step-up transformer, leads and closed circuit condenser.

(2) Closed, oscillatory circuit including closed circuit condenser, spark gap, closed circuit inductance and leads.

(3) Antenna circuit consisting of antenna (capacity) antenna circuit coupling and loading inductances, ground connection and leads.

31-104. Power for this transmitter is usually supplied by a motor-generator set, the motor of which is adapted to the voltage Power unit.

and type of current available. Frequently the motor is replaced by some other type of prime mover, such as an oil or gasoline engine. The alternator is of the 500-cycle single-phase inductor type. The armature winding consists of two sets of coils. The voltage can be changed by a series or parallel connection of the armature coils and by varying the excitation current of the field coil. In practice, the armature coils are usually connected in series, and the no-load voltage is approximately 275 volts.

The 500-cycle circuit.

31-105. The 500-cycle circuit is usually adjusted to be resonant at a frequency of 440 cycles. The inductance of this circuit includes that of the alternator, leads, reactance, and also a portion is contributed by the transformer as a result of the magnetic leakage. The capacity is primarily supplied by the closed circuit condenser. It has been found that, due to the action of the spark gap

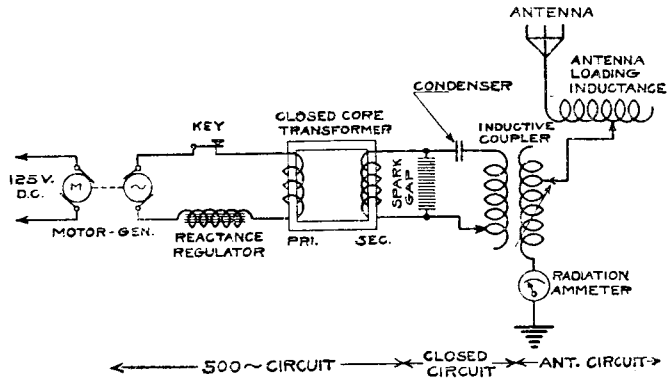


FIG. 31-2.—Circuit diagram of 500-cycle, quenched-spark transmitter.

when it breaks down, the closed circuit condenser acts as if it had a somewhat greater capacity than its actual value. The circuit is adjusted to be resonant to a frequency lower than that impressed upon it, in order that the action of the gap may be uniform, thereby preventing the note of the transmitter from soaring. The condenser is charged alternately to a positive and negative maximum value at a frequency corresponding to that of the alternator, namely, 500 cycles.

The closed circuit.

31-106. (1) The closed circuit, consisting of the closed circuit condenser, quenched-spark gap, primary circuit inductance and leads, oscillates at a radio frequency, the period depending almost entirely on the amount of the inductance and capacity in the circuit. Resistance has very little influence on this period. The theory of the circuit is as follows:

(2) When the spark gap length, resistance and reactance of the charging circuit, etc., have been properly adjusted the condenser is then charged to a voltage sufficiently high to break down the gap at each positive and negative maximum amplitude and one spark per alternation occurs. The spark ionizes the gap, making it a conductor, and oscillations are set up in the closed circuit. These oscillations induce oscillations in the antenna circuit. When the oscillations in the antenna circuit reach their maximum value they react on the oscillations in the closed circuit

through the coupler, decreasing the amplitude of the latter. The resulting current in the closed circuit is insufficient to keep the gap ionized and the gap rapidly becomes deionized and nonconducting. Further oscillation is impossible in the closed circuit. The circuit becomes inactive and the antenna is permitted to oscillate in its own period until all the power transferred to it has been dissipated. This entire operation is repeated with each recurring spark. The momentary current flowing in the closed circuit is very heavy and, if the antenna circuit is not coupled and in tune, there is a serious danger that the spark gap will be burned up, because the power will then be dissipated in a long series of current surges in the closed circuit, instead of being transferred by induction to the antenna circuit.

31-107. (1) The antenna circuit includes the antenna, coupling inductance, loading inductance, ground connection, radiation ammeter, and leads, and acts as a circuit containing inductance and capacity in series. The inductance is that of the coupling and loading coils and the capacity that of the antenna system to ground, the antenna being one plate and the ground the other plate of the condenser. The antenna circuit is usually tuned to resonance with the primary circuit by means of sliding contacts on the inductance coils. The inductance can not be reduced beyond that of the coupling coil which is necessary to transfer the power from the primary circuit to the antenna circuit. In order to obtain still shorter waves a capacity is placed in series with the antenna capacity to reduce the capacity of the circuit. The antenna circuit can then be tuned to resonance with the primary circuit at wave lengths shorter than otherwise possible.

(2) Oscillations are set up in the antenna circuit by induction from the primary circuit, and maximum effect is always produced in the antenna circuit when it is in resonance with the primary circuit.

(3) When adjustments have been properly made throughout the set, the decrement of the antenna circuit will be lowest for the reason that, after the power has been transferred to the antenna circuit, the gap opens and remains inoperative and the antenna circuit is left to oscillate at its own period and with its own decrement. The period is determined solely by the inductance and capacity of the circuit. The total resistance of the antenna circuit including ohmic, ground, dielectric, and radiation resistance, determines the losses in the circuit. The only useful resistance is that due to radiation and is dependent on the height of antenna and the wave length employed. The radiated power is given by the product of the square of the antenna current and the radiation resistance.

(4) The total antenna resistance does not affect the period of oscillations but does play an important part in determining the number of oscillations in each wave train; the higher the resistance the fewer will be the number of waves in the wave train and the more highly damped will be the circuit. The oscillations set up in the antenna circuit rise rapidly to a maximum value and then decrease in amplitude with a constant ratio between successive oscillations in the same direction. The more oscillations

The antenna circuit.

Antenna oscillations.

Decrement and radiation.

Number of oscillations.

there are in a wave train the more nearly does the character of the radiated wave approach that of a continuous wave transmitter. The average decrement is usually 0.05 and, at a distance, the signal tunes in very sharply on the receiving set, thereby causing very little interference.

**Table of standard installation.** 31-108. Data on the standard types of 500-cycle quenched-spark transmitters now in general use is given in the following table:

Kilo-watt.	Type number.	Wave-length range.	Number of wave lengths.	Type vessel used on.
½	CM 296.....			Auxiliary for vessels equipped with 2 and 5-kilowatt arc sets.
	SE 606.....	300-600	2	Shipping Board ships.
1	CE 606-A.....	425-600	2	Do.
	CE 869-859.....	300-952	6	Submarine power boats, tugs (small), submarines.
	CR 654-A.....	300-952	6	Do.
	CE 827.....	300-952	6	Do.
	CE 861.....	300-952	6	Mine sweepers.
	SE 1059.....	300-600	3	Shipping Board.
	SE 1075.....	300-952	6	Submarine chasers.
	CE 1221.....	300-952	6	Do.
	CM 395.....		6	Airplane bases.
	CL 344.....	300-1905	8	Naval vessels.
2	CL 342.....	300-1905	8	Do.
	CL 345.....	300-1905	8	Do.
	CL 346.....	300-1905	8	Do.
	CM 305.....	300-1905	8	Do.
	CR 655.....	300-1905	8	Do.
	CM 1089.....	300-600	3	Shipping Board.
	SE 1265.....	300-600	3	Do.
	CM 307.....	600-1905	8	Battleships (secondary), destroyers, tenders, auxiliaries.
	CR 1125.....	300-3020	9	Do.
	CM 853.....	300-3020	11 (any 9)	Do.
10	SE 1210.....	300-3020	11 (any 9)	Do.
	SE 1211.....	300, 3020	11 (any 9)	Do.
	CL 343.....	750-3020	8	Battleships.
	CL 304.....	750-3020	8	Do.

## PART 2.—DESCRIPTION.

31-112. The following description of the 5-kilowatt, 500-cycle quenched-spark transmitter, type CR 1125 applies to practically all powers and types of quenched-spark transmitters used by the Navy.

**Motor generator.** 31-113. The motor generator consists of a 120-volt direct current, 10-horsepower, 4-pole motor with commutating poles, speed 1,666 revolution per minute, direct connected to a 250-volt, 5-kilowatt, 500-cycle, single-phase inductor-type alternator. The armature of the motor and the rotor of the alternator are mounted on the same shaft supported by two end bearings. The complete unit is semienclosed and has overall efficiency of approximately 70 per cent. The bearings are of the ring oil type made of cast iron with babbitt lining of ample surface and held in place with set screws. Hinged covers are fitted over the opening in the top of the bearing housings to keep dust out of the bearings. Sight gauges are provided to indicate the oil level, and the ends of the bearing housings are fitted with oil-tight brass caps. Terminal boxes with an insulated interior fitting provide means of connection to the motor and alternator. The lugs on the ends of leads to the interior of the machine are tapered plugs which terminate in threaded bolt ends, thereby permitting them to be

easily drawn up tight in the taper holes of the terminal blocks. The boxes are tapped for conduit or terminal tubes for the exterior wiring.

31-114. (1) The transformer is of the closed core type and its construction is very simple and access to the different parts easy. In a typical transformer the primary coil consists of 57 turns, two wires in parallel and two layers, diameter of wire 0.1285-inch (No. 8 B. & S.), and is wound directly over one limb of the core and amply insulated from the core by a tube.

The trans-  
former.

Primary coil.

(2) The secondary winding is in eight sections mounted on a heavy micanite tube which is slipped over the primary coil. Each coil is wound with No. 22 B. & S. gauge D. S. C. wire in 18 layers, 17 turns per layer; total, 306 turns per coil. The layers are insulated with linotape and the wire run through hot "Ohmic" while being wound, and the same compound used for filling the interstices of the coils. Each coil is taped twice, varnished, and dried. The coils are insulated from each other by a micanite washer 40 mils in thickness.

The secondary  
winding.

(3) A reactance coil is contained in the transformer case. This coil is used when necessary to bring the 500-cycle circuit to exact resonance with the assigned frequency of 440 for which purpose a step by step adjustment is provided.

The reactance  
coil.

(4) The safety-spark gap should always be set at three-tenths of an inch. The purpose of this gap is to protect the secondary from being burned out, due to the quenched-spark or rotary gap not functioning properly or when either one has been set too wide.

The safety-  
spark gap.

31-115. (1) The switchboard contains the switches, circuit breakers, instruments, and rheostats necessary to the proper control of the direct-current and low-voltage alternating current circuits of the transmitting set.

The switch-  
board.

(2) There are three D. P. S. T. switches mounted on the board. They control (a) the direct-current supply to the motor; (b) the direct-current auxiliary power circuit, and (c) the 500-cycle low-voltage alternating-current circuit.

(3) A double pole circuit breaker is placed in the lower left-hand corner of the lower panel of the switchboard and protects the direct current circuit from a serious overload due to short-circuit or failure of the automatic motor starter to function properly or when the hand starter is operated too rapidly.

(4) A double pole solenoid switch is mounted in the lower right-hand corner of the same panel and is operated by direct current, the circuit for each solenoid being closed or opened by the send-receive switch. One contact controls the 500-cycle alternating-current circuit, while the other is in series with the alternator field coil circuit. Both contacts are closed in the "send" position and open in the "receive" position of the send-receive switch, thus constituting a safety device.

(5) Six instruments are included in the switchboard equipment. These are (a) alternating-current wattmeter; (b) frequency meter; (c) alternating-current ammeter; (d) alternating-current voltmeter; (e) direct-current ammeter; (f) direct-current voltmeter. Enough information can be obtained at all times from

these instruments for the proper and efficient control of the entire transmitting set exclusive of the radio-frequency circuits.

(6) Two rheostats are also supplied, one for varying the field strength of the generator, the other for varying the field strength of the motor. The first controls the voltage of the generator within rather wide limits for any given speed of the motor generator set, while the second controls the speed of the motor generator set, and hence the frequency of the alternator.

(7) A relay key, which breaks the alternating-current circuit and is operated by a hand-key on the direct-current supply, is frequently mounted on the switchboard below the A. C. D. P. S. T. switch.

**Transfer switch.** 31-116. A 5-pole double-throw transfer switch is supplied for connecting the direct current supply to either the automatic starter or hand starter. Normally, the automatic starter is used, the hand starter being employed only in cases of emergency.

**Spark gaps.** 31-117. Two types of spark gaps are supplied with this set. They are the quenched-spark gap unit and the rotary gap unit, the first being generally used.

**The quenched gap.** (1) The quenched gap consists of 15 gaps in series. The number of gaps employed can be regulated by means of sliding clips. Defective gaps may be cut out of circuit by short-circuiting clips. Each gap is a complete unit and is made airtight by means of suitable gaskets. There are two sparking surfaces in each unit, which are plane and parallel to each other, the proper separation of 10 mils between the surfaces being effected by the thickness of the gasket. Individual gaps are clamped together to make the assembly, and the whole assembly kept cool by natural radiation from fins attached to the sparking surfaces. In some installations forced cooling is employed, in which case a blower is used.

**The rotary gap.** (2) The rotary gap is of the nonsynchronous type and consists of two parts (*a*) stator, and (*b*) rotor. A pure musical note, frequency 1,000, can be obtained. In addition, 500, 250, or 125 sparks per second can be obtained by decreasing the generator voltage. It is possible to operate at high power when the 1,000-spark per second note is employed, the break frequency in this case being approximately 5,000 per second. This is accomplished by the vernier arrangement of the electrodes, there being more revolving than stationary electrodes. Because of this unequal number of electrodes, there are a number of sparks around the circumference of the gap, while one of the revolving electrodes is passing from one stationary electrode to the next. There are 14 revolving and 12 stationary electrodes.

**Condensers.** 31-118. The condensers are of the mica dielectric type. Each unit has a capacity of 0.004  $\mu\text{f}$ . There are eight condensers in each set, which are mounted in a condenser rack, and the connections are made in such a way that for wave lengths above 538 meters all eight condensers are connected in parallel, capacity 0.032  $\mu\text{f}$ . For all wave lengths below 600 meters they are divided in two banks in series, each bank containing four condensers in parallel, the total capacity being 0.008  $\mu\text{f}$ . Full power can only be realized on those wave lengths employing all the condensers in parallel.



31-119. (1) The inductive coupler consists of two coils insulated from each other, one being fixed and the other movable. The amount of separation between the coils is controlled by a lever on the side of the coupler. Both coils are made of copper ribbon wound in spiral form. The fixed coil is the closed oscillatory circuit inductance and is in series with the spark gap and transmitting condenser. Contacts are provided on the front panel of the coupler for making the necessary connections to the condenser bank and to the primary inductance coil of the coupler. Taps are brought from the proper points on this coil to the contacts and a hand-operated lever is provided for making the various necessary connections. Inductive coupler.

(2) The inductive coupler also functions as a wave changer in that the wave length can be changed to previously determined values by means of the wave-changer switch. The shaft of this wave-changer switch carries on its far end a switch bar which makes contact on studs on the rear panel. The movable coil is included in the antenna circuit and is similar to the closed circuit inductance coil in that taps are brought from previously determined points on it to the proper studs on the rear panel. In this manner the wave changer switch cuts in or out approximately the proper amount of inductance for both the closed and antenna circuits.

31-120. No variometer is supplied with this set. Some types of sets are equipped with a variometer which is connected in series with the wave changer closed circuit inductance and consists of a few turns of spirally wound copper ribbon with a continuously variable or sliding contact finger mounted on the front panel. The purpose of the variometer is to permit a very close adjustment to the wave length of the closed circuit, thereby obviating the necessity of adjusting the clips on the closed circuit inductance with great precision. Variometer.

31-121. The antenna loading inductance consists of eight spirally wound copper-ribbon coils, quite similar in construction to the coils used in the inductive coupler. These coils are mounted on three insulating rods by clamps attached to their rims, and are connected in series by a strip passing from one coil to the next. The amount of inductance used in each coil can be varied continuously by turning a knob located near the rim of the coil. This knob is connected to a mechanism which revolves a clip that slides along the copper ribbon. A terminal is supplied on each coil for making connection to the proper contact stud on the rear panel of the inductive coupler and wave changer. There are as many coils in the antenna loading inductance unit as there are outgoing terminals on the wave changer switch. Antenna loading inductance.

31-122. (1) The send-receive switch is located in a position convenient to the operator's hand and is used primarily for transferring the antenna from the transmitter set to the receiving set, and at the same time opens or closes the proper circuits. Send-receive switch.

(2) In the "send" position (horizontal), the send-receive switch performs the following operations:

- (a) Closes a break in field circuit of alternator.

(b) Closes circuit that operates the solenoid of clapper switch on switchboard (which is a double-pole switch and controls alternator field and armature).

(c) Closes circuit that operates detector protective relay.

(d) Closes one spare set of contacts.

(e) Grounds the terminal that connects to receiver.

(f) Connects antenna to loading coil of transmitter.

(3) In the "receive" position (vertical), the switch does the following:

(g) Opens contacts closed by operations (a), (b), (c), (d).

(h) Connects receiver lead to the antenna. The connection (e) should remain closed until the antenna is grounded just before the switch reaches the final receiving position; contact (b) opens before (a) so that spark on breaking the field will occur at the clapper switch and not at the antenna switch unless the clapper switch should fail to open.

**Lightning switch.** 31-123. A switch is mounted next to the antenna lead-in and is used for connecting the antenna to the "send-receive" switch, or directly to ground for the protection of all the apparatus.

**Protective devices.** 31-124. (1) Protective devices are installed with the transmitter set to protect the following apparatus:

(a) Alternator armature.

(b) Direct current motor armature.

(c) Alternator field and direct current motor field.

(d) Primary of transformer.

(e) All auxiliary motors.

(2) The protective device consists of two mica dielectric condensers of approximately  $0.05 \mu\text{f}$  each, connected in series across the line to be protected, with the common connecting wire connected to the metal protective casing, which in turn is grounded.

**Antenna ammeter.** 31-125. A antenna ammeter is connected in series with the antenna circuit next to the ground connection to indicate the current flowing in the antenna circuit.

#### PART 3.—OPERATION.

**Tuning the 500-cycle circuit.** 31-129. The best performance and greatest efficiency of the transmitter is obtained when the 500-cycle circuit is resonant to the proper frequency. This frequency is 440 cycles for all Navy standard 500-cycle quenched-spark transmitters. It should, therefore, be ascertained whether or not the 500-cycle circuit is resonant to this frequency; and if not, it should be adjusted to 440 cycles. It was stated in Article 31-105 that, due to the short-circuiting action of the spark gap, the condenser assumes a fictitious value somewhat greater than the actual. Clearness of note, maximum radiation, and proper quenching are all closely related to the proper tuning of the 500-cycle circuit.

**Method of finding resonant frequency of 500-cycle circuit.** 31-130. (1) (a) Open quenched-spark gap completely so that no sparking will occur.

(b) Start motor generator set.

(c) Reduce frequency to lowest value possible.

(d) Open alternator field circuit. (This is very important.)

(e) Close transmitting key.

(f) Vary motor speed (alternator frequency) slowly from lowest to highest and carefully watch alternating current ammeter for maximum reading.

(g) Note frequency at which maximum reading of alternating current ammeter occurs. This is the resonant frequency.

(2) If this frequency is above or below 440 cycles, the circuit should be adjusted to be resonant to approximately 440 cycles. This is done by changing the inductance of the circuit, more inductance being added if the resonant frequency is above 440 cycles and some of the inductance removed if below this frequency. The device used for this purpose is called the *reactance regulator*. It is situated in the transformer casing, and is furnished with taps so that the amount of reactance may be varied by steps.

(3) This operation should be performed for each combination of motor generator and transformer when the set is installed. After this operation has been completed the transmitting set is ready for wave-length tuning.

31-131. Most transmitters are able to transmit on several different wave lengths, the 5-kilowatt set just described having eight wave lengths. The procedure for tuning is as follows:

Tuning the transmitter to specified wave lengths.

(1) Loosen coupling between primary and secondary coils of inductive coupler.

(2) Start motor generator set.

(3) Throw send-receive switch to send position and disconnect antenna by throwing lightning switch to ground.

(4) Reduce number of gaps cut in to two or three.

(5) Reduce alternating current voltage to very low value.

(6) Adjust frequency to 500 cycles.

(7) Adjust primary inductance to the required wave length, beginning with the longest to be used, and use a wavemeter coupled to the primary inductance for the determination of the wave length. (In making this adjustment do not keep the key closed any longer than necessary and clip the flexible lead to the point on the coil which gives the exact wave length, care being taken to allow room for the other leads.)

(8) Proceed in the same manner as above for the remaining wave lengths. The first tuning of the primary circuit is now complete.

(9) Set secondary (movable) coil approximately  $2\frac{1}{2}$  inches from the primary coil and lock it in this position.

(10) Connect antenna loading inductance coils to proper contact stud of secondary coil and from same contact stud run flexible lead to secondary coil cutting into circuit most of this coil.

(11) Adjust antenna circuit to resonance by varying the amount of inductance in the loading coil marked with the same wave length as that on the contact stud. Resonance is obtained when the radiation ammeter shows maximum deflection.

(12) Vary the coupling between the primary and secondary coils of the inductive coupler. If the radiation is greater at a coupling point quite far from the original setting ( $2\frac{1}{2}$  inches), change the amount of inductance in the secondary coil, increasing the inductance if the coupling is looser and decreasing if the

coupling is tighter than that desired. Compensate for the change by retuning with the loading inductance.

(13) Repeat this operation for all wave lengths, striving to keep the best coupling point as close as possible to the 2½-inch setting.

(14) Measure the wave length of the antenna circuit at each setting, making sure that the wavemeter is actuated by the antenna circuit and not by the closed circuit.

(15) Should any of the wave lengths, as determined by a wavemeter, be found off, readjust *both* primary and secondary until on wave length. (Due to the inductance of the leads it is always best to start at the longest wave length and work down to the shortest when tuning a transmitting set, because the addition of the various leads has less effect on the longer wave lengths where more inductance is in the circuit than on the shorter.) The transmitting set is now ready for high-power adjustment and tuning.

High-power  
adjustments and  
tuning.

31-132. (1) *It is very important* that the same number of gaps be used throughout this adjustment, as otherwise the coupling, note, quenching, and wave length will vary, making it next to impossible to tune the set. The procedure is as follows:

(a) Cut in the proper number of gaps and set wave changer switch on longest wave length.

(b) Increase alternating current voltage.

(c) Depress key and adjust frequency to 500 cycles.

(d) Vary alternating current voltage until spark note sounds clear (1,000 sparks per second).

(e) Adjust coupling between primary and secondary slowly and carefully, noting antenna ammeter reading and clearness of note.

(f) Make final adjustment for voltage, coupling and resonance and measure the wave length.

(2) Care must be taken when operating at high power. The key should not be kept closed any longer than absolutely necessary and dashes should be made only when a reading of the various instruments is necessary. Adjustment to proper voltage for clear note is best made while sending letters. The point to be remembered is that the spark gap will be seriously injured if the antenna does not radiate at its maximum.

(3) It will probably be found that the wave-length adjustments will need to be changed somewhat for high power. Final adjustment can be made only by trial. When all adjustments have been made, the transmitter should function efficiently and properly on all the wave lengths. Proper quenching will take place and the gap will not heat excessively. Only one wave will be radiated and the decrement will be the lowest obtainable for that particular antenna system.

(4) *It is very important* that (a) both circuits be in resonance; (b) proper voltage for the number of gaps used be supplied; (c) best coupling exist between the primary and secondary. *In no case* should the antenna circuit be *detuned* (thrown out of resonance with the primary), because (a) there will be a reaction between the two circuits and two waves will be radiated which can be found on a wavemeter coupled to the antenna circuit; (b)

the gap will not quench properly, thereby heating, and power will be retransferred from the antenna to the primary and back again to the antenna, and the decrement will be increased due to this retransfer of power. In other words, the utility and efficiency of the quenched spark system will be entirely lost.

31-133. Whenever it is desired to transmit on maximum power, special adjustments should invariably be made with a view to obtaining maximum output and maximum efficiency, thereby reducing injury to the set. The voltage, number of gaps, coupling, and tuning of the secondary circuit to the primary circuit should be carefully adjusted.

#### PART 4.—INSTALLATION.

31-136. (1) Install motor generator set in an accessible location, care being taken that the location is suitable from the standpoint of low temperature, dryness, and that the shaft is in a fore and aft position.

(2) The switchboard should be installed handy to the operator and spaced sufficiently from the bulkhead to allow access at the rear.

(3) The transformers should be located under the table near the condenser rack and the primary transformer transfer switch, due regard being given to the protection of the operator from the high potential leads and accessibility.

(4) The condenser rack should be installed as close as possible to the transformer secondary, spark gaps, and closed circuit inductance of the wave changer. Sharp bends and long leads should be avoided.

(5) The spark gaps should be installed in an accessible position and the leads to the rotary gap made as nearly the same as those to the quenched spark gap in order that the wave length will not be changed appreciably when one type of gap is substituted for the other. The rotary gap should be installed with its shaft in the vertical position.

(6) The inductive coupler and wave changer should be installed on the table accessible to the operator's hand.

(7) The antenna loading inductance should be mounted directly above and on the wave changer whenever practicable.

(8) The accessories, including send-receive switch, hand and emergency transmitting keys should be located so that the operator can manipulate them with the least amount of effort. In fact, the whole installation should be made with a view toward rendering the entire set accessible and easy to operate, thereby tending to increase the efficiency of the operating personnel.

#### PART 5.—CARE AND UPKEEP.

31-138. A transmitting set maintained in excellent condition reflects the efficiency and the morale of the operating personnel. The set will render better service when it is well kept and properly treated. Common sense plus a little knowledge of machinery and a working knowledge of radio apparatus are all that are required to obtain this end.

- Motor generator.** 31-139. The motor generator set should be inspected each morning and the bearings replenished with oil whenever necessary. Oil is supplied to the bearing surface by a ring which carries the oil up from the oil well. As long as oil is carried over by this ring and the bearing does not feel *hot* (compared to the other parts of the motor generator) the bearing is in good condition. Should the oil in the well become too low, the ring will not supply oil to the bearing. This results in expansion of the bearing and shaft, which causes "freezing," or the bearing melts allowing the rotating element to strike the pole faces, thereby putting the motor generator set out of commission. The sight gauge on the bearing indicates the level of the oil in the oil well. Reliance should not be placed on these gauges unless they are known to be in good operating condition, as they become clogged up from time to time. Renew the oil once per month and clean oil gauges.
- Switchboard Instruments.** 31-140. The instruments on the switchboard are properly connected at the navy yard and should not be tampered with. They will stand a moderate overload (off scale) without injury, but there is no occasion to operate under this condition. The direct-current instruments (voltmeter and ammeter) require proper connections to the circuit (positive to positive and negative to negative), otherwise they will read backward, thereby bending the needle. The alternating-current instruments have no polarity and will give a correct indication when connected to the alternating-current circuit (ammeter in series and voltmeter across the line). The frequency meter may be adjusted to read correctly by means of the adjustment arm on the box, when provided, located on the rear of the switchboard. For this purpose the generator should be run at a speed to give 500 cycles (use a revolution counter for determining the speed of the generator), and the two adjusting arms moved to cut in or out inductance and resistance until the frequency meter reads 500.
- Circuit breaker.** 31-141. The circuit breaker in the direct-current line is provided mainly for the purpose of protecting the motor of the motor generator set and should be set to trip at a current value slightly in excess of that required to start the motor generator set. The circuit breaker should be thrown in one pole at a time and *before* the main switch is closed otherwise it will not function as a protective device. Should the circuit breaker release during operation, the cause for this should be investigated and remedied before again closing the circuit breaker. Frequently the circuit breaker will open because the automatic motor starter contacts operate too rapidly and do not allow the motor to get up sufficient speed between steps. The oil dashpot type of automatic starter is particularly hard to adjust, the retarding action of the oil being dependent on the temperature.
- Switches.** 31-142. The switch blades and all contacts should be kept clean and smooth. Arcing at contacts should be prevented except where arcing is expected, as at the circuit-breaker carbon contacts and clapper-switch carbon contacts.
- Fuses.** 31-143. Oversize fuses should not be used, but the cause for fuses burning out should be investigated and remedied. Fuses

will carry a large overload without blowing. This is especially true of momentary overloads.

31-144. (1) The transformers give very little trouble, especially the primary winding. The primary can, however, become short-circuited between turns or be burned out (very rare). An open-circuited primary is indicated by no reading on the alternating-current ammeter when the key is closed, when the rest of the circuit is in good condition. Short-circuited turns are more difficult to discover and are indicated by heavy current and failure to break down the quenched-spark gap. If the secondary winding is intact and the proper capacity being used, short-circuited turns are also indicated by a change in the natural frequency of the circuit and, if key is kept closed for a short time, smoke will be given off.

Transformers.

(2) The secondary coils frequently burn out, caused by radio frequency and high potential surges from the oscillatory circuits. A burned-out secondary is indicated by failure of the transformer to break down the quenched-spark gap with ordinary voltages impressed on the primary; the primary current will also be very low. If one of the coils is short-circuited, the voltage will not be sufficient to break down the gap, and a clear note can not be obtained under any circumstances, due to the 500-cycle circuit being out of adjustment; more primary current than the normal value will flow. The secondary can be tested for open or short circuit by a Wheatstone bridge, care being taken to allow sufficient time after depressing the battery key on the Wheatstone bridge to allow the bridge current to reach a steady value in the coil before depressing the galvanometer key. Have galvanometer key open before opening battery key in order to protect the galvanometer from the inductive "kick."

(3) If the secondary winding is found to be defective, it will be necessary to disassemble the transformer. After disassembly, test each coil separately for continuity and replace defective coil with a spare, care being taken to place the coil properly with regard to direction of winding.

31-145. (1) The quenched-spark gap requires considerable attention. The amount of care required to maintain this gap in excellent condition depends upon the amount of operating done, whether high or low power is used and, above all, on the proper tuning of the transmitter. Increased radiation is the result of a clean gap.

Quenched-spark gap.

(2) A defective unit can be detected by a drop in the radiation, by the spark-gap tester, and by a change in the note. A gap in good condition should show a heavy white spark when tested with the spark-gap tester. A weak spark, or the absence of any spark at the tester point, is an indication that that spark gap is defective.

Defective units.

(3) The defective gaps should be disassembled and cleaned. For this purpose cover a plane faceplate with crocus cloth and, placing the sparking surface of the gap on it, give the gap a rotary motion. One type of gap has a gasket rim equal in height to the sparking surface. The rim and sparking surface can, therefore, be dressed down simultaneously. Another type has its

- gasket rim lower than the sparking surface. With this type care must be taken not to round off the edges of the sparking surface.
- Gap sparking surface.** (4) The sparking surface is of silver or copper, the silver surface being about one thirty-second of an inch deep. In dressing down any sparking surface *do not* attempt to remove all the pits, but dress off the high spots. Test the sparking surface with a straightedge. If no light shows under the straightedge, the surface is true. Where a lathe is available the spark gap unit may be revolved and dressed down by the use of crocus cloth held by a plane surface.
- Fish-paper gaskets.** (5) The standard spark gap gasket is made of 35 mil fish paper. The gaskets should be renewed whenever the spark gap is cleaned. This type of gasket will keep the spark gap airtight but, on account of its compressibility, will gradually reduce the spark-gap length until a short circuit results. The gasket rim for this type of gasket is below the sparking surface so that the normal separation of the sparking surfaces will be 10 mils.
- Mica gaskets.** (6) The mica gasket is rather difficult to handle and is not absolutely airtight, but has an advantage over the fish-paper gasket in that it is not affected by heat, whereas the fish-paper gasket rapidly deteriorates due to the heat of the spark gap. Should mica be substituted for fish paper, care must be taken to build up the mica gasket to a thickness of 35 mils. Mica gaskets do not need frequent renewals. Broken or cracked mica gaskets should be replaced.
- Rotary spark gap.** 31-146. (1) The rotary spark gap operates best when the natural frequency of the 500-cycle circuit is close to 500 cycles. Where a reactance regulator is supplied, the 500-cycle circuit should be adjusted to be resonant to 500 cycles when transmission at full power is required. For ordinary intermittent and medium or low power transmitting, this natural frequency should not be adjusted.
- Clearance.** (2) The clearance between stationary and revolving electrodes is approximately one-eighth of an inch for full power and a 1,000-spark note, while for lower powers and the same note the clearance must be *reduced* until the correct amount is determined. About 50 per cent more current in the 500-cycle circuit is required for this type of gap than for the quenched-spark gap.
- Adjustment.** (3) The gap may be adjusted to any desired length in the following manner:
- (a) Remove cover.
  - (b) Bring rotor electrode exactly opposite a stator electrode.
  - (c) Loosen set screw on shank of stator electrode.
  - (d) Adjust clearance by inserting metal gauge of the desired thickness between the two electrodes.
  - (e) Tighten set screw and at same time keep the two electrode tips in the same plane.
  - (f) After adjustment has been made revolve rotor by hand to test clearance before starting the motor.
- Both the stator and the rotor electrodes can be removed only after the rotor is removed from the motor shaft. It is not necessary to remove either set of electrodes except when badly worn.