PLANT REQUIREMENTS FOR PROCESSING POTATO CHIPS

DEPARTMENT OF STATE

AGENCY FOR INTERNATIONAL DEVELOPMENT

COMMUNICATIONS RESOURCES DIVISION

Washington 25, D. C.

Reference Center
Room 2656 [illegible]

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 Agency for International Development, but merely a citation that is typical in its field.

This report was prepared by the United States Testing Company, Inc., 1415 Park Avenue, Hoboken, New Jersey for the technical aids program through the facilities of the Office of Technical Services, U. S. Department of Commerce.

* * * * * * * * * * * * * * * * * *

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

Code Number
PR 116

April 1962

ACKNOWLEDGEMENT

The author gratefully acknowledges the cooperation of the following companies in providing technical information and illustrations for use in this report.

Mr. Harvey Noss
Potato Chip Institute International
946 Hanna Building
Cleveland, Ohio

Mr. Joseph DiSpigno, Secretary
Treat Potato Chip Company
Div. of East Coast Food Corporation
356 Jefferson Street
Brooklyn 37, New York

Mr. Richard A. Coleman, President
J. D. Ferry Company, Inc.
117 - 147 South Cameron Street
Harrisburg, Pennsylvania

A-M Machinery Company
4217 Gaston Avenue
Dallas 10, Texas

E. R. Knott Machine Company
71-73 Glendale Road
Sharon, Massachusetts

Salvo Machinery Division
Made-Rite Potato Chip Company
Fall River, Massachusetts

Machbeth Engineering Company
Tenth and Hanna Streets
Harrisburg, Pennsylvania

Wallace and Tiernan
Newark 1, New Jersey

The manuscript for this report was reviewed by Mr. L. H. Long, the J. D. Ferry Company, and his comments and suggestions were of great value in its preparation.

TABLE OF CONTENTS

	Page
Introduction	1
General Assumptions	1
Product Specifications	2
Production Capacity	2
Manufacturing Operations	3
Sanitary Controls and Precautions	4
Direct Materials	4
Storage	5
Potato Buying	5
Production Requirements	6
Cooking Oil	6
Salt	7
Estimated Cost of Direct Materials	7
Direct Labor	8
Indirect Labor	8
Production Equipment	8
Other Tools and Equipment	9
Furniture and Fixtures	9
Maintenance	9
Supplies	10

	Page
Provision for Expansion	10
Plant Layout	10
Plant Site	11
Building	11
Power	11
Water	11
Fuel	11
Manufacturing Cost	12
Fixed Assets	12
Working Capital	12
Depreciation	13
Manufacturing Overhead	13
Packaging Costs	13
Capital Requirements	14
Sales Revenue	14
Recapitulation of Costs, Sales and Profits	15
Budget Control	16
Engineers	17
Purchase Requisition	18
Sample Check	19
Training	20
Safety	21
Other Considerations	22

	Page
Materials and Supplies	22
Market Factors	22
Export Markets	23
Marketing Problems	24
Economic Factors	24
Personnel	25
Laws and Regulations	25
Financial Factors	26
Financial Requirements of the Project	26
Short Term Bank Credits	26
Financial Plan	27
Illustrations	28-34
Bibliography	35

* * * * * * * * * * * *

INTRODUCTION

The purpose of this report is to present basic information for establishing and operating a manufacturing plant in a foreign country to produce potato chips.

In the United States, the plant outlined in this report is considered small to medium-sized. Other typical United States plants are more mechanized and have higher production rates.

A plant of this kind, if built in a foreign country, could use less equipment and require more labor but a smaller capital investment.

GENERAL ASSUMPTIONS

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

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

2. Material costs are based on size 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, and fifty weeks a year.

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. 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

This plant is designed to manufacture potato chips and package them in glassine bags and friction sealed cans.

PRODUCTION CAPACITY

The production capacity of this plant is 1200 pounds of potato chips per eight hour shift. Based upon one eight-hour shift 250 days per year, the annual output is 300,000 pounds. This plant contains facilities for packaging the potato chips in glassine bags in 3/4 ounce, 1-1/2 ounce, 4 ounce, and 6-3/4 ounce sizes and in 5 pound cans. The quantity of each will depend upon the local market.

MANUFACTURING OPERATIONS

The manufacture of potato chips begins with raw potatoes which are peeled, sliced, cooked, salted, and packaged.

The raw potatoes are dumped in bulk into a potato peeler, where they are peeled and washed with cold water. From the peeler, they pass over a peeled potato inspection conveyor. The potatoes pass from this conveyor to a receiving hopper from which the potatoes are elevated to the slicers where they are sliced and washed again in cold water. The two washing operations are to carry away the starch which is liberated when the potato cell walls are cut away by the peeling and slicing operations.

The potato slices are carried by a flat belt conveyor to the cooker. Above the conveyor is a series of air jets which provide a steady stream of high velocity air to blow away the excess water. The potato chips are traversed through the cooker by rake-like fingers which keep the potatoes submerged in the cooking oil. It is desirable to maintain a constant cooking oil temperature between 350° and 375° F.

The cooked potato chips emerge from the cooker by means of a woven wire mesh conveyor belt. The speed of this belt is variable permitting control of the residence time in the frying kettle. From this conveyor, the chips pass to a second wire mesh conveyor for the purpose of spreading the chips as they pass from one conveyor to another and to permit drainage of the surface oil. From this stage, the chips pass beneath the salter mounted on the discharge end of the fryer. The chips then pass over a cooling and packaging conveyor system to be fed to the bag weighing and filling machine. The same packaging machine is used to fill all four size glassine bags by replacing the chutes feeding the bags. The filled bags may be sealed by heat sealing, stapling or riveting.

If it is desired to fill the potato chips in five-pound cans, a by-pass on the conveyor feeding the filling machine diverts the flow of potato chips to a chute with a conveyor containing cans below it. The cans are weighed and corrected by hand before the snug-fitting top is applied.

SANITARY CONTROLS AND PRECAUTIONS

There are two important factors in the sanitary conditions of a potato chip plant. The first is cleanliness. The operators should wear white garments and be instructed to work with clean hands. Women employees are required to wear hair nets or hair covering in the packing room. The floors should be swept daily using a powdered substance to prevent dust from scattering in the air.

The second important factor is safety to the operators, especially with regard to the cooker. As a means of eliminating the contamination of the air with fumes, smoke, and odors, the following recommendations should be followed:

1. That a program be set up for a complete inspection of the potato chip cooker at regular intervals, particularly looking for any leaks in the combustion chamber and the exhaust system.

2. That the cooker be equipped with an outside air supply duct so that fresh air for combustion will not be drawn from the working area.

3. That the exhaust system be equipped with a blower or some other means to insure a positive movement of the exhaust gases to the outside atmosphere.

4. That the outside portion of the exhaust stack be located so that the prevailing winds will tend to sweep the gases away from fresh air intakes to prevent any of the gases being drawn into the plant.

5. That all parts of the plant be supplied with adequate fresh air ventilation so that there will be a positive draft up the vent stack at all times to remove steam and other vapors from the working area.

DIRECT MATERIALS

The successful manufacture of potato chips is, to a large extent, based upon the type of potato used, since not all potatoes will

chip. The following types of potatoes are used in the United States: Burbank, Early Ohio, Warba, Red Warba, Triumph, Irish Cobbler, White Rose, Chippewa, Houma, Katahdin, Green Mountain, Red McClure, Russet Burbank, Russet Rural, Sebago, Sequoia, and Kennebec.

The important factor in selecting a potato for chipping is its history. Any potato removed from the ground after it has been chilled below 32° F. will not chip properly, consequently it is not suitable for processing.

STORAGE

Considerable skill and experience are required in the selection and handling of raw stock from which to make chips. The storage history of these potatoes has much to do with the quality of the product that will result. Potatoes that have been stored for more than a few days at temperatures much above 50° F. will usually start to sprout in eight or ten weeks.

When the chip manufacturer can control the storage of his raw stock, it is the best practice to hold a certain amount at approximately 50° F. for use during the first two or three months following harvest. Stock for later use may be held at 40° F. to 45° F. Two to three weeks prior to use, this stock can be reconditioned in a special room held at approximately 70° F. - 75° F. Potatoes that have been stored at a temperature below 40° F. will usually be found difficult to recondition satisfactorily for chip making.

The handling and storage of potatoes will vary considerably in the many geographic locations in the world. The importance of adequate potato storage to insure a source of supply during the winter and spring months cannot be stressed too strongly. This is particularly true in areas in the world where first crops of new potatoes are not available until late spring. The temperature at which potatoes are stored quite often will depend upon the variety of the potato. In addition to the control of the temperature, humidity is also an important factor.

POTATO BUYING

Many chip manufacturers depend on the current market for their supply of raw stock. Where the previous storage history is not known, the only safe procedure after cold weather sets in is to make a cooking test on every lot before purchasing.

Even if a lot cooks dark, an operator may know from experience whether it can be reconditioned for later use. For the cooking test, it is usual to cut a half-inch hole with an apple corer through the flat dimension of a dozen or more representative potatoes taken from different parts of the lots and then run them through the usual process along with the other stock being used at the time. The chips from the test lot will have a hole through each one and thus can be readily picked out for inspection.

Good chips can be made from almost any variety of potato for a while after harvest, but after a few weeks of storage, some varieties are more dependable than others as to the color and quality of the chips that can be made from them. The Russet Rural variety is favored for this purpose, although the Chippewa and Sebago are about equally good. Other good varieties are the Irish Cobbler and Russet Burbank.

PRODUCTION REQUIREMENTS

To produce the daily requirements of 1200 pounds of potato chips, it is required to use 4800 pounds of potatoes, since 100 pounds of raw potatoes will result in 25 pounds of chips. If the potatoes are stored by the manufacturer, 7% spoilage must be allowed for, so that 5150 pounds of stored potatoes will yield 4800 usable pounds. The spoilage rate can be reduced with extra effort placed in storage controls.

COOKING OIL

Another important material used in the manufacture of potato chips is cooking oil. The best oils are corn oil or cotton seed

oil; however, most any vegetable oil may be used depending on accessability to the manufacturer. The oil in the cooker is maintained between 350° and 375° F. The oil system is never completely changed but is circulated through a filter for cleaning. It is also advisable to have a preheater in the oil system to preheat the reserve oil before it enters the cooker. The oil must contain an antioxidizing agent to prevent rancidity.

It is necessary to add three drums or 480 pounds of oil to the system every day for the daily requirement of 1200 pounds of potato chips.

SALT

The salt used in the manufacture of potato chips is the flake variety rather than crystal salt. The flakes adhere to the hot potato chips emerging from the cooker. The quantity of salt used is negligible and estimated at 2%, so that 24 pounds of salt is required for the daily requirement of 1200 pounds of potato chips.

ESTIMATED ANNUAL COST OF DIRECT MATERIALS

The annual estimated cost of direct materials, based on an annual output of 300,000 pounds of potato chips amounting to $60,180, will be used for cost purposes in this report. The cost breakdown of direct materials is shown below.

ITEM	No. OF POUNDS	COST PER POUND	COST ESTIMATED	COST ACTUAL
Potatoes	1,200,000	$0.03	$36,000	_____
Cooking Oil	120,000	$0.20	$24,000	_____
Salt	6,000	$0.03	$ 180	_____
	Total Annual Cost		$60,180	

DIRECT LABOR

Job Classification	Number Required	Hourly Rate	ANNUAL COST Estimated	Actual
Skilled Operator	1	$3.00	$ 6,000	_____
Semi-Skilled	1	$2.00	$ 4,000	_____
Unskilled Operators	9	$1.25	$22,500	_____
Total	11		$32,500	

INDIRECT LABOR

Job Classification	Number Required	Hourly Rate	ANNUAL COST Estimated	Actual
Manager	1		$ 7,000	_____
Office Worker	1		$ 3,000	_____
Maintenance Man	1		$ 6,000	_____
Total	3		$16,000	

PRODUCTION EQUIPMENT

Item	Number Required	Unit Cost	COST Estimated	Actual
Potato Peeler	1	$ 600	$ 600	_____
Potato Slicer	1	$ 600	$ 600	_____
Cooker	1	$10,000	$10,000	_____
Cooking Oil Filter	1	$ 1,000	$ 1,000	_____
Oil Preheater	1	$ 1,200	$ 1,200	_____
Filling Machine and Accessories	1	$ 8,700	$ 8,700	_____

PRODUCTION EQUIPMENT (continued)

Item	Number Required	Unit Cost	COST Estimated	COST Actual
Bucket Conveyor	1	$2,000	$ 2,000	_____
Flat Bed Conveyor	2	2,700	5,400	_____
Extra Flat Belts	2	750	1,500	_____
Total			$31,000	

OTHER TOOLS AND EQUIPMENT

Item	Number Required	Unit Cost	COST Estimated	COST Actual
Maintenance tools, cleaning equipment			$ 1,500	_____
Work tables, shipping room equipment			1,000	_____
Exhaust Fan			175	_____
Delivery truck			3,000	_____
Total			$ 5,675	

FURNITURE AND FIXTURES

Item	Number Required	Unit Cost	COST Estimated	COST Actual
Desks and Chairs	2	$150	$ 300	_____
Filing Cabinets	2	75	150	_____
Typewriter	1	150	150	_____
Adding Machine	1	150	150	_____
Total			$ 750	

MAINTENANCE

Due to the fact that a number of automatic and semi-automatic machines are used, it is important to have a skilled mechanic on

the premises, since any time that a piece of equipment becomes inoperative, production is hampered.

In addition to repair maintenance, the washing and peeling equipment should be cleaned daily at the end of each production run. The potato chip frying equipment should be boiled out with detergent weekly.

In order to facilitate this cleaning process, it is recommended to have a double set of flat belt conveyor belts so that one set is in operation while another is being cleaned.

SUPPLIES

Item	ANNUAL COST Estimated	Actual
Oil and Lubricants	$ 100	_____
Hand Tools	$ 100	_____
Detergents	$ 75	_____
Office Supplies	$ 100	_____
Maintenance and Spare Parts	$1,500	_____
Total	$1,875	

PROVISION FOR EXPANSION

The production capacity of the plant described in this report can be increased by working two or three shifts. By making the increase in this way, it will be possible to avoid increasing the capital investment.

PLANT LAYOUT

A plant layout showing the location of equipment is shown on Page 28. Page 29 shows a work flow diagram.

PLANT SITE

The plant site should be 1/4 to 1/2 acre of level ground accessible to good transportation. It is advisable to select a site near a major city or other market for potato chips to facilitate distribution. The estimated cost of this site is $1,000.

BUILDING

The building required for the production of potato chips as described in this report is 100 feet wide and 300 feet long. The floor area is 30,000 square feet. The building should have a concrete floor. Local materials may be used. The estimated cost of the building is $150,000.

POWER

About 12 horsepower connected load is required. The total estimated annual cost of electrical power is $2,400.

WATER

The estimated annual cost of water required for production plus sanitation purposes is $350. In addition, a water filter and purifier as shown on Page 30 is estimated at $5000.

FUEL

The estimated annual cost of fuel oil used in the manufacturing operation and for heating the building is $600.

MANUFACTURING COST

Item	COST Estimated	Actual
Direct Materials	$ 60,180	_____
Direct Labor	$ 32,500	_____
Manufacturing Overhead (see P. 13)	$ 37,467	_____
Total	$130,147	

FIXED ASSETS

Item	COST Estimated	Actual
Land	$ 1,000	_____
Building	$150,000	_____
Production Tools and Equipment	$ 31,000	_____
Other Tools and Equipment	$ 5,675	_____
Furniture and Fixtures	$ 750	_____
Total	$188,425	

WORKING CAPITAL

Item		COST Estimated	Actual
Direct Materials	60 days	$10,030	_____
Direct Labor	30 days	$ 2,708	_____
Manufacturing Overhead	30 days	$ 3,122	_____
Reserve for Sales Collections	30 days	$15,000	_____
Total		$30,860	

DEPRECIATION

Description	Estimated Cost	Years Life	PER YEAR Estimated	PER YEAR Actual
Building	$150,000	20	$12,500	_____
Production Tools and Equipment	31,000	10	3,100	_____
Other Tools and Equipment	5,675	10	567	_____
Furniture and Fixtures	750	10	75	_____
Total			$16,242	

MANUFACTURING OVERHEAD

Item	COST Estimated	COST Actual
Depreciation	$16,242	_____
Power	2,400	_____
Water	350	_____
Fuel	600	_____
Supplies	1,875	_____
Indirect Labor	16,000	_____
Total	$37,467	

ANNUAL PACKAGING COSTS

Bag Size	Cost Per Thousand	Cost of Box Per Thousand
3/4 ounces	$ 8.00	$100
1 1/2 ounces	15.00	100

ANNUAL PACKAGING COSTS (continued)

Bag Size	Cost Per Thousand	Cost of Box Per Thousand
4 ounces	$ 25	$180
6-3/4 ounces	$ 40	$180
5 r ınd can	$300	

For .e purpose of this report, the estimated cost of packaging wil ɔe based on all one size (1-1/2 ounce) and packed 24 bags p box. The estimated annual cost for packaging is $5,000.

CAPITAL REQUIREMENTS

Item	COST Estimated	Actual
Fixed Assets	$188,425	_____
Working Capital	$ 30,860	_____
Total	$219,285	

SALES REVENUE

The annual sales price of potato chips is based on $.05 per ounce and pro-rated for each bag size depending on the weight of each bag size. Based on the annual production of 300,000 pounds, the annual sales volume would be $240,000.

RECAPITULATION OF COSTS, SALES AND PROFITS

Item	COST Estimated	Actual
Direct Materials	$60,180	_____

RECAPITULATION OF COSTS, SALES AND PROFITS
(continued)

Item	Estimated	COST	Actual
Packaging Costs	$ 5,000		_____
Direct Labor	$32,500		_____
Manufacturing Overhead	$37,467		_____
Total Manufacturing Cost	$	$135,147	_____
Interest on Loans	$ 4,000		_____
Insurance	$ 400		_____
Legal Services	$ 300		_____
Auditing	$ 600		_____
Unforeseen Expense	$ 2,000		_____
Total Administrative Costs and Unforeseen Expense	$	$ 7,300	_____
Sales Expense		$ 4,000	_____
Freight-out, travel, bad debts, discounts and allowances		$ 1,700	_____
Total Business Costs		$148,147	_____
Profit before Taxes		$ 91,853	_____
Annual Sales Revenue		$240,000	_____

* * * * * * *

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 Page 18.

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, on Page 19, 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 breakdown 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
AA Administrative	$_____	$ 443	$ 5,300	_____

BUDGET CONTROL ACCOUNTS (continued)

Account Number	Monthly Expense	Monthly Budget	Annual Budget	Actual
BB Sales	$_____	$ 335	$ 4,000	_____
CC Direct Materials	$_____	$5,015	$60,180	_____
DD Supplies	$_____	$ 156	$ 1,875	_____
EE Power*	$_____	$ 200	$ 2,400	_____
FF Water*	$_____	$ 30	$ 350	_____
GG Fuel	$_____	$ 50	$ 600	_____
HH Unforeseen Expense (Reserve Account)	$_____	$ 167	$ 2,000	_____
LL Direct Labor*	$_____	$2,709	$32,500	_____
KK Indirect Labor*	$_____	$1,334	$16,000	_____
SS Depreciation (Reserve Account)	$_____	$1,358	$16,242	_____

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

PURCHASE REQUISITION	COMPANY NAME	DATE

- [ ] AA ADMINISTRATION
- [ ] DD SUPPLIES
- [ ] BB SALES
- [ ] EE UTILITIES
- [ ] CC MATERIALS
- [ ] HH 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 #	ORDER DTE.

UNITED STATES TESTING COMPANY, INC.
1415 PARK AVENUE

41-88
150

HOBOKEN, N. J. _____ 19____ No. 1000

PAY _____ DOLLARS $ _____
To the Order of

THE HUDSON
TRUST COMPANY
ANYWHERE, U.S.A.

UNITED STATES TESTING CO., INC.

BY SAMPLE CHECK
PRESIDENT

ACCOUNT NUMBER

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

UNITED STATES TESTING COMPANY, INC.

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 product 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 quality and quantity 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 every 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?

* * * * * * * * * * * *

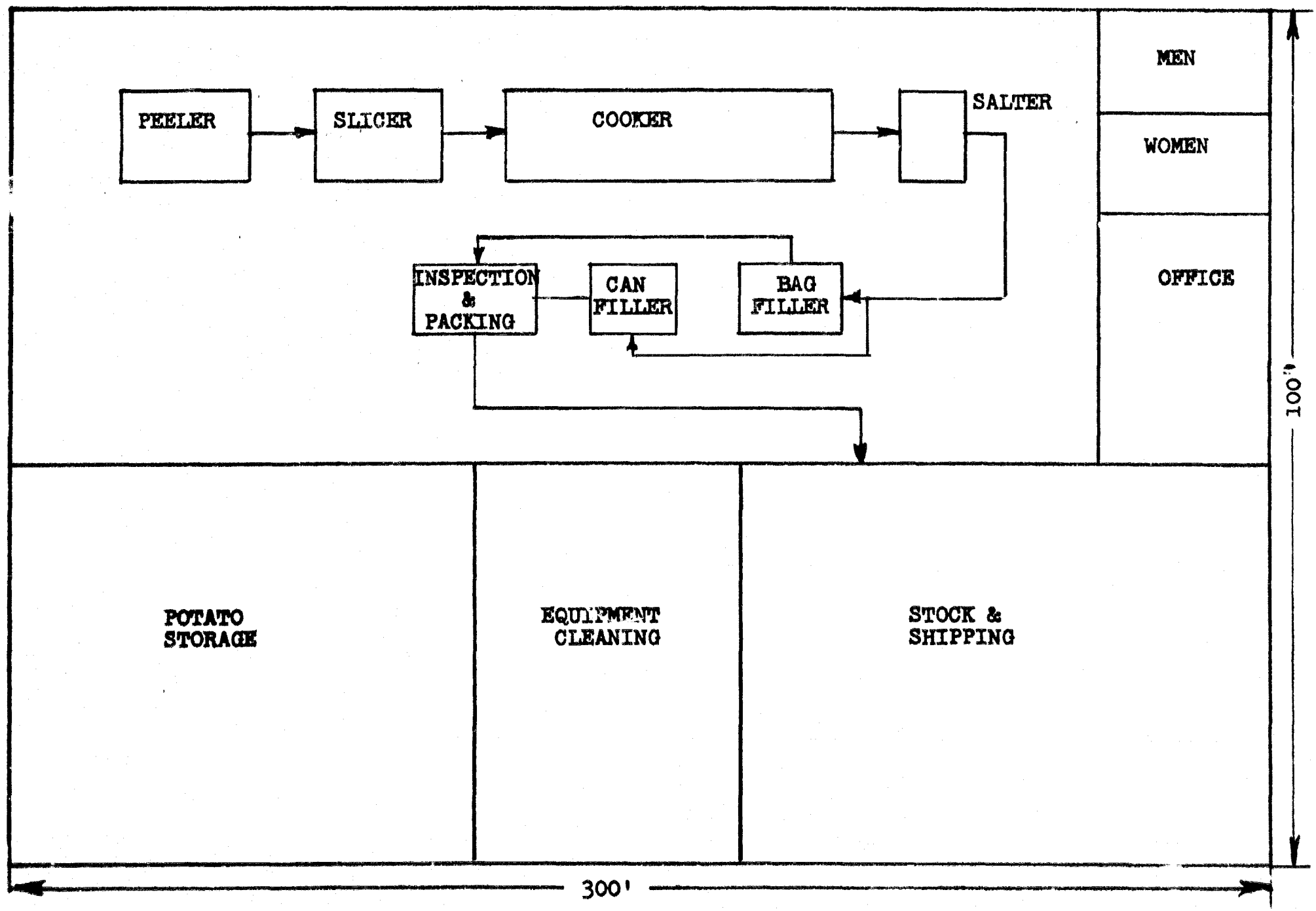


FIG. I

PLANT LAYOUT

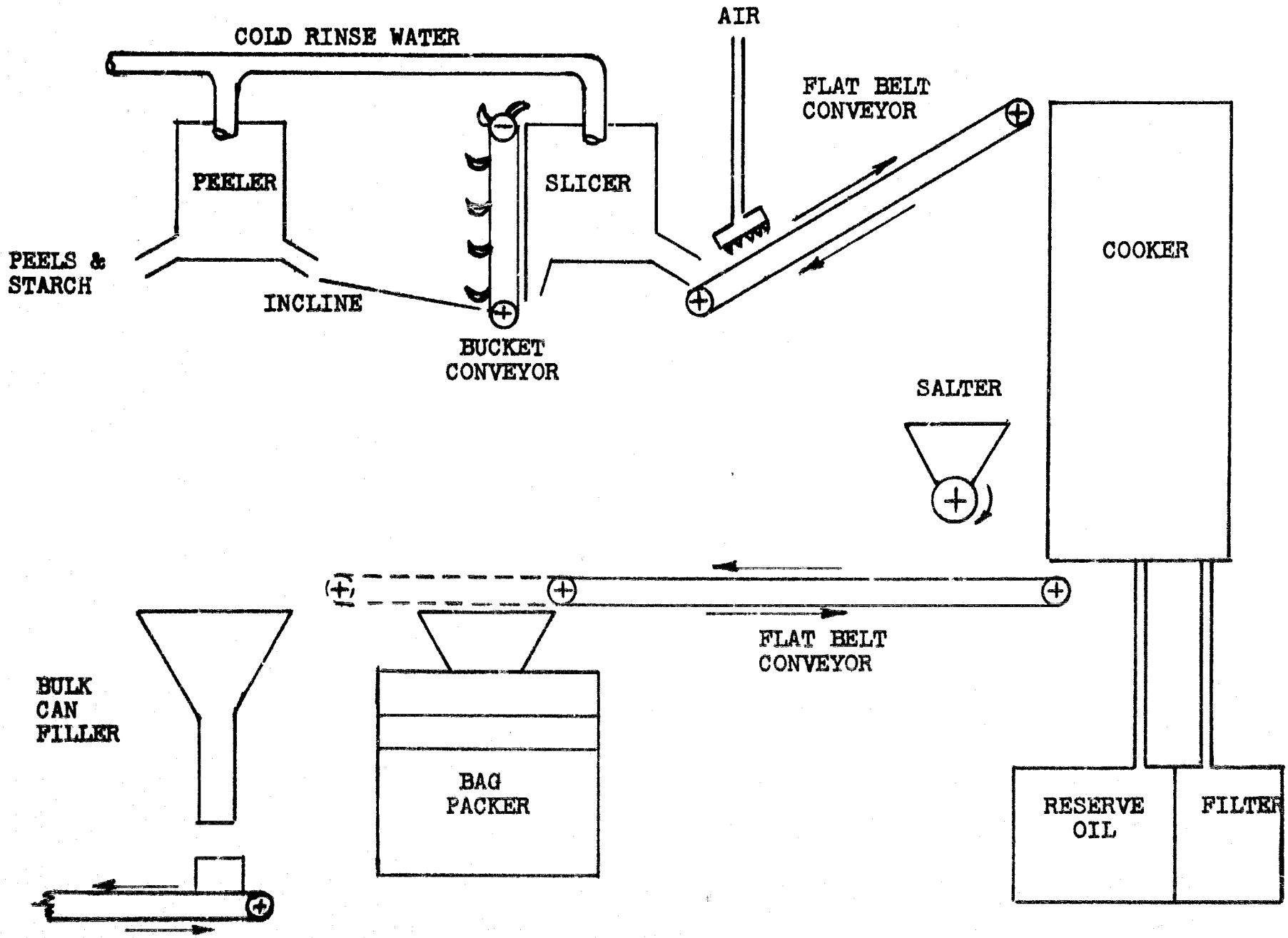


FIG. 2
MANUFACTURING PROCESS

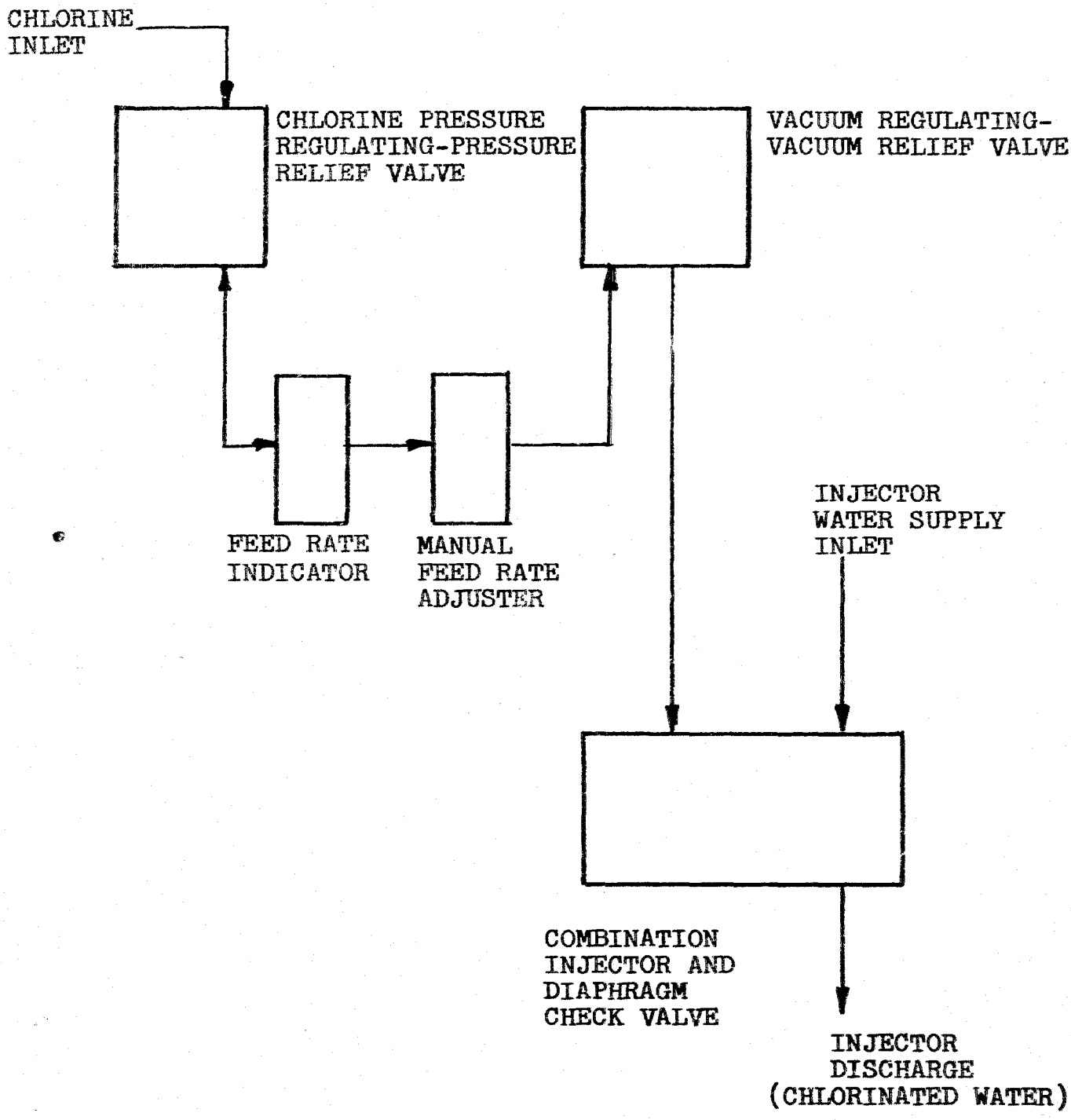
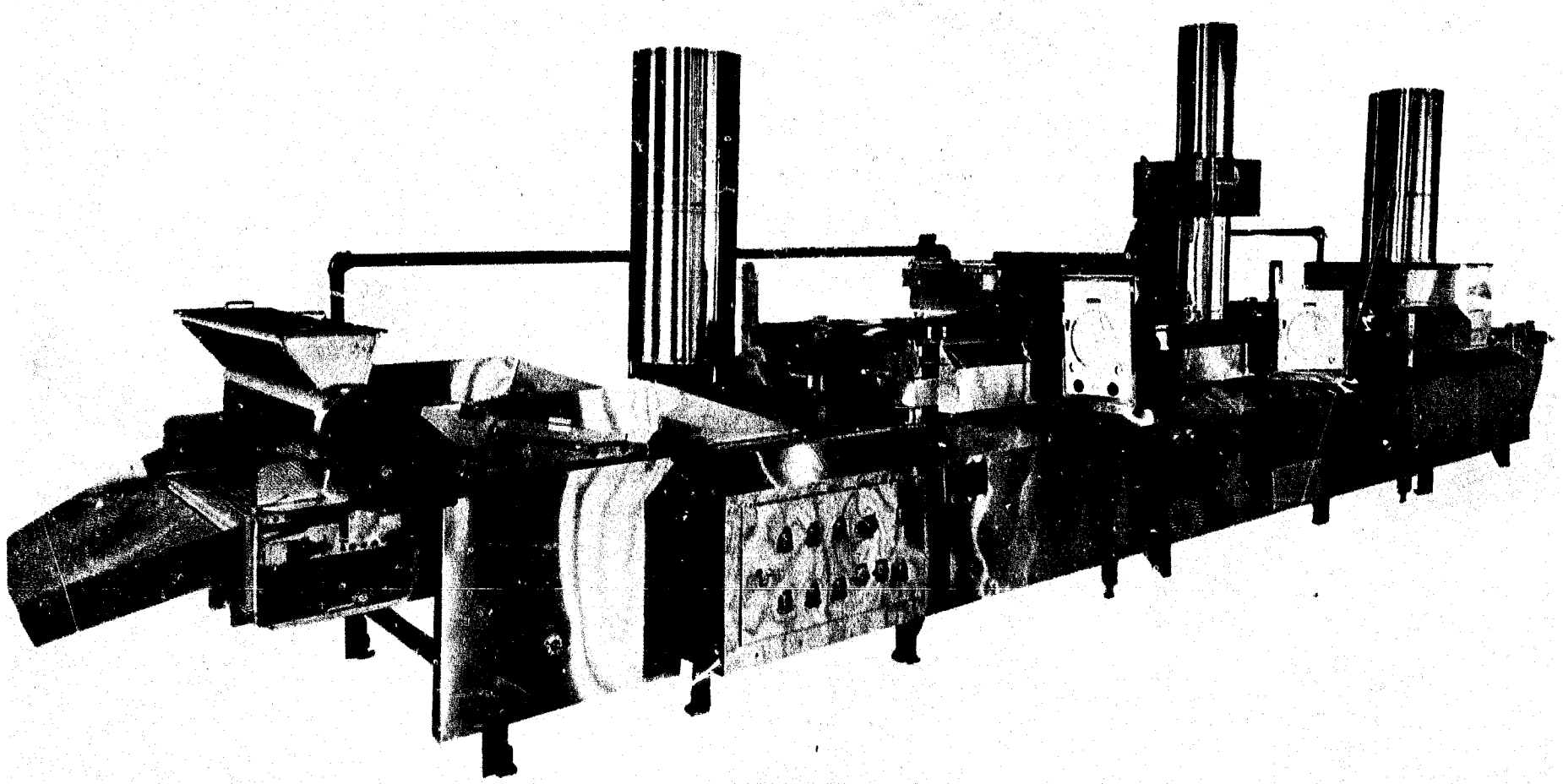


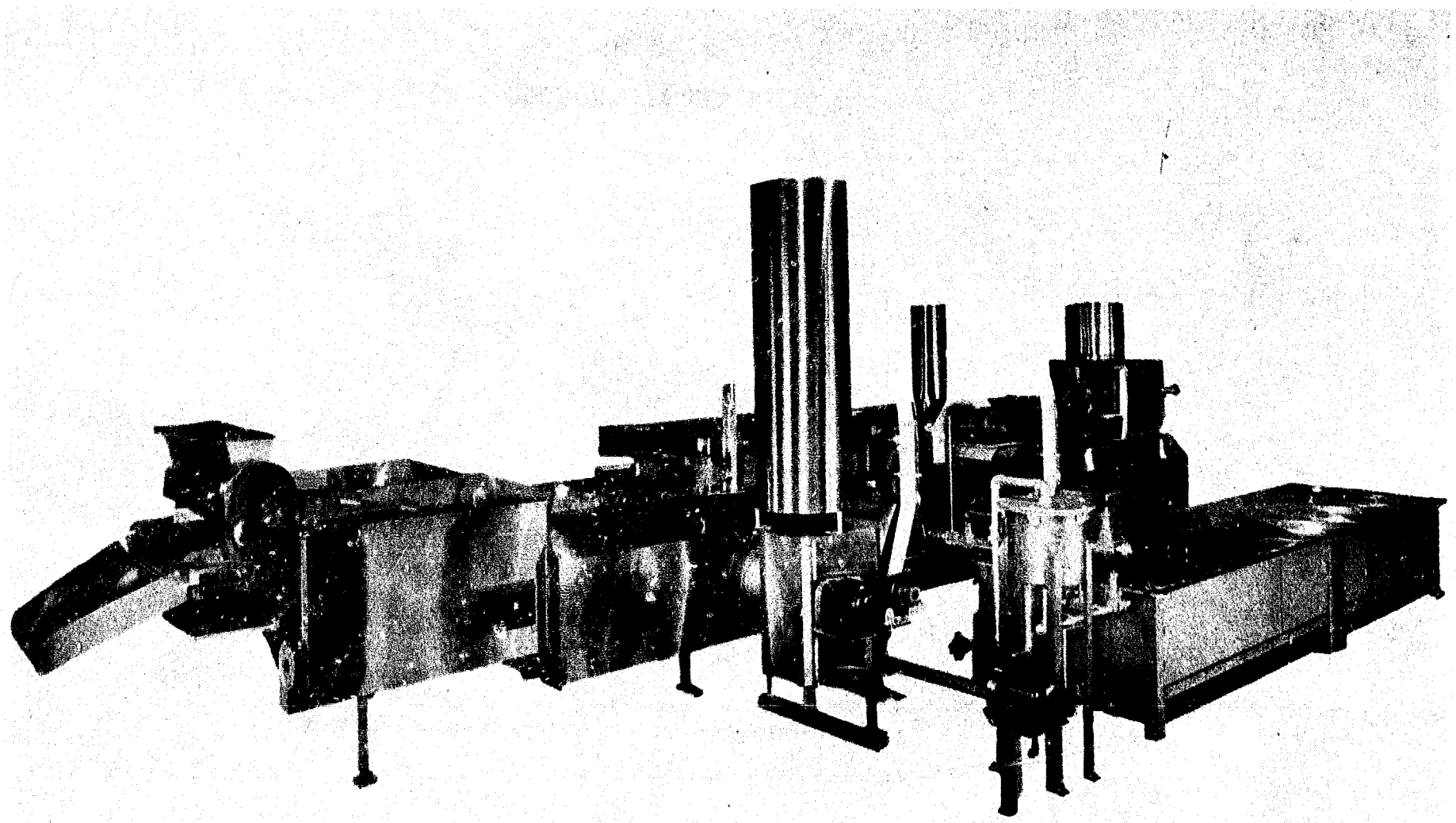
FIG. 3

SIMPLIFIED FLOW DIAGRAM
OF
WATER PURIFIER



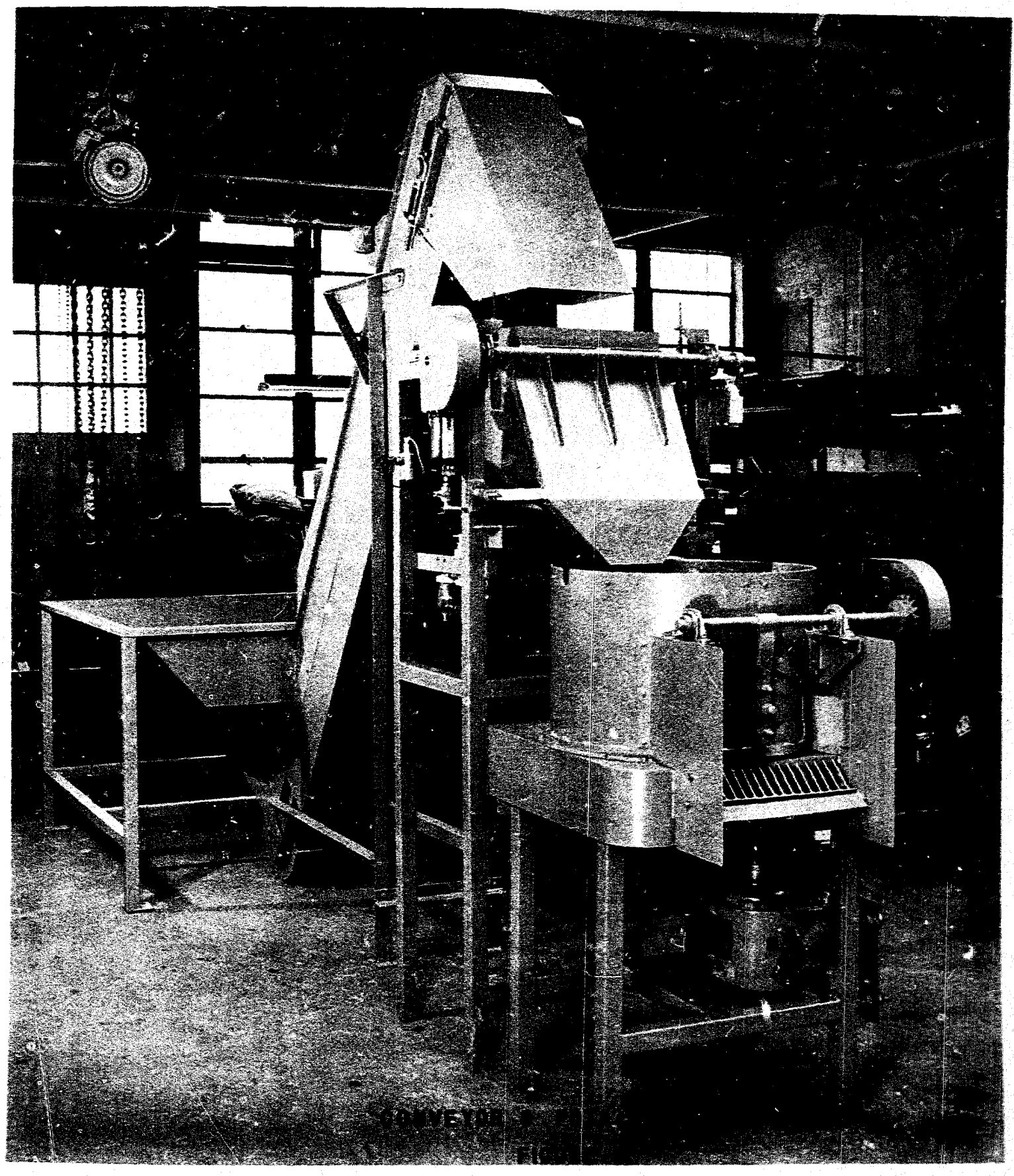
COOKER - FRONT VIEW

FIGURE 4

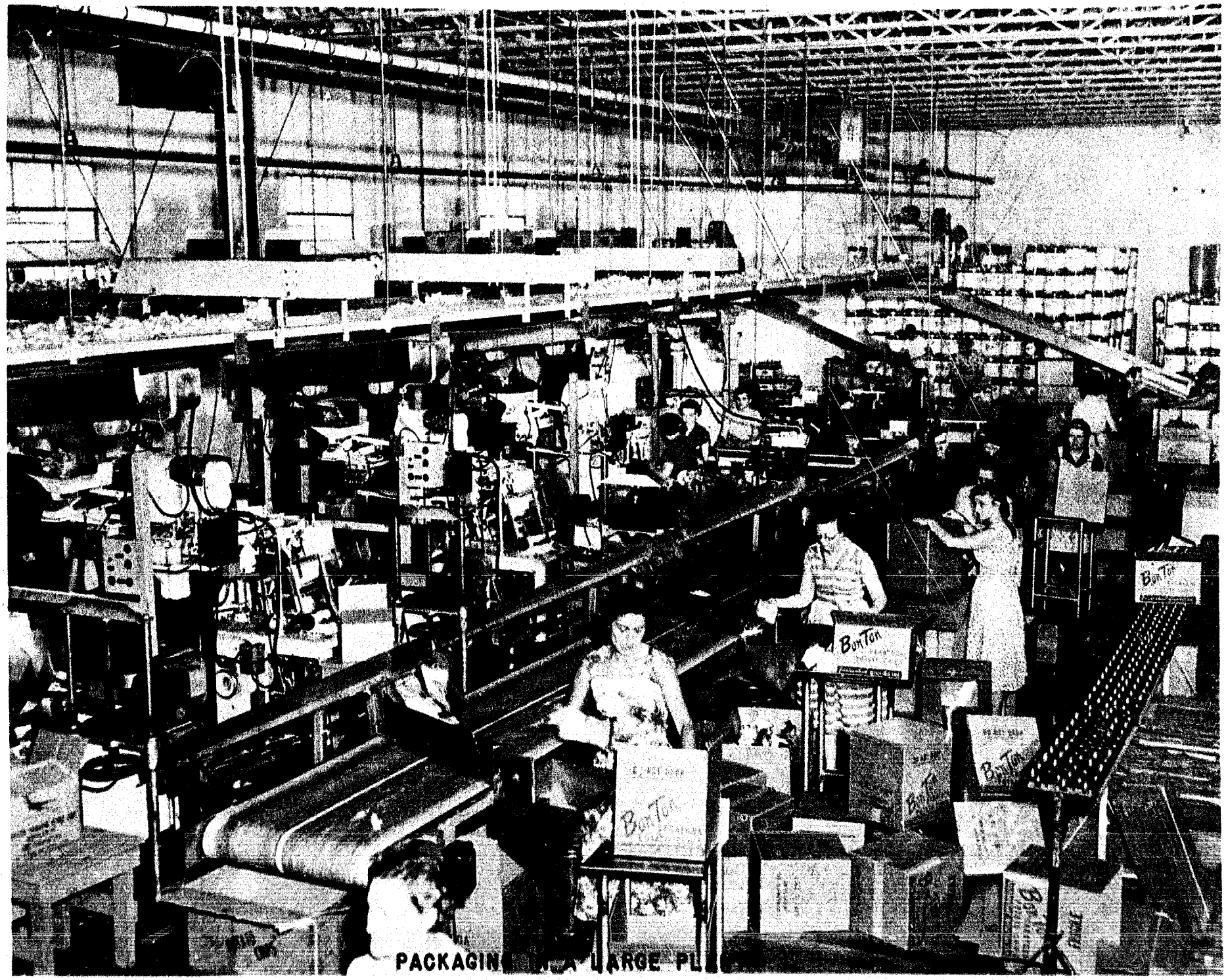


COOKER - REAR VIEW

FIGURE 5



J. B. FERRY CO., INC. - HARRISBURG, PENNA. - FLOOR TYPE POTATO HOPPER - MIN. 1200 LB. CAPACITY WITH WEIGHING HOPPER AND 100 LB. FERRY PEELER AUTOMATICALLY OPERATED - 10/3/58



PACKAGIN[illegible] IN A LARGE PL[illegible]

BIBLIOGRAPHY

Anonymous, 1958. Potatoes for Chipping, Potatc Chip Institute International.

Anonymous, 1960. Proceedings of the Production and Technical Division of Potato Chip Institute International.

Brown, Dr. Howard D., Potato Chip Industry, United States Department of Health, Education, and Welfare.

Noss, Harvey F., 1959, Processing of Potato Chips, Potato Chip Institute International.

Porges, R. and Towne, W. W. "Wastes from the Potato Chip Industry." Sewage and Industrial Waste 31, 1, 53-59 (January 1959)

Smith, Dr. Ora, "Its Dry Matter that Counts!" Potato Chipper, June 1951.

Treadway, R. H., and Colaon, T. C., "The Chemicals We Get from Potatoes." Yearbook of Agriculture - Crops in Peace and War, 1950-51, Pages 19-194.

Wright, R. C., Davis, Martha E., and Hendel, C. R., "The Making of Potato Chips", Ibid Pages 188-189.

Wright, R. C., and Whiteman, T. M., "What Does 32° Exposure Do to the Chipping Quality of Potatoes?", The Potato Chipper, May 1954.

* * * * * * * * * * *