MICA CONCENTRATION BY RISING CURRENT ELUTRIATION AND SCREENING

RML Project No. 2

Minerals Research Laboratory January 1971 Progress Report

Lab. No. 3376 - Book 237, p. 76-87

by
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Introduction

"High grade unreagentized mica concentrate would be a highly desirable product and would sell for an unbelievable price." This statement was made by an industrial representative during his visit at the Minerals Research Laboratory. He was familiar with gravity and screening procedures used in mica processing plants and commented that concentrate from these operations did not meet high grade (low grit) requirements.

A project was undertaken directed toward separating mica from sand by using the difference in particle shape to effect a separation by elutriation and screening. The feed consisted of a mica schist ore, containing 44.2 percent mica, obtained from a deposit between Bryson City and Franklin, North Carolina.

Objective

The object of this project was to explore the possibilities of concentrating mica by rising current elutriation followed by screening. The larger size mica flakes would respond in a manner similar to that of smaller size sand particles in a rising column of water. The overflow material would be screened to concentrate mica in the oversize fraction and remove sands as a screen through-put.

Procedure

Sample Preparation

Samples for testing were prepared by rod milling 500-gram samples for four minutes with five rods in a slurry containing 25 percent solids and 20 cc. of 2.5 percent NaOH. The mill discharge was transferred to a 10-quart bucket, water added to a near-full container, and allowed to settle for one minute.

The pulp was poured over a 200 mesh screen for desliming. Two desliming stages were used. The material was then proportioned into batch samples for testing.

Testing - Particle Behavior

A test sample was placed in a glass cylinder containing an opening near the bottom through which water was injected at a predetermined rate. The upward flow of water transported a portion of the mica and sands which overflowed into a pan. The flow of water was shut off and the remaining material (underflow) settled to the bottom of the glass cylinder.

The two fractions, overflow and underflow, were dried and separated into size fractions by screening on a Ro-Tap. The screen analyses data for the overflow material were plotted on a graph as cumulative percent passing. The screen analyses data for the underflow material were plotted on a graph as cumulative percent retained.

By plotting the overflow as percent passing and the underflow as percent retained, the intersection of the two curves would be the theoretical mesh for efficient separation at a particular water velocity. Data derived from the intersection points of the curves from various tests were plotted on a common graph. This graph projects the theoretical mesh for efficient separation for an arbitrary water velocity.

Testing - Elutriation and Screening

The test sample was prepared as in previous tests with the exception of the desliming stage which was accomplished in the test cylinder. The rod milled material was placed in the glass cylinder and water added at pre-determined rates. Overflow material was recovered after each increase in water velocity until the final overflow product was obtained. The material remaining in the cylinder was recovered and classified as underflow. Each elutriated product was dried and screened at a mesh size which recovered clean mica as a screen oversize, with the sands being rejected as a screen through-put.

Results

Screen analyses of underflow percent retained and overflow percent passing for water velocities ranging from 0.90 to 4.00 feet per minute are shown in Figures 1-4. The theoretical mesh for efficient separation for these tests are combined in Figure 5. With a water velocity of 1.00 foot per minute the most efficient separation should occur at 125 mesh. With a water velocity of 6.00 feet per minute the most efficient separation should occur at 48 mesh.

The data for the elutriation and screening test are shown in Table 1. Two hundred mesh mica was recovered by screening material elutriated at 0.60-0.80 feet per minute. Sixty-five mesh mica was recovered by screening material elutriated at 3.20-4.00 feet per minute.

Approximately ninety percent of the mica was recovered by this procedure.

Conclusions

It has been demonstrated in the laboratory that mica could be concentrated by elutriation and screening. The procedure may not be practical as a commercial process for bulk concentration of mica; however, the basic idea may be applicable to a particular phase of a plant flowsheet.

The writer anticipates pursuing the procedure further as a means of sub-sieve sizing mica concentrate.

Figure 1

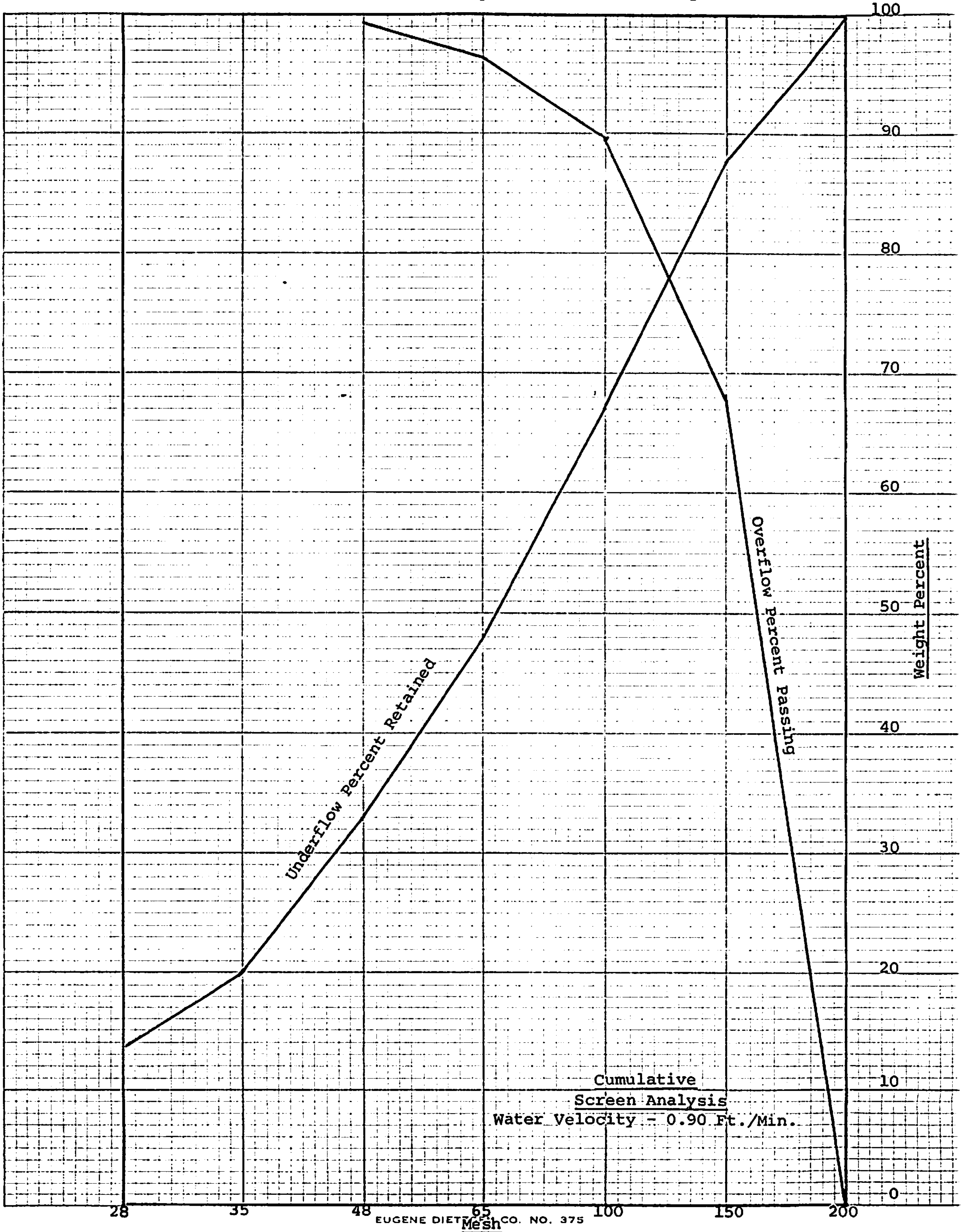

100
90
80
70
60
50
40
30
20
10
0
Weight Percent
Underflow Percent Retained
Overflow Percent Passing
Cumulative
Screen Analysis
Water Velocity - 0.90 Ft./Min.
28
35
48
65
100
150
200
Mesh
EUGENE DIET[...] CO. NO. 375

Figure 2

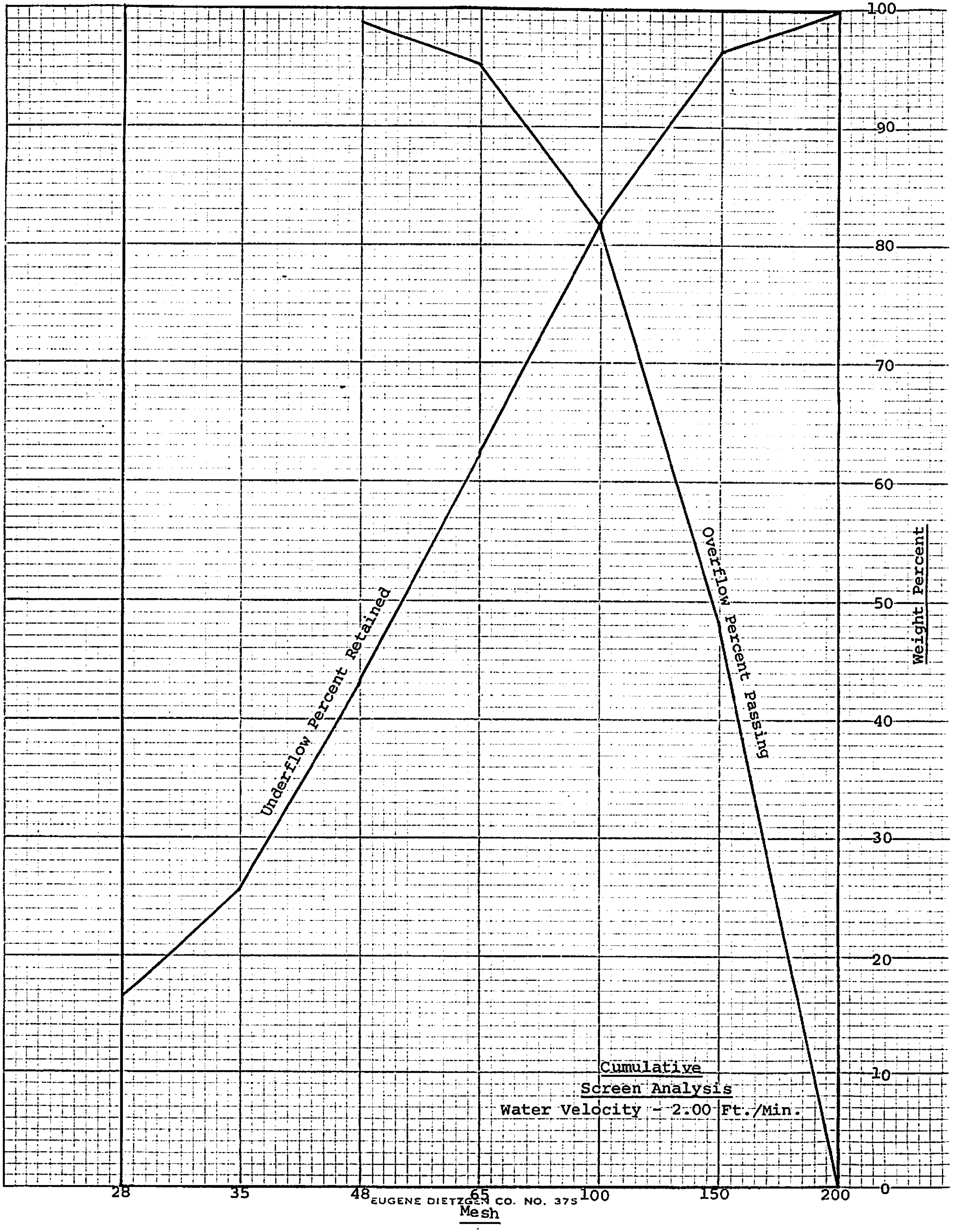
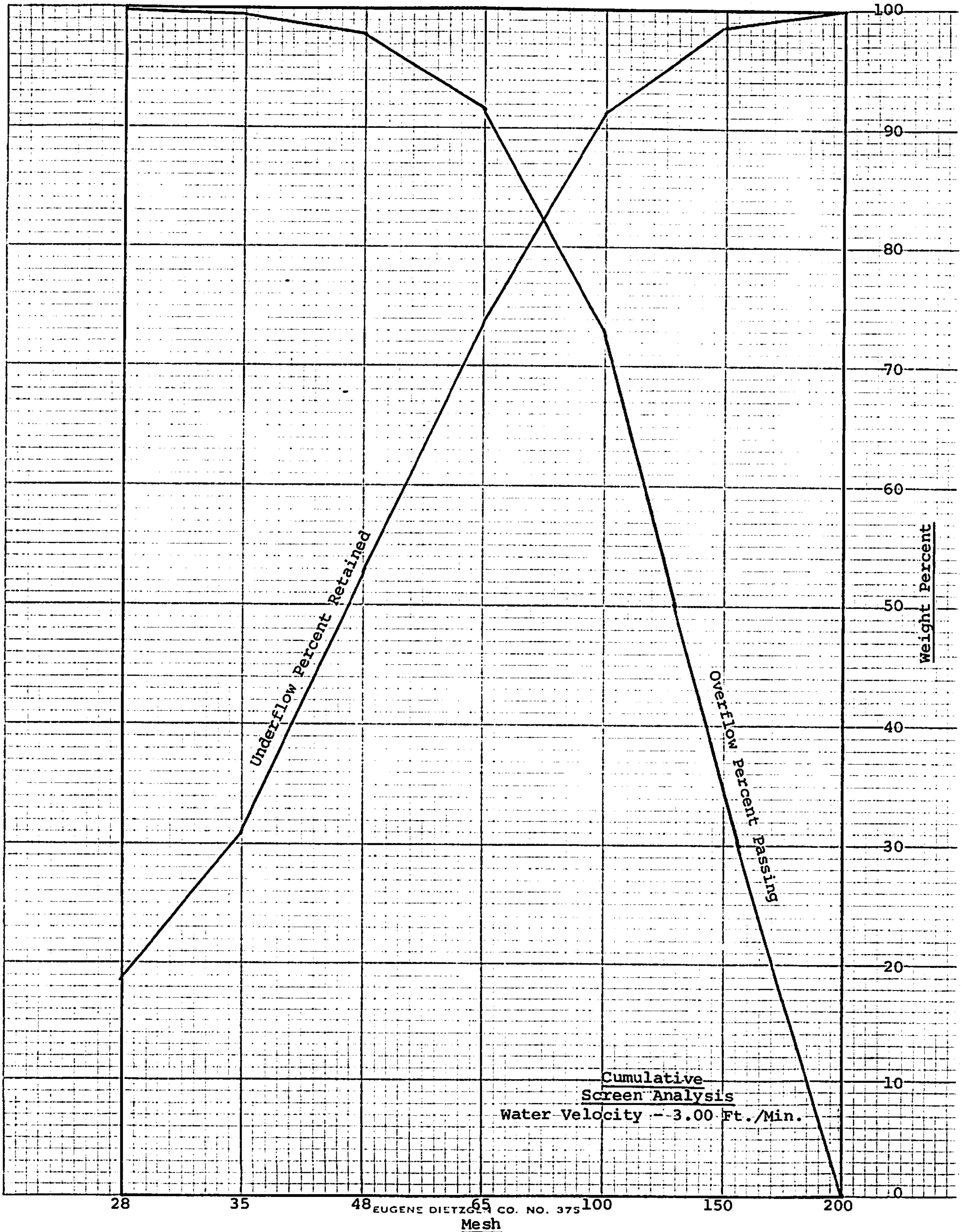

100
90
80
70
60
50
40
30
20
10
0
Weight Percent
Underflow Percent Retained
Overflow Percent Passing
Cumulative
Screen Analysis
Water Velocity - 2.00 Ft./Min.
28
35
48
65
100
150
200
EUGENE DIETZGEN CO. NO. 375
Mesh

Figure 3


100
90
80
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0
Weight Percent
Underflow Percent Retained
Overflow Percent Passing
Cumulative
Screen Analysis
Water Velocity - 3.00 Ft./Min.
28
35
48
65
100
150
200
EUGENE DIETZGEN CO. NO. 375
Mesh

Figure 4

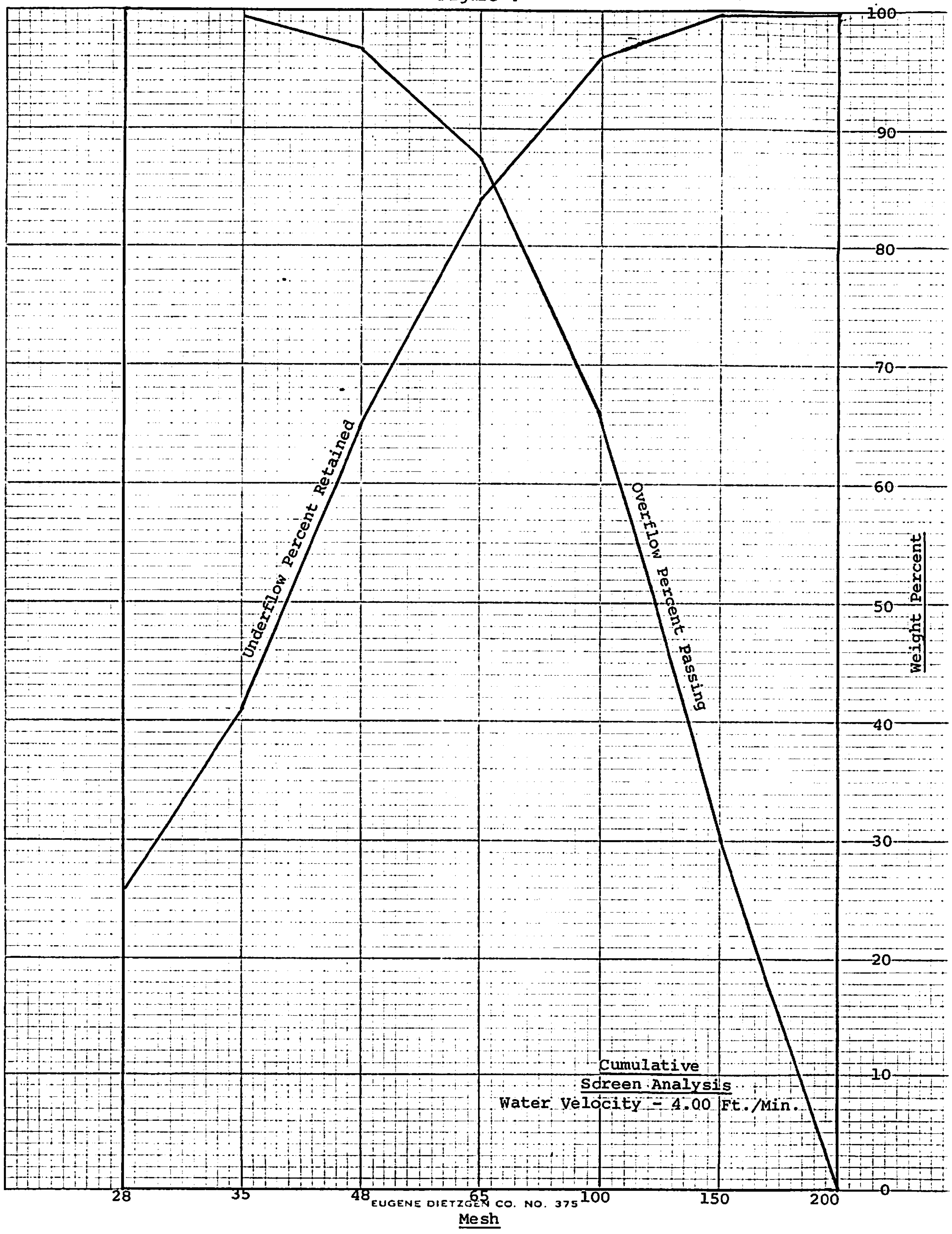
100
90
80
70
60
50
40
30
20
10
0
Weight Percent
Underflow Percent Retained
Overflow Percent Passing
Cumulative
Screen Analysis
Water Velocity - 4.00 Ft./Min.
28
35
48
65
100
150
200
EUGENE DIETZGEN CO. NO. 375
Mesh

Figure 5

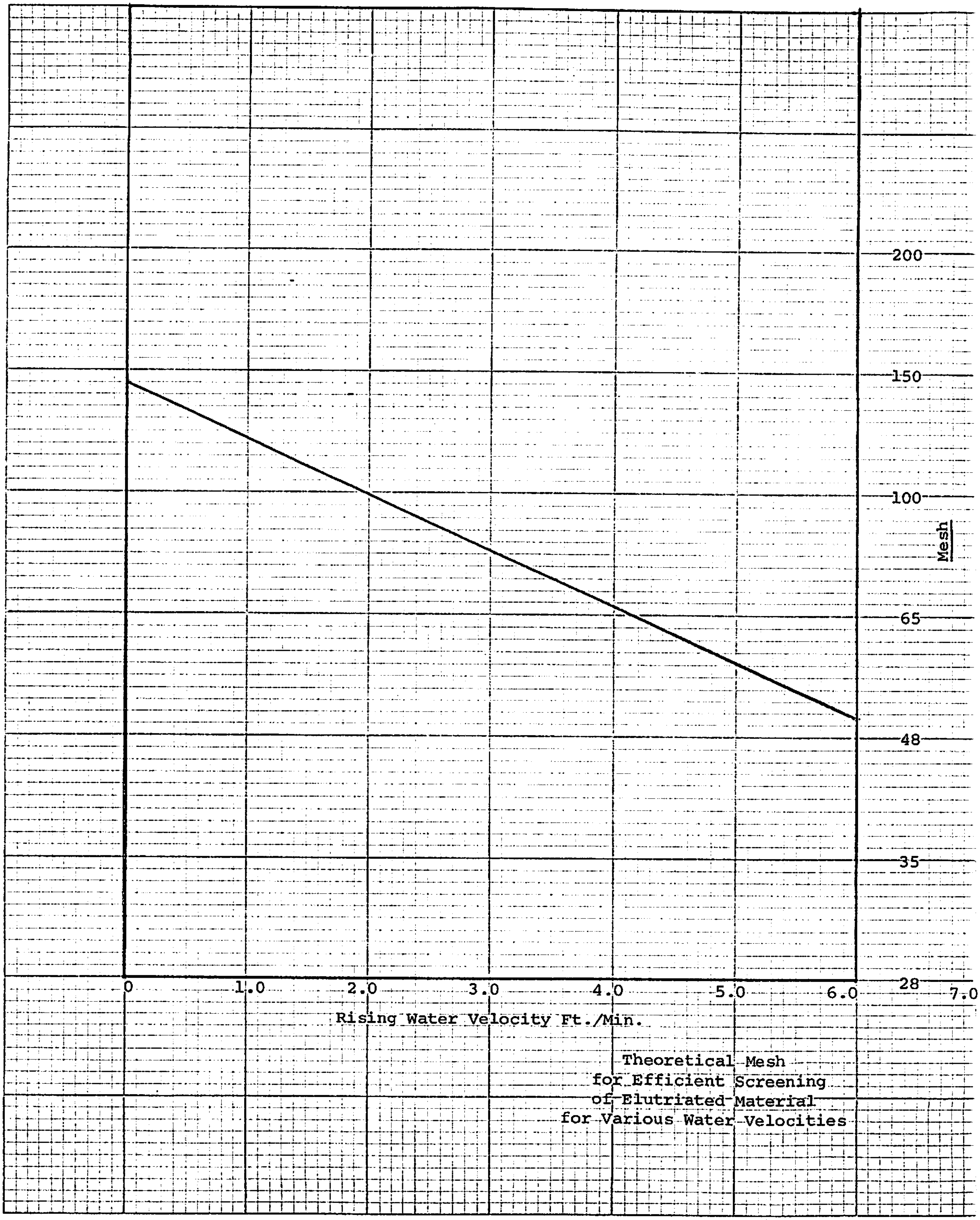
200
150
100
65
48
35
28
Mesh
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Rising Water Velocity Ft./Min.
Theoretical Mesh
for Efficient Screening
of Elutriated Material
for Various Water Velocities

Table 1

Elutriation and Screening Test

Water Velocity Ft/Min	Elutriated Product		Mica Product		
	Sample	Wt %	Mesh*	Wt %**	Dist. %
0.40	Overflow	10.4	-	-	-
0.60	"	8.2	200	33	6.4
0.80	"	8.7	200	40	8.2
1.00	"	2.4	150	22	1.2
1.20	"	2.7	150	32	2.0
1.40	"	3.3	150	39	3.0
1.60	"	2.4	150	49	2.8
1.80	"	3.3	100	35	2.7
2.00	"	3.0	100	39	2.8
2.20	"	3.1	100	50	3.6
2.40	"	2.1	80	24	1.2
2.60	"	2.5	80	27	1.6
2.80	"	2.6	80	34	2.1
3.00	"	2.6	80	38	2.3
3.20	"	0.4	65	50	0.5
3.40	"	2.3	65	31	1.7
3.60	"	2.3	65	33	1.8
3.80	"	2.3	65	43	2.3
4.00	"	1.3	65	46	1.4
7.10	"	16.9	48	43	17.1
7.10	Underflow	17.0	48	88	35.3
Total		100.0		42.5	100.0
Head Feed				44.0	

* Each sample was screened on the mesh screen which produced clean mica as a screen oversize.

** Weight percent of elutriated sample recovered as mica product.