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PLANT REQUIREMENTS FOR MANUFACTURE OF MEN'S UNDERWEAR

A.I.D.
Reference Center
Room 1656 NS

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
COMMUNICATIONS RESOURCES DIVISION
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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.

* * * * * * * *

The original report was prepared by the Wolf Management Engineering Company, Chicago, Illinois.

Technical information, as well as review, was provided by R. Poliakoff, Industrial Consultant, 126 Eleventh Avenue, New York 11, New York.

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PLANT REQUIREMENTS FOR MANUFACTURE OF MEN'S UNDERWEAR

INTRODUCTION

Knit fabrics are constructed on knitting machines which unite a number of yarns with interlocking loops, thus giving the fabric elasticity. This is contrasted with woven fabrics which are made by interlacing yarns at right angles, thus producing little elasticity in the fabric.

In the United States, the knitting industry is made up of more than 3,000 different manufacturing establishments; over 2,000 of these manufacturers employ fewer than 50 persons. This illustrates one of the major advantages of selecting the knitting industry for this study, that is, the amount of capital required to establish a knitting enterprise is low, enabling small firms with modest capital to engage in this type of business. Other advantages of the knitting industry are that knitted fabrics can be produced, yard for yard, cheaper than woven fabrics, and that knitted fabrics can be adapted to almost all types of clothing.

Cotton is the principal raw material of the knitting industry, and, fortunately, cotton is grown in almost every part of the world. The International Cotton Advisory Committee recently published the following figures on world cotton production:

North America	16,546,000 bales
Asia and Oceania	8,668,000 bales
Europe	3,800,000 bales
South America	3,051,000 bales
Africa	3,041,000 bales

All indications point toward a continued expansion of knitted products; and as synthetic fibers become more widely accepted, the field for knitted products will continue to broaden because these fibers are particularly suitable for the knitting process.

GENERAL ASSUMPTIONS

In order to make realistic estimates in this manual, certain assumptions are made. These are:

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

2. Material costs are based on sizes and specifications of materials used 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.

4. Adequate power and water are available at the plant site.

5. Adequate transportation facilities are available at the plant site.

6. The plant operates eight hours a day, five days a week, and fifty weeks per year.

7. No special provision is made for the training of new personnel. It is assumed that learner's rates are paid in such cases.

8. The following items cannot be estimated realistically:

   a. Land value;
   b. Distribution and selling costs;
   c. In-freight and out-freight;
   d. Taxes.

   While general estimates will be made of each of these items except taxes, 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 report should be adjusted to conform to local conditions.

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

PRODUCT SPECIFICATIONS

Garments Selected

Although the knitting industry covers a broad field, no segment of it is more basic or world-wide than underwear. Within the knitted underwear field the supporter-type brief and the "T" shirts have been outstanding for their increasing popularity both in this country and abroad. The "T" shirt is now widely accepted as outerwear in addition to being used as underwear.

Having this in mind, a particular style of brief and "T" shirt was selected which would permit a small manufacturer to:

a. Have an integrated operation that would be profitable;
b. Produce serviceable garments at a low cost;
c. Invest a minimum amount of capital;
d. Employ few men.

Sizes

Sizing for both garments has been based upon average experience in selling to the adult male in the United States. Undoubtedly, there would be certain revisions necessary in the sizing if the garments were manufactured and sold in a foreign country where the people may be smaller or larger in stature and of different proportions.

The size scale of men's underwear briefs, on a percentage of sales basis, and representing the experience of an American manufacturer of this type of garment, is as follows:

Size	Percent of Sales
28	3.5%
30	14.1
32	22.3
34	23.5
36	15.5
38	10.3
40	5.1
42	3.2
44	1.5
46	0.6
48	0.2
50	0.2

These percentages of sales by sizes were used in the preparation of chart shown on page 5. It will be noted that three of the larger sizes and one smaller size were omitted from this operation, eliminating 4.5% of the sales in these sizes, for the purpose of simplifying manufacturing.

The "T" shirt is to be made in only three sizes -- small, medium, and large -- with an appropriate percentage distribution of each size to conform with sales experience. This is common practice in the United States.

MANUFACTURING UNIT

The manufacturing unit in a plant producing men's underwear is one dozen pieces.

PRODUCTION CAPACITY

In addition to the problem of what sizes to make, experience must also be the governing factor as to the number of lowers (briefs) versus the number of uppers ("T" shirts). Experience of underwear mills in the United States indicates that only 50-60 per cent as many "T" shirts are sold as briefs; so the production of this plant is based upon 120 dozen briefs per day and 64 dozen "T" shirts per day. If demand warrants and as the business progresses, athletic uppers (sleeveless shirts) may be added or substituted for "T" shirts.

On this basis the annual capacity of the plant is 30,000 dozen briefs, and 16,000 dozen "T" shirts.

MANUFACTURING PROCESS

The two types of garments selected for manufacture at the beginning of the enterprise are made of the following parts:

(1) The brief is made from four pieces of fabric cut in economical lots:

back
front
two flies

Other parts of the garment are:

top waist elastic
two pieces of leg elastic
two leg bindings
label

(2) The "T" shirt has only three pieces of fabric:

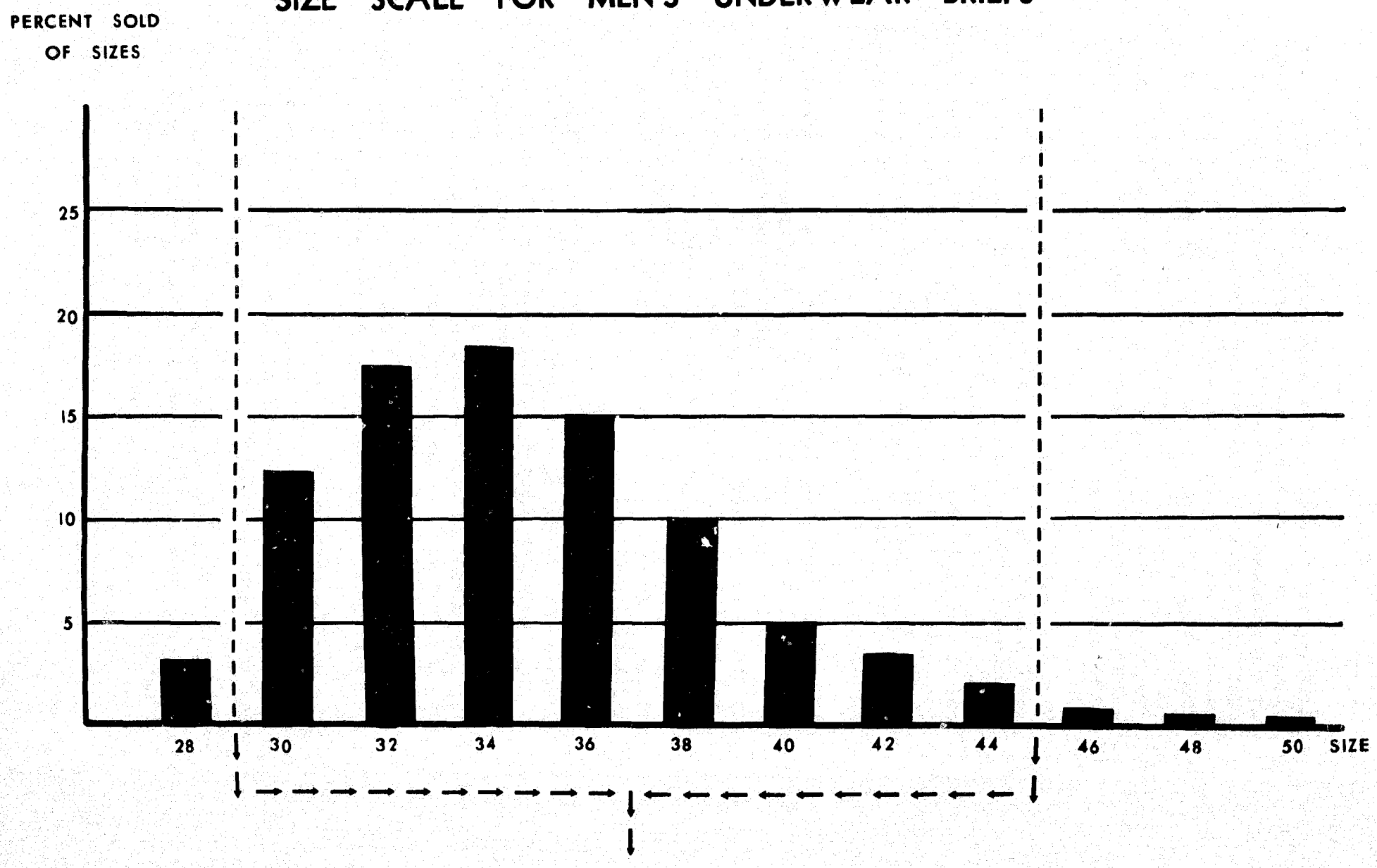
two sleeves
body

Other parts:

collar binding
two pieces of reinforcing tape in shoulders
label

As a saving, the binding will be made of the same cloth as the body.

SIZE SCALE FOR MEN'S UNDERWEAR BRIEFS



BY ELIMINATING SIZES 28,46,48,&50 ONLY 4. 5 PERCENT ARE NOT COVERED

Knitting is the start of the manufacturing process. Yarn spindles, or cones are taken from cartons of yarn stored in the warehouse and placed in small trucks, 3 feet x 6 feet, that can be wheeled into the knitting room. The knitter places the yarn cones on the spindles on top of the knitting machine and then properly threads the yarn through the knitting machine. As the knitting cylinder revolves, cloth is produced in a roll below or above the knitting machine, depending on the construction and design of the particular machine.

When the rolls of cloth are large enough, approximately 35 to 40 pounds, they are placed in hand trucks and wheeled to the lay-up table. A shaft is inserted through the center of the cloth and is horizontally supported in a rack at the end of the table. The operator takes the end of the cloth and walks to the other end of the table with the cloth in hand. As he returns to the other end of the table he smooths the cloth and makes certain the edges of the successive plies are in alignment.

At the same time the cloth is examined, and any defects in the fabric are marked or cut out so that imperfect material will not be cut into garments. When the operator returns to the starting point, he cuts the cloth so that the end will be even with the previous layers. This procedure is continued until the proper number of plies has been laid up, which can be 12 plies to 96 plies, depending upon the number of garments to be cut that day from a particular width of cloth.

When the entire lay-up has been made, the cutter places his patterns on the top layer and marks around them. Then the cutter, using an electric vibration knife, follows these lines in his cutting. The cut parts necessary to make a standard size lot for stitching, generally 3 dozen garments, are then assembled with the findings (elastic, leg rubber, binding) and sent to the sewing room.

Elastic webbing and strip rubber are laid out on the elastic cutting table, marked for proper length, and cut.

The binding must be cut on the bias, and, therefore, the fabric must go through the binding cutter machine which turns the fabric to a 45-degree angle and cuts the binding (collars, and leg bands).

Bundles of cut parts are placed upon the make-up table in the sewing room and distributed to the operators by the forelady.

The sewing room is arranged in two distinct groups:

(1) a "brief" line of eight basic operations;

(2) a "T" shirt line of six basic operations.

Brief Line Operations

1. Hem fly, both pieces
2. Seam in fly to two front pieces
3. Seam sides
4. Attach elastic
5. Bind leg
6. Seam crotch
7. Attach label and tack leg openings
8. Inspect, fold, and pack one dozen to the box

"T" Shirt Line Operations

1. Hem bottom body and hem sleeves
2. Seam right shoulder, with tape
3. Bind neck and attach collar
4. Seam left shoulder, with tape
5. Seam up and seam in sleeves
6. Inspect, fold and pack one dozen to the box

At the end of these operations, the boxes, or bags, containing the finished goods are put in the stock room by style and size.

MATERIAL REQUIREMENTS

Both garments are to be made from the same yarn -- 30-count carded cotton yarn which would produce lightweight comfortable garments. Carded yarn was selected for this study, since it varies between $0.06 and $0.10 a pound cheaper than combed yarn, yet produces a garment with practically the same wearing qualities. The yarn would be knitted into rib knit fabric.

Neither garment would be washed or bleached, thereby reducing the amount of capital necessary to start the enterprise and the funds necessary to pay the personnel to operate the machinery. By omitting these operations, the quality of the garment would remain unaffected, but as the market grows,

demand for bleached garments will undoubtedly have to be considered. The only difference in final appearance between a bleached garment and an unbleached garment is the color, the unbleached being rich cream in color.

MATERIAL COSTS PER DOZEN GARMENTS
(Based on Average Size)

Item	Estimate Brief	Estimate "T" Shirt	Actual Brief	Actual "T" Shirt
Yarn	$ 1.374	$ 3.002	_____	_____
Waist elastic	.890	--	_____	_____
Leg elastic	.076	--	_____	_____
Shoulder tape	--	.382	_____	_____
Thread	.114	.178	_____	_____
Label	.050	.050	_____	_____
Box	.064	.064	_____	_____
Cartons and wrapping paper	.016	.010	_____	_____
Total	$ 2.584	$ 3.686	_____	_____

The above items include average allowances for knitting, cutting, sewing, and waste.

Based on the above cost of materials per dozen garments, the annual cost of raw materials would be as follows:

Briefs	30,000	X	$ 2.584	=	$ 77,520
"T" Shirts	16,000	X	3.686	=	58,976
Total Annual Cost of Materials					$ 136,496

PRODUCTION TOOLS AND EQUIPMENT

Knitting

To produce 120 dozen briefs and 64 dozen "T" shirts per day in the appropriate size ranges, 477 pounds of cloth are required.* To knit this number of pounds in the proper width of cloth to reduce waste would require four knitting machines:

Type	Units Needed	Cylinder Size	Feeds	Pounds	Estimated Cost	Actual Cost
14-cut rib knit	2	17-inch	16	120	$ 5,800	_____
14-cut rib knit	2	20-inch	20	156	6,800	_____
14-cut rib knit	2	22-inch	22	160	7,600	_____
14-cut rib knit	1**	24-inch	24	41	4,000	_____
Total Knitting					$24,200	_____

* This includes allowances for cutting room waste, holes in fabric and other loss factors.

** In an emergency, the 24-inch knitting machine could produce more cloth in the event of a breakdown of any of the other machines.

Should the market exceed the capacity of this plant, additional production can be secured, by working either one extra day per week, or overtime a night, or if the sales are doubled, by working complete extra shift.

Finishing

Description	Units Needed	Total Estimated Cost	Actual Cost
Electric cutting knife, with 8-inch blade. This would enable one cutter to cut all of the fabric required in slightly over two hours' time. The balance of the time this electric knife would be used to cut elastic for waist bands.	1	$ 400	_____
Electric binding cutter wich will cut the binding in less than two hours time.	1	1,200	_____
Sewing Machines* (18)			
Stitch type 504 - superlock	7	3,500	_____
Stitch type 605 - triple interlock, 16-gauge	2	1,510	_____
Stitch type 602 - 2-needle interlock, 12-gauge	3	2,370	_____
Stitch type 606 - flat lock	1	850	_____
Stitch type 301 - lock stitch	2	510	_____
Stitch type 502 - blind hem	1	500	_____
Extra machines - in parts	2	1,000	_____
Lay-up Table - 24 feet x 2-1/2 feet, wooden	1	200	_____
Shape Table - 6 feet x 11 feet, wooden	1	100	_____
Table for Cutting Elastic - 22 feet x 2 feet, wooden	1	200	_____
Table for Sorting	1	100	_____
Inspection Tables	2	200	_____
Supplies Rack	1	100	_____
Work Bench	1	50	_____
Folder - to relax tension on cloth	1	3,000	_____
Wash Tub - wooden, 200-lb., with motor	1	1,500	_____
Extractor	1	1,200	_____
One-Section Multipass Dryer - installed	1	11,000	_____
Total Finishing		$29,490	_____

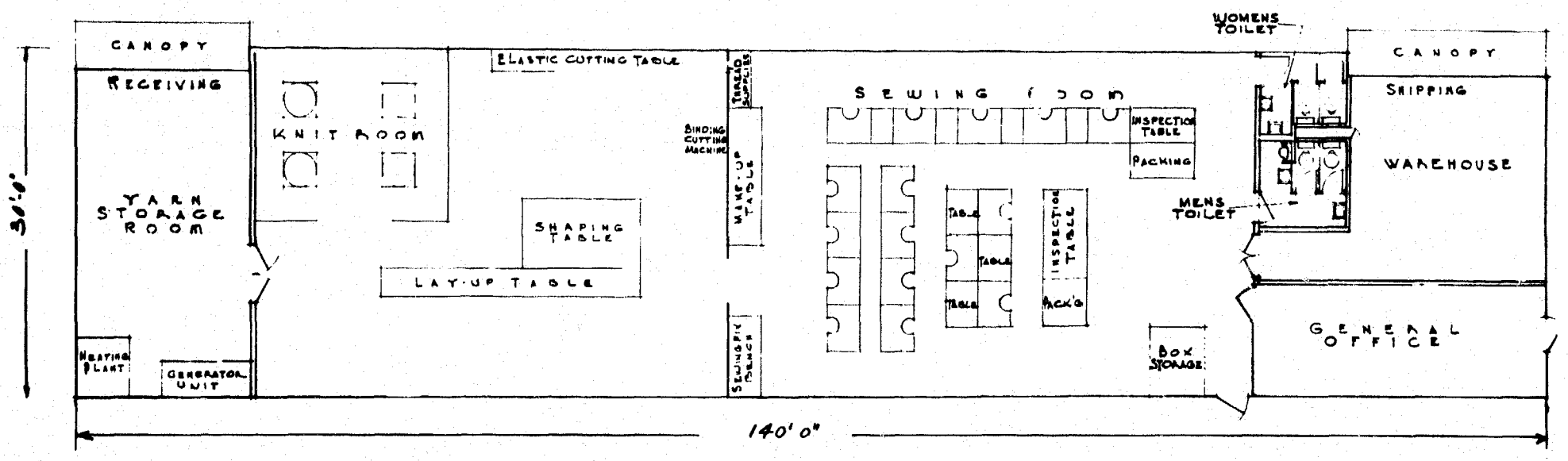
* Described in stitch types in accordance with Federal specifications including lap board, table, motor, clutch, 45,000 revolutions per minute, 3-phase.

OTHER TOOLS AND EQUIPMENT

Description	Units Needed	Total Estimated Cost	Actual Cost
Hand Trucks - 3 feet x 6 feet x 4 feet, wooden	12	$ 900	_____
Loading Trucks	2	100	_____
Bench Grinder	1	125	_____
Small Drill Press	1	150	_____
Hand Tools		200	_____
Chairs	17	340	_____
Spare Parts for all Machines		3,000	_____
Total		$ 4,815	_____

FURNITURE AND FIXTURES

Description	Units Needed	Total Estimated Cost	Actual Cost
Desks and Chairs	3	$ 375	_____
Typewriter	1	150	_____
Adding Machine	1	150	_____
Filing Cabinets	2	95	_____
Total		$ 770	_____



LEGEND

KNITTING MACHINES

SEWING MACHINES

DIAGRAMATIC LAYOUT of SMALL KNIT UNDERWEAR MILL

PLANT LAYOUT

Preliminary to laying out a plant, it is necessary to study local conditions with respect to the climate, type of transportation facilities, advisability of renting or building, and many other considerations. However, there are a number of general principles about a small plant layout which would be applicable in most locations, and these are illustrated in the layout opposite this page. This layout also serves to establish the amount of space needed for the operation under consideration.

The layout, being rectangular, is suited to a continuous flow of work:

Yarn and supplies are received in the rear.

Yarn is sent into the knitting room.

Knitted cloth moves on to the lay-up table.

Bundles of cut cloth are wheeled to the sewing room.

Finished garments are boxed and sent into the stock room.

Shipping facilities are adjacent to the stock room.

If the operation were expanded, there would be little problem in adding an adjoining building. For the present operation, the space allowed is generous but not wasteful. As more knitting machines or more sewing machines are added, they would be placed in line, thereby taking less square feet per machine than the present machines.

One of the primary objectives of this layout has been to allow adequate space to prevent congestion, which is a common feature of inefficiency in many small textile operations. Furthermore, the receiving room and finished stock room have adequate space for housing a six-months' supply of material, thus avoiding tie-ups if transporation is slow or unreliable.

It should also be pointed out that the space in the receiving and shipping rooms would supply a larger operation, since any addition or increase in space would no doubt involve washing, bleaching, dyeing, drying facilities. Even the office is adequate for more personnel in the event some of the sales operations were joined with manufacturing and located at the mill.

PLANT SITE

To provide for eventual expansion about 12,000 square feet of land will be required. The site should be as advantageously located as possible with respect to transporation facilities, power, water, fuel, raw material, and sources of labor and markets. The cost of the plant site is estimated at $800.

BUILDING

A one-story building 30 feet x 140 feet or about 4,200 square feet of floor space will provide ample space for all operations including the office. The building may be constructed with any suitable local materials. It should be well lighted, heated and ventilated. The cost of the building including a boiler, adequate plumbing and wiring is estimated at $3.50 per square foot or about $14,700.

POWER

The cost of power to operate this plant is estimated at $3,000.

WATER

The water requirement for all purposes including production, sanitary and fire protection is estimated at $300.

FUEL

Consideration should be given to available local fuel when the boiler is purchased. The cost of fuel is estimated at $900.

DIRECT LABOR

Occupation	Personnel Required	Hourly Rate	Estimated Cost	Actual Cost
Knitters	2	$ 1.60	$ 6,400	_____
Cutter	1	1.60	3,200	_____
Cutter Helper	1	1.50	3,000	_____
Sewing*	17	1.25	42,500	_____
Total			$55,100	_____

* The sewing is done by female operators.

INDIRECT LABOR

Occupation	Personnel Required	Hourly Rate	Estimated Cost	Actual Cost
Manager	1		$ 8,000	_____
Forelady	1	$ 1.70	3,400	_____
Machine Fixer	1	2.00	4,000	_____
Bookkeeper	1		4,800	_____
Stock Clerk, Janitor	1	1.50	3,000	_____
Total			$23,200	_____

SUPPLIES

Item	Estimated Cost	Actual Cost
Maintenance Materials	$ 600	_____
Spare Parts	1,000	_____
Lubricants	100	_____
Tools	100	_____
Office Supplies	200	_____
Total	$ 2,000	_____

DEPRECIATION

Item	Estimated Cost	Years Life	Estimated Per Year	Actual Per Year
Building	$14,700	20	$ 735	_____
Production Tools and Equipment				
Knitting	24,200	10	2,420	_____
Finishing	29,490	10	2,949	_____
Other Tools and Equipment	4,815	10	482	_____
Furniture and Fixtures	770	10	77	_____
Total			$ 6,663	_____

MANUFACTURING OVERHEAD

Item	Estimated Cost	Actual Cost
Depreciation	$ 6,663	_____
Indirect Labor	23,200	_____
Supplies	2,000	_____
Power	3,000	_____
Water	300	_____
Fuel	900	_____
Total	$36,063	_____

MANUFACTURING COST

Item	Estimated Cost	Actual Cost
Direct Materials	$ 136,496	_____
Direct Labor	55,100	_____
Manufacturing Overhead	36,063	_____
Total	$ 227,659	_____

FIXED ASSETS

Item	Estimated Cost	Actual Cost
Land	$ 800	_____
Building	14,700	_____
Production Tools and Equipment		
Knitting	24,200	_____
Finishing	29,490	_____
Other Tools and Equipment	4,815	_____
Furniture and Fixtures	770	_____
Total	$74,775	_____

WORKING CAPITAL

Item		Estimated Cost	Actual Cost
Direct Materials	- 30 days	$11,300	_____
Direct Labor	- 30 days	4,600	_____
Manufacturing Overhead	- 30 days	3,000	_____
Reserve for Sales Collections	- 30 days	24,300	_____
Total		$43,200	_____

CAPITAL REQUIREMENTS

Item	Estimated Cost	Actual Cost
Fixed Assets	$ 74,775	_____
Working Capital	43,200	_____
Total	$ 117,975	_____

SALES REVENUE

The current prices for these products f.o.b. plant in the United States are as follows:

Briefs	$6.00 per dozen
"T" Shirts	$7.00 per dozen

Based on these prices the annual sales revenue will be --

Briefs	30,000 x $6.00	=	$ 180,000
"T" Shirts	16,000 x 7.00	=	112,000
Annual Gross Sales			$ 292,000

RECAPITULATION OF COSTS, SALES AND PROFITS

Item	Estimated Cost		Actual Cost
Direct Materials	$ 136,496		_____
Direct Labor	55,100		_____
Manufacturing Overhead	36,063		_____
Total Manufacturing Cost		$ 227,659	_____
Interest on Loans	$ 1,500		_____
Insurance	500		_____
Legal	800		_____
Auditing	1,200		_____
Unforeseen Expense	4,341		_____
Total Administrative Cost		8,341	_____
Sales Commissions, Travel Freight Out, Bad Debts, Discounts and Allowances		18,000	_____
Profit before Taxes		38,000	_____
Total Annual Gross Sales		$ 292,000	_____

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	$_____	$ 333	$ 4,000	$_____
20	Sales	_____	1,500	18,000	_____
30	Direct Materials	_____	11,374	136,496	_____
40	Supplies	_____	166	2,000	_____
51	Power*	_____	250	3,000	_____
52	Water*	_____	25	300	_____
53	Fuel	_____	75	900	_____
60	Unforeseen Expense (Reserve Account)	_____	361	4,341	_____
71	Direct Labor*	_____	4,591	55,100	_____
72	Indirect Labor*	_____	1,933	23,200	_____
80	Depreciation (Reserve Account)	_____	---	6,663	_____

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 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 manual would be a profitable undertaking.

There are some determinations, however, that should be made before a decision is reached to b ld 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?

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7 East 12th Street
New York, New York

ABBREVIATIONS

'	Foot or feet
"	Inch or inches
%	Percent
lb.	Pound
lbs.	Pounds
f.o.b.	Free on board

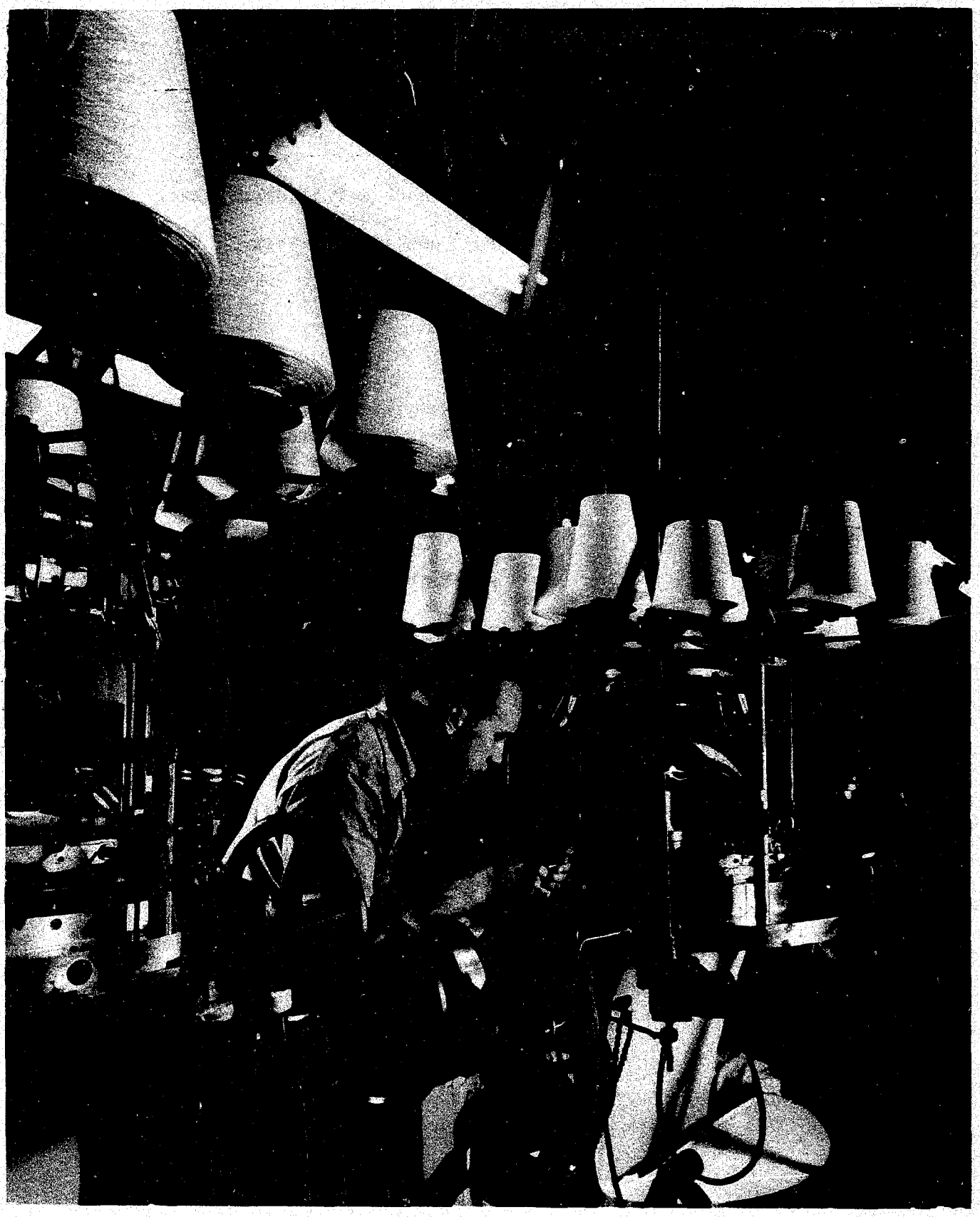
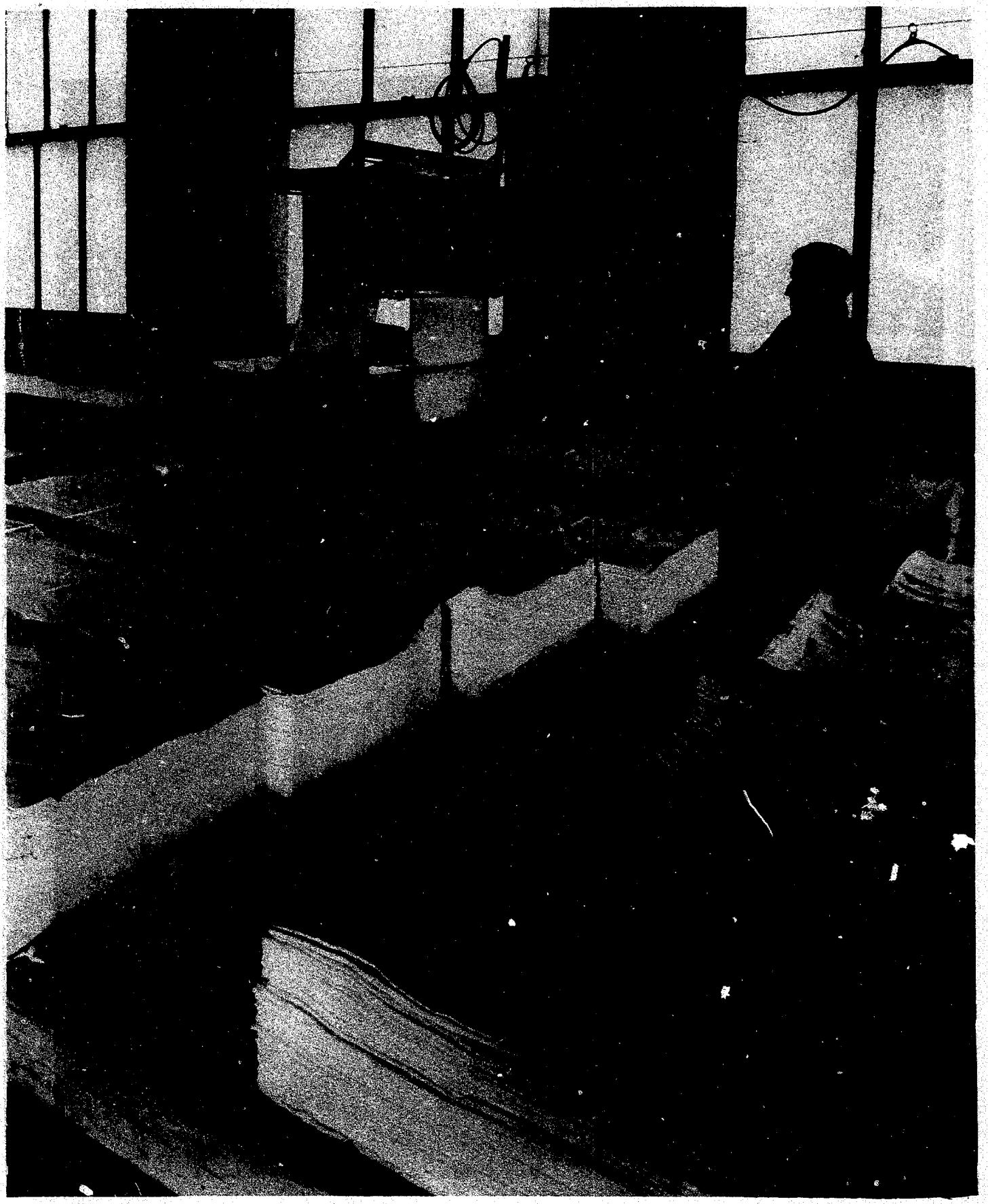


Figure I - Underwear knitting machines in operation

Figure 2 - Thread cones



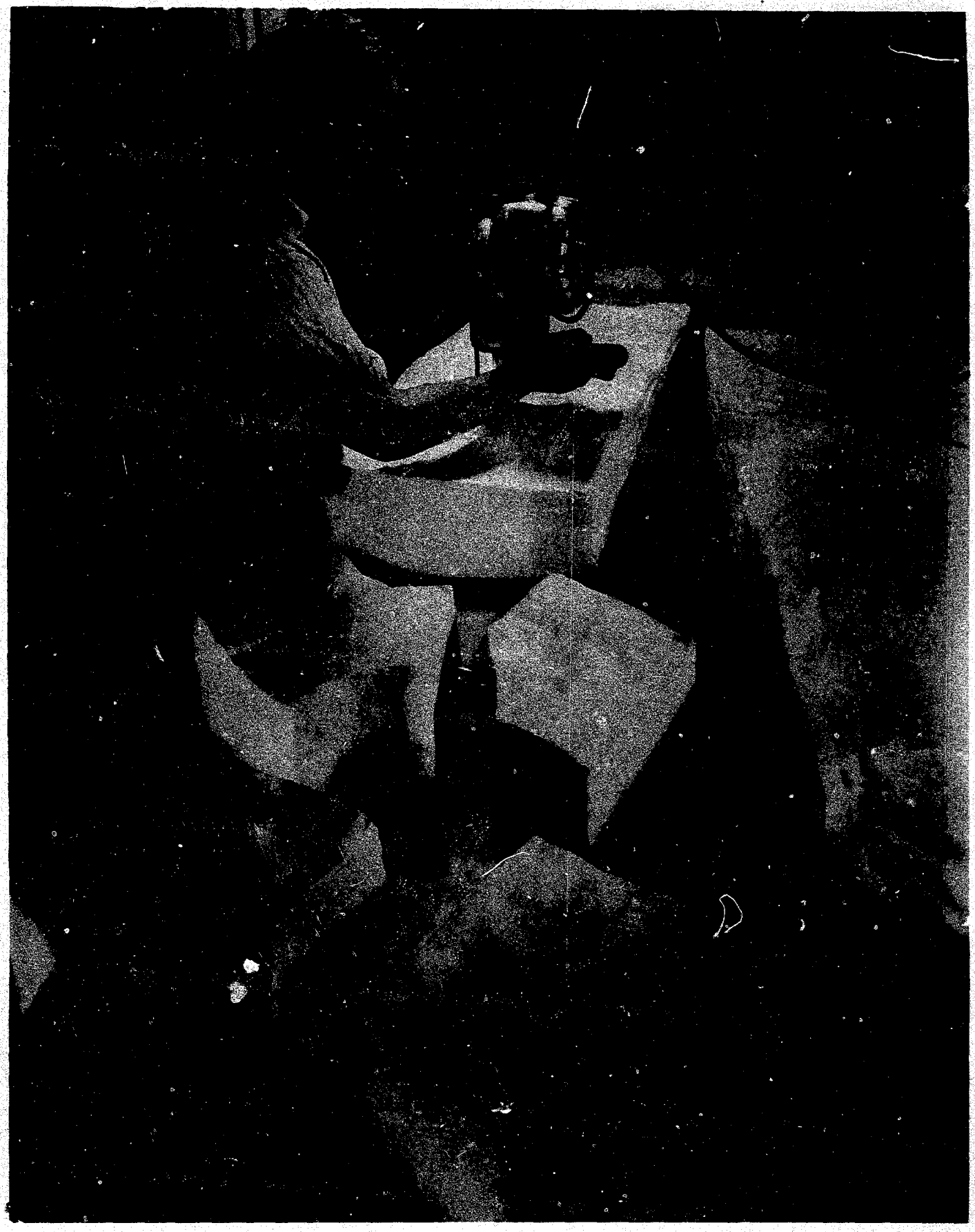


Figure 4

A master pattern marker is placed on top of block of laid-up fabric, and electric cutter cuts entire block in one operation.

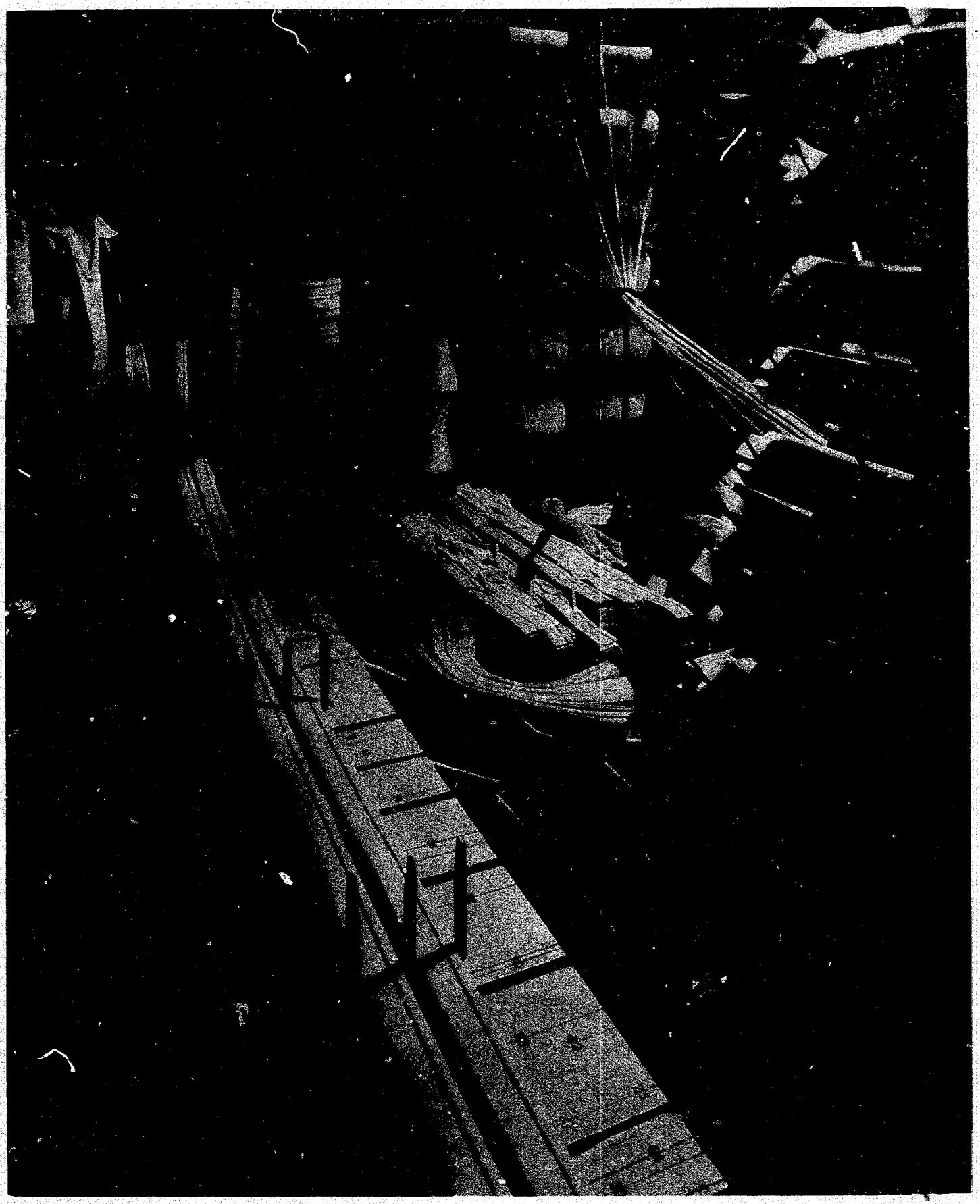


Figure 5 - Flastic waist-band cutting.

Figure 6 - Typical sewing operation.

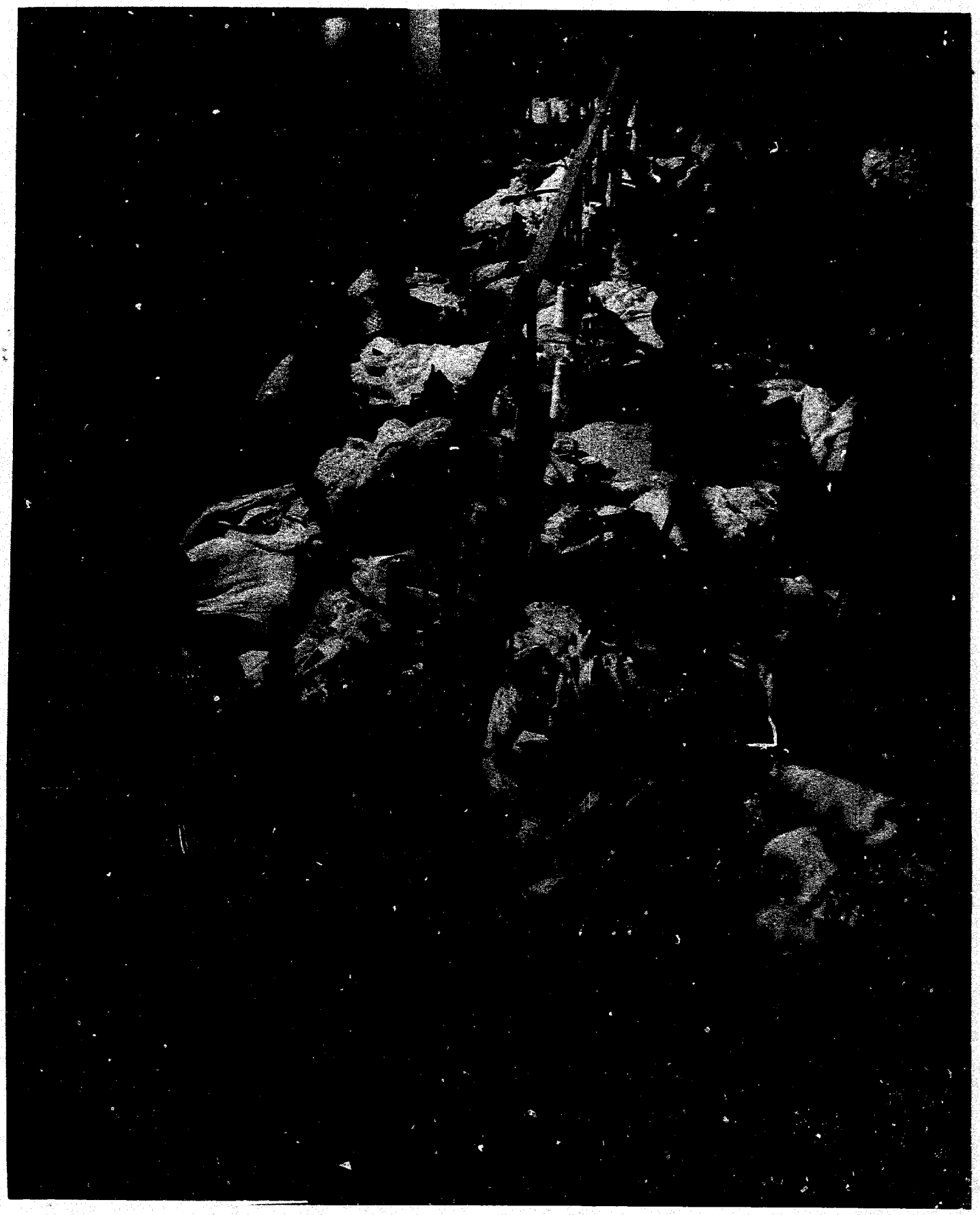


Figure 7 - Progressive sewing unit.

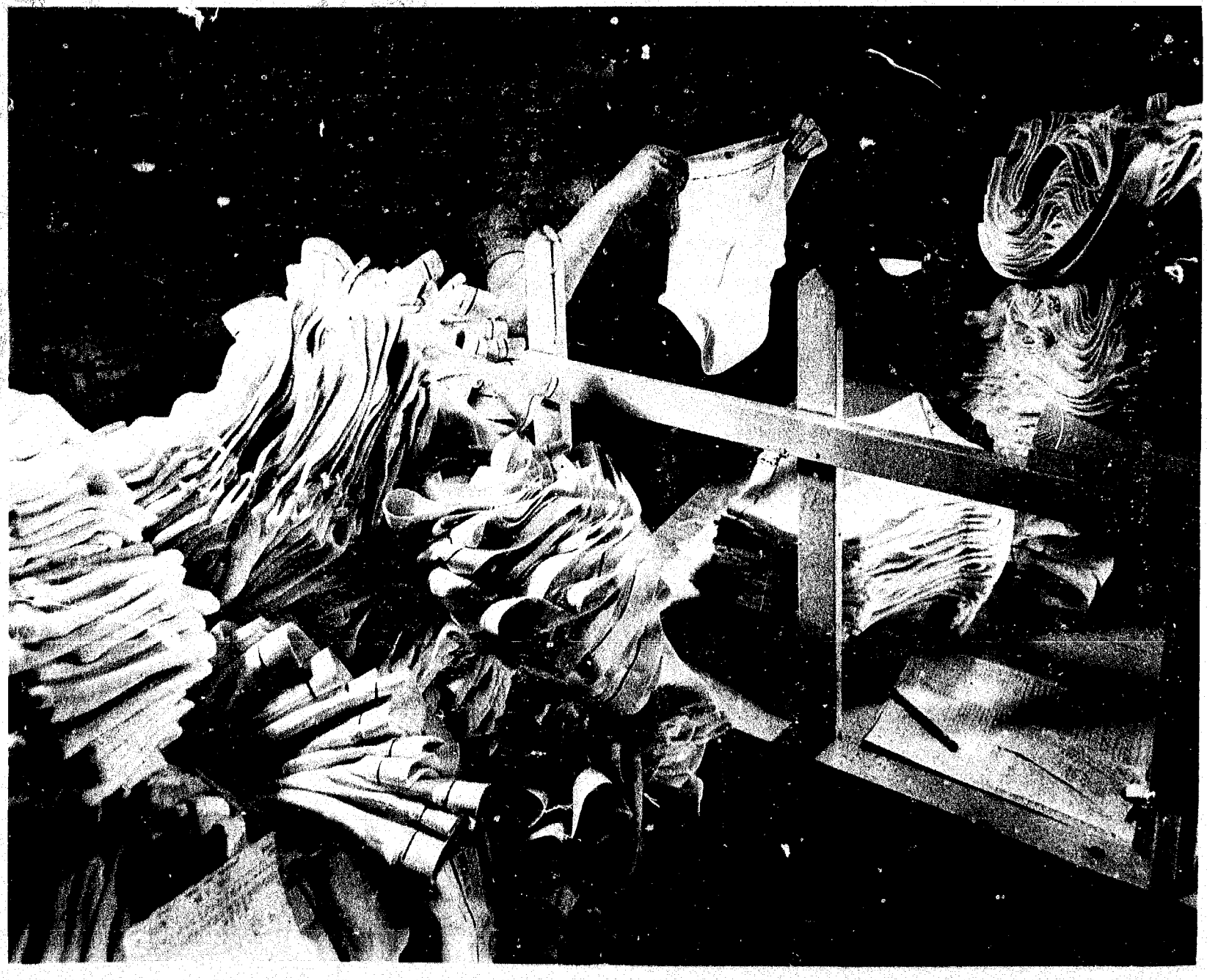


Figure 8 - Garment final inspection

INTERNATIONAL COOPERATION ADMINISTRATION

SERVICES OF THE INDUSTRIAL TECHNICAL COOPERATION PROGRAM

TYPE III - TECHNICAL AIDS FOR OVERSEAS

- **INDUSTRIAL REPORTS SERVICE**

Provides basic information regarding:

1. Data and reference materials relating to private capital mobilization and its application in economic development.
2. Requirements for establishing and operating small factories in basic industries.
3. Man-hour requirements, operational characteristics, and equipment utilization in representative U. S. factories in selected industries.
4. Man-hour and materials savings through standardization, simplification, and specialization studies.
5. Supervisory and other specialized training procedures and techniques.
6. U. S. experience in specialized fields.

- **TECHNICAL DIGEST SERVICE**

Provides digests and abstracts, full length articles, and bibliographical references on U. S. developments in products, processes, and work techniques derived from U. S. technical, scientific, and trade periodicals, and other pertinent sources.

- **TECHNICAL INQUIRY SERVICE**

Provides answers to individual questions relating to products, processes, machinery and equipment, production operations, work techniques, management practices and concepts, factory engineering, and basic requirements for industrial production.

- **TRAINING MATERIALS SERVICE**

Provides basic materials for use by specialized technicians in the conduct of management, supervisory and specialized training courses in host countries.

- **TECHNICAL LITERATURE SERVICE**

Provides recommendations and guidance regarding current useful world-wide publications relating to industry and productivity improvement; distributes carefully selected and representative new publications of particular value for program use; and facilitates mission literature procurement.

- **U. S. BOOK EXCHANGE SERVICE**

Provides, on Mission approval, technical and scientific books and periodicals on exchange basis to overseas libraries.

- **VISUALS AND NEW MEDIA**

Provides technical advice and guidance to missions on new industrial visuals. Provides for cooperative program adaptation and use a variety of visual materials, including loan exhibits, silk-screen display panels, graphic brochures, slide and sound kits, and related materials.

- **TECHNICAL FILM SERVICE**

Provides guidance for and facilitates procurement of U. S. technical and training films for program use; provides representative U. S. technical industrial films and filmstrips on loan basis for short-term program requirements; and facilitates adaptation of films into foreign language versions for program use overseas.