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PLANT REQUIREMENTS FOR MANUFACTURE OF TERRY CLOTH

TECHNICAL AIDS BRANCH

INTERNATIONAL COOPERATION ADMINISTRATION

Washington, D. C.

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FOREWORD

This manual is a revision of an earlier report of the same type issued in 1955. This revised version includes current costs of labor, machinery, equipment and supplies, as well as additional information relative to engineering, training, safety, markets, sales, financial and economic factors.

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This manual is designed to provide a general picture of the factors which must be considered in establishing and operating a small-scale factory of this type. It should prove useful in creating interest in the subject, and serve to give enough understanding of the related considerations to help government officials, other leaders and businessmen to determine whether the potential deserves more-detailed attention.

However, it is important to note that in most cases plans for the actual development and installation of a plant will require expert engineering and financial advice in order to meet specific local situations. For further information and assistance, readers should contact their local Productivity Center, Industrial Institute, Servicio, or United States Operations Mission.

Mention of the name of any firm, product, or process in this manual is not to be considered a recommendation or endorsement by the International Cooperation Administration, but merely a citation that is typical in its field.

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The original report was prepared by the Methods Engineering Council, Pittsburgh, Pennsylvania.

Technical information, as well as review, was provided by Technical Enterprises, Inc., 31 South Street, New York 4, New York.

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PLANT REQUIREMENTS FOR MANUFACTURE OF TERRY CLOTH

INTRODUCTION

Terry cloth is cotton fabric covered with loops on one or both sides. It requires two sets of warps and one set of filling; one set of warp threads is held taut while weaving, the other set is released to form the loops.

When woven in linen (rare) or bleached cotton in narrow widths, terry cloth is called "Turkish toweling." This usually has two loops (called double-loop terry). It can also be made in checks, stripes, or plaid, or bleached and dyed. Uses include towels, wash cloths, robes, bath mats, bathing suits or sunsuits, linings for suits and coats, draperies, spreads, bedrolls, and potholders.

Terry cloth readily absorbs and retains moisture, making it suitable for use as wash cloths and toweling. It is used in some applications because of its efficiency as an insulating medium and because it is readily washed when soiled.

Due to the fact that the applications of single-loop terry cloth are numerous and in good volume, the present discussion will concern itself with the production of cloth of that type in a mill of minimum economic size.

GENERAL ASSUMPTIONS

1. Labor costs used are the average labor costs for the industry and skills described, and are based on averages of current U.S. wage rates in representative plants.

2. All other costs, statistics, and figures are based on average current prices in the United States.

3. Adequate heat, light, water, transportation, and electrical facilities are available at the plant site.

4. The plant will operate 8 hours per day, 5 days per week, 50 weeks per year.

5. The following items cannot be estimated realistically:

   A. Land value
   B. Distribution methods and selling costs
   C. In-freight and out-freight
   D. Taxes

   While general estimates will be made of each of these items, for the purpose of completing cost estimates, adjustment should be made in accordance with actual local costs. In fact, all cost estimates contained in this brochure should be adjusted to conform to local conditions.

6. No set-up time has been allowed in the unit cost calculations, as each machine will be set up to do one operation.

7. No allowance has been made for training of new personnel. It has been assumed that those learning new jobs will be paid learner's rates.

8. Columns are provided in the tables included in this report to facilitate the conversion of cost figures to conform with local costs.

THE MANUFACTURING PROCESS

The manufacturing of double-loop terry cloth is done in these steps:

1. Preparing Warp
2. Weaving
3. Inspecting, Folding, Baling
4. Drawing-in-Tying in

These steps may be described as follows:

Preparing Warp

Warp yarns are purchased either on "cone" forms or on "cheese" forms, depending upon the type of creeler used. Some creelers are adaptable to forms of either type. The loaded forms are placed on racks or "creelers," as they are called. This operation is called "creeling."

The thread is transferred to a rotating device called a "beam" (resembling a very large spool) by being wound onto the beam so that the threads are parallel (the turns of adjacent threads not overlapping each other). This operation is called "beaming."

Weaving

After the warp threads, both main and loop, are wound on loom beams, they are moved to the looms where they are "tied-in." The filling thread bobbins are put into the shuttles as required. The three sets of threads, having gone through the looms, form the terry cloth, which is called gray cloth, and is removed from the loom beams.

The loom recommended for weaving terry cloth is a plain type of automatic loom, which makes 150 to 180 "picks" per minute, and has individual motor drive so as not to interfere with monorail hoists or overhead material handling equipment.

Terry cloth is woven in much the same way as any simple piled fabric, the loom being arranged to make the loops in the loop warp on both sides of the main warp and filling.

Inspecting, Folding and Baling

After weaving, the cloth is moved by truck to the "gray goods" room where it is removed from the beam, inspected, folded for baling, and baled for storage of shipping. The extent of care used in all the mill operations, from opening the yarn containers to weaving the cloth, is evident from the number of manhours expended in the cloth room and from the amount of production classified as substandard or as "seconds."

"Seconds" are defined generally as cloth that does not meet all the specifications. The width should be within a certain percentage, usually two to three percent of that prescribed, and the yarn count in any given portion must be within three or four percent of the established specifications..

The cloth must meet certain tests for tensile strength and must be free from oil, dirt, and other foreign matter. Cloth cannot deviate materials from the specifications, and the cloth that does not meet these tests is sold as seconds, provided the deficiencies are not great. The grading of cloth does not lend itself fully to specific definitions, and practices vary with different uses.

Second quality cloth is caused by such factors as poor quality cotton and carelessness during processing. It also results from time to time from failure to promptly correct mechanical maladjustments in mill equipment.

Spooling

Since the threads are not all the same length, the left-over threads are rewound on spools so that they can be used up completely.

Drawing-In-Tying-In

Drawing-in and tying-in are preparatory steps necessary to weaving. Drawing-in has to do with preparing to weave a new pattern or to start a new piece of cloth. Tying-in is done when warps are being placed so to change the construction of the cloth.

Drawing-in is done by passing the warp threads through the "eyes" of a harness, in a sequence determined by the pattern to be produced. It may be done mechanically or by hand.

MATERIALS AND MATERIAL REQUIREMENTS

The material used, of course, is almost all yarn. Yarns are available in the United States in many qualities and according to many specifications, so many that the management must be careful to buy exactly the yarn required to meet the specifications of the products to be made. For that reason, the calculations required are presented in considerable detail.

The terry cloth to be produced in the operation herein outlined is of medium quality, weighing 8.9 ounces per square yard or 1.82 yards per pound. The thread count for the warp, both main and loop, is 32 per inches, and for the weft or filling, the count is 30 threads per inch. Take-up on the main warp is 2-1/2%, and on the loop warp, 330%.

The yarns are single-thread carded cotton, using 19's* for the main warp, 18's for the loop warp, and 11's for the filling.

One pound of	11's	contains	9,240	yards
" "	18's	"	15,120	"
" "	19's	"	15,960	"

*See Glossary under "Hank."

The requirement for yarn of each type for one square yard of cloth is determined as follows:

Main warp: 32 threads per inch x 36 inches width x 36 inches length + 2 1/2% = 1,181 yards of thread.

Since one pound of 19's yarn is 15,960 yards, it will require .074 pounds of yarn.

Loop warp: 32 threads per inch x 36 inches width x 36 inches length + 330% = 4,954 yards, or .328 pounds of 18's yarn.

Filling: 30 threads per inch x 36 inches width x 36 inches length = 1,080 yards, or .117 pounds of 11's yarn.

Expressed in requirements for 1,000 square yards:

Main warp	(19's)	74 pounds
Loop warp	(18's)	328 pounds
Filling	(11's)	117 pounds

Current prices of single-thread corded cotton yarn are:

19's	-	$0.62 to $0.63 per pound
18's	-	0.61 to 0.62 per pound
11's	-	0.58 to 0.59 per pound

Using the lower figures and adding the normal rate for unavoidable waste, the costs of yarns are:

	Estimate	Actual
19's - 74 lbs. + 4% waste = 77.0 lbs. @ 0.62	$ 47.74	_____
18's - 328 lbs. + 4% waste = 341.0 lbs. @ 0.61	207.01	_____
11's - 117 lbs. + 3% waste = 120.5 lbs. @ 0.58	69.89	_____
Total Yarn Cost per 1,000 Square Yards	$ 324.64	_____

Assuming an average loom speed of 172 picks per minute, and using the formula:

$$\text{Yards per hour} = \frac{\text{picks per minute} \times 60 \text{ minutes}}{\text{picks per inch} \times 36 \text{ inches}}$$

each loom at normal speed will turn out:

$$\frac{172 \times 60}{30 \times 36} \text{ or } 9.55 \text{ square yards per hour.}$$

Experience shows that the looms will average about 95% of full normal rate of production. This would be an average of 9 yards per hour for each loom.

At this rate and at 8 hours per day each loom would product 8 x 9 yards or 72 yards per day.

At 72 yards per day, 60 looms would produce 60 x 72 yards or 4,320 yards per day.

The annual production would be 250 x 4,320 yards or 1,080,000 yards.

Based on a yarn cost of $324.64 per 1,000 square yards, the annual cost of direct materials would be 1,080 x $324.64 or $350,611.

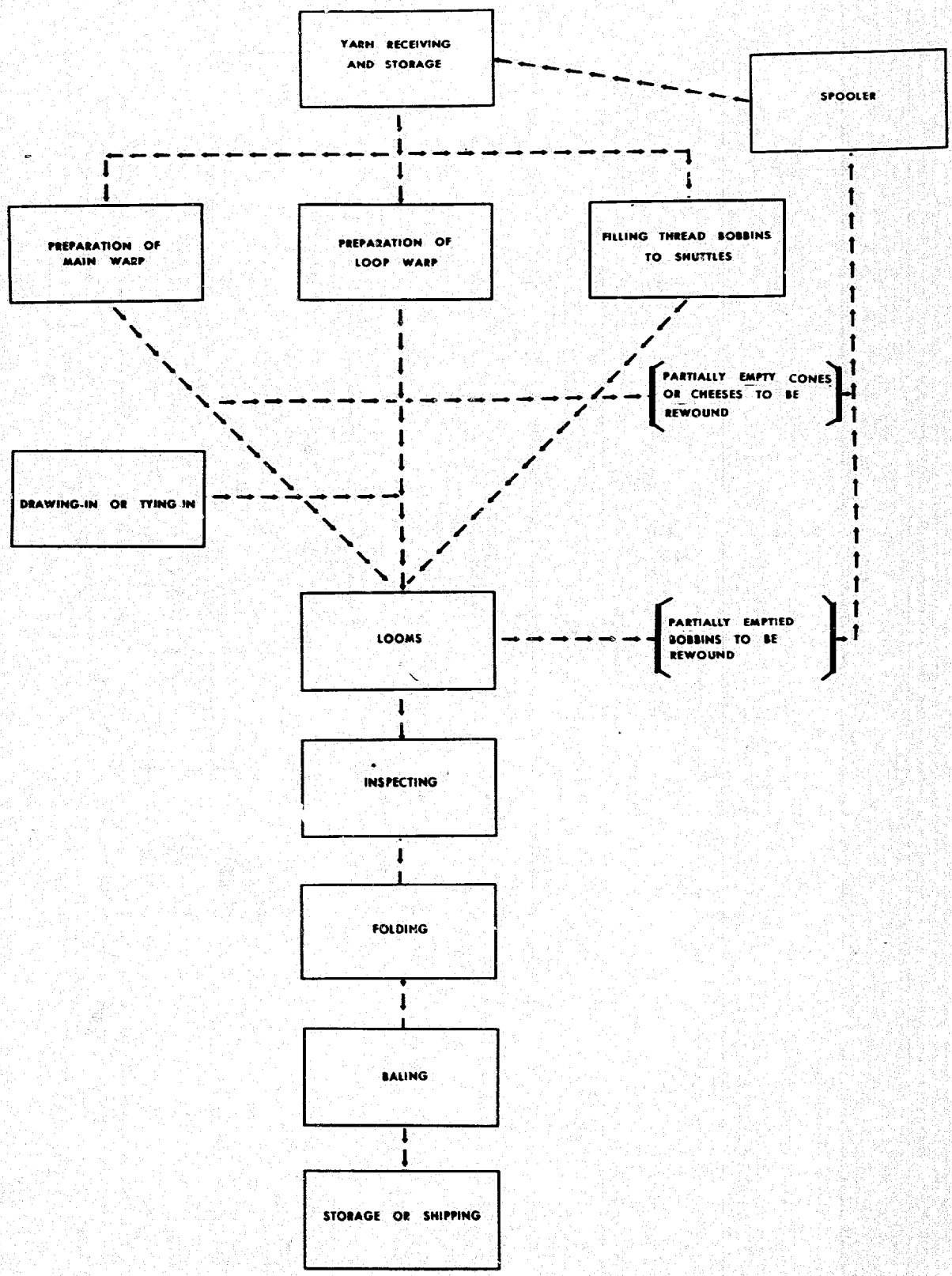
EQUIPMENT REQUIREMENTS

The equipment required would be as follows:

Production Equipment	Estimate	Actual
Incoming yarn scale; creeling trucks; beaming creeler; beamer; monorail hoist for loaded beams	$ 16,000	_____
Looms - 60 @ $19,000 each	114,000	_____
Tying-in machine	12,800	_____
Auxiliary equipment (spare beams, bobbins, shuttles, special trucks, etc.)	6,000	_____
Shipping and receiving room equipment (baler, strapping equipment, scales, trucks, etc.)	1,200	_____
Total Production Equipment:	$ 150,000	_____
Maintenance Equipment		
Metal and woodworking tools for maintenance of mill equipment (engine lathe, circular saw, drill press, grinders, etc.)	$ 5,000	_____
General plant maintenance (carpentry, pipe fittings, electrical, welding tools, power vacuum cleaner, etc.)	3,000	_____
Total Maintenance Equipment:	$ 8,000	_____
Office Equipment		
Office furniture and fixtures	$ 2,000	_____
Total Cost of Equipment	$ 160,000	_____

PRODUCTION FLOW DIAGRAM

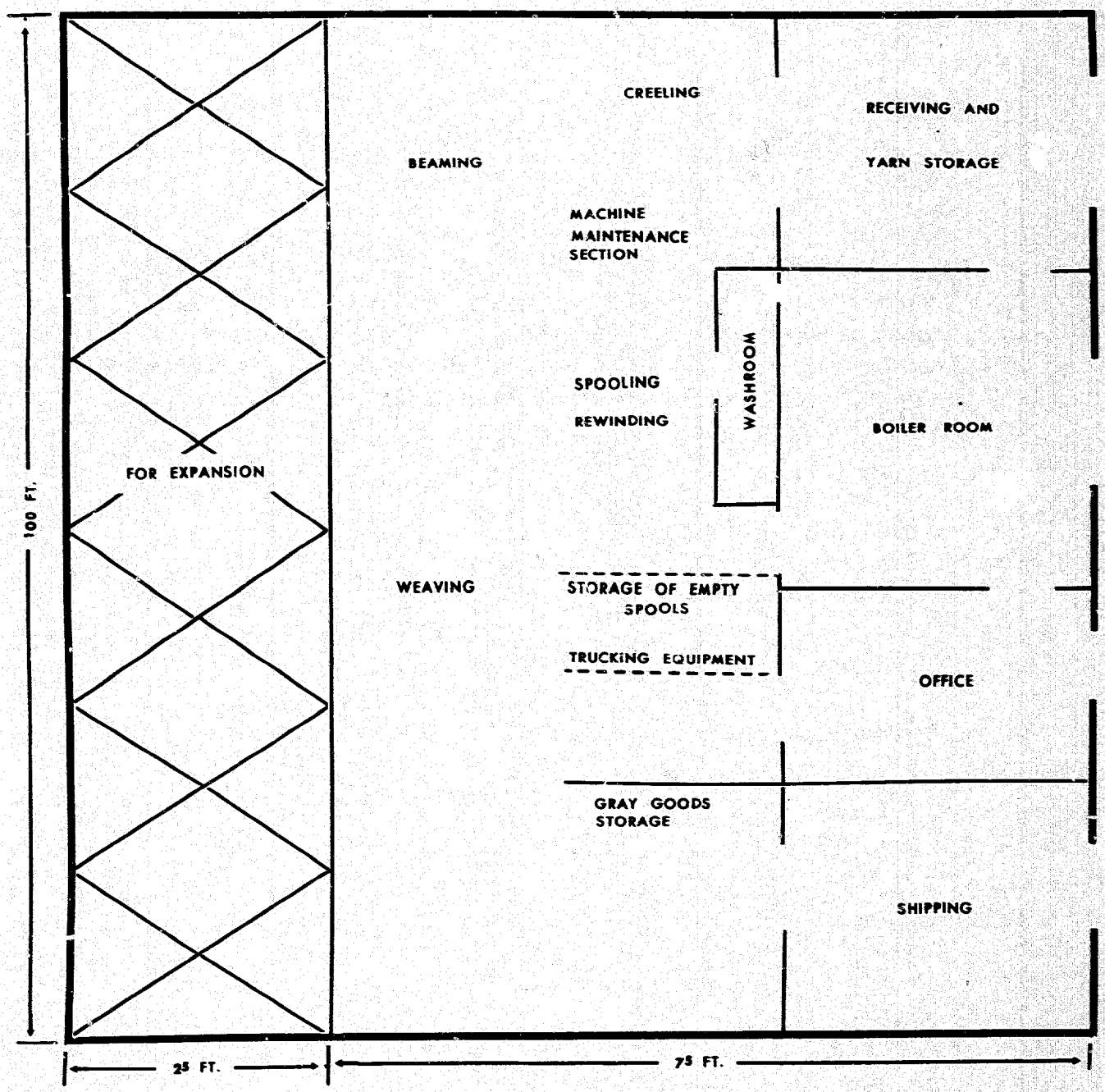
DOUBLE LOOP TERRY CLOTH PLANT



PREPARATION OF WARP USUALLY INCLUDES WARPING — AND SLASHING OR SIZING AND DRYING, AND BEAMING. TO CONSERVE INITIAL CAPITAL, THE SLASHING PROCESS HAS BEEN OMITTED IN THE PLANT UNDER CONSIDERATION.

TERRY CLOTH WEAVING MILL

SCHEMATIC FLOOR PLAN



PLANT SITE

To provide space for eventual expansion, a site of well drained level land of about one acre would be desirable. The site should be as advantageously located as possible with respect to transportation, power, water, fuel, sources of material, labor, and markets. The value of the land is estimated at $1,000.

BUILDING

The type of building preferred for the proposed operation is a one story fireproof construction with a monitor type roof and about 15 feet of overhead clearance. The 100 x 100 foot dimensions shown in the schematic floor plan on page nine is preferred.

It is estimated that the cost of this building, including wiring, plumbing, and humidifying, would be about $3.50 per square foot, or a total cost of $35,000.

Humidifiers reduce the breaking of threads that occur when the thread becomes brittle from lack of moisture in the air, thus interrupting production.

POWER

A dependable supply of power is required for the operation of this plant. The estimates in this brocure do not include provisions for a power generating unit, but are made on the assumption that the power requirements will be purchased from outside sources. A diesel engine generator set would be practicable, however, if power from local sources is not available.

It is estimated that the annual cost of purchased power would amount to $6,800.

WATER

The only water required in this plant is for heating, humidifying, drinking, sanitary purposes, and fire protection. The cost of water is estimated at $400.

FUEL

The annual cost of fuel is estimated at $800.

LABOR REQUIREMENTS

Direct Labor

Classification	Number	Hourly Wage	Total Annual Cost	Actual Hourly Wage	Actual Annual Cost
Head weaver	2	$ 2.00	$ 8,000	_____	_____
Weaver helper	4	1.50	12,000	_____	_____
Creeler and beamer	2	1.80	7,200	_____	_____
Rewinder	1	1.50	3,000	_____	_____
Warp tier	2	1.50	6,000	_____	_____
Gray goods man	1	1.80	3,600	_____	_____
Helpers	10	1.25	25,000	_____	_____
Totals	24		$64,800	_____	_____

Indirect Labor

Classification	Number	Hourly Wage	Total Annual Cost	Actual Hourly Wage	Actual Annual Cost
Manager	1		$ 8,000		_____
Fixer, loom and mill equipment	2	$ 2.00	8,000	_____	_____
Bookkeeper	1		5,000		_____
Totals	4		$21,000	_____	_____

SUPPLIES

Item	Estimated	Actual
Lubricants	$ 200	_____
Spare Parts and Maintenance	3,200	_____
Tools	300	_____
Office Supplies	300	_____
Total	$4,000	_____

DEPRECIATION

Item	Estimated Cost	Actual Cost	Life (years)	Yearly Depreciation Estimated	Yearly Depreciation Actual
Building	$ 35,000	_____	20	$ 1,750	_____
Production machines	150,000	_____	15	10,000	_____
Tools and equipment	8,000	_____	5	1,600	_____
Furniture and fixtures	2,000	_____	10	200	_____
Total				$ 13,550	

MANUFACTURING OVERHEAD

Item	Estimated	Actual
Depreciation	$ 13,550	_____
Indirect Labor	21,000	_____
Power	6,800	_____
Water	400	_____
Fuel	800	_____
Supplies, Including Office	4,000	_____
Total Annual Overhead Expense	$ 46,550	_____

MANUFACTURING COST

	Estimated	Actual
Direct Labor	$ 64,800	_____
Direct Materials	350,611	_____
Manufacturing Overhead	46,550	_____
Total	$461,961	_____

FIXED ASSETS

	Estimated	Actual
Land	$ 1,000	_____
Building	35,000	_____
Production Equipment	150,000	_____
Maintenance Equipment	8,000	_____
Furniture and Fixtures	2,000	_____
Total	$196,000	_____

WORKING CAPITAL

	Estimated	Actual
Direct Materials, 30 Days	$ 27,550	_____
Direct Labor, 30 Days	5,400	_____
Manufacturing Overhead, 30 Days	3,840	_____
Reserve for Sales Collections, 30 Days	51,000	_____
Total	$ 87,790	_____

TOTAL CAPITAL REQUIREMENTS

	Estimated	Actual
Fixed Assets	$196,000	_____
Working Capital	87,790	_____
Total	$283,790	_____

SALES REVENUE

The price being paid currently for terry cloth of the unfinished grade contemplated averages $0.60 per square yard. On the basis of full normal operation, the mill proposed would produce 1,080,000 square yards per year.

The gross revenue would be 1,080,000 square yards x $0.60, or $648,000 per year.

Experience shows that some of the cloth made will not bring the full market price because of minor defects but will bring a somewhat lower price. Allowing 10% loss of revenue for the lower quality goods and the handling expense in connection therewith, the net sales would amount to $583,200.

RECAPITULATION OF COSTS, SALES AND PROFITS

	Estimated		Actual
Direct Material	$ 350,611		_____
Direct Labor	64,800		_____
Overhead	46,550		_____
Total Manufacturing Costs		$ 461,961	_____
Interest on Loans	$ 4,000		_____
Insurance	1,500		_____
Legal	1,000		_____
Auditing	1,500		_____
Unforeseen Expense	9,239		_____
Total Administrative Costs		17,239	_____
Sales commissions, freight out, discounts, allowances, travel, and bad debts		30,000	_____
Profit before Taxes		74,000	_____
Annual Gross Sales		$ 583,200	_____

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 the following page.

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 below) 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.

Following the requisition form, a sample voucher check is shown. 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. If the expenditures exceed the budgeted monthly allowances of any of the accounts, the bookkeeper will furnish the manager with a break-down 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 Number		Monthly Expense	Monthly Budget	Annual Budget	Actual
10	Administrative	$_____	$ 666	$ 8,000	$_____
20	Sales	_____	2,500	30,000	_____
30	Direct Materials	_____	29,218	350,611	_____
40	Supplies	_____	333	4,000	_____
51	Power*	_____	566	6,800	_____
52	Water*	_____	33	400	_____
53	Fuel	_____	666	800	_____
60	Unforeseen Expense (Reserve Account)	_____	770	9,239	_____
71	Direct Labor*	_____	5,400	64,800	_____
72	Indirect Labor*	_____	1,750	21,000	_____
80	Depreciation (Reserve Account)	_____	---	13,550	_____

Note: Administrative includes interest on loans, insurance, legal and auditing.

PURCHASE REQUISITION	COMPANY NAME	DATE

☐ 10 ADMINISTRATION ☐ 40 SUPPLIES

☐ 20 SALES ☐ 50 UTILITIES

☐ 30 MATERIALS ☐ 60 UNFORESEEN EXPENSE

INDICATE BELOW THE USE OF MATERIALS

☐ DIRECT MATERIALS ☐ MAINTENANCE SERVICES

☐ MAINTENANCE MATERIALS ☐ 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 has 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 manual would be a profitable undertaking.

There are some determinations, however, that should be made before a decision is reached to build and operate such a plant. Among the necessary determinations to be made are those with respect to the following items:

MATERIALS AND SUPPLIES

1. Are all materials and supplies available locally?
2. Is the local material market competitive?
3. Are 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?

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?

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?

GLOSSARY

Beamer	A piece of equipment used to wind several hundred strands of warp yarn simultaneously into a single beam. The beam is used on the loom to supply the sley to a given construction.
Bolt	A roll of finished cloth, at least 30 yards long.
Creel	A frame holding several containers from which material is drawn to supply a machine, as a creel of a warper.
Construction	A given number of threads of warp yarn and filling yarn per inch of fabric.
Filling	Yarn used in the cross weave of a fabric.
Hank	A length of 840 yards of finished cotton yarn. The number used to express the size of yarn, such as 8's, 16's, 40's, indicates the number of hanks per pound. Thus, the large the number, the finer the yarn; a number 40 has 40 hanks to a pound, which is equal to 33,600 yards.
Heddles	A part of the loom consisting of reels, or metal rods, each of which contains an "eye" through which the individual strands of warp yarn must pass.
Picks	Threads woven crosswise into a fabric. Loom capacity is generally measured by the number of picks it weaves into warp per minute.
Seconds	Fabrics which do not meet the minimum requirements of standard quality fabrics.
Selvage	The outer edge of a fabric; usually made of heavier weight warp yarn as well as being of a closer weave than that used for the main portion of the fabric.
Shuttle	The part of the loom which carries the filling yarn across the fabric between the strands of warp during weaving.
Sizing	Ingredients added to the warp yarn or to woven fabrics so as to add certain desired characteristics to the original product.
Slashing	The process whereby sizing is added to the warp yarn.
Sley	Strands of yarn running lengthwise in a piece of fabric. Sley is measured by the number of threads per inch. (See "Picks).

Staple	A term indicating the average length of the fiber in a sample of raw cotton.
Take-Up	The amount of yarn which is used by the interlacing of the material, as one thread has to go part way around the other; in loop fabrics, the amount of yarn to form the loops.
Warp	See "Sley."
Warper	A piece of equipment used to draw warp yarn from several hundred spools and wind them onto a cylinder. Two or more such cylinders are used to supply the yarn to one loom beam.

BIBLIOGRAPHY

Textbooks

The Textile Fibers	John Wiley & Sons, Inc. 440 Fourth Avenue New York 16, New York
Textile Fabrics	Houghton Mifflin Co. 432 Fourth Avenue New York 16, New York
Industrial Fabrics	Wellington Sears Co., Inc. 65 Worth Street New York 13, New York
Clark's Weave Room Calculations	W. A. Graham Clark Clark Publishing Co. Charlotte, North Carolina

Periodicals

Daily New Record	Fairchilds Publishers Inc. 7 East 13 Street New York 3, New York
Textile World	McGraw-Hill Book Company, Inc. 330 West 42nd Street New York 36, New York

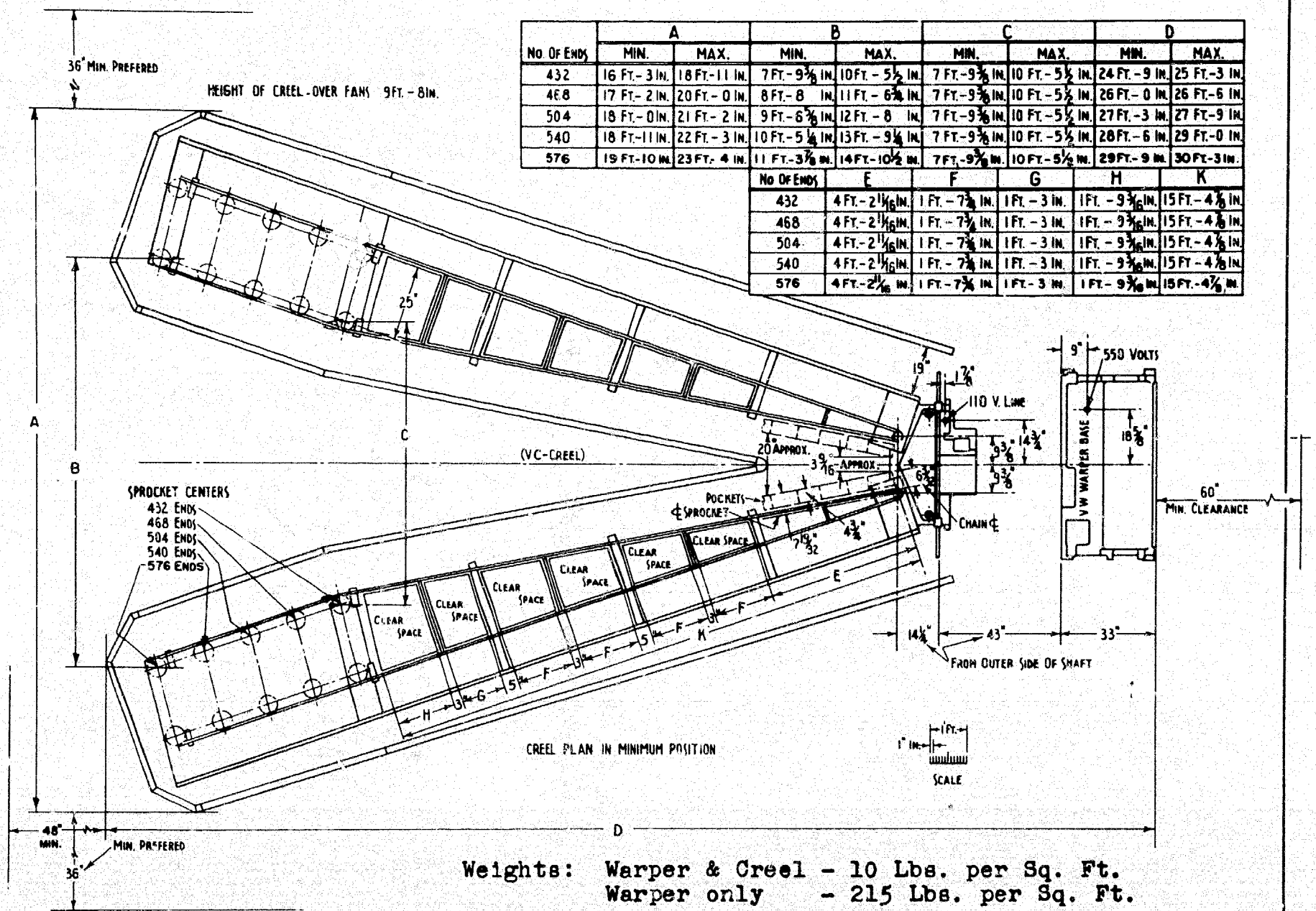
ABBREVIATIONS

%	Percent
@	At the price of
lbs	Pounds
sq. ft.	Square feet
in.	Inch or irches
FT	Foot or feet
"	Inch or inches
'	Foot or feet
min.	Minimum

Figure 1 - WARPER AND CREEL INSTALLATION

No. Of Ends	A MIN.	A MAX.	B MIN.	B MAX.	C MIN.	C MAX.	D MIN.	D MAX.
432	16 Ft.-3 In.	18 Ft.-11 In.	7 Ft.-9 3/8 In.	10 Ft.-5 1/2 In.	7 Ft.-9 3/8 In.	10 Ft.-5 1/2 In.	24 Ft.-9 In.	25 Ft.-3 In.
468	17 Ft.-2 In.	20 Ft.-0 In.	8 Ft.-8 In.	11 Ft.-6 7/8 In.	7 Ft.-9 3/8 In.	10 Ft.-5 1/2 In.	26 Ft.-0 In.	26 Ft.-6 In.
504	18 Ft.-0 In.	21 Ft.-2 In.	9 Ft.-6 3/8 In.	12 Ft.-8 In.	7 Ft.-9 3/8 In.	10 Ft.-5 1/2 In.	27 Ft.-3 In.	27 Ft.-9 In.
540	18 Ft.-11 In.	22 Ft.-3 In.	10 Ft.-5 1/4 In.	13 Ft.-9 1/4 In.	7 Ft.-9 3/8 In.	10 Ft.-5 1/2 In.	28 Ft.-6 In.	29 Ft.-0 In.
576	19 Ft.-10 In.	23 Ft.-4 In.	11 Ft.-3 7/8 In.	14 Ft.-10 1/2 In.	7 Ft.-9 3/8 In.	10 Ft.-5 1/2 In.	29 Ft.-9 In.	30 Ft.-3 In.

No Of Ends	E	F	G	H	K
432	4 Ft.-2 11/16 In.	1 Ft.-7 3/8 In.	1 Ft.-3 In.	1 Ft.-9 3/16 In.	15 Ft.-4 7/8 In.
468	4 Ft.-2 11/16 In.	1 Ft.-7 3/8 In.	1 Ft.-3 In.	1 Ft.-9 3/16 In.	15 Ft.-4 7/8 In.
504	4 Ft.-2 11/16 In.	1 Ft.-7 3/8 In.	1 Ft.-3 In.	1 Ft.-9 3/16 In.	15 Ft.-4 7/8 In.
540	4 Ft.-2 11/16 In.	1 Ft.-7 3/8 In.	1 Ft.-3 In.	1 Ft.-9 3/16 In.	15 Ft.-4 7/8 In.
576	4 Ft.-2 11/16 In.	1 Ft.-7 3/8 In.	1 Ft.-3 In.	1 Ft.-9 3/16 In.	15 Ft.-4 7/8 In.



Weights: Warper & Creel - 10 Lbs. per Sq. Ft.
Warper only - 215 Lbs. per Sq. Ft.

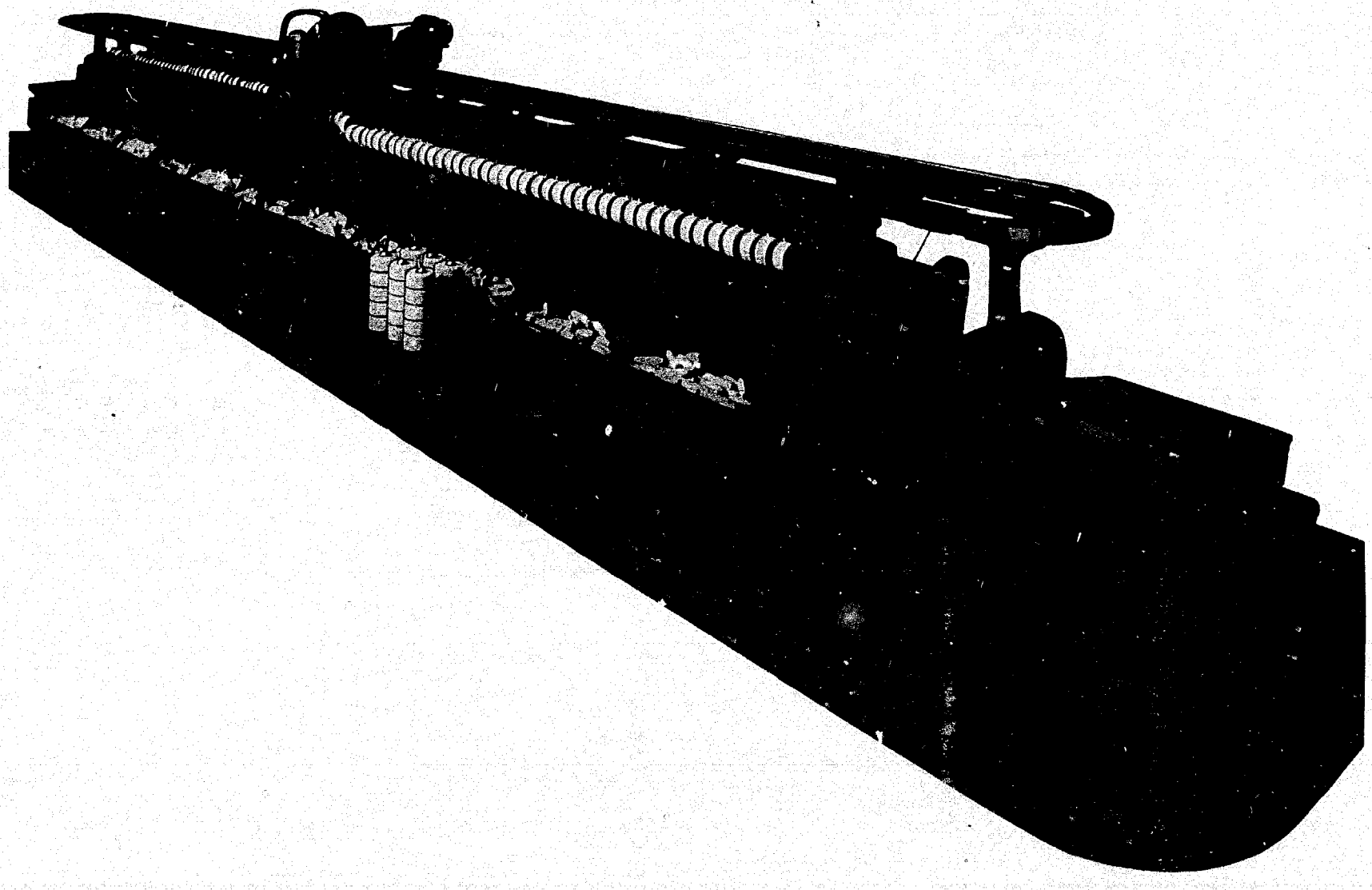
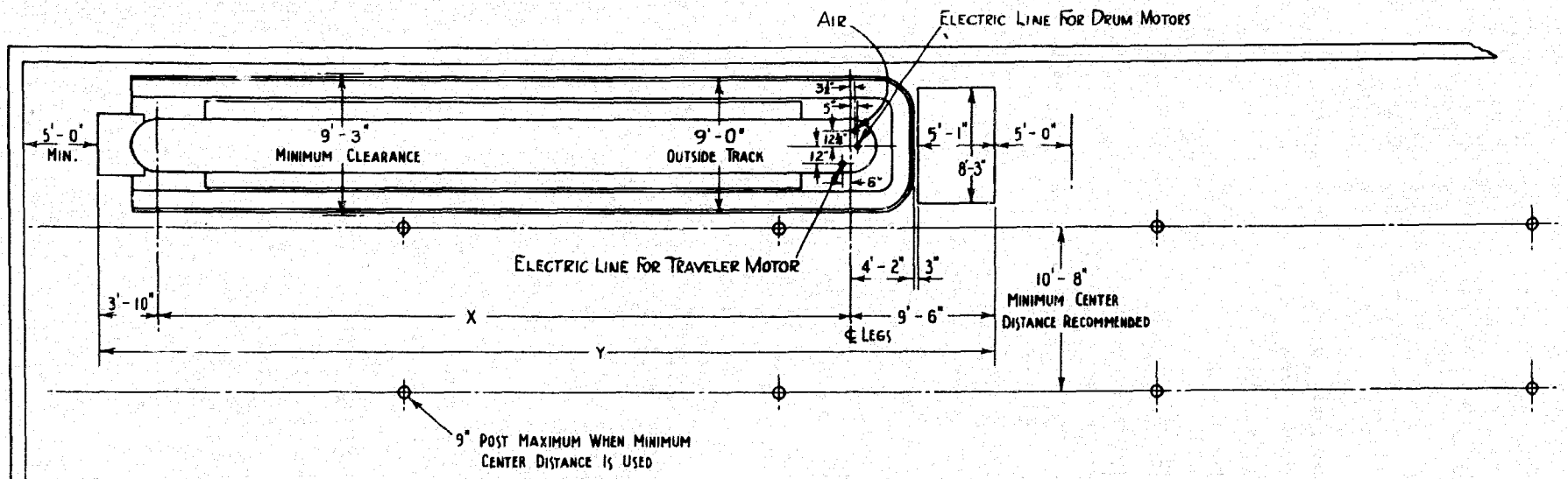
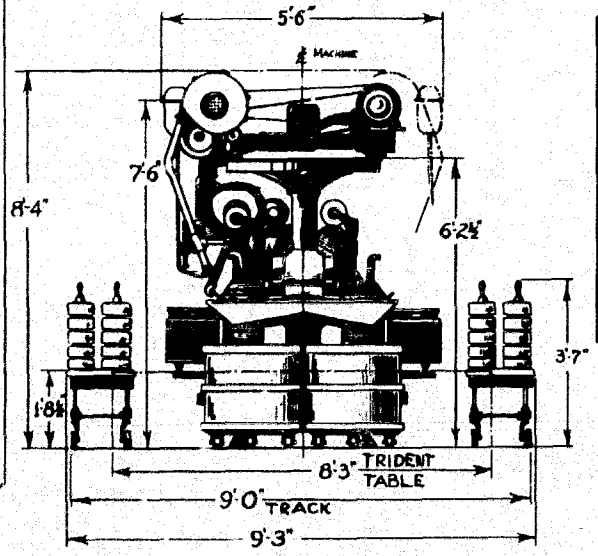


Figure 2 - AUTOMATIC WARPER

Figure 3 - SPOOLER INSTALLATION
2 COUNT MACHINES





SIZE OF MACH.	TYPE "A" & "B"	TYPE "C"	"X"	"Y"
4 BAY	80 UNITS	72 UNITS	20'-8⅛"	34'-¼"
5 BAY	100 UNITS	90 UNITS	24'-3 5/16"	37'-7 7/16"
6 BAY	120 UNITS	108 UNITS	27'-10½"	41'-2⅝"
7 BAY	140 UNITS	126 UNITS	31'-5 11/16"	44'-9 13/16"
8 BAY	160 UNITS	144 UNITS	35'-⅞"	48'-5"
9 BAY	180 UNITS	162 UNITS	38'-8 1/16"	52'-3/16"
10 BAY	200 UNITS	180 UNITS	42'-3¼"	55'-7⅜"
11 BAY	220 UNITS	198 UNITS	45'-10 7/16"	59'-2 9/16"
12 BAY	240 UNITS	216 UNITS	49'-5⅝"	62'-9¾"
13 BAY	260 UNITS	234 UNITS	53'-13/16"	66'-4 15/16"

Spooler Weights: From 40 to 50 Lbs. per Sq. Ft.

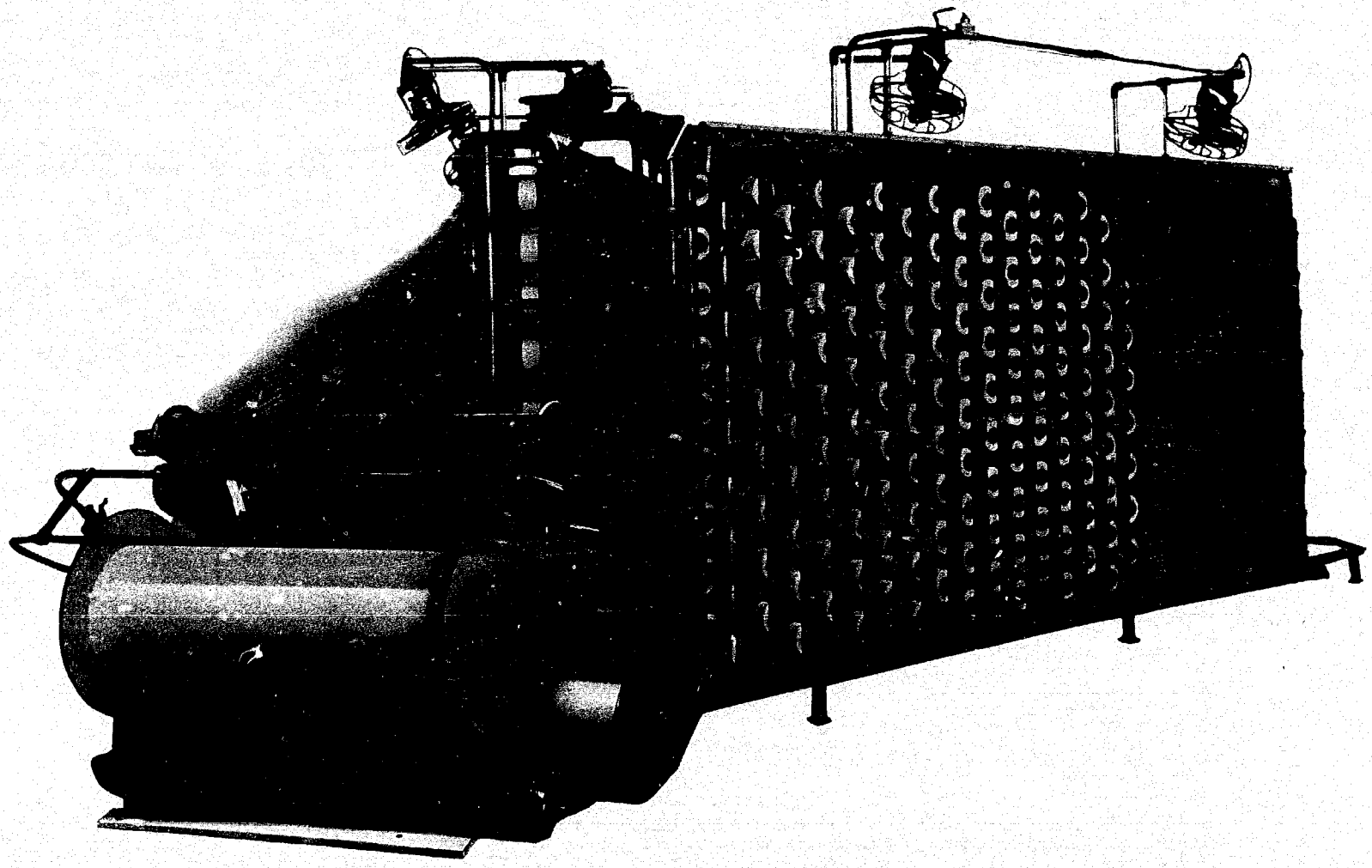


Figure 4 - **AUTOMATIC SPOOLER**

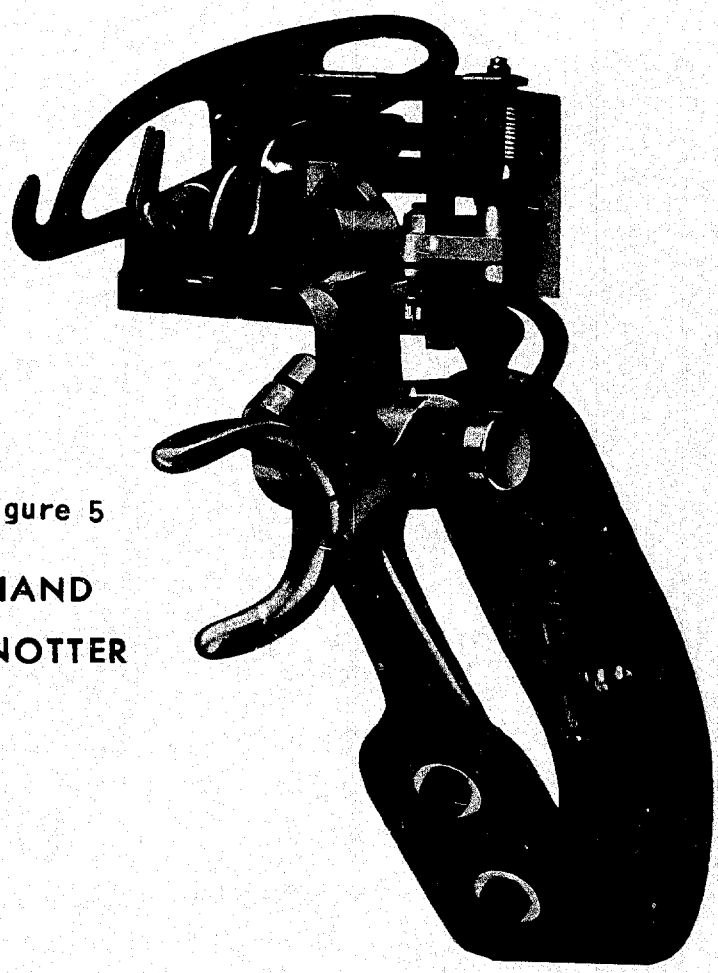


Figure 5

HAND KNOTTER

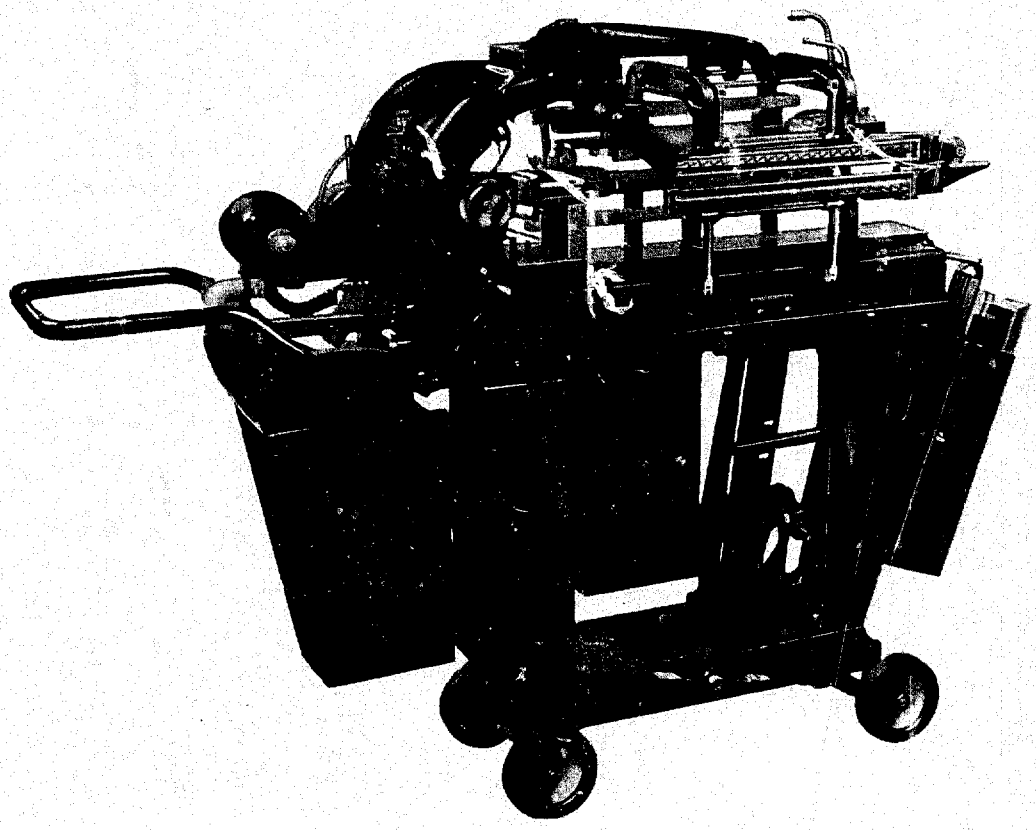


Figure 6

PORTABLE WARP TYING MACHINE

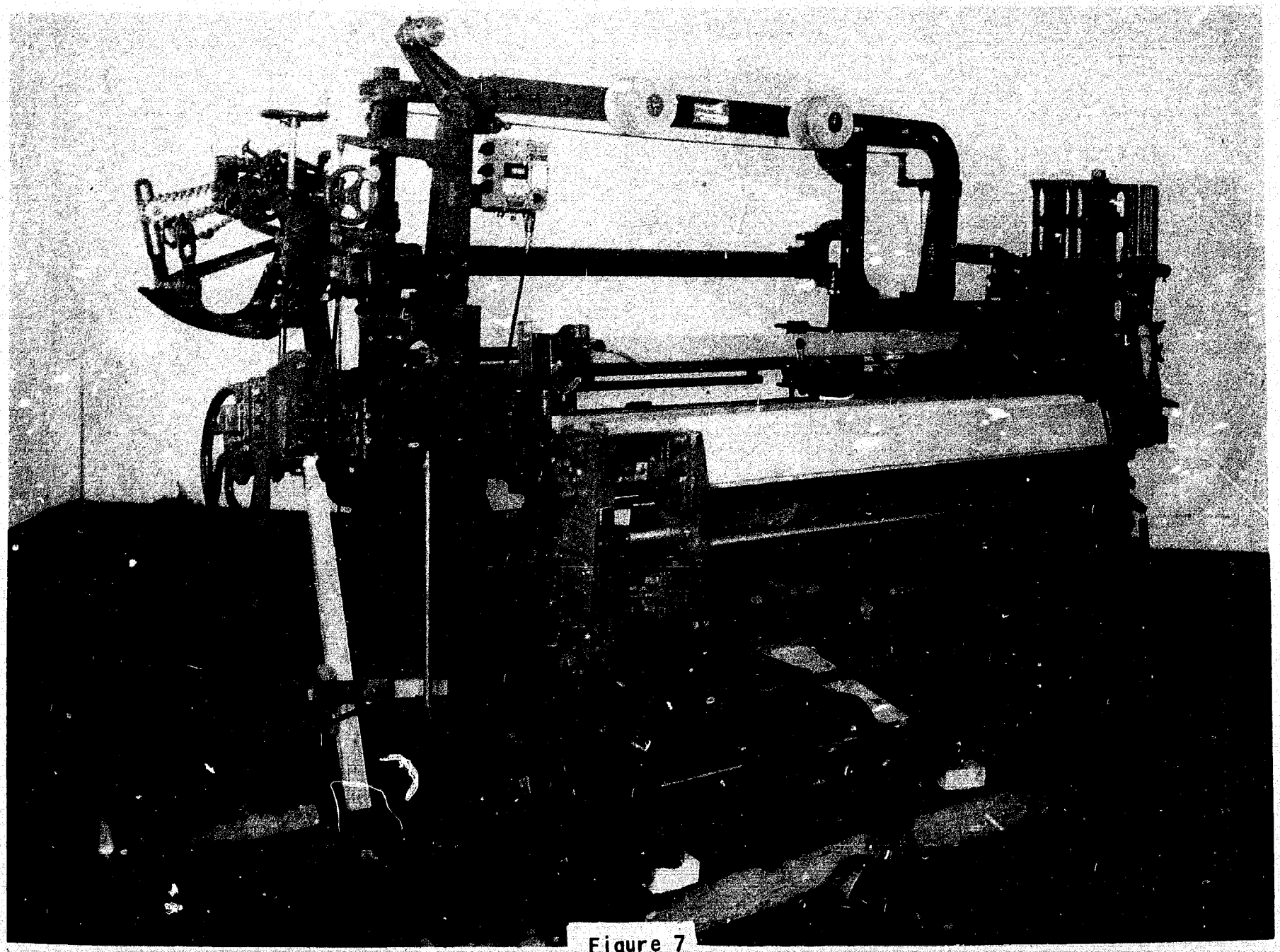


Figure 7

AUTOMATIC BOBBIN CHANGING UNDERCAM JACQUARD TYPE TERRY CLOTH LOOM

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