PLANT REQUIREMENTS TO SET UP AND OPERATE A WOOL SCOURING PLANT

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
COMMUNICATIONS RESOURCES DIVISION
Washington 25, D. C.

FOREWORD

This brochure is one of a series of reports resulting from overseas technical inquiries on factory or commercial establishments, operation, management, and engineering. The report is designed to provide only a general picture of the factors that must be considered in establishing and operating a factory of this type. In most cases, plans for actual installations will require expert engineering and financial advice in order to meet specific local conditions.

Mention of the name of any firm, product, or process in this report is not to be considered a recommendation or an endorsement by the Agency for International Development, but merely a citation that is typical in its field.

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The original report was prepared by Thompson and Williams, Washington, D. C., for the technical aids program through the facilities of the Office of Technical Services, U. S. Department of Commerce.

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This report has been revised and rewritten by Vitro Engineering Company, a division of Vitro Corporation of America, 1025 Connecticut Avenue, N. W., Washington, D. C.

For further information and assistance, contact should be made with the local Productivity Center, Industrial Institute, Servicio, or United States AID Missions.

Code Number
PR 113

March 1962

ACKNOWLEDGEMENT

The author gratefully acknowledges the technical assistance and illustrations provided by the following companies:

C. G. Sargent's Sons Corporation
Graniteville, Massachusetts
Manufacturer of feeders, dusters, openers, washing bowl trains, dryers, and associated wool scouring equipment.

Aldrich Machine Works
Greenwood, South Carolina
Representative for the Lummus Cotton Gin Company, Columbus, Georgia, manufacturers of baling presses for the textile industry.

Combustion Engineering, Inc.
1001 Connecticut Avenue, N. W., Washington 6, D. C.
Manufacturer of industrial boilers and other products for the power field.

Special thanks are extended to Mr. Albert Gilet of the Gilet Wool Scouring Corporation, North Chelmsford, Massachusetts for his helpful assistance in reviewing the report manuscript prior to publication.

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INTRODUCTION

The purpose of this report is to present basic information relative to the establishment of a wool scouring (washing) plant in a foreign country.

This plant will scour raw grease wool and bale the scoured wool on a commission basis. Charges for this service are applied on the grease wool weight and the owner accepts 50 to 60 per cent of the original weight in scoured wool free of most impurities.

American mills process more than 300 varieties of wool which are generally classified as: apparel wool and carpet wool. There are two kinds of apparel wools; the fine, short-staple type used in the manufacture of woolen cloth, and the fine, longer-stapled combing wools used in the manufacture of worsteds. Carpet wools are very coarse and long, and require less cleaning than the apparel wool.

In the United States, wool is usually obtained from domesticated sheep. However, in other parts of the world, fibers from many breeds of sheep, as well as from other animals, are often processed. These would include mohair from the angora goat; wool (hair) from the llama, alpaca, and vicuna; angora hair from the rabbit; cashmere from the Kashmir goat; and camel hair. The pure Merino sheep, or breeds with predominantly Merino blood, are principally raised in the United States, South Africa, and Australia, and produce fleece graded as fine wool. This fine wool ranges from 2-1/2 to 5 inches in length, has 2,400 scales to the inch, a diameter of about 1/2000th of an inch, and of high fat content. Apparel wool may be graded by the blood system (proportion of Merino blood); the count system; or the Argentine wool system.

Carpet wool is produced all over the world. However, a large proportion of it is supplied by African and Asiatic animals such as the somali, hirrick, sikkim bera, and the tartarian breeds.

Although this report is based on the operation of a commission scourer, other mills such as combing plants, yarn manufacturers, and fully integrated mills may operate their own scouring trains. This may be necessary in the following cases: (1) worsted mills, who must blend different grades of wool during the sorting and scouring process; (2) to minimize freight rates to an outside plant; or (3) for economical operation of continuous processing of one or a few grades of wool in very large quantities, employing several shifts a day and two or three scouring trains. Data from this report can be adjusted easily to fit these circumstances.

This plant will require a substantial capital investment and moderate labor skills, under experienced supervision, to insure quality control. The proposed production rate of 5 million pounds of grease wool per year is considered to be the minimum for economical operation. This rate should be increased as soon as the market warrants, since unit costs decrease rapidly as production increases. When production rises to 10 million pounds per year, installation of equipment to recover wool fat or wax would become profitable.

GENERAL ASSUMPTIONS

In order to make realistic cost estimates in this report, it is necessary to make the following assumptions:

1. The costs of the building and general facilities are based on the United States prices.

2. Material and equipment costs are based on sizes and specifications current in the United States.

3. Labor costs are based on the average for the industry as recently published by the United States Bureau of Labor Statistics.

4. Adequate water, power, sewerage, and transportation facilities are available at the plant site.

5. The available water supply will require some purification to make it suitable for the scouring process.

6. This plant operates two eight hour shifts daily, 5 days a week, and fifty weeks a year. Personnel are paid for 52 weeks.

7. The plant manager and the production foremen are experienced men, capable of doing all the labor training necessary. It is assumed that learner's rates will be paid in such cases and that the costs can be charged under unforseen expense.

8. This plant is equipped with mechanical and chemical machinery that is suitable for the processing of apparel wools.

9. The processing of carpet wools and other supplemental procedures such as grease recovery and carbonizing, although described herein for informational purposes, are not applicable to initial operation of this plant.

10. The following items cannot be estimated realistically:

a. Land value

b. Distribution and selling costs

c. In-freight and out-freight

d. Administrative costs

e. Taxes

Approximate estimates are made for each of these items, with the exception of taxes, for the purpose of completing cost estimates; however, adjustments should be made in accordance with actual local costs.

11. All cost estimates contained in this report are to be adjusted to conform to local conditions. Colums are provided in the tables included in this report to facilitate conversion of cost figures to those existing locally.

PRODUCT SPECIFICATIONS

Technically, the generic term "wool" means the hair fiber of the sheep or lamb while the commercial connotation includes such specialty fibers as the hair from all of the other animals discussed in the introduction. This report is based on the scouring of grease wool that is the natural fiber from the fleece of a living sheep.

The American Standards Association (ASA) and the American Society for Testing Materials (ASTM) provide pertinent information in the following specifications:

ASA	L14. 12-1957	Standard Definitions of Terms Relating to Textile Materials (ASTM D123-55)
ASA	L14. 26-1957	Standard Specifications and Method of Test for Fineness of Wool (ASTM D419-58)
ASA	L14. 40-1956	Standard Methods of Test for Wool Content of Raw Wool, Laboratory Scale (ASTM D584-57)
ASA	L14. 84-1956	Evaluation of Continuous Scouring of Raw Grease Wool
ASA	L14. 104-1960	Method of Test for Average Fiber Diameter of Wool Tops, Card Sliver, and Scoured Wool by Micronaire Method (ASTM D1282-57T)
ASA	L14. 105-1960	Method of Test for Alkali-Solubility of Wool (ASTM D1283-57)
ASTM	D1060-58	Core Sampling of Raw Wool in Packages for Determination of Percentage of Clean Wool Fiber Present
ASTM	D1575-58T	Tentative Method of Test for Fiber Length of Wool

ASTM D1334-58	Standard Method of Test for Wool Content of Raw Wool, Commercial Scale
ASTM D1576-58T	Tentative Method of Test for Moisture in Wool by Oven Drying
ASTM D1234-54	Standard Method of Sampling and Testing Staple Length of Wool in the Grease
ASTM D1113-54T	Tentative Method of Test for Vegetable Matter and Alkali-Insoluble Impurities in Scoured Wool
ASTM D861-58T	Tentative Recommended Practice for Use of Tex System to Designate Linear Density of Fibers, Yarn Intermediates, Yarns, and other Textile Materials
ASTM D596-58	Standard Method of Reporting Results of Analysis of Industrial Water and Industrial Waste Water
ASTM D1256-53T	Tentative Scheme for Analysis of Industrial Water and Industrial Waste Water
ASTM D1129-58	Standard Definitions of Terms Relating to Soaps and Other Detergents

Many other ASTM specifications are available on water analysis, soaps and other detergents, natural waxes, and alkaline detergents.

PRODUCTION CAPACITY

This plant has an estimated annual production capacity to scour approximately five million pounds of apparel-grade grease wool. This is based on an hourly wool input of about 1,250 pounds or 20,000 pounds per day for the two shifts. The 48-inch equipment listed herein has an input capacity of approximately 3,000 pounds of grease wool per hour. This popular commercial size is superior to the 36-inch size but, of course, cannot compare with the larger production capacities of the commonly used 60-inch size.

In times of peak demand the capacity can be stepped up, extra help hired, and another shift added for optimum production. The greater the volume of wool scoured, the greater the margin of profit since less time is lost in dumping the tanks, and chemicals are thus employed more economically and efficiently.

Along with increased output, other processing services such as carpet wool or specialty wool scouring; grease recovery; blending; combing; carding; or carbonizing could be advantageously added. Any of these services could be provided with installation of the necessary machinery.

The plant should reach rated production in about two months, with all labor training being accomplished by the plant manager and the two foremen.

PRODUCTION UNIT

The production unit for the scouring of grease wool is the pound.

PRODUCTION OPERATIONS

Raw grease wool, containing approximately 50 per cent of natural and acquired impurities, is received at the plant in 225 to 350 pound bags. The purpose of the scouring operation is to remove these impurities and prepare the wool for further processing.

Natural impurities consist of grease (wool fat or wax), suint (the dried perspiration of the sheep, composed mainly of a water-soluble potassium soap), manure, and blood. The grease and suint, which coat the hair fibers during growth for protection against the elements, are produced by the sheep's glands.

Acquired impurities may consist of such things as dust, dirt, insecticides, identification paints, and vegetable matter such as burs, twigs, seeds, leaves, and grass.

Cleaning and scouring of grease wool is accomplished by two methods -- mechanical and chemical. The mechanical treatment removes most of the impurities except the wool fat and suint which are extracted during the chemical process. During the cleaning and scouring operations, the wool is opened, washed, raked, dried, and baled. Detailed descriptions of the mechanical and chemical processes are given in the following paragraphs.

MECHANICAL TREATMENT

The objective of the mechanical treatment is to beat out as much of the acquired impurities as possible, to open the clumps of fibers, and to deliver a uniform material to the chemical scouring train.

Automatic Feeder. The raw wool is delivered to the automatic feeder, illustrated in figure 1, by a spike apron consisting of wood slats equipped with steel pins, and attached to an iron chain. An oscillating comb (doffer) opens the wool fibers, a revolving beater knocks the wool off the pins, and an even layer of stock is delivered to the feed apron of the opener.

Opener. The opener, illustrated in figure 1, is a double cylinder type, 48 inches wide. The wool is delivered to a pair of feed rolls by a wood slat apron. It is picked up by the first rotating cylinder and forced open between this cylinder and the feed rolls. The wool then passes over a screen where some of the heavy dirt drops out before it is delivered to a faster turning second cylinder. Further opening action takes place between the cylinders, and more dirt is screened out under the second cylinder. The wool then goes into a chute where it is directed to the first washer bowl of the scouring train.

Conveyor. In the proposed plant, as in most installations, the bowls and dryer are all in one line. However, if there is not sufficient length to install them in this way, some of the washer bowls can be put in one line and the rest of the bowls and the dryer run back parallel to them. In this case, a "Z" type conveyor, such as the one illustrated in figure 2, can be used to take the wool from one line of washer bowls to the other, and still allow a passage way through the aisle. This conveyor is not included in the list of equipment for this plant.

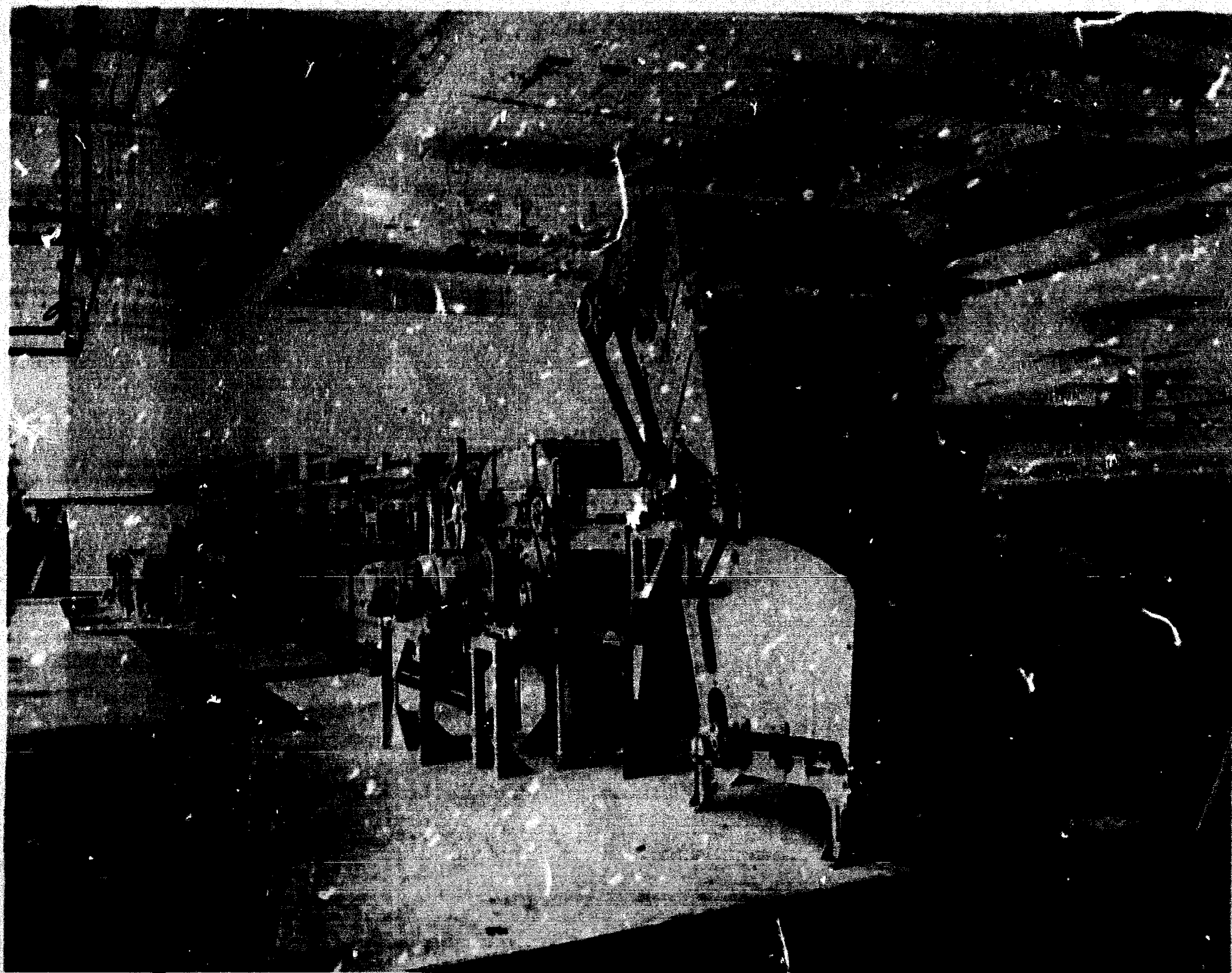


Figure 1. Typical Automatic Feeder and Double Cylinder Opener

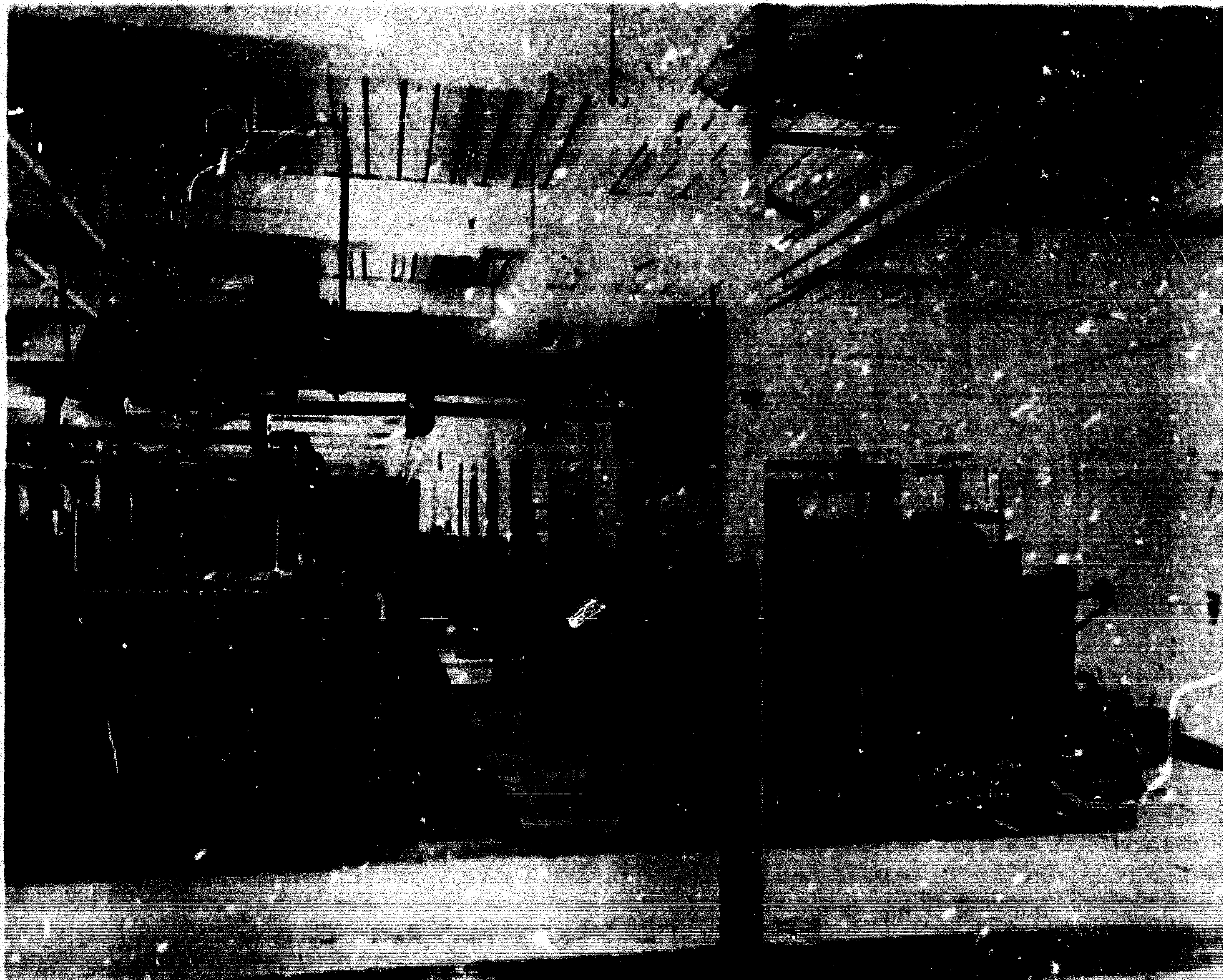


Figure 2. "Z" Type Conveyor

CHEMICAL TREATMENT

A 5-bowl scouring train, illustrated in figures 1 and 3, is used in the chemical and washing process. Mechanical arrangements pass the wool from bowl to bowl where the fat and suint are saponified by the addition of an alkali. A commercial soap or detergent is then added to emulsify the resulting saponified products so that they can be separated from the wool fibers.

Saponification. Alkalis, such as sodium and potassium carbonate, ammonia, sodium silicates and phosphates, are used to saponify the wool grease and suint. The alkali chosen depends on the grade of wool being processed. It may be fed directly to the bowls from side tanks by means of pails, or it may be piped from gravity tanks installed above the bowls.

Emulsification. The natural soap, formed during the saponification process, must be supplemented by a commercial soap or synthetic detergent to promote complete emulsification of the fat and other impurities. The emulsified impurities are then floated away from the wool fibers.

Scouring Train. A 5-bowl scouring train is recommended for the chemical process. The cast iron or steel washer bowls are 48 inches wide, and equipped with 60 degree hopper bottoms, perforated false bottoms, counterflow plumbing, and pneumatic squeeze rolls, the bottom rolls being made of steel and the top rolls of rubber.

Bowls 1 and 2 are 32 and 27 feet long, respectively, and are equipped with settling tanks and automatic dumping arrangements by valves located in the hopper bottoms. Bowl 3 is 21 feet long, has no settling tank, and is dumped manually by means of hand levers for opening the valves in the hopper bottoms. Bowls 4 and 5 are the same as bowl 3, except that they are only 16 feet long. If the wool is to be bleached, the last bowl is usually constructed of stainless steel.

There are two different models of wool washers in common use. One, termed the "Wet Nip", has a long rake running over the entire length of the bowl. This rake delivers the wool over an incline where water carries it into the nip of the rolls. Another, termed the "Dry Nip", has an auxiliary rake, making four revolutions to one revolution of the long rake, that takes the wool and thins out the layer as it is carried over a screen without water and into the nip of the rolls.

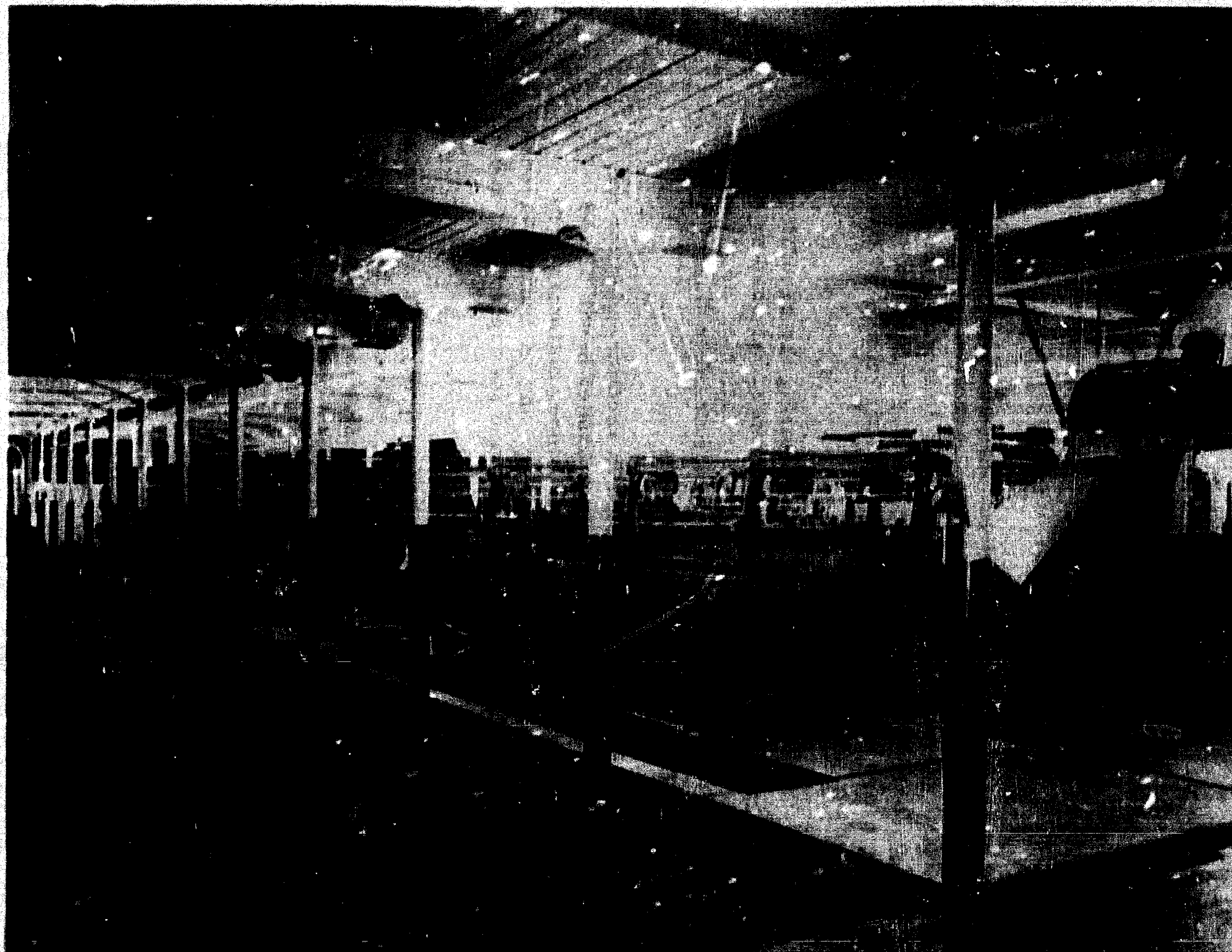


Figure 3. Typical Scouring Train

There are two different methods of washing in common use; one called "de-suinting", the other "counterflow".

In the de-suinting method the first bowl contains only warm water to remove the suint and other soluble materials. The second and third bowls contain warm water, detergent, and alkali to extract most of the grease and remaining dirt. These are the bowls that would feed a grease recovery system if such a system is incorporated. The fourth and fifth bowls serve as the warm and cool water rinses, respectively.

The counterflow method, recommended in this report, differs from the de-suinting method principally in the use of the first bowl. In this system, detergent and alkali are added to bowls 1, 2, and 3, which are held at a temperature of 125-130 degrees Fahrenheit. Fresh water is taken in at bowls 4 and 5 and their overflow is run back through each of the preceding bowls (counter to the wool flow) and discharged from bowl 1. Thus, bowl 1 would be the one to feed a grease recovery system if it were installed. This method is economical since much of the detergent and alkali can be recovered and used over and over again. Employing this system, operators have reported running for as long as five days without dumping the bowls.

DRYING

After scouring, the wool passes from the last scouring bowl to an automatic feeder which is similar to, but wider than, the one supplying the opener. This feeder opens the wool and feeds an even layer to the dryer. The dryer is a single apron, six section unit, equipped with an 8-foot wide conveyor to carry the wool through the dryer, as illustrated in figure 4. Each dryer section is 45 inches long and equipped with an individually powered, centrifugal-type fan. Finned-type heating coils are mounted directly over the conveyor, and air is forced down through the heaters and thus through the wool. The dryer is thoroughly insulated and equipped with hinged access doors. Steam for heating the drying coils, as well as the water for the scouring train, is provided by a boiler such as the one illustrated in figure 5.

The wool, as delivered to the dryer, contains about 45-50 percent moisture; after leaving the dryer, the moisture content has been reduced to approximately 12 percent. The dryer is capable of drying about 1,000 pounds of wool per hour, depending upon the type being dried. Fine wool is more difficult to dry than the coarser types.

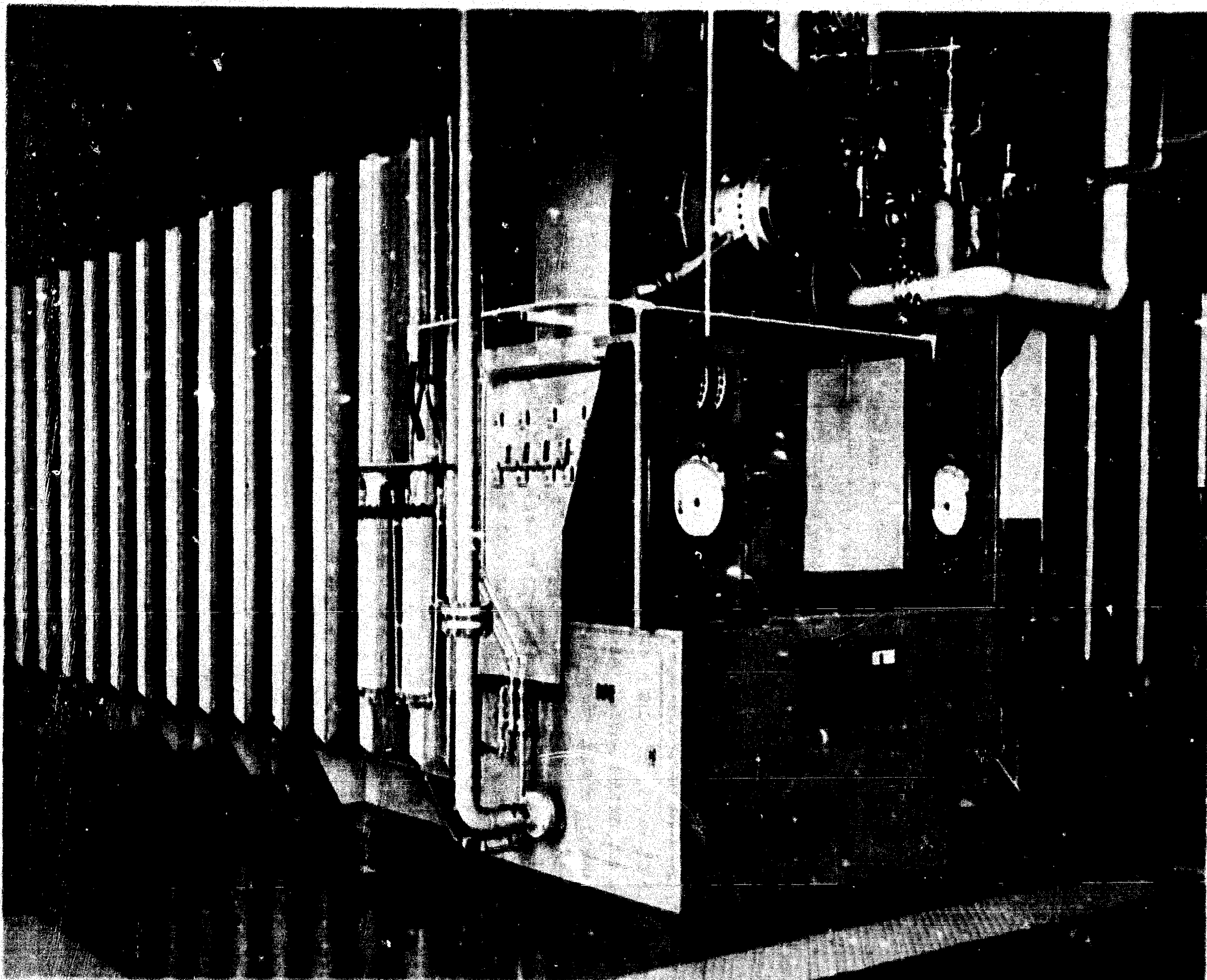


Figure 5. Typical Steam Boiler

BALING

From the dryer the wool is delivered by conveyor to a double-box hydraulic baling press, similar to the one illustrated in figure 6. This press produces the American standard 27 by 54 inch bale. One or two attendants can bale, weigh, tie, and tag four to six bales per hour.

QUALITY CONTROL

In order to insure well scoured wool, it is essential that certain visual, tactile, and chemical tests be performed at various points in the process. It is assumed that the production foremen is an experienced wool scourer, and it should be his responsibility to supervise such tests.

In wool scouring, the amounts of alkali, soap, and detergent used in the process determine the final quality of the wool. The required amounts of these materials vary with the type of wool being processed, and an experienced scourer can often regulate them solely by the appearance and "feel" of the scoured wool. Excessive alkali will produce a harsh, dull-appearing wool; excessive soap or detergent will produce a sticky or tacky wool with a yellow color and a stringy appearance. Insufficient alkali, soap, or detergent generally causes a poor color. Usually, it is advisable to submit samples of the scouring liquid to chemical tests to determine the appropriate additions of saponifying and emulsifying materials. Such tests are relatively simple to perform since they merely involve titrating the samples with an acid to determine the amounts of free and combined alkalis in the scouring bowls. Automatic equipment is available to provide an instantaneous indication of the alkali concentration.

For the more sophisticated plant, the Sargent Company can provide a complete laboratory unit consisting of a miniature scouring train, and its attendant control panel, which will provide a complete record of an entire process. This sample washer reproduces every factor entering into the calculations for the most efficient washing and scouring of any particular type of wool. It takes into account deviations in raw stock, alkali content, soap and detergent concentrations, process timing, and the removal of pollution agents when stream pollution by the discharged products of the scouring

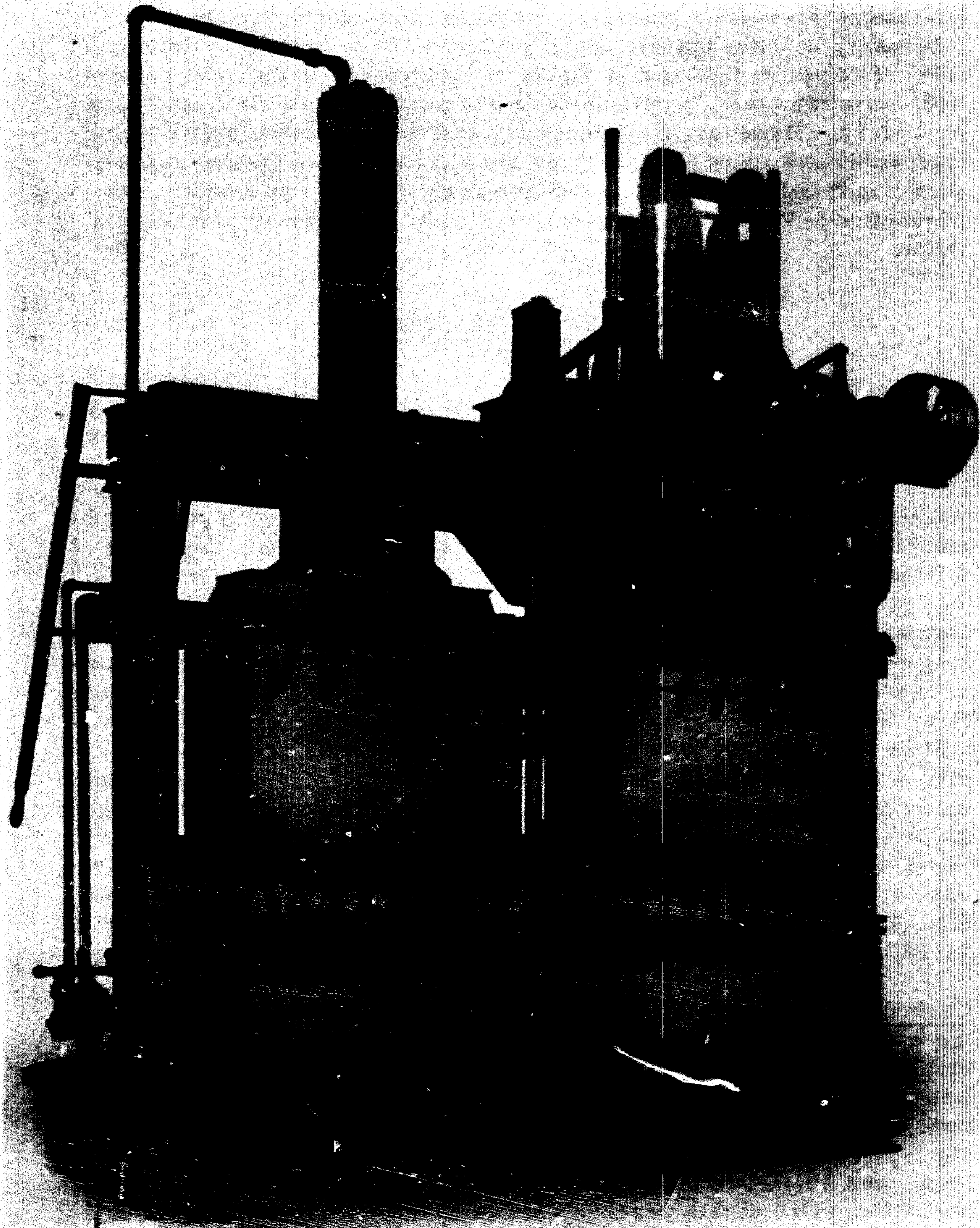


Figure 6. Typical Baling Press

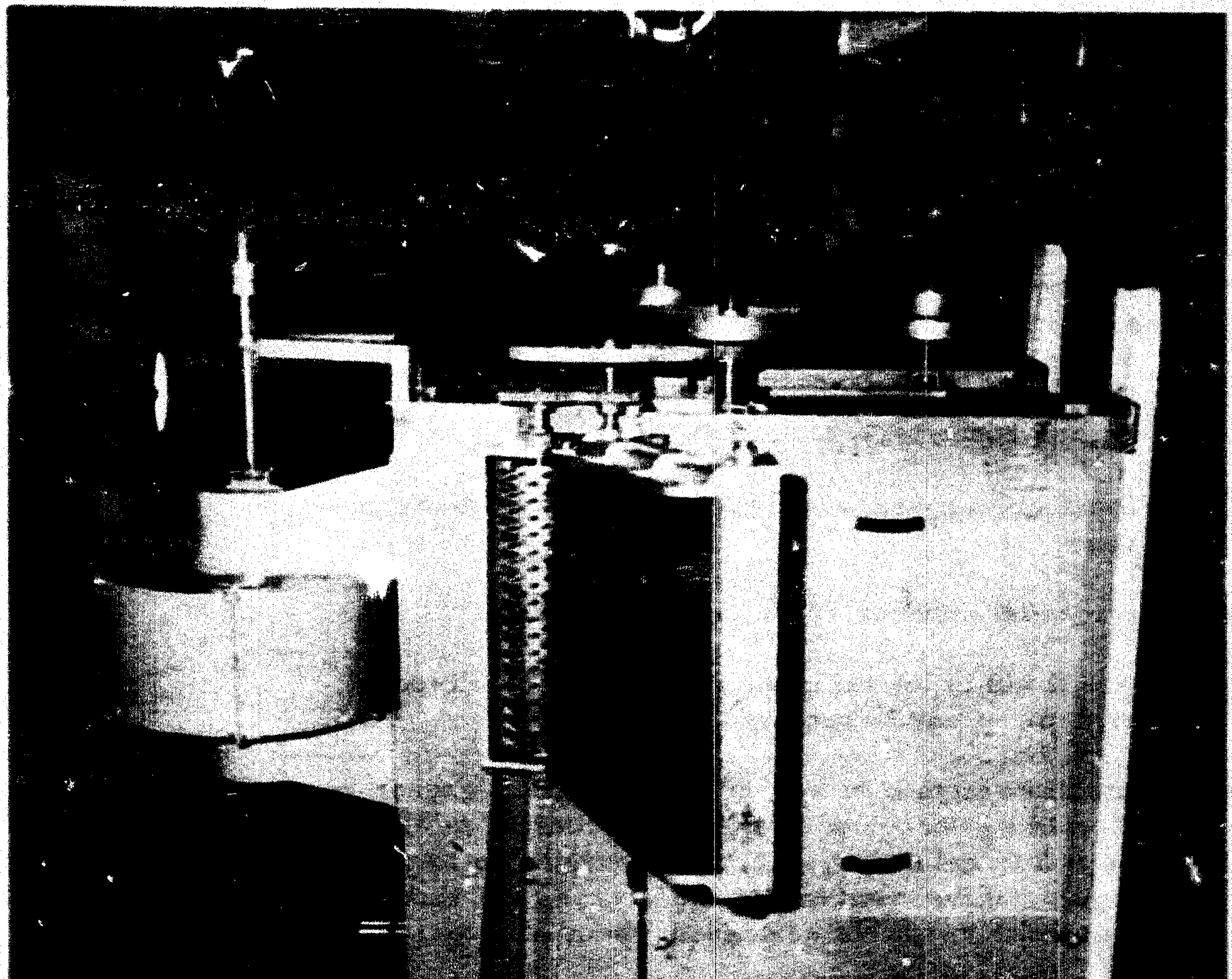
operations presents a problem. The controls established by this laboratory unit are transferred directly to the production scouring line. The use of this unit is highly recommended in any progressive wool scouring plant, particularly if different types of wool are being processed. However, for economic reasons, and since only apparel-type wools are to be processed by the plant proposed in this report, such a unit is not included in the list of production equipment. As production is diversified, consideration should be given to its installation.

AUXILIARY PROCESSES

Although the proposed plant is set up initially to scour only apparel-type wools, it will be desirable as the market increases to diversify production to include the scouring of carpet-type wools, and to include such refinements as carbonizing and grease recovery. These additional processes are discussed briefly in the following paragraphs, merely as an aid to such diversification should it become desirable at a later date.

Carpet Wool Scouring. Carpet-type wools are very coarse, generally long-fibered, dusty, and have a low grease content. They are cleaned in essentially the same manner as previously described in this report. However, due to their dirtier nature, an extra beater or a cone duster will be required. A typical cone duster, which will remove this extra dirt is illustrated in figure 7. It should be installed between the automatic feeder and opener (figure 1). The additional cost would be about $7,000. It would also be necessary to install an additional fan for removal of light dust from the opener, at a cost of about $600. In the case of very light wools, it may be necessary to oil them prior to baling. The baling press can be modified to accomplish this for about $1,000.

Carbonizing. Carbonizing equipment is often included in plants scouring exceptionally fine wools, or those containing large amounts of vegetable impurities. The vegetable matter is extracted by running the wool through a sulfuric acid solution in a stainless steel or lead-lined bowl, removing excess moisture with squeeze rolls, heating to 212-250 degrees Fahrenheit, shaking out the burned vegetable matter, neutralizing, and drying. This process may be inserted after the scouring operation. Use of this process results in a cleaner, whiter wool and the additional service can, of course, command a higher price. Equipment to carbonize approximately 1,200 pounds of wool per hour would cost an additional $75,000 to install, and would require additional personnel for its operation.



Grease Recovery. At present, wool fat or grease is the only salable by-product of the wool scouring industry, and can be quite a profitable operation when production is high. Wool grease is used in the treatment of leather, as a rust preventive, in lubricants, in the manufacture of lanoline, as a fur and belt dressing, and in printing inks, cutting oils, pharmaceutical and cosmetic products. To make the recovery of wool grease profitable, the following conditions must exist:

(1) The raw material must be a fine wool with a high grease content

(2) Production must be at least ten million pounds per year

(3) A market must exist for the wool grease

(4) It will aid in lowering the cost of a waste disposal system, if one is required.

If the counterflow method of scouring is used, the grease recovery equipment could be connected to the first scouring bowl; if the desuinting method is employed, it could be connected to the second and third bowls. After removal of the grease, the scouring liquid can be reused with resultant savings in chemical costs.

Grease recovery equipment would involve an additional investment of about $40,000, and would require two extra workmen to operate it. Under favorable conditions, a plant scouring 10 million pounds of fine wool per year, could produce approximately 300,000 pounds of wool grease with an estimated sales value in the neighborhood of $20,000.

PLANT SITE

Approximately one acre of land will be required to accommodate the building and to allow for normal future expansion. It should be located as advantageously as possible with respect to transportation, water, power, fuel, sources of labor, and a substantial demand for its scouring services. The cost of the land is estimated at $2,000.

BUILDING

About 20,400 square feet of floor space would be required for the scouring process, the warehouse section, and a utility room. Suggested dimensions of the building are approximately 100 feet wide and 200 feet long, divided in the center by a fireproof wall and floored with concrete. The utility room, about 20 by 20 feet or 400 square feet in area, could be located outside the main wall. It should contain the steam boiler and the water purification system. The building should be constructed of cement block, sheet metal, or any fireproof material. The cost of the building, including all utilities, is estimated at $145,000. Figure 8 shows a proposed wool scouring plant and warehouse combination with suggested layout and workflow.

POWER

The total connected power requirements for this plant are approximately 58 kilowatts per hour. Assuming 4,000 operating hours per year, and a rate of 1.3 cents per kilowatt hour, the annual power cost is estimated at $3,000. Even in the United States, power costs vary considerably with locality.

WATER

Approximately 20 million gallons of water are required annually for production, sanitation, and fire protection. The cost of the water is estimated at $6,000.

FUEL

The annual requirement of fuel oil for the operation of the boiler for production and general heating is estimated at 200,000 gallons of oil at an annual cost of $14,000.

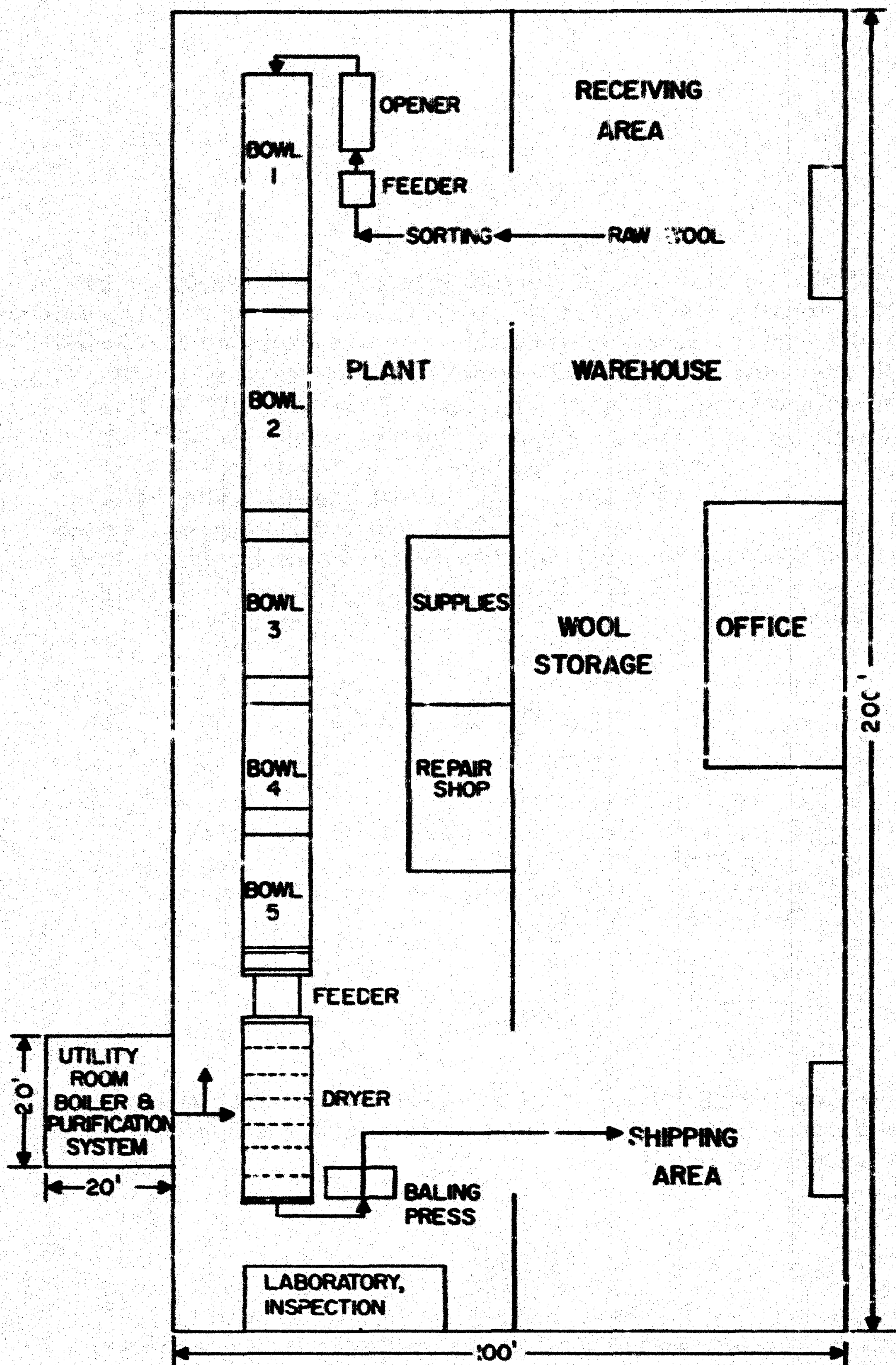


Figure 8. Plant Layout and Workflow

DIRECT LABOR

Occupation	Number Required	Hourly Rate	Annual Cost Estimated	Annual Cost Actual
Production Line Foremen	2	$3.25	$13,520	
Utility Room Operators	4	2.50	20,800	
Production Men	4	2.00	16,640	
Baling Press Attendants	4	1.75	14,560	
Totals	14		$65,520	

INDIRECT LABOR

Occupation	Number Required	Hourly Rate	Annual Cost Estimated	Annual Cost Actual
Plant Manager	1		$ 8,000	
Bookkeeper-Secretary	1	$2.50	5,200	
Shipping-Receiving Clerk	1	1.50	3,120	
General Laborers	4	1.25	10,400	
Totals	7		$26,720	

DIRECT MATERIALS

Since this is a commission operation, processing five million pounds of raw grease wool per year, there is no cost involved for direct materials.

SUPPLIES

Item	Annual Cost Estimated	Annual Cost Actual
Lubricants and Hand Tools	$ 500	
Chemicals	8,000	
Maintenance and Repair Parts	2,500	
Office Supplies	500	
Baling Materials	1,000	
Total	$12,500	

PRODUCTION TOOLS AND EQUIPMENT (boxed for export, f.o.b.)

Description	Number Required	Unit	Total	Actual Cost
Automatic Feeder, Complete	1	$ 3,934	$ 3,934	
Opener, Complete	1	7,269	7,269	
Washer Bowl, No. 1	1	19,943	19,943	
Washer Bowl, No. 2	1	18,369	18,369	
Washer Bowl, No. 3	1	14,663	14,663	
Washer Bowl, No. 4	1	13,526	13,526	
Washer Bowl, No. 5	1	13,526	13,526	
Dryer, Complete	1	19,555	19,555	
Conveyor	1	1,504	1,504	
Baling Press, Complete	1	15,111	15,111	
Boiler, Complete	1	15,000	15,000	
Water Purification Equipment, etc.	1	8,000	8,000	
Total			$150,400	

OTHER TOOLS AND EQUIPMENT

Miscellaneous scales, tanks, tables, pumps, trucks, belts, piping, valves, fittings, wiring, laboratory equipment, etc. are estimated at $20,000.

FURNITURE AND FIXTURES

Description	Number Required	Unit Cost	Cost Estimated	Cost Actual
Desk and Chair Sets	3	$100	$ 300	
Typewriter and Table	1	110	110	
Adding Machine	1	100	100	
Storage Cabinet	1	30	30	
File Cabinet	2	50	100	
Drinking Fountain	1	100	100	
Locker Section	8	20	160	
Garment Rack	1	25	25	
Miscellaneous			75	
Total			$1,000	

DEPRECIATION

Description	Estimated Cost	Years Life	Per Year Estimated	Per Year Actual
Building	$145,000	20	$ 7,250	
Production Tools and Equipment	150,400	10	15,040	
Other Tools and Equipment	20,000	10	2,000	
Furniture and Fixtures	1,000	10	100	
Total			$24,390	

MANUFACTURING OVERHEAD

Item	Cost Estimated	Cost Actual
Depreciation	$24,390	
Indirect Labor	26,720	
Power	3,000	
Water	6,000	
Fuel	14,000	
Supplies	12,500	
Total	$86,610	

MANUFACTURING COST

Item	Cost Estimated	Cost Actual
Direct Materials	$ 0	
Direct Labor	65,520	
Manufacturing Overhead	86,610	
Total	$152,130	

FIXED ASSETS

Item	Cost Estimated	Cost Actual
Land	$ 2,000	
Building	145,000	
Production Tools and Equipment	150,400	
Other Tools and Equipment	20,000	
Furniture and Fixtures	1,000	
Total	$318,400	

WORKING CAPITAL

Item	Cost Estimated	Cost Actual
Direct Materials, 30 Days	$ 0	
Direct Labor, 30 Days	5,460	
Manufacturing Overhead, 30 Days	7,218	
Reserve for Sales Collections, 30 Days	417	
Total	$13,095	

CAPITAL REQUIREMENTS

Item	Cost Estimated	Cost Actual
Fixed Assets	$318,400	
Working Capital	13,095	
Total	$331,495	

SALES REVENUE

The service charge for the scouring of grease wool is estimated at $.038 per pound. On this basis, the total annual revenue for scouring 5 million pounds would be $190,000.

RECAPITULATION OF COSTS, SALES AND PROFITS

Item	ANNUAL COSTS Estimated	Total	Actual
Direct Materials	$ 0	$ 0	
Direct Labor	65,520		
Manufacturing Overhead	86,610		
Total Manufacturing Costs		152,130	
Interest on Loans	1,000		
Insurance	350		
Legal	300		
Auditing	350		
Unforeseen Expense	1,000		
Total Administrative Cost		3,000	
*Total Sales Costs		5,000	
Profit Before Taxes		29,870	
Total Annual Gross Revenue		$190,000	

* Includes Sales Commissions, Travel, Freight-out, Discounts, and Allowances, Etc.

BUDGET CONTROL

A requisition form designed to provide accurate records of procurement and indicate the purpose of procurement with the least amount of time and effort is shown on page 32.

This form has an account number for each type of the various expenditures which the manager will review in detail, monthly or oftener, in order to control his expenses. Some items, such as power and water, are usually under contract and are easily checked by reference to monthly bills. For simplification, items (marked with an asterisk in the table on page 31) are omitted from the purchase requisition. Variations in the labor costs are easily reviewed by examination of the payroll vouchers. The simplified type of control thus provided makes certain that the manager can control expenditures promptly.

In addition to the requisition form, a sample voucher check is shown on page 33. Voucher checks should be used for the payment of all expenditures and the appropriate book account number placed on each voucher.

At the end of each month the manager will receive a statement of all expenditures broken down by budget accounts, as shown on page 31. If the expenditures exceed the budgeted monthly allowances of any of the accounts, the bookkeeper will furnish the manager with a breakdown of all expenditures relative to the budgeted accounts exceeded. All these supporting data can be secured by reference to the purchase requisitions and the check vouchers. This reference will enable the manager to determine what caused the over-expenditure and take corrective action.

If at any time during each month it becomes apparent that expenditures will exceed any of the budget accounts, the bookkeeper will bring this to the attention of the manager for his information and action.

BUDGET CONTROL ACCOUNTS

Account	Monthly Expense	Monthly Budget	Annual Budget	Actual
10 Administrative		$ 167	$ 2,000	
20 Sales		417	5,000	
30 Direct Materials		0	0	
40 Supplies		1,042	12,500	
51 Power*		250	3,000	
52 Water*		500	6,000	
53 Fuel		1,167	14,000	
60 Unforeseen Expense (Reserve Account)		83	1,000	
71 Direct Labor*		5,460	65,520	
72 Indirect Labor*		2,226	26,720	
80 Depreciation (Reserve Account)		2,033	24,390	
Total		$13,345	$160,130	

PURCHASE REQUISITION	COMPANY NAME	DATE

- ☐ 10 ADMINISTRATION
- ☐ 20 SALES
- ☐ 30 MATERIALS
- ☐ 40 SUPPLIES
- ☐ 50 UTILITIES
- ☐ 60 UNFORESEEN EXPENSE

INDICATE BELOW THE USE OF MATERIALS

- ☐ DIRECT MATERIALS
- ☐ MAINTENANCE MATERIALS
- ☐ MAINTENANCE SERVICES
- ☐ OPERATING SUPPLIES

	PLEASE ORDER THESE MATERIALS OR SERVICES	DELIVERY WANTED	
QUANTITY	DESCRIPTION	UNIT	TOTAL

QUOTES FROM		REQUISITIONED BY	
QUOTES FROM		APPROVED BY	
QUOTES FROM		ORDER NO.	ORDER DATE

R. W. MITCHELL MANUFACTURING COMPANY

1422 BOSWORTH STREET, S. E.

65-22/514

ANYWHERE, U. S. A. ______________ 19___ No. 10000

PAY ________________________________ DOLLARS $ __________

TO THE ORDER OF

R. W. MITCHELL MANUFACTURING COMPANY

TO FIRST NATIONAL BANK
ANYWHERE, U. S. A.

BY SAMPLE CHECK

VICE PRESIDENT

ACCOUNT NUMBER

Sample voucher check to be used for the payment of all expenditures in connection with Budget Control.

R. W. MITCHELL MANUFACTURING COMPANY

ENGINEERS

The services of professional engineers are desirable in the design of this plant, even though the proposed plant is small.

A correct design is one which provides the greatest economy in the investment of funds and establishes the basis of operation that will be most profitable in the beginning and will also be capable of expansion without expensive alteration.

The addresses of professional engineers who specialize in industrial design, some of whom may be willing to undertake such work on low cost projects overseas, can be secured by reference to the published cards in various engineering magazines. They may also be reached through their national organizations, one of which is the

National Society of Professional Engineers
2029 K Street, Northwest,
Washington 6, D.C.

Manufacturers of industrial equipment employ engineers familiar with the design and installation of their specialized products. These manufacturers are usually willing to give prospective customers the benefit of technical advice by those engineers in determining the suitability of their equipment in any proposed project.

The equipment manufacturers also know, and can recommend, professional engineers in private practice who are willing and able to provide appropriate consulting services.

TRAINING

Manufacturing an inferior quality of product during the training period could create sales resistance that might be difficult to cope with later. To avoid such possibilities, the quality of the product should be maintained at all times, including the training period.

In some areas skilled operators may be available locally. In other areas all the operators may have to be trained.

If skilled operators are not available, adequate training would be assured by using one or more of the following methods:

A. If the plant is designed and installed by a competent engineering firm, the contract should be negotiated, if possible, on a turn-key basis. On this basis the contractor agrees to operate the plant and produce the quality and quantity of the product stated in the contract for an agreed period of time. Such a contract would assure adequate personnel training, since full quantity and quality could not be produced with an untrained organization.

B. The engineering firm that designs and installs the plant can usually make training arrangements to have key personnel placed, for training purposes, in a foreign industry that produces the same type of product. This would provide training for the key personnel while the plant is being installed.

C. If neither of the above methods is possible, then qualified and experienced individuals should be employed for the key positions, either permanently or temporarily, to perform the key operations and assist in training the organization, even if they must be secured outside the country.

D. The manager should have years of successful experience in this type of business and be fully qualified in all phases of management, including the training of employees.

SAFETY

There is always danger of accident and injury in any industrial plant. Because of this, the manager should take specific action to bring to the attention of each employee the importance of safety precautions and intelligent first aid.

Practically all machines have safety appliances, and the manager should see that these are in good working condition and that the operators are making full use of them.

In addition to constant watchfulness to make sure that all practicable safety precautions are taken, first aid supplies should be readily available. One complete first aid kit should be maintained near the manager's office, and others at appropriate places throughout the plant. Some of the employees should be trained to provide first aid service.

The use of accident posters in the plant have proved to be of value in reducing accidents. It is recommended that such posters be used, and that some direct special action be taken by the manager, at least once each month, to bring to the attention of all personnel the importance of safety precautions.

A fire brigade should be established and each member trained as to his responsibility in case of fire. Fire drills should be conducted periodically.

It is recommended that the employees be encouraged to offer suggestions or recommendations relative to prevention of accidents, removal of fire hazards and maintaining general interest in all safety factors.

SUMMARY

A small plant built and operated according to the assumptions made in this report would be a profitable undertaking.

Provision is made for inserting local cost in connection with all cost figures shown in this report. A careful analysis should be made of all cost figures to determine the local potential profits in any location where such a plant is being considered.

There are some determinations, however, that should be made before a decision is reached to build and operate such a plant.

For example, what are the possibilities of future expansion within the country for this industry?

What other products could be manufactured with the machinery and equipment specified in this report?

Is there a market for such additional products?

How does this industry compare with other industries that may be needed in the country relative to the following factors:

1. The economic value to the country.
2. The needs of the majority of the people.
3. The amount of investment capital required.

Consideration should also be given to such factors as :

> The amount of power required and the availability of a dependable supply. If an adequate supply is not available the installation of power equipment may be required.

The water requirements for all purposes including fire protection and potable water for drinking purposes.

The fuel requirements and availability. If local fuel can be used the boiler should be adaptable to such fuel.

The transportation facilities to and from the plant. If they are not adequate an investment in trucks may be required.

OTHER CONSIDERATIONS

There are other important subjects, shown below, that should be fully investigated and considered. Information on these subjects is usually available from such sources as banks, government agencies, exporters and importers, wholesalers, retailers, transportation companies and manufacturers.

MATERIALS AND SUPPLIES

1. Are all materials and supplies available locally?
2. Is the local material market competitive?
3. Is satisfactory delivery of local materials assured at reasonable prices?
4. What materials and supplies must be imported?
5. Are they available in world markets at competitive prices?
6. Would prompt delivery of imported materials and supplies be assured so that large inventories would not be required?

MARKET FACTORS

1. Is there already a demand for the product?
    - A. Who are the principal consumers?
    - B. Who are possible new consumers?

2. How is demand for the product now satisfied?
    - A. By local production? If so, what is the volume of annual production?
    - B. What percentage of consumption is filled by local production?
    - C. By imports? If so, what is the volume of annual imports?
    - D. What percentage of consumption is met by imports?
    - E. From what areas are imports derived?

3. What is the estimated annual increase in local consumption over the next five years?
    - A. How were such estimates made?
    - B. By reference to official figures on population growth, family budgets, imports, etc.?
    - C. By consultation with trade or industry, ministries, associations, bankers, commercial houses, wholesalers, retailers, industrial consumers, etc.?

4. If the product is already being manufactured, can the existing and estimated future local market absorb production of the new plant without price-cutting or other dislocations?

5. Would the estimated sales price and quality of the new product make it competitive with an imported equivalent?
   A. After adjusting cost to local conditions, is the estimated sales price of the product so high that tariff protection is necessary to protect it from imports?

EXPORT MARKETS

1. Could the product compete in export markets on the basis of price, quality and dependability of supply?
2. Can export markets for the product be developed?
3. If so, in what areas and in what annual volume?
4. What procedures would be necessary to develop export markets?
5. What would it cost?

MARKETING PROBLEMS

1. In calculating costs of the product, has adequate allowance been made for the expense of a sales department, advertising and promotion that might be required?

2. Do consumer prejudices against locally manufactured products exist?
   A. If so, why?
   B. Would they apply to the new product?
   C. If so, how could they be overcome and what would it cost to do so?

3. Do marketing and distribution facilities for the product exist?
   A. If not, can they be set up?
   B. What would it cost to do so?

4. Will the product be sold to:
   A. Wholesalers?
   B. Retailers?
   C. Direct to consumer?
   D. Other industries?
   E. Government?

FINANCIAL FACTORS

1. Technical advice on selection of machinery and equipment.
   - A. In selecting the machinery and equipment for the new plant, have reputable and competent engineers and technicians been consulted?
   - B. Have they been asked for advice on the most suitable types of machinery and equipment for the process and locality?
   - C. Have they carefully compared costs of various suppliers?
   - D. Credit terms offered purchasers?

FINANCIAL REQUIREMENTS OF THE PROJECT

1. In estimating the cost of the project, has careful consideration been given to:
   - A. The effect on costs of delays in construction schedules?
   - B. In delivery and installation of machinery and equipment?
   - C. In import of essential raw materials and supplies?

2. In calculating cash flow and working capital requirements, has careful consideration been given to:
   - A. Maintaining adequate inventories of raw materials?
   - B. Supplies and spare parts?
   - C. Seasonal fluctuations in the business?
   - D. The time required to liquidate credit sales to customers and bad debts?
   - E. The period necessary to get the plant into production?
   - F. Cash required to amortize its principle loans?

3. If the economy is in a period of inflation, has full allowance been made for the influence of rising prices and wages on the cost of the project and on working capital requirements?

SHORT TERM BANK CREDITS

1. Has it been possible to make arrangements with local banks to finance short-time working capital requirements of the business?

FINANCIAL PLAN

1. Has a definite plan to finance the project been worked out?
   - A. Is sufficient capital available locally?
   - B. If not, what is the plan to obtain the required capital?

ECONOMIC FACTORS

1. How much foreign exchange (and in what currency) is required to import machinery, equipment and supplies:
   A. How much foreign exchange (and in what currency) is required for annual interest payments and amortization of any loans contracted to import machinery and equipment, or for payment of royalties and technical services?
   B. How much foreign exchange (and in what currency) is required for annual import of raw materials and supplies?
   C. What are estimated annual foreign exchange earnings and in what currencies?
   D. Has careful consideration been given to the possibility of depreciation in the foreign exchange value of the local currency?
   E. Has careful consideration been given to the possibility of import controls, or restrictions on availabilities of foreign exchange necessary to operate the business?
   F. What benefits would the new business bring to the economy in the use of local raw materials: in employment and in technology?
   G. Do dependable facilities exist for transportation, power, fuel, water and sewage?
      (1) If not, can existing deficiencies be eliminated satisfactorily?
      (2) What would be the cost to do so?

PERSONNEL

1. Is there an adequate labor supply near the plant location?
   A. If not, how can the problem be solved?

2. Can the problem of training competent management and supervisory personnel be solved?
   A. Also, the training of skilled labor?
   B. Is technical advice available in the locality?
   C. If not, where can it be obtained and what will it cost?

LAWS AND REGULATIONS

1. Do existing labor laws, government regulations, laws and taxes favor establishment of new business?
   A. If not, can existing obstacles be removed?
   B. If so, how and when?

GOVERNMENT PUBLICATIONS

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Wool-grading (and Standardization), 1945, James Wiley Christie, Farmers Bulletin No. 1805, U. S. Department of Agriculture, Washington 25, D. C.

Physical Measurements and Their Application in Describing Wool, 1958, D. C. Johnston et al., U. S. Department of Agriculture, Agricultural Marketing Service, Livestock Division, Washington 25, D. C.

Value-determining Physical Properties and Characteristics of Domestic Wools, 1958, E. M. Pohle et al., U. S. Department of Agriculture, Agricultural Marketing Service, Livestock Division, Washington 25, D. C.

Wool Statistics and Related Data, 1954, Eva Ann Burrough, U. S. Department of Agriculture, Agricultural Marketing Service, Livestock Division, Washington 25, D. C.

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Wool Grease, 1955, Marketing Research Report No. 89, U. S. Department of Agriculture, Washington 25, D. C.

MISCELLANEOUS PUBLICATIONS

A Wool Primer, 1943, Botany Mills, Inc., Passaic, New Jersey

Wool and the Wool Trade, 2nd Edition, 1955, Prepared for the Wool Associates of the New York Cotton Exchange, Inc., 60 Beaver Street, New York, New York

Wool, from the Raw Material to the Finished Product, 7th Edition, 1953, Samuel Kershaw, Pitman and Sons, Ltd., London, England

Pollution Sources in Wool Scouring and Finishing Mills and Their Reduction Through Process and Process Chemical Change, 1954, Joseph W. Maselli and M. Gilbert Burford, Wesleyan University, Middletown, Connecticut, Prepared for the New England Interstate Water Pollution Control Commission

A Wool Scouring Plant in New Orleans, 1945, Andre L. Van Assenderp, College of Commerce and Business Administration, Tulane University, Louisiana

American Wool Handbook, 2nd Edition, 1945, W. von Bergen and H. R. Mauersberger, Textile Book Publishers, New York, New York

Wool, 3rd Edition, 1960, Serial 6040-3, John K. Stearns, International Correspondence School, Scranton, Pennsylvania

The World Wool Digest, International Wool Secretariat in the United States, 360 Lexington Avenue, New York, New York

Wool Wax; Chemistry and Technology, 1956, Vernon E. Truter, Cleaver-Hume Press, London

Mechanical Engineers' Handbook, 5th Edition, 1951, Edited by Lionel S. Marks, McGraw-Hill Book Company, Inc.

TECHNICAL AND TRADE ASSOCIATIONS

American Society for Testing Materials (ASTM), 1916 Race Street, Philadelphia 3, Pennsylvania

American Standards Association Inc., (ASA), 10 East 40th Street, New York 16, New York

International Organization for Standardization (ISO), Technical Committee 38 on Textiles (refer to ASA member)

Wool Bureau, 16 West 46th Street, New York 36, New York

American Association of Textile Chemists and Colorists (AATCC), 1 Textile Avenue, Lowell, Massachusetts

New York Cotton Exchange, Inc., (Wool Associates) 60 Beaver Street, New York, New York