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Report No. 12810-8

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~~Aerojet~~

ENGINEERING CORPORATION

AZUSA, CALIFORNIA

FORMAL REPORT OF PROGRESS

Copy No. 3

26 February 1953

TO: Head, Armament Branch
Naval Sciences Division
Office of Naval Research
Washington 25, D.C.

VIA: Bureau of Aeronautics Representative
Pasadena
c/o Aerojet Engineering Corporation
6352 N. Irwindale
Azusa, California

SUBJECT: Development of a Device for Mine-Sweeping

CONTRACT: Nott-686(00)

PERIOD
COVERED: 1 January through 31 January 1953

This is the eighth in a series of informal reports submitted in partial fulfillment of the contract.

AEROJET ENGINEERING CORPORATION

W. M. Roberts

for C. A. Congwer
Manager
Underwater Engine Division

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59AA-8943

L-2717

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Report No. L2810-8

I. OBJECTIVE

In accordance with Contract Nonr-686(00), the following work is to be performed:

A. Conduct research on pulsed-pressure signal investigation. This work shall include, but shall not necessarily be limited to, fundamental studies primarily concerned with the design of an exit section for a ring-vortex generator, to obtain more efficient energy conversion to the vortex, and studies planned to provide information necessary for the prototype generator design.

B. Design a full-scale generating device based on the results of experiments.

II. DESCRIPTION OF WORK

A. Work has been continued on the 1/18-scale model generator and barge. The initial tests were conducted using a barge, the scaled-up dimensions of which were equivalent to those of a barge having a displacement of 300 tons. The model was photographed during testing to determine the amplitude of recoil with the generator mounted vertically. Figure 1 is a series of nonconsecutive frames illustrating a typical recoil. The backdrop is calibrated in inches. This particular sequence shows a recoil amplitude of $3 \frac{1}{3}$ inches upward and a resulting downward movement of $1 \frac{1}{3}$ inches from the equilibrium position. Scaled up, this is equal to a recoil of more than 5 feet.

B. The same barge was then modified to give an apparent mass of 585 tons. The increase in mass was due entirely to the addition of horizontal plates designed to engage a greater mass of water and to the addition of a weir which would control the runoff and influx of water as the barge recoiled upward and fell downward. The weir was designed to provide a damping force as well as added mass. The recoil amplitude obtained with this barge was limited to $2 \frac{1}{4}$ inches (3.4 feet, scaled up) and a downward amplitude of $1 \frac{1}{2}$ inches with almost complete damping after one cycle. While it is believed that this recoil amplitude is too severe for a large structure, several devices which are planned for the prototype will reduce the recoil to a controllable quantity:

1. Controlled re-flooding of the chamber will aid in decreasing the degree of movement in counter-recoil.

2. A non-vertical mounting of the generator will reduce the upward thrust by an amount proportional to one minus the cosine of the angle between the generator axis and the vertical.

C. An additional model has been constructed and is being tested. This model features a barge equivalent to a 600-ton-displacement barge in the prototype size, with the generator mounted with its axis 45° from the vertical. The axis of the line of thrust theoretically should pass through the center of

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gravity. However, two additional features must be investigated: (1) the forward movement due to thrust causes the barge to pivot around its bow, tending to force the stern upward and increase the angle between the generator and the vertical; (2) the buoyant force of the chamber, as the water slug is ejected, amounting to approximately 62.5 tons, tends to force the stern further upward. To correct this situation, it is planned to use the forward-forcing component of thrust to cause the bow to plane upward so as to keep the barge on an even keel. The relationship between the axis of thrust, the center of gravity and the forward planing surface will be calculated.

D. Conversations with representatives of the Office of Naval Research indicate that the barge to be used will probably be constructed basically from available pontoons. Design work has been initiated to determine the feasibility of such a construction and possible methods of combining these pontoons into a flotation barge capable of withstanding the heavy impulse loads induced by the firing of the prototype generator. If they prove to be feasible, preliminary plans and calculations will be submitted to the Office of Naval Research.

III. WORK PLANNED FOR NEXT REPORT PERIOD

- A. Design of a suitable flotation barge will be continued.
- B. Model testing will be continued.

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(a) Barge Position Before Firing



(b) Maximum Recoil Up



(c) Maximum Counter Recoil



(d) Maximum Height,
of Oscill.

Typical Recoil Cycle, Model of 300-Ton Barge, with
Vortex Generator Vertical

S E C R E T