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Department of Labor and Industry

Lewis G. Hines, Secretary

SAFE PRACTICE BULLETIN

No.

Occupational Disease Prevention



EXHAUSTING ASBESTOS FIBER AND DUST IN WIRE INSULATION MANUFACTURE

Deputy Secretary

Department of Labor and Industry

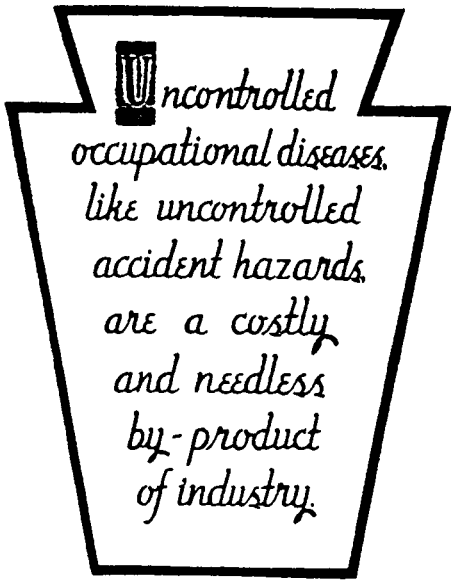
Frank K. Boal

Director

Workmen's Compensation Bureau

H. H. Chesnut

APRIL 1942


Uncontrolled
occupational diseases,
like uncontrolled
accident hazards,
are a costly
and needless
by-product
of industry.

EXHAUSTING ASBESTOS FIBER AND DUST

IN

WIRE INSULATION MANUFACTURE

Edited by:-

Robert L. Houts,
Industrial Chemist

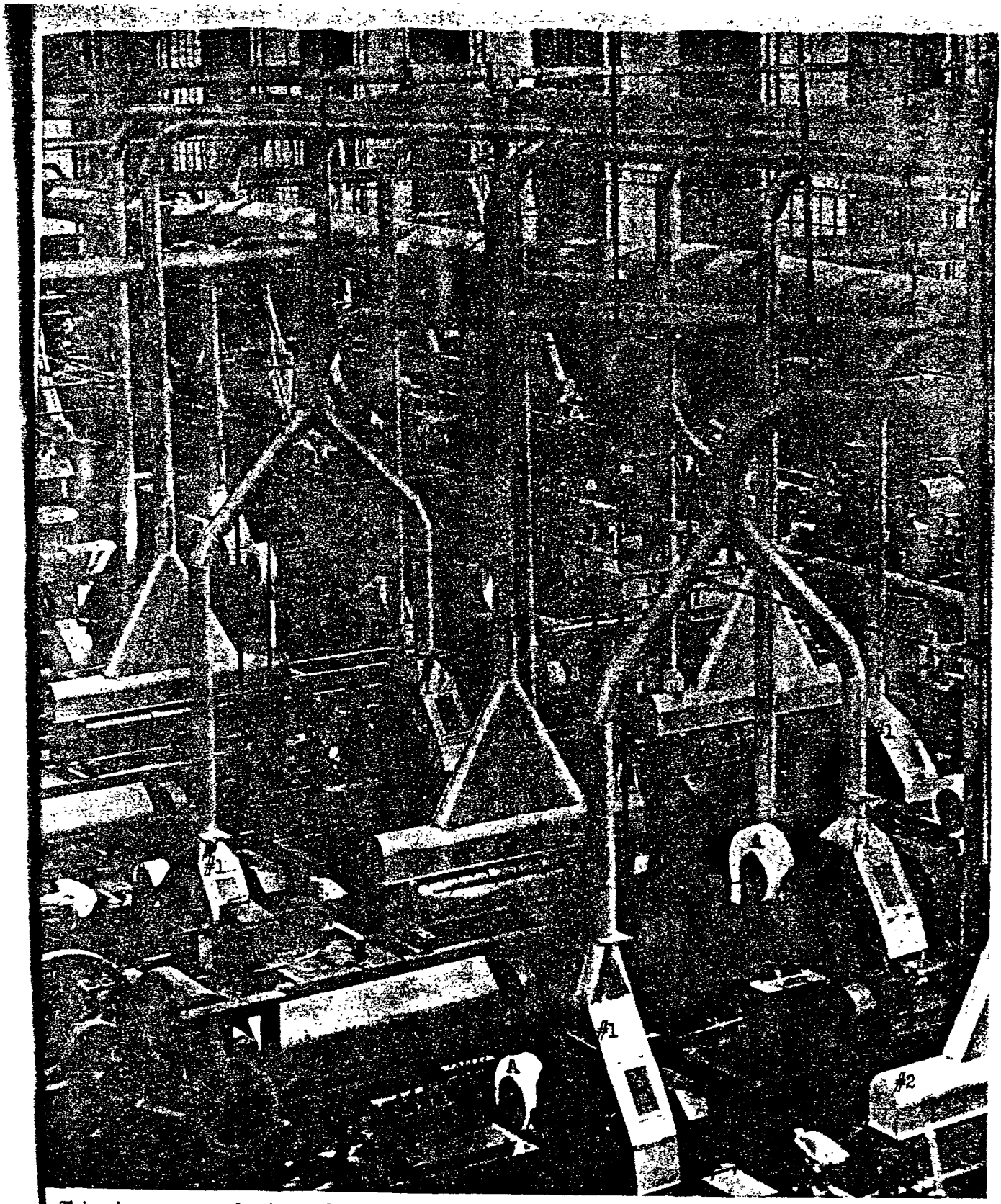
When asbestos is used as an insulation agent in the manufacture of wire it enters the plant in a refined form, having been through a previous manufacturing or processing treatment at some asbestos factory, which has conditioned the raw supply of asbestos.

Thus we find two general types of asbestos supply, one the yarn of asbestos in the spool form (to be used for braiding the outside of the finished wire), and the other the batt, or lap, form of asbestos which is loosely wound in a reel (this is the form that is used on the carding machines). High grade asbestos, of long staple and free-from-iron content, is used in wire manufacture intended for electrical insulation.

The wire manufacturer is more concerned with removal of a rather long-stapled waste, than the finer dust particles which are found associated with asbestos-ore processing about the picker-carding machine for example.

However, this asbestos by-product, if allowed to escape into the workroom, would soon float into the far boundaries of the plant and hang like Spanish moss, even from the rafters, and settling on belts, pulleys and equipment. It soon gets beyond the control of good housekeeping if unremoved at its origin. Asbestos has a decided abrasive action and its presence is not beneficial to the long life of plant equipment with which it comes in contact.

The plant procedure of the General Electric Company's wire works at York, Pennsylvania is considered a model in its asbestos waste removal system, and an illustrated description of the processes used, makes up the basis of this Safe Practice Bulletin.



This is a general view of the insulating room of the General Electric Company's ire Works plant at York,Penna. The asbestos carding machine ventilating hoods are ndicated by #1, with the white reel of asbestos felt , marked "A".

The larger ventilation hoods, marked #2 are to carry away the volatile fumes of lcohol-base solvents used in lacquers for the wire, and are over the drying ovens.

This general type of machine is known as M-Machine. This turns out magnet wire for otors and generators, and electric railways. The asbestos dust is delivered to the angborn Dust Collector, and this system is independent of the one for alcohol fumes.

The following illustrated talk was presented by Fred R. Kaimer, at a monthly safe practice conference sponsored jointly by Pennsylvania State College and the State Department of Labor and Industry. This conference was held at the Nittany Lion Inn and was under the joint chairmanship of Dr. Frank C. Whitmore, Dean of the School of Chemistry and Physics of the College and Mr. William H. Chesnut, Director of the Bureau of Workmen's Compensation.

EXHAUSTING ASBESTOS FIBER AND DUST IN WIRE INSULATION MANUFACTURE

by

Fred R. Kaimer,

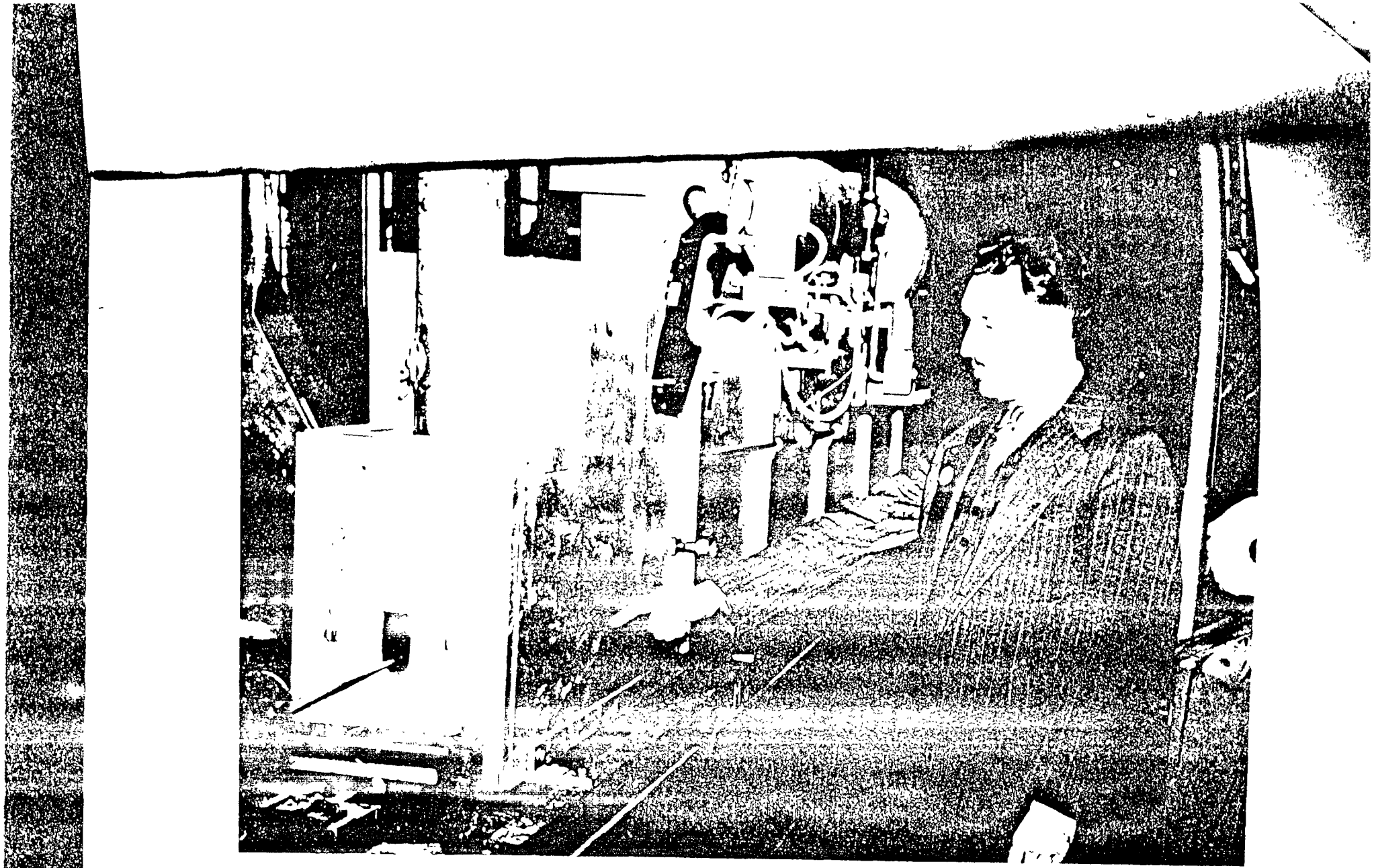
Assistant to Manager

General Electric Co. York Works

The use of asbestos fiber in the manufacture of insulated wire usually introduces a dust control problem which may require attention either as a potential dust hazard, a housekeeping problem or both. These conditions depend upon the quality and grade of fiber used, the form in which it is applied and the method of applying the insulation material.

The York Works of the General Electric Company includes in a complete program of control not only the essential exhausting and collecting equipment for controlling the asbestos fly and dust at its source, but a routine inspection and continuous maintenance of all systems, a periodic check of air conditions, thorough physical examination of all new employees and re-examination periodically for all employees.

The success of this program depends upon the uniform stress placed upon each unit of precautionary measure. The employee, as well as the employer, share a definite responsibility to insure safety, improved health and better working conditions.



The author of this bulletin is Mr. Fred Kaimer, who is general manager of the York Wire Works division of the General Electric Company's plant at York, Penna. and who is shown standing beside a drying oven, where the solvent alcohol is removed, through the agency of gas fires and ventilation, together with mechanical inclosure. This is an M-Machine and handles the larger diameter wire, usually copper, ranging from 9 gauge (0.114 in.) to 0000 gauge (0.460 in.), American wire standards. The magnet wire is observed as entering the inclosure from the left side through the opening. (In a previous bulletin, Safe Pract. Bulletin #21, Mr. Kaimer has described: Insulation of Wire with Synthetic Wax. Illustrated)

A brief outline of the method employed in asbestos wire manufacture is essential to qualify some of the illustrations and clarify the mechanics of asbestos fiber removal and collection.

"Deltabeston" the General Electric Company's trade name for asbestos insulated wire, comprises an insulating fiber of the crysotile variety $H_4M_{93}Si_2O_9$ free from iron and other foreign elements. The fiber is physically recognized as pure white #1 quality insulating fiber, length $\frac{3}{4}$" - 1" or #2 grade length 3/8" - 5/8". The method of grading employed by the asbestos mill comprises a screen test which is described briefly as follows: A 16 oz. sample of asbestos fiber is successively screened using first, two mesh screen, then four mesh and ten mesh. The bottom is a solid pan which retains "shorts" or fine splinters of unopened fiber. A typical screen analysis of #1 fiber and #2 fiber is given below:-

Method of grading

#1 Fiber 16 oz. sample

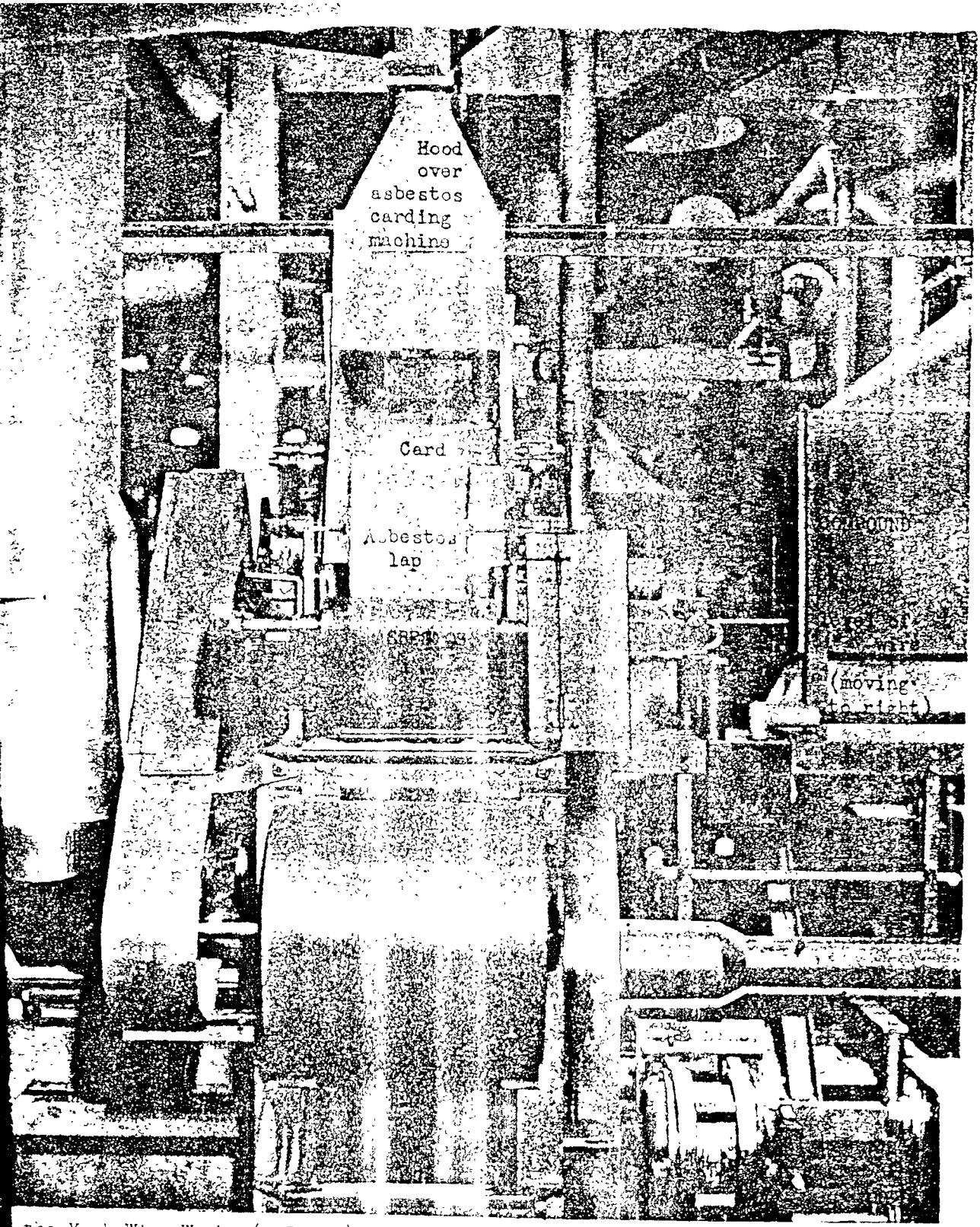
First screen	2 mesh	15.376 oz.	96% retained
Second "	4 "	.354 "	"
Third "	10 "	.240 "	"
Bottom - Solid pan		.030 "	0.18% shorts

#2 Fiber

First	15.085 oz.	94% retained
Second	.640 "	"
Third	.193 "	"
Bottom	.082 "	1% shorts

Asbestos Textiles for Insulations

The above grading represents a final control test of quality of fiber used in the manufacture of asbestos textiles, such as roving, yarn



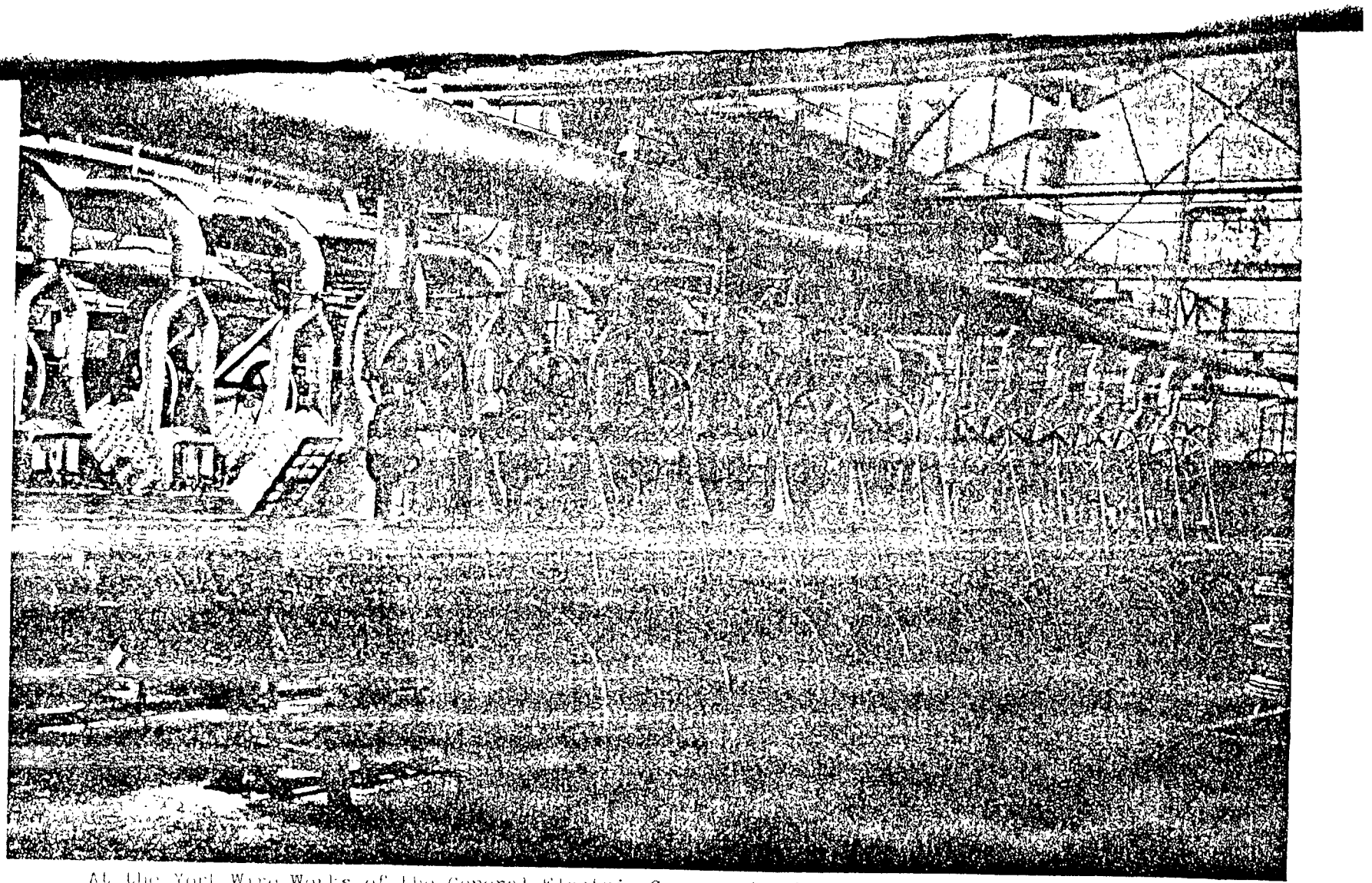
the York Wire Works (G.E.Co.)is shown a K-Machine.About 50-50 amounts of stos and compound are placed upon the wire by this machine.The asbestos is ed and placed upon the wire as a felt.The asbestos dust and waste from this ess are removed by the hood shown. This type of wire is used in electric es, motor leads and fluorescent light fixtures. The steps are (1)asbestos on wire, (2)run through viscous compound, and (3) "polish out" excess ound. The movement of wire through this machine is from left to right.

and lap designed for use in insulated wire manufacture. The fact may now be recognized that the quality and grade of product supplied by the asbestos mill for wire insulating purposes is already highly refined. The crushing, grading and refining has been completed leaving the product which the wire manufacturers must handle free from dust particles. The problem therefore becomes one of controlling the fly of short asbestos fibers. If permitted to fly in the work room, the fibers adhere to practically all rough surfaces and projections, settle on operating equipment, floors, beams, etc. and cause in a short time an unsightly appearance. The abrasive action of the asbestos on rotating members, bearings, gears, cams, is also extremely violent necessitating costly replacements and repairs or high maintenance costs. The installation of adequate ventilating equipment and control measures at York has effectively eliminated these conditions as well as any semblance of health hazard.

The process of manufacturing asbestos insulated wire at the General Electric Company, York Works, requires the utilization of asbestos fiber in the form of lap or rolls.(Sample for illustration). The material received from the asbestos mill in this form is re-carded and fed to the wire element in the required quantity to produce the desired insulation thickness.

See 1.

The process of re-carding the asbestos fiber and transferring ame to the wire element generates asbestos dust and fly, which is controlled proper exhaust equipment. The simplest, most effective and lowest cost thod which we have devised, without interfering with production, incorpotes a hood completely enclosing the generating unit utilizing hinged rts with shatter proof glass windows for operating control. The volume air handled is a function of hood opening and velocity, the latter being



At the York Wire Works of the General Electric Company, is shown the asbestos braiding operation. Here all types of wire are braided with asbestos yarn. Bobbins of asbestos (called packare) are observed at the left center. Asbestos is used on wire for Class-B insulation (125 deg. C) for example; boiler rooms, switch boards, elevators, cranes, battleships, etc.

The by product, asbestos dust, or waste, is efficiently removed by the illustrated ventilation system and piped to a dust collector, outside the building.

dependent upon particle size, specific gravity turbulence and location of hood opening for most effective control.

C.F.M. = Area (Sq. Ft.) X V (F.P.M.)

Referring to figure #1 - Slide No. 1 pictured is a typical hood used in the process completely enclosing the generating unit. The hood opening measures 1' x 3' x 1' making an overall area of 3 sq. ft. The velocity used at hood opening is 300 ft/ min. or a volume of air handled of 900 C.F.M.

The single branch pipe velocity at entrance to hood is 2000 ft/ min. A blast gate and by pass damper are also provided for reducing velocities if desired.

Figure (2) illustrates the method of fiber collection and system of removing the collected fibers. The equipment comprises a Pangborn Cloth Screen Dust Collector, arranged for outside location and selective operation. There are 124 screens covered with cotton filter fabric arranged ide spaced 5½" centers providing an active area of 5150 sq. ft. These re equipped with motor driven screen vibrating mechanism utilizing 4 800 RPM motors.

The collector is provided with a central partition through the llector screen section and dust box shown below to permit continuous eration. Under normal operations, air flows to both sides of the collector. visions have been made permitting the entire air flow to be diverted the collector in order to vibrate screens in the other half and clean the dust box section below the isolated screen section. The air flow es are then reversed to permit screen vibration and cleaning of the osite half of the collector. The air flow gates are finally opened so o return both screens sections to the line. This operating cycle is ormed once each day as a result of our experience. The removal of

asbestos fibers from the dust box section is accomplished manually through four unloading thimbles in the bottom of dust box. Large collector bags positioned with bag clamps receive the asbestos fiber (See photo.) The dust velocity maintained throughout the main duct system is 4000 ft/ min.

The system is operated by a single exhauster, backward curved blade type, designed to handle 16,420 C.F.M. from 70, 4" diameter exhaust connectors. A 10% leakage allowance brings the total C.F.M. to 18,120, at 1629 R.P.M. A 40 HP - 1800 RPM motor is used to operate the exhauster! This installation has now been in operation approximately three years continuous service and has proven its value through results secured in improved housekeeping, working conditions and good health insurance. The waste asbestos fiber formerly thrown away has been reduced by 20%. In other words, we have added to our saleable waste 20% of good fiber which is valued at $500. per year.

Health Routine

The procedure which constitutes a complete program of health routine at the York Works, I feel is of tremendous importance and if time permitted would justify more detail regarding the administration of each precautionary measure. In brief, this program to protect the health and safety of employees develops the following practices:

1. A thorough physical examination and pre-employment history a pre-requisite to initial employment.
2. A distribution of G. E. Co. Booklets on general safety requirements requiring employees signatures.
3. A distribution of booklets on rules and precautions of safety and health applying specifically to the York Works.
4. Distribution and furnishing of following materials:
   (a) Clothing - Coveralls - Underwear - caps - gloves.
   (b) Towels - Soap - Protective Cream