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No. 3 of 11 copies, Series A

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Date October 20, 1949

Subject LONG-LIVED ACTIVITIES IN RALA

Written By R. S. Pressly

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Approved By A. F. Rupp

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LONG-LIVED ACTIVITIES IN RALA

October 20, 1949

Introduction

It is necessary to know the extent and nature of the traces of long-lived radioactivities in RaLa preparations in order to evaluate the probable contamination which will remain when the material is used. A special run was made in the 706-D equipment to produce RaLa under exactly the same conditions as normally prevail during processing. The product was analyzed to contain 1,440 curies of Ba^{140} at 8:00 a.m., July 12, 1948. This product was evaporated to dryness and stored in a stainless steel cone to allow it to decay. The material remaining in the cone was dissolved in 0.68 N HCl and removed in May, 1949. The solution contained suspended material which was filtered off and analyzed separately. This preliminary report describes initial work done to establish the nature of the contamination in RaLa.

Experimental

The volume of supernate was adjusted to 200 ml. The suspended material was put into solution by boiling with HCl and HNO_3, and then diluted to 200 ml. volume. The total solids were found to be 40 mg. for the supernate and 1,360 mg. for the suspended material. Spectrographic analysis of the two components showed the following elements:

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	Suspended Material	Supernate
Barium	None	Faint Trace
Calcium	Trace	Very Weak
Chromium	Very Weak	Strong
Copper	Moderate	Very Weak
Iron	Strong	Very Strong
Magnesium	Weak	Faint Trace
Nickel	None	Moderate
Platinum	None	Very Weak
Silicon	Very Strong	Trace

The bulk of the iron, chromium, and nickel found, in all probability, resulted from storage of the solution in a stainless steel vessel.

A radiochemical analysis using carrier and co-precipitation techniques was made on this solution with results shown in Table I.

A separation of the activities was made by ion exchange using a Dowex 50 resin column. The total activity was absorbed on the resin from a weak HCl solution. The column was eluted with a 0.2 M citrate solution at pH's varying from 3.0 to 5.8.

Curve IV shows half-thicknesses, in milligrams of aluminum, taken from various absorption curves drawn on the fractions removed from the resin column. The abscissa is running time in hours.

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TABLE I.

RADIOCHEMICAL ANALYSIS OF RALA RESIDUE

Calculated to May 10, 1949

	Mc/ml in Suspended Material	Mc/ml in Supernate	Total mc in 200 ml of Supernate and Suspended Material	Percent
Gross Beta	3.59×10^{-3}	1.98	396.07	100.00
Barium Beta	2.29×10^{-6}	5.02×10^{-4}	.101	.026
$Sr^{89,90}$	1.51×10^{-5}	1.06	212.030	53.53
Y^{90}	1.41×10^{-5}	.730	146.028	36.88
TRE-Ce-Y^{90}	---	.111	22.228	5.61
Activity not shown by Analysis		---	15.684	3.95
Pu Alpha	12 counts/minute, 50% geometry	125 counts/minute	---	---

TABLE II.

RADIOCHEMICAL ANALYSIS OF RALA RESIDUE

Calculated back to Starting Time July 12, 1948

	Curies in Suspended Material	Curies Supernate	Total Curies	Percent
Gross Beta	5.40	1358.08	1363.47	100.00
Barium Beta	5.40	1356.50	1361.90	99.88
Sr^{89}	5.0×10^{-8}	1.21	1.21	.08
Sr^{90}	1.04×10^{-7}	.18	.18	.01
Y^{90}	1.04×10^{-7}	.18	.18	.01
Total Pu	---	---	0.79 micrograms	---

Discussion

In the radiochemical analysis for Ba, a portion of the Sr activity was also carried as shown by the beta absorption Curve I. Using this curve and the Ba beta count, the amount of Ba^{140} was calculated.

The beta absorption curve on the radiochemical Sr separation clearly indicates the ratio between Sr^{89} and Sr^{90} (Curve III.). From this curve the amount of Y^{90} was calculated. Curve II. indicated a difference between Total Rare Earths (minus Ce) and the calculated Y^{90}. This difference is indicated as TRE-Ce-Y^{90} in Table I., but remains unidentified and is such a small component that it is not significant in calculated data in Table II.

Conclusions

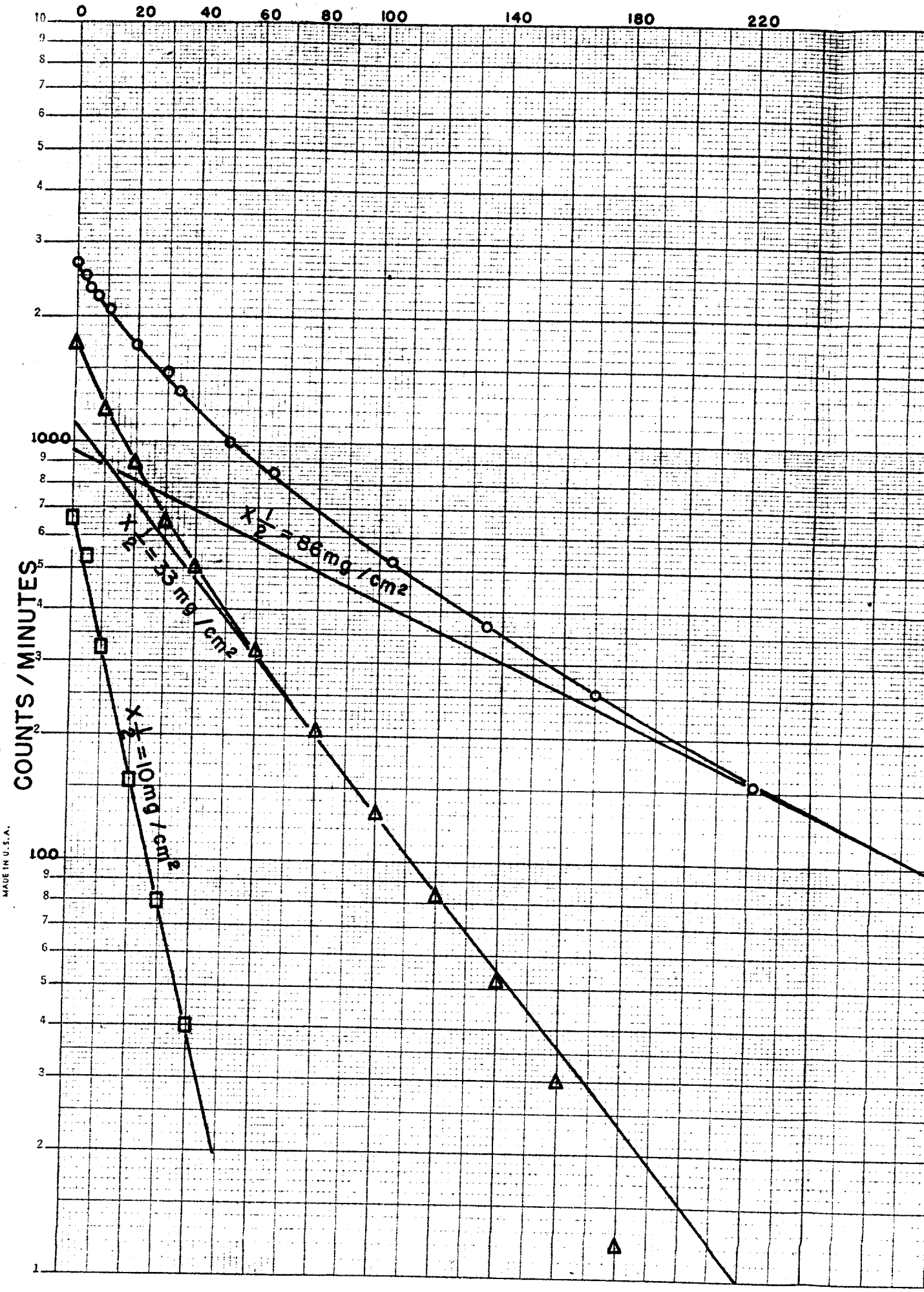
The activity remaining in this RaLa preparation after one year is mostly $Sr^{89,90}$ and the Sr^{90} daughter, Y^{90}; this constitutes approximately 0.02% of the original activity.

Further analysis and separations will be made in an effort to separate traces of long-lived activities from the $Sr^{89,90}$ and Y^{90}.

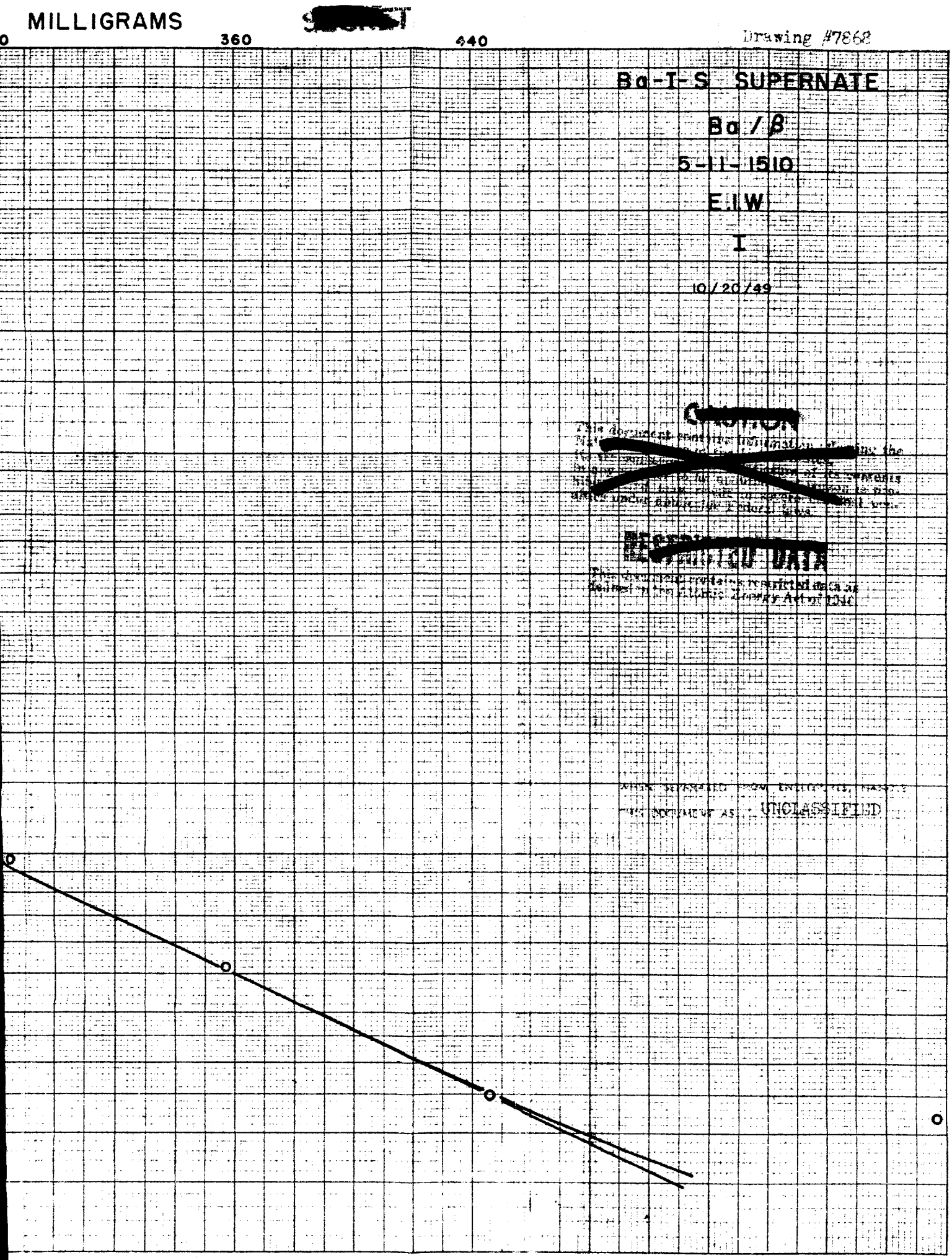
Written by Roscoe S. Pressly

Approved by A F Rupp

wp



KEUFFEL & ESSER CO., N. Y. NO. 359-731.
Semi-Logarithmic.
3 Cycles X 10 to the 1/2 inch, 5th lines accented.
MADE IN U.S.A.


MILLIGRAMS
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0
360
440
Drawing #7868
Ba-I-S SUPERNATE
Ba / β
5-11-1510
E.I.W
I
10/20/49
[redacted]
[redacted]
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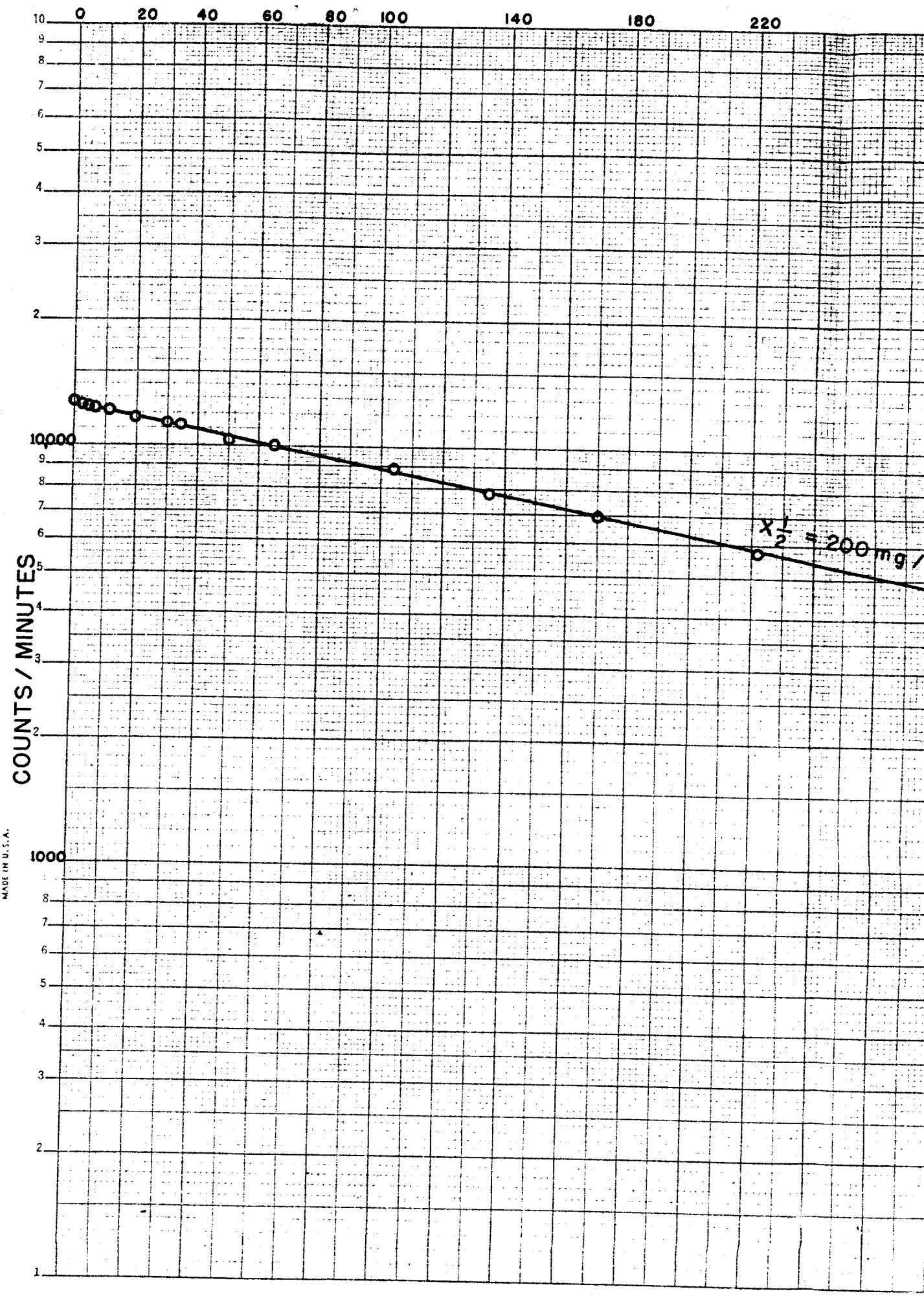
0
20
40
60
80
100
140
180
220
10
9
8
7
6
5
4
3
2
10,000
9
8
7
6
5
4
3
2
1000
8
7
6
5
4
3
2
1
COUNTS / MINUTES
$X_{\frac{1}{2}}$ = 200 mg/
KEUFFEL & ESSER CO., N. Y. NO. 358-73L
Semi-Logarithmic.
2 Cycles × 10 to the 15 inch, 5th lines accented.
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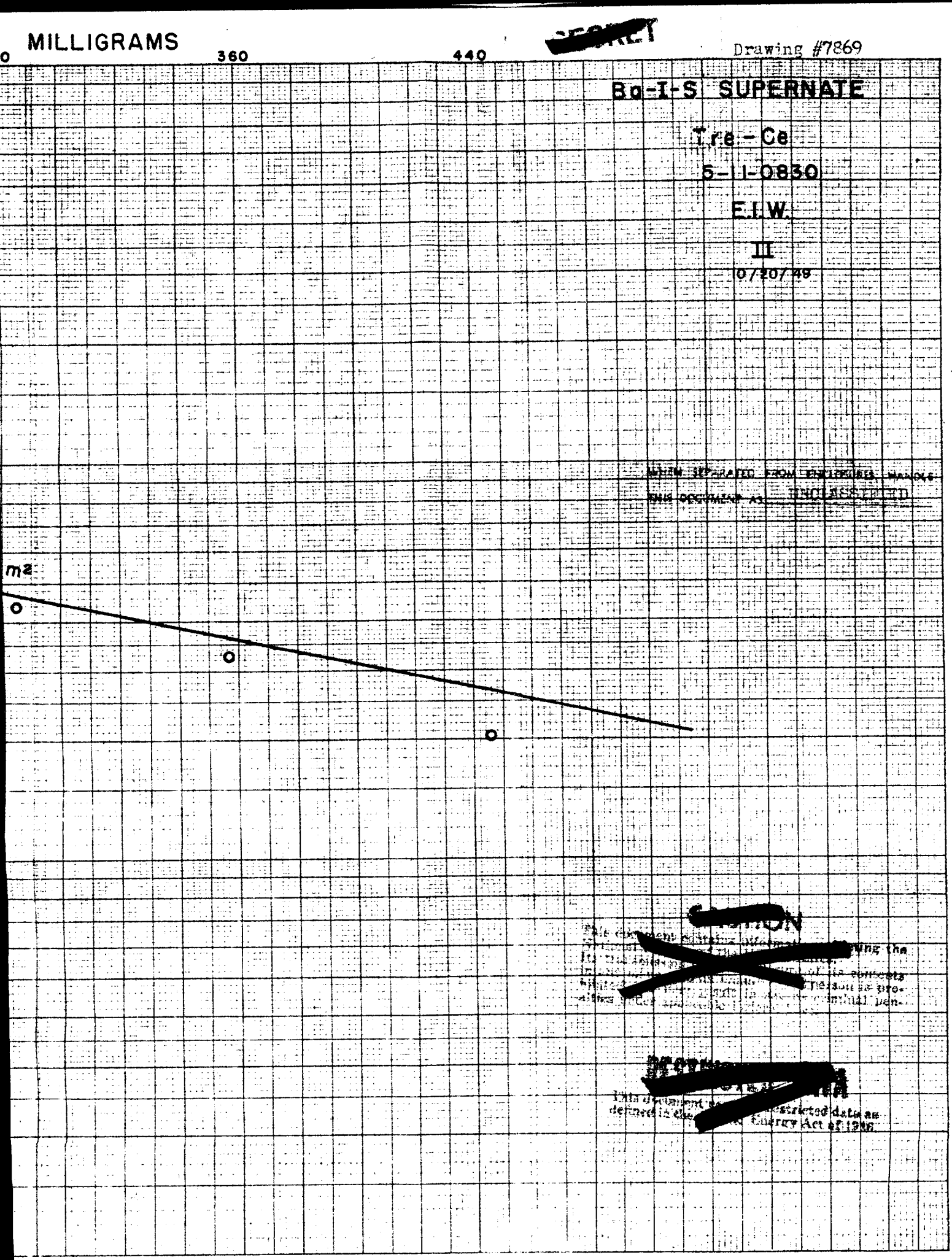
Drawing #7869



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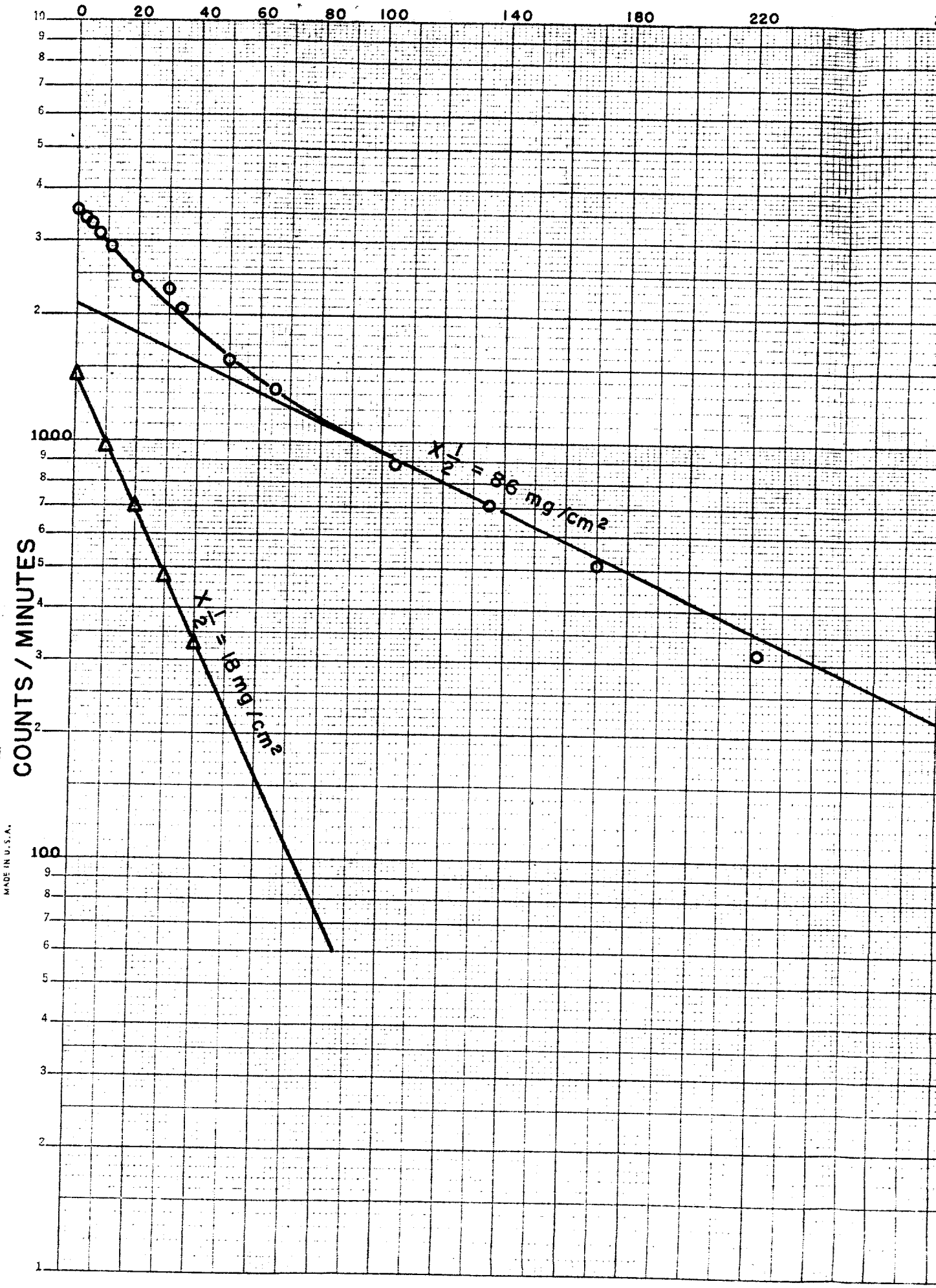

KEUFFEL & ESSER CO., N. Y. NO. 359-79L
Semi-Logarithmic
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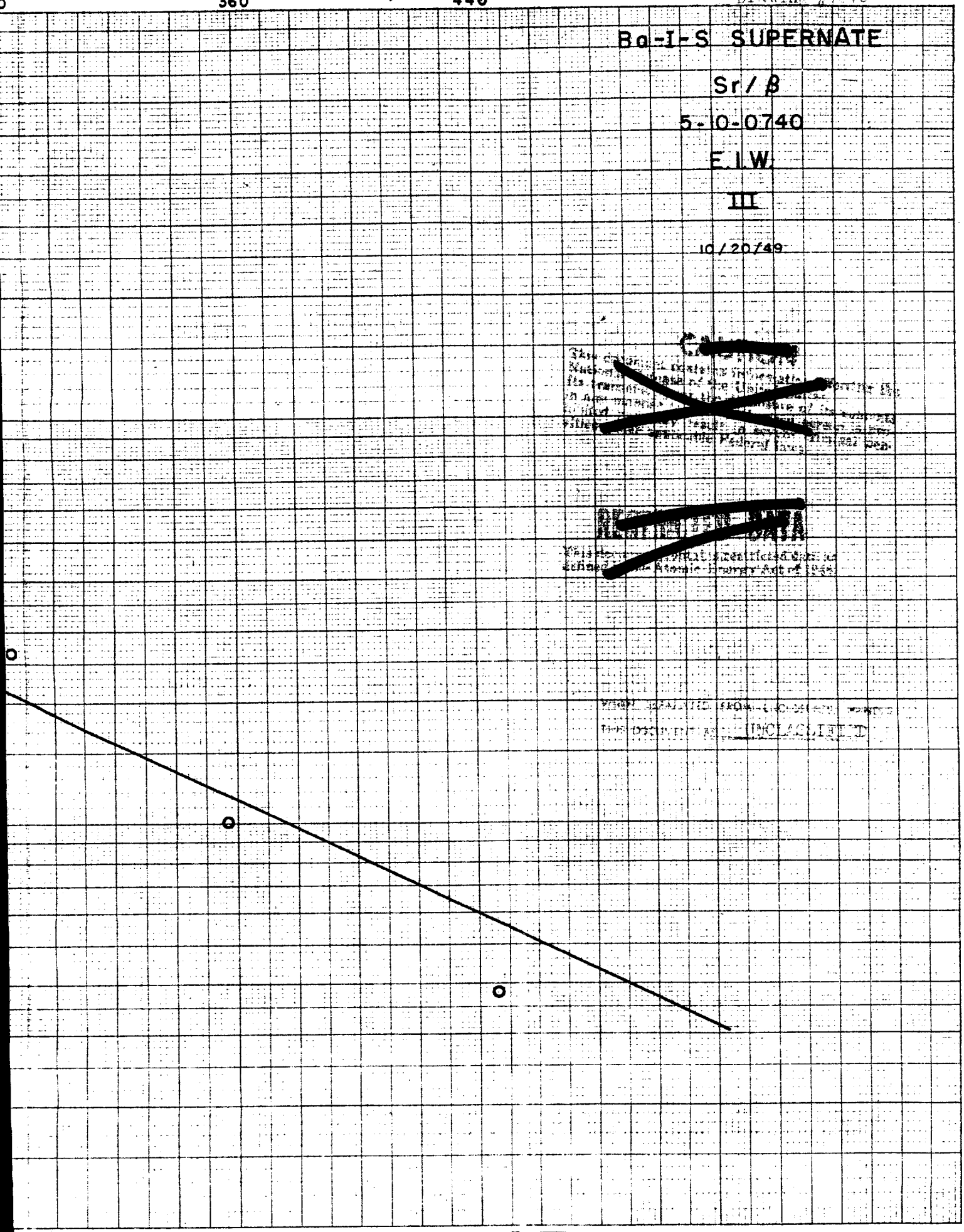
[redacted]

Drawing #7870



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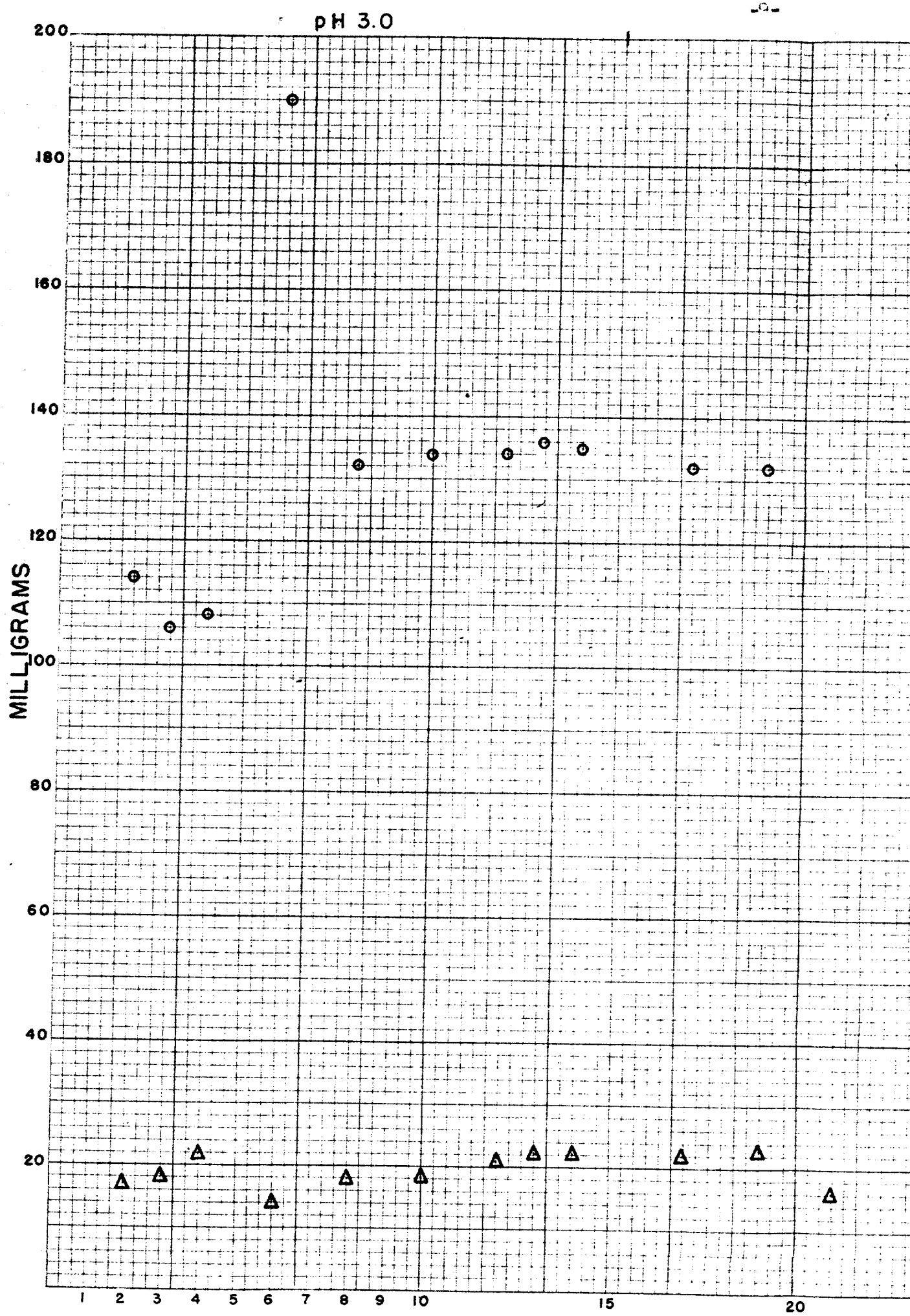
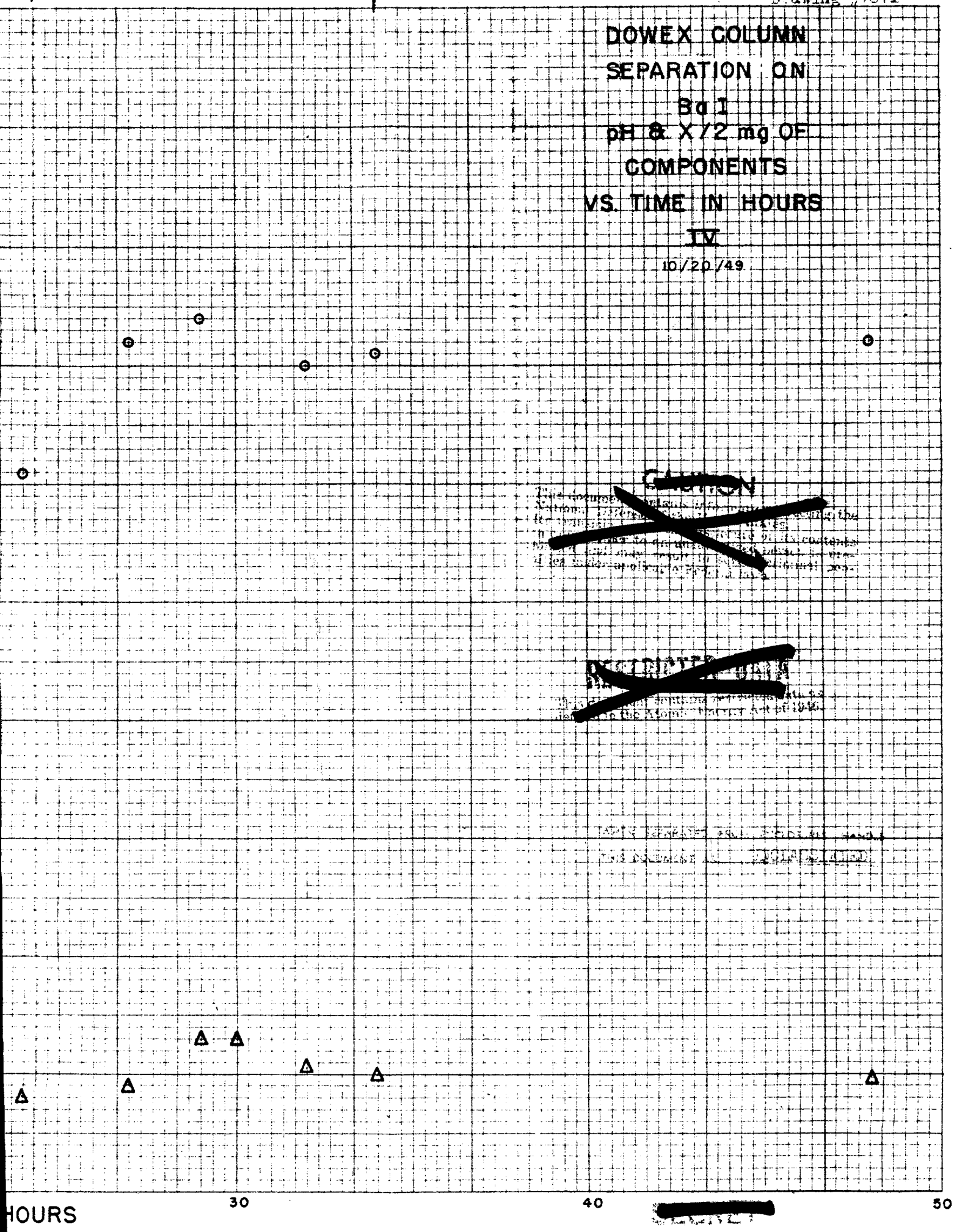


LOUIS E. DIETZGEN CO.
NO. 340D 10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

pH 4.5 [redacted] pH 5-8 Drawing #7871



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