

REPORT NO. B-1256

DATE 30 March 1936

FR-1256

SUBJECT

Report of
Test on Siren, Motor-Operated,
Submitted by
Federal Electric Company,
Chicago, Illinois

by

J. S. Bryant
W. B. Roberts

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NAVAL RESEARCH LABORATORY

WASHINGTON 25, D. C.

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NAVY DEPARTMENT
BUREAU OF ENGINEERING

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Test on Siren, Motor-Operated,
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NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D.C.

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Authorization: BuEng. ltr. S65-4/L5(11-14-Ds) of 16 Nov. 1935.
Date of Test: March 1936.
Tested by: J. S. Bryant, Sr.Eng.Aide.
Prepared by: W. F. Roberts, Pr.Eng.Aide, Chief of Section.
Reviewed by: W. M. Haynsworth, Jr., Lieut., USN.
Approved by: H. M. Cooley, Captain, USN., Director.
Distribution:
BuEng.(5)

mbe

AUTHORIZATION

1. This test was authorized by reference (a) and another reference pertinent to this problem is listed as reference (b).

Reference: (a) BuEng.ltr. S65-4/L5(11-14-Ds) of 16 Nov. 1935.
(b) Specifications SGS(65)-105. Sirens, Interior Communication, of 15 February 1936.

OBJECT OF TEST

2. The object of this test was to determine how closely the subject siren complied with the specifications, reference (b), and its suitability for use in the Naval service.

ABSTRACT OF TEST

3. The siren as received from the manufacturer was first tested for its shock integrity, required by the specifications, reference (b), subparagraph F-3h. Following, it was set up in a standard test circuit and carefully observed while under test for the required 48-hour endurance run, operated at intervals of every alternate minute, at its rated voltage. During this test, the temperature rise of the motor at ambient temperature of 65°C was measured, using the resistance method. All remaining tests were made, in order, as outlined under the specifications, reference (b). The test was concluded with an inspection of the materials, design and workmanship.

CONCLUSIONS

(a) This siren, as manufactured and submitted by the Federal Electric Company, Chicago, Illinois, complied with the specifications, reference (b), in so far as the electrical characteristics were concerned, but it is not considered suitable for Naval use due to its unsatisfactory mechanical design.

RECOMMENDATIONS

(a) In view of its unsatisfactory mechanical design, noted under comments of this report, it is recommended that the subject siren be not approved for the Naval service.

(b) Inasmuch as the workmanship on the siren is good and it meets the specifications relative to the electrical characteristics, it is also recommended that the manufacturer be invited to build a siren, incorporating features shown on Plate 3, and submit same to this Laboratory for type approval test. Plate 3, a sketch of a desirable type of construction, has not been listed in the table of contents of this report.

DESCRIPTION OF MATERIAL UNDER TEST

4. This siren was manufactured by the Federal Electric Company, Chicago, Illinois, and submitted as a Navy type B1, high powered siren (flight crash signal) for type approval test.

5. The motor is bipolar, series wound, designed for 115 volts, AC-DC operation, is rated at 0.5 H.P., and has a speed of 6000 r.p.m. It is equipped with sleeve bearings lubricated through oil cups provided with dust caps.

6. The magnetic circuit is made up with laminated punchings, each pole piece supporting its respective form wound coil. The motor is housed in a cast iron frame and located inside of a cast aluminum alloy case supported by the stationary cylinder with four round head steel machine screws.

7. The sixteen (16) aperture cast aluminum rotor is cast in one piece and has three (3) 8/32 round head machine screws tapped into a hub for securing it to the motor shaft.

8. The stationary cylinder supporting the motor fits into a recessed flange secured to the case with six (6) brass hex head cap screws, nickel plated. The cylinder is held in place by the rotor guard secured to the flange with eight (8) 1/4" hex head steel through-bolts provided with lockwashers.

9. The aluminum alloy case is provided with four (4) mounting lugs, equally spaced, and a terminal box embodying two (2) bosses, tapped for 3/4" standard terminal tubes. The terminal box, equipped with a removable cover, is not an integral part of the case, but is secured with six (6) round head steel machine screws. The bottom of the case is recessed to allow for uneven surfaces when mounting.

10. Located on the motor frame is a terminal block of phenolic material, secured with two (2) machine screws, for making line connections.

11. The motor lead wires are connected to binding posts located on the inboard end-bell of the motor.

12. Further details in the design and construction of the siren are shown on Plates 1 and 2.

METHOD OF TEST

13. The siren as received from the manufacturer was first placed on a Bureau of Engineering shock stand and given shocks under conditions specified under reference (b), to determine its ruggedness.

14. It was next tested for endurance by placing it in a compartment having an ambient temperature of 65°C and operating it one minute, every alternate minute, for 24 hours. During this test, the temperature rise of the motor was obtained, using the resistance method. The temperature was then lowered to 40°C and the siren again operated one minute every alternate minute, for 24 hours.

15. Following, the siren was tested for its operating characteristics when inclined 30° from the vertical in any plane when supplied with current at voltages between 20% under and 10% over normal operating voltage. It was also tested for operation over a frequency range of 55 to 65 cycles.

16. The pitch of note was obtained by beating it on a General Radio beat frequency oscillator, type 513-B. During this test, the rated voltage and frequency of the siren was maintained.

17. Prior to conducting the splash test, 1500 volts, alternating current, 60 cycles, was applied between all current carrying parts and ground for a period of one minute, to determine its dielectric strength. Then followed the insulation resistance test, using a 500-volt megger.

18. The sound output of the siren was measured in a sound-proof room, using a General Radio noise meter, located 18 feet from and on the axis of the siren.

19. The watertight integrity of the siren was determined by spraying it with a stream of water of one inch diameter, under a pressure-head of approximately 35 feet from a hose at a distance of 10 feet for a period of 5 minutes.

20. Then followed the usual power consumption measurement at rated voltage and frequency.

21. The test was concluded with an inspection of the siren to note any defects brought out by the tests and its conformance with the specifications relative to materials, design and workmanship.

RESULTS OF TEST

22. The data obtained during the tests follow:

| <u>Requirements</u> | <u>Test Values</u> |
|---|---|
| Voltage: 115 volts. | 115 volts. |
| Current: Alternating. | Alternating. |
| Frequency: 60 cycles. | 60 cycles. |
| Watts: Not over 500 watts for type B-1 (flight crash signal sirens). | 330 watts. |
| Power Factor: Not less than 60%. | 85.66%. |
| Endurance: One minute every alternate minute for 24 hours at ambient temperature of 65°C ., and one minute every alternate minute for 24 hours at ambient temperature of 30°C . | Satisfactory operation under both conditions. |
| Inclination: Shall operate satisfactorily when inclined 30° from the vertical in any plane when supplied with current at voltages between 20% under and 10% over normal operating voltage. | Satisfactory operation under conditions as specified. |

Requirements

Frequency range: Shall operate satisfactorily over a frequency range of 55 to 65 cycles.

Dielectric strength: Shall withstand 1500 volts, a.c., 60 cycle, applied between all current carrying parts to ground for a period of one minute.

Insulation resistance: Shall be not less than 10 megohms at 500 volts between any electrical point to ground following the dielectric test.

Splash test: Shall not leak when sprayed with a stream of water of 1 inch diameter under a pressure-head of 35 feet, played from a hose at a distance of 10 feet, for a period of 5 min.

Motor bearings: Ball bearings, N.D. Specifications 42B5.

Temperature rise: Shall not exceed 35°C at ambient temperature of 65°C. during first part of endurance test.

Pitch of note: 1500 to 2500 C.P.S.

Audibility range: Minimum of 3000 yards in still air in the open.

Decibel output: Not specified.

Case Material: Shall be made of aluminum alloy.

Rotating cylinder requirements: Shall be made of aluminum alloy in one piece.

Weight: Not specified.

Dimensions: Not specified.

Motor Characteristics "Bipolar - Series"

Volts - 115 AC-DC R.P.M. - 6000
H.P. - 0.5 Amps. - 3.3

*Denoted failure to comply with specifications.

Test Values

Satisfactory operation under conditions as specified.

Satisfactory, no break-downs occurring.

The minimum insulation resistance by 500 volt megger was approximately 100 megohms.

*See "Comments", par. 24.
(Case leaked badly.)

*See "Comments", par.25.
(Motor embodies sleeve bearings.)

Maximum temperature rise was 34.88°C.

1550 C.P.S.

* 2500 yards.
Note: Computed from the db. output given below.
100 db., measurement made in sound-proof room, using a General Radio noise meter, located 18 feet from and on the axis of siren under test.

Aluminum alloy, as specified.

One piece aluminum alloy casting, as specified.

19 lbs. 12 oz.

Overall length 9"50.
Maximum diameter 8"50

COMMENTS ON RESULTS OF TEST

23. For high powered sirens, the specifications require a minimum audibility range of 3000 yards in still air in the open. This test was not conducted for lack of having an open space of sufficient area. However, its audibility range was determined by computing it from the decibel output of the siren. It has a sound output of 100 db. measured in a sound-proof room with a General Radio noise meter, located 18 feet from and on the axis of the siren. This is equivalent to approximately 2500 yards according to a curve furnished by the Bureau.

24. Under the splash test, the siren case leaked considerable water due to improper design. In view of this, the dielectric strength and insulation resistance tests following the splash test were not conducted.

25. The motor embodies sleeve bearings instead of ball bearings as required by the specifications.

26. Regarding the inspection of the siren for conformance with the specifications relative to design and materials, the following comments are made.

- (a) The one piece aluminum rotor casting has a flaw partly surrounding the central boss. For the manufacturer's information, this flaw has been marked.
- (b) The present windows in the rotor housing are of such size that it is possible that some one may be injured by the rotating cylinder. Two small rings, cast integral with the housing, would provide a safety feature.
- (c) A better method should be employed for securing the rotor to the motor shaft, possibly by using a split steel conical bushing having external threads and provided with a suitable nut and locknut. All steel parts should be protected against corrosion.
- (d) Brass, hex head machine screws, secure the aluminum flange to the case. These screws are unnecessary as the flange could be cast integral with the case. The terminal box should also be case integral with the case and steel inserts should be provided for the case cover securing screws.
- (e) The terminal block should be secured to cast bosses located in the terminal box rather than mounted on the motor housing. The lead wires should be brought out of the motor housing and the binding posts eliminated.
- (f) The stationary cylinder should be protected against corrosion as required by the specifications.
- (g) Inasmuch as the specifications require ball bearings

for the motor, the oil cups could be eliminated, were the bearings properly packed with light petrolatum when assembled.

27. The motor when energized with a potential of 115 volts, direct current, produced a note of 1775 C.P.S. and a sound output of 101 decibels.

28. As requested by the Bureau, an additional test was made using a similar type of siren which embodied a projector surrounding the stationary cylinder, to determine the effect of the projector with respect to direction and sound output. This test was made in a sound-proof room, using a General Radio noise meter located 18 feet from and on the axis of the siren under test. The comparative test results follow:

(a) With projector:

| <u>Direction</u> | <u>Test Values in db.</u> |
|------------------|---------------------------|
| Dead ahead | 94 |
| 90° from normal | 86 |

(b) Without projector:

| <u>Direction</u> | <u>Test Values in db.</u> |
|------------------|---------------------------|
| Dead ahead | 86 |
| 90° from normal | 85 |

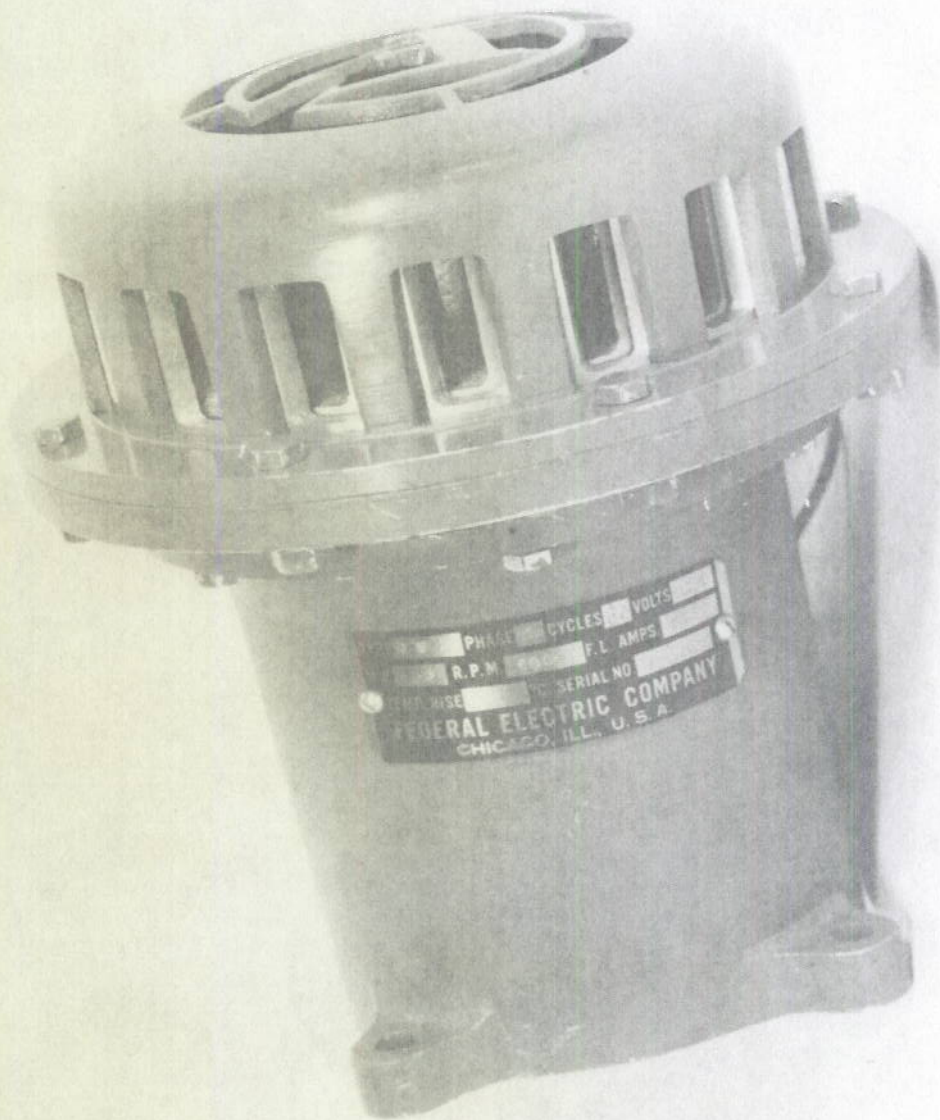
29. From the test results obtained, it appears that a projector may be used on a siren to obtain a directive feature.

30. The siren, embodying the sound directive feature, is Government property and is now located at this Laboratory. Any additional information or tests desired by the Bureau can be had upon request.

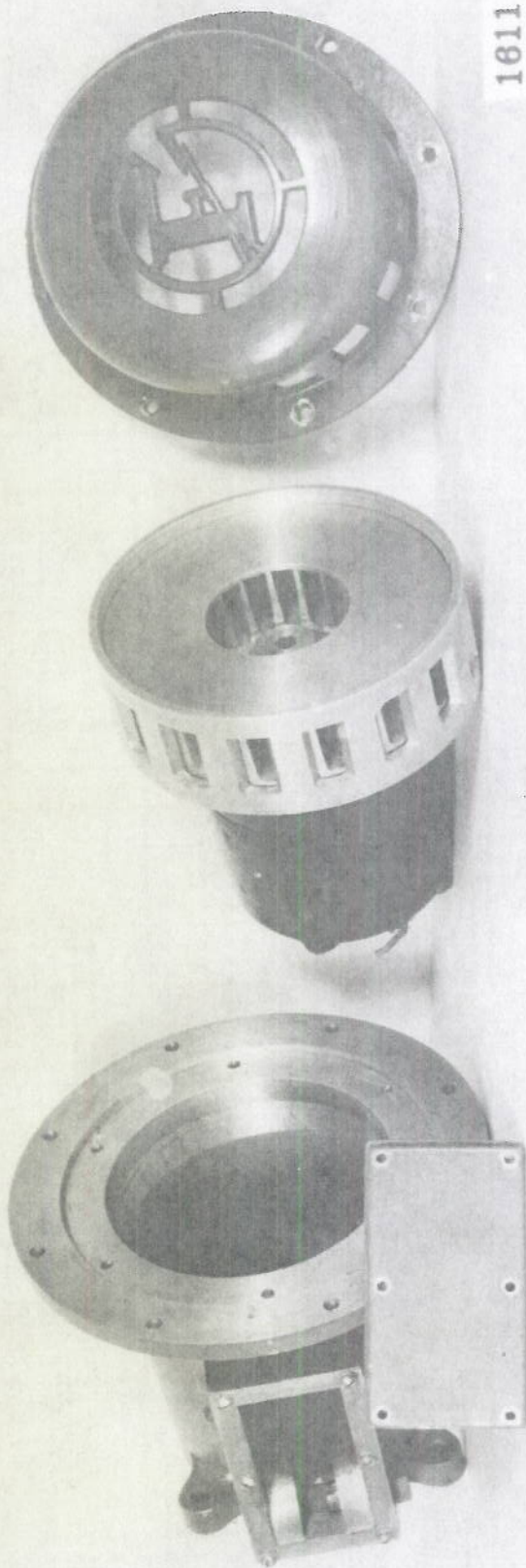
CONCLUSIONS

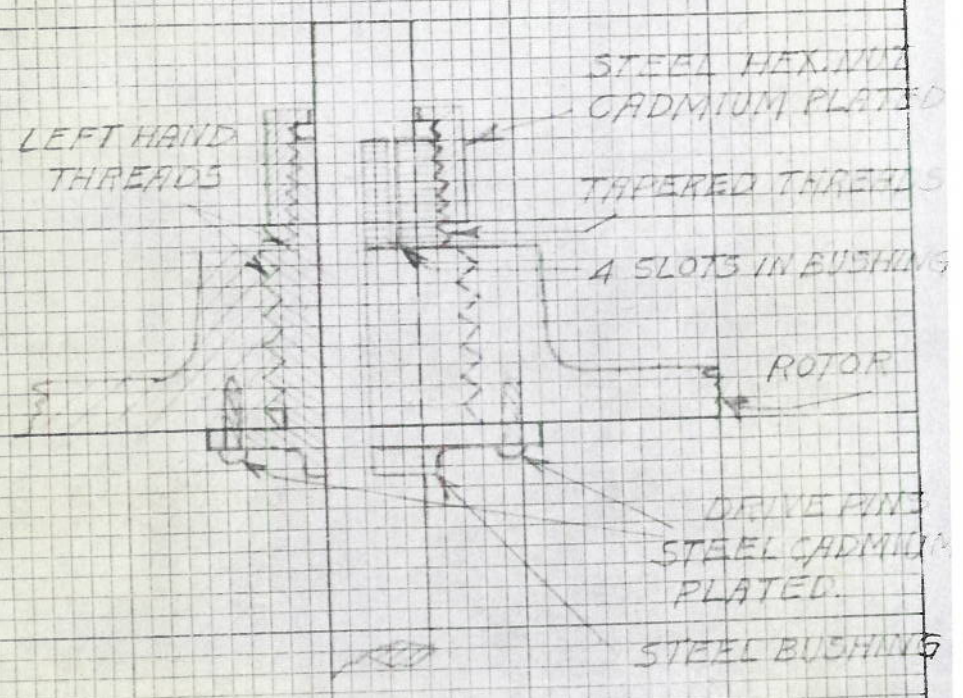
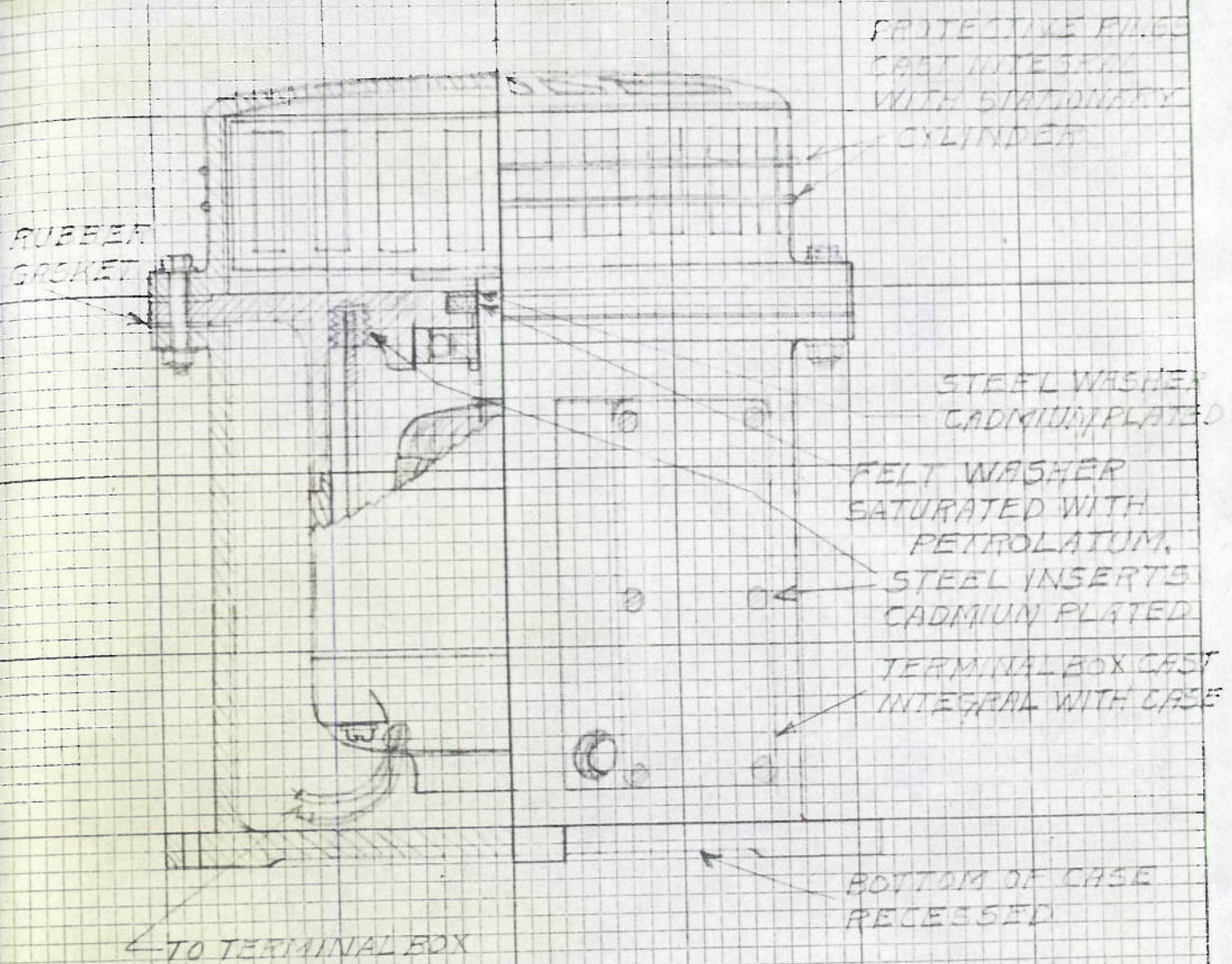
31. This siren, as manufactured and submitted by the Federal Electric Company, Chicago, Illinois, complied with the specifications, reference (b), in so far as the electrical characteristics were concerned, but it is not considered suitable for Naval use due to its unsatisfactory mechanical design.

1610



1611





METHOD OF MOUNTING
ROTOR