PLANT REQUIREMENTS FOR MANUFACTURE OF KITCHEN EARTHENWARE

TECHNICAL AIDS BRANCH

INTERNATIONAL COOPERATION ADMINISTRATION

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FOREWORD

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

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

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

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

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The original report was prepared by the 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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K I T C H E N E A R T H E N W A R E

INTRODUCTION

Kitchen earthenware is the name given in the United States to that form of clay pottery commonly used in the kitchens and on the tables of American homes and restaurants, cafeterias and other establishments and institutions serving foods. While such ware may be decorated, by far the greater portion is white without decoration and simple in design.

Because each home, establishment or institution uses many plates, saucers, cups and other earthenware dishes, the total number required runs into many millions. This large market keeps many kitchen earthenware plants busy year after year.

Kitchen earthenware is comparatively inexpensive because low cost raw materials are found in many places; and by using mass production methods wherever possible, the labor and other costs are kept low.

These facts make for a fairly stabilized large volume market. For the most part, the plants making this ware are consistently profitable.

GENERAL ASSUMPTIONS

In order to make realistic estimates, it has been necessary to use certain general assumptions. These are:

1. Costs are based on 1959 prices in the United States. Labor rates were determined by averaging going rates in United States plants similar to the operation herein described.

2. Adequate and suitable water, sewage, power and transportation are available at the plant site.

3. The plant will operate 5 eight-hour shifts per week, 50 weeks per year, except for the kiln, which will operate three shifts per working day.

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

5. 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 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.

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

PRODUCTION CAPACITY

The production capacity of this plant is 16,000 units per day, based on an 8 hour day, or 4,000,000 units per year, based on 250 days per year. The production can be increased by working more hours per day, more days per week, or extra shifts per day.

MANUFACTURING PROCESS

Kitchen earthenware is made in either of two basic ways:

Slip Casting

In this method, the clay body used is fluid enough to pour. The water content may vary from 12% to more than 50% of the dry clay, usually nearer the latter amount in order for the product to be more homogeneous when finished.

Soft Mud

In this method, the clay is soft enough to be readily formed, instead of cast, and at the same time it is stiff enough to hold its shape after forming. The water usually range from 25% to 40% of the dry clay. This method permits the use of clays having a wide range of physical properties.

For these reasons, the soft mud process is the most suitable for small plant contemplated herein.

The soft mud method requires the following process:

A. Blunging
B. Screening
C. Filter Pressing
D. Pug Milling and Extruding
E. Molding
F. Glazing
G. Firing
H. Inspection
I. Packing

PREPARATORY STEPS

Before the clay is mixed in the blunger, it must be analyzed, aged, purified, and, in some cases, ground fine enough to assure ware of the desired quality. Depending upon the analysis, some clays are allowed to "season" or "weather" before being used; some must be checked for drying qualities; some must have impurities removed, especially those which would cause discolorations.

In presenting the manufacturing process, it has been assumed that the necessary materials are available in proper quality.

A. Blunging

Once the proportions of raw materials (including water) have been carefully determined by analysis, they are put into a blunger (or mixer) where they are thoroughly mixed to the desired consistency. Usually the blunger is an oval tank, 4 feet across, 5 feet deep, and 8 feet long, containing some 8,000 pounds of dry materials and 1,200 to 1,400 gallons of water. It is equipped with power-driven paddles or agitators.

Running time for each batch will vary with the materials, but usually will range from 3/4 to 1-1/4 hours. The resulting mixture or slurry, called "slip", is semi-liquid and is drawn off through a pipe.

B. Screening

The slip may contain bits of metal, small pebbles, hard pieces of clay, or other foreign objects, so it is passed over a magnetized "lawn", or screen, usually 24 inches across and with a 1/16-inch mesh. This equipment is frequently homemade. The slip then passes into an underground cistern of about twice the capacity of the blunger. This cistern is equipped with a motor-driven agitator, so that the slip may be kept thoroughly mixed.

The slip is pumped over a 36-inch screen (about 90 - 100 mesh).

C. Filter Pressing

The screened slip is too fluid for soft-mud molding, so some of the water must be removed. This is done in a filter press from which the clay is removed in slabs about 4 inches by 24 inches by 24 inches, each slab weighing approximately 45 pounds. The slabs are stored in a surge cistern, where they can age for three days or more.

D. Pug Milling and Extruding

Since the slabs of clay are not uniformly dry, they are put through a kneading operation, which is done in a pug mill. The clay is extruded from the pug mill very much as sausage comes from the meat grinder.

The plasticity of the clay may be controlled, within limits, by the length of time it is pugged. Sometimes the clay goes through a series of mills in order to get the desired plasticity and uniformity.

E. Molding

The clay then is molded on a mechanized potter's wheel, called a "jigger." The clay extruded by the pug mill is cut off into a lump of the right size, dropped onto a revolving jigger mold and flattened into a circular "bat." If the clay is in proper condition, the bat will show no cracks or deformities. It is then transferred to a mold spinning at 300 to 400 revolutions per minute.

The upper surface, lubricated by water, is shaped by a tool pressing from above. The surface is shaped by compacting the bat and by scraping off the excess clay. The newly-shaped bat and the plaster mold, on which it rested during the molding operation, are removed from the jigger, put on a conveyor belt, which carries the ware (as it is now called) and the mold into the drying room. After 24 hours, the ware is removed from the plaster mold and inspected.

Two molding machines are operated by one man.

F. Glazing

After inspection, the ware goes on a link conveyor into the glaze dipping tank, where the glaze is applied. The glaze is set during a period called "preheating" which follows.

G. Firing

After preheating, the ware is loaded onto wheeled trucks and arranged so that the heat can reach all surfaces of each piece. Then each loaded truck is wheeled into the kiln where it remains 25 to 30 hours, depending upon the type of ware and the quality desired.

H. Inspection

After the ware is properly fired, it is wheeled out for cooling and final inspection. Small surface imperfections are removed with a fine abrasive cloth.

I. Packing

The finished ware is then packed for shipping, usually in barrels. The individual pieces are protected by straw.

MATERIAL REQUIREMENTS

Earthenware is made of many materials, the amounts of each varying with the materials themselves and with the requirements of the ware to be made.

The materials used in greatest amounts are listed below, with typical relative amounts used in making common earthenware.

Item	Composition	Amount	Purpose
Kaolin or china clay	Silica, alumina	30%	Plasticity
Ball clay	Silica	8%	Green strength
Flint	Ground quartz, calcined	37%	Controls shrinking
Feldspar	Silica	25%	Flux

Some of the materials required in comparatively small volume are: color compounds, limestone, plaster, glazing compounds, wires, rods, brushes, abrasive cloth, whiting, etc.

Experience indicates that imperfect ware will average about 15% of the marketable ware. This means that in order to average 16,000 pounds of acceptable ware, it is necessary to use approximately 18,400 pounds of materials, plus glazing material.

Careful selection of the raw materials is essential to the quality of the ware produced.

PRINCIPAL MATERIAL REQUIREMENTS

Item	Relative Amount	Weight (pounds)	Estimated Unit Price	Estimated Total Cost	Actual Unit Price	Actual Total Cost
Kaolin	30%	5,520	$10/ton	$27.60	____	____
Flint	37%	6,808	$ 9/ton	30.60	____	____
Feldspar	25%	4,600	$20/ton	46.00	____	____
Ball clay	8%	1,472	$15/ton	11.04	____	____
Glaze	-	1,361	$ 0.20/lb	272.20	____	____
Total Daily Cost of Principal Materials:				$387.44		____
				____		____
Annual cost of Principal Materials -				$96,860.00		____
Add: Miscellaneous Materials				940.00		____
Total Annual Materials Cost:				$97,800.00		____
				____		____

EQUIPMENT REQUIREMENTS

Kitchen earthenware is usually made with standardized equipment. However, different manufacturers have varied opinions relative to equipment requirements. The following equipment will be found in most United States plants producing like quantities and kinds of earthenware:

PRODUCTION EQUIPMENT

Raw Material Storage and Mixing Department	Estimated Cost	Comparative Figures
Portable bucket conveyor	$ 2,000	____
Chain and hoist	300	____
Large hods (homemade)	200	____
Special material bins (homemade)	400	____
Scales	900	____
Total	$ 3,800	____

Blunging and Screening Department	Estimated Cost	Comparative Figures
Blunger	$ 2,100	_____
Cistern with agitator	2,700	_____
Piping system (all processing)	2,500	_____
Magnetic screen	200	_____
100-mesh screen and tank	500	_____
Total	$ 8,000	_____

Filter Press and Clay Slab Storage		
Filter press	$ 4,000	_____
Trough for water	200	_____
Cistern (stationary)	1,200	_____
Scoop shovel lift truck	4,000	_____
Total	$ 9,400	_____

Molding (including Pug Mill & Extrusion)		
Power conveyor (continuous)	$ 3,800	_____
Pug mill	3,200	_____
Extruder	2,000	_____
Molding machines (8)	24,000	_____
Benches	200	_____
Total	$33,200	_____

Drying Room Equipment		
Conveyor (powered-overhead and belt)	$ 3,000	_____
Racks, benches, (homemade)	2,000	_____
Total	$ 5,000	_____

Glazing Department		
Dipping machine	$ 3,550	_____
Miscellaneous equipment	750	_____
Total	$ 4,300	_____

Baking and Finishing	Estimated Cost	Comparative Figures
* Tunnel kiln, 200-feet long, including all controls, flat cars and racks	$ 100,000	_____
Miscellaneous equipment	2,000	_____
Total	$ 102,000	_____
Total Cost of Production Equipment	$ 165,700	_____
Installation Costs	9,300	_____
Total	$ 175,000	_____

GENERAL EQUIPMENT

Description	Estimated Cost	Actual Cost
1 Fork-lift truck	$ 3,000	_____
1 Air compressor	3,000	_____
Pattern shop equipment	3,500	_____
Chemical equipment	3,000	_____
Miscellaneous requirements (lockers, benches, stools)	500	_____
1 one-ton pickup truck	2,500	_____
Total	$ 15,500	_____

FURNITURE AND FIXTURES

Desks and chairs	$ 800	_____
Filing Cabinets	250	_____
Drafting Board and Tools	300	_____
Typewriter	150	_____
Total	$ 1,500	_____

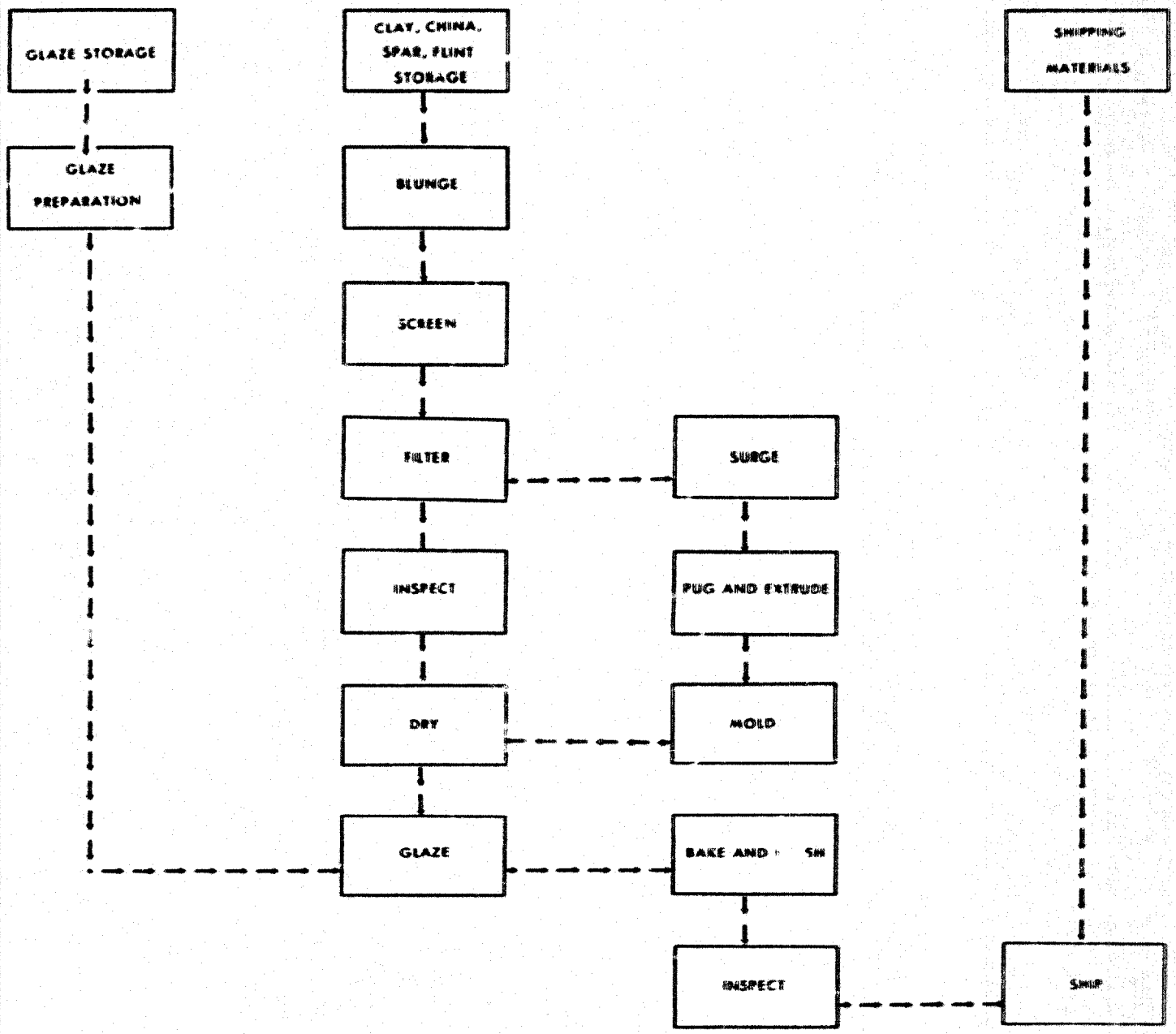
TOTAL EQUIPMENT COSTS

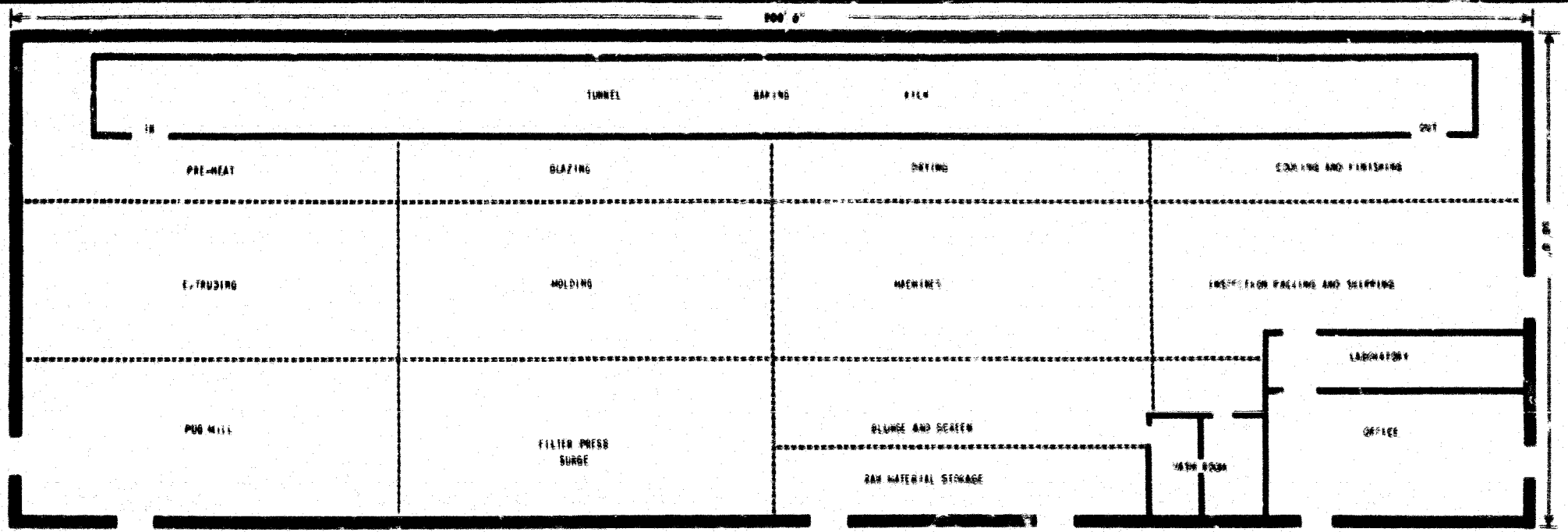
Production Equipment	$ 175,000	_____
General Equipment	15,500	_____
Furniture and Fixtures	1,500	_____
Total	$ 192,000	_____

* If desired, a chamber kiln, which would cost approximately $58,000, could be used instead.

FLOW CHART

KITCHEN EARTHENWARE PRODUCTION PLANT





DIAGRAMMATIC LAYOUT

KITCHEN EARTHENWARE PRODUCTION PLANT

PLANT LAYOUT

A plant layout is shown on Page 10 and a flow chart is shown on Page 9.

PLANT SITE

To provide space for eventual expansion, a site of at least 35,000 square feet will be required. The site should be advantageously located with respect to transportation, power, water, fuel, raw materials, labor and markets. The cost is estimated at $2,000.

BUILDING REQUIREMENTS

The building requirements for a kitchen earthenware plant are comparatively simple; a one-story fireproof structure, with clear space 16 feet high, is preferred. Approximately 12,000 squre feet of space will be required, the preferred arrangement being indicated on the diagrammic layout chart.

Other arrangements would be acceptable, but should permit a straight-line flow of products without back-tracking, if possible. The back-tracking is not only ineffecient from a material handling point of view, but adds to congestion and delay.

A structure of minimum cost has been contemplated for this plant, and the building cost estimate of $3.50 per square foot has been based on this premise.

At $3.50 per square foot, the 12,000 square feet will cost $42,000, including wiring, sanitary and truck or railroad dock facilities.

POWER

The connected load of all motors used will not exceed 100 horse power. The peak demand will probably be about 75 horse power. It is estimated that the annual cost of power will amount to about $2,400.

WATER

An adequate supply of good water must be available at the plant site, since the water used ranges from 15% to 40% of the dry clay. The estimated cost of water for production, sanitation and fire protection is $1,800.

FUEL

The fuel used for firing the ware is usually Bunker C oil. It is estimated that the cost of fuel will amount to approximately $6,000.

TRUCK

A 1-ton pickup and delivery truck is included in general equipment. The cost of the driver is included in the indirect labor and the cost of gas, oil and maintenance, amounting to $500, is included in the supplies.

LABOR REQUIREMENTS

The work force tabulated below would produce, in the United States, 16,000 acceptable pieces of finished kitchen ware per eight-hour day:

DIRECT LABOR

Department	Number Required	Hourly Rate	Annual Payroll	Actual
Raw Material Handlers	2	$1.50	$ 6,000	____
Blunging and Screening Operator	1	1.70	3,400	____
Filter Press Operator	1	1.70	3,400	____
Pug Mill Operator	1	1.60	3,200	____
Extrusion Operator	1	1.60	3,200	____
Molding Machine Operators	4	1.80	14,400	____
Dry Room Laborers	2	1.50	6,000	____
Glazing Machine Operator	1	1.70	3,400	____
Conveyor & Flat Car Laborers	1	1.50	3,000	____
Kiln Operators	3	1.80	10,800	____
Cooling Area Laborers	2	1.50	6,000	____
Inspectors	2	1.80	3,600	____
Packers	2	1.60	6,400	____
Shipper	1	1.60	3,200	____
Lift-Truck Operator	1	1.70	3,400	____
Apprentices	4	1.00	8,000	____
Total	29		$ 87,400	____

INDIRECT LABOR

Department	Number Required	Hourly Rate	Annual Payroll	Actual
Manager	1		$ 10,000	____
Chemist - Foreman	1		8,000	____
*Maintenance Man	1		4,000	____
Bookkeeper	1		5,000	____
Secretary	1		3,000	____
Janitor	1		3,000	____
Truck Driver	1		3,000	____
Total	7		$ 36,000	____

*To also maintain patterns.

SUPPLIES

Item	Estimate	Actual
Maintenance	$ 2,000	_____
Hand Tools	300	_____
Pickup Truck Expense	500	_____
Office Supplies	200	_____
Grinding Tools and other	1,000	_____
Packing Materials	6,000	_____
Total	$ 10,000	_____

DEPRECIATION

Item	Actual Cost	Estimated Cost	Years' Life	Depreciation per Year	Actual Depreciation per Year
Building	_____	$ 42,000	20	$ 2,100	_____
Production Equip.	_____	175,000	15	11,666	_____
General Equipment	_____	15,500	10	1,550	_____
Office Equipment	_____	1,500	10	150	_____
Truck	_____	2,500	4	625	_____
Total	_____	$236,500		$ 16,091	_____

MANUFACTURING OVERHEAD

Item	Estimated Cost per Year	Actual Cost per Year
Depreciation	$ 16,091	_____
Indirect Labor	36,000	_____
Power	2,400	_____
Water	1,800	_____
Fuel	6,000	_____
Supplies	10,000	_____
Total	$ 72,291	_____

MANUFACTURING COST

Item	Annual Cost	Actual
Direct Labor	$ 37,400	_____
Materials	97,800	_____
Overhead	72,291	_____
Total	$257,491	_____

FIXED INVESTMENT

Item	Estimated	Actual
Land	$ 2,000	_____
Buildings	42,000	_____
Production Equipment	175,000	_____
General Equipment	15,500	_____
Furniture and Fixtures	1,500	_____
Total	$ 236,000	_____

WORKING CAPITAL

Direct Material Inventory	- 30 days	$ 8,150	_____
Direct Labor	- 30 days	7,280	_____
Manufacturing Overhead	- 30 days	6,020	_____
Reserve Sales Collections	- 30 days	33,330	_____
Total		$ 54,780	_____

TOTAL INVESTMENT REQUIRED

Fixed Assets	$ 236,000	_____
Working Capital	54,780	_____
Total	$ 290,780	_____

SALES REVENUE

The total number of pieces produced per year is estimated at 4,000,000. The average sales price at the factory for ware of this quality is estimated at $.10 each.

Estimated Annual Sales Volume = 4,000,000 x $.10 = $400,000.

RECAPITULATION OF COSTS, SALES AND PROFITS

Item	Estimated		Actual
Direct Materials	$ 97,800		_____
Direct Labor	87,400		_____
Overhead	72,291		_____
Total Manufacturing Costs		$ 257,491	_____
Interest on Loans	$ 7,000		_____
Insurance	1,500		_____
Legal	2,400		_____
Auditing	3,600		_____
Unforeseen Expense	15,009		_____
Total Administrative Costs		29,509	_____
Sales Cost, including commissions, discounts, bad debts, returns, allowances, travel		40,000	_____
Profit before Taxes		73,000	_____
Annual Gross Sales		$ 400,000	_____

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	$_____	$ 1,108	$ 14,500	$_____
20	Sales	_____	3,333	40,000	_____
30	Direct Materials	_____	8,150	97,800	_____
40	Supplies	_____	833	10,000	_____
51	Power*	_____	200	2,400	_____
52	Water*	_____	150	1,800	_____
53	Fuel	_____	500	6,000	_____
60	Unforeseen Expense (Reserve Account)	_____	1,250	15,009	_____
71	Direct Labor*	_____	7,208	87,400	_____
72	Indirect Labor*	_____	3,000	36,000	_____
80	Depreciation (Reserve Account)	_____	——	16,091	_____

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

PURCHASE REQUISITION	COMPANY NAME	DATE

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

INDICATE BELOW THE USE OF MATERIALS

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

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

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

R. W. MITCHELL MANUFACTURING COMPANY
1422 BOSWORTH STREET, S. E.

65-22
514

ANYWHERE, U. S. A._____19____ No. 10000

PAY _____ DOLLARS $ _____
TO THE ORDER OF

R. W. MITCHELL MANUFACTURING COMPANY

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

BY SAMPLE CHECK
VICE PRESIDENT

ACCOUNT NUMBER

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

R. W. MITCHELL MANUFACTURING COMPANY

ENGINEERS

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

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

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

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

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

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

TRAINING

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

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

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

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

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

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

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

SAFETY

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

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

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

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

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

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

SUMMARY

A small plant, built and operated according to the assumptions made in this 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?

BIBLIOGRAPHY

Textbook

Ceramic Data Book	Industrial Publishers, Inc., 5 South Wabash Avenue, Chicago, Illinois.

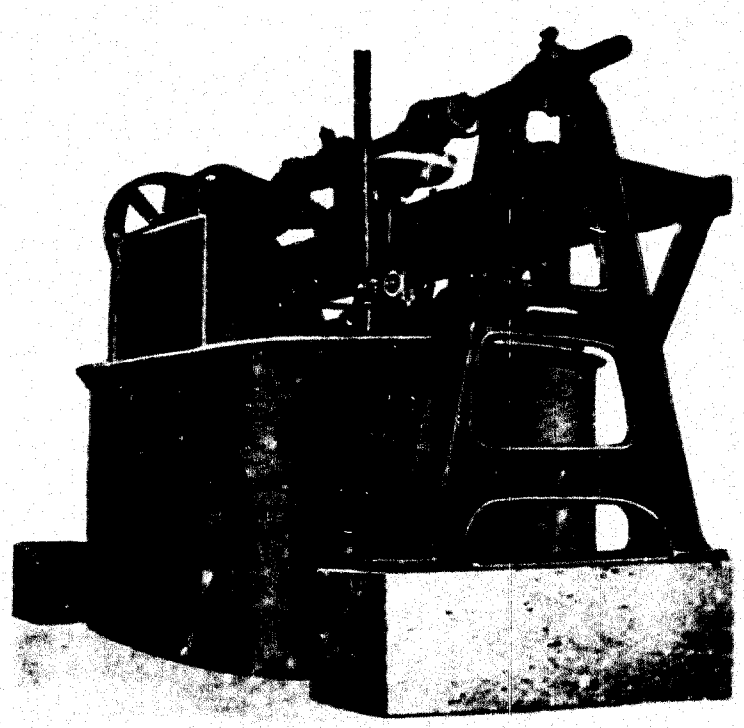
PERIODICALS

Ceramic Age	Pinover Publications, Inc., 114 East 32 Street, New York 16, N. Y.
Ceramic Industries	Industrial Publishers, Inc., 5 South Wabash Avenue, Chicago, Illinois.

ABBREVIATIONS

'	Foot or Feet
"	Inch or Inches
%	Percent
lb.	Pound
lbs.	Pounds

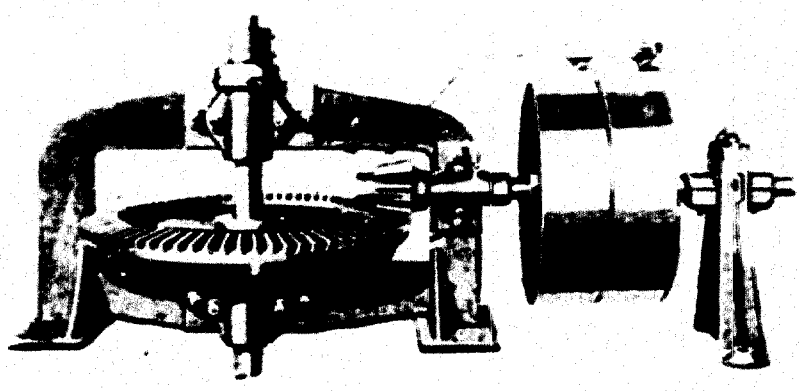
Figure I - STEPLESS BLUNGER



The cut represents a double stepless blunger or mixer used to mix clay into a uniform solution.

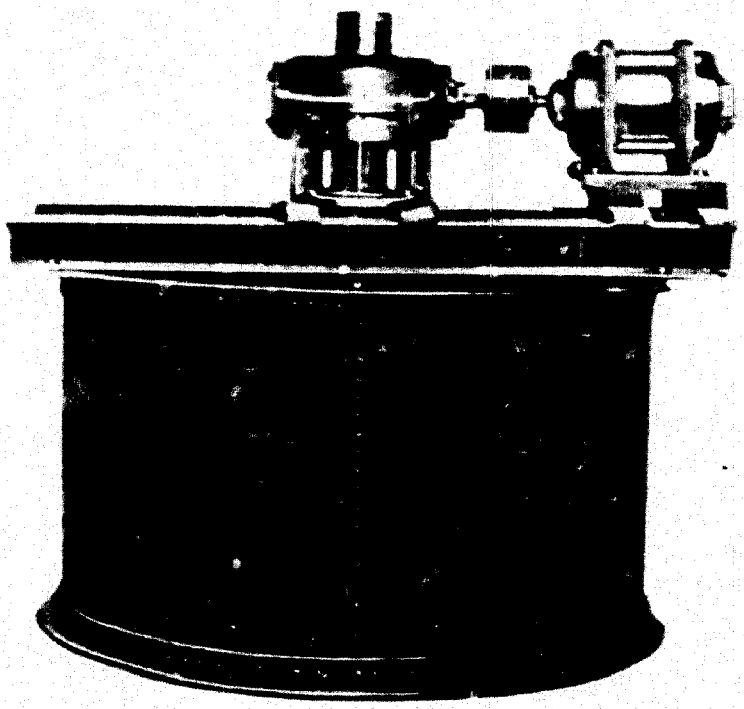
This blunger is 7 feet by 13 feet and has a capacity for 15,000 pounds of clay, requiring from 3/4 to 1-1/4 hours to blunge a charge, according to the nature of the materials used. A 5 H. P. motor is used for operation.

Figure 2 - FLOOR OR INVERTED BRACKET TYPE AGITATOR



The above agitator is designed for use where the drive is desired on the floor and the cistern or mixing tank is located underground. Approximately a 2 H. P. motor is required for operation. A speed reducer should also be installed.

Figure 3 - CISTERN OR MIXING TANK



This cistern or tank is designed for mixing liquid materials, such as clay compositions, and can be built of steel to suit any capacity. It is used in conjunction with above agitator.

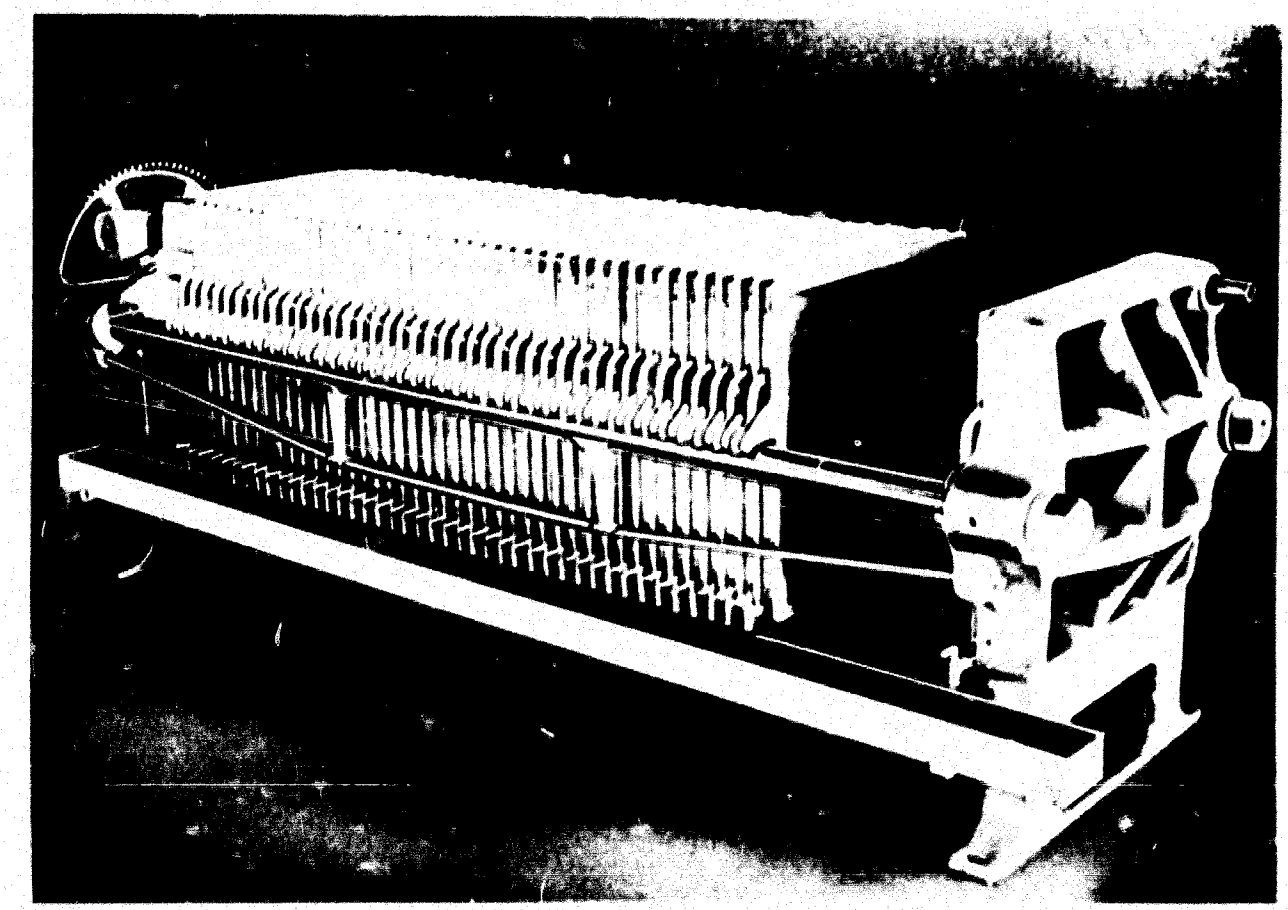


Figure 4 - FILTER PRESS

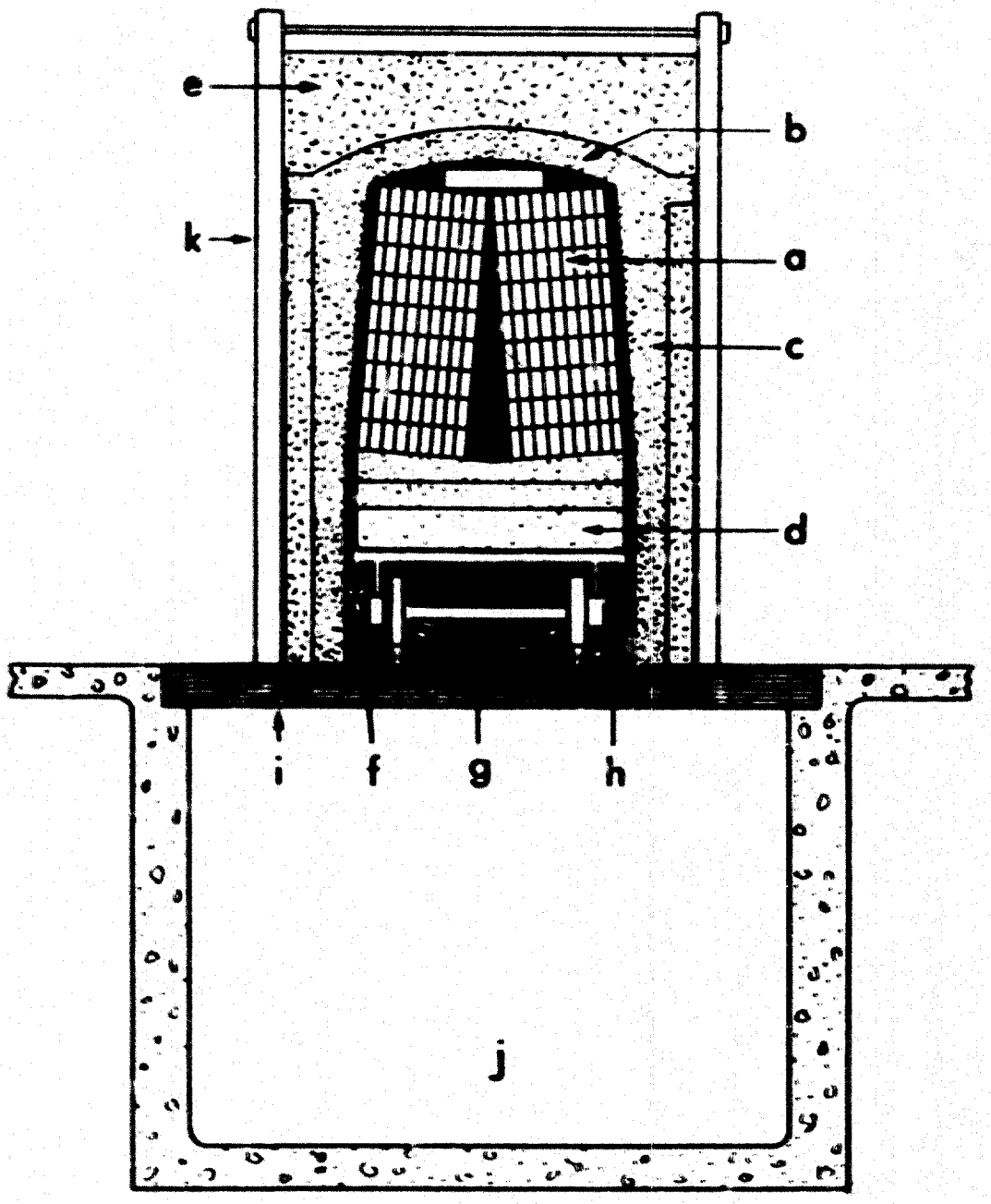


Figure 5 - CROSS-SECTION OF TUNNEL KILN

a. Green ware
b. Refractory roof
c. Refractory walls
d. Car bed
e. Thermal insulation
f. Sliding sand seal
g. Car wheels
h. Rails
i. Supporting member
j. Inspection tunnel
k. Buck stays

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