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NEAR FIELD SOUND PRESSURE MEASUREMENTS OF A VIBRATED SONAR TRAN--ETC(U)
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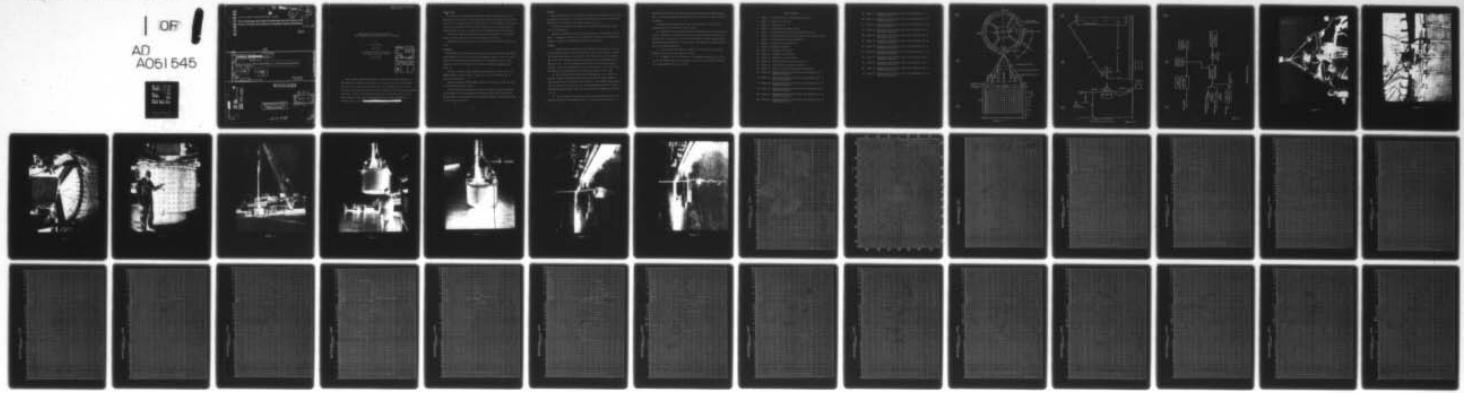
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This is a working paper giving tentative information about some work in progress at NEL.

If cited in the literature the information is to be identified as tentative and unpublished.

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TR-208 - AN/SQS-23.

11 Jul 1966

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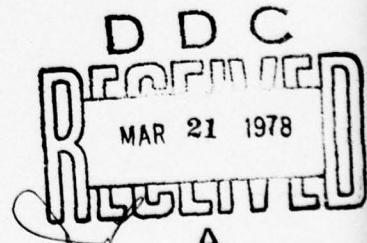
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NEAR FIELD SOUND PRESSURE MEASUREMENTS
OF A VIBRATED SONAR TRANSDUCER TR-208 - AN/SQS-23

by

G. M. Coleman

Code 3130

U. S. Navy Electronics Laboratory
San Diego, California 92152

11 July 1966

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This technical memorandum represents a portion of the work being done on NEL Problem J714, AN/SQS-23 Performance and Integration Retrofit Program (PAIR). It should not be construed as a formal report as its primary intent is to present some of the problems confronting project personnel and some of the preliminary conclusions. While it was originally published in a different form, it is now being included in the technical memorandum series for sake of documentation uniformity and control. [REDACTED]

INTRODUCTION

As a part of the AN/SQS-23 Modernization Program, NEL Problem J714, and particularly that portion of the program directed to the description of possible sonar self noise problem areas the work reported in this memorandum is an effort to point out one aspect of the Self Noise Picture; that is, locally produced noise pressures caused by the vibration of the AN/SQS-23 transducer assembly.

Testing was conducted by personnel of the Electrodynamics Division, Code 3130, 9-11 March 1966, at the U. S. Naval Station, San Diego.

Handling of the array during the test period was by the Naval Station Crane Crew.

PROCEDURE

The method of testing consisted of measuring local water borne (near field) sound pressures at ten (10) discrete probe hydrophone positions about the periphery of the Sonar Transducer TR-208/SQS-23, (the transducer) while it was vibrated in each of two directions by vibration generators (shakers), (see Figure 1).

As shown in Figure 2, the transducer was suspended in water so that the shaker assembly was above water. Suspension of the entire assembly was by means of a truck crane. *Also*

Figures 4 through 12 described the sequence of assembly and final positioning of the transducer for testing.

For convenience and rapid data acquisition outputs of the pre-calibrated accelerometers and Probe Hydrophones were analyzed and recorded sequentially as the shakers were vibrated with a sweep control frequency ranging from 50 cps to 5,000 cps, (see Figure 3).

RESULTS

For the two directions of vibration measurements were made of the near field sound pressure levels at the ten (10) probe hydrophone positions as well as the transducer's acceleration at two mounting flange positions.

The resulting data have been reduced to normalized sound pressure levels for one G acceleration.

Figures 14 through 22 are for vertical excitation of the transducer by the shaker. Figures 23 through 31 are for horizontal excitation of the transducer. Figures 13 through 15 are graphical summaries of the results.

COMMENTS

1. For the vertical excitation of the transducer there appears to be two general frequency bands of distinct character, the first up to about 1 KC where the average sound pressure level decrease with frequency at a rate of approximately 12 db per decade and having an average excursion of approximately plus and minus 8 db. The second frequency band is above 1 KC having an apparent increase in level with frequency of about 8 db per decade. In the second band the excursion of level decreases with frequency to about 10 db at 5 KC.

2. For the horizontal excitation case there appears to be a number of specific frequency bands where the average sound pressure levels suggests a multi-resonance and anti-resonance characteristic. The maximum average response level is about 80 db at about 375 cps, with an approximate excursion of 20 db. The minimum average response level is about 46 db with an approximate excursion of 7 db.

3. For the horizontal excitation case the mean sound pressure levels are fairly uniform about the periphery except in the direction of excitation. In

the bearing of 000 levels are significantly down throughout the sample frequency bands. In the bearing of 180 the mean levels are up for three of the five bands considered.

The polar plots slightly suggest that as the frequency of vibration is increased there is an increase in lobe structure.

4. Considering the vertical plan profile of generated sound pressure levels, when the transducer is vibrated horizontally the mean levels are minimum in the mid section of the transducer, for all consider frequency bands, suggesting that rocking modes are generated. At the upper and lower regions the levels are down only in the higher frequencies.

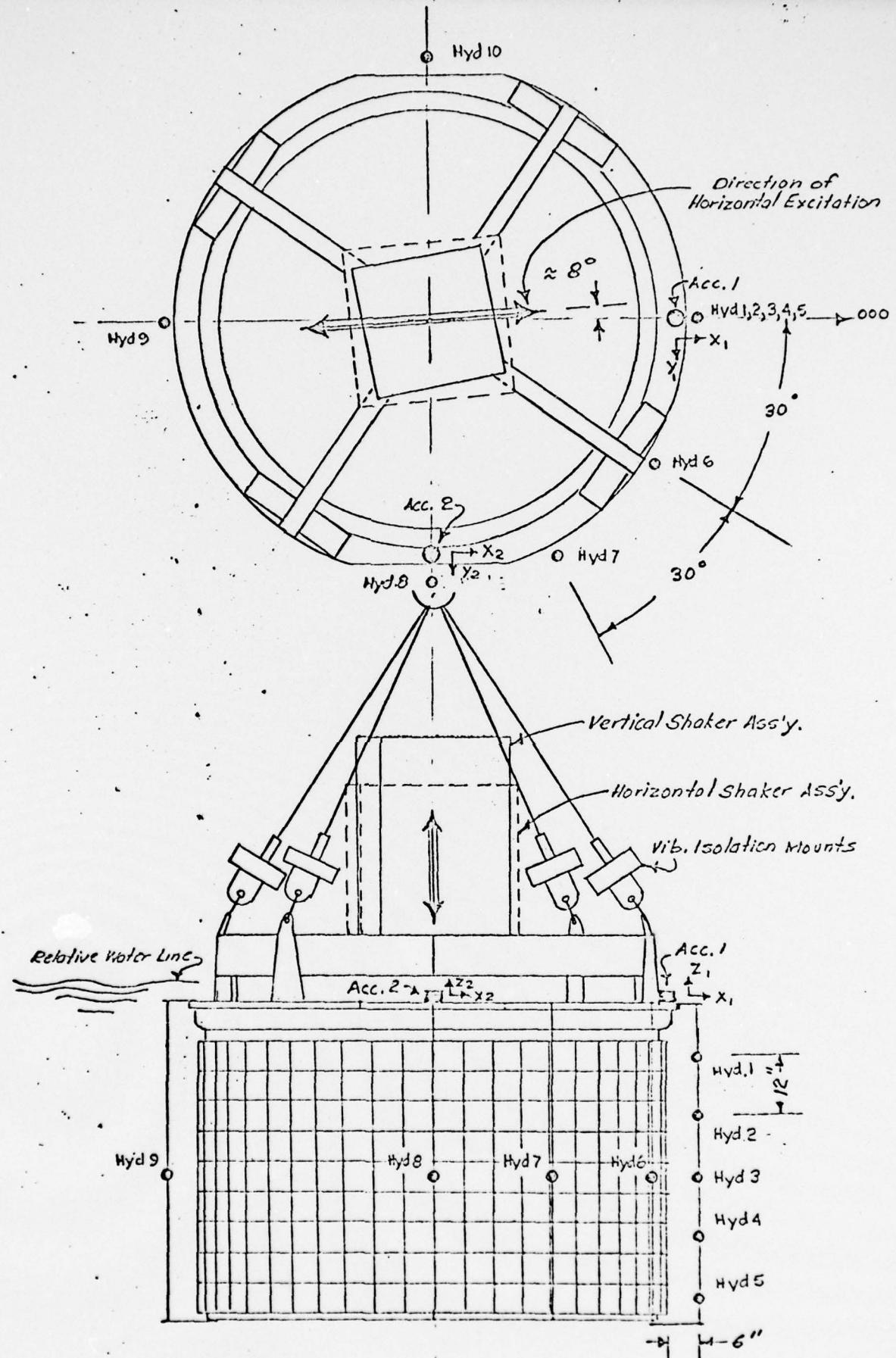
5. In the case of the vertical excitation the sound pressure fields were generally uniform about the transducer surface.

6. It appears that if the transducer is randomly accelerated at a level of one "G" the average near field sound pressure level six inches from the surface will be approximately 60 db re one μ bar.

LIST OF FIGURES

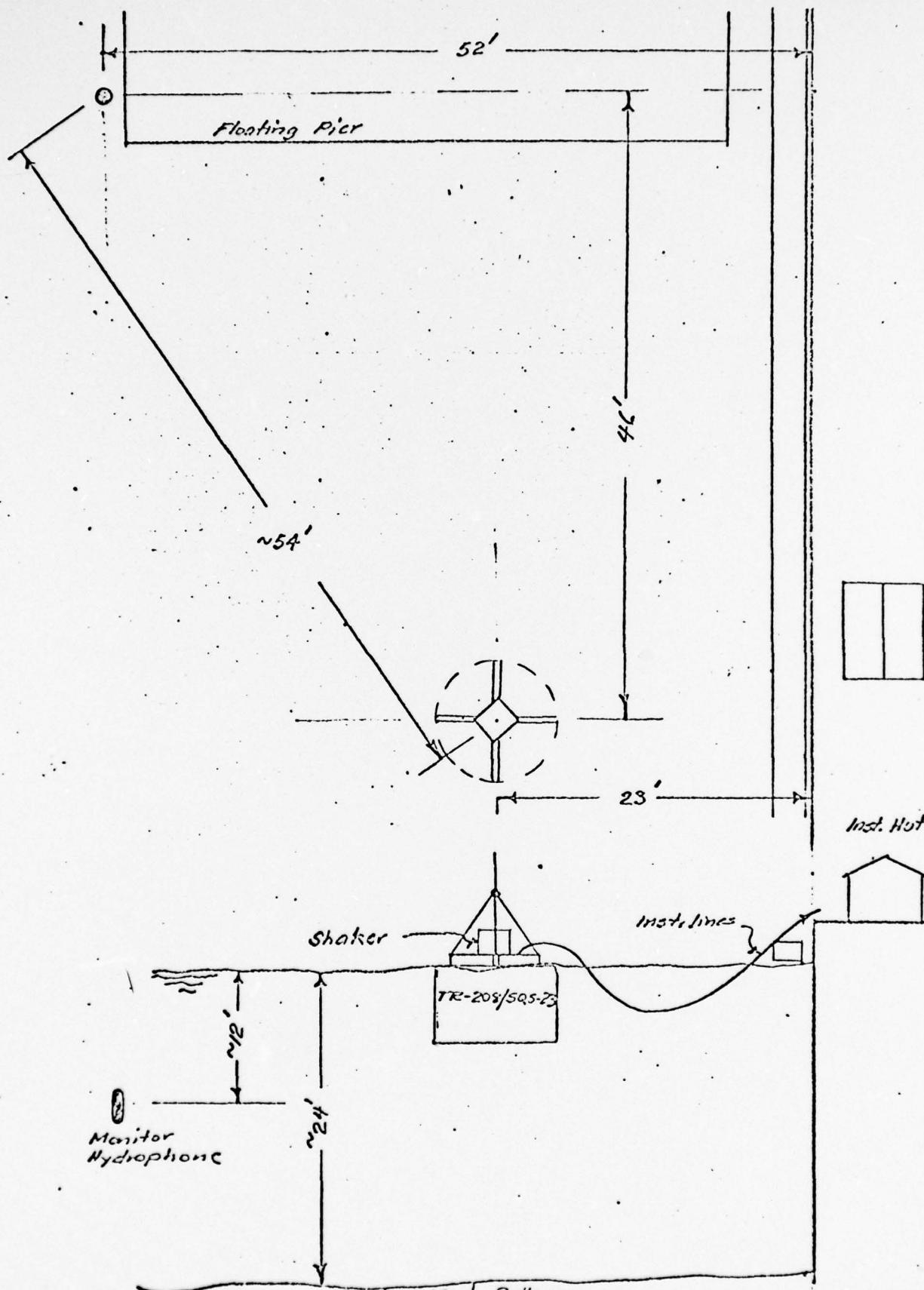
1. Figure 1 - Instrumentation on TR-203/SQS-23 Transducer
2. Figure 2 - Geometry of Test Site
3. Figure 3 - Instrumentation
4. Figure 4 - Installation of Shaker Assembly
5. Figure 5 - Accelerometer Housing and Probe Hydrophone Mount
6. Figure 6 - Attached Shaker Assembly and Support Cable Isolation Mounts
7. Figure 7 - Vertical String of Probe Hydrophones
8. Figure 8 - Lifting Crane and Transducer
9. Figure 9 - Transducer Suspended
10. Figure 10 - Transducer over Water
11. Figure 11 - Transducer Being Lowered
12. Figure 12 - Transducer in Test Position
13. Figure 13 - Average Normalized Sound Pressure Level
14. Figure 14 - Polar Profile, Horizontal Excitation
15. Figure 15 - Vertical Plane Profile, Horizontal Excitation
16. Figure 16 - Normalized Sound Pressure Level, Probe Hydrophone No. 1, Vertical Excitation
17. Figure 17 - Normalized Sound Pressure Level, Probe Hydrophone No. 2, Vertical Excitation
18. Figure 18 - Normalized Sound Pressure Level, Probe Hydrophone No. 3, Vertical Excitation
19. Figure 19 - Normalized Sound Pressure Level, Probe Hydrophone No. 4, Vertical Excitation
20. Figure 20 - Normalized Sound Pressure Level, Probe Hydrophone No. 5, Vertical Excitation
21. Figure 21 - Normalized Sound Pressure Level, Probe Hydrophone No. 6, Vertical Excitation

22. Figure 22 - Normalized Sound Pressure Level, Probe Hydrophone No. 7,
Vertical Excitation
23. Figure 23 - Normalized Sound Pressure Level, Probe Hydrophone No. 9,
Vertical Excitation
24. Figure 24 - Normalized Sound Pressure Level, Probe Hydrophone No. 10,
Vertical Excitation
25. Figure 25 - Normalized Sound Pressure Level, Probe Hydrophone No. 1,
Horizontal Excitation
26. Figure 26 - Normalized Sound Pressure Level, Probe Hydrophone No. 2,
Horizontal Excitation
27. Figure 27 - Normalized Sound Pressure Level, Probe Hydrophone No. 3,
Horizontal Excitation
28. Figure 28 - Normalized Sound Pressure Level, Probe Hydrophone No. 4,
Horizontal Excitation
29. Figure 29 - Normalized Sound Pressure Level, Probe Hydrophone No. 5,
Horizontal Excitation
30. Figure 30 - Normalized Sound Pressure Level, Probe Hydrophone No. 6,
Horizontal Excitation
31. Figure 31 - Normalized Sound Pressure Level, Probe Hydrophone No. 7,
Horizontal Excitation
32. Figure 32 - Normalized Sound Pressure Level, Probe Hydrophone No. 9,
Horizontal Excitation
33. Figure 33 - Normalized Sound Pressure Level, Probe Hydrophone No. 10,
Horizontal Excitation



INSTRUMENTATION ON TR-208/SQS-23 TRANSDUCER

Figure 1



GEOMETRY OF TEST SITE

Figure 2

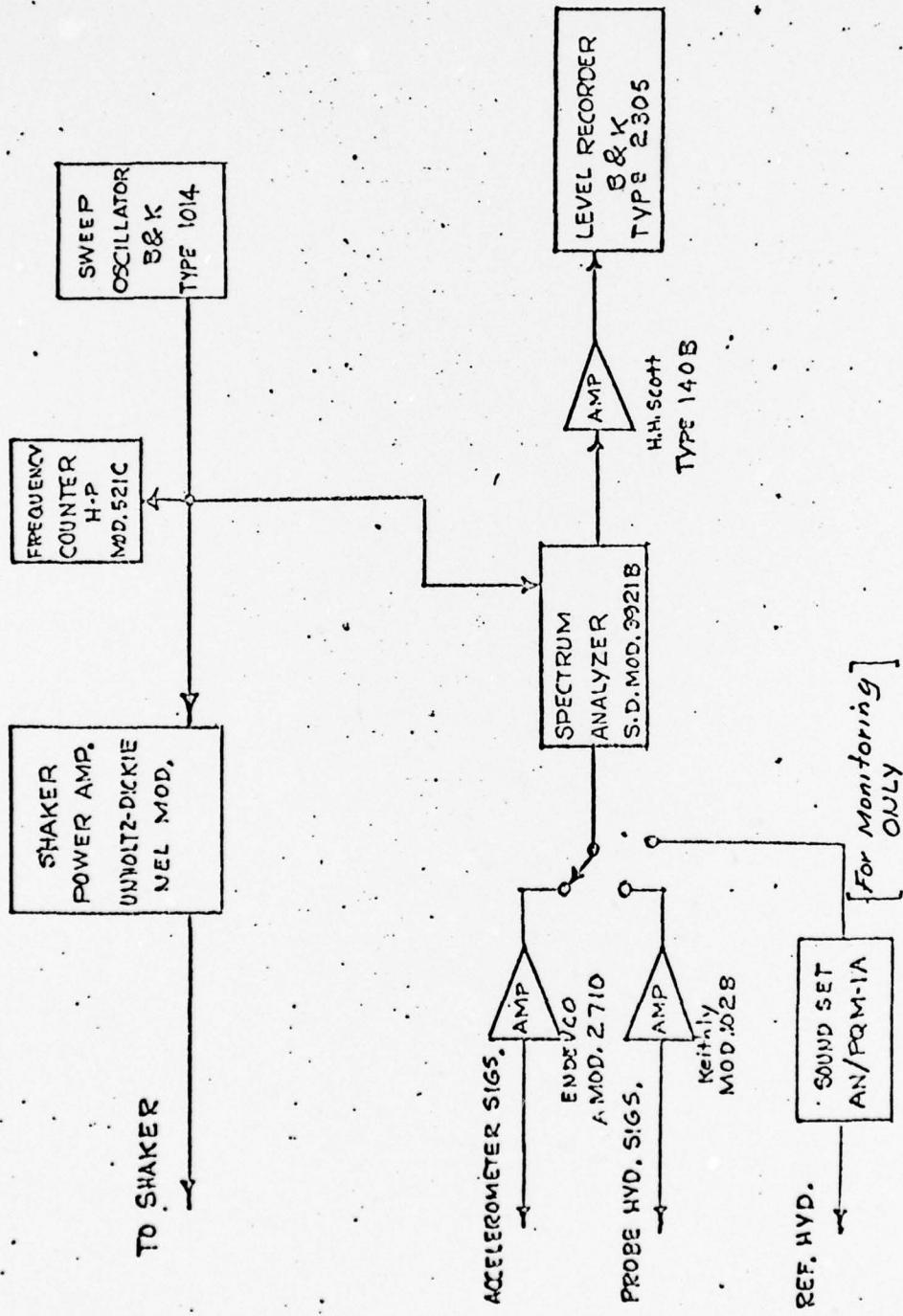


Figure 3

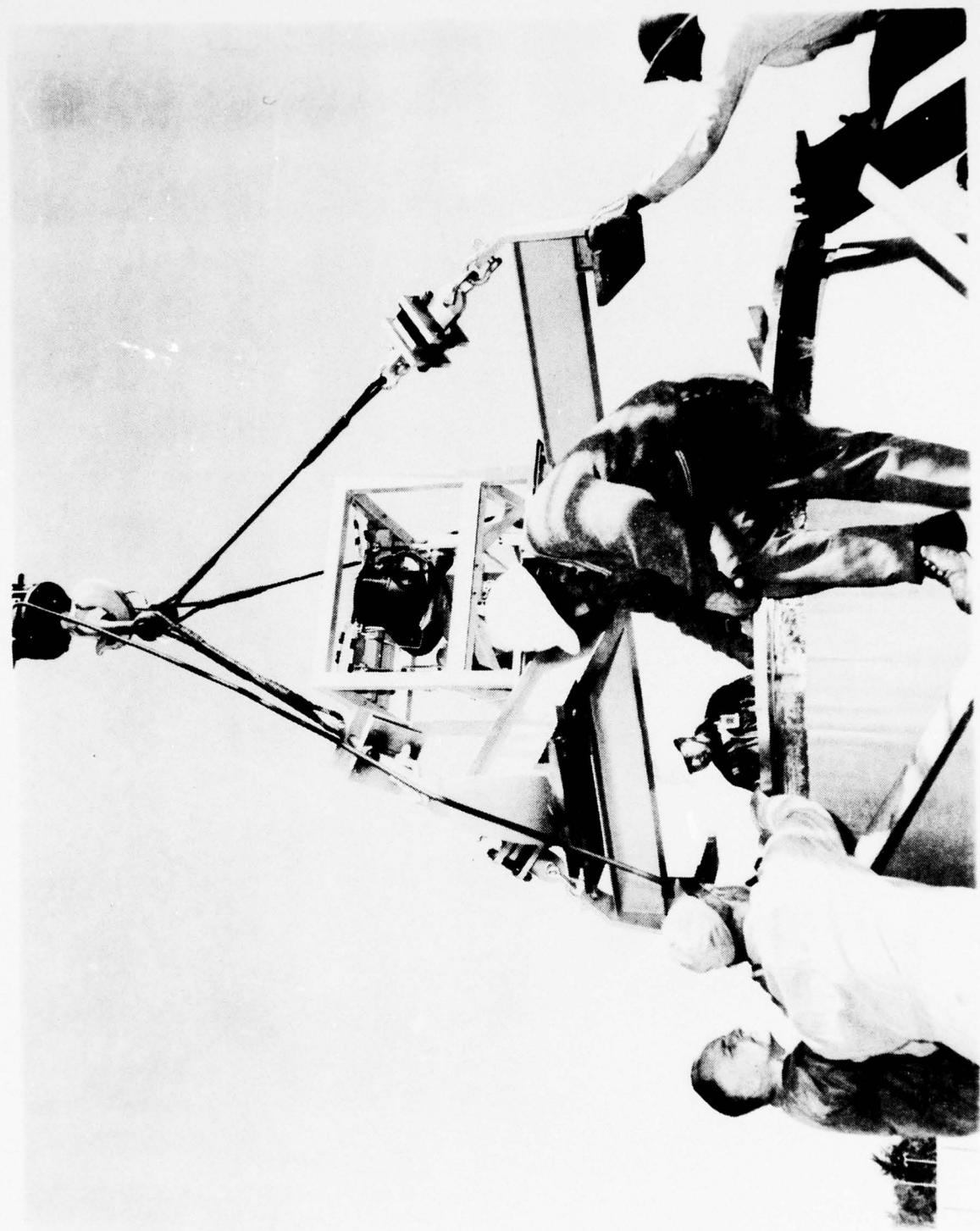


Figure 4

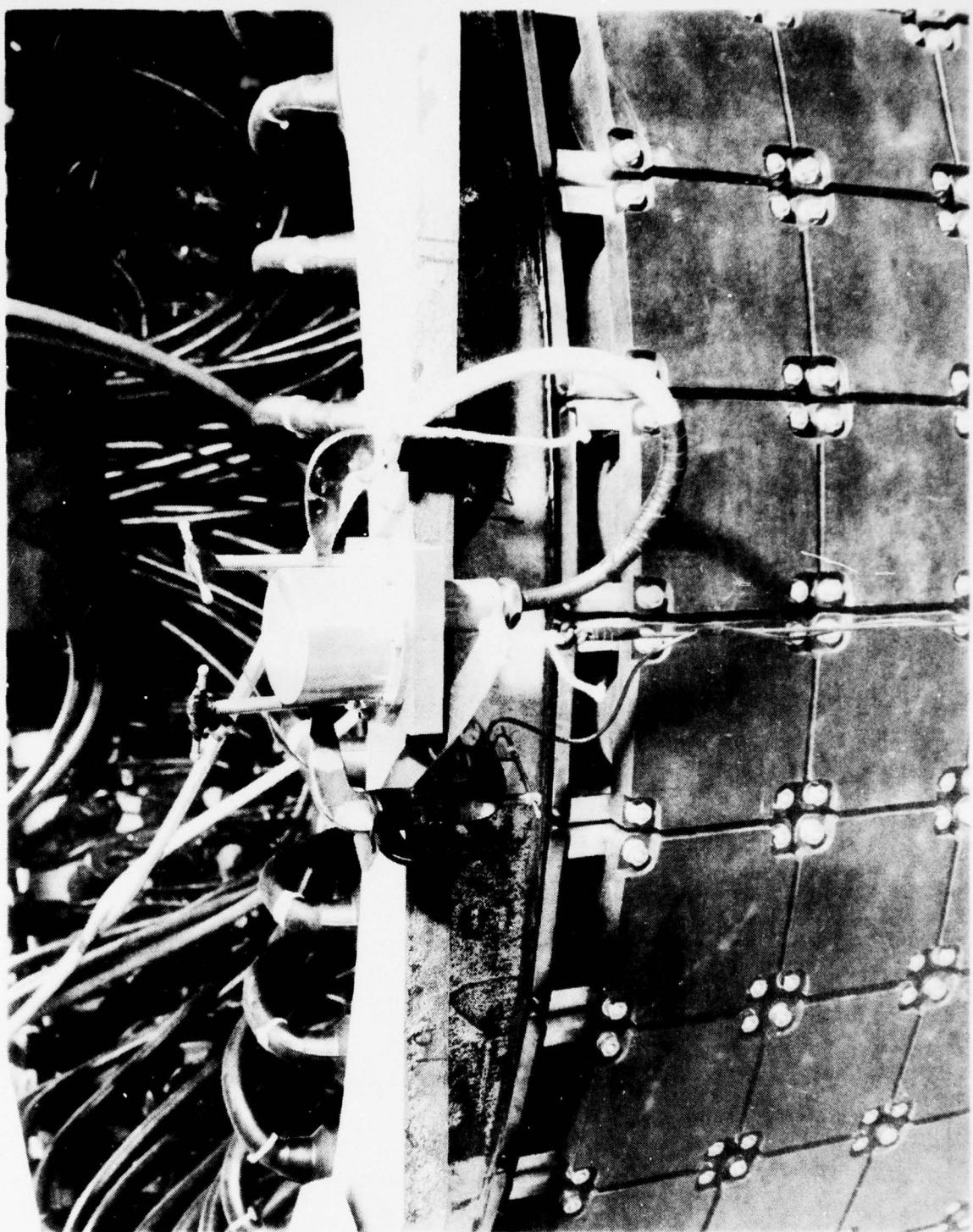


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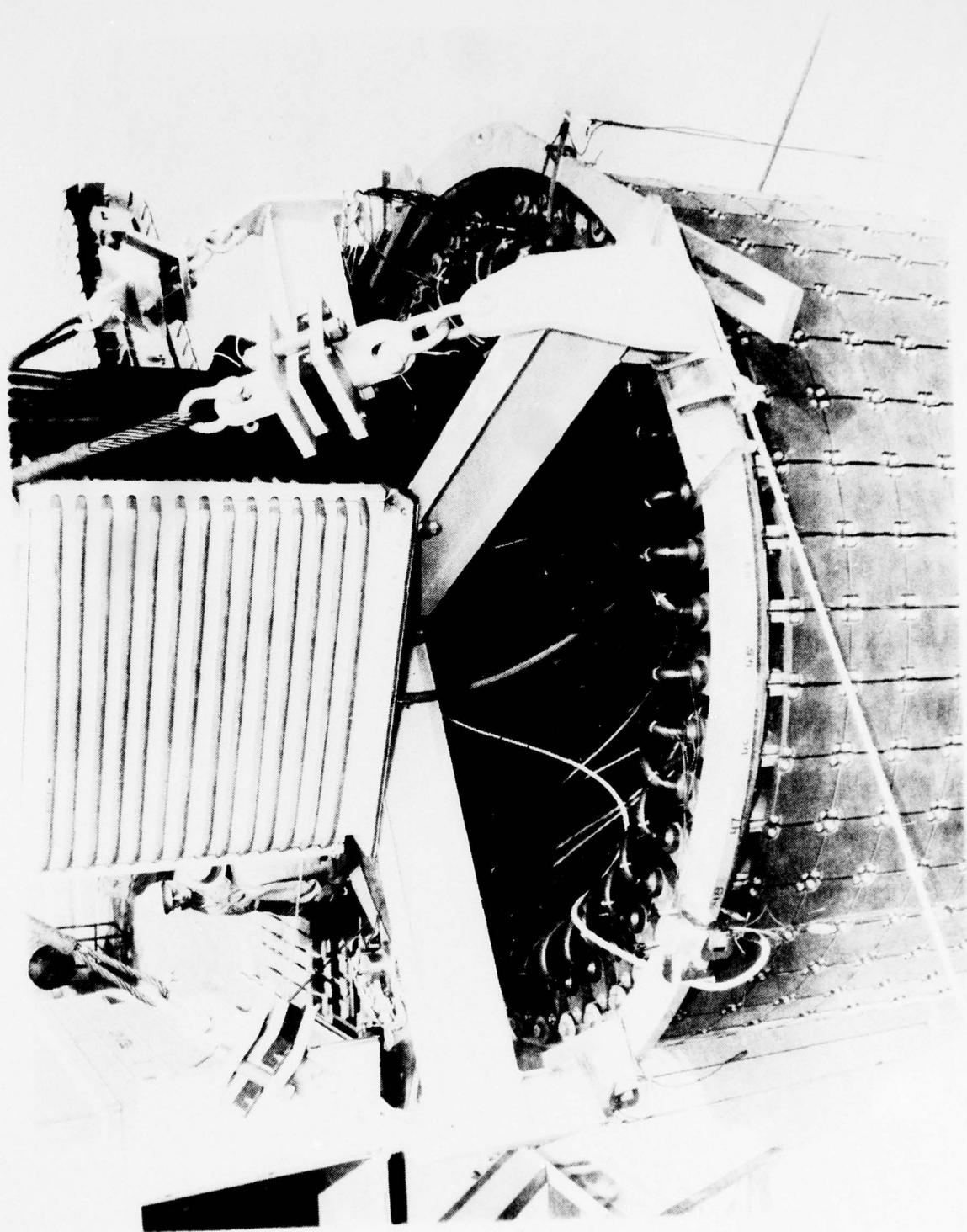


Figure 6

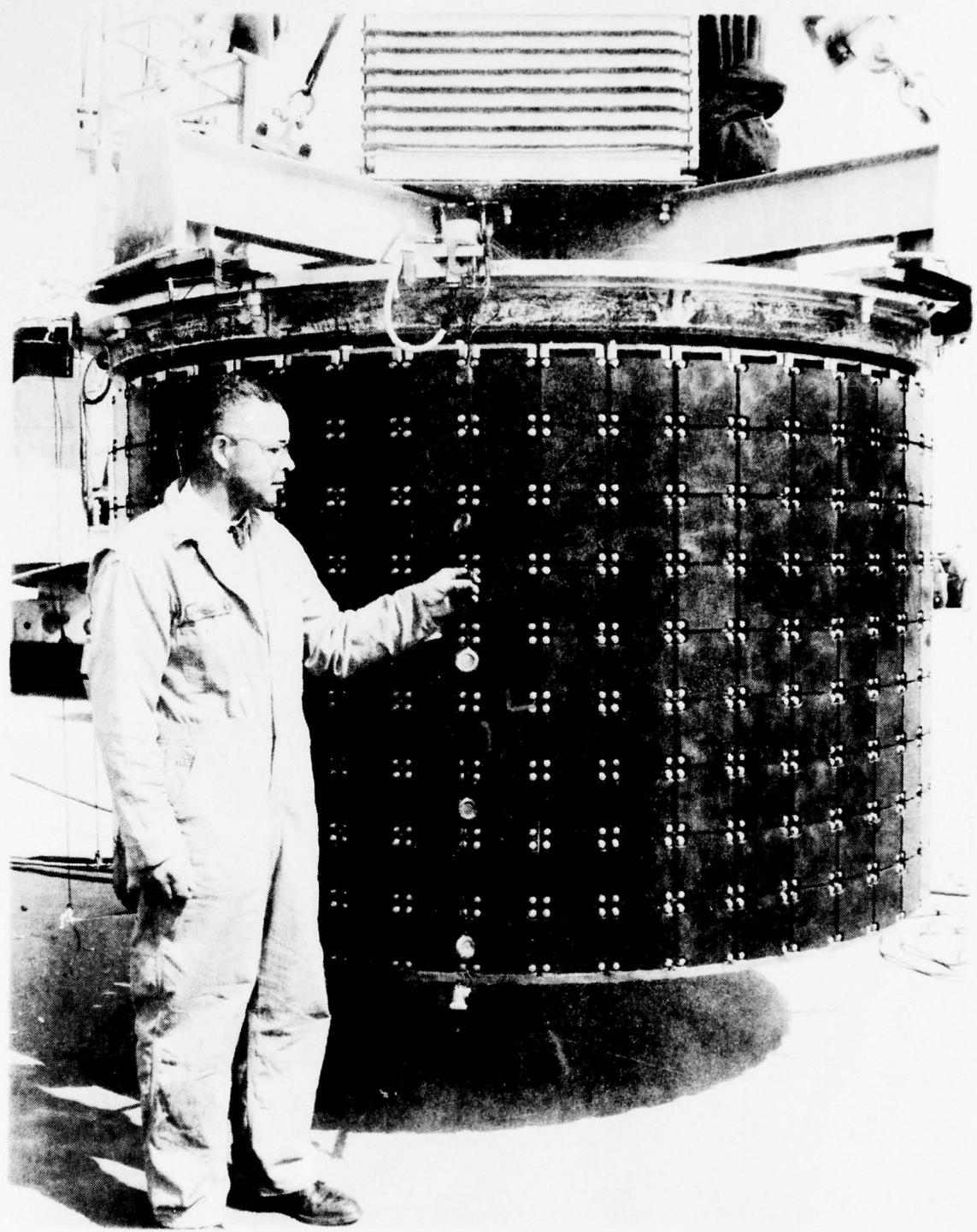


Figure 7

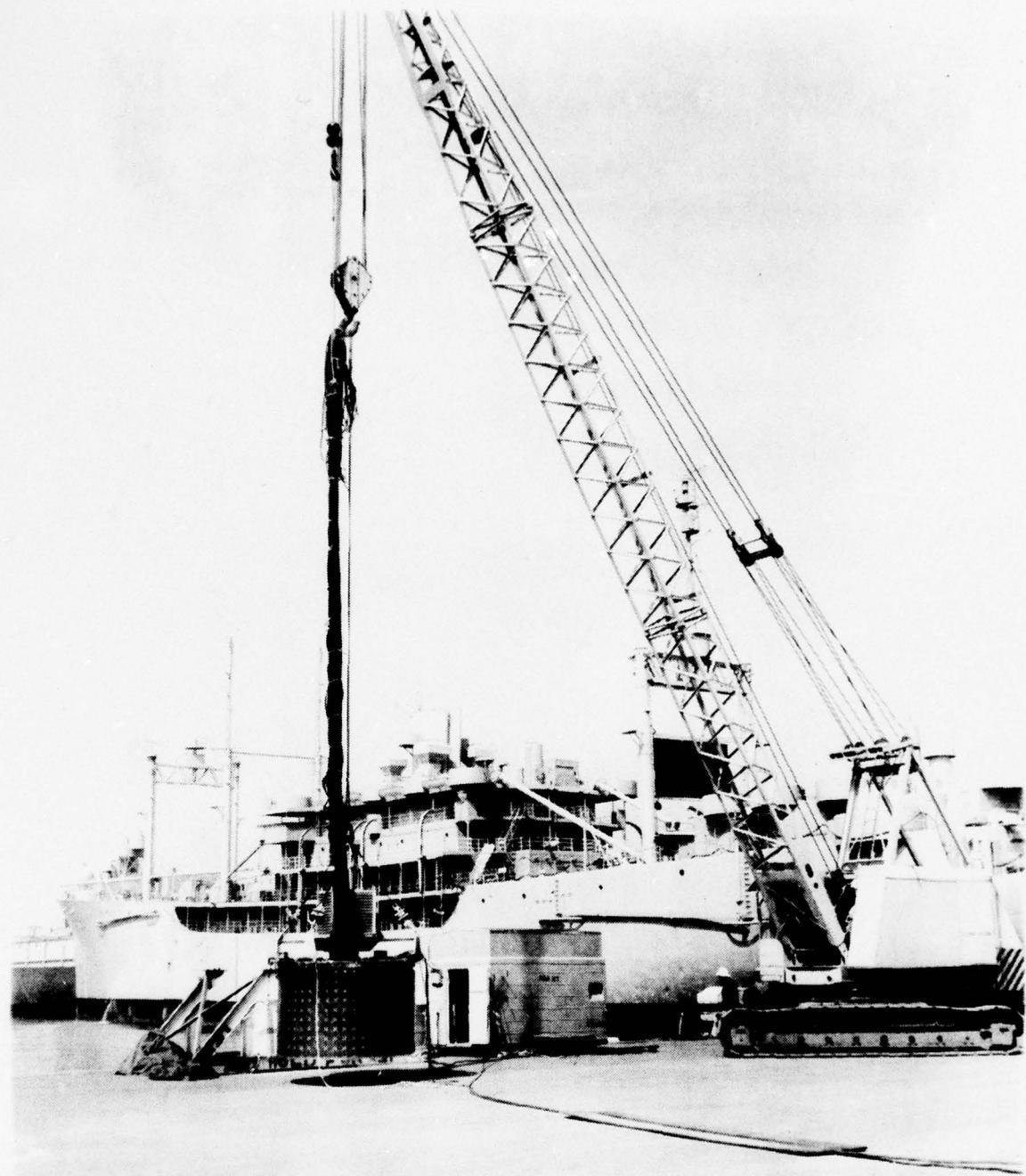


Figure 8



Figure 9

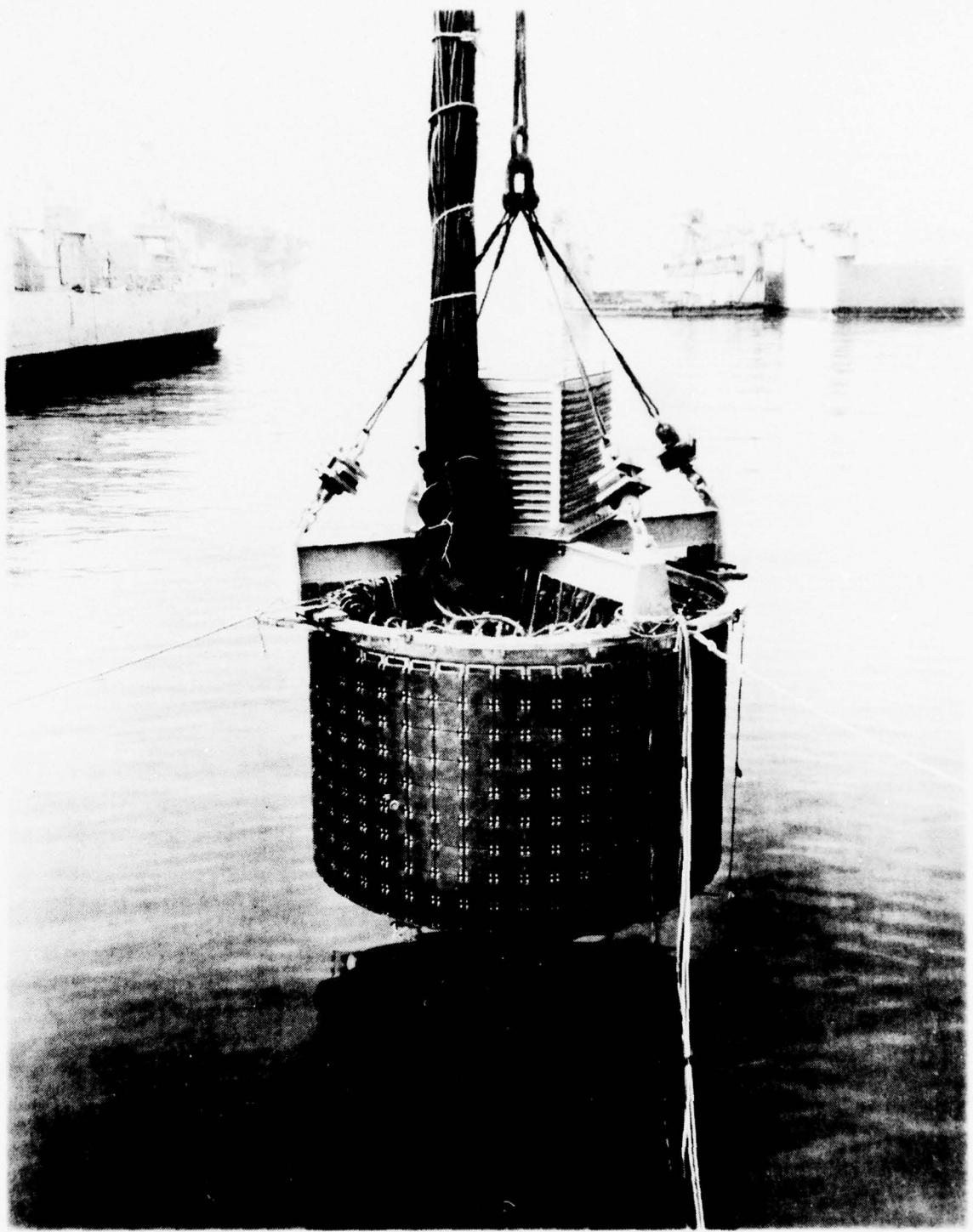


Figure 10

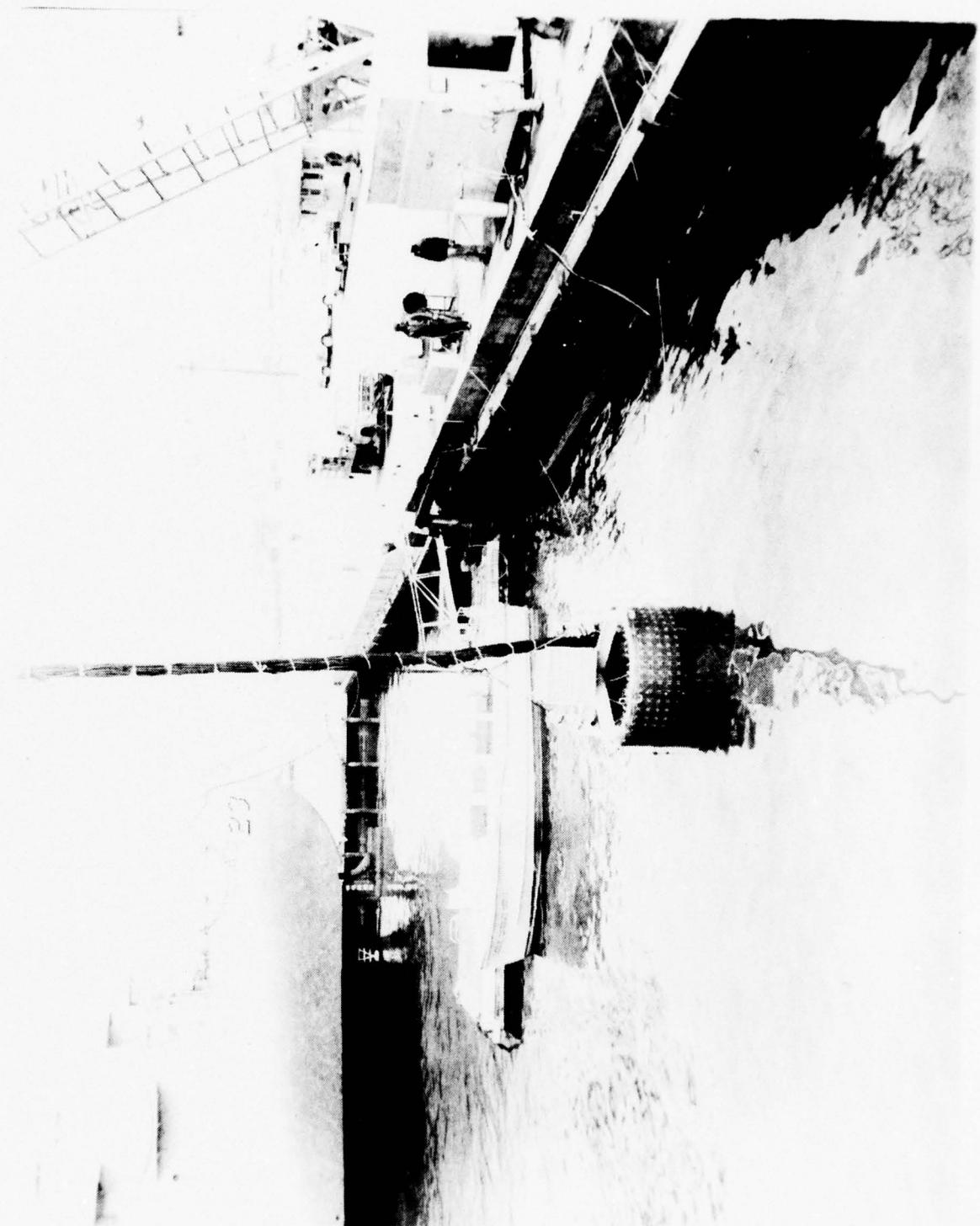


Figure 11

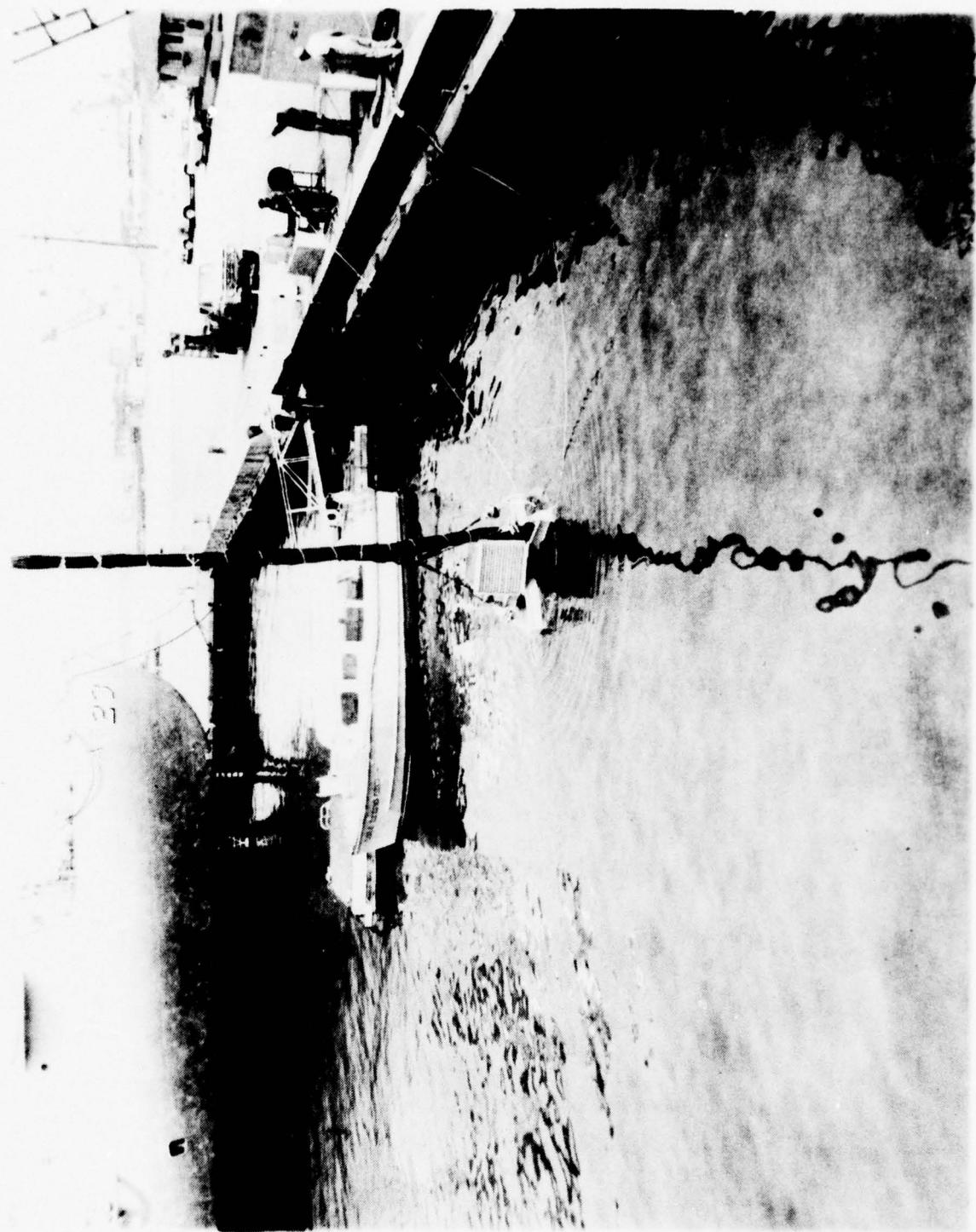


Figure 12

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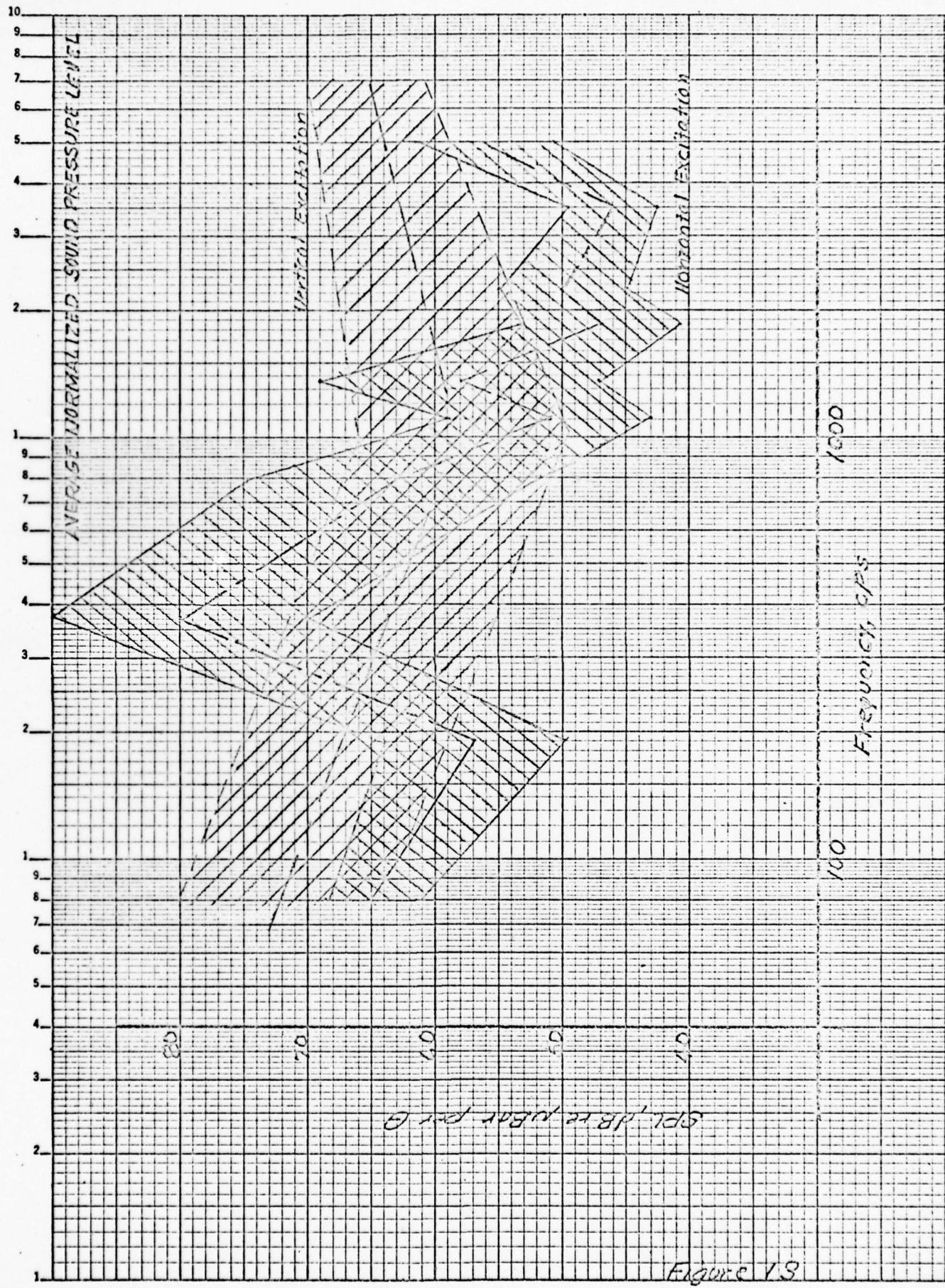
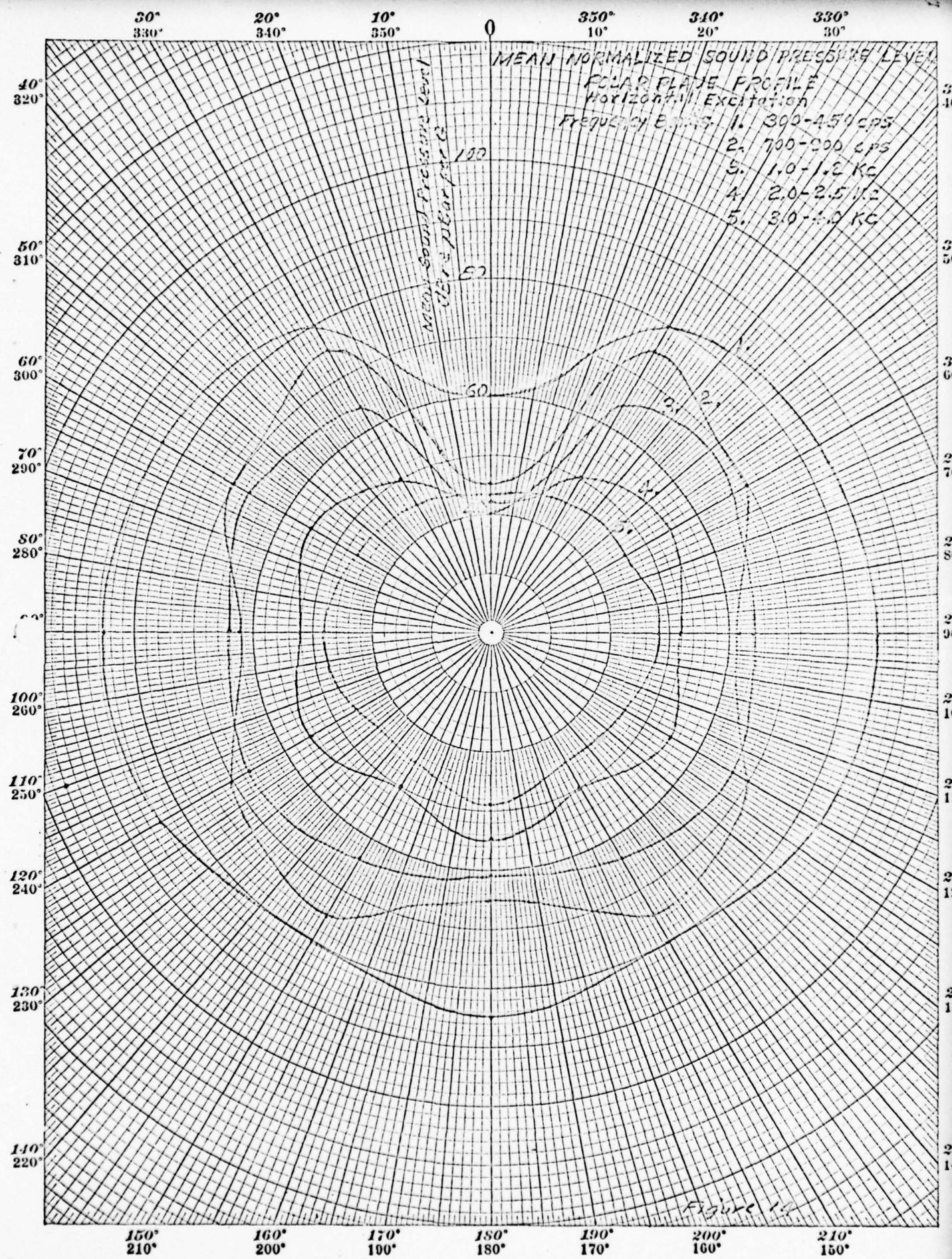


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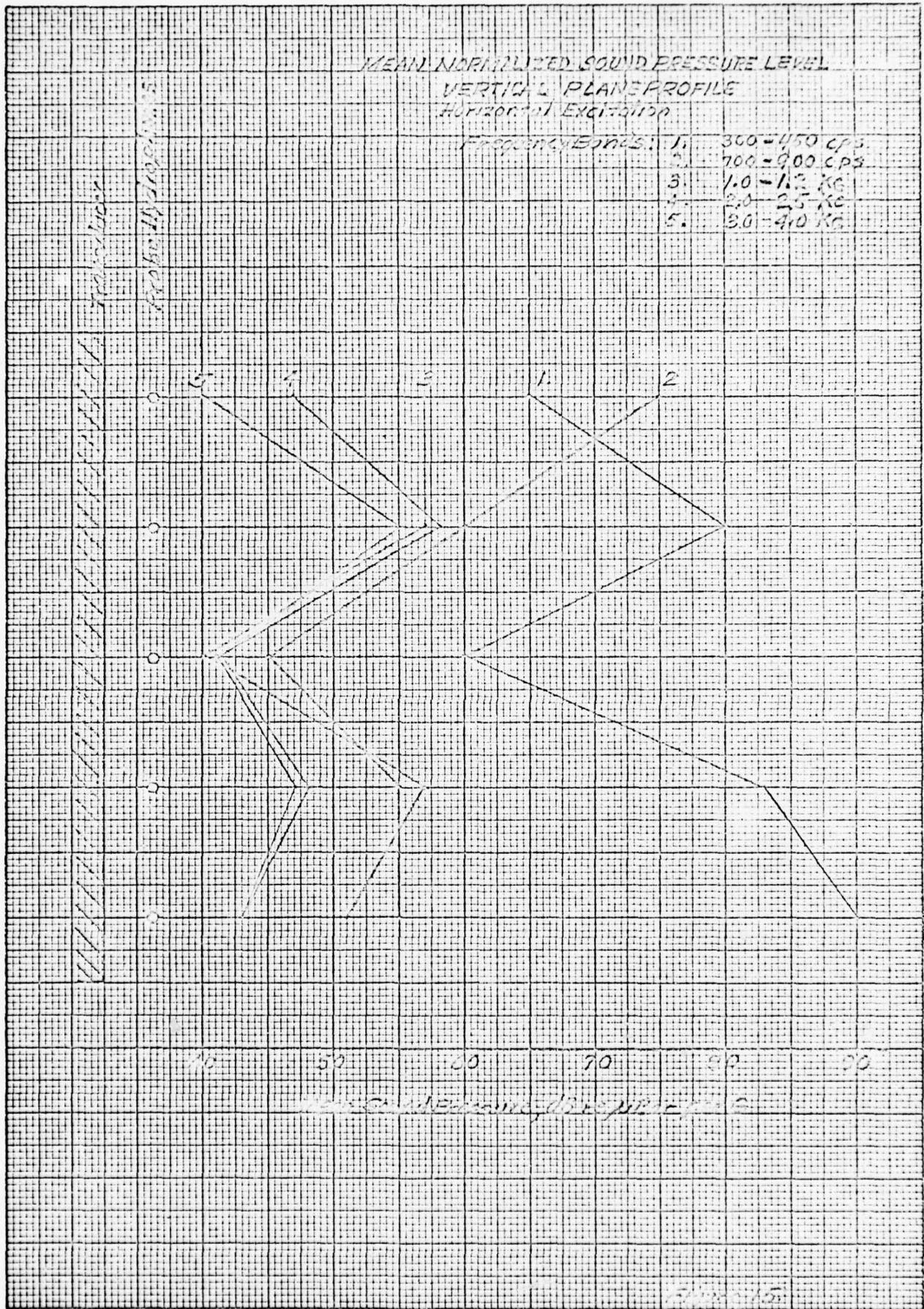
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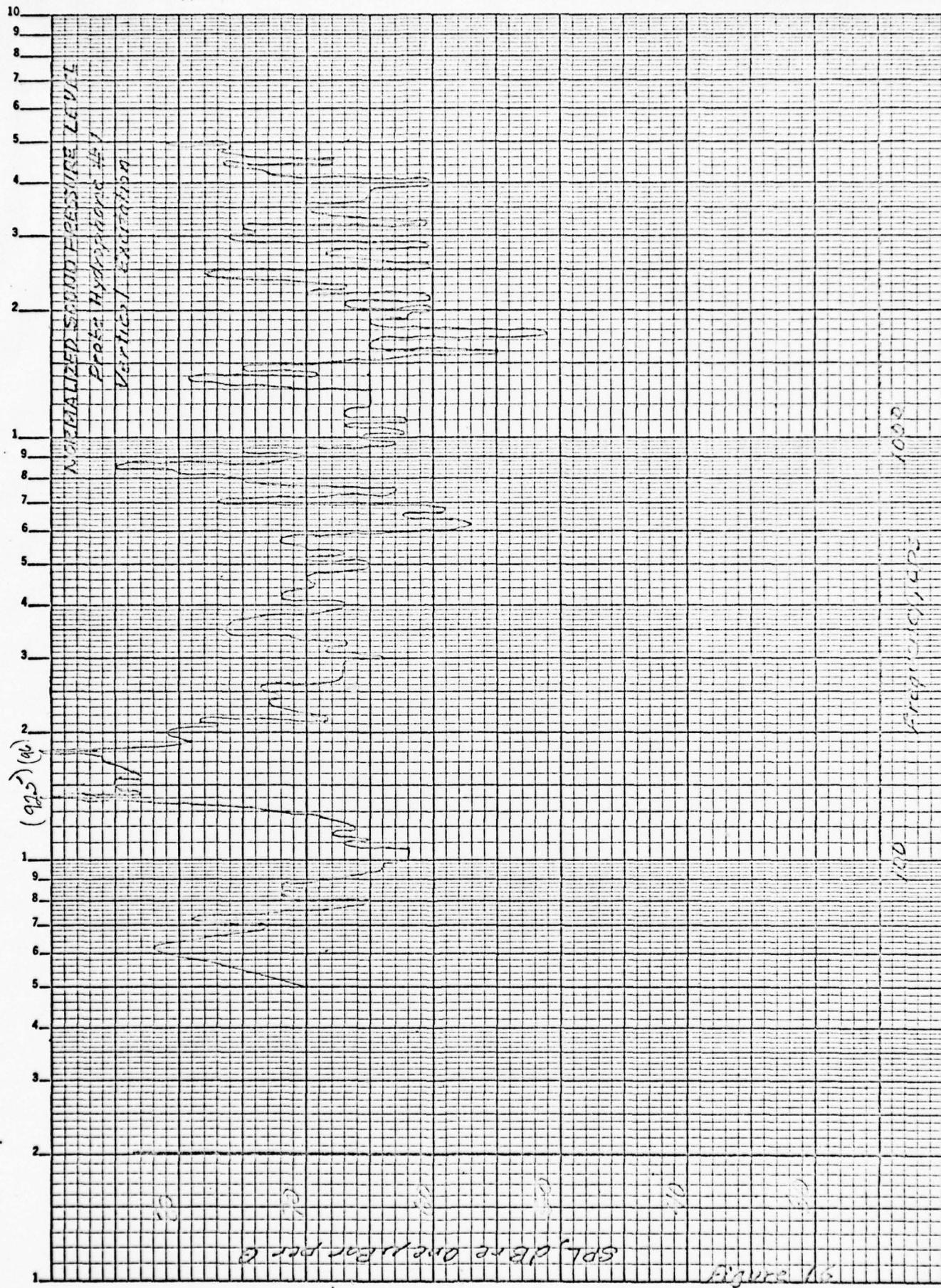
MEAN NORMALIZED SOUND PRESSURE LEVEL
VERTICAL PLANE PROFILE
HORIZONTAL EXCITATION

FREQUENCY CYCLES: 1. 300-400 CPS
2. 700-900 CPS
3. 1.0-1.5 KC
4. 2.0-2.5 KC
5. 3.0-4.0 KC

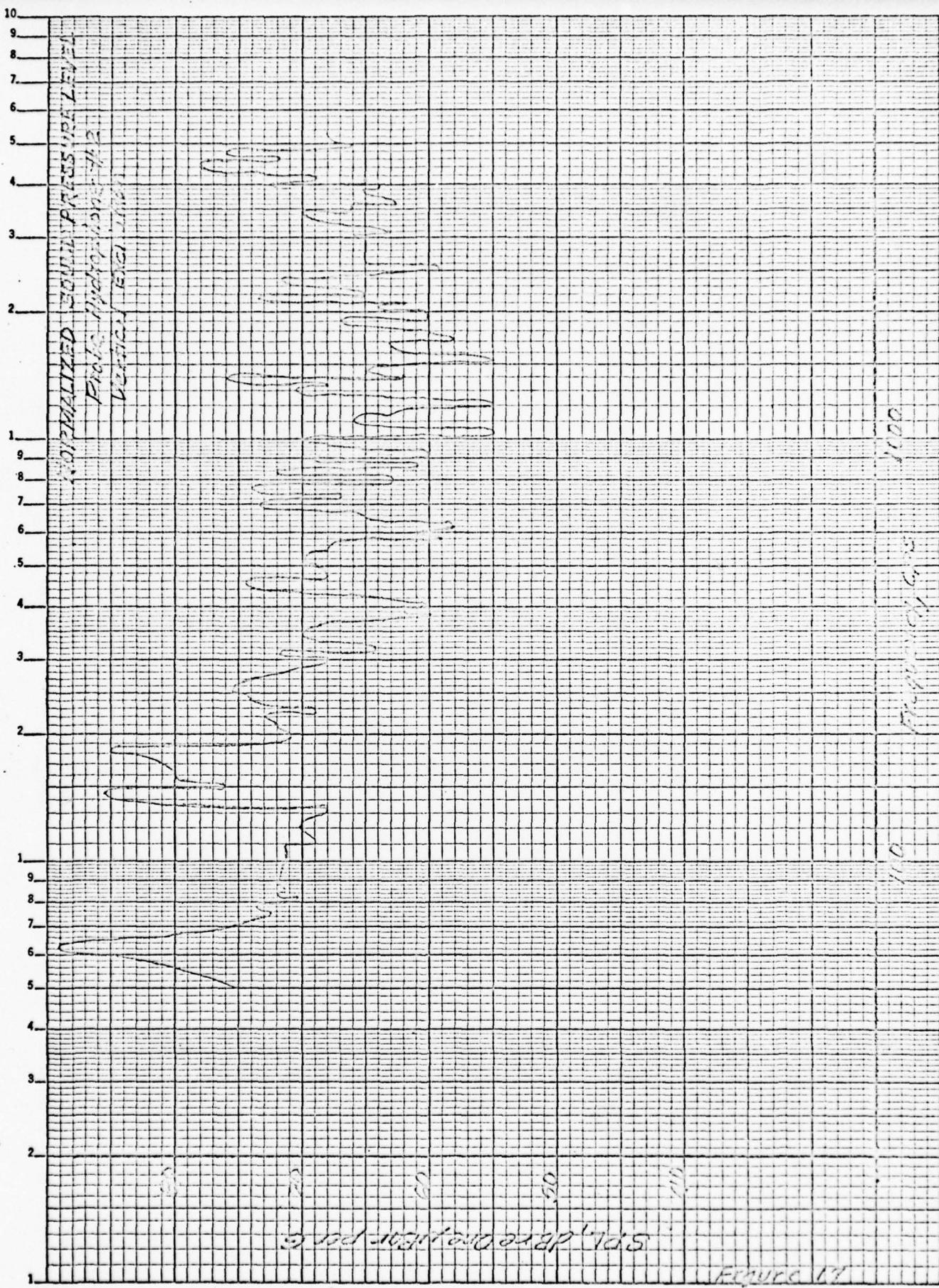
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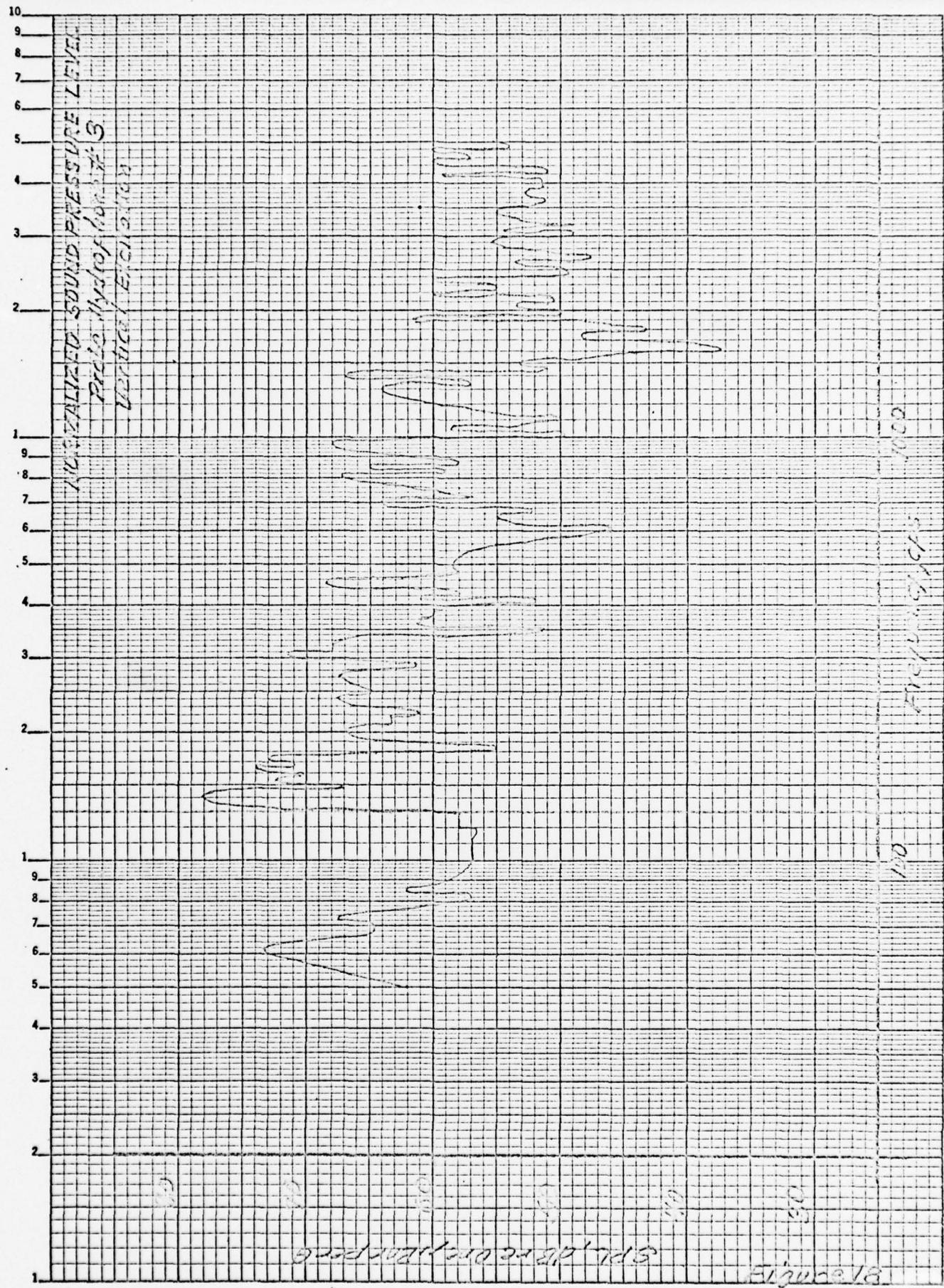
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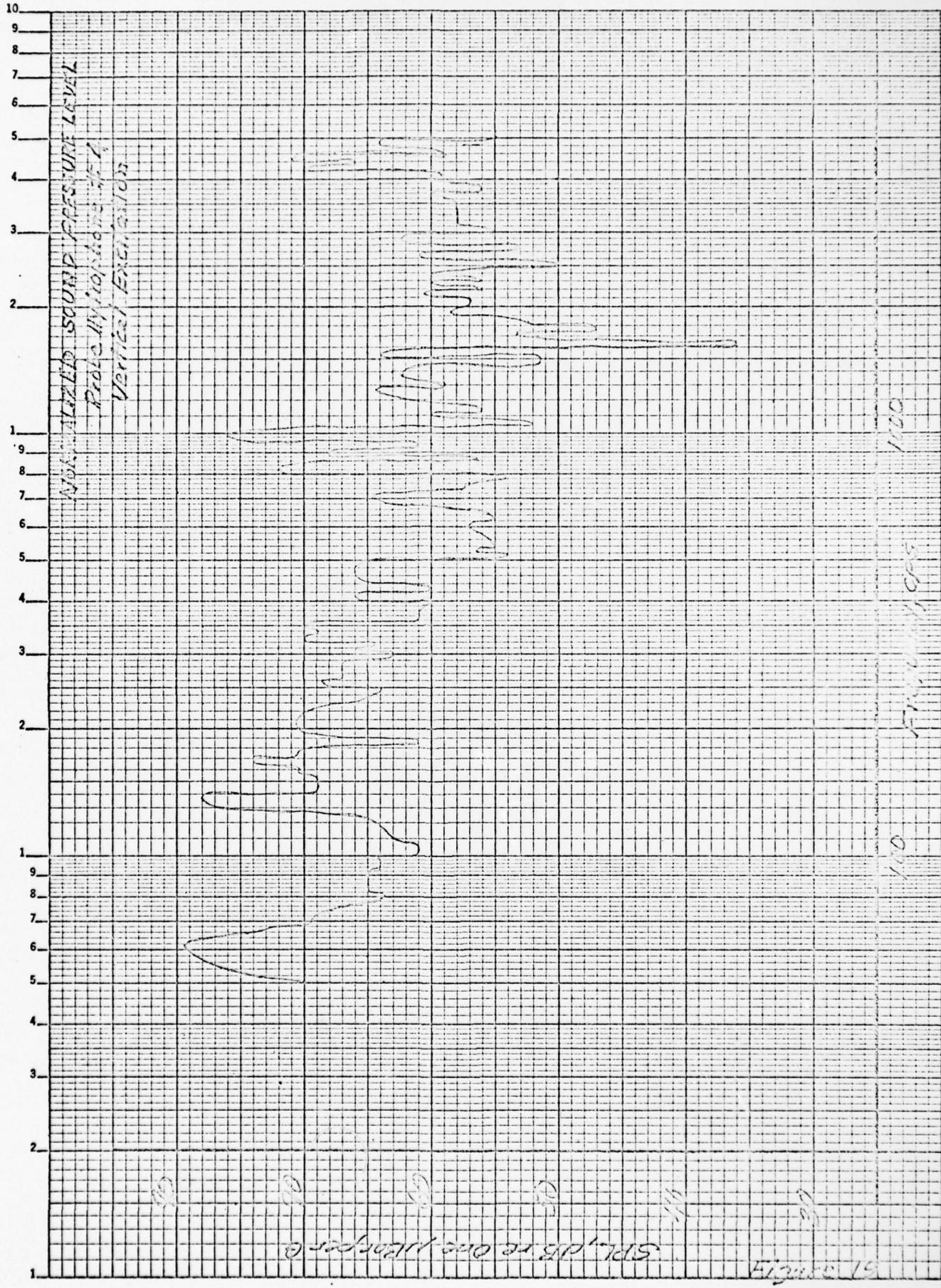
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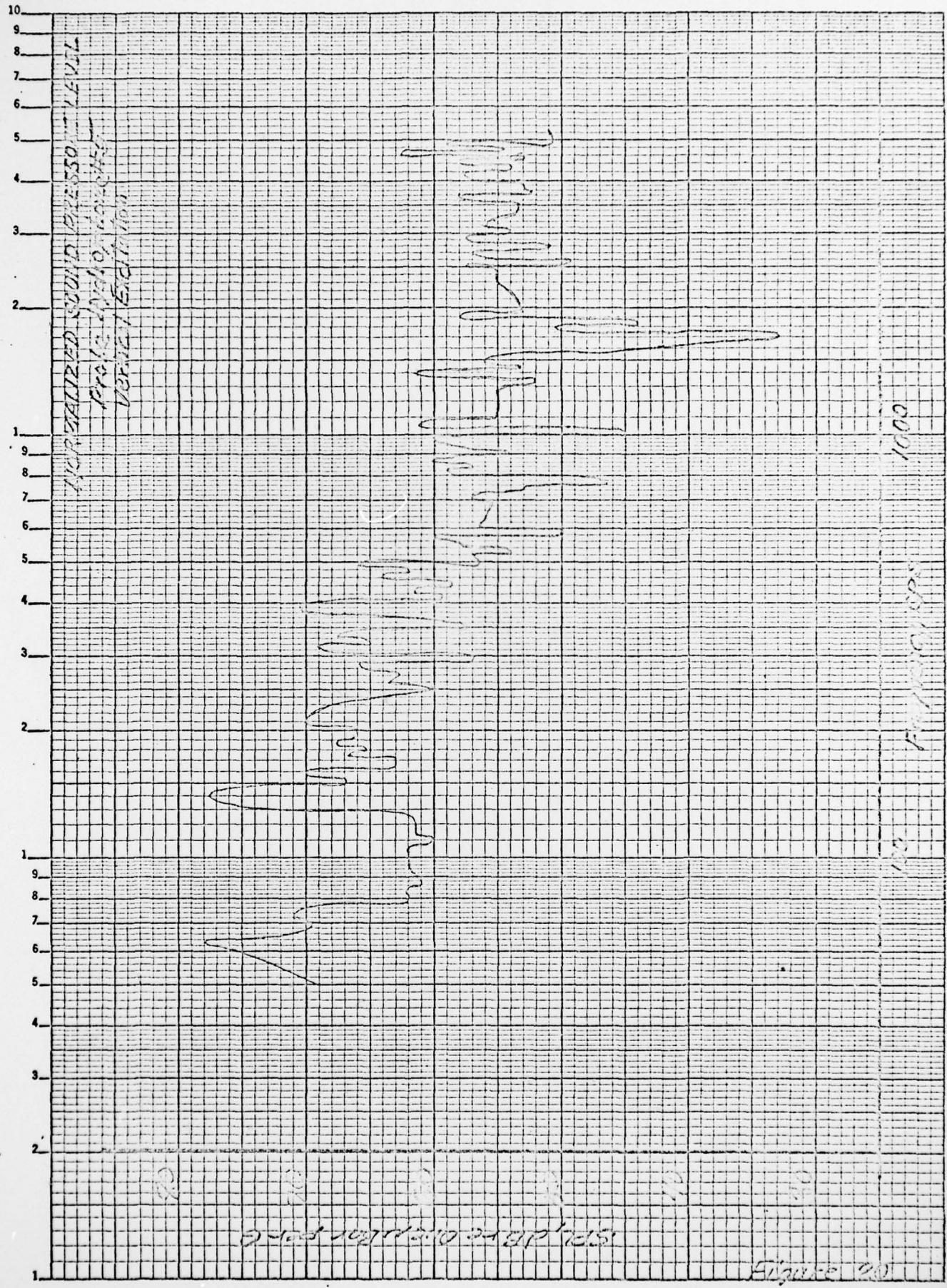
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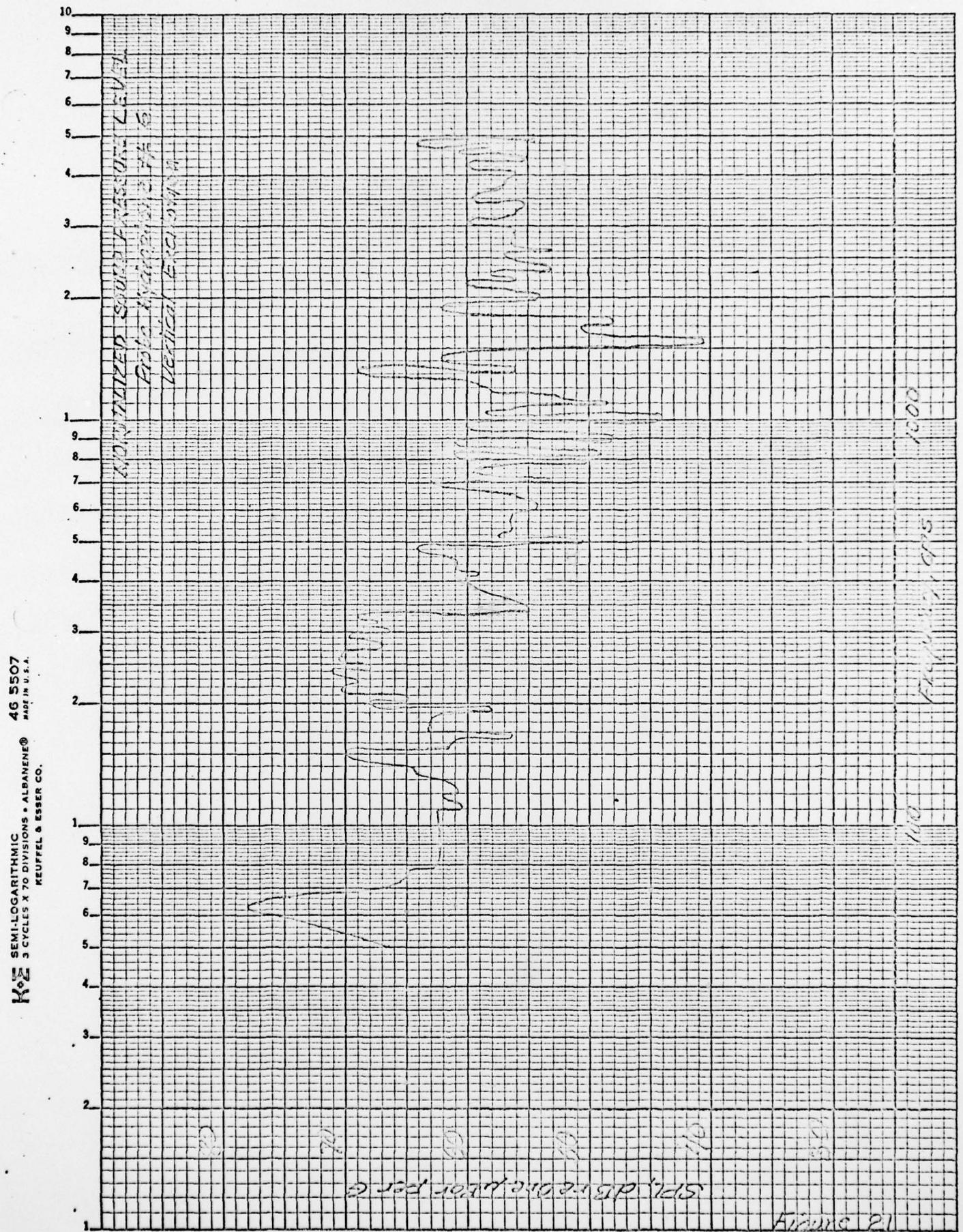
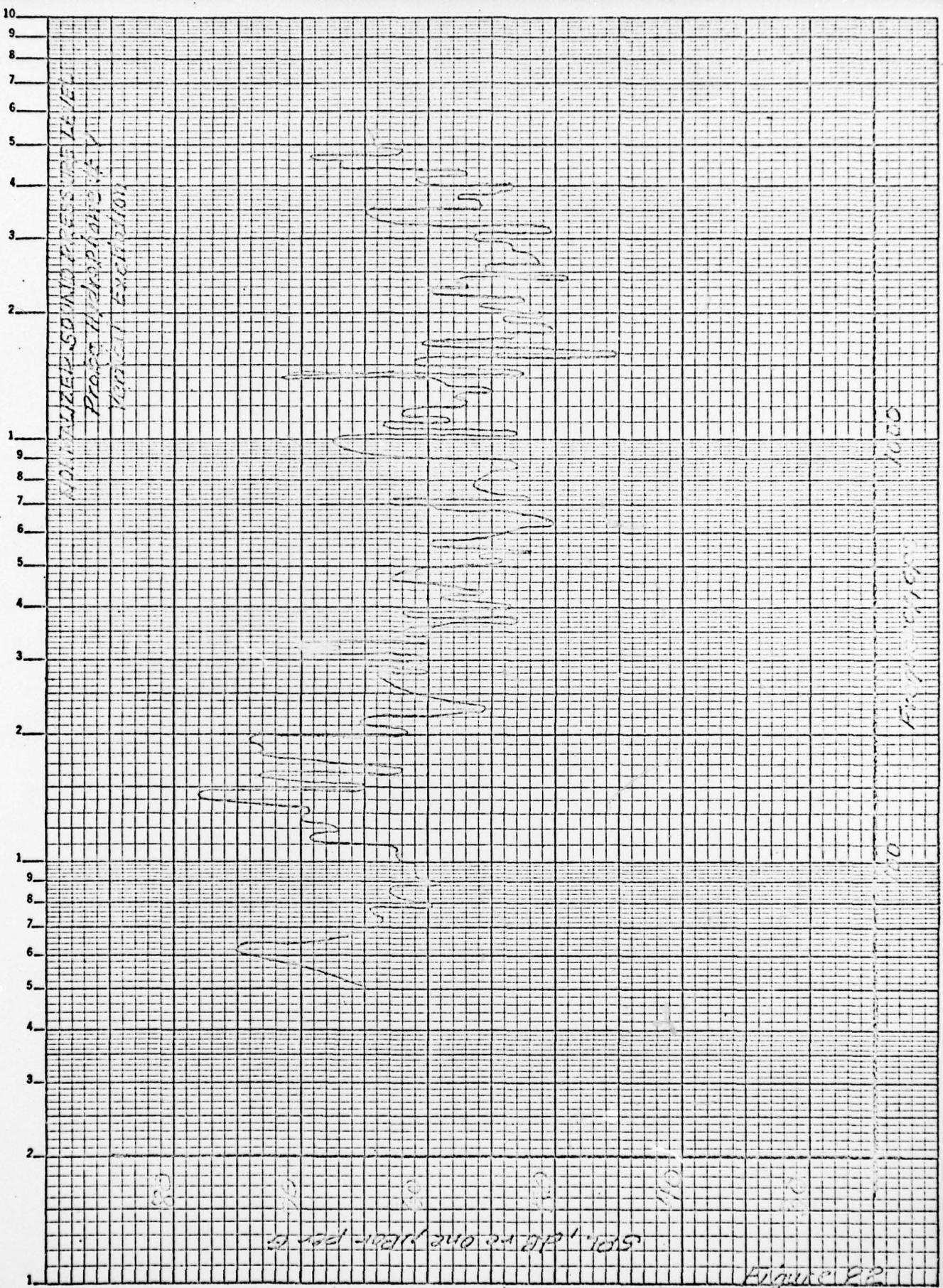


Figure 21

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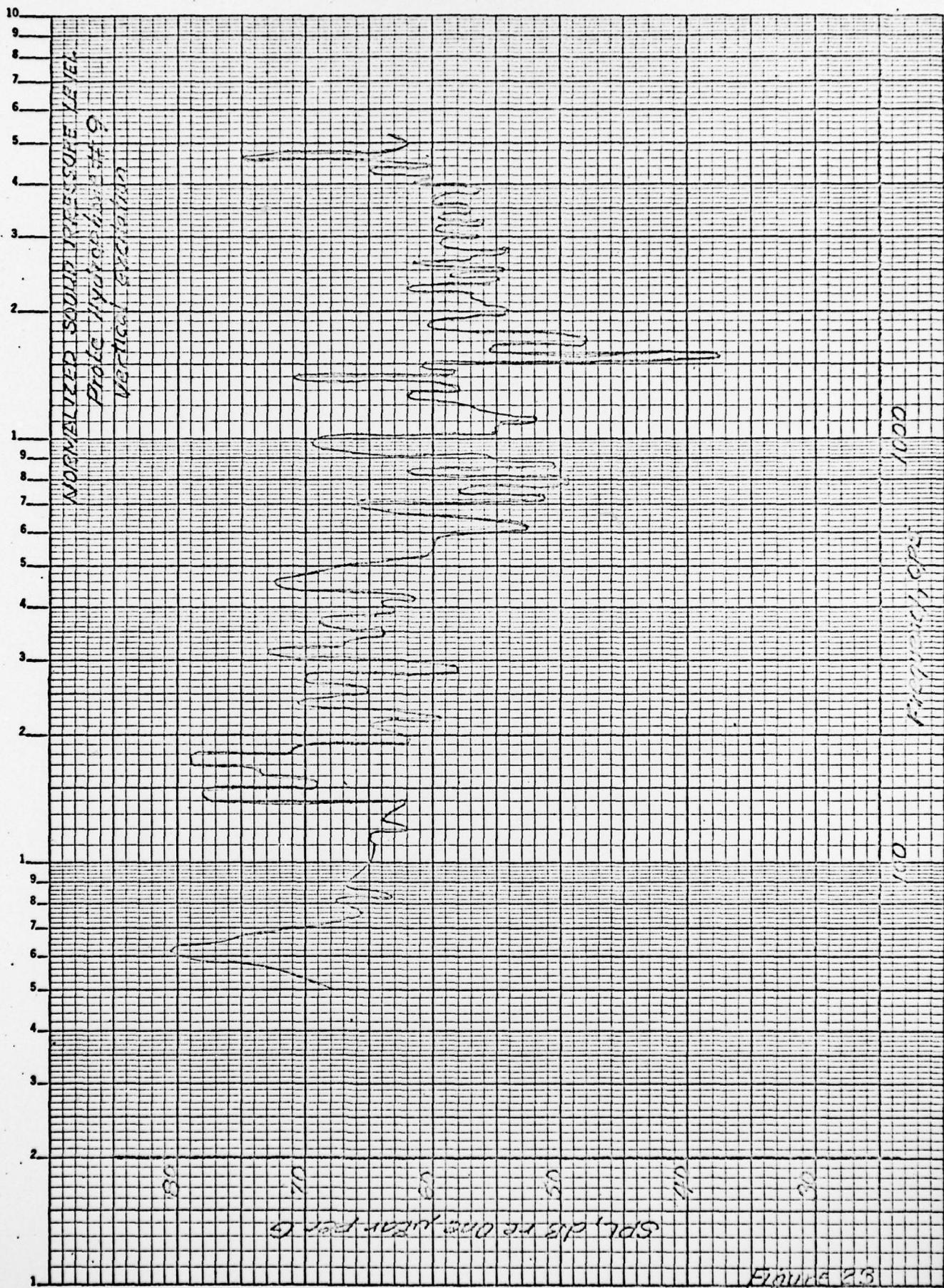
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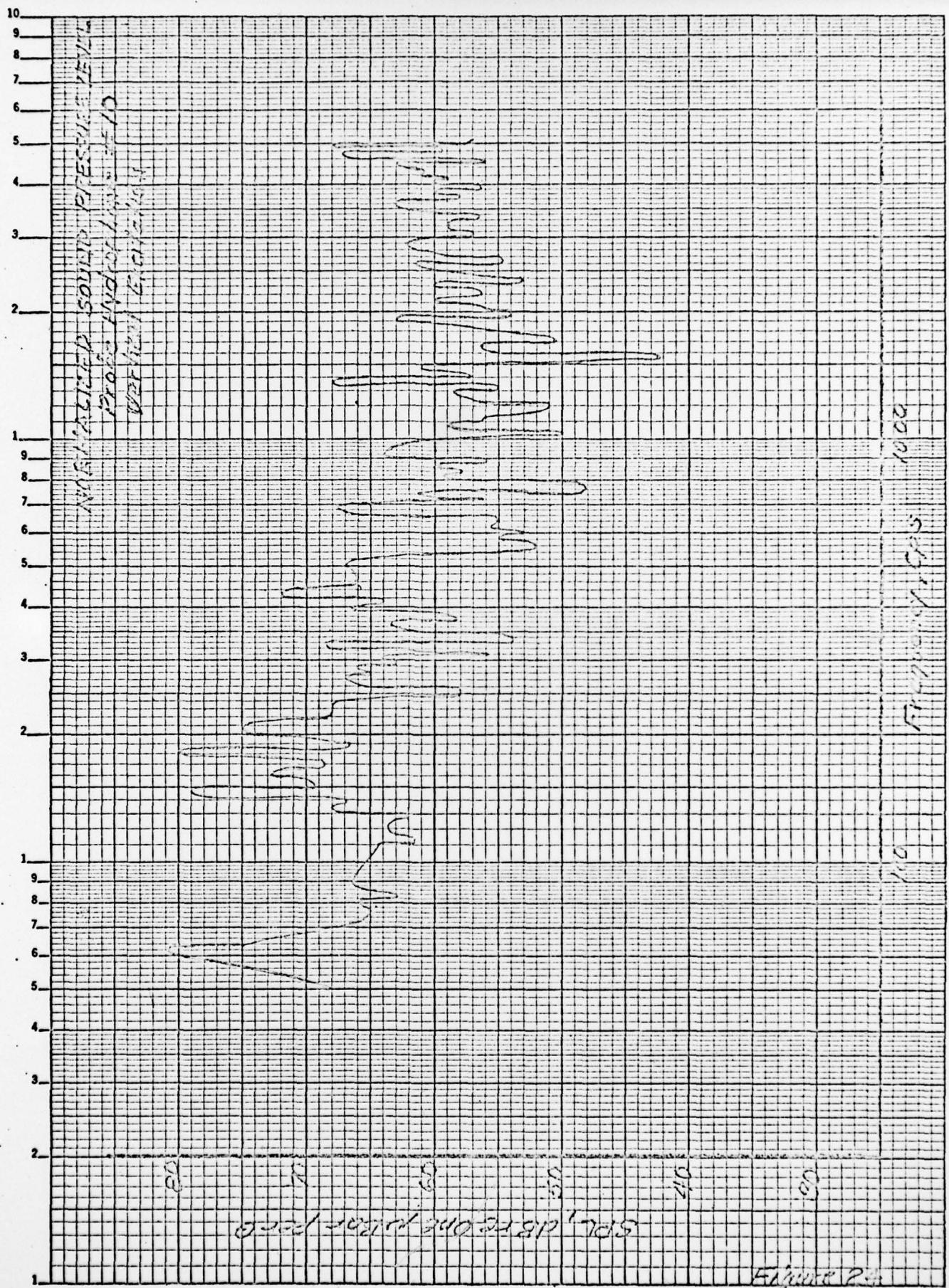


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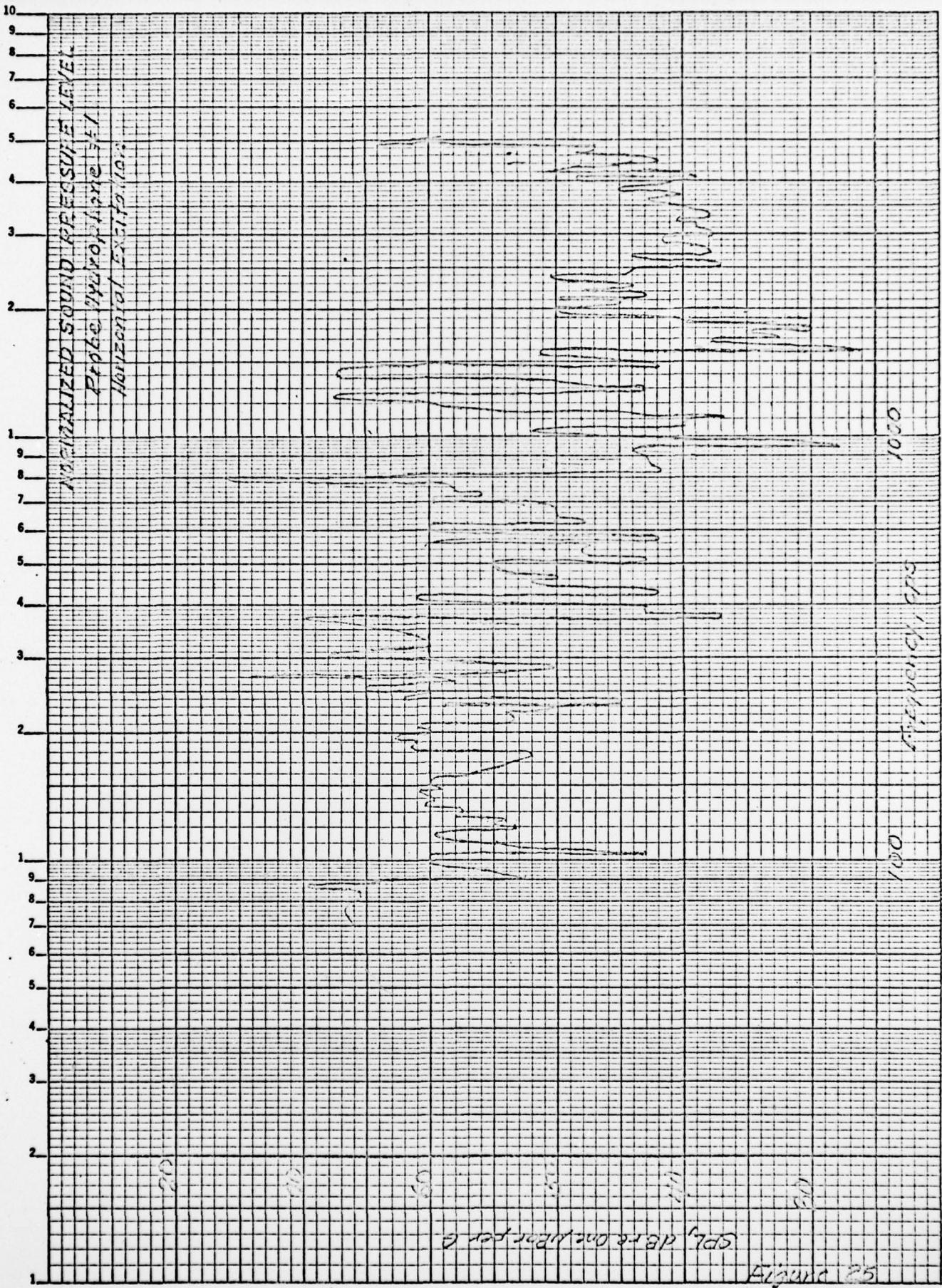


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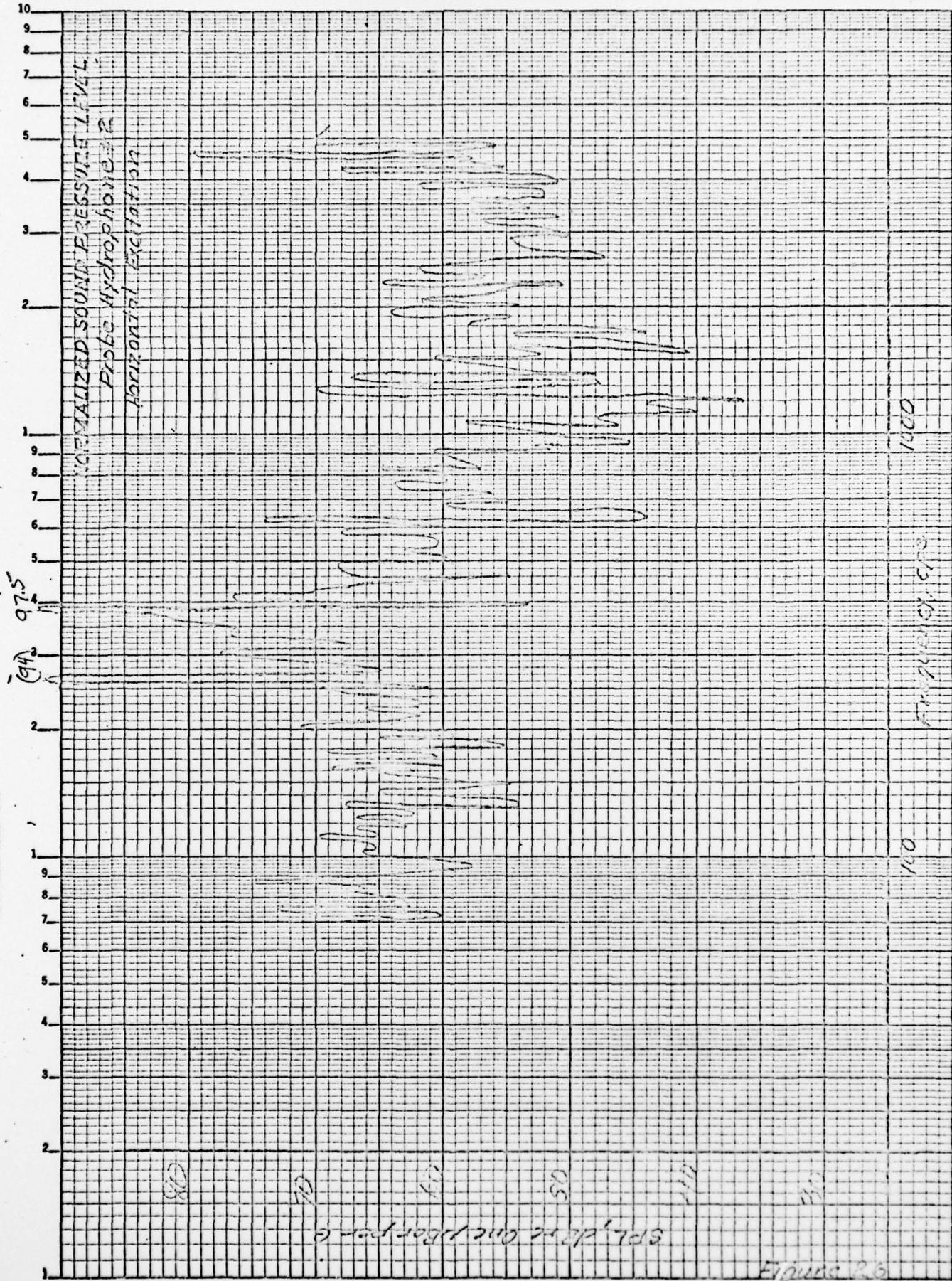


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A hand-drawn graph on grid paper showing SPL vs Frequency. The y-axis is labeled "SPL, dB re one microbar per sec" and ranges from 0 to 10. The x-axis is labeled "Frequency, cps" and ranges from 0 to 1000. A curve starts at approximately (100, 1), rises to a peak of about (200, 6), then decreases to a minimum of about (400, 2), and then rises again to a second peak of about (600, 8).

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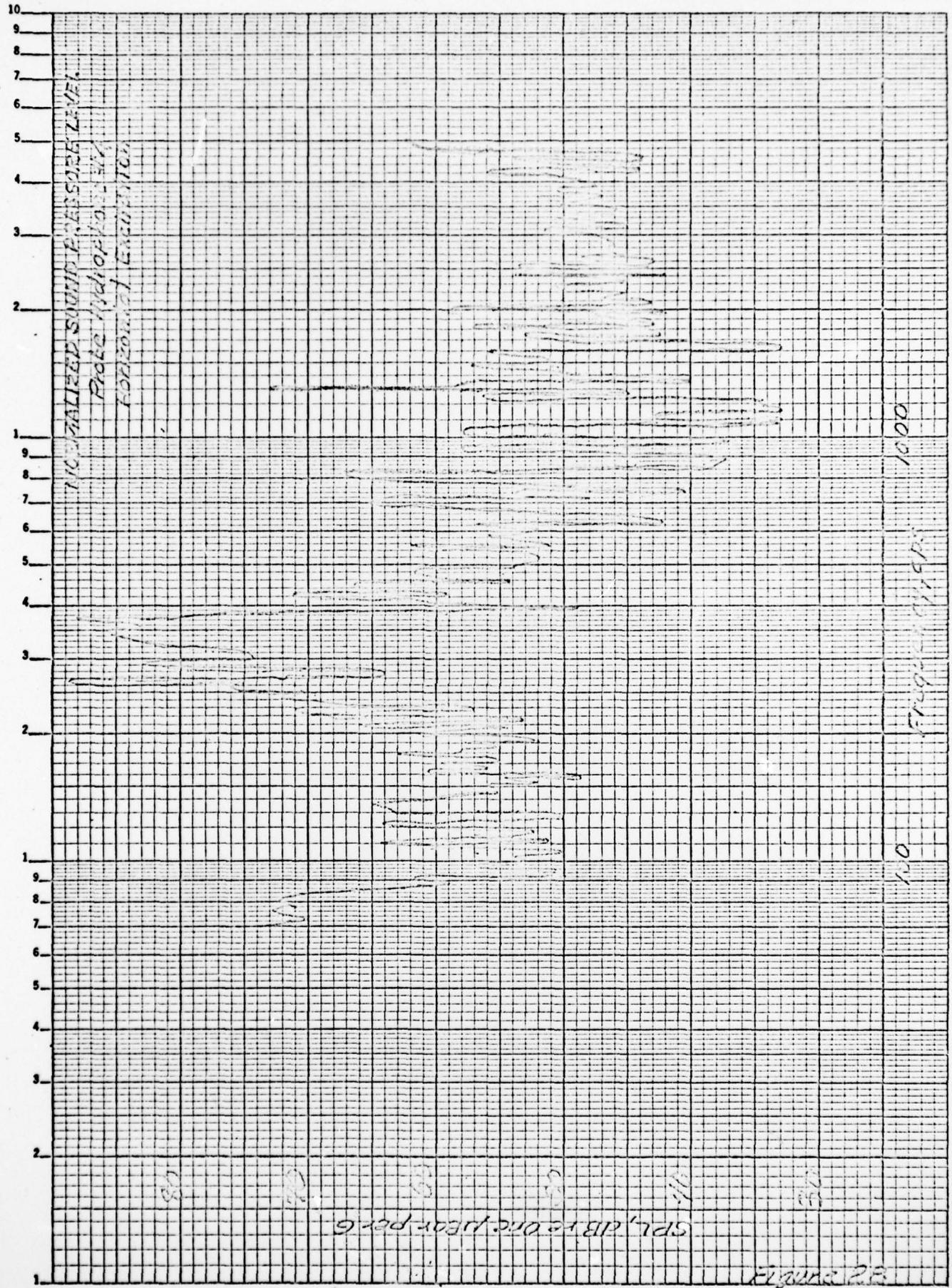


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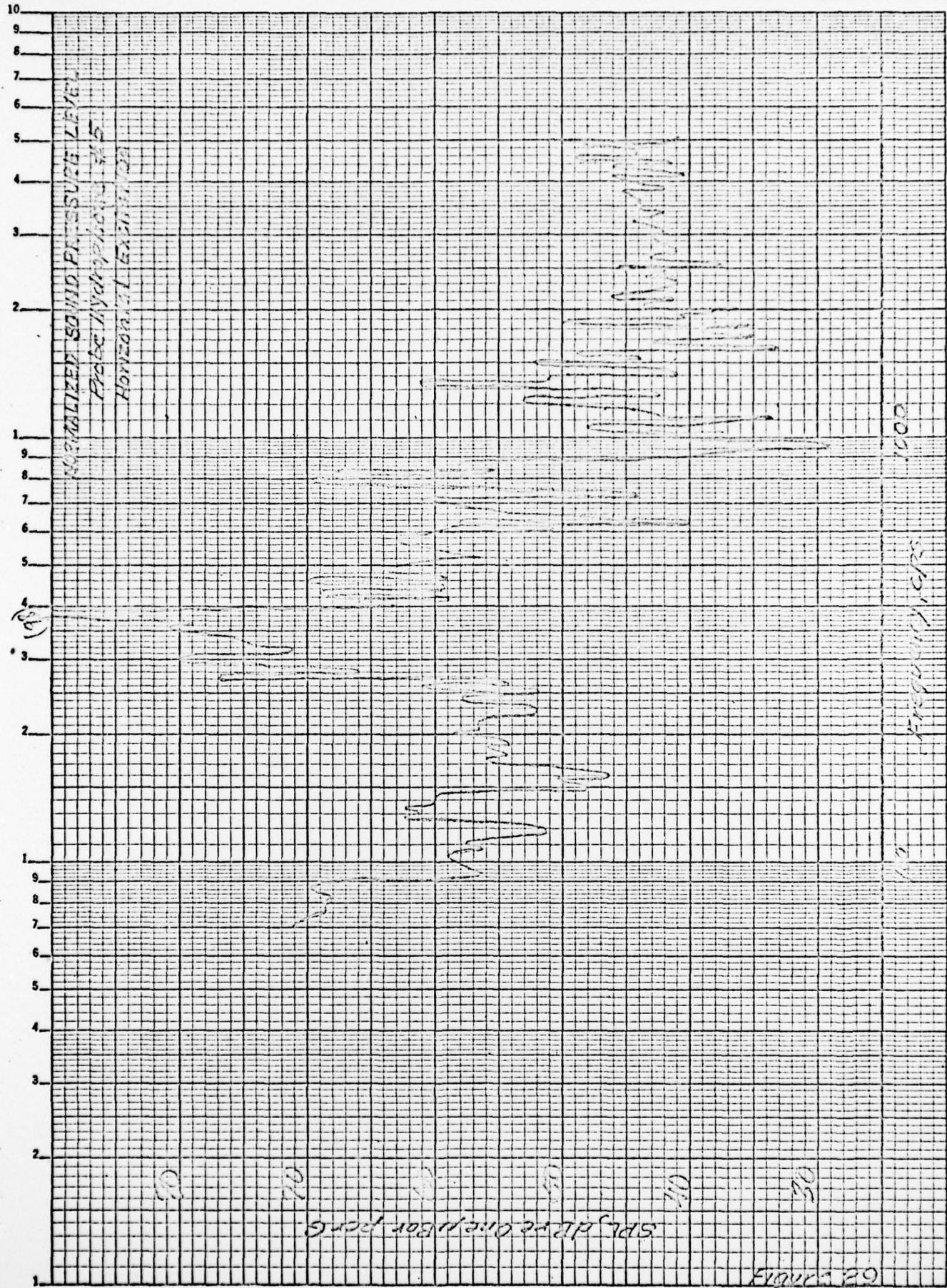
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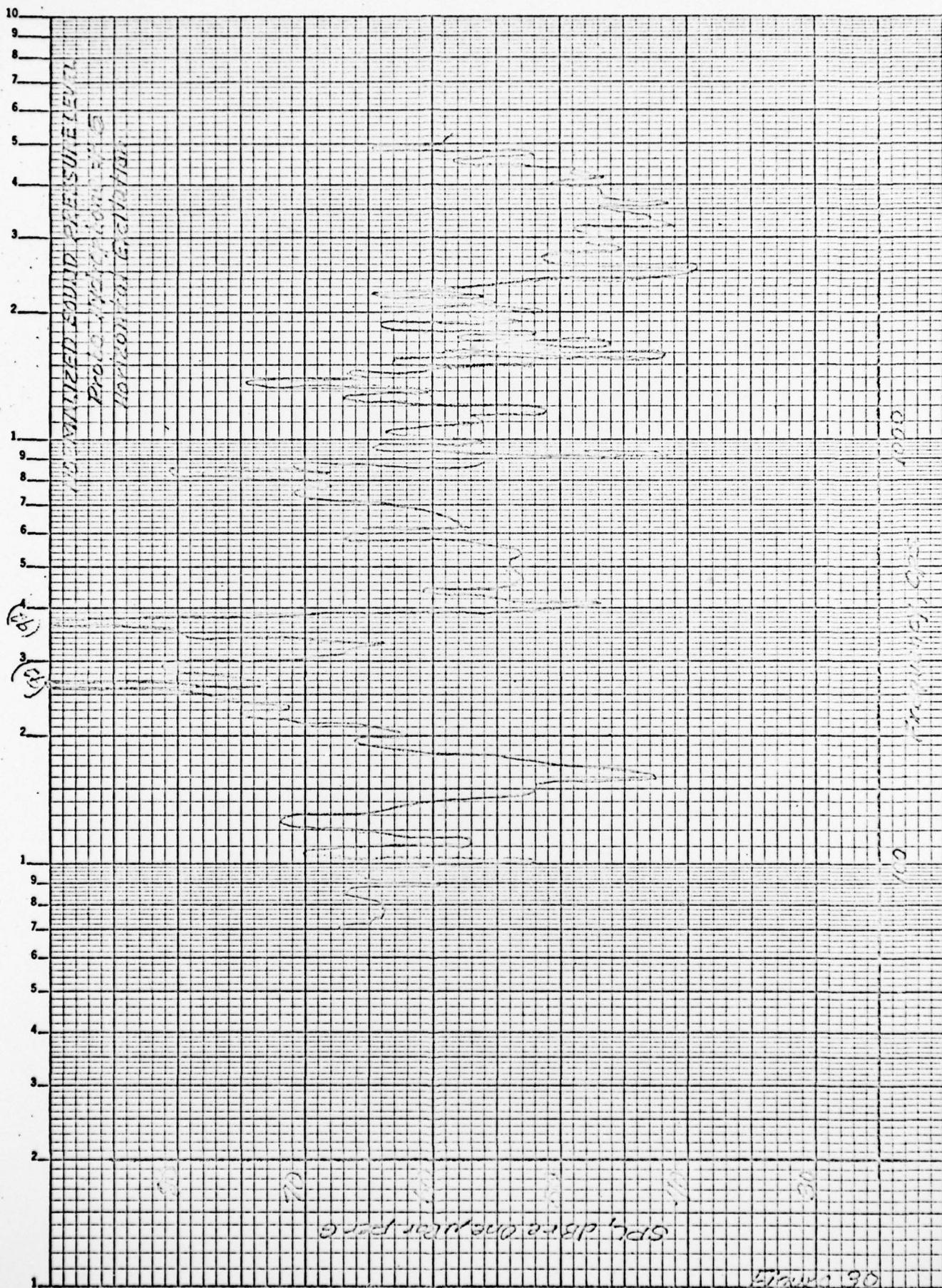
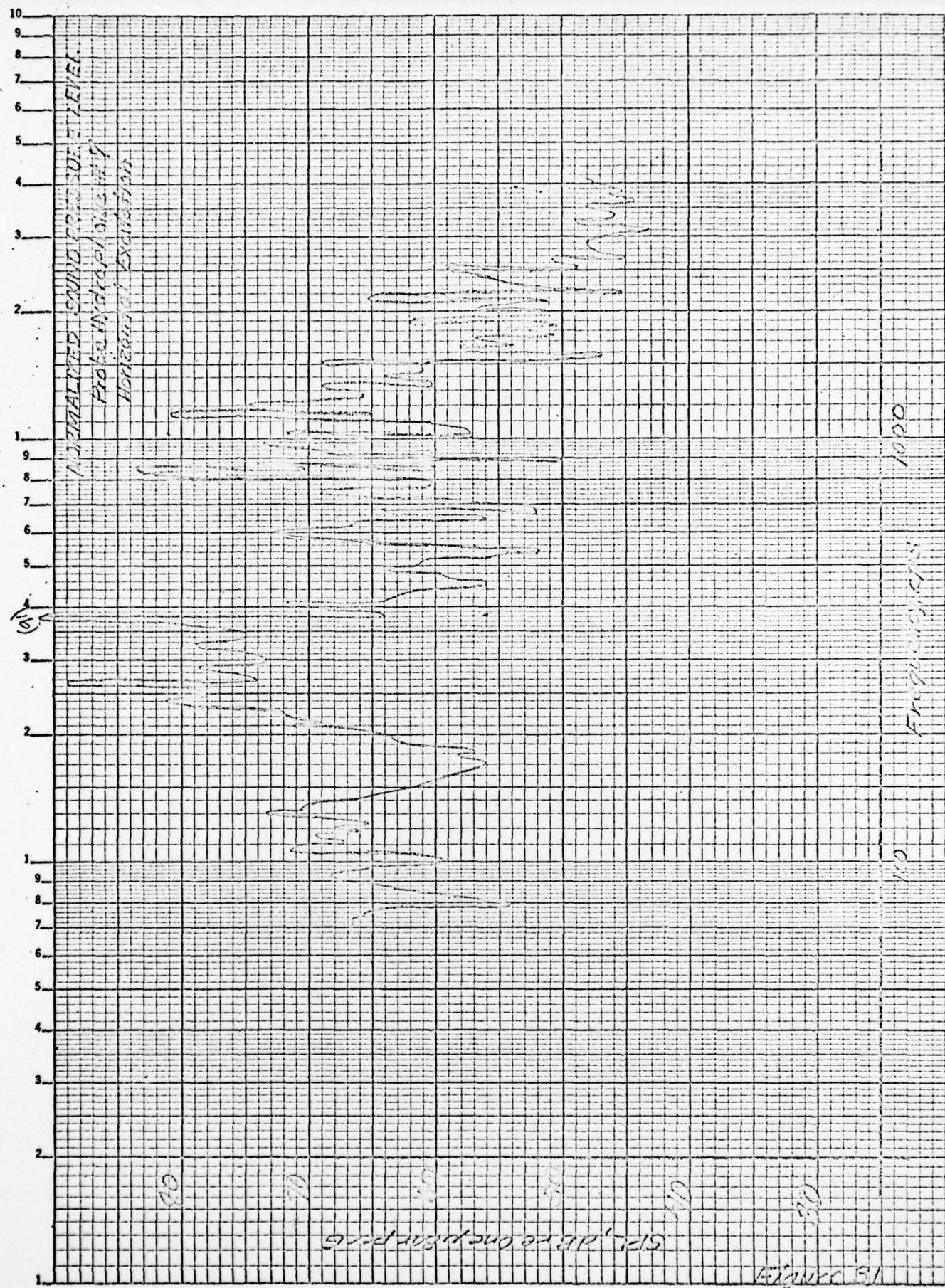
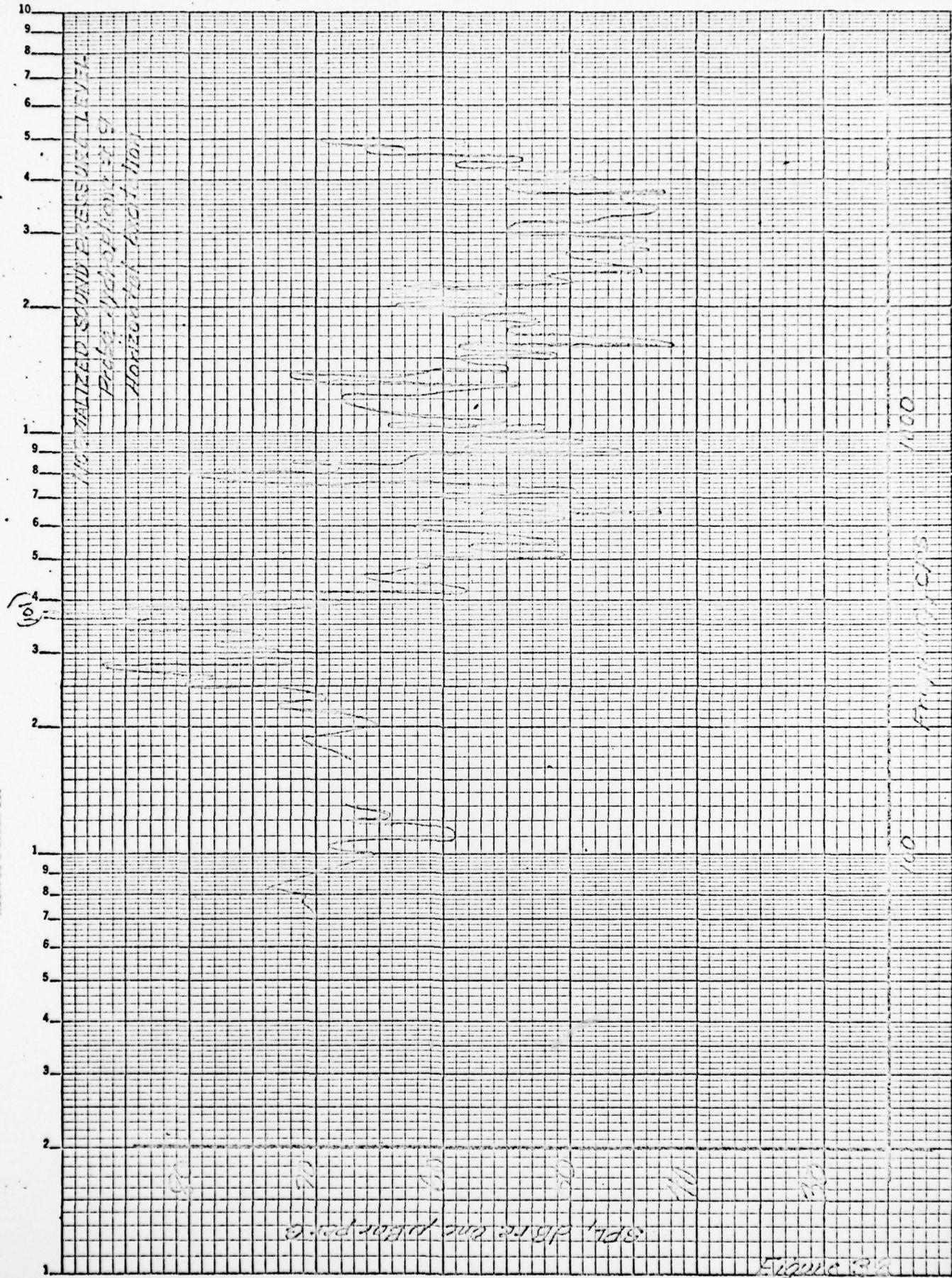


Figure 20

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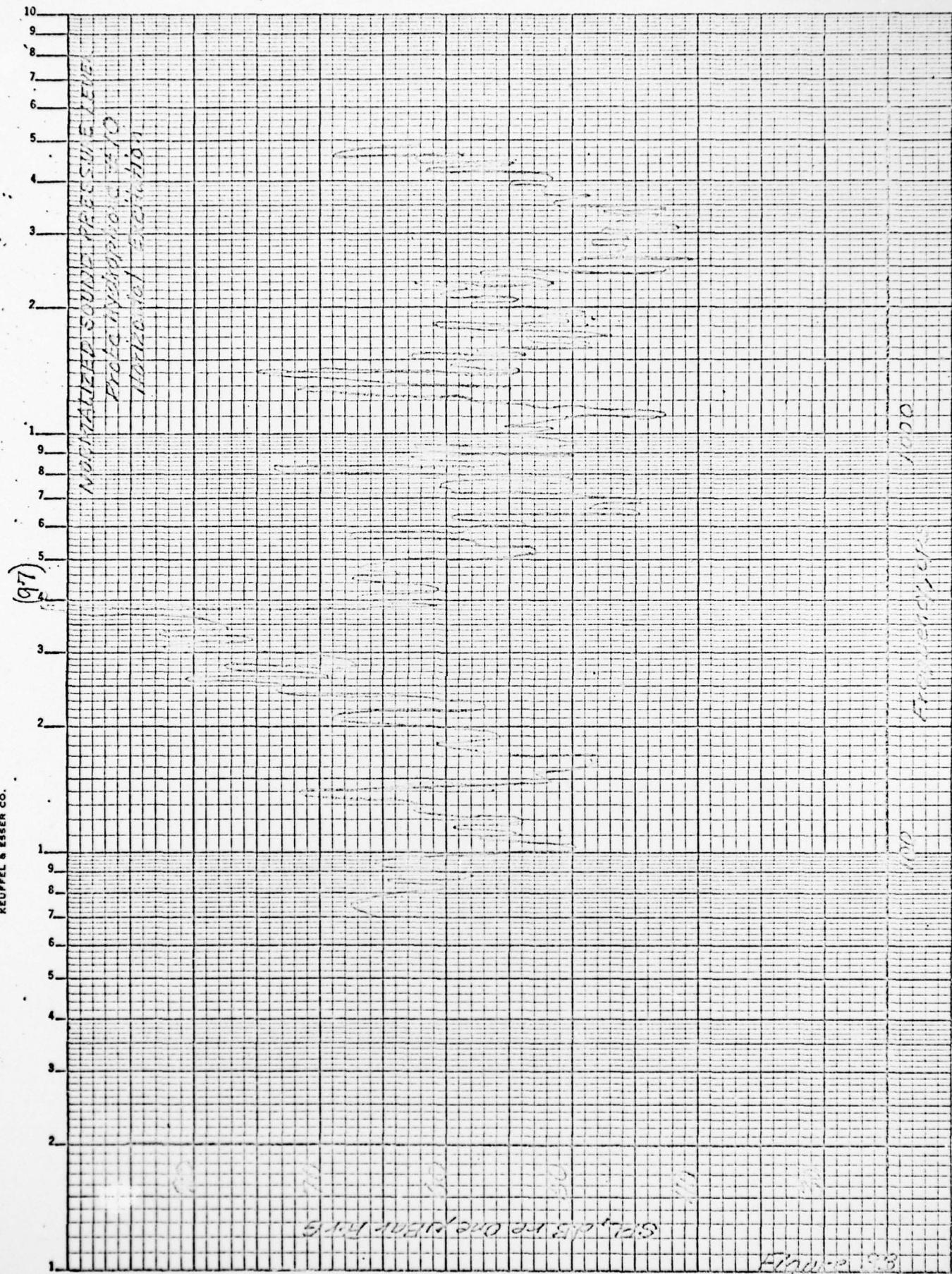


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