

PLAINTIFF'S EXHIBIT

MET-592

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PHL-345
AT
1/19/79

A STUDY OF DUST CONDITIONS
in the Machine Plant
of the
UNITED STATES ASBESTOS & RUBBER DIVISION OF THE PATHEMOS-VALENTIN,
INC.

1930

CO-1

Exhibit J

The following report is a study of dust conditions in the
Manhala plant of the United States Asbestos & Rubber Division of the
Raybestos-Manhattan, Inc. This study was carried on during February,
1930, by the Industrial Health Service of the Metropolitan Life Insur-
ance Company.

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

This study differs from the two preceding ones in that there
were included physical examinations of employees, hence it is more com-
plete and informative.

APPARATUS AND METHODS OF SAMPLING:

The impinger method⁽¹⁾ was used for collecting samples of dust in the air. This is accomplished by aspirating the air to be sampled, and impinging it upon a flat surface under a liquid of either distilled water or alcohol. In general whenever the dust collected is of a siliceous nature an alcohol-water mixture is used to prevent any silica going into solution. Pyrex flasks are used as containers to collect the samples, as experience has shown that this glass is, for all purposes, practically insoluble. The volume of air is measured by means of a flow meter or else a vacuum gauge and the air sample is aspirated by suction supplied either by an electrically driven pump or else by an ejector actuated by compressed air. Each dust sample collected represented a volume of air of from 50 to 80 cubic feet.

Due to the high concentrations of dust in the departments of this plant this size sample was found to be representative and of sufficient size for analysis. The impinger was placed in close proximity to and at the breathing level of the workmen.

Air samples were also taken with the electric precipitator⁽²⁾ for dust particle measurements. This instrument is designed upon the principle of the Cottrell precipitator. Air is drawn through an electrostatic field, where the dust particles are deposited upon a celluloid foil, by means of a small electrically driven pump. The volume of air sampled is measured by means

(1) "Comparative Tests of Instruments for Determining Atmospheric Dusts", - Public Health Bulletin, No. 144, Treasury Dept., Washington, D.C.

(2) "Determination of Suspensoids by Alternating Current Precipitators", - Philip Drinker and Robert H. Thomson, Journal of Industrial Hygiene, Vol. VII, No. 8, June, 1925.

of a flow meter. From 10 to 50 cubic feet of air were taken for a sample.

The collected dust samples were transported to the laboratory where total dust counts were made, and particle size measurements were taken. The results are tabulated and appear in graphs attached. The percentages of the various sized particles may be interpolated from these graphs.

Microphotographs of these dust particles were taken under high power and were further enlarged by being projected upon a screen by means of a lantern slide projector. The enlarged particles were then measured with a ruler. Knowing the entire enlargement (by actual measurement) it was possible to calculate the original particle size.⁽³⁾ By the use of Hazen's⁽⁴⁾ logarithmic probability paper, the logarithms of the function to be measured - in this case microns - are plotted as ordinates against the probability of occurrence as abscissae. Since the line is straight, extrapolation and interpolation of any desired region is facilitated.

It will be noted from these curves that from 25 to 88% of the particles are less than 10 microns in their greatest diameter.

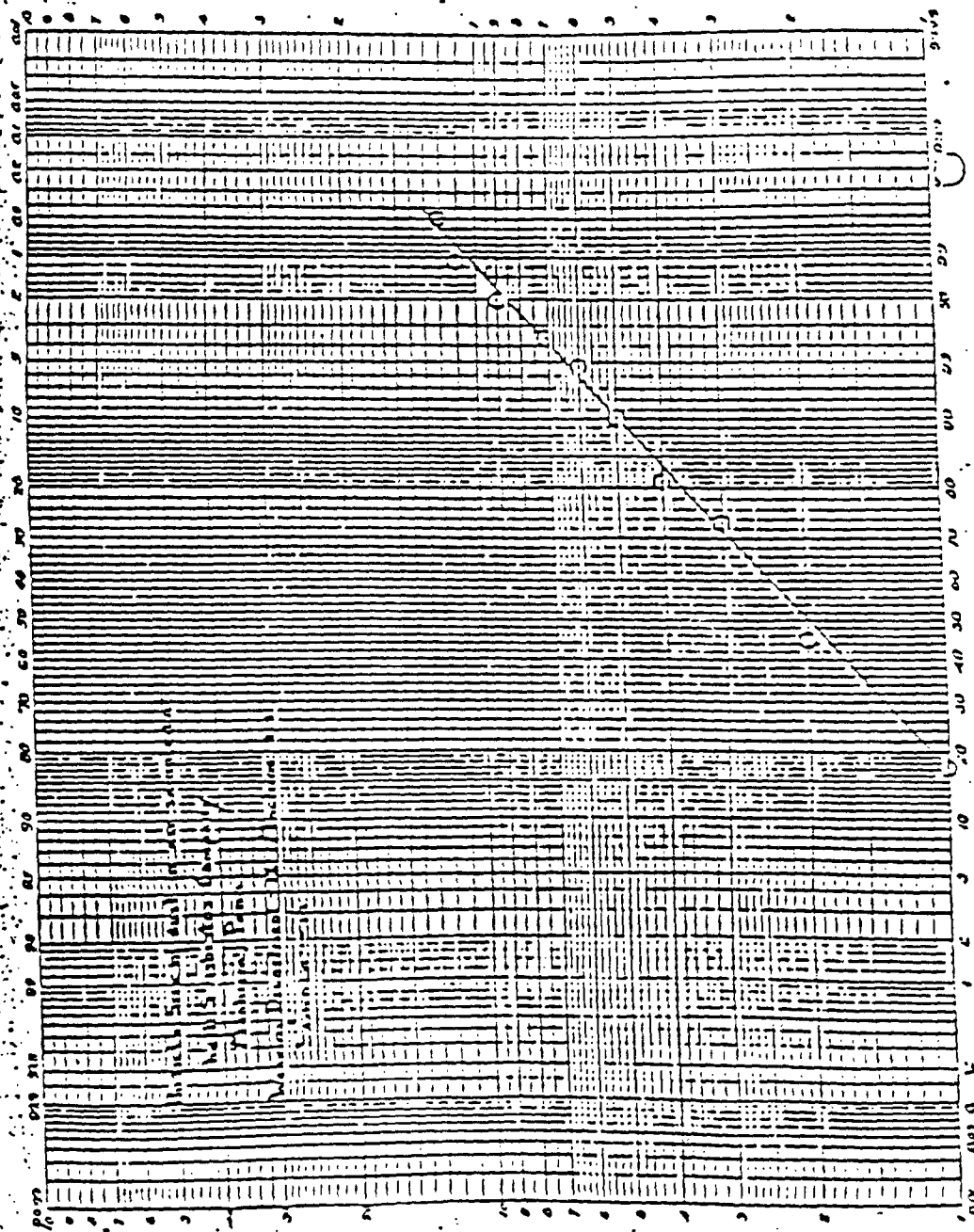
The analyses are reported in total particles per cubic foot, and also in the corresponding weight of the dust in milligrams. There is no indicated relationship between the dust counts and the corresponding weights.

DESCRIPTION OF PLANT:

The plant at Vanburen consists of a number of one-story and two two-story buildings. One of the two-story buildings houses the offices, laboratories, dispensary and store room, while the other is devoted to the preparation

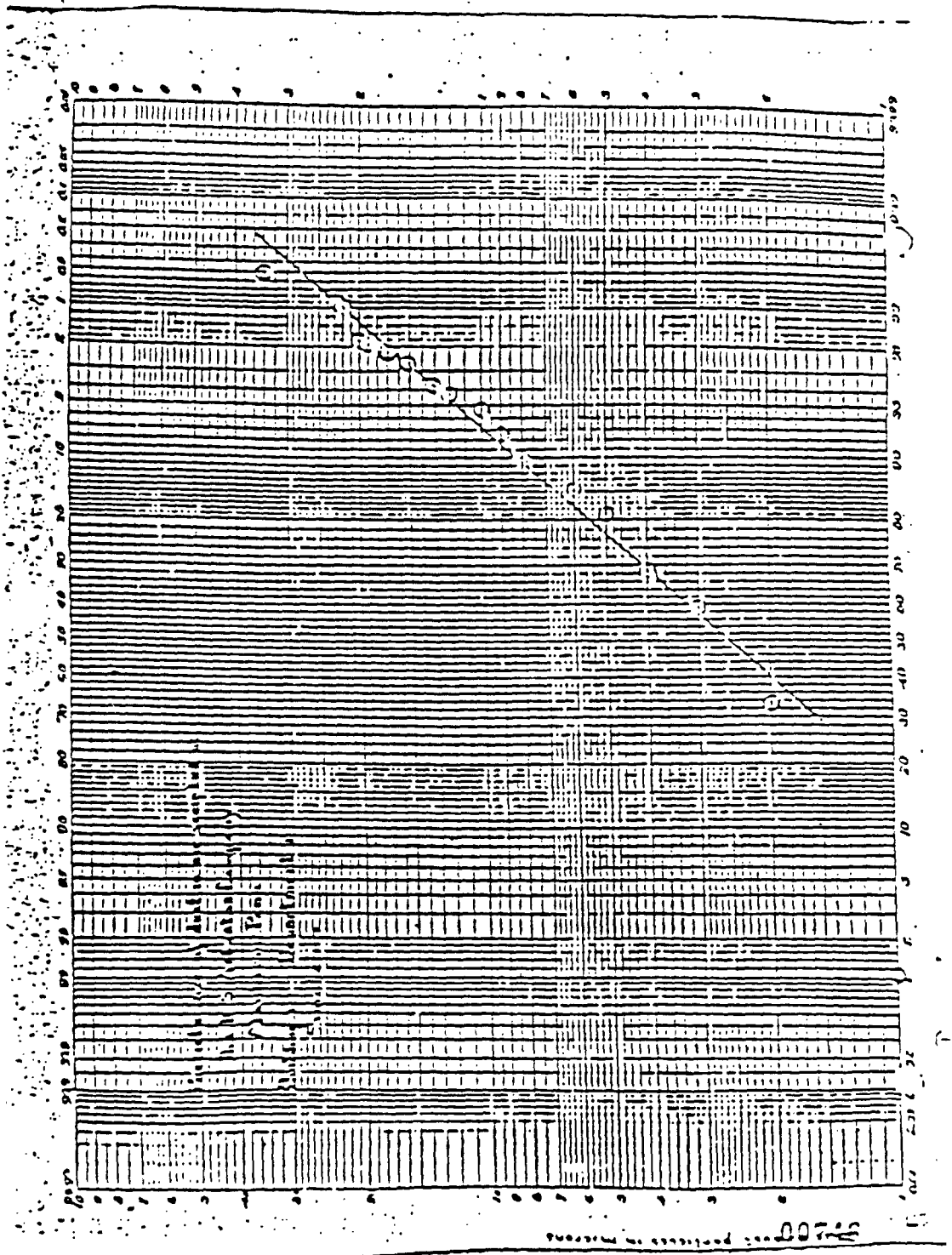
⁽³⁾Green, E. W. "A Photomicrographic Method for the Determination of Particle Size of Paint and Rubber Pigments", Journal Franklin Institute, 1921, 132, 657.

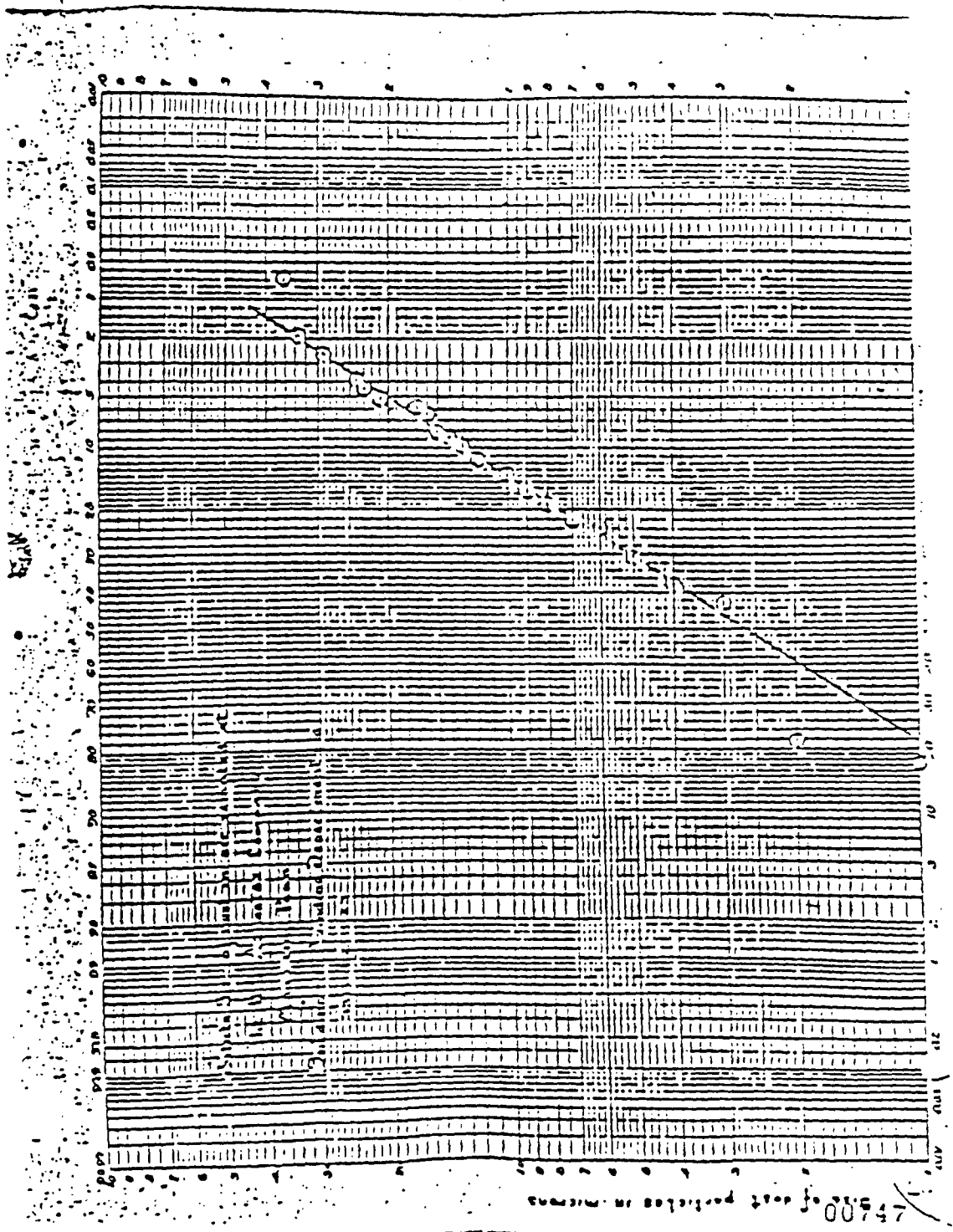
⁽⁴⁾Wentz, G.C. "Vital Statistics", N.Y. John Wiley & Sons, Inc. 1925, p. 457.

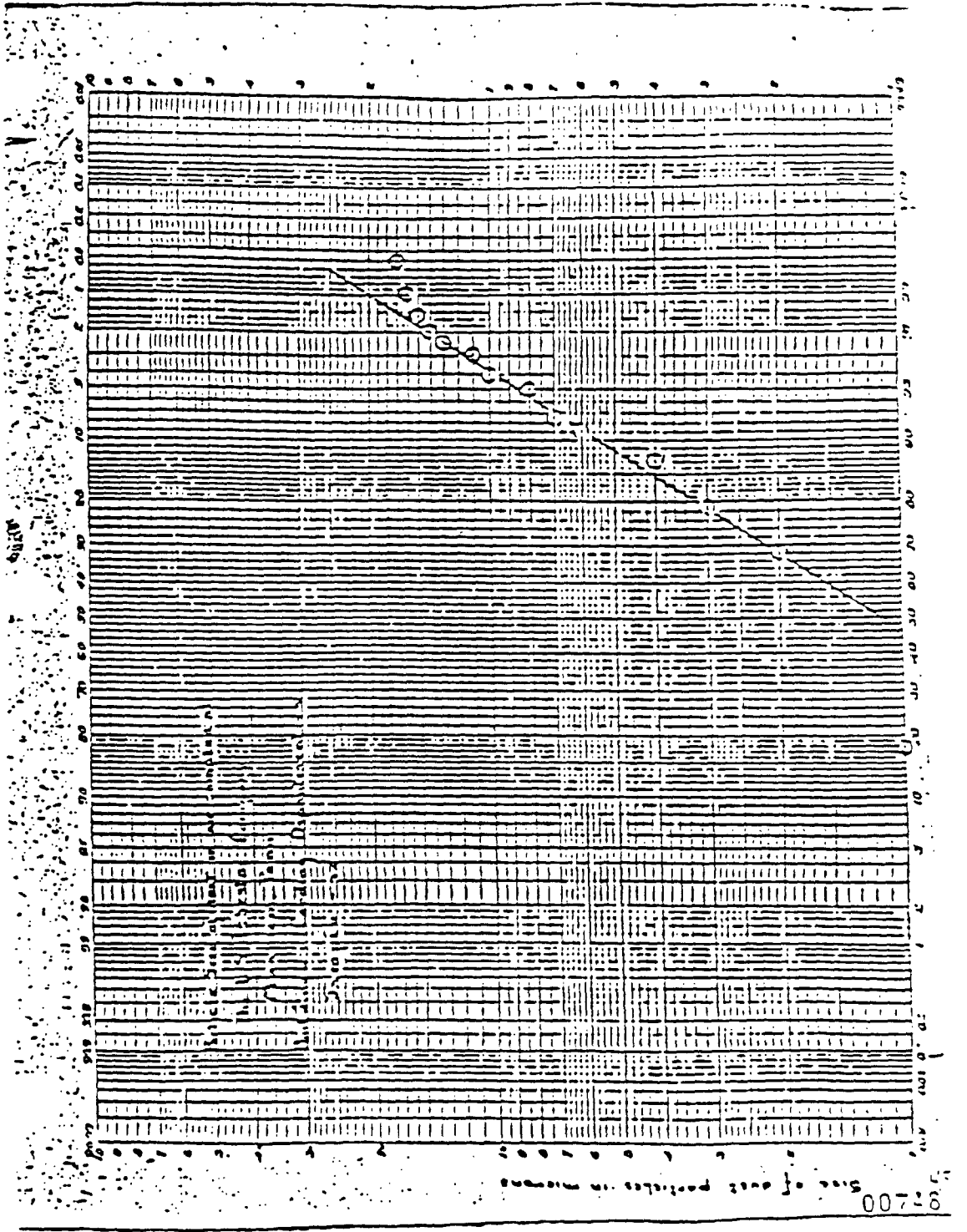


Percent frequency of dust particles

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two and brake-band weave room on the first floor and the carding, spinning and spoiling operations are performed on the second floor.

The other one-story buildings are occupied by spoiling, twisting and broad loom operations, brake-band twisting and packing manufacturing, shops and shipping department.

PREPARATION DEPARTMENT:

The asbestos is received in bags and emptied upon the floor. It is then shoveled into pug mills or chasers from which it is passed into an opener and on a shaker sieve. Here it is piled on the floor to make up into mixtures with proportionate amounts of cotton which has already been passed through an opener. The batches of mixed cotton and asbestos are passed through a mixer picker and carried by suction through a pipe to bins in the card room on the second floor. In this suction pipe oil is applied to the mixture of cotton and asbestos by means of sprayers. Judging from the high dust counts found in the card room, as compared with those found at similar locations in the plant at Charleston, the method of applying the oil does not appear to be as effective.

Two card machines working on waste material are making picking in this department. One loom is operating on brake-bands.

The exhaust systems at the various machines were only in partial operation due to relocation of machines. No humidifying system was in operation. The temperature of this department at the time of visit was 87° F. with a relative humidity of 37%, as compared with outdoor temperature of 39° F. and a relative humidity of 67%. The high incidence of dust in this department is partly due to the alterations being made.

TABLE NO. 1

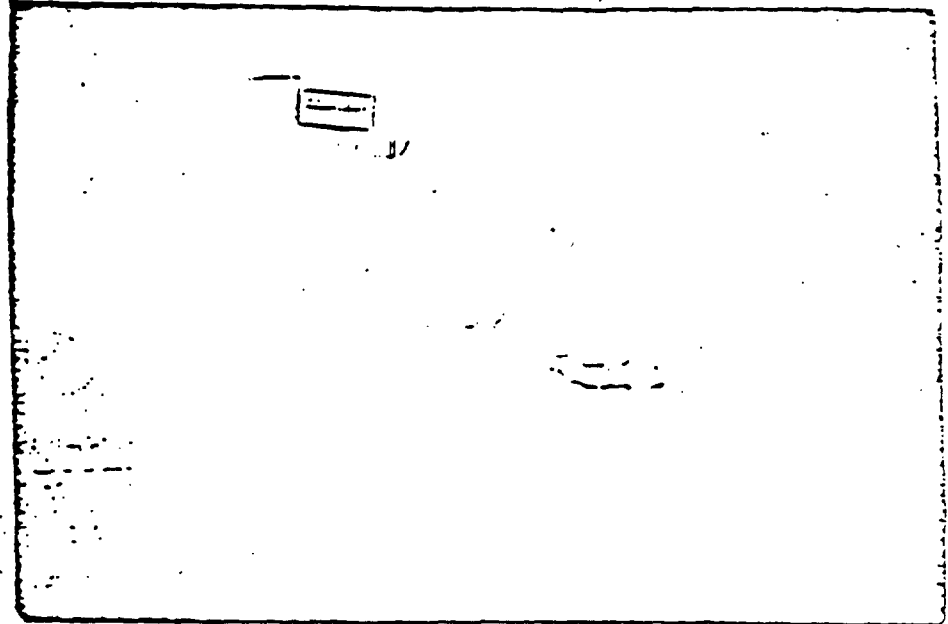
MILLERATION ROOM

Sample No.	Initiating Dept. No.	Location of Sampling	Total Counts of Dust Particles per cubic foot	Weight of Dust in milligrams per cubic foot
1	3	1 Alongside exhaust pipe from vertical opener discharging on to shaker above	43,259,134	2.5
2	5	1 Alongside Loom 946. Only one loom in preparation room	2,201,697	.48
4	5	1 Alongside choppers #1 and 2	5,136,214	.47
5	5	1 At the side of shaker above	23,809,628	1.37
6	5	1 Floor mixing center of room	3,467,089	.45
8	5	1 Alongside feeder end of wick card working waste material, machine 136	8,007,179	.40
9	5	1 Machine #10, feeder hopper of breaker card	23,210,145	8.4
11	5	1 At the take off end of wick card machine #136	4,906,616	.66

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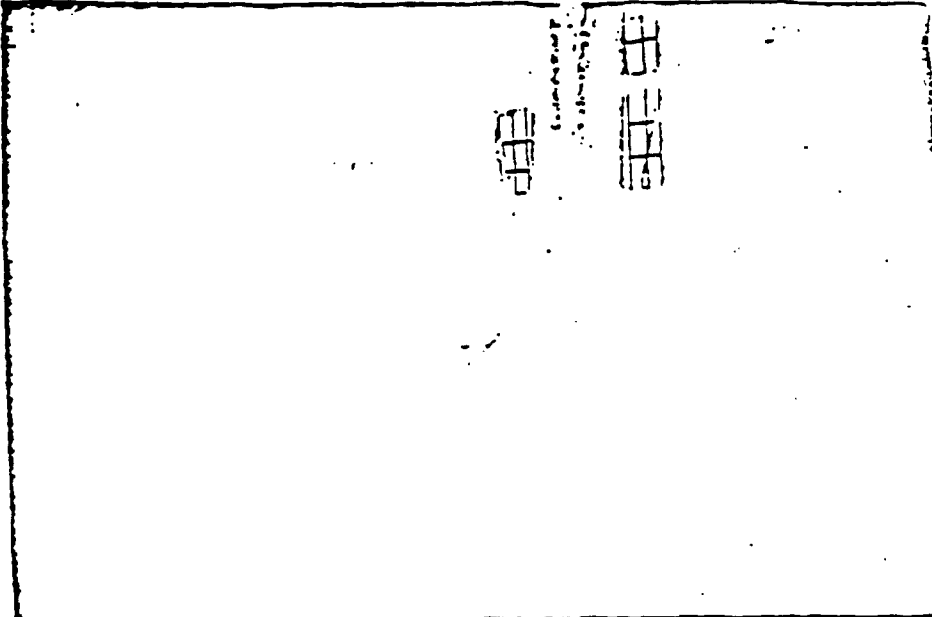
Changes and Patch Viewing Time
in
Preparation Room

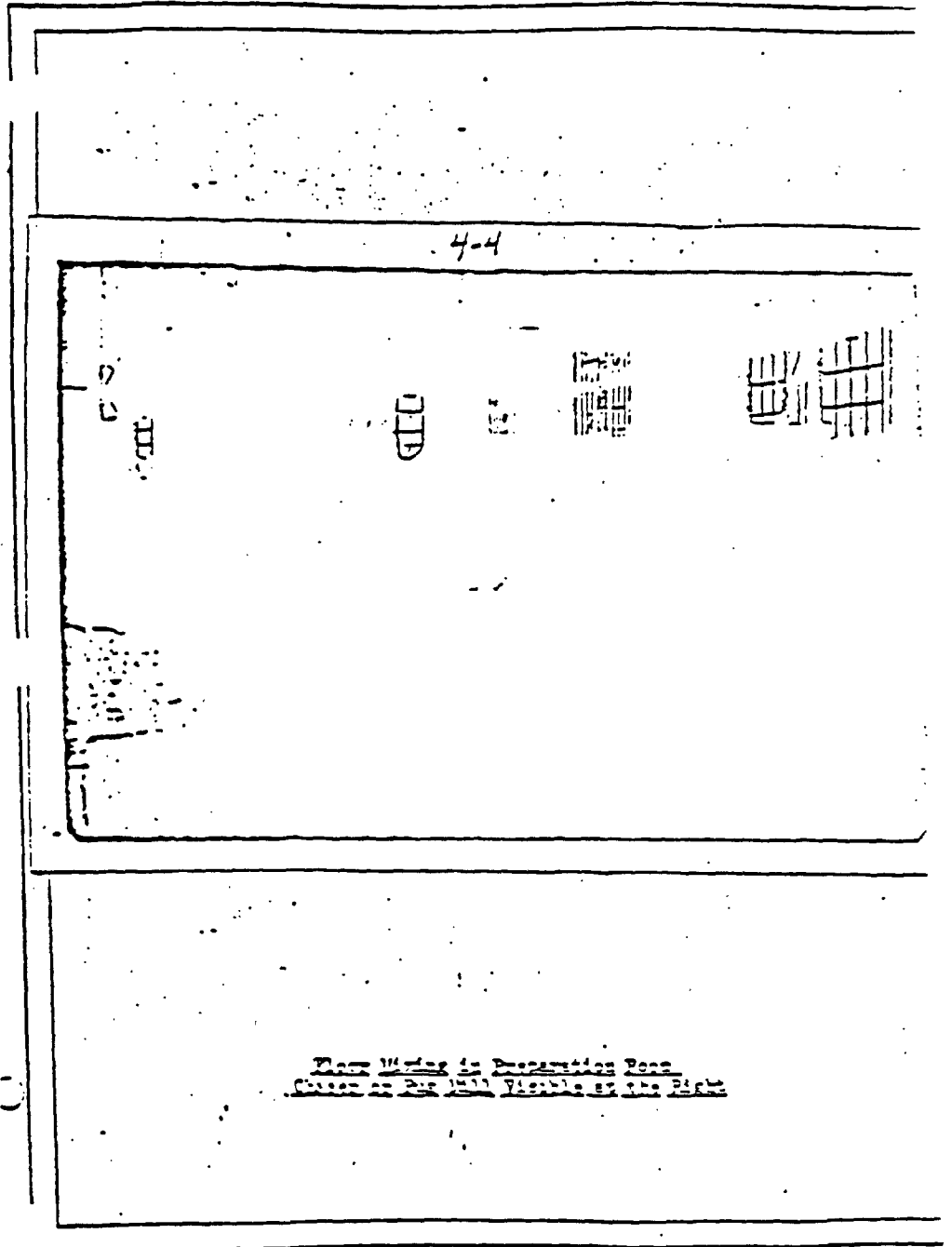
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<u>Reference and of Station Name</u> <u>Deposition Date</u>



Plan of Deck 4-4
Shown as per 1911 Visible at the Right

It will be noticed that the dust count is high in places and exceeds 20,000,000 particles, the standard adopted by the U.S. Public Health Service in their study of the granite industry. (5)

SPRAY AND FOGGING DEPARTMENT:

This process is conducted in a room adjacent to the preparation department. This room is equipped with hand controlled water sprays for humidifying. The temperature in this department was found to be 69° F. and the relative humidity was 75%.

Artificial illumination is furnished by Cooper Hewitt lamps.

Dust counts were collected in close proximity to the workers and are as follows:

(5) Public Health Bulletin No. 197 "The Health of Workers in Dusty Trades II. Exposure to Siliceous Dust (Granite Industry)" - U.S.P.H.S., Treasury Dept., Washington, D.C. 1929.

TANK No. 2

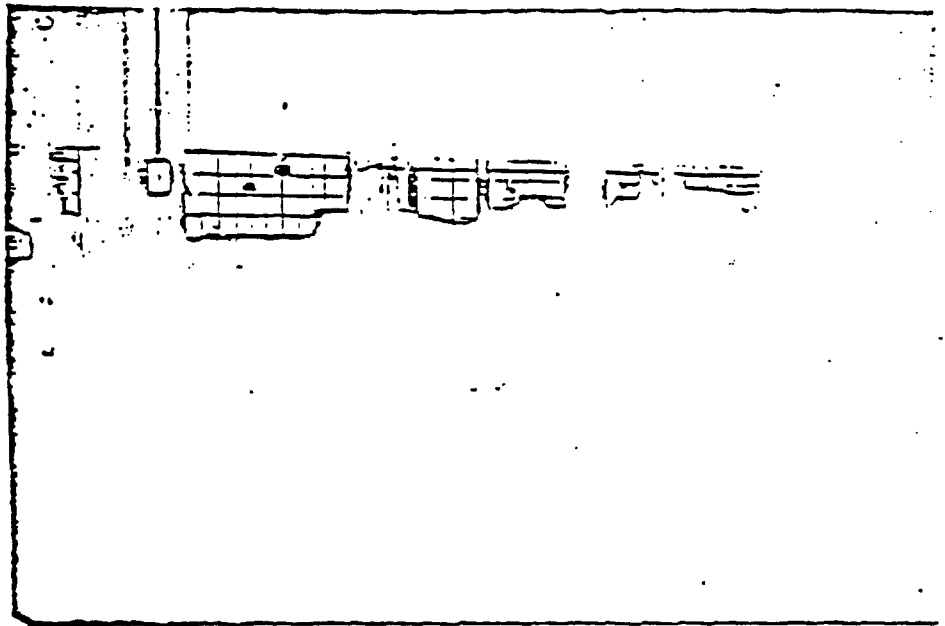
WEAVY LOOM (UNWE DAMP)

Sample No.	Building No.	Dept. No.	Location of Sample	Total Counts of Dust Particles per cubic foot	Weight of Dust in milligrams per cubic foot
12	1	12	Alongside loom 9 space 8. Machine #918	0,101,852	.00
18	1	12	Alongside loom 6 space 8. Machine #915	6,074,858	1.1
15	1	12	Alongside loom 5 space 12. Machine #025	4,024,606	.60
11	1	12	Front of loom 10 space 8. Machine #033	5,703,703	—
19	1	12	Front of loom 87 space 4. Machine #944	0,302,630	1.1
14	1	12	Front of loom 10 space 1. Machine #025	0,076,705	1.3

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Standard Engine

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The number of particles per cubic foot of air in this room are considerably less than in the preparation room, and slightly below the standard stated above.

SPINNING, TWISTING AND WOUND LOOM REWINDING:

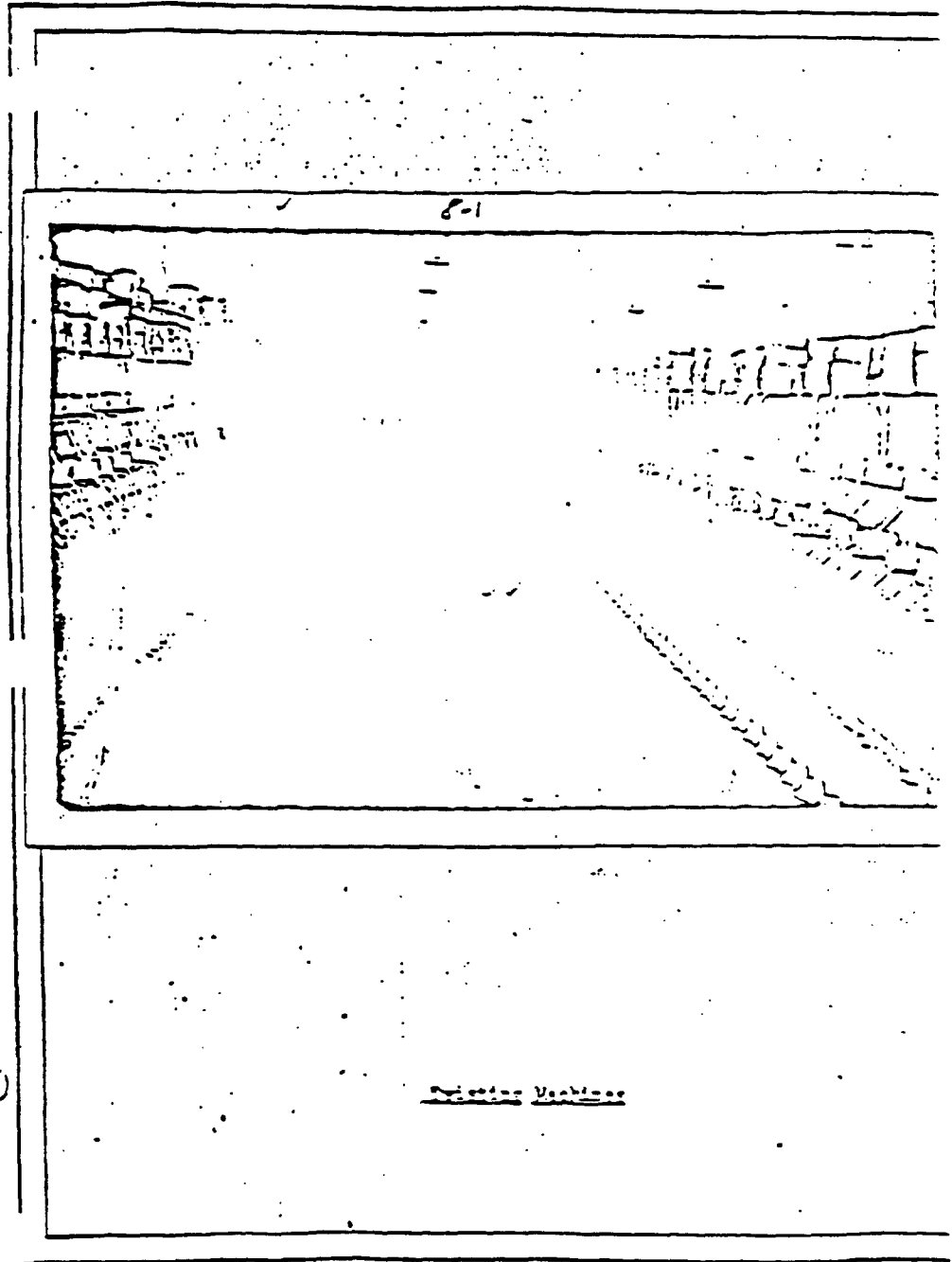
These processes are likewise carried out on the first floor of building number one. This department is equipped with the Gardner Air Conditioning units which furnish ample humidification. The temperature was found to be 74° F and the relative humidity was 50%.

TABLE No. 8

SPOOLING, TWISTING AND WEAVING

Sample No.	Building No.	Dept. No.	Location of Sample	Total Counts of Dust Particles per cubic foot	Weight of Dust in milligrams per cubic foot
20	1	6	Between spoolers 605 and 602	2,073,801	.65
21	1	6	Front of spooler #605	1,160,178	.25
22	1	10	Between universal winders 701 and 709	1,322,761	.50
23	1	7	Between twisters 660 and 661	3,732,688	.60
25	1	10	Alongside loom #1016 weaving broad cloth	2,270,408	.38
26	1	5	Alongside machine #451. Ring spinning	1,409,320	.35
28	1	10	Alongside loom #1017. (dry weaving)	3,182,070	.30
30	1	10	Between looms 5, 21 and 20 dry weaving on wide material	2,704,121	.50

First floor of building #1 equipped with the Carrier system.



Selection Machine

The dust counts as shown in the table indicate a relatively small number of particles.

SPINNING DEPARTMENT:

This department is located on the second floor of building No. 1 at one end of the main card room.

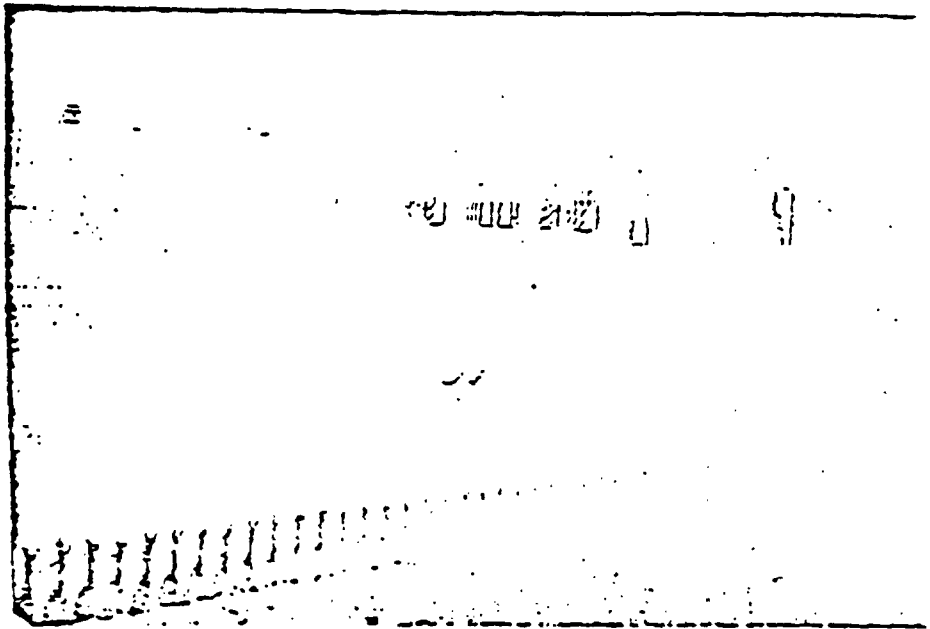
Wile spinning and some spooling operations are carried on here. The department is provided with the Carrier System. No ring frame spinning is done.

TABLE No. 4

SEMINUM

Sample No.	Building No.	Depth No.	Location of Sample	Total Counts of Dust Particles per cubic foot	Weight of dust in milligrams per cubic foot
32	1 2nd floor	4	Between miles 405 and 406 at S.E. corner of room	2,314,014	.40
39	1 2nd floor	4	Between miles 405 and 406 at the W.E. corner of room	4,576,610	.40
54	1 2nd floor	4	At the end of elevator 467	1,254,164	—

These counts are comparatively low and indicate effective control.



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CARDING ROOM:

This room consists of two connecting departments occupying the second floors of building No. 1 and No. 3, except for a portion in building No. 1 devoted to spinning.

The section located in building No. 1 is equipped with the Carrier System. No form of modification is used in building No. 3.

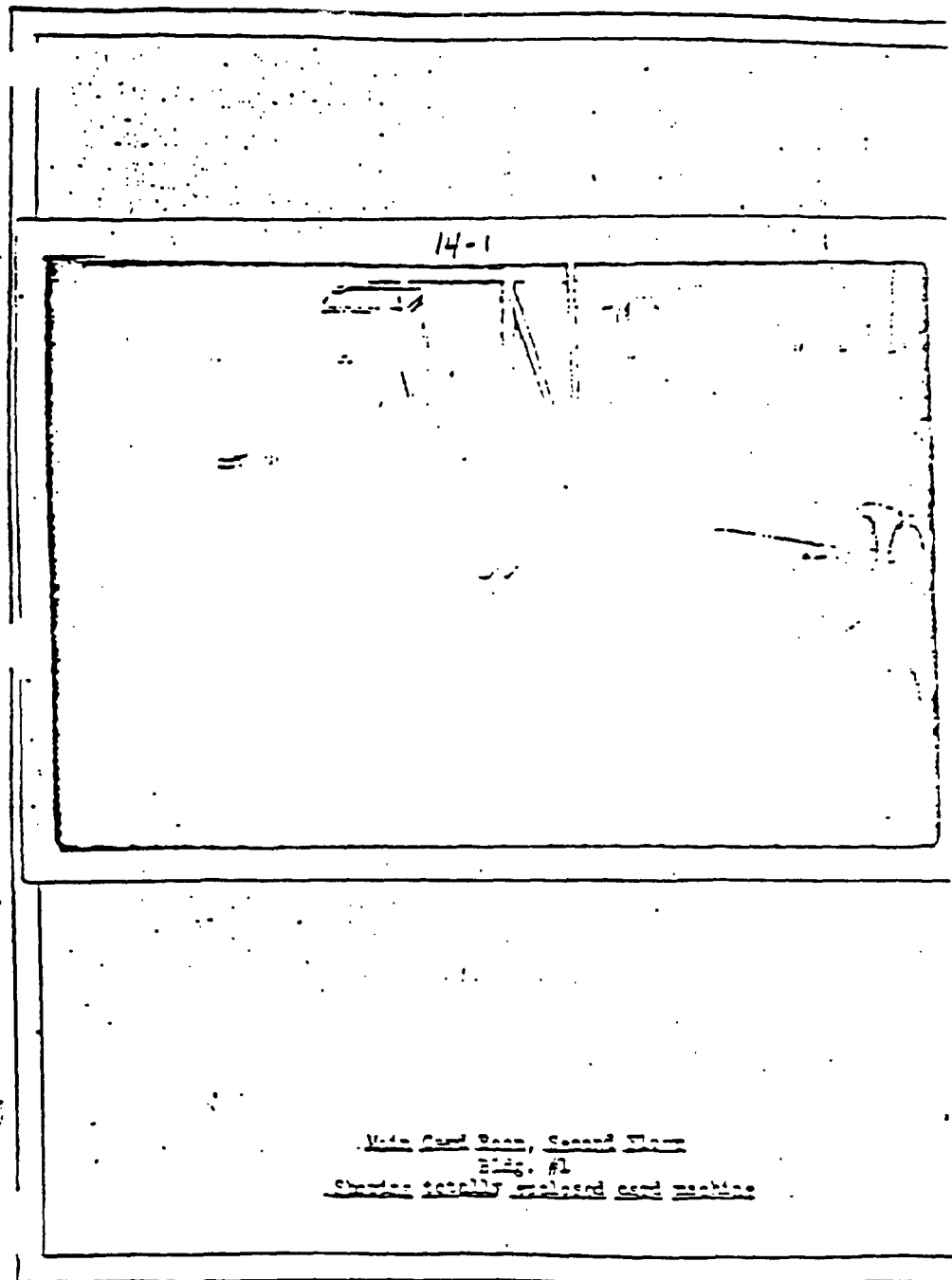
The carding machines in building No. 1 are totally enclosed by canvas covered wooden frames and each enclosure is equipped with an exhaust to remove the dust. That section located in building No. 3 is not totally enclosed. The exhaust on these machines is connected with the hood covering the comb of the card.

TABLE No. 5
CANDID LXXXIX

Sample No.	Building No.	Dept. No.	Location of Sample	Total Counts of Dust Particles per cubic foot	Weight of Dust in milligrams per cubic foot
30	1 2nd Floor	2	Between cards #101 and 102	10,127,314	1.60
37	1 2nd Floor	2	Alongside of card #201	5,619,120	.70
38	1 2nd Floor	2	On spooler #469	5,625,318	.99
39	5 2nd Floor	5	Alongside card #104	7,620,930	1.20
40	5 2nd Floor	5	Alongside card #172	15,677,062	1.86
41	5 2nd Floor	5	Between cards #162 and 193	6,221,084	.67

It will be noticed that the counts vary considerably and in two instances are quite high. No marked difference is noticed where the machines are totally enclosed and only partially enclosed.

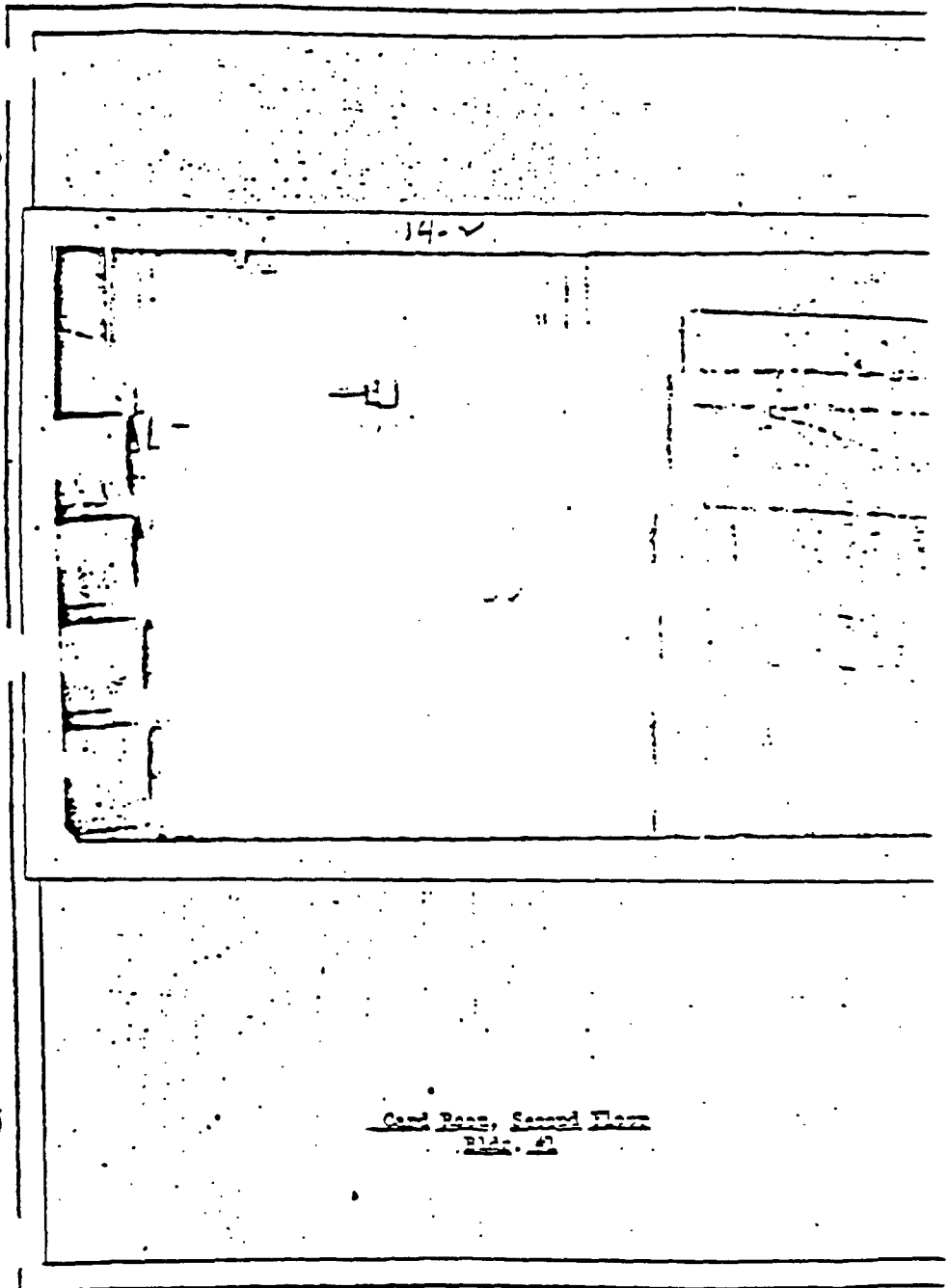
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Note Card One, Second View
Fig. #1
Shows top of vehicle and machine

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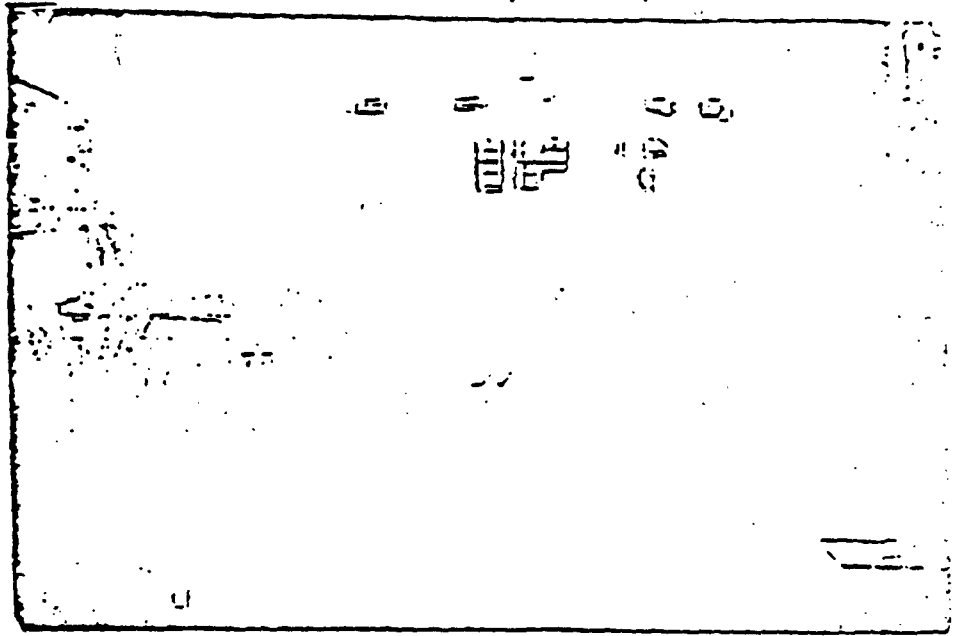
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14-3

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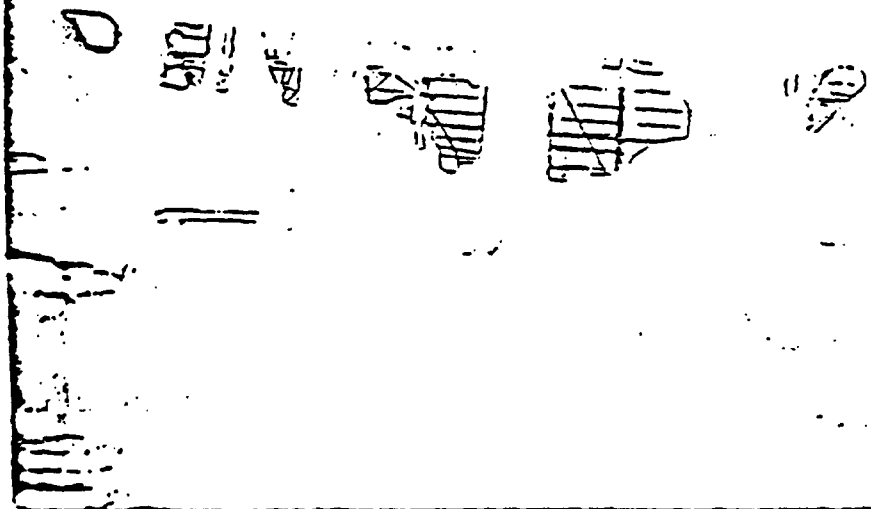


Card Room, Second Floor
Building #5

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14-4



Card Room, Second Floor
Building #2

00770

PLANT HOUSEKEEPING:

The floors are dry swept almost continuously throughout the working period. Each Friday the dust is removed from the ceilings, walls, and machines by means of an air hose during the working period. The dust counts during this period of cleaning would be increased considerably. It is recommended that cleaning be accomplished by means of a vacuum system. There are portable units on the market designed for this kind of work.

PHYSICAL EXAMINATIONS:

Physical examinations were made on fifty-four employees. All who worked in an asbestos industry three years or longer were included in this group. These employees were examined for symptoms usually associated with what English authorities term "asbestosis". These include anemia, leaden faced complexion, emaciation, dyspnea, cyanosis, cough, expectoration, "asbestos cough", decrease in chest expansion, clubbing of fingers, swelling of skin at the nails, and history of chest trouble. The chests of these employees were then examined for friction rubs, rales, dullness, diminished breath sounds, increased voice sounds, and where the symptoms and findings suggested further examination, X-ray pictures of the lungs were taken.

X-ray examinations were made of 20 employees; of these 10 showed definite evidence of asbestos dust injury to the lungs; one showed tuberculous without dust injury, and nine were negative.

The action of inorganic dust upon the lung tissue is such as to cause the development of fibrous tissue - fibrosis. Such dust fibroses are classified under the general term pneumoconiosis. The various types of pneu-

condioids are further differentiated by more specific titles which define the selves, such as silicosis, anthracosis, and asbestosis.

On page 2 of the first unit report of this series of studies it was stated, in relation to the action of asbestos dust on the lungs, "We are confronted with three alternatives:

- (1) Asbestos dust does not cause pulmonary damage.
- (2) Asbestos dust does cause pulmonary damage akin to silicosis, but of a milder nature.
- (3) Asbestos dust itself does cause pulmonary damage, but in a manner and of a type entirely distinct from silicosis."

The X-ray films of this study definitely inform us that individuals exposed to the inhalation of asbestos will in time show structural changes in their lungs - pneumoconiosis. Our studies have not progressed sufficiently for us to construe this type of pneumoconiosis in term of disability or of increased susceptibility to tuberculosis. This type of pneumoconiosis, to which the term asbestosis may properly be applied, is quite distinct in its X-ray film appearance from true silicosis and an experienced technician would have no difficulty in distinguishing the two conditions. The evidence so far would indicate that the action of asbestos dust is in accord with the second alternative quoted above.

Four films showing definite asbestosis also showed old tuberculous lesions, apparently inactive, 3 of the films negative for asbestosis also showed such lesions; this would lend support to the contention that asbestosis does not tend to activate quiescent tuberculous lesions which is in accord with the meagre evidence so far available from animal experimentation and with the limited clinical experience.

The following table summarizes the X-ray examinations.

No.	Sex	Age	Occupational History	Remarks
1	F	38	Weaving 21 yrs. off & on, 4 yrs. U.S. Asbestos Co.	Negative
2	F	37	Weaving 15 years	Late first degree asbestosis
3	M	32	Weaving 12 years	Early first degree asbestosis; old tuberculous lesion
4	M	33	Spooling 6 years	Negative
5	M	47	Spooling 8 yrs. U.S. As. Co. 14 yrs. elsewhere	Negative
6	M	63	Weaving 12 years	Negative; old tuberculous lesion
7	M	50	Weaving 10 years	Early first degree asbestosis
8	M	44	Carding 5 years	Early first degree asbestosis; heart lesion
9	M	33	Spooling 5 years	Beginning asbestosis
10	M	37	Weaving 6 years	Negative
11	M	37	Weaving 9 years	Negative. Old tuberculous lesion
12	M	36	Weaving 22 years	First degree asbestosis. Old tuberculous lesion
13	M	45	Weaving 7 years U.S. As. Co. 11 yrs. elsewhere off & on	Negative
14	M	64	Weaving 12 years	Negative

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<u>Id.</u>	<u>Sex</u>	<u>Age</u>	<u>Occupational History</u>	<u>Diagnosis</u>
15	M	29	Weaving 5 years	Negative. Old tuber- culous lesion active
16	M	52	Weaving 18 years	Early asbestosis
17	F	41	Spinning 8 years	Negative
18	FM	33	Carding 7 years	First degree asbes- tosis
19	M	48	Yarnman 22 years	Early second degree asbestosis
20	M		Worked in asbestos 20 years, out of plant 10 years	Late second degree asbestosis. Old tuberculous lesion