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ANNUAL REPORT

of the

INDUSTRIAL HEALTH SECTION

1936

W. J. McConnell, M.D.
Assistant Medical Director

PERSONNEL OF STAFF

Dr. W. J. McConnell, Assistant Medical Director, Director, Industrial Health Section
Miss Eleanor Rantoul, Research Assistant
Miss Anne Reilly, Secretary to Dr. McConnell
Miss Anne Conway, Stenographer

Mr. J. Wm. Fehnel, Chemist-in-Charge of Industrial Hygiene Laboratory
Mr. Peter Petrick, Technician
Mr. John J. Ferry, Assistant Chemist
Mr. Austin Long, Assistant Chemist
Mr. John Milesnick, Porter in the laboratory

MAJOR SURVEY

The survey of the asbestos plants and mines started in 1934 has been concluded during 1936. This included a recheck survey of some of the plants to determine what improvements, if any, have been effected by the inatallation of certain equipment designed to control the dust, as well as a number of new plants, particularly on the Pacific Coast. Plants studied in 1936 were:

Johns-Manville
Redwood City, Cal.
Pittsburg, Cal.
Los Angeles, Cal.
Lompoc, Cal.

General Asbestos & Rubber Division of Raybestos-Manhattan, Inc.
North Charleston, S.C.

X-rays of the chests of exposed workers were sent in to the Home Office for diagnosis. In 1936 - 2570 X-rays were interpreted. Over, 3,200 X-rays of asbestos workers have been read in connection with the second asbestos study.

X-RAY INTERPRETATIONS

In addition to the 2570 X-rays of asbestos workers interpreted during 1936 the American Car and Foundry Company has been continuing to send in for diagnosis X-rays of their foundry employees. During 1936, X-rays of 177 of their workers were interpreted. We have also been asked to diagnose X-rays from other Group policyholders sent to us by the Group Claim Section in connection with claims.

SPECIAL RESEARCH

A study was made to determine a method of entrapping mercury and a chemical method of estimation of mercury in the air of a storage battery plant. This was necessary due to the fact that all available methods dealt with the determination of mercury in either the metallic state or in the forms of a

chloride or nitrate but not in the state of the oxide. Therefore, in order to determine the presence and concentration of mercuric oxide in the atmosphere of the plant in question a method giving concordant results was developed.

The presence of the oxides of nitrogen and their concentration in the fumes given off in acetylene welding were studied and a chemical method adapted which gave a true index.

Settled dusts of typical industries were studied and measured to determine the percentages of the various sizes present that might be considered pathogenic.

Various new atmospheric dust sampling devices were tried out under controlled conditions to determine their efficiency and comparison with the accepted standard method.

Methods for the determination of mixtures of acid fumes and solvent vapors are in process of study and development.

SPECIAL SERVICES

A great variety of requests for information or assistance on industrial hygiene subjects are received in this division. These are divided as follows:

Reports (Those requests requiring time and research to answer)	
Group policyholders	64
Non-policyholders and prospects	58
Met. Life Ins. Co. and H.O.	13
	135

Special Inquiries (Those requests for which information was supplied but not considered as reports)	
Group policyholders	97
Non-policyholders and prospects	180
Met. Life Ins. Co. and H.O.	55
	332

LABORATORY SURVEYS

Included in the above number of special services are 42 surveys made by the Industrial Hygiene Laboratory. In analyzing the samples of atmospheric dusts, fumes and gases collected in the plants studied, 819 analyses were made in the laboratory. The classes of materials analyzed were:

silica and silicates
metals (lead, zinc, copper, tin, mercury, etc.)
fumes (lead, zinc, mercury, solvents such as amyl acetate, methyl alcohol, dichlorbenzine, tricresylphosphate, etc.)
gases (carbon monoxide, sulphur dioxide, nitrous fumes, etc.)

The companies studied by the laboratory represent a wide variety of industrial processes. Included are:

floor coverings, pipe insulation and fire brick manufacture
grey and malleable castings foundry
asbestos fabricating plants
public utilities
heat resistant glass manufacture
gas and combination range manufacture
stainless steel and regular steel products such as open hearth, etc.
glass manufacturing
automobile radiators and car heaters
paint manufacture
railroad car specialties
Alloy steel manufacture
alkaline type storage battery manufacture
china ware - hotel supply
printing ink manufacture
decalcomania
bookkeeping book manufacture
asbestos pipe insulation and magnesia blocks
mining and milling diatomaceous earth
gold mine
oil well equipment

These 42 surveys represent 8 more than were made by the Industrial Hygiene Department of Connecticut during 1936.

FIELD VISITS

During the year there were 85 field visits, exclusive of visits for laboratory survey. Included in this figure are 75 interviews in the Home Office.

ADDRESSES AND MEETINGS

Dr. McConnell and other members of the division attended 17 meetings of medical and safety organizations and made addresses at 7 of these meetings. Forty-eight newspapers and other publications gave press notices to these addresses in 505 column inches.

EXHIBITS

The Industrial Hygiene Laboratory held an exhibit at the American Medical Association meeting in Kansas City, Mo. In addition to a display of dust sampling equipment, 24 X-rays of chests of cases of first and second stages of silicosis and asbestosis, fungus infection, pneumoconiosis caused by exposure to amorphous silica were displayed.

An exhibit was also held of these X-rays at the Graduate Fortnight of the New York Academy of Medicine.

Dr. Philip Pierson, Clinical Professor of Medicine at Stanford University School of Medicine exhibited this collection of X-rays at an exhibit held in California.

PUBLICATIONS

Three booklets of the Industrial Health Section were completely revised and printed during the year. These are:

Physical Examinations in Industry
Industrial Dental Service
Protection of Workers in Welding Processes

LITERATURE

During the year 1936, 11,557 copies of publications were sent to Group policyholders and non-policyholders. Of these 9,409 were sent by Welfare Division order but the letter was sent from this section.

LETTERS

Incoming letters numbered 1,798; outgoing, 1,511.

HOME OFFICE CONDITIONS

In addition to field surveys of the Industrial Hygiene Laboratory, the Industrial Health Section has been of assistance to a number of divisions in the Home Office Buildings in studying their lighting and ventilating problems. In

connection with the use of carbon tetrachloride in certain divisions in the Home Office to clean type a study was made of the concentration of fumes escaping and recommendations were made of safe methods of handling this solvent. We have also assisted the Physician in Charge of our Sanatorium in analyzing for toxicity the paint used in some of the rooms at the Sanatorium.

GROUP ACTUARIAL HEALTH CLAIMS

We are continuing to assist the Group Actuarial Division in analyzing the experience of Groups whose claim experience has been unfavorable in order to ascertain the cause. In a number of instances, where the claims would indicate a potential health hazard, we have found it necessary to visit these plants and make an inspection or survey. Reports of findings and recommendations of ways of controlling these hazards were submitted to the Actuarial Division in order to assist them in arriving at a decision regarding rates.

- - - - -

In connection with the practice of having Group policyholders defray incidental expenses of surveys, these have amounted in 1936 to $3,406.20. $509.53 of this amount has been incurred but not yet billed. This is a credit against our travel account.

J. V. MacConnell
Assistant Medical Director

PML-132
9BC

-: M E M O R A N D U M :- 4/13/79

The week following Dr. Wheatley's, Mr. Sabourin's and my visit to Thetford Mines, I returned to make studies of the dust conditions in:

1. Mill and Mine of the Johnson Company
2. Mill of the Bell Company
3. Mill of the Asbestos Corporation

I started these studies on Monday, October 23 and finished Thursday, October 26.

On Friday, October 27 and Saturday, October 28, I studied the mill and factory of the Johns-Manville Company at Asbestos.

On October 30 and 31 I studied operations in the plant of the R.C.A. Victor Company and the plant of Charles E. Frosst Company on November 1, 1944.

On Thursday, November 2, 1944 I visited the plant of the General Steel Wares, Ltd., a Group prospect, in Montreal, with Supervisors Frank Roe of Montreal and Roy Campbell of Toronto.

I made some observations and tests in this plant and will give the report to Mr. Perry for delivery to the Group prospect.

J. Wm. Fehnel

J. Wm. Fehnel, Chemist
Industrial Hygiene Laboratory

November 24, 1944.

PHL-338
4/19/79

A STUDY OF DUST CONDITIONS
in the
BRIDGEPORT AND STRATFORD, CONN. PLANTS
of the
RAYBESTOS DIVISION OF THE RAYBESTOS-MANHATTAN, INC.

The following report is a study of dust conditions in the Bridgeport and Stratford, Connecticut plants of the Raybestos Division of the Raybestos-Manhattan, Inc. This study was carried on during February and March of 1950, by the Industrial Health Service of the Metropolitan Life Insurance Company.

It is the fourth unit in a series of studies of the asbestos industry of the United States and Canada for the purpose of determining the extent and nature of atmospheric pollution to which asbestos workers are exposed and whether there can be demonstrated any harmful effects to such workers.

This study includes a limited number of physical examinations, the nature of the evidence derived from which is similar to that obtained from the third unit study (United States Asbestos Division at Manheim, Pennsylvania.)

The operations of this company are conducted in two plants, one at Bridgeport which engages in the weaving of brake-band lining and the treating and processing of the same, and the other plant at Stratford, Connecticut which manufactures molded brake-band lining, clutch disks, and asbestos packing.

The yarn used for brake-band lining in the Bridgeport plant is supplied by the General Asbestos plant at Charleston, S. C.

THE BRIDGEPORT PLANT

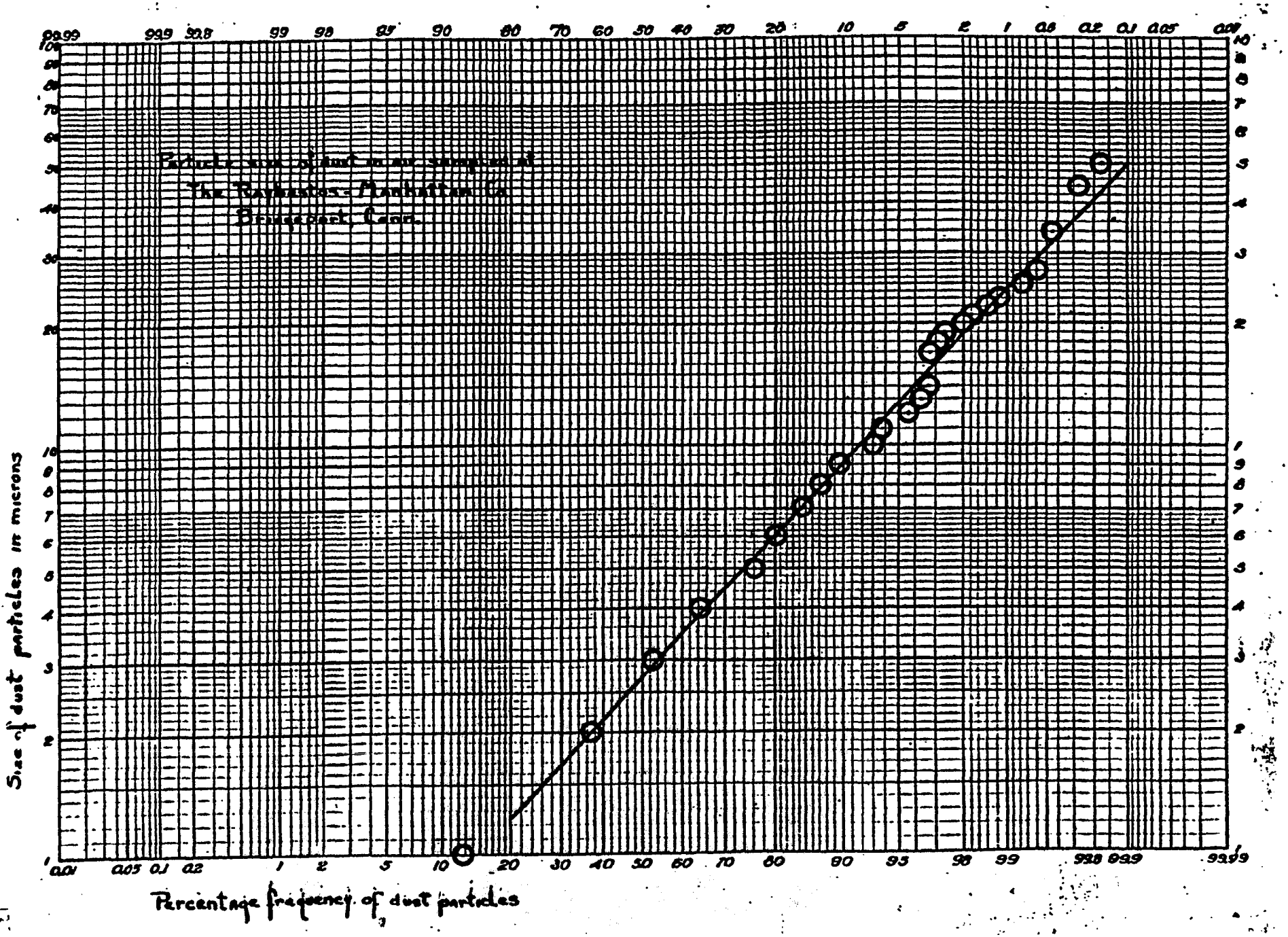
This plant consists principally of one three-story building with looms on three floors. Another two-story building is used for treating of brake-band material and for the laboratories.

Dust counts were taken at representative points throughout the weaving department.

Although the yarn received at the Bridgeport plant has received an oil treatment, the yarn used for warp is usually again run through oil.

The methods used in the collecting of dust samples and counting are identical with those given in reports of other plants of this company and as outlined in the United States Public Health Service Bulletin No. 144, Treasury Department, Washington, D.C.

Particle size measurements of the dust were made and the results are recorded in the attached graph from which the percentage of the various sizes can be determined. It will be noted from the curve that 95% of the particles are less than 10 microns in their greatest diameter.


LOGARITHMIC PROBABILITY PAPER, NO. 3128. DESIGNED BY HAZEN, WHIPPLE & FULLER.
CODEX BOOK CO., INC., NEW YORK N. Y.
Particle size of dust in air sampled at
The Raybestos-Manhattan Co.
Bridgeport, Conn.
Size of dust particles in microns
Percentage frequency of dust particles

No method of humidification is used in this plant although different units for humidifying the air in certain departments were installed for tests. Due to the large size of the rooms sufficient equipment had not be installed to accurately accomplish humidification.

The dust counts with locations indicated are listed in the following table.

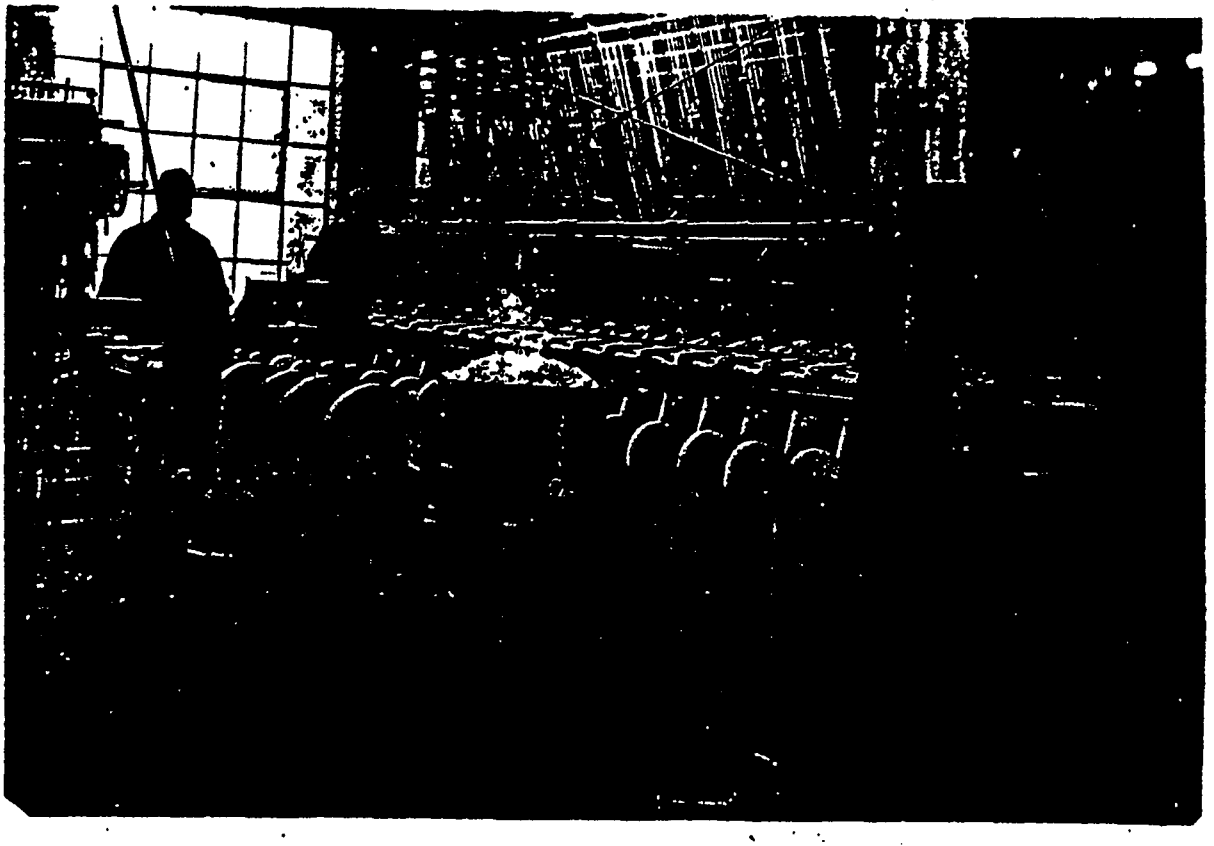
TABLE #1.

WEAVE ROOMS
2nd and 3rd Floors

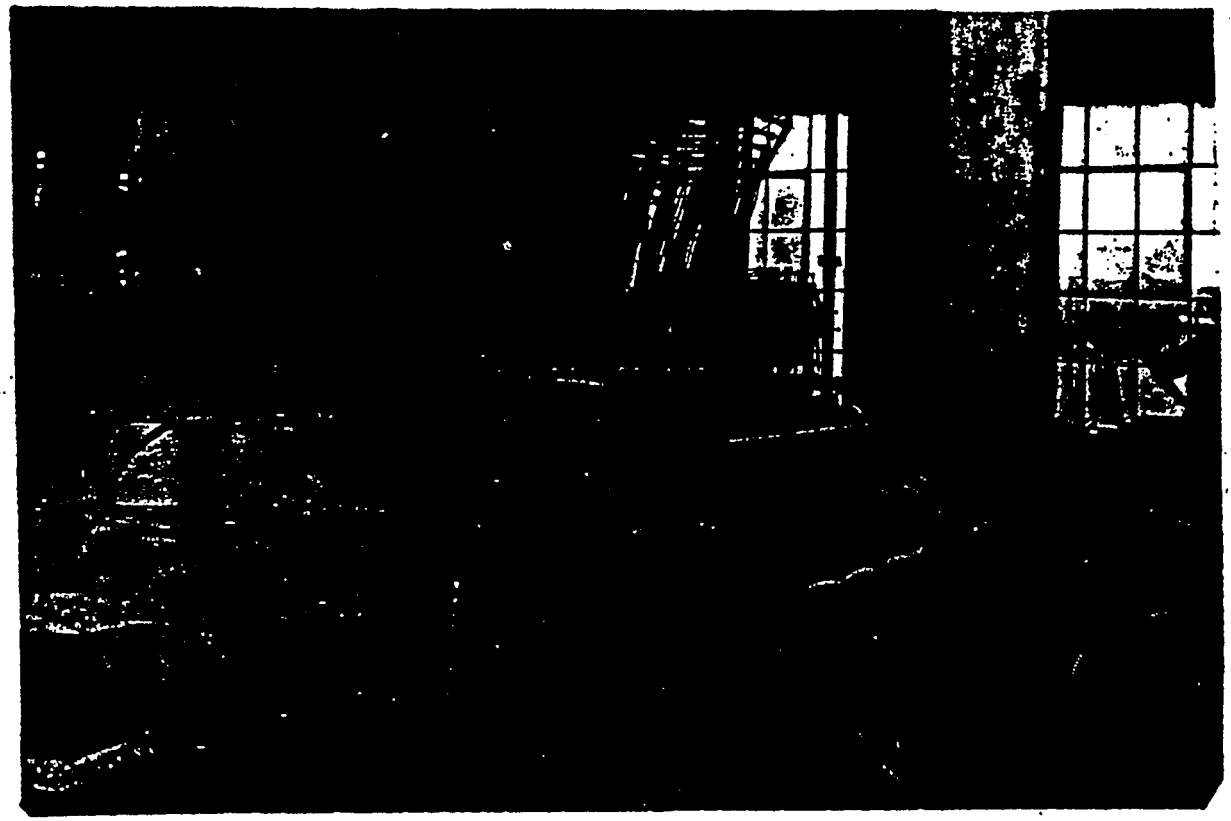
Approx Flow

Sample No.	Building No.	Floor No.	Location of Sample	Total Counts of Dust Particles per Cubic Foot	Weights of Dust in Milligrams per cubic Foot
1	1	3rd	Loom at northeast corner of weave room	956,170	.23
3	1	3rd	Between looms #54 and #55	2,515,725	.25
4	1	3rd	Between looms #74 and #75	5,010,150	.26
5	1	3rd	Between looms #60 and #61	1,382,978	.12
6	1	3rd	Between looms #70 and #71	1,000,000	.30
7	1	3rd	At loom #55	5,056,876	.19
9	1	2nd	At loom #44	2,000,000	.55
10	1	2nd	Between looms #39 and #40	2,297,870	.22
11	1	2nd	Between looms #57 and #58	6,304,348	.26
13	1	2nd	Between looms #54 and #55	1,764,706	.27
14	1	2nd	Between looms #26 and #27	997,850	.30
15	1	2nd	Between looms #9 and #10	4,468,085	.18
17	1	1st	Weave room for broad cloth	2,127,659	.26
18	1	1st	Warp machines #264 and #265	6,304,762	.36
19	1	1st	Machine at left hand corner of room	2,466,666	.55

These counts are not excessive, but it must be remembered that the preparation and manufacturing of the yarn involving the handling of the raw material is not performed in this plant. As the material approaches the finished processes, as it does in this plant, the dustiness becomes less.



Brake-band weaving in the
Bridgeport plant.



Another view of the
weaving room in the Bridgeport plant.

THE STRATFORD PLANT

This plant consists of two one-story brick buildings; one housing the molded brake-band lining and clutch disk manufacturing, and the other the manufacturing of asbestos packing material. This latter operation is isolated due to the use of inflammable solvents. Paper pulp combined with asbestos fibre and various binding materials, such as starch, are used in the manufacturing of the molded brake-band lining.

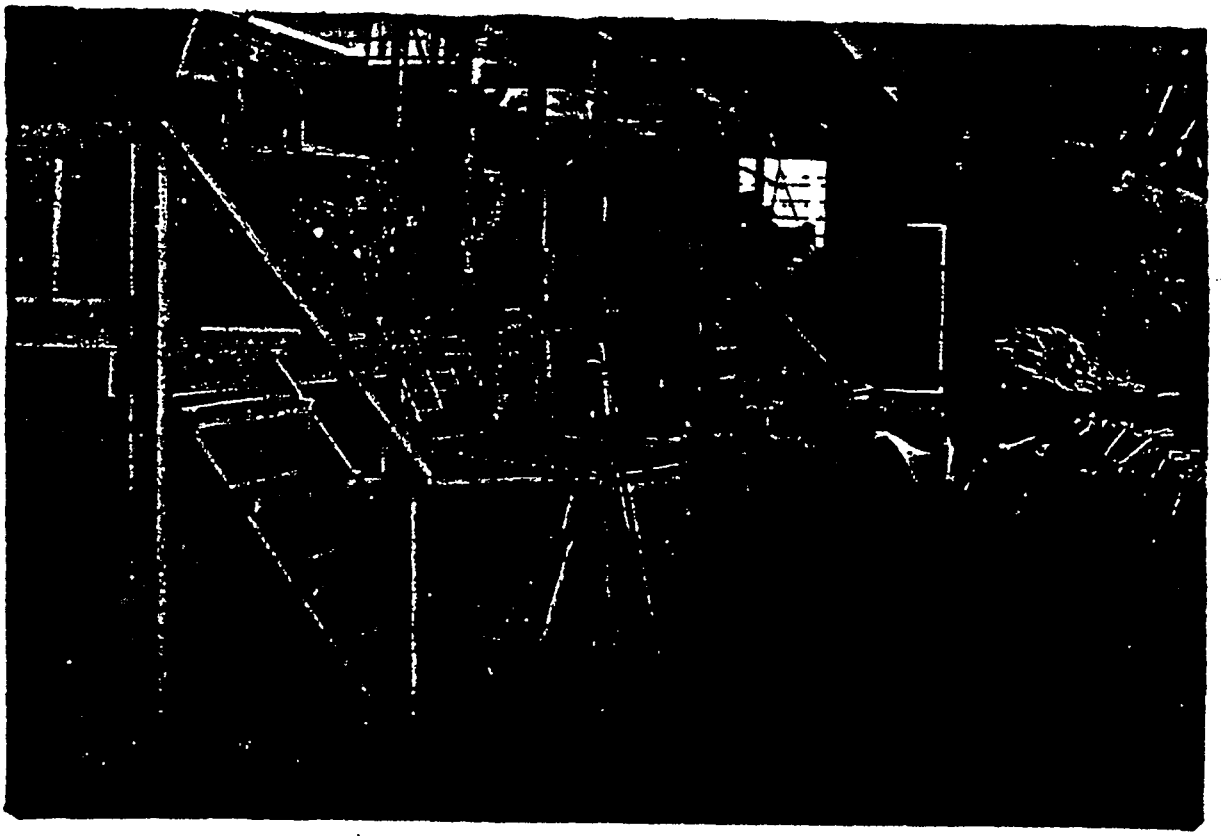
In the manufacture of the asbestos packing material the asbestos fibres are combined with rubber and other binders dissolved in gasoline. On account of the vapors which are quite evident in this department, it was considered inadvisable to operate the motor used on the pump for collecting air samples because of the possibility of explosion. Dust samples were taken therefore only at the two other apparent dusty processes; namely the mixing of the pulp and the grinding of the clutch face disks. These counts are given in the following table.

TABLE #2.

STRATFORD, CONN. PLANT

Sample No.	Building No.	Location of Sample	Total Counts of Dust Particles per Cubic Foot	Weight of Dust in Milligrams per Cubic Foot
21	Main	Grinding operation on the Cincinnati machine	654,598	
22	Main	Paper mixing. Center machine #2	529,915	.10

It is noted that these are very low and should not present a hazard.



Pulp making in the Stratford plant.

Grinding clutch facing at the Stratford plant.

Another view of the clutch face finishing department at the Stratford plant.

PHYSICAL EXAMINATIONS

Physical examinations were made on ninety-one employees. This group included all those who had been engaged in the asbestos industry for a period of three years or longer, and included employees from both the Bridgeport and Stratford plants.

All signs and symptoms, usually associated with what English authorities term "asbestosis", were listed when found. These include anorexia, leaden-hued complexion, emaciation, dyspnoea, cyanosis, cough, expectoration, "asbestos corns", decrease in chest expansion, clubbing of fingers, swelling of skin at the nails, and history of chest troubles. The chests of these employees were then examined for friction rubs, râles, dullness, diminished breath sounds, and increased voice sounds.

The action of inorganic dust upon the lung tissue is to cause the development of fibrous tissue - fibrosis. Such dust fibroses are classified under the general term pneumoconiosis. The various types of pneumoconioses are differentiated by more specific titles which define themselves, such as silicosis, anthracosis, and asbestosis. These conditions can be satisfactorily demonstrated only by X-ray.

Twelve employees were selected for X-ray examination. The films of three of these were unsatisfactory. The following table analyzes the occupational history and X-ray diagnosis of the remaining nine.

TABLE #5.

No.	Sex	Age	Occupational History	Diagnosis
1	M	58	Weaver — 9 years	Early first degree asbestosis
2	M	27	Weaver - 6 years	Negative
3	M	41	Weaver — 8 years	Early asbestosis
4	M	45	Weaver - 9 years	Negative -recent pleurisy
5	M	44	Foreman - 16 years	First degree asbestosis with aneurism of the arch of the aorta.
6	M	45	Weaver - 10 years	Negative
7	M	50	Weaver - 8 years	Negative
8	M	55	Weaver - 12 years	Well advanced first degree asbestosis.
9	M	68	Elevator operator — 9 years	First degree asbestosis

A study of this table reveals that the X-ray films of five men showed the characteristic appearance of dust fibrosis. Four were rated negative and it should be noted here that in these studies, where X-ray films were secured, all doubtful cases were classed as negative, the diagnosis being given as positive for dust fibrosis only where the evidence was unmistakable.

None of these five cases of asbestosis presented evidence of tuberculosis which lends support to the contention that the inhalation of asbestos dust does not tend to activate tuberculosis. The number of cases in this study is too small to draw any sweeping or definite conclusions.

SUMMARY

The dust counts in this study are relatively low.

X-ray films of five out of nine men selected from those physically examined revealed typical dust fibrosis. The number of years exposure together with the X-ray appearances tends to confirm the impression that the action of asbestos dust upon the lungs is to cause a mild fibrosis. What the end results of this type of fibrosis are we are not yet in a position to state.

RECOMMENDATIONS:

1. That the weave rooms be humidified. This procedure will not only decrease the number of breakages in the yarn, but will assist in allaying the dust.

2. That cleaning be done by means of a vacuum system instead of the present method of blowing with compressed air. Portable vacuum units are sold on the market.

3. That the dust be exhausted at the source of origin, where possible, and drawn away from the breathing level of the operator.

4. That all employees be given an initial physical examination and periodically thereafter. X-ray examinations should be made when indicated.

* * * * *

Box 11

Doc-340

4/19/39

Ref to Survey

RAYBESTOS - MANHATTAN, INC.

BRIDGEPORT AND STRATFORD PLANTS

This survey was made on the 24th, 25th, and 26th of March, 1936.

BRIDGEPORT PLANT

It is evident from the dust counts of this survey that the dust conditions of the weave rooms have been improved. The change from the dry binder to wet binder is the reason for this improvement. This survey was made under winter conditions with most of the windows closed.

Comparing the survey of 1935 and that of 1936 other facts are noticed. At the time of the 1935 survey, seven looms were running on the third floor as compared with four at the time of the 1936 survey. There were fewer looms running on the second floor at the time of the 1936 survey than were running during the 1935 survey.

The dust concentrations at the warp machines may vary to a considerable extent depending upon the moisture content of the yarn, the speed at which the machines are operating, and the amount of natural ventilation; however, the operators have been supplied with approved respirators for protection against the dust generated.

The condition of the Brake Department has been improved by the removal of the drill presses.

The exhaust hood of the Pratt and Whitney Grinder has also been improved.

Table #1 shows results of 1936 survey

Table #2 - shows comparative results of identical locations or operations of survey of 1935 and survey of 1936.

Exhibit E.

BRIDGEPORT PLANT - TABLE #1

Sample No.	Station	Date	Cu. Ft.	Millions of particles per cu. ft. of air sampled		Type of Dust	Lead Results mg/cu.ft.	mg/cu.m	mg/10 hr. day	Remarks
1.	2nd floor - Between looms #225 & 227	3/24/36	40.0	.90	5	Asbestos				Old looms #30 & 31
2.	2nd floor - Between looms #234 & 236	"	39.2	1.2	7	Lead	000	000	000	Old looms #29 & 37
3.	2nd floor - at loom #9	"	37.5	.85	5	Asbestos				
4.	" " - at loom #220	"	47.1	1.1	7	"				Old loom #25
5.	" " - Between looms #238 & 240	"	34.5	1.4	8	"				Old looms #62 & 63
7.	2nd floor - at inspection table	"	42.2	3.6	21	"				Exhaust system - Damp stock "
8.	" " - at loom #45	"	42.3	1.6	9	"				
6.	1st floor - Between looms #82 and #83	"	45.6	1.2	7	"				
9.	1st floor - warp room between cop. winders	"	50.9	1.3	8	"				1032 - Rayon yarn 1030 - Cotton 1033 - Mule
11.	1st floor - " " #3 warp machine - run at fast speed. 1032 - 1 cotton	"	27.1	5.8	46	"				Corresponds to #2 in Packards survey
15.	1st floor-warp room-warp machine #6 - 1033 mule	3/25/36	28.8	17.1	69	"				Windows closed- respirators supplied to workers
10.	1st floor - Brake department general air	3/24/36	42.2	.90	5	Brake lining clutch facing	.000425	.015	0.15	Taken near presses drill presses moved to stratford

Sample No.	Station	Date	Cu. Ft.
12.	1st Floor-Brake Department at Pratt & Whitney Grinder Brake Leaking	3/24/36	32.9
13.	3rd Floor - Between Looms #319 & 321	3/25/36	47.9
14.	General Air Near Loom #309	"	45.2

BRIDGEPORT PLANT - TABLE #1 (CONTINUED)

MILLIONS OF PARTICLES PER CU. FT. OF AIR SAMPLED		TYPE OF DUST	LEAD RESULTS MG/CU.FT.	MG/CU.M	MG/10 HR. DAY	REMARKS
2.3	.14	BRAKE LINING				EXHAUST HOOD IMPROVED SINCE PREVIOUS SURVEY
4.6	~7	ASBESTOS				OLD LOOMS #68 & #69
3.3	~8	"				4 LOOMS RUNNING ON 3RD FLOOR

BRIDGEPORT PLANT - TABLE #2

Survey of March, 1936 Sample Number	Dust Count in Millions of Particles per cu. ft. of air sampled	Survey of June, 1935 Sample Number	Dust Count in Millions of Particles per cu. ft. of air sampled	Remarks
2nd Floor				
3	.85	12	9.9	Loom #10 removed since 1935 survey.
1	.90	7	3.6	
2	1.2	34	4.5	
4	1.1	11	3.5	
7	3.6	15	9.6	
3rd Floor				
13	4.6	4	6.1	Loom #68 not running 1935 survey
14	3.3	8	5.4	
1st Floor				
6	1.2	16	2.5	
11	5.8	19	3.3	
9	1.3	25	2.6	
Brake Department				
10	.90	18	1.3	
12	2.3	29	2.2	

Old No.		New No.	No. Spaces	Size
2(30	-	225	16	2 x 5/32
(31	-	227	16	2 x 5/32
(29	-	234	12	2 x 196
(37	-	236	12	2 x 196
9	-	—	3	13/4 x 1/4
			4	$2\frac{1}{2}$ x $\frac{1}{4}$
25	-	220	3	1 7/8 x 1/8
			3	1 7/8 x 133
			3	1 11/16 x 133
			3	1 13/16 x 133
(62	-	238	12	2 x 3/16
(63	-	240	12	2 x 3/16
82	-	—	1	$2\frac{1}{2}$ x 5/16
			1	3 x 5/16
			2	5 x 5/16
83	-	—	1	$9\frac{1}{2}$ x 1
			1	9 3/4 x 1
45	-	—	2	3 x $\frac{1}{4}$
			1	$3\frac{1}{2}$ x $\frac{1}{4}$
			3	4 x $\frac{1}{4}$
69	-	319	20	$1\frac{1}{2}$ x 1/8
68	-	321	20	$1\frac{1}{2}$ x 1/8

Type		Type of Yarn
B 50 E	Wet Binder & Filling-	(1032 Mule & Jute
B 50 E	" " "	(
154 W04	Stuffed Binder & Filling	(1030 - 1 Cotton
154 W04	" " " "	(1032 - 1 C.C.
		(1033 - Mule
BPT.	Wet Binder & Filling	(1032 - Mule
BPT.	" " " "	(1030 - 1 Cot.
		(1033 - 1 Cot.
Z-120	Stuffed Binder & Wet Filling	(1033 - Mule
Z-120	" " " "	(1030 - 1 Cot.
Z-120	" " " "	(1032 - L C Z
Z-120	" " " "	(1032 - Z
Rayb.	Wet Binder & Filling	(1032 - Mule
Rayb.	" " " "	(1030 - 1 Cot.
F.W.	Wet Binder & Filling	(1030 - 1 Cot.
F.W.	" " " "	(1033 - 1 Cot.
F.W.	" " " "	(1030 - 2 Cot.
		(1032 - 1 Cot. Zinc
No Wire	Dry	(1030 - 2 Cot.
No Wire	Dry	(1090 - Rope
Bpt.	Wet Binder & Filling	(1033 - Mule
Bpt.	" " " "	(1033 - 1 Cot.
Bpt.	" " " "	
R.S.	Wet Binder & Filling	(1032 - Mule
R.S.	" " " "	

STRATFORD PLANT

The samples taken during this survey show improvement in most of the locations.

* The dust concentration around the heaters may vary with the amount of raw material used. The heater room should be separated from the rest of the plant to guard against the pollution of the atmosphere of other sections of the building. The heater used in making pulp which contains litharge should be in a separate room from the others and employees should be required to wear approved respirators.

The dust concentrations at the Blanchard Grinders, Cincinati Grinder, external grinders, and internal grinders, is probably caused more by the handling of the material than by the machines. Dust can be seen rising from the stacks of rings when they are moved. The employees at these machines have been supplied with approved respirators. The approval should be for lead dust as well as other dusts.

The exhaust equipment installed since the 1935 survey has improved dust conditions in that section of the building and around those machines that have exhaust hoods connected to it.

Sample #25 shows a very high count. This work is done on all clutch facing rings. The dustgenerated tends to pollute the atmosphere of the entire inspection room. This work should be done in a separate room or an enclosure that has an exhaust system installed to remove the dust generated. The employees doing this work should be supplied with positive pressure respirators supplied with clean air.

* Sample #1, taken in the fibre room of #6 Department, is high. The shaker screen should be enclosed; however, there is only one employee

working in this room, and he is supplied with a respirator which is adequate protection provided that it is maintained properly and used.

Table #3 shows results of 1936 survey.

Table #4 shows comparative results of identical locations or operations of survey of 1935 and survey of 1936.

STRATFORD PLANT - TABLE # 4

Survey of March, 1936 Sample Number	Dust Count in Millions of Particles per cu. ft. of air sampled	Survey of June, 1935 Sample Number	Dust Count in Millions of Particles per cu. ft. of air sampled	Remarks
2	.94	2	2.3	
3	.73	4	2.6	
6	2.8			
14	3.2	12	4.4	
4	4.5	13	1.4	
7	1.4	18	6.5	
8	3.5	22	2.6	
9	2.7	20	1.4	
11	3.0	14	1.8	
12	1.9	27	4.1	
15	4.7	30	12.8	
16	2.0	24	1.9	
17	1.6	32	2.3	
18	.94	28	1.8	
23	1.3	26	12.0	
19	1.4	16	1.4	

Sample No.	Station	Date	Cu. Ft.
	20 Dept.		
1.	Fibre Room - Shaker screen and opener running	3/25/36	32.6
2.	Between mixers #11, 12, 14, & 15	"	40.2
3.	Between mixers #4, 5, 17, & 18	"	52.6
5.	Weighing Linapse from drum to pan on scale & dumping into mixer #19	"	7.5
4.	Filling beater #2	"	76.0
6.	At press #15-cutting rings on cutting presses	"	32.6
7.	At blanchard grinder #1 clutch facing rings	"	30.0
8.	At automobile drill press #20	"	28.8
9.	At Cincinati grinder 52C cure rings	3/26/36	58.6
10.	Testing rings for Brinnell hardness	"	28.1
11.	General air - between two calenders	"	31.6
12.	At internal grinder #4 machine #46	"	40.6
13.	At Stedfast-Roulston grinder machine #264	"	55.4

STRATFORD PLANT - TABLE #3

Millions of Particles Per Cu. Ft. of Air Sampled		Type of Dust	Lead Results µg/cu.ft.	µg/cu.m.	µg/10 hr. day	Remarks
19.0	113	ASBESTOS				FIBRE FALLING INTO HAND TRUCKS
.94	5	ASBESTOS LEAD	.000348	.0123	0.123	
.73	4	"	000	000	000	
6.4	31	LEAD	.00127	.066	0.66	
4.5	27	ASBESTOS				
2.8	17	"				BOILER PIPES AND STACKS FIXED ON TO SKID
1.4	8	CLUTCH FACING	000	000	000	EXHAUST
3.5	21	" "	.00243	.852	0.852	"
2.7	16	" "	000	000	000	" RESPIRATOR
1.6	8	" "	000	000	000	ONE MAN RESPIRATOR
3.0	18	ASBESTOS				
1.9	11	CLUTCH FACING	.000345	.0122	0.122	EXHAUST. RESPIRATOR
1.2	7	BRAKE LINING	000	000	000	GRINDING LINING TO WIDTH. EXHAUST

SAMPLE NO.	STATION	DATE	Cu. Ft.
14.	SAME AS 26 JUST TAKEN AT PRESS #17	3/26/36	34.0
15.	BETWEEN FLANGHARD GRINDERS #4 & 5	"	43.0
16.	AT SANDER-MACH. #103 BELT SANDER	"	21.6
17.	AT SANDER #92	"	28.6
18.	AT INSIDE GRINDER MACH. #126	"	38.5
19.	GENERAL AIR - INSPECTION AND SHIPPING DEPT.	"	39.1
20.	AT AUTOMATIC DRILL PRES. MACH. #383	"	56.5
21.	AT SHAPER #130 GRINDING ENDS OF BRAKE LINING	"	27.7
22.	AT INSPECTION TABLE - CLUTCH FACING	"	36.9
23.	AT EXTERNAL GRINDER MACH. #25	"	38.6
24.	BETWEEN SHAPER #116 AND SANDER #117	"	31.6
25.	TAPPING RINGS - INSPECTION FOR CRACKED RINGS	"	26.8

STRATFORD PLANT - TABLE #3 (CONTINUED)

MILLIONS OF PARTICLES PER CU. FT. OF AIR SAMPLED		TYPE OF DUST	LEAD RESULTS mg/cu.ft.	mg/cu.m	mg/10 hr. day	REMARKS
3.2	#9	ASBESTOS				
4.7	#8	BRAKE LINING CLUTCH FACING	.000326	.0115	0.115	
2.0	#V	BRAKE LINING	000	000	000	ONE MAN, EXHAUST
1.6	#F	" "	000	000	000	2 MEN, EXHAUST
.34	#S	" "	.000727	.0257	0.257	ONE MAN. "
1.4	#8	CLUTCH FACING	000	000	000	
.82	#4	BRAKE LINING	000	000	000	ONE MAN, EXHAUST, MECH. MOVED FROM BRIDGEPORT PLANT
3.5	#1	" "	000	000	000	ONE MAN, EXHAUST
4.2	#3	CLUTCH FACING RINGS	.000759	.0264	0.264	4 WOMEN - THREE MEN
1.3	#F	BRAKE LINING	.000363	.0128	0.128	SIMILAR TO #105 IN PREVIOUS SURVEY. ONE MAN EXHAUST
2.1	#3	" "	.000686	.0313	0.313	ONE MAN ON EACH MACH. EXHAUST ON " "
82.1	#9V	RING	.00261	.0921	0.921	ONE MAN

Box 1

PHL-341
4/19/79

[redacted] Survey
of

[redacted], Inc.

[redacted], Conn.

A third survey of this plant was conducted on October 12, 13 and 16, 1939 by the Industrial Health Section of the Metropolitan Life Insurance Company. The two previous surveys had been made during March, 1930 and June, 1935.

This plant is engaged in the manufacture of packing, gaskets, and brake linings. Since the previous surveys the woven brake lining processes have been eliminated and new processes have been installed.

* * *

Exhibit F.

PLANT CONSTRUCTION

The plant is housed in a number of one and two story brick buildings of modern construction. Ample natural illumination and ventilation are supplied by numerous side wall windows and skylights. Offices are located in separate buildings apart from the manufacturing departments.

PLANT PROCESSES

Bldg. 6, Dept. 13. Sheet Packing

In this building sheet packing is made, from which brake lining, gaskets, and packing are stamped or cut.

Asbestos Room

Asbestos used in sheet packing is prepared for use in a crusher and opener. The asbestos is graded on screens. The asbestos passing through the opener is dumped on the floor and then hand shoveled into the opener. The opened asbestos is then conveyed by air to a hopper on the roof and dropped through pipes into the grading screens or directly into a hand truck. Scrap material is ground in a pulverizer, then conveyed by air to hoppers on the roof and dropped through pipes directly into bags. The lone operator in this room is supplied with an approved dust respirator. This room opens directly into the dry mold mix room and the main mixing and roll room. Since the previous survey, the equipment in this room has been improved. Sample 6 of 1935 survey and sample 3 of the present survey show that good results have been attained.

Dry Mold Mix Room

Material for the dry mold mix is hand scooped from original containers and dumped into a barrel on a scale. Most of the materials used are

kept in loosely covered or uncovered containers. After the batch is weighed out, the operator carries the barrel up a flight of stairs to a platform and dumps the batch into the mixer. The mixed batch is then dropped from the bottom of the mixer into a truck. The materials used in these batches contain asbestos, bakelite, resin, softener (plasticizer) and scrap. Two rubber mills are located in this room. At the time of sampling one of these mills was operating. The rubber is thrown around the floor scattering some accumulated dust. Respirators are available to the operator but it was noted that the respirator was not used. No exhaust equipment is used in this department.

Rubber Compounding Room

This room is located at one end of the building and opens into the mixing and roll room. The operations in this room are intermittent. Batches containing large quantities of litharge (15% free lead) and mica are weighed out from original containers into a pan on a scale. The mica is received in bags. These bags are ripped open down the middle and allowed to lie on the floor. It was noticed that during the weighing considerable quantities of the litharge and mica were spilled upon the scale and floor where they were allowed to remain until close to the end of the shift. The floors and scale were then cleaned by dry sweeping. The complete batch contains liquid bakelite, sulphur, mica, asbestos, litharge, aroclor, scrap and rubber. The percent of litharge in the batch varies from 30 to 35%. The weighed batch is then trucked to the mixer into which it is dumped and mixed with gasoline and asbestos. The operator working in this department had been at one time supplied with a dust respirator but preferred to work without it, complaining that it interfered with his glasses. He also said it was too hot for comfort. This man stated that he has been engaged at this work for about seven years.

Mixing and Rolling

In this department the batches are mixed with gasoline in closed mixers. The mixed material is then hand shoveled from the mixer into the rolls. One roll is hot, the other cold. The material adheres to the cold roll. The material is rolled to the desired thickness. From the rolls the material is then run into cutting tables where the sheets are cut to length. The gasoline used is recovered in a condenser located in the same room. From the sheets, rings, gaskets and packing are stamped out on power machines.

One end of the building is used for storage of raw material.

Main Building, Dept. 20 - Asbestos Board

Asbestos board used in making clutch facing and a special material called LS is made in this department.

Scrap material and new asbestos are hand dumped into paper beaters, mixed with water and starch and worked to the proper consistency. The pulp is then passed through the rolls to the required thickness. The LS material which is composed of asbestos, atomized metallic lead, alum, gilsonite, graphite, and scrap are mixed in a beater and the pulp pumped to storage tanks. The atomized lead is about 200 mesh. The lead is dumped on a piece of cardboard on the floor in front of the beater and is sieved into the pulp by hand shoveling into a sieve resting on the top of the beater. The wet pulp is run from the beaters to storage tanks. From the storage tank the wet pulp is run into troughs (coffins) where the water is drained out, leaving the solid material in the trough. The solid material is then transferred to a heated press where it is pressed to required thickness, removed and cut into strips by hand. It was noted that the operator handling the atomized lead as well as others in close

proximity did not wear respirators.

Cutting Dept. #21.

Asbestos board is cut to size for the punching machines. Facings are stamped out on machines by men and wiped and stacked on skips by girls. The composition of this board is practically 95% or more asbestos.

Finishing Dept. #24

Facings are cured and then finished. The finishing operations include grinding surfaces and edges on Blanchard, Cincinnati and cylinder grinders; drilling and shot blasting. All machines in this department are equipped with exhaust systems. On the Blanchard grinders and drilling operations these exhaust systems are augmented by the use of compressed air. At the time of this survey, the compressed air line on the grinder, machine #754, sample #19, had been moved out of position, causing puffs of dust to be dispersed into the atmosphere with each revolution of the grinder. This condition was readily remedied after attention had been called to the condition. Considerable dust adhering to the clutch facings is dispersed into the atmosphere when loading the machines and restacking the facings on the skips. No provision is made to entrap the dust at these points.

Dry Mold

This is a new operation. The mixture for this operation is made in building #6. At the time of this survey machines were being installed or renovated, so that tests taken at this operation would not have been representative. Therefore, no tests were made.

Wiremold

The materials used in the wiremold batch are mixed in small mixers

in a partitioned area on the main floor. These materials include asbestos, hardwood pitch, sulphur, Lampblack, graphite, asbestine, powdered white lead and index oil. The hardwood pitch is run through a grinder four times to the required mesh. The pitch is hand scooped from the container into the grinder. This grinder is enclosed and exhausted. The powdered white lead, as well as the pitch and index oils, are kept in open barrels just outside the partition on the main floor. The compounded batch is used on the wiremold machine which is also located in this partition. The men engaged at batch mixing wear dust respirators, but the men at the machine a few feet from the mixer are not so protected. The mixed material is pressed around a wire backing and is used to make brake lining. Information was advanced that plans and appropriations have been made to provide dust control at these operations.

Depts. # 22 and 24 - Molded and Rubber Brake

Molded and rubber brake linings are finished in these departments. The operations consist of grinding and drilling. All machines, with the exception of a few small drill presses (machines #150, 277 and 93) are exhausted.

Dept. #26 - L8 Pressing

In this department L8 brake lining is shaped and pressed in mandrels. Soapstone is hand dusted to prevent the linings from sticking. The operator on this job wears an approved dust respirator.

Saturant Room

The dopes used on the brake linings and clutch facings are prepared and stored in a separate brick building. All solvents are kept and prepared in closed tanks. The main solvents used are xylol, formaldehyde, cresylic acid and acetone. The acetone is stored in tanks outside the building. The

prepared saturant is pumped to the saturation room as required. The asphalt used in the saturation is not a coal tar product.

Other operations and departments include inspection, assembly of parts and packing of finished product, also a machine shop and stock section. These operations are located in the newest section of the main building. There are no dusts produced by these operations.

PERSONAL FACILITIES AND DUST HOUSEKEEPING

Ample washing and toilet facilities are provided. Drinking water is supplied from mechanically cooled bubbler fountains. A restaurant is available to all employees. A first aid room under the direction of a full time nurse is maintained.

Housekeeping in general is good. Aisles are well defined and are always kept free from obstructions. Vacuum cleaning is employed on the rafters, walls and floors in the main building. It is planned to extend this to other buildings.

Safety meetings are held once a week, at which time the employees' representatives, as well as the foremen, are present and take an active part in the proceedings.

METHODS OF SAMPLING AND ANALYSIS

Atmospheric dust samples were taken with the impinger[1] and the solvent fumes with the interferometer at the breathing level of the workmen at representative operations. The interferometer is an instrument designed for use in detecting gases and vapors. The impinger, developed by the United States Public Health Service, is the standard method used in this country. Air is drawn in through a glass tube at the rate of one cubic foot per minute.

(1)U.S. Public Health Service, Public Health Bulletin #217, Determination and Control of Industrial Dust, J.J. Bloomfield and J.A. Vallaville, 1935.

The tube ends in a constricted orifice under the surface of distilled water contained in a flask. The air passes through the orifice and impinges upon a glass plate which breaks up the air stream, allowing the dust particles to be wet and entrapped in the water in the flask.

Alcohol is added to the sample as a preservative to inhibit the solution of the fine particles and also to prevent the formation of agglomerates of the fine particles by clumping.

Suction is supplied for drawing the air sample through the impinger by means of an ejector, or else an electrically driven pump where compressed air is not available to actuate the impinger.

The dust counts were made by the methods and techniques developed and used by the United States Public Health Service.

The following table offers comparison of the results of analysis of samples taken at identical locations for the 1935 and 1939 surveys. As asbestos is involved at practically all operations, dust counts are given as total count in millions of particles per cubic foot of air.

Sample No.	Location	1933 Date of Sampling	No. Ft. Air Sampled	Millions Dust Particles per cu. ft.	Milligrams Lead per cu. ft.	Milligrams Lead per 10-hr. day	1935 Sample No.	Date of Sampling	No. Ft. Air Sampled	Millions Dust Particles per cu. ft.	Milligrams Lead per cu. ft.	Milligrams Lead per 10-hr. day	Type of Dust	Remarks
1	Bldg. 6, Dept. 19, asbestos room at crusher	10/12/33	30.0	19.3									Asbestos	[illegible] respirator [illegible]
2	Pulverizer, waste etc.	"	43.0	3.9			1	6/25/35	49.5	4.7			"	Scrap [illegible] floor into pulverizer
3	At opener	"	37.0	6.2			6	"	8.5	20.5			"	Asbestos [illegible]
4	Dry mill mix room	"	21.0	24.0									Asbestos & cop. [illegible] paste [illegible]	[illegible]
5	Between mixer #?3 and roll #?48, working batch #740	"	42.0	3.3	0.??21	0.353	2	"	49.3	2.3	0.00335	0.136	[illegible] asbestos [illegible]	[illegible]
6	Between mixers #33 and 313	"	35.0	49.0									Cartolite	[illegible]
7	Rubber compounding room	"	9.0	58.6	0.3?95	137.0							Litharge asbestos rubber [illegible]	[illegible] dust control applied
14	Check on sample #7	10/13/33	12.0	45.0	0.1329	167.0							"	No dust control applied
8	[illegible] machine [illegible]	10,13,33	25.0	4.0	0	0							"	2 men
9	Between rolls #?46 and mixers #?42 and #?41	"	42.3	2.5	0	0							"	Mixers and rolls [illegible]
10	Power press, machine #?59	10/13/33	27.5	1.1	0	0	7	"	42.7	1.2	0	0	"	
11	[illegible] Bldg. [illegible] between [illegible]	"	34.0	3.5			11	6/26/35	1?7.3	1.4			Asbestos	[illegible]
12	Bowler 44, 12 [illegible]	"	10.5	6.4	0.??7	0.??							[illegible]	[illegible]
13	12 job, at [illegible]	"	23.0	2.3	6	0							"	[illegible]
13	At #2 [illegible] machine	"	37.0	1.2			11	6/26/35	27.7	2.4			Asbestos	
16	Cutting [illegible] at [illegible] machine [illegible]	"	12.0	2.3			12	"	45.3	4.4			"	[illegible]
17	Cutting at machine [illegible]	"	26.0	4.4			13	6/26/35	49.4	1.6			"	[illegible]
18	At [illegible] machines #?59 and 27	"	22.0	3.1			14	"	42.0	1.7			"	No dust control applied
19	Finishing Dept. #?4 between [illegible] grinders, machines #?73 and 162	10/16/33	46.0	14.?	?.?135	4.5	15	"	25.4	6.5	2	2	"	[illegible]
20	Between [illegible] grinding machines 41, 43, 44, and 45	"	47.0	3.9	?.0003	0.105	?2	"	44.5	2.6	0	0	"	[illegible]
21	Between [illegible] grinders, machines #?57 and 155	"	41.0	2.9	?.??016	?.12	3?	"	42.1	12.9	0.0???	2.95	"	[illegible]
22	[illegible] grinder	"	[illegible]	2.9	0	0							"	[illegible]
23	Steel shot [illegible] machine #?? and [illegible] brake lining, roll grinder, machine #??	"	38.3	1.4	0	0							"	
24	[illegible] Dept. #?8 [illegible] of [illegible] brake lining, machine #??	"	36.0	8.2	0.???	?.???							Asbestos [illegible]	[illegible]
25	At hardened pitch grinder	"	18.0	2.4									Pitch	[illegible]
25	Dept. ??, [illegible] cutting machine #??	"	19.0	1.8										
26	Dept. 26, [illegible] brake lining between machines [illegible], 277, and 93	"	43.0	1.2	0	0								Only machines [illegible], and 93 not exhausted.
29	Rubber brake, drilling and grinding. Machines #?74 and 216	"	38.0	3.5	0.00037	0.13								Exhaust applied.
28	Dept. [illegible] brake linings [illegible] machines #?? and 174	"	47.0	1.1	0.0?03	0.105							Asbestos	Exhaust applied.
30	Dept. #?3, at internal grinder, machine #??	"	38.0	1.6	0	0	25	6/25/35	3.7	18.4			"	Exhaust applied
31	Dept. #??, external grinder, machine #?65	"	49.0	1.4	0	0	26	"	31.3	13.0			"	Exhaust applied
32	Mandrels, pressing 16 brake lining [illegible]	"	42.0	4.2									Asbestos	No dust [illegible] respirator [illegible]

CONCLUSIONS AND RECOMMENDATIONS

In the asbestos room the count at the crusher is high (sample #1). Apparently the operator was overloading the pans. Crushed asbestos was falling upon the floor, necessitating frequent sweeping and hand shoveling. It is recommended that the amount of material that can be handled without spilling on the floor be established and controlled. Enclosing this crusher would also be of value. Since the other operations in this room are now well controlled, as evidenced by samples #2 and 3, it is not necessary to install an elaborate system for this one machine. The operator is supplied with and wears the proper type of respirator.

The dry mold batch weighing is a dust dispersing operation (sample #4). The operator is exposed to the heavy concentrations because of the close proximity of his face to the containers while scooping out the ingredients and carrying the weighed batch up the stairs to the mixer platform.

It is recommended that all batch weighing operations - dry mold, wire-mold and rubber compounding - be done at one point where effective control by exhaust systems should be installed.

Hand handling of materials should be eliminated as much as possible. The resin (bakelite) used in this batch may produce a dermatitis. Therefore, it will be necessary to provide some protection for the skin if the resin is to be handled by hand. Weighed batches should then be kept in closed containers when transporting to the department where they are to be used. Vacuum system should be used for all cleaning purposes.

The mixing and rolling operations do not present any dusty conditions, with the exception of mixers #312 and 313 (sample #6). At this point consider-

sible cardolite dust is discovered when dumping and mixing, until the material becomes thoroughly wet. This is for a short time only. The floor around these mixers is slippery due to the spilled material and moisture. These operators could be adequately protected if they were supplied with and were approved dust respirators while handling and dumping the cardolite. The floor should be kept free of the dust to eliminate the hazardous slippery condition that exists.

Concentrations of 148 to 160 parts per million of gasoline vapors were detected in department 19, mixing and milling room. This concentration is far below approximately 1,000 parts per million, which is the maximum concentration allowable for prolonged exposure.

The batch weighing operations in the rubber compounding room are definitely hazardous under the present methods of operation. Samples 7 and 14 show concentrations of lead far in excess of the toxic limits, which have been determined to be 1.5 milligrams in a ten-hour day. The dust respirators supplied to the operator are not approved for lead dust. As this operator has not worn the respirator supplied him and has been exposed for a period of seven years, on and off, it is recommended that he be physically examined. Symptoms of lead poisoning are given in the rear of the report for the information of your physician.

Sample #15 does not indicate the need for any further protection for the operators working in the vicinity of #4 beater, other than the proper type of respirator. As this is an intermittent and comparatively short operation, the insistance by the foreman that the respirators be worn should not be a serious hardship for the men.

Sample #17 (in the finishing department between Blanchard grinders 371 and 753) shows a definite hazardous condition. Although this result was

obtained under an abnormal condition due to improper setting of the exhaust system, it serves to demonstrate the need for periodic check up of these systems by the engineering staff. The lead concentration found at this point is three times greater than the toxic limit. Sample #[illegible]1, between machines 4[illegible]7 and 45[illegible], indicates the more normal condition at the Blanchard grinders.

Sample #14, department #[illegible]8, shows a lead concentration approaching closely to the toxic limit. This condition could be eliminated by means of one central batch weighing and mixing department, as has already been suggested for other batch weighing operations.

The saturant room did not show any dangerous concentrations of solvents. Sixty-four parts per million of xylol were found. The maximum concentration for prolonged exposure of xylol has been estimated to be less than 100 parts per million.

It is recommended that when new processes are to be installed a study be made of the various ingredients in the material, as to their toxicity, and the proper protection applied at the beginning of the operation and while it is in the experimental stage.

Taking into consideration the amount of grinding and drilling done, the counts found were low, indicating the efficiency of the exhaust systems. The hazards in the plant are confined solely to the batch weighing and mixing operations. Proper control of these operations will eliminate the health hazards in this plant.

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The report of the survey made in June 1935 contains a discussion of health hazards of the toxic substances used. Reference should be made to this report in connection with the findings of the present report.

PHL-343
AJ
4/9/79

THE GENERAL ASBESTOS AND RUBBER DIVISION

of

RAYBESTOS-MANHATTAN, INC.

North Charleston, S.C. 1934

* * *

The dust survey included in this report is supplementary to the survey made in January, 1930 and was conducted to determine the extent of dust removal accomplished by the installation of new exhaust equipment and redesign of old exhaust equipment.

The number of buildings, the processes and arrangement of machinery are the same as at the time of the previous survey.

The exhaust systems of the cards have been redesigned to cover the machines more completely. In an experimental case one card was covered as completely as possible. This machine was enclosed in muslin and an air sample was taken inside the enclosure and two general air samples were taken in the card room proper at the same time. The first set of samples was taken before the conveyors from the preparation room began to bring the fibre to the bins in the card room. A second set of air samples was taken after the conveyors had been carrying fibre to the bins for more than an hour.

An exhaust system and revolving brush are in use for the inspection of woven cloth in the weave room. This work was formerly done by hand brushing. The loose fibre is brushed from the cloth in order that any flaws could be noticed and removed.

Exhibit H

An air sample was taken at the table and two general air samples were taken in the weave room at the same time - one set was taken with both the revolving brush and exhaust fan running and one set with the revolving brush operating but without the exhaust fan. One set was taken with the workmen brushing the cloth by hand, the method used before the exhaust system and revolving brush were installed.

The inspection table was enclosed with beaver board and a series of samples was taken both inside the enclosure and outside.

The following tables indicate the analysis of air samples taken at representative points in the different departments. Attention is called to the fact that the previous survey was made in January and this survey in July.

Particle size measurements were made of the dust by a direct projection method. The results are tabulated and appear in the graphs attached at the rear of the report. It will be noted that from 92 to 98.5% of the particles are less than 10 microns in greatest diameter.

A detailed discussion of the disease asbestosis and a correlation of the X-ray findings are reserved for the general report.

PREPARATION ROOM

Sample No.	Station	Date	Cu. Ft. Air Sampled	Millions of Particles per cu. ft. air sampled	Millions of Particles less than 10 microns per cu.ft. air sampled	Type of Dust	Remarks
1	At chaser #1 near open doors	7/9/34	32.6	1.9	1.8	Asbestos	One man working at two chasers African C & C
2	At chaser #4	"	26.7	8.2	7.9	"	Man uses hands to put asbestos from bag into chaser and from chaser into truck
3	At end of fibre shaker screen	"	48.9	2.6	2.5	"	Separating long fibre from short fibre
4	At feeding end of Garnet machine	"	34.2	1.2	1.1	"	Waste yarn put onto conveyer by one man
5	At fly shaker	7/10/34	29.1	1.5	1.4	"	One man
6	At vertical fibre opener	"	27.2	0.87	0.83	"	Hopper end, one man
7	Floor mixing of cotton and asbestos	"	39.5	7.8	7.6	Asbestos and cotton	Two men mixing; one forking mixture into picker #2
8	At shaker screen, loading hand trucks with asbestos from opener	"	31.3	8.1	7.7	Asbestos	One man; asbestos drops off end of shaker screen into truck.
9	At feeder end of cotton fibre opener	"	30.1	1.3	1.3	Cotton	One man
10	At conveyor end of picker #2	"	25.9	1.9	1.8	Cotton and asbestos	Material drop from one belt to another, oil mixed in

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The average dust count of the Preparation Room is 3.5 million particles, which is identical with the average found in January, 1930.

CARD ROOM

ample No.	Station	Date	Cu. Ft. Air Sampled	Millions of Particles per cu. ft. air sampled	Millions of Particles less than 10 microns per cu. ft. air sampled	Type of Dust	Remarks
27	Card room - center aisle between cards #2 and 21	7/11/34	30.7	5.5	5.2	Asbestos	No humidifers
28	General air - card room center aisle, west of bins	"	28.4	15.9	15.2	"	Between cards #10 and #29; belt broken on fan
29	General air - card room, center aisle, east of bins	"	28.8	13.2	12.6	"	Between cards #35 and #16; belt broken on fan
30	General air - wick, rope and twisted card room	"	31.6	2.7	2.6	"	
37	General air - west of bins - card room; conveyors from preparation room not running	7/12/34	35.7	1.8	1.7	"	Same time as #38 and #39.
38	Inside muslin enclosure, one card	"	28.2	1.5	1.4	" Card #37	Windows closed; same time as #37 and #39, one man
39	General air - east of bins - card room	"	32.6	2.8	2.7	"	Same time as #37 and #38
40	General air - west of bins, card room; conveyors from preparation room running	"	30.6	4.5	4.3	"	Same time as #41 and #42
41	Inside enclosure - conveyors from preparation room running	"	28.2	5.0	4.6	" Card #37	One man, same time as #40 and #42
42	General air - east of bins, card room	"	30.4	4.1	3.9	"	Same time as #40 and #41

General air samples - average 3.5 on samples 27, 30, 37, 39, 40 and 42. The average for the survey of January 1930 was 2.6 million particles per cubic foot.

X Not included in the average

SPINNING DEPARTMENT

Sample No.	Station	Date	Cu. Ft. Air Sampled	Millions of Particles per cu. ft. air sampled	Millions of Particles less than 10 microns per cu. ft. air sampled	Type of Dust	Remarks
13	Bldg. #5, general air, braiders	7/10/34	29.4	1.1	1.0	Asbestos and graphite	Two men making stock for ring presses; graphite and fish oil
14	General air, ring frame spinning	"	32.3	0.99	0.94	Asbestos	Two women - 4 men
15	General air - twisters	"	30.0	2.3	2.2	"	Twisting yarn and brass
16	General air - spoolers	"	27.9	0.93	0.89	"	Four women, spooling yarn from ring frame near windows on north side
17	General air - spoolers	"	30.6	8.1	7.7	"	Ten women, spooling yarn from mule spinners at partition wall
18	General air - mule spinning	"	30.3	2.5	2.4	"	In aisle between #3 and #4 - #9 and #10 - mules
19	General air - mule spinning	"	30.4	1.3	1.3	"	In aisle between #9 and #10 - #15 and #16 - mules
11	General air Bldg. #5 braiders	"	33.5	1.6	1.6	"	Two women - two men
12	Bldg. #5 between two ring presses	"	23.4	2.1	2.0	Asbestos and graphite	Two men forming small-sized packing

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Average general air samples #14 to 19 inclusive, spinning - 2.68 million particles per cubic foot air, which is higher than average of .6 million found in survey of January 1930. This is accounted for by fact that at time of previous survey more mule spinning and less frame spinning was done, i.e., ring frame spinning and twisting may be greater dust producers than mule spinning. The possibility of dust from the collectors on top of the machine shop and adjacent to this department being blown into the mule spinning should not be overlooked.

LEAVE ROOM

Sample No.	Station	Date	Cu. Ft. Air Sampled	Millions of Particles per cu. ft. air sampled	Millions of Particles less than 10 microns per cu. ft. air sampled	Type of Dust	Remarks
22	General air - west end of weave room	7/10/34	32.6	6.3	6.1	Asbestos	
24	Same as #22	7/11/34	35.7	0.6	0.5	"	
25	At inspection table weave cloth	"	27.3	2.6	2.5	"	Revolving brush - exhaust hood - two men
26	General air - east end of weave room	"	27.9	5.5	5.3	"	
31	Inspection table enclosed in beaver board two men - sample taken inside enclosure	"	20.2	3.2	3.0	"	Taken with revolving brush and exhaust running, Manhatten cloth G315 and 160
32	Taken just outside enclosure	"	19.0	9.4	9.3	"	Same time as #31
33	Taken inside enclosure	"	20.2	23.2	21.9	"	Revolving brush - no exhaust two men
34	Taken outside enclosure	"	18.8	1.5	1.5	"	Same time as #33
35	Taken inside enclosure	"	20.2	1.5	1.4	"	Hand brushing - three men
36	Taken outside enclosure	"	19.0	2.1	2.0	"	Same time as #35
43	General air - east end of weave room	7/13/34	18.8	9.3	9.2	"	Before work started in morning, shut down from midnight
44	General air - east end of weave room	"	18.6	6.0	5.9	"	" " "

The dust counts of samples #43 and 44 were taken before work started in the morning. These counts are considerably higher than samples taken during operating periods. This may be due to closing of windows, shutting off of humidifiers and floor sweeping.

WEAVE ROOM (Continued)

Sample No.	Station	Date	Cu. Ft. Air Sampled	Millions of Particles per cu. ft. air sampled	Millions of Particles less than 10 microns per cu. ft. air sampled	Type of Dust	Remarks
45	General air - east end of weave room	7/13/34	27.0	2.6	2.6	Asbestos	Same time as #46 and 47; weave room started at 7 o'clock
46	General air - west end of weave room	"	27.9	2.7	2.7	"	Same time as #45 and 47
47	At inspection table for woven cloth, dry woven cloth 10P225	"	30.3	0.8	0.8	"	Revolving brush and exhaust; two men, same time as #45 and 46
48	Same location as #45	"	27.0	3.0	2.9	"	Same time as #49 and 50
49	Same location as #46	"	27.9	5.1	5.0	"	Same time as #48 and 50
50	Inspection table - hand brushing	"	30.3	0.8	0.8	"	Three men - at same time as #48 and 49
51	Same location as #45	"	18.9	4.9	4.8	"	At same time as #52 and 53
52	Same location as #46	"	20.5	0.9	0.9	"	Same time as #51 and 53
53	Table inspection woven cloth, revolving brush, no exhaust	"	21.2	1.8	1.7	"	Same time as #51 and 52; two men

General air samples, #22, 24 and 26, 45, 46, 48, 49, 51 and 52, averaged

3.5 million particles per cubic foot air, as compared with .6 found in survey of January 1930.

PACKING DEPARTMENT

Sample No.	Station	Date	Cu. Ft. Air Sampled	Millions of Particles per cu. ft. air sampled	Millions of Particles less than 10 microns per cu. ft. air sampled	Type of Dust	Remarks
20	General air - molded packing department	7/10/34	62.3	0.45	0.43	Asbestos	
23	General air - rubber compounding room	"	28.2	1.4	1.3	Clay lead talc sulphur	

LEAD ANALYSES

Sample No.	Station	Date	Cu. Ft. Air Sampled	Milligrams of lead per cu. ft. air sampled	Type of dust	Remarks
21	Between two rubber compounding mills	7/10/34	33.6	Negative for lead	Clay lead talc sulphur	Exhaust hood with cloth curtains
23	General air - rubber compounding room	"	28.2	Negative for lead	"	

CLOTH INSPECTION (WEAVE ROOM)

Table showing the results of special tests run at the cloth inspection table

	Millions of Dust Particles per cu. ft. air sampled	
	Inside enclosure (doors closed)	Normal conditions enclosure removed
Average general air - weave room during tests	3.5	3.8
Cloth inspection table - exhaust and revolving brush	3.2	0.8
Cloth inspection table - no exhaust but with revolving brush	23.2	1.8
Cloth inspection table - hand brushing, no exhaust	1.5	0.8

It was noted that only slight changes had been made in the preparation room since the survey in 1930. The method of oiling and conveying the fibre remains the same. As noted, the average dust count remained constant.

Extensive changes and increased methods of dust entrapping and removal in the card room were noted. The method of conveying the fibre from the preparation to the card room is the same and the fibre is carted from the storage bins to the feed hoppers on the cards in the same manner.

Natural ventilation is supplied by open windows which occupy approximately two thirds of the total wall space.

Samples No. 37 and 39 were taken before the fibre conveyors from the preparation room were running, while samples No. 40 and 42 were taken after the conveyors were put into operation. The increased count is evidently due to dust generated by the fibre conveyors and leakage from the storage bins in the card room.

In the test on the enclosed card, samples 37, 38, and 39 were taken before the fibre conveyors were operating and samples No. 40, 41 and 42 were taken after the conveyors were running. The muslin enclosure is not effective in keeping out the fine dust, as evidenced by the comparison of counts on samples taken simultaneously inside and outside the enclosure. The increased counts after the conveyor was operating should be noted.

The natural ventilation in the weave room is augmented by a forced air supply through the fan and distributing ducts used for heating in the winter months. The chance of dust pollution from this outside air supply is remote, as the dust collectors are located at a distance east of the weave room. Experimental work is in progress on entrapping and exhausting dust generated by the looms.

Attention is called to the tests run on the cloth inspection table, with the mechanically operated brush, which show that the exhaust system is effective in keeping the dust concentration down to the same count as under the system of hand brushing without exhaust.

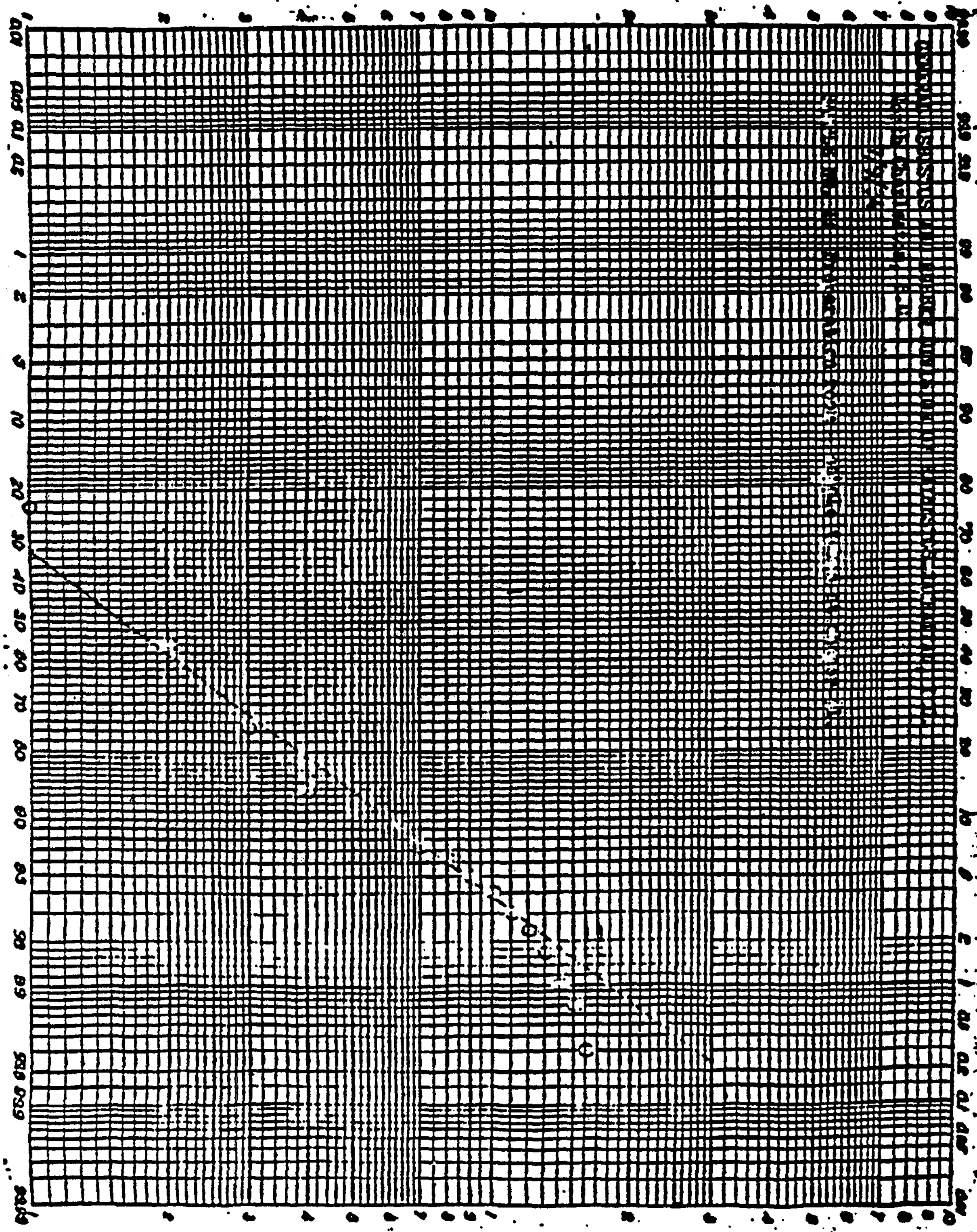
The lead pollution at the rubber compounding operations of the packing department has been corrected, as shown by the absence of lead in the air samples taken.

CONCLUSIONS AND RECOMMENDATIONS

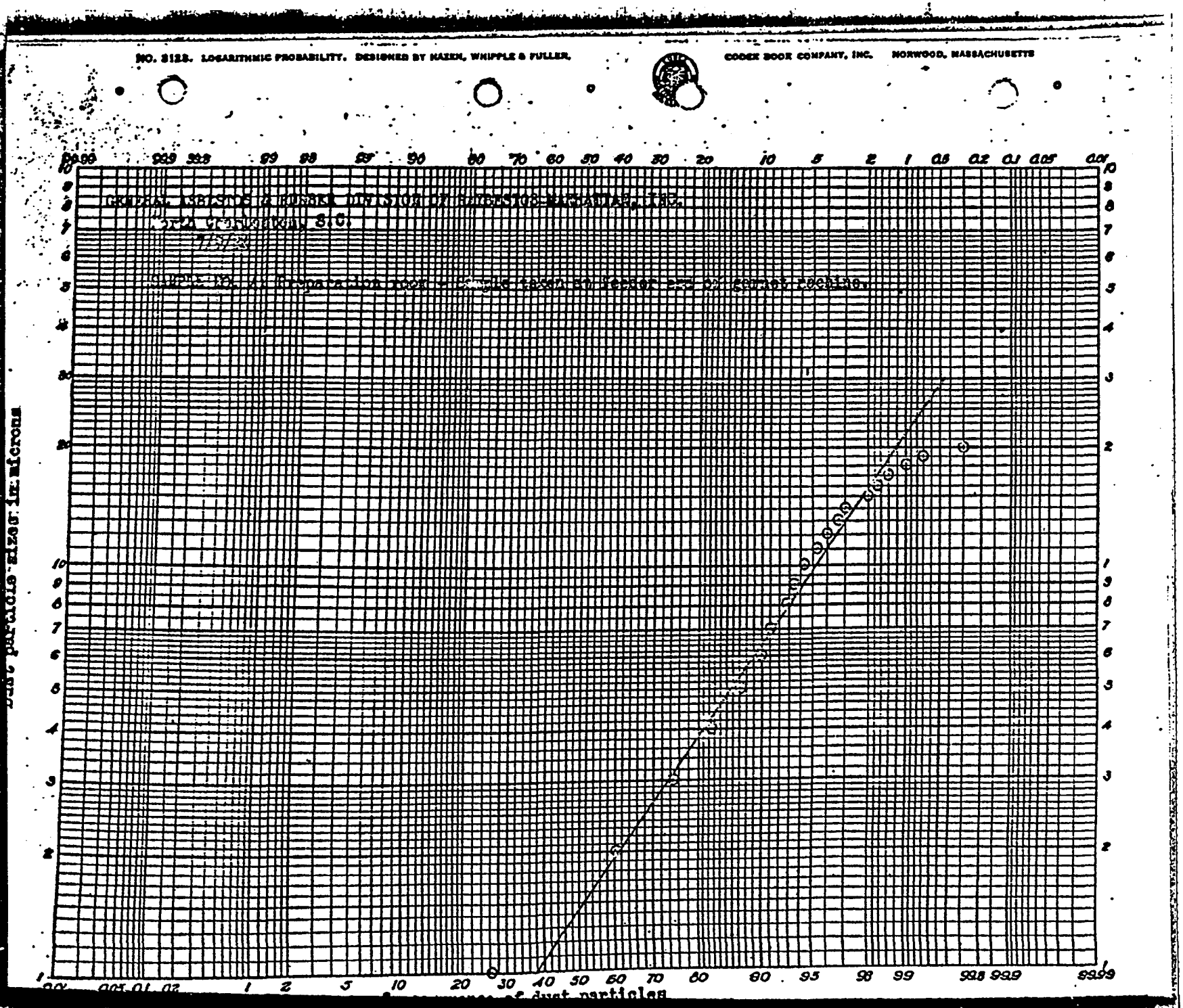
An exhaust system is under construction in the card room and experimental work is in progress for entrapping and exhausting dust generated by the looms in the weave room, and until this work is completed and checks run on the efficiency of the exhaust system, no other recommendations can be made.

Tests conducted in the card room show that there is an increase in the general air dust content when the fibre conveyors are in operation. This is due to leakage of dust from the fibre storage bins in the card room and efforts should be made to seal this leakage.

Dust particle sizes in microns



NO. 3128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER. CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS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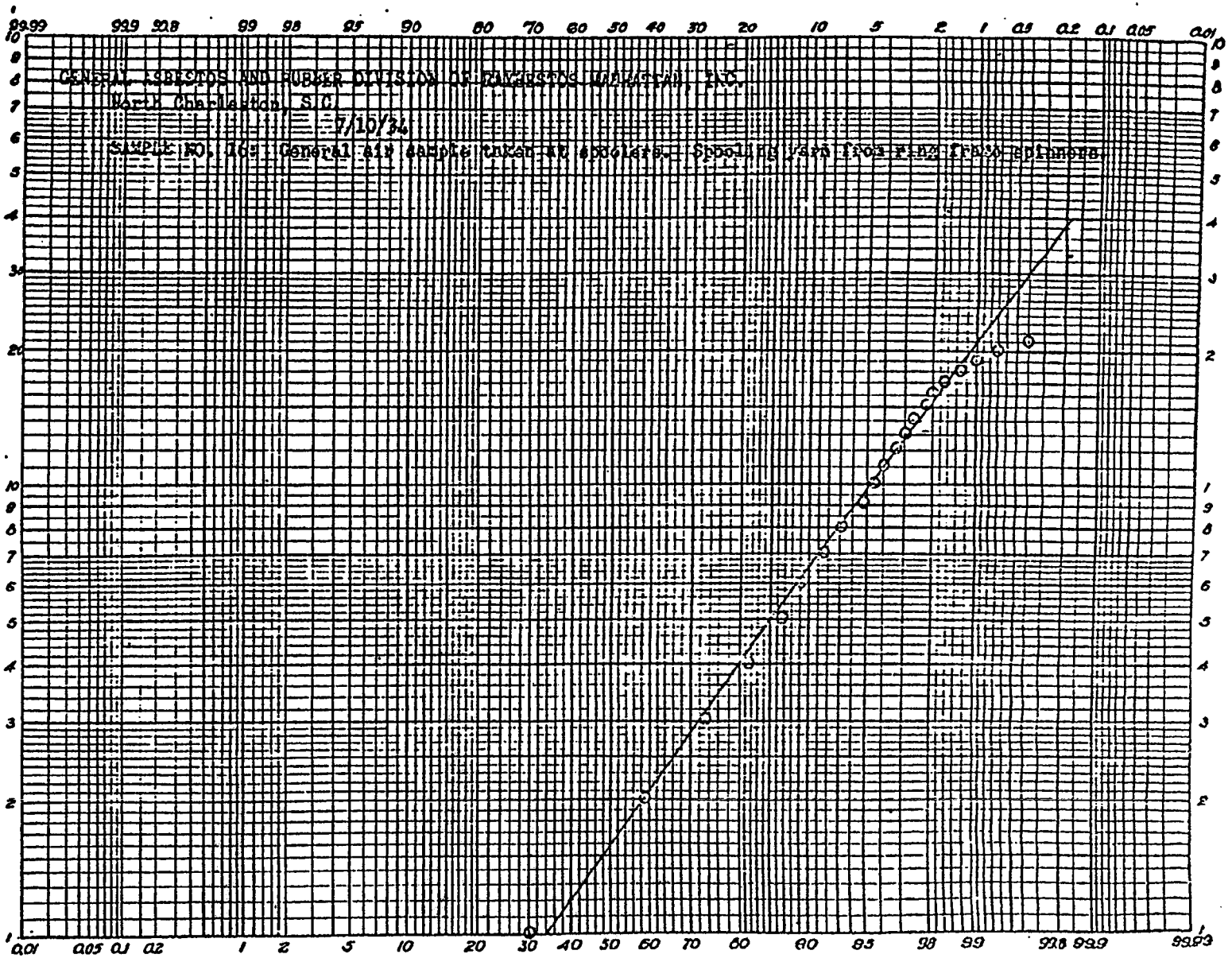
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
10 9 8 7 6 5 4 3 2 1
0.01 0.02 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
Particle size in microns
of dust particles



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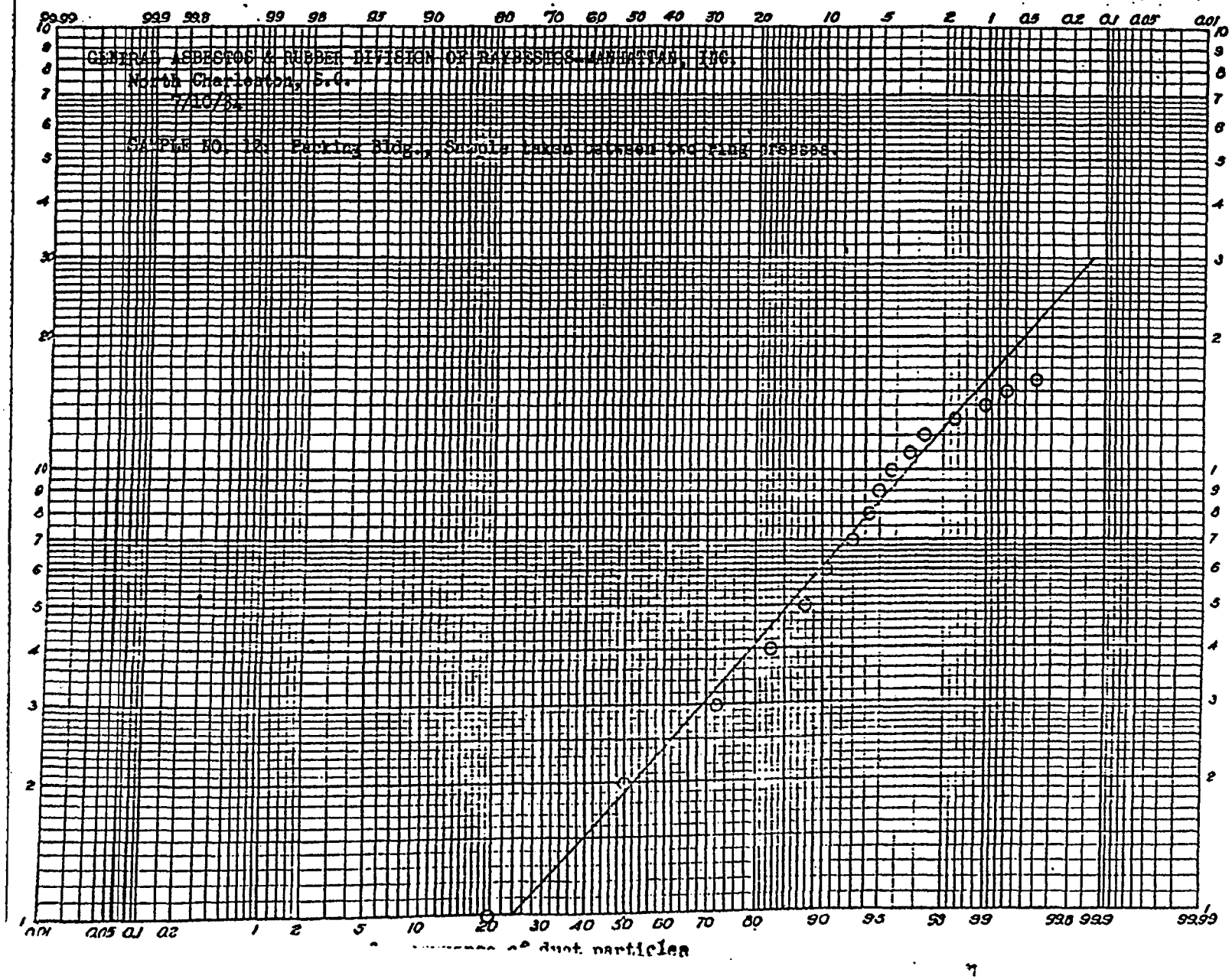
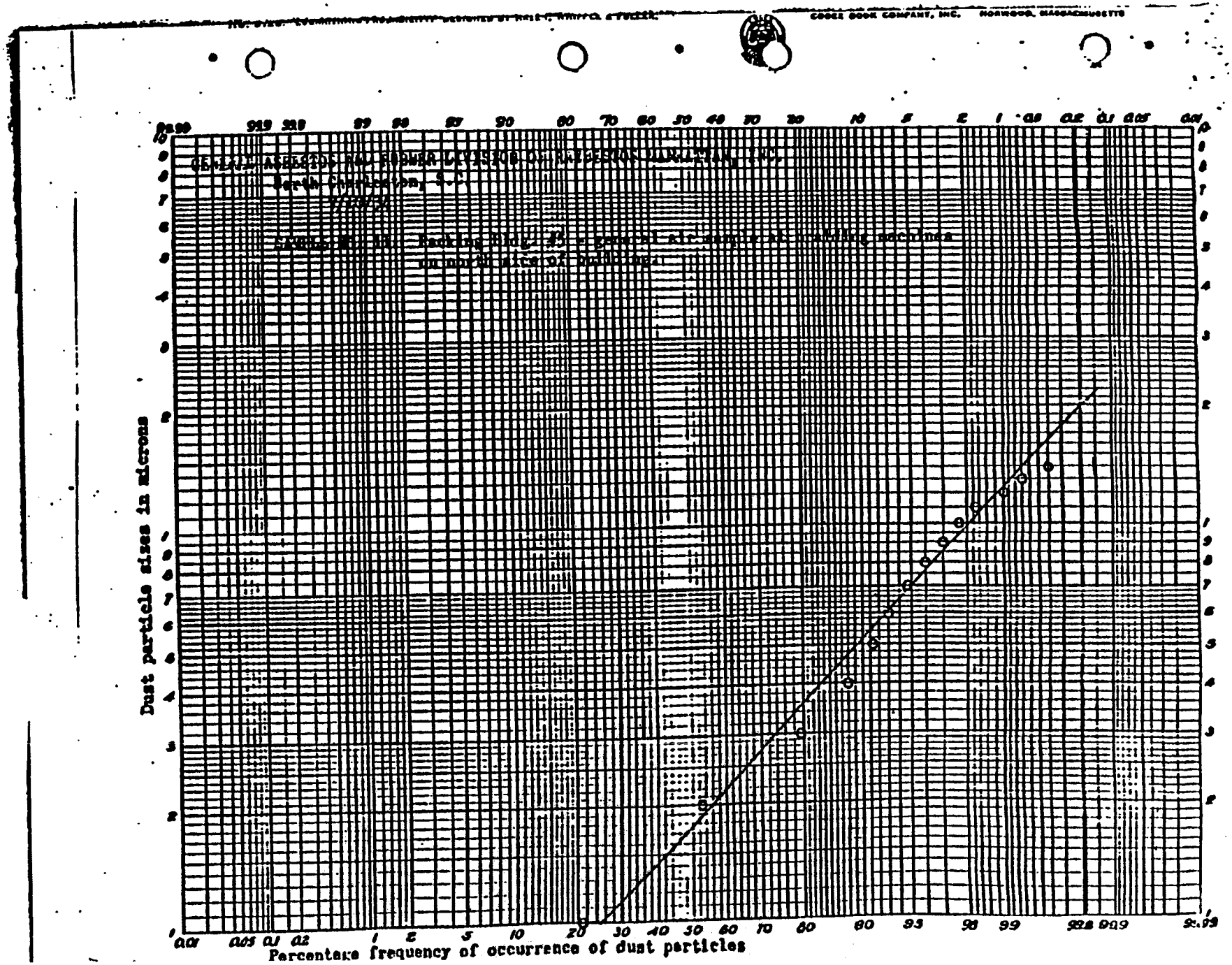
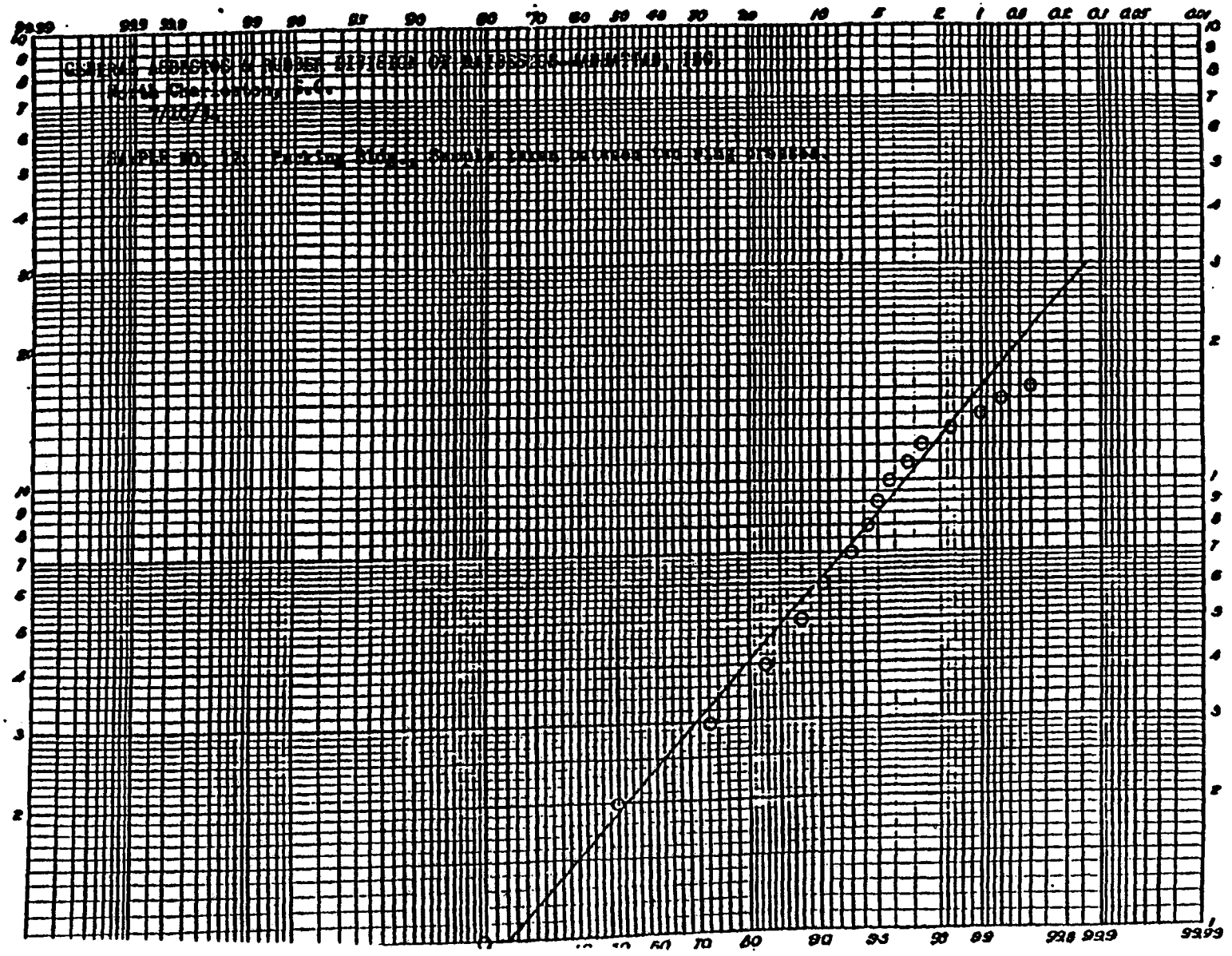
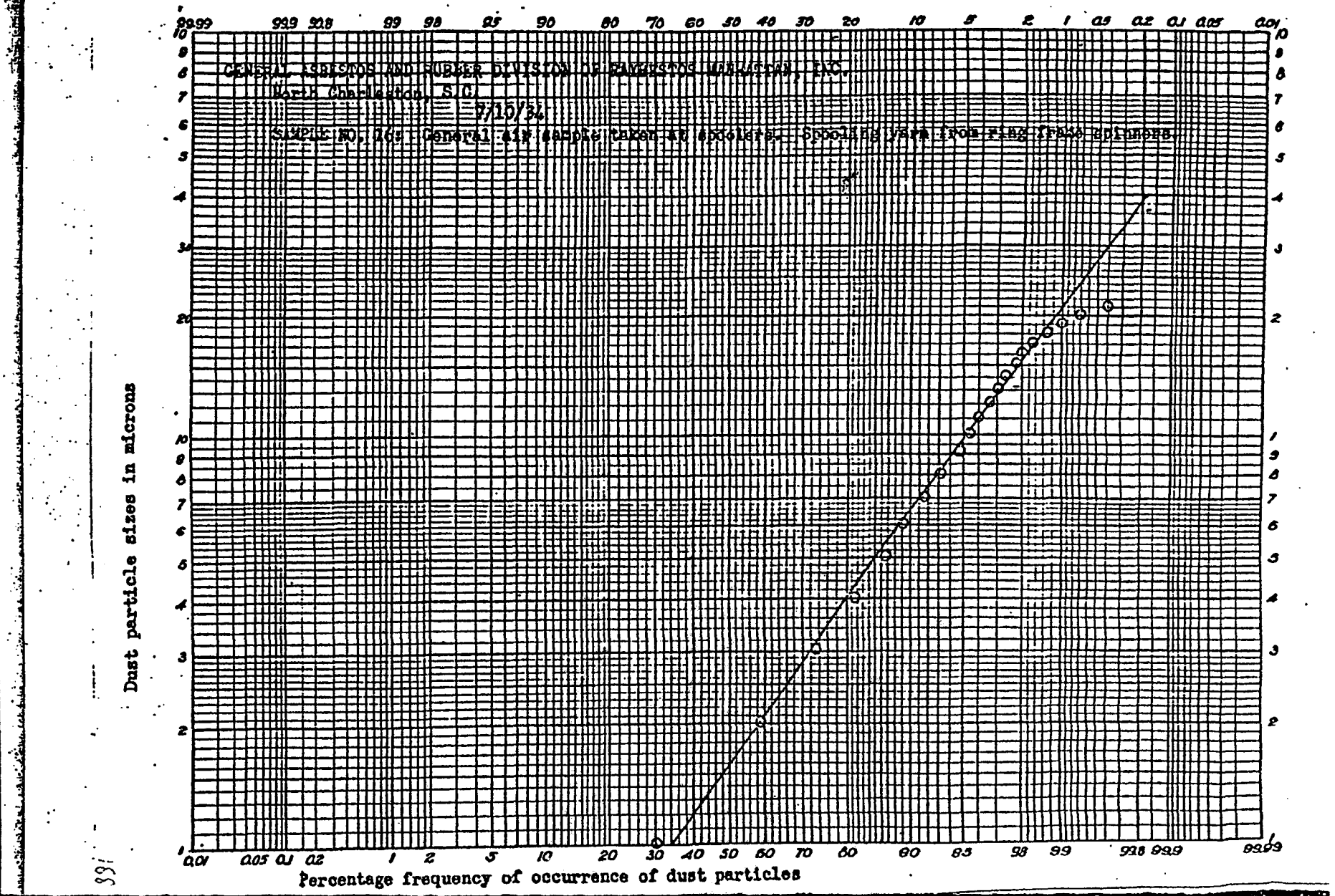


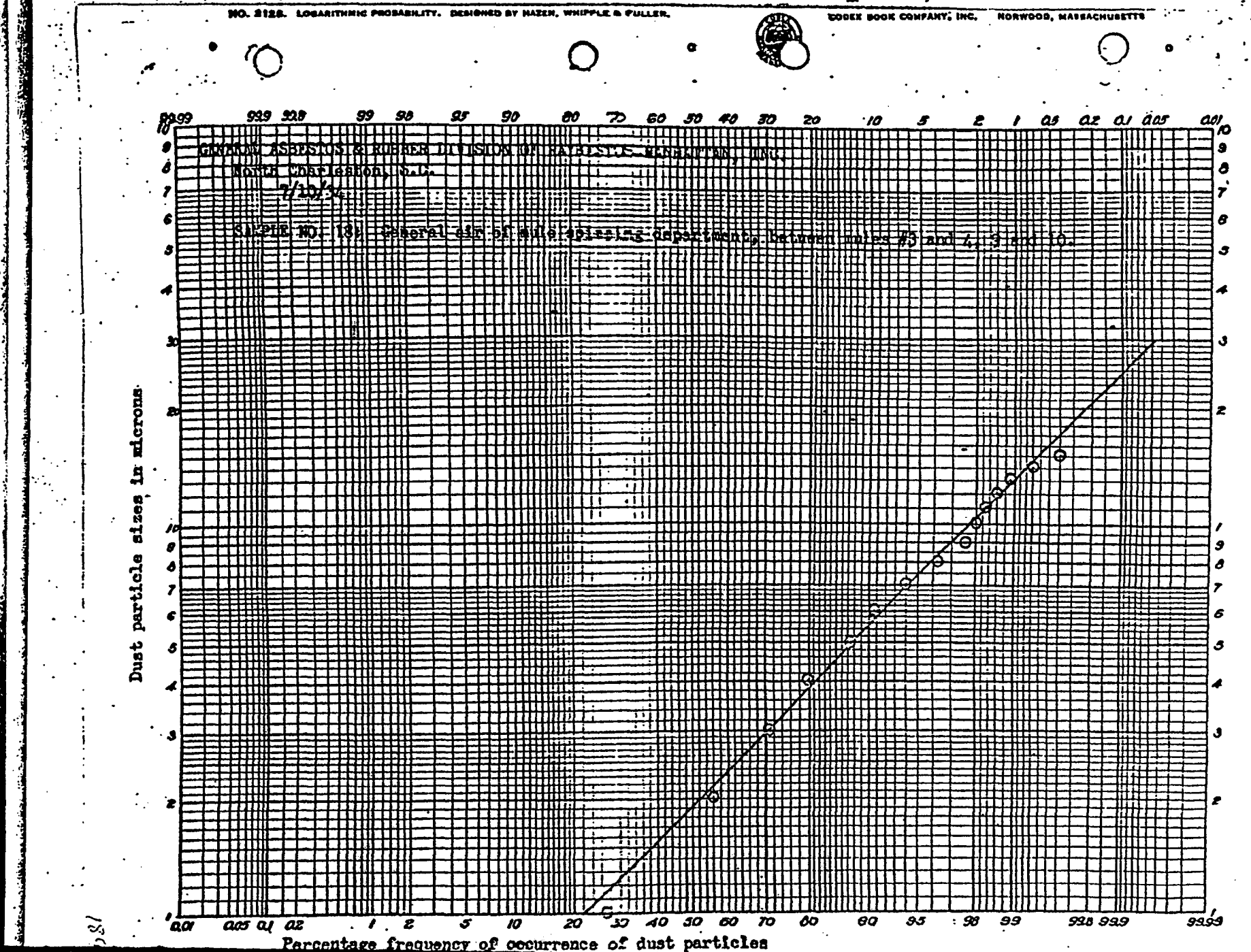

Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

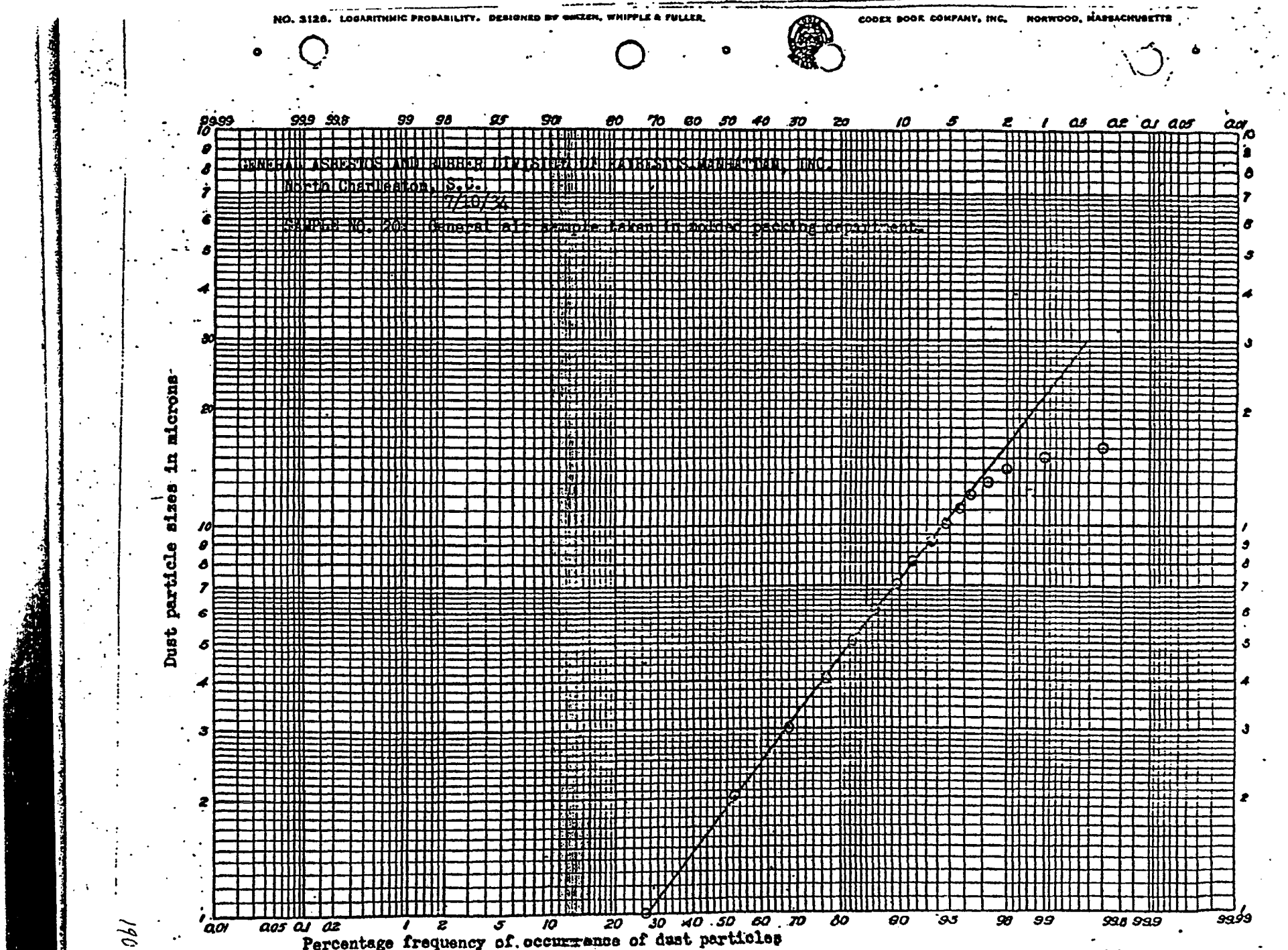
NO. 3128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WINSLOW & FULLER.

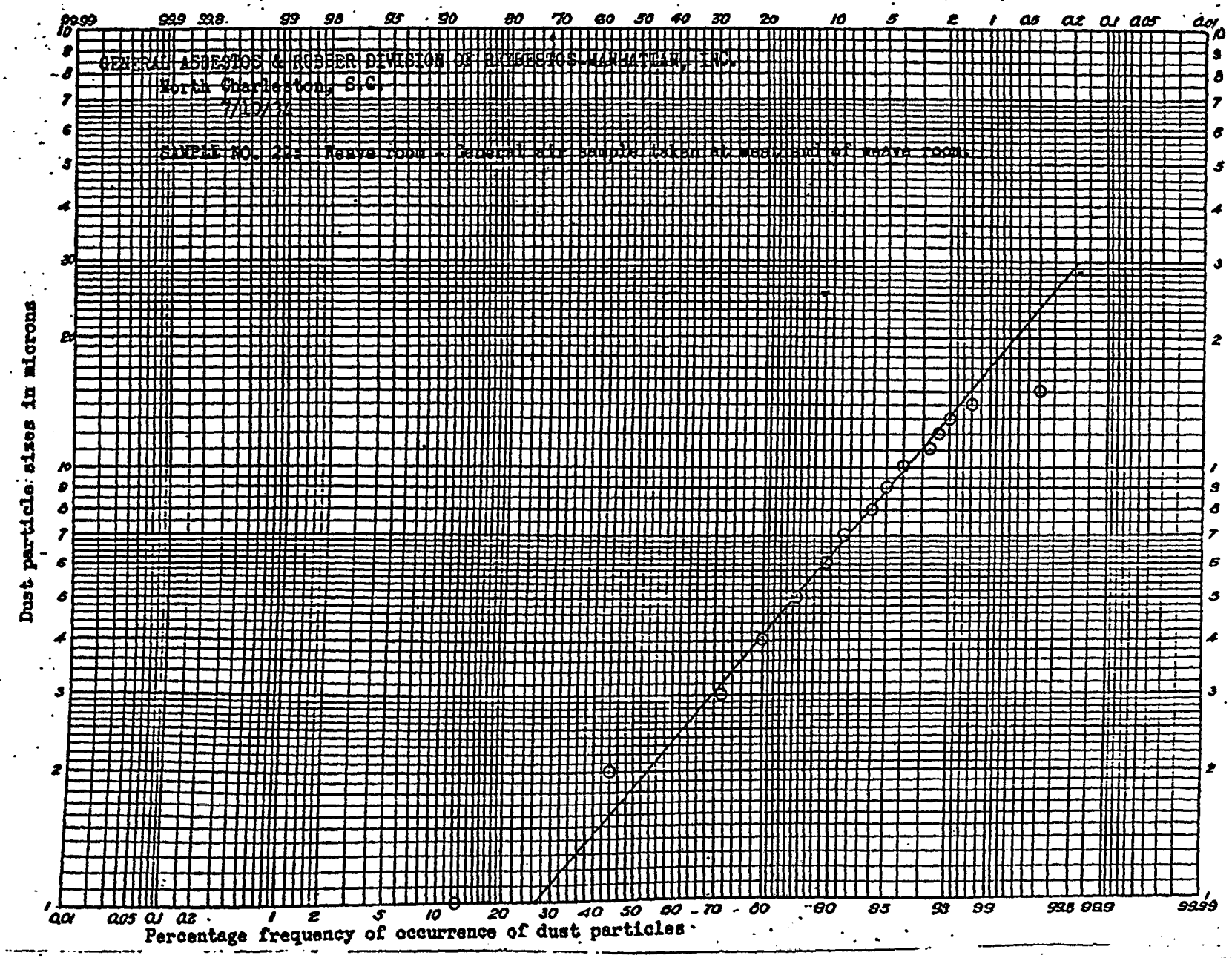
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS

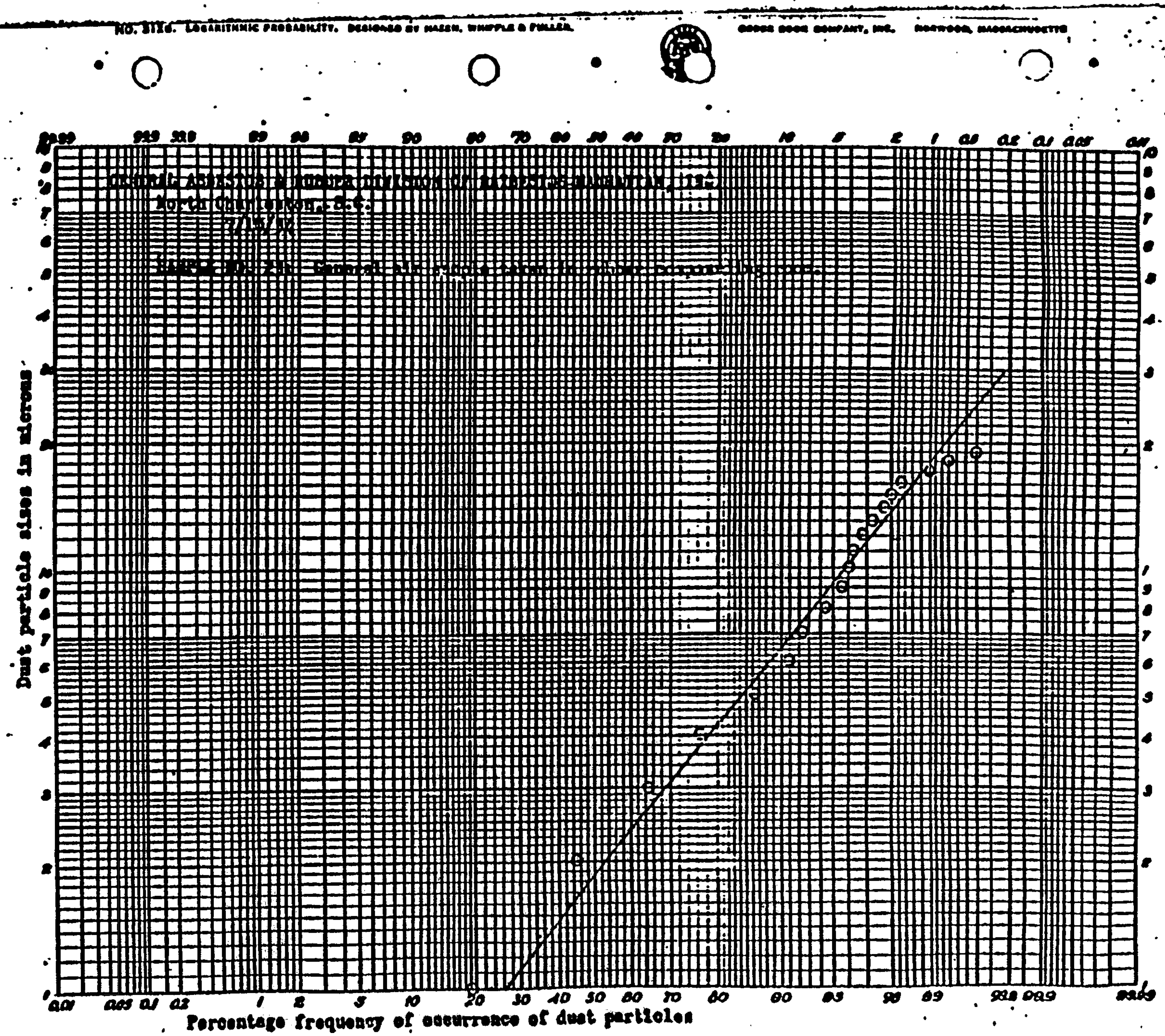


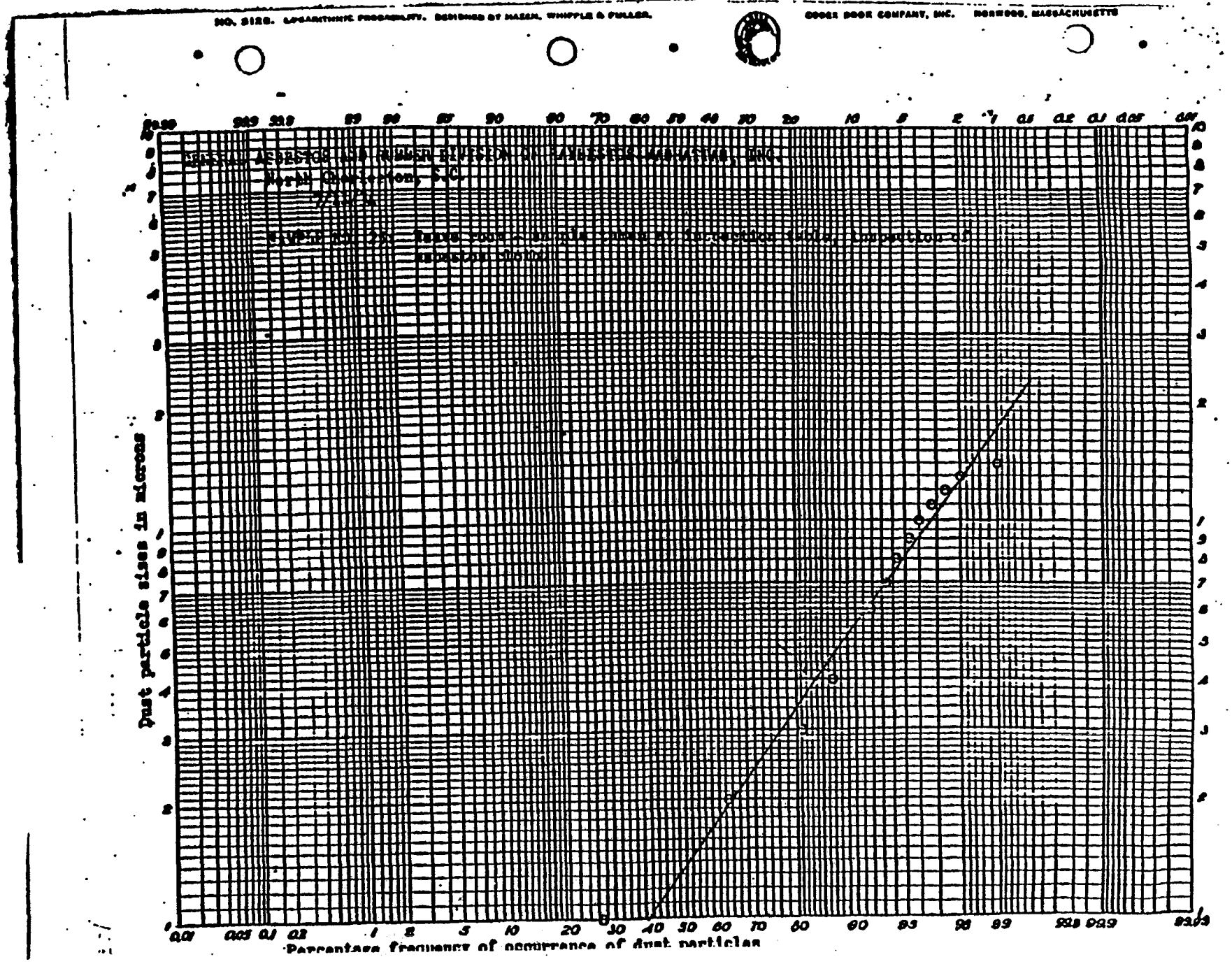

NO. 3128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER.
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS
99.99 99.8 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
GENERAL ASBESTOS AND RUBBER DIVISION OF RAYBESTOS MANHATTAN, INC.
North Charleston, S.C.
7/10/34
SAMPLE NO. 76: General air sample taken at Picklers. Spooling yarn from ring frame spinners.
Dust particle sizes in microns
Percentage frequency of occurrence of dust particles
0.01 0.05 0.1 0.2 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

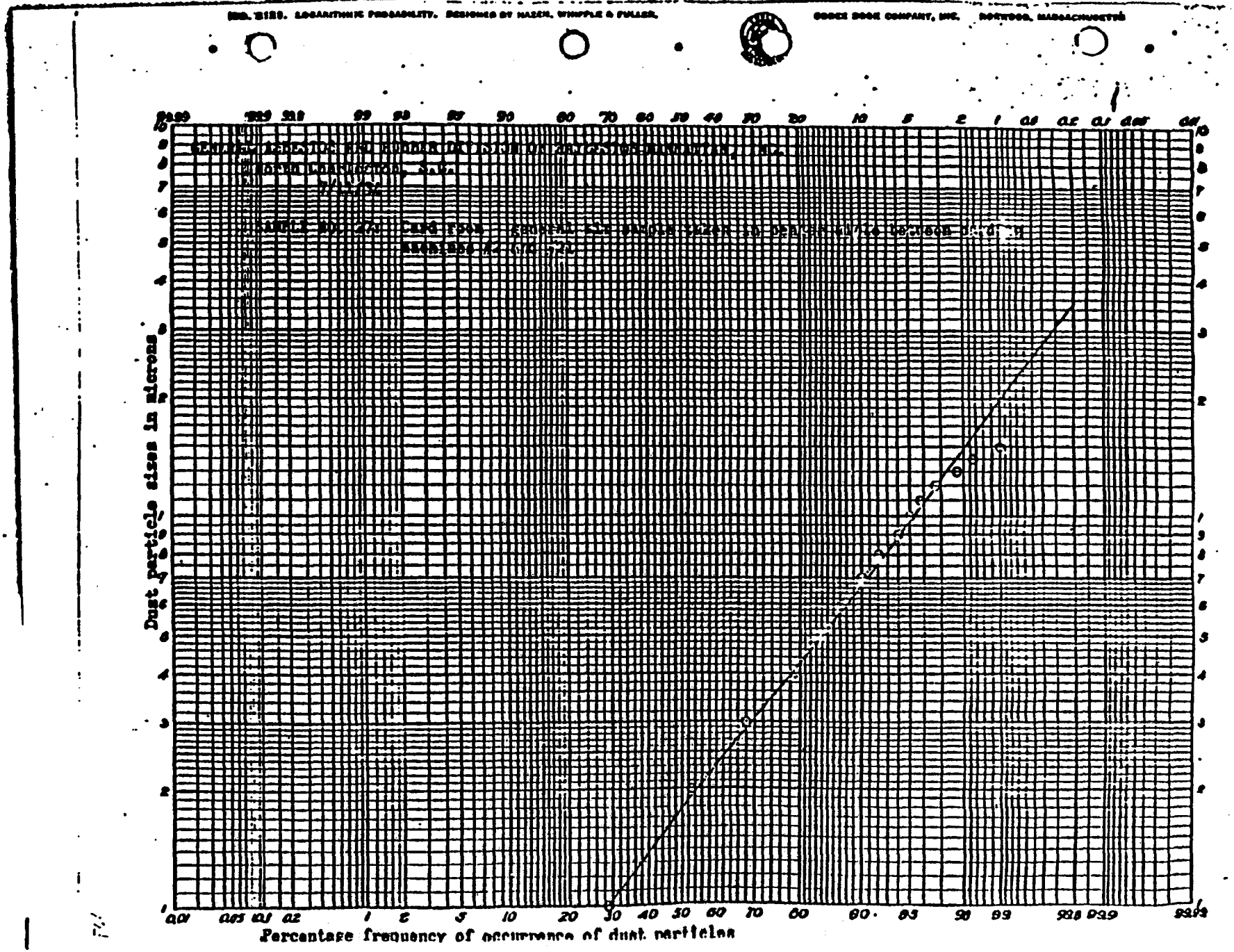

NO. 2128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER.
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
GINNING, ASBESTOS & RUBBER DIVISION OF RAYBESTOS-MANHATTAN, INC.
North Charleston, S.C.
9/10/54
SAMPLE NO. 181 General air of mill spinning department, between aisles #3 and 4, 3 and 10.
Dust particle sizes in microns
Percentage frequency of occurrence of dust particles
0.01 0.05 0.1 0.2 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

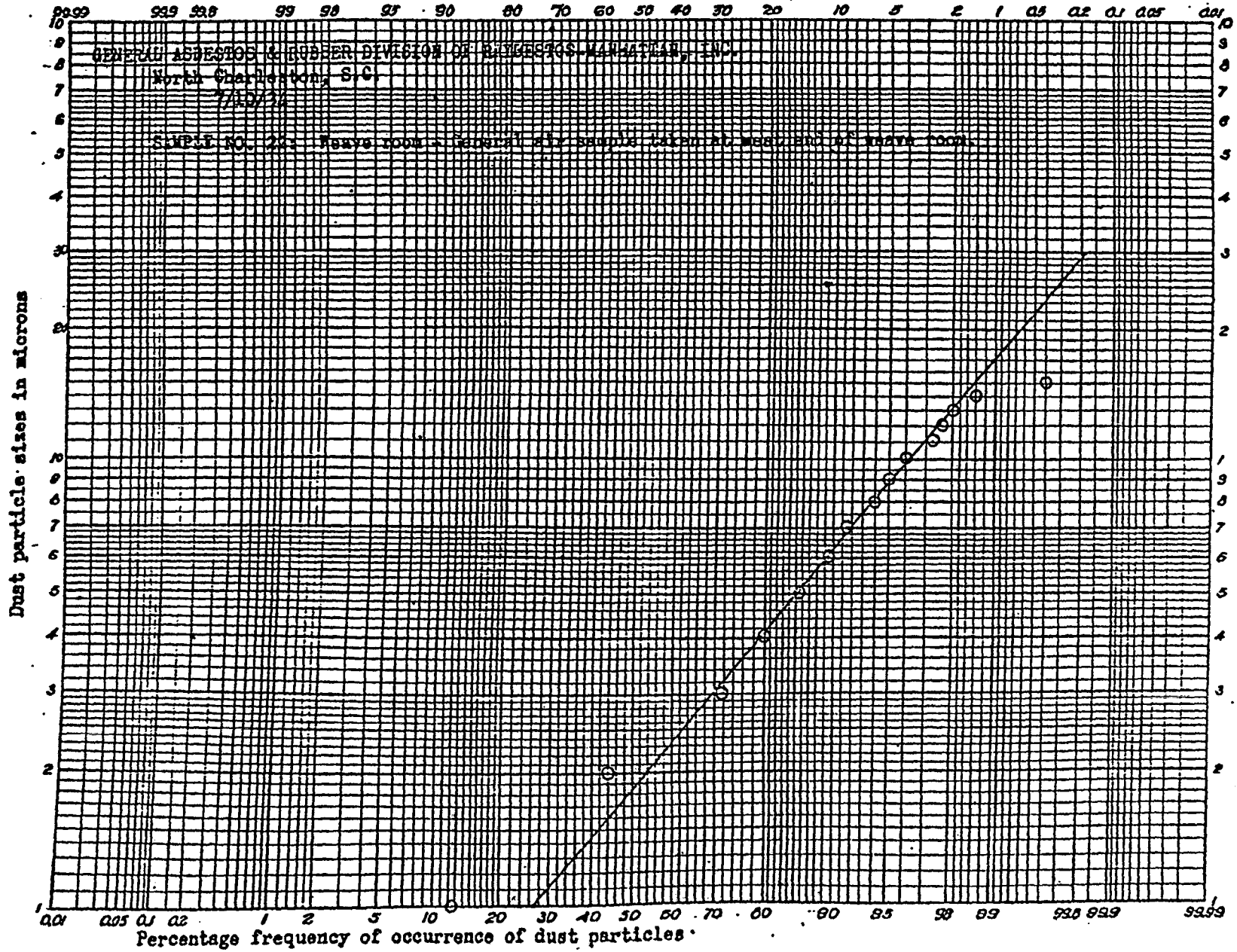

NO. 3128. LOGARITHMIC PROBABILITY. DESIGNED BY GOLDEN, WHIPPLE & FULLER.
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS
GENERAL ASBESTOS AND RUBBER DIVISION OF RATHESTOS-MANHATTAN, INC.
North Charleston, S.C.
7/10/54
SAMPLE NO. 20: General air sample taken in bolder packing department.
Dust particle sizes in microns
Percentage frequency of occurrance of dust particles


GENERAL ASBESTOS & RUBBER DIVISION OF RAYBESTOS-MANHATTAN, INC.
North Charleston, S.C.
7/10/72
SAMPLE NO. 223 Reeve room - General air sample taken at west end of weave room.
Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

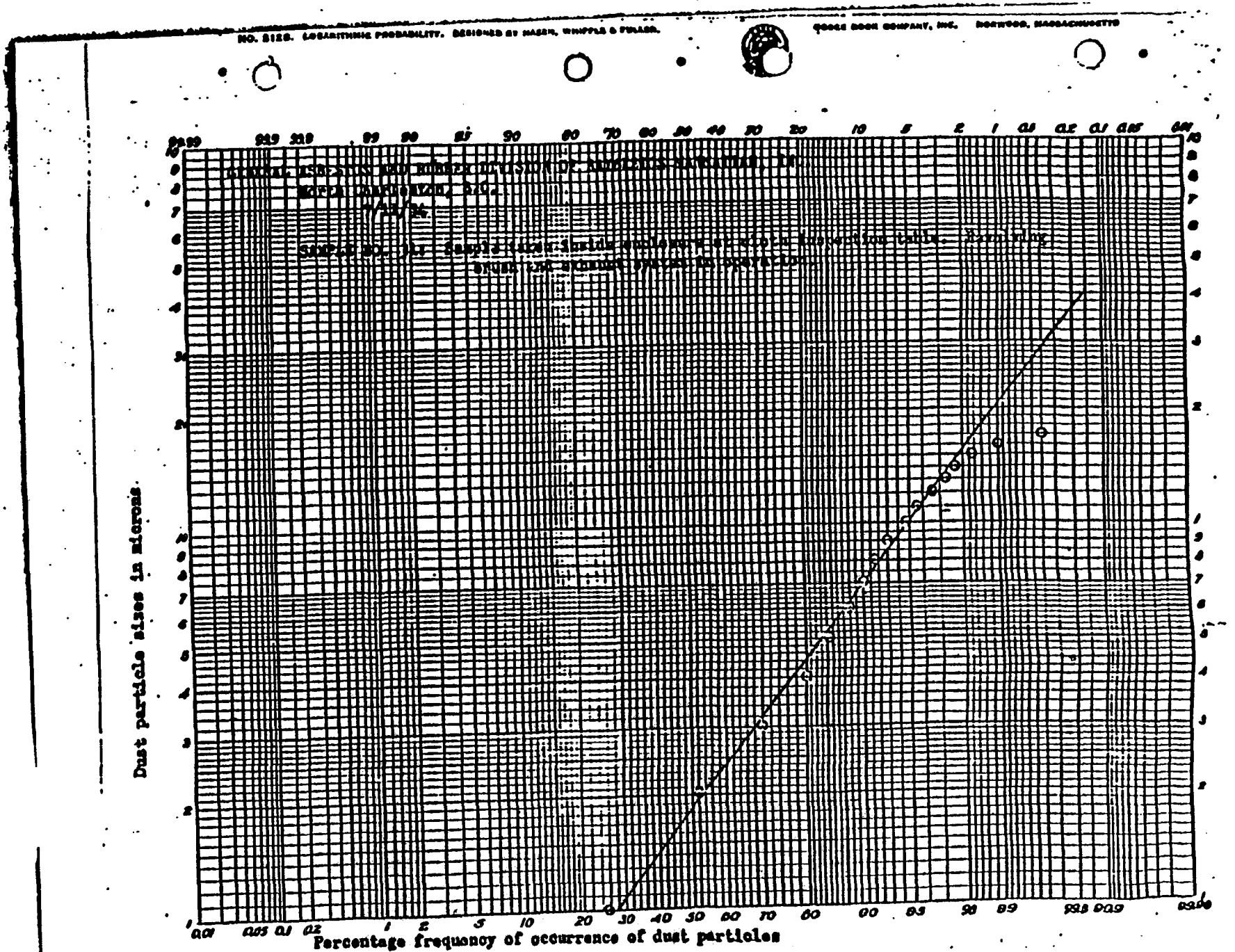

NO. 31X6. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER.
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS
North Charleston, S.C.
Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

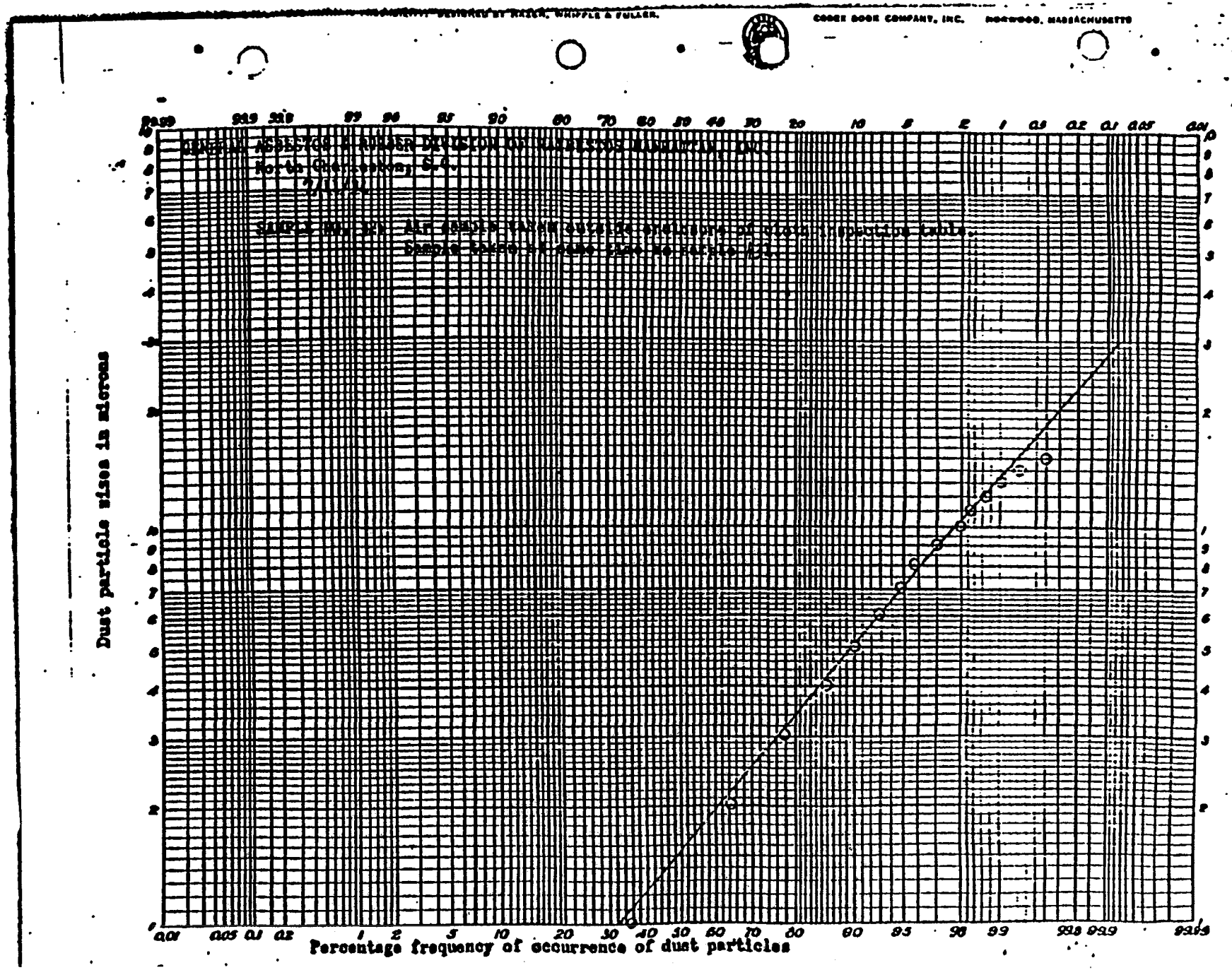

Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

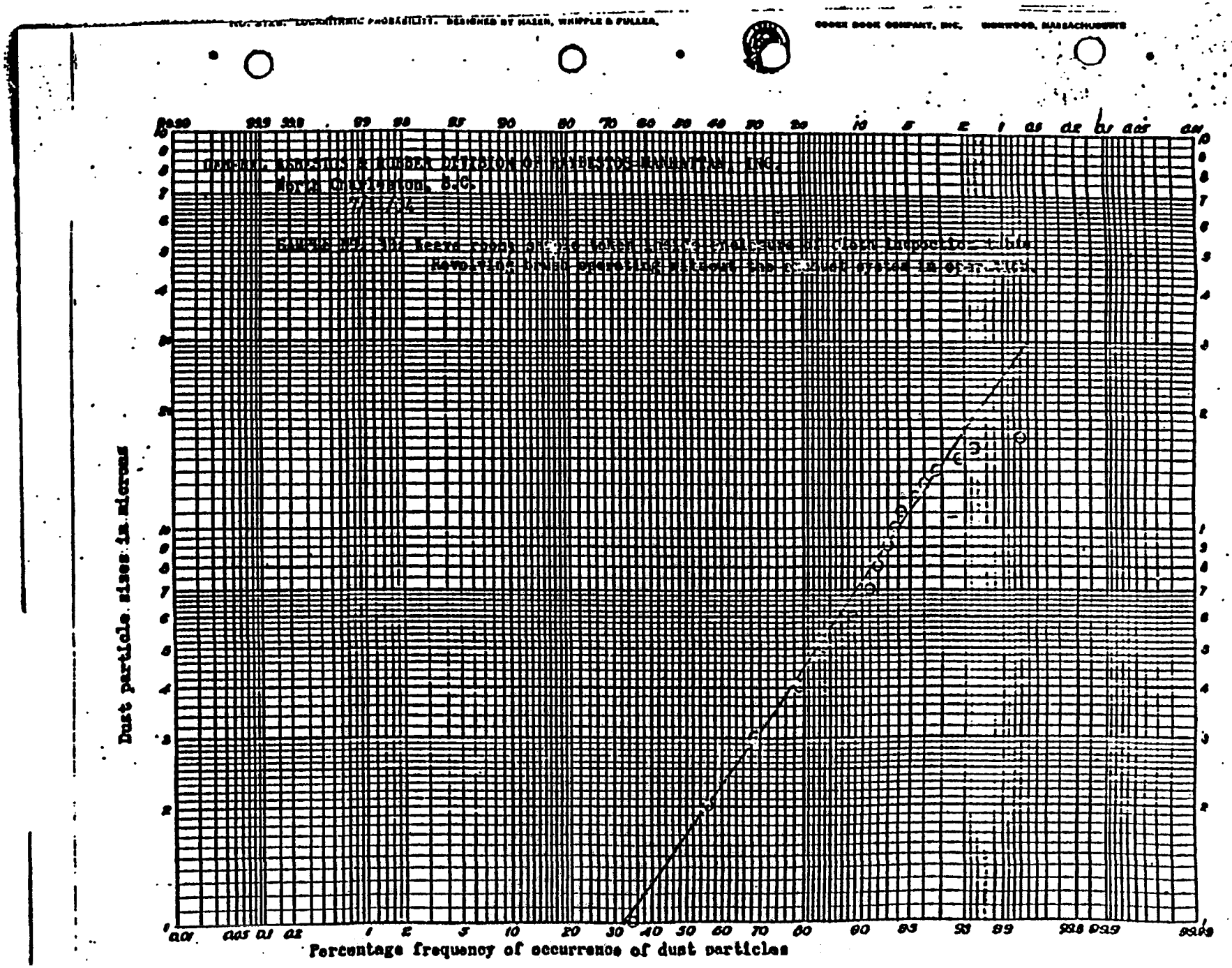

Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

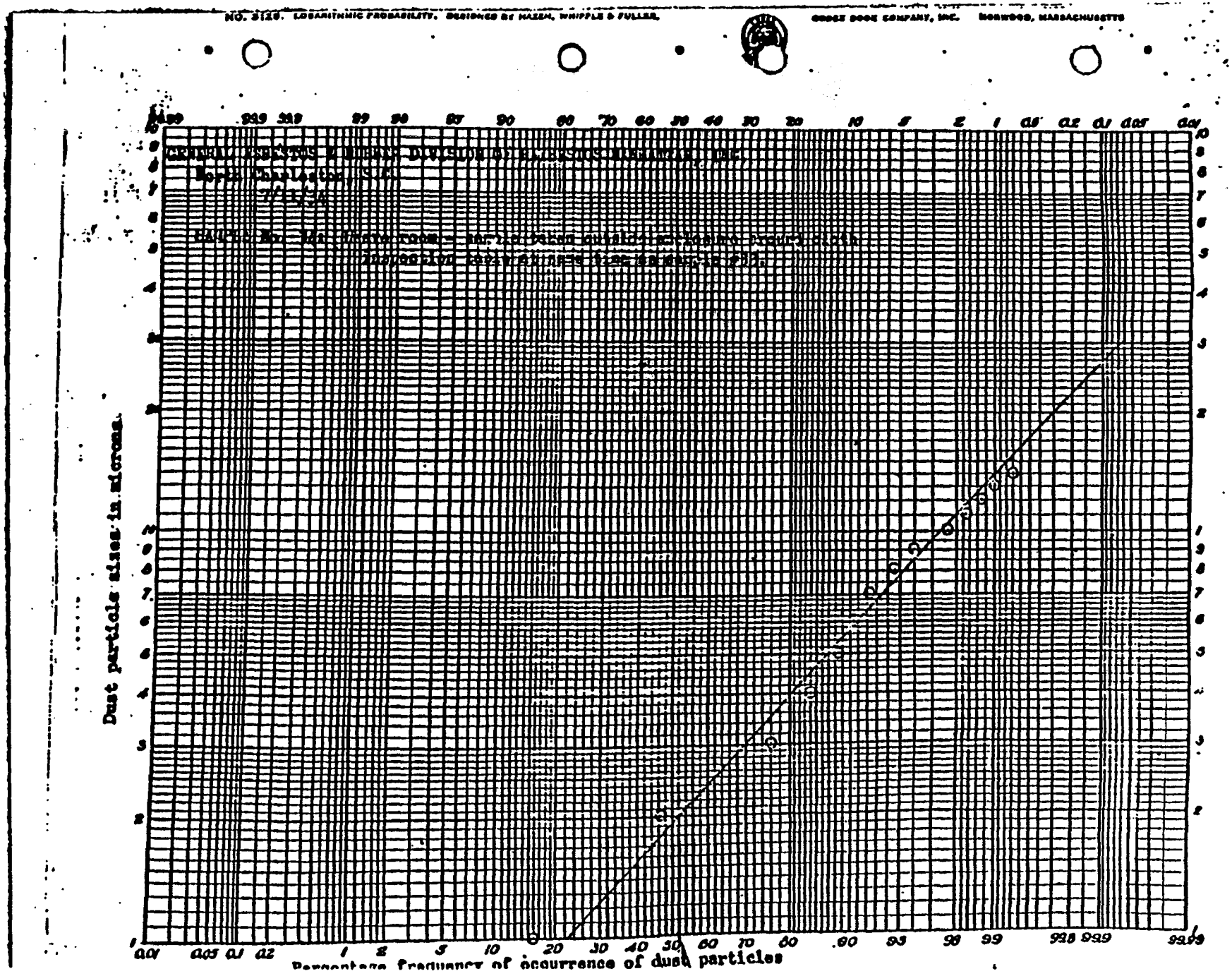


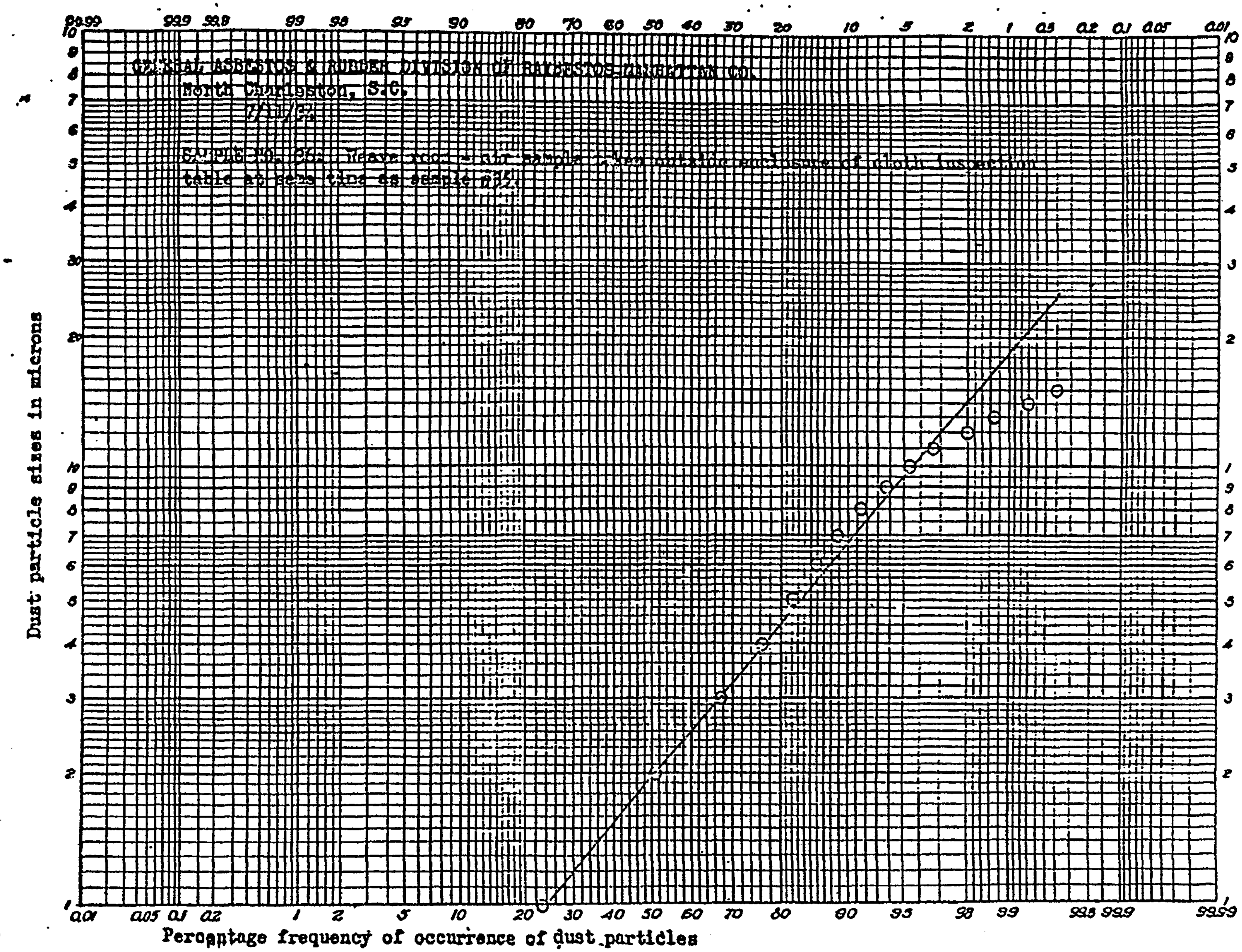
GENERAL ASBESTOS & RUBBER DIVISION OF RAYBESTOS-MANHATTAN, INC.
North Charleston, S.C.
7/19/71
SAMPLE NO. 2A: Weave room - General air sample taken at Mack and at weave room.


Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

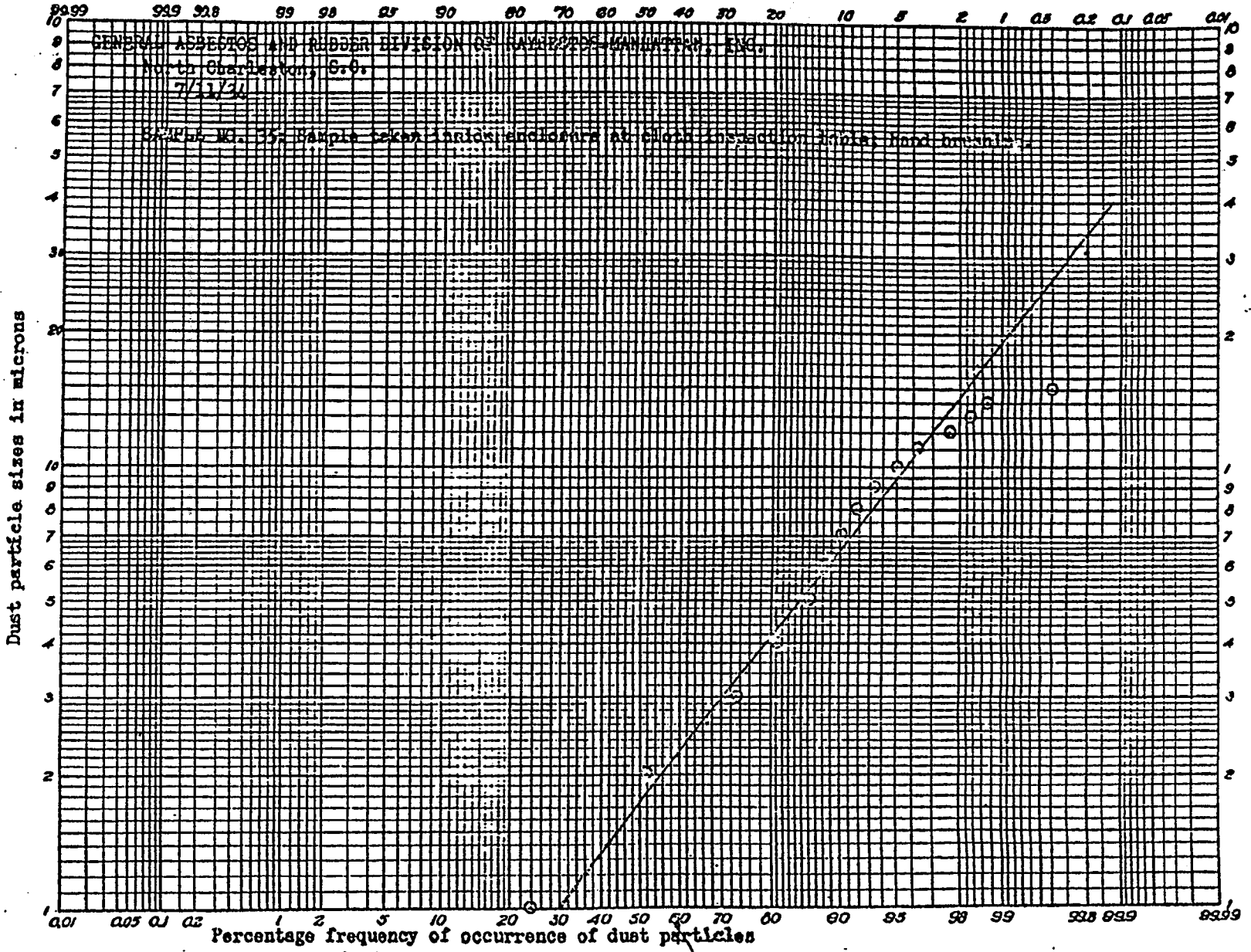

Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

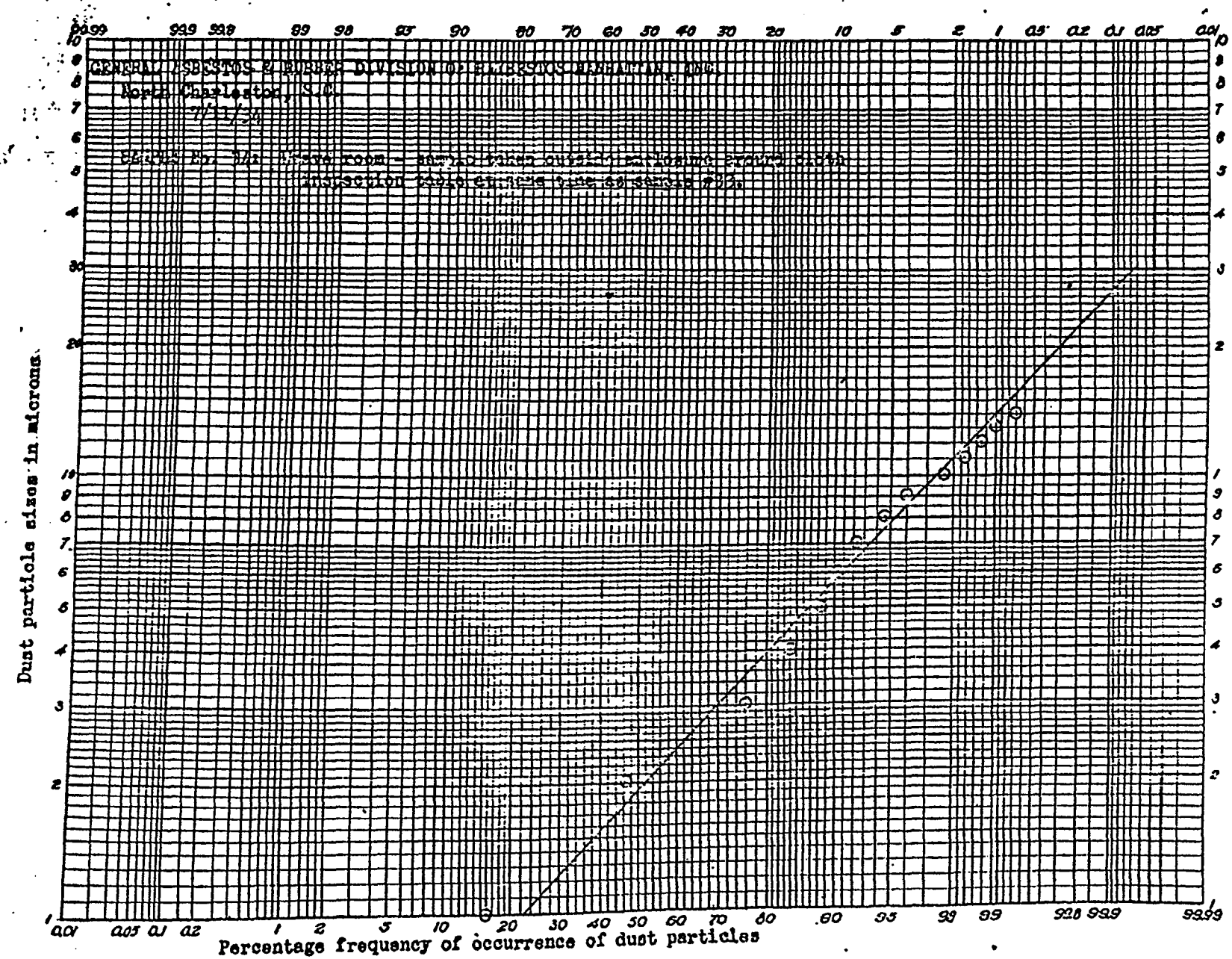

Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

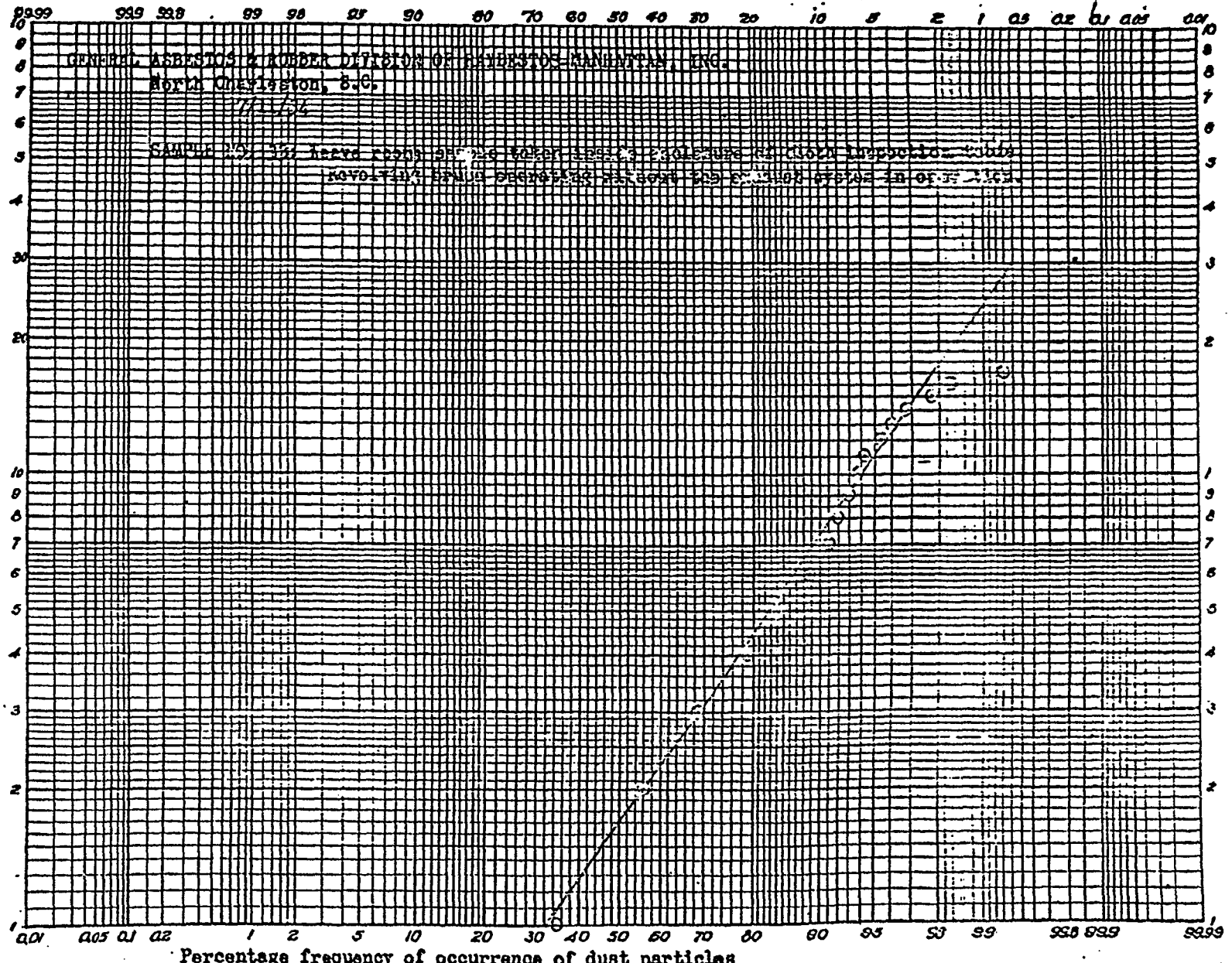

NO. 5128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER.
KEUFFEL & ESSER CO.
Dust particle sizes in microns.
Percentage frequency of occurrence of dust particles

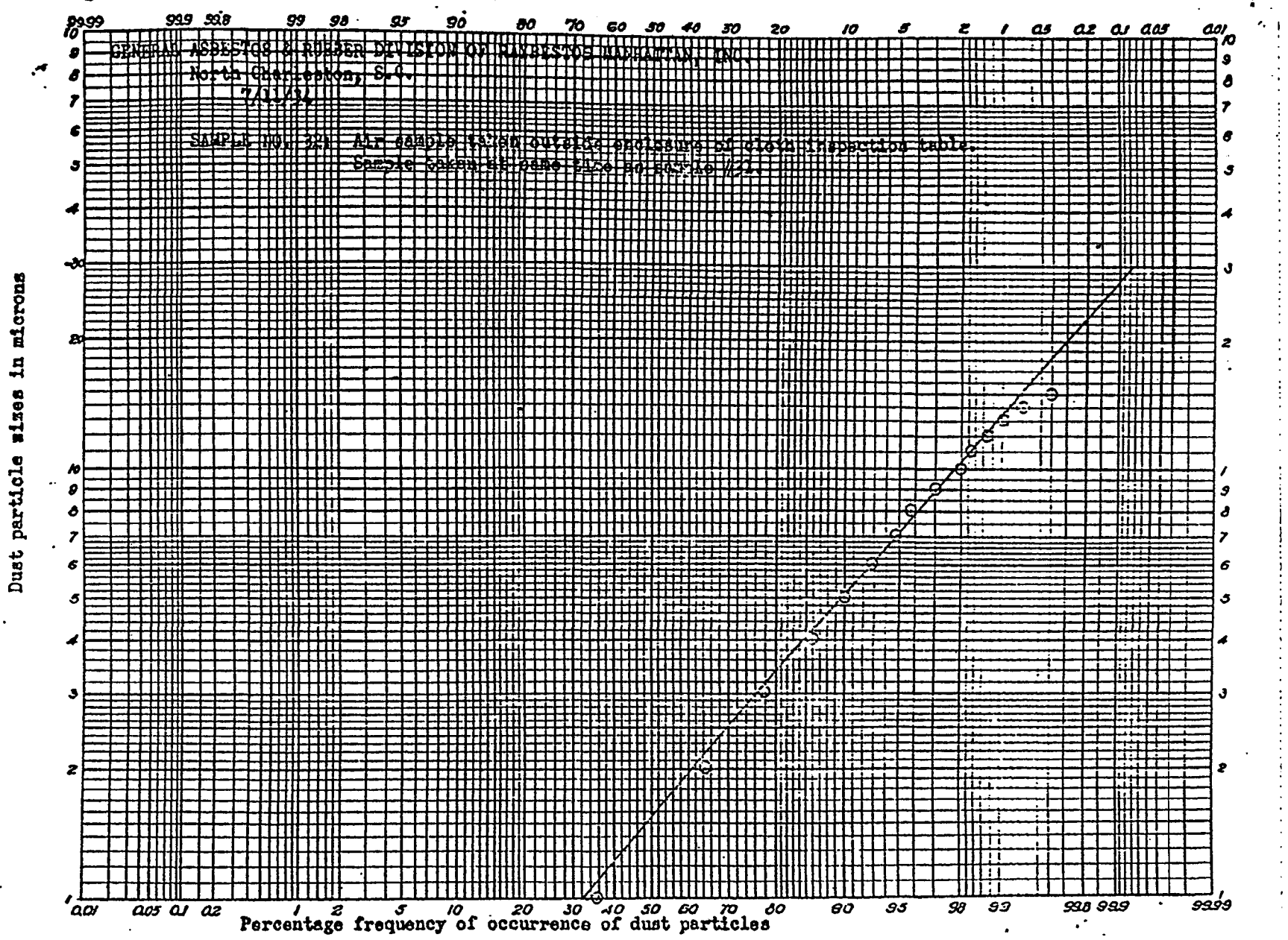

North Charleston, S.C.
Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

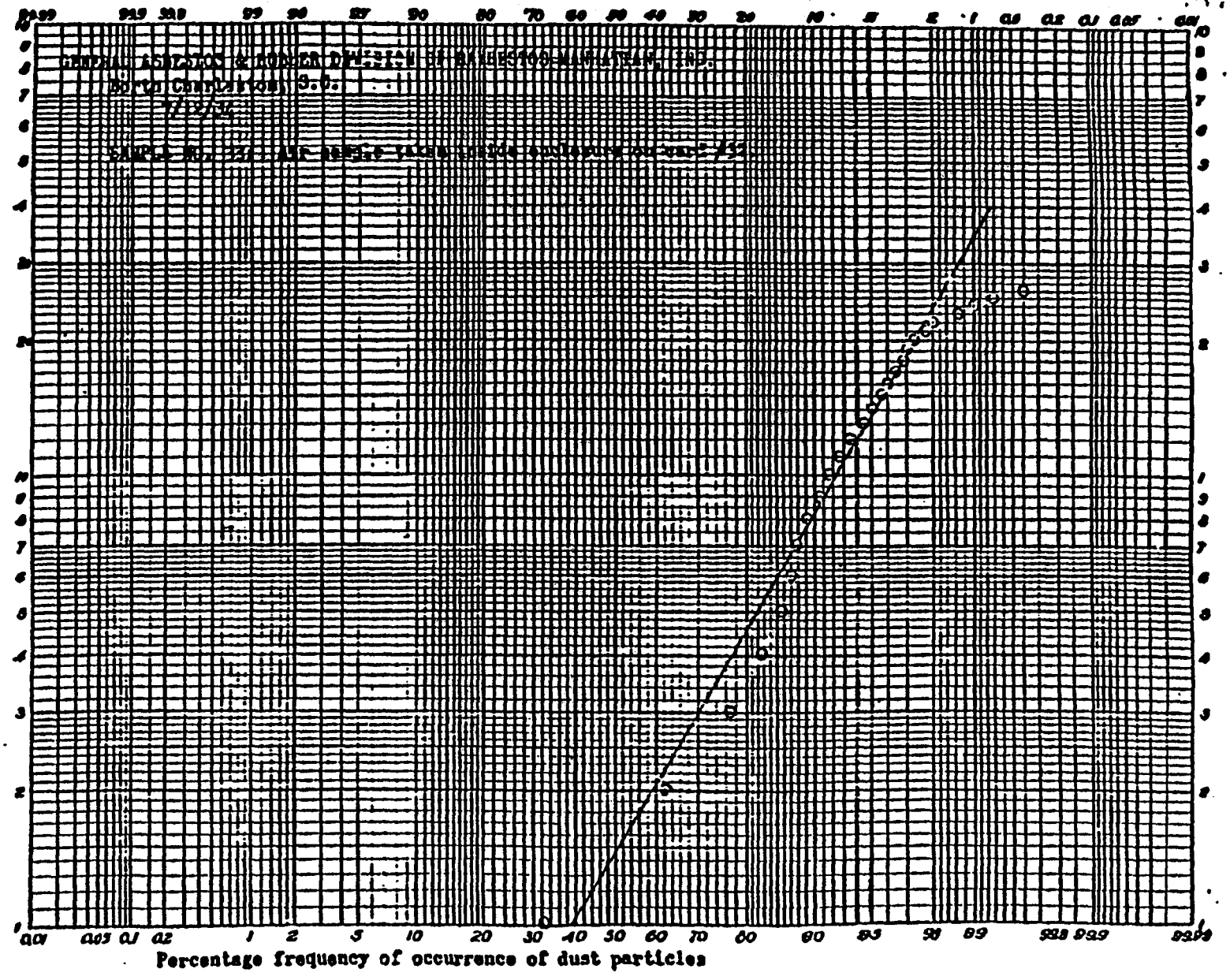
NO. 3126. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER. CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS

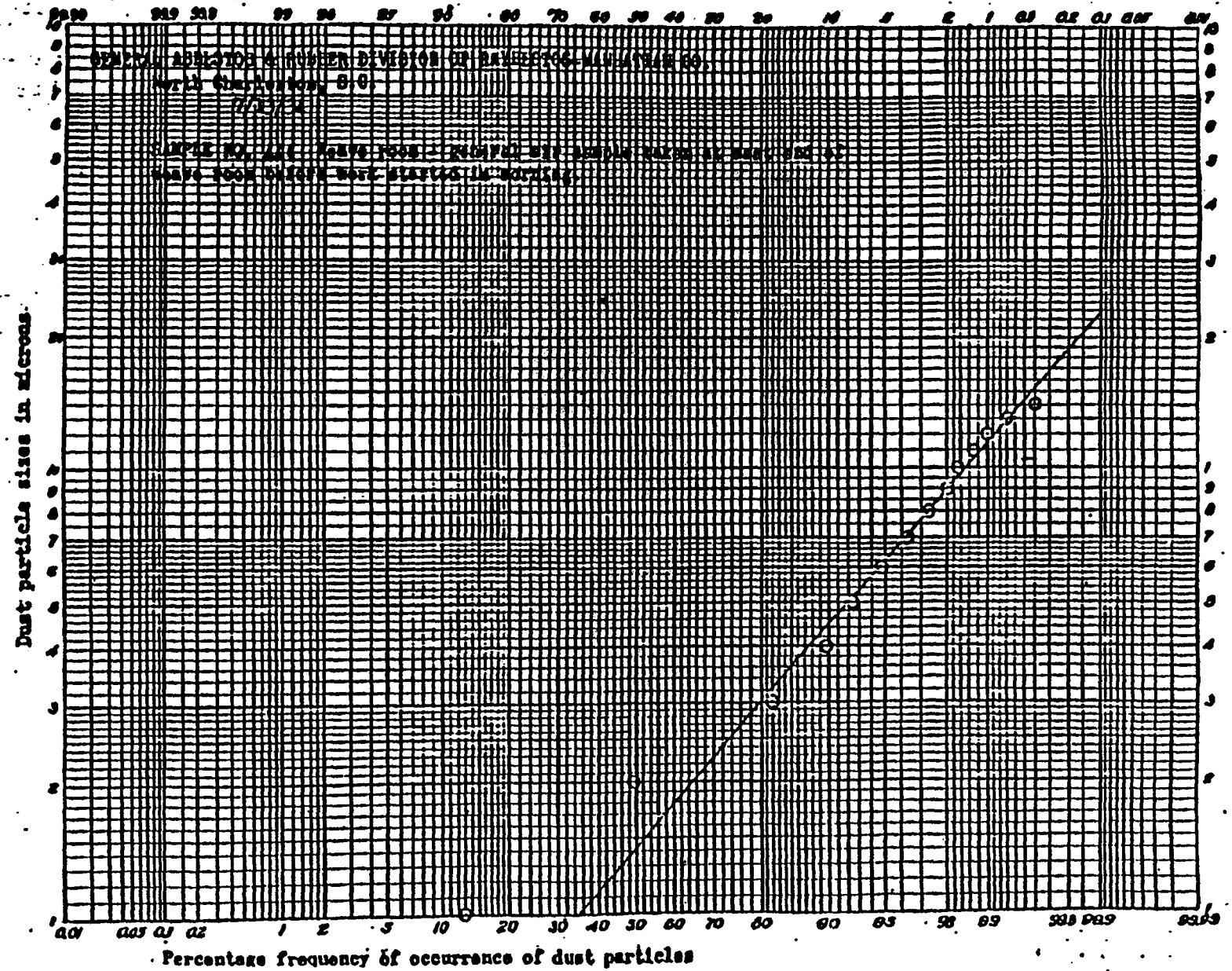



GENERAL ASBESTOS & RUBBER DIVISION OF ELIZABETHTOWN, INC.
North Charleston, S.C.
7/13/39
Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

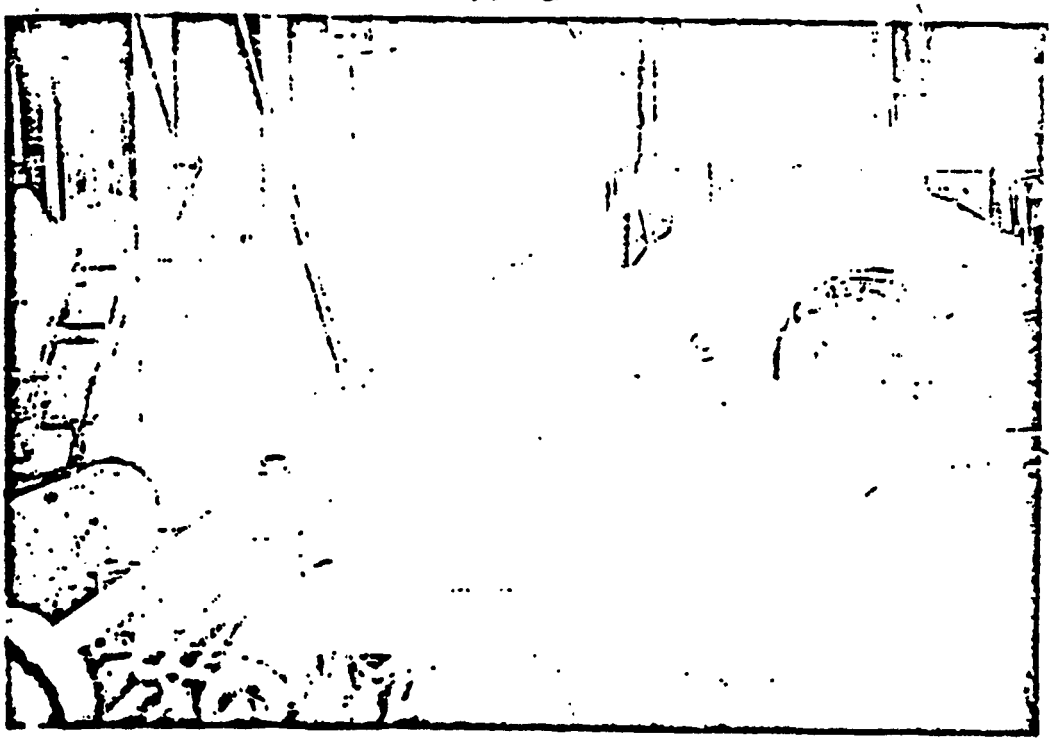





Dust particle sizes in microns
Percentage frequency of occurrence of dust particles


Dust particle sizes in microns
Percentage frequency of occurrence of dust particles

12-B

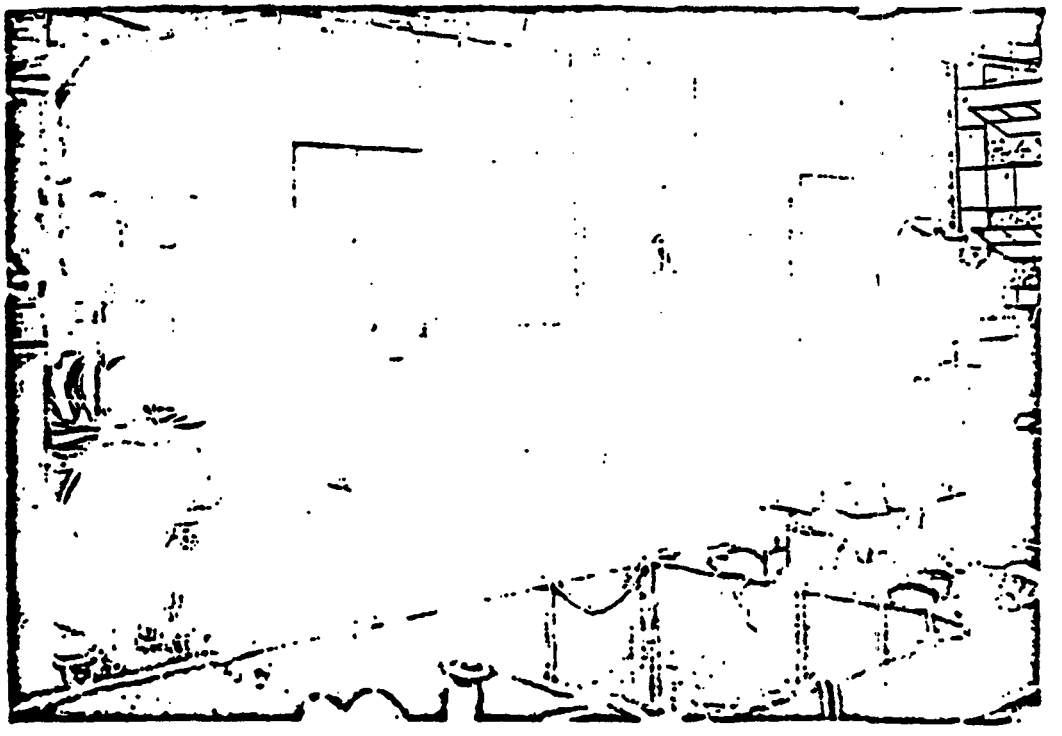


12-B

Card Room.

General Asbestos & Rubber Division
Raybestos-Manhattan, Inc.
Charleston, S.C.

14-B

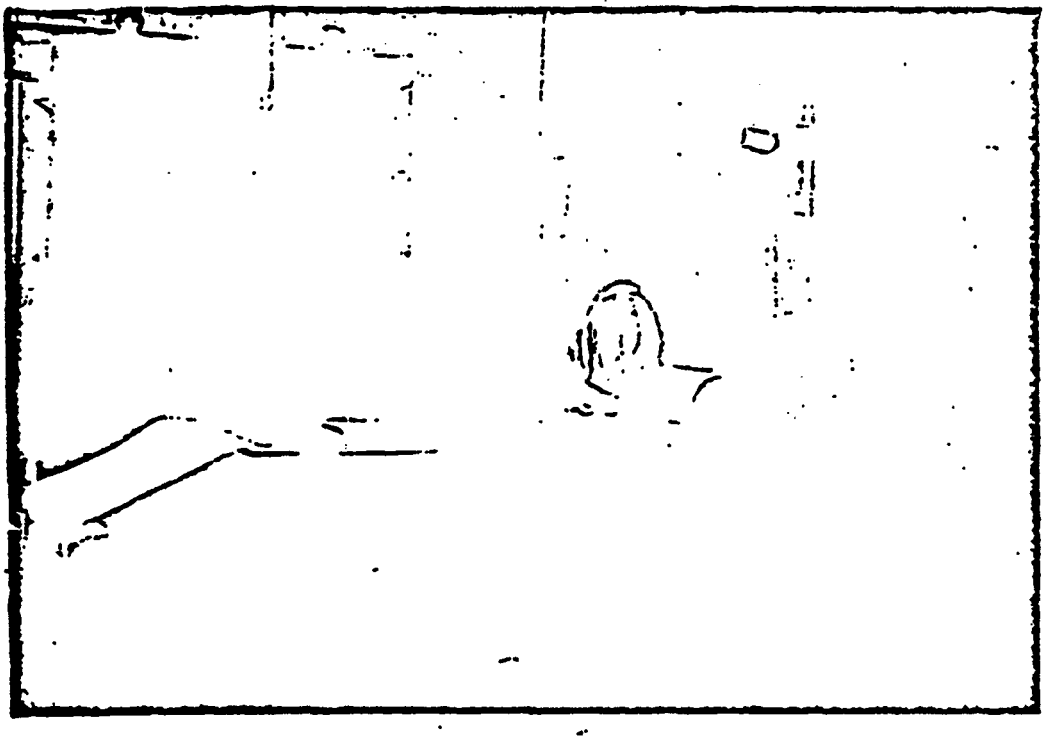


SAMPLES NO. 31, 32, 33, 34, 35 and 36

Enclosure built around table inspection of woven cloth in weave room

General Asbestos & Rubber Division
Raybestos-Manhattan, Inc.
Charleston, S.C.

19-B



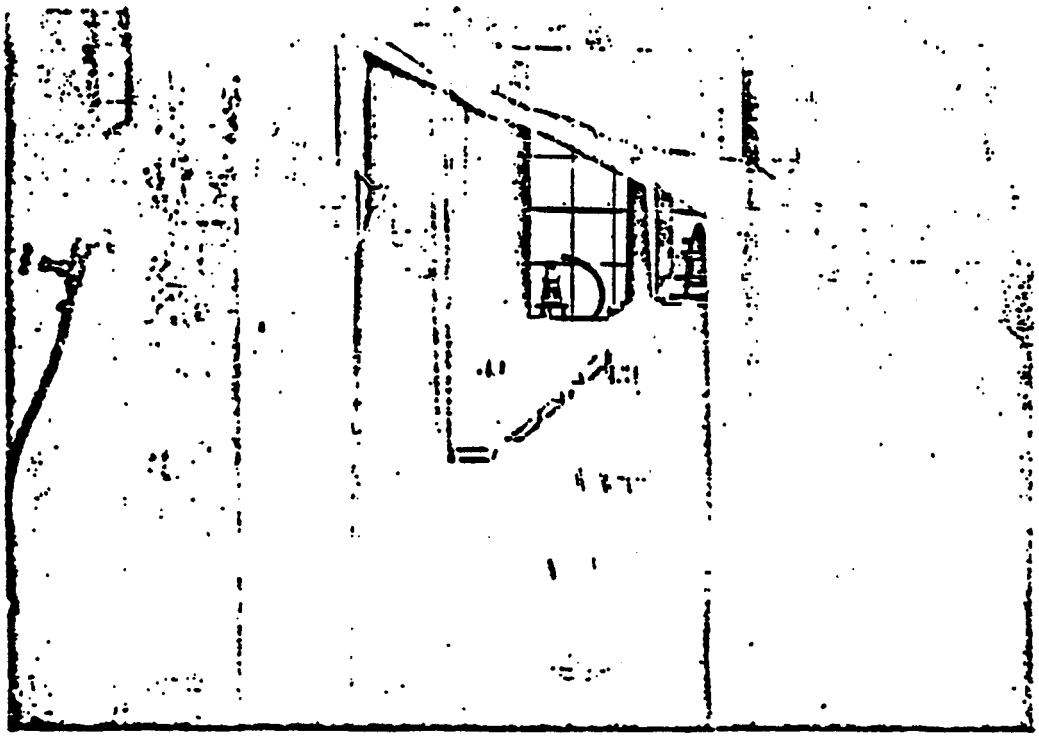
SAMPLES NO. 25, 47, 50 and 53

At inspection table – woven cloth

General Asbestos & Rubber Division
Raybestos-Manhattan, Inc.
Charleston, S.C.

15-B

15-B



SAMPLE NO. 38

One card inside muslin enclosure

General Asbestos & Rubber Division
Raybestos-Manhattan, Inc.
Charleston, S.C.