IT REQUIREMENTS FOR MANUFACTURE OF SANITARY WARE

TECHNICAL AIDS BRANCH

INTERNATIONAL COOPERATION ADMINISTRATION

Washington, D. C.

REVISED
MAY 1959

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 R. Poliakoff, Industrial Consultant, 126 Eleventh Avenue, New York 11, New York.

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SANITARY WARE

INTRODUCTION

The process of enameling cast iron sanitary ware imparts a hard, glossy surface to the object. This coating permits easy cleaning and presents a pleasing appearance. It is stain resistant, highly acid resistant, and, if properly applied and given reasonable care in usuage, will last almost indefinitely.

The type of plant selected for this manual is one which could be set up in almost any part of the world. The basic raw materials -- pig iron, scrap iron, and sand -- are ordinarily obtainable in all parts of the world. Where special skills would be required for the production of the ware, modern machinery has been substituted wherever feasible. In this way, the operation can be started more readily and quality standards can be reached sooner.

GENERAL ASSUMPTIONS

In order to make realistic estimates, certain assumptions must be made. These are:

1. The costs of building, equipment, and material necessary are based on United States prices.

2. Labor costs used are the average for the industry and skill described, based on recently published figures of the United States Bureau of Labor Statistics.

3. All other costs, statistics, and figures are based on current United States prices.

4. Adequate heat, light, water, and electricity are available at the plant site.

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

6. The plant operates on a 40-hour week -- a one-shift labor force, except for enameling sections which operate on a 24-hour basis.

7. No special provision is made for the training of new personnel. It is assumed that learners' 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, for the purpose of computing 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

Basically there are two sanitary ware markets:

1. Consumer (private dwelling)
2. Industrial and institutional

Where plumbing and sewage systems are already installed, the consumer market represents a great sales potential. However, in areas where these facilities must be installed before private dwellings can make use of sanitary ware, the industrial and institutional market will offer the largest potential. There are two reasons for this: first, water supply and sewage disposal are necessary for the operation of most plants; second, government regulations usually require adequate sanitary facilities in public use for the control of disease.

The product line used for this study is of a design suited primarily for industrial and institutional use. It was chosen on the basis of simplicity in manufacturing requirements and for function rather than style.

The enameled cast iron process lends itself well to the more simple shapes of ware in which the surfaces requiring an enamel coating are easily reached. The ability of enameled cast iron ware to withstand rough handling and usage combined with its lower weight makes it the most favorable type to consider for most areas.

The three products used as a basis for this report are illustrated in figure 1. The drawings serve only to indicate the types of products assumed.

MANUFACTURING OPERATIONS

The manufacturing operations used to produce enameled cast iron sanitary ware fall into three distinct divisions:

1. Casting or molding the product
2. Preparing the casting for enameling
3. Enameling the casting

Casting

The quality of the finished ware is determined to a large extent at the time of casting. As a result, the mold makers must be careful workers of relatively high skill.

To prepare a mold into which molten iron will be poured and there solidify to the shape of the pattern used to make the mold, the following steps must be carried out:

1. The bottom half (drag) of a flask (see figure 2) is placed with its top down on the jolt stripper machine (figure 3) around the pattern which is attached to the table of the machine. Molding sand, which has been conditioned by adding water and binders, is then dropped into the drag from an overhead conveyor-fed hopper (figure 4). The machine packs the sand around the pattern to the proper density and then lifts the drag away from the pattern. The drag is then turned over using the hoist and placed on the gravity conveyor.

2. The upper half of the flask (the cope) is prepared in a similar manner. Pouring holes, riser holes, and vents are cut from the top of the cope in to the pattern so that the molten iron can flow freely throughout the cavity formed when the cope is placed on the drag.

3. The cope is placed on top of the drag and locked in place. For this operation, the hoist is used to lift and move the cope. Three men having better than average skill are required to bring the mold up to this point.

4. The assembled mold then moves to the pouring station. The molten iron is tipped from the cupola (figure 5) into a large (bull) ladle (figure 6). It is then poured into a smaller ladle (figure 6) which is easily handled by 2 men. The metal is poured into the mold, through the pouring hole, and completely fills the cavity left by the removal of the pattern. This operation requires 2 men and also demands a great amount of care to insure a well-formed casting.

5. The mold moves along the conveyor and is allowed to cool from 6 to 9 minutes before moving onto the shakeout machine (figure 7). Here the flask is removed and the shakeout machine vibrates the casting, removing the sand. The sand drops through grids in the shakeout into a bin to be prepared for reuse at the molding machine. Here also sprues and gates are snapped off. The operation is relatively simple and requires only low skilled labor.

The sand which has been removed can be reconditioned for use as backup sand only. All foreigh materials are screened out and the sand is remixed with new binders. New sand must be used in conjunction with the old and must be added each day in the preparation of one part new sand to 5 parts old sand.

Preparing the Casting for Enameling

Before the product is enameled it is necessary to remove all roughness from its exposed surfaces. This is done by directing metal particles under pressure at the surface as the casting revolves. This is accomplished in a specially designed cleaning room (figure 8). The rough spots not removed by the blasting are ground off using an abrasive wheel on a hand grinder (figure 9). The operation requires relatively low skilled personnel.

Enameling

The first operation in the enameling process is the spraying on of the ground coat which is a wet base enamel (figure 10). This coat can be air dried. The product is then moved to a furnace to be heated preparatory to receiving the finish coat of enamel. When the product has reached a temperature of approximately 1800°F., it is removed from the furnace onto an air operated tilting table. The table is then moved under a mechanical sieve which sifts the "frit" onto the product. Here the frit partially fires to the surface because of the high temperature of the product, but to complete the fusion, it is returned to the furnace. The furnace is capable of handling one product at a time and while one product is being heated, another is being enameled. These operations require a high degree of skill in order to insure a uniform coating free from crazing, cracks, chips, or hairlines.

The product is then crated in wood crates using steel straps to secure the packing.

MANUFACTURING UNIT USED

The total plant capacity is about 10 tons of finished work per day. This production is figured on the basis of producing 40 wash sinks each weighing 200 pounds, 57 urinals each weighing 140 pounds, and 80 toilets each weighing 50 pounds. Those associated with the cast iron enamel ware industry generally agree that this is the smallest manufacturing unit that can be produced with any economy.

DIRECT MATERIALS

The list of direct materials is based on the needs for one year's production. The enameling agent (frit) is regarded as being purchased already prepared for application. Actually, further consideration may show that an additional investment for machinery for preparing chemicals for frit may result in worthwhile savings.

Direct Materials Required for One Year's Production

Description	Consumption Per Year	Unit Price	Estimated Price	Actual Price
Pig iron	1,462 tons	$ 70.00	$ 102,340	
Purchased scrap	1,280 tons	40.00	51,200	
Home scrap	957 tons	40.00	38,280	
Crating lumber	630 M bd ft	85.00	53,550	
Steel strapping 3/4"	15,800 lin ft	.12	1,900	
Wet base enamel	37.5 tons	280.00	10,500	
Frit - dry ground	250 tons	200.00	50,000	
Total			$ 307,770	

PRODUCTION TOOLS AND EQUIPMENT

Description	Units Required	Unit Price	Estimated Price	Actual Price
Melting				
#4 Cupola	1	$ 3,500	$ 3,500	
Spark arrester	1	200	200	
Roof board	1	150	150	
Blower with motor and controls	1	2,700	2,700	
Cupola lining		1,100	1,100	
Balance type car	1	1,500	1,500	
Platform scale	1	1,100	1,100	
Sand Preparation				
Heavy duty shakeout	1	6,600	6,600	
Sand handling equipment including: feeder, magnetic head pulley, vibrating screen, mixer, conveyor		10,000	10,000	
Molding				
Jolt stripper machine	1	19,000	19,000	
1,500 pound capacity bull ladle including gearing	1	1,500	1,500	

Production Tools and Equipment - Continued

Description	Units Required	Unit Price	Estimated Price	Actual Price
Molding - Continued				
600 pound capacity ladle with 2-man pouring shank	1	$ 300	$ 300	
3-ton hoist with track	1	3,300	3,300	
Patterns	2	5,000	10,000	
Patterns	2	3,000	6,000	
Gravity conveyor	1	3,000	3,000	
Cast iron flasks with grids	15	600	9,000	
1-ton hoist and monorail	1	800	800	
Cleaning				
Metal abrasive throwing equipment	1	43,000	43,000	
Portable electric grinder and converter	1	1,000	1,000	
Enameling				
Furnace 8' x 6' x 4'	2	8,500	17,000	
Air operated table	2	1,500	3,000	
Mechanical sieve	2	100	200	
Spray equipment including: pressure feed tank, regulator transformer, hose and connections, compressor	1	4,000	4,000	
Dry ceramic spray booth	1	1,700	1,700	
Spray gun	1	50	50	
General				
Exhaust fans	2	350	700	
Hand trucks	2	50	100	
Total			$ 1,[illegible]500	

OTHER TOOLS AND EQUIPMENT

Maintenance				
Tools and equipment		$ 500	$ 500	
Office				
Typewriters	2	150	300	
Adding machine	1	125	125	
Total			$ 925	

FURNITURE AND FIXTURES

Description	Units Required	Unit Price	Estimated Price	Actual Price
Filing cabinets	3	$ 80	$ 240	
Desks and chairs	4	100	400	
Total			$ 640	

PLANT LAYOUT

A preliminary layout of the major pieces of equipment listed on page 5 is given in figure 11. The general arrangement of both departments and equipment is designed to facilitate economical manufacturing.

PLANT SITE

To provide for eventual expansion, the land for the plant site should contain at least 30,000 square feet. The site should be level, well drained, and should be located as advantageously as possible with respect to transportation, power, water, fuel, sources of markets and labor. The cost of such a site is estimated at $1,000.

BUILDING

A one-story building, 170 feet x 70 feet or about 12,000 square feet, with a sidewall height of about 16 feet, will provide ample space for all operations including an office. It may be constructed with any suitable building materials. It is estimated that the complete building, including adequate plumbing and wiring, will cost about $4.00 per square foot, or a total of about $48,000.

POWER

About 160 kilowatt hours per day of power will be required. Based on a cost of $.025 per kilowatt, the annual cost of power for all purposes is estimated at $1,000.

FUEL

It is estimated that the fuel and oil consumption for production, heating and sanitary purposes will amount to about $18,000 per year.

WATER

Water requirements for the purposes of production, heat, sanitary facilities, drinking purposes and fire protection is estimated at $300 per year.

ANNUAL PRODUCTION CAPACITY

Based on the daily capacity shown on page 4 under Manufacturing Unit Used, the annual production capacity is listed below.

Wash Sinks	10,000
Urinals	14,250
Toilets	20,000

DIRECT LABOR

Operation	Number Required	Hourly Rate	Annual Cost	Actual Cost
Cupola	1	$ 1.80	$ 3,600	
Cupola Helpers	2	1.50	6,000	
Molding Machine	1	1.80	3,600	
Molding Machine Helpers	2	1.50	6,000	
Pouring	2	1.70	6,800	
Crane Operator	1	1.70	3,400	
Shakeout	3	1.50	9,000	
Cleaning	3	1.50	9,000	
Grinding	2	1.50	6,000	
Spraying	3	1.60	9,600	
Enameling	18	1.50	54,000	
Sanding and Handling	2	1.50	6,000	
Crating	5	1.50	15,000	
Utility Man	1	1.50	3,000	
Total	46		$141,000	

INDIRECT LABOR

Operation	Number Required	Hourly Rate	Annual Cost	Actual Cost
Manager	1		$ 10,000	
Foreman - Molding	1		6,000	
Foreman - Enameling	1		6,000	
Bookkeeper	1		5,000	
Secretary	1		3,000	
Maintenance	1	$ 1.80	3,600	
Receiving and Shipping	1	1.60	3,200	
Janitor	1	1.50	3,000	
Total	8		$ 39,800	

DEPRECIATION

Description	Estimated Price	Years' Life	Estimated Per Year	Actual Per Year
Building	$ 48,000	20	$ 2,400	
Production tools and equipment	150,500	10	15,050	
Other tools and equipment	925	10	93	
Furniture and fixtures	640	10	64	
Total			$17,607	

SUPPLIES

Item	Annual Estimate	Annual Actual
Molding sand	$ 33,900	
Coke by-product	15,000	
Metal abrasives	10,000	
Alloy briquettes, parting sand and fire clay	5,000	
Maintenance	1,800	
Hand tools	400	
Office supplies	300	
Total	$ 66,400	

MANUFACTURING OVERHEAD

Item	Annual Estimate	Annual Actual
Indirect Labor	$ 39,800	
Power	1,000	
Fuel and oil	18,000	
Water	300	
Supplies	66,400	
Depreciation	17,607	
Total Manufacturing Overhead	$143,107	

UNIT COST OF MANUFACTURING

		Estimated	Actual
Wash Sinks			
Direct Labor	- 35%	$ 49,350	
Materials	- 37%	113,875	
Overhead	- 35%	50,087	
Total		$ 213,312	
Unit Cost - Wash Sinks		$ 21.33	
Urinals			
Direct Labor	- 40%	$ 56,400	
Materials	- 36%	110,797	
Overhead	- 40%	57,243	
Total		$ 224,440	
Unit Cost - Urinals		$ 15.75	
Toilets			
Direct Labor	- 25%	$ 35,250	
Materials	- 27%	83,098	
Overhead	- 25%	35,777	
Total		$ 154,125	
Unit Cost - Toilets		$ 7.71	

TOTAL COST OF MANUFACTURING

Direct Labor	$ 141,000	
Materials	307,770	
Overhead	143,107	
Total Manufacturing Cost	$ 591,877	

WORKING CAPITAL

Item		Estimated	Actual
Materials	- 30 days	$ 25,600	
Direct Labor	- 30 days	11,700	
Overhead	- 30 days	11,800	
Reserve Accounts Received	- 30 days	76,800	
Total		$ 125,900	

FIXED ASSETS

Land	$ 1,000	
Building	48,000	
Production Tools and Equipment	150,500	
Other Tools and Equipment	925	
Furniture and Fixtures	640	
Total	$ 201,065	

CAPITAL REQUIREMENTS

Working Capital	$ 125,900	
Fixed Assets	201,065	
Total	$ 326,965	

PROVISION FOR EXPANSION

The most simple change in the product line would be in other sizes of the products illustrated in figure 1. However, the line may be diversified to include sanitary ware for home use, such as lavatories and kitchen sinks, with minor changes in the production setup. The addition of new mold patterns would of course be necessary. Heavier products such as bath tubs and laundry sinks could be accommodated by the present equiment plus the addition of a heavier crane and such aids as would be necessary to facilitate handling through the finishing and packing operations.

SALES REVENUE

Products similar in design, weight and production requirements manufactured in the United States sell to wholesalers for about:

$33.00 for the Wash Sink
24.00 for the Urinal
12.50 for the Toilet

On this basis the gross sales would amount to:

Wash Sink	10,000 x $33.00	=	$ 330,000
Urinal	14,250 x 24.00	=	342,000
Toilet	20,000 x 12.50	=	250,000
	Total		$ 922,000

RECAPITULATION OF COSTS, SALES AND PROFITS

	Estimated		Actual
Direct Materials	$ 307,770		
Direct Labor	141,000		
Manufacturing Overhead	143,107		
Total Manufacturing Costs		$ 591,877	
Interest on Loans	$ 30,000		
Insurance	4,000		
Legal	2,400		
Auditing	3,600		
Unforeseen Expense	27,123		
Total Administrative Costs		67,123	
Sales Commissions, Travel Freight Out, Bad Debts, Discounts and Allowances		63,000	
Profit before Taxes		200,000	
Total Annual Gross Sales		$ 922,000	

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	$_____	$ 3,333	$ 40,000	$_____
20	Sales	_____	5,250	63,000	_____
30	Direct Materials	_____	52,647	307,770	_____
40	Supplies	_____	5,533	66,400	_____
51	Power*	_____	83	1,000	_____
52	Water*	_____	25	300	_____
53	Fuel	_____	1,500	18,000	_____
60	Unforeseen Expense (Reserve Account)	_____	2,260	27,123	_____
71	Direct Labor*	_____	11,750	141,000	_____
72	Indirect Labor*	_____	3,316	39,800	_____
80	Depreciation (Reserve Account)	_____	---	17,607	_____

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

PURCHASE REQUISITION	COMPANY NAME	DATE

☐ 10 AIMINISTRATION ☐ 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 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

Pattern	An accurate replica of a part, generally made of wood, which is used to form the cavities in a sand casting mold.
Flask	A metal or wood box without top and without fixed bottom, used to hold the sand in which a mold is formed. It usually consists of two parts, cope and drag. It remains on a mold during pouring.
Cope	The upper section of a flask, mold, or pattern.
Drag	The lower section of a flask, mold, or pattern; also sometimes called a nowel.
Riser	A reservois or molten metal provided to compensate for the internal contraction of the casting as it solidifies.
Gate	The end of the runner where the molten metal enters the mold.
Runner	The connection between the sprue and the gate.
Sprue	Gates and risers.
Cupola	A kind of blast furnace for melting metal, which consists of a vertical cylinder lined with refractory material and provided with openings for the entrance of a "blast" of air under pressure. In it metal is melted in direct contact with the fuel.
Frit	Small friable pieces of enamel glass, the result of quenching and shattering the molten enamel.
Crazing	The spontaneous occurrence, on an enameled piece, of fine, nearly invisible lines which are definite cracks in the enamel coating, extending to the base metal.
Hairlines	Lines appearing in an enameled surface which are slightly depressed below the surface in the shape of a groove and <u>not</u> extending to the base metal.

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Textbooks

Cast Metals Handbook	American Foundrymen's Society Gulf and Wold Road Des Plaines, Illinois
Steel Castings Handbook	Steel Foundry Assoc. of America 606 Terminal Tower Building Cleveland 13, Ohio
Gray Iron Casting Handbook	Gray Iron Foundry Society 930 National City Building East 6th Street Cleveland 14, Ohio
American Malleable Iron	Malleable Founders' Society 1800 Union Commerce Building Cleveland 14, Ohio

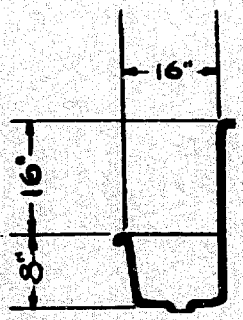
Periodicals

Foundry	Penton Publishing Company Cleveland 13, Ohio
Iron Age	Chilton Company Chestnut and 56th Streets Philadelphia 39, Pennsylvania

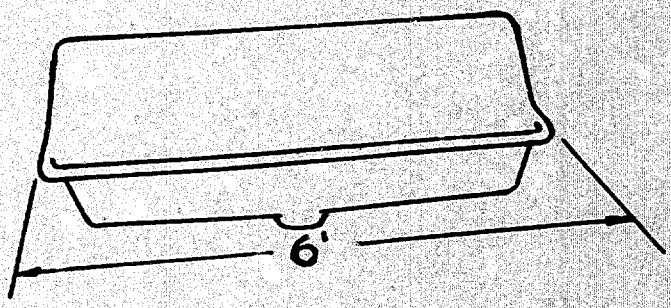
ABBREVIATIONS

^{o}F	Degree Fahrenheit
%	Percent
#	Number
'	Foot or feet
"	Inch or inches
M	Thousand
bd ft	Board feet
lin ft	Lineal feet

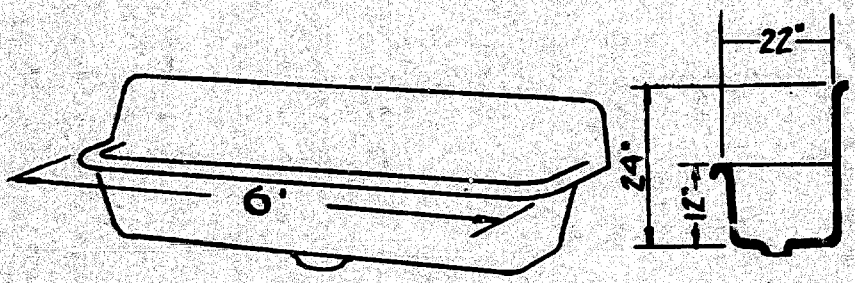
APPENDIX IV -- ILLUSTRATIONS:



SECTION

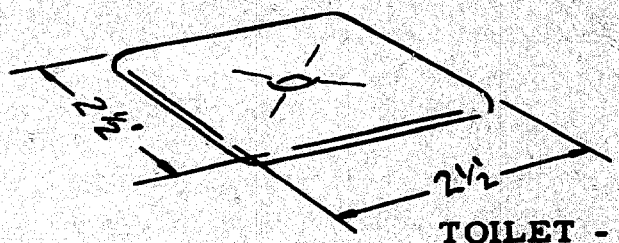


URINAL - 140 Pounds



SECTION

WASH SINK - 200 Pounds



TOILET - 50 Pounds

SECTION

Figure 1 - Sanitary ware products

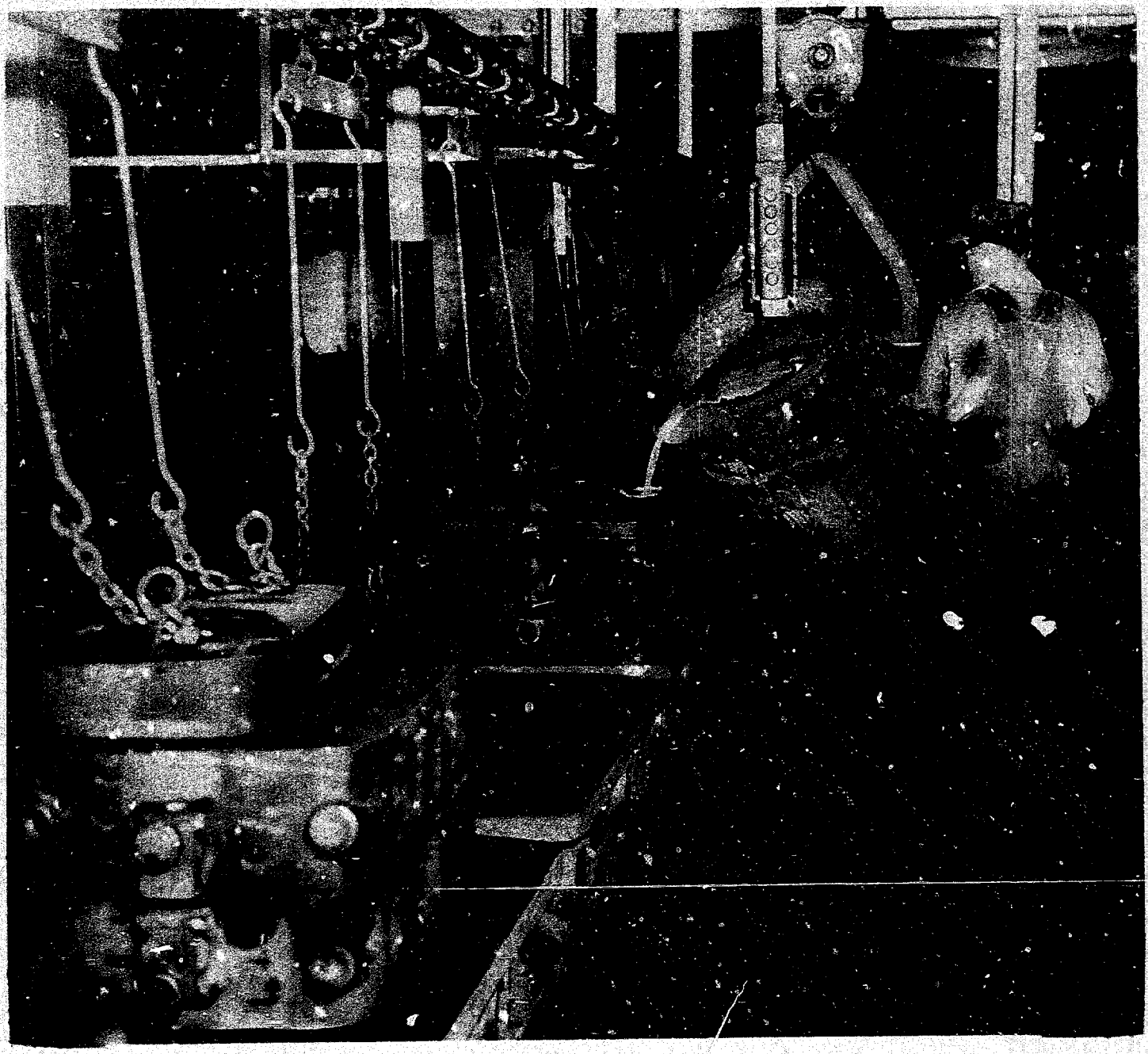


Figure 2 - Molten iron being poured into molds in assembled flasks

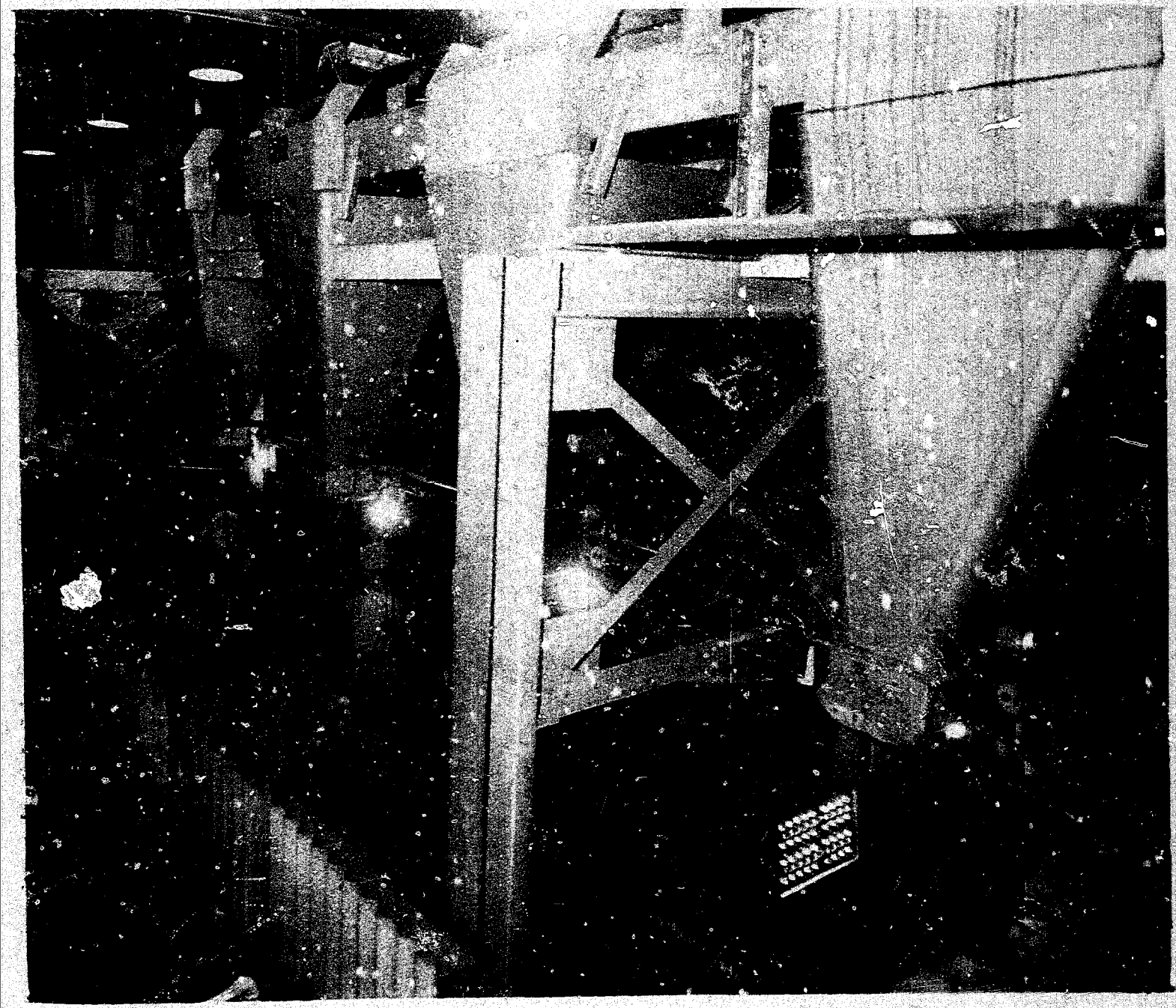


Figure 3 - Overhead conveyor-fed sand

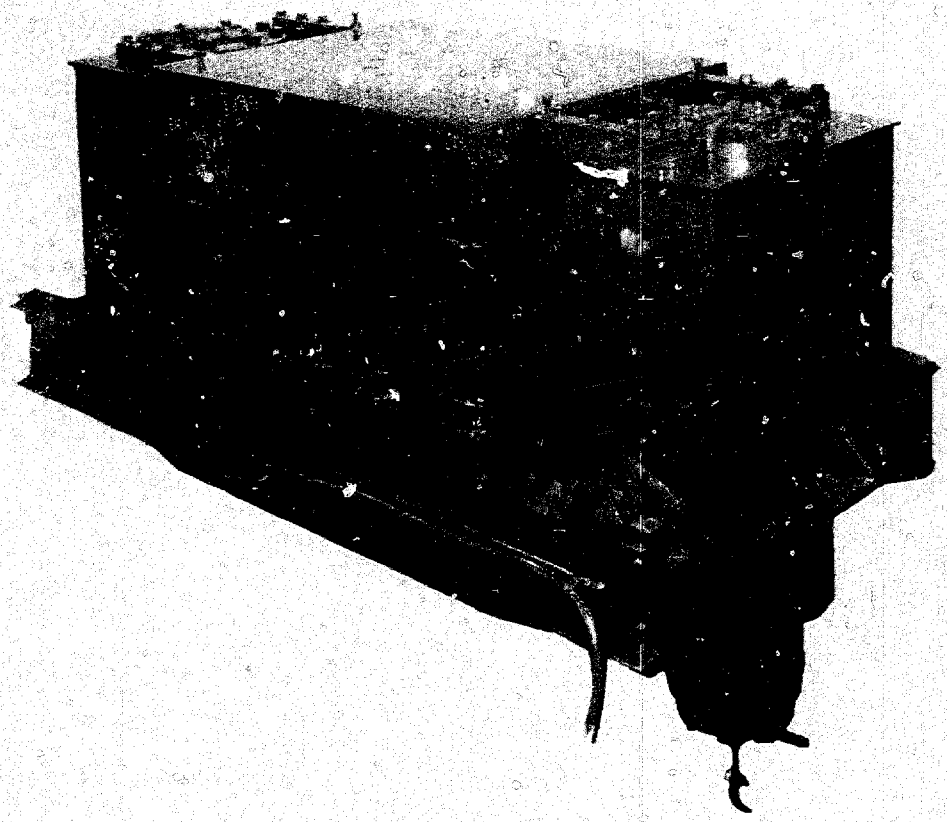


Figure 4 - Jolt stripper machine

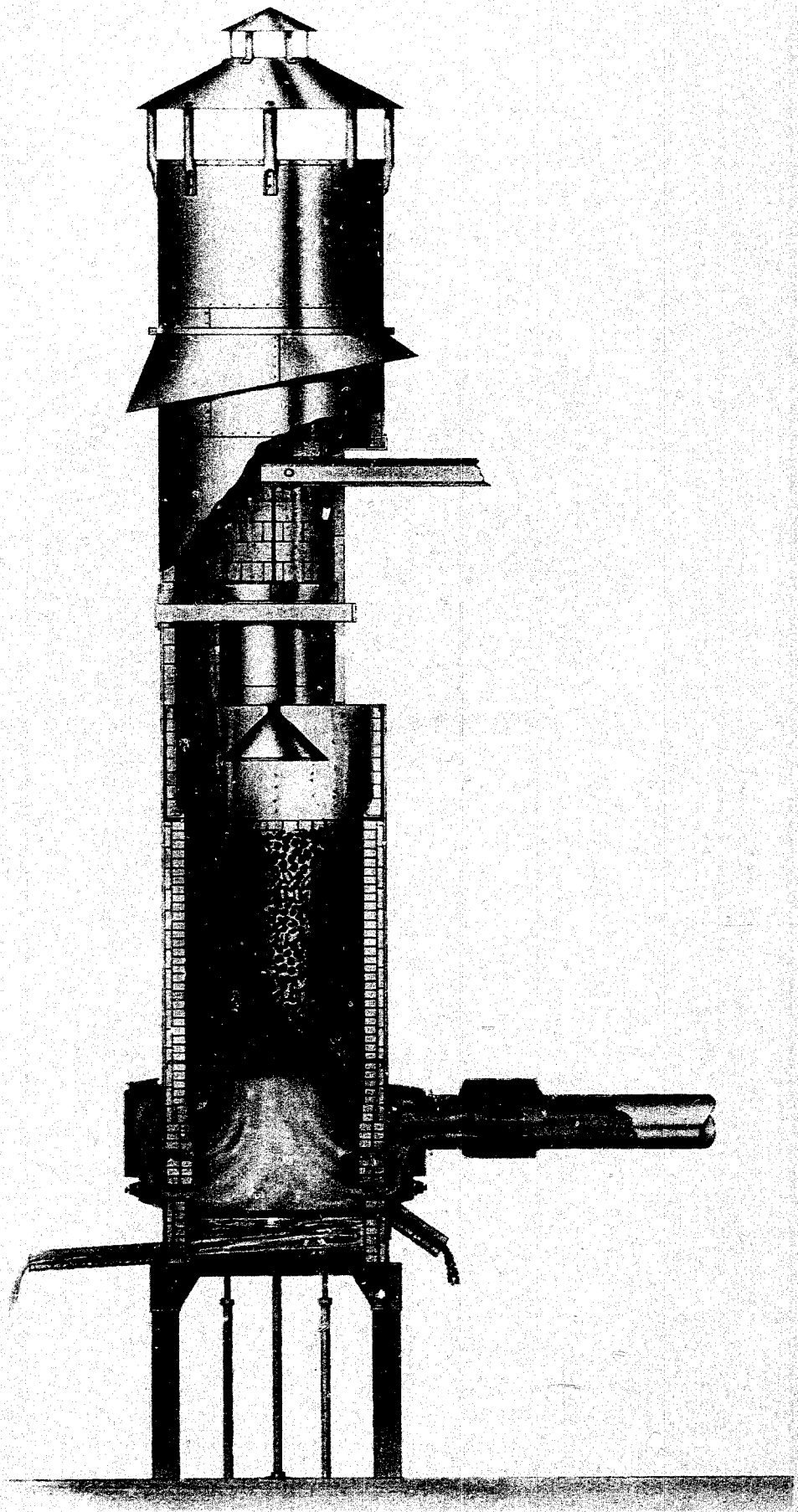


Figure 5 - Cross section of a cupola

Figure 6 - Pouring molten iron from a bull ladle into a small ladle

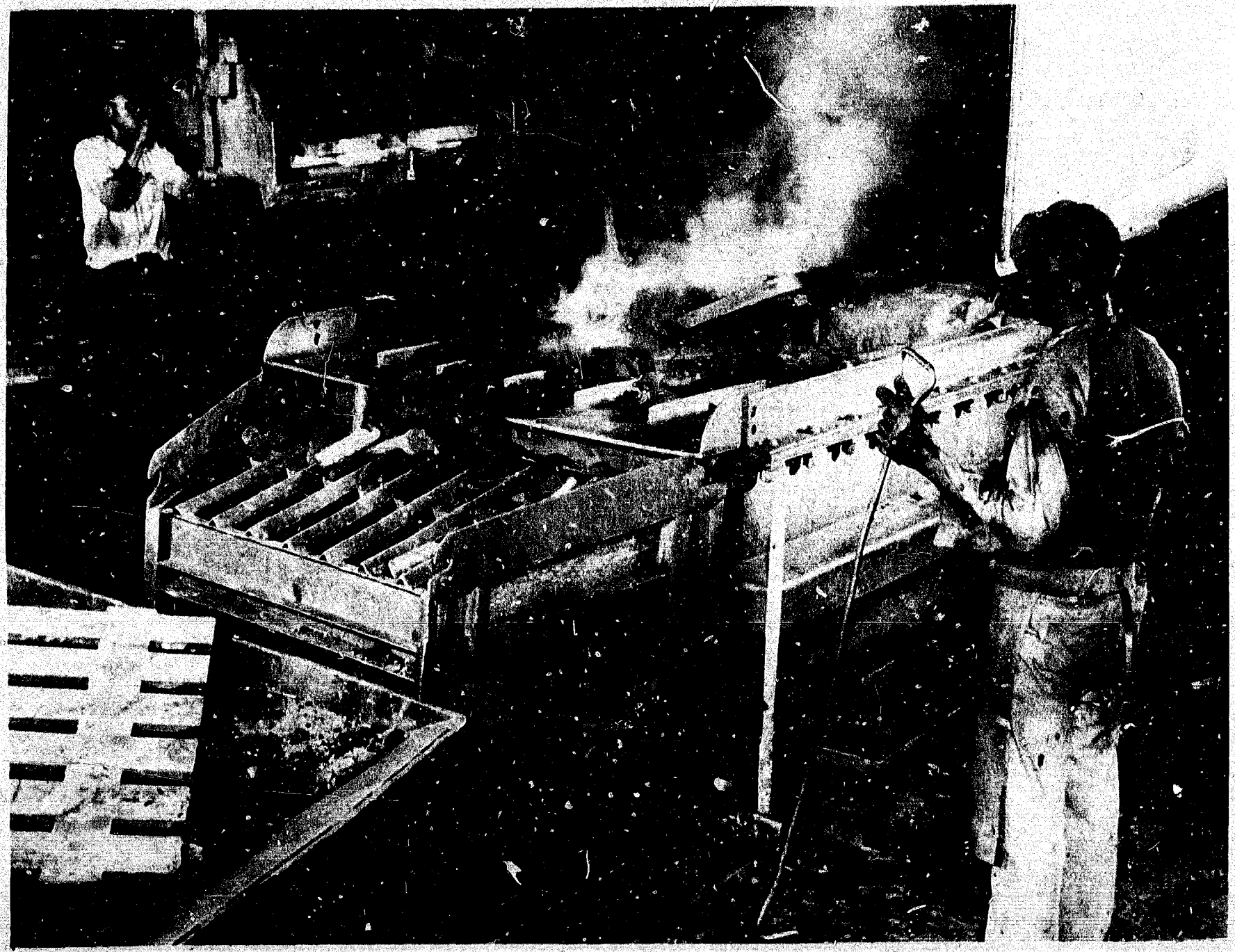


Figure 7 - A shakeout for separating sand from casting

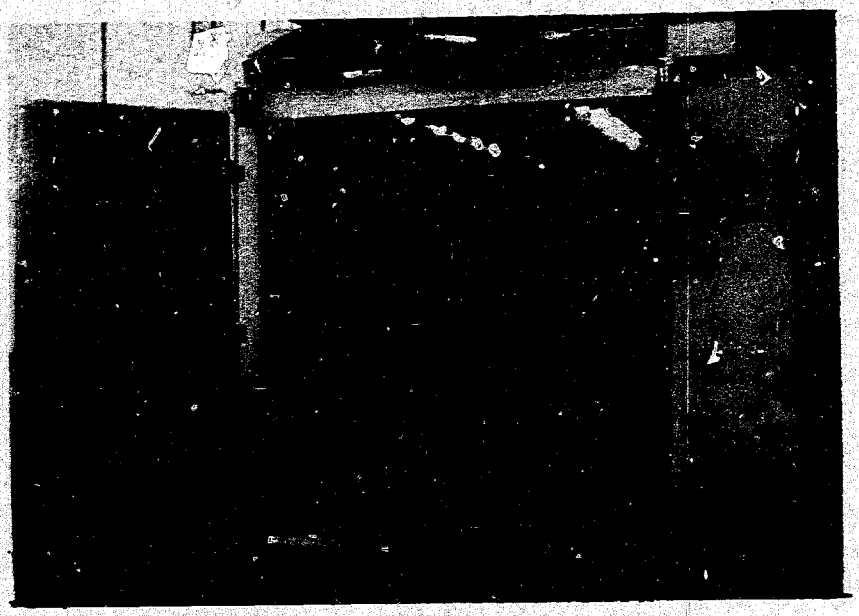


Figure 8 - Cleaning room

Figure 9 - Hand grinding operation

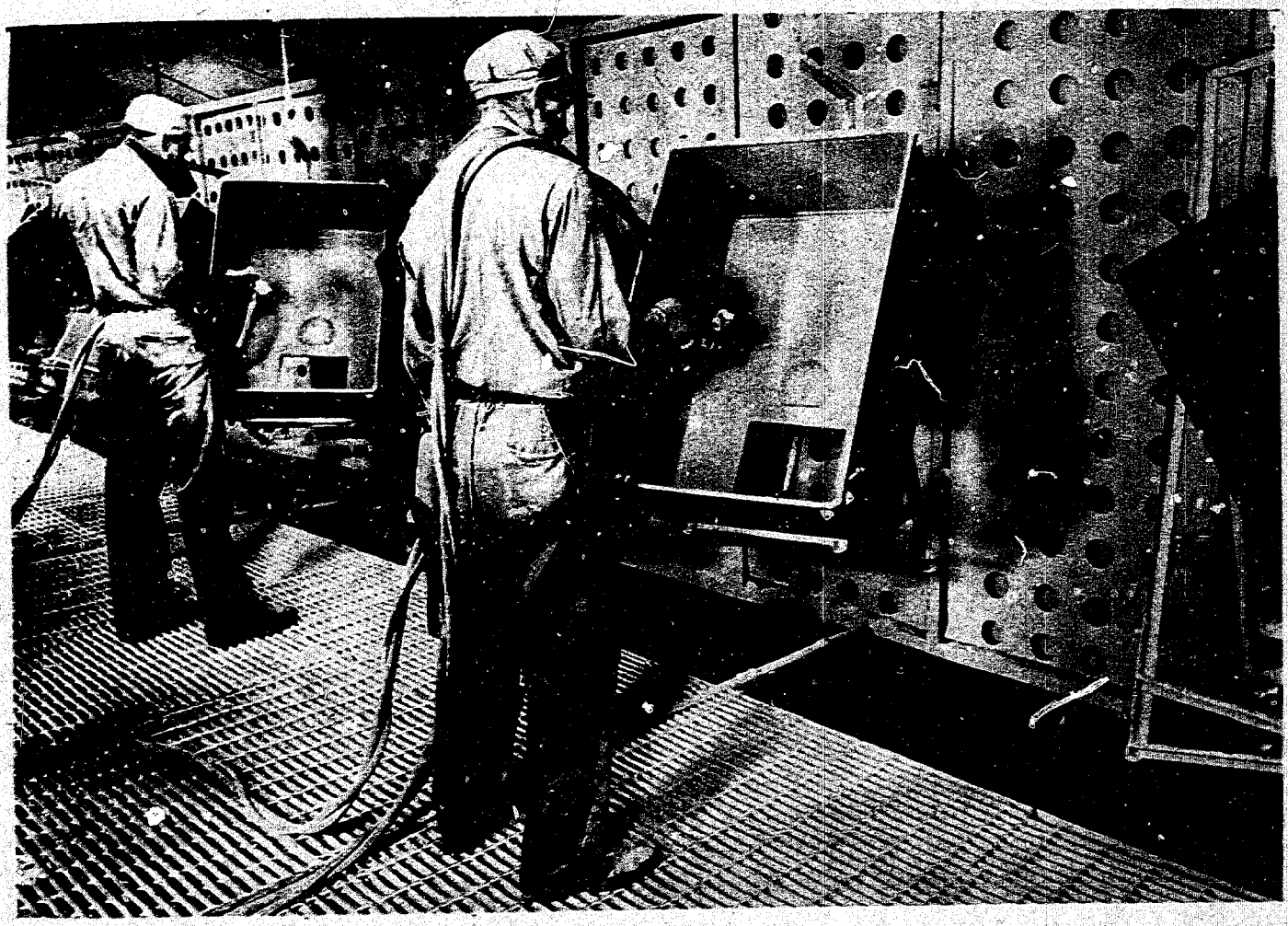
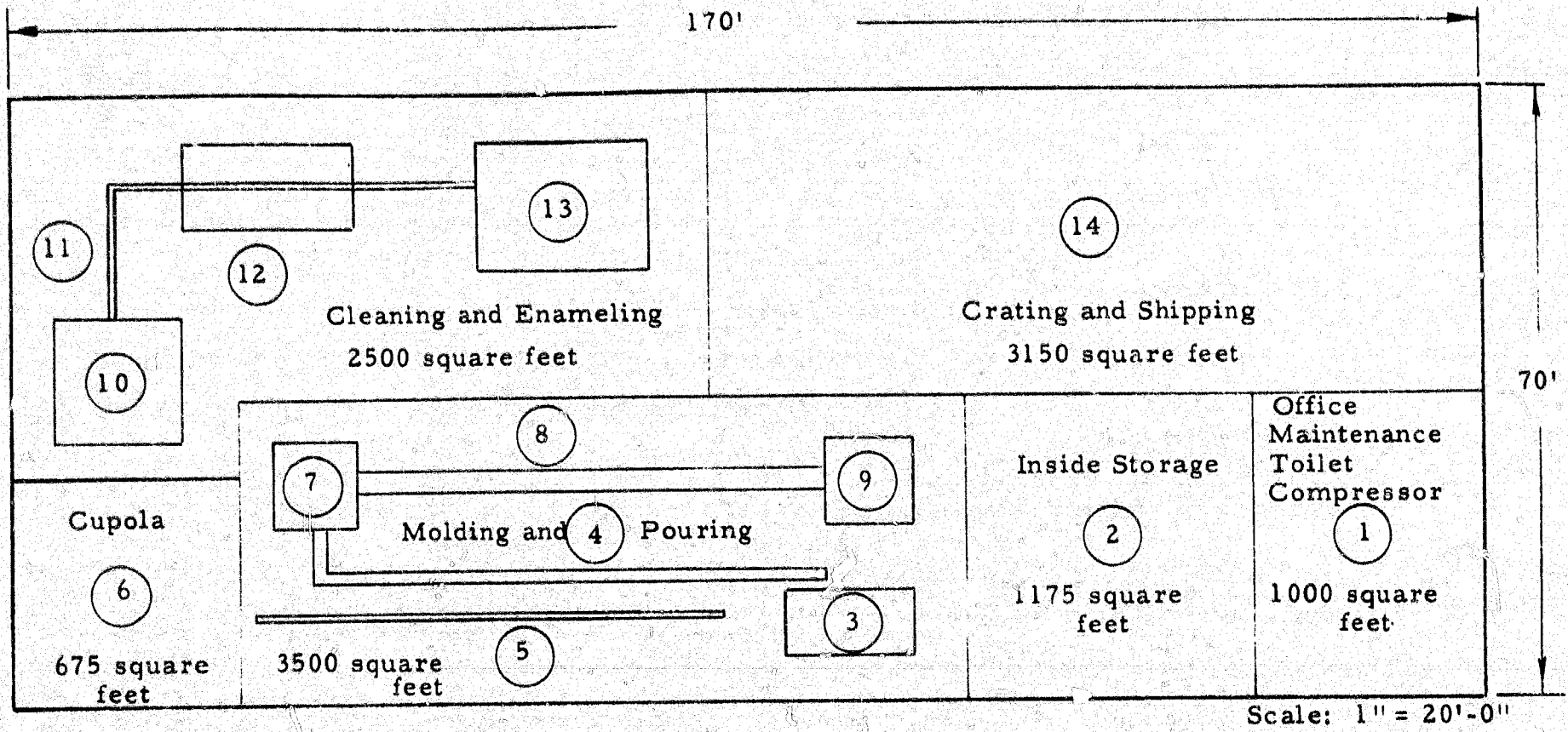


Figure 10 - Spraying ground coat



Key

1. Office, maintenance, rest rooms, and compressor
2. Inside storage
3. Molding machine
4. Gravity conveyor
5. Ladle hoist
6. Cupola
7. Shakeout machine
8. Used sand conveyor
9. Sand reconditioner
10. Cleaning
11. Ground coat spray area
12. Tilt table and frit applicator
13. Enameling furnace
14. Crating and shipping

Figure 11 - Preliminary plant layout

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.

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● TRAINING MATERIALS SERVICE

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