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SUBJECT Report on Test of Model XTAJ-6 Radio Transmitting Equipment

(Contractor: General Electric Company)

FR-1328

NAVAL RESEARCH LABORATORY

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NAVY DEPARTMENT

BUREAU OF ENGINEERING

Report on

Test of Model XTAJ-6 Radio Transmitting Equipment

(Contractor: General Electric Company)

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D.C.

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Authorization: BuEng. Let. C-NOs-47390(7-7-W8) of 31 August 1936.

Date of Test: 25 September to 19 November 1936.

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APPENDICES

AUTHORIZATION OF TEST

1. The tests herein reported were authorized by reference (a). Other pertinent data are listed as references (b) to (f), inclusive.

Reference:
(a) BuEng. ltr. C-NOs-47390(7-7-W8) of 31 August 1936.
(b) Specifications RE 13A 328J.
(c) Contract NOs-47390 of 28 February 1936.
(d) G.E. descriptive specifications RA-1465.
(e) Inspection test data on XTAJ-6 transmitter.
(f) BuEng. ltr. C-NOs-47390(10-22-W8) of 7 November 1936.

OBJECT OF TEST

2. The object of the tests was to determine compliance of the preliminary Model XTAJ-6 with the terms of the governing specifications and contract and also to determine whether any particular features of design would be of value in Naval use.

ABSTRACT OF TESTS

3. The tests herein reported were conducted to determine the degree of compliance of the Model XTAJ-6 transmitting equipment (preliminary model) with the mechanical and electrical requirements set forth in references (b) and (c).

4. Specifically, tests were conducted to determine the following:

(a) Ability of the equipment to withstand shipment.
(b) Check of mechanical or physical construction and assembly; general workmanship; materials used; corrosion resisting measures employed; and adequacy of electrical circuits to withstand operation under Naval service conditions.
(c) Power output; power input; overall efficiency and flexibility of antenna coupling circuits.
(d) Quality of emitted signals; lilt; undesirable modulation.
(e) Check of dimensions and weights.
(f) Determination of frequency overlap, limiting frequencies of various circuits and cycles per division of master oscillator control.
(g) Check of protective circuits.
(h) Determination of percentage modulation, MCW power output and frequency of audio modulation.
(i) Frequency stability and accuracy under following conditions:
    (1) Accuracy of reset.
    (2) Lost motion, backlash and torque lash.
    (3) Operation of Adjust-Tune-Operate control.
    (4) Detuning of circuits.
    (5) Operation of power output control.
    (6) Change of tubes.

(7) Variation of supply voltage.
(8) Variation in ambient temperature.
(9) Variations in humidity.
(10) Locked key operation for two hours.
(11) Key locked to intermittently keyed condition.
(12) Continuously keyed to intermittently keyed condition.
(13) Inclination due to roll and pitch.
(14) Vibration.
(15) Shock.

The above tests were conducted on at least two frequencies within the range of the transmitter.

5. The adequacy of the power equipment was determined, including voltage regulation and percentage of voltage ripple.

Conclusions

(a) The external appearance of the equipment is good, although the design employed is such that it is impossible to view the interior of the transmitter unit when the shields are in place and the access doors are closed. This interferes with the proper monitoring of the transmitter. A rugged framework of aluminum alloy provides the basis of a design in which the various component parts have been assembled in a manner which provides excellent accessibility in the lower compartment of the transmitter. The upper compartments of the transmitter unit are less accessible, although provision is made for removal of the master oscillator compartment. Certain controls are of smaller size than those usually employed in equipment of this type, although in the majority of instances they embody strength suitable for the needs of the service.

(b) The power output requirements of the specifications have been complied with in all instances. The quality of the emitted signal is excellent and is free from undesirable modulations. The tuning controls do not operate in as sharp and decisive manner as is desirable, which is partly attributable to the fact that the plate current meters which are employed to indicate resonance are located in the common or cathode return. Thus they indicate the summation of currents flowing in the plate, screen grid and control grid circuits, which prevents a well defined resonance "dip." The antenna coupling circuit provided proved adequate for producing full power output into antennas of the various constants listed in the governing specifications. The reaction of the antenna circuits upon the power amplifier tank circuit, however, is somewhat greater than encountered in other equipments of a similar nature.

(c) The frequency stability characteristics of the transmitter fail to comply with the specification requirements in numerous instances and one exceptionally undesirable feature is the tendency of the frequency to continue to drift over long periods of time. While the transmitter is capable of accurate reset and the frequency of the master oscillator is not greatly influenced by tuning reactions from subsequent stages, the virtue of these characteristics is practically vitiated by the large frequency drifts encountered.

(d) The equipment fails to comply with the general and important requirement of safe and satisfactory operation under conditions encountered in the Naval service. Various component parts are adversely affected by vibration; power amplifier tubes of the 38161 type lost emission to the extent that non-operation occurred at intervals ranging from 10 hours to approximately 25 hours full power operation. Numerous other defects were noted and while some of these are minor in nature when considered individually, in the aggregate they assume serious proportions. It must be concluded, therefore, that in its present condition, the preliminary Model XTAJ-6 equipment is unsuitable for use in the Naval service.

Recommendations

It is recommended:

(a) That screen grid resistors be furnished which will withstand the effects of severe vibration (see par. 31).

(b) That the external voltmeter multipliers be provided with satisfactory cases as required by specifications (par. 31).

(c) That all band change switches employed in the equipment be of such design and construction as to assure satisfactory operation during the life of the equipment (par. 34).

(d) That an improved type of interlock be provided on the antenna band change switch (par. 34).

(e) That the filament rheostat controls be modified to prevent accidental movement by having these controls operate at greater tension (par. 35).

(f) That a bias field rheostat be furnished which possesses a satisfactory range of adjustment (par. 35).

(g) That the hinge pins employed on the transmitter access doors be made of non-ferrous corrosion resisting metal (par. 39).

(h) That the most suitable grade of phenolic insulation be employed throughout the transmitter assembly (par. 40).

(i) That re-fillable type fuses, in accordance with the requirements of the governing specifications, be provided in circuits operating at potentials of 440 volts or less (par. 42).

(j) That the overload protection afforded the various tubes in the equipment be improved (par. 43(a)).

(k) That the operation of the tube protective relay (five second drop out) be modified to insure satisfactory and reliable operation (par. 43(b)).

(l) That an improved re-set device be provided for re-setting the overload relay (par. 43(c)).

(m) That the tube access door be provided with perforations and that the side and rear shields be perforated to provide for proper monitoring of the equipment (par. 45).

(n) That the necessary steps be taken to provide a power amplifier plate choke which will not become overheated during key locked operation (par. 47).

(o) That the operating characteristics of the equipment be modified to prevent failure of 3816l tubes through loss of emission over short intervals of operation (par. 49).

(p) That the necessary steps be taken to insure that the entire equipment will comply with the specification requirement that "safe operation and satisfactory performance are assured." (Par. 50).

(q) That a solid mounting pedestal of adequate strength providing proper clearance above the deck be substituted for the flexible mounting with which the preliminary model was provided (par. 51 and par. 127(b)).

(r) That the design of the equipment be so modified as to prevent the failure of any part when the equipment is subjected to severe vibration (par. 52 and par. 53).

(s) That all rheostats be marked to indicate the direction of rotation for increasing potentials, and that door latches of a more satisfactory design be supplied (par. 56).

(t) That the main nameplate be revised in order to properly identify the Contractor (par. 59).

(u) That the master oscillator dial be modified to eliminate undesirable "spring" or "jump" effect and that the main and vernier scales match properly through their range (par. 62).

(v) That an improved design of flexible couplings be furnished throughout the equipment and that the use of the Allen type of set screws be avoided (par. 63).

(w) That all tube sockets be marked to indicate the type of tube which should be employed in each socket (par. 71).

(x) That the rubber washers employed in the present lifting devices be replaced by a more suitable type of anti-rattle device (par. 72 and par. 73).

(y) That the heads of the shield securing screws be provided with a dull finish in place of the present polished finish (par. 76).

(z) That indicator lamp assemblies of an approved type be provided (par. 77 and par. 116).

(aa) That the frequency stability of the equipment be improved to the extent that it will meet the specification requirements under the various conditions imposed by the governing specifications (par. 91 to par. 99, inclusive).

(bb) That the filament stand-by circuit and the filament monitoring circuit be modified so as to produce a more suitable and satisfactory arrangement (par. 100).

(cc) That the circuit arrangement be modified so as to prevent oscillation of the master oscillator under key open conditions when the "Adjust-Tune-Operate" switch is in the "Adjust" position (paragraphs 102, 111 and 113).

(dd) That adequate overlap be provided in all circuits (par. 103).

(ee) That the necessary modifications be made to provide more satisfactory tuning adjustments and indications and that all plate meters be so connected into the circuit that they indicate plate current only; that the master oscillator circuit be provided with a meter in the screen grid circuit and one in the plate circuit (par. 104 and par. 117).

(ff) That the letters designating the tuning controls be increased in size (par. 105).

(gg) That a satisfactory master oscillator dial lock be provided (par. 108).

(hh) That the adjustable positioning devices on the tuning controls be designed to accommodate cards upon which the frequency may be marked, as required by the specifications (par. 109).

(ii) That the necessary precautions be taken to secure all wiring in the transmitter in a satisfactory manner (par. 122).

(jj) That all transformers be marked to indicate the voltage and function of the various terminals (par. 60 and par. 125).

(kk) That the shield securing screws be anchored in a satisfactory manner and that the frame beneath the eyelet openings in the shields be painted black to improve the appearance of the equipment (par. 128).

(ll) That a satisfactory 2-position switch be provided for "remote-local" control in place of the present 3-position switch (par. 139).

(mm) That square head dowels be provided for aligning units of the motor generator assembly (par. 147).

(nn) That suitable nameplates indicating the Navy type of lubricating medium to be employed be provided near the lubrication fittings on the motor generator equipment and that the grease cup on the outboard end of the high voltage generator be made more accessible (par. 151).

(oo) That the use of a separate fuse box be avoided and that all fuses designed to protect the motor generator equipment be mounted directly at the motor generator terminals in suitable housings (par. 152).

(pp) That the ripple content of the bias motor generator be reduced to a value complying with the governing specifications (par. 153).

(qq) That the operation of the magnetic interlock on the cover of the automatic starter be modified and adjusted to operate satisfactorily (par. 154).

(rr) That the brushes on the motor generator equipment be staggered so as to distribute wear evenly over the entire commutator surfaces; that an improved method of securing cover plates on the motor generator equipment be provided and that the direction of rotation of the motor generator be indicated in a conspicuous manner (par. 156).

(ss) That proper precautions be taken to prevent errors in instruction book composition and the wiring diagrams be modified in the interests of simplicity and usefulness (par. 157 to 162, inclusive.).

(tt) That the Bureau of Engineering investigate the desirability and necessity of limiting keying circuit currents to a maximum value of 100 milliamperes in order to insure proper functioning of automatic keying equipment on board ship (par. 163).

(uu) That the Bureau of Engineering consider the advisability of conferring with the Contractor to determine whether it would be expedient to gang the operation of the range switches in the master oscillator, intermediate amplifier, and power amplifier circuits so as to function as a single control, in the interests of simplicity (par. 54 and par. 104).

(vv) That the preliminary Model XTAJ-6 equipment, in its present form, be considered unsatisfactory for use in the Naval Service and that formal acceptance be held in abeyance until the Contractor has demonstrated that all of the above items have been corrected in a manner meeting the approval of the Bureau of Engineering.

MATERIAL UNDER TEST

6. The material under test consisted of one preliminary model XTAJ-6 transmitting equipment complete with motor generators designed to operate from a 440 volt, 3 phase line supply. The equipment was manufactured under Contract NOs-47390 by the General Electric Company. The transmitter is rated at a nominal output of 500 watts and covers the frequency range of 175 to 600 kilocycles. The equipment is capable of both CW and MCW emission.

7. The Model XTAJ-6 was received at the Naval Research Laboratory on 24 September 1936.

METHOD OF TEST

8. The equipment, when received, was carefully examined to determine whether adequate precautions had been observed in preparing the material for shipment and whether any damage had been incurred during the process of transportation.

9. The equipment was then wired up and placed into commission, particular attention being paid to the preliminary instruction books to determine whether or not they were adequate for the purpose intended.

10. Power output measurements were made using dummy antennas of the proper characteristics, employing essentially non-inductive resistors and low loss capacitors. A precision type instrument connected in the ground side of the dummy antenna was used for measuring the radio frequency current.

11. Frequency changes and drifts were checked by means of the Model LK frequency indicator, Serial No. 2, the transmitter being operated at full power output whenever the governing specifications required this type of operation.

12. Frequency range, overlap and kilocycles per division of dial marking were determined by means of an SE-2307 master heterodyne frequency meter.

13. The transmitting equipment, including motor generator, starter and fuse box, were placed within the Naval Research Laboratory test chamber and subjected to variations in ambient temperature between the limits of -1° to +50°C. and variations in relative humidity between the limits of approximately 20% and 95%. During these tests frequency measurements were made by means of the LK visual frequency indicator.

14. Measurement of the ripple voltage present in the outputs of the various generators was made by means of a Model 636 wave analyzer.

15. The percentage of modulation was determined by means of a Model OB audio analyzer.

16. Model RAA receiver, Serial No. 2, was employed for determining the quality of emission.

17. The keying response of the transmitter was investigated at various keying speeds by means of an automatic sender and recording type of oscillograph.

18. The ability of the equipment to withstand vibration and the roll and pitch of a vessel in a heavy sea was determined by mounting the entire equipment on a test stand capable of producing the necessary vibration and inclined operation.

19. Shock tests were conducted by subjecting the equipment to blows from a 20-pound weight suspended in the manner required by the governing specifications.

20. The degree of amplitude modulation present in the CW output was determined through the medium of a half wave rectifier, the tuned input of which was coupled to the output of the transmitter. The output of the rectifier was adjusted to give 100 volts d.c. across the load circuit. The d.c. was then blocked off by means of a 6 mfd. condenser and the audio component determined by means of a suitable output meter.

DATA RECORDED

21. Complete data were recorded during all tests conducted and this information is appended hereto as Tables 1 to 45 and Plates 1 to 31, inclusive.

PROBABLE ERRORS IN RESULTS

22. Precautions were taken to minimize errors in the results obtained through the use of accurately calibrated instruments and at certain points re-checks were made in order to verify the original results. Identical tests were conducted at different frequencies in order to determine the reliable average operation of the equipment.

23. The visual frequency indicating equipment employed is capable of measuring beat note frequencies to within one or two cycles.

24. Power output determinations are considered accurate to within plus or minus 5%.

25. All external meters employed in the measurements were of the precision type whose calibrations were verified previous to use to insure accuracy.

26. The measurement of modulation is considered accurate to within 5% at the levels involved.

27. The ripple content in the output of the motor generators is accurate to within 5%.

RESULTS OF TESTS

28. The Model XTAJ-6 equipment was received in undamaged condition, proper precautions having been taken to insure safe transportation.

29. In the following paragraphs of this report reference is made to the governing specifications RE 13A 328J under which the equipment was constructed. Where no specific reference to any particular paragraph is made it is to be understood that the equipment under test complies with this paragraph and that no further explanatory remarks are considered necessary.

30. In general, the Model XTAJ-6 equipment as submitted for test meets the requirements of the introductory section of the specifications. The frequency range and types of emission are those called for in paragraph 1-2 and paragraph 1-3. Such defects in operation or design as would prevent the equipment functioning in a satisfactory manner under service conditions are pointed out under appropriate paragraph headings.

31. Par. 2-2 (1). As far as could be determined from tests and inspection without resorting to disassembly and destruction of the various component parts, the requirements of the referenced specifications have, in general, been complied with. All fixed resistors in the equipment were investigated and in no instance was the potential drop across the resistor, or the power dissipation of any resistor unit, in excess of that permitted by Specifications RE 13A 372G. Some of the resistor units furnished with the XTAJ-6 equipment appeared to be old stock, but in the majority of cases new stock, complying with specification requirements was employed. Resistors used in the screen grid circuits are not of the vitreous enamelled type. In these circuits 10-watt lamps are employed and while they give satisfactory operation from the electrical standpoint, the filaments of these lamps are subject to breakage when subjected to vibration, as pointed out under paragraph 52 of this report. It is recommended that resistors complying with the requirements of Specifications RE 13A 372G be substituted for these lamps. In connection with the resistors used for voltage multipliers attention is invited to the fact that the resistors are not contained in a protective case as required by Specifications 17-I-12, page 15, paragraph 5(a). Instead, the resistors are mounted in clips secured to an insulating strip in back of the front panel.

32. Par. 2-2 (2). The Model XTAJ-6 employs three tubes of the 38160 type and one tube of the 38161 type.

33. Par. 2-3 (general). The frame of the equipment is ruggedly constructed from aluminum alloy angles and sheets. The frame angles

are 1-1/2" x 1-1/2" x 3/16". Riveted construction is used, employing 5" x 5" x 3/16" gussets for corner bracing. The horizontal shelves and the side shields are constructed from 1/8" thick sheet while the front panels are 3/16" thick. It is understood that in production equipment certain panel items, such as the section carrying meters set at an angle for increased visibility, will be of cast construction.

34. Par. 2-3 (1)(2). The Model XTAJ-6 equipment utilizes five switches of a design which is new to equipment of this character. The switches in question are as follows:

(a) M.O. band change switch.
(b) Intermediate amplifier band change switch.
(c) Power amplifier band change switch.
(d) Antenna coupling switch.
(e) Adjust-Tune-Operate switch.

These switches, it is understood, are fitted with plated beryllium-copper contacts mounted in a ceramic frame (Isolantite). The switches are small in size and fitted with interlocks so that the radio frequency contacts are not actually required to make or break a circuit in the presence of radio frequency current. The radio frequency contacts operate with a wiping or self-cleaning action. However, the interlock contact, which makes and breaks under load, does not possess this feature. The above switches operated satisfactorily during the course of the tests reported herein with the exception of the power amplifier band switch, which gave evidence of galling as time progressed, although not to the point of failure. The mechanical operation of this switch was decidedly unsatisfactory by the time the tests were concluded. A sample switch, similar to those employed in the XTAJ-6 equipment was obtained from the manufacturer and subjected to independent tests. It was operated at a speed of 9 r.p.m. for a total of approximately 12,500 revolutions. During this period the interlock contact broke a 60 watt, 110 volt, 60 cycle load circuit approximately 25,000 times before it failed to function properly. (Note: The interlock makes and breaks three times per revolution.) The failure was apparently due to the flexible spring contact taking a permanent set. The contact gap, previous to the test, was measured as 0.0395" while at the conclusion of the test this gap had increased to 0.0405". All contacts, with the exception of the interlock, were thoroughly lubricated previous to the test. In spite of this precaution, the center contacts of the switch which slide on a metallic disc cut a very appreciable groove into the disc. The foregoing test indicates that the interlock contact is likely to fail under continued operation and eventually the cutting of the disc member will cause the radio frequency contacts to fail. The manufacturer is of the opinion that lubrication is not essential. Under service conditions it would be extremely difficult to service the various switches due to inaccessibility. It is difficult to estimate the number of makes and breaks a switch of this nature would be called upon to accomplish during the normal life of the equipment so that the foregoing test cannot be considered to prove conclusively that the switches will fail in normal service. Efforts should be made, however, to improve the operation of the interlock contacts and

prevent the cutting or wear of the radio frequency center contact. Furthermore, the galling noted during normal operation must be completely eliminated before switches of this type can be considered satisfactory for Naval service. The sample switch was mounted on a test stand and subjected to a number of impacts or shocks of varying magnitude. In succession, the switch was subjected to five shocks of 25-foot pounds, 5 shocks of 50-foot pounds, and 5 shocks of 100-foot pounds. No breakage or other damage occurred during this test, indicating that the mechanical construction, in spite of its small size, is extremely rugged. The antenna band switch, control "H", is provided with an interlock of different construction wherein two flat spring members make and break the circuit with a total absence of wiping or self-cleaning action. This condition must be remedied before it can be considered suitable. Although no failures occurred during the course of the tests herein reported, evidence is at hand that failures have occurred in the Fleet where interlocks of this nature were provided.

35. Par. 2-3 (3). All variable resistors are of the wire wound type provided with a glazed vitreous enamel coating. The master oscillator filament rheostat is of very small size. This rheostat and the main filament rheostat, which is of somewhat larger dimensions, should be provided with controls operating at greater tension in order to prevent accidental misadjustment. In spite of the small size of these units, no signs of overheating or failure were observed during the course of these tests. The bias field rheostat covers a wider resistance range than is desirable or necessary. A representative of the Contractor states that this condition will be remedied in the production equipments.

36. Par. 2-4. While the workmanship employed in the construction of the XTAJ-6 equipment is, in general, of good quality, certain features of design, methods of assembly and constructional practices are employed which are considered as violating the intent of this paragraph of the specifications. Such items as do not comply with this requirement will be discussed in detail under appropriate paragraph headings.

37. Par. 2-5. The equipment is so designed that it may be operated continuously in any ambient temperature between the limits of -1°C. and +50°C. and at humidities up to 95%. However, as pointed out in paragraphs 92 and 93 below, the operation under these conditions is not satisfactory from the standpoint of frequency stability and power output since the results obtained fail to comply with paragraphs 3-7-8 and 3-7-9 of the governing specifications.

38. Par. 2-6. All items used in the construction of this equipment have been fabricated from corrosive resisting materials or have been treated to protect them from the effects of a moist sea atmosphere. During the course of the tests conducted no signs of corrosion were detected.

39. Par. 2-7. The use of iron and steel, except where specifically required for electro-magnetic purposes, has been kept to a practical minimum.

protection for the intermediate tubes. To obtain maximum tube protection an individual overload relay should be provided for each tube. However, a far greater degree of protection than is at present provided would be obtained if the 38161 tube were provided with an individual overload relay and the remaining 38160 tubes were protected by a common overload relay. It is recommended that at least one additional overload relay be provided.

(b) Protective relay, RL-3, is provided to open the keying circuit should the remote key be held closed for more than five seconds. In actual operation the action of this relay is unsatisfactory since with a given adjustment the opening time varies from 6 to 45 seconds and it requires 5 seconds to return to the normal keying position after opening. This random operation of relay RL-3 is apparently caused by a loose and ill-fitting plunger element. A relay with positive action should be provided.

(c) Overload relay RL-1 is reset by means of a 3/16" diameter bakelite rod protruding through an opening in the lower left-hand access door for a distance of 7/8". This frail device located in an exposed location near the bottom of the transmitter is not considered acceptable since it will undoubtedly become damaged in service. Should this re-set rod be made of steel, in the interests of greater strength, the relay itself would be exposed to damage, particularly if an accidental force were applied to the rod in a transverse direction when the access door is open. If the relay remains in its present location and must be re-set through an opening in the access door, the re-set device should be of the type which is not actually connected to the relay proper and which will contact the overload relay only when a force is applied perpendicular to the re-set button. The re-set button should be of at least one-half inch diameter.

44. Par. 2-12. The construction of the equipment is such that all external parts are at ground potential. Access doors are provided with interlocks which operate to shut down the motor generator equipment and thus remove high potentials from the equipment. The interlocks are operated at a potential of 110 volts a.c. derived from the step down transformer T-3. Since the line supply is 440 volts this potential is still available within the transmitter even though the access doors are open.

45. Par. 2-13. The Model XTAJ-6 equipment represents a departure from the type of construction ordinarily employed in equipment of this type. Solid side shields are employed throughout, only the top shield being perforated. The tube access door is not provided with perforations or other vision opening and hence it is impossible to observe the operation of the tubes when the shields are in place and the door is closed. Ventilation is provided by a "chimney" effect on the right hand side of the transmitter, none of the horizontal shields or shelving extending into the "chimney" area. The main heat producing units are located on the right hand side of the transmitter, such as fixed resistors, tubes, etc. While no definite evidence was observed

during these tests which indicated a lack of proper ventilation, the inability to observe the interior of the equipment is objectionable from another standpoint. It is possible for tubes to become seriously overheated when drawing normal plate current. Ordinarily this trouble would be detected by observing plate color. In the case of the XTAJ-6 this procedure is not possible. Another instance which illustrates the necessity of having the interior readily visible occurred during the vibration tests of the equipment. Vibration caused the filament terminals on the flexible tube cradle to short circuit. During this test the side shields had been removed. Almost instantly smoke was observed to issue from the transformer and power was removed before serious damage resulted. Had the solid shields been in place the transformer would undoubtedly have been destroyed. It is recommended, therefore, that the side shields and the tube access door be perforated in a manner similar to the top shield.

46. Par. 2-14. No signs of compound leakage were noted from any of the component units of the transmitter during the course of the tests.

47. Par. 2-15. The equipment was subjected to several two-hour locked key tests. During the course of these tests no signs of overheating were noted other than that the power amplifier plate choke became exceedingly hot, temperatures as high as 136°C. being observed. These temperatures caused some discoloration of the choke coil but did not destroy it. The equipment is capable of being keyed at 100 words per minute without signs of brush discharge or arcing.

48. Par. 2-16. The equipment is so designed and constructed that it is capable of operating, when adjusted to full power, without damage when the antenna is short circuited or open circuited. Table No. 1, appended hereto, covers tests conducted at 200 and 600 kilocycles. No damage resulted from these tests.

49. Par. 2-17. The equipment is so designed that the vacuum tubes employed operate within the limits of Navy tube specifications judging from the currents flowing in the various circuits and the potentials applied to the various elements. However, during the course of these tests four tube failures occurred, as follows:

(a) The CG-38160 tube, Serial No. 58924, furnished with the equipment and used in the master oscillator circuit, started to draw excessive plate current after several hours of operation. Inspection revealed that this tube had become gassy.

(b) CG-38161 tube, Serial No. 16132, furnished with the equipment and used in the power amplifier circuit, lost emission sufficiently to interfere with proper operation after about ten hours of test.

(c) CG-38161 tube, Serial No. 16128, furnished with the equipment, and used in the power amplifier circuit, lost emission sufficiently to interfere with proper operation after approximately 25 hours of operation at full power. During this period of test the filaments had been energized for a period of 58 hours.

(d) CG-38161 tube, Serial No. 15155, property of the Naval Research Laboratory, used in the power amplifier circuit, lost emission sufficiently to interfere with satisfactory and safe operation. This tube had had previous use but performed satisfactorily when placed in the XTAJ-6. It failed after 36 hours of filament life and approximately 25 hours of full power operation.

It is believed that the failure of the CG-38160 tube, Serial No. 58924, was due to a defective tube, since no further trouble was encountered in the master oscillator circuit from this source. The 38161 tubes in the power amplifier circuit appear to be subjected to conditions of operation which shorten the life of the tubes in spite of the fact that plate current, grid current, and screen grid current fall within the limits of the specified values. These tube failures were called to the attention of the Contractor who made arrangements to have a representative investigate this condition. This investigation failed to reveal the cause of tube failures. At the request of the Contractor's representative, CG-38161 tubes, serial numbers 16132 and 16128, both of which are of the carbon anode type, were returned to the General Electric Company on November 20, 1936, for further tests and investigation. Before the Model XTAJ-6 equipment can be considered satisfactory for service use, the manufacturer should be required to eliminate this difficulty and give adequate assurance that all tubes will give the required number of hours service.

50. Par. 2-18. While, in general, the equipment is so designed and constructed that safe and satisfactory operation may be expected from a majority of the component parts employed, certain defects in design, construction and operation have been noted, as outlined under various appropriate paragraph headings throughout this report, which require remedial action. These defects must be overcome and corrected before it can be stated without qualification that the Model XTAJ-6 equipment meets the requirements of this paragraph of the governing specifications.

51. Par. 2-19. The Model XTAJ-6 transmitter as submitted was provided with a special flexible base consisting of a steel frame work upon which the transmitter was secured through the medium of four "Lord" mountings. This mounting proved to be adequate to support the equipment when mounted on a moving platform inclining up to 45° from the vertical in any direction, such as would be encountered on board ship when operating in a heavy sea. The maximum deflection noted when the equipment was inclined at an angle of 45° from the vertical was one (1) degree from the perpendicular. As will be described in greater detail under paragraph 3-7-13 of the governing specifications, the use of the flexible mounting reduced the frequency shift due to roll and pitch to approximately one half

the value noted when the equipment was secured to the test stand by means of solid base fittings. However, as described in paragraph 52 below, the use of the flexible mounting in the presence of severe vibration subjects the equipment to undue stresses and hence its use is not recommended.

52. Par. 2-20. As described in paragraph 51 above, the transmitter was provided with a special flexible mounting to minimize the effect of roll and pitch, shock and vibration.

(a) The equipment was subjected to the shock test as outlined in paragraph 3-7-15 of the governing specifications without damage to any part.

(b) When subjected to vibration it was noted that the employment of the flexible mounting caused greater variations in frequency, by a ratio of 2 to 1, than when the transmitter was secured to the vibration stand by means of solid base fittings. The effect of vibration upon frequency is discussed in detail under paragraph 3-7-14 of the governing specifications. It was further discovered that while the equipment was being vibrated at a certain frequency a small shock would cause the entire transmitter to assume a mode of oscillation approximately at right angles to the direction in which the force was applied and at a frequency which was apparently governed by the natural period of the entire assembly. This type of vibration was extremely severe and apparently subjected all parts of the assembly to severe stresses. While the transmitter was vibrating in this manner it would be impossible to make any adjustments or tune the transmitter. For this reason it is recommended that the use of the flexible mounting be abandoned and that the transmitter be provided with a suitable base pedestal of solid form.

(c) All vacuum tubes and screen grid resistor lamps are mounted on a flexible tube cradle supported by "Lord" rubber mountings. When subjected to vibration of the proper frequency this tube cradle vibrates excessively. It was noted that this vibration appeared to be greater when the transmitter was supported by the flexible base mounting than when it was secured to the test stand by means of solid base fittings. After a period of vibration the following failures occurred:

(1) The intermediate power amplifier filament terminals on the terminal board at the rear of the tube cradle short circuited, which in turn shorted the secondary of the filament transformer. Smoke issued from the transformer, but due to the fact that the side shields had been removed previous to this test, this was observed immediately and power was removed before the transformer was destroyed. Plate No. 21 is a view showing the lack of clearance between terminals connecting to the tube cradle.

(2) One of the flexible leads by means of which the tube cradle is connected to ground broke off and the remaining lead is frayed where numerous small wires had broken.

(3) The filaments of the three 10-watt lamps in the screen grid circuit of the power amplifier tube carried away, putting the transmitter out of commission.

(4) The audio oscillator tube was caused to strike against the insulated support carrying the grid and plate connections for this tube. The impact was so severe that the tube had to be removed to prevent breakage.

(5) Various flexible leads connecting to the tube cradle are insulated by means of ceramic beads. Certain of these leads vibrated excessively, sometimes striking the glass envelopes of the 38160 tubes. No actual failure occurred and it is obvious that other leads would break if subjected to continued vibration over a period of time.

(6) The tube cradle is so positioned within the frame of the transmitter that the movement to the right (looking at the front of the transmitter) is limited to about 1/16", after which it comes in contact with the frame of the transmitter.

In view of the above difficulties it is recommended that the Contractor be required to modify the equipment in order to overcome these defects. If the present form of tube cradle is provided it must be so designed as to provide greater damping action; greater voltage clearances must be provided on the terminal boards connecting to the tube cradle; the cradle must be prevented from striking the frame; the screen grid resistors must be of a type which will withstand vibration; the audio oscillator tube must be prevented from striking against adjacent objects and flexible connections should be such that they will not break under continued vibration. The tube cradle is mounted on aluminum supports which are secured to the front of the transmitter. These supports are inadequate since they move when subjected to a slight pressure.

(d) In the majority of cases wires connected to terminals are fastened to the terminals by crimping the terminals on the wire. However, in the case of choke coils the construction is such that no terminals are employed. Such coils as are mounted on ceramic forms have the connections directly soldered to a terminal which is similar to a cotter pin inserted in a hole in the ceramic form. The wire which leads from the choke coil is not given any additional protection, such

as sleaving, and is drawn taut before soldering. It is feared that this type of construction puts undue strain on these small wires. This belief is substantiated by the fact that when the equipment was received one of the connections on the intermediate power amplifier grid choke had broken away, preventing the equipment from operating. It is recommended that these coil terminals be such that the ends of the choke wires be terminated in lugs, with the lead properly protected by suitable sleaving. The lugs in turn should be secured to a terminal of the binding post or screw type so that unsoldering would be unnecessary if it is desired to remove a connection. Where Litz wire is employed, the connections are made in the following manner. A copper sleave is crimped over the end of the wire while the enamel is still in place. The end of the sleave is then filed away exposing the ends of the wires. These ends are then coated with solder and the sleave encased end is soldered into a lug. Thus it will be seen that only the ends of the wires make electrical contact. During the course of these tests no difficulties were encountered which could be attributed to this type of construction, however, since it differs from that usually employed in similar equipment and appears to be subject to the possibility of providing poor contact. It is recommended that extremely careful inspection be employed to avoid difficulties.

53. Par. 2-21. As explained in paragraph 52 above, all tubes, including the 10-watt lamps used as screen grid resistors, are mounted on a flexibly suspended cradle. This type of suspension has given evidence of defective and unsatisfactory operation and certain improvements and modifications must be effected before the tube support can be considered satisfactory for Naval use.

54. Par. 2-22. The design and control of the XTAJ-6 equipment has, in general, been made as simple as possible within the requirements of the governing specifications. It would be possible to effect some simplification of control by combining the functions of the following controls into a single control:

"A" - Master oscillator band change switch.
"C" - Intermediate power amplifier band change switch.
"E" - Power amplifier band change switch.

As will be noted by reference to Tables numbers 3, 4, 5 and 6, these three switches are set to the same position for any given frequency. On the other hand, mechanical complications would result from the ganging of these three controls which might outweigh the benefits derived from such a modification. At the present time the controls are such that the entire transmitter may be adjusted within the required period of one-man-minute.

55. Par. 2-23 (1). All indicating instruments, indicator lights, and controls necessary for the operation of the transmitter are located on the front panel. These devices have been arranged in a symmetrical manner pleasing to the eye and the meter, which is affected by the

manipulation of any given control, is located close to that control.

56. Par. 2-23 (2). On each control and meter, or adjacent to it, is a suitably etched nameplate indicating the purpose of the control or meter. The markings are of such size as to be readily readable at a distance of 24 inches and are permanent in character. The following voltage controls are not marked to indicate the direction of rotation for increasing voltage:

Master oscillator filament rheostat.
Bias field rheostat.
Main field rheostat.
Main filament rheostat.

It is recommended that the proper designating arrows be provided to indicate the direction of rotation for increased voltage. The door latch control knobs do not operate satisfactorily. The knobs are too small to provide a proper grip; the arrows which indicate the location of the catch are so small as to be almost invisible; no stops are provided to limit the motion of the catch in one direction and a slight amount of wear permits the catch to operate through 360 degrees. Larger knobs should be provided, clearly marked. Stops should be provided to suitably limit the motion of the catch and a reinforcing plate of hard metal should be provided to prevent wear.

57. Par. 2-24. All control shafts and bushings are grounded and all control knobs and handles are insulated for the protection of personnel.

58. Par. 2-25. All electrical indicating instruments employed in the XTAJ-6 equipment are of the 3.5" diameter flush type with bakelite cases fitted with anti-glare glass. The meters are so located that they may be replaced with other meters of the same nominal size having the maximum dimensions permitted by specifications. All d.c. meters employing external multipliers have a sensitivity of 1000 ohms per volt. However, as pointed out under paragraph 31 above, the voltage multipliers are not contained in a protective case as required by Specifications 17-I-12. All d.c. meters are by-passed with 0.01 mfd. condensers.

59. Par. 2-26. Nameplates have been affixed to all major units. However, attention is invited to the fact that the nameplate provided on the transmitter unit is so worded and the layout is such as to indicate that the Navy Department, Bureau of Engineering, is the Contractor rather than the General Electric Company. In order to avoid misinterpretation it is recommended that the word "Contractor" be placed below the name "General Electric Company."

60. Par. 2-27. All assembled separate items, such as motor starters, generators, etc., have been marked as to operating voltage, current, etc. In the case of transformers, however, as is noted in

paragraph 125 below, certain additional markings are desirable to indicate secondary and primary voltages.

61. Par. 2-30 (1). All controls on the equipment are so designed that the values of settings increase numerically with increase of the final controlled effect. Clockwise rotation of all control knobs increases the final controlled effect. The master oscillator control employs a main and a vernier dial which are viewed through a window. The numerals on both dials progress in the same direction.

62. Par. 2-30 (2). All dials and verniers are marked in evenly spaced divisions. The width of the smallest division of marking (MO dial) is approximately 0.05 inch. Two significant figures are visible at all times on the M.O. dial. Attention is invited to the fact, however, that when the M.O. dial is adjusted to a given setting, the vernier dial "jumps" back about one division when the control knob is released. It was necessary to compensate for this effect when making tuning adjustments by going past the desired point and allowing the dial to spring back to the proper point. The M.O. vernier dial has the additional defect that the vernier zero mark aligns only with the zero mark on the main dial. At No. 5 point on the main dial the vernier dial is 8 divisions off. These defects should be corrected before the master oscillator dial can be considered satisfactory.

63. Par. 2-30 (3). The flexible couplings used on the intermediate power amplifier, power amplifier, and antenna tuning controls are not considered satisfactory. The construction of these couplings is such that the shafts which should be rigidly secured to the flexible driving strips are free to move. The rigidity of the joint depends upon the friction produced by a swedging process, or some similar process. At any rate, the resulting product is unsatisfactory and steps should be taken to correct this defect. It was noted that the master oscillator control is secured by means of an Allen type set screw. While this type of set screw has marked mechanical advantages the necessity of employing a special wrench is considered a drawback. Even if the proper wrench is supplied, an object of such small size is likely to be misplaced and hence rapid repairs or adjustments can not be accomplished. Ordinary filister head set screws which can be operated by means of a screw driver should prove to be more satisfactory in the Naval service.

64. Par. 2-31 (1). Proper precautions have been taken in the construction of this equipment to provide sufficient tolerances to permit the replacement of tubes, resistors, etc., by similar units having the limiting dimensions set forth in the specifications covering such units.

65. Par. 2-31 (2). The lower, or control section, of the XTAJ-6 transmitter, is extremely accessible and replacement of parts may be effected with ease. The master oscillator compartment is so constructed that after certain leads and connections have been removed, this unit may be withdrawn from the rear of the transmitter frame.

66. Par. 2-31 (3). The toggle switches employed in the equipment are so mounted that they may be serviced with ease from the front of the panel. The switches are mounted on a sub-panel which may be removed from the main panel and sufficient length of lead is provided so that the entire assembly of switches may be moved forward.

67. Par. 2-32. The combined weight of the equipment is 1524 pounds as shown in Table No. 2. This includes the weight of the flexible base mounting.

68. Par. 2-33. Any single unit of the equipment is capable of passage through a door 25 inches wide by 54 inches high or through a hatch 30 inches square.

69. Par. 2-34. The equipment was subjected to sudden and also gradual line voltage variations of plus and minus 5 per cent without damage to any part.

70. Par. 2-35 (1). The various component parts of the transmitter have been designated by the symbols used in the instruction book and wiring diagrams. These markings, made with red paint, are adjacent to or on the units they identify. Certain errors in marking were noted, which will be discussed under the subject of Instruction Books (see paragraph 162).

71. Par. 2-35 (2). Resistor mountings are marked to indicate the value of resistance to be employed. No type numbers are given since paragraph 2-28 exempts the preliminary model from this type of marking. Tube sockets are not marked to designate the type of tube to be used in the socket.

72. Par. 2-36. The rubber used in the tube cradle supports is of such a design that it may readily be replaced with new units when required. Rubber washers are used to prevent vibration of the lifting eyes with which the transmitter is equipped. It would be impossible to renew these washers without considerable disassembly, including removal of the front panel of the transmitter. It is recommended that an improved means to make the lifting eyes rattle-proof be furnished.

73. Par. 2-38. Rugged lifting eyes have been provided in the four top corners of the transmitter unit to facilitate lowering and hoisting the equipment. Nameplates have been attached on the side shields near the lifting devices to indicate their position. As stated above in paragraph 72, the lifting eyes have been made rattle-proof by the use of rubber washers instead of spring clips, and due to the difficulty in replacing these washers an improved method to prevent rattle should be provided.

74. Par. 2-39 (1). The front panel of the transmitter unit is provided with a black wrinkle finish. The remaining external surfaces are provided with a flat, black finish.

75. Par. 2-39 (2). All interior aluminum surfaces have been treated with a corrosion resisting finish which has been removed where necessary to make good electrical contact.

76. Par. 2-39 (3). The knurled head screws employed for securing the side shields are furnished with a polished chromium finish instead of the dull finish required by the specifications.

77. Par. 2-40. The following indicator lights are provided on the front panel of the transmitter:

Power - red
Bias - green
Plate - red

These indicators are of a new type which do not conform to the requirements of paragraph 2-40. They are of the neon type, operating at 115 volts. The color code mentioned above is provided by encircling the neon lamps with metallic rings which are painted with an appropriate color. The lamps which operate in d.c. circuits are lighted by a glow which surrounds only one of the two elements in the lamp.

78. Par. 2-41. Electrolytic condensers are not used in the construction of the transmitter.

79. Par. 2-50. Due to the fact that the bias potentials used in the transmitter are derived from the excitor generator, plate voltage cannot be generated in the absence of bias potential. The wiring of the transmitter is such that should an open circuit in the transmitter wiring prevent the bias voltage from being applied to the transmitter the plate generator would also fail to receive excitation.

80. Par. 3-1. The XTAJ-6 transmitter employs the master oscillator power amplifier principle. The following circuits are provided:

(1) Master oscillator circuit, using one type 38160 tube in the so-called "electron coupled" oscillator circuit. Frequency multiplication is not resorted to and the variable tuning element consists of a variable air condenser.

(2) An intermediate power amplifier circuit using one type 38160 vacuum tube. Tuning is accomplished by means of a variable air condenser.

(3) A final power amplifier circuit using one type 38161 vacuum tube. This circuit is also tuned by means of a variable air condenser.

(4) An antenna circuit which is resonated by means of a variometer and loading inductor. Capacitive coupling to the antenna is provided.

(5) An audio oscillator circuit using one type 38160 vacuum tube.

81. Par. 3-2 and 3-3. Tables numbers 3, 4, 5, 6, and 7 list in detail the results of tests conducted to determine the power output characteristics of the transmitter when operating into antenna constants as specified in these paragraphs. It will be noted that in all cases the CW power output conforms with the requirements of the governing specifications.

82. Par. 3-4. The transmitter produces a signal of good quality, free from lilt and objectionable modulations. As pointed out under paragraph 49 above, the power amplifier tube appears to be subjected to an overload condition which causes a serious reduction in filament emission and may also have a tendency to increase the harmonic radiation. It should be stated, however, that no harmonic measurements were undertaken. Reference to Table No. 8 reveals that the amplitude modulation of the carrier on CW operation is far less than the required value of two per cent, being of the order of 0.1 per cent. The transmitter is equipped with a filter in the keying circuit designed to minimize the effect of key clicks.

83. Par. 3-5. The transmitter is capable of emitting a signal modulated at approximately 70 per cent over the entire frequency range. (See Table No. 9.) The frequency of modulation was measured as 837 cycles. When employing MCW operation the power output is reduced by a factor of less than 50 per cent as will be noted by referring to Tables numbers 3, 4, 5, and 6. Selection of CW or MCW operation is effected by means of a suitable switch located on the front panel of the transmitter.

84. Par. 3-6. The transmitter is capable of adjustment by means of front of panel controls to any frequency within the specified range, when employing antenna constants within the limits specified in Paragraph 3-2.

85. Par. 3-7 (1). Accuracy of reset to previously calibrated frequencies. It is possible for an operator to adjust the equipment by means of controls on the front panel, in a period of less than one-man-minute, to a previously calibrated frequency with an accuracy complying with the requirements of the governing specifications. Referring to Table No. 10 it will be noted that the average deviation of five reset trials at 200 kilocycles was 0.0051%, at 400 kilocycles, 0.0065%, while at 600 kilocycles the average deviation was 0.0068%. Specifications permit an average of 0.01%. No one trial exceeded the value of 0.015% permitted by the specifications.

86. Par. 3-7 (2). Lost motion, back lash and torque lash. Table No. 11 covers tests conducted to determine the degree of lost motion inherent in the controls which govern the frequency establishing circuit. At 200 kilocycles the frequency error due to the causes listed above averaged 0.03% for five trials while at 600 kilocycles the average of five trials was 0.0113%. No single trial exceeded the maximum specification

value of 0.06%. The Model XTAJ-6 equipment complies with the requirements of this paragraph of the governing specifications.

87. Par. 3-7 (3). Operation of Adjust-Tune-Operate control. As illustrated in Table No. 12, the equipment under test complies with the specification requirements outlined in this paragraph. The maximum divergence found was 0.005%, whereas the specifications permit a value of 0.01%.

88. Par. 3-7 (4). Detuning of circuits. Table No. 13 illustrates the results of tests conducted at 200 and 600 kilocycles to determine the degree of frequency shift resulting from detuning circuits subsequent to the frequency establishing circuit. At 200 kilocycles the largest deviation encountered was 0.0065%, while at 600 kilocycles the largest deviation was 0.0058%. The equipment complies fully with this portion of the governing specifications, which limit the frequency change to a value of 0.01%.

89. Par. 3-7 (5). Operation of power output control. Table No. 14 outlined the results of tests conducted at 200 and 600 kilocycles for the purpose of determining the frequency shift incident to the operation of the power output control, i.e., the plate motor generator field rheostat. The power output was varied between the limits of 100% and 25% and the largest frequency shift which occurred during this operation was found to be 0.0045% at 200 kilocycles and 0.0035% at 600 kilocycles. The equipment complies with the requirements of the governing specifications which limit the variation in frequency to a value of 0.005%.

90. Par. 3-7 (6). Change of tubes. As illustrated in Table No. 15 the average deviation from the mean frequency caused by the substitution of ten tubes in the master oscillator circuit, at 200 kilocycles, was 0.023%, while the change for the intermediate amplifier circuit was 0.0035%. Table No. 16 covers tests conducted at 600 kilocycles. Here the change for the master oscillator circuit was 0.0176% and for the intermediate amplifier circuit it was 0.003%. Specifications permit a change of 0.02% for the master oscillator and 0.005% for the intermediate amplifier circuit. In the case of the master oscillator at 200 kilocycles, the specification value is exceeded by a small amount. This excess is so small as to be negligible and may be partly caused by observational errors. It is recommended therefore that the XTAJ-6 equipment be considered as complying with the governing specifications with respect to this paragraph.

91. Par. 3-7 (7). Variation of supply line voltage or variation of voltages applied to transmitter unit. Table No. 17 illustrates the results of tests conducted at 600 and 200 kilocycles wherein the various voltages applied to the transmitter unit were varied independently and in unison from a value of 5% below normal to a value of 5% above normal. It will be noted that at 600 kilocycles these variations of potential caused frequency changes which were of smaller magnitude than the 0.01%

permitted by the specifications. At 200 kilocycles the variations in frequency caused by the variation of all potentials simultaneously exceeded the specification value. A plus 5% variation caused a frequency shift of 0.0125%, while a negative 5% variation caused a frequency shift of 0.0175%. An additional test was conducted, as illustrated in Table No. 18, wherein the line voltage was varied between the limits of -5% and +5% in a time of one minute and additionally in a time of 5 minutes. Tests were conducted at frequencies of 200 and 600 kilocycles. The maximum frequency change under these conditions was 0.0085% at 200 kilocycles and 0.0008% at 600 kilocycles. It will be noted that a ±5% change in line voltage has as almost negligible effect upon the generator voltages and only a minor effect upon the frequency stability of the equipment.

92. Par. 3-7 (8). Variations in ambient temperature. Tables numbers 19, 20, 21, and 22 and Plates numbers 1, 2, 3, and 4 cover tests conducted to determine the effect of variations in ambient temperature. It will be noted that the relative humidity was maintained essentially constant at a low value during all tests. The test illustrated in Table No. 21 was the first temperature test, in order of time, which was conducted. During this test the power amplifier plate current and the radio frequency output decreased steadily in spite of the fact that the various potentials applied to the transmitter were readjusted several times. At the conclusion of the test it was discovered that the power amplifier tube had lost emission sufficiently to impair its usefulness. Referring to the summary included in Table No. 19 it will be noted that the specification requirements of 0.005% are exceeded except in the region of 30 to 35°C. at 200 kilocycles. Table No. 20 shows that the transmitter fails to comply with the specification requirements except in the range of temperature of 5° to zero. During the 600 kilocycle test illustrated in Table No. 21, the frequency changes noted complied with the specification requirements over the temperature range of 25 to 50 degrees. However, as shown in Table No. 22 the transmitter failed to meet the specification requirements of 0.005% except in the region of 10 to 5°C. During these tests, as was the case in other tests where time is an essential element, the initial drift of the transmitter was so rapid and continued for such a long time that it undoubtedly had an influence upon the results obtained. In other words, this drift has a tendency to obscure the effects which are being investigated. Previous to the test shown in Table No. 22 the master oscillator filament was energized overnight, or for a period of 16 hours, in an effort to decrease this drift. This procedure had a tendency to decrease the drift slightly as may be noted from comparing the results obtained during the first hours of operation in Tables numbers 21 and 22. In Table No. 21 the master filament was not lighted previous to the test. It must be concluded that the Model XTAJ-6 equipment fails to comply with the specification requirements of paragraph 3-7 (8).

93. Par. 3-7 (9). Variations in humidity. With the transmitter adjusted to a frequency of 200 kilocycles, the equipment was subjected to a variation in relative humidity between the limits of approximately 20% and 95%, the ambient temperature being held essentially constant at 40°C. Table No. 23 and Plate No. 5 cover the results obtained

during this test. It will be noted that the greatest frequency variation noted, in accordance with the terms of the test, was 0.149%, whereas the specifications permit a value of only 0.05%. The specifications state that the transmitter shall be operated key locked for 30 minutes at a low humidity during the first portion of the test. In order to permit a reasonable degree of stabilization the first portion of the test was run for one hour. However, the power values used in the attached tables, numbers 23 and 24, were based on the power output noted during the thirty minutes immediately preceding the change in humidity from 20% to 95%. The decrease in power output during the 200 kilocycle test was 13.3%, whereas the specifications permit 5 per cent. Table No. 24 and Plate No. 6 cover a test conducted at 600 kilocycles. The frequency variation noted was 0.084%, while the power reduction was 5.5%. The XTAJ-6 equipment fails to comply with the requirements of paragraph 3-7 (9).

94. Par. 3-7 (10). Locked key operation for two hours. Table No. 25 covers the results of a test conducted at 200 kilocycles, Table No. 26 a test at 400 kilocycles, while Tables numbers 27 and 28 cover tests conducted at 600 kilocycles. In all tests the equipment fails to comply with the specification requirements. It will also be noted that the power amplifier plate choke became exceedingly hot during these runs. While no actual breakdown occurred, this choke coil showed signs of discoloration.

95. Par. 3-7 (11). Change from key locked to intermittently keyed condition. Table No. 29 covers tests conducted at 200 and 600 kilocycles in conformity with this paragraph of the specifications. Only the test at 200 kilocycles wherein the filament of the master oscillator tube was lighted complies with the specification requirements. In the remaining tests the frequency changes encountered exceed the specification limits.

96. Par. 3-7 (12). Change from continuously keyed to intermittently keyed condition. Table No. 30 covers tests conducted at 200 and 600 kilocycles. It will be noted that at 200 kilocycles the equipment complies with the specification requirements. At 600 kilocycles the frequency change encountered was 148 cycles or 0.0246%, whereas the specifications permit only 0.015%. The equipment fails to comply with this paragraph of the specifications at 600 kilocycles.

97. Par. 3-7 (13). Inclination due to roll and pitch of ship. The entire XTAJ-6 equipment, including transmitter unit, motor generator, starter and fuse box, was mounted on a test stand which permitted inclination through an angle of 45 degrees on either side of the vertical at a rate of 6 cycles per minute. As stated in paragraph 51 above, the transmitter was provided with a special flexible mounting to afford protection against the effects of shock, vibration and inclination. Several inclination tests were conducted at 200 and 600 kilocycles under varying conditions, as follows:

(a) Transmitter secured to test stand through medium of flexible mounting and subjected to inclination, the motion of which was parallel to the front of the transmitter and parallel with the axis of the motor generator.

(b) Transmitter secured to test stand through medium of flexible mounting, and subjected to inclination, the motion of which was at right angles to front of transmitter and at right angles to the axis of the motor generator.

(c) Transmitter secured to test stand through medium of solid base fittings and subjected to inclination, the motion of which was at right angles to the front of the transmitter and at right angles to the axis of the motor generator.

Plates numbers 22, 23, and 24 are views of the equipment secured to the test stand through the medium of the solid base fittings. Tables numbers 31, 32, and 33 and Plates numbers 7, 8, 9, 10 and 11 cover tests conducted under the conditions outlined under (a), (b), and (c) above, respectively. Previous to each test the equipment was operated key locked for a considerable period of time in an effort to eliminate drift. While the drift was greatly reduced during the actual test by this procedure, a small amount was still present which influenced the results of the test to a certain degree. Thus, it will be noticed that the frequency at the beginning of the test, with the equipment stationary in a vertical position was somewhat different than the frequency at the end of the test with the equipment again stationary and vertical. The frequency changes listed in the above tables were based on the maximum frequency difference noted during the half hour test from the frequency at the start of the test. In Table No. 31 it will be noted that the maximum frequency change at 600 kilocycles was 9 cycles, or 0.0015%, while at 200 kilocycles this value was 9 cycles or 0.0045%. This meets the specification requirement of 0.005%. The results listed in Table No. 32 show that again the specification requirements are complied with at both frequencies. In Table No. 33, wherein the solid base fittings were employed, the equipment fails to comply with the specification requirements, the frequency changes noted being 38 cycles at 600 kilocycles, or 0.0063%, while at 200 kilocycles the change was 22 cycles or 0.011%. While the use of flexible mountings reduces the frequency change due to roll and pitch, the use of such mountings is not recommended for the reasons given in paragraph 52(c) above.

98. Par. 3-7 (14). Vibration. The entire equipment was subjected to vibration, while operating at 600 and 200 kilocycles. Tests were conducted with the transmitter secured to the test stand through the medium of the flexible mounting and also while the transmitter was bolted rigidly to the test stand through the medium of solid base fittings. Table No. 34 and Plates 12 and 13 illustrate the results obtained while using the flexible mounting. It will be noted that the specification value of 0.005% has been exceeded. Table No. 35 and Plates 14 and 15 cover the

tests conducted with the transmitter secured by means of solid base fittings. Under these conditions the frequency change due to vibration is less than that encountered when using the flexible mounting. A change of 0.0033% at 600 kilocycles and a change of 0.0035% at 200 kilocycles was recorded, which is within the specification limitations. During these vibration tests the inherent drift of the transmitter undoubtedly influenced the results to some extent. However, it could be observed that the amplitude of vibration, particularly that of the tube cradle, was decidedly less when the solid base fittings were employed as compared to the flexible mounting.

99. Par. 3-7 (15). Shock. With the transmitter mounted on the flexible base mounting, shocks were applied to the four sides in the manner outlined in the governing specifications. Table No. 36 covers the results of these tests conducted at 600 and 200 kilocycles. At 600 kilocycles no shock affected the frequency to the extent permitted by the specifications. At 200 kilocycles the effect of shock was somewhat more noticeable and in two instances the specification value was exceeded. The average value, however, falls with the limits prescribed by the specifications.

100. Par. 3-8. Provision has been made for energizing the filament of the master oscillator tube during the periods in which the transmitter is shut down. Power for this purpose is obtained from the 440 volt, 60 cycle line through the medium of a step down transformer (440 to 110), symbol T3. Two filament lighting transformers are operated from this 110 volt supply. The main filament transformer supplies the intermediate power amplifier, power amplifier, and audio oscillator circuits, while the auxiliary filament transformer, T2, lights the filaments of the master oscillator tube. When the transmitter is in operating condition the primary of transformer T2 is energized in parallel with the main filament transformer through a set of contacts on the master control relay. In this condition a single filament rheostat adjusts the voltages of both transformers. When the equipment is shut down the master oscillator filament transformer is energized by means of a panel switch and another pair of contacts on the master control relay directly from the 110 volt supply through a separate rheostat. The primary of the main filament transformer is open circuited when this condition exists by means of a set of contacts on the master control relay. A voltmeter is connected across the primary of the master oscillator filament transformer by means of which all filament voltages are adjusted. In the preliminary model it was necessary to adjust this voltmeter to read 103 volts in order to obtain the approximate potentials required by the various tubes. It is recommended that the circuit arrangement be modified by eliminating the present filament voltmeter and in place thereof provide a suitable scale meter which will read directly the potential applied to the filaments of the 38161 power amplifier tube. This will provide a more direct method of insuring that the most costly tube in the equipment is being operated at the proper filament potential. It is further recommended that the master oscillator filament rheostat, which is used to adjust the voltage on this tube when the transmitter is in stand-by condition, be replaced by a suitable fixed resistor by means of which the approximately correct

potential will be applied to the master oscillator filament when in the stand-by position. Such variations in filament potential as may be experienced due to line voltage variations will not adversely affect the master oscillator tube, as long as they do not exceed the maximum value, since the tube is not subjected to plate potential in the stand-by condition.

101. Par. 3-9. Due to the use of screen grid type tubes in this equipment the need for any additional neutralization is obviated.

102. Par. 3-10. All radio frequency tubes cease to oscillate when the key is open only when the "Adjust-Tune-Operate" switch is in the "tune" or "operate" position. When this switch in the "adjust" position, the master oscillator tube continues to oscillate and the radiation therefrom may readily be picked up in a nearby receiver. This condition is brought about by reason of the fact that the keying bias is derived from the drop across resistor R-15, which is a portion of the main plate generator potentiometer. When the "Adjust-Tune-Operate" switch is thrown to "adjust" position, the field circuit of the main plate generator is open circuited and hence no voltage is developed, thus eliminating the keying bias. This condition should be corrected. It would appear that the keying bias may be obtained from the 1200 volt master oscillator plate generator which is not affected by the operation of the "Adjust-Tune-Operate" switch. The audio frequency oscillator continues to oscillate during keying operations, when the transmitter is adjusted for MCW operation, but ceases to oscillate a few seconds after keying stops. This type of operation is authorized by page 2 of the contract notes. The equipment may be keyed at the rate of 100 words per minute, either CW or MCW, in a satisfactory manner.

103. Par. 3-11. The frequency range of the transmitter is divided into bands controlled by range selector switches. The master oscillator, intermediate amplifier and power amplifier circuits are divided into seven bands each controlled by a separate switch. These switches are provided with interlocks which momentarily remove the power from the circuits during the operation of the range selector switches. It is possible to make adjustments for frequencies within any band, not requiring shifting of the selector switch, with power on the transmitter. Tables numbers 37, 38, and 39 show the degree of overlap provided between the various taps of the range selector switches of the master oscillator, intermediate power amplifier, and power amplifier circuits, respectively. Specifications RE 13A 328J do not define the method by which the percentage of overlap shall be computed. Paragraph 3-11 on page 39 of Contractor's Descriptive Specifications RA-1465 states: "An overlap of not less than 5 per cent will be provided between bands, this overlap consisting in each case of 5 per cent of the frequency band spanned by that particular band." In connection with the determination of overlap the Bureau of Engineering has recently promulgated the following definitions:

(a) "The percentage frequency overlap between any two bands where limiting frequencies are not specified shall be computed by determining the minimum and maximum frequencies common to the two bands, dividing the difference by one-half their sum, and multiplying the resultant by 100."

(b) "Where a limiting frequency is specified, the percentage frequency overlap shall be computed by determining the difference between the actual (top or bottom) frequency and the specified (top or bottom) frequency, then dividing this difference by one-half the sum of the actual and specified frequencies and multiplying the resultant by 100."

The percentage overlap is calculated on the basis of both definitions in the above tables. Where the master oscillator circuit is concerned, the equipment fails to comply with the Bureau of Engineering definition, but does comply with the Contractor's definition of overlap. At the lower end of the frequency range the intermediate amplifier circuit fails to comply with either definition, but from tap 3 upward the requirements of the Contractor's definition are complied with. Certain portions of the power amplifier circuit fail to comply with the Contractor's definition and in no case is the Bureau of Engineering definition complied with. The antenna system tuning was investigated with various values of antenna constants and it was found that the transmitter could be resonated without difficulty. Regardless of which definition with respect to percentage overlap is employed, it is evident from the attached tables that the Model XTAJ-6 transmitter is unsatisfactory from the viewpoint of overlap. The fact that no frequency overlap exists at certain points in the intermediate amplifier circuits prevents an operator from arriving at satisfactory resonance adjustments.

104. Par. 3-12. The transmitter is provided with controls located on the front panel for providing adjustment to any frequency within the range of the equipment. As pointed out under paragraph 54 above, it appears that some reduction in the number of controls could be effected by combining the functions of the band switches into a single control. The desirability of such a modification, however, is doubtful. The ease and accuracy of tuning adjustment is affected, however, in an adverse manner by the broadness of tuning of the intermediate amplifier stage. This effect is so pronounced that it is difficult to arrive at the most advantageous setting. The so-called plate current meters provided actually measure the cathode current of the various tubes, since they are connected in the common return. Thus it is necessary to adjust these meters to an arbitrary value which is not considered good practice. It is recommended that the plate current meters be connected into the various circuits so that the actual plate current only is indicated. With the present system, wherein the meters indicate a total of plate, screen grid, and control grid currents the well known "minimum plate dip" which is the usual means for determining resonance, is greatly blunted. In the case of the master oscillator circuit meters should be provided for indicating both the screen grid current and the actual plate current, since the screen grid is actually employed as the oscillatory anode. This practice of providing

two meters has been employed in previous equipment which utilizes the electron coupled oscillator for the master circuit.

105. Par. 3-13. Table No. 40 lists the controls provided on the front panel of the XTAJ-6 equipment. Each control is identified by a nameplate to indicate the function of the control. An additional designating letter ranging from "A" to "I" is used to identify each tuning control. These designating letters are of small size, lightly engraved on round buttons. The letters are 1/8-inch in height and are not readily readable under poor lighting conditions. It is recommended that the size of these letters be increased to improve readability.

106. Par. 3-14. Provision has been made for mounting calibration cards in a holder on the front panel suitable for recording reset data for ten frequencies.

107. Par. 3-15. Verniers are provided on the tuning controls by means of positive gearing. The variation of resonant frequency per division of marking of the master oscillator dial is illustrated in Table No. 41. The variation falls within the limits of 0.03% and 0.015% required by the governing specifications.

108. Par. 3-16. Each continuously variable control is provided with a friction type locking device. The lock on the master oscillator control does not operate in a positive manner, permitting the dial to rotate when in the locked condition. Steps should be taken to overcome this defect.

109. Par. 3-17. Controls "D", "F", and "I" are equipped with five adjustable positioning devices. These devices are stamped with numerals from "1" to "5". Specifications require that positioning devices should permit the insertion of a card on which the frequency may be marked.

110. Par. 3-18. The equipment is so designed that it is possible to shift from one frequency to another or from one mode of transmission to another, CW to MCW, without readjusting filament, plate or bias voltages.

111. Par. 3-19. A three-position switch has been incorporated in the design to facilitate frequency shifting and resonating operations, as follows:

Position 1 - Plate potential is removed from the amplifier circuits by opening the field of the generator.

Position 2 - Reduced plate potential is applied to the amplifiers by inserting a resistor in the field of the plate generator.

Position 3 - Plate potentials are increased to normal operating values.

As stated above in paragraph 102, when the switch is in Position 1, the master tube continues to oscillate.

112. Par. 3-20. A lever type test key has been provided which permits the selection of key open, momentary key closed or key locked positions. The key is so connected that the five second drop out relay is ineffective from the test position.

113. Par. 3-21. As explained in paragraphs 102 and 111 above, the transmitter emits a signal with the key open when in the "Adjust" position and hence does not comply with the requirements of this paragraph. "Break-in" operation is not provided since the specifications exempt equipments in excess of 200 watts output from this provision.

114. Par. 3-22. No rotating equipment is employed in the construction of the XTAJ-6 equipment, other than the motor generator equipment which supplies the necessary power for operation. No interference which could be attributed to the operation of the motor generator equipment was noted when listening tests were conducted adjacent to the transmitter and generator units.

115. Par. 3-23. It is possible to vary the power output of the transmitter from the maximum value specified to a minimum value of 25% by means of the plate motor generator field rheostat. (See Table No. 14.)

116. Par. 3-24. As pointed out in paragraph 77 above, three indicating lamps have been provided to indicate the following functions:

(a) When bias voltage is supplied to transmitter.
(b) When plate voltage is supplied to transmitter.
(c) When starting contactor is energized.

The form of the indicator lamps does not comply with the requirements of the specifications, as explained in paragraph 77 above.

117. Par. 3-25. A list of the indicating instruments supplied with the XTAJ-6 equipment is shown in Table No. 42, appended hereto. As pointed out in paragraph 104 above, it is recommended that plate current meters be connected in the high potential side of the plate circuit so that plate current only and not a combination of plate, screen grid, and control grid currents, be read by each meter. It is further recommended that two meters be supplied for monitoring the master oscillator circuit, one for indicating screen grid current and the other to indicate plate current.

118. Par. 3-26. A self-starting synchronous motor type of filament hour meter is provided on the final amplifier stage to register the number of hours of operation. This meter is connected across the primary of the main filament transformer and operates at a potential of 110 volts.

119. Par. 3-27. The Model XTAJ-6 transmitter consists of a single unit of the dimensions listed in Table No. 2. The dimensions comply with the contractual requirements as modified by page 1 of the contract notes, which authorized an increase in the depth dimension from 20 inches to 24 inches.

120. Par. 3-28. The dimensions of the equipment are such that they comply with the requirements of this paragraph.

121. Par. 3-29. The transmitter unit includes, integral with its assembly, all vacuum tubes, radio frequency circuits, meters, filament transformers, relays and filter unit.

122. Par. 3-30. The front of the transmitter is shielded by means of the regular panel plates while the sides and rear of the unit are shielded by solid shields containing no perforations. The top is shielded by means of a perforated plate. The bottom of the unit is shielded by means of various base plates which form the supports for transformers, capacitors, etc., leaving sufficient openings for cable entrance. The master oscillator circuit, exclusive of the tube, is in a completely shielded compartment. The intermediate power amplifier circuits are completely shielded, with the exception of the vacuum tube. The power amplifier and antenna circuits are in the upper compartment of the transmitter unit and are not shielded from each other. All vacuum tubes are mounted on one flexibly supported "cradle" and no shielding is provided between the tubes of the various circuits, nor are the tubes completely shielded from the power amplifier and antenna circuits. While this lack of shielding between the tubes used in the various circuits caused no apparent frequency instability, the pronounced frequency drift which was noted during the course of the tests, may in some measure be caused by reactions between the vacuum tubes. All wiring not carrying radio frequency currents are of the lead sheathed type except in the cases where connections are made to switches, meters and the flexibly mounted tube cradle. In these latter instances, flexible wires covered with cambric tubing, or a similar insulation, are employed for meter and switch connections and flexible wires insulated by means of ceramic beads are used for connections to the tube cradle. The lead sheathed wires are secured to the frame of the transmitter at frequent intervale, although in a number of instances the cabled leads are not adequately secured, particularly the leads passing directly over transformer T-3. Plate No. 30 shows a view of the leads in question. These cabled leads clear the transformer terminals by a small fraction of an inch. This should be remedied. Due to the use of insulating tape beneath the fittings employed for securing the wire to the frame, an actual ground connection is not obtained at these points. The cables depend upon ground connections being made by virtue of the cabled leads touching the frame at various points along their length. Lead sheathed wires are not spotted together but are held together by means of flexible metal strips inserted in wiring buckles. Insulating tape is employed beneath the strips and buckles.

123. Par. 3-31. All d.c. meters and external multipliers are by-passed by means of 0.01 mfd. condensers.

124. Par. 3-32. The primaries of the filament transformers are designed for operation at either 110 or 220 volts.

125. Par. 3-33. The transformers provided showed no signs of undue heating under key locked operation in ambient temperatures ranging up to 50°C. Terminal leads are secured to suitably insulated terminals on a terminal board bearing designating numerals. These numerals do not indicate the potentials available. It is recommended that the markings be expanded to include this information.

126. Par. 3-34. The transformers are so designed and operated that the filament potentials do not fluctuate when the transmitter is being keyed.

127. Par. 3-35. The Model XTAJ-6 equipment is so constructed that:

(a) It can be installed with its back flush against a bulk-head, access being provided through the doors in the front panel or by removing the side shields.

(b) The foundation pedestal of the transmitter consists of a flexible mounting unit as described in paragraph 51 above. This mounting proved to be unsatisfactory in the presence of vibration (see paragraph 52), and it is recommended that a suitable rigid mounting be provided for securing the equipment to the deck.

(c) External cable connections can be effected at a terminal panel suitably located for access at the bottom of the transmitter unit. The terminal board is located 5 inches back of the front panel and 6 inches above the deck level (with the flexible mounting in place). It is possible to bring in the cables at the same deck level upon which the transmitter rests.

(d) All tubes may be replaced through the tube compartment door. It is necessary, however, to remove the master oscillator tube before the audio oscillator tube can be removed. All relays can be adjusted through the bottom access doors.

(e) The key relay is located behind the lower left hand access door and its operation can be observed through a windown in this door.

(f) The antenna lead is brought through a 4-inch diameter opening in the top shield.

128. Par. 3-36. The top shielding is secured to the frame by means of round head machine screws. The side shields are held in place by knurled head screws. As pointed out under paragraph 76 above, these screws are supplied with a polished chromium finish instead of the dull finish required by the specifications. In addition the knurling is too shallow to afford a good grip. A deeper cut should be provided. The threaded portion of this securing device is secured in the frame by threading it in flush to the rear surface and then staking it on the outer surface. This type of construction is inherently weak when employed in a soft material like aluminum alloy. Several of the shield securing screws became loose and could be withdrawn during the course of these tests. An improved means of securing should be provided. The appearance of the equipment would be enhanced if the openings in the shield directly beneath the knurled head screws did not show the natural aluminum color of the frame members. It is recommended that the frame be painted black at these points.

129. Par. 3-37. Access doors are provided only in the front panel of the transmitter. These doors are equipped with piano type hinges of non-ferrous metal, although the hinge pins are of magnetic steel. The doors are provided with suitable stops to protect the hinges against excess strain and to hold the door in the open position.

130. Par. 3-38. The access door to the tube compartment is of ample size to permit convenient replacement of tubes. All doors are of the overlapping type.

131. Par. 3-39. A suitable insulated vertical hand rail is provided on the front panel adjacent to each side of the transmitter for convenience of operating personnel when making adjustments during heavy weather. These hand rails are of strong and rugged construction of the rubber plated metal type.

132. Par. 3-40. Direct current potentials are prevented from reaching the antenna by means of a suitable blocking condenser.

133. Par. 5-1. The control system provided complies with the requirements of the Navy four wire control circuit. Starting is accomplished through the medium of a 110 volt, a.c. circuit, this potential being provided by means of a step down transformer connected to the 440 volt supply line. After the equipment has been started, 115 volts d.c. is available for control and relay purposes from the 115 volt bias-exciter generator.

134. Par. 5-2 to 5-5, inclusive. The requirements of these paragraphs have been complied with in the construction of the XTAJ-6 equipment.

135. Par. 5-6. Since the XTAJ-6 equipment has an output in excess of 200 watts, the keying relay is designed to control only the emission of the transmitter for telegraphic signalling.

136. Par. 5-7. The keying control circuit is so arranged that the keying relay is not energized before the motor generator has attained full operating speed.

137. Par. 5-8. The keying relay operates satisfactorily up to speeds of 100 words per minute. The relay is suitable for operation from a 115 volt supply, with a suitable series resistor and the keying circuit is required to break approximately 500 M.A. Since the coil of the key relay, the audio oscillator relay and the five-second relay are in parallel, this value represents the current drawn by the three relays. Specifications permit a current value of one ampere.

138. Par. 5-9. The circuit arrangement is such that the remote indicator lamp functions only when the equipment is controlled from the remote position.

139. Par. 5-10. The local start-stop control of the transmitter is effected by a start-stop switch which is located on the front panel and this switch is so connected that it is in series with the remote start-stop switch when the control transfer switch is thrown to the remote control position. The "Remote-Local" transfer switch is of the three position lever type. When this switch is in the up position control is transferred to the remote station; in the down position only local control is available. When the switch is in the neutral or central position it is impossible to start the equipment. This action is considered undesirable since it may cause a considerable loss of time in starting the equipment. A remote-local switch provided with two positions only should be supplied, so that either local or remote control is available without any intermediate condition which is likely to confuse an operator. A prominently marked (Red) emergency shut down switch is provided, so connected that the equipment cannot be started from any point other than the one from which it has been shut down.

140. Par. 5-11. The start-stop remote control circuits require 220 M.A. at 115 volts A.C. for operation.

141. Par. 5-24. The master control relay in the equipment is energized from a 115 volt A.C. source while the remaining relays with the exception of the plate overload, are energized from 115 volts D.C. obtained from the bias-exciter generator.

142. Par. 5-25. All relays incorporated in the XTAJ-6 equipment operate in a quiet manner without undue hum or chatter.

143. Par. 6-3. The equipment operates satisfactorily without damage to any part when subjected to line voltages variations of 5% above and below normal line voltage. No means was available for varying the frequency of the AC supply between the limits of plus and minus 5%.

144. Par. 6-4. The power equipment was subjected to numerous full power key locked tests of from two to eight hours duration without overheating or showing any other signs of failure.

145. Par. 6-5. The power required from the supply lines for the operation of the XTAJ-6 equipment is shown in Table No. 43. Full power key locked operation requires 2.77 KW; specifications limit this value to 4.0 KW.

146. Par. 6-7. Suitable generators have been provided for furnishing the necessary plate and bias potentials.

147. Par. 6-16. The motor generator equipment supplied conforms to the requirements of this paragraph with the exception that the dowels employed for alignment of units are not provided with square heads. Standard taper pins are employed.

148. Par. 6-17. All motor and generator frames are grounded to the bed plate. All metal cover plates which protect the terminals are grounded and are of sufficient strength to support the weight of a heavy man.

149. Par. 6-18. The main plate generator is provided with an individual lifting eye near which a suitable nameplate is affixed warning against using the eye for lifting the entire motor generator set. The A.C. motor and the auxiliary generator are not provided with lifting eyes. The bed plate of the motor generator is fitted with suitable lifting bails.

150. Par. 6-19. The dimensions of the motor generator comply with the requirements of the specifications as illustrated in Table No. 2.

151. Par. 6-21. Nameplates have not been provided on the motor generator to specify the type of lubricant to be employed. All bearings are provided with "Zerk" lubricating fittings with the exception of the outboard bearing of the high voltage generator. This bearing is provided with a standard grease cup. This cup is hidden beneath a cover plate fitted over the regular access plate to the brush rigging. The position of the cup is such that the cap must be turned down tight in order to clear the cover plate and hence the cup retains no grease. It is feared that the inaccessible location of this fitting will prevent the outboard bearing from receiving proper attention, and it is recommended that this condition be corrected.

152. Par. 6-23. The protective fuses furnished, and which are listed under paragraph 42 (2) above, are not installed at the generator terminals but are housed within a separate container or fuse box, which is illustrated in Plate No. 25. It is recommended that the use of such a separate container be avoided in the interests of maximum protection and simplification of wiring. The fuses should be installed directly at the generator terminals. The terminal covers now provided could be enlarged sufficiently to accommodate the necessary fuses and the Thyrite field discharge devices without exceeding the limiting dimensions specified.

153. Par. 6-31. The voltage regulation of the generators supplied was measured with the results illustrated in Table No. 44. It

will be noted that the requirements of the governing specifications are complied with in all instances. The percent generator ripple present is listed in Table No. 45. Only the 115 volt generator showed a ripple in excess of the 0.25% specified. This generator is used for both excitation and grid bias purposes and hence falls within the 0.25% limitation.

154. Par. 6-34. The motor starter furnished with the equipment functioned satisfactorily throughout the tests with one exception. A magnetic interlock is provided to prevent the opening of the door while the equipment is in operation. This lock fails to work properly so that even though the equipment is shut down it is impossible to open the door except by removing the hinge pins or by subjecting the starter to a series of shocks in an effort to release the lock. It is recommended that steps be taken to correct this difficulty.

155. Par. 6-36. The door of the starter cabinet is mounted on hinges with removable pins and the pins are secured to the cabinet by means of short chains to prevent loss.

156. General. Certain items of generator construction and design are capable of modification and improvement, as follows:

(a) Both sets of brushes on any one commutator are so positioned that they make contact with the commutator over the same surface, thus utilizing only a portion of the commutator surface. It is recommended that the brushes be staggered to distribute the wear over a greater surface and reduce the possibility of cutting grooves in the commutator.

(b) The cover plates are secured in place by means of four screws of the cross bar type. Each screw and the cover plate itself is secured to the generator frame by means of chains. These chains readily become entangled, are subject to breakage and do not present a desirable ship-shape appearance. It is impossible to insert the lower inside screws in the exciter generator screens due to the proximity of the generator end plate, hence these securing screws must be left dangling. It is recommended that an improved method for securing the cover plates be provided.

(c) It is recommended that the direction of rotation be indicated on the motor and generators by means of prominent and visible arrows. At present the direction of rotation is indicated by a small painted arrow near the commutator and it is necessary to remove the cover plates to perceive this indication.

157. Section IX. Instruction Books. The instruction books furnished with the preliminary Model XTAJ-6 equipment contained a number of errors, particularly in the wiring diagrams, which caused considerable confusion and delay.

(a) Connections No. 1 and 11 were confused on the external connection diagram, which prevented operation until this difficulty was overcome.

(b) Terminals 3 and 4 on the remote control unit were reversed on the external connection diagram, causing considerable delay.

(c) The field connections on the exciter generator did not correspond to the markings on the external connection diagram. F2 was labelled F1 in the machine and F1 carried no designation.

158. In general, the major criticism of the Instruction Books lies in the various wiring diagrams, namely, the External Connection diagram, the Schematic Diagram and the Connection Diagram (Internal). The various terminals in the transmitter are given arbitrary numeral designations but the actual purpose or function of any given terminal cannot be ascertained readily from any one of the wiring diagrams. Thus when an error in numbering does occur, it is a difficult matter to correct the difficulty. It is recommended, therefore, that the External Connection Diagram contain additional information by means of which the various terminals may be identified by the addition of such legends as "-115 volts", "110 volts AC", etc.

159. The usefulness of the Schematic Diagram would be enhanced if the transmitter terminal numbers appeared upon this drawing. In its present form no terminal designations appear in this diagram.

160. The Connection Diagram (Internal) is exceedingly complicated and it is a difficult matter to trace any individual lead or wire. A simplification of this diagram would be desirable.

161. Examples of diagrams of various sorts, such as Schematic, Interconnection (External) and Interconnection (Internal), which have proved to be satisfactory in connection with other radio equipment of this nature, are those furnished under Contract NOs-36091.

162. The instruction books as furnished contain a number of typographical errors and incorrect information. For example, in identifying the location of the various vacuum tubes the position of the master oscillator and the audio oscillator have been reversed. Another example of incorrect marking and designation occurs in connection with the relays used in the equipment. The instruction book and Schematic Diagram refers to relays, RL-1, RL-2, RL-3, RL-4 and RL-5. The Connection Diagram (Internal) and the actual relays in the transmitter are designated as RL-1, RL-2, RL-3, RL-5 and RL-6. No list of material was furnished in the instruction books making it difficult to identify the characteristics and use of any particular component part.

163. Section X. The tests required by this section of the specifications are described in the body of this report under appropriate paragraph headings. In addition, keying tests were conducted in accordance with paragraph 10-32 (Test No. 27). Plates 16 to 20 inclusive are oscillographic records of the tests conducted.

Plate 16 - 20 words per minute, CW and MCW
Plate 17 - 40 words per minute, CW and MCW
Plate 18 - 60 words per minute, CW and MCW
Plate 19 - 80 words per minute, CW and MCW
Plate 20 - 100 words per minute, CW and MCW

It will be noted that satisfactory keying action was obtained at these various speeds on both types of emission. The timing frequency employed during these tests was 60 cycles. Although no definite determination of the amplitude of key clicks was made, a study of the foregoing oscillograms indicates that key clicks are present to the same degree as in other equipment of a similar nature. In order to minimize the interference from key clicks vacuum tube keying would have to be employed. An automatic keyer was used during these tests and it was found necessary to interpose an additional relay between the keyer and the key relay in the transmitter in order to handle the current involved. This raises the question as to whether the keying circuit supplied with the XTAJ-6 will be suitable for use on board ship, in spite of the fact that it complies with the specification requirements of paragraph 5-8. The 500 MA drawn in the key circuit, as explained in paragraph 137 above, causes a vicious arc at the key contacts. Arcs of this nature cause disasterous interference in ship board receivers. In addition it is doubtful whether any automatic keying device, without the use of additional relays, will be capable of successfully breaking this value of current. Shipboard operating personnel are of the opinion that every effort should be made to keep keying currents below a value of 100 M.A. It is recommended therefore that the Bureau of Engineering consider the advisability of modifying paragraph 5-8 of the governing specifications to limit keying currents to 100 MA maximum and that the necessary steps be taken to modify the keying circuit of the XTAJ-6 equipment so that the key will be required to break a current of 100 MA or less.

164. Among the various plates attached hereto are views showing the appearance and construction of the Model XTAJ-6 Equipment.

Plate 25 - View of Starter and Fuse Box (Covers removed).
Plate 26 - Oblique Front view of Transmitter.
Plate 27 - View of Right Side (Shields removed).
Plate 28 - View of Left Side (Shields removed).
Plate 29 - Rear view (Shields removed).
Plate 30 - View through lower access doors.
Plate 31 - View of Motor Generator Equipment.

165. A summary of the defects noted and such items as fail to comply with the requirements of the governing specifications, together with such additional amendments as appear necessary to provide suitable operation for Naval use, are listed below. The numerals enclosed in parentheses refer to the paragraph of this report under which these items are discussed in detail.

(a) (31) Screen grid resistors do not conform to specification requirements.

(b) (31) Voltmeter multipliers are not encased as required by Specifications 17-I-12.

(c) (34) P. A. Band Change Switch galled.

(d) (34) Interlock on Antenna Band Change Switch unsatisfactory.

(e) (35) Movement of Filament Rheostat controls should be subject to greater tension.

(f) (35) Bias field rheostat is of improper resistance value.

(g) (39) Steel hinge pins used in hinges of access doors on transmitter.

(h) (40) Various phenolic compounds used; should be confined to use of the most suitable grades.

(i) (42) Non-renewable fuses used in circuits operating at 440 volts and lower.

(j) (43a) Overload Relay, RL-1, does not provide maximum protection.

(k) (43b) Operation of Protective Relay, RL-3, is not positive in action.

(l) (43c) Re-set device on Overload Relay, RL-1, is unsatisfactory.

(m) (45) Interior of equipment not visible when doors and shields are in place, preventing proper monitoring of equipment.

(n) (47) Power Amplifier Plate Choke overheats during locked key operation.

(o) (49) 38160 and 38161 tubes failed during tests after 10 to 25 hours of operation.

(p) (50) The equipment fails to comply with the requirement that "safe operation and satisfactory performance are assured."

(q) (51) (127b) Flexible transmitter mounting provided is unsatisfactory.

(r) (52) (53) Equipment fails to operate properly when subjected to vibration; short circuits occurred; flexible connections broke; filaments of screen grid lamps carried away; audio tube strikes near-by insulator; tube cradle mounting unsatisfactory; choke coil construction unsatisfactory and methods used in processing Litz wire connections doubtful.

(s) (56) Rheostats not marked to indicate direction of rotation; door latches unsatisfactory.

(t) (59) Main nameplate should be modified.

(u) (62) Master Oscillator dial unsatisfactory.

(v) (63) Flexible couplings on IPA, PA and Antenna Tuning controls not satisfactory; use of Allen type set screws to be avoided.

(ll) (103) The overlap provided, particularly in the IPA circuit, is inadequate.

(mm) (104) (117) Tuning adjustments and indications are not satisfactory, plate current meters should read current in plate circuit only; MO circuit should be provided with two meters.

(nn) (105) Letters designating tuning controls are too small and inconspicuous.

(oo) (108) Master Oscillator dial lock is not satisfactory.

(pp) (109) Adjustable positioning devices on tuning controls are not designed for insertion of cards as required by specifications.

(qq) (122) Wiring not secured properly throughout the transmitter assembly.

(rr) (125) (60) Transformers not marked to indicate function of the various terminals.

(ss) (128) Shield securing screws are not satisfactorily anchored; frame should be painted black beneath button hole openings in shields.

(tt) (139) The remote-local switch provided on the transmitter panel is not satisfactory.

(uu) (147) Square head dowels are not provided for alignment of units of the motor generator.

(vv) (151) Lubrication nameplates are not provided on motor generator and one grease cup is too inaccessible.

(ww) (152) Employment of a separate fuse box instead of mounting fuses on motor generator terminals not considered satisfactory.

(xx) (153) Ripple content of grid bias generator exceeds specification value.

(yy) (154) Magnetic interlock on starter fails to function properly.

(zz) (156) Brushes should be staggered on motor generator to distribute wear; improved method of securing cover plates on motor generator should be provided; direction of rotation of motor generator should be clearly indicated.

(aaa) (157) to (162) Preliminary instruction books contain errors and modification of the various wiring diagrams is recommended; incorrect symbol numbers have been applied to relays in the equipment.

(bbb) (163) Keying circuit unsatisfactory for automatic operation due to excessive current and sparking.

CONCLUSIONS.

166. The external appearance of the equipment is good, although the design employed is such that it is impossible to view the interior of the transmitter unit when the shields are in place and the access doors are closed. This interferes with the proper monitoring of the transmitter. A rugged framework of aluminum alloy provides the basis of a design in which the various component parts have been assembled in a manner which provides excellent accessibility in the lower compartment of the transmitter. The upper compartments of the transmitter unit are less accessible, although provision is made for removal of the master oscillator compartment. Certain controls are of smaller size than those usually employed in equipment of this type, although in the majority of instances they embody strength suitable for the needs of the service.

167. The power output requirements of the specifications have been complied with in all instances. The quality of the emitted signal is excellent and is free from undesirable modulations. The tuning controls do not operate in as sharp and decisive manner as is desirable, which is partly attributable to the fact that the plate current meters which are employed to indicate resonance are located in the common or cathode return. Thus they indicate the summation of currents flowing in the plate, screen grid and control grid circuits, which prevents a well defined resonance "dip". The antenna coupling circuit provided proved adequate for producing full power output into antennas of the various constants listed in the governing specifications. The reaction of the antenna circuits upon the Power Amplifier tank circuit, however, is somewhat greater than encountered in other equipments of a similar nature.

168. The frequency stability characteristics of the transmitter fail to comply with the specification requirements in numerous instances and one exceptionally undesirable feature is the tendency of the frequency to continue to drift over long periods of time. While the transmitter is capable of accurate reset and the frequency of the master is not greatly influenced by tuning reactions from subsequent stages, the virtue of these characteristics is practically vitiated by the large frequency drifts encountered.

169. The equipment fails to comply with the general and important requirement of safe and satisfactory operation under conditions encountered in the Naval service. Various component parts are adversely affected by vibration; power amplifier tubes of the 38161 type lost emission to the extent that non-operation occurred at intervals ranging from 10 hours to approximately 25 hours full power operation. Numerous

other defects were noted and while some of these are minor in nature when considered individually, in the aggregate they assume serious proportions. It must be concluded, therefore, that in its present condition, the preliminary Model XTAJ-6 equipment is unsuitable for use in the Naval service.

Table 1

Model XTAJ-6 Transmitting Equipment

ANTENNA SHORT CIRCUITED AND OPEN CIRCUITED

Test as per paragraph 2-16 of Specifications RE 13A 328J

Frequency KC	Antenna	Plate Current
200	Normal	300
200	Shorted	270
200	Open	270
600	Normal	300
600	Shorted	140
600	Open	180

No damage was incurred by any portion of the equipment.

Table 2

Model XTAJ-6 Transmitting Equipment

DIMENSIONS AND WEIGHTS

Test as per paragraphs 2-32, 2-33 and 3-27

of Specifications RE 13A 328J.

	Weight	Specification Requirements	Actual Dimensions
Transmitter	638 lbs.		
Height		72 in.	72 in.
Width		27 in.	27 in.
Depth		24 in. *	24 in.
Generator	844 lbs.		
Length		75 in.	71-5/8 in.
Height		23 in.	17-3/4 in. **
			20-1/4 in. ***
Width		21 in.	16 in.
Starter	22 lbs.		
Height			17-3/4 in.
Width			10-1/8 in.
Depth			7-3/4 in.
Fuse Box	14 lbs.		
Height			9-1/4 in.
Width			13-1/4 in.
Depth			5 in.

Total weight - 1524 lbs.
Permitted by specifications - 1600 lbs.

Note: * Denotes this dimension increased from 20 in. to 24 in. by authority contained in Contract Note (page 1).

** Denotes height without lifting eye.

*** Denotes height over lifting eye.

Table 3

Model XTAJ-6 Transmitting Equipment

DETERMINATION OF POWER OUTPUT

Test as per paragraph 3-2-1 of Specifications RE 13A 328J.

Control or Meter	175 Kcs.		300 Kcs.		400 Kcs.	
A	1		3		5	
B	193		735		620	
C	1		3		5	
D	0		70		54	
E	1		3		5	
F	0		84		60	
G	6		4		4	
H	6		12		13	
I	21		61		74	
	CW	MCW	CW	MCW	CW	MCW
MO Ip	43	43	51	51	56	56
IPA Ip	110	83	138	107	140	110
PA Ip*	465	340	440	350	450	350
Ant I ext**	6.3	4.9	7.4	6.1	9.15	7.5
Ant I set	7.0	5.5	8.5	7.6	10.0	8.3
MO Ep	1320	1320	1310	1310	1310	1310
Eg	115	115	115	115	115	115
PA Ep	3000	3000	3000	3000	3000	3000
Ant Res	12.2	12.2	8.8	8.8	6.0	6.0
Ant Cap	810	810	810	810	810	810
Watts Out	485	292	481	327	502	336
% MCW-CW		60		68		67
Aud Osc Ip		133		130		131
Specification Requirements	475	238	475	238	460	230

Note: * Denotes panel meter which reads Ip in common return.

** Precision meter connected into circuit between base of dummy antenna resistor and ground.

Table 4

Model XTAJ-6 Transmitting Equipment

DETERMINATION OF POWER OUTPUT

Test as per paragraph 3-2-1 of Specifications RE 13A 328J.

Control or Meter	500 Kcs.		600 Kcs.	
A	6		7	
B	769		805	
C	6		7	
D	72		75	
E	6		7	
F	82		73	
G	4		4	
H	14		15	
I	64		32	
	CW	MCW	CW	MCW
MO Ip	59	59	68	68
1PA Ip	140	110	120	95
PA Ip*	470	370	480	380
Ant I ext**	10.4	8.6	11.2	9.3
Ant I set	11.5	9.8	12.5	10.5
MO Ep	1310	1310	1310	1310
Eg	115	115	115	115
PA Ep	3000	3000	3000	3000
Ant Res	4.5	4.5	3.75	3.75
Ant Cap	852	852	962	962
Watts Out	486	334	472	324
% MCW-CW		69		69
Aud Osc Ip		132		132
Specification Requirements	460	230	445	223

Note: * Denotes panel meter which reads Ip in common return.

** Precision meter connected into circuit between base of dummy antenna resistor and ground.

Table 5

Model XTAJ-6 Transmitting Equipment

DETERMINATION OF POWER OUTPUT

Test as per paragraph 3-2-2 of Specifications RE 13A 328J

Control or Meter	175 Kcs.		200 Kcs.		355 Kcs.	
A	1		1		4	
B	193		691		730	
C	1		1		4	
D	0		66		69	
E	1		1		4	
F	10		77		77	
G	6		5		4	
H	2		6		13	
I	65		22		57	
	CW	MCW	CW	MCW	CW	MCW
MO Ip	43	43	44	44	53	53
IPA Ip	110	85	112	86	140	112
PA Ip*	480	340	450	320	465	370
Ant I ext**	7.4	5.5	7.7	5.75	10.2	8.4
Ant I set	8.3	6.0	8.5	6.6	11.1	10.4
MO Ep	1320	1320	1320	1320	1320	1320
Eg	115	115	115	115	115	115
PA Ep	3000	3000	3000	3000	3000	3000
Ant Res	6.2	6.2	6.2	6.2	4.26	4.26
Ant Cap	595	595	595	595	900	900
Watts Out	338	188	368	209	443	300
% MCW-CW		56		57		67
Aud Osc Ip		134		141		130
Specification Requirements	325	163	345	173	432	216

Note: * Denotes panel meter which reads Ip in common return.

** Precision meter connected into circuit between base of dummy antenna resistor and ground.

Table 6

Model XTAJ-6 Transmitting Equipment

DETERMINATION OF POWER OUTPUT

Test as per paragraph 3-2-2 of Specifications RE 13A 328J.

Control or Meter	500 Kcs.	600 Kcs.
A	6	7
B	769	805
C	6	7
D	73	75
E	6	7
F	77	77
G	3	2
H	14	15
I	87	63

	CW	MCW	CW	MCW
MO Ip	58	58	67	67
IPA Ip	138	110	120	96
PA Ip*	460	360	460	360
Ant I ext**	12.6	10.5	16.05	13.2
Ant I set	13.6	11.5	17.5	14.4
MO Ep	1320	1320	1310	1310
Eg	115	115	115	115
PA Ep	3000	3000	3000	3000
Ant Res	2.58	2.58	1.45	1.45
Ant Cap	1192	1192	1401	1401
Watts Out	410	284	374	252
% MCW-CW		69		67
Aud Osc Ip		131		132
Specification Requirements	405	203	334	167

Note: * Denotes panel meter which reads Ip in common return.

** Precision ammeter connected into circuit between base of dummy antenna resistor and ground.

Table 7

Model XTAJ-6 Transmitting Equipment

25% VARIATION IN CONSTANTS OF ANTENNAS

Test as per paragraph 3-2 of Specifications RE 13A 328J.

Control or Meter	600 Kcs.	175 Kcs.
A	7	1
B	805	193
C	7	1
D	75	0
E	7	1
F	77	14
G	2	6
H	15	2
I	63	55

	CW	MCW	CW	MCW
MO Ip	67	67	43	43
IPA Ip	120	96	110	85
PA Ip*	460	360	470	330
Ant I ext**	16.05	13.2	6.5	5.0
Ant I set	17.5	14.4	7.5	5.6
MO Ep	1310	1310	1330	1330
Eg	115	115	115	115
PA Ep	3000	3000	3000	3000
Ant Res	1.45	1.45	9.0	9.0
Ant Cap	1401	1401	579	579
Watts Out	374	252	380	225
Aud Osc Ip		132		135

Note: * Denotes panel meter which reads Ip in common return.

** Precision meter connected into circuit between base of dummy antenna resistor and ground.

Table 8

Model XTAJ-6 Transmitting Equipment

AMPLITUDE MODULATION OF CW CARRIER

Test as per paragraph 3-4-2 of Specifications RE 13A 328J.

Operation at 600 KC, full power.

Rectified carrier: 100 volts, d.c.
A.C. component: 0.1 volt.
Per cent modulation: 0.1
Permitted by specifications: 2.0 per cent.

Note: The a.c. component of ripple was too small for accurate measurement.

Table 9

Model XTAJ-6 Transmitting Equipment

MCW OPERATION

Test as per paragraph 3-5 of Specifications RE 13A 328J.

Frequency Kcs.	Per cent Modulation	
	Negative Peaks	Positive Peaks
175	78	0
275	70	14
300	68	14
325	69	0
355	64	14
375	70	14
400	70	14
600	65	12

Frequency of modulation: 837 cycles.

Specification requirements:
Per cent modulation: 70 per cent.
Frequency: 800 cycles, plus or minus 5 per cent.

Table 10

Model XTAJ-6 Transmitting Equipment

ACCURACY OF RESET TO PREVIOUSLY CALIBRATED FREQUENCIES

Test as per paragraph 3-7-1 of Specifications RE 13A 328J.

Trial No.	Frequency KC	Time Seconds	Deviation in Frequency Cycles	Per Cent
Original	200.730			
1	.739	55	9	0.0045
2	.730	30	0	0
3	.736	29	6	0.003
4	.756	32	26	0.013
5	.740	30	10	0.005
		Average: 10.2 cycles;		0.0051
Original	400.627			
1	.648	28	21	0.0052
2	.658	35	31	0.0077
3	.653	40	26	0.0065
4	.658	32	31	0.0077
5	.649	35	22	0.0055
		Average: 26.2 cycles;		0.0065
Original	600.650			
1	.669	30	19	0.0031
2	.653	30	3	0.0005
3	.702	29	52	0.0086
4	.718	33	68	0.0113
5	.715	28	65	0.0108
		Average: 41 cycles;		0.0068

Permitted by specifications -
Average: 0.01 per cent.
Maximum: 0.015 per cent.

Table 11

Model XTAJ-6 Transmitting Equipment

TEST FOR LOST MOTION, BACK LASH AND TORQUE LASH

Test as per paragraph 3-7-2 of Specifications RE 13A 328J.

Trial No.	Frequency when approached from Counter Clockwise Direction	Frequency when approached from Clockwise Direction	Back Lash Cycles	Back Lash Per Cent
1	200.560	200.492	68	0.033
2	.564	.498	66	0.033
3	.550	.492	58	0.029
4	.550	.490	60	0.030
5	.540	.488	52	0.026
			Average:	0.030
1	600.681	600.611	70	0.012
2	.681	.625	56	0.009
3	.679	.601	78	0.013
4	.670	.601	69	0.012
5	.667	.600	67	0.011
			Average:	0.0113

Permitted by specifications:
Average - 0.03 per cent.
Maximum - 0.06 per cent.

Table 12

Model XTAJ-6 Transmitting Equipment

OPERATION OF ADJUST-TUNE-OPERATE CONTROL

Test as per paragraph 3-7-3 of Specifications RE 13A 328J.

Position 1 Adjust	Position 2 Tune	Position 3 Operate	Maximum Frequency Change Cycles	Maximum Frequency Change Per Cent
600.550	600.560	600.560	10	0.0016
500.458	500.471	500.483	25	0.005
400.470	400.468	400.470	2	0.0005
300.500	300.501	300.510	10	0.003
200.500	200.506	200.510	10	0.005

Permitted by specifications: 0.01 per cent.

Table 13

Model XTAJ-6 Transmitting Equipment

DETUNING OF CIRCUITS

Test as per paragraph 3-7-4 of Specifications RE 13A 328J.

Circuit Detuned	Frequency KC	Change in Frequency Cycles	Change in Frequency Per Cent
Normal	200.434		
IPA "D" cc	.421	13	0.0065
IPA "D" c	.436	2	0.001
PA "F" cc	.430	4	0.002
PA "F" c	.433	1	0.0005
Ant. "I" cc	.438	4	0.002
Ant "I" c	.432	2	0.001
Normal	600.470		
IPA "D" cc	.435	35	0.0058
IPA "D" c	.503	33	0.0055
PA "F" cc	.476	6	0.001
PA "F" c	.470	0	0
Ant "I" cc	.486	16	0.0027
Ant "I" c	.472	2	0.0003

Note: IPA "D" cc denotes circuit detuned in counter clockwise direction.
IPA "D" c denotes circuit detuned in clockwise direction.

Permitted by specifications: 0.01 per cent.

Table 14

Model XTAJ-6 Transmitting Equipment

OPERATION OF POWER OUTPUT CONTROL

Test as per paragraph 3-7-5 of Specifications RE 13A 328J.

Power Output Watts	Per Cent Power	Antenna Current	Plate Volts	Frequency KC	Frequency Change Cycles	Frequency Change Per Cent
500	100	6.4	3000	200.499		
375	75	5.6	2700	.498	1	-
250	50	4.5	2200	.492	7	0.0035
125	25	3.2	1600	.490	9	0.0045
500	100	6.4	3000	600.428		
375	75	5.6	2700	.421	7	0.0012
250	50	4.5	2230	.415	13	0.0022
125	25	3.2	1630	.407	21	0.0035

Antenna constants: Resistance - 12.2 ohms; capacity - 970 uuf.

Note: It was necessary to allow the transmitter to warm up thoroughly before conducting these tests in order to prevent the preliminary drift from obscuring the results of the power output changes.

Permitted by specifications: 0.005 per cent.

Table 15

Model XTAJ-6 Transmitting Equipment

CHANGE OF TUBES

Test as per paragraph 3-7-6 of Specifications RE 13A 328J.

Tube No.	Frequency	Deviation from Mean Frequency Cycles	Per Cent
	Master Oscillator Circuit		
GE58900	200.572	10	0.005
GE58118	.642	60	0.030
GE58128	.647	65	0.032
GE58121	.649	77	0.038
GE58120	.643	61	0.030
RCA11899	.579	3	0.0015
RCA11900	.570	12	0.006
RCA11902	.572	10	0.005
RCA11904	.543	39	0.019
CWL42795	.501	81	0.040
CWL42797	.491	91	0.045
Mean:	200.582 KC	46.2 cycles	0.023%
	Intermediate Amplifier Circuit		
GE58955	200.568	3	0.0015
GE58118	.561	10	0.005
GE58128	.561	10	0.005
GE58121	.562	9	0.0045
GE58120	.558	13	0.0065
RCA11899	.572	2	0.001
RCA11900	.578	7	0.0035
RCA11902	.576	5	0.0025
RCA11904	.581	10	0.005
CWL42795	.574	3	0.0015
CWL42797	.576	5	0.0025
Mean:	200.571 KC	7 cycles	0.0035%

Permitted by specifications:
Master oscillator - 0.02%
Subsequent stage - 0.005%

Table 16

Model XTAJ-6 Transmitting Equipment

CHANGE OF TUBES

Test as per paragraph 3-7-6 of Specifications RE 13A 328J.

Tube No.	Frequency KC	Deviation from Mean Frequency Cycles	Per Cent
	Master Oscillator Circuit		
GE58900	600.585	72	0.012
GE58118	.588	69	0.011
GE58128	.640	17	0.0029
GE58121	.628	29	0.0048
GE58120	.695	38	0.0063
RCA11899	.610	47	0.0079
RCA11900	.612	45	0.0075
RCA11902	.598	59	0.01
RCA11904	.650	7	0.001
CWL42795	.290	367	0.061
CWL24797	.240	417	0.069
Mean:	600.657 KC	106 cycles	0.0176%
	Intermediate Amplifier Circuit		
GE58955	600.705	78	0.013
GE58118	.658	31	0.005
GE58128	.640	13	0.002
GE58121	.625	2	0.0003
GE58120	.624	3	0.0005
RCA11899	.622	5	0.0008
RCA11900	.612	5	0.0008
RCA11902	.612	5	0.0008
RCA11904	.610	3	0.0005
CWL42795	.600	27	0.0045
CWL42797	.598	29	0.0048
Mean:	600.627 KC	18.2 cycles	0.003%

Permitted by specifications:
Master oscillator - 0.02%
Subsequent stage - 0.005%

Table 17

Model XTAJ-6 Transmitting Equipment

VARIATIONS OF VOLTAGE APPLIED TO TRANSMITTER UNIT

Test as per paragraph 3-7-7 of Specifications RE 13A 328J.

Frequency KC	M.O. Ep	P.A. Ep	E fil	% Voltage Change	Frequency Change Cycles	Frequency Change Per Cent
600.512	1320	3000	103	-		
.489	1320	3000	108.2	+5 Fil	23	0.0038
.522	1320	3000	97.8	-5 Fil	7	0.0015
.515	1320	3150	103	+5 PA Ep	3	0.0005
.512	1320	2850	103	-5 PA Ep	0	0
.515	1386	3000	103	+5 MO Ep	3	0.0005
.508	1254	3000	103	-5 MO Ep	4	0.00068
.488	1386	3150	108.2	+5 All	24	0.004
.512	1254	2850	97.8	-5 All	0	0
200.490	1320	3000	103	-		
.500	1320	3000	108.2	+5 Fil	10	0.005
.483	1320	3000	97.8	-5 Fil	7	0.0035
.495	1320	3150	103	+5 PA Ep	5	0.0025
.490	1320	2850	103	-5 PA Ep	0	0
.500	1386	3000	103	+5 MO Ep	10	0.005
.478	1254	3000	103	-5 MO Ep	12	0.006
.515	1386	3150	108.2	+5 All	25	0.0125
.455	1254	2850	97.8	-5 All	35	0.0175

Permitted by specifications: 0.01%.

Table 18

Model XTAJ-6 Transmitting Equipment

VARIATION OF LINE VOLTAGE

Test as per paragraphs 3-7 (7) and 6-3

of Specifications RE 13A 328J.

Line Volts	Fil. Volts	Bias Volts	M.O. Ep	P.A. Ep	Antenna Current	Frequency KC	Cycles Change	% Change
418	96.5	114.0	1315	2995	5.0	200.559		
440	103.0	114.5	1320	3000	5.0	.567		
462	110.0	114.5	1320	3000	5.0	.576	17	0.0085
418	97.0	115.0	1310	2995	5.0	600.550		
440	102.5	115.0	1312	3000	5.0	.552		
462	108.0	115.5	1320	3000	5.0	.555	5	0.0008

Note: During the above test the line voltage was varied from 5% below to 5% above normal in a period of one minute.

418	96.5	114.0	1310	2990	5.0	200.554		
440	102.5	114.0	1310	2995	5.0	.562		
462	108.0	114.5	1315	3000	5.0	.568	14	0.007
418	96.5	114.5	1308	2990	5.0	600.545		
440	102.5	114.5	1305	2980	5.0	.550		
462	108.0	115.0	1308	2980	5.0	.548	5	0.0008

Note: During the above test the line voltage was varied from 5% below to 5% above normal in a period of five minutes.

No damage to parts resulted from variation of line voltage.

Table 19

Model XTAJ-6 Transmitting Equipment

VARIATIONS IN AMBIENT TEMPERATURE

Test as per paragraph 3-7-8 of Specifications RE 13A 328J.

Time	Ambient Temp.°C.	Frequency KC	P.A. Ip	I.P.A. Ip	M.O. Ip	P.A. Isg	P.A. Icath	Antenna Current	Watts Output	Relative Humidity %	P.A. Ep	Line Volts
8:00	24.5	200.870	325	110	43	68	450	6.72	498	21	3000	424
:15	25.0	.734	320	106	42	68	440	6.60	480	20	2910	438
:30	25.0	.685	310	105	41	68	430	6.47	460	20	2880	432
:45	25.0	.657	310	104	41	68	425	6.40	450	20	2860	426
9:00	25.0	.637	305	102	40	67	420	6.36	446	20	2830	426
9:15	29.5	.614	300	101	40	67	420	6.32	439	20	2820	434
:30	30.0	.590	300	100	40	67	412	6.28	434	21	2810	430
:45	30.0	.574	300	100	40	67	410	6.25	430	21	2810	428
10:00	30.0	.567	300	100	40	67	410	6.24	428	21	2800	432
:15	30.0	.560	295	100	40	67	410	6.22	426	21	2800	432
10:30	35.0	.550	295	100	40	66	405	6.22	426	20	2800	438
:45	35.0	.530	290	100	40	67	402	6.18	419	20	2790	441
11:00	35.0	.516	290	100	40	67	400	6.14	413	20	2790	441
:15	35.0	.518	285	99	39	67	400	6.12	412	20	2780	438
:30	35.0	.517	285	99	39	67	400	6.12	412	20	2780	436
11:45	41.5	.510	285	99	39	67	400	6.12	412	16	2780	441
12:00	41.0	.491	285	99	39	67	400	6.12	412	21	2780	441
:15	41.0	.475	279	98	38	67	400	6.05	403	20	2780	445
:30	41.5	.461	279	98	38	67	395	6.03	400	20	2780	444
:45	41.0	.459	275	96	38	67	390	6.03	400	20	2770	440

Table 19 (Continued)

Time	Ambient Temp. °C.	Frequency KC	P.A. Ip	I.P.A. Ip	M.O. Ip	P.A. Isg	P.A. Icath	Antenna Current	Watts Output	Relative Humidity %	P.A. Ep	Line Volts
1:00	45.0	200.442	270	95	38	67	388	6.00	396	17	2760	445
:15	45.0	.422	265	96	38	67	380	5.95	390	20	2750	444
:30	45.0	.403	261	96	38	67	378	5.87	380	20	2730	446
:45	45.5	.411	260	96	38	68	378	5.87	380	20	2730	447
2:00	45.5	.406	259	95	37	68	372	5.81	371	20	2710	436
2:15	52.0	.386	250	95	38	68	370	5.76	365	21	2710	441
:30	51.5	.360	247	95	38	69	363	5.70	356	23	2700	441
:45	52.0	.337	243	95	38	69	360	5.66	352	24	2700	442
3:00	52.0	.315	240	95	38	69	360	5.60	345	26	2700	447
:15	52.0	.305	240	94	38	69	355	5.58	344	26	2700	445

Antenna constants: Resistance, 11 ohms; capacity, 829 uuf.

Summary

Temperature °C.	Cycles Change per 5°C.	Per Cent Change per 1°C.
25 to 30	77	0.0075
30 to 35	43	0.0045
35 to 40	58	0.006
40 to 45	53	0.0055
45 to 50	101	0.01

Permitted by specifications: 0.005%.

Table 20

Model XTAJ-6 Transmitting Equipment

VARIATIONS IN AMBIENT TEMPERATURE

Test as per paragraph 3-7-8 of Specifications RE 13A 328J.

Time	Ambient Temp. °C.	Frequency KC	P.A. Ip	I.P.A. Ip	M.O. Ip	P.A. Isg	P.A. Icath	Antenna Current	Watts Output	Relative Humidity %	P.A. Ep	Line Volts
8:30	25.0	200.460	325	110	43	69	455	6.72	498	20	3000	428
:45	25.0	.361	325	106	42	69	440	6.59	478	20	2920	424
9:00	25.5	.323	315	103	42	68	430	6.42	453	20	2870	430
:15	25.0	.312	310	103	42	65	425	6.33	440	17	2830	426
:30	25.0	.305	310	101	42	65	420	6.30	436	20	2810	432
9:45	20.0	.321	310	101	42	65	422	6.30	436	20	2810	438
10:00	20.0	.340	310	101	42	65	420	6.30	436	20	2810	437
:15	20.0	.354	310	101	41	65	420	6.28	434	20	2810	432
:30	20.0	.370	315	101	41	65	420	6.28	434	20	2810	437
:45	20.0	.381	315	101	41	65	420	6.27	432	20	2810	437
11:00	15.0	.410	315	101	41	65	420	6.25	430	20	2810	436
:15	15.0	.431	315	101	41	65	425	6.27	432	20	2820	438
:30	15.0	.450	318	103	41	65	428	6.28	434	20	2850	438
:45	15.0	.461	320	103	41	65	428	6.28	434	20	2850	436
12:00	15.0	.475	320	104	41	65	430	6.28	434	20	2850	443
12:15	10.0	.500	320	104	41	65	430	6.30	436	20	2880	443
:30	10.0	.518	325	104	41	65	430	6.31	438	20	2880	443
:45	10.0	.534	325	105	42	65	432	6.31	438	20	2890	441
1:00	10.0	.543	325	104	42	65	430	6.30	436	20	2890	438
:15	10.0	.553	325	104	42	65	430	6.30	436	19	2890	436

Table 20 (Continued)

Time	Ambient Temp. °C.	Frequency KC	P.A. Ip	I.P.A. Ip	M.O. Ip	P.A. Isg	P.A. Icath	Antenna Current	Watts Output	Relative Humidity %	P.A. Ep	Line Volts
1:30	5.0	200.580	325	105	42	65	430	6.30	436	-	2900	440
:45	6.0	.596	328	105	42	65	430	6.30	436		2900	436
2:00	5.0	.607	328	105	42	65	430	6.30	436		2900	437
:15	5.0	.621	328	105	42	65	430	6.30	436		2900	434
:30	5.0	.630	328	105	42	65	430	6.30	436		2900	435
2:45	0.5	.650	333	105	42	64	435	6.38	448		2920	425
3:00	0.5	.653	335	105	42	64	438	6.40	451		2930	425
:15	0.0	.656	338	105	42	64	440	6.40	451		2930	429
:30	0.0	.661	338	105	42	64	440	6.41	452		2940	427
:45	0.0	.664	338	106	42	63	440	6.41	452		2940	427
3:46*			330	109	43	65	448	6.72	498		3000	

Note: * Denotes that voltages were brought back to normal at end of run.

Antenna constants: Resistance, 11 ohms; capacity, 829 uuf.

Summary

Temperature °C.	Cycles Change per 5 °C.	Per Cent Change per 1 °C.
25 to 20	76	0.0075
20 to 15	94	0.0095
15 to 10	78	0.008
10 to 5	77	0.0075
5 to 0	34	0.0035

Permitted by specifications: 0.005%.

Table 21

Model XTAJ-6 Transmitting Equipment

VARIATIONS IN AMBINET TEMPERATURE

Test as per paragraph 3-7-8 of Specifications RE 13A 328J.

Time	Ambient Temp.°C.	Frequency KC	P. A. Ip	Antenna Current	Watts Output	Relative Humidity %
9:00	25.0	600.950	320	6.9	525	29
:15	25.5	.485	310	6.62	482	26
:30	25.0	.495	305	6.43	447	17
:45	25.0	.550	305	6.33	441	16
10:00	26.0	.605	300	6.28	433	17
10:15	30.0	.575	320*	6.55	472	18
:30	30.0	.583	305	6.35	443	21
:45	30.0	.618	305	6.35	443	20
11:00	30.0	.643	300	6.28	433	20
:15	30.5	.669	300	6.20	423	21
11:30	35.0	.650	300	6.10	409	18
:45	35.0	.635	300	6.10	409	18
12:00	35.0	.643	295	6.05	403	18
:15	35.0	.660	295	6.05	403	18
:30	34.5	.670	290	5.90	383	16
12:45	40.0	.605	290*	5.92	386	16
1:00	41.0	.558	293	5.95	390	18
:15	41.0	.537	285	5.90	383	17
:30	41.0	.532	285	5.83	374	17
:45	41.0	.545	285	5.80	371	17
2:00	45.5	.498	280	5.70	357	21
:15	45.5	.569	280	5.65	352	15
:30	45.0	.561	275	5.60	341	16
:45	45.5	.576	275	5.60	341	16
3:00	45.5	.573	265	5.43	324	16
3:15	51.0	.527	265	5.43	324	13
:30	51.0	.521	265	5.35	315	13
:45	52.0	.498	250	5.20	298	13
4:00	51.5	.495	250	5.15	292	13
:15	50.0	.461	255	5.20	298	21
4:16**			255	5.50	333	

Note: * Denotes adjusted all voltages.
** Denotes re-tuned transmitter at end of run after readjusting all voltages.

Table 21 (Continued)

Antenna constants: Resistance, 11 ohms; capacity, 829 uuf.

Summary

Temperature °C.	Cycles Change per 5°C.	Per Cent Change per 1°C.
25 to 30	64	0.0021
30 to 35	1	0.00008
35 to 40	125	0.0041
40 to 45	28	0.00093
45 to 50	112	0.0037

Permitted by specifications: 0.005%.

Due to inability to bring power up to previous level, a new tube was installed in the P.A. circuit and normal power output was again obtained. Original tube was tested and found to be deficient in emission.

Table 22

Model XTAJ-6 Transmitting Equipment

VARIATIONS IN AMBIENT TEMPERATURE

Test as per paragraph 3-7-8 of Specifications RE 13A 328J.

Time	Ambient Temp. °C.	Frequency KC	P. A. Ip	I.P.A. Ip	M. O. Ip	Antenna Current	Watts Output	Relative Humidity %	P. A. Ep
9:00	26.0	600.815	310	140	65	7.28	583	60	3000
:15	25.0	.515	305	140	65	7.15	563	23	
:30	24.5	.550	300	136	64	7.08	551	22	
:45	25.0	.539	300	135	64	7.06	547	23	
10:00	25.0	.531	300	135	63	7.02	542	23	2850
10:15	19.5	.568	300	135	63	7.01	541	23	2850
:30	20.0	.630	300	135	63	7.02	542	23	2850
:45	20.0	.670	300	135	63	7.01	541	23	2850
11:00	20.0	.700	300	135	63	7.01	541	23	2850
:15	20.0	.730	300	135	63	7.01	541	23	2850
11:30	15.0	.778	300	135	63	7.02	542	20	2870
:45	15.0	.840	305	136	63	7.05	547	20	2890
12:00	15.0	.888	305	137	63	7.07	548	20	2900
:15	15.0	.920	307	137	63	7.07	548	20	2900
:30	15.0	.950	307	137	63	7.07	548	20	2900
12:45	11.0	.990	307	138	63	7.07	548	23	2900
1:00	10.0	601.080	310	138	63	7.10	555	16	2900
:15	10.0	.145	310	138	63	7.10	555	21	2900
:30	10.0	.190	310	138	63	7.10	555	21	2900
:45	10.0	.215	310	138	64	7.11	556	21	2900

Table 22 (Continued)

Time	Ambient Temp. °C.	Frequency KC	P. A. Ip	I.P.A. Ip	M. O. Ip	Antenna Current	Watts Output	Relative Humidity %	P. A. Ep
2:00	5.0	601.245	315	138	64	7.13	559	-	2910
:15	5.0	.260	318	139	64	7.14	561		2910
:30	5.0	.260	320	138	64	7.14	561		2910
:45	5.0	.265	320	139	64	7.15	562		2910
3:00	5.0	.280	320	140	64	7.16	564		2910
3:15	0.5	.335	320	140	65	7.15	562		2920
:30	0.5	.380	320	140	65	7.18	567		2930
:45*	3.0	.500	320	140	65	7.15	562		2930
4:00	0.5	.490	320	140	65	7.16	564		2930
:15	0.0	.530	320	140	65	7.15	562		2920

Note: * Denotes main line supply failed momentarily.

Antenna constants: Resistance, 11 ohms; capacity, 829 uuf.

Summary

Temperature °C.	Cycles Change per 5°C.	Per Cent Change per 1°C.
25 to 20	199	0.0066
20 to 15	220	0.0073
15 to 10	365	0.012
10 to 5	65	0.002
5 to 0	250	0.0083

Permitted by specifications: 0.005%.

Table 23

Model XTAJ-6 Transmitting Equipment

VARIATIONS IN HUMIDITY

Test as per paragraph 3-7-9 of Specifications RE 13A 328J.

Time	Ambient Temp.°C.	Frequency KC	P.A. Ip	I.P.A. Ip	M.O. Ip	P.A. Isg	P.A. Icath	Antenna Current	Watts Output	Relative Humidity %	P.A. Ep	Line Volts
9:30	40.5	200.638	320	109	43	64	447	6.72	498	20	3000	420
:45	41.0	.542	310	105	42	64	430	6.51	467	20	2900	421
10:00	41.0	.520	305	105	42	64	420	6.42	453	21	2880	429
:15	41.0	.493	300	104	41	64	419	6.33	440	20	2860	428
:30	41.0	.492	300	101	41	64	412	6.30	436	20	2840	420
10:45	40.5	.430	295	100	40	64	402	6.23	427	63	2820	426
11:00	40.5	.280	280	101	40	66	395	6.02	399	93	2810	426
:15	41.0	.240	280	101	40	66	393	6.03	401	90	2810	436
:30	40.5	.220	275	101	40	68	390	6.02	399	93	2810	436
:45	40.5	.195	270	101	40	69	390	5.98	393	93	2810	430
12:00	40.5	.193	270	101	40	70	390	6.00	396	93	2810	439
12:15	40.5	.302	280	101	40	70	390	6.07	404	34	2810	438
12:30	40.5	.348	280	100	40	68	390	6.08	406	21	2800	436
:45	40.5	.380	280	100	40	66	395	6.10	409	20	2790	440
1:00	40.5	.395	280	100	40	66	395	6.11	411	20	2790	434
:15	40.5	.422	280	100	40	66	395	6.10	409	20	2790	435
:30	40.5	.426	282	100	40	66	395	6.11	411	20	2790	434

Greatest frequency variation noted during second and third tests from that prevailing at end of first test: 299 cycles; 0.149%. Permitted by specifications: 0.05%.
Antenna constants: Resistance, 11 ohms; capacity, 829 uuf.
Decrease in power output during test: 13.3%. Permitted by specifications: 5.0%.
Note: Temperature of P.A. plate choke was 136°C. at end of test.

Table 24

Model XTAJ-6 Transmitting Equipment

VARIATIONS IN HUMIDITY

Test as per paragraph 3-7-9 of Specifications RE 13A 328J.

Time	Ambient Temp. °C.	Frequency KC	P.A. Ip	I.P.A. Ip	M.O. Ip	P.A. Isg	P.A. Icath	Antenna Current	Watts Output	Relative Humidity %	P.A. Ep	Line Volts
10:45	40.5	600.671	300	118	65	72	430	6.88	521	25	2950	437
11:00	40.5	.612	290	116	64	71	420	6.77	505	23	2900	437
:15	40.5	.583	290	115	64	70	420	6.70	495	25	2890	438
:30	40.5	.609	285	115	63	70	415	6.68	491	23	2890	438
:45	40.5	.638	285	114	63	70	410	6.67	490	23	2880	437
12:00	40.5	.452	285	114	63	70	410	6.63	484	71	2880	438
12:15	40.5	.175	282	113	63	70	410	6.58	476	93	2870	437
:30	40.5	.160	281	113	63	70	410	6.53	468	93	2860	437
:45	40.5	.131	280	113	62	70	405	6.52	467	93	2860	438
1:00	40.5	.115	280	113	62	70	405	6.53	468	93	2860	438
:15	40.5	.178	280	112	62	70	405	6.53	468	93	2850	438
1:30	40.0	.351	285	112	62	70	408	6.56	473	39	2850	438
1:45	40.5	.542	285	112	62	70	408	6.56	473	27	2850	438
2:00	40.5	.680	285	112	62	70	408	6.57	475	23	2850	438
:15	40.5	.721	285	112	62	70	408	6.57	475	23	2850	438
:30	40.5	.760	285	112	62	70	408	6.57	475	23	2850	438
:45	40.5	.780	285	112	62	70	408	6.57	475	23	2850	438

After end of test all voltages were adjusted to normal with the following results:

	290	120	65	72	430	7.00	540		3000

Greatest frequency variation noted during second and third tests from that prevailing at end of first test: 507 cycles; 0.084%. Permitted by specifications: 0.05%.

Antenna constants: Resistance, 11 ohms; capacity, 829 uuf.

Decrease in power output during test: 5.5%. Permitted by specifications: 5.0%.

Table 25

Model XTAJ-6 Transmitting Equipment

LOCKED KEY OPERATION FOR TWO HOURS

Test as per paragraph 3-7-10 of Specifications RE 13A 328J.

Time	Ambient Temp. °C.	Frequency KC	Cycles Change	% Change	Ant. Cur.	Watts Output	Plate Volts	P.A. Icath	M.O. Ep
12:55		(Filament energized)							
1:00	23.5	200.750			6.75	500	3000	455	1330
:05	23.5	.717	33	0.0165	6.71	496	2990	450	1320
:10	23.5	.694	56	0.028	6.61	482	2980	445	1310
:15	23.5	.686	64	0.032	6.56	475	2980	440	1310
:20	23.5	.684	66	0.033	6.50	465	2970	435	1300
:25	23.5	.677	73	0.0365	6.40	450	2950	430	1300
:30	23.5	.672	78	0.039	6.36	446	2930	420	1295
:35	23.5	.668	82	0.041	6.30	437	2920	418	1295
:40	23.5	.660	90	0.045	6.20	423	[illegible]	410	1295
:45	23.8	.656	94	0.047	6.12	412	2910	400	1290
:50	23.8	.654	96	0.048	6.08	407	2910	397	1290
:55	23.8	.651	99	0.0495	6.00	396	2900	390	1290
2:00	23.8	.650	100	0.050	5.96	390	2900	382	1285
:05	23.8	.646	104	0.052	5.91	385	2900	380	1285
:10	24.0	.646	104	0.052	5.92	385	2900	380	1285
:15	24.0	.646	104	0.052	5.90	383	2900	380	1285
:20	24.0	.646	104	0.052	5.86	379	2900	375	1285
:25	24.0	.646	104	0.052	5.80	370	2900	370	1285
:30	24.0	.646	104	0.052	5.78	367	2900	368	1285
:35	24.0	.640	110	0.055	5.72	360	2900	365	1285
:40	24.0	.640	110	0.055	5.68	355	2900	360	1285
:45	24.0	.640	110	0.055	5.62	348	2900	355	1285
:50	24.0	.640	110	0.055	5.60	346	2900	350	1285
:55	24.0	.636	114	0.057	5.55	339	2900	347	1285
3:00	24.0	.638	112	0.056	5.50	333	2900	343	1285

Frequency change during first five minutes: 33 cycles; 0.0165%.
Specification requirements: 0.015%.
Frequency change during remainder of test: 81 cycles; 0.04%.
Specification requirements: 0.03%.

Post trial inspection revealed no signs of breakdown but it was noted that the temperature of the power amplifier plate choke had risen to 110°C.

Antenna constants: Resistance, 11.0 ohms; capacity, 970 uuf.

Table 26

Model XTAJ-6 Transmitting Equipment

LOCKED KEY OPERATION FOR TWO HOURS

Test as per paragraph 3-7-10 of Specifications RE 13A 328J.

Time	Ambient Temp.°C.	Frequency KC	Cycles Change	Ant. Cur.	Watts Output	Plate Volts	P.A. Ip	P.A. Icath	P.A. Isg
1:00		(Filaments energized)							
:05	24.9	400.750		6.81	510	3000	280	425	73
:10	25.1	.655	95	6.80	508	3000	280	425	73
:15	24.6	.610	140	6.73	498	2950	278	420	72
:20	24.5	.592	158	6.72	497	2950	278	420	72
:25	24.6	.575	175	6.70	493	2940	275	415	71
:30	24.6	.565	185	6.68	491	2930	275	415	71
:35	24.8	.556	194	6.65	487	2920	275	412	71
:40	24.8	.550	200	6.62	483	2920	270	410	71
:45	24.8	.542	208	6.62	483	2910	270	410	71
:50	24.8	.540	210	6.62	483	2910	270	410	71
:55	24.9	.538	212	6.62	483	2910	270	410	71
2:00	25.0	.536	214	6.62	483	2910	270	410	71
:05	24.9	.526	224	6.60	479	2900	270	410	70
:10	24.9	.525	225	6.62	483	2900	270	410	70
:15	24.6	.525	225	6.62	483	2900	270	410	70
:20	24.6	.525	225	6.62	483	2900	270	410	70
:25	24.6	.525	225	6.62	483	2900	270	410	70
:30	24.5	.525	225	6.62	483	2900	270	410	70
:35	24.2	.525	225	6.62	483	2900	270	410	70
:40	24.4	.525	225	6.62	483	2900	270	410	70
:45	24.5	.526	224	6.62	483	2900	270	410	70
:50	24.5	.530	220	6.62	483	2900	270	410	70
:55	24.4	.530	220	6.62	483	2900	270	410	70
3:00	24.3	.530	220	6.62	483	2900	270	410	70
:05	24.3	.538	212	6.62	483	2900	270	410	70

Antenna constants: Resistance, 11 ohms; capacity, 970 uuf.

Frequency change during first five minutes: 95 cycles; 0.024%.
Specification requirements: 0.015%.
Frequency change during remainder of test: 130 cycles; 0.032%.
Specification requirements: 0.03%.

Temperature of power amplifier choke at end of test: 90°C.

Table 27

Model XTAJ-6 Transmitting Equipment

LOCKED KEY OPERATION FOR TWO HOURS

Test as per paragraph 3-7-10 of Specifications RE 13A 328J.

Time	Ambient Temp. °C.	Frequency KC	Cycles Change	Ant. Cur.	Watts Output	Plate Volts	P.A. Ip	P.A. Icath	P.A. Isg
9:00		(Filaments energized)							
:05	25.8	600.870		6.78	506	3000	280	420	73
:10	25.8	.567	303	6.78	506	3000	280	420	73
:15	25.8	.470	400	6.73	498	2980	280	420	73
:20	25.8	.443	427	6.70	494	2980	280	415	72
:25	26.0	.435	435	6.70	494	2970	278	415	71
:30	26.2	.433	437	6.67	489	2950	278	415	71
:35	26.2	.448	422	6.65	486	2940	278	412	71
:40	26.2	.452	418	6.63	483	2930	275	410	71
:45	26.3	.463	407	6.63	483	2930	275	410	71
:50	26.2	.483	387	6.63	483	2930	275	410	71
:55	26.1	.500	370	6.62	482	2930	275	410	71
10:00	26.1	.510	360	6.60	479	2920	270	410	71
:05	26.0	.530	340	6.60	479	2920	270	410	71
:10	25.8	.543	327	6.60	479	2920	270	410	71
:15	25.8	.565	305	6.60	479	2920	270	410	71
:20	25.8	.580	290	6.60	479	2920	270	408	71
:25	25.8	.599	271	6.60	479	2920	270	408	71
:30	25.8	.612	258	6.60	479	2920	270	405	71
:35	25.7	.628	242	6.58	477	2910	270	405	71
:40	25.7	.642	228	6.58	477	2910	270	405	71
:45	25.7	.660	210	6.58	477	2910	270	405	71
:50	25.7	.675	195	6.58	477	2910	270	405	71
:55	25.5	.687	183	6.58	477	2910	270	405	71
11:00	25.4	.699	171	6.58	477	2910	270	405	71
:05	25.4	.710	160	6.58	477	2910	270	405	71

Antenna constants: Resistance, 11.0 ohms; capacity, 970 uuf.

Frequency change during first five minutes: 303 cycles; 0.05%.
Specification requirements: 0.015%.
Frequency change during remainder of test: 277 cycles; 0.046%.
Specification requirements: 0.03%.

Temperature of power amplifier plate choke at end of test: 79°C.

Table 28

Model XTAJ-6 Transmitting Equipment

LOCKED KEY OPERATION FOR TWO HOURS

Test as per paragraph 3-7-10 of Specifications RE 13A 328J.

Time	Ambient Temp. °C.	Frequency KC	Cycles Change	Ant. Cur.	Watts Output	Plate Volts	P.A. Ip	P.A. Icath	P.A. Isg
10:50		(Filaments energized)							
:55	25.0	600.975		6.80	510	3000	281	425	73
11:00	25.0	.715	260	6.78	505	3000	281	420	73
:05	25.0	.655	320	6.73	500	2980	280	420	73
:10	25.0	.628	347	6.70	493	2970	280	415	72
:15	25.3	.622	353	6.68	491	2950	280	415	72
:20	25.3	.628	347	6.66	488	2950	280	415	72
:25	26.0	.638	337	6.66	488	2950	280	412	72
:30	25.6	.650	325	6.66	488	2950	280	412	72
:35	25.6	.660	315	6.63	484	2940	278	410	72
:40	25.4	.680	295	6.63	484	2940	278	410	72
:45	25.4	.695	280	6.60	480	2930	275	410	72
:50	25.6	.710	265	6.60	480	2930	275	410	72
:55	25.7	.730	245	6.60	480	2930	275	410	72
12:00	25.7	.740	235	6.60	480	2920	270	408	71
:05	25.7	.760	215	6.58	477	2920	268	408	71
:10	25.7	.780	195	6.58	477	2920	268	408	71
:15	25.7	.800	175	6.60	480	2930	268	408	71
:20	25.7	.815	160	6.60	480	2930	268	408	71
:25	25.7	.822	153	6.60	480	2930	270	408	71
:30	26.0	.870	105	6.55	472	2900	270	402	71
:35	26.2	.870	105	6.58	477	2920	270	405	71
:40	26.2	.880	95	6.58	477	2920	270	405	71
:45	26.2	.973	2	6.58	477	2920	270	405	71
:50	26.2	.985	10	6.58	477	2920	270	405	71
:55	26.2	601.000	25	6.58	477	2920	270	405	71

Antenna constants: Resistance, 11.0 ohms; capacity, 970 uuf.

Frequency change during first five minutes: 260 cycles; 0.043%.
Specification requirements: 0.015%.
Frequency change during remainder of test: 378 cycles; 0.063%.
Specification requirements: 0.03%.

Temperature of power amplifier plate choke at end of test: 80°C.

Table 29

Model XTAJ-6 Transmitting Equipment

CHANGE FROM KEY LOCKED TO INTERMITTENTLY KEYED CONDITION

Test as per paragraph 3-7-11 of Specifications RE 13A 328J.

Test Condition	Frequency at end of 10 min. key locked period (KC)	Frequency at end of 10 sec. dash 20 min. later (KC)	Change in Frequency Cycles	Change in Frequency Per Cent
MO filament lighted	200.558	200.585	27	0.0135
MO filament not lighted	200.527	200.621	94	0.047
MO filament lighted	600.348	600.610	262	0.044*
MO filament not lighted	600.350	600.845	495	0.081

Note: * A second test was conducted at 600 KC with master oscillator filament lighted resulting in a frequency change of 302 cycles or 0.05 per cent.

Permitted by specifications:
Filament lighted: 0.015%.
Filament not lighted: 0.03%.

Table 30

Model XTAJ-6 Transmitting Equipment

CHANGE FROM CONTINUOUSLY KEYED TO INTERMITTENTLY KEYED CONDITION

Test as per paragraph 3-7-12 of Specifications RE 13A 328J.

Frequency at end of 30 minutes of continuous keying	Frequency at end of 10 sec. dash after 20 min. pause	Change in Frequency	
		Cycles	Per Cent
200.575	200.592	17	0.0085
600.260	600.408	148	0.0246

Filaments remained energized during entire test.

Permitted by specifications: 0.015%.

Table 31

Model XTAJ-6 Transmitting Equipment

INCLINATION DUE TO ROLL AND PITCH OF SHIP

Test as per paragraph 3-7-13 of Specifications RE 13A 328J.

Transmitter secured to test stand through medium of flexible mounting. Motion parallel with front of transmitter and parallel with axis of generator.

Time	Maximum Frequency	Minimum Frequency
Stationary	600.545 Start	
11:21	600.545	600.545
:26	.548	.542
:31	.546	.540
:36	.551	.544
:41	.551	.542
:46	.542	.540
:51	.542	.536
Stationary	600.539 End	

Maximum frequency change during test from frequency at start of test: 9 cycles; 0.0015%.

Stationary	200.570 Start	
1:40	200.570	
:45	.576	200.572
:50	.571	.563
:55	.570	.561
2:00	.570	.563
:05	.568	.561
:10	.570	.562
Stationary	200.566 End	

Maximum frequency change during test from frequency at start of test: 9 cycles; 0.0045%.

Permitted by specifications: 0.005%.

Table 32

Model XTAJ-6 Transmitting Equipment

INCLINATION DUE TO ROLL AND PITCH OF SHIP

Test as per paragraph 3-7-13 of Specifications RE 13A 328J.

Transmitter secured to test stand through medium of flexible mounting. Motion at right angle to front of transmitter and at right angle to axis of motor generator.

Time	Maximum Frequency		Minimum Frequency
Stationary	600.558	Start	
11:35	600.558		
:40	.555		600.548
:45	.550		.541
:50	.550		.541
:55	.555		.546
12:00	.560		.550
:05	.560		.550
Stationary	600.560	End	

Maximum frequency change during test from frequency at start of test: 17 cycles; 0.0028%.

Stationary	200.573	Start	
3:30	200.573		
:35	.571		200.563
:40	.570		.566
:45	.571		.566
:50	.572		.568
:55	.577		.571
4:00	.580		.572
Stationary	200.577	End	

Maximum frequency change during test from frequency at start of test: 10 cycles; 0.005%.

Permitted by specifications: 0.005%.

Table 33

Model XTAJ-6 Transmitting Equipment

INCLINATION DUE TO ROLL AND PITCH OF SHIP

Test as per paragraph 3-7-13 of Specifications RE 13A 328J.

Transmitter secured to test stand through medium of solid base fittings. Motion at right angle to front of transmitter and at right angle to axis of motor generator.

Time	Maximum Frequency		Minimum Frequency
Stationary	600.680	Start	
1:35	600.680		
:40	.682		600.672
:45	.683		.671
:50	.692		.680
:55	.699		.682
2:00	.705		.691
:05	.718		.701
Stationary	600.710	End	

Maximum frequency change during test from frequency at start of test: 38 cycles; 0.0063%.

Stationary	200.668	Start	
3:00	200.668		
:05	.680		200.673
:10	.681		.676
:15	.685		.680
:20	.685		.680
:25	.686		.680
:30	.690		.685
Stationary	200.690	End	

Maximum frequency change during test from frequency at start of test: 22 cycles; 0.011%.

Permitted by specifications: 0.005%.

Table 34

Model XTAJ-6 Transmitting Equipment

VIBRATION

Test as per paragraph 3-7-14 of Specifications RE 13A 328J.

Transmitter secured to test stand through medium of flexible mounting.

Time	Frequency	
12:45	600.525	Start
:50	.524	
:55	.527	
1:00	.528	
:05	.554	
:10	.545	
:15	.565	End

Maximum set in frequency between beginning and end of test: 40 cycles
0.0065%

9:30	200.603	Start
:35	.606	
:40	.594	
:45	.589	
:50	.594	
:55	.581	
10:00	.581	End

Maximum set in frequency between beginning and end of test: 22 cycles
0.011%

Permitted by specifications: 0.005%.

Table 35

Model XTAJ-6 Transmitting Equipment

VIBRATION

Test as per paragraph 3-7-14 of Specifications RE 13A 328J.

Transmitter secured to test stand through medium of solid base fittings.

Time	Frequency	
12:45	600.691	Start
:50	.660	
:55	.670	
1:00	.670	
:05	.672	
:10	.668	
:15	.671	End

Maximum set in frequency between beginning and end of test: 20 cycles
0.0033%

2:25	200.661	Start
:30	.670	
:35	.670	
:40	.650	
:45	.661	
:50	.661	
:55	.668	End

Maximum set in frequency between beginning and end of test: 7 cycles
0.0035%

Permitted by specifications: 0.005%.

Table 36

Model XTAJ-6 Transmitting Equipment

SHOCK TEST

Test as per paragraph 3-7-15 of Specifications RE 13A 328J.

Shock Applied to	Frequency before shock	Frequency after shock	Set in Frequency Cycles	Set in Frequency Per Cent
Front	200.720	200.718	2	0.001
Left	.760	.741	19	0.0095
Right	.700	.710	10	0.005
Back	.719	.730	11	0.0055
Front	600.570	600.559	11	0.0018
Left	.602	.591	11	0.0018
Right	.593	.592	1	0.0001
Back	.420	.431	11	0.0018

Specification requirements: 0.005%.

Table 37

Model XTAJ-6 Transmitting Equipment

DETERMINATION OF LIMITING FREQUENCIES AND OVERLAP

MASTER OSCILLATOR CIRCUIT

Test as per paragraph 3-11 of Specifications RE 13A 328J.

Control

A	1	1	2	2	3	3	4	4	5	5	6	6	7	7
B	0	900	0	900	0	900	0	900	0	900	0	900	0	900
C	1	1	1	2	3	3	3	4	5	5	5	6	6	7
D	0	89	79	88	0	88	69	83	3	85	67	63	65	85
E	1	1	1	3	3	4	3	5	4	6	5	7	6	7
F	0	79	84	14	0	24	94	19	77	8	77	8	73	90
G	6	6	6	6	6	6	5	5	6	5	6	5	6	6
H	6	10	9	11	11	13	12	14	13	14	14	14	14	15
I	53	18	76	80	63	26	83	4	54	52	42	77	67	38
Freq. Kcs.	169.2	211.0	208.13	259.8	249.9	312.8	296.1	370.9	346.8	433.8	414.2	517.6	491.6	612.7
Overlap KC	5.8		3.0		9.9		16.7		24.1		19.6		26.0	12.7
Mean Freq.	172.1		209.5		254.8		304.4		363.8		424.0		504.6	606.3
% Overlap*	3.36		1.4		3.9		5.5		6.6		4.6		5.2	2.1
Band Range		41.8		51.7		62.9		74.8		87.0		103.4		121.1
% Overlap**		13.8		5.8		15.7		22		27		19		21
														10

Note: * Denotes percentage overlap per latest definition of Bureau of Engineering.
** Denotes percentage overlap per definition in Contractor's descriptive specifications RA-1465.

Table 38

Model XTAJ-6 Transmitter Equipment

DETERMINATION OF LIMITING FREQUENCIES AND OVERLAP

INTERMEDIATE AMPLIFIER CIRCUIT

Test as per paragraph 3-11 of Specifications RE 13A 328J.

Control														
A	1	2#	2#	3	3	4	4	5	5	6	6	6	7	7
B	222	122	132	382	211	391	203	453	215	370	200	895	203	900
C	1	1	2	2	3	3	4	4	5	5	6	6	7	7
D	0	100	0	100	0	100	0	100	0	100	0	100	0	100
E	1	1	2	3	3	4	4	5	5	6	6	7	6	7
F	8	97	0	38	28	36	13	44	11	29	0	4	92	88
G	5	6	6	6	6	6	6	6	6	6	6	6	6	6
H	7	10	10	12	12	13	13	14	13	14	14	14	14	15
I	64	32	36	52	35	38	23	18	66	56	47	76	73	36
Freq. Kcs.	176.9	212.8	213.3	271.7	261.6	323.3	309.0	383.9	362.3	449.2	431.2	517.5	512.8	613.0
Overlap KC	-		-		10.1		14.3		21.6		18.0		4.7	13.0
Mean Freq.	-		-		266.6		316.2		373.1		440.2		515.2	606.5
% Overlap*	0		0		3.8		4.5		5.8		4.1		0.91	2.1
Band Range		35.9		58.4		61.7		74.9		86.9		86.3		100.2
% Overlap**		0		0		20		18		25		21		4.7
														13

Note: * Denotes percentage overlap per latest definition of Bureau of Engineering.

** Denotes percentage overlap per definition in Contractor's descriptive specification RA-1465.

\# Denotes that due to the extremely blunt and broad tuning of the Intermediate Amplifier stage, the frequency measurements at these points are not accurate.

The coupling between the Intermediate Amplifier and the Power Amplifier circuits is such that it is impossible to determine accurately the overlap of the Intermediate Amplifier stage. This tight coupling broadens the Intermediate Amplifier tuning and causes bad reaction from the Power Amplifier stage, which results in several tuning points for the Intermediate Amplifier at the same frequency.

Table 39

Model XTAJ-6 Transmitting Equipment

DETERMINATION OF LIMITING FREQUENCIES AND OVERLAP

POWER AMPLIFIER CIRCUIT

Test as per paragraph 3-11 of Specifications RE 13A 328J.

Control

A	1	1	1	2	2	3	3	4	4	5	5	7	7	7
B	140	878	807	781	753	173	157	843	789	876	849	241	237	900
C	1	1	1	2	2	3	3	4	4	5	5	6	6	7
D	0	87	83	73	72	74	72	81	71	83	82	86	82	84
E	1	1	2	2	3	3	4	4	5	5	6	6	7	7
F	0	100	0	100	0	100	0	100	0	100	0	100	0	87
G	6	6	6	6	6	6	6	6	6	6	6	6	6	6
H	7	9	9	11	11	12	12	13	13	14	14	14	14	15
I	41	89	71	67	63	90	88	69	64	49	48	75	75	36
Freq. Kcs.	174.0	210.6	204.7	252.5	250.9	303.1	302.0	367.2	358.9	432.7	429.7	516.6	515.9	613.1
Overlap KC	1.0		5.9		1.4		1.1		8.3		3.0		0.7	13.1
Mean Freq.	174.5		207.7		251.7		302.6		363.1		431.2		516.3	606.6
% Overlap*	0.57		2.8		0.56		0.36		2.3		0.70		0.14	2.2
Band Range		36.6		47.8		52.2		65.2		73.8		86.9		97.2
% Overlap**		2.7		12		2.6		1.7		11		3.4		0.72
														13.5

Note: * Denotes percentage overlap per latest definition of Bureau of Engineering.
** Denotes percentage overlap per definition in Contractor's descriptive specifications RA-1465.

Table 40

Model XTAJ-6 Transmitting Equipment

LIST OF CONTROLS

Data as per paragraph 3-13 of Specifications RE 13A 328J.

Designating Letter	Purpose of Control
A	MO band change switch, 7 positions, interlocked.
B	MO tuning control, 900 divisions.
C	IPA band change switch, 7 positions, interlocked.
D	IPA tuning control, 100 divisions.
E	PA band change switch, 7 positions, interlocked.
F	PA tuning control, 100 divisions.
G	Antenna coupling switch, 6 positions, interlocked.
H	Antenna band change switch, 15 positions, interlocked.
I	Antenna tuning control, 100 divisions.
	Adjust-tune-operate switch, 3 positions, interlocked.
	Emergency stop switch.
	Local-remote switch.
	M.G. start-stop switch.
	M.O. filament line transfer switch.
	CW-MCW switch.
	M.O. filament rheostat (Line).
	Bias field rheostat.
	Main field rheostat.
	Main filament rheostat.
	Overload re-set.

Table 41

Model XTAJ-6 Transmitting Equipment

VARIATION OF RESONANT FREQUENCY OF MASTER OSCILLATOR PER DIVISION OF DIAL MARKING.

Test as per paragraph 3-15 of Specifications RE 13A 328J.

Control "A"	Control "B"	Frequency KC	Divisions Change	KC per Division	Per Cent per Division
1	0	169.3			
1	176	175.0	176	0.032	0.018
1	697	200.0	521	0.048	0.024
2	358	225.0			
2	748	250.0	390	0.064	0.026
3	430	275.0			
3	738	300.0	308	0.081	0.027
4	413	325.0			
4	688	350.0	275	0.091	0.026
5	359	375.0			
5	608	400.0	249	0.100	0.025
5	811	425.0	203	0.123	0.029
6	378	450.0			
6	587	475.0	209	0.120	0.025
6	763	500.0	176	0.142	0.028
7	309	525.0			
7	499	550.0	190	0.132	0.024
7	663	575.0	164	0.152	0.026
7	805	600.0	142	0.176	0.029

Specification requirements: Not more than 0.03% or less than 0.015% per division of marking.

Table 42

Model XTAJ-6 Transmitting Equipment

LIST OF METERS

Data as per paragraph 3-25 of Specifications RE 13A 328J.

1 - Power amplifier plate current meter, 750 MA.
1 - Intermediate amplifier plate current meter, 300 MA.
1 - Master oscillator plate current meter, 200 MA.
1 - Audio oscillator plate current meter, 200 MA.
1 - Bias voltmeter, 150 volts.
1 - Master oscillator plate voltmeter, 1500 volts.
1 - Power amplifier plate voltmeter, 4000 volts.
1 - Filament voltmeter, 150 volts (A.C.)
1 - Antenna ammeter, 20 amps., (R. F.).

Table 43

Model XTAJ-6 Transmitting Equipment

POWER REQUIRED FROM SUPPLY LINES

Test as per paragraph 6-5 of Specifications RE 13A 328J.

Transmitter tuned to 600 KC -

Stand-by condition:	1.3 KW
Full power, key locked:	2.77 KW
Full power, 25 WPM:	2.1 KW

Permitted by specifications:
Key locked, full power: 4.0 KW

Table 44

Model XTAJ-6 Transmitting Equipment

VOLTAGE REGULATION OF D.C. GENERATORS

Test as per paragraph 6-31 of Specifications RE 13A 328J.

Generator	No Load Voltage	Full Load Voltage	Voltage Change	Per Cent Regulation
3000 volts, plate	3060	3000	60	1.96
3000 volts, plate, mid tap	1540	1500	40	2.6
1200 volts, MO plate	1320	1305	15	1.1
115 volts, bias	120.5	115	5.5	4.5

Permitted by specifications: 5%.

Table 45

Model XTAJ-6 Transmitting Equipment

MEASUREMENT OF GENERATOR RIPPLE

Test as per paragraph 6-31 of Specifications RE 13A 328J.

Generator Voltage	Ripple voltage at (cycles) 30	60	90	120	Total RMS Volts	Per Cent Ripple
3000, key up	0.65	1.60	-	0.65	1.84	0.061
3000, key down	1.20	1.00	-	0.75	1.73	0.057
1500, key up	0.57	0.67	0.13	0.22	0.91	0.061
1500, key down	0.80	0.47	0.12	0.30	0.98	0.065
1325, key up	2.1	0.27	0.16	0.42	2.16	0.163
1325, key down	1.7	0.27	0.17	0.43	1.78	0.135
115, key up	0.14	0.17	0.04	0.40	0.446	0.39
115, key down	0.13	0.22	-	0.40	0.490	0.427

Specification requirements: 0.25%.

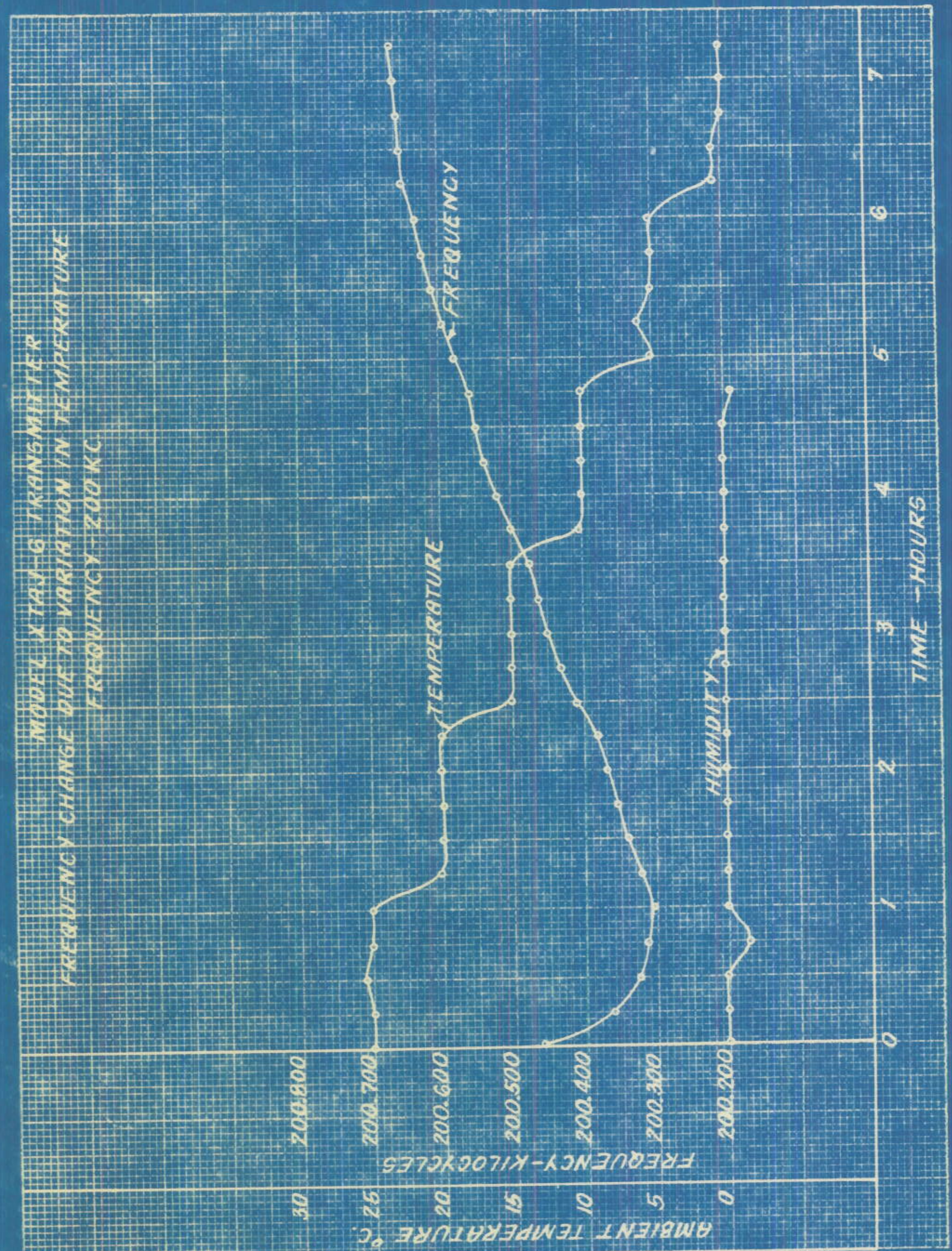


PLATE 2

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

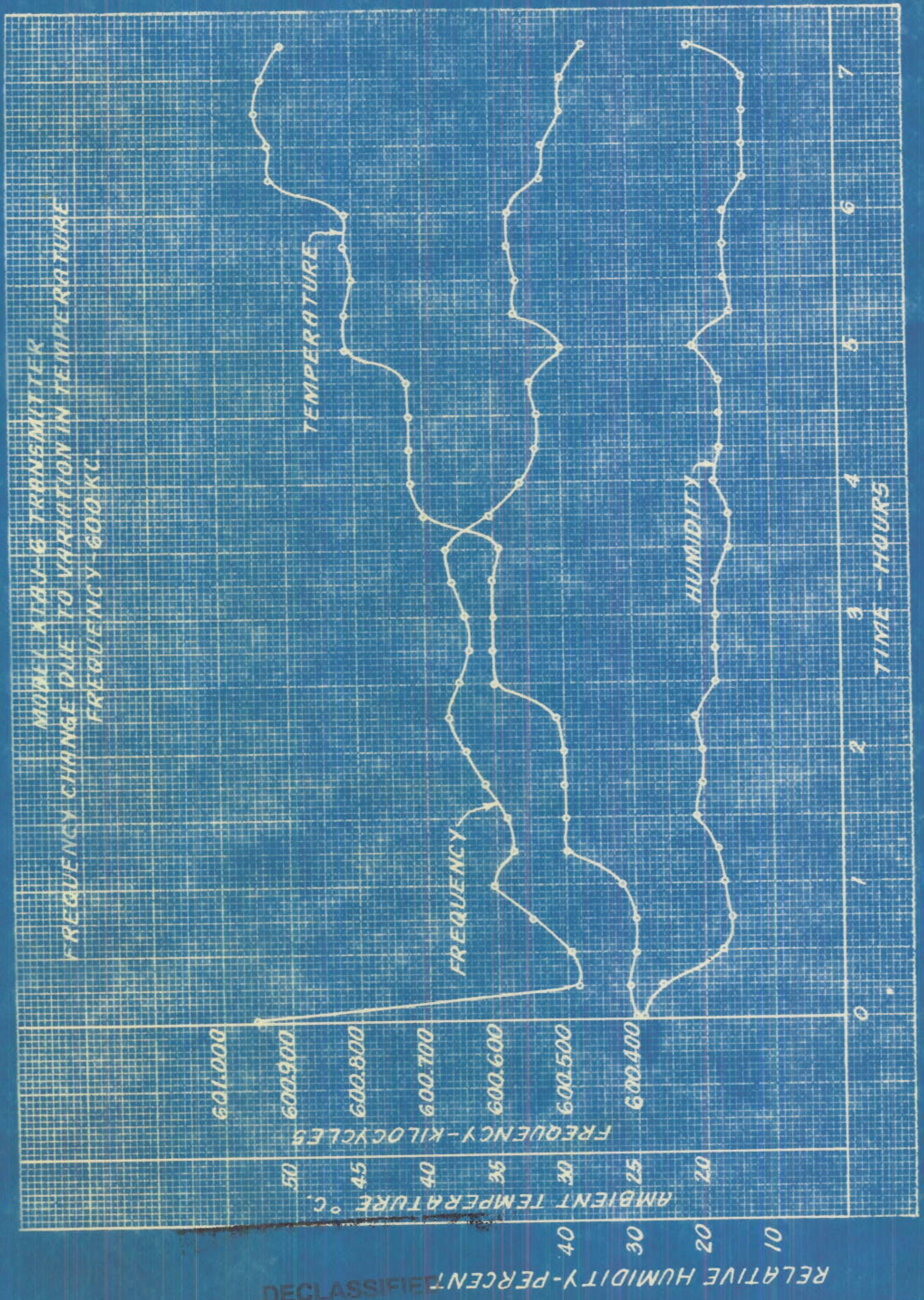
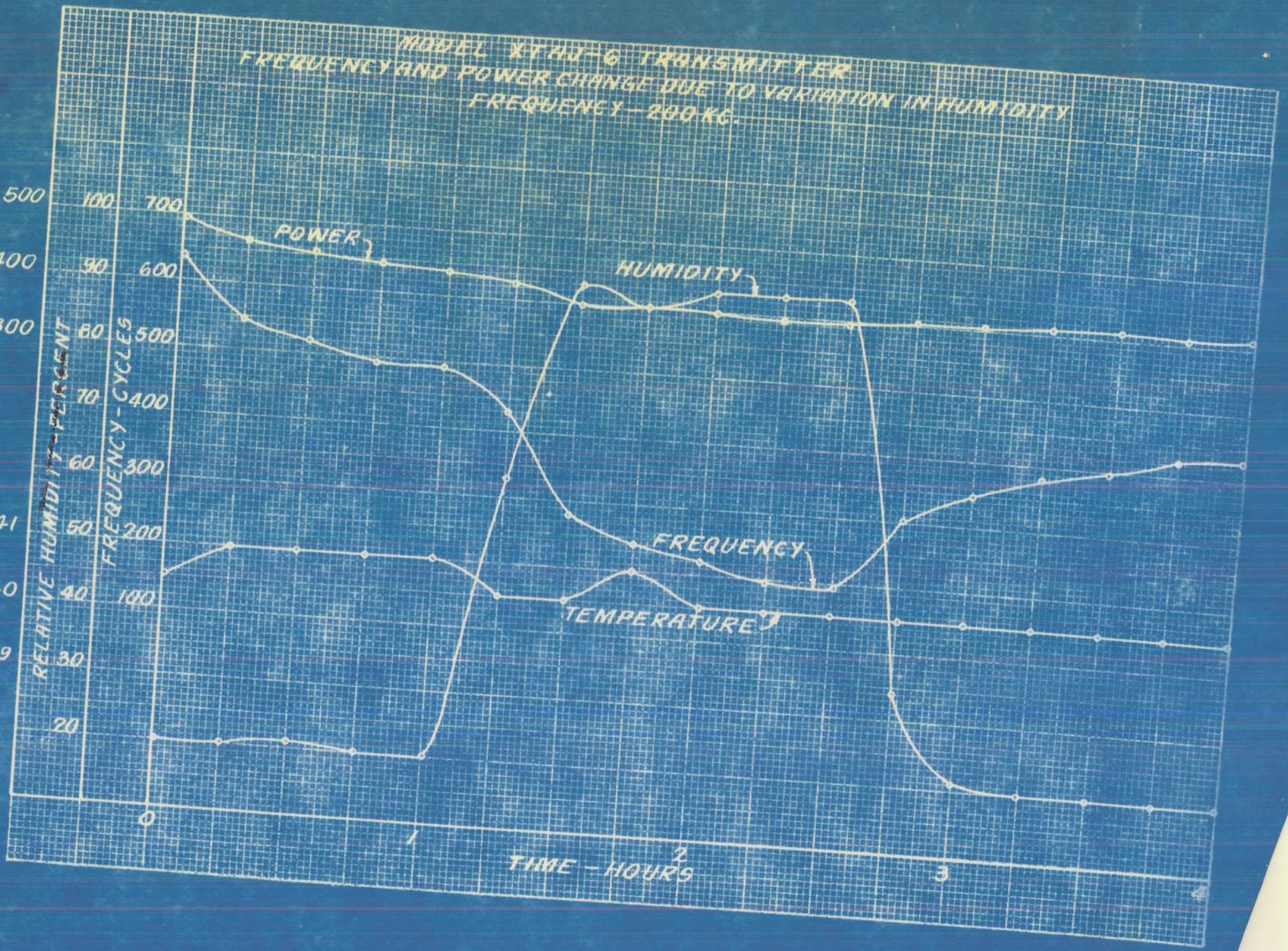


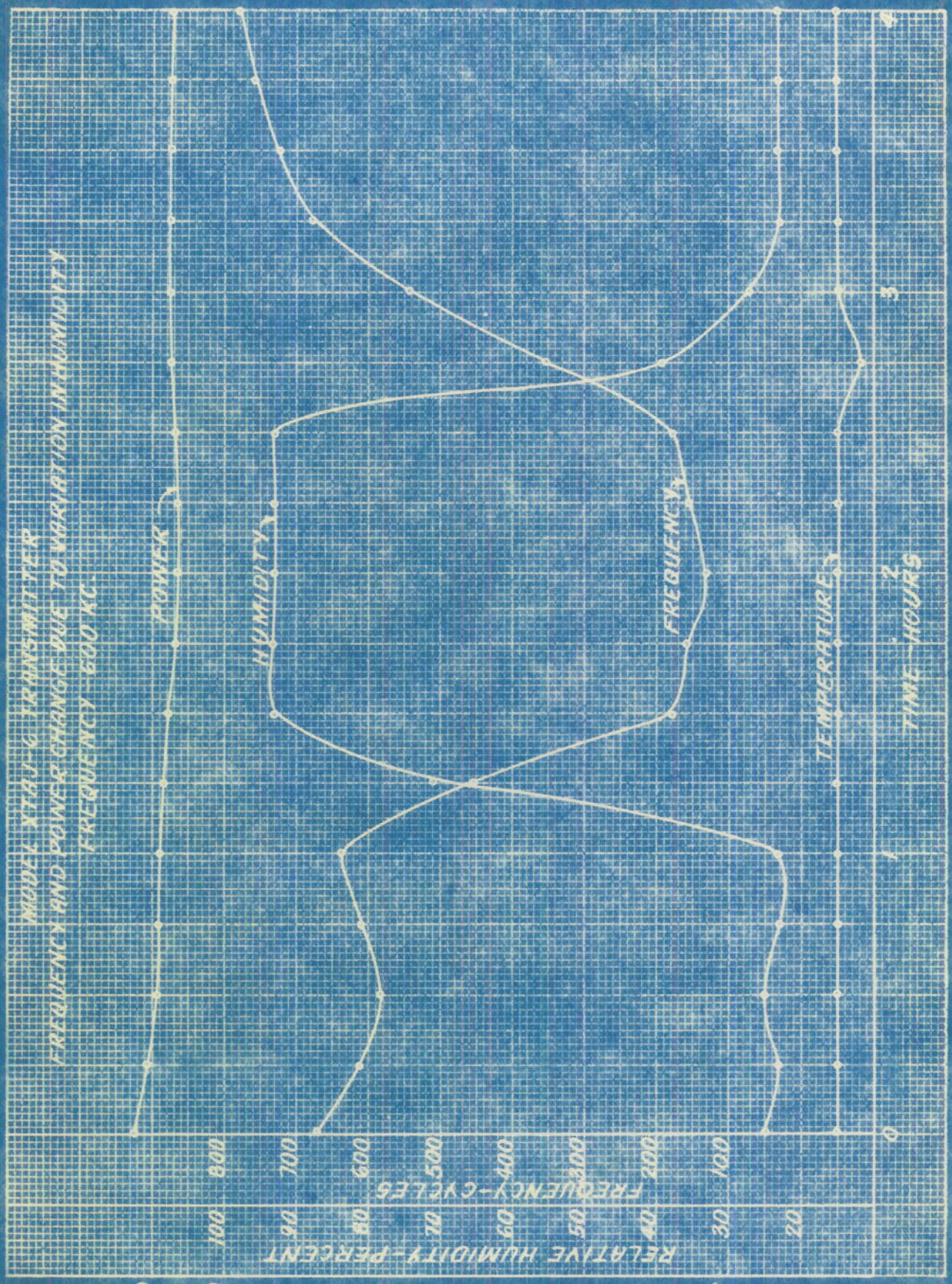
PLATE 3

N. R. L. 34A



U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE



N. R. L. 31A

PLATE 6

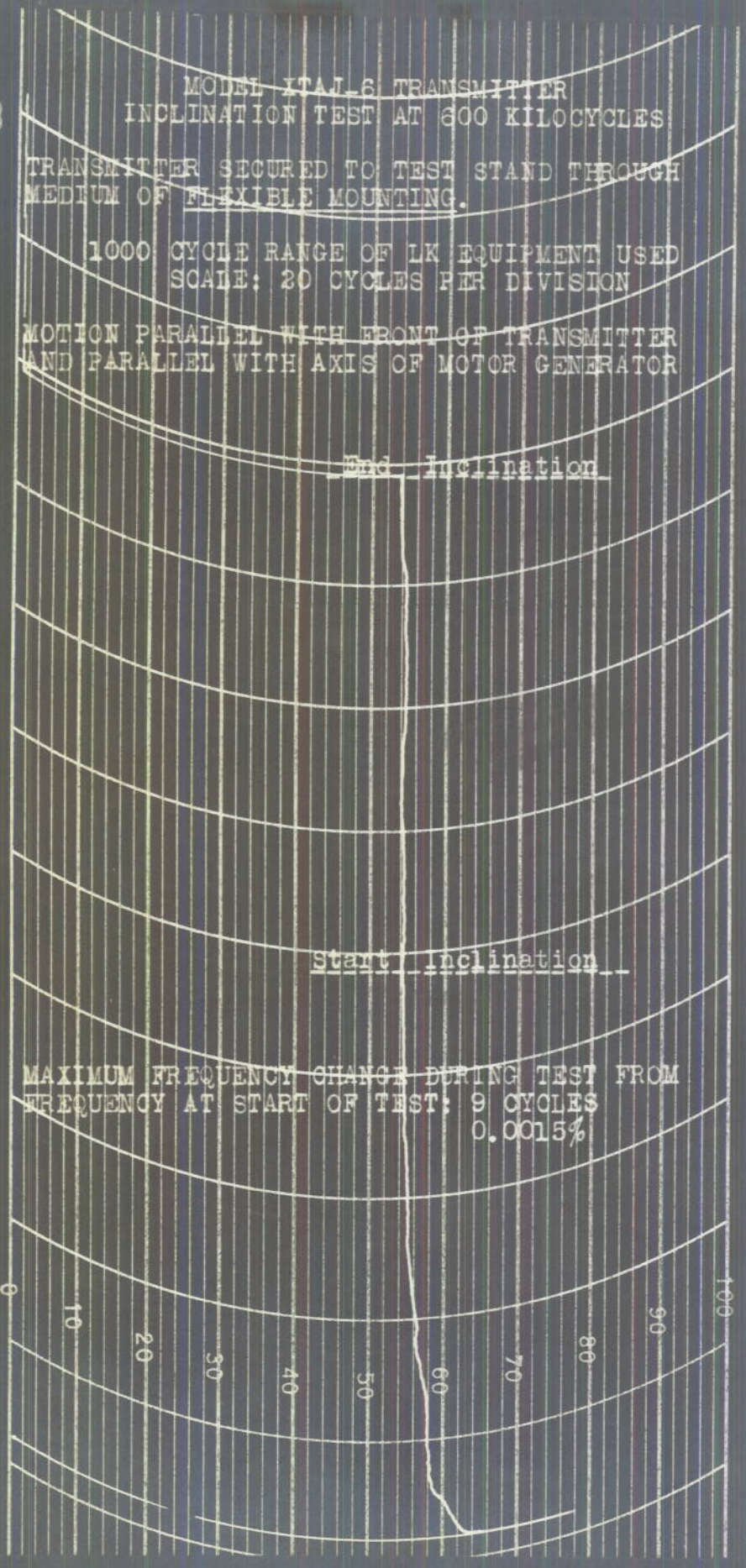


Plate 7

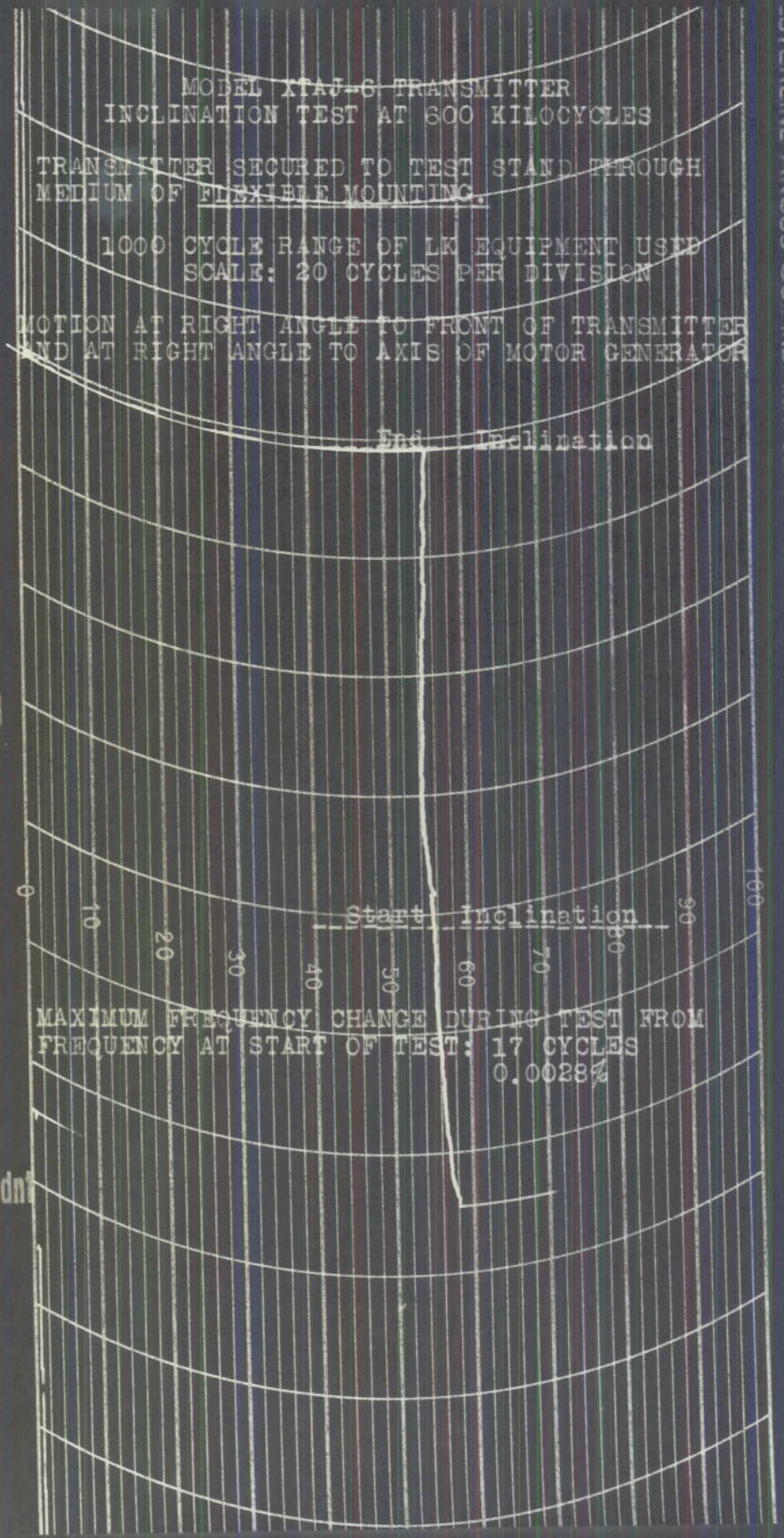
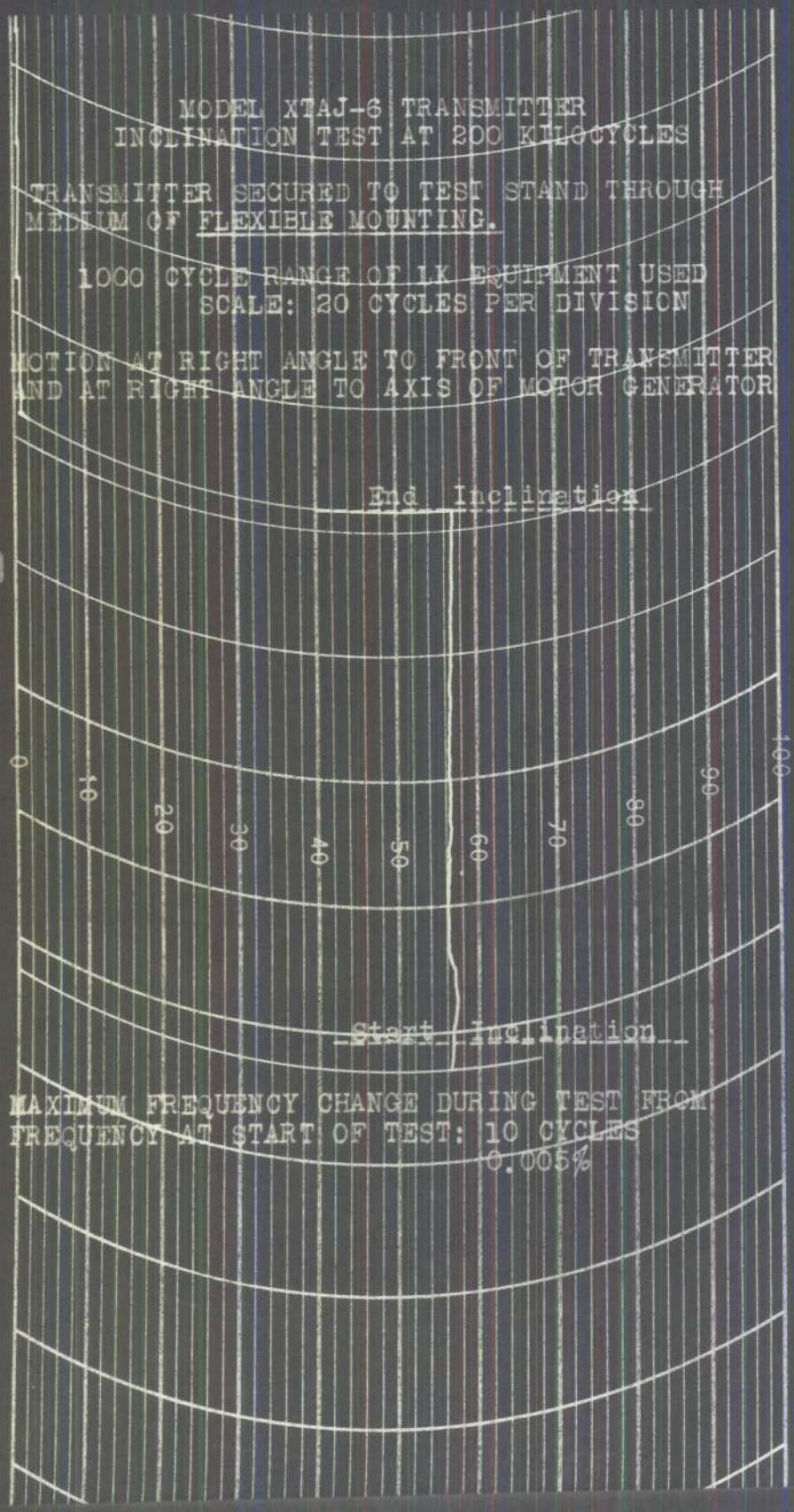


Plate 8



THE ESTERLINE-ANGUS CO., IND

Plate 9

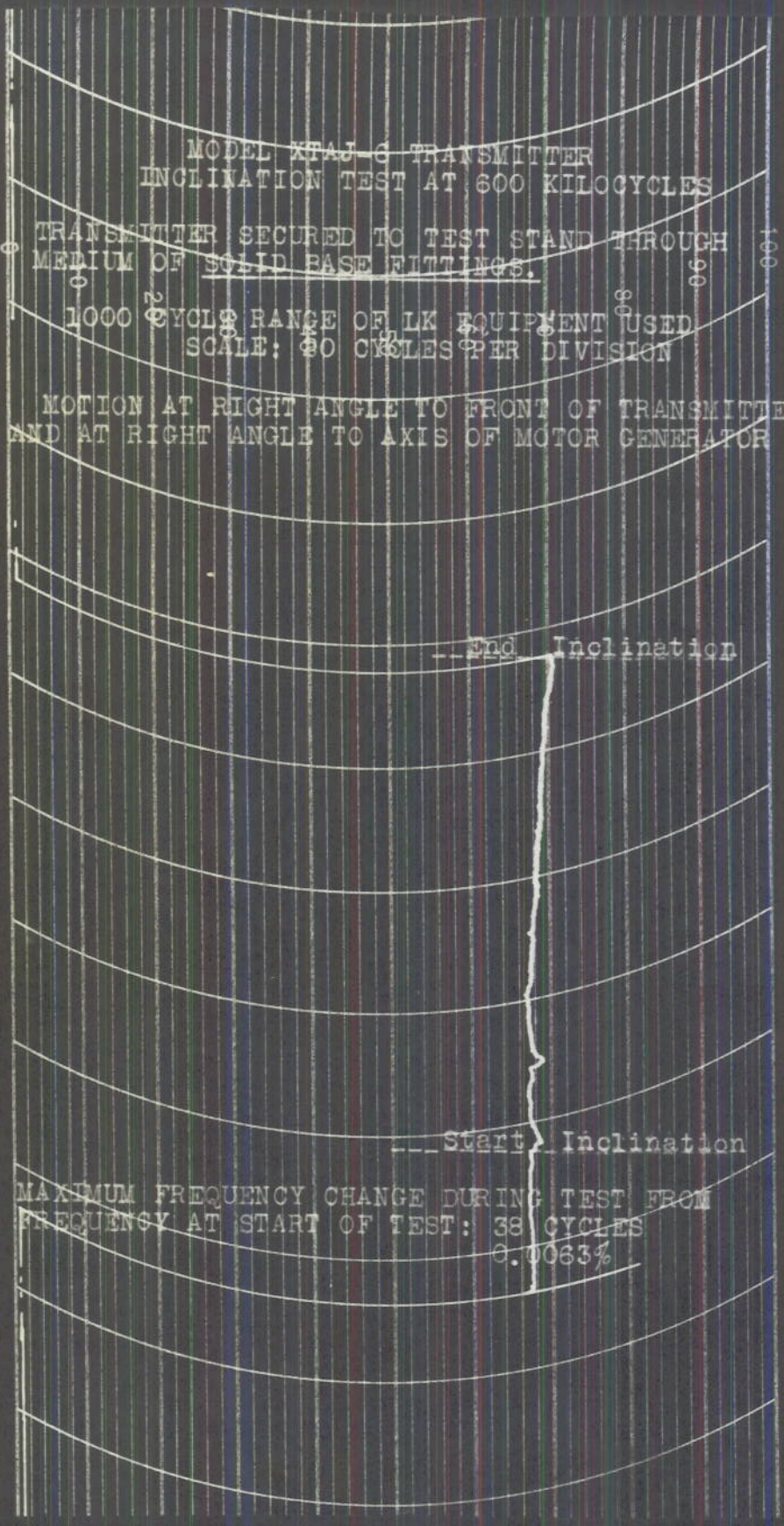


Plate 10

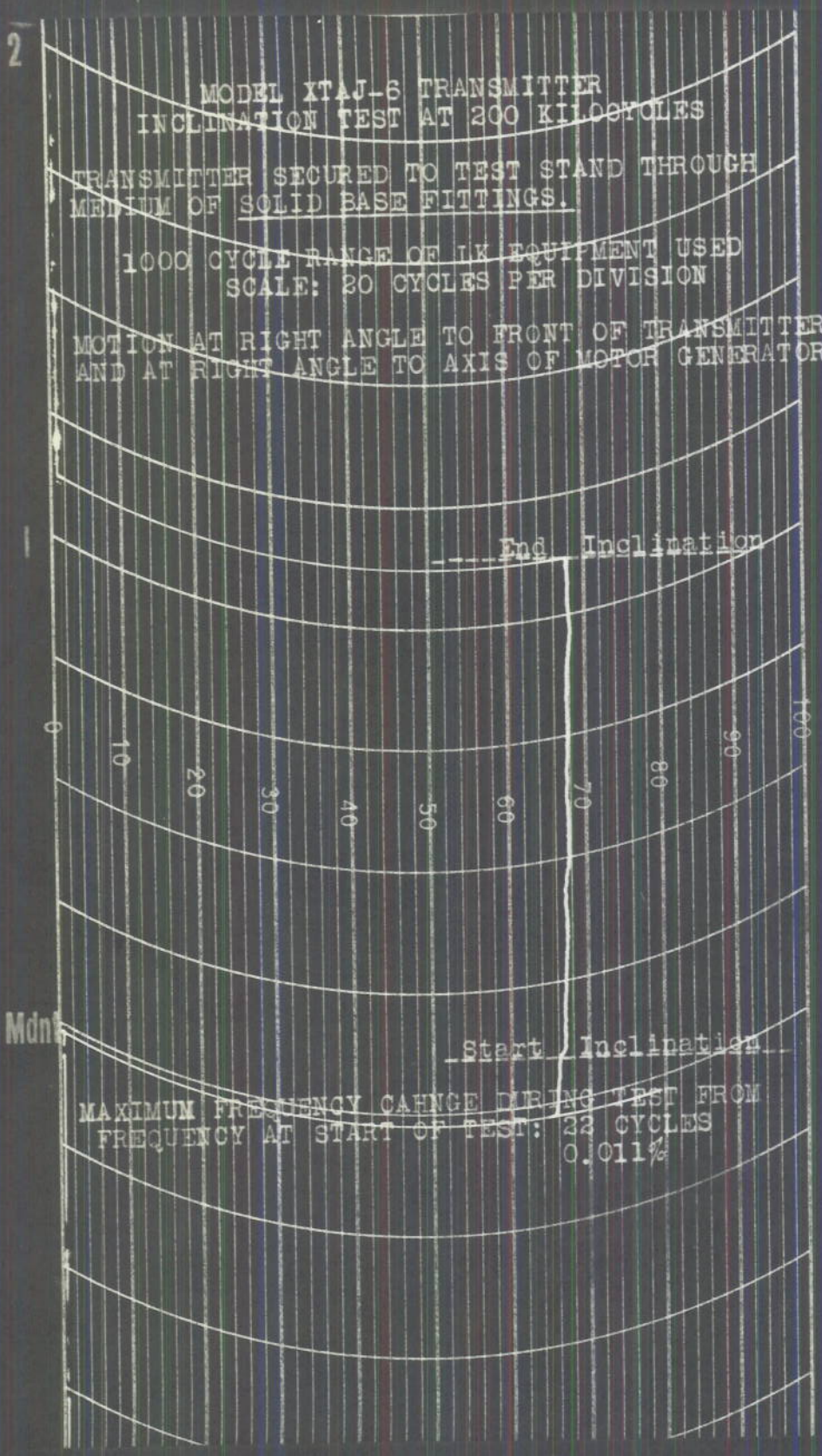

MODEL XTAJ-6 TRANSMITTER
INCLINATION TEST AT 200 KILOCYCLES
TRANSMITTER SECURED TO TEST STAND THROUGH MEDIUM OF SOLID BASE FITTINGS.
1000 CYCLE RANGE OF IK EQUIPMENT USED
SCALE: 20 CYCLES PER DIVISION
MOTION AT RIGHT ANGLE TO FRONT OF TRANSMITTER AND AT RIGHT ANGLE TO AXIS OF MOTOR GENERATOR
End Inclination
Start Inclination
0
10
20
30
40
50
60
70
80
90
100
MAXIMUM FREQUENCY CHANGE DURING TEST FROM FREQUENCY AT START OF TEST: 22 CYCLES
0.011%

Plate 11


7
MODEL XTAJ-6 TRANSMITTER
VIBRATION TEST AT 600 KILOCYCLES
TRANSMITTER SECURED TO TEST STAND THROUGH MEDIUM OF FLEXIBLE MOUNTING.
1000 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 20 CYCLES PER DIVISION
End Vibration
6
Start Vibration
5
MAXIMUM SET IN FREQUENCY BETWEEN BEGINNING AND END OF TEST: 40 CYCLES
0.0065%

Plate 12

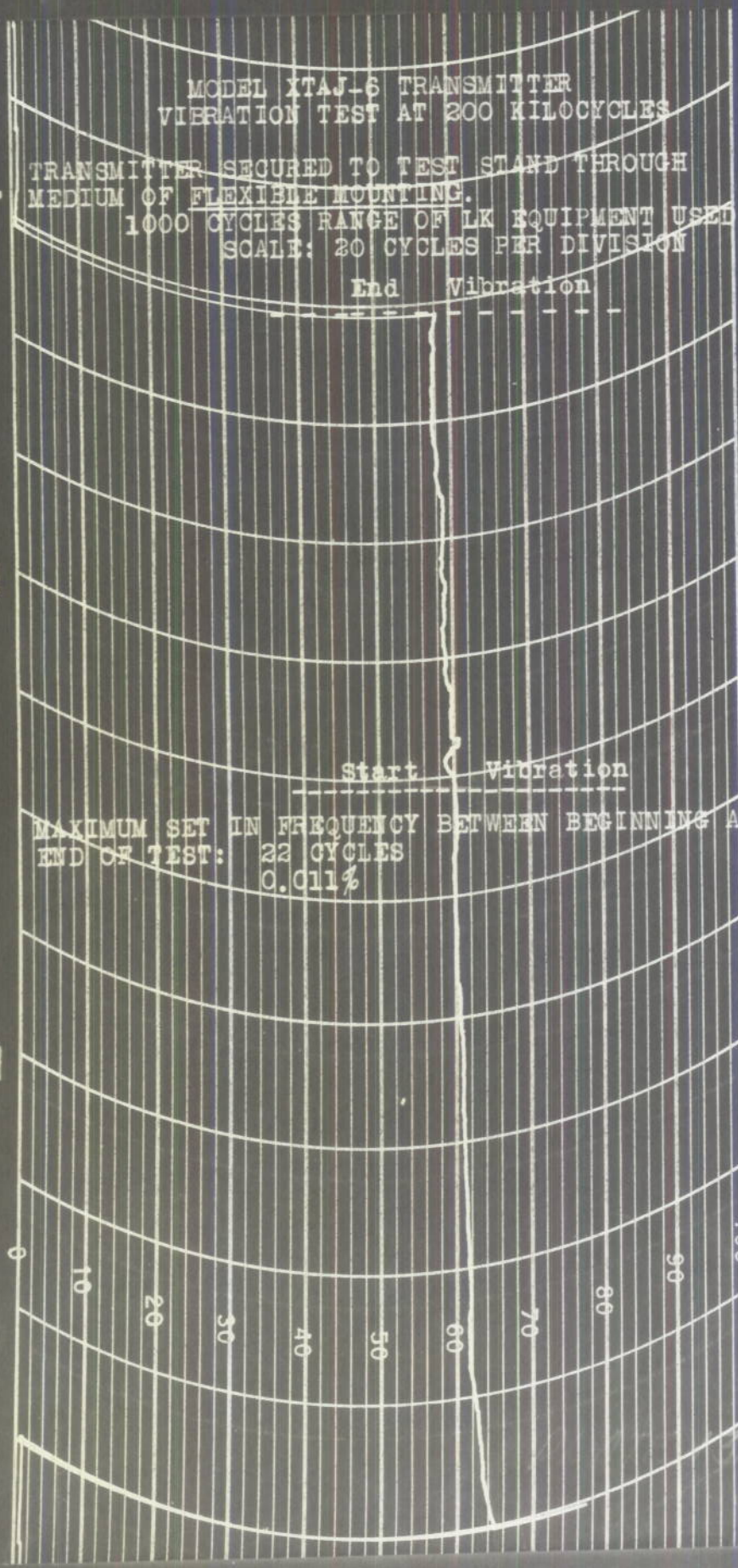

MODEL XTAJ-6 TRANSMITTER
VIBRATION TEST AT 200 KILOCYCLES
TRANSMITTER SECURED TO TEST STAND THROUGH MEDIUM OF FLEXIBLE MOUNTING.
1000 CYCLES RANGE OF LK EQUIPMENT USED
SCALE: 20 CYCLES PER DIVISION
End Vibration
Start Vibration
MAXIMUM SET IN FREQUENCY BETWEEN BEGINNING AND END OF TEST: 22 CYCLES
0.011%
3
2
1
0
10
20
30
40
50
60
70
80
90
100
MADE IN U.S.A.
THE ESTERLINE-ANGUS CO. INDIANAPOLIS, IND. U.S.A.
ES

Plate 13

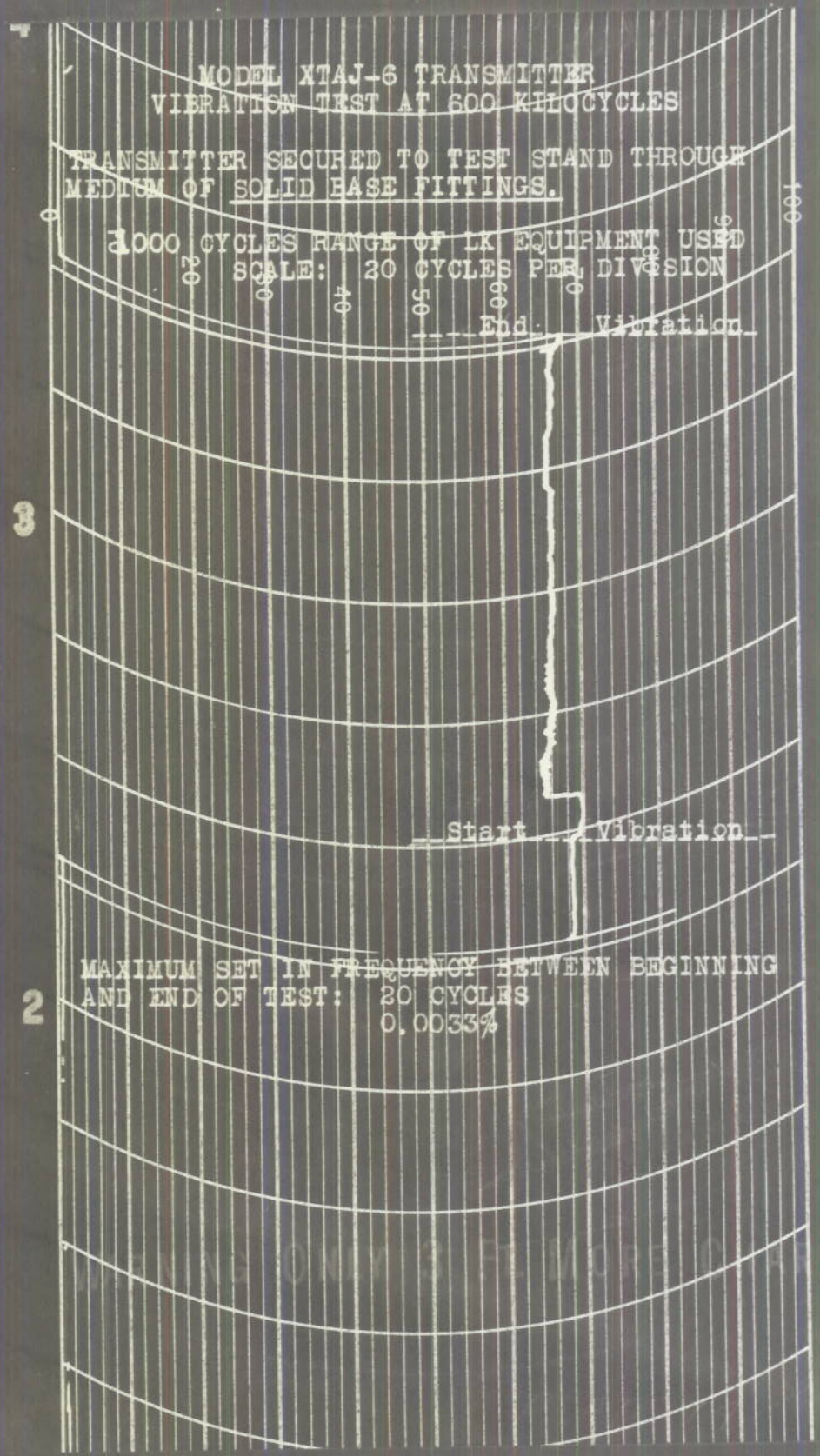

MODEL XTAJ-6 TRANSMITTER
VIBRATION TEST AT 600 KILOCYCLES
TRANSMITTER SECURED TO TEST STAND THROUGH MEDIUM OF SOLID BASE FITTINGS.
1000 CYCLES RANGE OF LK EQUIPMENT USED
SCALE: 20 CYCLES PER DIVISION
20 30 40 50 60 80 100
End Vibration
Start Vibration
MAXIMUM SET IN FREQUENCY BETWEEN BEGINNING AND END OF TEST: 20 CYCLES
0.0033%
MADE IN U.S.A. THE ESTERLINE ANGUS CO. INDIANAPOLIS IND. U.S.A.

Plate 14

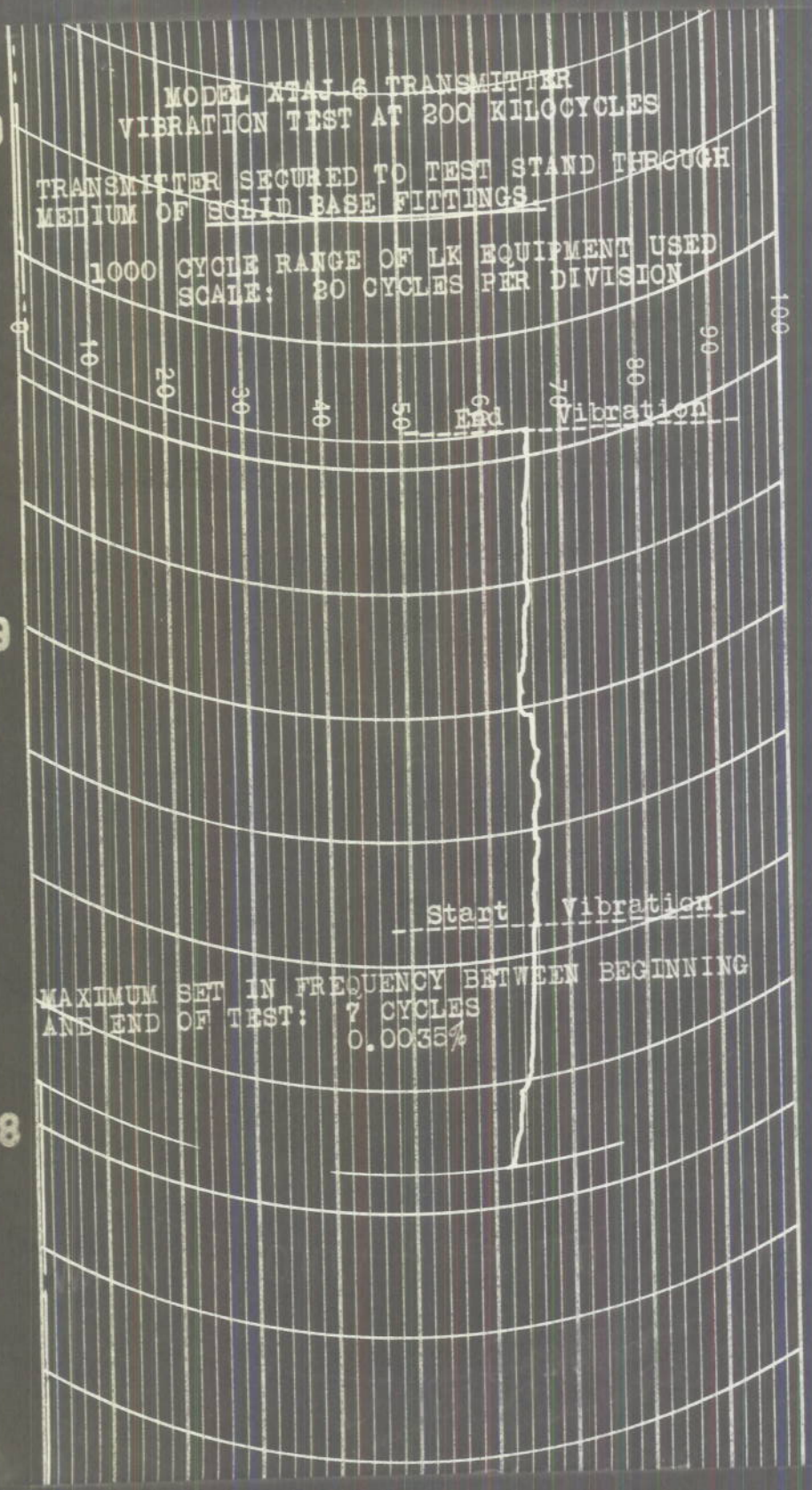
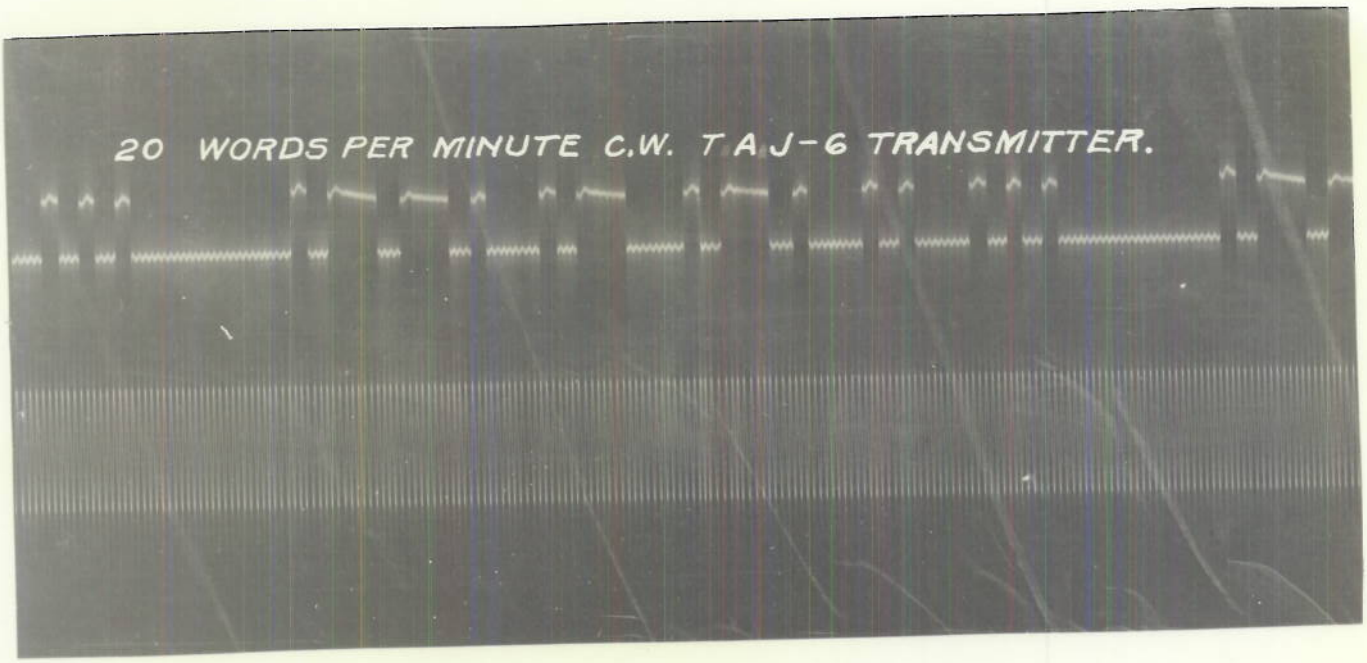

MODEL XTAJ-6 TRANSMITTER
VIBRATION TEST AT 200 KILOCYCLES
TRANSMITTER SECURED TO TEST STAND THROUGH MEDIUM OF SOLID BASE FITTINGS.
1000 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 20 CYCLES PER DIVISION
10
9
8
20
40
60
80
100
End Vibration
Start Vibration
MAXIMUM SET IN FREQUENCY BETWEEN BEGINNING AND END OF TEST: 7 CYCLES
0.0035%
THE ESTERLINE-ANGUS CO., INDIANAPOLIS, IND., U.S.A.
CHART NO

Plate 15



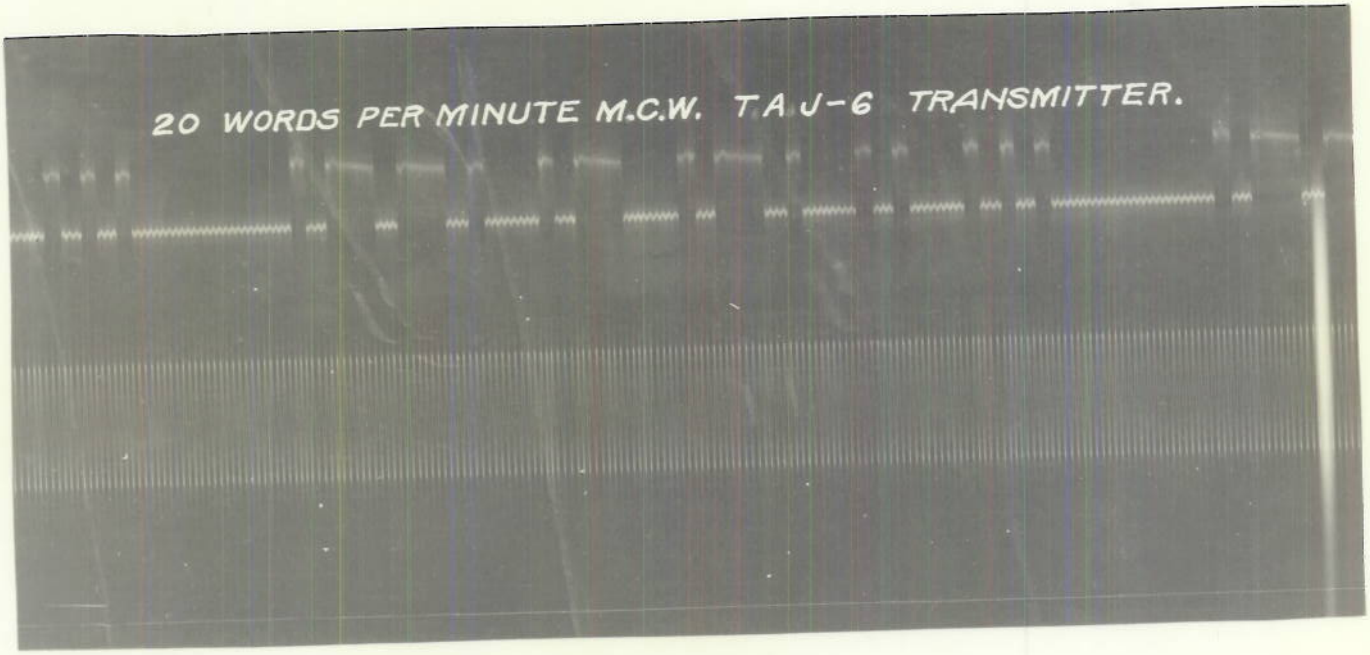
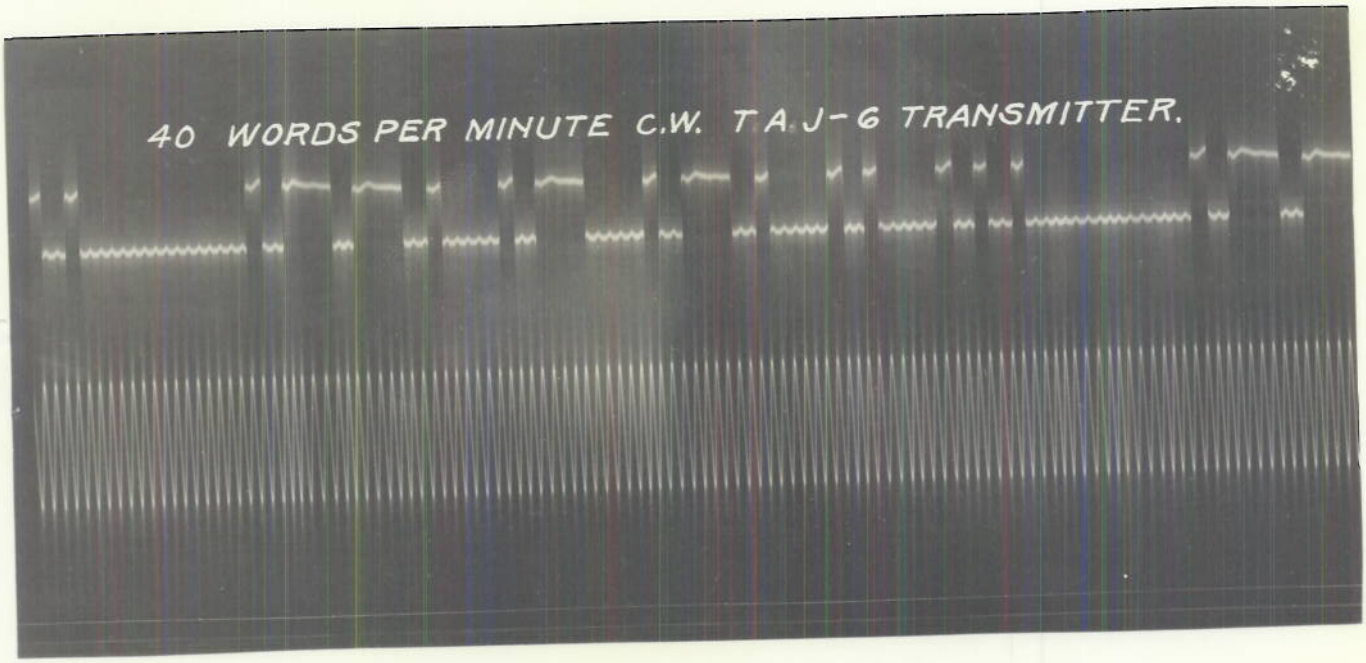
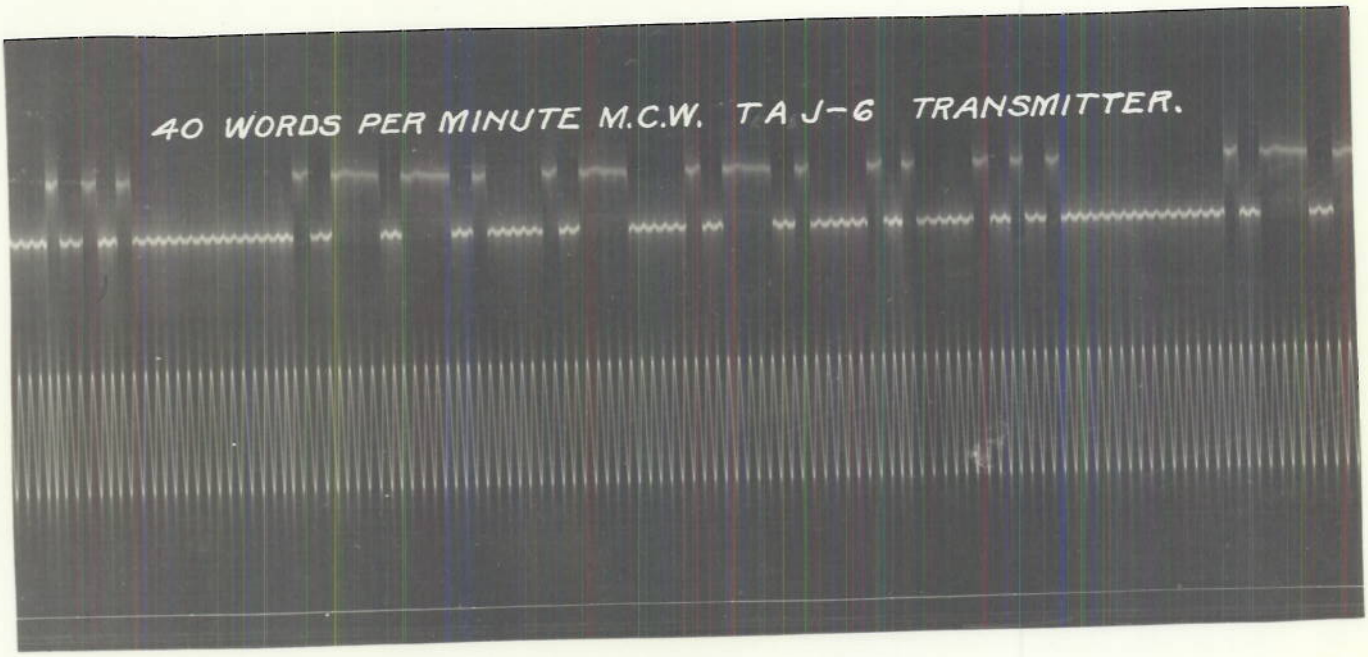
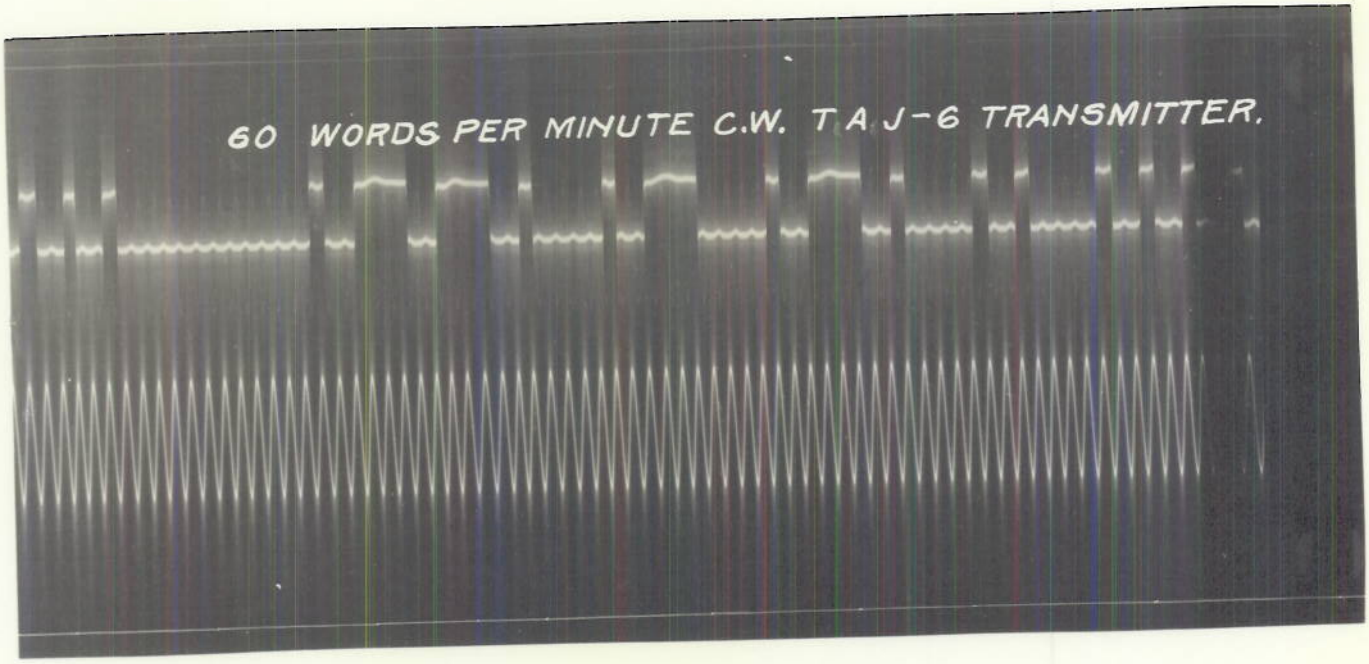


Plate 16







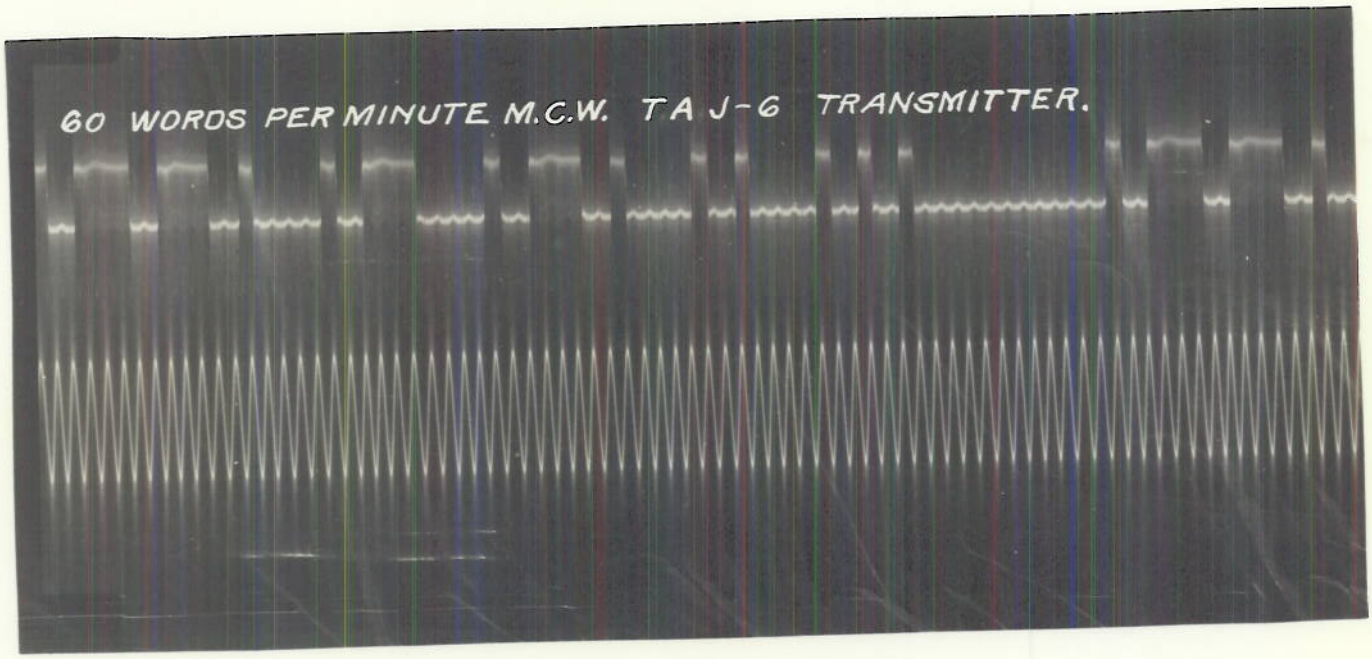
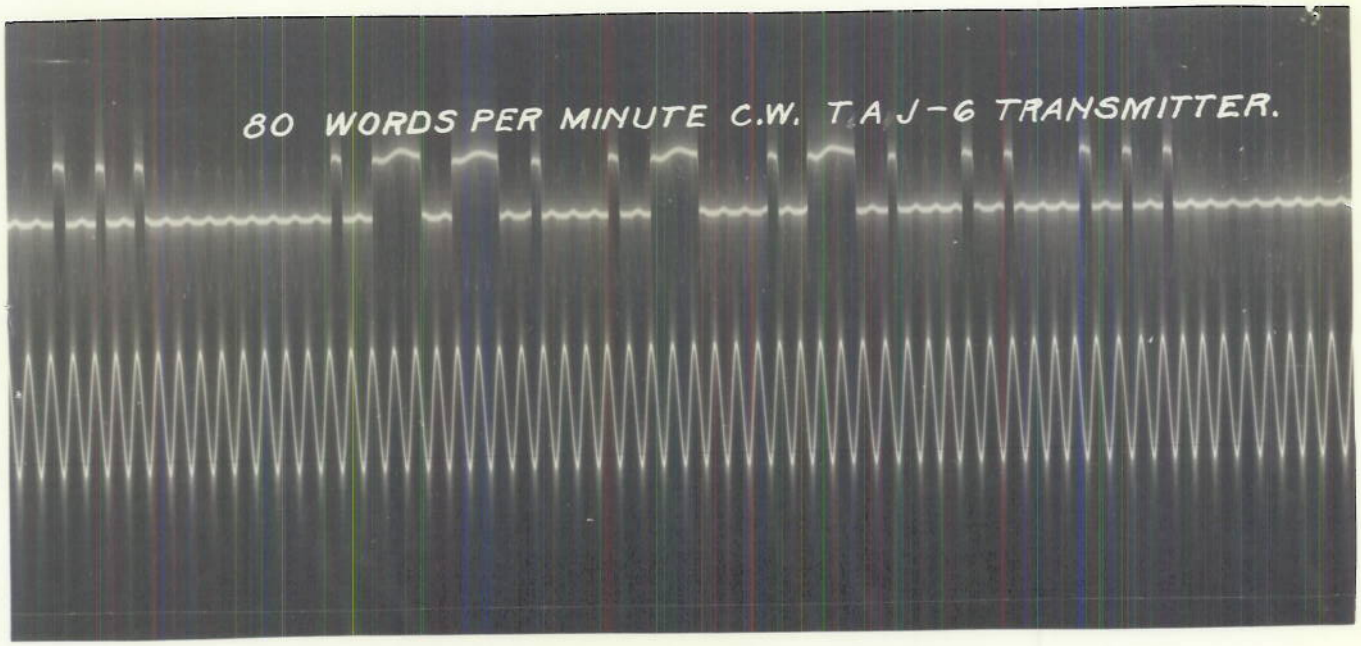


Plate B



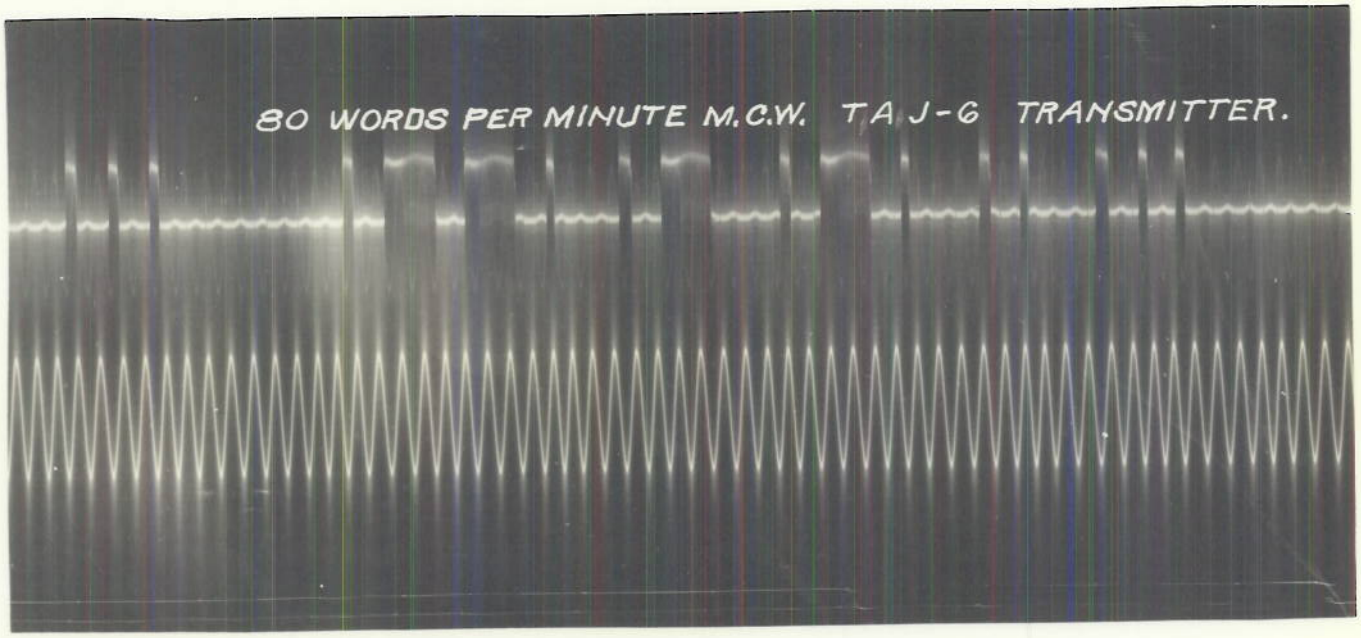
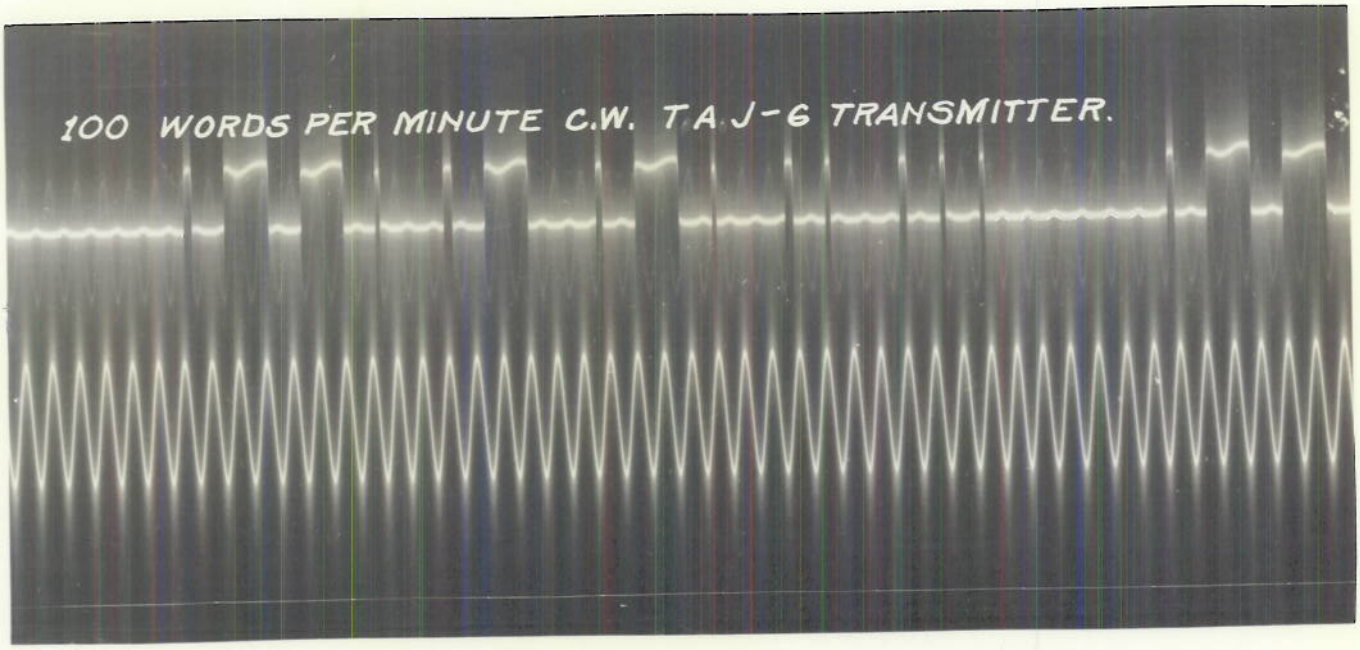
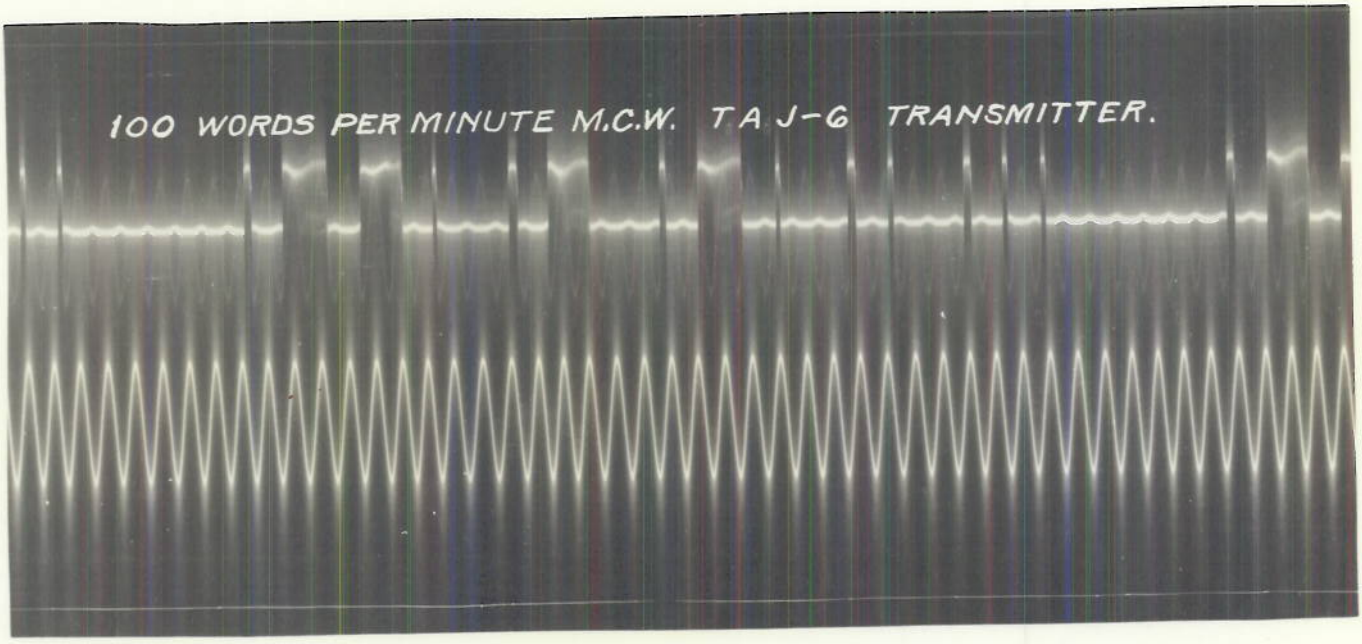


Plate 19





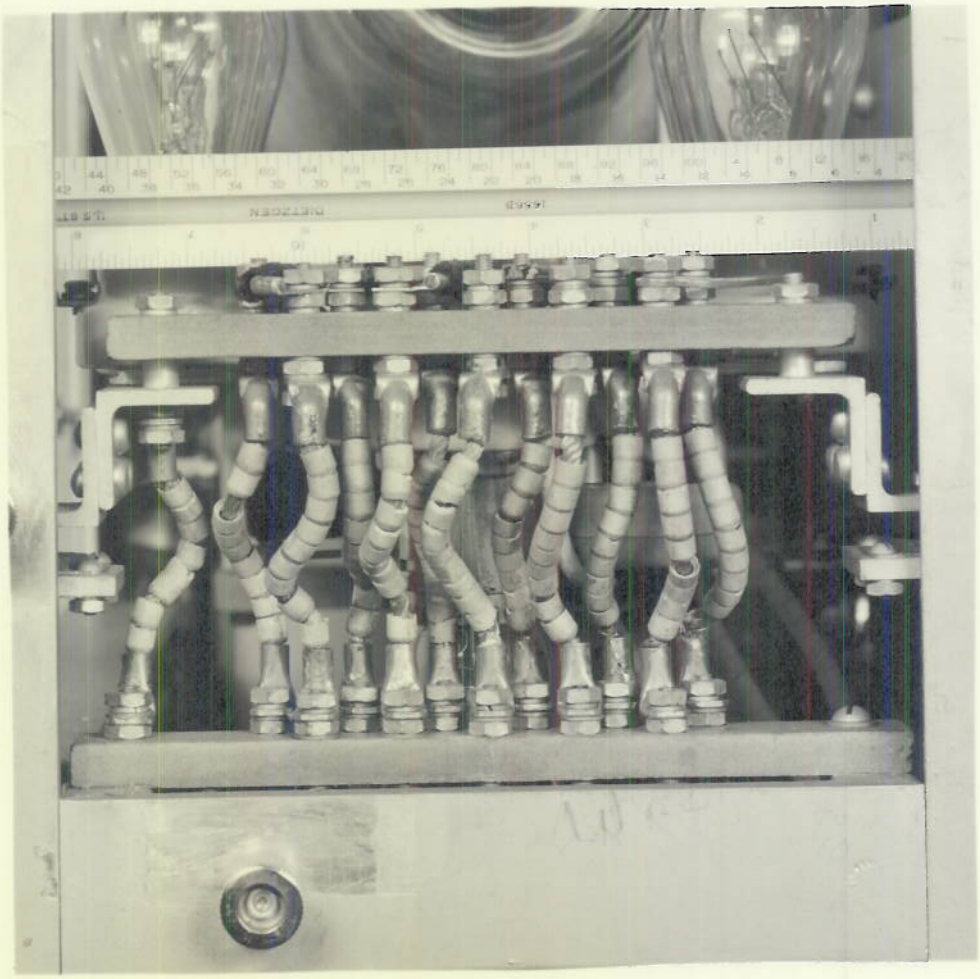


Plate 21

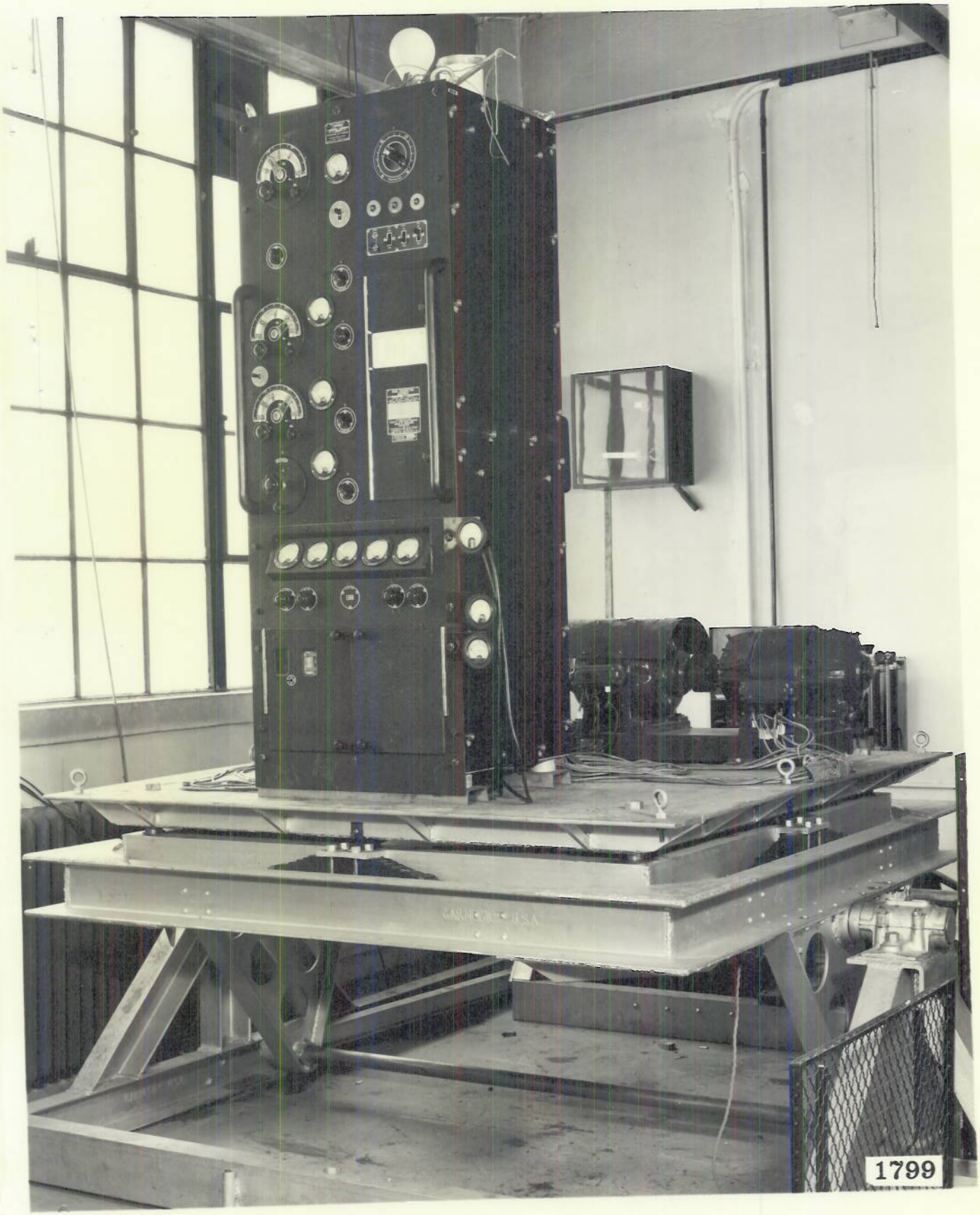


Plate 22

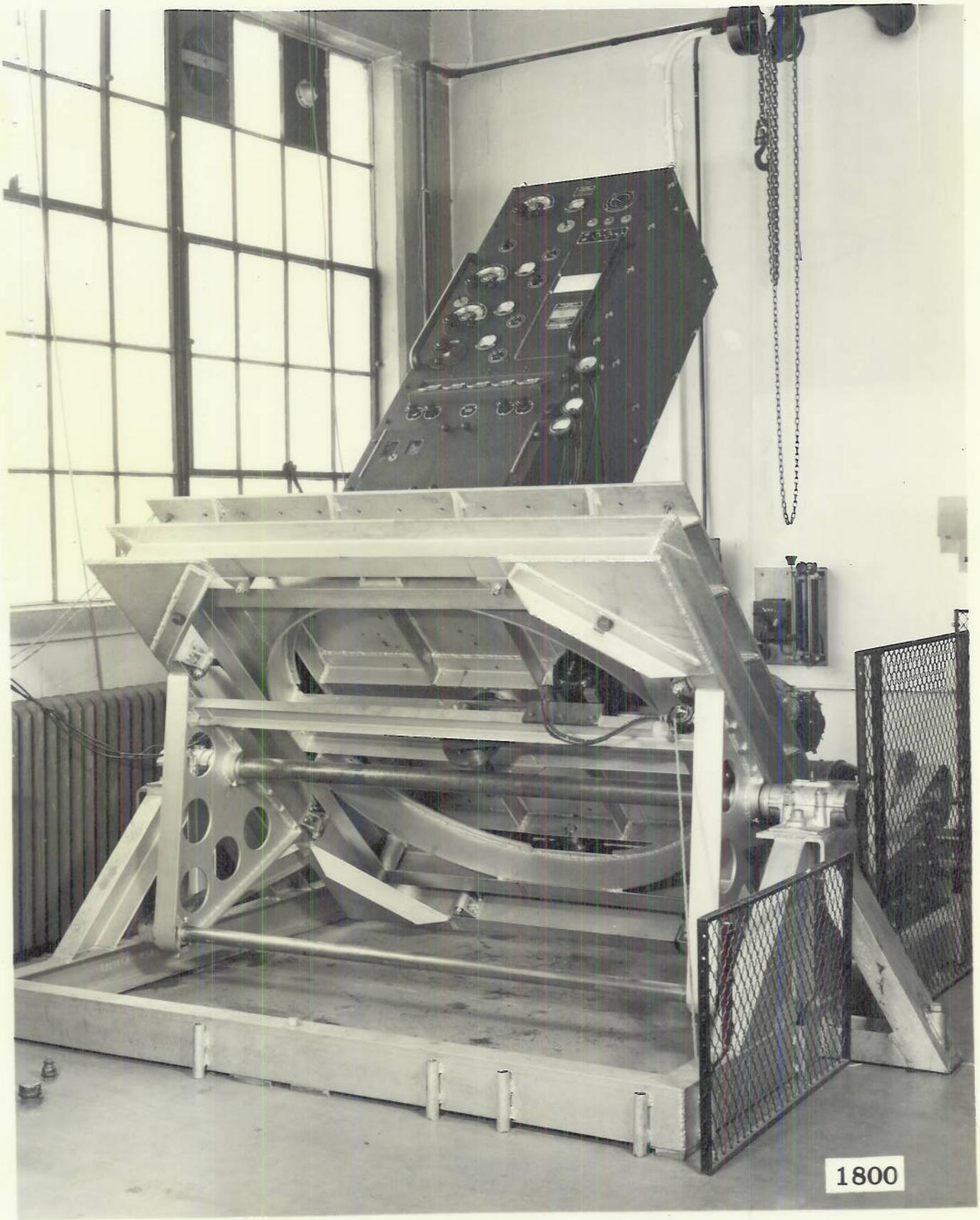


Plate 23

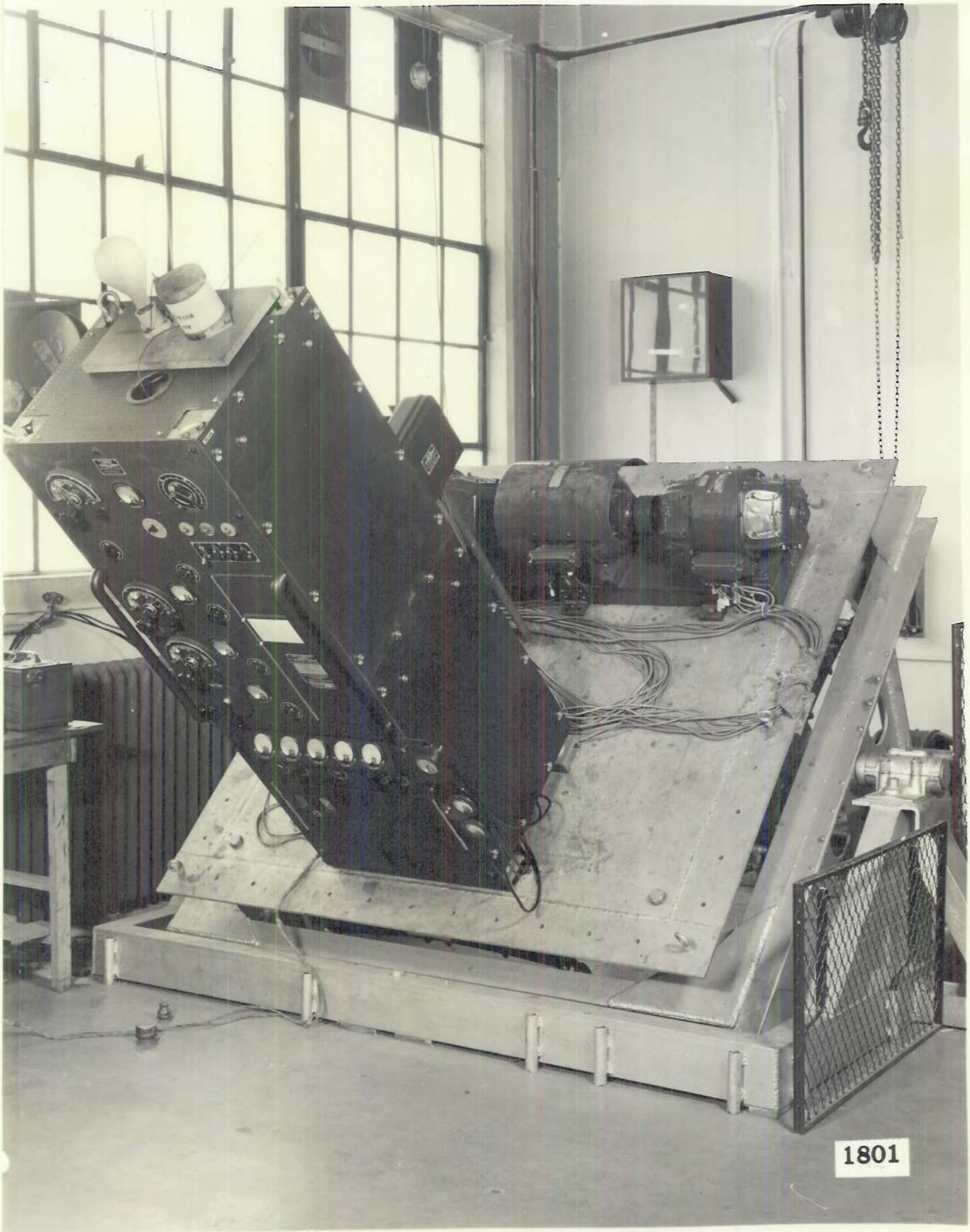


Plate 24

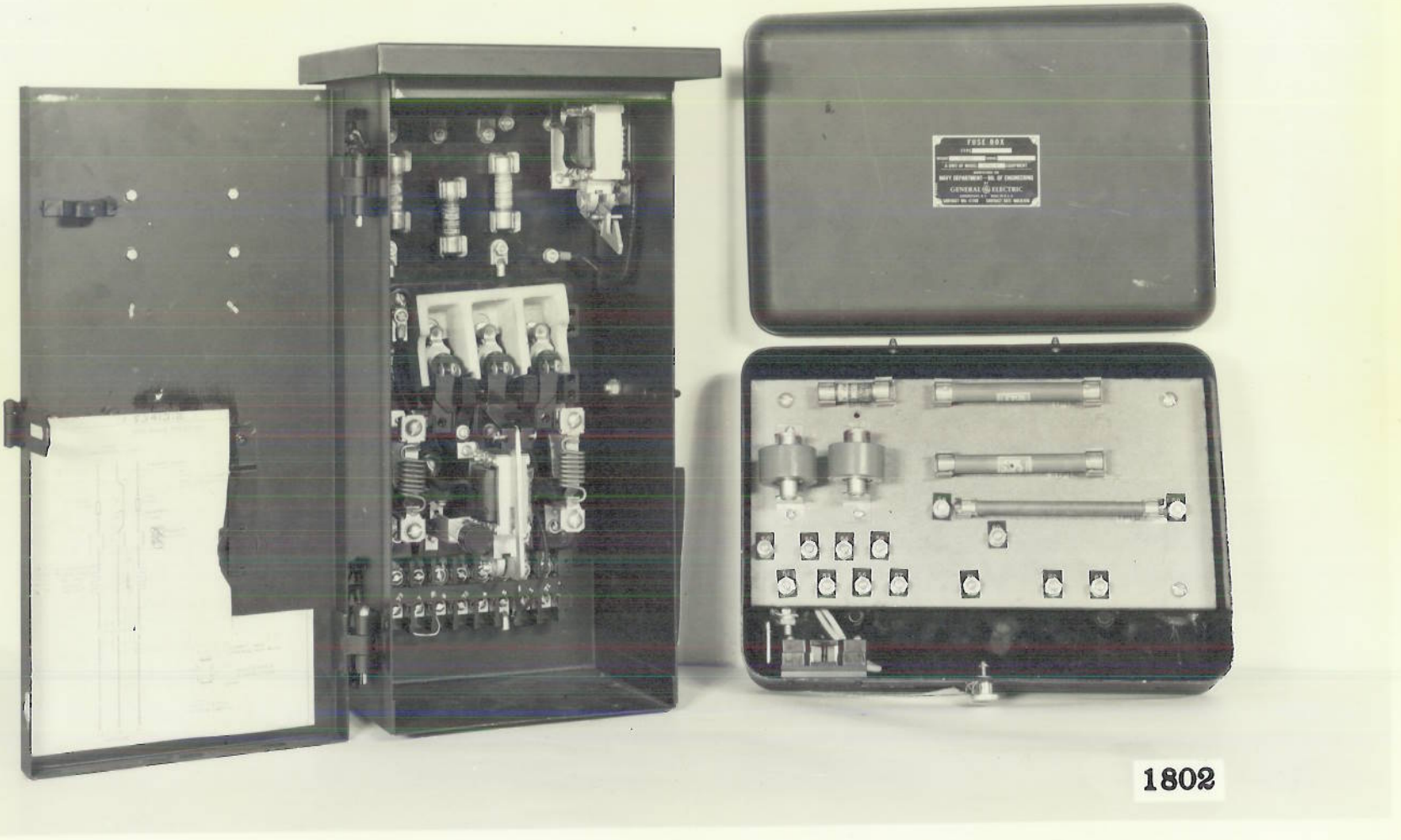


Plate 25

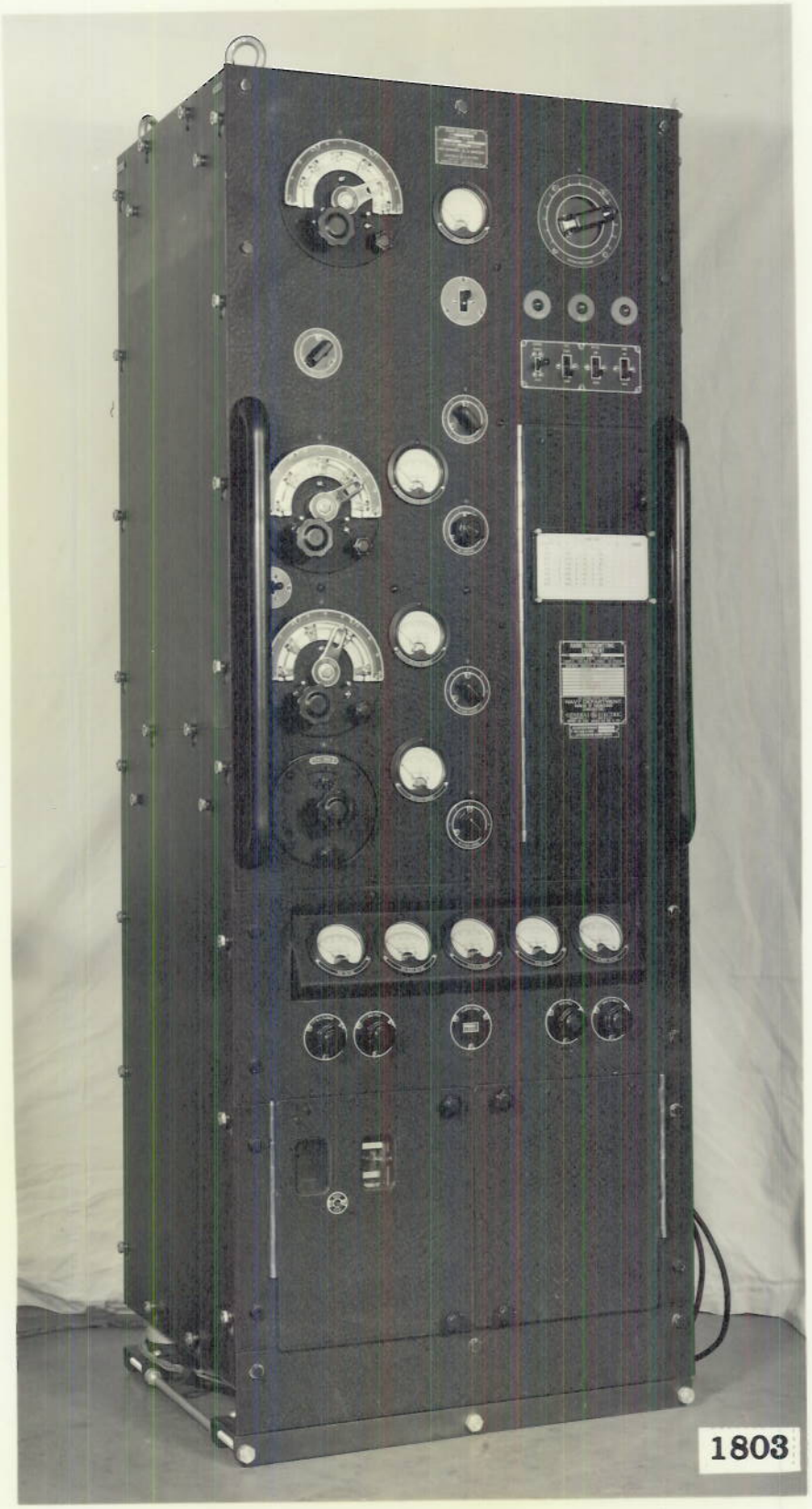


Plate 26

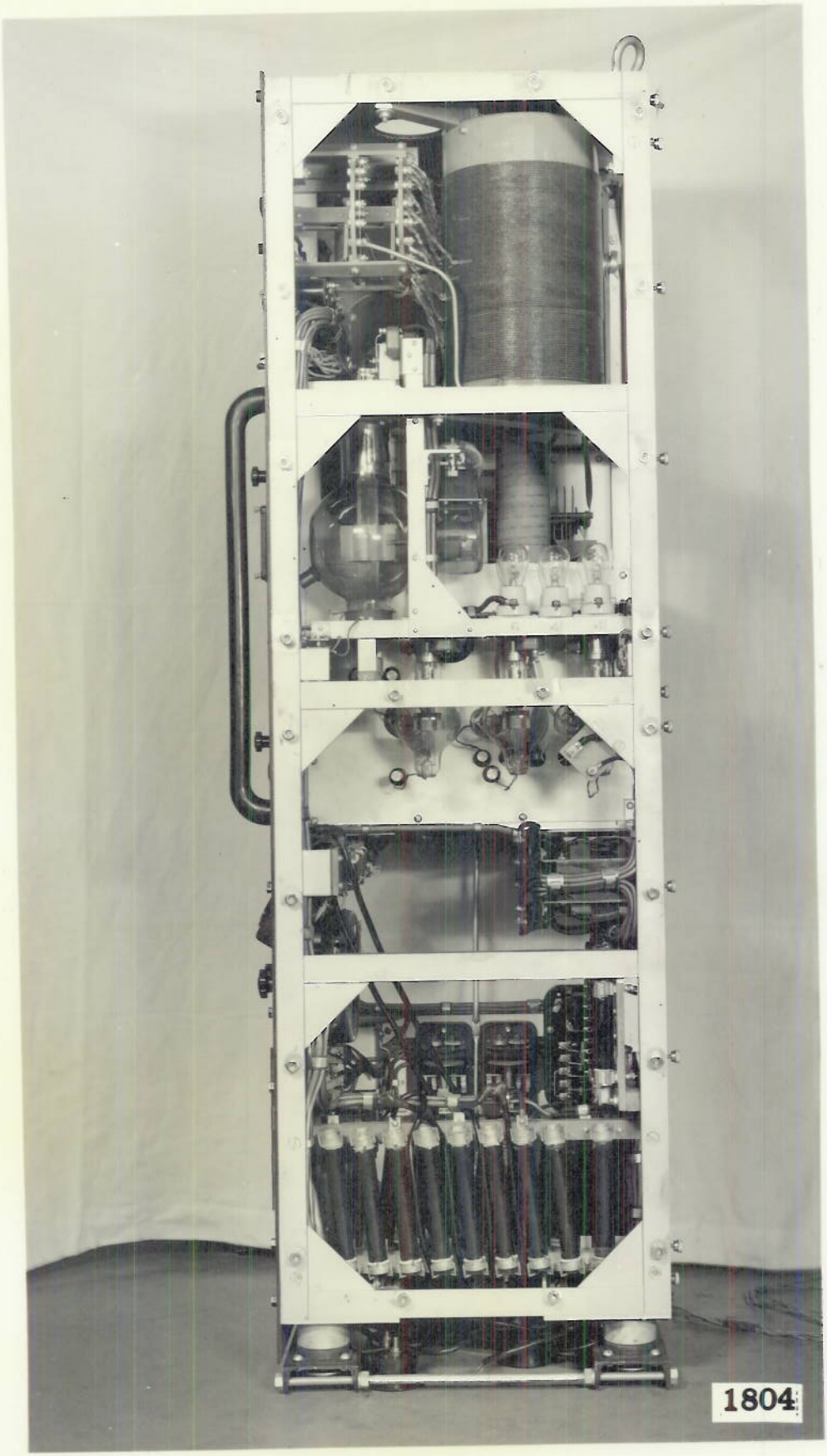


Plate 27

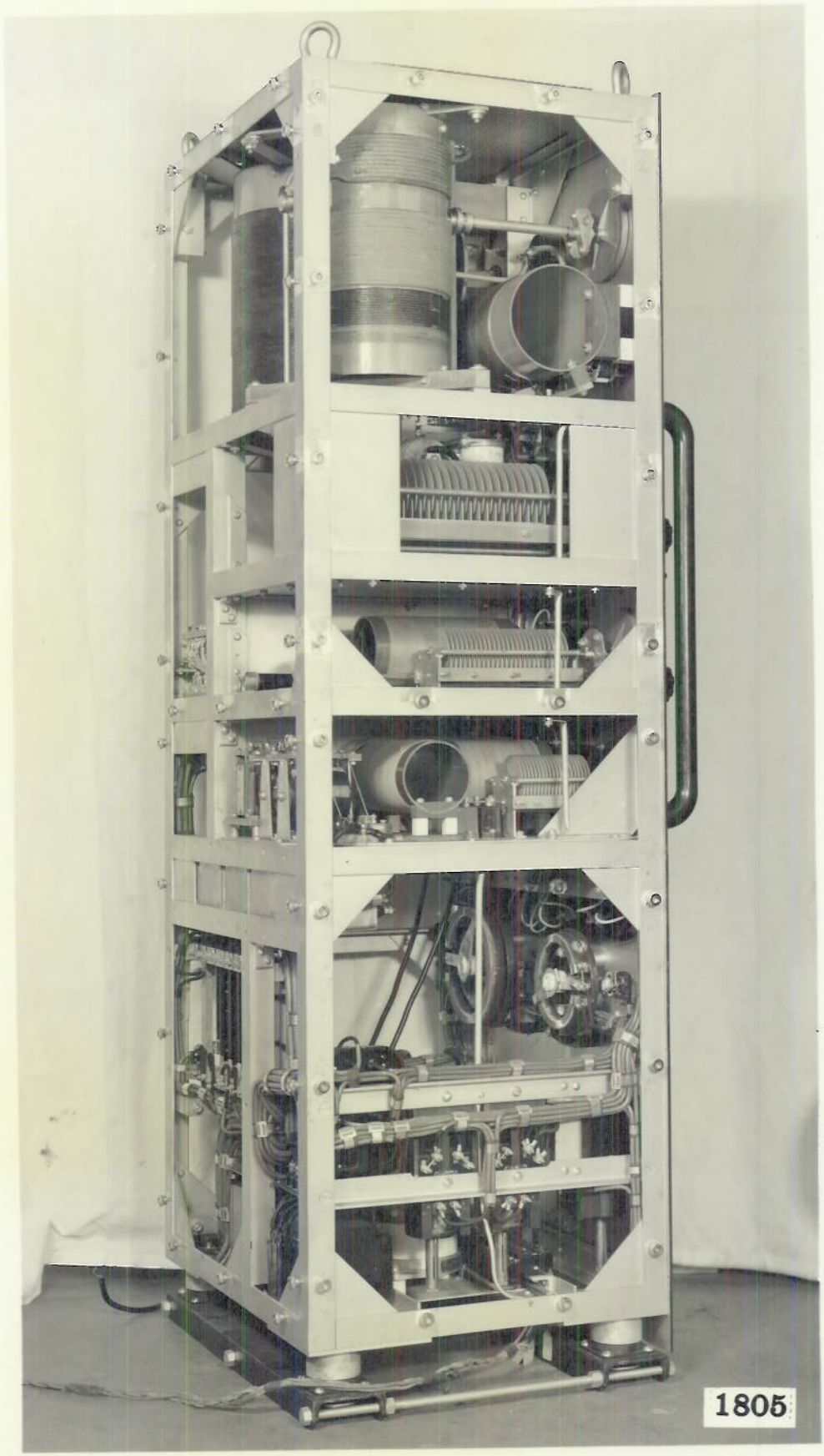


Plate 28

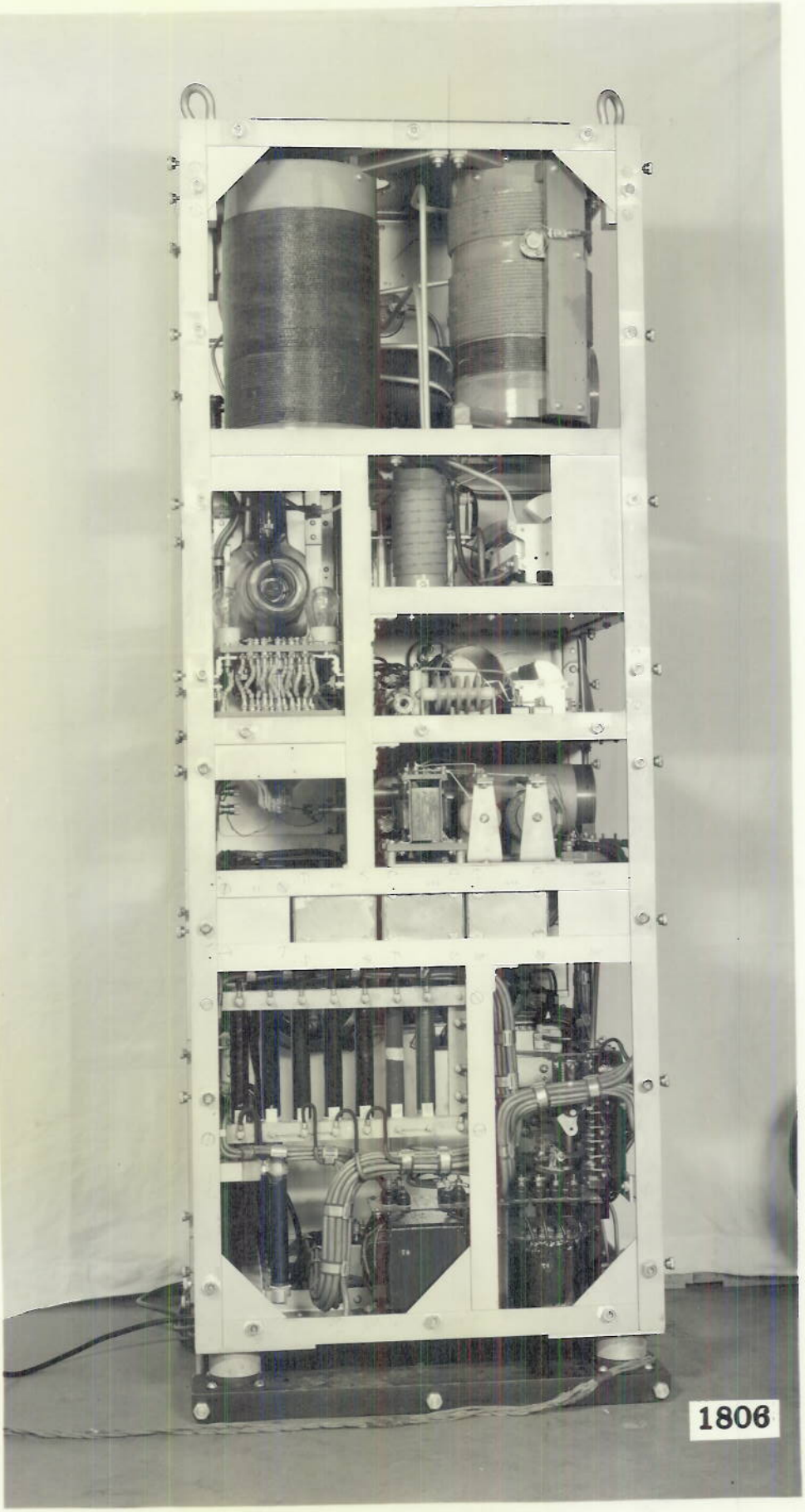


Plate 29

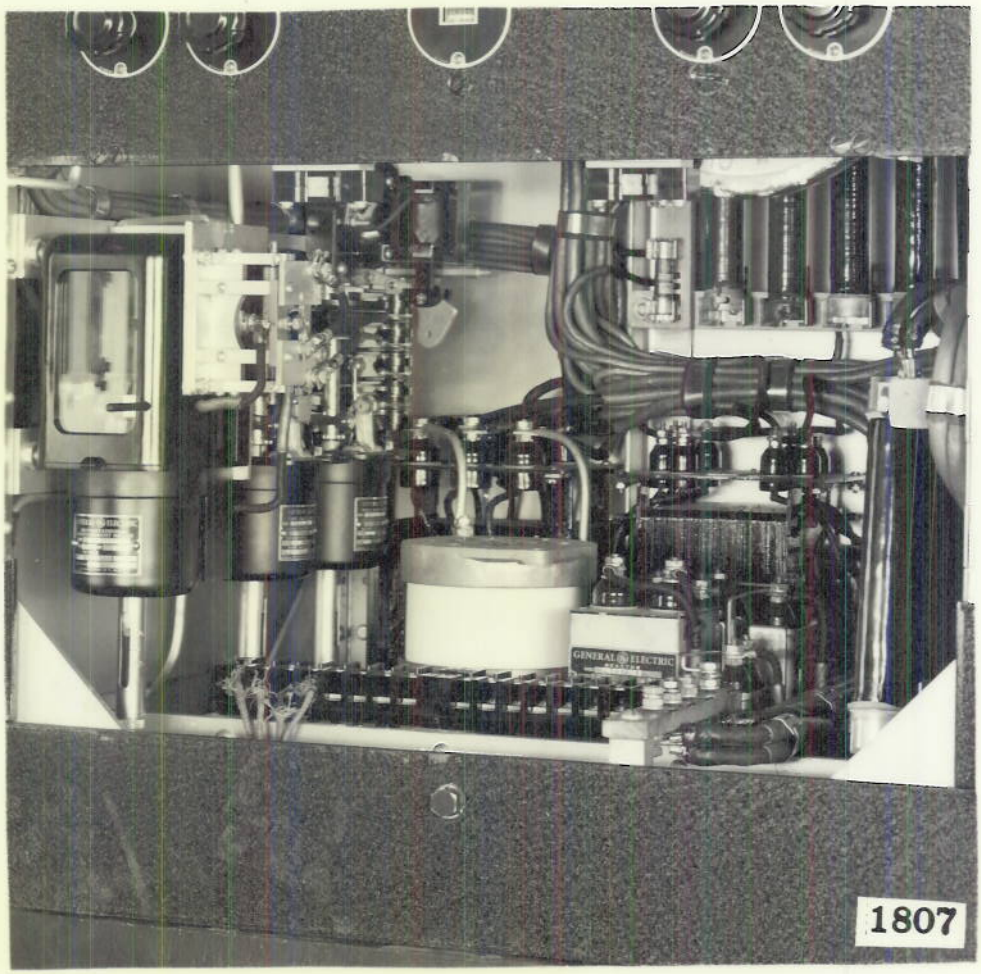


Plate 30

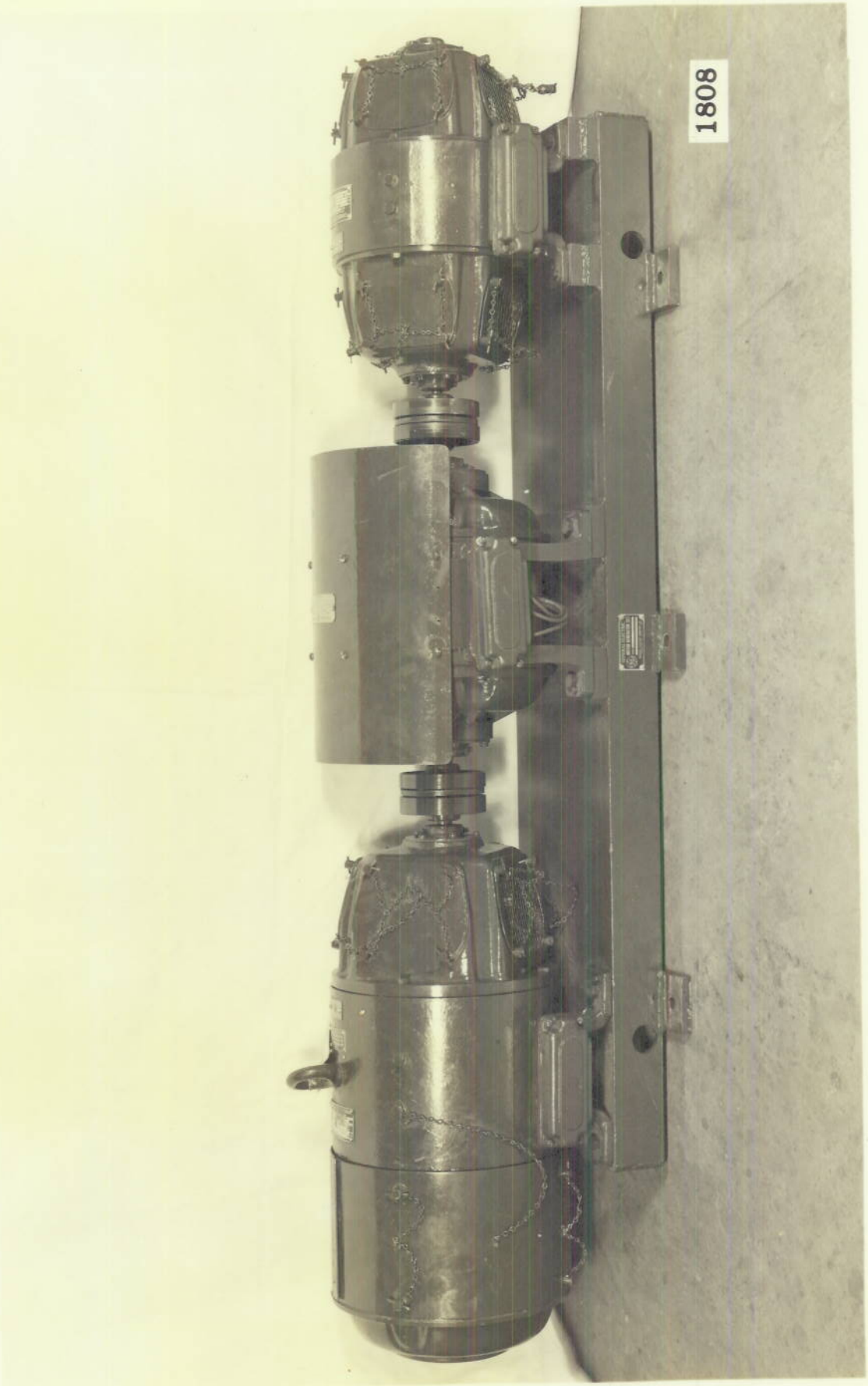


Plate 31