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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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 (N-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, 21, 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

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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 ensure 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 agare-

(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.

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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.

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
1	Insul. [illegible] saw man, Carrier surface grinder, [illegible]	9/22/36	37.0	1.4	1.3	0.0006	0.01	0.1	Asbestos Lead	Dry process brake lining; exhaust system
2	Mill plower - cutting brake lining out of pressed sheet	"	36.4	1.4	1.3	0.0006	0.01	0.1	"	Exhaust system; one man
3	Grinding dry process lining to width, disc grinder, emeries [illegible]	"	33.9	1.3	1.4	0.0010	0.04	0.4	"	Exhaust system; door open at time of sampling; one man
4	Covering of [illegible] with wet process lining after baked in a heated [illegible]	"	2.5	16.0	14.4	0.0056	0.28	2.8	"	2 men
5	General air; inspecting brake linings	"	28.4	1.8	1.6	0.0071	0.27	0.7	"	5 men
6	Grooving ends of brake [illegible] lining, with abrasive wheel	[illegible]	28.2	1.7	1.5	0.0025	0.02	0.2	"	1 man; exhaust system [illegible]
7	Cutting wet process lining [illegible] to length with abrasive wheel	"	29.0	1.8	1.6	0.0022	0.07	0.7	"	1 man; exhaust system
8	At [illegible] surface grinder [illegible] service disks, dry process brake [illegible]	"	33.0	2.9	2.6	0.0025	0.09	0.9	"	1 man; exhaust system
9	Grinding [illegible] surface of dry process lining	"	19.3	2.8	2.5	0.0022	0.01	0.1	"	Horizontal wheel; one man; exhaust system
27	At surface grinder #18.6 continuous process; wet process lining	9/27/36	29.5	1.9	1.7	0.00078	0.035	0.35	"	At discharge end; exhaust system
28	Same as grinder #1?? wet process lining on resin, grinding wheel	"	30.0	2.7	2.4	0.0019	0.07	0.7	"	Lining goes through into grinder before going into grinder direct exhaust system
29	Grinding and [illegible] dry process lining	9/28/36	24.0	1.7	1.5	0.0055	0.12	1.2	"	Two men; exhaust needs
10	Inside at General air; friction and inspection of finished rubber products	9/25/36	32.0	1.6	1.4	0.0029	0.03	0.3	Rubber Lead	
11	General air, steam press room	"	33.9	1.8	1.6				Rubber	Molding rubber products
12	Forcing and [illegible] compound rubber	"	33.2	2.4	2.2				Rubber	Two men
13	Insul. #2: General air; [illegible] platens	9/25/36	44.9	1.8	1.6	0.0017	0.07	0.7	Rubber	
14	Insul. #2: Forcing rubber lining from lining and tin	"	38.5	2.8	2.6				Soapstone	Two men
24	At rubber cementing mill	9/27/36	39.1	2.9	2.6	0.0038	0.03	0.3	Fullers, [illegible], drilling, wheel flour, hydrochloride, [illegible], lead (at times)	
25	Insul. #2: at scrubbing [illegible] for clutch facing	9/28/36	27.2	1.8	1.6				Lead	One man; dress from outside cabinet
16	Grinding clutch facings, Besly grinder	"	29.4	1.9	1.7				Asbestos	Two man; exhaust system

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17	Grinding clutch facings 9/25/36 Blanchard machine #[illegible]		24.2	4.96	4.4				Asbestos rubber	One man; exhaust system
18	Forming clutch facing stock out of asbestos cloth treated with rubber	"	28.2	1.6	1.4				"	One man
19	At F & D Powergrace punching holes in clutch facing stock, tool #1482	"	28.3	2.5	2.2				"	
20	General air; inspection of clutch facing	"	36.9	4.9	4.4				"	Five men
21	Stripping and filling holes for clutch facing	"	36.9	2.9	2.8				"	Two men
22	Grinding clutch facing on Gardner grinder #1712	"	18.2	3.5	3.1				"	One man; exhaust system
23	At operator's position on grinding machine; cloth folded and circled	9/27/36	57.5	0.52	0.49				"	
24	Locs. 7 and 17: General air	9/26/36	30.9	1.4	1.3	0.0004	0.01	0.1		
25	Locs. 2: Batch weighing and mixing for abrasive wheels, mill 8	9/27/36	10.3	11.3	10.6	0.0147	1.37	13.7	Carbon, sulphur, resin, litharge; asbestos rubber - one man, covered	
27	At Bartlett pot; Bartlett used for mixture of abrasive wheels	"	37.8	—	—	0.0008	0.03	0.3	Lead	One man; exhaust hood; no goggles
30	Grinding burrs on abrasive wheels, machine #1[illegible]8	"	32.8	8.1	7.6	0.0016	0.16	1.6	Carbon, sulphur, Lead, resin asbestos - one man; exhaust system	
31	Truing outer diameter of abrasive wheels, lathe #[illegible]3	"	31.7	4.0	3.8	0.0074	0.26	2.6	" " " "	
32	Truing and smoothing sides of abrasive wheels, lathe #[illegible]4	"	32.1	3.2	3.0	0.0017	0.06	0.6	" " " "	
33	Truing abrasive wheels machine #1[illegible]3	"	30.9	5.2	4.9	0.0009	0.03	0.3	" " " "	
34	Batch mixing for abrasive wheels	9/28/36	44.6	30.0	28.0	0.1009	3.56	35.6	Carbon, sulphur, Lead, resin asbestos; two batches mixed; 17 lbs. Lead used - colored man	
35	Abrasive wheel molding machine #1[illegible]5	"	49.5	2.3	2.2	0.000			Carbon, sulphur, Lead, resin asbestos - size wheel 16 x 2 x 4- one man	
36	Truing abrasive wheels machine #1[illegible]4	"	24.0	7.0	6.6	0.0049	0.17	1.7	Carbon, sulphur, Lead, resin asbestos - exhaust system - one man	
37	General air; cut-off wheel room; air credit used	"	42.1	1.4	1.3				Resin - exhaust hoods over mixing barrels	
38	General air; mixing material for abrasive wheels and molding wheels	"	31.4	2.5	2.4	0.0003	0.01	0.1	Carbon, sulphur, Lead, asbestos, resin	
39	Locs. 4[illegible]: Dry mixture taken from mixer on chute and put into box cart	"	31.9	3.3	3.1	0.0036	0.13	1.3	Rubber, Lead, resin, asbestos, sulphur - exhaust hood over cart and opening in mixer; one man, Silicon silica respirator	
40	Weighing up rubber for wet process mix	"	14.6	4.1	3.8				Asbestos - one man working under exhaust hood	
42	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 - Silicon respirator	
43	In mixing room during mixing up of mix for clutch facings; dry process	"	65.3	2.8	2.6	0.0112	0.40	4.0	Rubber, resin free dept. No lead, carbon, resin, sulphur two men, Silicon respirators	
44	In small room at hammer-mill	10/[illegible]/36	33.7	5.1	4.7				Asbestos - one man, exhaust hood, Silicon respirator - asbestos on floor	
45	At hopper of picker	"	30.6	9.3	8.2				Asbestos - one empties bags of asbestos into hopper	
46	At picker screen back of picker	"	33.0	8.6	7.7				Asbestos - exhaust system at discharge end of picker	

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47	Between two bagging operations	10/22/34	29.4	7.3	3.1				Asbestos	Enclosed and exhausted; cloth curtains on fronts
48	Mill #: General air; east end	"	32.0	2.6	2.3	0.0018	0.065	0.65	Lead rubber	Rear belting winder
52	Cutting brake lining to length, power shear #1482	"	30.9	5.2	5.0				Asbestos rubber	2 men, asbestos woven cloth treated with rubber
66	General air; second floor	10/23/34	24.4	1.9	1.2	0.0034	0.12	1.2	Lead	
51	Mill: Mill: General air; belt press room	10/22/34	29.4	2.8	1.9	0.0014	0.05	0.5	Lead asbestos rubber	
53	Grinding, reeling and measuring brake lining	"	26.4	1.2	1.1				Asbestos rubber	Machine #1689 and 1690
49	Mill: #: General air; taken at press #16	"	41.9	6.8	6.3	0.0014	0.05	0.5	Lead rubber	
50	General air; taken at gum cutting table; west end	"	29.0	2.8	2.6	0.0053	0.19	1.9	Lead rubber	
54	General air; near Cammachine #1377)	"	23.9	2.4	2.2				Scapstone	
33	Mill: 1: General air; rubber mills, east end	"	45.1	3.5	3.2	0.0132	0.11	1.1	Tale rubber	Cleaning process for raw rubber, cutting added, machine #1343 and 1344
56	At rubber compounding mill #133	10/23/34	34.0	1.5	1.4	0.0004	0.01	0.1	Lead, sulphur whiting, rubber	- one man
57	At rubber compounding mill #1343	"	30.0	1.6	1.5	0.0078	0.28	2.8	"	"
58	On platform of Banbury mixer #1	"	43.2	2.2	2.0	0.0184	0.66	6.6	Lead, whiting sulphur, soapstone, rubber	One man, intermittently, mix charged by hand
59	On platform of Banbury mixer #2	"	41.9	2.1	1.9	0.0274	0.97	9.7	"	Mix charged from 2nd floor
60	Between compounding mills #1329 and #1328	"	34.6	3.1	2.9	0.0064	0.23	2.3	"	One man at each mill
61	Mixing batches of compound from hoppers	"	35.0	11.1	10.2	0.2368	8.36	83.6	"	Traveling scale on track under hoppers; one man
62	General air in compound mixing room	"	27.1	5.6	5.3	0.0005	0.02	0.2	"	Three men
63	Discharge of rubber conveyors from compounding mills	"	27.3	4.4	4.0	0.0011	0.04	0.4	Soapstone lead	Two men; dusting with soapstone and putting on skids
64	General air; 2nd floor weighing stock for Banbury mixer	"	33.3	1.7	1.6	0.0017	0.06	0.6	"	Dry sweeping
72	Cutting raw rubber, power press, 3rd floor, machine #1344	10/24/34	30.0	1.1	0.96				Rubber	One man
122	Dumping B-72 into hopper through grating; taken under respirator	11/1/34	12.6	- -	-0	0.0194	0.69	6.9	Lead	Outside storage building in corrugated iron room; Willcox Duplite respirator
123	2nd floor at discharge end of conveyor; taken while bringing B-72 to hopper	"	30.9	- -	—	0.0513	1.81	18.1	"	At same time as #122, cloth box to collect dust and let air out of hopper
65	Mill: 1: 1st floor mill #71	10/23/34	34.6	1.8	1.7	0.0005	0.02	0.2	Lead rubber	

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66	At rubber mill #7A and friction calender	10/3/34	33.8	1.9	1.4	0.0008	0.03	0.3	Lead rubber	Three men
72	Crushing resin machines #1&8 and #(9)	10/24/34	21.0	3.2	3.0				Resin	One man
69	Insd. W: Fitting brass lining machine #(31)	10/31/34	29.9	0.70	0.65	0.0005	0.02	0.2	Ash-stos rubber lead	Two men
71	Insd. 23: 4th floor, one end grinding rubber belts where vulcanized	10/24/34	26.4	2.1	2.0	0.0011	0.04	0.4	Rubber lead	Machine #8-7&8
73	General air, Dept. 33, 25 and 26; 4th floor	"	28.3	1.7	1.6				Rubber soapstone	
74	Insd. 4: General air; 9 men coating pipe joints with rubber	"	30.4	4.2	4.0	0.0019	0.07	0.7	Lead	High test gasoline
75	Insd. 28: General air, rubber rolls	"	27.6	1.9	1.8				Rubber	Fifteen men, west end
76	Grinding rubber roll machine #(24)	"	42.0	5.4	5.0	0.0063	0.22	2.2	Rubber soapstone	Exhaust system one man
77	Sawing gall rolls, machine #(13)8	"	45.3	1.9	1.8	0.000			Rubber	One man
78	Insd. 3: General air; west end, main bay	"	27.3	9.2	8.4				Soapstone	
79	General air; west end, main bay	"	27.3	1.5	1.4				"	
80	Grinding rubber tubing on mandrils, lathe #(14)	10/29/34	36.8	8.5	8.5	0.0084	0.31	3.1	Rubber lead	Balcony floor, exhaust system
81	Grinding rubber tubing machine #(31)	"	21.9	3.1	2.9	0.0013	0.05	0.5	"	Balcony floor, exhaust system
82	Grinding, Sixteen Passon Drier strips, machine #(14	"	19.2	10.2	9.5	0.0030	0.11	1.1	"	Balcony floor, exhaust system
84	Sanding wool covering rings on belt sander	"	10.9	9.3	8.6	0.0645	2.42	24.2	"	Exhaust system
83	General air; balcony floor	"	30.4	0.95	0.87	0.0017	0.06	0.6	"	
87	Forming and cooling rubber from tubing machines; general air, 3 machines	"	26.4	16.7	15.8				Soapstone sheet flour	West room
85	Insd. 12B: General air; testing fire hose	"	28.2	1.6	1.5				Rubber cotton	
86	Insd. 12A: Between 2 circular looms weaving fire hose covering	"	30.9	0.97	0.92				Cotton	Machine #310 and 311
88	Insd. 6: At tube machines, between two machines	"	31.8	43.1	42.4	0.0047	0.17	1.7	Rice flour soapstone	Two men at each machine
89	Inserting rods in rubber tubing, 1 rolls fibre rod through tubes	"	33.7	6.4	6.2				"	Exhaust system
90	Spooling covering for rubber tubing	"	32.4	0.86	0.81				Cotton	Three braiders, two running
91	Insd. 21: General air; compounding rubber for gasoline and oil hose	10/29/34	29.3	0.82	0.41	0.0010	0.04	0.4	Sulphur lead	Exhaust system; B.L.P. - By-products of tear gas
92	Insd. 35: General air; curing flat belts and V belts; heater gang	"	29.1	2.2	2.1				Rubber cotton	

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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 in mgs. in Milligrams in 10-h ur day on basis of workman breathing 10 cubic meters of air daily	Type of Dust	Remarks
99	General air; curing end heater end	12/30/34	31.5	2.0	1.9				Rubber cotton	Curing fourteen inch covering, 3-V belts, six men
100	General air; applying rubberized fabric covering to V belts and flat belts	"	27.3	0.31	0.77				"	Twelve women; two men
93	Insd. 12: General air, forming and cutting brake blocks	10/29/34	32.6	2.7	2.4	0.0004	0.01	0.1	Asbestos rubber Lead resin	Mixture made in Dept. 578; dry process
94	At sandblasting cabinet; operator views from outside cabinet; looks through glass	"	34.0	3.9	3.6				Sand	Exhaust system; one man
95	Insd. 17: General air; mills not running	"	19.5	3.8	4-4				Soapstone	Moving stock from skids to racks and sweeping
101	At rubber mill #1469 salvage dept. for defective rubber	12/30/34	33.6	3.3	3.0	0.0009	0.03	0.3	Soapstone Lead	Exhaust hood over mills; nothing added to rubber
96	Insd. 2nd: General air; 6 braiders 2 layers of fabric braided cable tubing	10/29/34	33.4	6.5	5.9				Cotton	Two men; hydraulic brake hose and air brake hose
97	At rubber mill #84 matting added to rubber	"	30.5	2.9	2.7	0.0019	0.07	0.7	Soapstone Lead	Rubber for covering braided fabric on tubes; one man
98	Insd. 11: General air; wood shop	10/30/34	32.0	3.5	3.2				Wood	
67	2nd floor over hoppers amber screen	10/23/34	49.0	2.3	2.3	Milligrams Zinc 0.002	Milligrams Zinc 0.07	Milligrams Zinc 0.7	Zinc oxide	Sifting zinc oxide

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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

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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

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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.

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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

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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-

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

Sample #88, Department 6: The ': is reworked in a mill and then put through the tube machines. Th' the tube machines could be exhausted to eliminate the lead hazard ·int.

The workmen should be taught t' compounds are harmful when the dust is breathed into the lungs and to carefully. It was noticed that the workmen were careless in putting t' into the lead compound and brushing it on their clothes.

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

Lunch rooms should be maintai. parated from the departments where lead is used. Workmen should no' ed to eat lunch in the departments.

Samples of material used in t' nt products were obtained and analyzed to determine harmful elements llowing results were obtained:

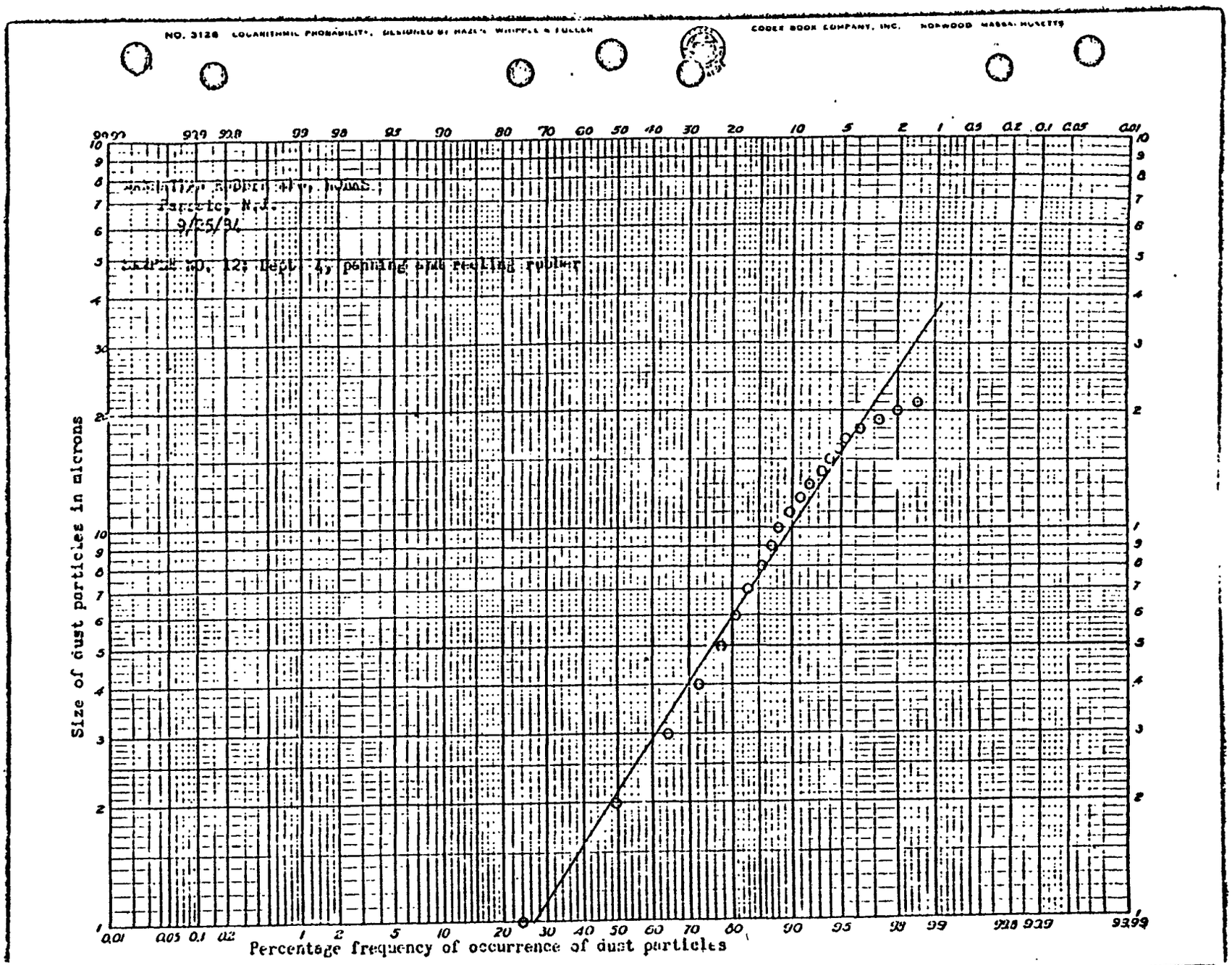
Lead compound (D-70) - 93.4[illegible]
" " (D-80) - 94.7[illegible]
Waste material from Dept. 53 (R-[illegible] 65% lead; 13.91% total silica
" " " " " (R-[illegible] 32% lead; 12.94% " "

Samples of dust from three gr erations were obtained and analyzed.

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

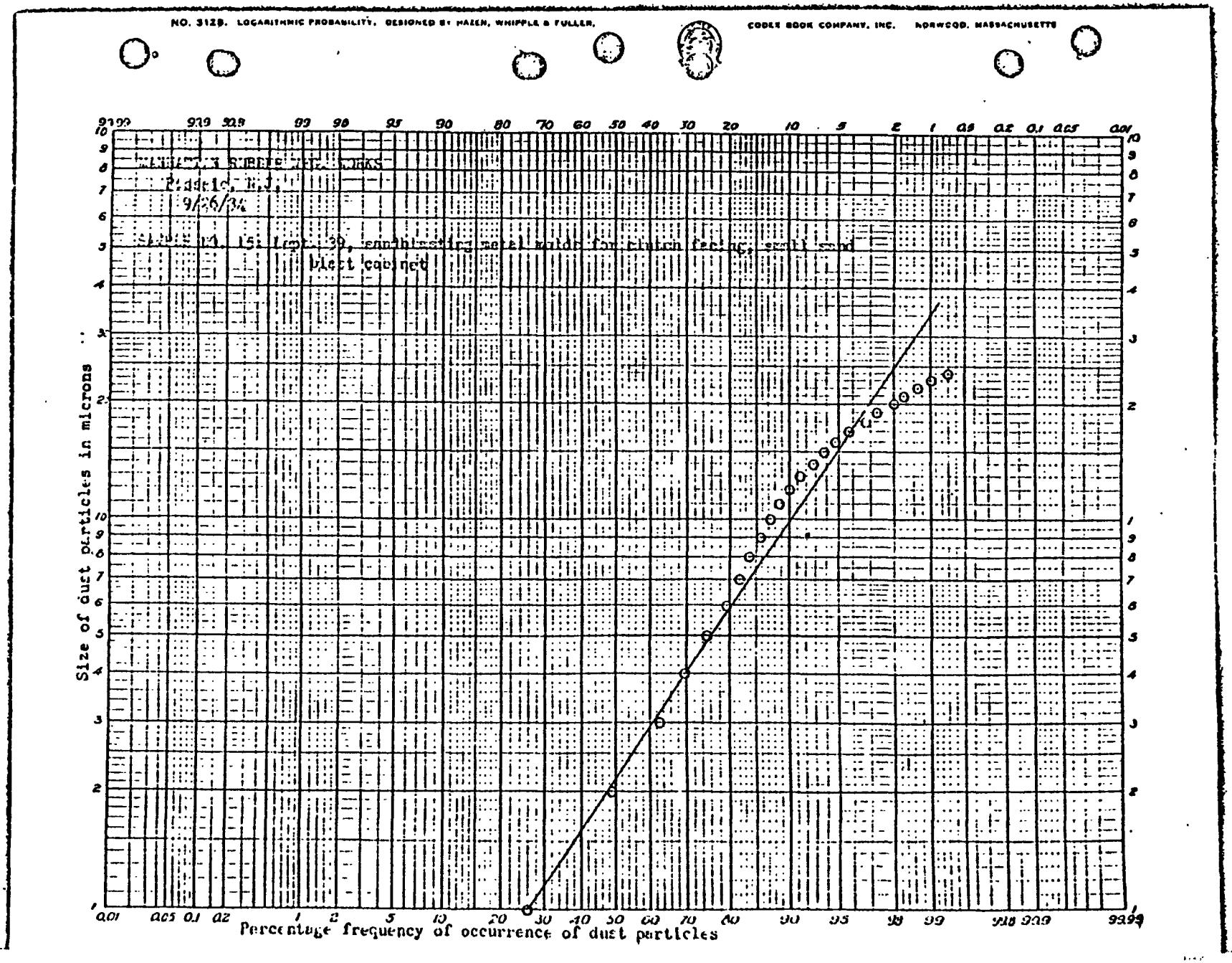
Samples of dust from rafters were taken in various departments and analyzed. The following results were obtained:

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% "



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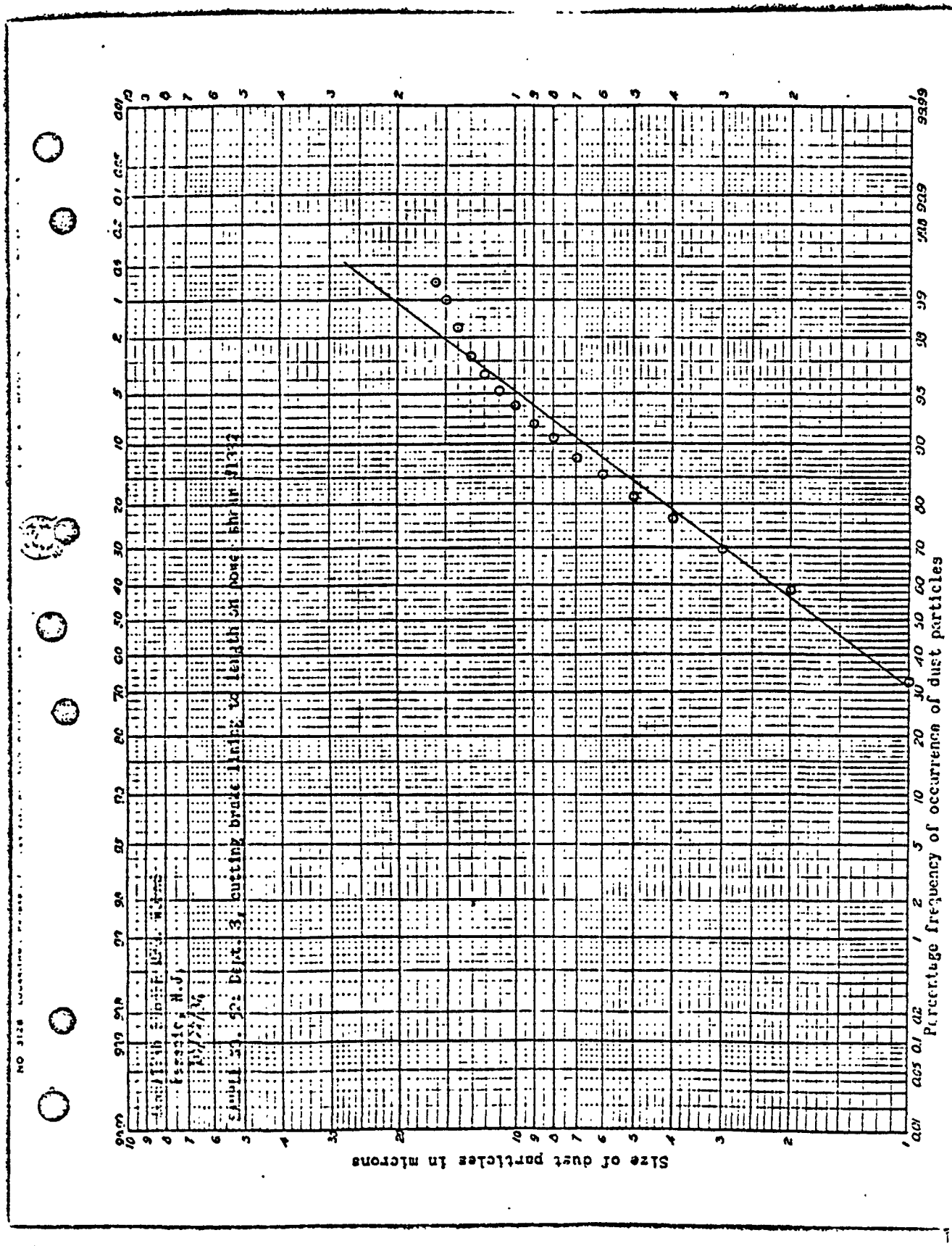
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NO. 3128. LOGARITHMIC PROBABILITY, DESIGNED BY HAZEN, WHIPPLE & FULLER.
KEUFFEL & ESSER CO. NEW YORK
KEUFFEL & ESSER CO. HOBOKEN, N.J.
COSES BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS
Size of dust particles in microns
Percentage frequency of occurrence of dust particles

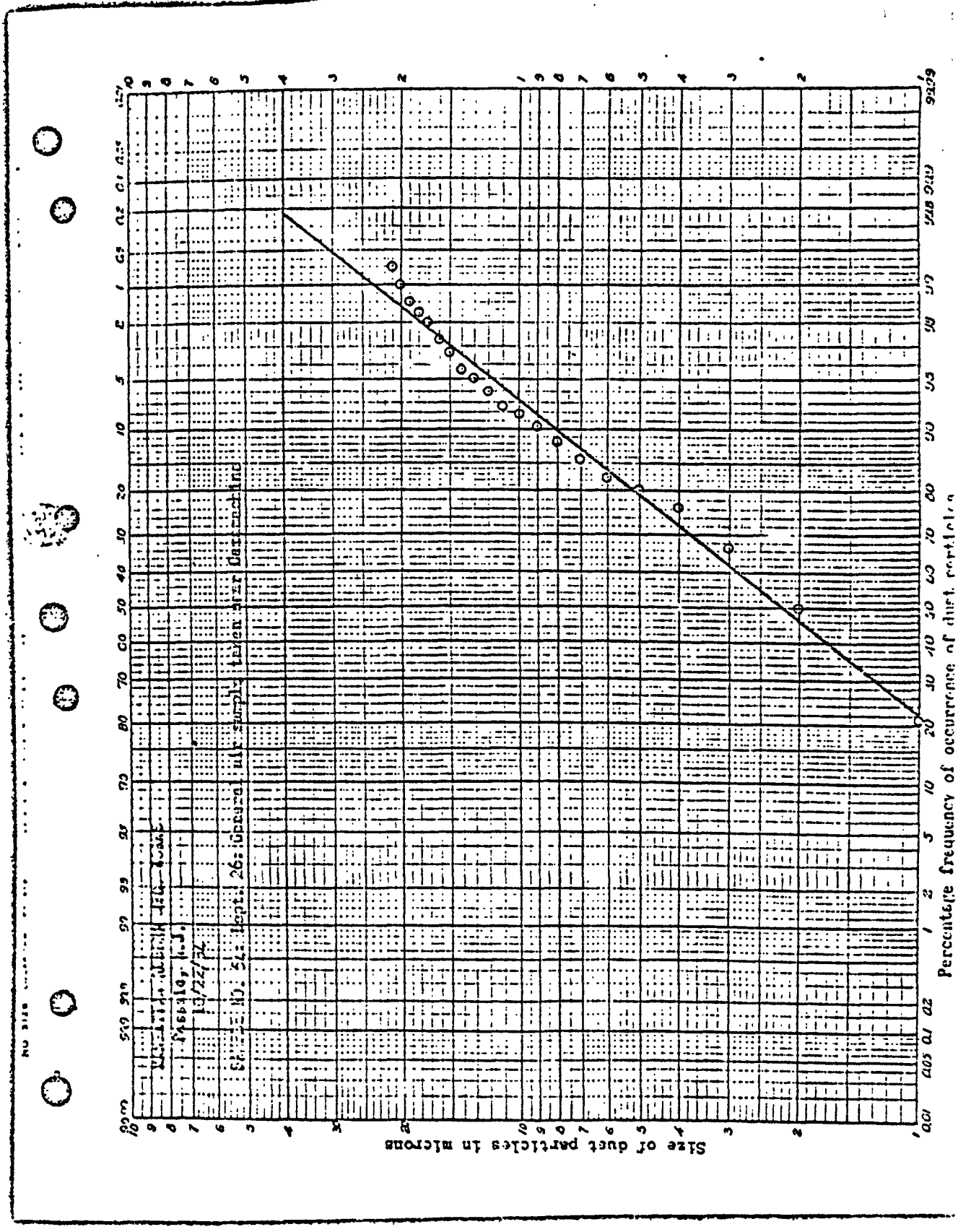
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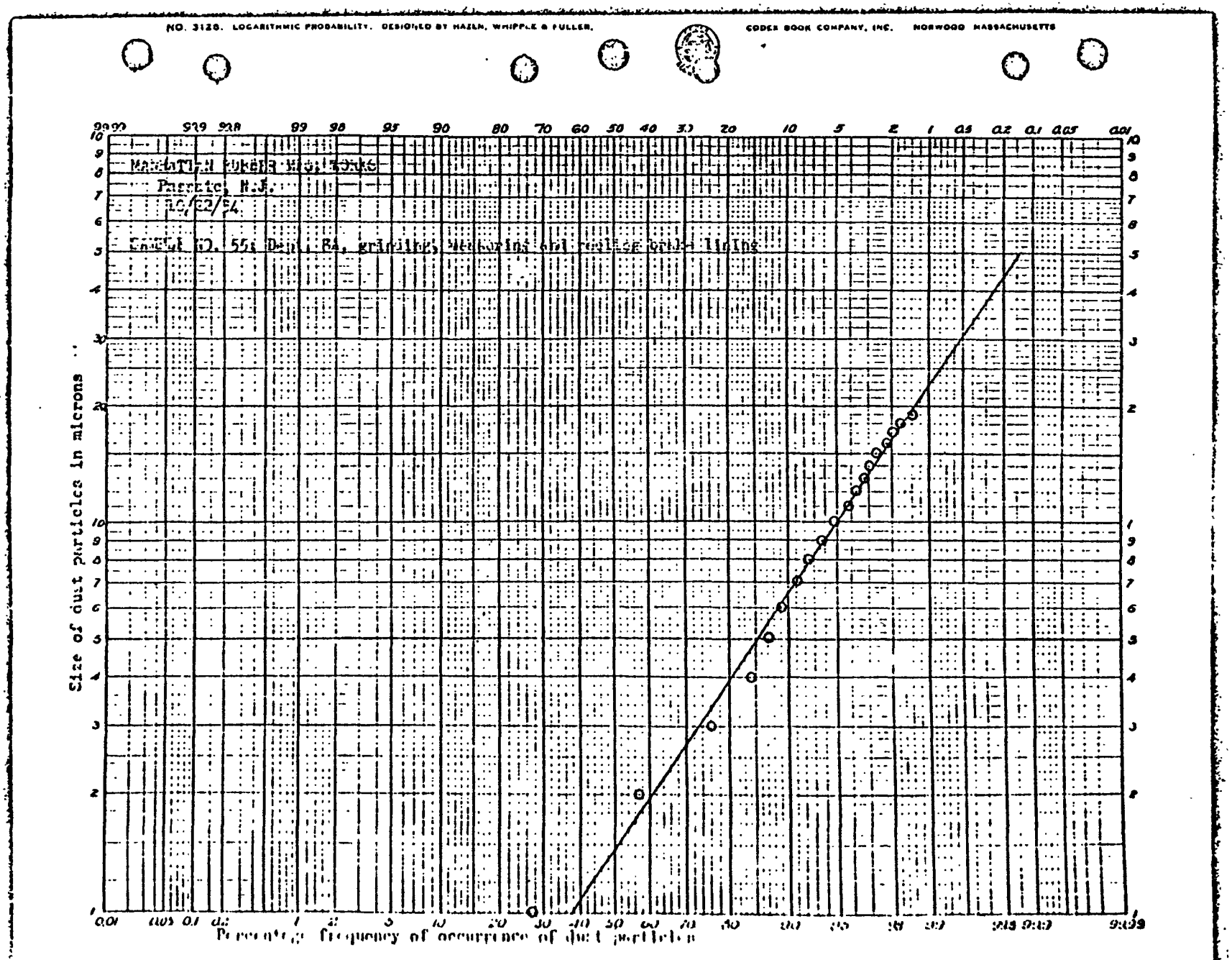
NO. 3139 LOGARITHMIC PROBABILITY. DESIGNED BY HASLN WHIPPLE & FULLER.
COOPER BOOS COMPANY, INC. NORWOOD, MASSACHUSETTS
Size of dust particles in microns
Percentage frequency of occurrence of dust particles



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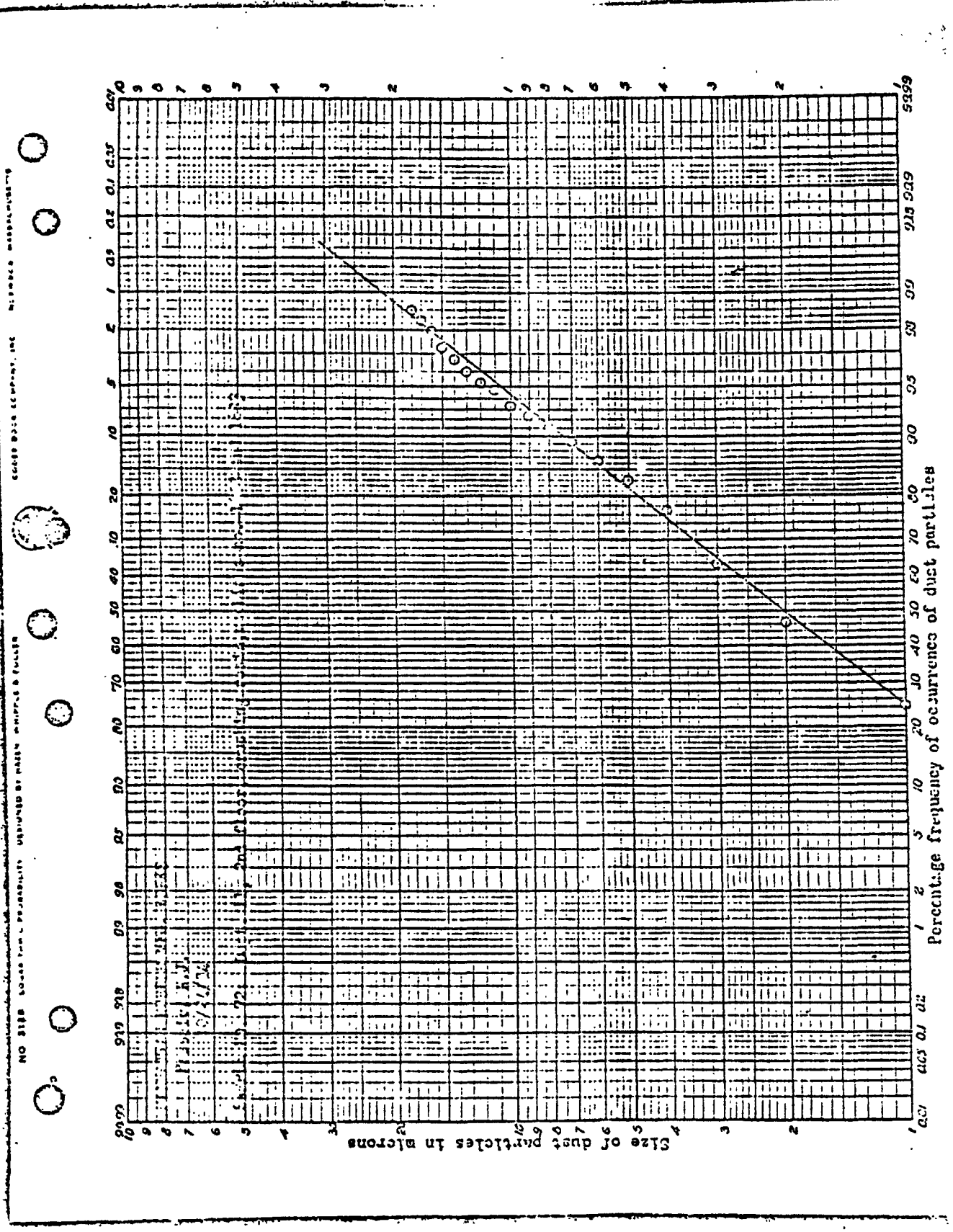


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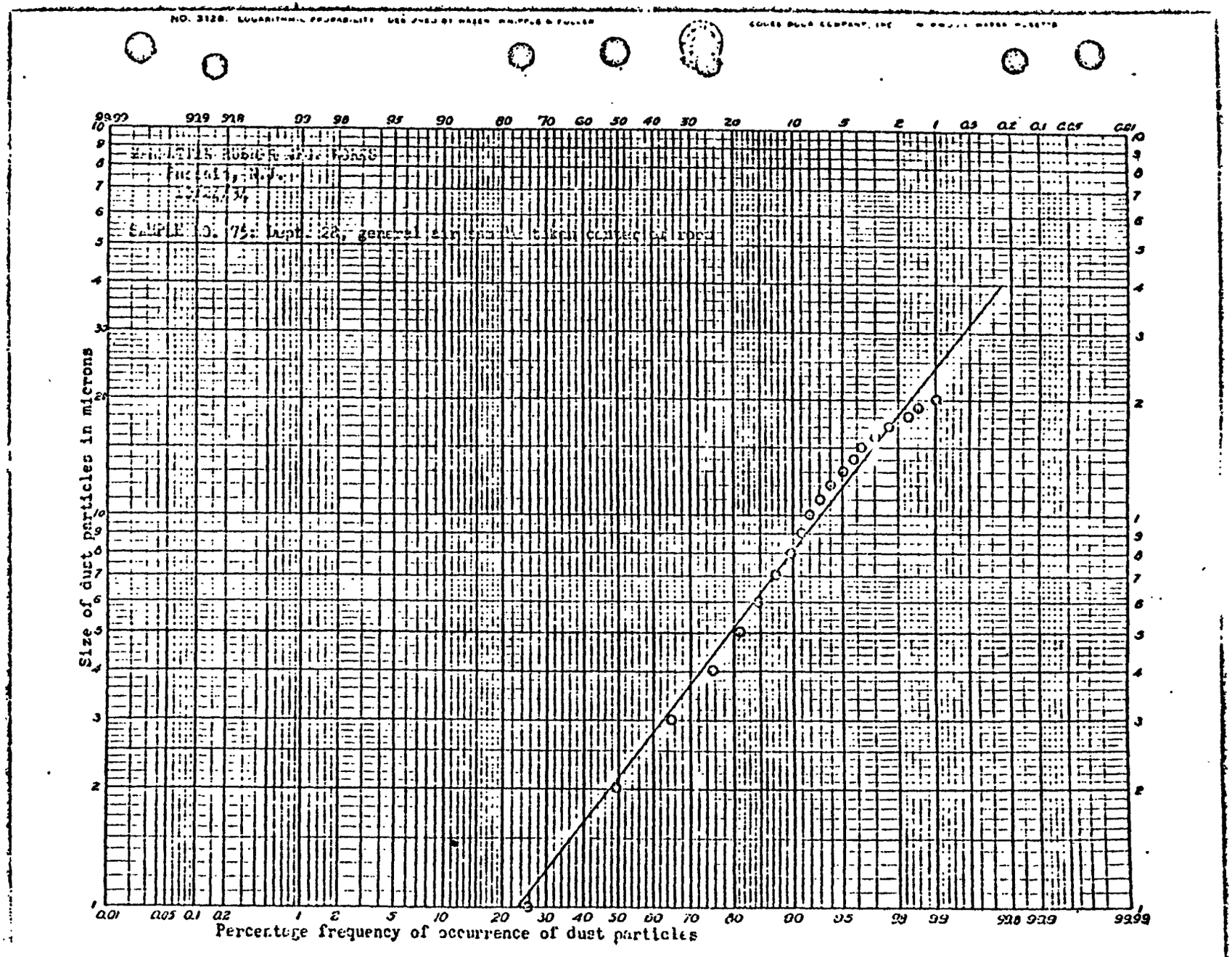


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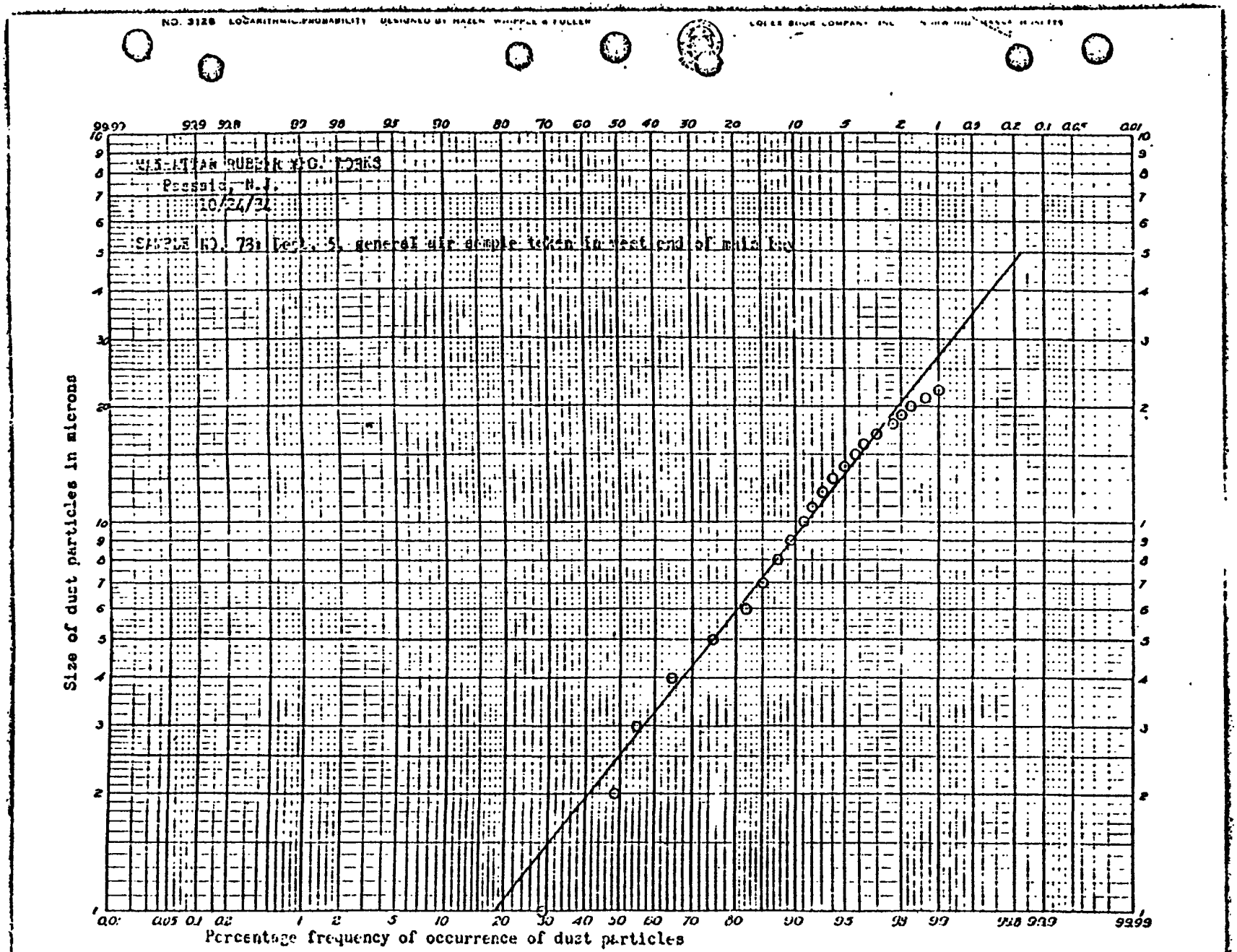
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Size of dust particles in microns
Percentage frequency of occurrence of dust particles

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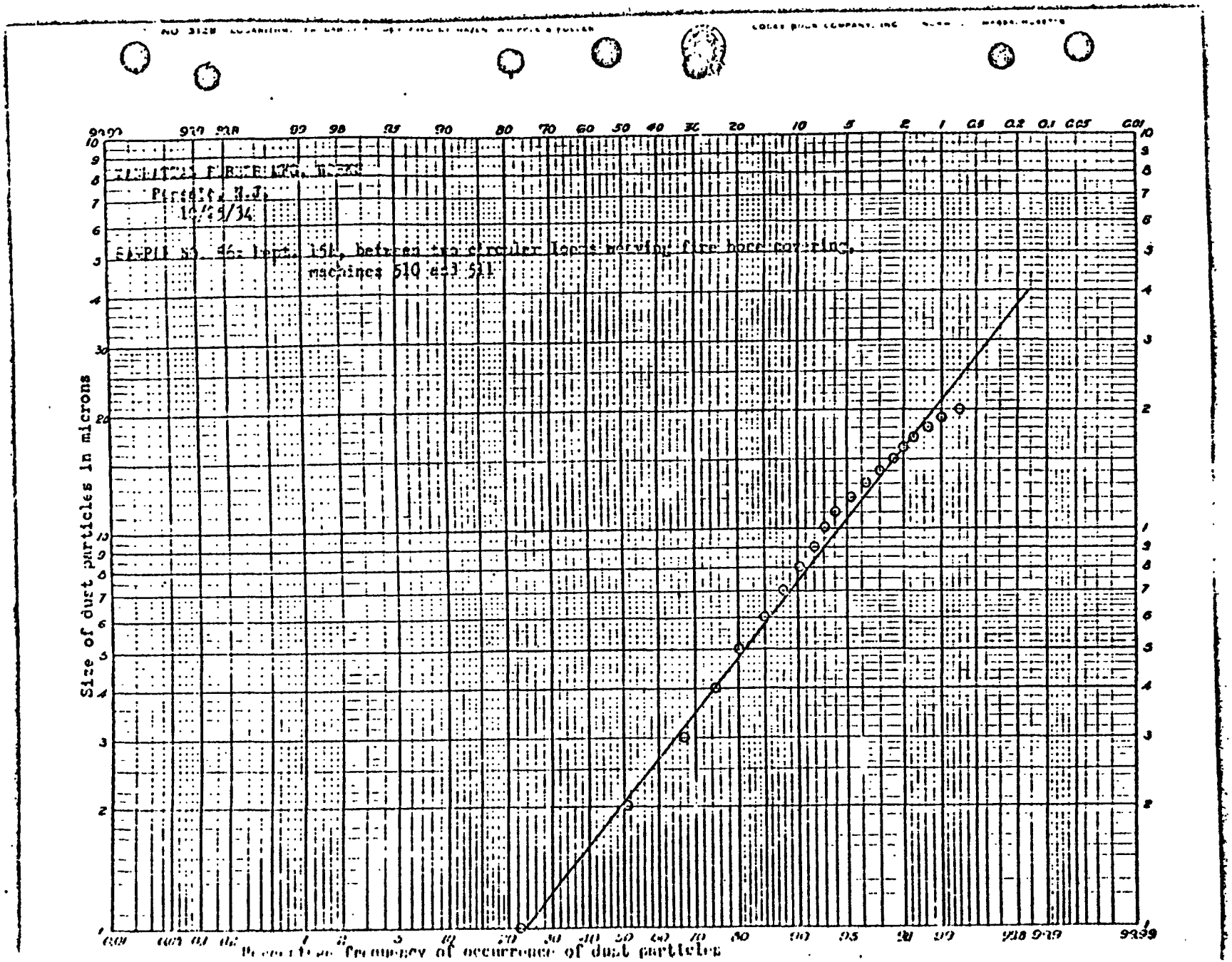


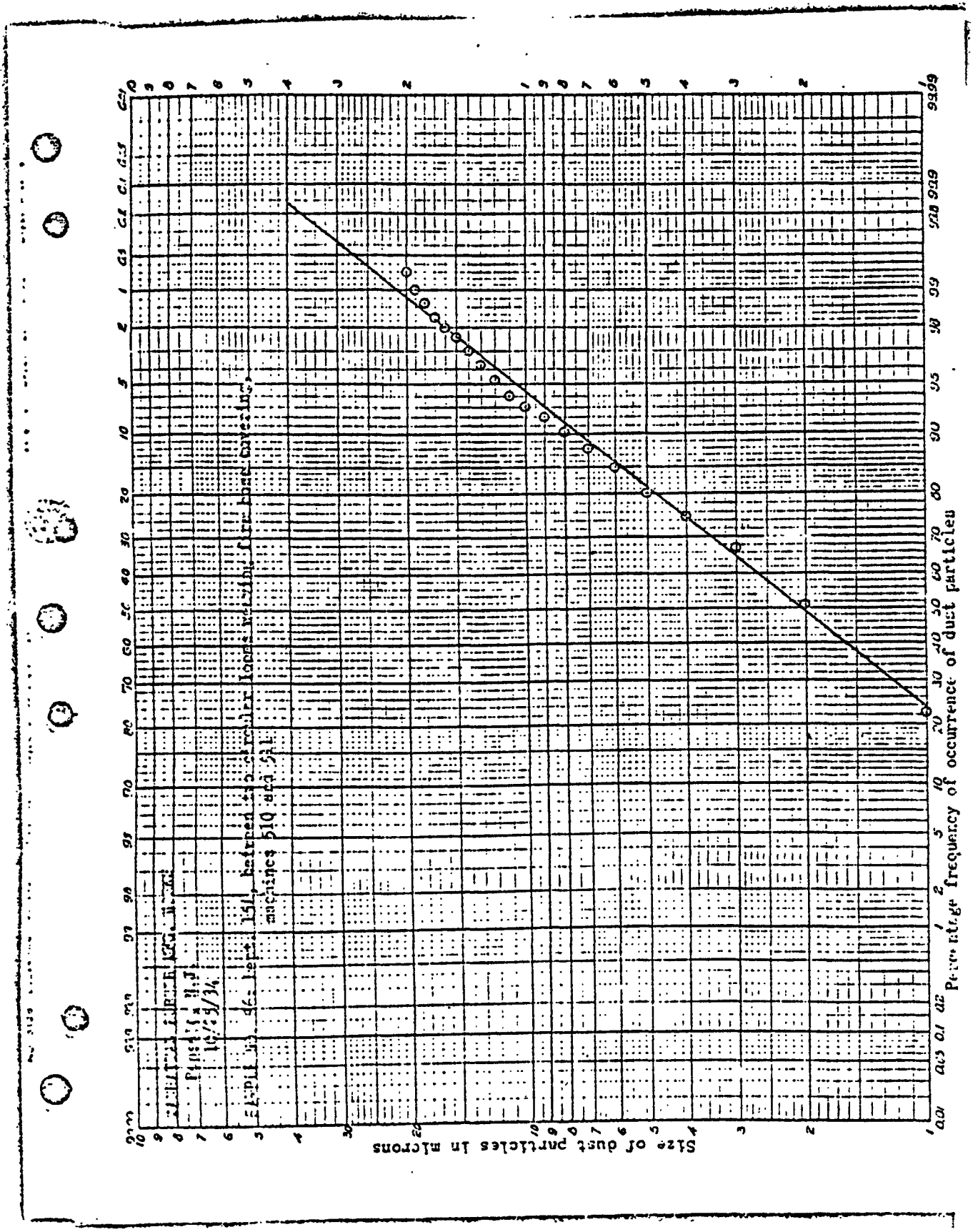
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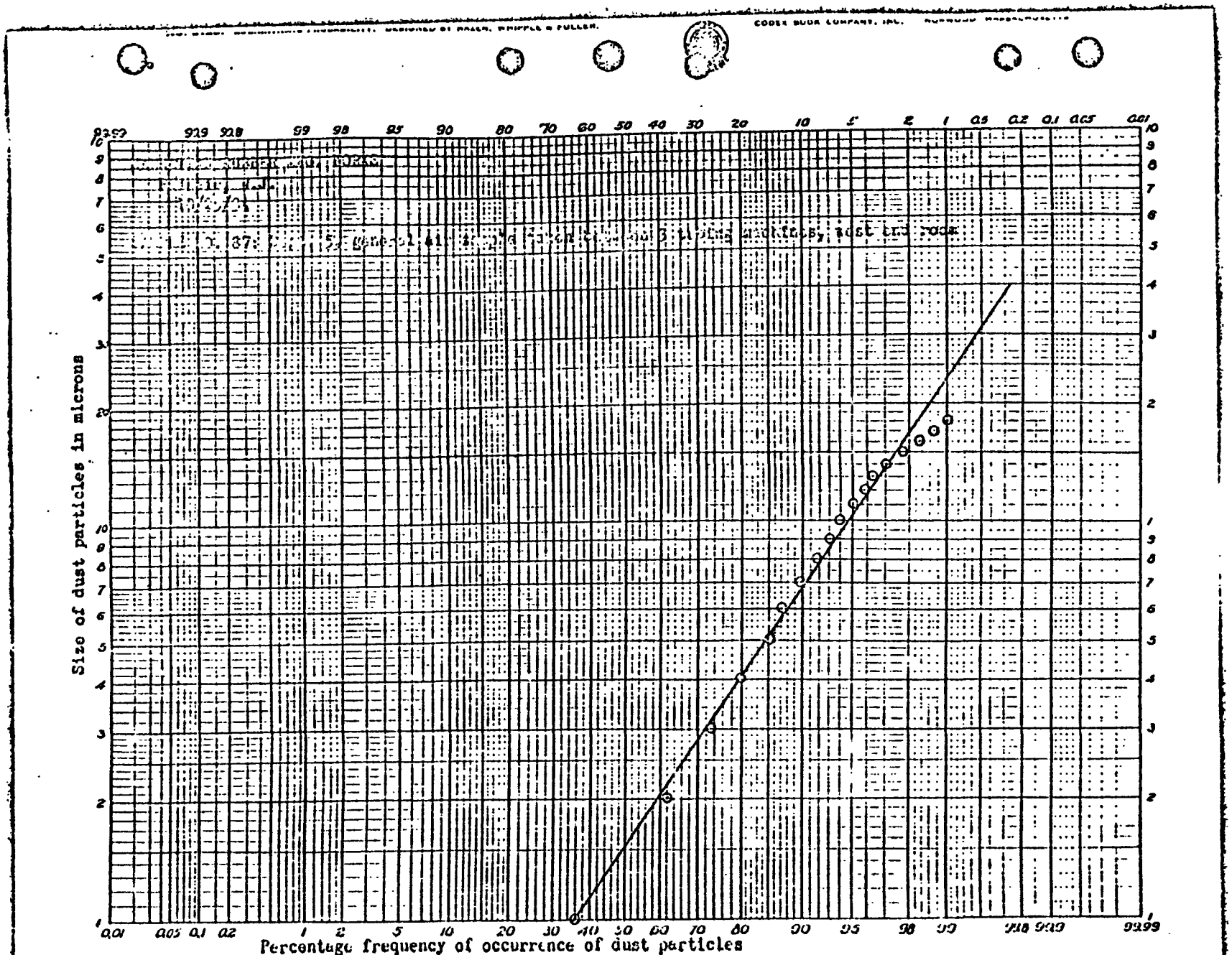
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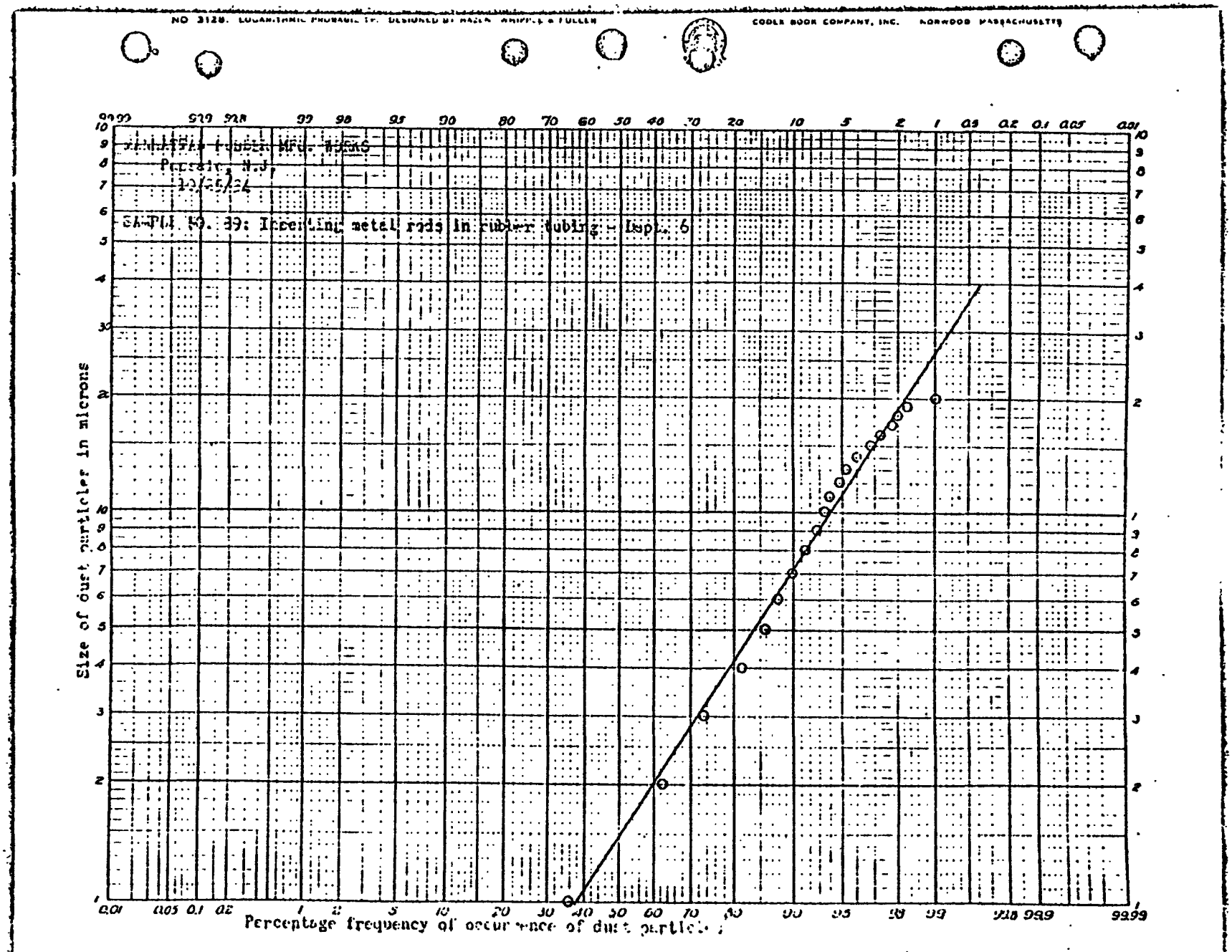


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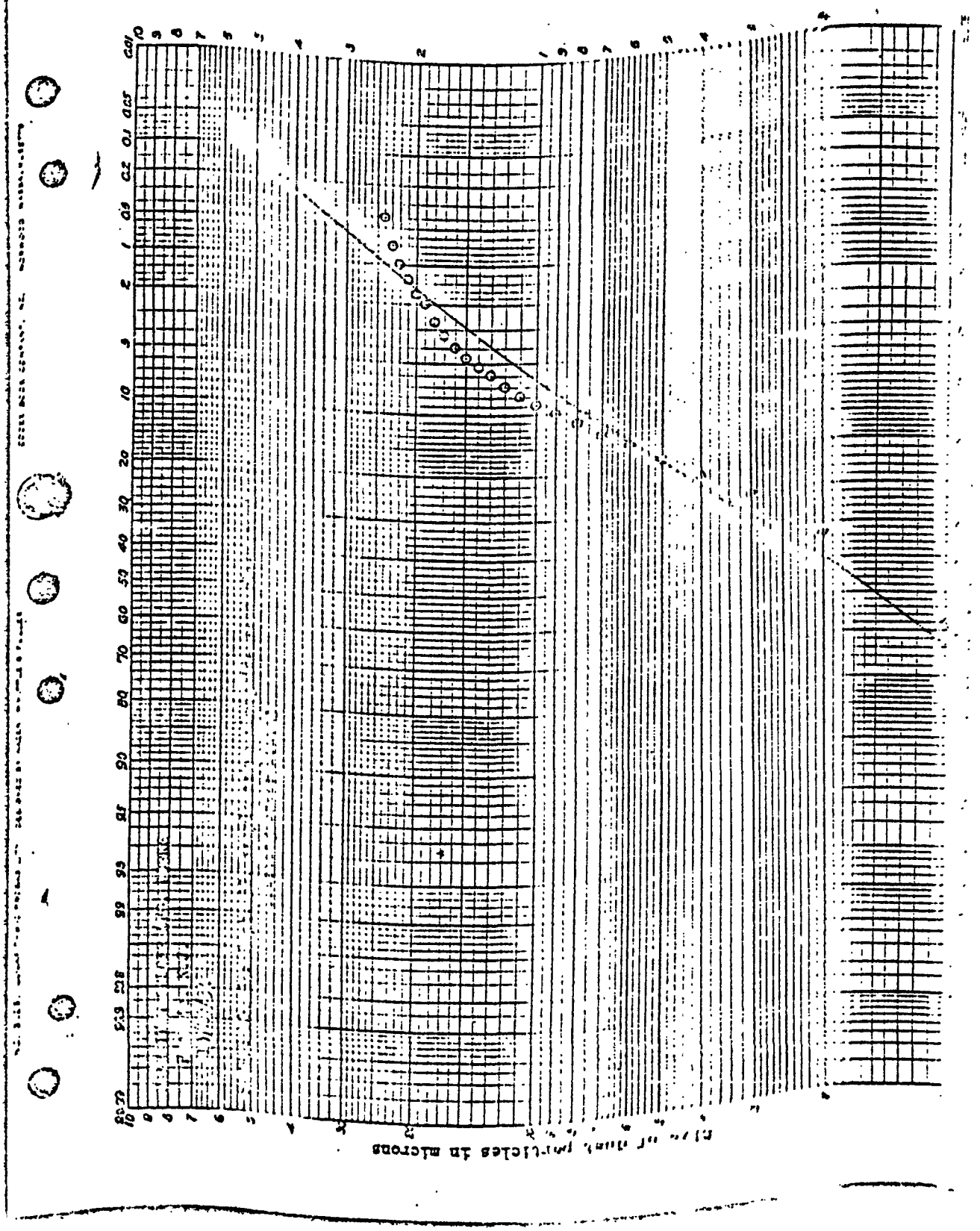
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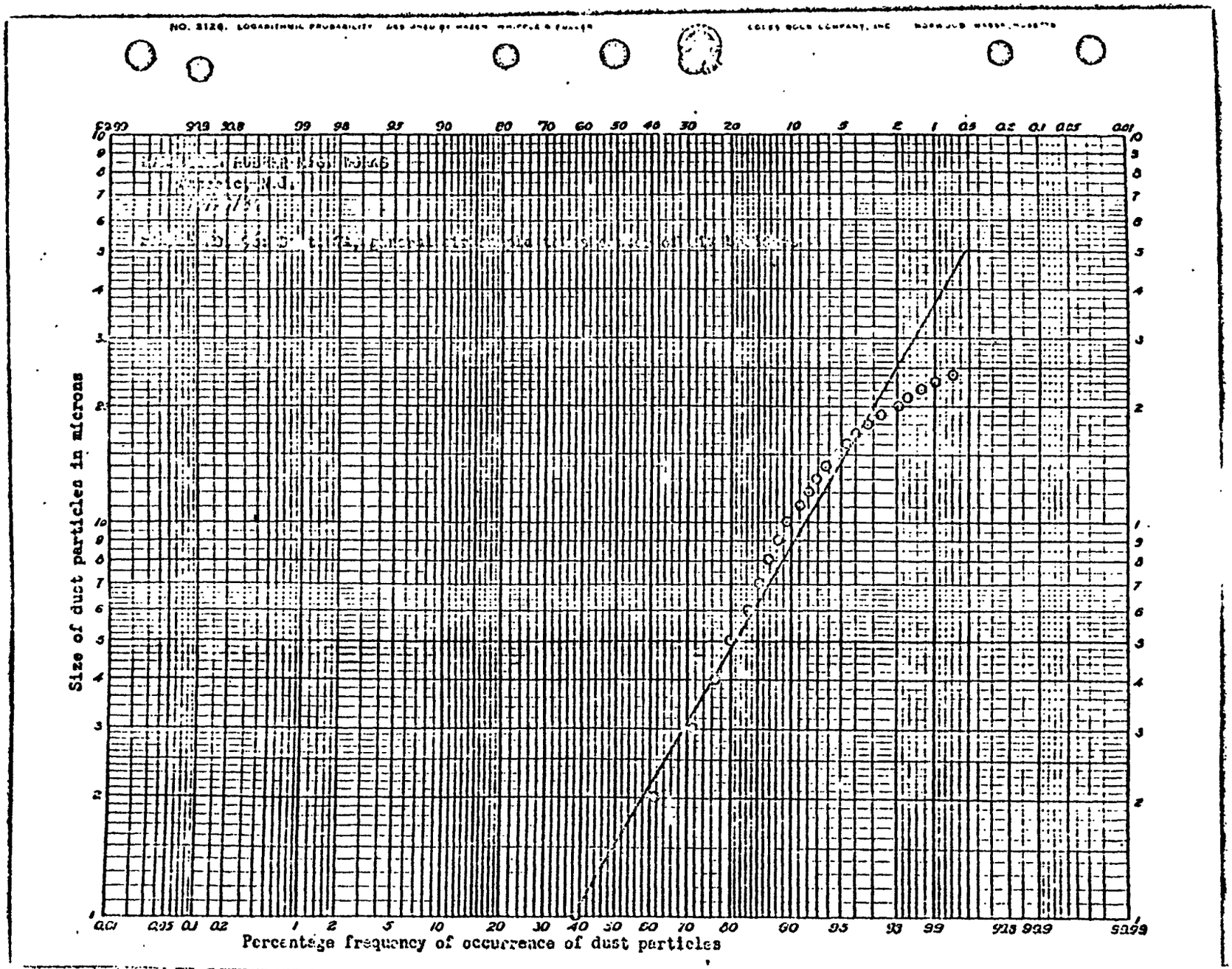
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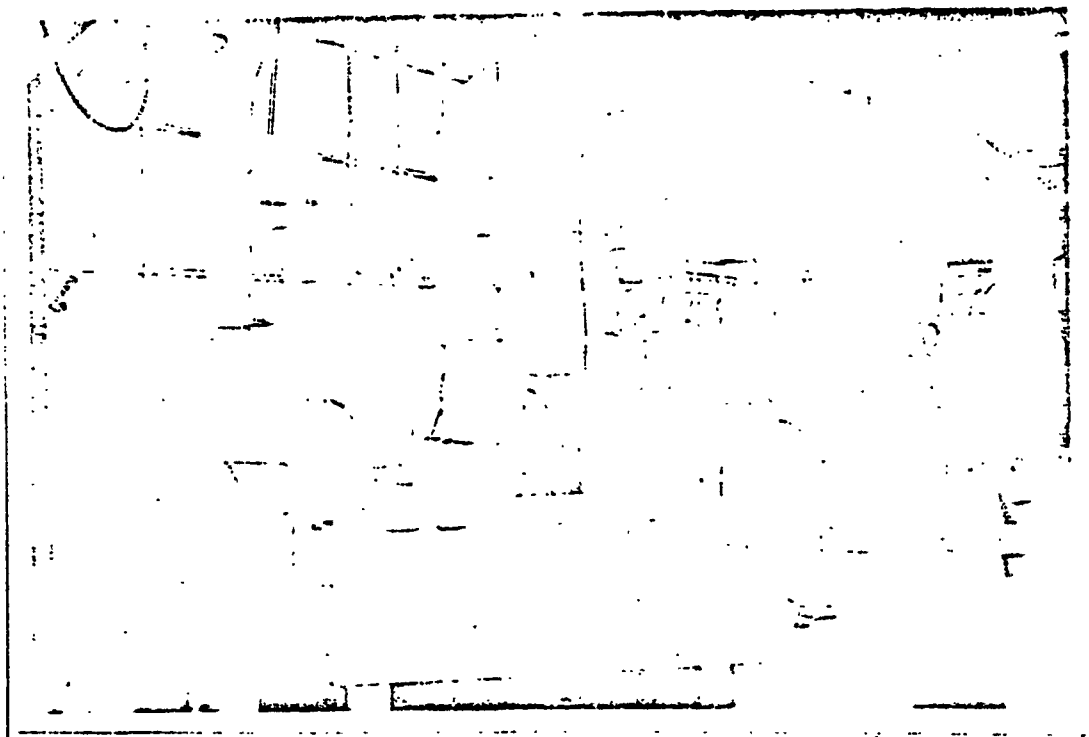
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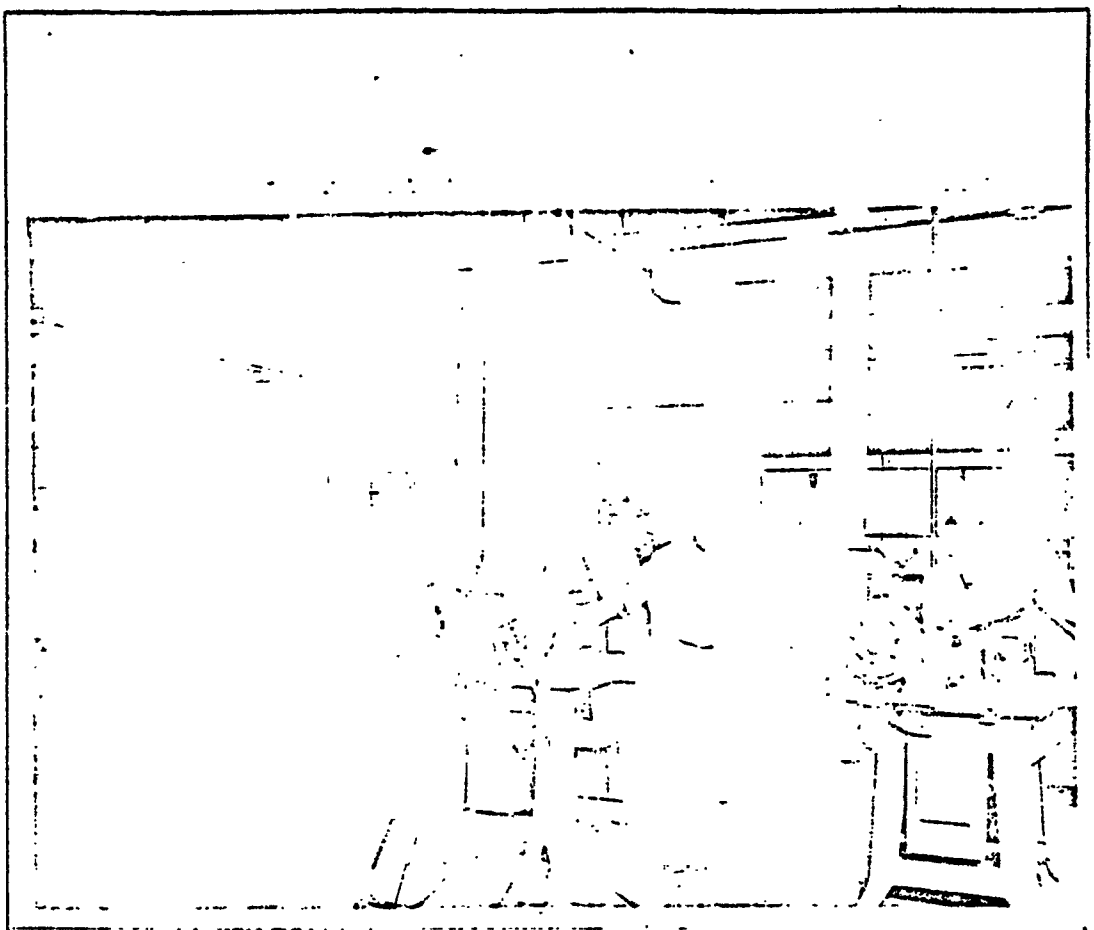


SAMPLE NO. 6
Dept. 53

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

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of Raybestos-Manhattan, Inc.

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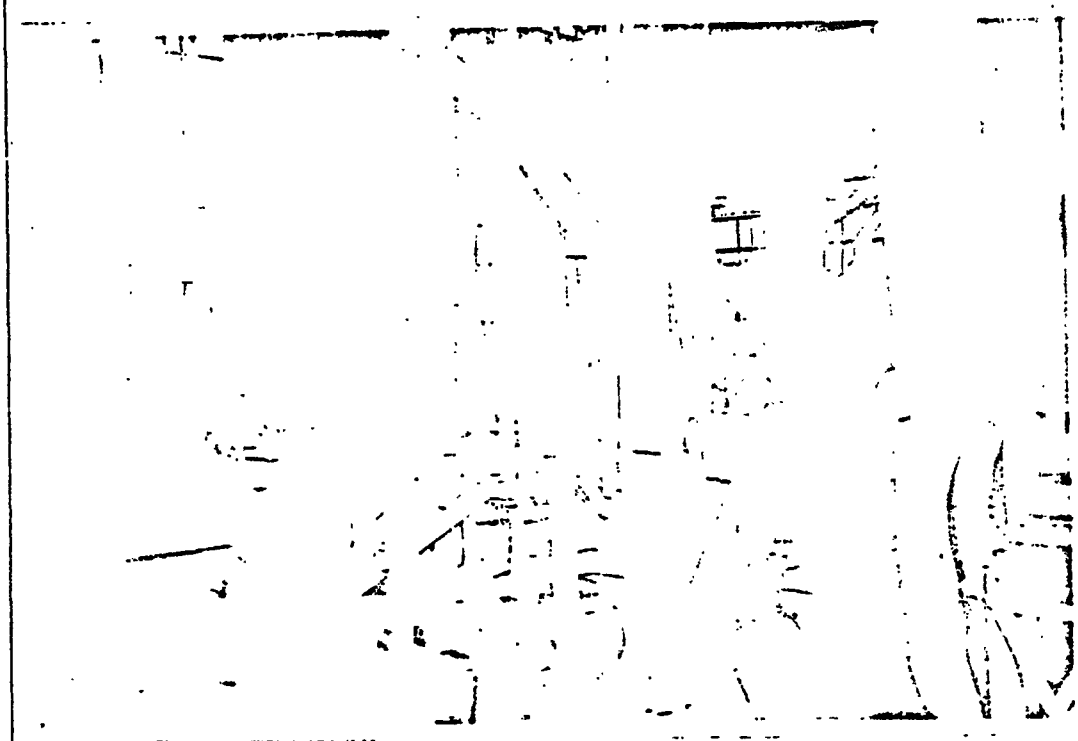


SAMPLE NO. 7
Dept. 53

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

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

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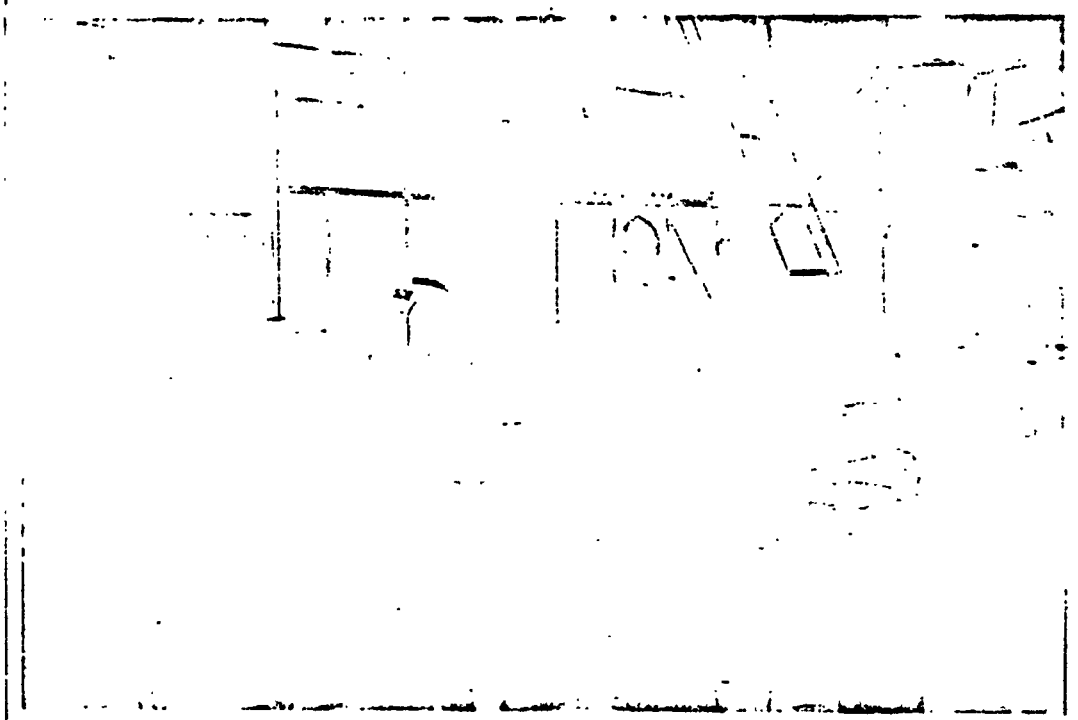


SAMPLE NO. 2
Dept. 53

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

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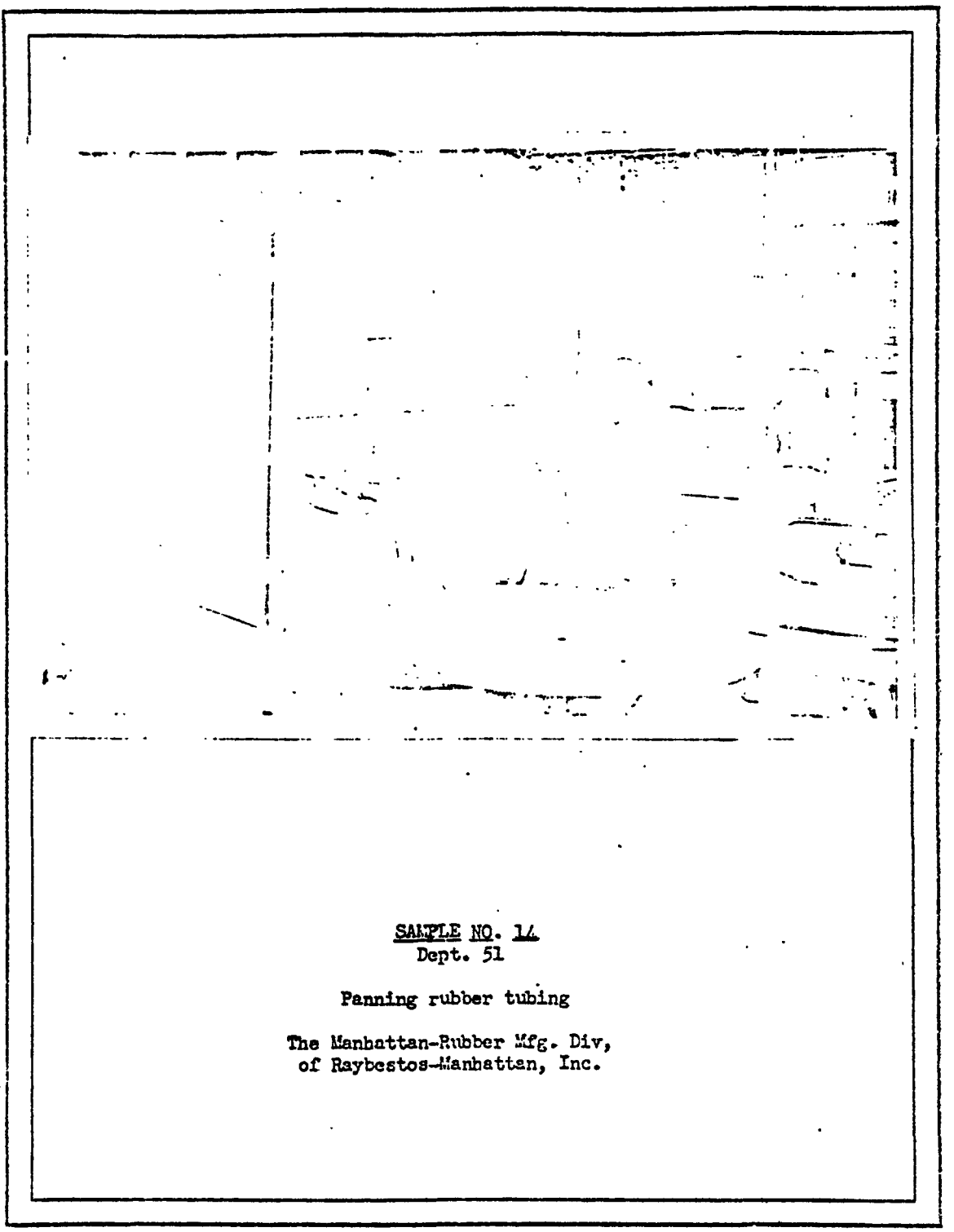


SAMPLE NO. 9
Dept. 53

Circular grinder while grinding inside surface of brake lining

The Manhattan Rubber Mfg. Div.

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SAMPLE NO. 14
Dept. 51

Panning rubber tubing

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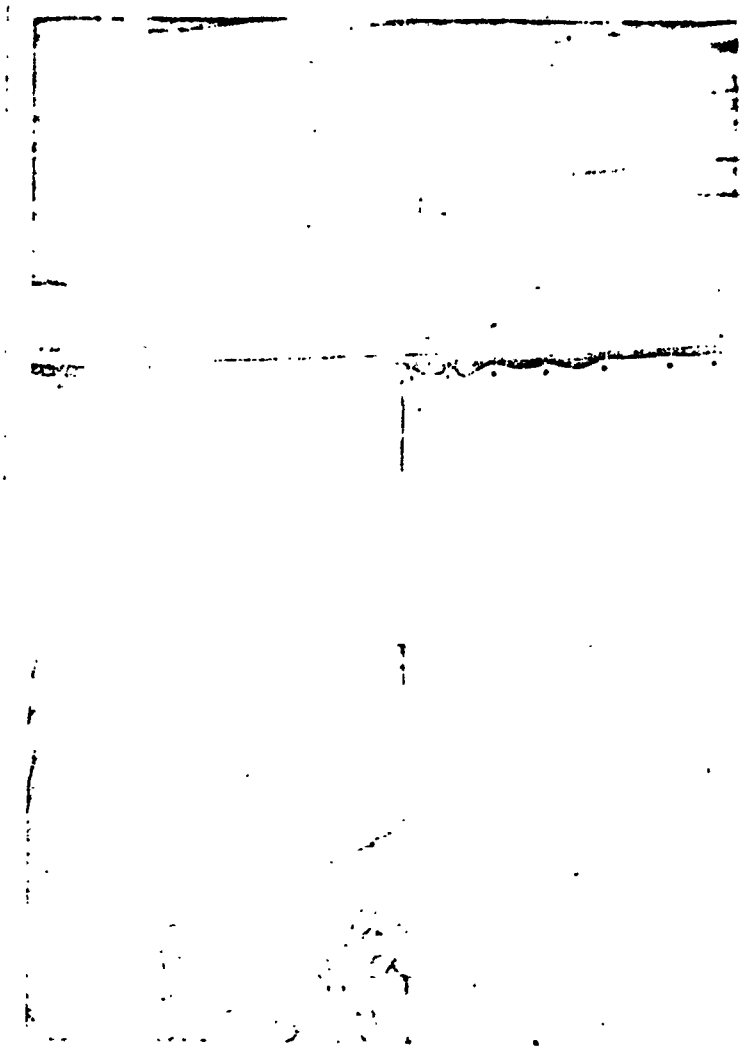


SAMPLES NO. 16 and 17
Dept. 39

Grinding clutch facing

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of
Raybestos-Manhattan, Inc.

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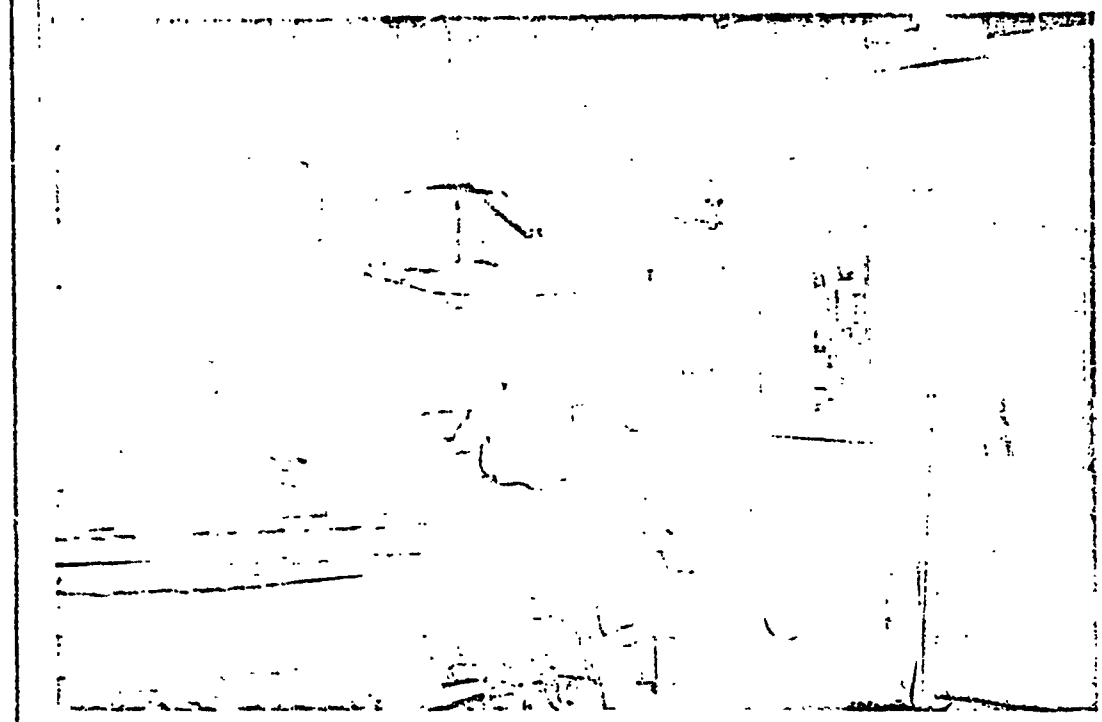
SAMPLE NO. 40

Dept. 53-T

Weighing rubber for wet process mixture

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Raybestos-Manhattan, Inc.

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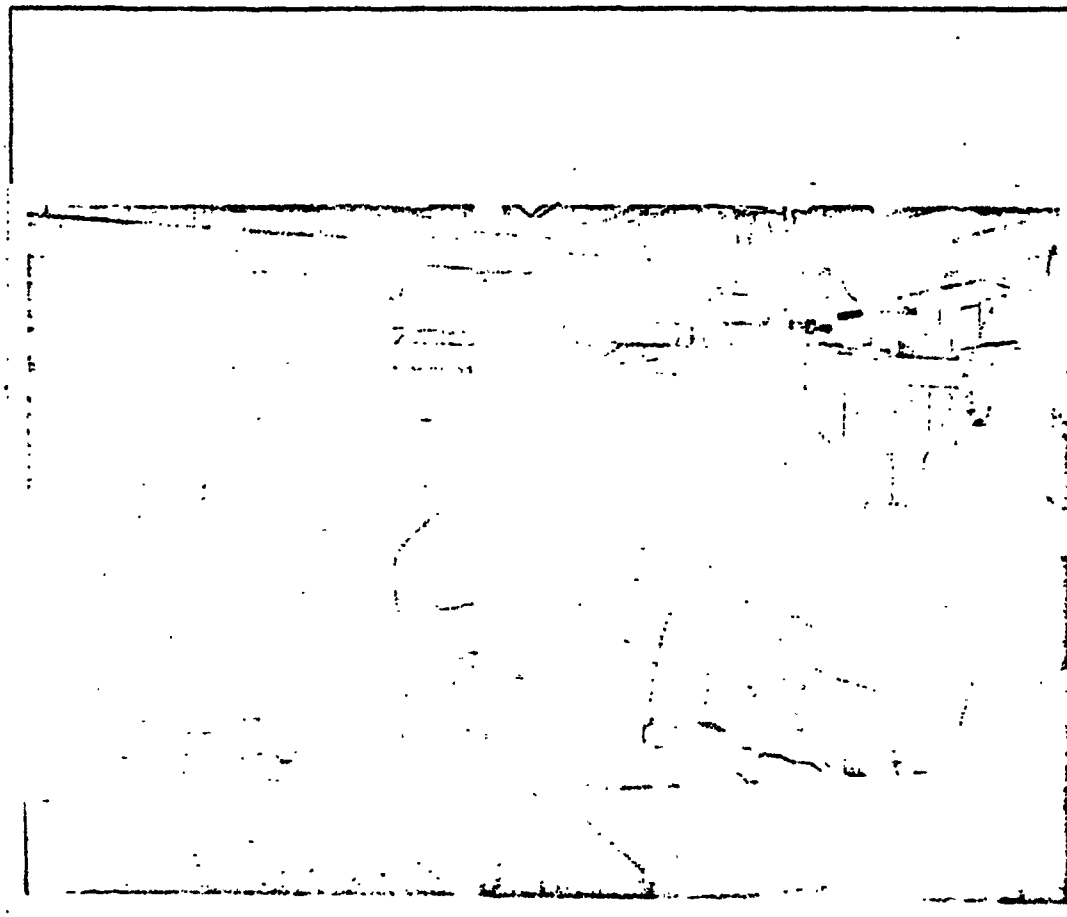


SAMPLE NO. 15
Dept. 39

Sandblasting molds for pressing clutch facings

The Manhattan Rubber Mfg. Div.

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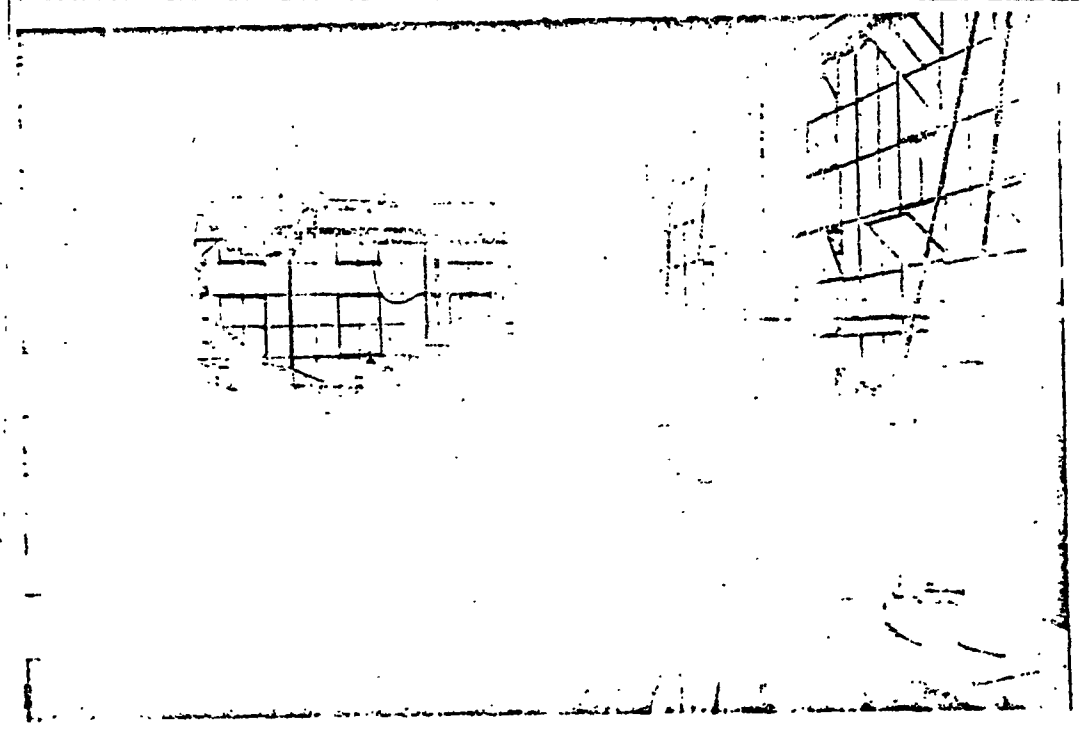


SAMPLES NO. 18 and 19
Dept. 39

Punching clutch-facing material out of asbestos cloth

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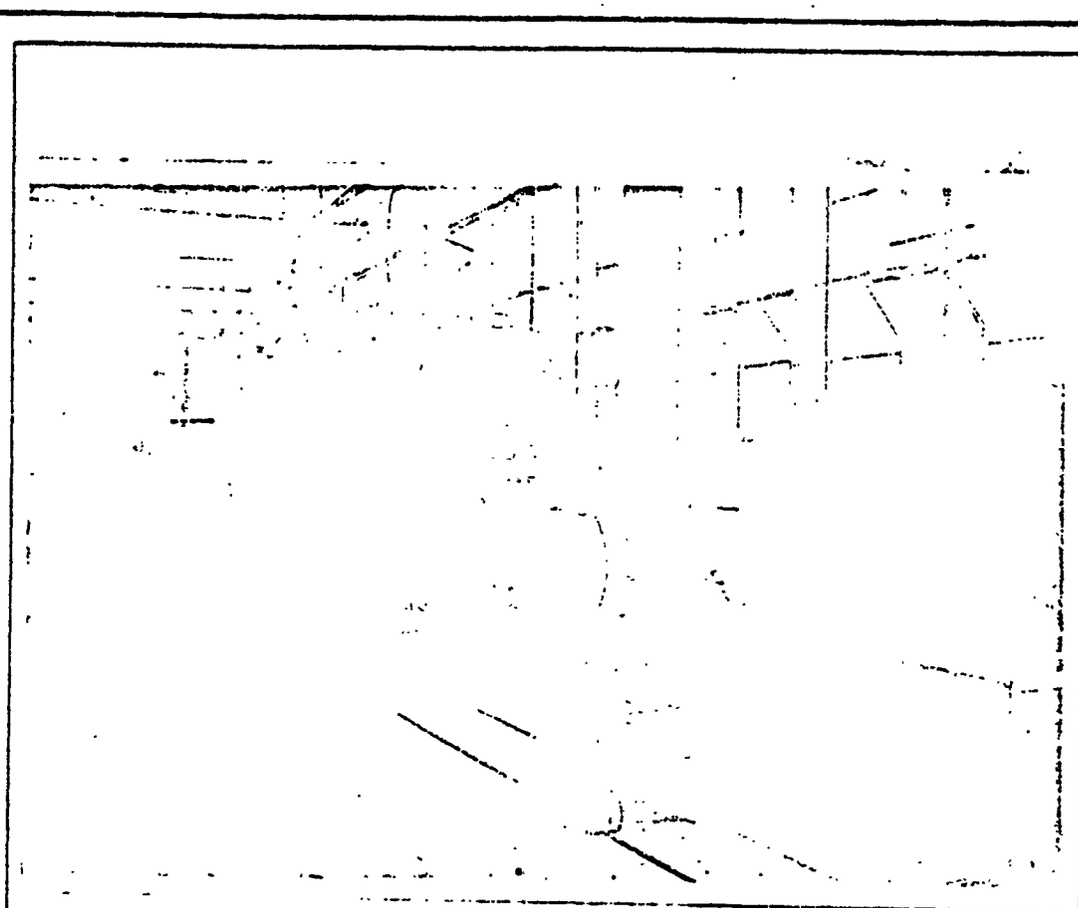


SAMPLES NO. 31, 32,33
Dept. 2

Trueing abrasive wheels

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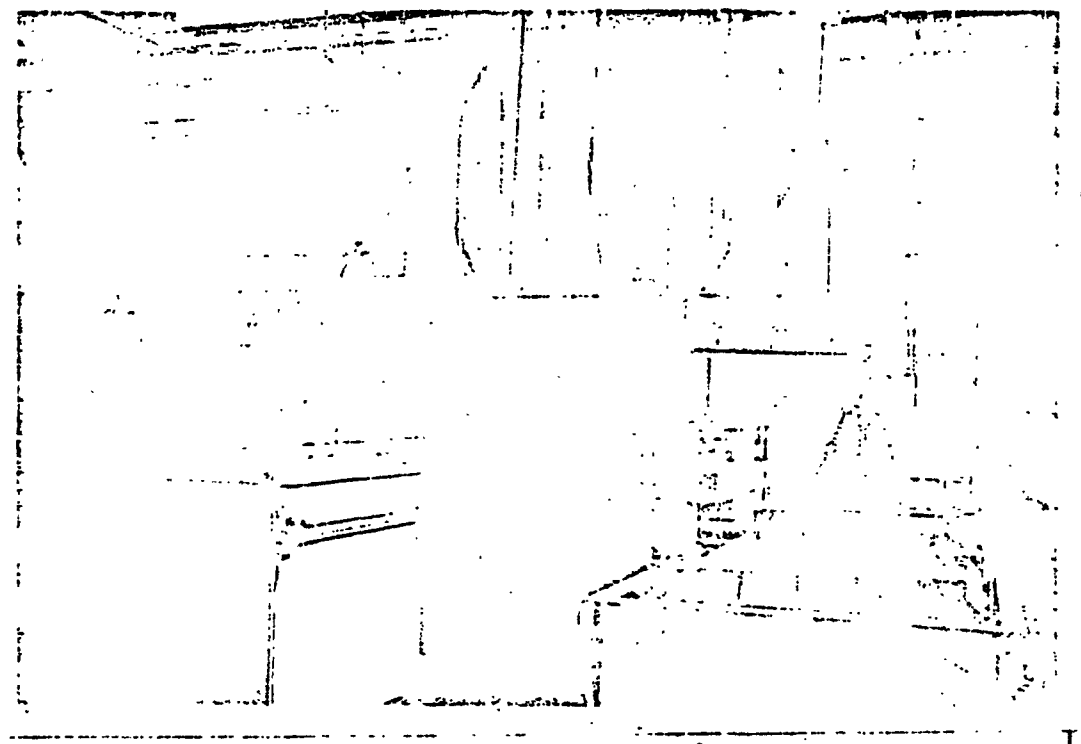


SAMPLE NO. 34
Dept. 2

Batch mixing for abrasive wheels

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of Raybestos-Manhattan, Inc.

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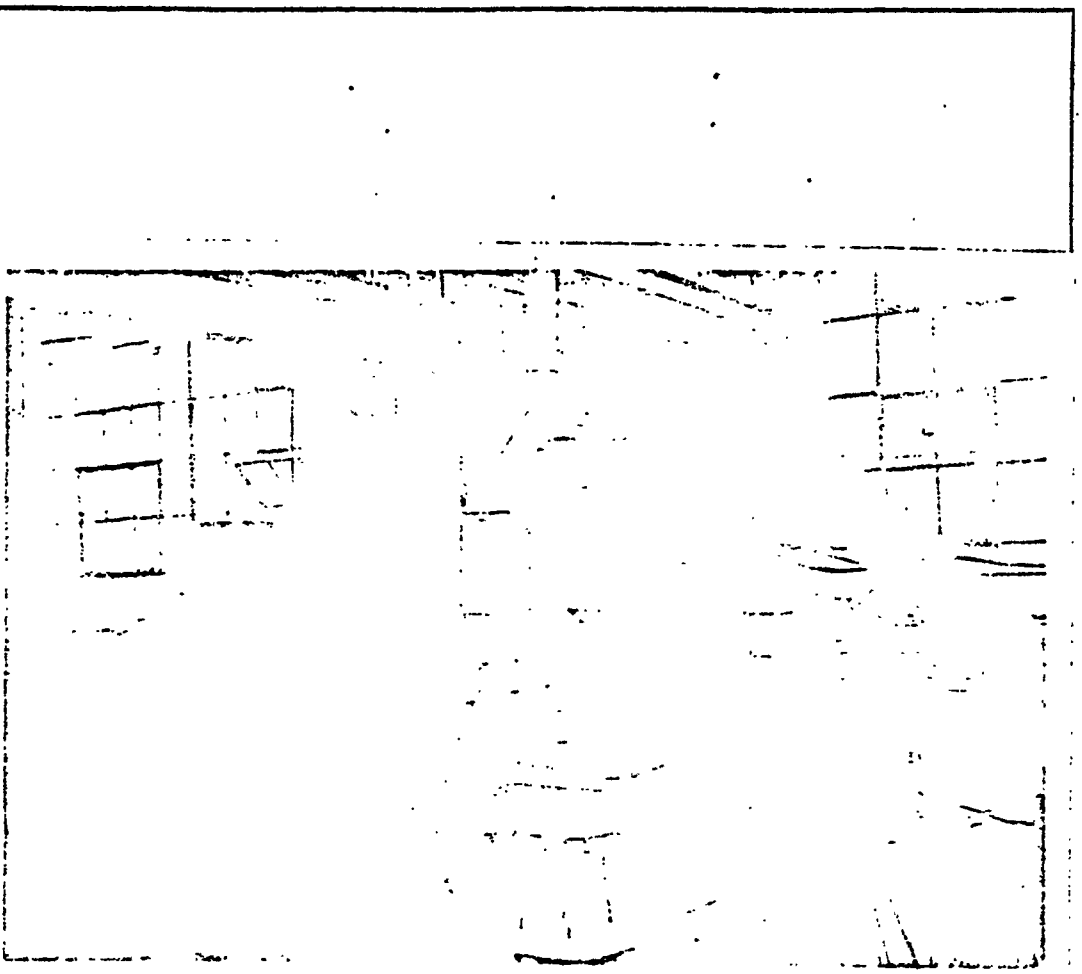


SAMPLE NO. 41
Dept. 53

Weighing and pressing dry process brake lining

The Manhattan Rubber Mfg. Div.

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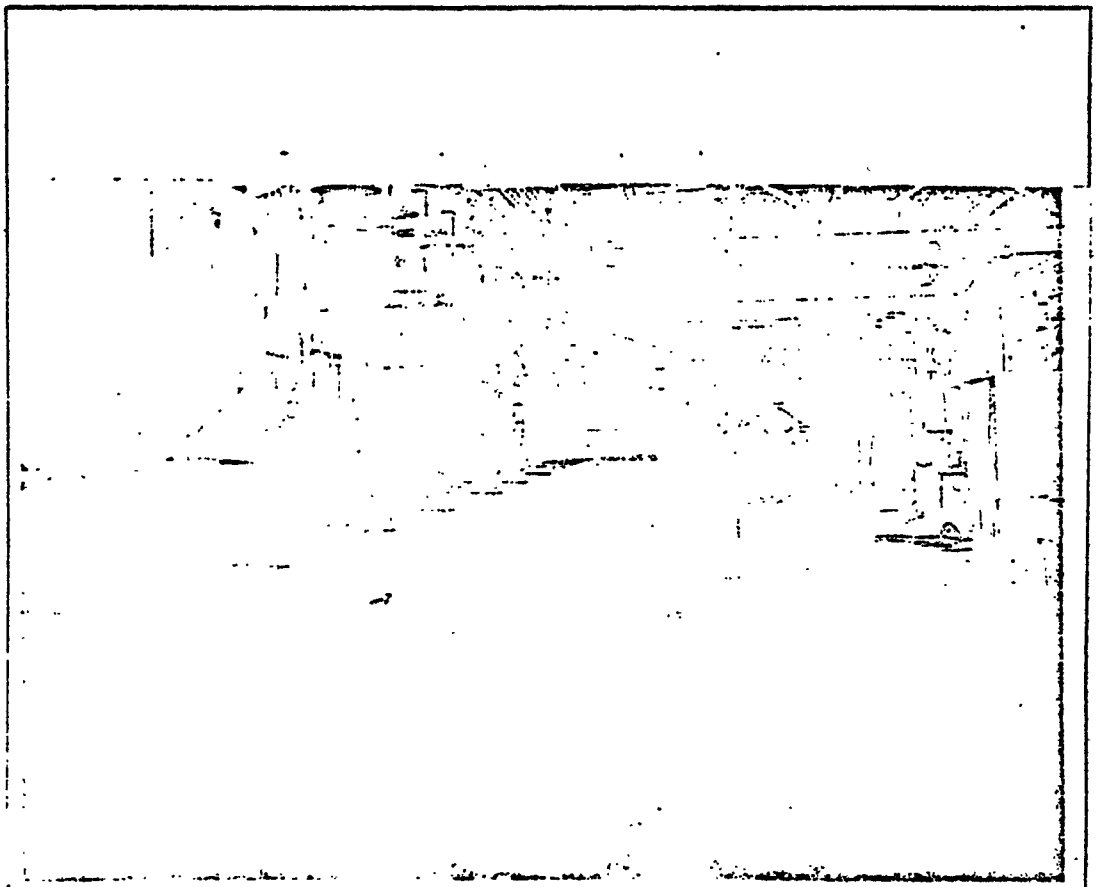


SAMPLE NO. 30
Dept. 2

Grinding bores on abrasive wheels, machine #1558

The Manhattan Rubber Mfg. Div.

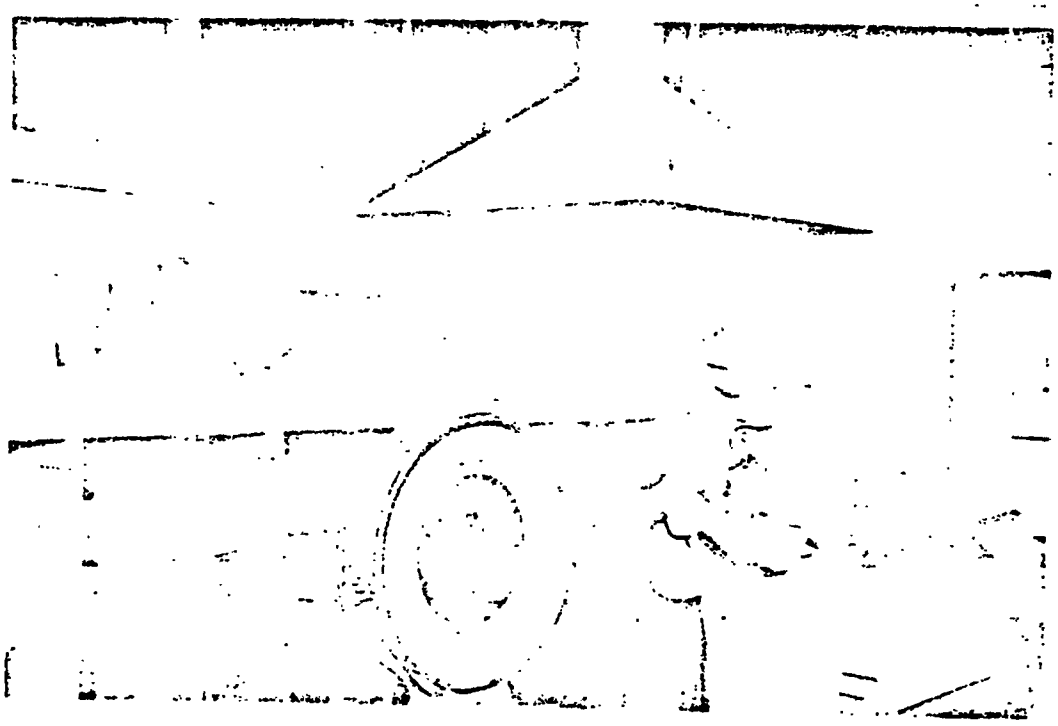
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SAMPLE NO. 42
Dept. 53-T

Weighing materials for wet process brake lining mixture

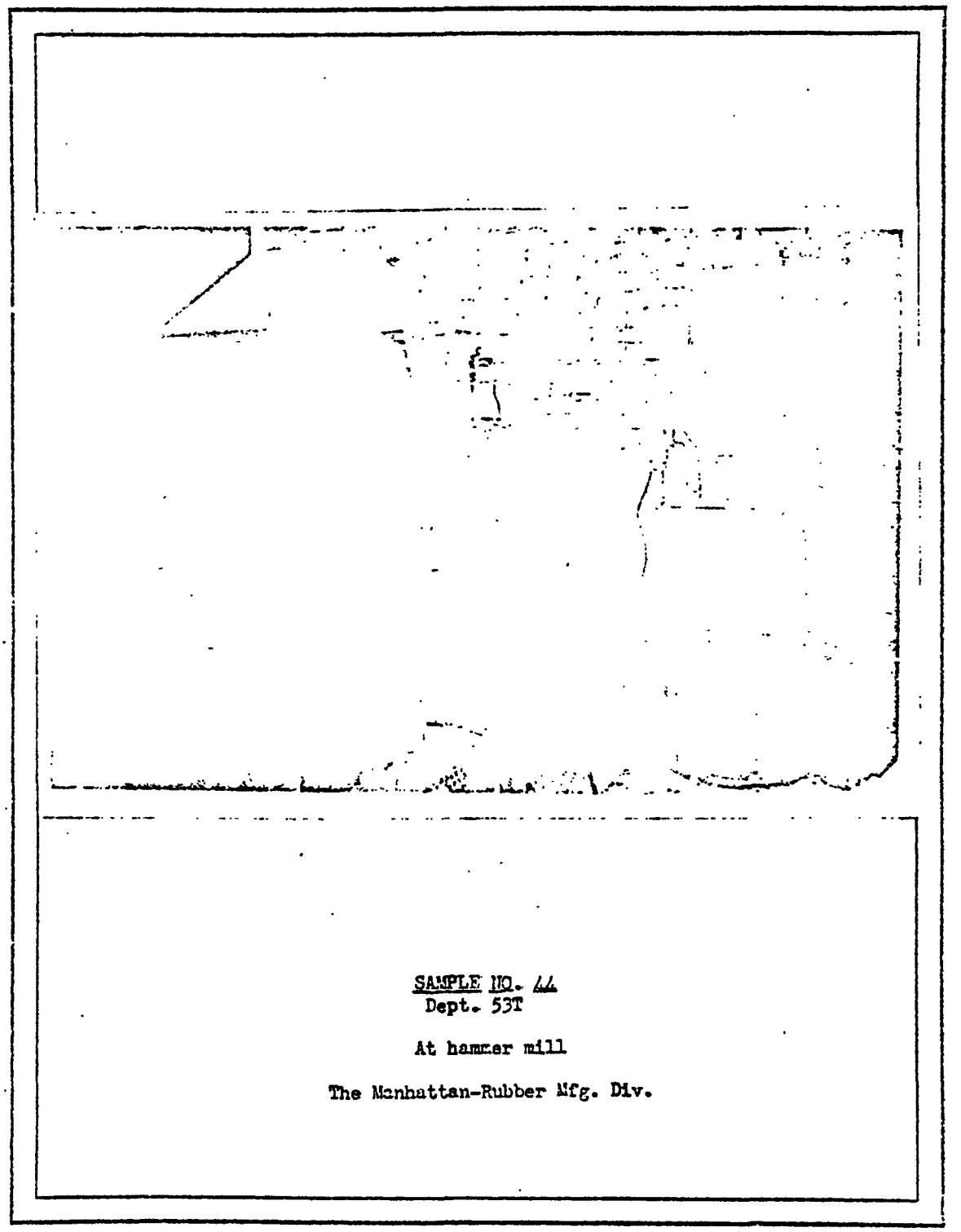
The Manhattan Rubber Mfg. Div.



SAMPLE NO. 43
Dept. 53T
In mixing room during time & mix was prepared and put into mixer. Clutch facing mix for Dept. 39

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

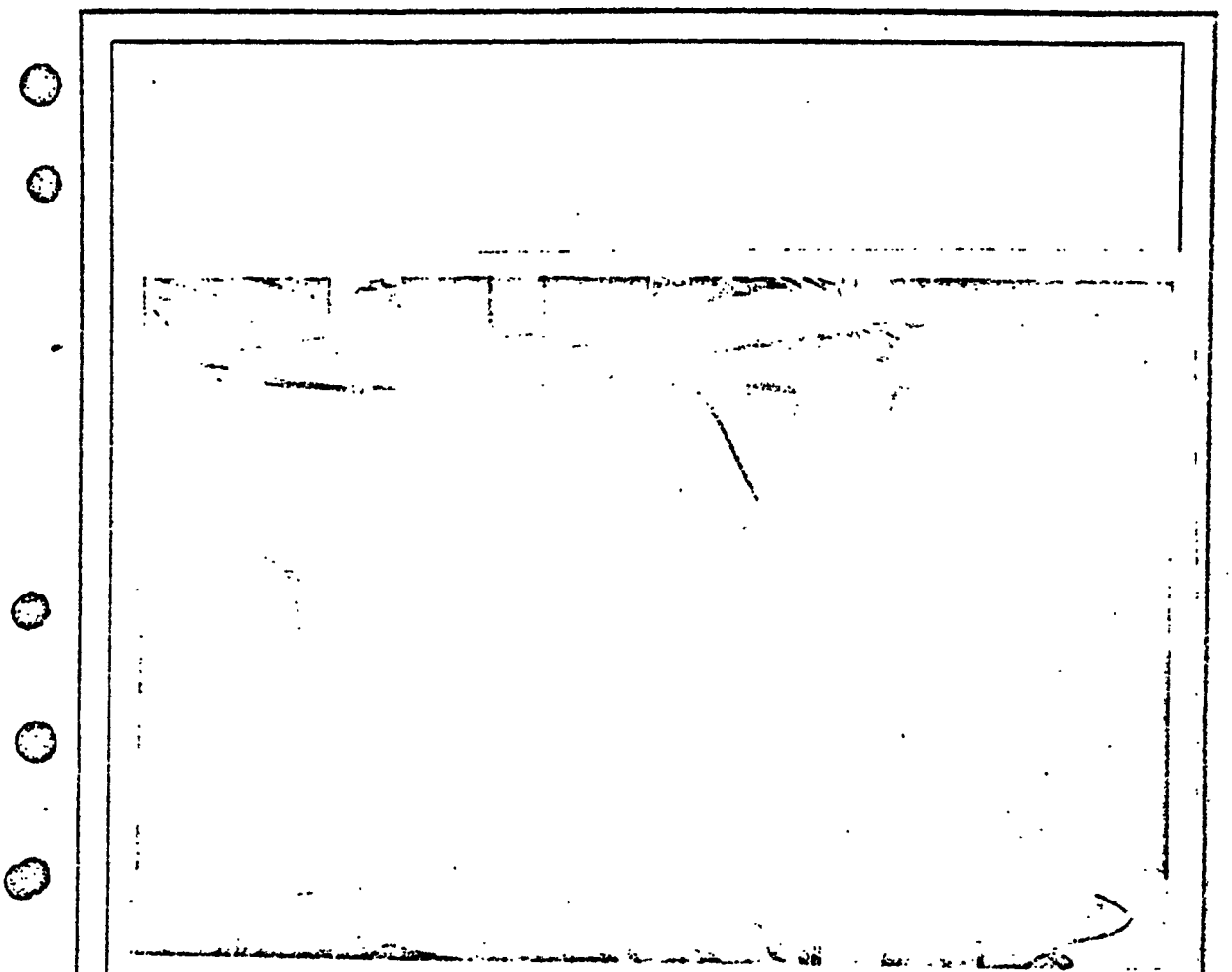
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SAMPLE NO. 44
Dept. 53T

At hammer mill

The Manhattan-Rubber Mfg. Div.

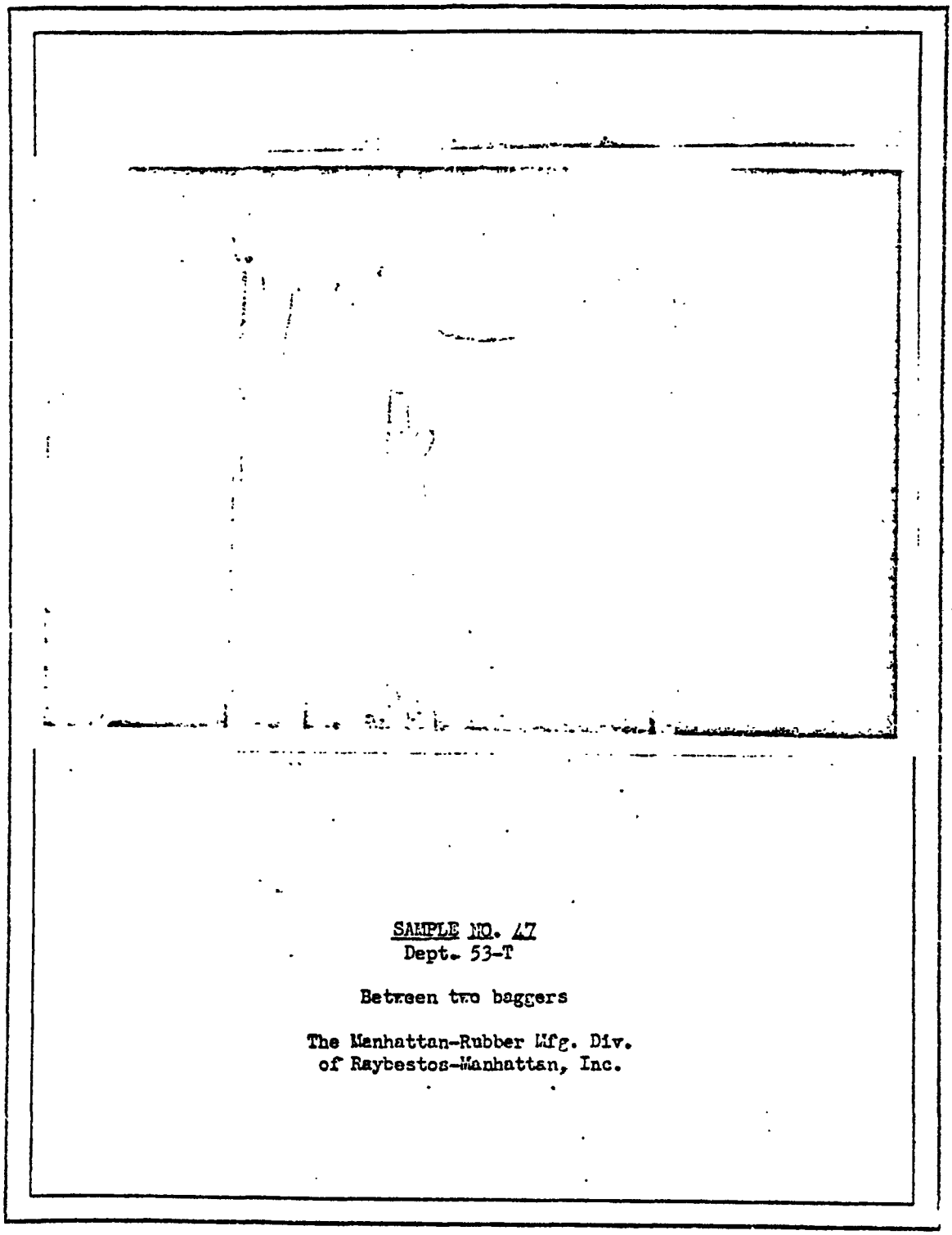


SAMPLES NO. 45 and 46
Dept. 53T

At hopper of picker and at shaker screen

The Manhattan Rubber Mfg. Div.

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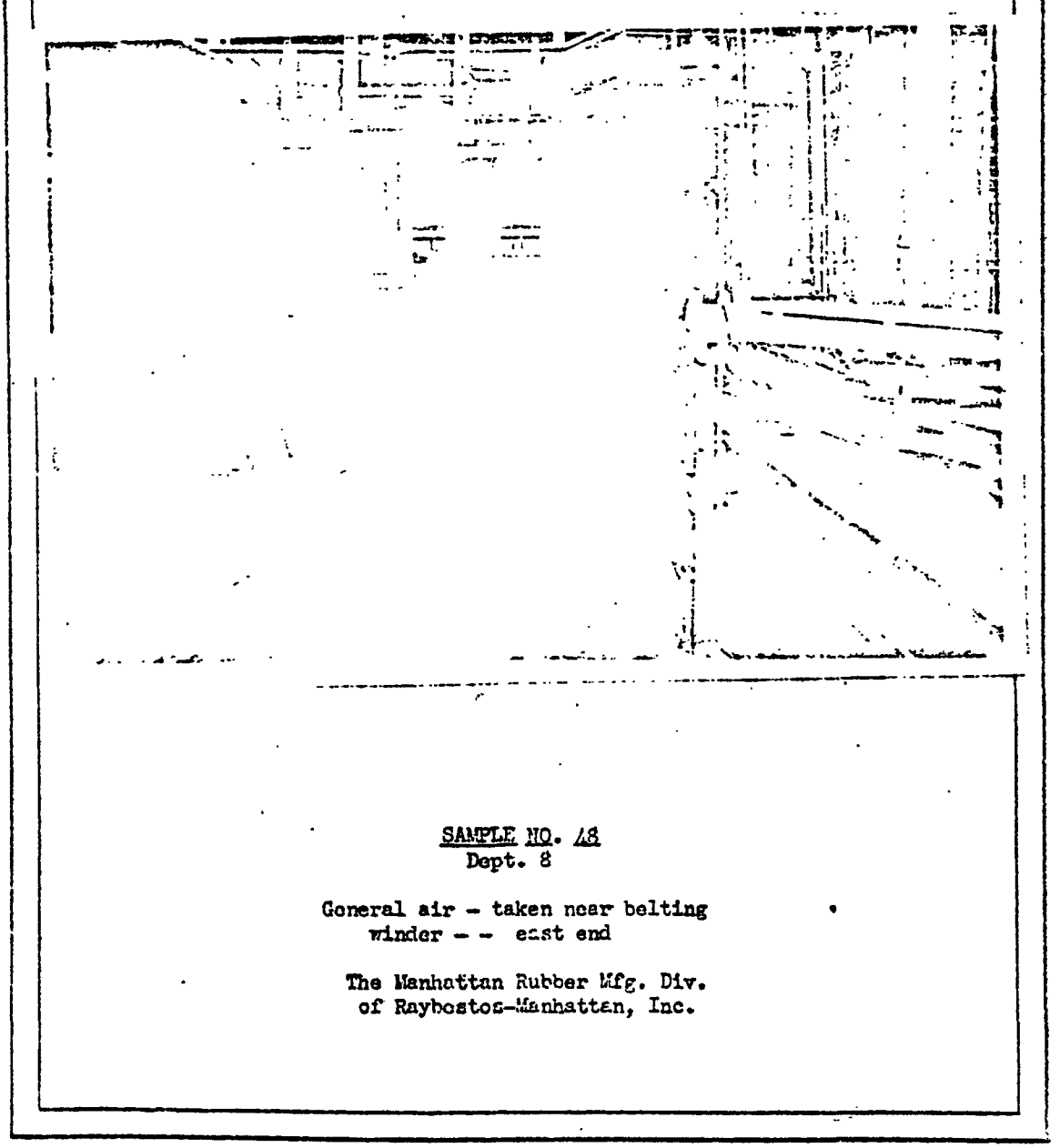


SAMPLE NO. 47
Dept. 53-T

Between two baggers

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

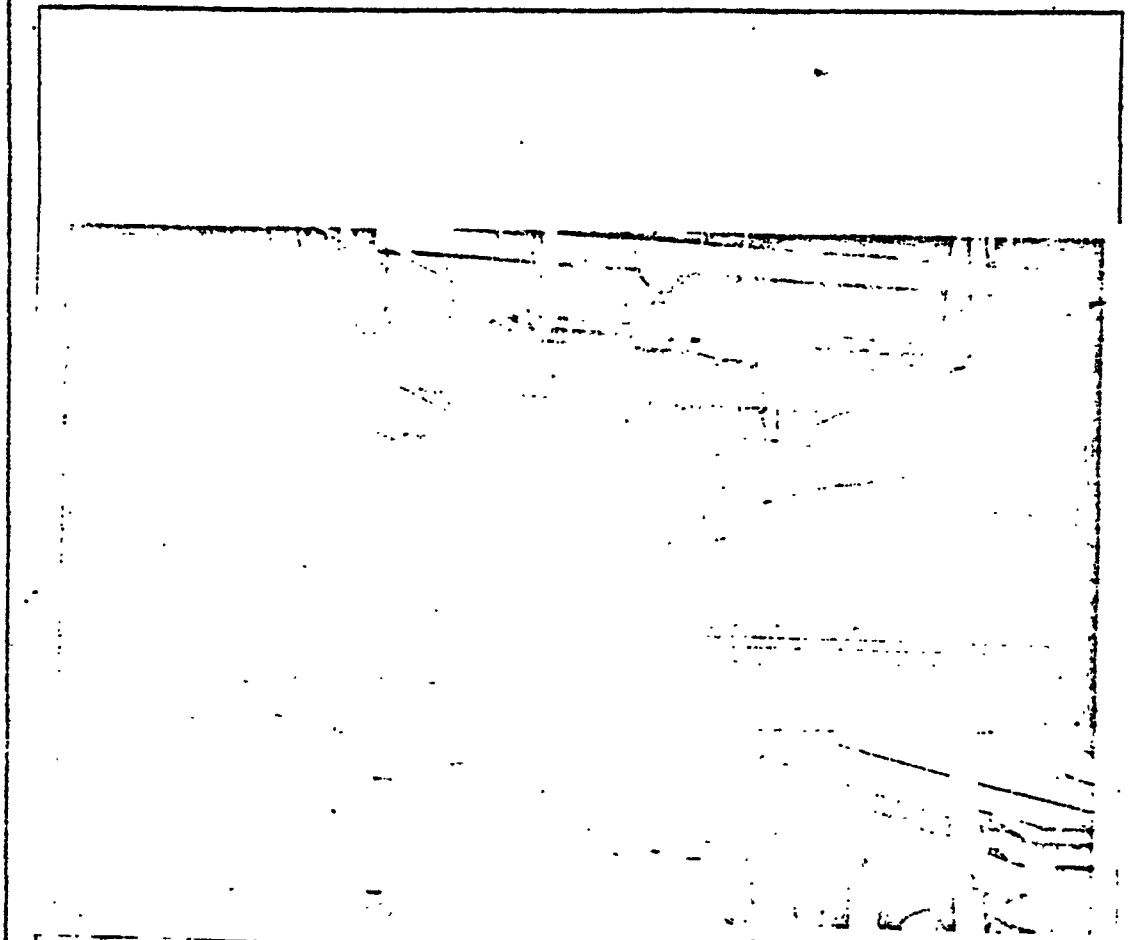
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SAMPLE NO. 48
Dept. 8

General air - taken near belting winder - - east end

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

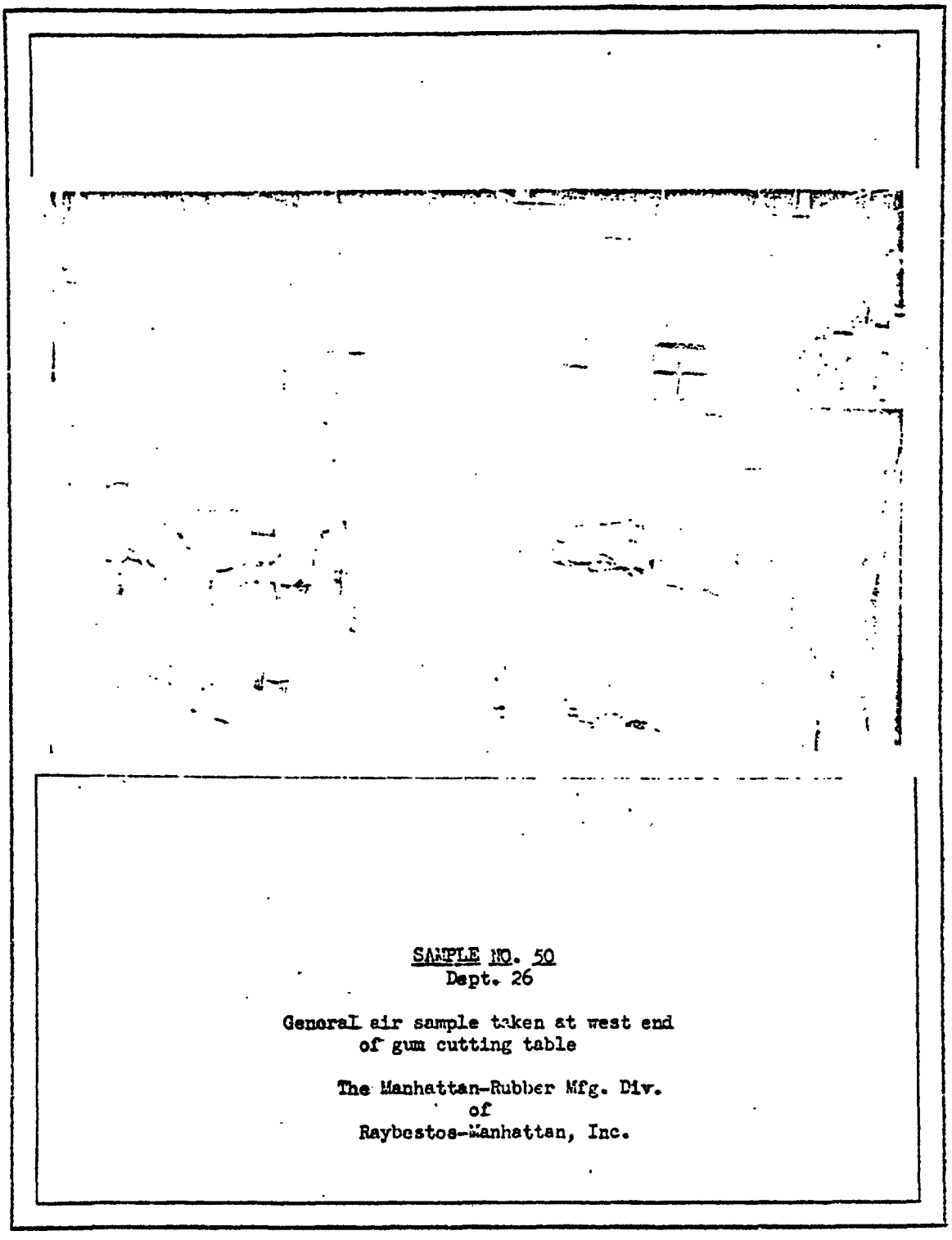


SAMPLE NO. 49
Dept. 26

General air sample taken at Press #16

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

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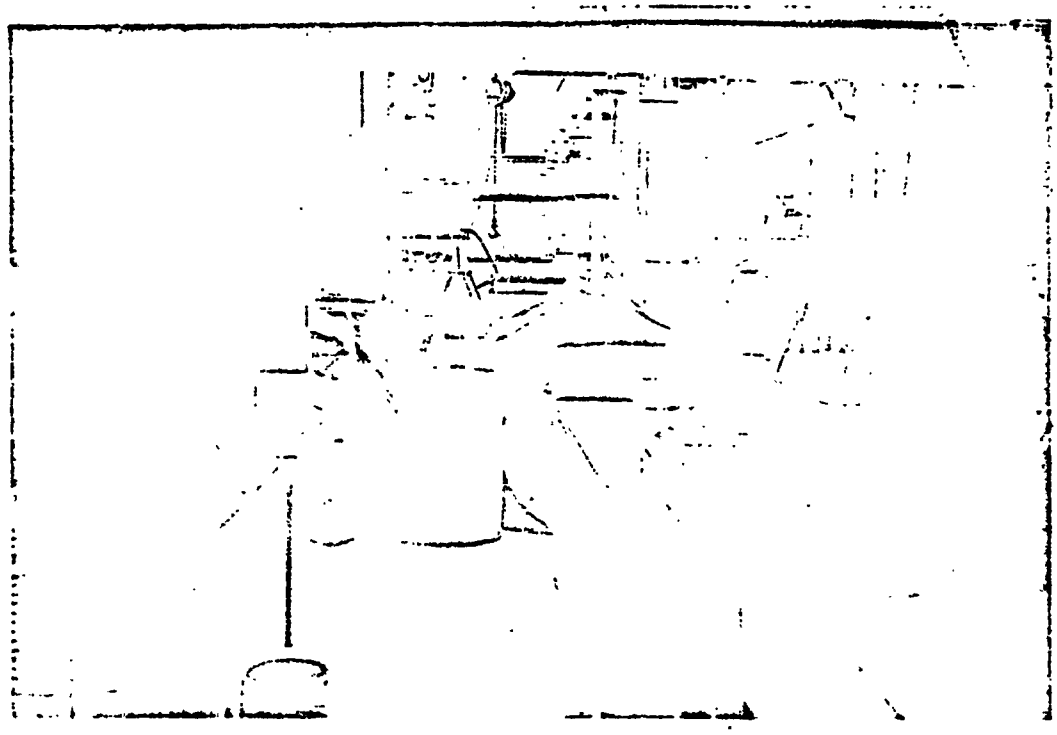


SAMPLE NO. 50
Dept. 26

General air sample taken at west end
of gum cutting table

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

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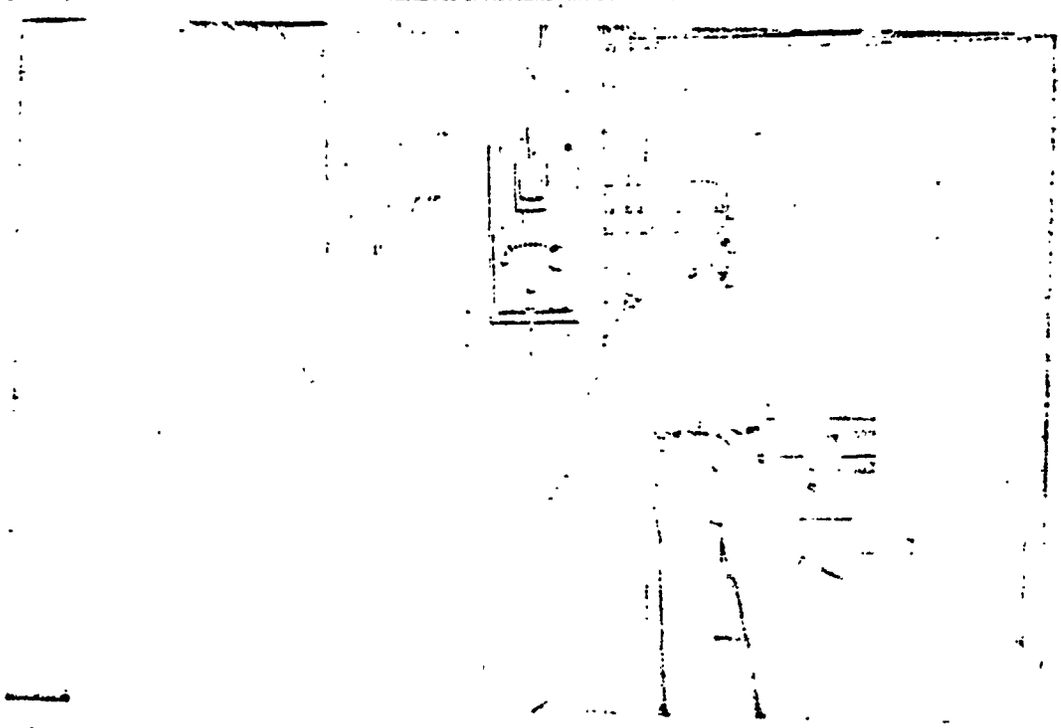


SAMPLE NO. 51
Dept. 8A

General air taken in belt press room

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

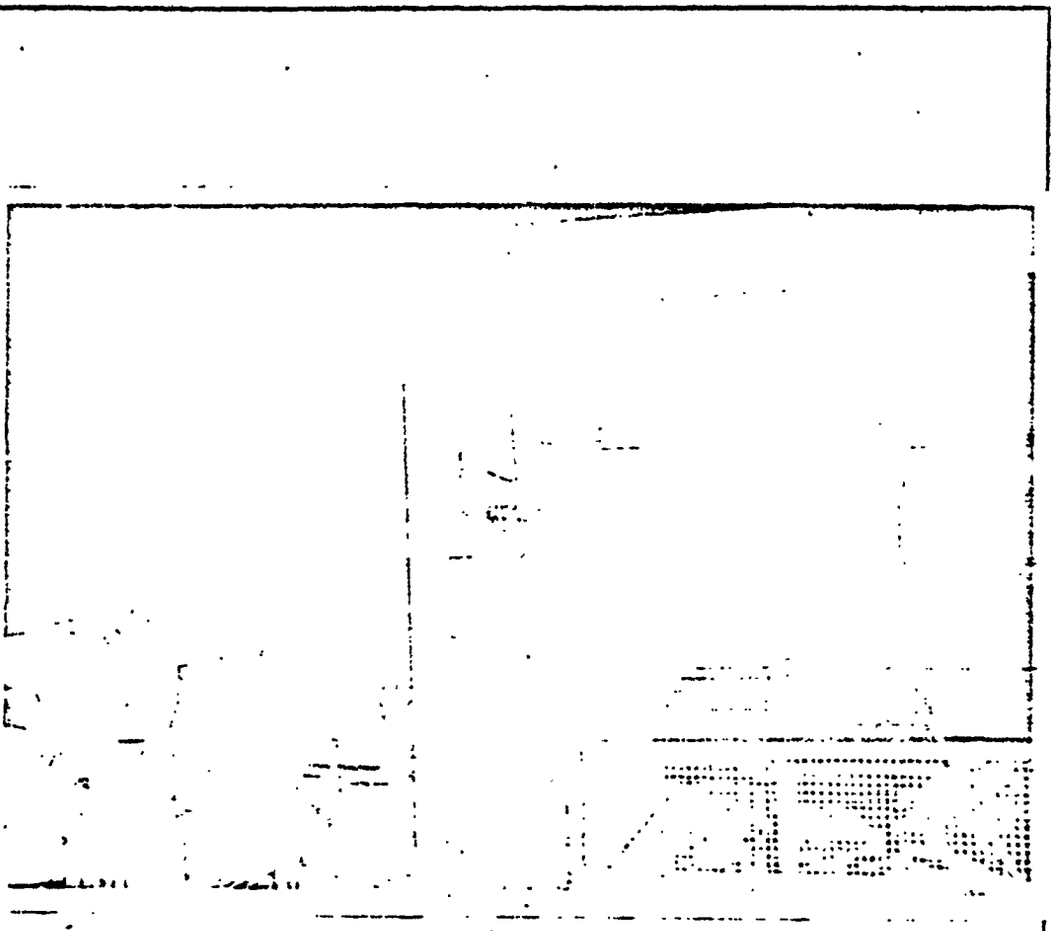
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SAMPLE NO. 52
Dept. 8

Cutting brake lining to length; power shear
#1382

The Manhattan Rubber Mfg. Div.

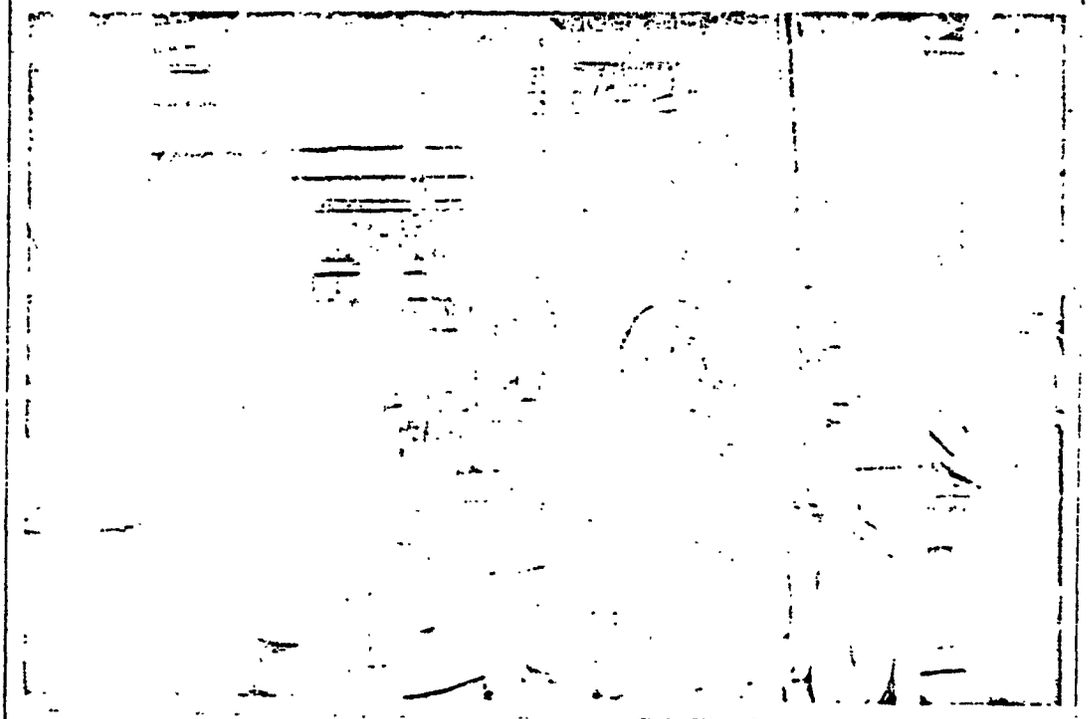


SAMPLE NO. 53
Dept. 1

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.

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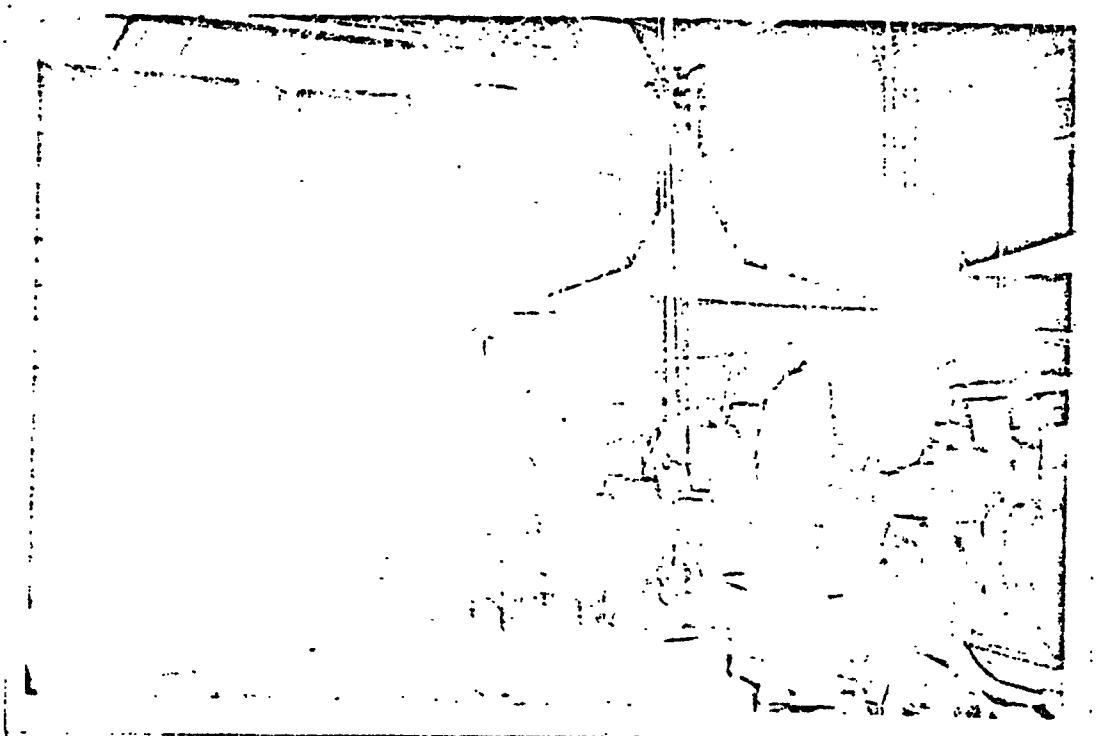
SAMPLE NO. 55

Dept. 8-A

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

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

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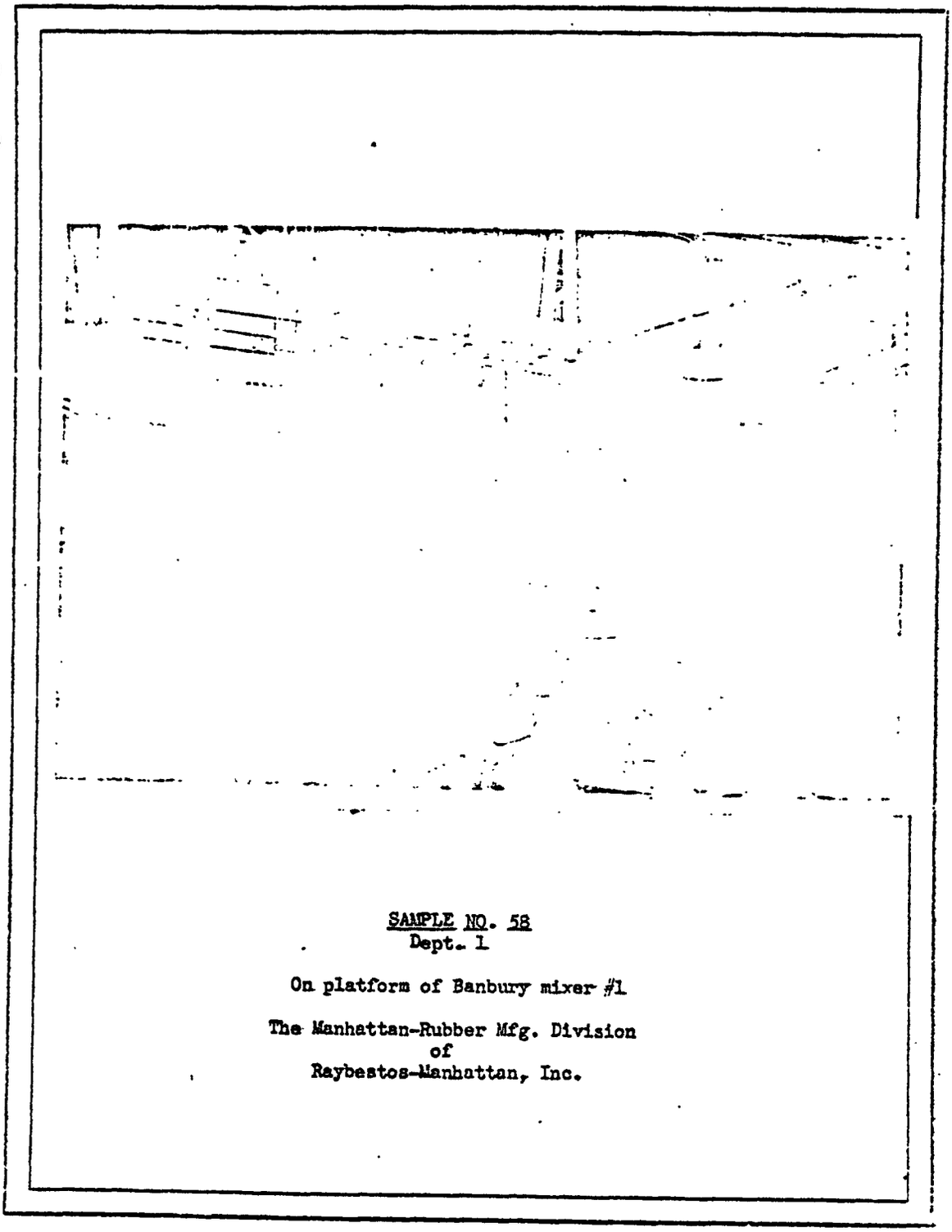


SAMPLES NO. 56 and 60
Dept. 1

Rubber compounding mills #128, 129 & 130

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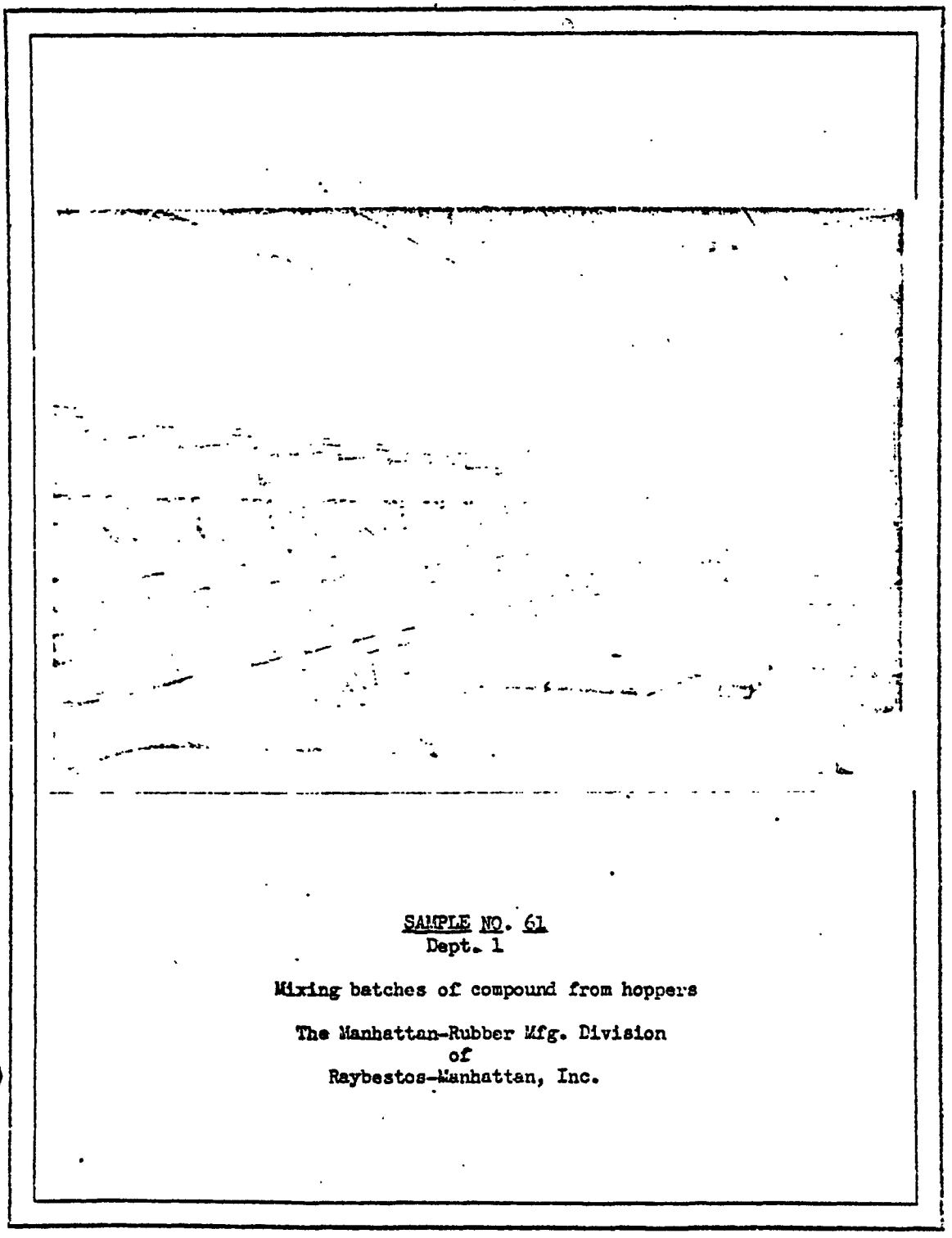


SAMPLE NO. 58
Dept. 1

On platform of Banbury mixer #1

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

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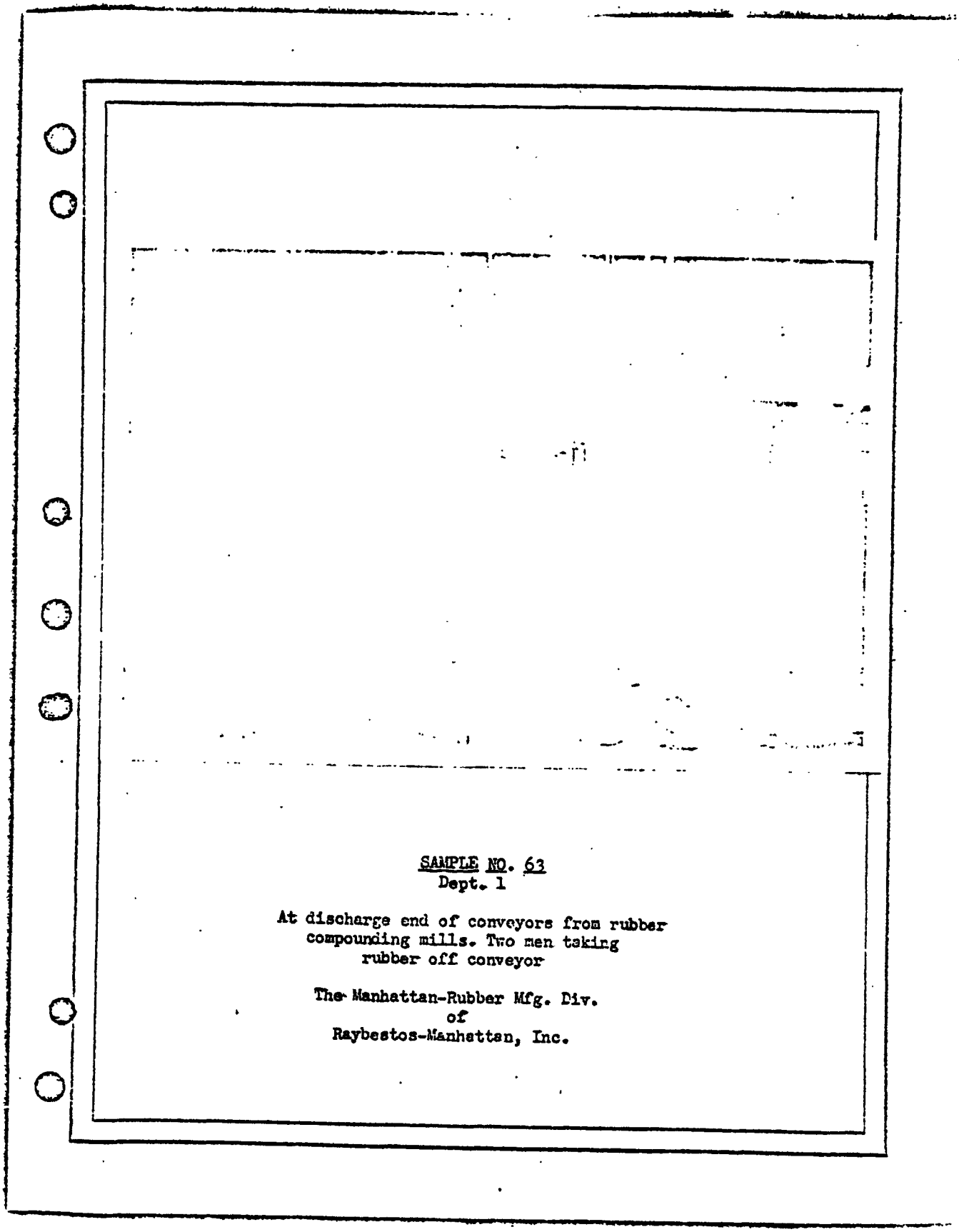


SAMPLE NO. 61
Dept. 1

Mixing batches of compound from hoppers

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

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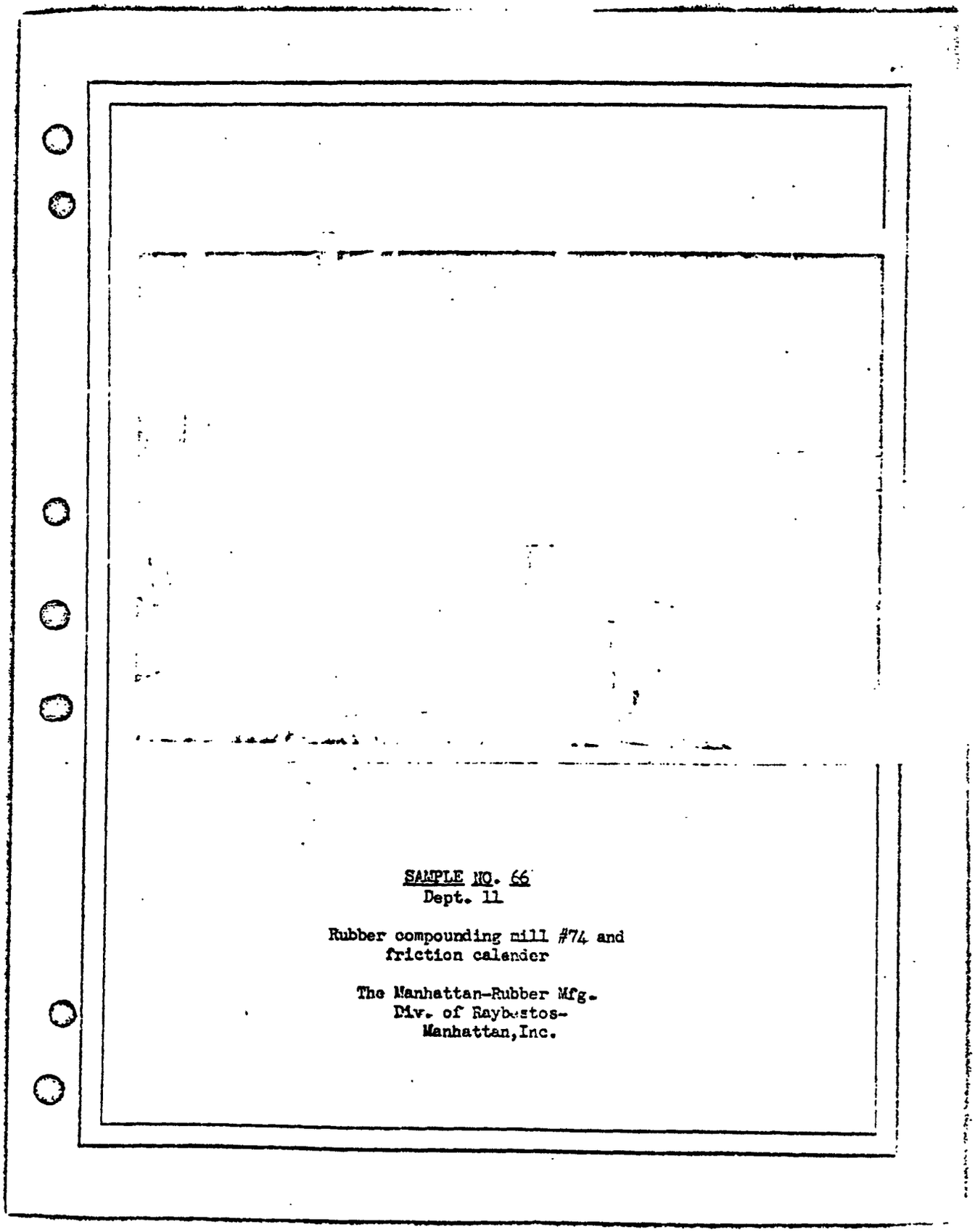


SAMPLE NO. 63
Dept. 1

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

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

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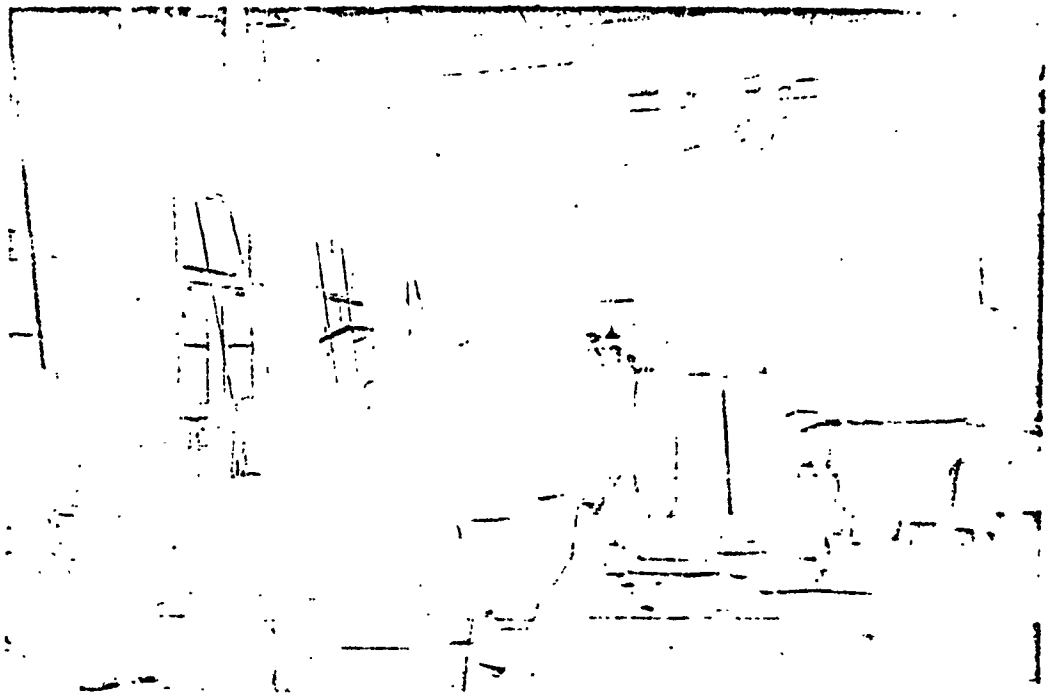


SAMPLE NO. 66
Dept. 11

Rubber compounding mill #74 and
friction calender

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Div. of Raybestos-
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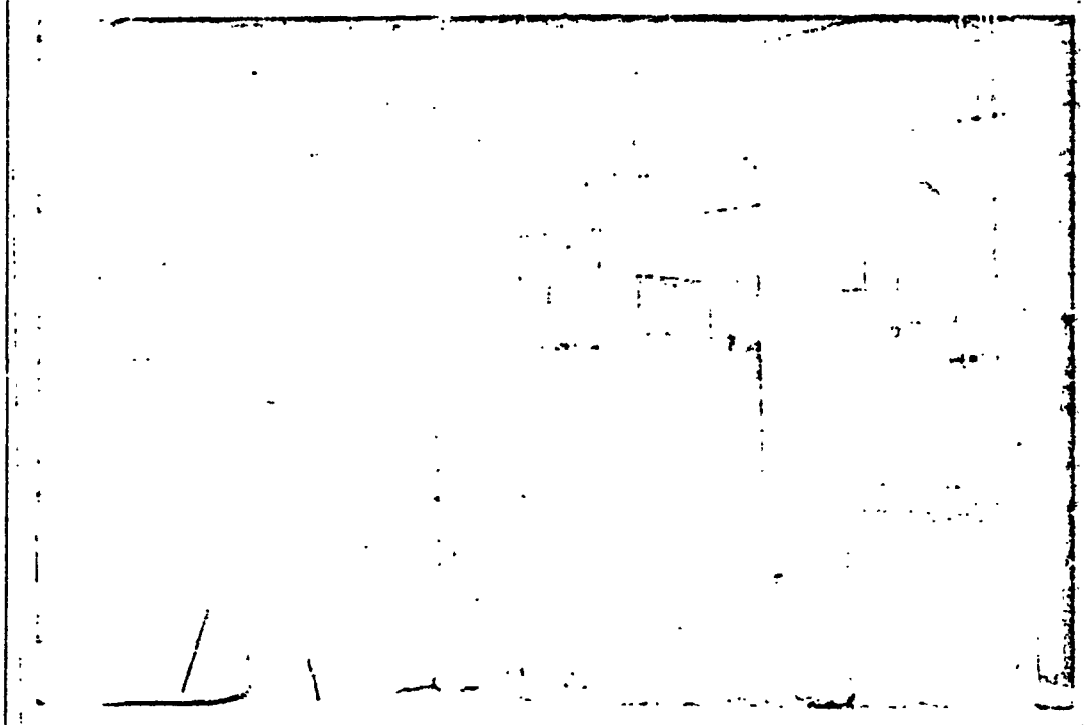
SAMPLES NO. 80 - 84

Dept. 5 - Balcony

Grinding and sanding rubber

The Manhattan-Rubber Mfg.
Div. of Raybestos-Man-
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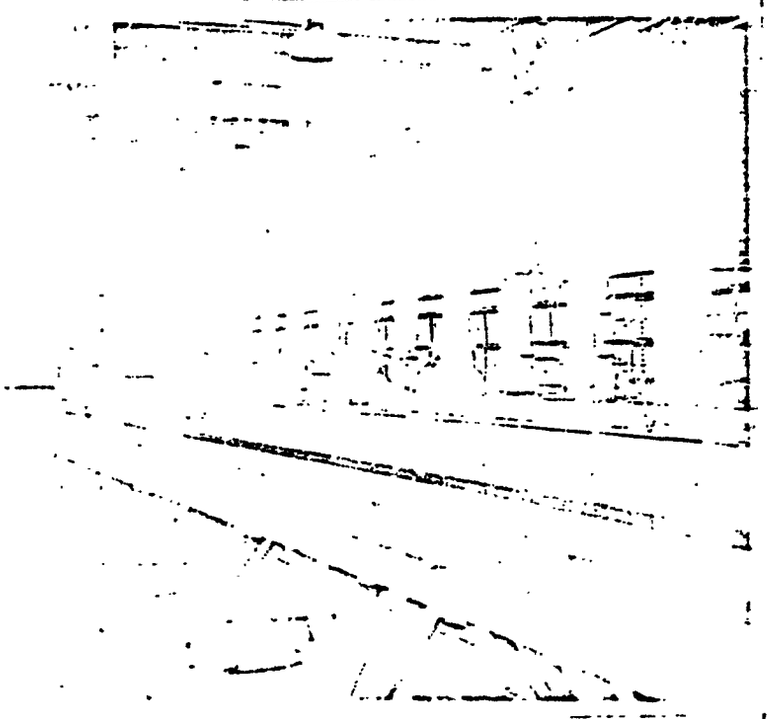


SAMPLE NO. 87
Dept. 5 West End Room

General air sample between three machines
panning and reeling rubber tubing

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

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SAMPLE NO. 89

Dept. 6

Inserting rods in rubber tubing; exhaust system

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