NATIONAL BUREAU OF STANDARDS REPORT

7063

on

Interlaboratory Intercomparisons

of

40-Watt T12 Daylight Fluorescent Lamps

by

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Metrology Division

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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Abstract

A group of eight 40-watt, T12, daylight fluorescent lamps was measured in each of eight laboratories. The line voltage was held constant at 236.0 volts across the lamps in series with a reactor having 439 ohms impedance and 7 to 8% power factors. The luminous flux, current, lamp volts, lamp watts, and the x and y chromaticity coordinates were measured. The results of the measurements made by the individual laboratories and an analysis of the results are given in this report.

I. Introduction

This intercomparison was undertaken to determine the uniformity of measurements on 40-watt, T12, daylight fluorescent lamps made at the participating laboratories. The laboratories participating and the order of reading are as follows:

1. Duro Test
2. Electrical Testing Laboratories
3. Westinghouse
4. General Electric
5. Interlectric
6. Sylvania
7. Champion
8. National Bureau of Standards

Each laboratory followed its own customary procedure in making the measurements. Measurements at each laboratory were obtained while holding the line voltage constant at 236.0 volts across the lamps in series with a reactor having 439 ohms impedance and 7 to 8% power factor. The power supply was connected to the marked pins.

This group started at Duro Test with twelve lamps. Four lamps were broken at various times during the intercomparisons. The values for only the eight remaining lamps are reported herein.

II. Results of Measurements

The results reported are given in tables 1 through 7. The averages reported for each lamp and for each laboratory are given. The differences between the average for each laboratory and the average of all laboratories for all the lamps are also given in the tables.

III. Analysis of the Results

An analysis of the results of the measurements has been made following a modification of the method described by W. J. Youden (1), (2), and (3). The

modified method is described in National Bureau of Standards Report No. 6605 "Interlaboratory Intercomparisons of 32-watt T10 Cool-White Circline Lamps" and No. 6698 "Interlaboratory Intercomparisons of 40-watt T12 Cool-White Fluorescent Lamps". The analysis is shown on the following graphs. The point representing the measurements by an individual laboratory is designated by the first letter in the name of the laboratory. The point representing the average of all laboratories is designated by the letter A.

(1) Graphical Diagnosis of Interlaboratory Test Results; Industrial Quality Control Vol. XV, No. 11, May 1959.

(2) Product Specification and Test Procedures; Industrial and Engineering Chemistry, Vol. 50, page 914, October 1958.

(3) Circumstances Alter the Cases; Industrial and Engineering Chemistry, Vol. 50, page 77A, December 1958.

Table 1

Lumens

Lamp No.	Duro Test	ETL	West	GE	Interl	Syl	Champ	NBS	Ave.
2	2273	2290	2231	2339	2270	2314	2280	2302	2287.4
3	2285	2245	2232	2339	2262	2330	2296	2300	2286.1
4	2300	2325	2264	2358	2265	2362	2282	2306	2307.8
6	2284	2250	2226	2331	2230	2314	2268	2287	2273.8
7	2290	2330	2235	2345	2253	2334	2268	2278	2291.6
8	2295	2285	2247	2359	2260	2332	2296	2288	2295.2
10	2304	2335	2235	2349	2272	2298	2276	2285	2294.2
12	2300	2335	2263	2367	2288	2324	2290	2297	2308.0
Ave.	2291.4	2299.4	2241.6	2348.4	2262.5	2326.0	2282.0	2292.9	2293.0
Δ	-1.6	+6.4	-51.4	+55.4	-30.5	+33.0	-11.0	-.1	
% Δ	-.07%	+.28%	-2.24%	+2.42%	-1.33%	+1.44%	-.48%	-.00%	

Table 2

Amperes

Lamp No.	Duro Test	ETL	West	GE	Interl	Syl	Champ	NBS	Ave.
2	.429	.423	.430	.428	.430	.431	.431	.431	.4291
3	.428	.423	.429	.428	.430	.429	.431	.428	.4282
4	.430	.426	.430	.430	.430	.431	.431	.430	.4298
6	.427	.425	.430	.430	.430	.430	.433	.430	.4294
7	.430	.422	.430	.429	.430	.432	.433	.428	.4292
8	.430	.425	.430	.429	.430	.430	.435	.430	.4299
10	.429	.424	.429	.431	.430	.430	.432	.429	.4292
12	.429	.423	.430	.429	.430	.431	.431	.427	.4288
Ave.	.4290	.4239	.4298	.4292	.4300	.4305	.4321	.4291	.4292
Δ	-.0002	-.0053	+.0006	.0000	+.0008	+.0013	+.0029	-.0001	
% Δ	-.05%	-1.23%	+.14%	.00%	+.19%	+.30%	+.68%	-.02%	

Table 3

Lamp Volts

Lamp No.	Duro Test	ETL	West	GE	Interl	Syl	Champ	NBS	Ave.
2	102.5	103.0	102.7	102.7	101.5	101.8	102.0	101	102.15
3	103.0	103.0	103.6	103.0	103.5	103.0	104.0	103	103.26
4	102.2	102.0	102.8	103.0	102.5	101.5	104.7	102	102.59
6	102.5	102.0	102.5	102.7	103.0	102.3	102.8	103	102.60
7	102.5	104.0	103.2	103.2	103.5	100.8	103.0	104	103.02
8	101.6	102.5	102.6	102.7	103.5	102.5	102.0	103	102.55
10	100.8	102.5	103.2	101.9	102.5	101.5	103.1	102	102.19
12	102.2	103.0	103.6	102.7	103.0	102.5	104.0	104	103.12
Ave.	102.16	102.75	103.02	102.74	102.88	101.99	103.20	102.75	102.69
Δ	-.53	+.06	+.33	+.05	+.19	-.70	+.51	+.06	
% Δ	-.52%	+.06%	+.32%	+.05%	+.19%	-.68%	+.50%	+.06%	

Table 4

Lamp Watts

Lamp No.	Duro Test	ETL	West	GE	Interl	Syl	Champ	NBS	Ave
2	39.8	40.1	40.1	40.4	41.0	40.1	39.9	39.8	40.15
3	40.0	40.1	40.3	40.4	41.0	40.7	40.6	40.5	40.45
4	39.9	39.9	40.1	40.6	41.5	40.2	41.0	40.5	40.46
6	40.3	39.7	40.1	40.6	42.0	40.5	40.3	40.5	40.50
7	40.1	40.2	40.3	40.8	41.5	39.8	40.4	40.8	40.49
8	39.8	40.1	40.2	40.6	42.0	40.6	40.2	40.6	40.51
10	39.8	40.0	40.2	40.1	42.0	40.3	40.4	40.2	40.38
12	40.0	40.1	40.4	40.3	41.0	40.6	40.6	40.6	40.45
Ave.	39.96	40.02	40.21	40.48	41.50	40.35	40.42	40.44	40.42
Δ	-.46	-.40	-.21	+.06	+1.08	-.07	0	+.02	
% Δ	-1.14%	-.99%	-.52%	+.15%	+2.67%	-.17%	0	+.05%	

Table 5

Lumens per Watt

Lamp No.	Duro Test	ETL	West	GE	Interl	Syl	Champ	NBS	Ave
2	57.1	57.1	55.6	57.9	55.4	57.7	57.2	57.8	56.98
3	57.1	56.0	55.4	57.9	55.2	57.2	56.7	56.8	56.54
4	57.7	58.3	56.5	58.1	54.6	58.8	55.6	56.9	57.06
6	56.7	56.7	55.5	57.4	53.1	57.1	56.3	56.5	56.16
7	57.1	58.0	55.5	57.5	54.3	58.6	56.2	55.8	56.62
8	57.7	57.0	55.9	58.1	53.8	57.4	57.3	56.4	56.70
10	57.9	58.4	55.6	58.6	54.1	57.0	56.4	56.8	56.85
12	57.5	58.2	56.0	58.7	55.8	57.2	56.5	56.6	57.06
Ave.	57.35	57.46	55.75	58.02	54.54	57.62	56.52	56.70	56.75
Δ	+.60	+.71	-1.00	+1.27	-2.21	+.87	-.23	-.05	
% Δ	+1.06%	+1.25%	-1.76%	+2.24%	-3.89%	+1.53%	-.41%	-.09%	

Table 6

x Coordinate

Lamp No.	Duro Test	ETL	West	GE	Interl	Syl	Champ	NBS	Ave
2	.3182	.317	.320	.3187	.315	.319	.320	.319	.3184
3	.3177	.317	.319	.3190	.315	.318	.320	.319	.3181
4	.3183	.318	.319	.3206	.315	.319	.320	.319	.3186
6	.3182	.317	.319	.3194	.315	.319	.320	.319	.3183
7	.3178	.317	.319	.3197	.315	.318	.320	.319	.3182
8	.3178	.317	.319	.3197	.315	.318	.320	.319	.3182
10	.3174	.316	.319	.3198	.315	.318	.320	.318	.3179
12	.3175	.317	.320	.3197	.315	.319	.321	.319	.3185
Ave.	.3179	.3170	.3192	.3196	.3150	.3185	.3201	.3189	.3183
Δ	-.0004	-.0013	+.0009	+.0013	-.0033	+.0002	+.0018	+.0006	
% Δ	-.13%	-.41%	+.28%	+.41%	-1.04%	+.06%	+.57%	+.19%	

Table 7

y Coordinate

Lamp No.	Duro Test	ETL	West	GE	Interl	Syl	Champ	NBS	Ave.
2	.3476	.344	.348	.3459	.338	.348	.347	.349	.3459
3	.3482	.344	.348	.3463	.339	.347	.348	.350	.3463
4	.3480	.345	.348	.3465	.338	.348	.348	.350	.3464
6	.3480	.344	.347	.3461	.338	.347	.346	.350	.3458
7	.3472	.344	.347	.3462	.338	.347	.346	.350	.3457
8	.3492	.345	.347	.3456	.339	.348	.348	.350	.3465
10	.3467	.344	.347	.3461	.338	.347	.348	.349	.3457
12	.3478	.344	.347	.3467	.339	.348	.347	.350	.3462
Ave.	.3478	.3442	.3474	.3462	.3384	.3475	.3472	.3498	.3461
Δ	+.0017	-.0019	+.0013	+.0001	-.0077	+.0014	+.0011	+.0037	
% Δ	+.49%	-.55%	+.38%	+.03%	-2.22%	+.40%	+.32%	+1.07%	

Figure 1

Lumens

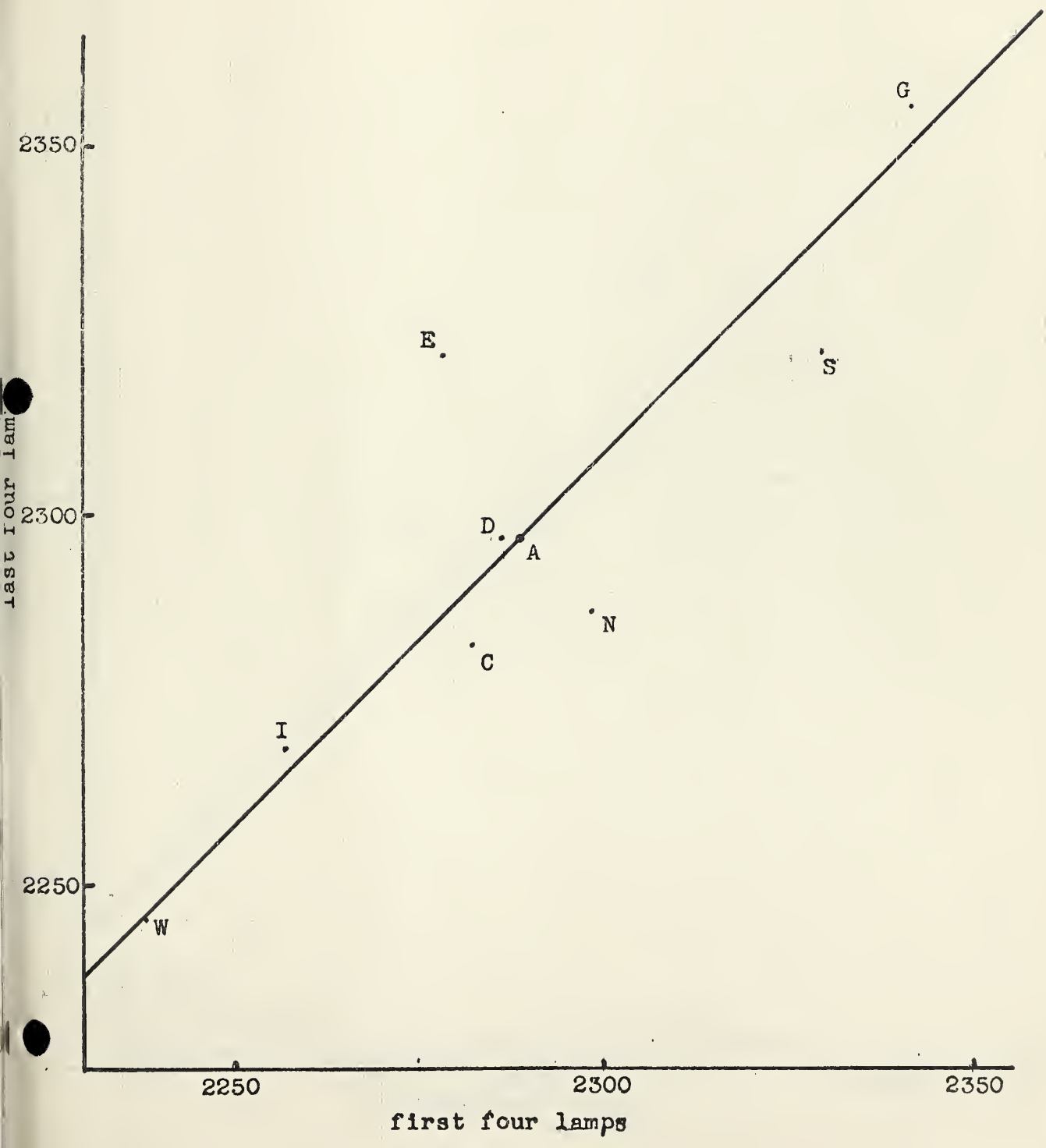


Figure 2

Amperes

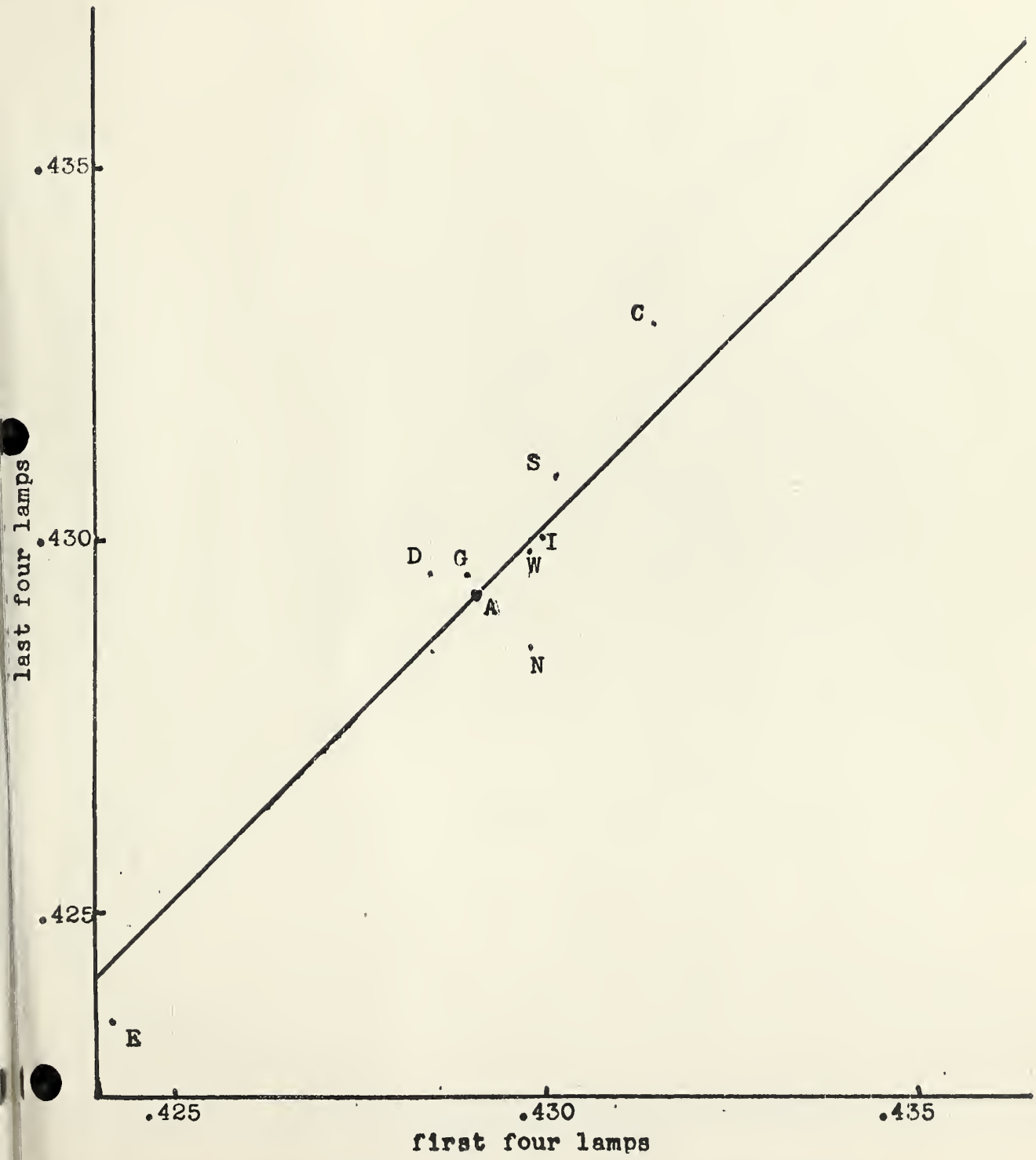


Figure 3

Lamp Volts

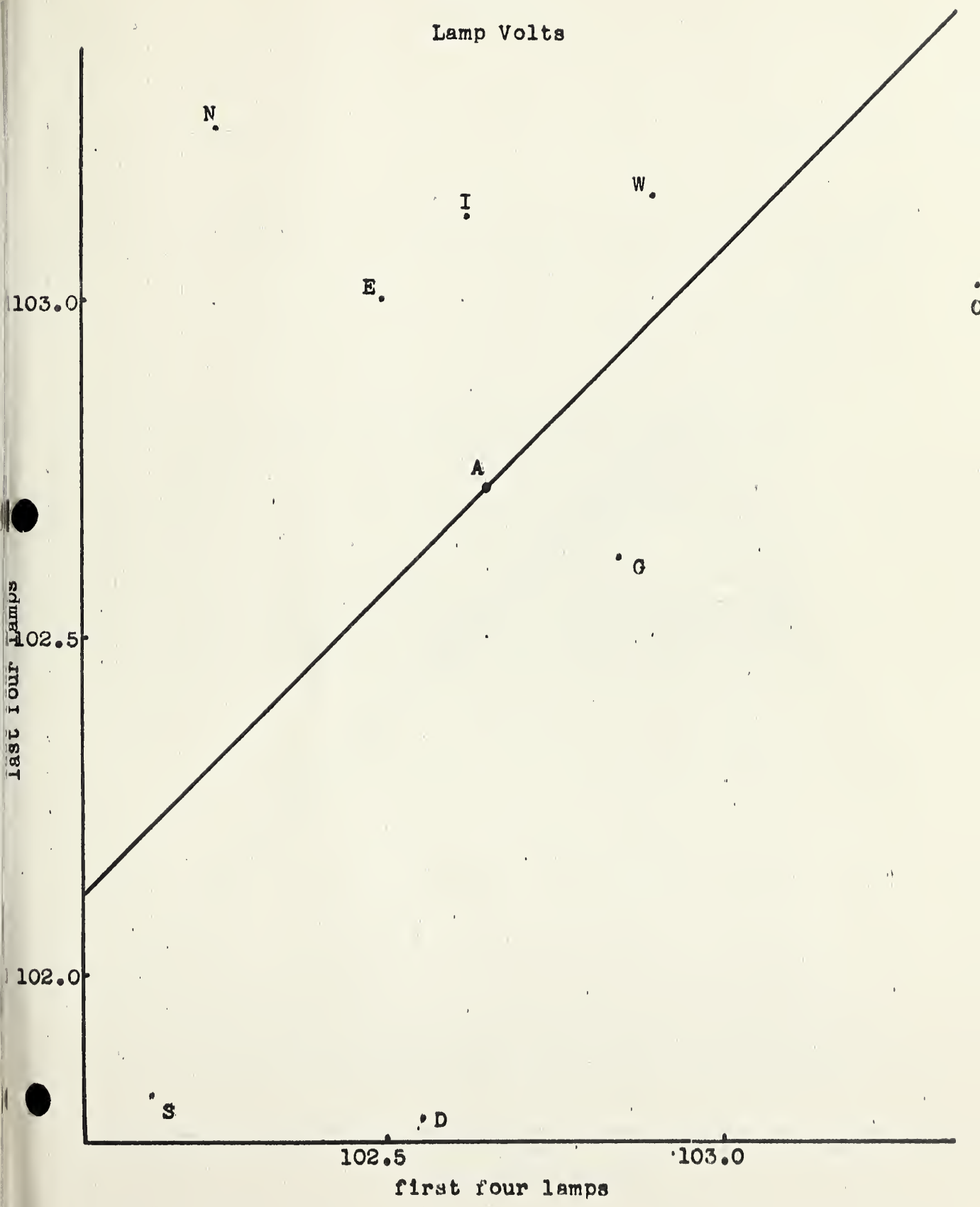


Figure 4

Lamp Watts

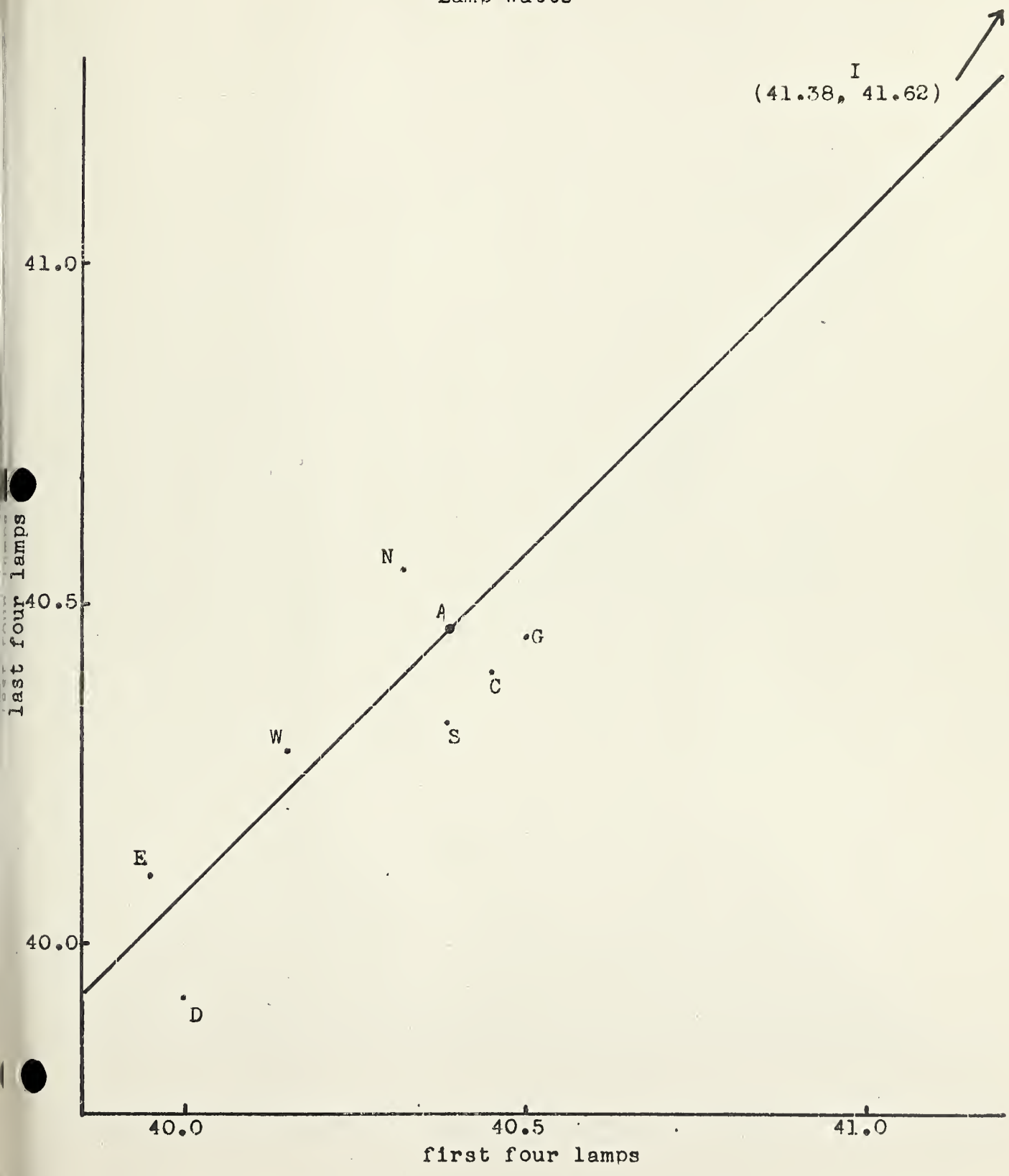


Figure 5

Lumens per Watt

Figure 6

x Coordinate

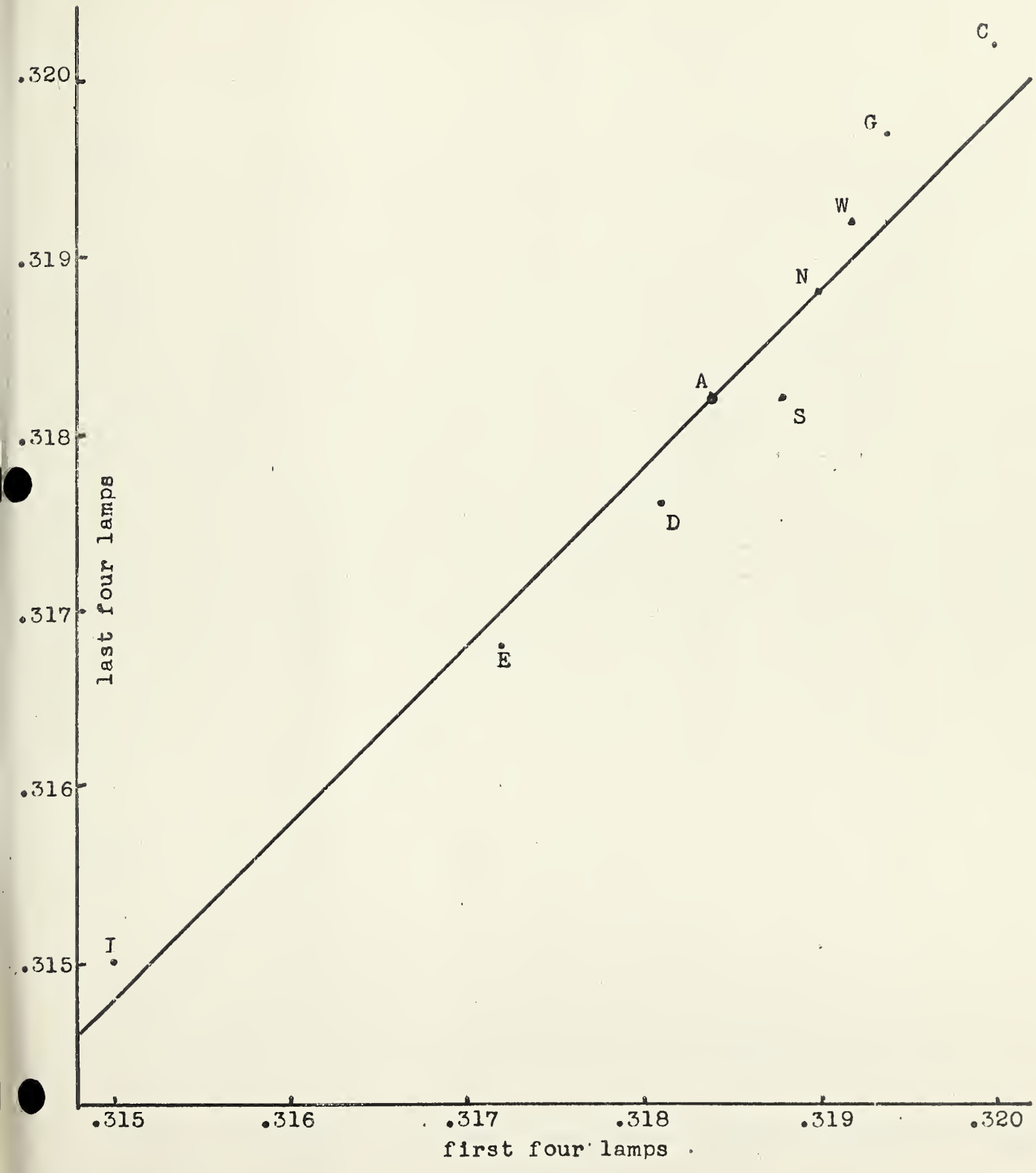
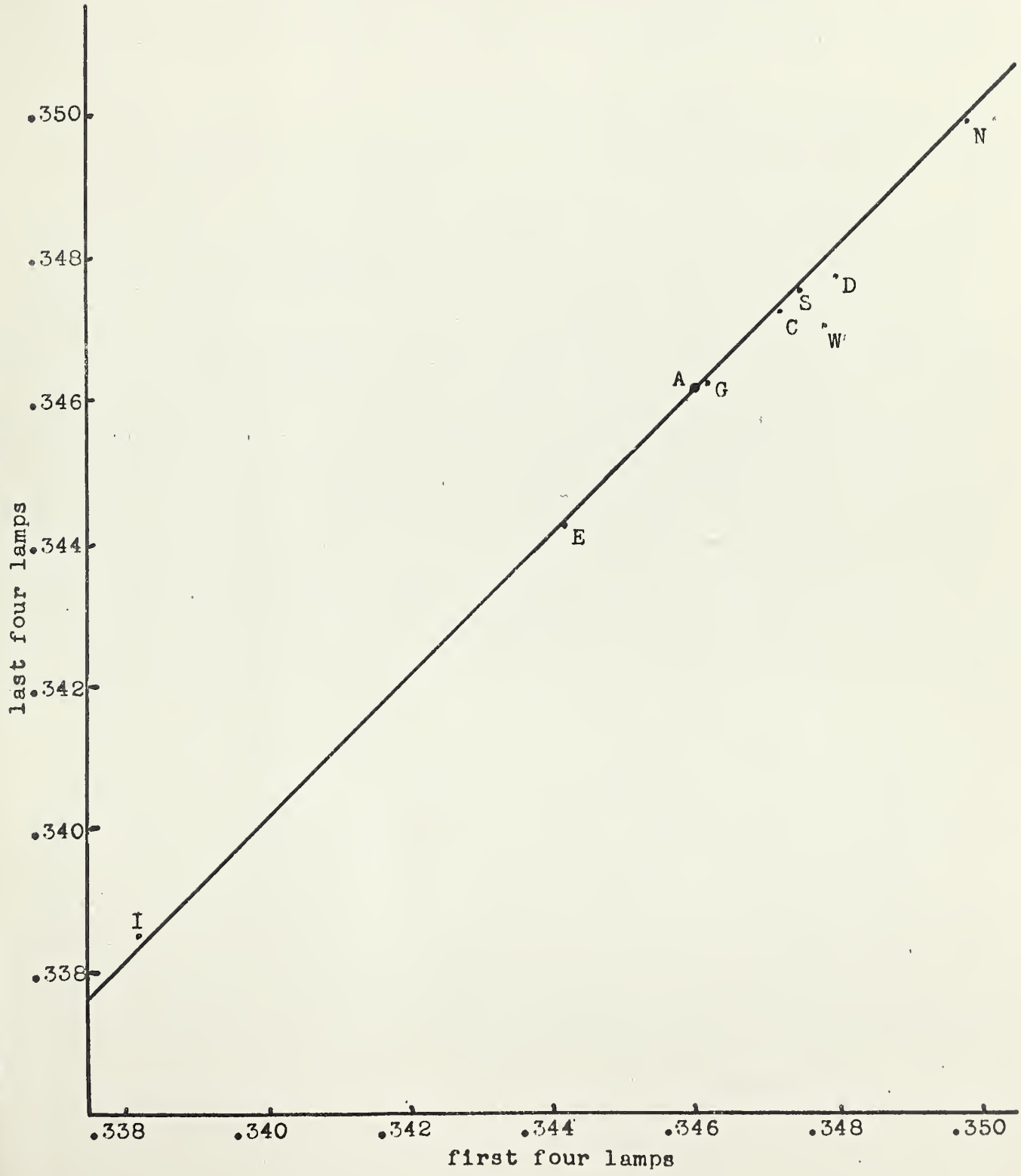


Figure 7

y Coordinate



U.S. DEPARTMENT OF COMMERCE
Frederick H. Mueller, *Secretary*

NATIONAL BUREAU OF STANDARDS
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THE NATIONAL BUREAU OF STANDARDS

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METROLOGY. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Scale. Volumetry and Densimetry.

HEAT. Temperature Physics. Heat Measurements, Cryogenic Physics. Rheology. Molecular Kinetics. Free Radicals Research. Equation of State. Statistical Physics. Molecular Spectroscopy.

RADIATION PHYSICS. X-Ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

CHEMISTRY. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Molecular Structure and Properties of Gases. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

MECHANICS. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Combustion Controls.

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Office of Weights and Measures.

BOULDER, COLO.

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IONOSPHERE RESEARCH AND PROPAGATION. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services.

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