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Union Asbestos & Rubber
Marshville, North Carolina
September, 1957

ACKNOWLEDGMENT

The author of this report wishes to express his appreciation for the cooperation and courtesy extended to him by management, and particularly that extended by Messrs. E. W. Lane, Jr., Plant Manager, E. A. Hayes, Director of Industrial Relations, and J. D. Aldridge, Project Engineer.

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PURPOSE OF SURVEY

I To evaluate control of the asbestosis hazard.

II To estimate probable further incidence of asbestosis.

III To determine what additional control measures are necessary to reduce the hazard to a minimal.

IV To compare dust sampling and counting methods.

CONCLUSIONS

I A. No control of dust is exercised in the following areas, but conditions are considered acceptable:

1. Ring frame spinning.
2. Winding
3. Mule spinning.

B. No control of dust is exercised in the following areas with resultant hazardous conditions:

1. Spooling

C. Wet control of dust is exercised in the following area with borderline conditions:

1. Twisting

D. Ventilation control of dust is provided in the following areas with acceptable control under the observed conditions:

1. Preparation operations
2. Cop winding
3. Carding
4. Weaving

II It is expected that the future incidence of asbestosis will be:

A. Negligible in ring spinning, mule spinning, winding, cop winding and preparation operations

B. Probably negligible in twisting and weaving

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C. Moderate in spooling

III Additional control measures are necessary as follows:

A. Ventilation control of the spooling operation.

B. Additional wet control of the twisting operations.

C. Continued maintenance of all control measures.

RECOMMENDATIONS

I Control measures should be instituted for the following operations:

A. Spooling--provide local exhaust ventilation

B. Twisting--consider doing all twisting wet

II Consider using Midget Impinger method of sampling

III Make weekly suction measurements at all hoods of exhaust systems and keep records of performance

IV Make weekly records of pressure drops on filter and maintain records.

DISCUSSION

A visit was made to the Union Asbestos & Rubber Company, Marshville, North Carolina, with Mr. W. N. Smith, Charlotte District Engineer, and Mr. B. O. Fleming, Engineer Trainee, on September 23, in company with Mr. Fleming on September 24, and alone on September 25. Atmospheric samples were taken with the Greenberg-Smith Impinger on September 23, 24, and 25 with the Midget Impinger on September 24, and with the Bausch & Lomb Dust Counter on September 23 and 24. In addition Mr. J. D. Aldridge took samples with the Union Asbestos & Rubber Company's

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Bausch & Lomb Dust Counter on September 23 and 24. These samples were all counted in the laboratory of the Union Asbestos & Rubber Company the same day that they were taken. Isopropyl alcohol was used as the collecting medium in the Greenberg-Smith Impinger and in the Midget Impinger. Results of the Greenberg Smith Impinger and Midget Impinger samples are summarized in Table I. The results of the individual impinger and midget impinger samples are listed in Table II, and a comparison of dust counts by the two different methods are summarized in Table III and plotted on Figure V. The location of the impinger and midget impinger dust samples are indicated in Figures I, II, and III.

The impinger and midget impinger dust samples were counted in the conventional manner; that is all visible particles (those above 0.9 microns) below ten microns and those fibrous particles regardless of size were counted. This is essentially the procedure used by most investigators when studying asbestosis and is the method used by the U. S. Public Health Service in their, "A Study of Asbestosis in the Asbestos Textile Industry".[1] The principal difference is that a haemocytometer cell was used instead of a Sedgwick Rafter cell for counting.[2] As a result of the study of asbestosis made by the Public Health Service, a maximum allowable concentration of five million particles per cubic foot has been set for counts made on this basis.

The examination of Table I reveals that only in spooling and twisting operations was the maximum allowable concentration

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exceeded. In spooling two of three samples exceeded the maximum allowable concentration. The minimum concentration found was 4.1 million particles per cubic foot, and the maximum 7.2 with an average of 5.5. Two of five samples taken in the twisting exceeded the maximum allowable concentration. A minimum of 1.3 million particles per cubic foot was found in these operations with a maximum of 8.8 and an average of 4.6. Two of the five samples which were hazardous were taken in the vicinity of the dry twisting operations. The three samples resulting in concentrations below the maximum allowable were taken in the vicinity of wet twisting operations and indicate the effectiveness of this method of control.

Mr. Lane made a study of the production records and found that 20 per cent of the production is accomplished using dry twisting methods. Therefore, a weighted average for the workers doing twisting would be 3.4 million particles per cubic foot under the conditions observed at the time of the study. It should be pointed out, however, that at the time of the study the weather was ideal and windows and doors were generally open. This would tend in itself to reduce dust concentrations considerably. Since the only reliable counts we have available to us of conditions under winter weather were obtained in our previous study in March, 1955, we have attempted to estimate the average weighted exposure of workers under winter conditions by assuming that the same reduction would be accomplished in the wet twisting methods under winter conditions. Utilizing the values obtained two years ago for dry twisting (the concentration was 17 million particles per cubic foot).

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we have calculated that under the same conditions the wet twisting concentrations would be 4.2 million particles per cubic foot. This would give a winter weighted average exposure of 6.8 million particles per cubic foot. If the windows and doors are allowed to remain open five months a year and are essentially closed the remaining seven months of a year, this would give an overall weighted exposure of the workers of 5.4 million particles per cubic foot. This is slightly above the maximum allowable concentration, and therefore, one must consider this exposure as being at best borderline.

We were informed that those operations involving twisting of asbestos with zinc, copper or brass wire and those involving the twisting of asbestos with fibreglass were done dry. It has been our experience in other plants that operations involving twisting with zinc and brass wires can be performed satisfactorily wet.

In order to do this, however, it is necessary to inform customers of the change, the reason for making the change, namely improving health conditions in the plant, and convincing them that the product which they obtain will be satisfactory. This has been done successfully elsewhere, and we believe that it should be given consideration by Union Asbestos & Rubber Company. Similarly, the samples taken for spooling were taken under conditions of excellent ventilation. This is reflected by the lower average obtained this time compared with that obtained in March of 1955. Using the same reasoning as above, a weighted average on a yearly basis considering both

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[illegible] for this [illegible].

According to a study of asbestosis in the American textile industry by the U. S. Public Health Service, it can be estimated that the incidence of asbestosis in the spooling operation would be moderate. That is, it would be expected that 19 per cent of the employees exposed would develop first-stage asbestosis in a period of five to nine point nine years, 53 per cent of them would develop it in 10 to 14.9 years, and 67 per cent of those exposed would develop it in an exposure over 15 years. While the average weighted concentration for twisting falls in the same range of 5 to 10 million particles per cubic foot, the fact that it is so close to five would lead one to suspect that the probability of workers developing asbestosis would not be nearly as severe in the twisting as in the spooling operation. Nevertheless, workers have been exposed in the past to fairly high concentrations. Their average weighted exposure still is slightly above the maximum allowable. For these reasons, it is considered that the control measures suggested above be seriously considered by management.

In our opinion the only adequate way to control the dust from the spooling operation is through local exhaust ventilation. Figure IV illustrates a method for providing local exhaust ventilation for this equipment which experience has shown will control the dust to acceptable limits.

Since our visit in March of 1955, the ventilation of the cards appears to have been improved and the feed bins for the cards have been provided with hinged covers as we recommended.

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There changes are reflected in the lower dust counts obtained at this time.

Several new looms have been installed in the weaving room These have been provided with overhead hoods rather than the hoods located under the warp which have been provided at the other looms.

The dust counts, while taken under favorable conditions, indicate no significant difference in control of dust by the overhead hoods compared with the under the warp hood. There would be a difference in the housekeeping required inasmuch as considerable material falls to the floor below the warp which is not collected by the overhead hood. It is probable that conditions on the weaving room are acceptable, although it should be pointed out that under winter conditions we did find higher counts.

The hoods appear to be better maintained than they were previously. The duct work, however, still shows evidence of having been damaged by objects being dropped on it. We believe that good maintenance would include provision of some protective devices as suggested in our earlier report for preventing additional damage to these ducts.

We previously recommended that the plant make weekly measurements of suction at the hoods. Such measurements, in our opinion, are of value in two ways. Significant decreases in the suction indicate that the system is not working well and would allow local plant management to make corrective measures at an early date and thus provide continued protection to the employees. Maintaining records of these measurements

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would also be good evidence, and of [illegible] assistance in combatting any ill-founded claim of asbestosis.

Two years ago we recommended that the plant make periodic dust counts at least every six months. This program was instituted some time ago and the counts have been made using a Bausch & Lomb Dust Counter. It was pointed out in correspondence among American Mutual engineers that the result obtained with Bausch & Lomb Dust Counters generally are not in agreement with those obtained with the impinger type apparatus. Inasmuch as the standards of dustiness in various industries have been established using the impinger as the sampling instrument, it is obvious that counts made on this basis are more strictly comparable to the standards than are counts made by different instruments. For that reason we wish to compare counts obtained with the Bausch & Lomb Dust Counter with the impinger apparatus. Consequently, Mr. Aldridge using the Union Asbestos Bausch & Lomb Dust Counter, the author using American Mutual's dust counter took simultaneous samples with those being obtained with the Greenberg Smith Impinger in a number of different operations. The results of these simultaneous samples are to be found in Table III. A plot showing a comparison of the Bausch & Lomb and Greenberg-Smith impinger samples appears as Figure V. It is obvious from a study of the table and more particularly from a study of Figure V that there is no correlation what so ever between the Bausch & Lomb and Greenberg-Smith impinger counts. This is not entirely unexpected. Previous studies have indicated the difficulty in obtaining any correlation between these instruments. Drinker & Hatch[3] report on such studies, "The ratios thus obtained are characterized by a singular lack of agreement."

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A more complete study of the Bausch & Lomb Dust Counter was made by Gurney, Williams and Meigs. Their conclusions as a result of a rather intensive study, "No correlation figure appears possible for use in changing Bausch & Lomb counts to equivalent impinger values under the varying condition of concentration, size, range, and composition found in industry."[4]

In view of these statements it is not surprising that we failed to find any correlation between the two counts. While Gurney, Williams and Meigs indicated that the Bausch & Lomb instrument was of value for routine plant measurement, the data contained in that paper in our opinion do not substantiate this conclusion..

If we were to use the counts obtained with the Union Asbestos & Rubber Company's instrument, we would conclude that a hazard existed in weaving where the impinger apparatus showed low dust counts, that conditions were borderline in spooling where the impinger showed fairly high dust counts, and that otherwise conditions were acceptable. The Bausch & Lomb instrument failed to indicate the high dustiness obtained in the vicinity of the dry twisting operations. Certain of the results obtained with American Mutual's Bausch & Lomb Dust counter are open to question, and it is possible that the slide on which these counts were taken were not properly conditioned. Since the Bausch & Lomb Dust Counter can lead one to erroneous conclusions concerning the existence and degree of hazard, we believe that it would be more practical to secure impinger apparatus preferably of the midget impinger type to

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evaluate these conditions. This would also have the advantage that if it should ever be necessary to present evidence that conditions were under control that there would be not question concerning the validity of the counts. Therefore, we recommend that consideration be given to the securing of midget impinger apparatus and microscope to count the dust by currently acceptable methods.

J.E.EXILMER:dd
October 11, 1957

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UNION ASBESTOS & RUBBER COMPANY
MARSHVILLE, NORTH CAROLINA

TABLE III

COMPARISON OF DUST COUNTS BY DIFFERENT METHODS

Operation	Greenberg-Smith Impinger		Am. Mut. B. & L.	Unarco B..& L.
Wet Twisting	1.3		2.6	3.25
			1.8	2.55
			3.1	3.05
		Ave.	2.5	2.95
	2.3		3.2	(0.00)[1]
			1.8	3.35
			1.5	3.20
		Ave.	2.2	Ave. 3.28
Dry Twisting	8.1		2.8	3.88
			3.6	3.85
			4.0	4.35
		Ave.	3.5	4.03
	8.8		3.5	4.28
			4.1	3.78
			4.3	5.40
		Ave.	4.0	4.49
Ring Spinning	0.2		0.6	0.67
			0.6(2)	0.92
			5.5	0.82
		Ave.	2.2	0.84
Ring Spinning	0.0		2.9	0.35
			3.1(2)	0.52
			9.5	1.07
		Ave.	5.2	Ave. 0.65
Opening	1.3		14.3(2)	1.35
			21.8(2)	2.10
			24.9(2)	2.82
		Ave.	20.3	2.11
Crushing	3.2		12.3(2)	1.47
			25.2(2)	1.67
			18.7(2)	2.82
		Ave.	19.1	1.99

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Date October 11, 1957

PLANT Union Asbestos & Rubber Company LOCATION Marshville, North Carolina

TABLE II (Cont'd)
AIR ANALYSIS TABLE

Sample No.	Time Min.	Location and Events	ASBESTOS Concentration (A) (B) (C)
12	10	General air beside loom 13, overhead hood.	0.6
No.4	10	Worker's exposure at cop winder.	1.2
13	10	General air beside feed to breaker 2 on finisher side.	2.1
14	10	General air beside feed to breaker 1 on finisher side (Nos. 1,2,4,5,6, 7, and 8 operating)	3.4
15	11	General air beside camel-back conveyor at breaker side of card 2.	3.4
16	11	General air beside camel-back conveyor at finisher side of card 4.	2.4
17	10	General air between mules 3 and 4 about 1/4 way from middle aisle	2.2
18	10	General air between mules 1 and 2 about 1/8 way from middle aisle.	2.2
19	10	General air between twisters 4 and 5 both sides of 4 operated wet, near side of 5 operated wet (near spooler end)	2.6
20	10	General air beside Leesona Model 6-C 6 head winder. Universal winder Model 50 also operating.	1.3
21	10	General air creel area beside rear corner of creel for No. 4 loom.	1.9
22	10	General air between workers operating No. 3 and No. 4 looms.	2.2
23	10	General air in corner of loom No. 14.	1.3
24	10	General air behind take-up rolls for tape loom No. 19 (wet fill)	1.1
		Maximum Allowable Concentration A—Milligrams per Cubic Meter B—Parts per Million C—Million Particles per Cubic Foot	5.0

AMERICAN MUTUAL [illegible]

Date [illegible] 11, 1957

PLANT Union Asbestos & Rubber Company LOCATION Marshville, North Carolina

TABLE II
AIR ANALYSIS TABLE

Sample No.	Time Min.	Location and Events	ASBESTOS Concentration A B (C)
1	10	General air beside twister No. 4 (operating wet) at end toward cards. No. 5 twister not operating.	1.3
2	10	General air beside twister No. 4 1/3 way from spooler end, No. 5 not running.	2.3
3	10	General air between No. 2 and No. 3 twisters (both operated dry) card end.	8.1
4	10	General air between No. 2 and No. 3 twisters--1/3 way from spooler end.	8.8
5	10	General air beside ring frame 2 17 spindles from card end--No. 1 not operating.	0.2
6	10	General air beside ring frame 2 18 spindles from window end--No. 1 not operating.	0.0
M-1	10	General air about ring frame 2. No. 1 not operating.	0.2
7	10	General air beside feed to Creighton opener.	1.3
8	10	General air beside crusher.	3.2
M-2	10	Worker's exposure operating Creighton opener and Pearnought Picker	2.0
9	10	General air over basket rack on twister side of spooler, 9 spools from from end near outside door	6.2
10	10	General air over basket rack on window side of spooler, 13 spools from end near outside door. Windows open.	4.1
M-3	10	Worker's exposure at spooler, twister side.	7.2
11	10	General air beside loom 7	0.8

Maximum Allowable Concentration 5.0
A—Milligrams per Cubic Meter
B—Parts per Million
C—Million Particles per Cubic Foot

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UNION ASBESTOS & RUBBER COMPANY
MARSHVILLE, NORTH CAROLINA

TABLE I

SUMMARY OF DUST COUNTS

Operation	No. Samples	Min.	Max.	Ave.	No. Above M. A. C.
Preparation	3	1.3	3.2	2.2	0
Carding	4	2.1	3.4	2.8	0
Mule Spinning	2	2.2	2.2	2.2	0
Ring Spinning	3	0.0	0.2	0.1	0
Spooling	3	4.1	7.2	5.5	2
Twisting	5	1.3	8.8	4.6	2
Winding	1	1.3	1.3	1.3	0
Weaving	6	0.6	2.2	1.3	0
Cop Winding	1	1.2	1.2	1.2	0

TABLE III (Cont'd)

Operation	Greenberg-Smith Impinger	Am. Mut. B. & L.	Unarco B. & L.
Spooling	6.2	6.3	6.12
		0.6	3.57
		1.8	5.80
		2.9	5.20
	4.1	0.6	3.08
		0.7	2.65
		1.3	4.42
		0.9	3.38
Weaving	0.8	3.1	9.22
		4.8	7.27
		4.2	4.97
		4.0	7.15
	0.6	3.9	15.30
		4.4	9.07
		4.0	2.68
		Ave. 4.1	Ave. 10.68

(1) Believe to be an error--not included in average.

(2) Tremendous number of extremely fine particles found--Count not believed true.

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SKETCH SHEET

File No.

Assured Union Asbestos & Rubber Co. Date 10-3-57

Location Marshville, N.C. Engineer J.B. Skinner

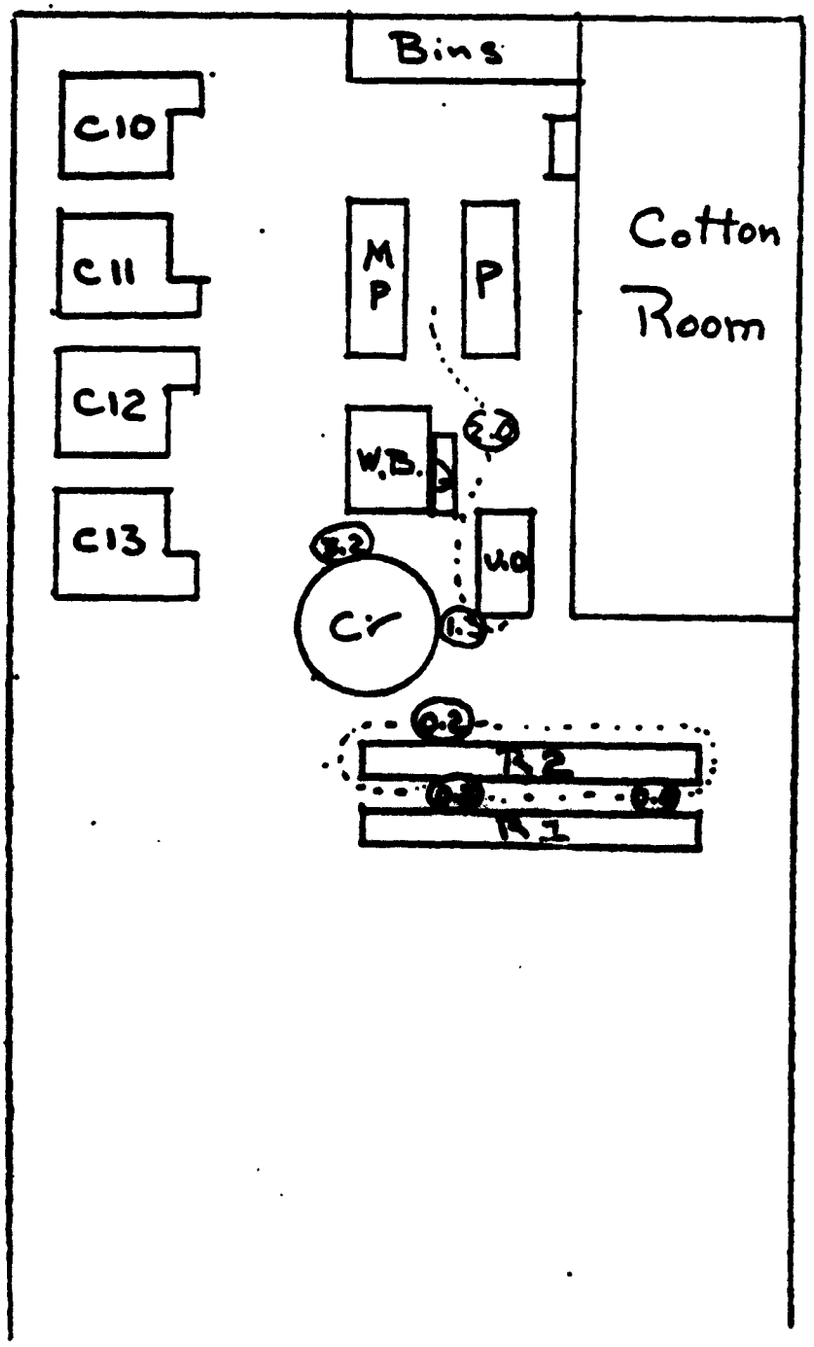


Fig 1
Location of Dust Samples in Ring Frame Spinning and Preparation

C = Cards
R = Ring Frames
W = Willower
WB = Willower Bin
U.O. = Upright Opener
MP = Mixer-Picker
P = Picker
Cr = Crusher

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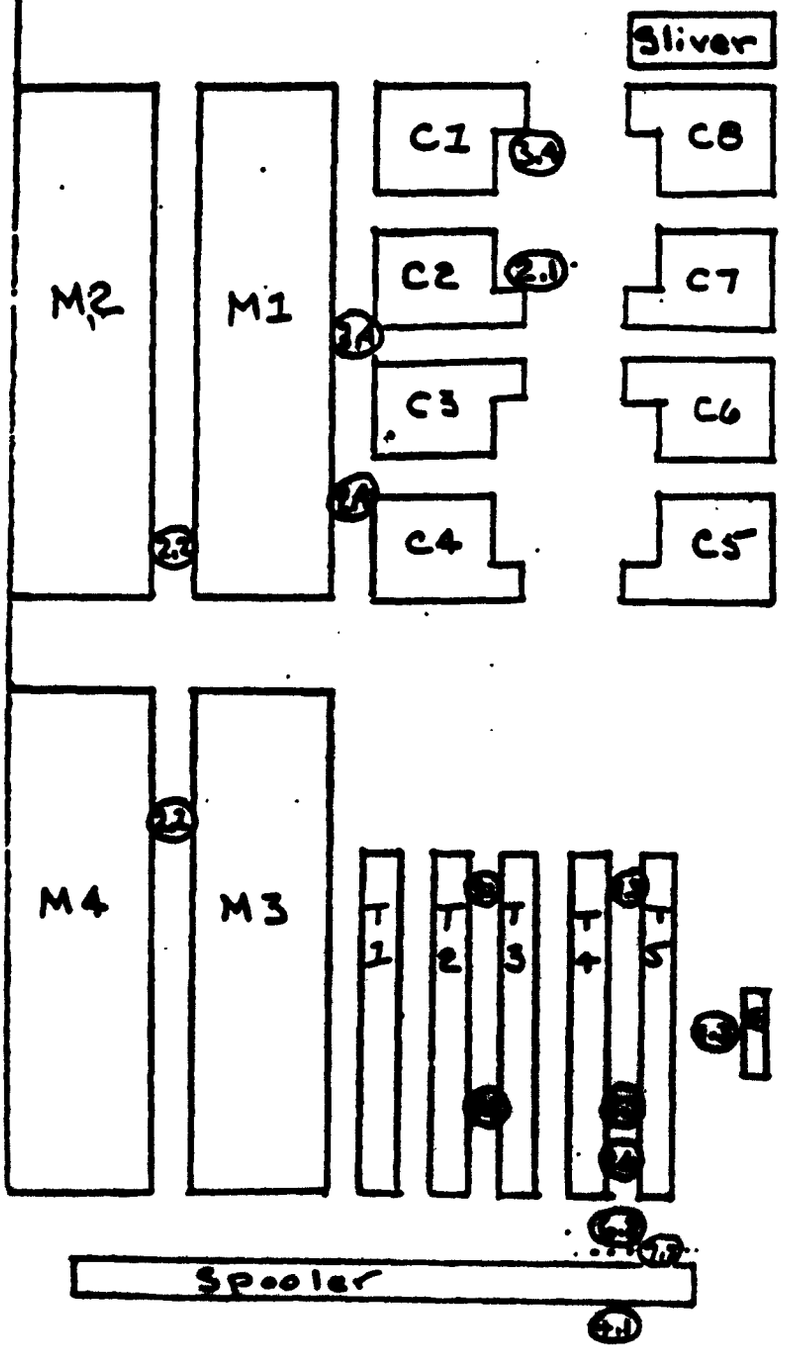


Fig 2
Location of Dust Samples in Mule Spinning, Carding Twisting, Winding and Spooling

C = Cards
T = Twisters
M = Mules
W = Winders

At time of sampling following equipment operated:

Cards 1, 2, 4, 5, 6, 7 + 8
Mules
2 Winders
Twisters
Spooler (½)

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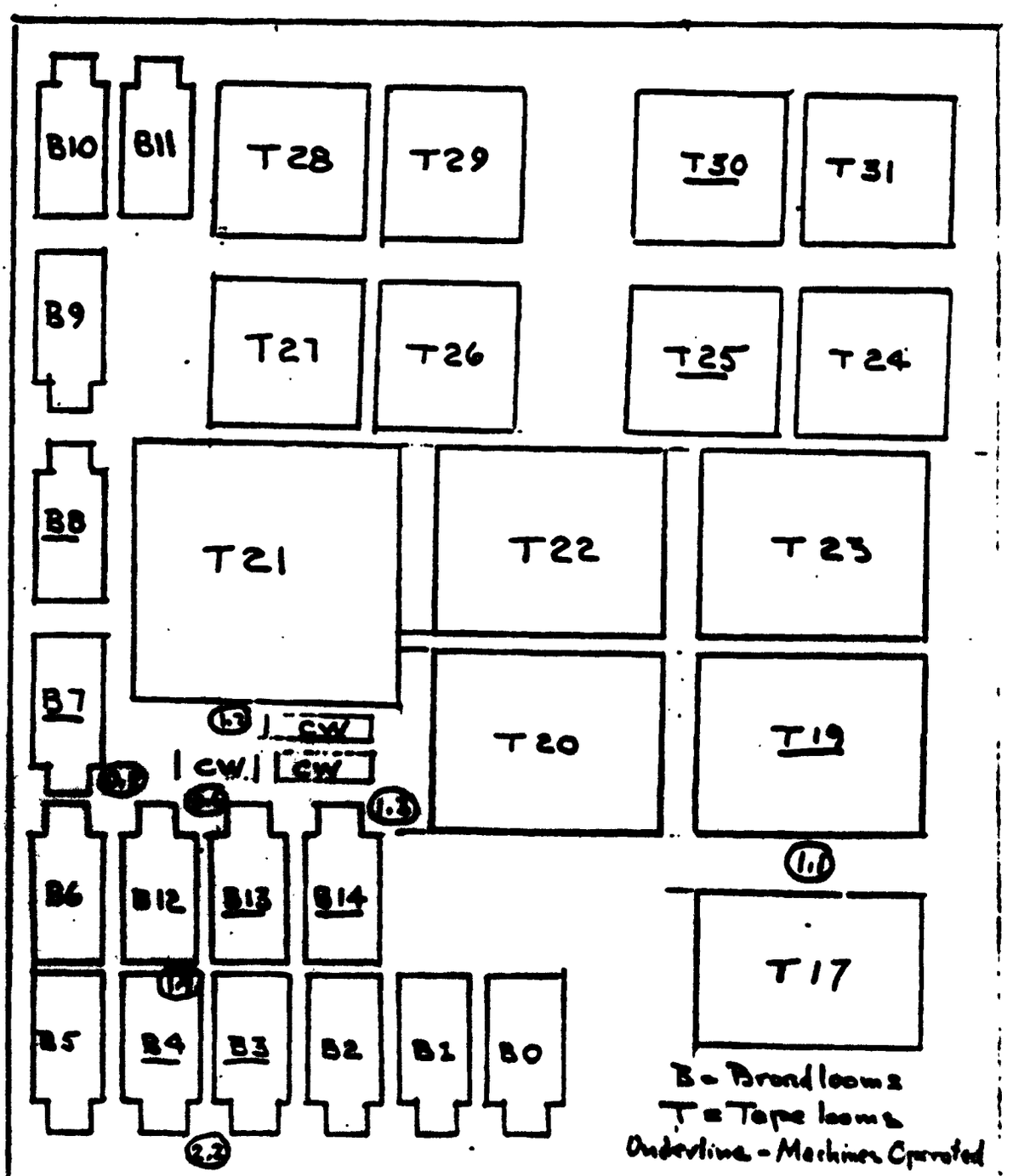


Fig 3 - Location of Dust Counts in Weave Room

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Location Marshville, N.C. Engineer J.B. Skinner

SUGGESTED VENTILATION FOR LARGE SPOOLER

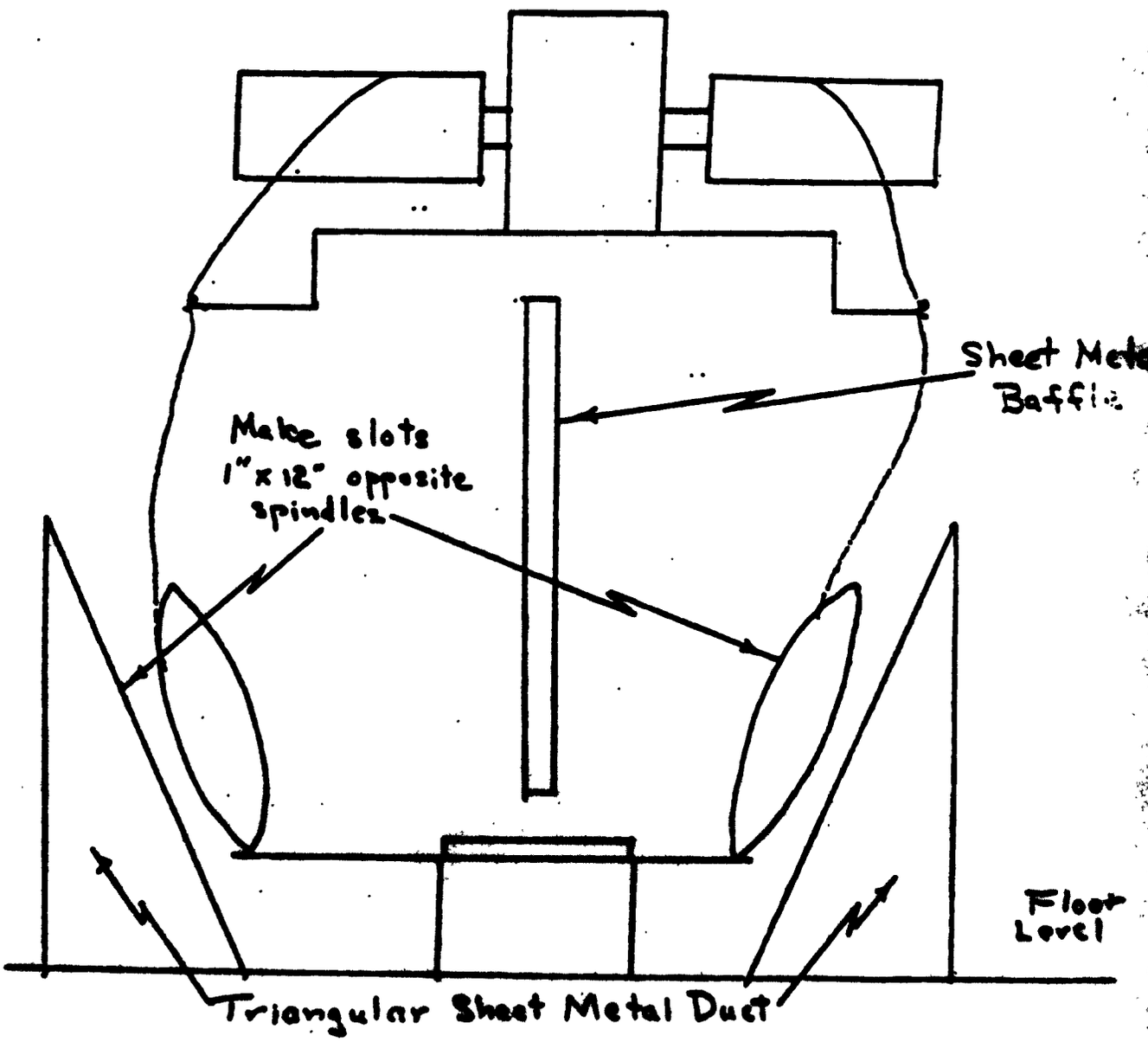


Fig. 4

Not drawn to scale

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SKETCH SHEET

File No.

Name Union Asbestos & Rubber Co Date 10-4-57

Location Marshville, N.C. Engineer J.B. Skinner

Comparison of Impinger and B&L Counts

+ Armico B&L Count: □ Unarco B&L Count

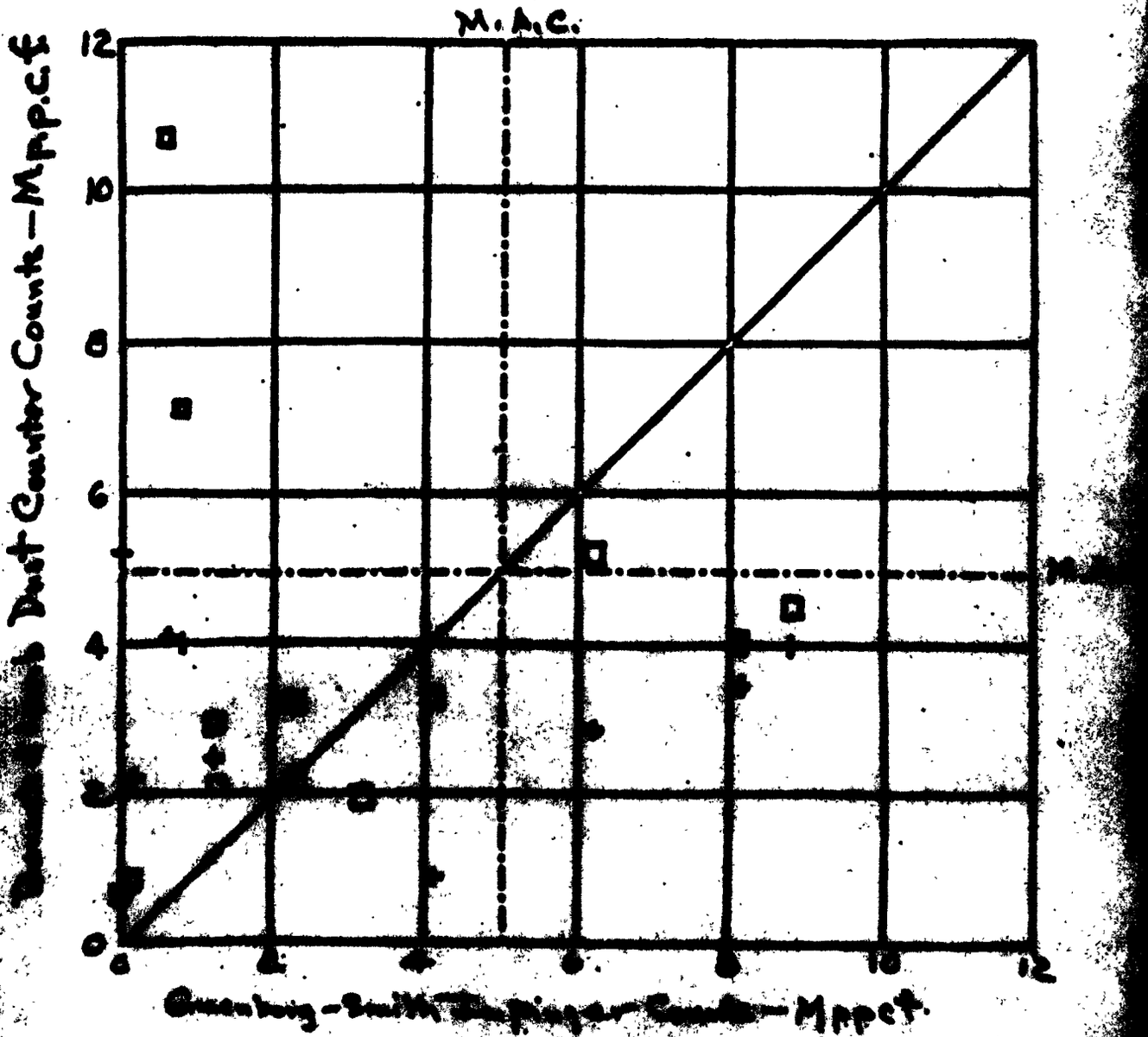


Fig. 5

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