IWS-32.35b

ASBESTOS DUST
and
PRELIMINARY INDUSTRIAL HYGIENE SURVEY

WORLD-BESTOS
The Firestone Tire and Rubber Company
New Castle, Indiana

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16. Abstract (Limit: 200 words)

Workers exposures to asbestos (1332214) were determined at the World-Bestos division of the Firestone Tire and Rubber Company (SIC-7539) in New Castle, Indiana, from September 20 to 24, 1971. The facility employed approximately 225 workers and had a safety director with no staff. No doctors or nurses were employed at the facility. Respirators were worn by wet and dry mixing operators and in the truck block performing operations. Ear protection devices and aprons and gloves were supplied by the company. Samples taken with a filter membrane ranged from 0.1 fibers greater than 5.0 microns in length per cubic centimeter (f/cc) for a surface grinder to 33.6f/cc for one hot press operator. The author concludes that potential hazards are exposure to asbestos dust, lead from mixing operations and noise. He recommends modifications and improvements in the ventilation systems, use of a vacuum system to clean-off machines and work clothes, and reductions in the noise levels of the hopper vibrators in the wet mix area.

17. Document Analysis a. Descriptors

Field-Study, Region-5, Asbestos-dusts, Occupational-exposure, Safety-measures, Protective-equipment, Filter-membranes, Air-flow, Noise-control, Vacuum-cleaning-systems

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Available to the Public	NA	21
	20. Security Class (This Page)	22. Price

Introduction and General Comments

The World-Bestos Plant is a Division of Firestone Tire and Rubber Company and is the only plant owned by the company which makes extensive use of asbestos fiber. The plant is approximately 26 years old and had its beginning as a very small operation. Presently, the company has approximately 225 employees including office personnel and floor supervisors. With the exception of the dry mixing operation, all operations are operative three shifts although manpower is cut considerably on second and third shifts.

The company has a full time Safety Director with no staff. There is no doctor or nurse on duty at the plant. It is not known how often chest x-rays are taken.

Presently, respirators are worn in the dry and wet mixing operations and the truck block preforming operation. Ear protective devices are worn in noisy sawing and cutting operations along with safety glasses. Aprons and hand gloves are supplied by the company.

The plant has basically four major product lines with a total of approximately 146 production workers. These products include:

1. Automobile Brake Linings (Cured & Uncured)
2. Truck & Bus Brake Blocks
3. Transmission Band Linings
4. Mercury Clutch Facings

Large disc brake pads are also made but to a much smaller scale than the above four products.

A list of the raw materials used in the plant is given in Table I of the appendix. Although only four major products are made in the plant, many different mixes are made for each of the products in order to comply with customer specifications.

Description of Manufacturing Processes

In order to make friction products, the ingredients are first weighed and mixed together. In the World-Bestos Plant, truck and bus brake blocks, transmission bands, and mercury clutch facings are made in dry mix operations while car brake linings are made in a wet mix operation.

All dry mix operations are very similar. The only difference being desired shape of the material. First, the materials are mixed in large blenders until uniform mixtures have been accomplished. Next, the material is taken from the blender and "preformed" into the desired shape. Preforming consists of placing a pre-determined amount of mix in a mold and then pressing with a pneumatic press until the material takes shape and remains stuck together as one mass. Truck brake blocks are preformed in

"U"-Shaped blocks while transmission bands are preformed into thin sheets.

After the materials have been preformed, they are placed in hot presses for approximately thirty minutes. The hot press serves the purpose of further shaping the material while causing the resins to bond the material in a rigid body. After the hot pressing has been completed, the materials are cut to desired shapes and then ground to proper surface finish according to customer specifications.

Automobile brake linings are made in a wet mixing operation. First the raw materials are weighed and placed into a blender. After the dry products have been thoroughly blended, oils, such as liquid cashew partical, are added to the mix so that a damp paste is formed.

Following the mixing operation, the material is rolled and pressed to the desired thickness and width on a continuous rolling machine. This machine rolls the shoes into coils approximately one foot in diameter.

After the rolling operation, the coils are placed on conveyors and carried to a curing oven. After the coils leave the oven they are cut to the desired length on a cradle saw and then ground to the desired finish. Further curing may also be done, depending on customer specifications.

General Impression of Plant

Housekeeping: In general, the plant was very crowded which made it almost impossible to keep passages clear. Conveying carts were nearly always blocking walkways. Machine cleaning was not done with a vacuum system. Several times during the week it was noted that machines, as well as personal clothing, were being blown off with compressed air. Floor cleaning was done with a vacuum sweeper several times per week.

Potential Health Hazards: The potential health hazards noted during the survey were:

1. Exposure to asbestos dust
2. Exposure to lead from mixing operations
3. Noise exposure, especially in wet mix area

Although these may be considered the major health hazards, it must be noted that potential exists for exposure to any of the raw materials. Carbon black was noted to be used rather extensively in the mixing areas leaving the workers almost completely black after only a short work period.

Respirator Protection: Presently, workers in wet and dry mixing operations and the truck block preforming operation use respirators. The respirators which are worn are manufactured by the Mine Safety Appliance Company and are of the single-inlet design. Workers in transmission band preforming

wear no respirators. Also, persons emptying the in-plant collector vented from the three Ridgway drills wear no respirators. A picture of this emptying process is given in the appendix (picture #18, # on upper right corners)

Ventilation: Almost every operation in the plant has some form of ventilation. Machines within the plant are vented to four outside baghouses and one in-plant collector. The outside baghouses have a total capacity of approximately 200,000 CFM while the in-plant collector has a capacity of approximately 225 CFM. The only air which is recycled is that from the in-plant bag type collector.

There is no make-up air supplied to the plant. While this may not produce any problem in summer months, there probably will be a negative pressure within the plant during heating months since doors and windows will be closed causing blowers to be starved for air. From this fact, it could be concluded that asbestos concentrations should probably be higher during winter months. During our survey, doors and windows were open.

Ventilation layout within the plant is shown in drawings 2 through 6. Each hood was assigned a number. Pictures of portions of the ventilation are given in the appendix. Table 2 gives a summary of the ventilation survey results.

Ventilation in the wet mixing operation was very poor. The design consisted of two large plenums with wall slots and hoods at the barrel weighing station. One plenum was completly inoperative and all the floor slots were blocked with refuse. The slot hood at the wet mix filling station was disconnected from the pipe as shown by the picture #21 in the appendix (picture numbers on upper right corners).

Public Health Service Survey

During the week beginning September 20, 1971 and ending September 24, 1971 approximately 192 personal samples and 15 sets of high volume air samples were taken. Each set of high volume samples consisted of one gross sample at approximately 50 CFM and one respirable sample at 35 CFM both collected on 8" x 10" Millipore Filters. Along with these two samples each high volume sample set had one horizontal elutriator sample at 50 liters per minute collected on a 4" diameter Millipore Filter. Drawing 1 shows the plant layout and lists the high volume sample locations.

Personal samples were collected on Millipore Type AA Filters at a flow rate of 1.7 liters per minute. Each personal sample was approximately one hour in duration with the exception of mixing operations which were cut short to prevent the filters from becoming overloaded with dust. Table 3 in the appendix lists a summary of the number of production employees in each operation and the number of personal samples taken.

To date approximately 74 of the 192 personal samples taken have been counted for asbestos fibers. The results of these samples and a comparison with

other PHS Surveys are given in Table 4.

From these results, several potential trouble spots are noted. The most obvious hazard is the fact that transmission band preformers do not wear respirators. The average concentration for these workers is above ten fibers greater than five microns in length/ml. Saw operators also appear to experience high concentrations.

Conclusions and Recommendations

The following conclusions and recommendations are necessary to improve the conditions at the plant:

1. The ventilation system needs to be improved. Some basic changes, such as, improved entry design of ducts into mains, provide adequate make-up air, good housekeeping at exhaust entries, etc., could be made utilizing the existing system. An evaluation of the existing system should be made to determine specifically which areas need to be improved.

2. Asbestos exposures to workers in the transmission band preforming area and unloading of the in-plant collectors are excessively high and adequate controls should be installed immediately. During the interim the operations should be stopped or the workers required to wear respirators (this is strictly a temporary alternative).

3. Compressed air is being utilized to "blow-off" machinery and clothing as part of the workers housekeeping chores. This should be eliminated and replaced with a vacuum system.

4. Hopper vibrators in the wet-mix area have noise levels which should be checked as they appear to be excessive.

A P P E N D I X

I. List of Tables

II. List of Drawings

III. Black & White Prints Taken During Survey

TABLE 1

POTENTIAL HAZARDOUS RAW MATERIALS USED BY THE PLANT

1. Asbestos Fiber
2. Litharge
3. Lead Powder
4. Hexamethytinetetramine
5. Phenolic Resin and Polyrez Resin
6. Toluene
7. Paints
8. Carbon Black
9. Barytes
10. Coal
11. Corundum
12. Santizier #9 and Santizer #630
13. Green Chrome Oxide
14. Iron Oxide
15. Limestone
16. Zinc Oxide
17. Petroleum Naphtha
18. Nuisance Dusts
    - Cements
    - Graphite

TABLE 2

SUMMARY OF WORLD - BESTOS VENTILATION SURVEY

Hood #	Machine or Area Controlled	Hood Type	Face Vel. fpm	Hood Volume cfm	Comments	Picture #
1	Preform Weigh Station	Large Slot	1500	370	Slot needs to cover length of storage bin	-
2	Preform Press	Machine Enclosure	----	---	Not able to get measurement	-
3	Preform Weigh Station	Large Slot	1600	380	Slot needs to cover length of storage bin	-
4	Preform Weigh Station	Large Slot	----	---	Machine not in use	-
5	Preform Weigh Station	Large Slot	1750	525	Slot needs to cover length of storage bin	3-2
6	Preform Weigh Station	Large Slot	4800	1400		-
7	Ribbon Blender Weigh Station	Slot over barrel	3500	1435	Appears to operate well	-
8	Barrel Filling from Ribbon Blender	Slot over barrel	2300	460	Hood Blocked by cloth filling shroud	-
9	Platform Filling Station	Large Hood with Slot	----	---	Not able to get a measurement	3-1
10	Filling from Nauta Mixer	Slots	1000	300	Hood not large enough, velocity too low	-
24	Sheet Preform Weigh Station	Slot	1800	900	Velocity low, slot needs to cover length of bin	3-4
26 & 27	Slots Over Sheet Preform Press	Slot	----	---	One slot bent almost completely closed	-
14	Slot Over Trans-Band Preformer	Slot	1300	520	Slot needs to cover length of storage bin	-
21	Slab Trimmer	Machine Enclosure	----	---	Appears to operate properly	-

TABLE 2 (continued)

Hood #	*Machine or Area Controlled*	*Hood Type*	*Face Vel. fpm*	*Hood Volume cfm*	*Comments*	*Picture #*
32 & 33	Slab Edge Trimmer	Blade Enclosure	2400	130	Volume too low	-
34	Abrasive Segment Cutter	Entrance Hood	2200	5400	Appears to operate properly	-
44	Drill & Counterbore	Enclosure	2200	150	Needs new rubber material at entrance	-
45	Drill & Counterbore	Enclosure	1800	120	Needs new rubber material at entrance	-
46	Drill & Counterbore	Enclosure	200	20	Velocity too low	-
47	Drill Press	Round Pipe Near Work	1500	110	Needs flange on hood	-
48	Drill Press	Round Pipe Near Work	2000	140	Needs flange on hood	-
60	Cut - Off Saw	Underneath Air	----	---	Needs overhead air also too many sharp pipe bends	3-11
61, 62 & 63	Cut - Off Saw	Underneath & Overhead	----	---	Sharp pipe bends - Volume appears low	-
71	Surface Grinder	Square Opening (Entrance)	2500	400	Grinder has underneath air. Also system appears to work well but has sharp pipe bends	3-13
72	Surface Grinder	Square Opening (Exit)	3500	560		
77 & 78	Cut - Off Saws	Machine Enclosure	----	---	Appears to work properly	-
79 & 81	Surface Grinder	Entrance & Exit Hoods	2000 Ent 1800 Ex	350 Ent 270 Ex	Grinder has underneath air also	-
82	Radial Grinder	Stone Enclosure	500	250	Elbows too sharp - Volume too low	-
83 & 84	Bevel Grinder	Machine Enclosure	200	60	Volume too low	-

TABLE 2 (continued)

Hood #	*Machine or Area Controlled*	*Hood Type*	*Face Vel. fpm*	*Hood Volume cfm*	*Comments*	*Picture #*
93 91	Surface Grinder Surface Grinder	Grinder Entrance Grinder Exit	1600	220	Grinder has underneath air also hood volumes probably too low	3-12
98	Buffer	Machine Enclosure	500	200	Machine not in use at time	-
99, 100 & 101	Rigway Drills	Enclosure	1100	75	Velocity probably low	-

TABLE 3

COMPARISON OF SAMPLES TAKEN
AND
NUMBER OF EMPLOYEES IN EACH OPERATION
EXCLUDING SUPERVISION

OPERATION	# Of Employees			# Of Samples			Coverage Ratio		
	First Shift	Second Shift	Third Shift	First Shift	Second Shift	Third Shift	First Shift	Second Shift	Third Shift
210 Mixing, Coating, Extruding									
Dry Mixing	4	0	0	10	0	0	2.5	1.0	1.0
Truck Block Preforming	3	3	2	6	3	2	2.0	1.0	1.0
Band Preforming	4	2	1	6	2	1	1.5	1.0	1.0
Wet Mixing	2	2	2	2	4	2	1.0	2.0	1.0
220 Forming									
Wet Rolling Machine	2	2	2	5	2	2	1.0	2.5	1.0
230 Hot Pressing	3	2	2	7	5	2	2.3	2.5	1.0
240 Baking									
Dregg Curing	6	6	3	7	5	3	1.2	0.8	1.0
250 Grinding and Sanding	11	10	9	18	9	7	1.6	0.9	0.8
260 Cutting and Drilling	18	12	8	20	27	6	1.1	2.3	0.8
280 Inspection	6	6	1	6	10	1	1.0	1.7	1.0
290 Miscellaneous									
Maintenance	6	4	2	6	4	1	1.0	1.0	0.5
Totals for shift	65	49	32	93	71	27	1.5	1.4	0.9
Totals for plant	146			181			1.3		

TABLE 4

COMPARISON OF FIBER COUNTS
U.S.P.H.S. SURVEYS

	OPERATION AND JOB	*PERSONAL SAMPLES FIBERS >5μ/cc* 9/20/71	1/23/69	9/1/66
210	*Mixing, Coating & Extruding*			
	Mixer and Weigher	32.4[1]	1.9	3.1
	Mixer and Weigher	1.5[1]	2.4	5.4
	Mixer and Weigher	--[2]	0.4	6.6
	Mixer and Weigher	9.6	0.1	4.6
	Mixer and Weigher	7.3[1]	0.5	2.7
	Mixer and Weigher		2.6	13.6
	Mixer and Weigher			3.7
	Mixer and Weigher			2.1
	Preform Operator	10.7[1]	4.1	7.7
	Preform Operator	18.4[1]	8.9	28.1
	Preform Operator	11.1[1]	16.6	11.0
	Preform Operator	4.3[1]	5.5	10.0
	Preform Operator	18.4[1]	10.1	16.3
	Preform Operator	10.8		1.2
	Preform Operator	7.0		24.2
	Preform Operator	12.2		11.2
	Preform Operator	10.5		3.3
	Preform Operator	10.5		13.5
	Preform Operator	9.4		
220	*Forming*			
	Auto Roller Operator (convexor)	9.2	0.4	2.1
	Auto Roller Operator (convexor)	1.9	0.8	4.4
	Auto Roller Operator (convexor)	1.5	0.2	1.1
	Auto Roller Operator (convexor)	1.7		6.8
230	*Hot Pressing*			
	Hot Press Operator	2.7	1.4	14.4
	Hot Press Operator	2.8	1.6	18.2
	Hot Press Operator	6.0	2.4	5.8
	Hot Press Operator	5.6		8.2
	Hot Press Operator	7.3		11.6
	Hot Press Operator			8.8
	Hot Press Operator			10.1
	Hot Press Operator			8.2
	Hot Press Operator			17.8
	Hot Press Operator			17.3

TABLE 4 (continued)

	OPERATION AND JOB	*PERSONAL SAMPLES FIBERS >5μ/cc* 9/20/71	1/23/69	9/1/66
230	*Hot Pressing (continued)*			
	Hot Press Operator			33.6
	Hot Press Operator			5.0
	Hot Press Operator			22.9
	Hot Press Operator			5.4
240	*Baking (Curing)*			
	Dregg Curer	4.0	0.6	9.1
	Dregg Curer	2.8	4.8	
	Dregg Curer	7.3	0.5	
	Dregg Curer	7.4	4.3	
	Dregg Curer	5.5		
250	*Grinding and Sanding*			
	Surface Grinders	6.1	0.8	2.9
	Surface Grinders	7.7	1.1	13.7
	Surface Grinders	3.6	1.5	5.4
	Surface Grinders	3.8	11.7	6.1
	Surface Grinders	5.9	2.6	9.3
	Surface Grinders	4.7	5.5	8.0
	Surface Grinders	3.5	6.9	8.1
	Surface Grinders	1.7	0.3	0.8
	Surface Grinders	2.9	4.3	1.1
	Surface Grinders	5.5		0.3
	Surface Grinders	3.2		0.6
	Surface Grinders	16.6		0.1
	Surface Grinders	2.0		2.1
	Surface Grinders			19.2
	Edge and Bevel Grinder	5.4	1.6	11.8
	Edge and Bevel Grinder	3.3	1.4	21.1
	Edge and Bevel Grinder		6.0	22.5
	Edge and Bevel Grinder			14.7
	Edge and Bevel Grinder			4.3
	Sander	7.3	2.8	3.6
	Sander			1.2
260	*Cutting and Drilling*			
	Abrasive Cut-Off Operator	7.2	7.0	22.1
	Abrasive Cut-Off Operator	2.4	0.2	10.6
	Abrasive Cut-Off Operator	7.9		6.0
	Abrasive Cut-Off Operator	10.9		10.1

TABLE 4 (continued)

	OPERATION AND JOB	PERSONAL SAMPLES FIBERS >5u/cc 9/20/71	1/23/69	9/1/66
260	*Cutting and Drilling (continued)*			
	Abrasive Cut-Off Operator	9.0		6.8
	Abrasive Cut-Off Operator	7.6		
	Abrasive Cut-Off Operator	11.8		
	Trimmer Saw	11.0	3.2	6.2
	Trimmer Saw	11.1	2.0	7.6
	Trimmer Saw	14.4		6.2
	Trimmer Saw	12.6		7.3
	Trimmer Saw			8.0
	Cradle Saw Operator	10.8		
	Cradle Saw Operator	1.9		
	Cradle Saw Operator	6.9		
	Drill Press Operator	15.3	1.2	7.9
	Drill Press Operator	1.1	1.2	27.0
	Drill Press Operator	2.7	2.7	5.7
	Drill Press Operator	5.2	3.4	4.2
	Drill Press Operator	2.4	5.4	12.6
	Drill Press Operator	2.5	2.3	7.9
	Drill Press Operator	4.4	0.3	8.0
	Drill Press Operator	12.8	0.1	2.4
	Drill Press Operator	5.5	0.1	5.5
	Drill Press Operator	5.0	2.1	30.8
	Drill Press Operator			19.2
	Drill Press Operator			6.3
	Drill Press Operator			3.0
	Drill Press Operator			5.7
280	*Inspection and Packing*			
	Inspector	11.1	2.4	25.3
	Inspector	8.2	0.4	8.2
	Inspector	0.7	2.3	13.1
	Inspector	0.3		17.0
	Inspector			0.7
	Inspector			0.8
	Inspector			4.5
	Inspector			12.7
	Inspector			23.9
	Inspector			26.5
	Inspector			20.7

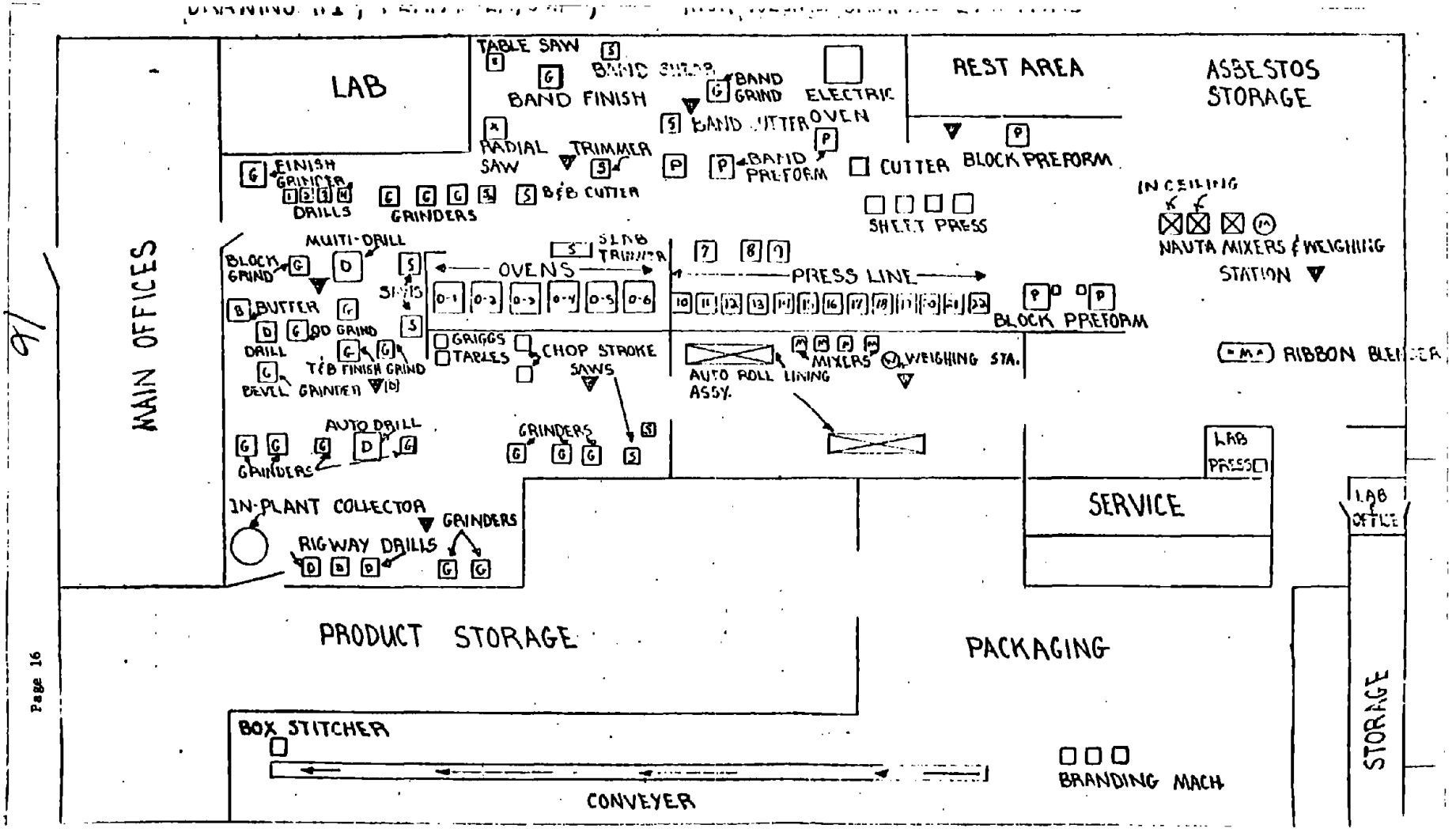
Notes: [1] *Workers wear respirators*
[2] *Too much background dust to get an accurate count*

TABLE 5

Roll #	*Picture #*	*F Stop*	*Speed*	*Type*	*Description*
3	1	4.0	1/30	B&W	Hood #9 - Filling Station at Transmission Band Mixer
3	2	4.0	1/30	B&W	Hood #5 - Brake Block Preform Weighing Station
3	3	4.0	1/30	B&W	Hood #10 - Nauta Mixer Filling Station
3	4	4.0	1/30	B&W	Hood #24 - Transmission Band Preform Storage Bin
3	5	4.0	1/30	B&W	Hood #22 - Transmission Band Abrasive Cutter, Outlet Slide
3	6	5.6	1/30	B&W	Hood #17 - Surface Sander for Transmission Band Sheets
3	7	2.8	1/125	B&W	Hood #19 - Edge Trimmer, Transmission Band
3	9	2.8	1/30	B&W	Hood #58 & 59 - Abrasive Cut-Off Saw for Disc Brake Blocks
3	10	2.8	1/30	B&W	Hoods #37 & 38 - At front of Belt Sander
3	11	2.8	1/30	B&W	Hoods #60 & 01 - Slab Trimmer, Truck Blocks (Note 90° Bend)
3	12	2.8	1/30	B&W	Hood #91 - Surface Grinder (Rough) Truck Blocks
3	13	2.4	1/30	B&W	Hoods #71 & 72 - Rough & Finish Surface Grinder, Car Shoes
3	14	4.0	1/30	B&W	Heater in Grinding Area (not Make-up air)
3	15	2.0	1/30	B&W	90° Entry Into Main Duct from Hoods 106 & 108
3	16	2.8	1/30	B&W	Ductwork in Auto Brake Shoe Area (note sharp entries into main)
3	17	2.8	1/30	B&W	In-Plant Collector (Cyclone & Fabric Filter) from Auto Drills

TABLE 5 (continued)

Roll #	*Picture #*	*F Stop*	*Speed*	*Type*	*Description*
3	18	2.8	1/30	B&W	Emptying of In-Plant Collector
3	20	2.8	1/30	B&W	Weighing Station for Wet Mixing Operation
3	21	2.8	1/30	B&W	Slots at Wet Mixing Filling Station (note pipe not connected)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BAND FINISH
BAND SAW
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ELECTRIC OVEN
BAND CUTTER
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ASBESTOS STORAGE
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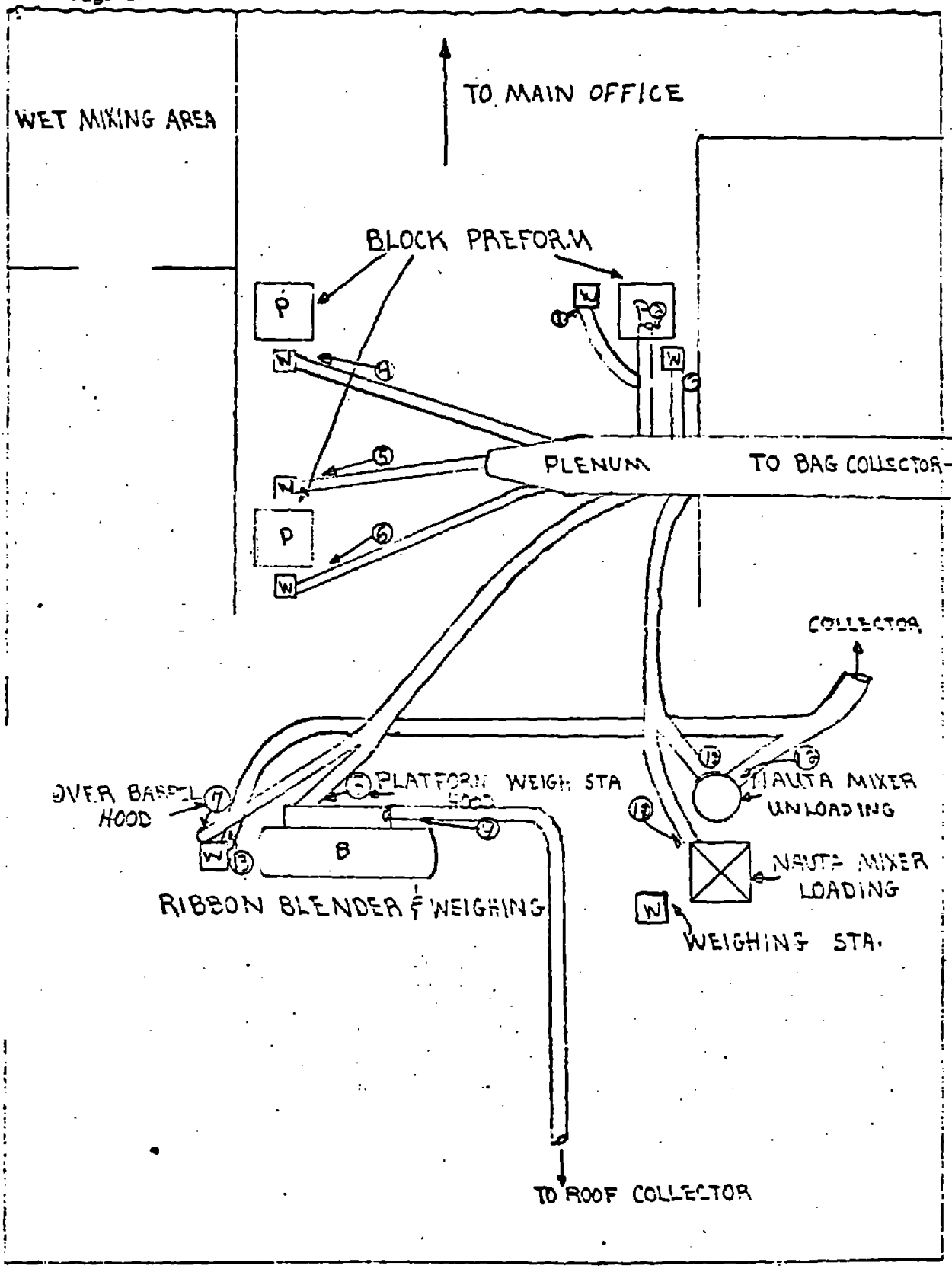
TRIMMER
BAND PREFORM
CUTTER
BLOCK PREFORM
FINISH GRINDER
DRILLS
GRINDERS
B&B CUTTER
SHEET PRESS
IN CEILING
NAUTA MIXERS & WEIGHING STATION
MAIN OFFICES
MULTI-DRILL
BLOCK GRIND
SLAB TRIMMER
OVENS
PRESS LINE
BUTTER
DRILL
BEVEL GRINDER
T&B FINISH GRIND
GRIGGS TABLES
CHOP STROKE SAWS
AUTO ROLL LINING ASSY.
MIXERS
WEIGHING STA.
BLOCK PREFORM
RIBBON BLENDER
AUTO DRILL
GRINDERS
IN-PLANT COLLECTOR
RIGWAY DRILLS
LAB PRESS
SERVICE
LAB OFFICE
PRODUCT STORAGE
PACKAGING
STORAGE
BOX STITCHER
CONVEYER
BRANDING MACH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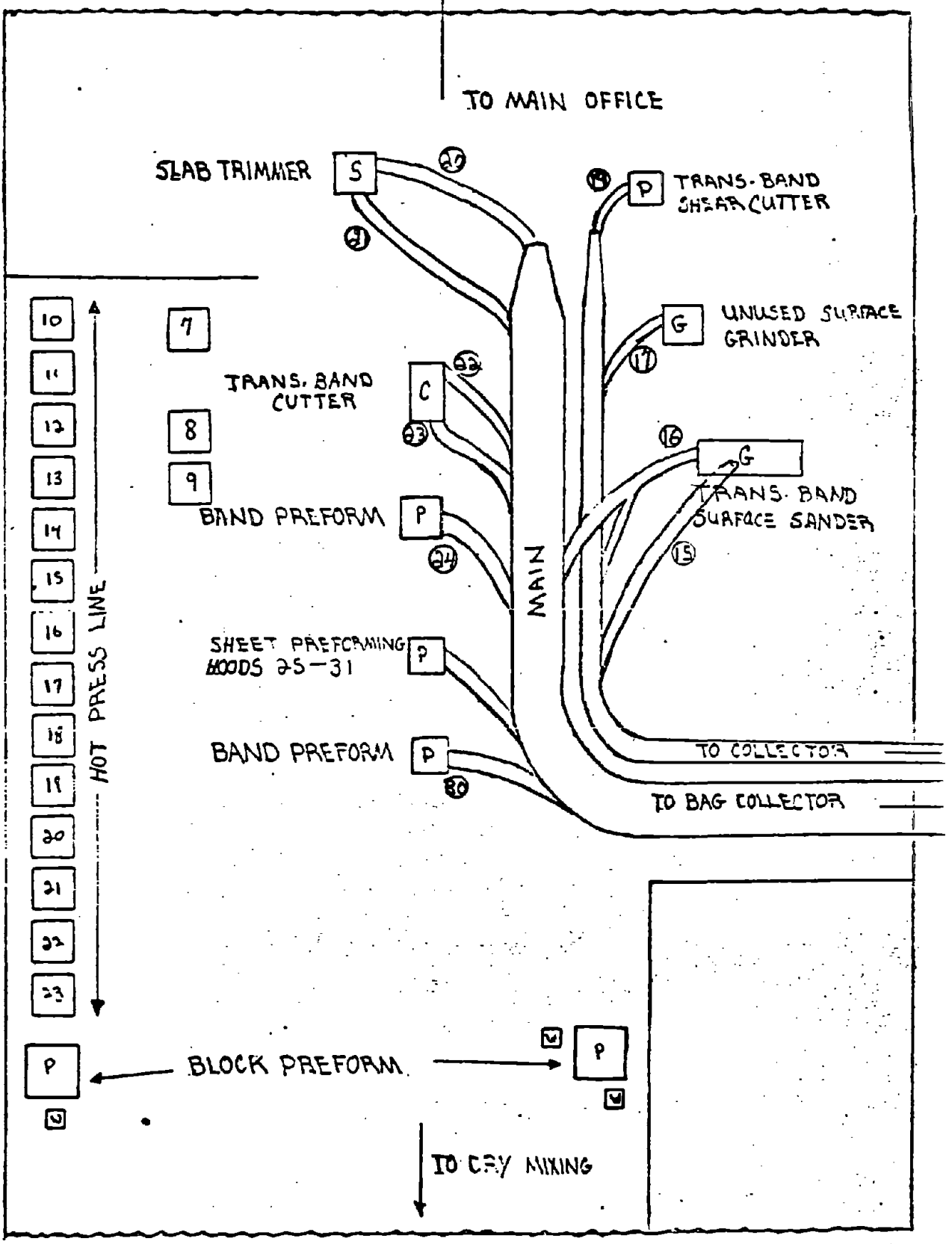
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TO COLLECTOR
TO BAG COLLECTOR
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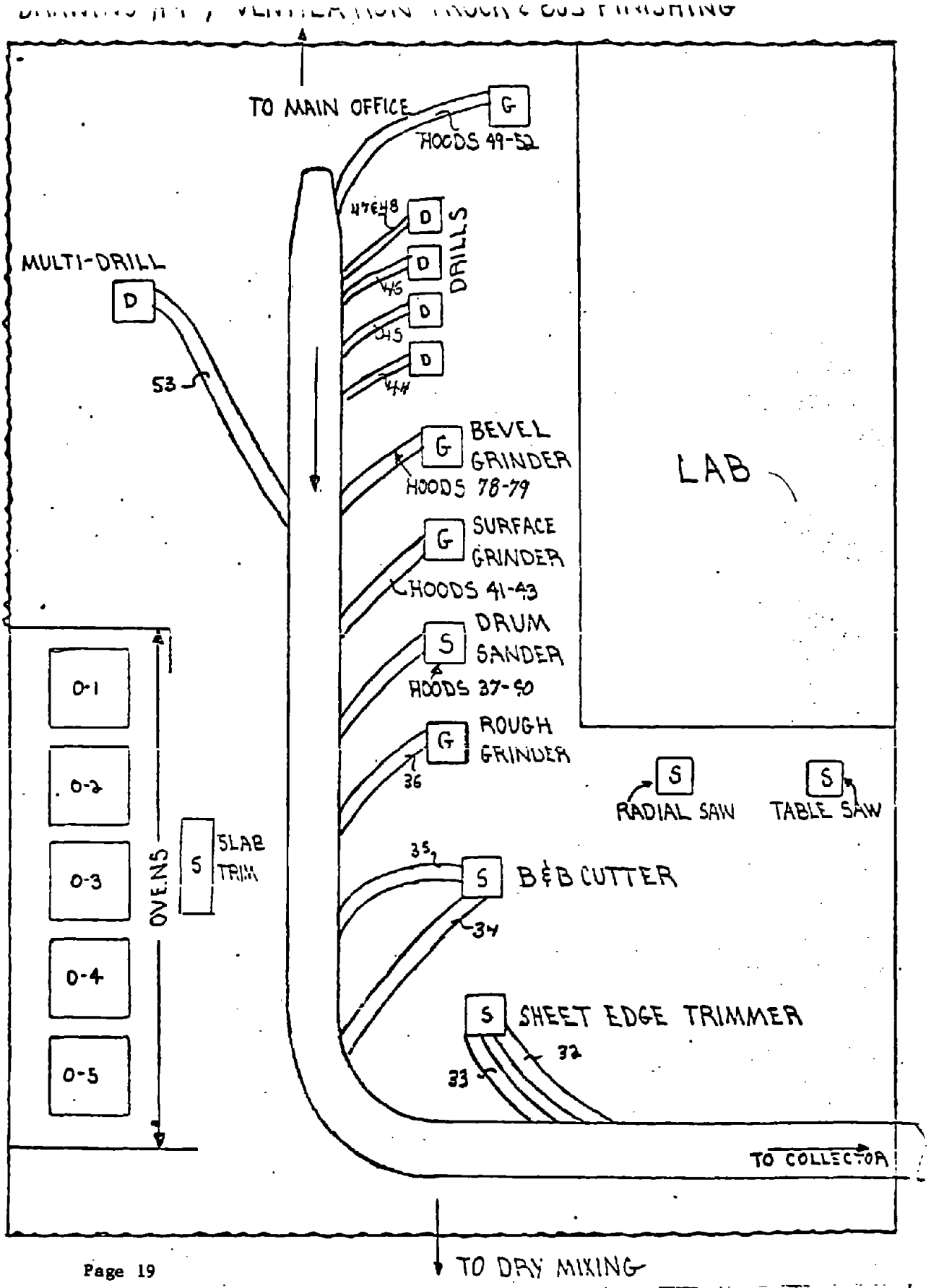
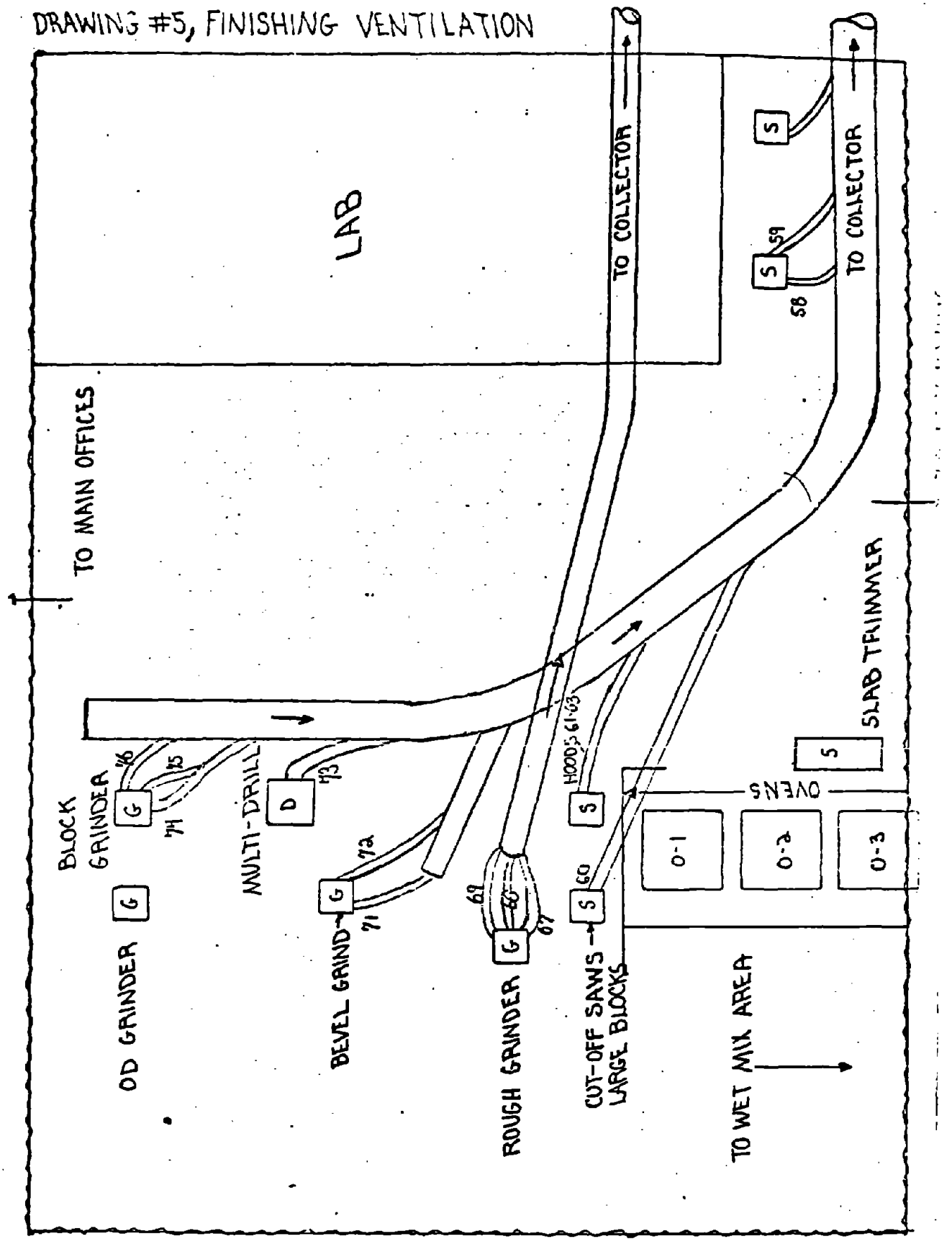
BLOCK PREFORM
P
TO DRY MIXING


TO MAIN OFFICE
G
HOODS 49-52
47&48
D
D
DRILLS
46
D
45
D
44
MULTI-DRILL
D
53
G
BEVEL GRINDER
HOODS 78-79
LAB
G
SURFACE GRINDER
HOODS 41-43
S
DRUM SANDER
HOODS 37-40
G
ROUGH GRINDER
36
S
RADIAL SAW
S
TABLE SAW
0-1
0-2
0-3
0-4
0-5
OVENS
S
SLAB TRIM
35
S
B&B CUTTER
34
S
SHEET EDGE TRIMMER
32
33
TO COLLECTOR
TO DRY MIXING

DRAWING #5, FINISHING VENTILATION



DRAWING #6, VENTILATION IN AUTO FINISHING