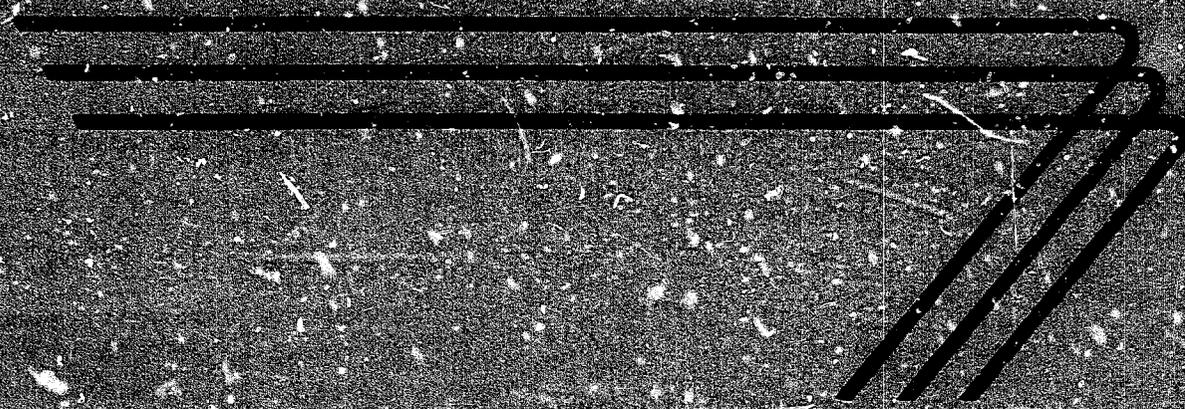


5261

# PLANT REQUIREMENTS FOR MANUFACTURE OF HOOKED RUGS

A. J. DEW  
Reference Cabinet  
Room 1446 B6



TECHNICAL AIDS BRANCH  
INTERNATIONAL COOPERATION  
ADMINISTRATION  
Washington, 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 International Cooperation Administration, but merely a citation that is typical in its field.

The original report was prepared in January 1958 by Barnes Textile Associates, Inc., Boston, Massachusetts.

\* \* \* \* \*

This report has been revised and rewritten by George H. Andrews Engineering Associates, Inc., 411 Southern Building, Washington 5, D. C.

\* \* \* \* \*

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

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# HOOKED RUGS

## INTRODUCTION

The purpose of this report is to present basic information for establishing a Hooked Rug plant in a foreign country.

This industry is peculiarly adapted to locations where wage rates are low since only \$260 for machinery and equipment is required and only sixteen workers, direct and indirect, are used.

It can be operated as a domestic, home, handicraft employing only the members of a family or as a small industry as shown in this report.

## GENERAL ASSUMPTIONS

In order to make realistic estimates in this report, 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 Statistics.

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 two hundred and fifty days a 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. Administrative costs.
  - E. 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 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

The following sizes of hooked rugs are the sizes most commonly used include: 20" x 32", 24" x 36", 24" x 40", 28" x 40", 28" x 45", 32" x 51", 32" x 54", 32" x 63", 36" x 56", and 18" x 18" round rugs. Other sizes of rugs up to 9' x 12' are made but the general demand is considered limited to the sizes indicated.

### PRODUCTION CAPACITY

The annual capacity of this plant is 1,200 rugs, 36 inches by 56 inches or 14 square feet in size. The annual sales value would remain about the same regardless of the size of the rugs, since smaller rugs would sell for proportionately more per square foot and larger rugs would sell for proportionately less per square foot.

### MANUFACTURING UNIT

The manufacturing unit for this plant is one rug regardless of dimensions.

### MANUFACTURING OPERATIONS

The methods being described are not to be considered the only ones employed. Observations of several operations uncovered a great variety, generally influenced by the type of material used and the experience of the worker. The following method combines the best observed:

The preliminary step following the selection of pattern and the yarn colors is to stretch the patterned burlap onto the wooden strips selected for that purpose, or onto the adjustable frame and stand, to hold that part of the rug backing in such a position that the sheet will be held flat and tight and be readily available to work on.

The sheet is attached firmly with tacks to a roll on the more modern

units and held tight on a second roll with various means for holding the selvages tight, generally with strings between the selvage and the outer strips of the stand. As work is completed, it is rolled from one roll to the other, keeping the sheet tight on which the hooking is being done.

In the hooking operation the various colors of yarn are held under the backing sheet and drawn up through the burlap by extending the hook through the burlap, engaging the yarn and drawing a loop up through and releasing the yarn from the hook to leave the loop at the desired length. The operation is followed continuously, guided by the pattern and the indications of the color marked on the backing by the designer of the rug.

Great care has to be taken to make sure the backing on the form is kept flat and even, to prevent pattern distortion. It is generally advisable to hold the sheet of the rugs back on the roll and allow enough for safe tacking to the frame without interfering with the pattern.

Production can be speeded up and the evenness of the height of the looms improved by using the new type of hook called the "Bluenose" Rug Hooker. This hooker is designed to hold the strand of yarn under control and feed through a specially designed needle which carries the yarn through the burlap or whatever the backing happens to be after it is penetrated, and by a special release leave a

uniform loop of fixed height in the rug after the needle has been withdrawn.

The use of this new hooker has improved the technique of all who use it.

\* \* \* \* \*

#### DIRECT MATERIALS

For the purpose of this brochure all cost figures for materials will be based on a hooked rug 36 inches by 56 inches or 14 square feet.

The backing which generally is either coarse cotton or burlap can be purchased from a limited number of sources. Three or four companies prepare backing by stencilling patterns ready for hooking and supply color combinations with the patterns. The cost of these patterns stencilled on the burlap range from a low of \$1.90 to a high of \$2.35 for the widths indicated earlier.

The rugs are hooked with straight wool or cotton yarns, blends with synthetics or narrow cut cloth in the original colors, or dyed, as desired. The cost for dyed woolen yarns varies with the market but current prices range between \$0.55 and \$0.60.

For the purpose of this brochure the cost of the patterns stencilled

on burlap with color combinations ready for hooking is estimated at \$2.35. Woolen yarns will be used and the cost of dyed woolen yarns ready for use is estimated at \$2.25 a pound. The above prices include delivery at the plant.

The estimated annual cost of raw materials for this plant is shown below.

<u>Item</u>	<u>No. of Units</u>	<u>Unit Cost</u>	<u>Annual Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Rug backing	1,200	\$2.35	\$ 2,820	_____
Woolen yarn	3,600 pounds	2.25	<u>8,100</u>	_____
TOTAL			\$ 10,920	_____

**SUPPLIES**

<u>Item</u>	<u>Annual Cost</u>	
	<u>Estimated</u>	<u>Actual</u>
Hand tools	\$ 25	_____
Office supplies	50	_____
Maintenance and spare parts	<u>125</u>	_____
TOTAL	\$ 200	_____

DIRECT LABOR

<u>Occupation</u>	<u>Number Required</u>	<u>Hourly Rate</u>	<u>Annual Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Rug hookers	10	\$1.60	\$ 32,000	_____
Material preparation	1	1.50	3,000	_____
Rug finishing	<u>1</u>	1.60	<u>3,200</u>	_____
TOTAL	12		\$ 38,200	_____

INDIRECT LABOR

<u>Occupation</u>	<u>Number Required</u>	<u>Hourly Rate</u>	<u>Annual Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Manager	1	Salary	\$ 5,000	_____
Package and shipping	1	\$1.50	<u>3,000</u>	_____
TOTAL			\$ 8,000	_____

The manager will keep the books, handle sales and procurement, and inspect the finished product.

PRODUCTION TOOLS AND EQUIPMENT

<u>Description</u>	<u>Number Required</u>	<u>Cost</u>	
		<u>Estimated</u>	<u>Actual</u>
Cloth stripping machine	1	\$ 14.25	_____
Yarn rewinder	1	23.00	_____
Adjustable floor stand rug frames	10	80.00	_____
Portable plain frames	10	10.00	_____
Clamps	40	26.00	_____
Bluenose hookers	10	20.00	_____
Rug hooks	10	3.50	_____
Rolling machines	2	32.00	_____
Tables	2	16.00	_____
Shelves (estimated)	40	12.00	_____
Hand tools		<u>23.25</u>	_____
<b>TOTAL COST FOR 10-POSITION UNIT</b>		<b>\$ 260.00</b>	_____

FURNITURE AND FIXTURES

<u>Item</u>	<u>Number Required</u>	<u>Unit Cost</u>	<u>Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Desk and chair	1	\$150	\$ 150	_____
File cabinet	1	75	75	_____
Typewriter	1	150	<u>150</u>	_____
<b>TOTAL</b>			<b>\$ 375</b>	_____

### PLANT LAYOUT

A plant layout is shown on the last page of this report.

### PLANT SITE

Since there are no large amounts of materials, transportation is not important. The plant site should be located as advantageously as possible with respect to power, water, fuel and sources of labor.

In many countries this product should have a good tourist trade market. Therefore, the site should be located easily accessible to tourist trade. The plant site should be large enough to provide parking space for tourists.

The estimated cost of the plant site is \$500.

### BUILDING

A one story building 16 feet by 24 feet or 384 square feet will be required. The building may be constructed with any suitable local material. The cost of the building is estimated at \$4.00 per square foot or a total of about \$1,534.

### POWER

The only power required will be for lights. The annual cost of power is estimated at \$100.

WATER

Water will be required for sanitary purposes and fire protection.  
The annual cost of water is estimated at \$20.

FUEL

Fuel will be required for heating the building. The amount of fuel used will depend on the climate. Any suitable local fuel may be used. The annual cost of fuel is estimated at \$200.

\* \* \* \* \*

DEPRECIATION

<u>Description</u>	<u>Estimated Cost</u>	<u>Years Life</u>	<u>Annual Cost</u>	
			<u>Estimated</u>	<u>Actual</u>
Building	\$ 1,536	20	\$ 74	_____
Production tools and equipment	260	10	26	_____
Furniture and fixtures	375	10	<u>37</u>	_____
TOTAL			\$ 137	_____

MANUFACTURING OVERHEAD

<u>Item</u>	<u>Annual Cost</u>	
	<u>Estimated</u>	<u>Actual</u>
Depreciation	\$ 137	_____
Indirect labor	8,000	_____
Power	100	_____
Water	20	_____
Fuel	200	_____
Supplies	<u>200</u>	_____
TOTAL	\$ 8,657	_____

MANUFACTURING COSTS

<u>Item</u>	Annual Cost	
	<u>Estimated</u>	<u>Actual</u>
Direct materials	\$ 10,920	_____
Direct labor	38,200	_____
Manufacturing overhead	<u>8,657</u>	_____
TOTAL	\$ 57,777	_____

FIXED ASSETS

<u>Item</u>	Cost	
	<u>Estimated</u>	<u>Actual</u>
Land	\$ 500	_____
Building	1,536	_____
Production tools and equipment	260	_____
Furniture and fixtures	<u>375</u>	_____
TOTAL	\$ 2,671	_____

WORKING CAPITAL

<u>Item</u>		Cost	
		<u>Estimated</u>	<u>Actual</u>
Direct materials	30 days	\$ 910	_____
Direct labor	30 days	3,183	_____
Manufacturing overhead	30 days	<u>721</u>	_____
TOTAL		\$ 4,814	_____

CAPITAL REQUIREMENTS

<u>Item</u>	Cost	
	<u>Estimated</u>	<u>Actual</u>
Fixed assets	\$ 2,671	_____
Working capital	<u>4,814</u>	_____
TOTAL	\$ 7,485	_____

### SALES REVENUE

The sales revenue will depend on the sales methods. If the entire output is sold to tourists, the sales revenue would be considerably more than would accrue from selling to stores. Based on selling one-half the output to tourists and one-half to stores, the sales price per rug would be about \$66.66. Based on this price the annual sales would amount to about \$80,000.

### RECAPITULATION OF COSTS, SALES AND PROFITS

<u>Item</u>	<u>Estimated Cost</u>		<u>Actual Cost</u>
Direct materials	\$ 10,920		_____
Direct labor	38,200		_____
Manufacturing overhead	<u>8,657</u>		_____
Total manufacturing cost		\$57,777	_____
Interest on loans	200		_____
Insurance	40		_____
Legal	150		_____
Auditing	400		_____
Unforeseen expense	<u>1,433</u>		_____
Total administrative costs		2,223	_____
Sales commissions		1,000	_____
Travel, bad debts, discounts and allowances, freight-out		500	_____
Profit before taxes		<u>18,500</u>	_____
Total annual gross sales		\$80,000	_____

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:

<u>Account Number</u>	<u>Monthly Expense</u>	<u>Monthly Budget</u>	<u>Annual Budget</u>	<u>Actual</u>
10 Administrative	\$ _____	\$ 66	\$ 790	\$ _____
20 Sales	_____	125	1,500	_____
30 Direct Materials	_____	910	10,920	_____
40 Supplies	_____	17	200	_____
51 Power*	_____	8	100	_____
52 Water*	_____	2	20	_____
53 Fuel	_____	17	200	_____
60 Unforeseen Expense (Reserve Account)	_____	120	1,433	_____
71 Direct Labor*	_____	3,183	38,200	_____
72 Indirect Labor*	_____	666	8,000	_____
80 Depreciation (Reserve Account)	_____	11	137	_____



**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

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

**R. W. MITCHELL MANUFACTURING COMPANY**

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.

### 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?

### 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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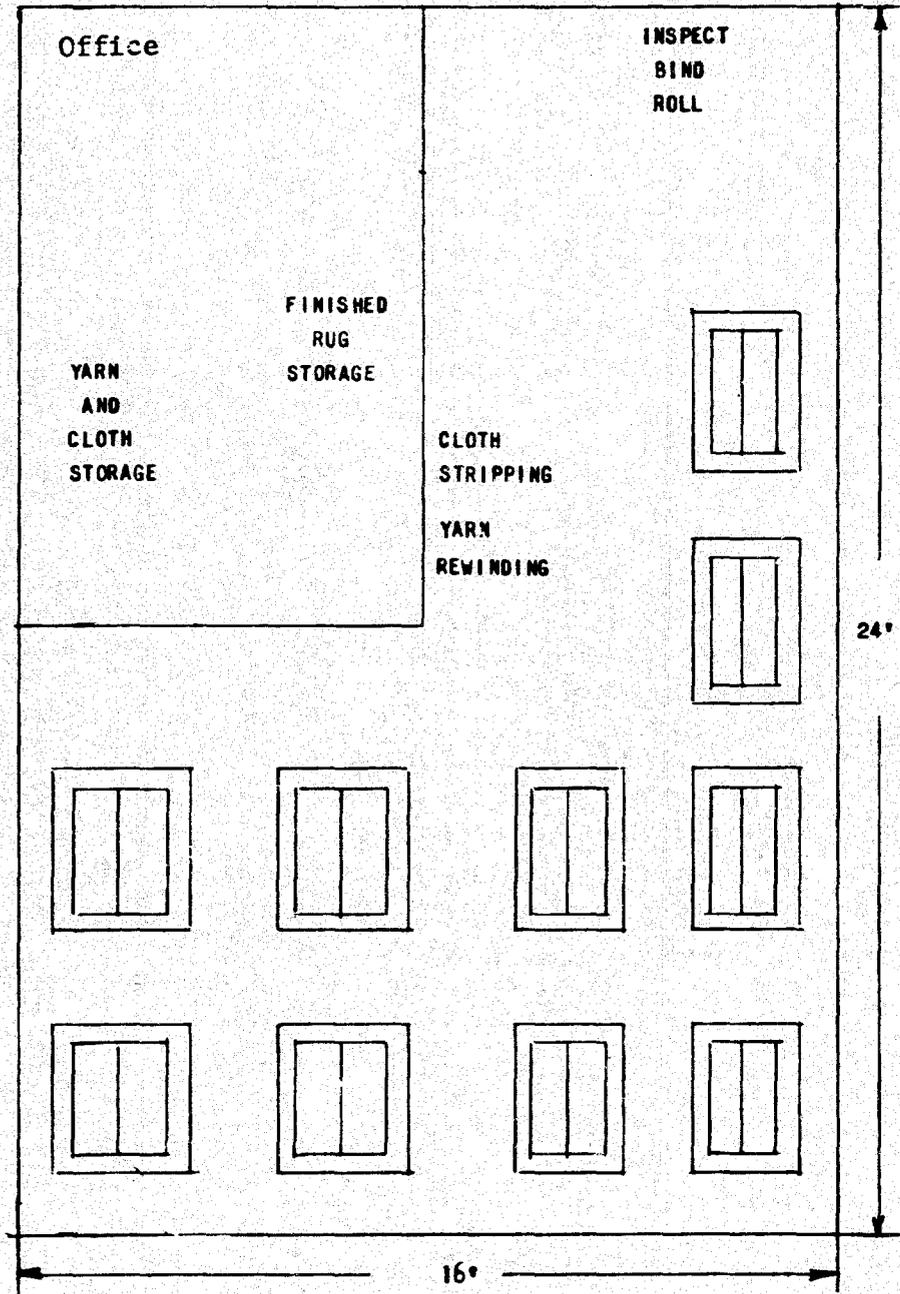
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"Rare Hooked Rugs," W. W. Kent \$2.95  
Harlem Book Co.  
221 Fourth Avenue  
New York 3, New York

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Rose Cottage  
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PLANT LAYOUT



Scale  $\frac{1}{4}'' = 1'$