AD NUMBER: AD0034351

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 28 May 1954. Other requests shall be referred to Office of Naval Research, Washington, DC 20360.

AUTHORITY

ONR LTR, 26 OCT 1977

Engineering Report No. 8

on

THE EFFECT OF PAINT UPON THE TRANSMISSIBILITY OF A RESILIENT MOUNTING--TESTED WITH IMPROVED APPARATUS

Engineering Report No. 8

on

THE EFFECT OF PAINT UPON THE TRANSMISSIBILITY OF A RESILIENT MOUNTING—TESTED WITH IMPROVED APPARATUS

Contract N7onr-32904
Project NR-264-003

"Resilient Mountings for Reciprocating and Rotating Machinery"

Sponsored by

Department of the Navy
Office of Naval Research

Mechanical Engineering Department
Illinois Institute of Technology
Technology Center
Chicago 16, Illinois

Dated: May 28, 1954

Copy No. 0008

TABLE OF CONTENTS

ACKNOWLEDGMENT

The study "The Effect of Paint upon the Transmissibility of a Resilient Mounting—Tested with Improved Apparatus" was made possible through sponsorship by the Department of the Navy, Undersea Warfare Branch, Office of Naval Research.

This research program was performed under the direction of the undersigned with the assistance of Messrs. O. E. Curth and R. A. Einweck.

Respectfully submitted,

Chester A. Arents

Professor Chester A. Arents
Project Director

I. INTRODUCTION

Background

Machinery units with their resilient mountings are sometimes located where it is easier to paint them than to avoid painting them. Consequently, they receive a coat of paint if precautionary measures are not taken to avoid this practice. The question naturally arises: Does a painted resilient mounting have the same isolation efficiency as an unpainted mounting? This report contains data on a mounting having successive coats of paint, excluding aging.

Scope

Laboratory tests were scheduled to determine the effect of paint on the transmissibility characteristics of a resilient mounting. A Lord 204PH35 mounting was chosen for these tests because its transmissibility had been checked many times [1, 2][1]. The mounting was tested prior to the application of paint, and then after each successive coat of paint.

The paint used in these tests was obtained from the U.S. Naval Reserve Training Center in Chicago, Ill. The paint is identified as follows: Enamel-Internal White Gloss; P-336-N; Mfd NPK NSY; Ports. Va; B-I- 3/53.

The transmissibility tests were made with an improved apparatus, which was developed by IIT personnel. As an aid to other investigations in this field, this improved apparatus is described in this report.

---

[1] Numbers in brackets refer to bibliography

II. PROCEDURE

Transmissibility Tests on a Painted Resilient Mounting

A Lord 204PH35 resilient mounting was chosen for this test and was assembled in the improved test apparatus shown in Fig. 1. It was allowed to drift to its static equilibrium position...a period of approximately 2 weeks. The sequence of transmissibility tests is shown in Table 1.

TABLE I — Sequence of Transmissibility

Chronological Order of Tests in Days	Remarks
1 st	Tested unpainted mounting and then applied first coat of paint.
20 th*	Tested with 1-coat of paint and applied 2-coat.
35 th	Tested with 2-coat of paint and applied 3-coat.
37 th	Tested with 3-coat and applied 4-coat.
47 th	Tested with 4-coat and applied 5-coat.
52 nd	Tested with 5-coat.

*Paint was not completely dry on rubber portion of the mounting. Subsequent tests were run with dry paint.

Two Massa Model 117 accelerometers were used to obtain the mounting's transmissibility characteristics. One was used to indicate the motion of the driven side of the mounting, and the other was used to

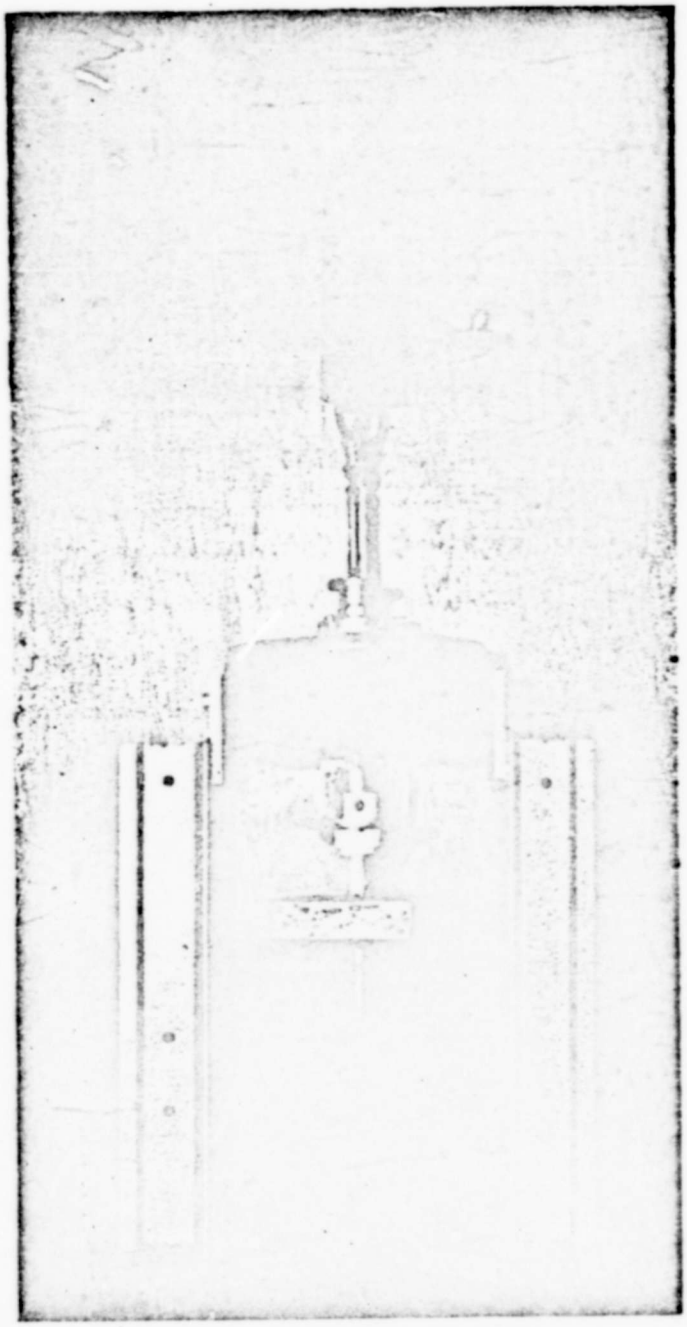

Figure 1

Photograph of Improved Testing Apparatus

indicate the motion of the mass which was the load for the mounting. It has been shown that the ratio of the two accelerometer readings is the transmissibility of an isolator with a rigid support [1, 2, 3]. The difference in the two readings expressed in decibels is the transmissibility in db. Readings were taken with Ballatine Model 300 voltmeters equipped, when neccessary, with Ballatine Model 220A decade amplifiers. The simusoidal wave form was checked by means of a Lissajous figure on a cathode ray oscilloscope.

Improved Apparatus for Transmissibility Tests

Since Engineering Reports 2, 3, and 4 were issued, [1, 2, 4] a new suspension system was developed for testing resilient mountings. This improved method of testing mountings is presented here to aid other investigators in simplifying their test apparatus. The present apparatus is shown in Figs. 1 and 2.

Unlike the previous method of testing isolators [1, 2] the new method eliminates most of the superstructure above the electromagnetic drive, including the guy wires and three of the four suspension springs, by hanging the isolator with its rated load below the electromagnetic driver, however, the instrumentation is the same as the previous method. This gives a stable system, which permits one to abandon the use of guy wires. A single spring holds the apparatus in the static equilibrium position and adjustments are easily made. This single supporting spring can easily be changed without disturbing the resilient mounting and its mass. The ease of changing springs is a considerable advantage, because spring resonances sometimes cause disturbances at certain frequencies, which eliminates taking data at these points in the frequency spectrum.

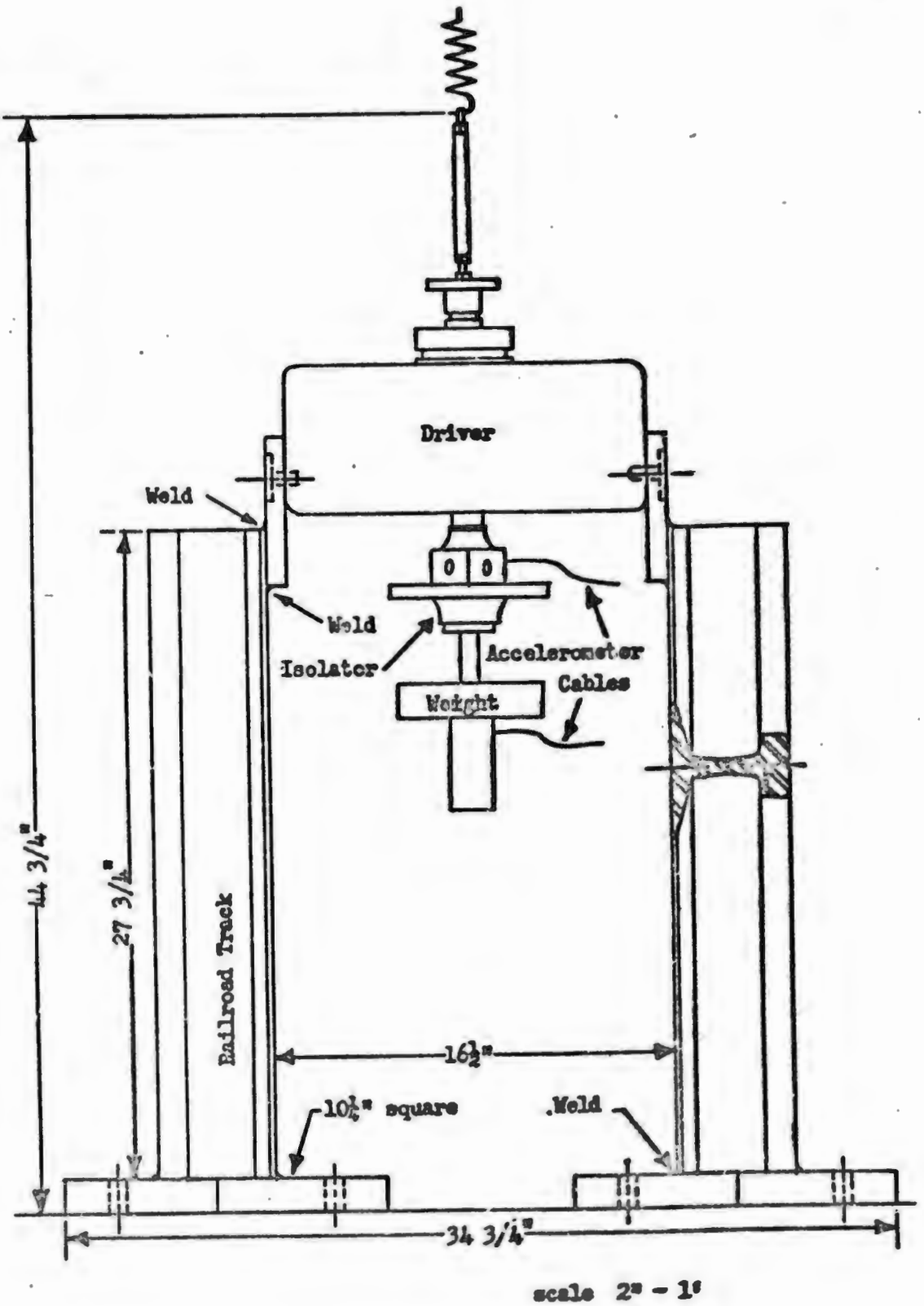

Fig. 2. Improved Transmissibility Testing Apparatus

If a spring is substituted having a different spring constant and dimensions, the resonances or disturbances are shifted in frequency, making it possible to obtain data.

When hanging the mass from the isolator as shown in Fig. 1, it is noted that the isolator actually has a tensile load rather than the common compression load. Many isolators are symetrical and either type of loading will give the same results. If a resilient mounting has been designed specifically for compression-type loads, one can make an adapter to load the mounting in compression as originally intended by the manufacturer.

III. DISCUSSION OF TESTS RESULTS

Each of the first four coats of paint stiffened the mount slightly and shifted the resonance point to a slightly higher frequency, see Figs. 3 and 4. This reduced the mounting's effectiveness up to the first wave resonance, since an increase in the resonant frequency decreases the attenuation for any given frequency where attenuation occurs. This increase in the mounting's transmissibility occurs in the low frequency range, where every effort should be made to maintain as low a transmissibility as possible. Therefore, painting a resilient mounting has an undesirable effect.

The data taken for the fifth coat of paint was found to lie between that taken for 3 and 4 coats of paint. Examination of the unit revealed a crack in the coating of paint on the mounting at the point of maximum strain. This partially nullified the effect of the paint. At this point further testing ceased.

It had been planned to remove the mounting from the apparatus, keeping it under load, and allowing it to dry thoroughly, before performing a final test, which would show the effect of aged or hardened paint. This could not be done however, as the paint had peeled away from the rubber at the crack.

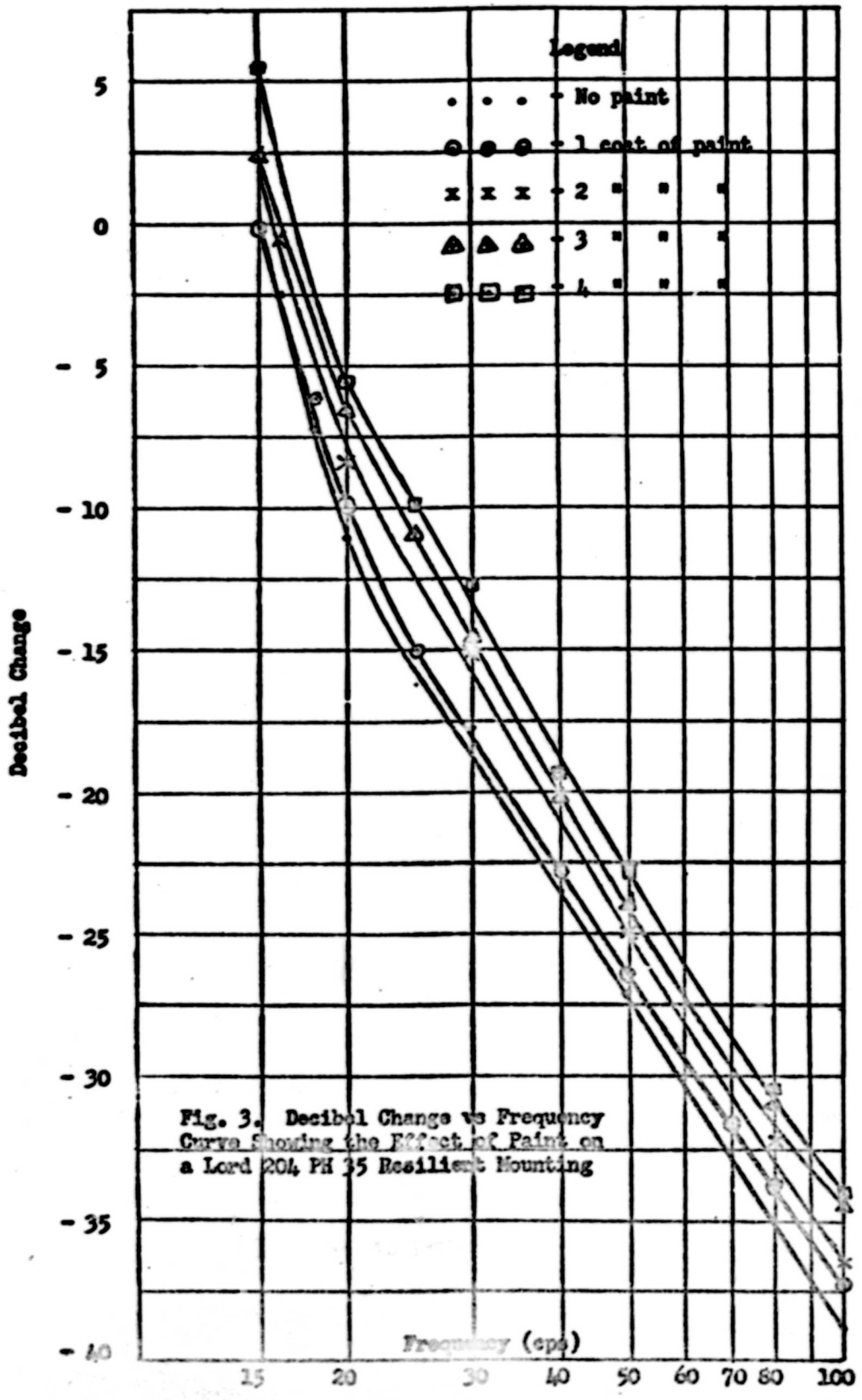

Fig. 3. Decibel Change vs Frequency Curve Showing the Effect of Paint on a Lord 204 PH 35 Resilient Mounting

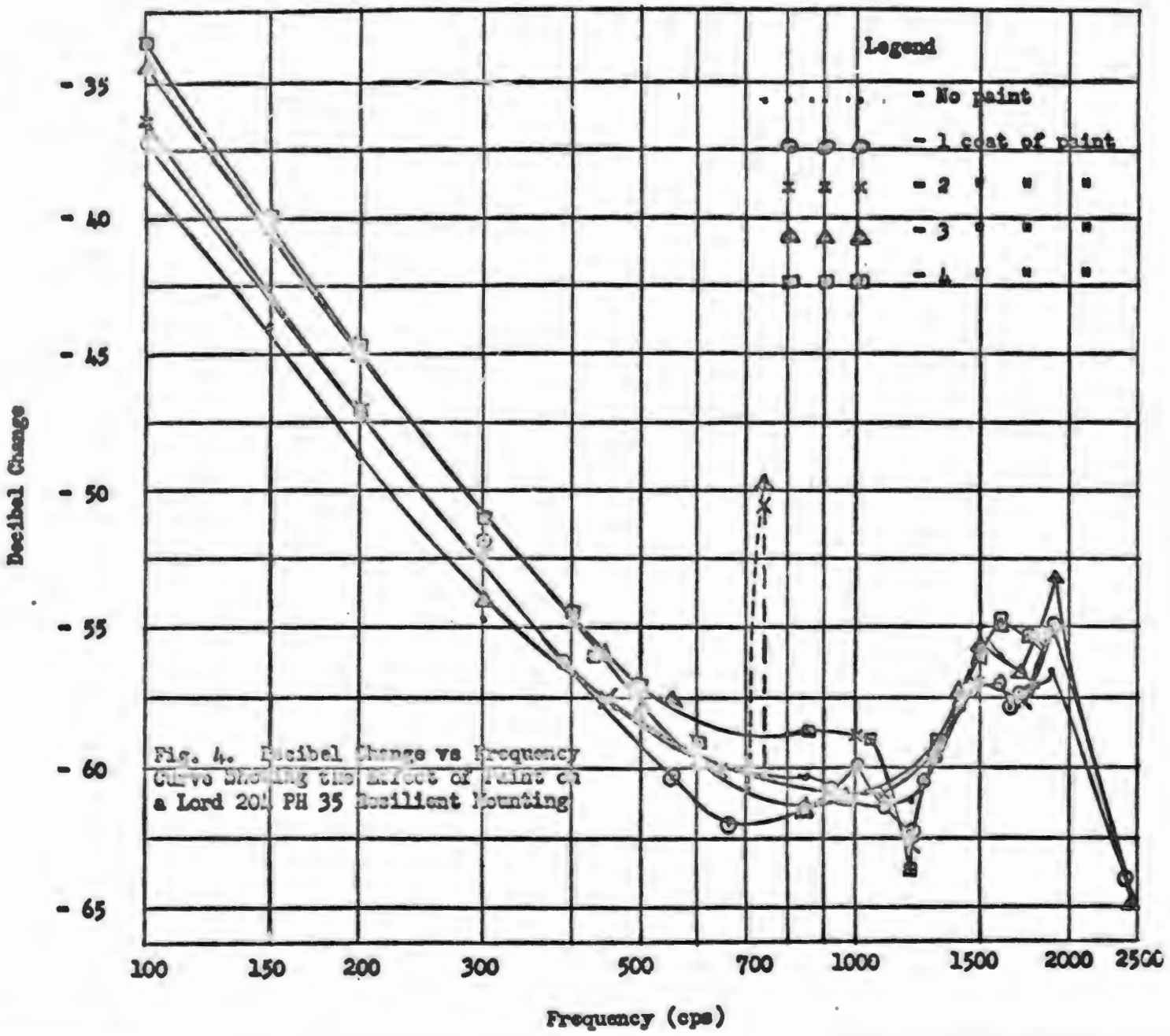

Fig. 4. Decibel Change vs Frequency Curve Showing the Effect of Paint on a Lord 201 PH 35 Resilient Mounting

IV. CONCLUSIONS

1. The data taken after each coat of paint had dried indicates an increase in transmissibility of about 1 db for each coat applied. This increase, which may be attributed to an increase in stiffness, occured between the vibration resonance and the frequency at which wave resonances occur. In other words, the paint effectively shifted the entire curve to the right and increased the transmissibility, which allows a greater portion of the disturbing force to reach the foundation.

2. The results given here are, of course, valid only for the type and size mounting tested. The effect of paint on a mounting rated at several hundred pounds might prove less objectionable, but time did not permit this datum to be taken. However, we may conclude that the effect of painting a mounting is to add to the stiffness of the mounting and increase its transmissibility. This effect is undesirable, and painting of resilient mountings should be avoided.

3. The improved method, outlined in this report, for testing resilient mountings to determine their transmission characteristics allows one to make these tests in a fraction of the time previously taken.

BIBLIOGRAPHY

[1] "Resilient Mountings for Reciprocating and Rotating Machinery." Engineering Report No. 2, Illinois Institute of Technology, ONR Contract N7onr-32904, June 1950.

[2] "Resilient Mountings for Reciprocating and Rotating Machinery." Engineering Report No. 3, Illinois Institute of Technology, ONR Contract N7onr-32904, July 1951.

[3] Harrison, M. A. Sykes and M. Martin. "Wave Effects in Isolation Mounts," David Taylor Model Basin Report 766, August 1952.

[4] "Resilient Mountings for Reciprocating and Rotating Machinery." Engineering Report No. 4, Illinois Institute of Technology, ONR Contract N7onr-32904, August 1953.

DISTRIBUTION LIST

Office of Naval Research
Washington 25, D.C.
Attention: Code 466 (5)

Armed Services Technical Information Agency
Documents Service Center
Knott Building
Dayton 2, Ohio (5)

Office of Technical Services
Department of Commerce
Washington 25, D.C. (1)

Director, Naval Research Laboratory
Technical Information Officer
Washington, D.C.
(Further distribution to be made by NRL
Code 2000 to B.J.S.M. and Canadian Joint Staff) (6)

Chief, Bureau of Ships
Department of the Navy
Washington 25, D.C.
Attention: Code 300 (1)
Code 344 (1)
Code 362 (1)
Code 371 (1)
Code 430 (1)
Code 490 (1)
Code 503b (1)
Code 515 (1)

Commander
Mare Island Naval Shipyard
Vallejo, California (1)

Commander
Materials Lab., New York
Naval Shipyard, Naval Base
Brooklyn 1, New York (1)

Commander
Design Division, Philadelphia
Naval Shipyard, Naval Base
Philadelphia, Pennsylvania (1)

Commander
Boiler and Turbine Laboratory
Philadelphia Naval Shipyard
Naval Base
Philadelphia, Pennsylvania (1)

Commander
Boston Naval Shipyard
Boston 28, Massachusetts (1)

Commander
Charleston Naval Shipyard
Naval Base
Charleston, South Carolina (1)

Commander
Portsmouth Naval Shipyard
Portsmouth, New Hampshire (1)

Commander
Pearl Harbor Naval Shipyard
Navy No. 128 Fleet Post Office
San Francisco, California (1)

Commander
Puget Sound Naval Shipyard
Bremerton, Washington (1)

Commander
New York Naval Shipyard
Naval Base
Brooklyn 1, New York (1)

Commander
Long Beach Naval Shipyard
Long Beach, California (1)

Commander
Norfolk Naval Shipyard
Portsmouth, Virginia (1)

Commander
San Francisco Naval Shipyard
San Francisco, California (1)

Commander
Mare Island Naval Shipyard
(Rubber Laboratory)
Vallejo, California (1)

Commanding Officer
U.S. Naval Submarine Base
Navy No. 128 Fleet Post Office
San Francisco, California (1)

Commanding Officer
U.S. Naval Submarine Base
New London, Connecticut (1)

Commanding Officer
U.S. Naval Ordnance Laboratory
White Oak Maryland
Attention: Mr. B. Snavely (1)

Commanding Officer and Director
U.S. Navy Underwater Sound Lab.
Fort Trumbull
New London, Connecticut (1)

Director
David Taylor Model Basin
Washington 7, D.C. (1)

Director
U.S. Navy Engineering Experiment Station
Annapolis, Maryland (1)

Director
U.S. Navy Electronics Lab.
San Diego, California (1)

Chief, Bureau of Ordnance Re6
Department of the Navy
Washington 25, D.C. (1)

U.S. Department of Commerce
National Bureau of Standards
Van Ness Street and Conn. Avenue
Washington, D.C. (1)

Supervisor of Shipbuilding USN and
Naval Inspector of Ordnance
Electric Boat Company
Groton, Connecticut (1)

Office of Naval Research Branch Office
150 Causeway Street
Boston, Massachusetts (1)

Office of Naval Research Branch Office
Tenth Floor
The John Crerar Library Building
86 East Randolph Street (1)
Chicago 1, Illinois

Office of Naval Research Branch Office
346 Broadway (1)
New York 13, New York

Office of Naval Research Branch Office
1030 E. Green Street (1)
Pasadena 1, California

Office of Naval Research Branch Office
1000 Geary Street (1)
San Francisco 9, California

Officer-in-Charge
Office of Naval Research
Navy No. 100
Fleet Post Office (2)
New York, New York

University of Michigan
Engineering Research Institute
Ann Arbor, Michigan (1)
Attention: Mr. R. N. Hamme

General Electric Company
General Engineering and Consulting Lab.
Schenectady, New York
Attention: Dr. R. Fehr
Via: NavInspect of Ord,
G. E. Company (1)
Schenectady, N.Y.

Commander
Submarine Development Group Two
Box 70 U.S. Naval Submarine Base
New London, Connecticut (1)
Attention: LCDR. O. B. Nelson, USN