PLAINTIFF'S EXHIBIT

MET-225

Box 11

PML-336

4/19/79

THE MANHATTAN RUBBER MFG. DIVISION

OF

RAYBESTOS-MANHATTAN, INC.

Passaic, N.J.

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A study of the health hazards, if any, incident to the inhalation of dust and fumes at the plant of the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc. at Passaic, N.J. was made between September 24, 1934 and November 1, 1934 by the Industrial Health Section of the Metropolitan Life Insurance Company.

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Exhibit A

PLANT CONSTRUCTION

This plant consists of a number of buildings constructed of brick, concrete and steel. The ground floors are of concrete and the remaining floors are of wood.

Natural illumination is furnished by clear glass windows. Artificial illumination is furnished by incandescent electric lights equipped with reflectors.

PLANT PROCESSES

Products manufactured in this plant involving the use of asbestos are: brake lining, brake blocks, and clutch facings.

Three types of brake lining are made. These are lining made from woven asbestos cloth, dry process lining, and wet process lining.

The asbestos cloth is made outside of this plant. The cloth is treated with rubber, cut into strips and folded to the size desired. The folding is done in Department 36 on machine #1513. This lining is cut to length in Department 8 on machine #1382. The dry process lining is made from a mixture of asbestos, rubber, resin, litharge and cotton. The mixture is made up in Department 53T in a rotary mixer. Canadian asbestos is used. The asbestos as received is put through a hammermill and then through a picker and over a shaker screen. The other materials are kept in containers. After the mixture is completed, it is taken to Department 53. The mixture is weighed and pressed into sheets in a heated press. Several of these sheets are heated in a press for a given time. The sheets are then cut into strips to the desired width on a mill planer. The strips are ground to the desired thickness in Gardner

surface grinders. They are then cut to length and formed to a given radius in a heated press. Holes are drilled in the lining on a gang drill machine. The ends are chamfered on abrasive wheels. The lining is inspected and packed for shipment.

The wet process lining is made from a mixture of asbestos, rubber, litharge and waste material from the finished product of Department 53. This mixture is made up in Department 53T. The different materials are kept in containers in stalls. A movable scale is equipped with an exhaust system so arranged that two stalls and the scale are exhausted at the same time. When the materials from the two stalls are weighed, the scale is moved to the next two stalls. The workman weighing out these materials is very careless in the handling of the lead used. He uses a hand scoop and manages to get the lead on his hands and clothes and on the floor. He wears a Willson silica respirator.

Gasoline is used as a solvent for the rubber. The mixing is accomplished in a mixer with rotating paddles. The material is then taken to Department 53 where it is formed into strips by means of an hydraulic press and a mold. The strips are dried in heated presses, ground to size in the Gardner Grinders and cut to length with an abrasive wheel. The lining is then formed on heated mandrels to the desired radius. Holes are drilled and the corners are chamfered. The lining is inspected and packed for shipment.

The brake blocks are made from a mixture of asbestos, rubber, resin, lead, etc. This mixture is made in Department 53T. The blocks are formed in heated molds and in a steam press in Department 32. The blocks are then turned to size on a lathe and cut to width on a band saw. They are finally put into

a sandblast cabinet and the surfaces are blasted. Holes are drilled and the finished block is inspected before shipment.

Dry process clutch facings are made from a mixture of asbestos, rubber, lead, resin, sulphur, carbon black and waste from Department 39. These materials are mixed in Department 53T in a rotary mixer and the mixture is carted to Department 39. The material is weighed and the clutch facings are formed in heated molds and presses. The facings are then ground to the desired thickness, holes are punched, and the facings are inspected before shipment.

One cloth type clutch facing is made from woven asbestos cloth treated with rubber. The cloth is folded and circled on a coning machine. The folded cloth is cut and the ends are fastened together. The facing is then put into heated molds and pressed in a steam press. After coming from the molds, the facing is ground to the thickness desired and holes are punched.

The other type of cloth clutch facing is made by punching the rubber treated cloth to size and then putting several thicknesses into the molds. The separate pieces are molded together and then they follow the same processes as the other facings.

The base stock of the rubber used throughout the different departments is compounded in Department 1. The raw rubber is received in wooden boxes and stored on the third floor of the building. As the rubber is needed, the boxes are opened and the mass of rubber from each box is placed in a power cutter that cuts the rubber mass into six pieces. These pieces are carried on a conveyor to the second floor where they are weighed into mixes for different base stocks along with different compounding materials.

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In some of the products the rubber must be free from any foreign matter. The raw rubber is put through mills and then put through a machine to take out foreign matter.

The compounding materials such as litharge, zinc oxide, sulphur, rosin, clay, and oils are kept in a row of hoppers and tanks that discharge on the first floor. A traveling scale is mounted on a small track that runs under the length of the row of hoppers. The batches of compound are weighed into open containers as desired for the different bases.

The hoppers are filled from the second floor. Some of the materials are sifted through a shaker screen before entering the hoppers. The litharge (D-70) is received in metal drums. It is dumped from the drums through a grating into a bin. This dumping is done in a small corrugated iron shed located on the north side of the storage building and receiving department. An open belt conveyor carries the litharge to the second floor of Department 1 where it enters the hopper. A cloth screened box is used to allow the air to escape from the hoppers and keep the litharge dust from the atmosphere. One man does the dumping and wears a Willson Dustite respirator.

Two Banbury mixers and six compounding mills are used to make up the various base stocks. As the rubber comes from the compounding mills, it is placed on a conveyor and carried to the center of the building where two colored men remove it, dust it with soapstone and stack it onto skids. Each base is tagged and finally stacked into open racks until needed or taken directly to the department where it is to be used.

Molded rubber products are made in Department 4. The base stock is reworked in rubber mills. It is cut into strips and put in tube machines that produce solid strips. These strips are cut into pieces and placed in metal molds. The molds are heated and pressed for a certain time, setting the rubber to the shape of the molds. The molds are stripped and the finished rubber is trimmed and inspected before packing for shipment.

Rubber bonded abrasive wheels are produced in Department 2. The base stock rubber is melted and mixed with asbestos, litharge, carbon, sulphur and abrasive materials in an open container. A colored man does the weighing and mixing. He does not wear a respirator while handling the dry materials. The mixture is molded to the desired sizes in molding machines. The molded wheels are then put into ovens where the solvents are driven off and the wheels set. The wheels are trued on lathes and grinders. These machines are exhausted. The smaller wheels have Babbitt centers. These centers are poured from a hand ladle. The Babbitt is melted in a pot under an exhausted hood.

Large rubber sheets used for flooring and floor protection are made up in Department 26. The base stock is rolled to the desired thickness and put into large heated presses where the rubber is cured or set. Mats of various designs and colors are made by cutting out sections and inserting or inlaying sections of different shapes and colors.

Rubber tubing is made in Departments 5, 51, 6, 61, and 7A. Tubing is produced for various purposes and of various sizes. The base stock is usually reworked in each department before entering the tube machines where the tube is produced. The tubes are cured on metal rods to give the desired inside diameters. The tubing is dusted with soapstone, wheat flour or rice

flour as it comes from the tube machines to keep it from sticking to adjacent tubing.

In some cases the tubing passes through braiders where a fabric covering is braided around it. Departments 7A and 6 do this type of work. Some types of tubing have various layers of fabric. This is accomplished by wrapping the tubing with cloth impregnated with rubber and allowing the rubber to set at the same time. The rubber of the cloth and tubing join together and the result is a solid tube with layers of fabric. This type of tubing is much stronger than plain rubber tubing.

The V type belts are made of a solid rubber core with a fabric covering. This fabric covering is applied to the core and cured in heated molds to assure the shape and size desired.

Flat belts are made of cloth impregnated with rubber. The cloth is folded mechanically and cured on heated mandrels, the edges being sealed together by a strip of rubber applied after the folding process. In the case of long belts the curing is accomplished in heated presses.

In Department 54 metal pipes, pipe joints and tanks are lined with rubber. The rubber is applied over a coating of rubber cement in thin layers to the desired thickness. This is uncured rubber and is applied with hand rollers. After the rubber is in place, it is cured in heated tanks making a solid rubber lining out of the several layers applied.

In Department 5 rubber tubing of various sizes is cut to length and placed on mandrels in lathe grinders. The outside diameter is ground to the size required. Other products are ground to size in this department also.

Wool scouring rings and Minturn Vacuum dryer strips were ground at the time of the survey.

Grinding of rubber rolls of large dimensions, such as paper mill rolls, is done in department 28. The majority of these grinding machines have exhaust systems.

PERSONAL FACILITIES

Drinking water is supplied throughout the plant by bubbler fountains of the electrically cooled type. Wash rooms and toilets are adequate and are kept clean.

PLANT HOUSEKEEPING

Housekeeping is good in most departments. At the time of this survey portable vacuum cleaners were used in cleaning the rafters before painting.

METHODS OF SAMPLING AND ANALYSIS

Atmospheric dust and fume samples were taken with the impinger(1 & 2) at the breathing zone of the workmen at representative operations. This instrument, 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. 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 silica particles and also to prevent the formation of aggre-

(1)Comparative Tests of Instruments for Determining Atmospheric Dusts, Public Health Bulletin #144, U.S. Public Health Service, Treas. Dept. Wash. D.C.Jan. 1925.
(2)The Impinger Sampling Apparatus as Used by the U.S. Public Health Service, Public Health Reports, March 18, 1932, Vol. 47, U.S.P.H.S., Treasury Dept. Wash. D.C.

gates 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 technique developed and used by the United States Public Health Service. 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 87 to 95.1% of the particles are less than 10 microns in greatest diameter.

The following table gives the results of analyses of air samples taken at representative points.

Station	Date of Sampling	Cu. Ft. Air Sampled	Millions of Dust Particles per cu. ft. air sampled	Millions of Dust Particles less than 10 microns in greatest diameter per cu. ft. air sampled	Milligrams of Lead per cu. ft. air sampled	Milligrams of Lead per cu. meter of air sampled	Lead Intake in Milligrams in 10-hour day on basis of workman breathing 10 cubic meters of air daily	Type of Dust	Remarks
Dept. 11: one man, Gardner surface grinder, machine #2047	9/24/34	37.0	1.4	1.3	0.0008	0.03	0.3	Asbestos Lead	Dry process brake linings exhaust system
Mill planer - cutting brake lining out of pressed sheet	"	36.4	1.4	1.3	0.0008	0.03	0.3	"	Exhaust system; one man
Grinding dry process lining to width, side grinder, machine #1704	"	33.9	1.5	1.4	0.0016	0.04	0.4	"	Exhaust system; door open at time of sampling; one man
Conveying at bending mill; wet process lining after taken from heated mandrill	"	2.5	14.0	14.4	0.0056	0.20	2.0	"	2 men
General air; inspecting brake lining	"	38.4	1.8	1.6	0.0021	0.07	0.7	"	9 men
Chamfering ends of brake lining with abrasive wheel	9/23/34	36.2	1.7	1.5	0.0005	0.02	0.2	"	1 man; exhaust system; machine #2
Cutting out process lining to length with abrasive wheel	"	39.0	1.8	1.6	0.0020	0.07	0.7	"	1 man; exhaust system
At Gardner surface grinder #2 machine #1510, dry process brake lining	"	33.0	2.9	2.6	0.0026	0.09	0.9	"	1 man; exhaust system
Grinding inside surface of dry process lining	"	39.3	2.0	2.3	0.0009	0.03	0.3	"	Horizontal wheel; one man; exhaust system
At surface grinder #1646 continuous process; wet process lining	9/27/34	39.5	1.9	1.7	0.00098	0.035	0.35	"	At discharge end; exhaust system
Gardner grinder #127 wet process lining on reels, grinding edges	"	38.0	2.7	2.4	0.0019	0.07	0.7	"	Lining goes through this grinder before going into grinder #1646; exhaust system
Cutting and pressing dry process lining	9/28/34	34.6	1.7	1.5	0.0033	0.12	1.2	"	One man; exhaust hoods
Dept. 21 General air; trimming and inspection of molded rubber products	9/25/34	38.0	1.6	1.4	0.0009	0.03	0.3	Rubber Lead	
General air; steam press room	"	33.0	1.8	1.6				Rubber	Molding rubber products
Forming and rolling compounded rubber	"	33.2	2.4	2.7				Rubber	Two men
Dept. 11: General air; typewriter platoon	9/26/34	44.9	1.8	1.6	0.0019	0.07	0.7	Rubber	
Dept. 21: Forming rubber tubing from tubing machine	"	38.5	2.8	2.6				Soapstone	Two men
At rubber compounding mill	9/27/34	39.1	2.9	2.6	0.0008	0.03	0.3	Sulphur, cork, whiting, wheat flour, hydrocarbons, iron oxide, Lead (at times)	
Dept. 22: At sandblast cabinet blasting molds for clutch facing	9/26/34	27.2	1.8	1.4				Sand	One man works from outside cabinet
Grinding clutch facings, Badger grinder	"	29.4	1.9	1.7				Asbestos	Two men; exhaust system

Machine	Date of Sampling	Cu. Ft. Air Sampled	Millions of Dust Particles per cu. ft. air sampled	Millions of Dust Particles less than 10 microns in greatest diameter per cu. ft. air sampled	Milligrams of Lead per cu. ft. air sampled	Milligrams of Lead per cu. meter of air sampled	Lead Intake in Milligrams in 10-hour day on basis of workmen breathing 10 cubic meters of air daily	Type of Dust	[illegible]
Grinding clutch facings Blanchard machine #1836	9/26/36	36.2	4.96	4.4				Asbestos rubber	One man; exhaust system
Punching clutch facing stock out of asbestos cloth treated with rubber	"	38.2	1.4	1.4				"	One man
At V & O Powerpress punching holes in clutch facing stock, tool #1488	"	38.3	2.9	2.2					
General air; inspection of clutch facing	"	38.9	4.9	4.4					Five men
Stripping and filling molds for clutch facing	"	36.9	2.3	2.0					Two men
Grinding clutch facing on Gardner grinder #1720	"	34.2	3.9	3.1					One man; exhaust system
At operator's position on sewing machine; cloth folded and circled	9/27/36	37.5	0.58	0.49					
Dept. 7 and 13: General air	9/28/36	30.9	1.4	1.3	0.0004	0.01	0.1		
Dept. 2: batch weighing and mixing for abrasive wheels, mill 8	9/27/36	30.3	11.3	10.6	0.0389	2.37	13.7	Carbon, sulphur, resin, litharge, asbestos rubber — one man, colored	
At Babbitt pot; Babbitt used for centers of abrasive wheels	"	37.0	—	—	0.0008	0.03	0.3	Lead	One man; exhaust hoods no goggles
Grinding bores on abrasive wheels, machine #1558	"	32.0	8.1	7.8	0.0046	0.16	1.6	Carbon, sulphur, lead, resin asbestos — one man; exhaust system	
Truing outer diameter of abrasive wheels, lathe #775	"	31.7	4.0	3.8	0.0071	0.26	2.6	" " " "	
Truing and smoothing sides of abrasive wheels, lathe #724	"	30.1	3.7	3.0	0.0017	0.06	0.6	" " " "	
Truing abrasive wheels machine #1353	"	30.9	5.2	4.9	0.0009	0.03	0.3	" " " "	
Batch mixing for abrasive wheels	9/28/36	44.6	30.0	28.8	0.1009	3.56	35.6	Carbon, sulphur, lead, resin asbestos; two batches mixed; 17 lbs. lead used — colored man	
Abrasive wheel molding machine #1779	"	49.9	2.9	2.2	0.000			Carbon, sulphur, lead, resin asbestos — size wheel 16 x 2 x 4 — one man	
Truing abrasive wheels machine #1544	"	26.0	7.0	6.4	0.0049	0.17	1.7	Carbon, sulphur, lead, resin asbestos — exhaust system — one man	
General air; cut-off wheel room; air conditioned	"	42.1	1.4	1.3				Resin — exhaust hoods over mixing barrels	
General air; mixing material for abrasive wheels and molding wheels	"	31.4	2.9	2.4	0.0003	0.01	0.1	Carbon, sulphur, lead, asbestos, resin	
Dept. 53X: Dry mixture taken from mixer on chute and put into box cart	"	31.9	3.9	3.1	0.0036	0.13	1.3	Rubber, lead, resin, asbestos, sulphur — exhaust hood over cart and opening in mixer; one man, Willson silica respirator	
Weighing up rubber for wet process mix	"	14.6	4.1	3.8				Soapstone — one man working under exhaust hood.	
Weighing up material for wet process mix	"	43.2	11.5	10.6	0.0013	0.05	0.5	Lead, sulphur, asbestos, ash — movable scale enclosed and exhausted; one man — Willson respirator	
In mixing room during making up of mix for clutch facings; dry process	"	69.5	2.8	2.4	0.0112	0.40	4.0	Rubber, waste from Dept. 39; lead, carbon, resin, sulphur — two men, Willson respirators	
In small room at hammer-mill	10/22/36	35.7	5.9	4.9				Asbestos — one man, exhaust hood, Willson respirator — asbestos on floor	
			--	3.2				Asbestos — man empties bags of asbestos into hopp[er]	

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Between two bagging operations	10/22/34	29.4	3.3	3.1				Asbestos	Enclosed and exhausted; cloth curtains on fronts
Dept. E: General air; east end	"	32.8	2.6	2.4	0.0018	0.065	0.65	Lead rubber	Near boiling winder
Cutting brake lining to length, power shear #1382	"	30.9	5.2	5.0				Asbestos rubber	2 men, asbestos woven cloth treated with rubber
General air; second floor	10/23/34	24.4	1.3	1.2	0.0034	0.12	1.2	Lead	
Dept. E-A: General air; belt press room	10/22/34	29.4	2.0	1.9	0.0014	0.05	0.5	Lead asbestos rubber	
Grinding, reeling and measuring brake lining	"	26.4	1.2	1.1				Asbestos rubber	Machine #1689 and 1690
Dept. 2E: General air; taken at press #16	"	41.0	6.8	6.5	0.0014	0.05	0.5	Lead rubber	
General air; taken at gum cutting table; west end	"	29.0	2.8	2.6	0.0025	0.19	1.9	Lead rubber	
General air; near Cammachine #1073	"	33.9	2.4	2.2				Soapstone	
Dept. 1; General air; rubber mills, east end	"	25.1	3.5	3.2	0.0038	0.11	1.1	Pale rubber	Cleaning process for raw rubber, nothing added, machine #1343 and 1344
At rubber compounding mill #130	10/23/34	34.0	1.5	1.4	0.0004	0.01	0.1	Lead, sulphur whiting, rubber	- one man
At rubber compounding mill #1242	"	30.9	1.6	1.5	0.0078	0.28	2.8	"	"
On platform of Banbury mixer #1	"	43.9	2.2	2.0	0.0168	0.66	6.6	Lead, whiting sulphur, soapstone, rubber	One man, intermittently, mix charged by hand
On platform of Banbury mixer #2	"	41.9	2.1	1.9	0.0274	0.97	9.7	"	Mix charged from 2nd floor
Between compounding mills #139 and #138	"	34.6	3.1	2.9	0.0064	0.23	2.3	"	One man at each mill
Mixing batches of compound from hoppers	"	35.0	11.1	10.3	0.2310	8.16	81.6	"	Traveling scale on truck under hoppers; one man
General air in compound mixing room	"	29.1	3.8	3.3	0.0085	0.02	0.2	"	Three men
Discharge of rubber conveyors from compounding mills	"	27.3	4.4	4.0	0.0021	0.01	0.1	Soapstone Lead	Two men dusting with soapstone and putting on skids
General air; 2nd floor weighing stock for Banbury mixer	"	33.3	1.7	1.6	0.0017	0.06	0.6	"	Dry sweeping
Cutting raw rubber, power press, 3rd floor, machine #2084	10/24/34	30.0	1.1	0.96				Rubber	One man
Dumping B-70 into hopper through grating; taken under respirator	11/1/34	12.6	- -	49	0.0194	0.69	6.9	Lead	Outside storage building in corrugated iron room; Willcox Bentite respirator
2nd floor at discharge end of conveyor; taken while bringing B-70 to hopper	"	30.9	- -	—	0.0519	1.83	18.3	"	At same time as #1688, cloth bag to collect dust and let air out of hopper
Dept. 11 In rubber mill #71	10/23/34	34.6	1.8	1.7	0.0005	0.02	0.2	Lead rubber	

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56	At rubber mill #74 and friction calender	10/23/34	33.8	1.5	1.4	0.0008	0.03	0.3	Lead rubber	Three men
72	Crushing resin machines #1668 and #1683	10/24/34	21.0	3.2	3.0				Resin	One man
59	Dept. 36: Folding brake lining machine #1513	10/23/34	39.9	0.70	0.65	0.0005	0.02	0.2	Asbestos rubber lead	Two men
71	Dept. 25: 4th floor, one man grinding rubber belts where vulcanized	10/24/34	26.4	2.1	2.0	0.0011	0.04	0.4	Rubber lead	Machine #L-786
73	General air, Dept. 55, 25 and 26; 4th floor	"	20.5	1.7	1.6				Rubber soapstone	
74	Dept. 54: General air; 8 men coating pipe joints with rubber	"	30.4	4.8	4.6	0.0019	0.07	0.7	Lead	High test gasoline
75	Dept. 28: General air, rubber rolls	"	27.6	1.9	1.8				Rubber	Fifteen men, west end
76	Grinding rubber roll machine #2048	"	42.0	5.4	5.0	0.0063	0.22	2.2	Rubber soapstone	Exhaust system; one man
77	Sanding pail rolls, machine #1038	"	45.3	1.9	1.8	0.000			Rubber	One man
78	Dept. 3: General air; west end, main bay	"	27.3	9.2	8.4				Soapstone	
79	General air; east end, main bay	"	27.3	1.5	1.4				"	
80	Grinding rubber tubing on mandrils, lathe #1240	10/25/34	36.8	0.5	0.5	0.0004	0.01	0.1	Rubber lead	Balcony floor, exhaust system
81	Grinding rubber tubing machine #1311	"	21.9	3.1	2.9	0.0013	0.05	0.5	"	Balcony floor, exhaust system
82	Grinding, Sixteen Vacuum Drier strips, machine #214	"	19.2	10.2	9.5	0.0030	0.11	1.1	"	Balcony floor, exhaust system
84	Sanding wool covering rings on belt sander	"	20.5	9.3	8.6	0.0683	2.42	24.2	"	Exhaust system
83	General air; balcony floor	"	30.4	0.95	0.87	0.0017	0.06	0.6	"	
87	Fanning and reeling rubber from tubing machines; general air, 3 machines	"	26.4	16.7	15.8				Soapstone wheat flour	Test oven
85	Dept. 13B: General air; testing fire hose	"	20.2	1.6	1.5				Rubber cotton	
86	Dept. 13A: Between 2 circular looms weaving fire hose covering	"	30.9	0.97	0.92				Cotton	Machines #310 and 311
88	Dept. 6: At tube machines, between two machines	"	31.0	43.1	42.4	0.0047	0.17	1.7	Rice flour soapstone	Two men at each machine
89	Inserting rods in rubber tubing, 2 rolls force rod through tubes	"	33.9	6.4	6.2				"	Exhaust system
90	Braiding covering for rubber tubing	"	32.6	0.86	0.82				Cotton	Three braiders, two running
91	Dept. 21: General air; compounding rubber for gasoline and oil hose	10/29/34	29.5	0.82	0.81	0.0010	0.04	0.4	Sulphur lead	Exhaust system; C.S.F. - by-products of town gas
92	Dept. 32: ... covering flat	"	29.1	2.2	2.1				Rubber cotton	

3

Sample No.	Station	Date of Sampling	Cu. Ft. Air Sampled	Millions of Dust Particles per cu. ft. air sampled	Millions of Dust Particles less than 10 microns in greatest diameter per cu. ft. air sampled	Milligrams of Lead per cu. ft. air sampled	Milligrams of Lead per cu. meter of air sampled	Lead Intake in Milligrams in 10-hour day on basis of workman breathing 10 cubic meters of air daily	Type of Dust	Remarks
99	General air; curing and heater end	10/30/34	31.5	2.8	1.9				Rubber cotton	Curing rubberized fabric covering V belts; six men
100	General air; applying rubberized fabric covering to V belts and flat belts	"	27.3	0.81	0.77				"	Twelve women; ten men
93	Dept. 32: General air, forming and cutting brake blocks	10/29/34	32.4	2.7	2.4	0.0024	0.08	0.8	Asbestos rubber lead oxide	Mixture made in Dept. 33?; dry process
94	At sandblasting cabinet; operator works from outside cabinet; looks through glass	"	34.0	3.9	3.6				Sand	Exhaust system; one man
95	Dept. 1D General air; mills not running	"	30.5	5.0	4.8				Soapstone	Moving stock from mills to racks and scooping
101	At rubber mill #1409 salvage dept. for defective rubber	10/30/34	33.4	3.3	3.0	0.0009	0.03	0.3	Soapstone lead	Exhaust hood over mill; nothing added to rubber.
96	Dept. 7-A: General air; 6 braiders 2 layers of fabric braided auto tubing	10/29/34	33.6	6.5	5.9				Cotton	Two men; hydraulic brake hose and air brake hose
97	At rubber mill #86 nothing added to rubber	"	30.5	2.9	2.7	0.0029	0.07	0.7	Soapstone lead	Rubber for covering braided fabric on tubing; one man
98	Dept. 31: General air; wood shop	10/30/34	35.0	3.9	3.2				Wood	
47	2nd floor over hoppers shaker screen	10/23/34	49.0	2.5	2.3	Milligrams Zinc 0.002	Milligrams Zinc 0.07	Milligrams Zinc 0.7	Zinc oxide	Sifting zinc oxide

Lead is present in most of the processes in combination with a number of other substances, but with the exception of lead, these substances are not in large enough quantities to be hazardous. Asbestosis will be discussed in general report.

TOXICITY OF LEAD

Lead poisoning is the commonest of the industrial intoxications. The toxicity of lead depends upon a number of factors such as: the form of lead taken into the body - vapor, dust or solid; the solubility of the lead compound in human tissues; the mode of entry of lead into the body - inhalation, ingestion or skin absorption; the extent of exposure; individual susceptibility which is heightened by numerous conditions particularly by previous attacks of poisoning.

Among the most readily toxic of the inorganic lead compounds are the oxides, the carbonate, the sulphate and the chromate.

Lead is a cumulative poison and, with a few exceptions, industrial lead poisoning is usually a chronic condition caused by the inhalation or ingestion of small amounts of soluble lead over long periods of time. This process of poisoning may go on slowly for a long period without manifesting any of the characteristic acute symptoms. Lead inhaled, however, is far more rapidly and surely toxic than lead ingested, since it reaches the blood stream more directly and comparatively little is eliminated unabsorbed.

There is little agreement in the estimates made by various authorities on the minimum amount of lead which can cause poisoning if taken into the body. For practical guidance, however, it can be assumed that from 1 to 2 milligrams taken in daily over a period of months or years may cause poisoning. A number of factors also enter into the estimation of the amount of air breathed by a man at active work during the working day. Ten cubic meters of air in a

ten hour day is an estimate which very probably errs on the safe side for the average workman. On the basis of these calculations, the lead content of the air of workrooms where men are continuously exposed should be kept as low as 0.1 of a milligram per cubic meter of air or else strict measures for protection should be installed to prevent poisoning.

The symptoms of chronic lead poisoning are many and may manifest themselves through the gastro-intestinal tract as in the familiar "lead colic" or the neuro-muscular system or both. Among the symptoms most commonly noted are colic, metallic taste in the mouth, obstinate constipation and loss of appetite, muscular weakness, particularly of the hands and wrists, neuritis and joint pains, loss of weight, headache, dizziness, nausea or vomiting, gastric distress or fatigue are among the minor symptoms that may or may not be present.

The principal diagnostic signs for the detection of lead poisoning in its early stages or of lead absorption, which is essentially pre-clinical poisoning before the onset of symptoms, are ashen pallor of the skin, tremor, lead line on the gums, stippling or basophilic degeneration of the red blood cells, hematoporphyrin in the urine and mild secondary anemia. Other abnormalities in the blood which are characteristic of lead poisoning are polychromatophilia, changed relative proportions of lymphocytes and polymorphonuclear leukocytes, increased mononuclear cells and increased reticulocytes.

Repeated physical examinations should be made of workers exposed to lead at fairly short intervals of from two to six months, depending upon the severity of exposure. It is important to prevent the occurrence of lead poisoning, since, even though it is not often fatal under modern conditions, it frequently results in premature development of chronic degenerative conditions in

the circulatory system.

The physiochemistry of lead poisoning and the treatment to be pursued have been the subject of intensive experimentation and study by Aub[3] and his associates at the Harvard School of Public Health and by Kehoe[4] and his colleagues of the University of Cincinnati.

(3)Lead Poisoning; J. C. Aub, et al; Williams and Wilkins, Baltimore, Md. 1926, pp. 265.
(4)On the Normal Absorption and Excretion of Lead, I-IV, R. A. Kehoe, F. Thamann, J. Cholak, Journal of Industrial Hygiene, Sept. 1933.

CONCLUSIONS AND RECOMMENDATIONS

The dust counts are low with the exception of sample #4 in Department 53. This concaving and bending unit is not exhausted. Although this operation is intermittent, precautions should be taken to eliminate any hazard by adequately entrapping and exhausting the arising dust.

Samples #26 and #34 in Department 2 and sample #61 in Department 1: these operations should be done under exhausted hoods to prevent the dispersion of dust throughout the rooms. The operator at these and all other batch mixing operations should be taught and compelled to handle the materials carefully to prevent the spilling of the materials on their clothing and on the floors.

Samples #87 in Department 5 and sample #88 in Department 6: careful handling of the soapstone and flours used and proper application of exhaust hoods over the pans and at the discharge ends of the tube machines would greatly reduce the dust concentration created at these points.

It will also be noticed that where there is an increase in dust counts and where lead compounds are present, as in samples #4, #26, #34, #61 and #88, there is a considerable increase in the concentration of lead compound in the air. The elimination of dust at these points would also tend to eliminate the lead compound concentration.

In addition to the samples listed in the preceding paragraph, the following were found to contain excessive amounts of lead: sample #41, Department 53; samples #30, #31 and #36, Department 2; samples #39 and #43, Department 53T; sample #76, Department 28; samples #82 and #84, Department 5. Although these operations are exhausted, they show an excess of lead concentration which may be due to the fact that the hoods are not properly placed or the suction is

not adequate to remove the arising dust.

Sample #50, Department 26: If possible, exhaust should be applied to gum cutting operations to eliminate the lead concentration.

Samples #53, 57, 58, 59, 60 in Department 1: The Banbury mixers and rubber compounding mills where lead compounds are used should be exhausted to eliminate the lead compound dust generated. The pollution of the air at the east end of the department where the raw rubber is cleaned is probably due to the Banbury mixers and compounding mills located near this section. The operators should be warned to handle the lead carefully.

Sample #102, Department 1: This sample was taken under the respirator of the workman while he was dumping drums of litharge through a grate onto a belt conveyor which conveys the litharge to the hoppers. A mechanical means should be installed, if possible, for the dumping of litharge at this place or the workman should be supplied with a positive pressure respirator and an exhaust hood applied properly. It was noted that clouds of litharge were blown from the shed and platform and there is a possibility that this lead would be carried into adjoining buildings. This would create an unnecessary hazard.

Sample #103, 2nd floor, Department 1: The lead concentration at this point was excessive. An exhaust should be applied to the open belt conveyor and at the hopper end to prevent the pollution of the air in this room. The present method does not keep the finer particles from being dispersed into the atmosphere of the room.

Sample #68, 2nd floor, Department 8: This sample shows a slight excess of lead concentration. This may be due to the working of the belting material while the rubber is still in the uncured state or may be due to pollu-

tion from sources outside of this room. Exhaust hoods could be applied to the tables.

Sample #88, Department 6: The base stock is reworked in a mill and then put through the tube machines. The mill and the tube machines could be exhausted to eliminate the lead hazard at this point.

The workmen should be taught that lead compounds are harmful when the dust is breathed into the lungs and to handle it carefully. It was noticed that the workmen were careless in putting their hands into the lead compound and brushing it on their clothes.

Operations where there is an excess of lead and where exhaust systems are not practicable should be isolated and efficient respirators supplied to the workmen.

Lunch rooms should be maintained and separated from the departments where lead is used. Workmen should not be allowed to eat lunch in the departments.

Samples of material used in the different products were obtained and analyzed to determine harmful elements. The following results were obtained:

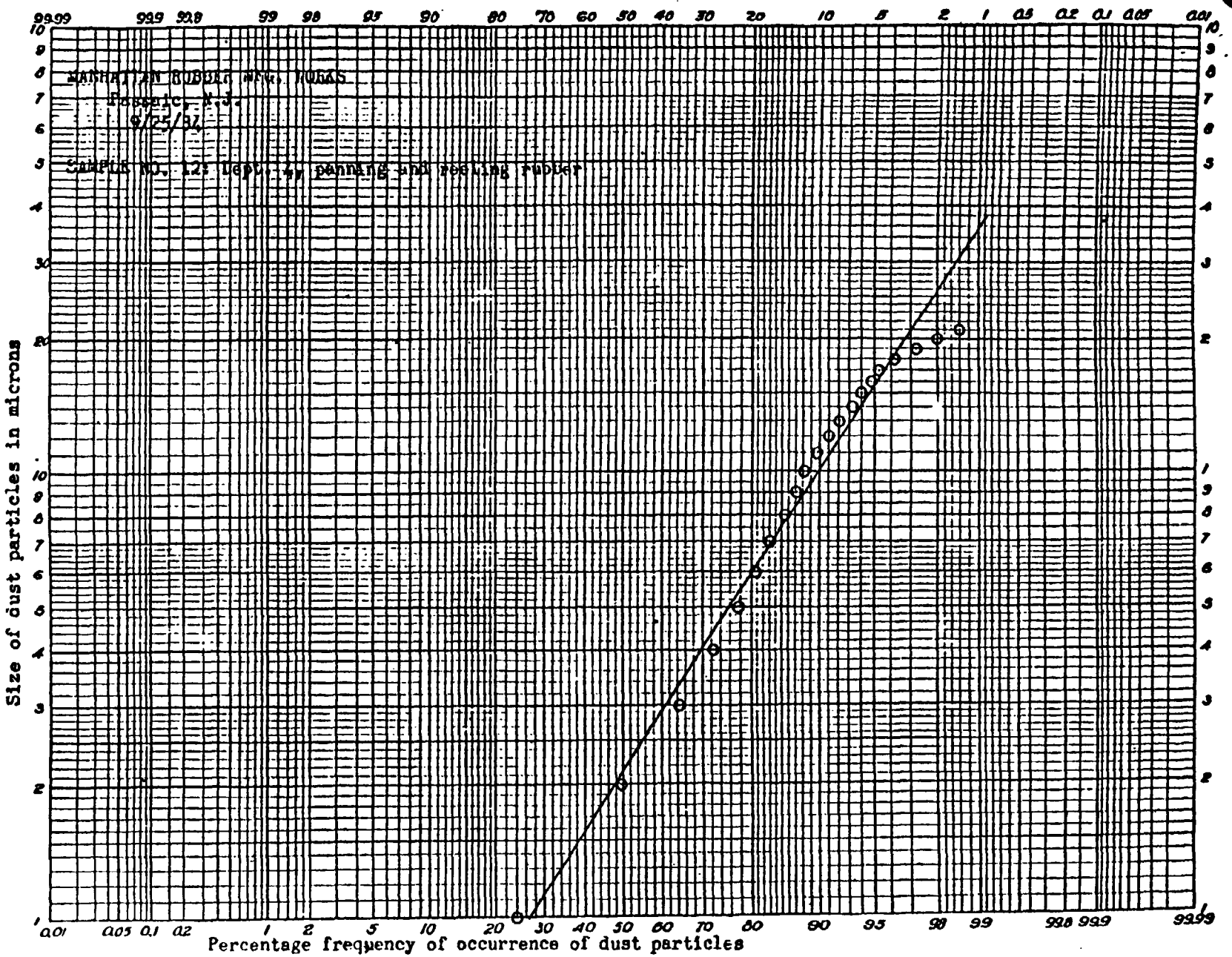
Lead compound (D-70) - 93.45% lead
" " (D-80) - 94.34% "
Waste material from Dept. 53 (R-56) - 24.65% lead; 13.91% total silica
" " " " " (R-47) - 27.32% lead; 12.94% " "

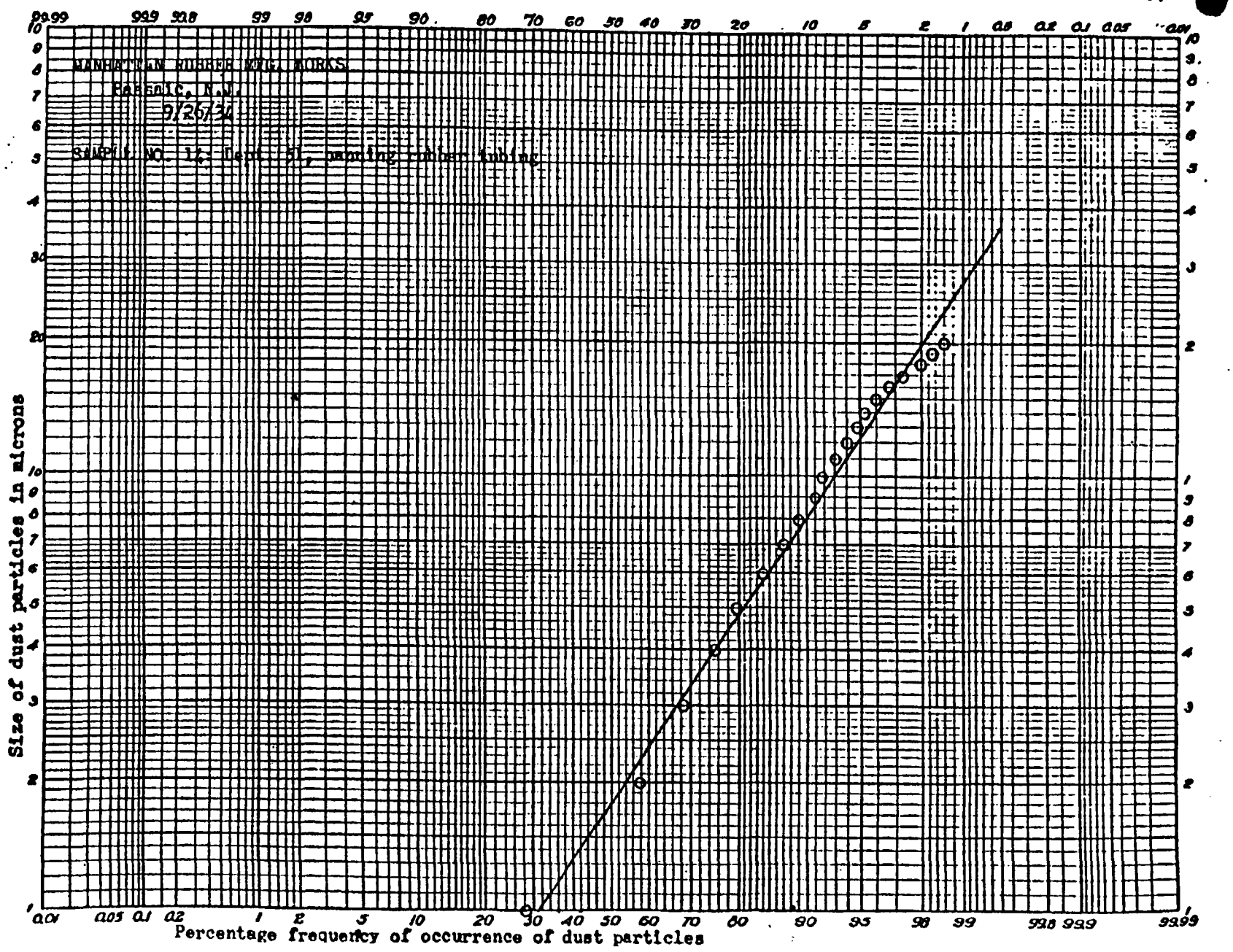
Samples of dust from three grinding operations were obtained and analyzed.

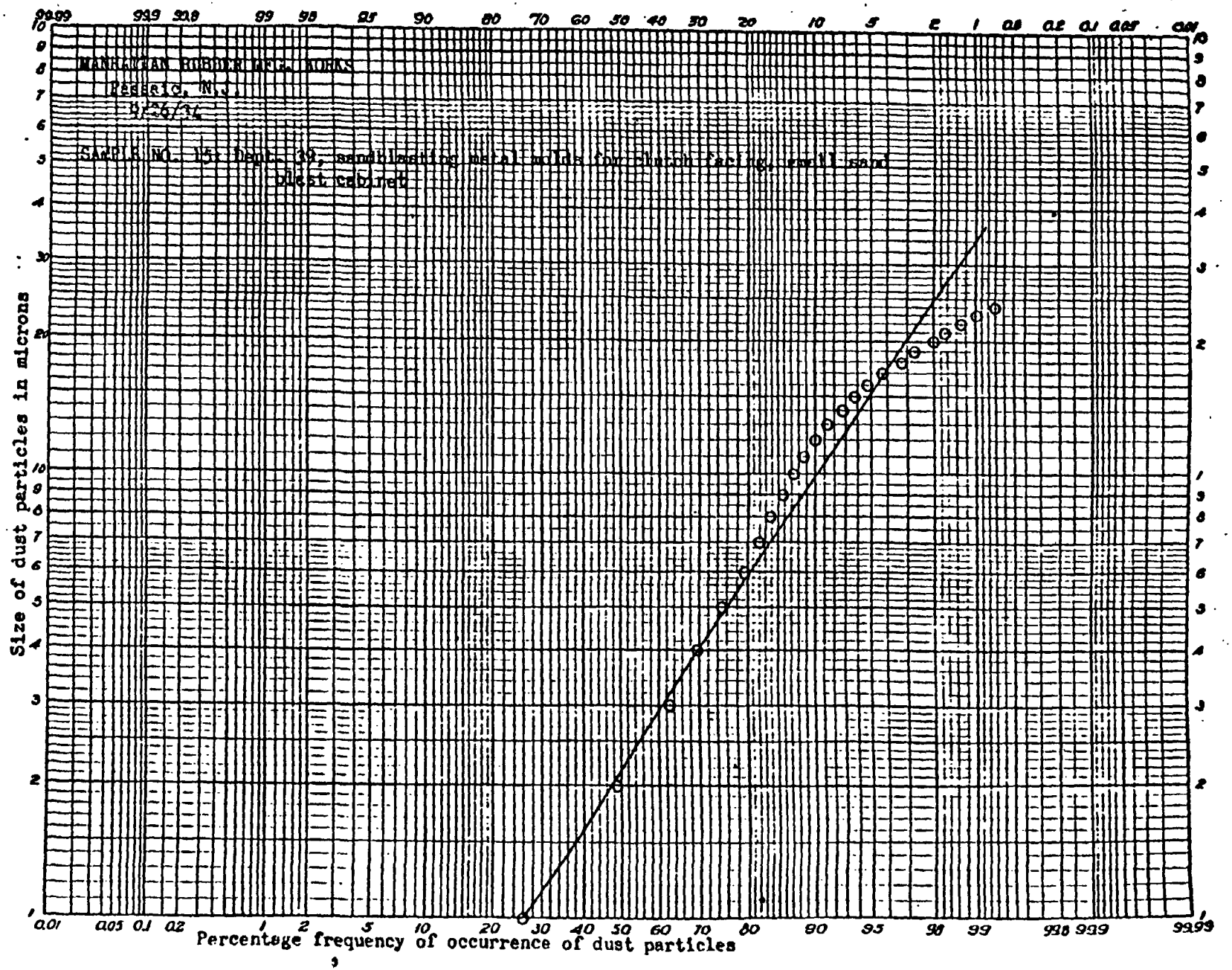
Dust from rubber grinding, Dept. 25, machine #M-746 - 7.85% lead
" " black rubber, Dept. 5, machine #1240 - 1.15% "
" " green rubber, Dept. 5, machine #1311 - 12.48% "

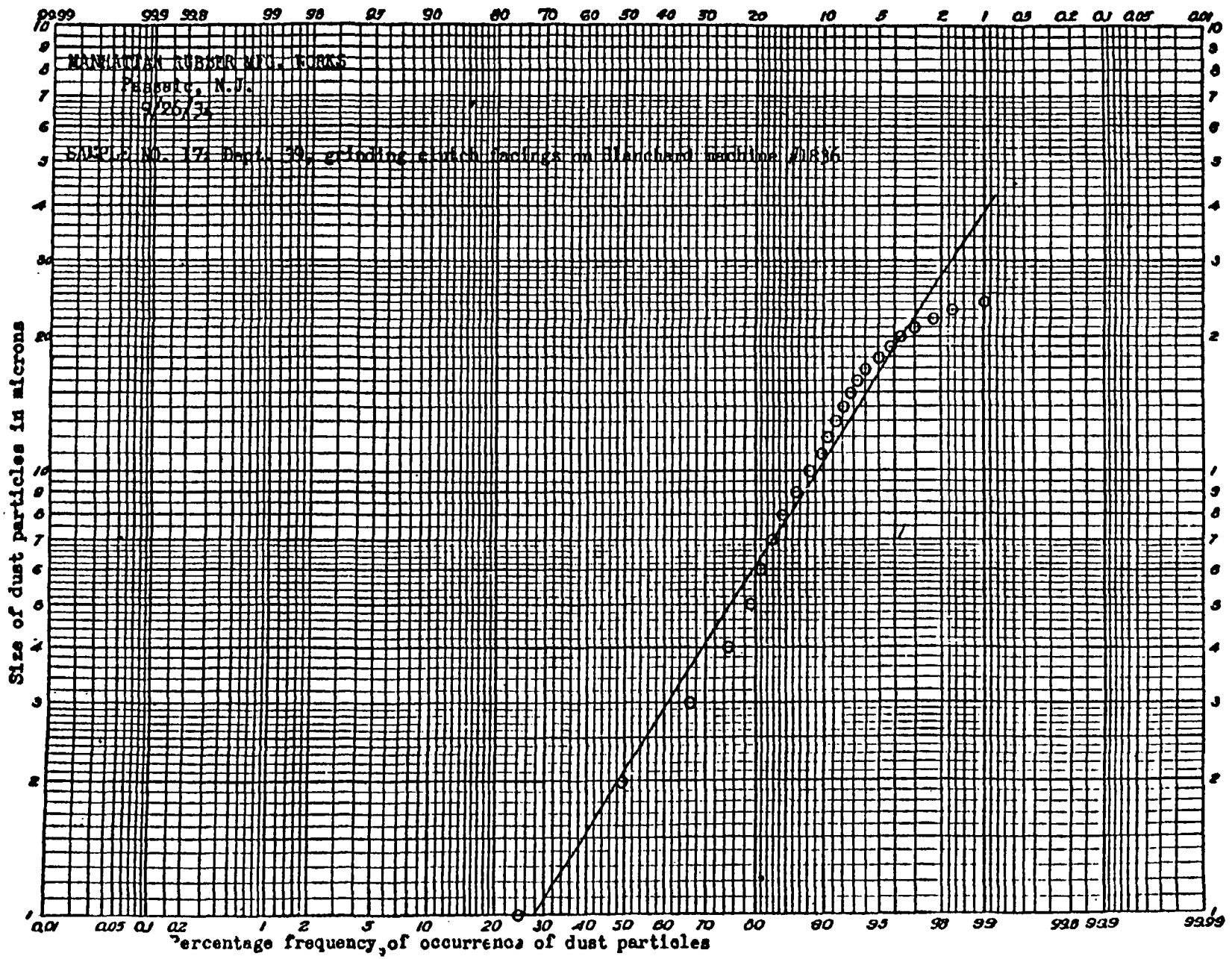
Samples of dust from rafters were taken in various departments and analyzed. The following results were obtained:

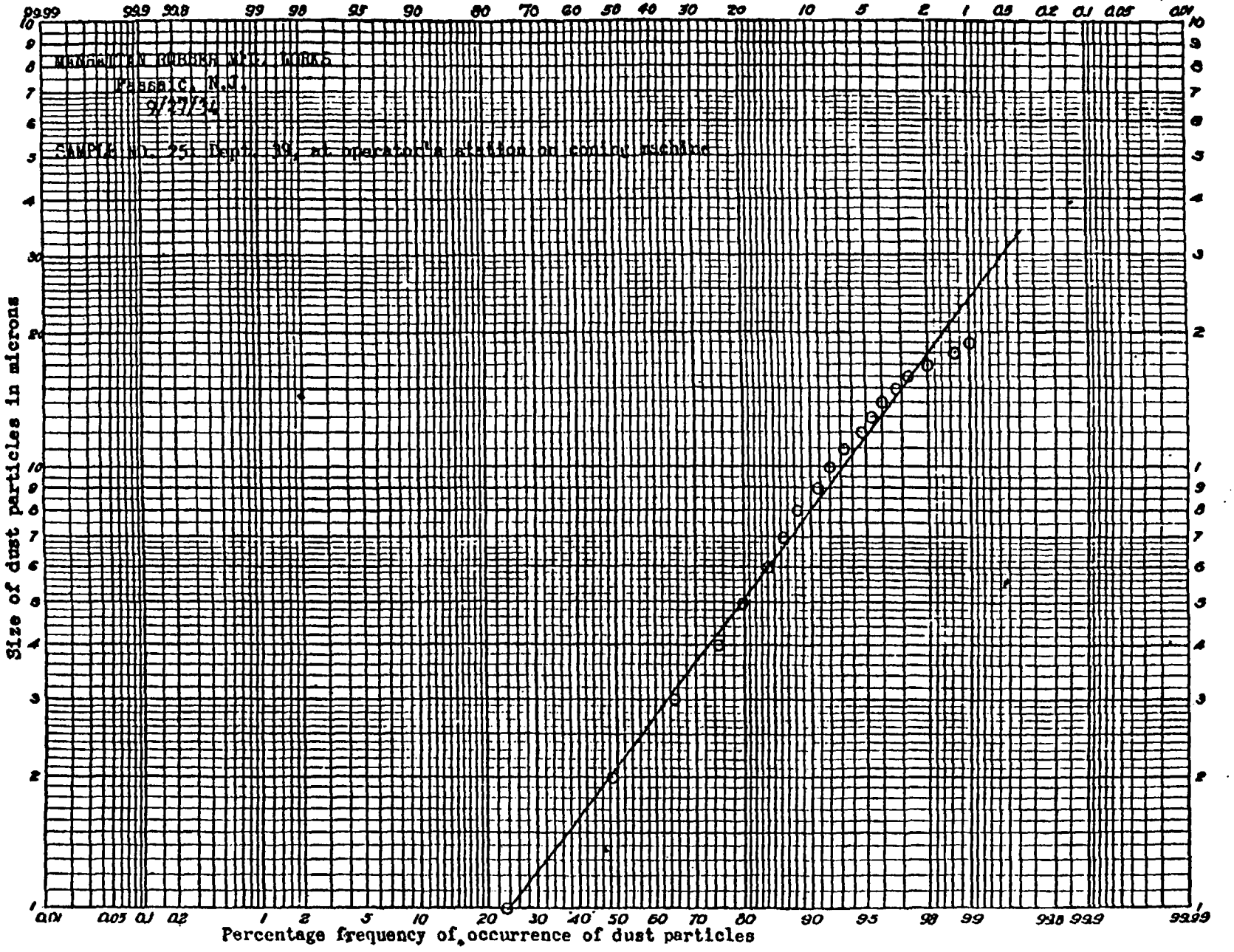
Dept. 2, dust from over batch mixing operations - 5.48% lead
" 2, " " " grinders .60% "
" 53T, " " " weighing - 7.19% lead; 25.51% total silica
" 6, at end where tube machines were located - .38% lead
" 25-26, 55 (4th floor) - 1.13% lead
" 11 - 2.08% "
" 32 - 28.18% "
" 31 - 2.66% "
" 26 (1st floor) - 3.50% "

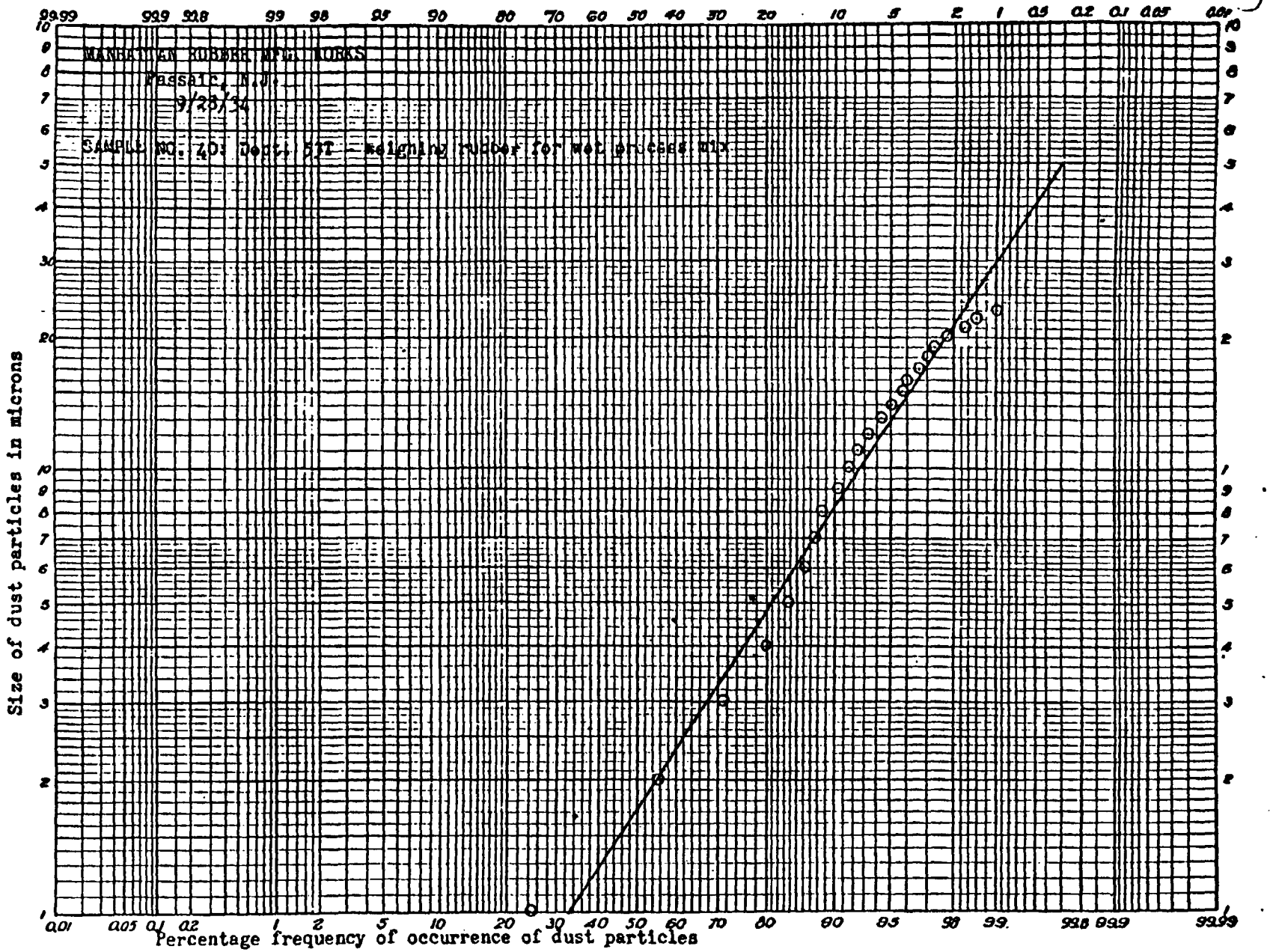

MANHATTAN RUBBER MFG. DIVISION
Passaic, N.J.
9/25/34
SAMPLE NO. 12: Dept. 44 penning and peeling rubber
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

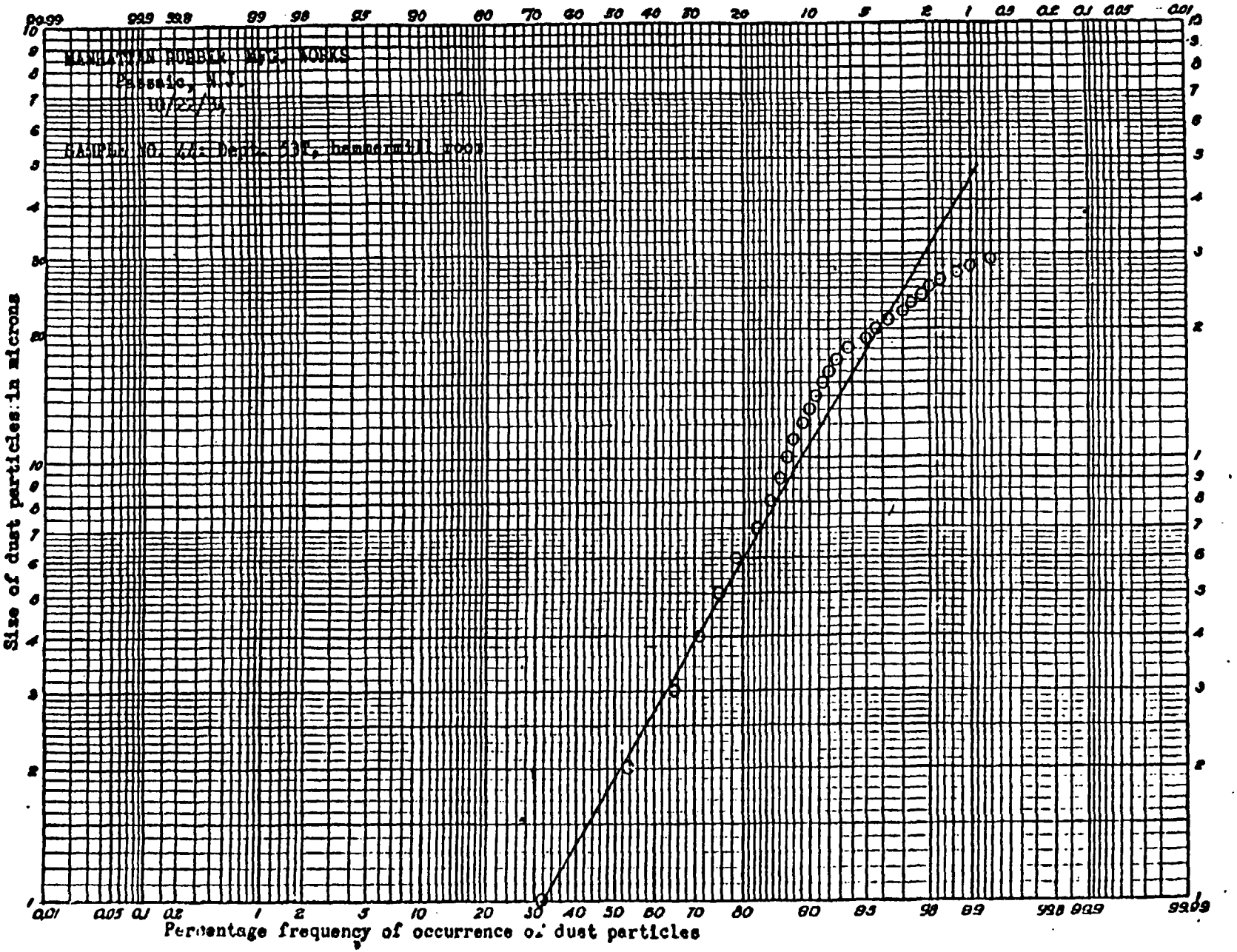

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
9/26/34
SAMPLE NO. 14. Dept. 51, running rubber tubing
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

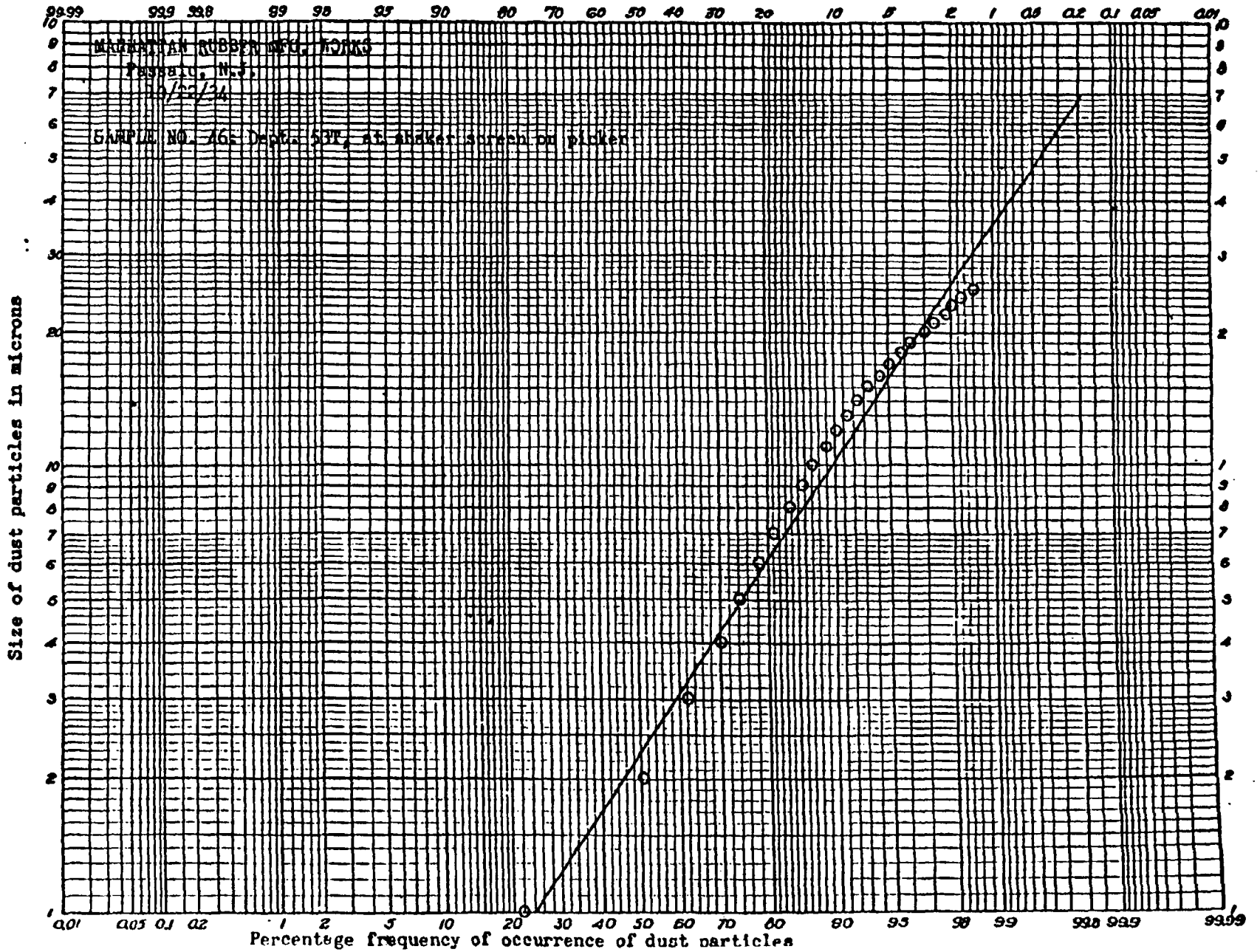

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
9/26/34
SAMPLE NO. 15: Dept. 39, sandblasting metal molds for clutch facing, small sand blast cabinet
Size of dust particles in microns
Percentage frequency of occurrence of dust particles
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.8 0.2 0.1 0.05 0.01
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


MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
9/26/34
SAMPLE NO. 174 Dept. 39, grinding clutch facings on Blanchard machine #1836
Size of dust particles in microns
Percentage frequency of occurrence of dust particles


MANVILLE-JENCKES MFG. WORKS
Paterson, N.J.
9/27/34
SAMPLE: NO. 25: Dept. 39, at operator's station on coning machine
Size of dust particles in microns
Percentage frequency of occurrence of dust particles
9999 999 998 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 05 02 01 005 001

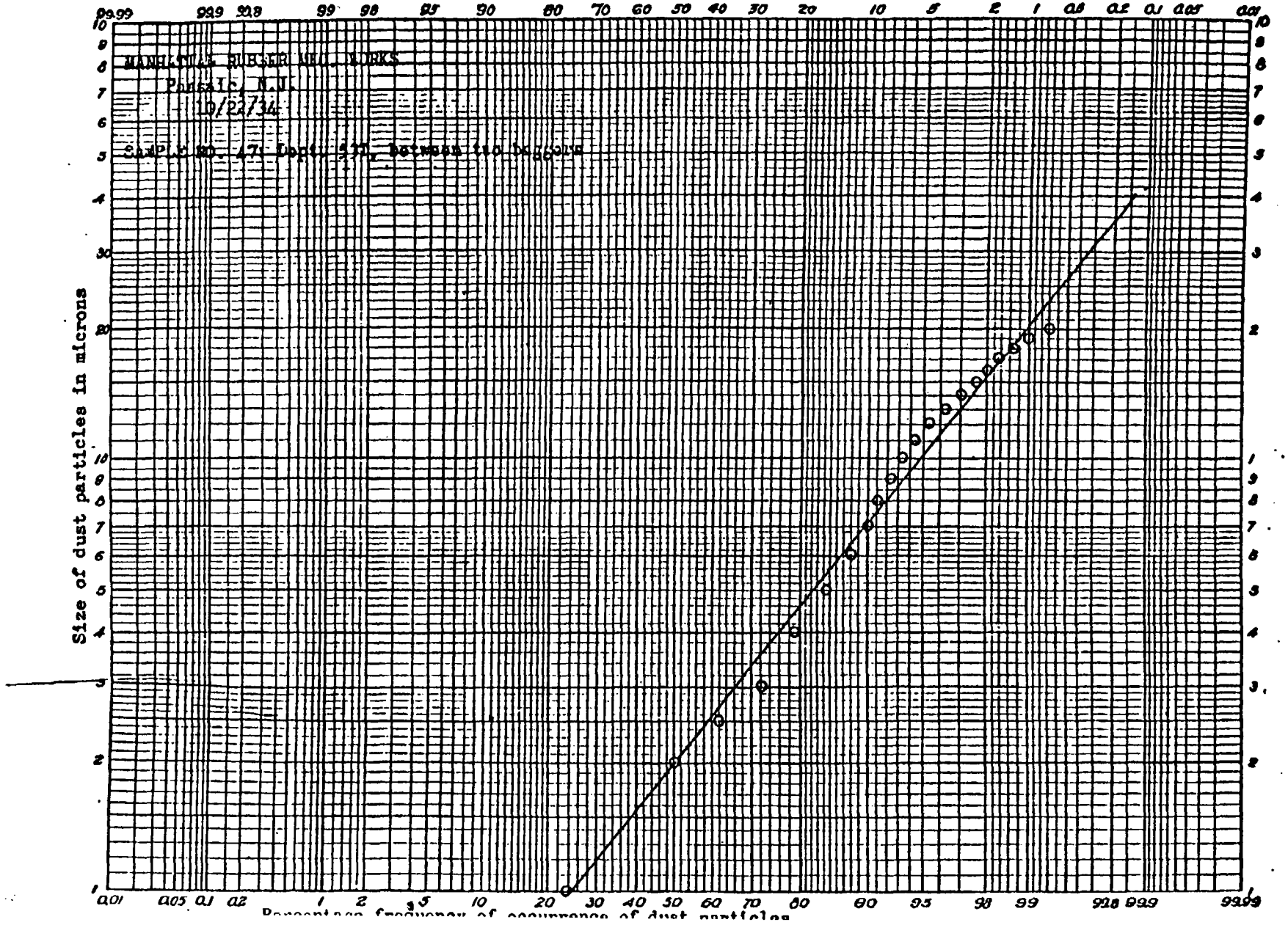

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
9/28/34
SAMPLE NO. 40: Dept. 51E - Weighing number for wet process mix
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

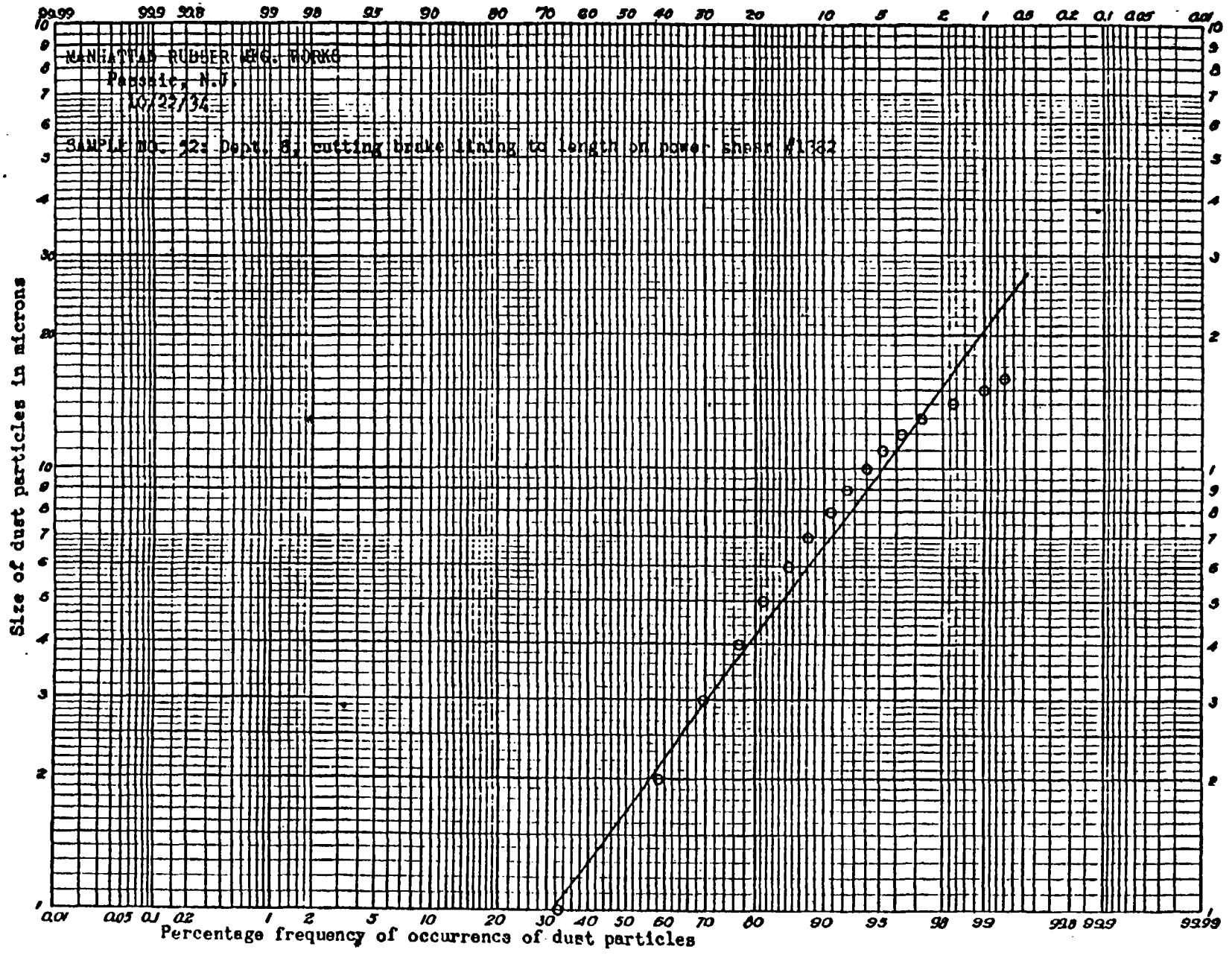

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/22/34
SAMPLE NO. 44: Depth 53', hammermill room
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

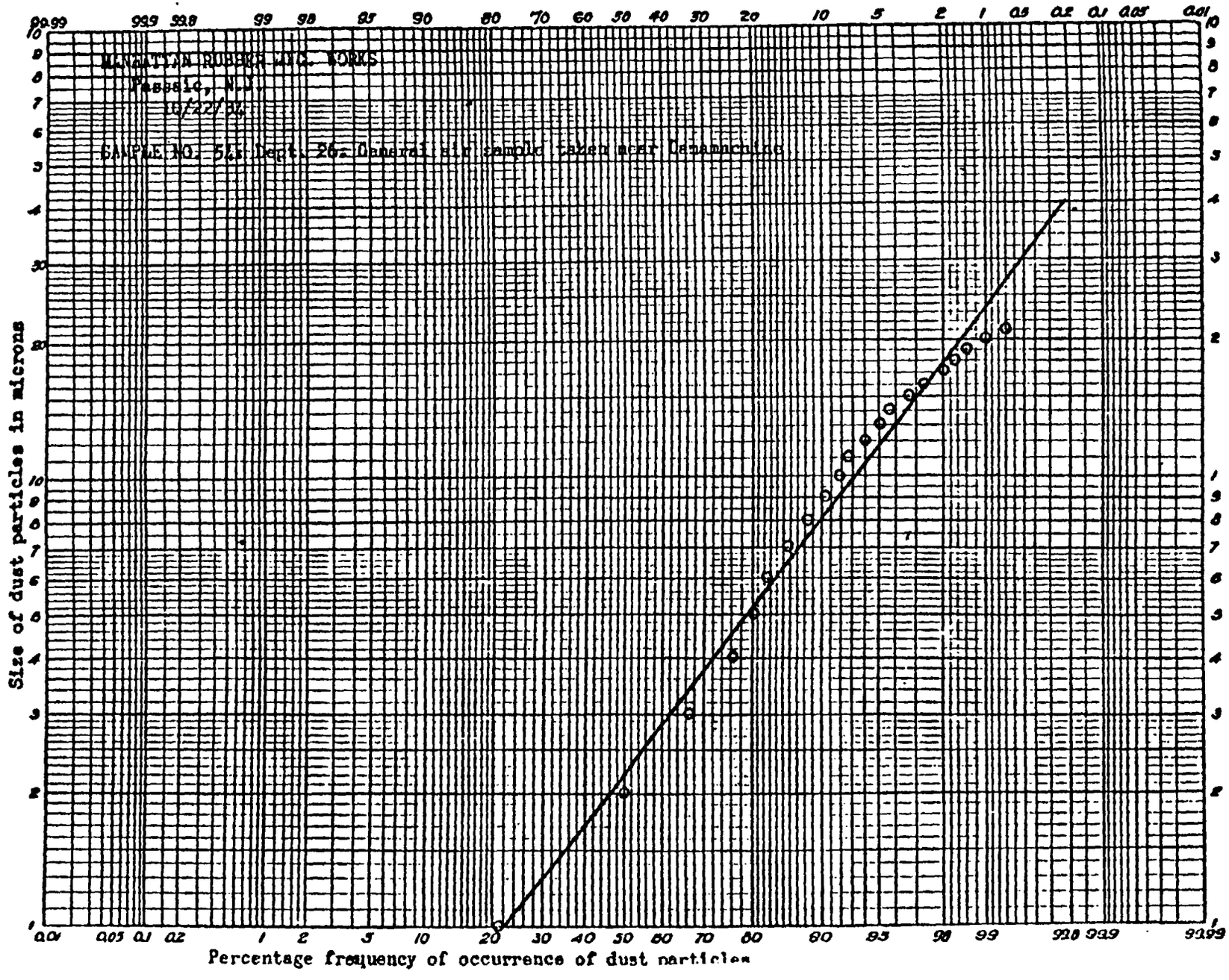

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/2-1/34
SAMPLE NO. 16: Dept. 53T, at shaker screen on picker
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

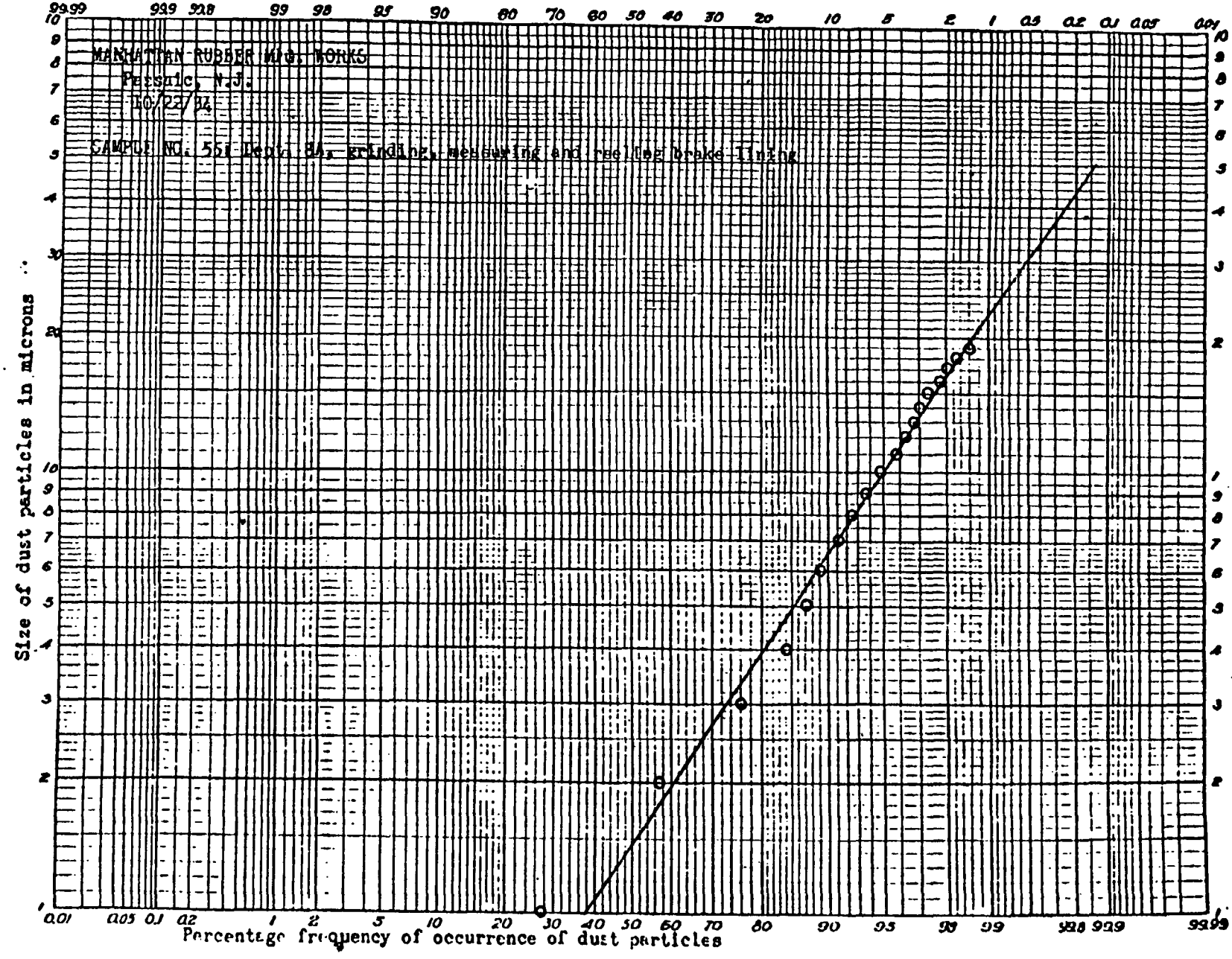
NO. 3128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER

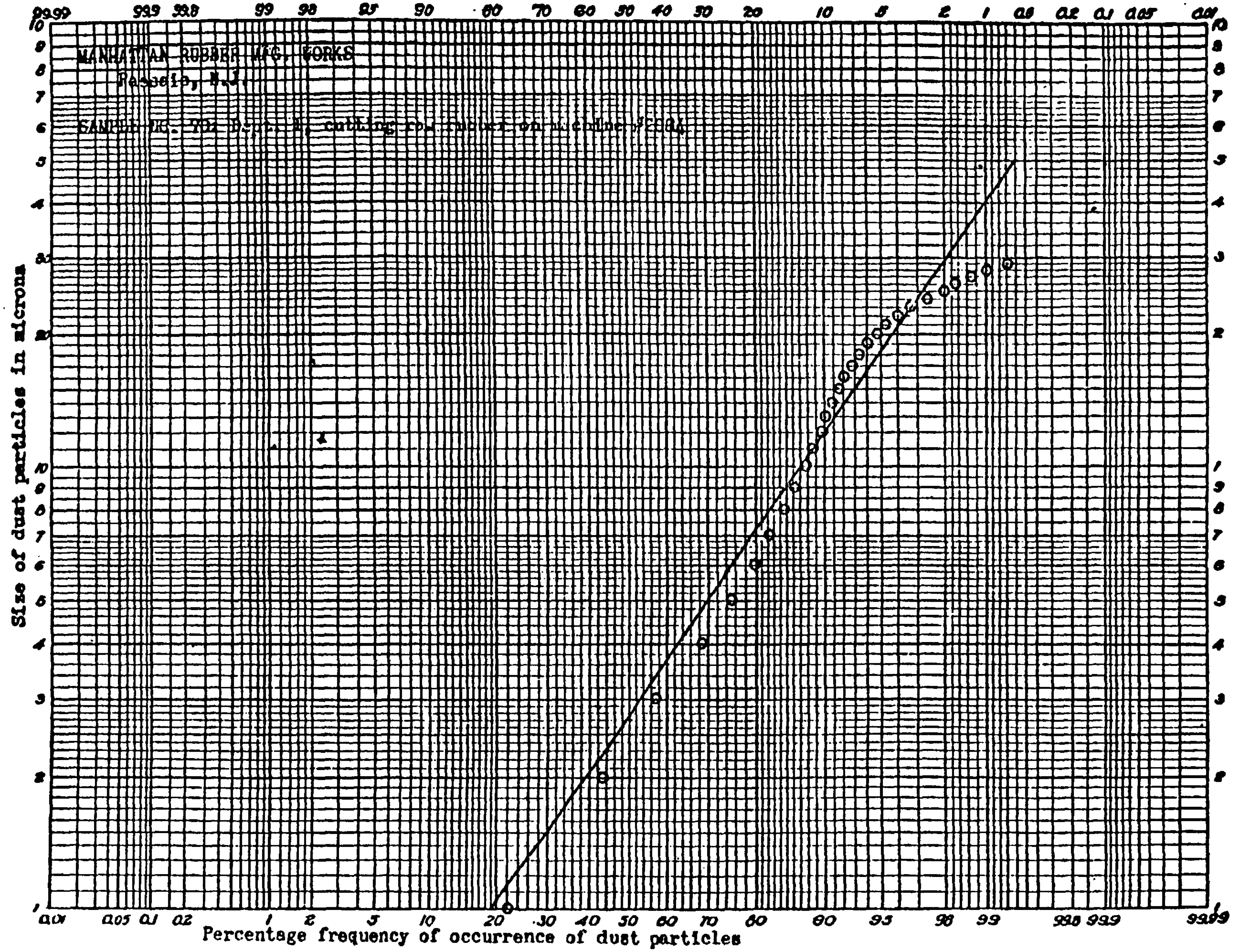
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS

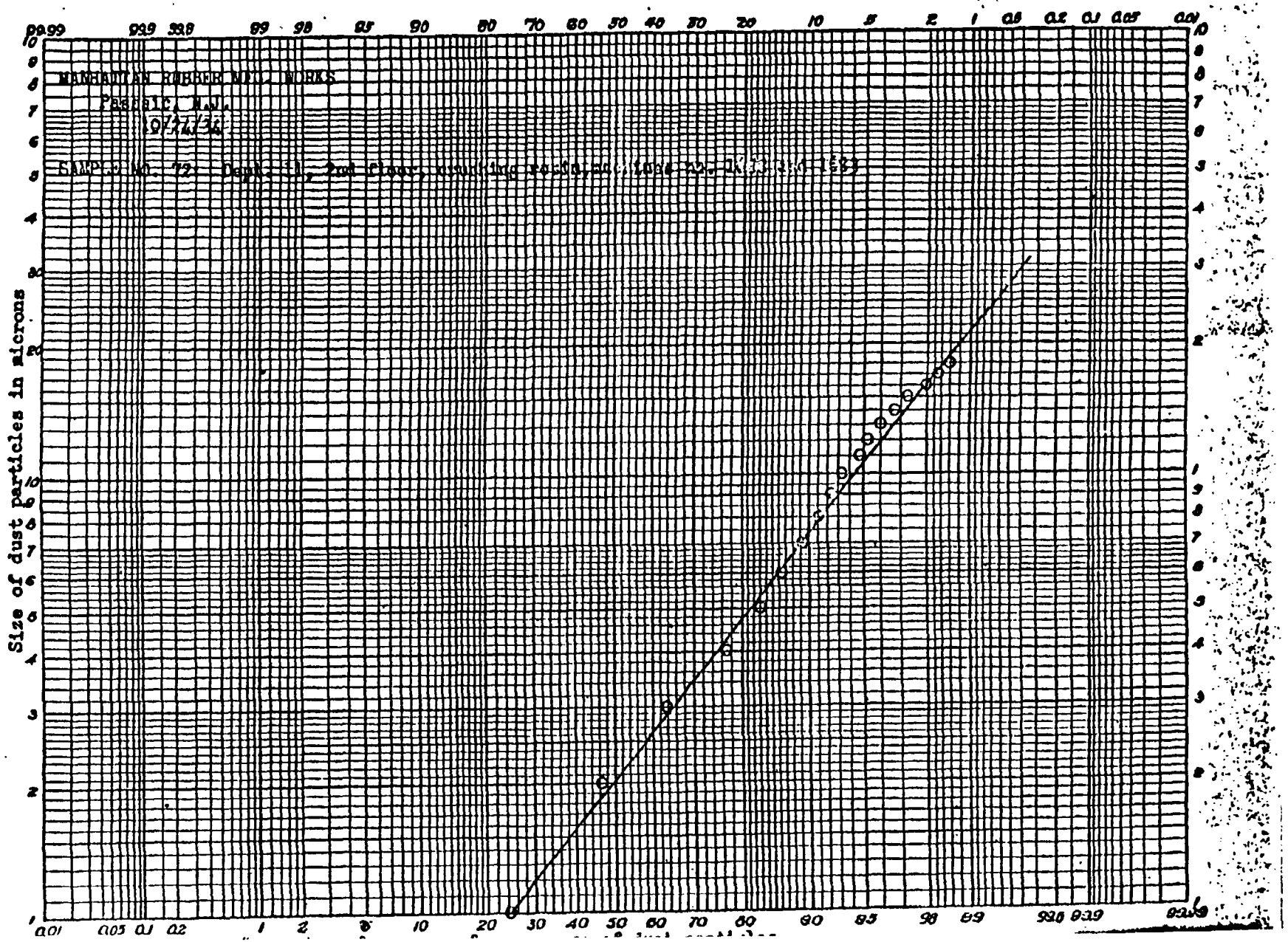


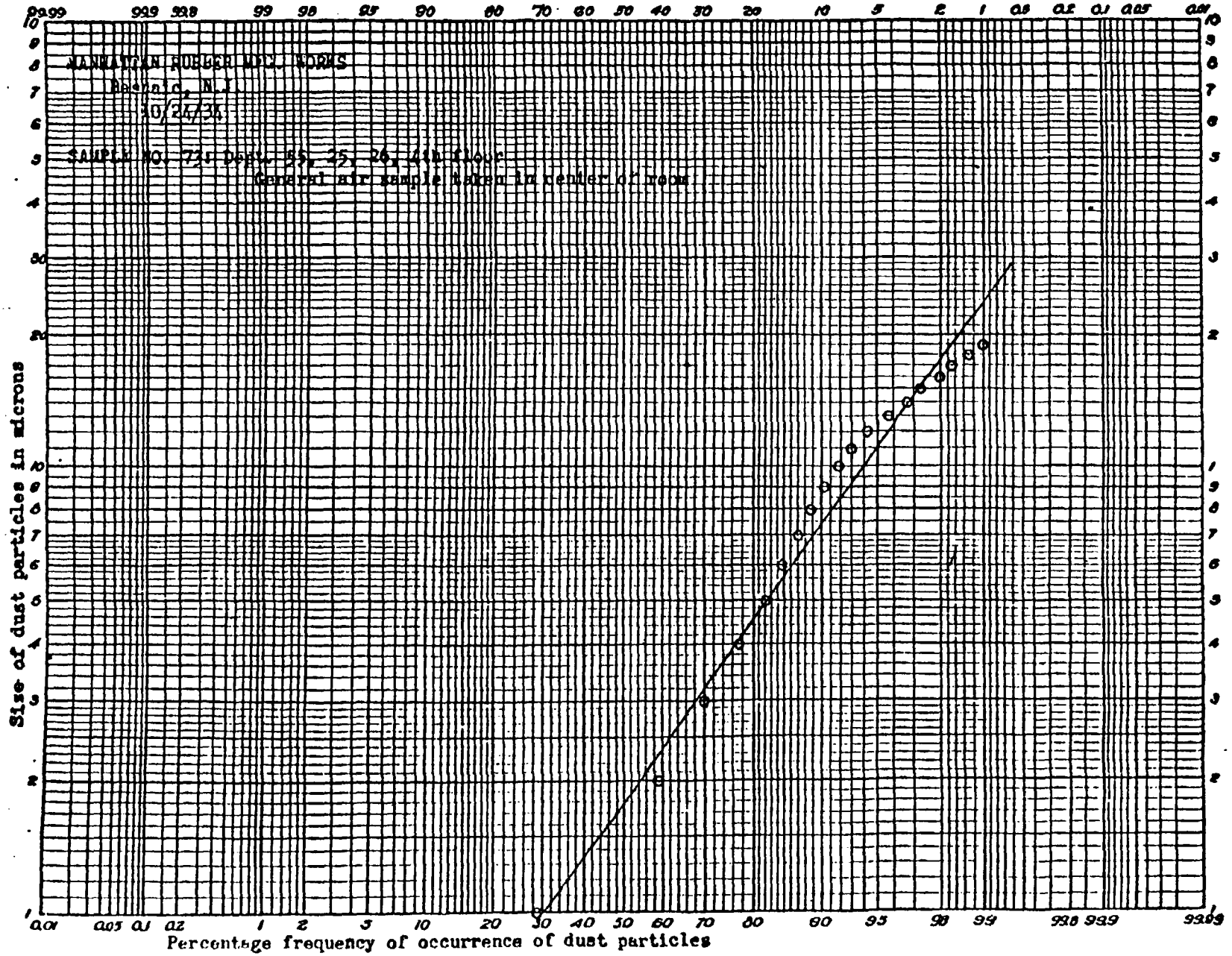

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/22/34
SAMPLE NO. 22: Dept. 8, cutting brake lining to length on power shear #1382
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

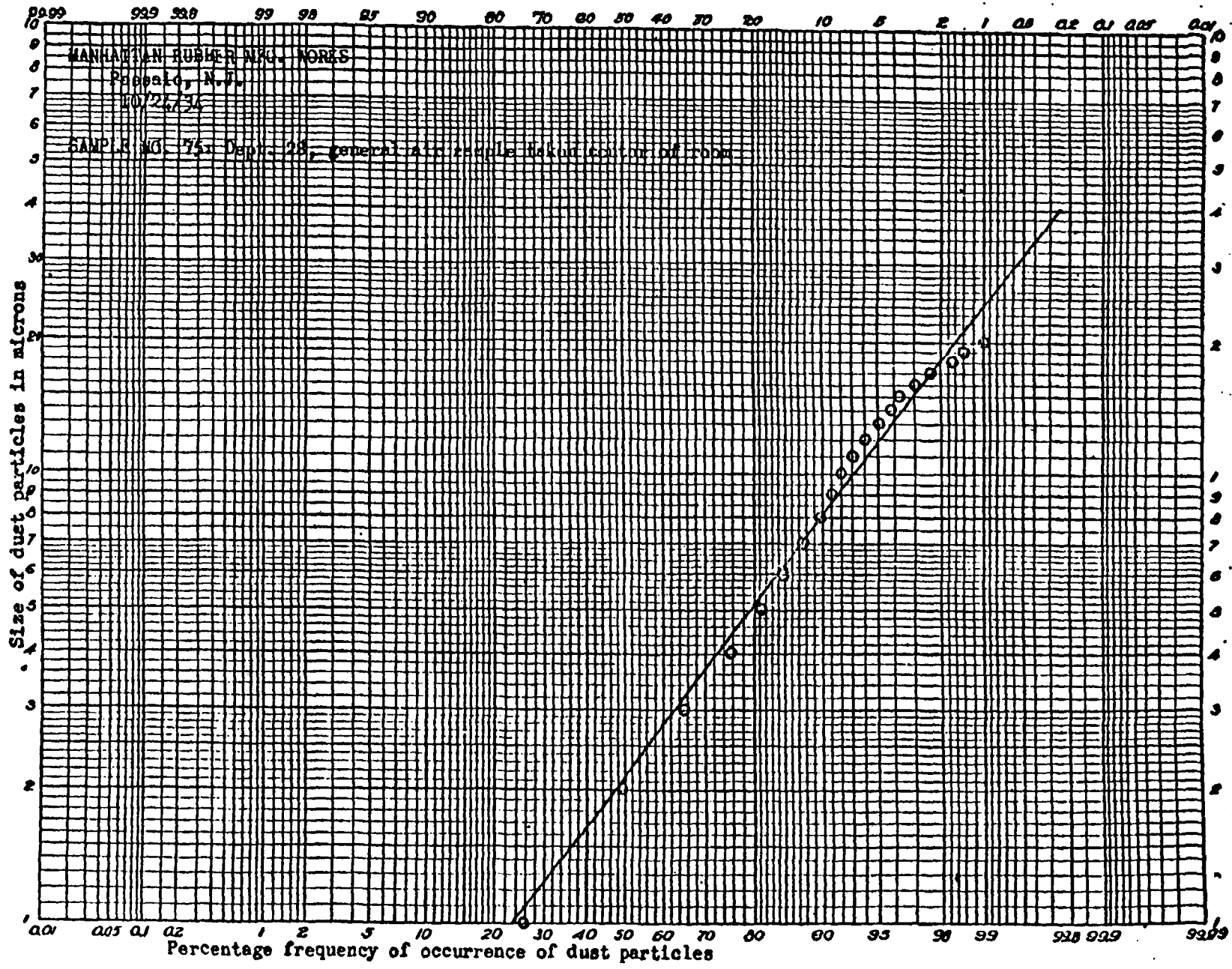

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/22/37
SAMPLE NO. 5½: Dept. 26. General air sample taken near Calendar roll.
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

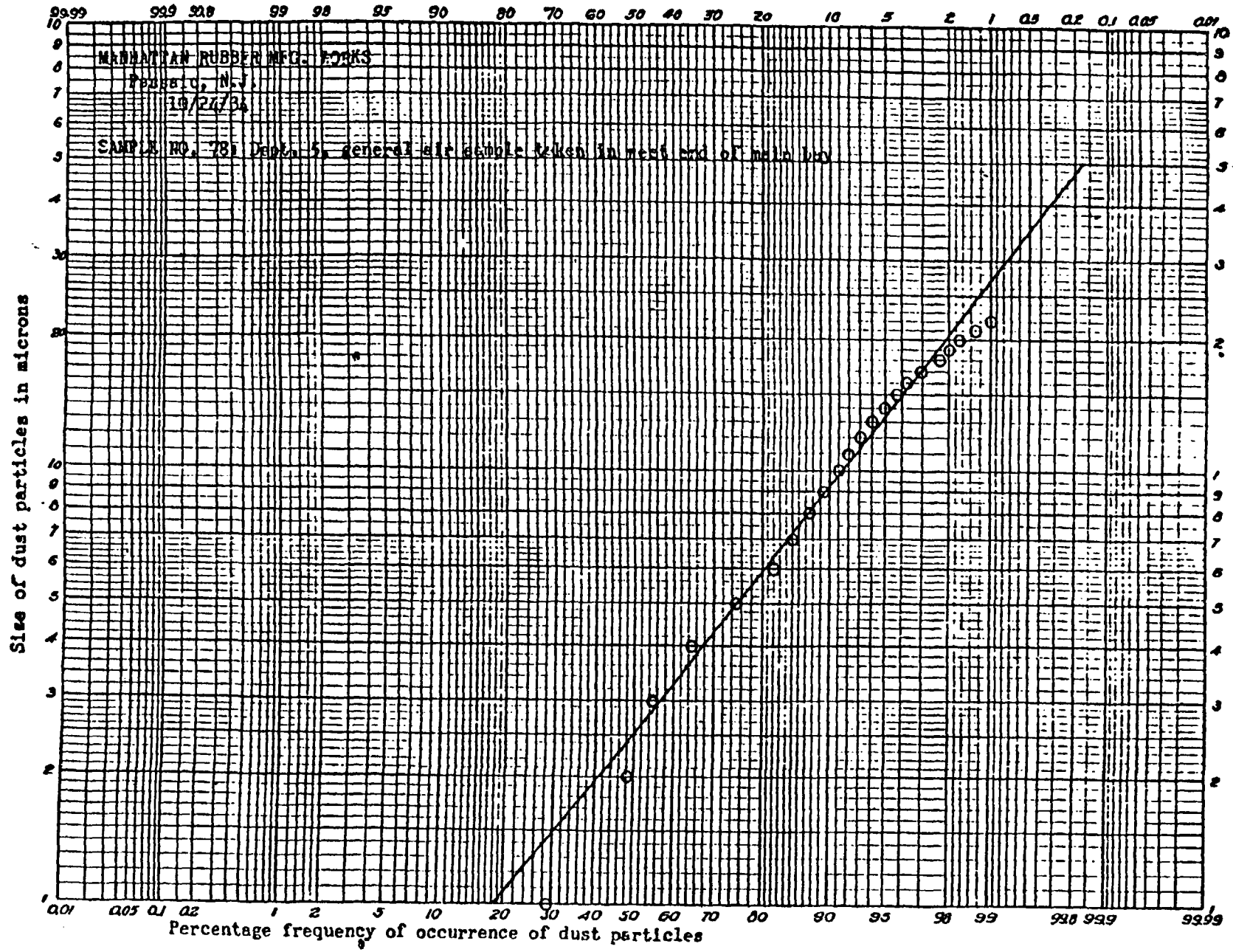

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/22/34
SAMPLE NO. 551 Depth 34, grinding, measuring and reeling brake lining
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

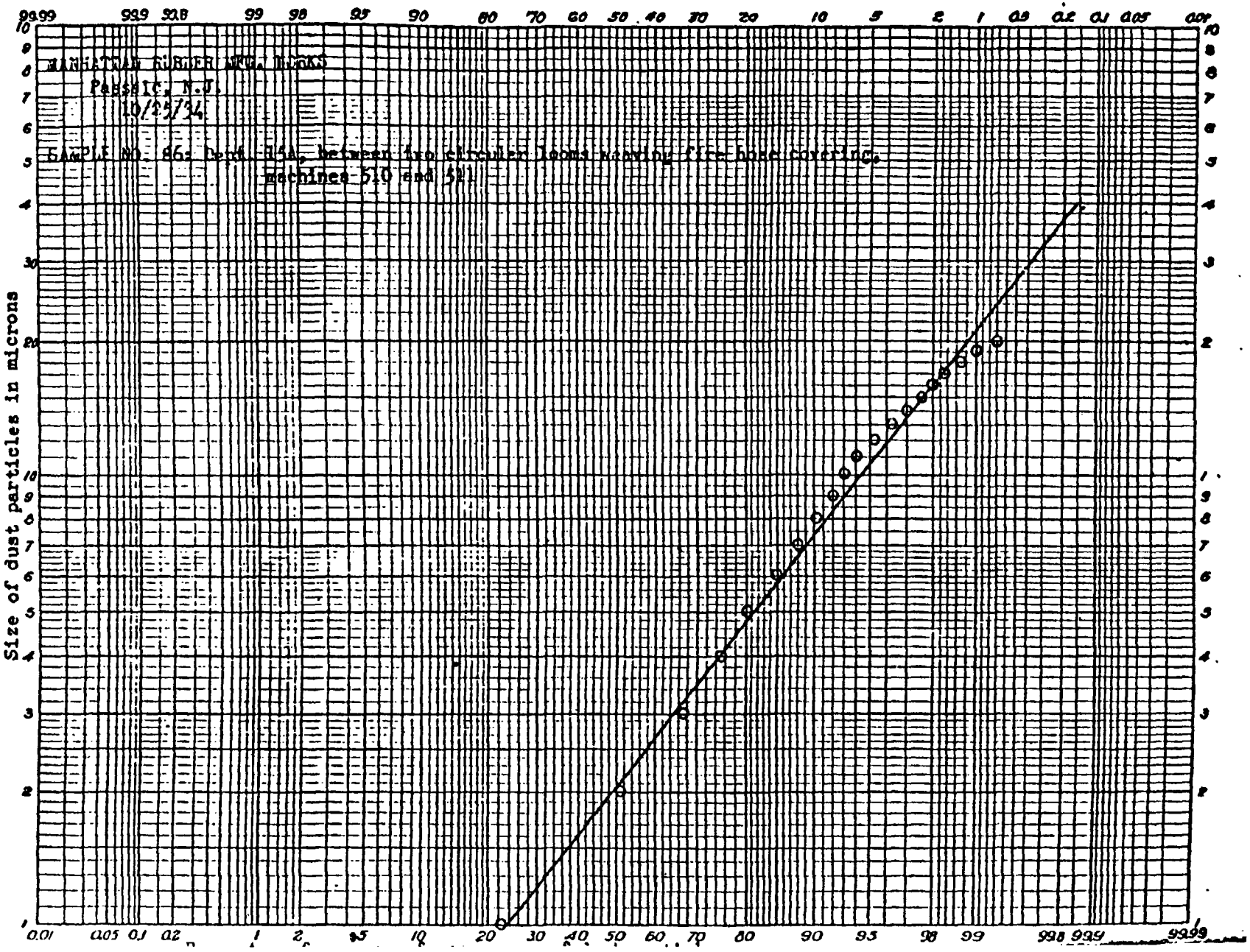

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

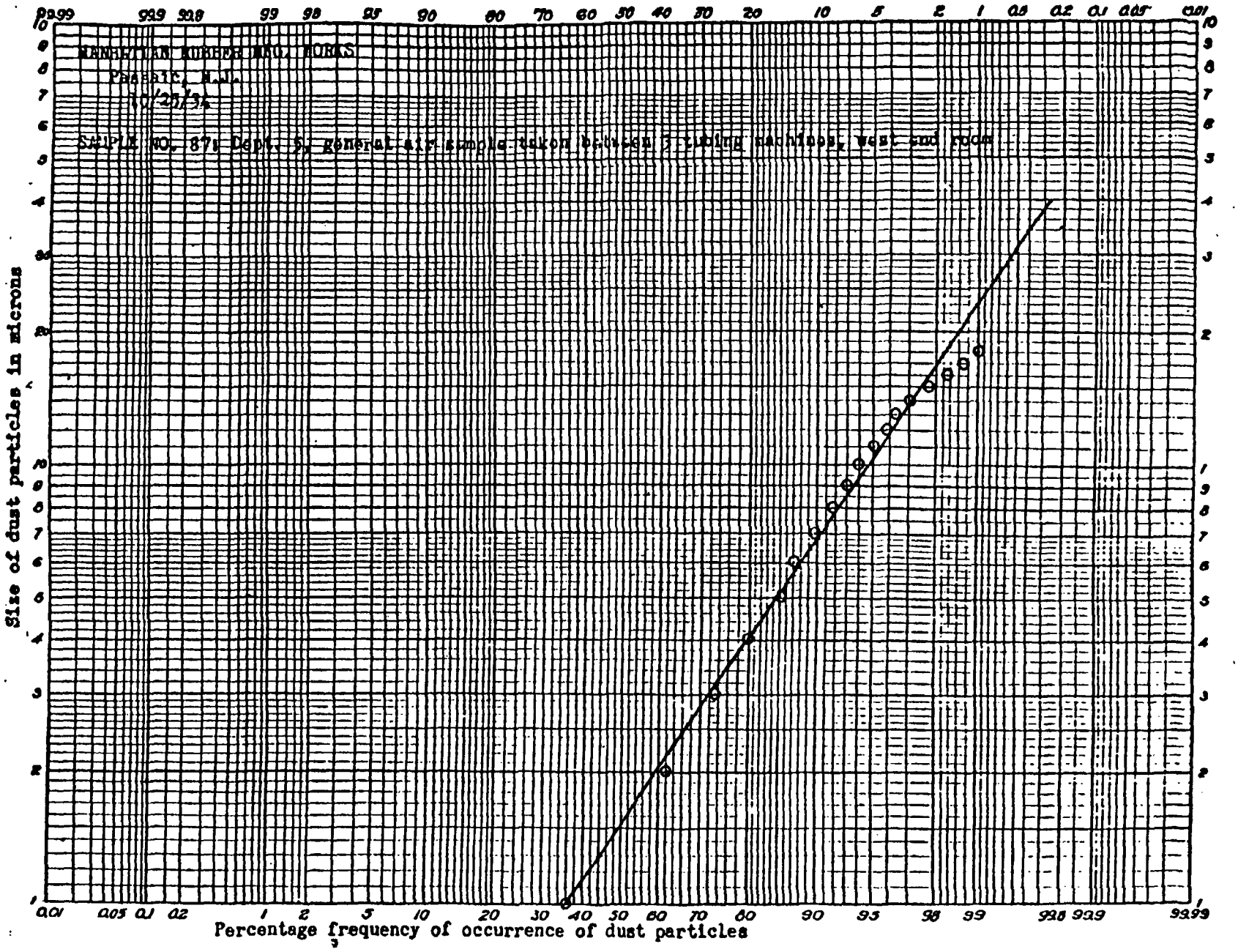

NO. 5128. LOGARITHMIC PROBABILITY. DESIGNED BY HAZEN, WHIPPLE & FULLER
COOKE BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS
MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
Size of dust particles in microns

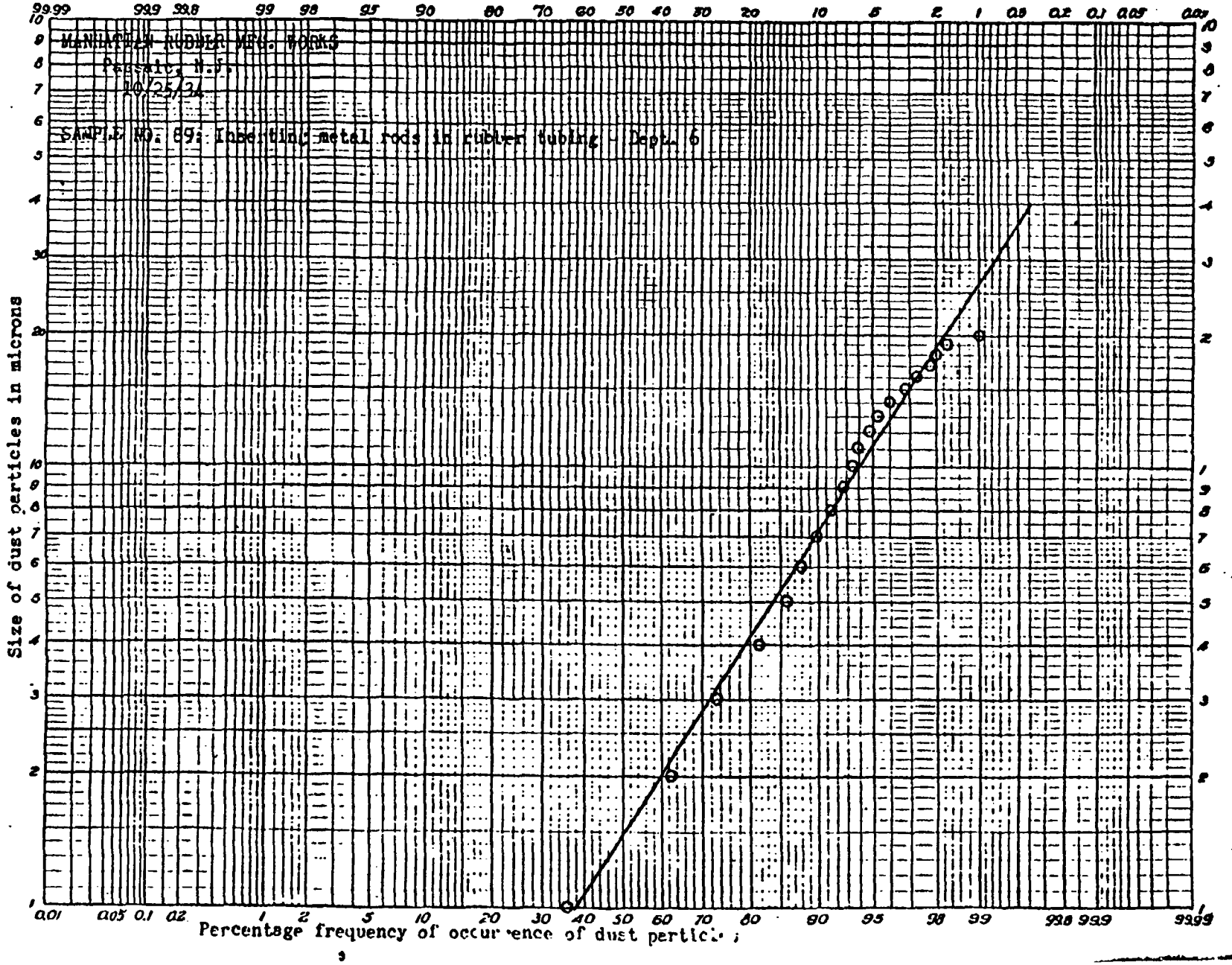

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/24/35
SAMPLE NO. 72: Dept. 55, 25, 26, 4th floor
General air sample taken in center of room
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

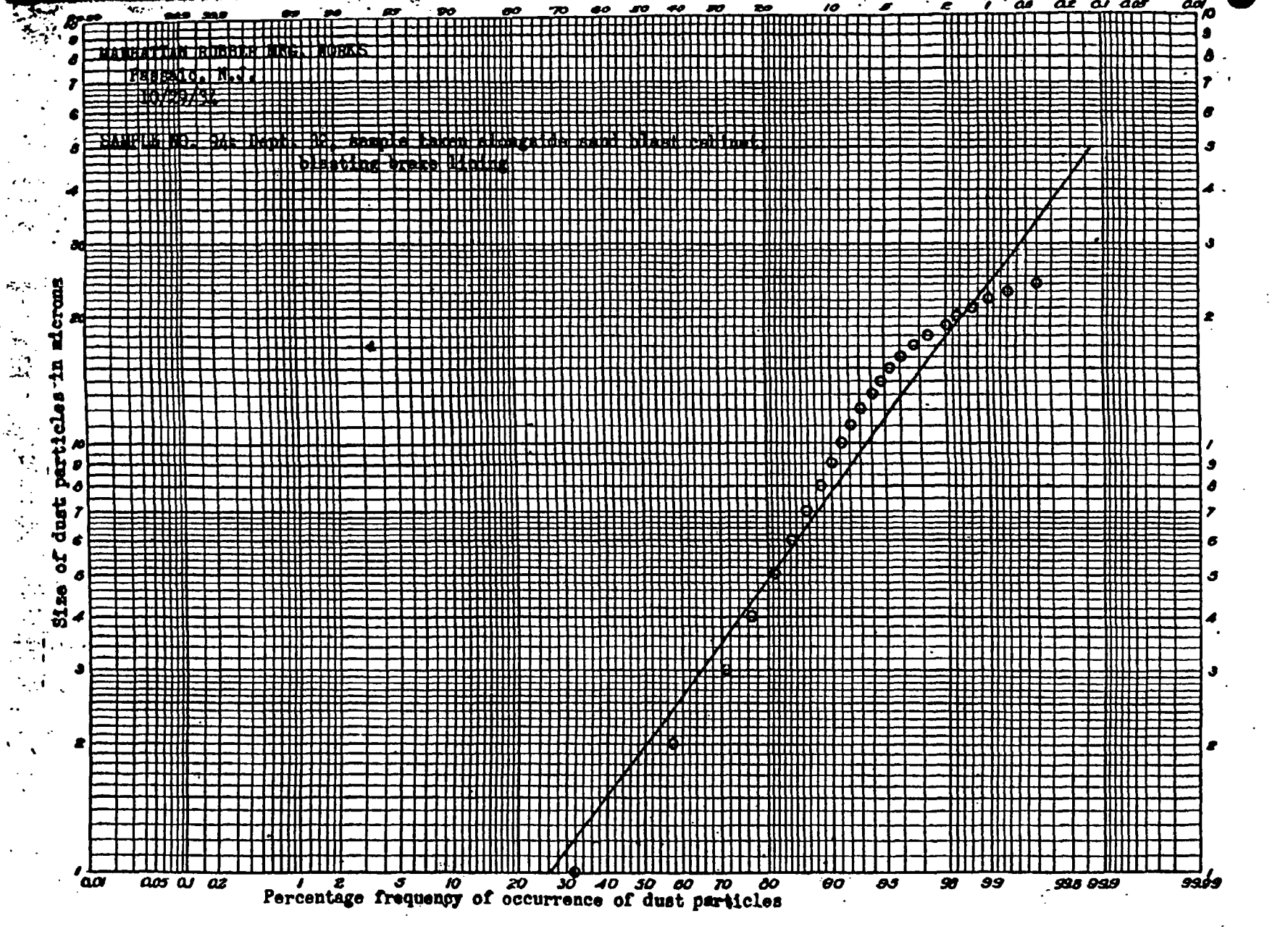

MANHATTAN RUBBER MFG. NORES
Passaic, N.J.
EO/2L/3L
SAMPLE NO. 75x Dept. 28 General air sample taken in room
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

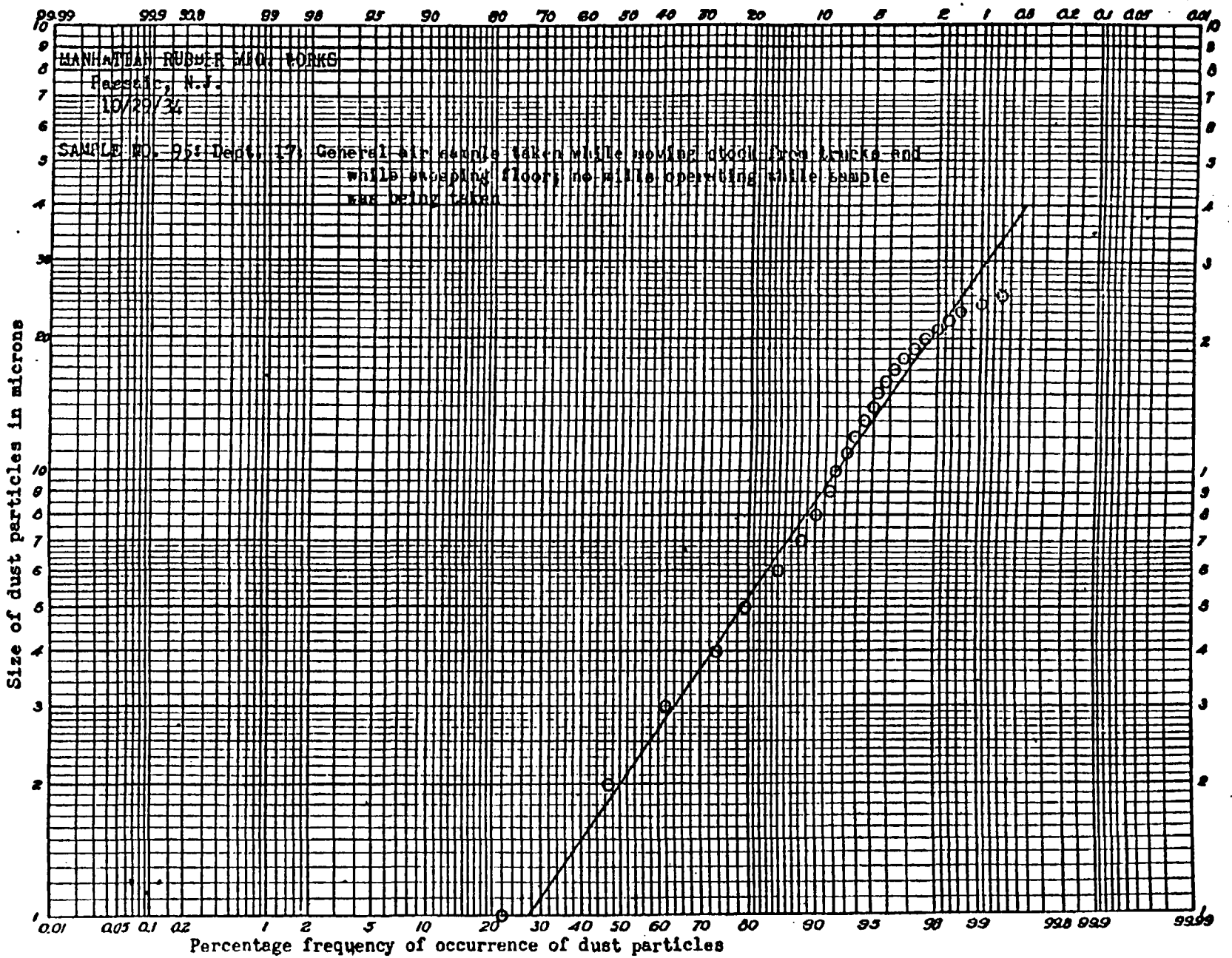

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/24/34
SAMPLE NO. 781 Dept. 5, general air sample taken in west end of main bay
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

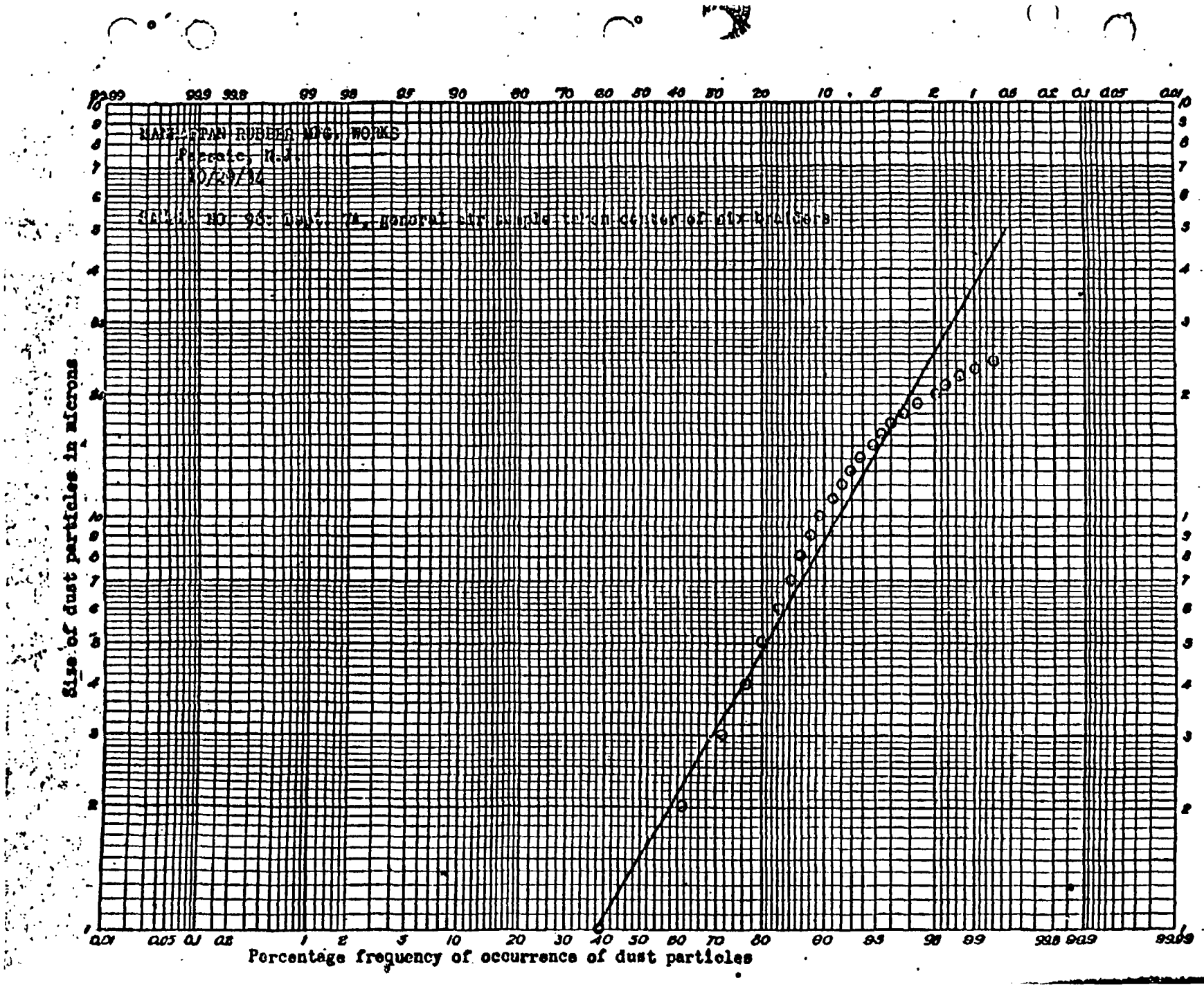

MANHATTAN RUBBER MFG. DIVISION
Passaic, N.J.
10/25/34
SAMPLE NO. 86: Dept. 54A, between two circular looms weaving fire hose covering, machines 510 and 511
Size of dust particles in microns
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

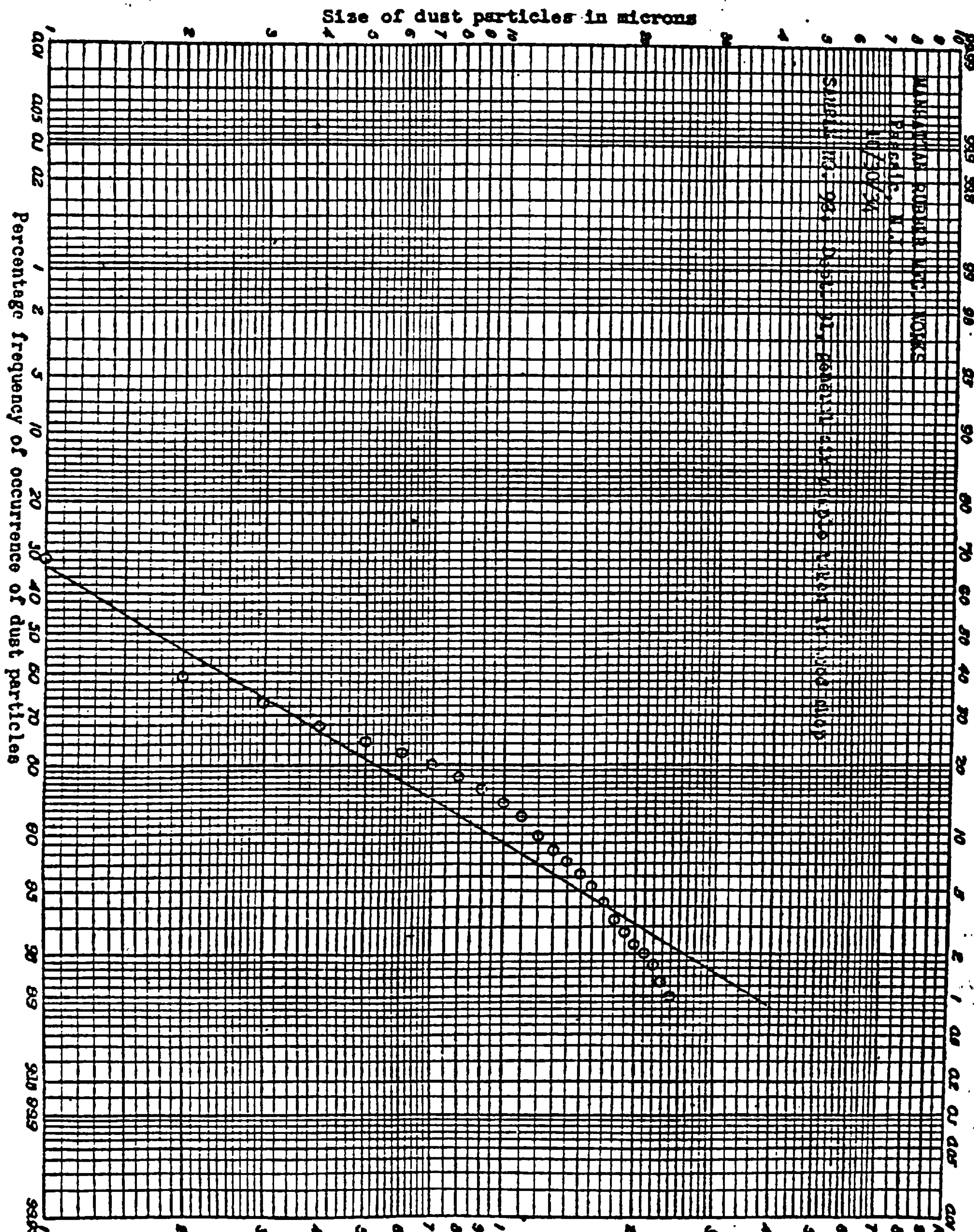

MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/25/34
SAMPLE NO. 871 Dept. 5, general air sample taken between 3 tubing machines, west end room
Size of dust particles in microns
Percentage frequency of occurrence of dust particles
P.999 .999 .998 .99 .98 .95 .90 .80 .70 .60 .50 .40 .30 .20 .10 .05 .02 .01 .005 .001
.001 .005 .01 .02 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 .998 .999 .9999


MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/25/24
SAMPLE NO. 89: Insertion metal rods in rubber tubing - Dept. 6
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

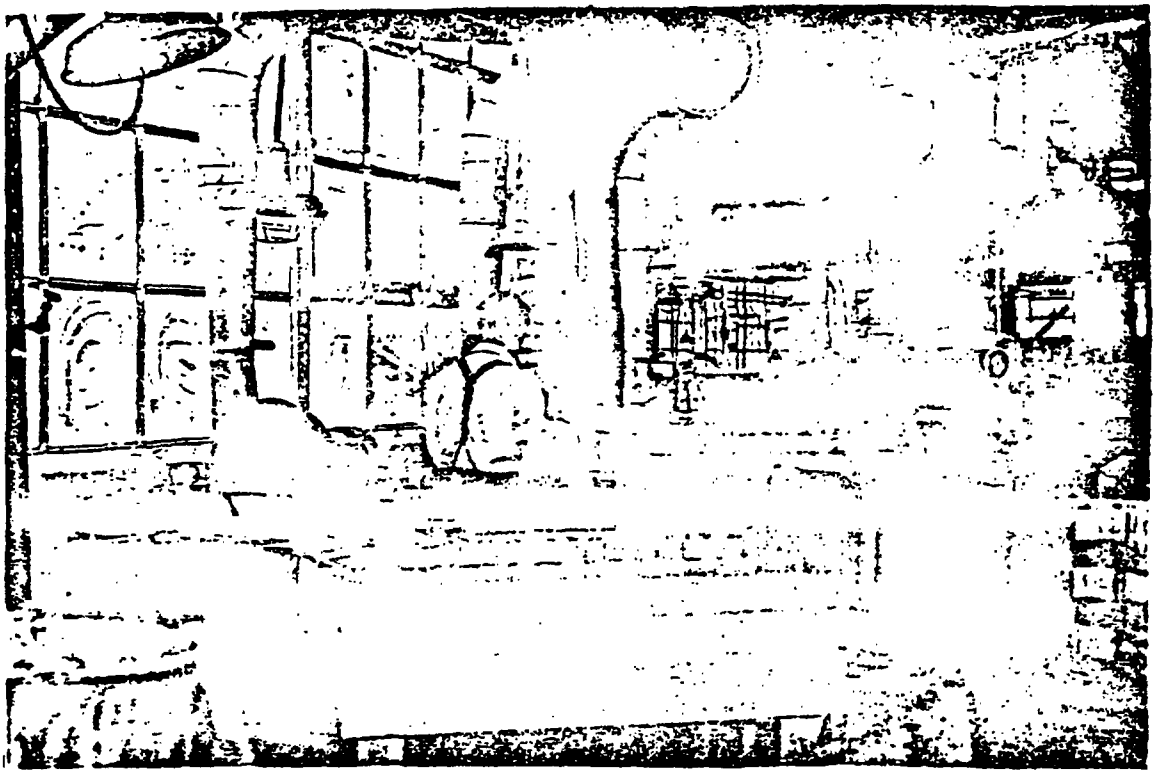

MANHATTAN RUBBER MFG. WORKS
PASSAIC, N.J.
10/29/34
SAMPLE NO. 34: Dept. 30. Sample taken at large de sand blast cabinet, blasting brass lining.
Size of dust particles in microns
Percentage frequency of occurrence of dust particles


MANHATTAN RUBBER MFG. WORKS
Passaic, N.J.
10/29/34
SAMPLE NO. 95: Dept. 17: General air sample taken while moving stock from trucks and while sweeping floors; no mills operating while sample was being taken
Size of dust particles in microns
Percentage frequency of occurrence of dust particles


Size of dust particles in microns
Percentage frequency of occurrence of dust particles



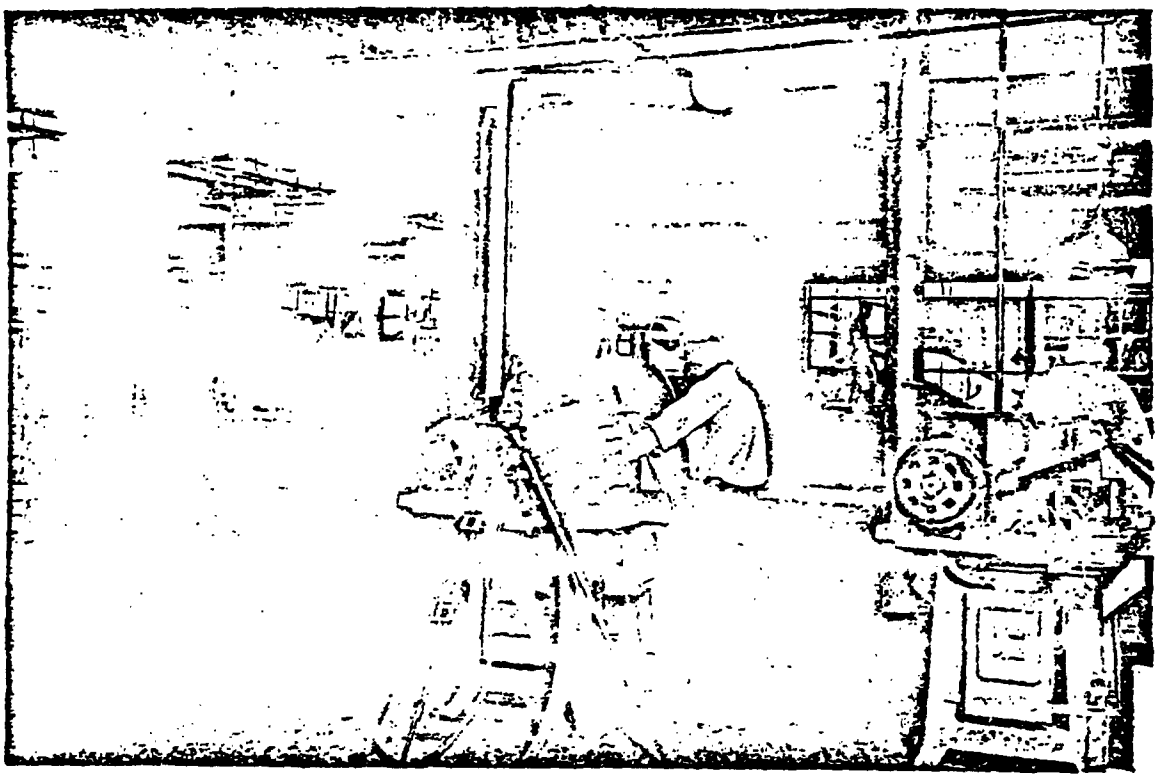
Size of dust particles in microns
Percentage frequency of occurrence of dust particles



SAMPLE NO. 6
Dept. 53

Grinding machine #2050, one man chamfering ends of brake lining on emery wheel

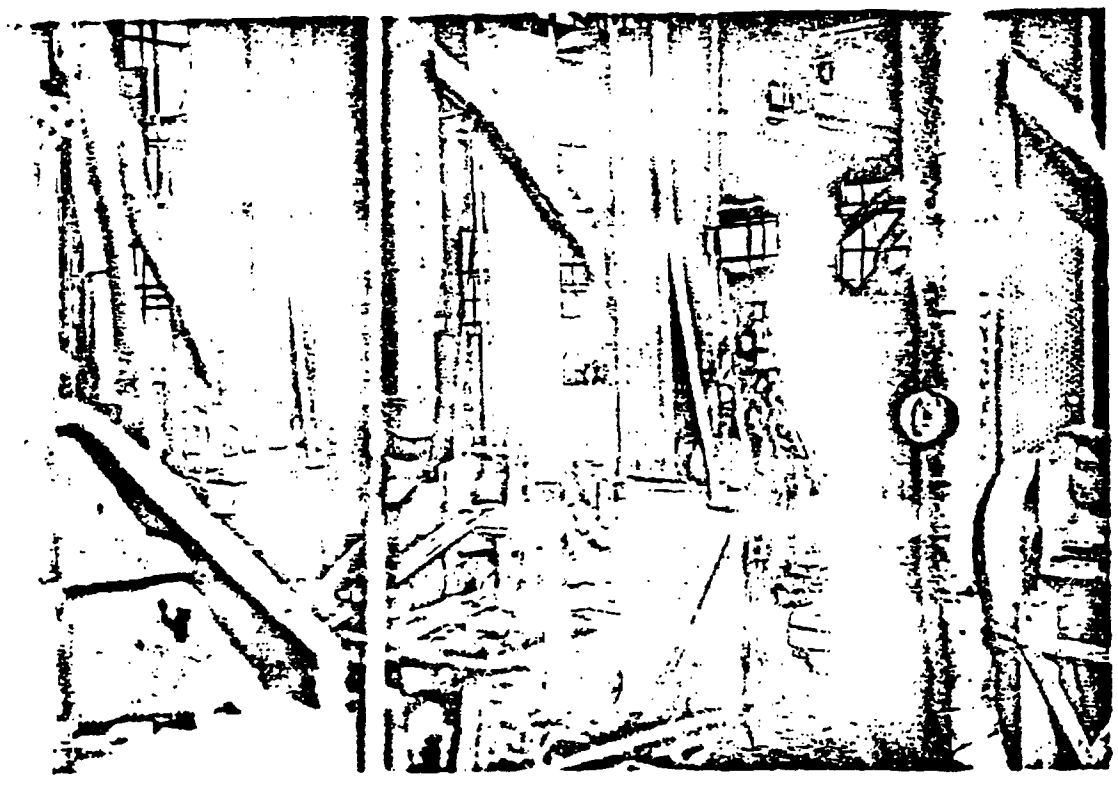
The Manhattan-Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLE NO. 7
Dept. 53

Cutting operation with carborundum wheel;
cutting wet process brake lining to length

The Manhattan-Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLE NO. 8
Dept. 53

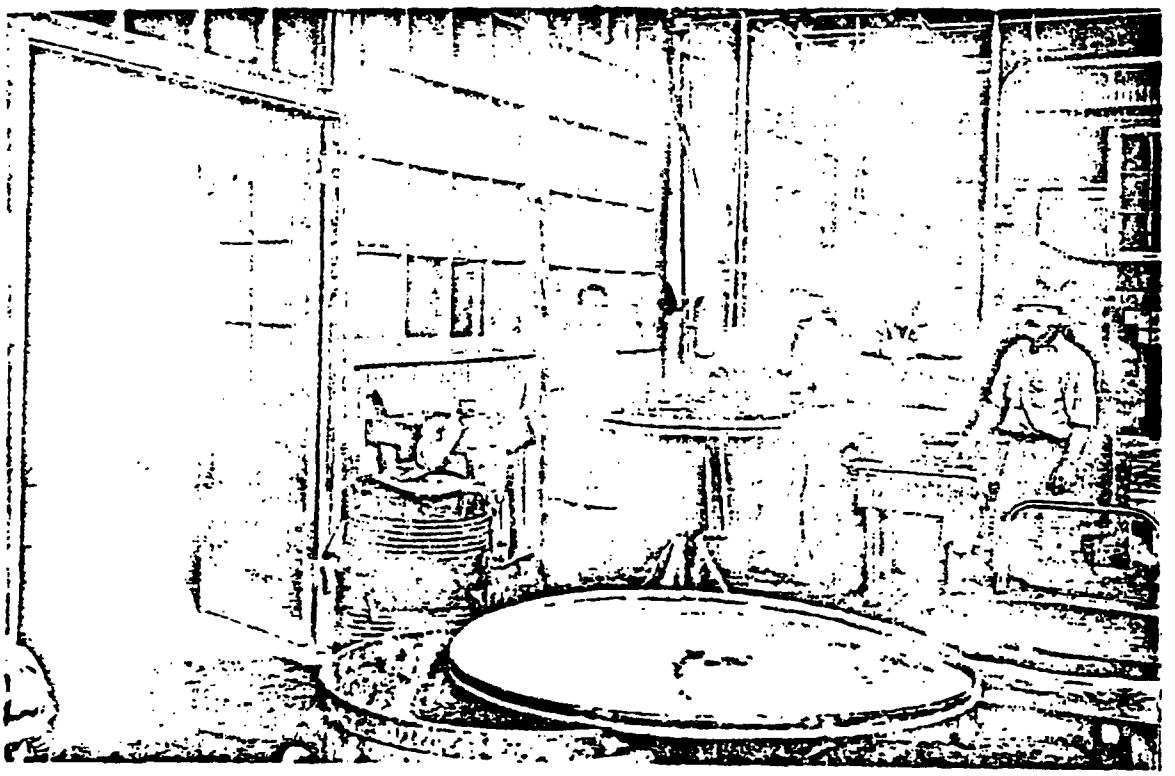
Gardner surface grinder #2, machine #1510
dry process lining

The Manhattan Rubber Mfg. Div.

SAMPLE NO. 9
Dept. 53

Circular grinder while grinding inside surface of brake lining

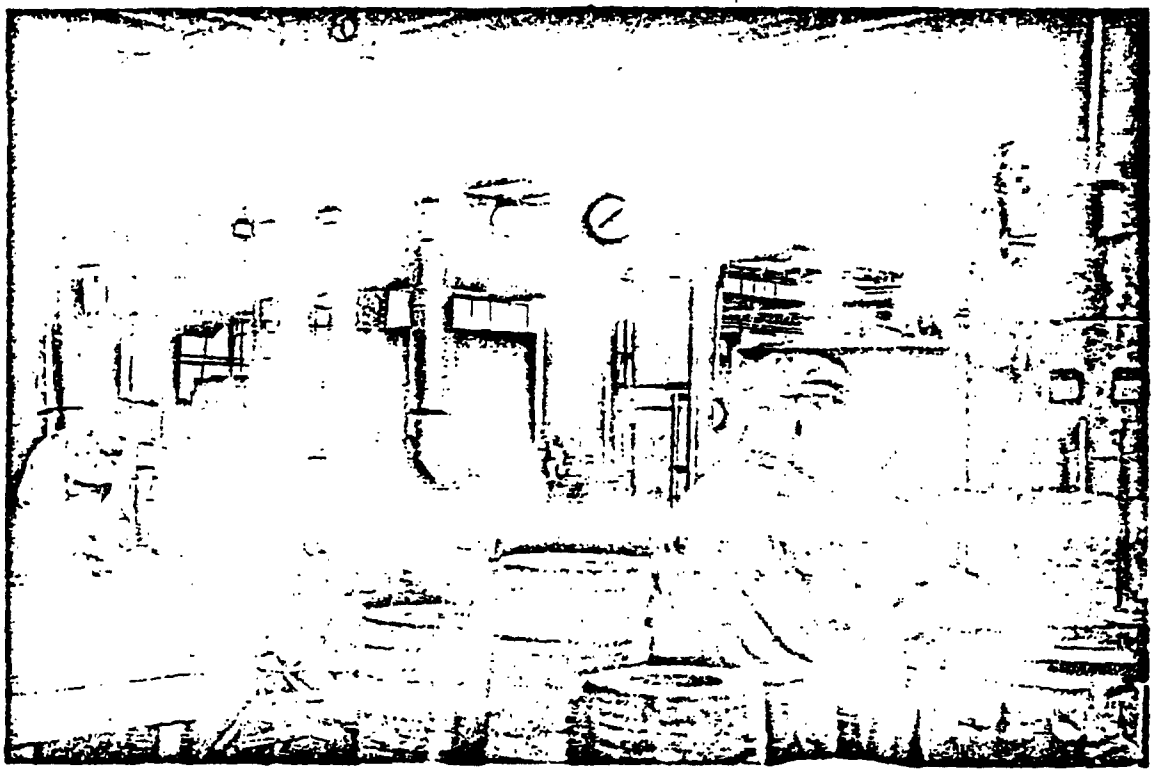
The Manhattan Rubber Mfg. Div.



SAMPLE NO. 14
Dept. 51

Panning rubber tubing

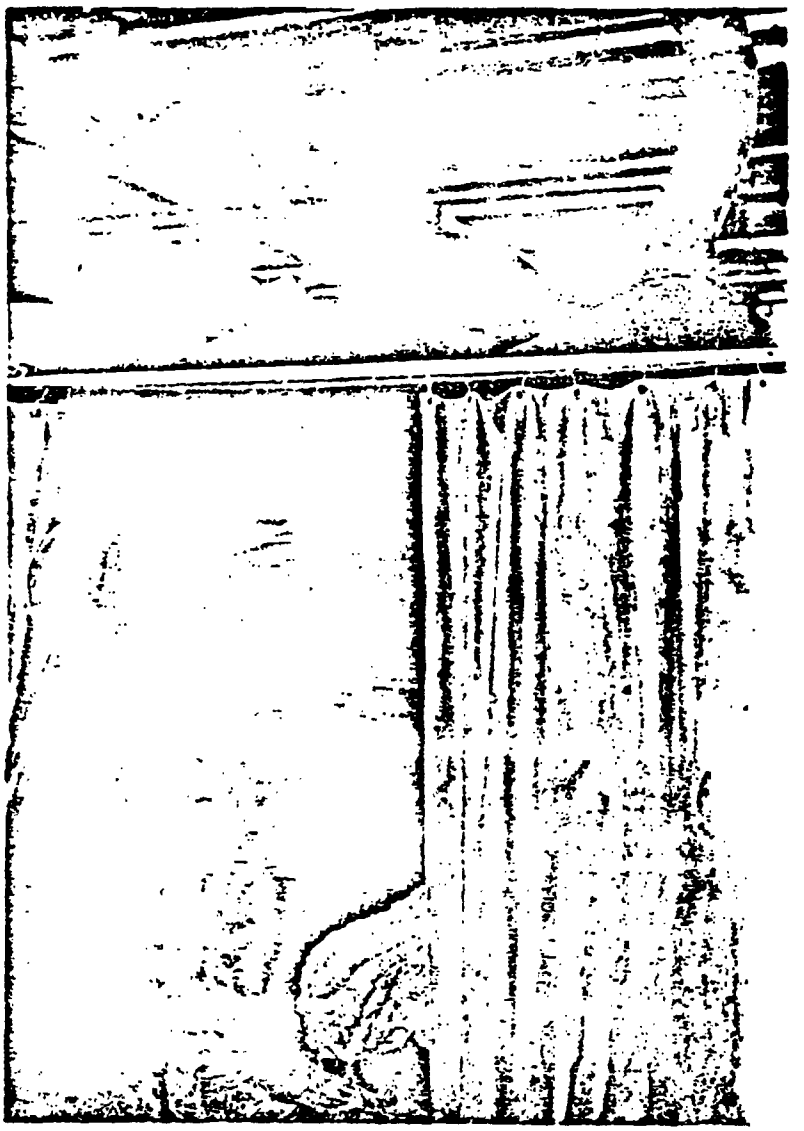
The Manhattan-Rubber Mfg. Div,
of Raybestos-Manhattan, Inc.



SAMPLES NO. 16 and 17
Dept. 39

Grinding clutch facing

The Manhattan-Rubber Mfg. Div.
of
Raybestos-Manhattan, Inc.

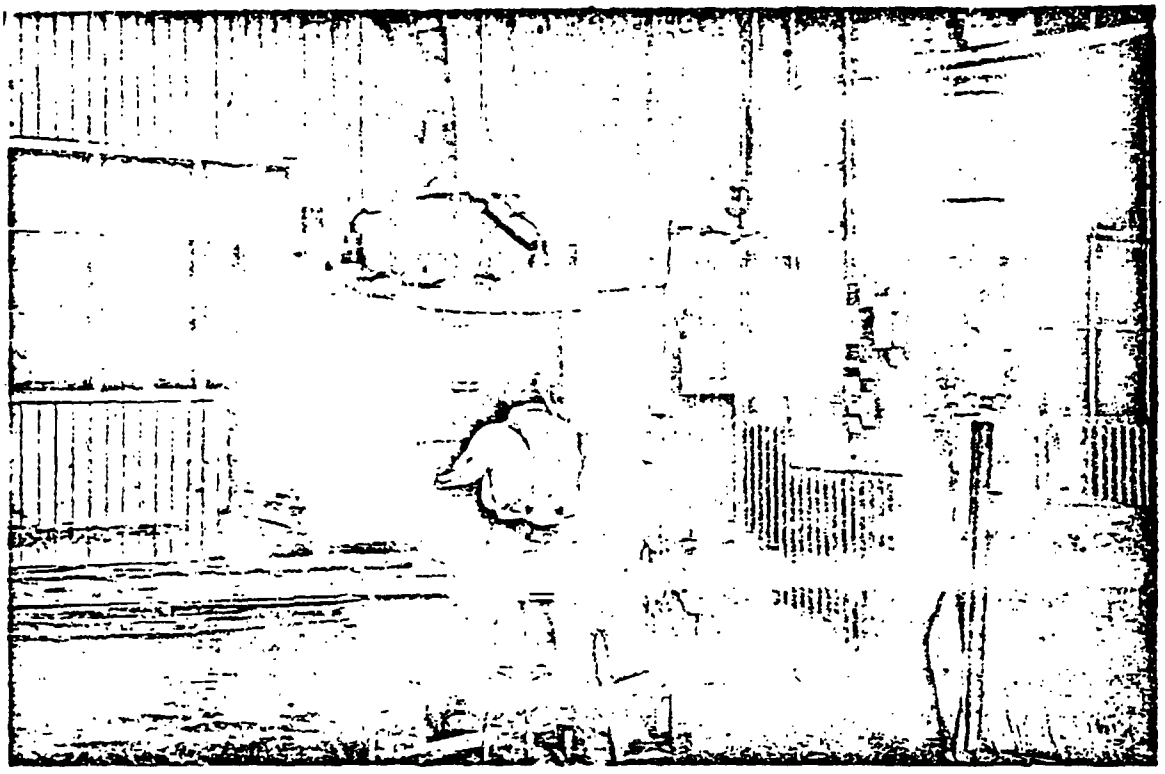


SAMPLE NO. 40

Dept. 53-T

Weighing rubber for wet process mixture

The Manhattan-Rubber Mfg. Div. of
Raybestos-Manhattan, Inc.



SAMPLE NO. 15
Dept. 39

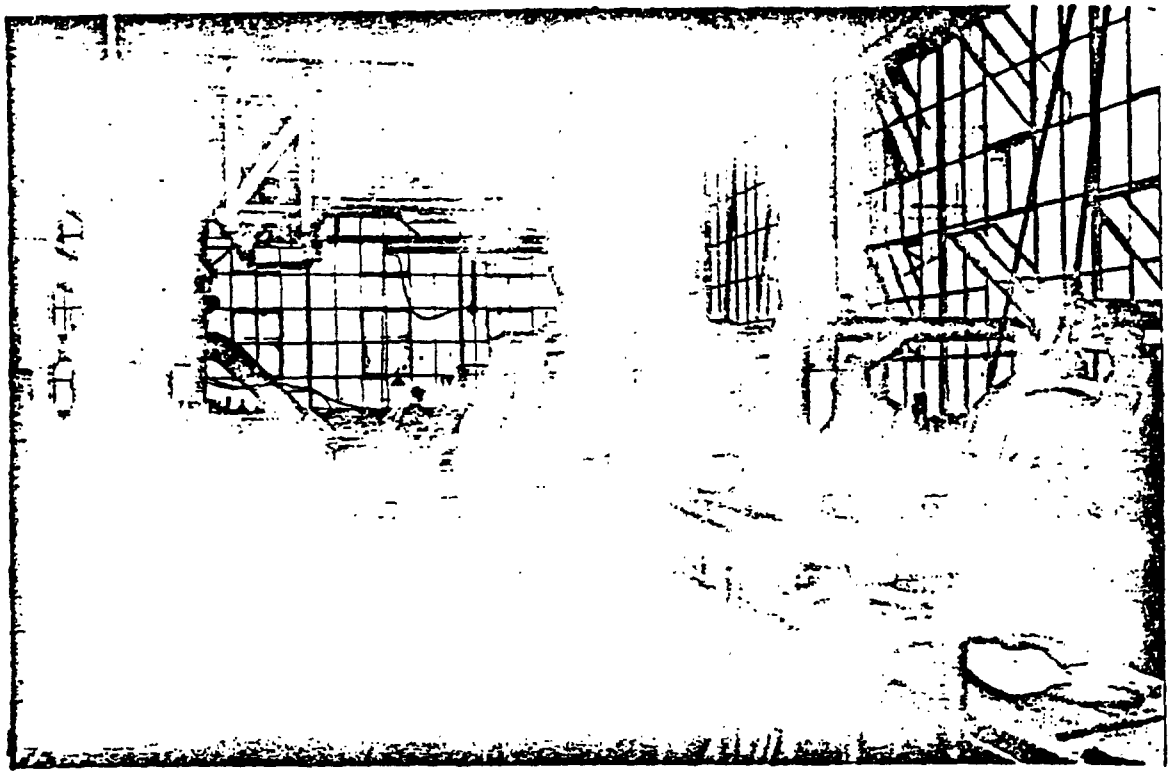
Sandblasting molds for pressing
clutch facings

The Manhattan Rubber Mfg. Div.

SAMPLES NO. 18 and 19
Dept. 39

Punching clutch-facing material out of asbestos cloth

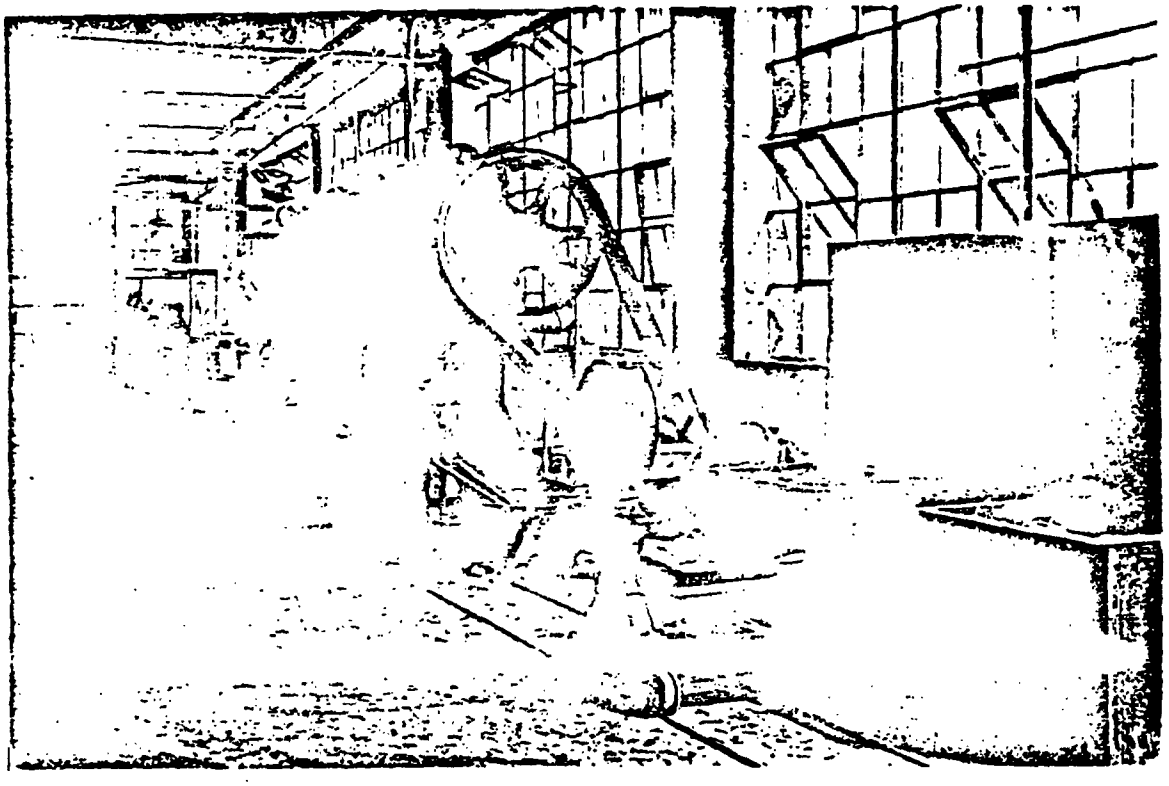
The Manhattan Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLES NO. 31, 32,33
Dept. 2

Truing abrasive wheels

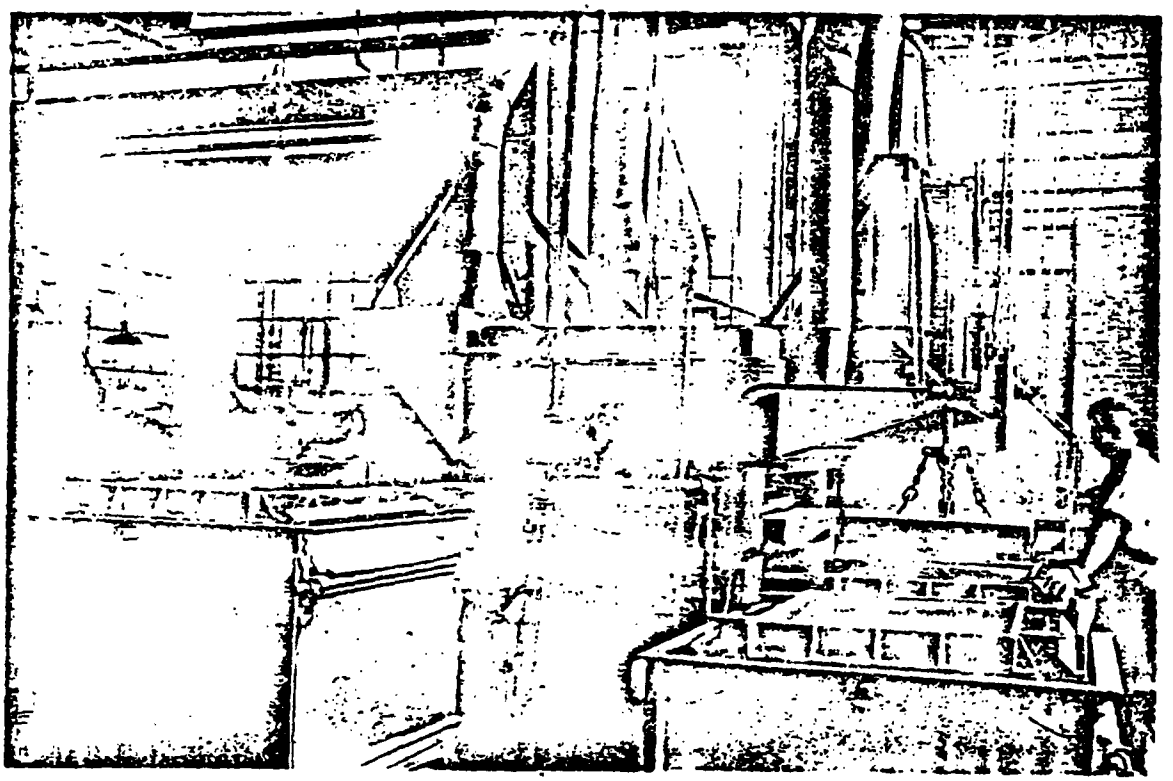
The Manhattan Rubber Mfg. Div.
of Raybestos-Manhattan,Inc.



SAMPLE NO. 34
Dept. 2

Batch mixing for abrasive wheels

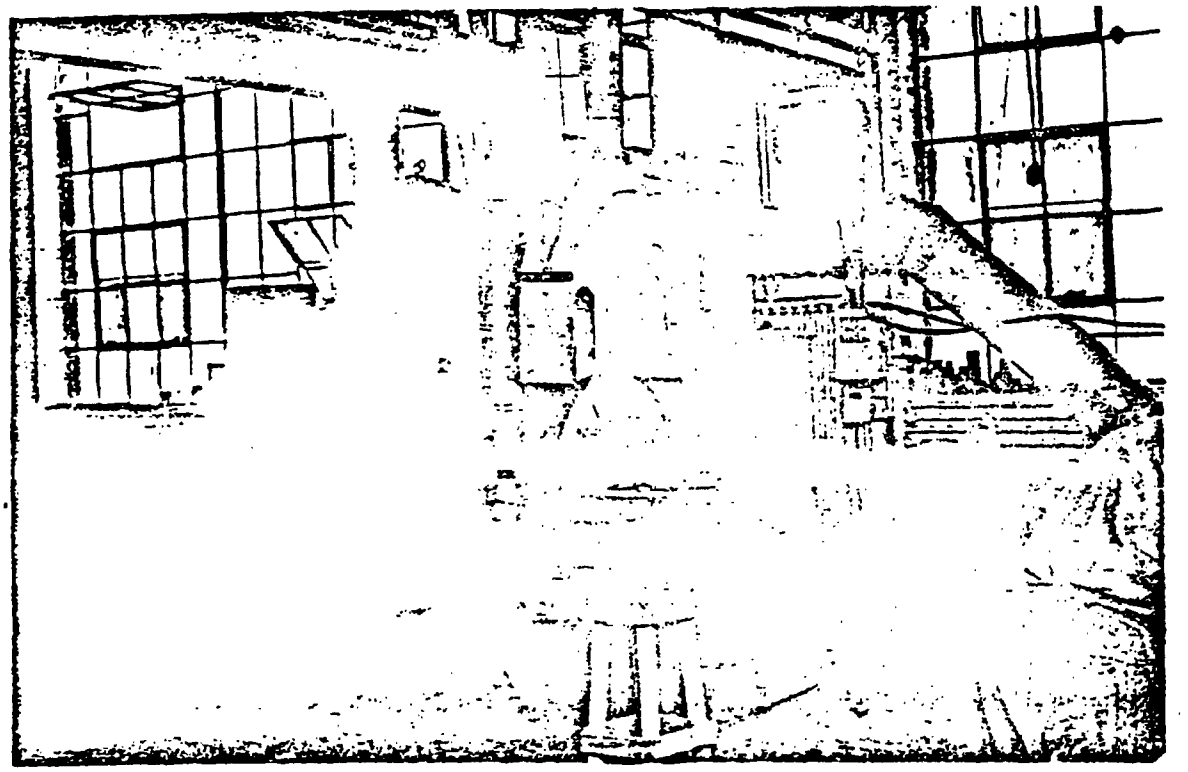
The Manhattan Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLE NO. A1
Dept. 53

Weighing and pressing dry process brake lining

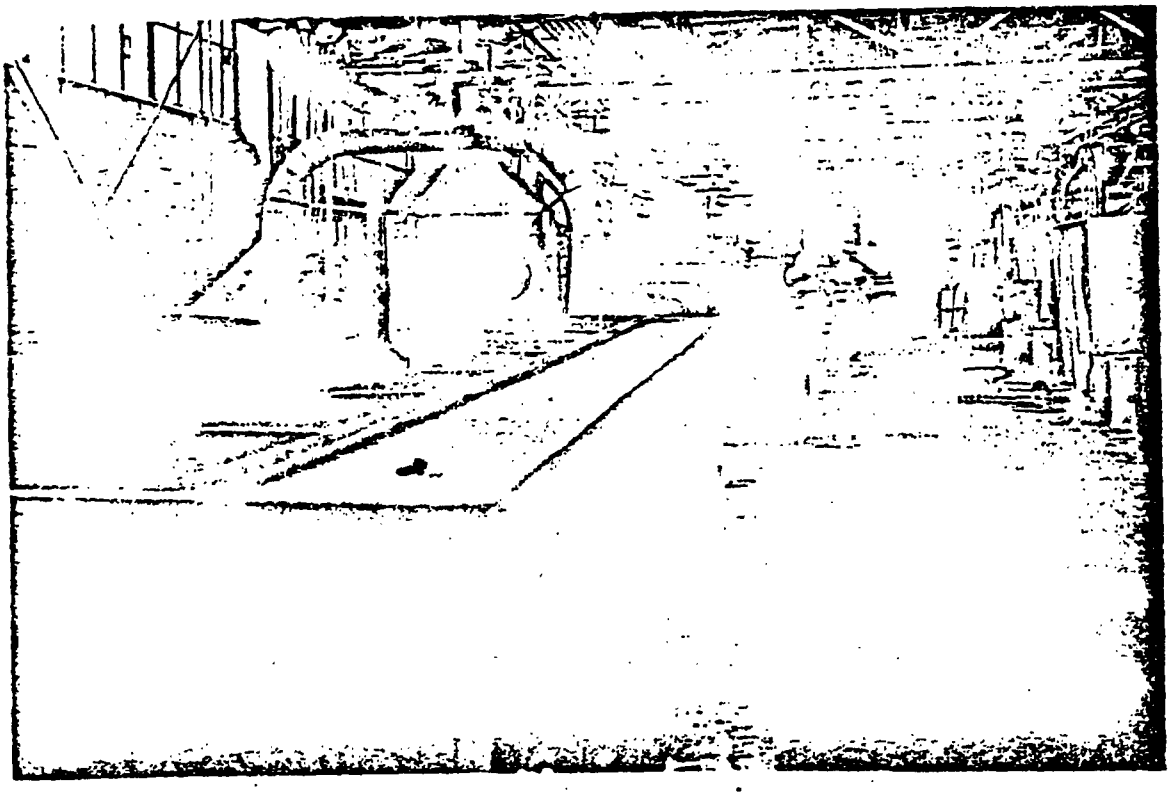
The Manhattan Rubber Mfg. Div.



SAMPLE NO. 30
Dept. 2

Grinding bores on abrasive wheels, machine #1558

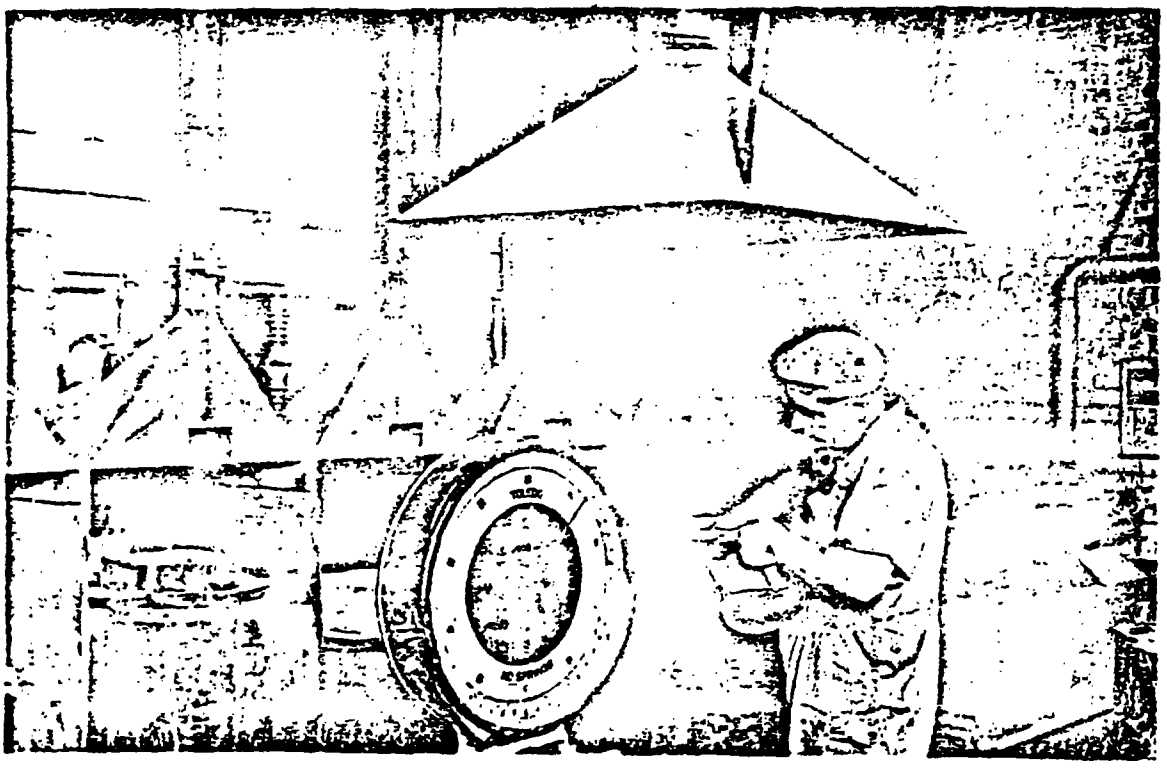
The Manhattan Rubber Mfg. Div.



SAMPLE NO. 42
Dept. 53-T

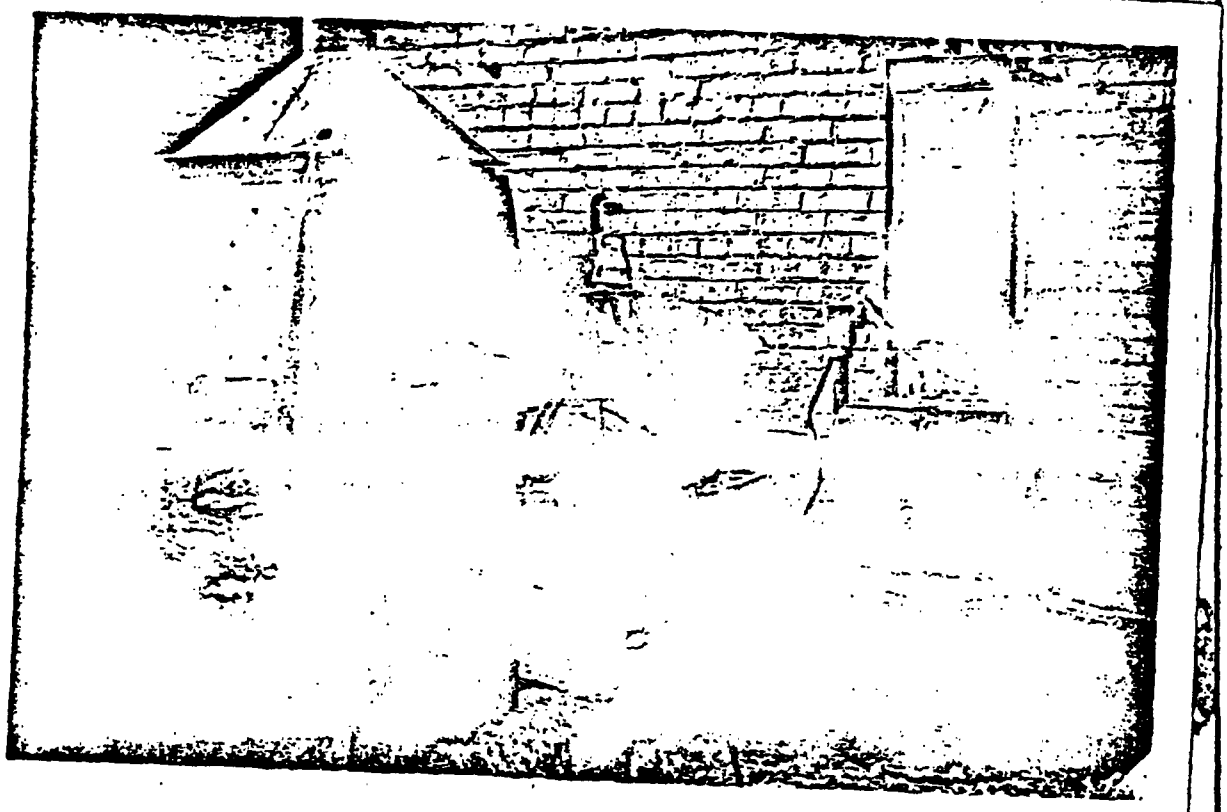
Weighing materials for wet process brake lining mixture

The Manhattan Rubber Mfg. Div.



SAMPLE NO. A3
Dept. 53T
In mixing room during time a mix was prepared and put into mixer. Clutch facing mix for Dept. 39

The Manhattan Rubber Mfg. Division
of
Raybestos-Manhattan, Inc.



SAMPLE NO. 44
Dept. 53T

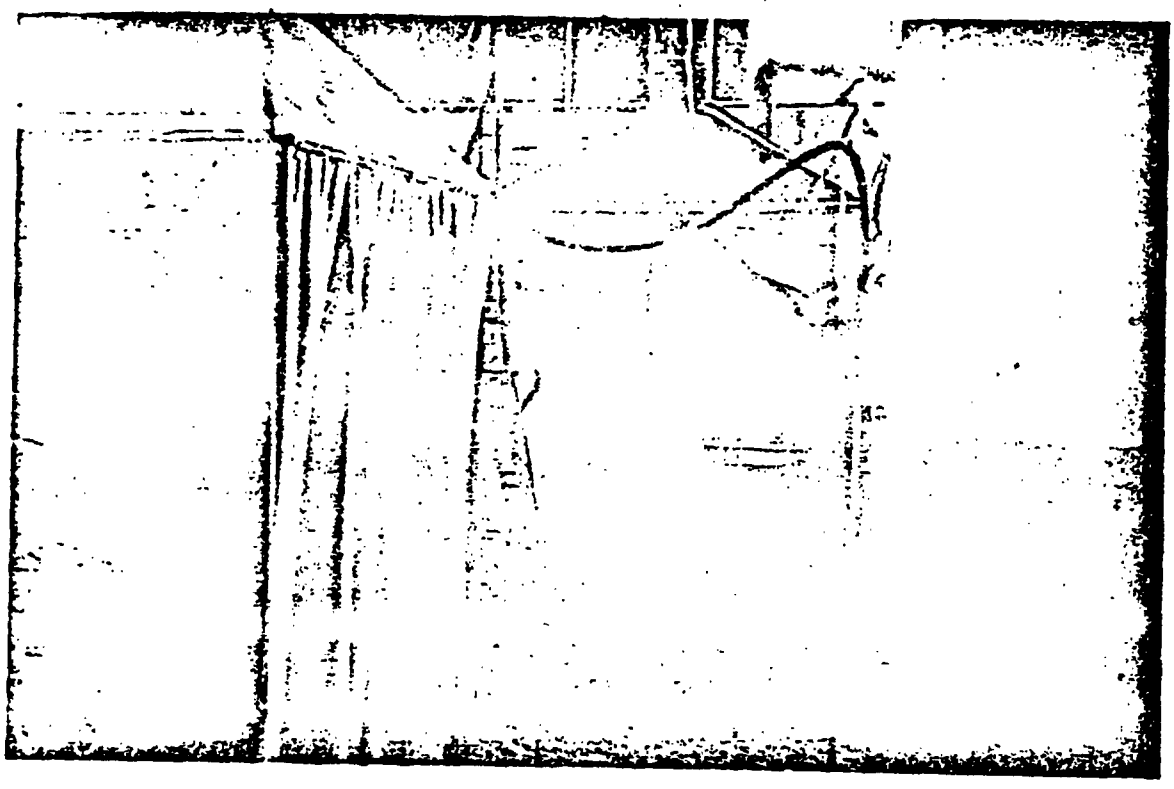
At hammer mill

The Manhattan-Rubber Mfg. Div.

SAMPLES NO. 45 and 46
Dept. 53T

At hopper of picker and at shaker screen

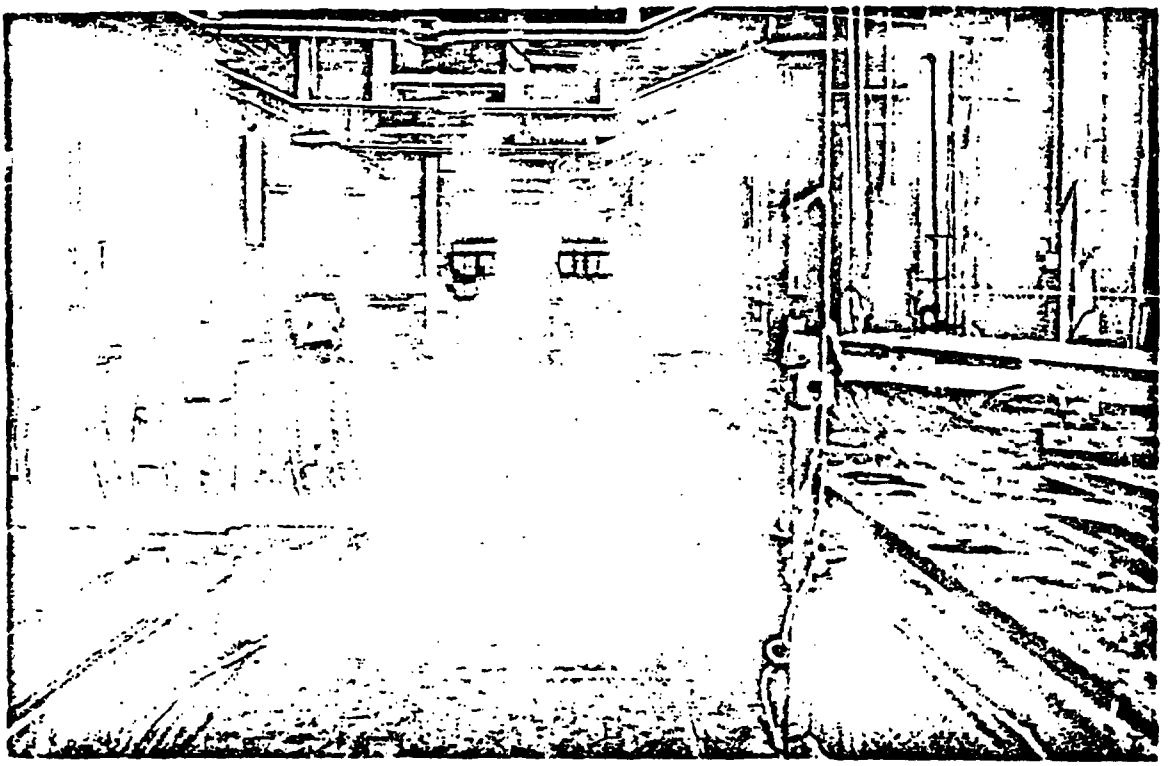
The Manhattan Rubber Mfg. Div.



SAMPLE NO. 47
Dept. 53-T

Between two baggers

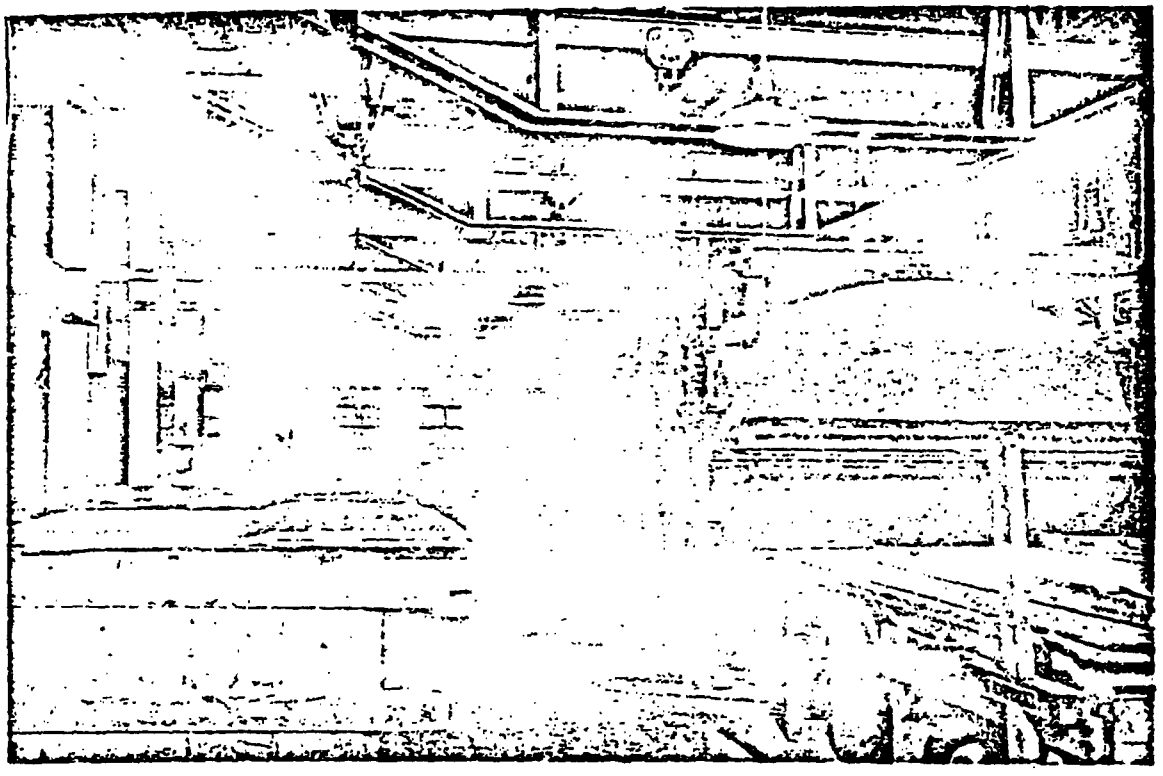
The Manhattan-Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLE NO. 18
Dept. 8

General air - taken near belting winder - - east end

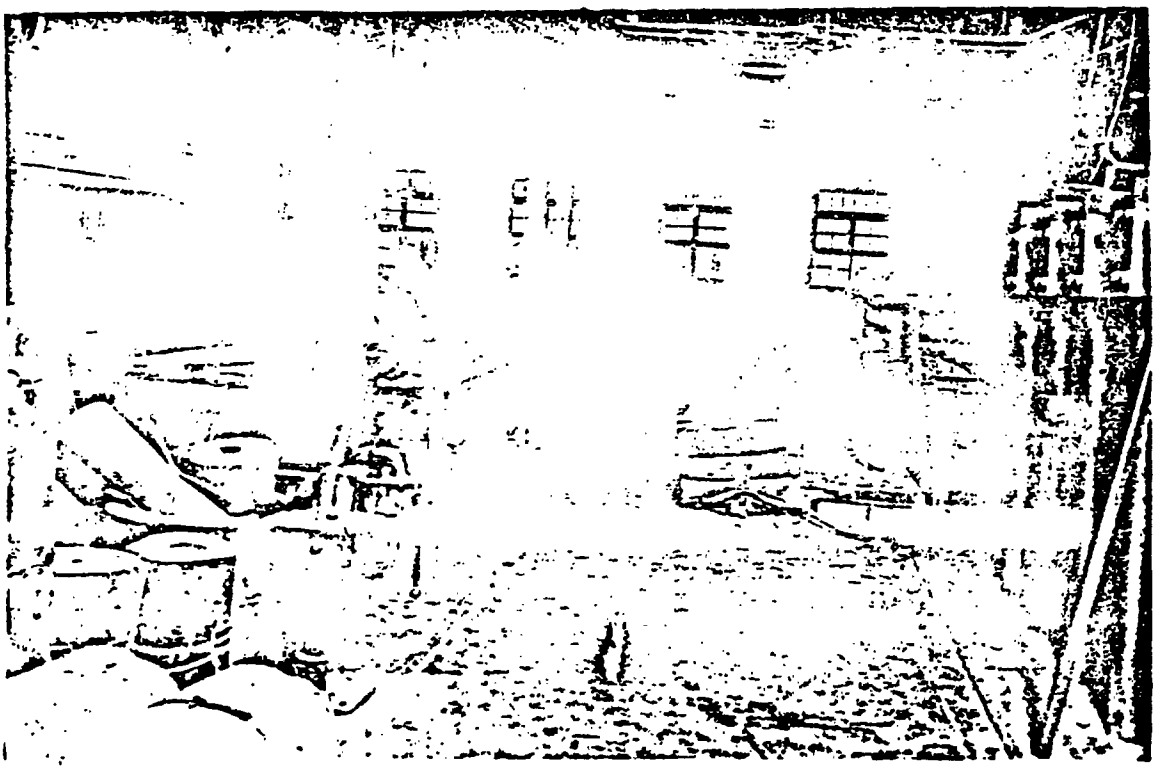
The Manhattan Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLE NO. 49
Dept. 26

General air sample taken at Press #16

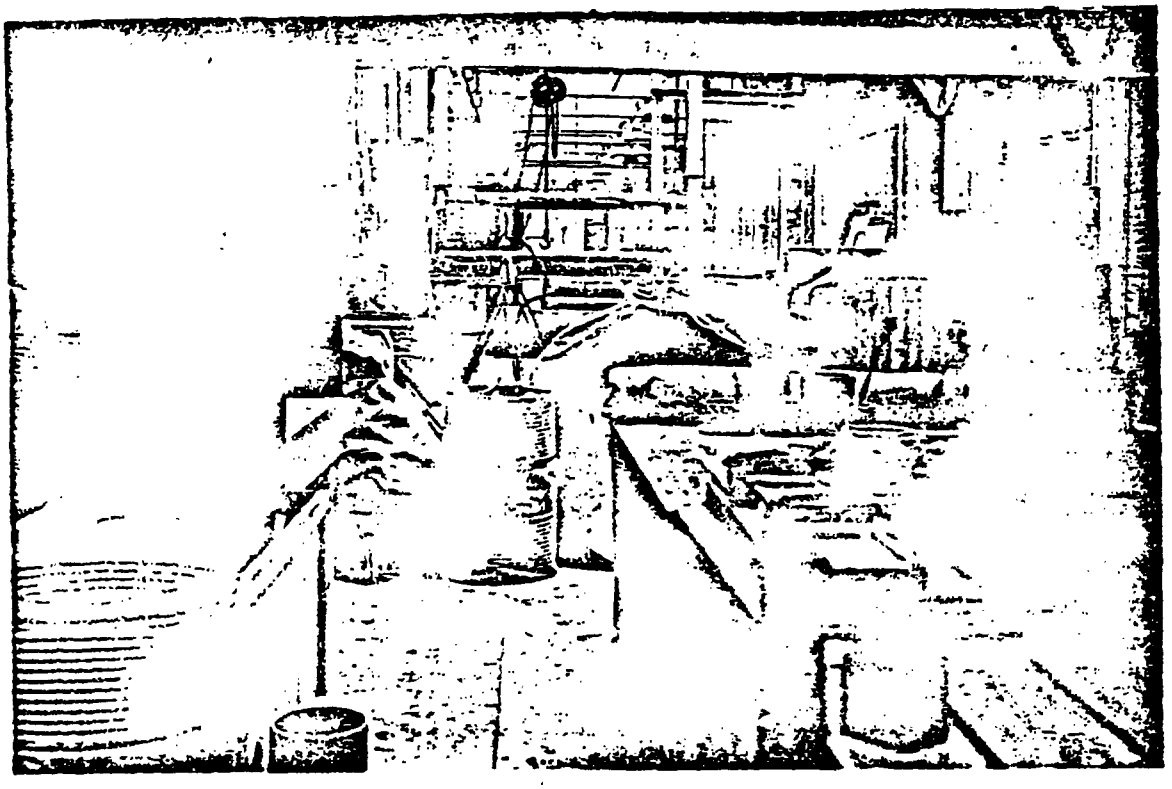
The Manhattan Rubber Mfg. Div.
of
Raybestos-Manhattan, Inc.



SAMPLE NO. 50
Dept. 26

General air sample taken at west end
of gum cutting table

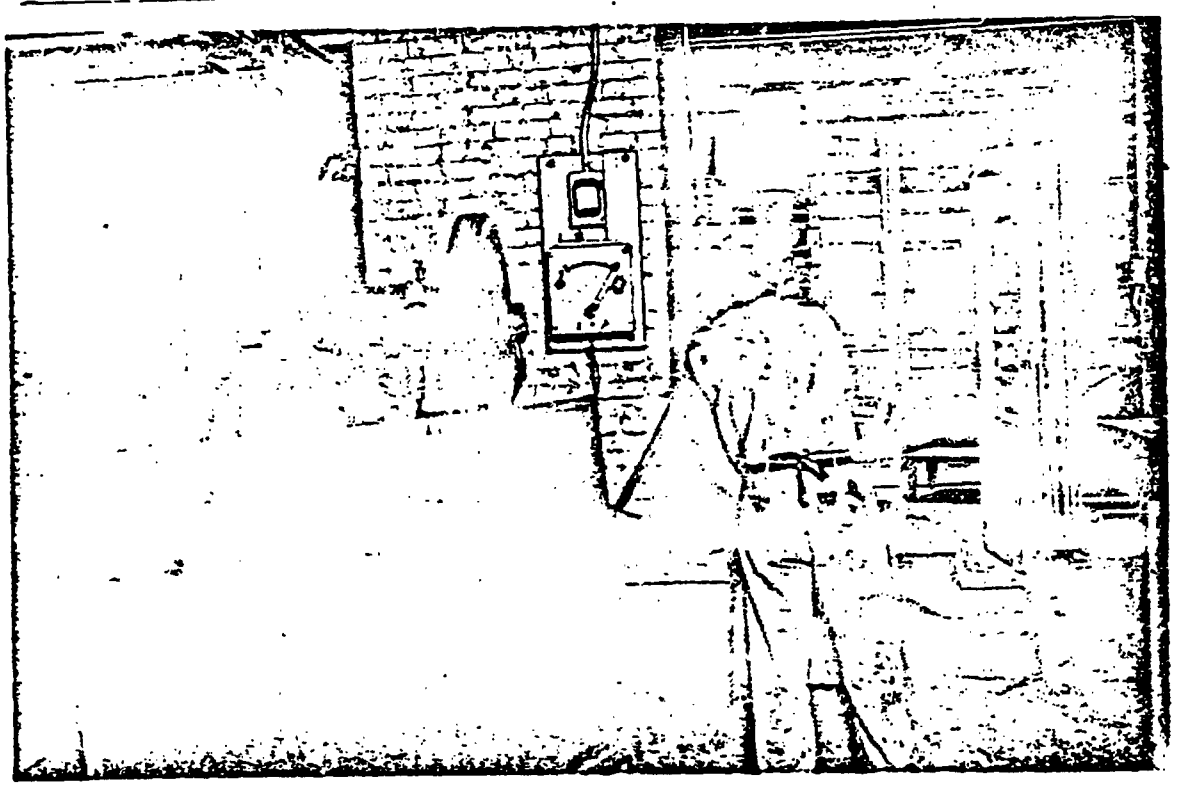
The Manhattan-Rubber Mfg. Div.
of
Raybestos-Manhattan, Inc.



SAMPLE NO. 51
Dept. 8A

General air taken in belt press room

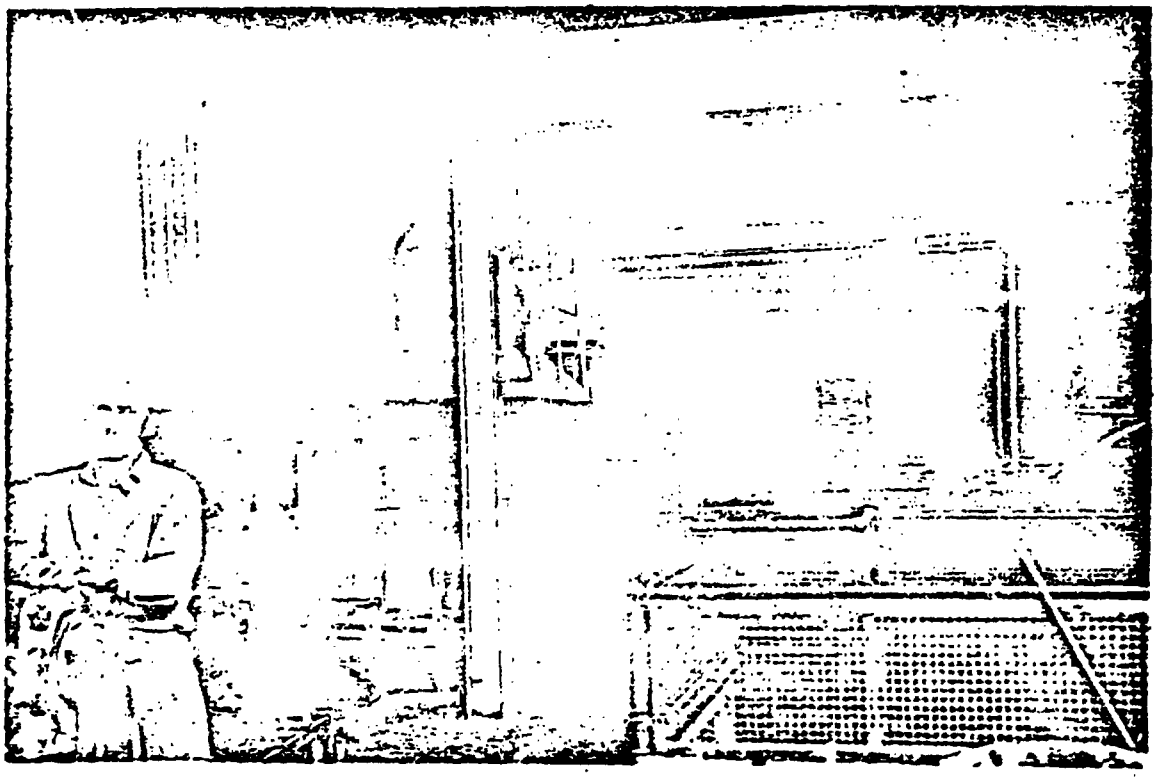
The Manhattan-Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLE NO. 52
Dept. 8

Cutting brake lining to length; power shear
#1382

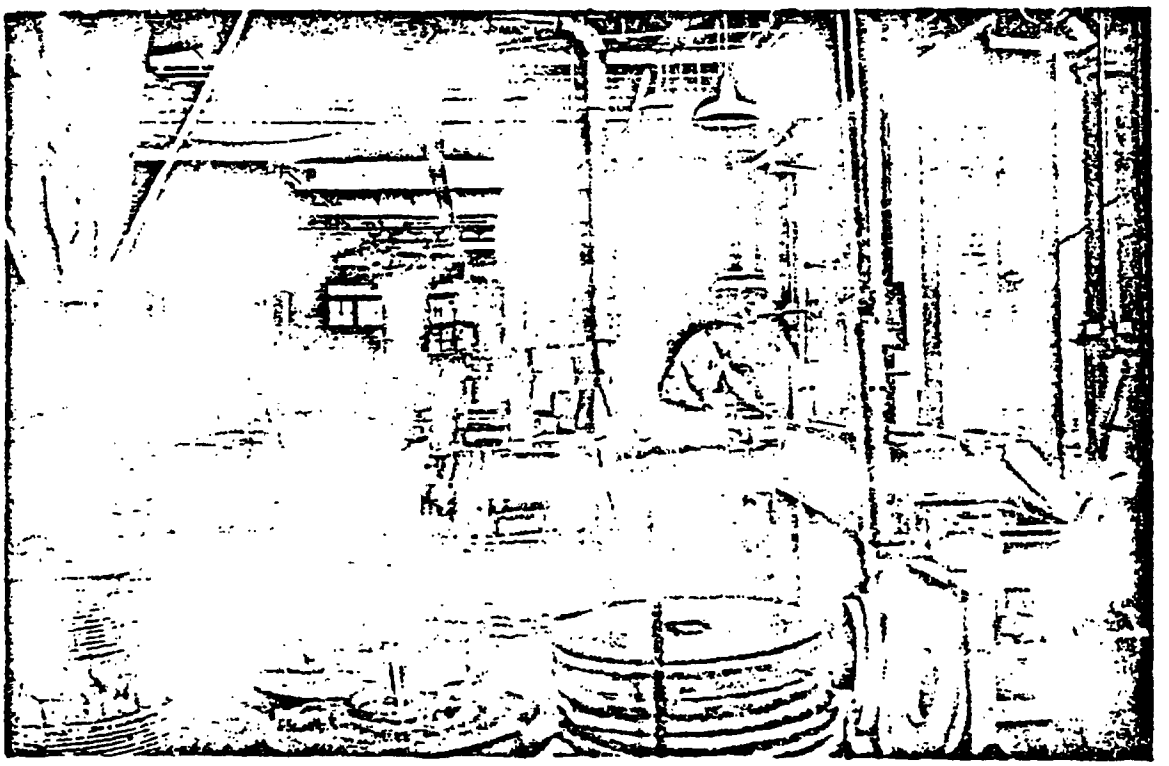
The Manhattan Rubber Mfg. Div.



SAMPLE NO. 53
Dept. 1

General air; rubber mills, east end, two mills #1343 and 1344 - cleaning process for raw rubber

The Manhattan Rubber Mfg. Div.
of Raybestos-Manhattan, Inc.



SAMPLE NO. 55

Dept. S-A

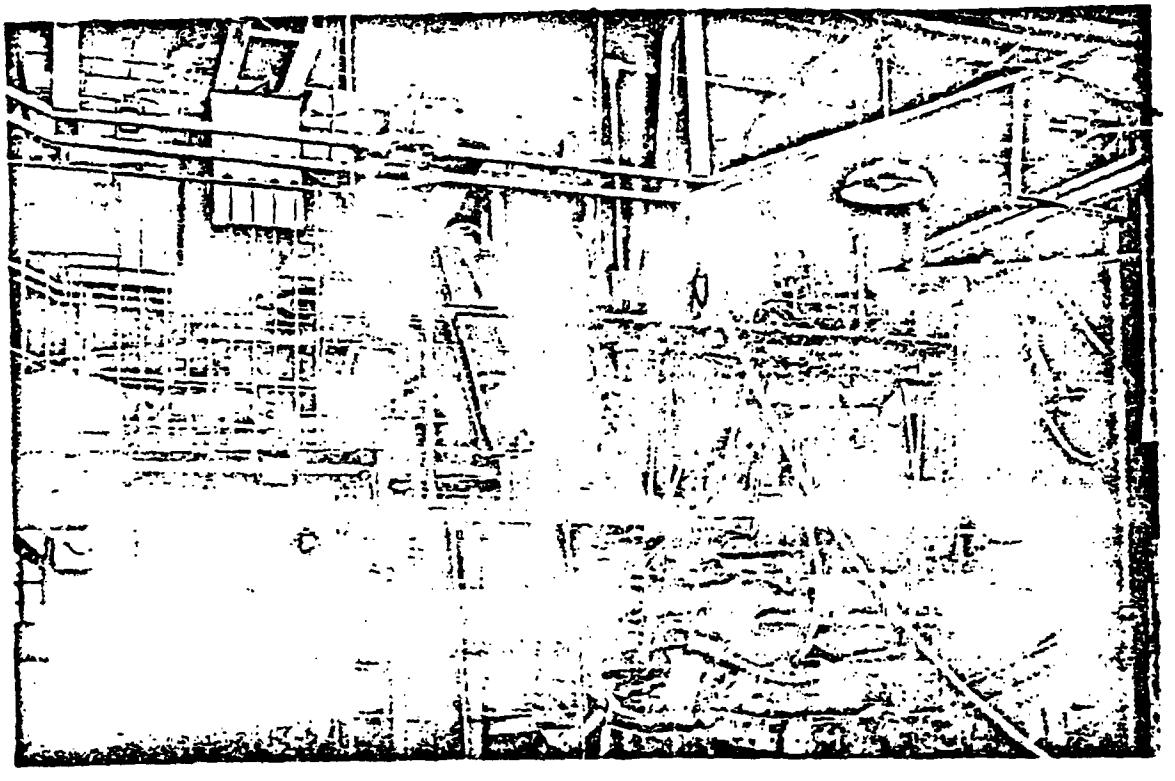
Grinding, reeling and measuring brake lining,
machines #1689 and
#1690

The Manhattan-Rubber Mfg.
Div. of Raybestos-Manhattan, Inc.

SAMPLES NO. 56 and 60
Dept. 1

Rubber compounding mills #128, 129 & 130

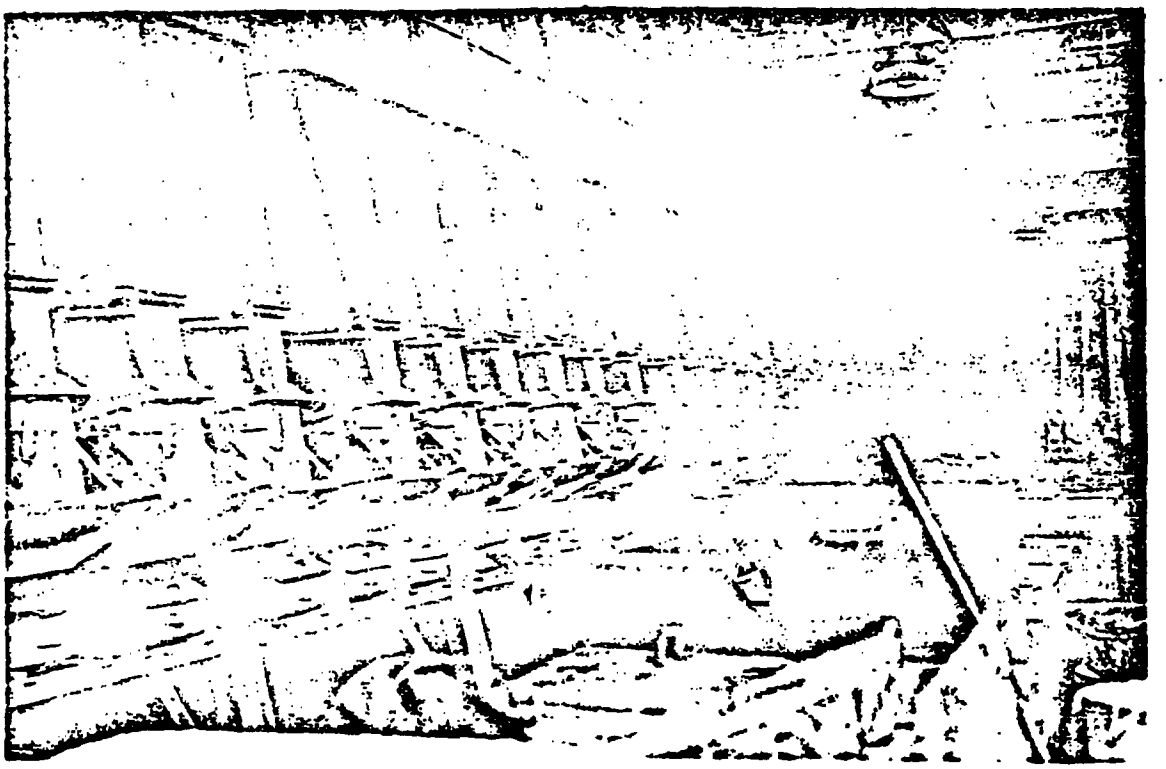
The Manhattan-Rubber Mfg. Div.
of
Raybestos-Manhattan, Inc.



SAMPLE NO. 58
Dept. 1

On platform of Banbury mixer #1

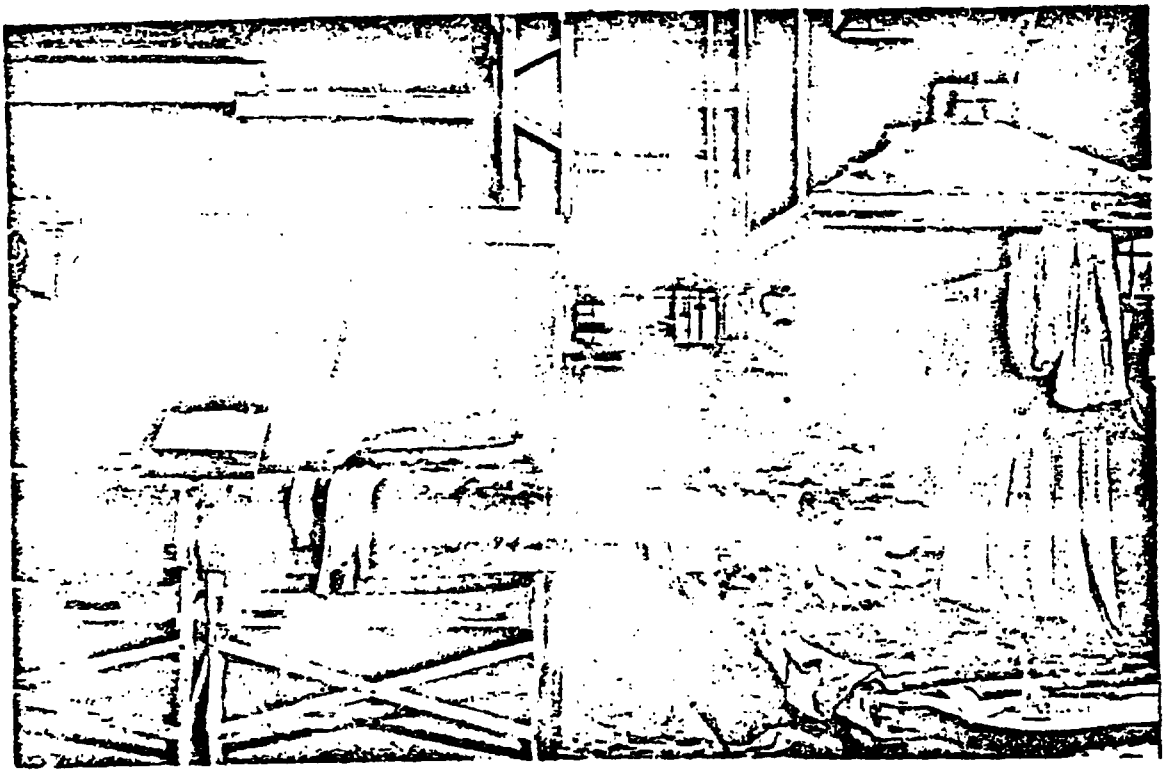
The Manhattan-Rubber Mfg. Division
of
Raybestos-Manhattan, Inc.



SAMPLE NO. 61
Dept. 1

Mixing batches of compound from hoppers

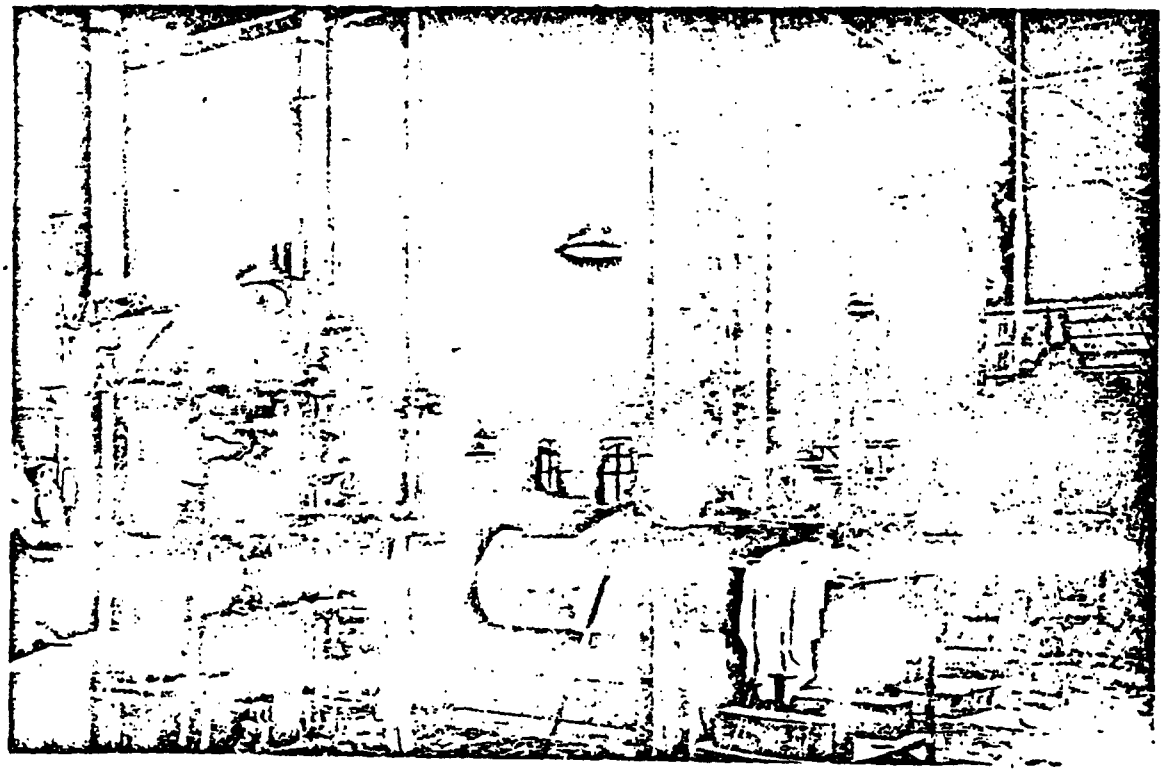
The Manhattan-Rubber Mfg. Division
of
Raybestos-Manhattan, Inc.



SAMPLE NO. 63
Dept. 1

At discharge end of conveyors from rubber compounding mills. Two men taking rubber off conveyor

The Manhattan-Rubber Mfg. Div.
of
Raybestos-Manhattan, Inc.



SAMPLE NO. 66
Dept. 11

Rubber compounding mill #74 and
friction calender

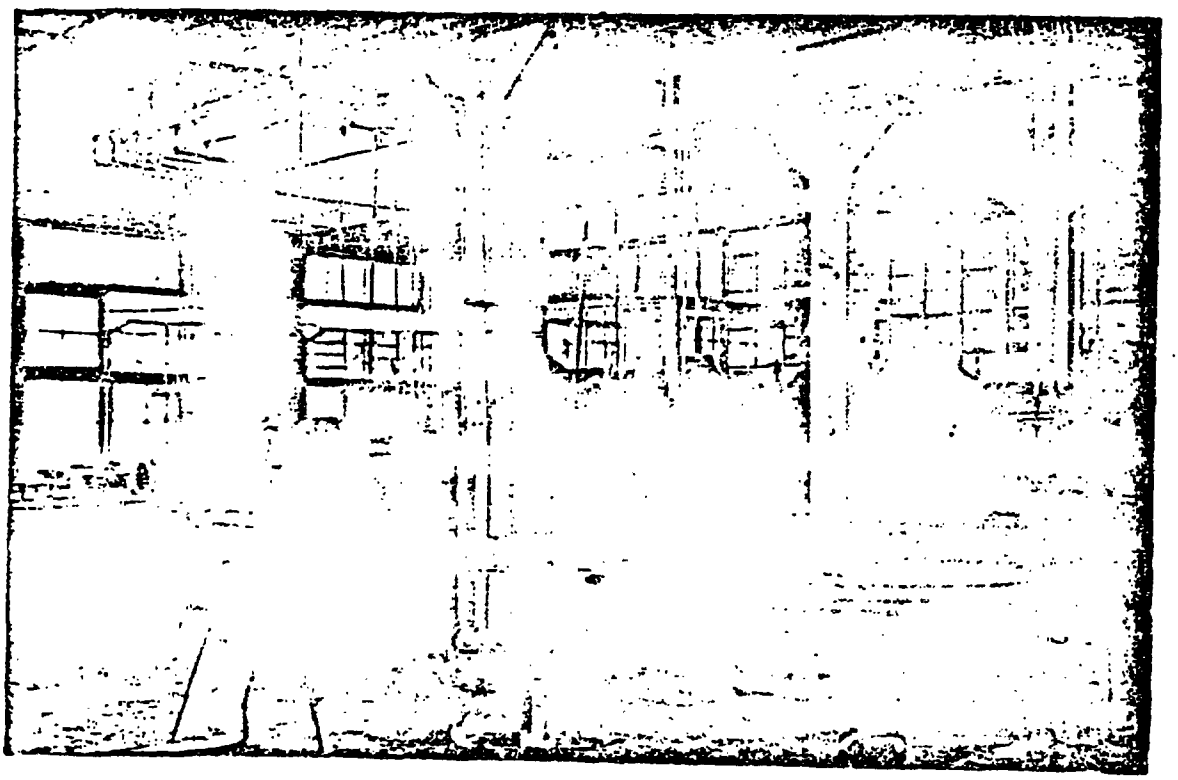
The Manhattan-Rubber Mfg.
Div. of Raybestos-
Manhattan, Inc.

SAMPLES NO. 80 - 84

Dept. 5 - Balcony

Grinding and sanding rubber

The Manhattan-Rubber Mfg.
Div. of Raybestos-Man-
hattan, Inc.



SAMPLE NO. 87
Dept. 5 West End Room

General air sample between three machines
panning and reeling rubber tubing

The Manhattan-Rubber Mfg. Div.
of
Raybestos-Manhattan, Inc.