AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY
Batch 87

1. SUBJECT CLASSIFICATION

A. PRIMARY
Development and economics — DM00-0000-0000

B. SECONDARY
Industries and industrialization

2. TITLE AND SUBTITLE
Plant requirements for manufacture of animal feed pellets

3. AUTHOR(S)
(101) Methods Engineering Council,Pittsburgh,Pa.; Andrews (George H.) Engineering Assoc. Inc.,New York

4. DOCUMENT DATE
1959

5. NUMBER OF PAGES
~~43~~p. 45p.

6. ARC NUMBER
ARC 664.76.I61

7. REFERENCE ORGANIZATION NAME AND ADDRESS
AID/TA/OST

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(Revised 1959)
(Plant requirement no.4)

9. ABSTRACT

10. CONTROL NUMBER
PN-AAF-691

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Feeding stuffs
Industrial plants
Manufacturing
Pelleting
Requirements
Small scale industries

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/TA/OST

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

TABLE OF CONTENTS

	Page
Introduction	1
General Assumptions	1
Product Specifications	2
Manufacturing Operations	3
Manufacturing Unit Used	4
Direct Materials	4
Cost of Two Chicken Feeding Formulas	5
Cost of a Chicken Feeding Formula	6
Cost of Two Cattle Feeding Formulas	7
Direct Materials Needed	8
Equipment Requirements	9
Production Tools and Equipment Needed	10
Other Tools and Equipment	11
Furniture and Fixtures	11
Direct Labor	12
Indirect Labor	12
Supplies	12
Plant Layout	13
Plant Site	13
Buildings	13
Power	14
Water	14
Fuel	14
Truck	14

	Page
Provisions for Expansion	14
Depreciation	15
Manufacturing Overhead	16
Manufacturing Costs	16
Fixed Assets	16
Working Capital	16
Capital Requirements	16
Sales Revenue	17
Recapitulation of Costs, Sales and Profits	17
Budget Control	18
Budget Control Accounts	18
Purchase Requisition	19
Voucher Check	20
Engineers	21
Training	22
Safety	23
Summary	24
Materials and Supplies	24
Market Factors	24
Export Markets	25
Marketing Problems	25
Economic Factors	26

	Page
Personnel	26
Laws and Regulations	26
Financial Factors	27
Financial Requirements of the Project	27
Short Term Bank Credits	27
Financial Plan	27
Bibliography	28
Abbreviations	28
Feed Mixer	29
Schematic Flow Chart	30
Grain Storage Tank	31
Hammer Mill	31
Molasses Mixer	32
Pelletizing and Bagging	32
Fork Lift Truck	33
Bucket Elevator Conveyors	34
Plant Layout	35
Cross Section View of Main Plant Area	36
Schematic Diagram of Handling Material	36

A N I M A L F E E D P E L L E T S

INTRODUCTION

The use of scientifically balanced diets is a widely recognized necessity for obtaining best results in the raising of animals and poultry. The diets vary with the type of animal, its age, and the purpose for raising it. In addition, the knowledge gained through research results in continuous changes in the recommended diets. Formulas for each of several applications are included in this report. They are representative of an infinite number of possible formulas for each of the conditions.

The food available in each locality should be substituted in these formulas to keep the cost at a minimum. This can be done while maintaining quality. The tables of costs include a blank column headed Actual where the local costs of all the items can be entered.

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 labor costs 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 will operate on three shifts per day, five days per week, fifty weeks per year, in order to utilize plant capacity to best advantage.

7. No special provision has been made for the training of new personnel. It is assumed that learner's rates will be 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 competing 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. Each machine will be set up to do one operation on one particular product most of the time. Apart from slight adjustments, no setup time will be required and none will be allowed in the unit cost calculations.

PRODUCT SPECIFICATIONS

The product specifications vary with the use of the food. For example, there is a difference between diets for broiler chickens and laying chickens. The formulas given later on pages 5, 6 and 7, are only representative and locally available feeds should be substituted where economically feasible.

Because of the advantages of the pellet form for animal and poultry feeds, the feed manufactured in this plant is in the pellet form. Two main advantages are:

1. There is little waste feed. Pellets are not as easily spread out and lost as dry feed.

2. The food consumed will be properly balanced. All of the necessary food elements are included in each pellet.

MANUFACTURING OPERATIONS

The process required to make feed pellets is one of weighing and mixing. Briefly, the process consists of weighing the correct amounts of material for one batch of a formula and then thoroughly mixing them. The mixing equipment, see Figure 1, is most important. The advantage of a formula over the usual use of owner grown feeds is that it contains all of the necessary food elements for proper growth and development. However, unless the mixing of the formula is complete this advantage will be lost. This is particularly true where highly concentrated vitamin supplements are used. Unless they are evenly spread throughout the entire formula batch some animals or poultry will be getting more vitamins than they can efficiently use. Others will get less than they require.

The flow of material through the plant is shown schematically in Figure 2. The large volume items received are dumped in the receiving hopper and carried by conveyors to the storage tanks. Small volume items are stored in their original containers adjacent to the scales. Three or four low skill men are required to handle incoming material, depending on how it is received. In addition a receiving clerk is necessary to record materials received. This clerk is expected to perform physical work when not engaged in clerical duties.

As the material in a storage tank (Figure 3) is required for a formula, it is moved by conveyor to the batch bins and the proper quantity is weighed out on the scale. From the scale it is conveyed to the crusher or hammer mill or both and then to the collectors for the mixers. Figure 4 illustrates a hammer mill open for inspection. Materials which are used only in relatively small volume are emptied from their original containers at the scale. One man is required full time for this part of the operation. He must have the ability to work with figures and maintain records. An additional man may be required part time to move the low volume materials from storage to the scales.

After all the dry materials for a batch are in the collector they are emptied into a mixer. The time required to mix thoroughly the materials varies with the formulas. Average mixing times for representative formulas will have to be obtained from the equipment manufacturer. One man is sufficient to control the dry mixers, molasses mixer, and pelleting machine as the process requires no manual labor. This man must have good judgment and be able to make minor repairs and adjustments to the machines. The foreman or plant manager is available to make any major decisions.

When the formula leaves the mixers it may be bagged or it may be mixed with molasses in the molasses mixer (Figure 5) and then pelletized in the pelletizing equipment. The final form depends

on customer requirements. The bagging of the formula requires two unskilled men. Figure 6 illustrates the pelletizing and bagging equipment. As each bag is filled it is closed and placed on a wooden pallet. These men use a hand operated lift truck to move the filled pallets far enough to keep their immediate area clear. Each of the pallets holds 20 bags (one ton) in four layers of five bags each. These pallets are moved to storage and stacked by a powered lift truck, see Figure 7, which is also used in shipping. The shipping of the formula requires three or four unskilled men plus a clerk to keep records and a man to operate the lift truck.

Many plants of this size in the United States receive and ship part of their material in railroad cars and the remainder by truck. The plant discussed in this report is of a size which would permit all incoming and outgoing shipments to be made by truck. Rail shipments should be considered, however, as they may result in savings in freight costs.

MANUFACTURING UNIT USED

The capacity of the plant is approximately 2 tons per hour, or 50 tons in 24 hours, based on the capacity of the pellet machine. The capacity of all the equipment will depend upon the material or materials being processed. For example, the greater the variety of materials in a mixture, the longer it usually takes to complete the mixing. The annual production is estimated at 12,500 tons.

DIRECT MATERIALS

The direct materials used by this plant for cost estimating will be only those used in the formulas assumed. In addition, bags are needed for the completed products. The total costs of the direct materials in each of the representative formulas are shown pages 5, 6 and 7.

The direct material costs for one week's production of 250 tons will depend on the volume of each formula produced; this is variable. Therefore, to obtain an estimate of the direct material used it was assumed that the week's production would consist of the following quantities of each formula:

Chicken starter mash	25 tons
Chicken laying mash	70 tons
Broiler mash	70 tons
Calf starter	35 tons
Beef cattle supplement	50 tons
Total	250 tons

COST OF TWO CHICKEN FEEDING FORMULAS

Ingredients	Starter Mash			Laying Mash		
	Quantity in Pounds	Cost per 100 Pounds	Cost per Formula	Quantity in Pounds	Cost per 100 Pounds	Cost per Formula
Yellow corn - ground	923.6	$ 2.09	$ 19.31	762.6	$ 2.09	$ 15.95
Wheat middlings	300.0	2.20	6.60	300.0	2.20	6.60
Crushed oats	100.0	2.16	2.16	200.0	2.16	4.32
Dehydrated alfalfa meal	100.0	3.05	3.05	120.0	3.05	3.66
Soybean oil meal	300.0	2.85	8.55	400.0	2.85	11.40
Fish meal	50.0	9.30	4.65			
Meat scrap	100.0	5.13	5.13	100.0	5.13	5.13
Dried whey	60.0	7.50	4.50			
Riboflavin supplement containing 20 milligrams per pound	30.0	24.00	7.20			
Ground limestone	30.0	1.25	.38	20.0	1.25	.25
Bone meal or dicalcium phosphate				80.0	5.31	4.25
Iodized salt	5.0	1.58	.08	15.0	1.58	.24
D-activated animal sterol	1.0	11.00	.11	2.0	11.00	.22
Manganese sulfate	0.4	6.00	.02	0.4	6.00	.02
Totals	2000.0		$ 61.74	2000.0		$ 52.04

COST OF A CHICKEN FEEDING FORMULA

Ingredients	Quantity in Pounds	Cost per 100 Pounds	Cost per Formula
Yellow corn - ground	983.6	$ 2.09	$ 20.57
Wheat bran	50.0	2.13	1.07
Wheat middlings	200.0	2.20	4.40
Crushed oats	50.0	2.16	1.08
Dehydrated alfalfa meal	80.0	3.05	2.44
Soybean oil meal	300.0	2.85	8.55
Fish meal	100.0	9.30	7.00
Meat scrap	40.0	5.13	2.05
Dried whey	40.0	7.50	3.00
Brewers' dried yeast	30.0	9.50	2.85
Distillers' fried solubles - grain	80.0	4.00	3.20
Ground limestone	40.0	1.25	.50
Iodized salt	5.0	1.58	.08
Anhydrous manganese sulfate	0.4	6.00	.02
D-activated animal sterol	1.0	11.00	.11
Totals	2000.0		$ 56.92

COST OF TWO CATTLE FEEDING FORMULAS

Ingredients	Calf Starter			Beef Cattle Supplement		
	Quantity in Pounds	Cost per 100 Pounds	Cost per Formula	Quantity in Pounds	Cost per 100 Pounds	Cost per Formula
Yellow corn - ground	400.0	$ 2.09	$ 8.36			
Wheat bran	300.0	2.13	6.39			
Crushed oats	400.0	2.20	8.80			
Linseed oil	140.0	3.55	4.97			
Soybean oil meal	290.0	2.85	8.27	1301.0	$ 2.85	$ 37.08
Dehydrated alfalfa meal	140.0	3.05	4.27	280.0	3.05	8.54
Cane molasses	100.0	1.05	1.05	280.0	1.05	2.94
Dried skim milk	100.0	9.78	9.78			
Distillers' dried solubles - grain	100.0	4.00	4.00			
Irradiated yeast	0.5	16.00	.08			
Bone meal	10.0	5.31	.53	104.0	5.31	5.52
Ground limestone	10.0	1.25	.13			
Iodized salt	10.0	1.58	.16	34.0	1.58	.54
Vitamin A feeding oil (2,724,000 units of vitamin A per pound)	3.0	30.00	.90			
Vitamin A and D concentrate (4,540,000 units A and 565,500 units D per pound)				1.0	99.00	.99
Totals	2003.5		$ 57.69	2000.0		$ 55.61

DIRECT MATERIALS NEEDED FOR ONE WEEK'S PRODUCTION

Material	Quantity per Week in Pounds	Cost per 100 Pounds	Total Cost	Actual Cost per 100 Pounds	Actual Total Cost
Yellow corn	159,324	$ 2.09	$ 3,330		
Wheat bran	14,000	2.13	296		
Wheat middlings	42,500	2.20	935		
Oats	34,000	2.16	734		
Linseed oil meal	4,900	3.55	174		
Dehydrated alfalfa	35,400	3.05	797		
Soybean oil meal	131,700	2.93	3,853		
Molasses	17,500	1.05	184		
Fish meal	8,250	9.30	767		
Meat scraps	12,300	5.13	631		
Dried whey	4,300	7.50	323		
Dried skim milk	3,500	9.78	342		
Brewers' dried yeast	2,100	9.50	199		
Distillers' dried solubles - grain	9,100	4.00	364		
Riboflavin supplement	750	24.00	180		
Irradiated yeast	18	16.00	3		
Bone meal	11,150	5.31	864		
Ground limestone	5,300	1.25	66		
Iodized salt	3,575	1.58	56		
Anhydrous manganese sulfate	28	6.00	2		
D-activated sterol	235	11.00	26		
Manganese sulfate	38	6.00	2		
Vitamin A feeding oil	105	30.00	32		
Vitamin A and D concentrate	50	100.00	50		
Three-thickness paper bags	5,000	each .11	550		
Total			$14,760		

Total Annual Cost of Direct Material $738,000.

EQUIPMENT REQUIREMENTS

The majority of the equipment in a feed mill is of a standard type. However, it must be specialized for a particular installation. The exact length of a screw conveyor, the height of a bucket elevator (Figure 8) and the location of discharge chutes must be determined for each installation. For this reason, a single price covers the complete equipment necessary to set up the production facilities of the plant. The purchase of all production equipment from one dependable source insures a well engineered plant with balanced productive capacities of the individual units.

The grain storage tanks, an example of which was shown in Figure 3, are included in the productive equipment list, as they are directly connected to the hammer mill, molasses mixer, and pelletizer through conveyors and chutes.

The use of these storage tanks materially reduces the amount of manpower required to receive, store, and move direct materials to the mixers. Also, the sole purpose of the boiler is to supply steam to the pelletizer; therefore, it is considered production equipment.

The warehouse equipment consists of a gasoline powered lift truck and wooden pallets. The use of a lift truck and pallets reduces the manpower required to move incoming and outgoing material. In addition it reduces the size of the warehouse by allowing the material to be stacked. This efficiently utilizes the height of the building. The hand-operated pallet trucks are useful in short moves of material to and from the production unit.

Production tools and equipment needed are listed on page 10.

PRODUCTION TOOLS AND EQUIPMENT NEEDED

Department	Tools and Equipment	Total Installed Price	Actual Total Installed Price
Production	Hammermill - 14"		
	Crusher		
	Mixer -- 100-bushel		
	Molasses mixing unit		
	Pellet mill system - complete		
	Steel bucket elevator		
	Screw conveyors		
	Hopper scale		
	Total	$36,000	_____
	4 - Grain storage tanks	21,000	_____
	1 - 15 hp. -- 75 p.s.i. boiler	5,000	_____
Warehouse	1 - Lift truck - 1 1/2 ton capacity 8 foot lift	4,000	_____
	500 - Wooden pallets -- 2 faced, 4' x 4'	1,500	_____
	3 - Hand operated pallet trucks	1,000	_____
	Total	$68,500	_____

OTHER TOOLS AND EQUIPMENT

Little additional equipment will be required. Trucks are probably necessary for the delivery of the feed to local consumers and not too distant retailers or distributors. The typewriter and adding machines are for use in the office. Several stand-by electric motors of various sizes are necessary for emergencies.

Department	Description	Number Needed	Price Each	Total Price	Actual Price Each	Actual Total Price
Office	Typewriter	1	$ 150	$ 150	____	____
	Adding machine	1	150	150	____	____
Shipping	3-ton truck	2	2,700	5,400	____	____
Maintenance	Electric motors	4	200	800	____	____
	Mechanics' tools	1	200	200	____	____
	Total			$ 6,700		____

FURNITURE AND FIXTURES

Department	Description	Number Needed	Price Each	Total Price	Actual Price Each	Actual Total Price
Office	Desks	2	$ 75	$ 150	____	____
	Filing cabinets	2	75	150	____	____
	Chairs	5	30	150	____	____
	Total			$ 450		____

DIRECT LABOR

The direct labor manpower requirements per shift are 2 men to operate the production equipment and 2 men to move materials. The three-shift operation will require 12 men.

Description	Number Needed	Hourly Rate	Annual Cost	Actual
Operators	6	$ 1.75	$ 20,000	
Material Handlers	6	1.50	18,000	
Total	12		$ 38,000	

INDIRECT LABOR

Description	Number Needed	Hourly Rate	Annual Cost	Actual
Manager	1		$ 8,000	
Foreman	2		12,000	
Maintenance	3	$ 2.00	12,000	
Bookkeeper	1		5,000	
Secretary	1		3,000	
Receiving and Shipping	10	1.50	30,000	
Truck Drivers	2	1.50	6,000	
Total	20		$ 76,000	

SUPPLIES

Items	Annual Cost	Actual
Oil and Grease	$ 300	
Factory Maintenance and Repairs	3,000	
Truck Gas, Oil and Repairs	1,900	
Office Supplies	300	
Total	$ 5,500	

PLANT LAYOUT

The preliminary plant layout is shown in Figure 9. It is designed for a straight line flow of material from storage, through processing, and into the warehouse.

The location of the machinery is such that elevator conveyors can service more than one machine. Different materials require different processing, so it is possible to by-pass some of the machines. This has been done with a minimum number of mechanical material handling devices.

For safety reasons, the boiler unit should be in a separate building or, if in the main building, separated from the production units by a heavy wall. The plant layout shows a separate building.

PLANT SITE

The first consideration in determining the plant site is its nearness to raw materials and consumers so freight costs will not be excessive. The total land area required is approximately two acres. This will permit future expansion.

The site should be fairly level to minimize construction costs. It should be serviced by good roads if trucks are necessary to deliver both the finished product to the consumer and the materials to the plant. The estimated cost of the plant site is $2,000.

The plant layout shows a railroad siding. This is desirable but not necessary. The use of a railroad to handle part of the volume of material passing through the plant should be less expensive than the handling of all material by truck. Figure 11 shows the ease of handling incoming material received by rail.

BUILDINGS

The suggested buildings are steel framed and sheet steel covered, with a cement floor. Figure 10 shows a cross section view of the main portion of the building which is 42 feet long by 30 feet wide, by 20 feet high. There is an 8-foot deep basement under 24 feet of this length. The monitor top shown is only large enough to cover the collectors. The remainder of the building, the warehouse, is 12 feet high by 116 feet long, by 30 feet wide. The building for the boiler unit is 10 feet wide by 20 feet long.

The estimated cost of these buildings, including the necessary wiring and plumbing, and the concrete slab for the grain storage tanks, is $19,800.

POWER

It is assumed that adequate power will be available at the plant site. The cost of annual power requirements for this plant should not exceed $2,400.

WATER

The annual water requirements for production, boiler, sanitary purposes and fire protection is estimated at $1,200.

FUEL

The kind of fuel to be used should be determined in accordance with the cheapest fuel available where the plant is to be established. Coal or Bunker C oil is the recommended fuel depending on local conditions. The estimated annual cost of fuel is $3,000.

TRUCK

Two 3-ton delivery trucks are listed in the equipment requirements. The cost of gas, oil and repairs for these trucks is included in Supplies. The cost of the truck driver is included in Indirect Labor.

PROVISION FOR EXPANSION

The output of the plant is limited by the pelletizing equipment. The installation of a pelletizer of larger capacity would also require a larger boiler. However, the output of the plant can be easily increased by producing feed in dry loose form if the consumer will accept the feed in this form. There is sufficient space to add another mixer and still utilize the present conveying equipment. This would increase the output of the plant 50 percent.

DEPRECIATION

Item	Actual Cost	Estimated Cost	Years' Life	Estimated per Year	Actual per Year
Building	_____	$19,800	20	$ 990	_____
Production tools and equipment					
Processing equipment	_____	68,500	20	3,425	_____
Lift truck	_____	5,000	10	500	_____
Hand pallet trucks	_____	900	10	90	_____
Pallets	_____	1,500	1	1,500	_____
Other tools and equipment					
Office	_____	300	10	30	_____
Trucks	_____	5,400	3	1,800	_____
Maintenance motors	_____	800	3	265	_____
Mechanics' tools	_____	200	2	100	_____
Furniture and fixtures	_____	450	10	45	_____
Total				$ 8,745	_____

MANUFACTURING OVERHEAD

Item	Estimated	Actual
Depreciation	$ 8,745	_____
Indirect Labor	76,000	_____
Power	2,400	_____
Water	1,200	_____
Fuel	3,000	_____
Supplies	5,500	_____
Total	$ 96,845	_____

MANUFACTURING COSTS

Direct Labor	38,000	_____
Direct Materials	738,000	_____
Manufacturing Overhead	96,845	_____
Total	$ 872,845	_____

Manufacturing Cost per ton $69.90

FIXED ASSETS

Land	$ 2,000	_____
Building	19,800	_____
Production Tools and Equipment	68,500	_____
Other Tools and Equipment	6,700	_____
Furniture and Fixtures	450	_____
Total	$ 97,450	_____

WORKING CAPITAL

Direct Materials	- 10 days	$ 29,000	_____
Direct Labor	- 10 days	1,520	_____
Manufacturing Overhead	- 10 days	3,874	_____
Reserve Sales Collections	- 30 days	93,750	_____
Total		$ 128,144	_____

CAPITAL REQUIREMENTS

Fixed Assets	$ 97,450	_____
Working Capital	128,144	_____
Total	$ 225,594	_____

SALES REVENUE

Manufacturers in the United States usually offer quantity discounts of about 8 percent on orders of 8 tons or over. Discounts are also allowed on large orders when delivery is accepted at the plant.

The average price for fertilizer delivered by the Manufacturer is $90 per ton. The annual gross sales are estimated at $1,125,000.

The 8 percent discount for quantity orders and the discounts for delivery accepted at the plant usually averages about 0.373 percent on the total annual gross sales. This would amount to about $42,000 per year.

RECAPITULATION OF COSTS, SALES AND PROFITS

	Estimated		Actual
Direct Material	$ 738,000		_____
Direct Labor	38,000		_____
Manufacturing Overhead	96,845		_____
Total Manufacturing Costs		$ 872,845	_____
Interest on Loans	$ 8,000		_____
Insurance	2,000		_____
Legal	2,400		_____
Auditing	3,600		_____
Unforeseen Expense	23,155		_____
Total Administrative Costs		39,155	_____
Sales commissions, travel, freight out and bad debts		31,000	_____
Discounts and allowances		42,000	_____
Profit before taxes		140,000	_____
Annual Gross Sales		$1,125,000	_____

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	$_____	$ 1,333	$ 16,000	$_____
20	Sales	_____	6,083	73,000	_____
30	Direct Materials	_____	61,500	738,000	_____
40	Supplies	_____	458	5,500	_____
51	Power*	_____	200	2,400	_____
52	Water*	_____	100	1,200	_____
53	Fuel	_____	250	3,000	_____
60	Unforeseen Expense (Reserve Account)	_____	1,763	23,155	_____
71	Direct Labor*	_____	3,166	38,000	_____
72	Indirect Labor*	_____	6,333	76,000	_____
80	Depreciation (Reserve Account)	_____	---	8,745	_____

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

Feeds and Feeding — Morrisson Publishing Company, Ithaca, New York

Periodicals

Feed Age — American Trade Publishing Co., 71 Vanderbilt Avenue, New York 17, New York

Feed Bag — Editorial Service Publishing Co., 1712 West St. Paul Avenue, Milwaukee 3, Wisconsin

ABBREVIATIONS

'	Foot or feet
"	Inch or inches
H.P.	Horsepower
P.S.I.	Pounds per square inch
sq. ft.	Square feet or foot

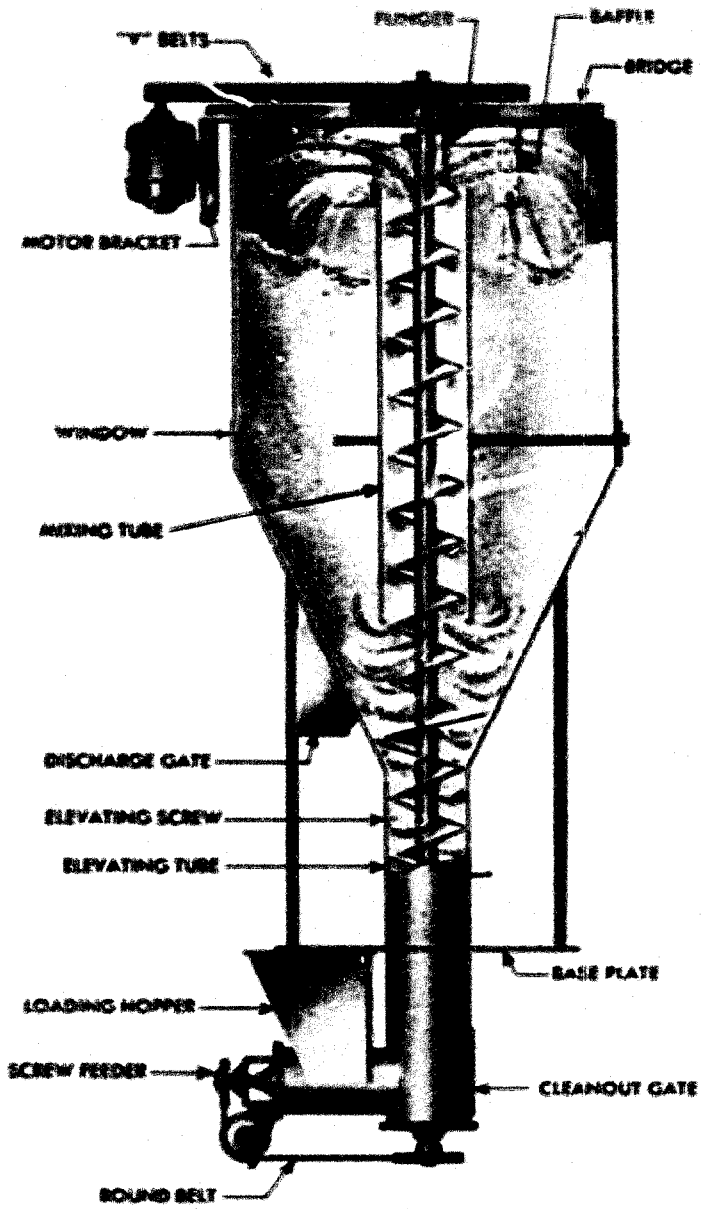


Figure 1 -- Cross Sectional View of Feed Mixer

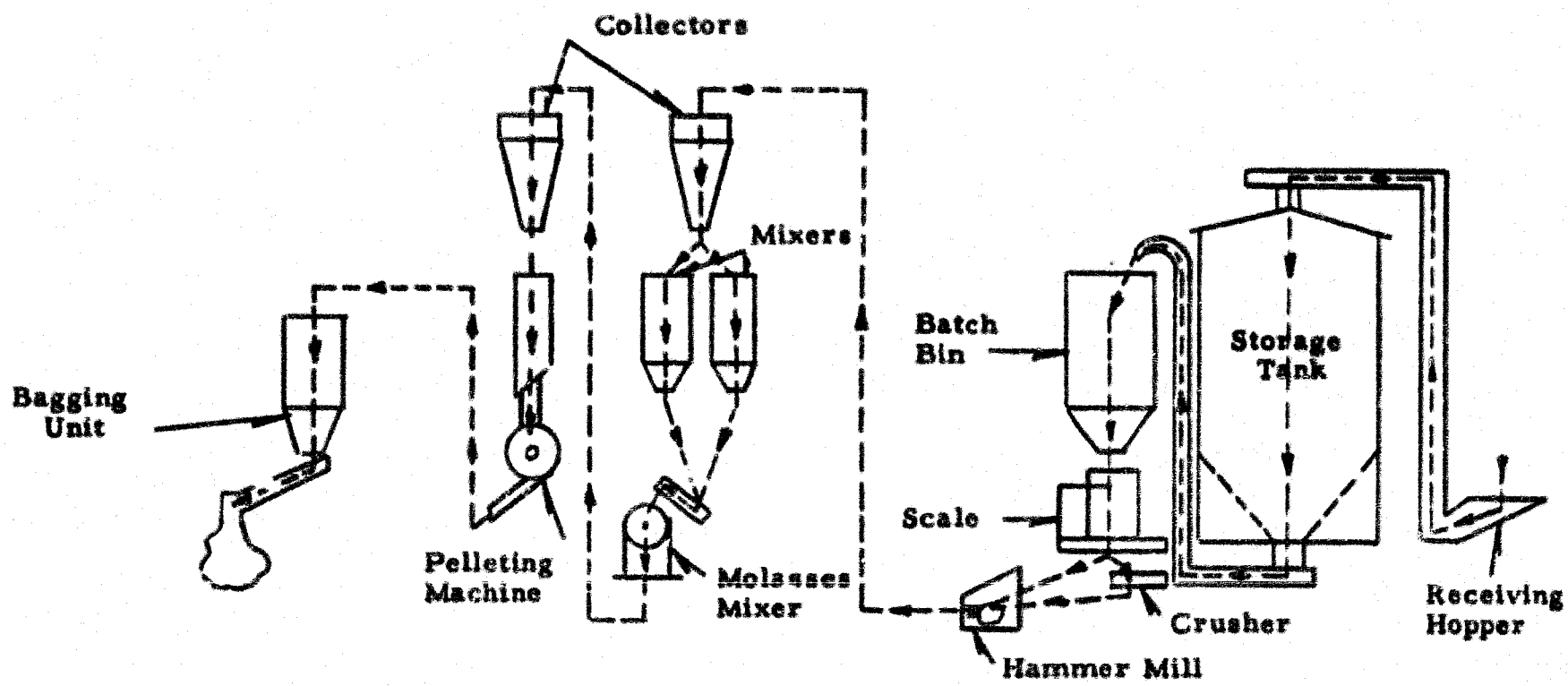


Figure 2 -- Schematic View of Material Flow Through Processing

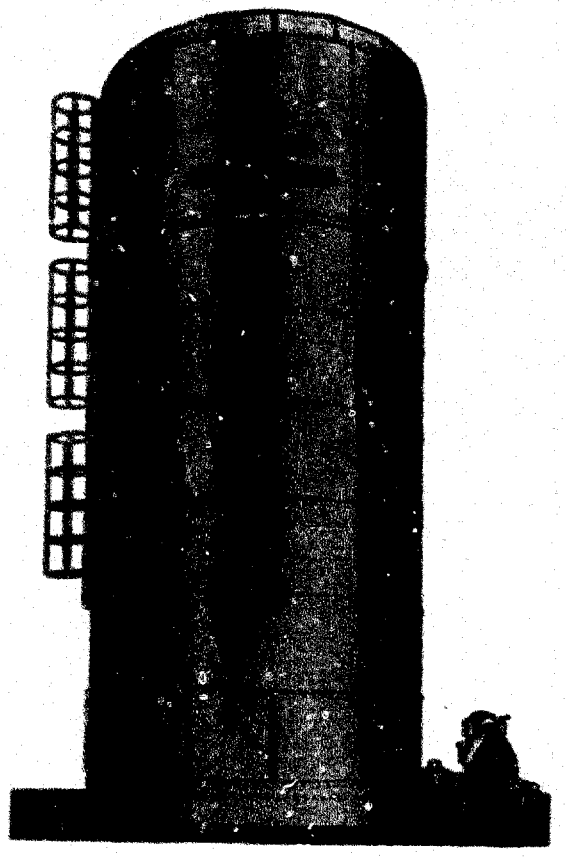


Figure 3 -- Grain Storage Tank

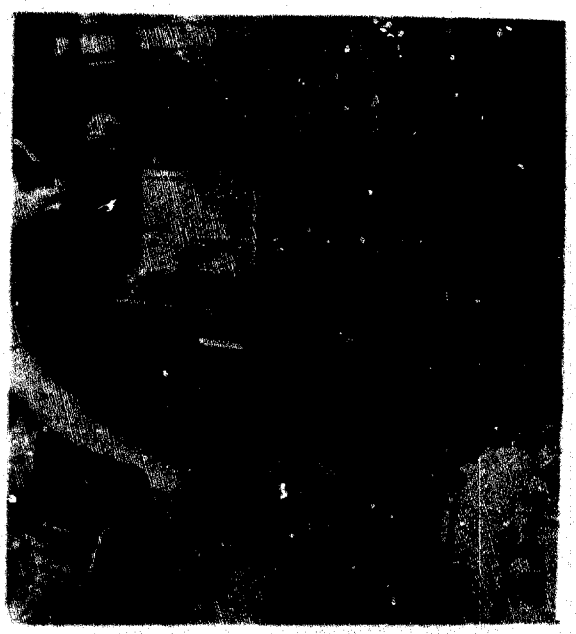


Figure 4 -- Hammer Mill Open
For Inspection

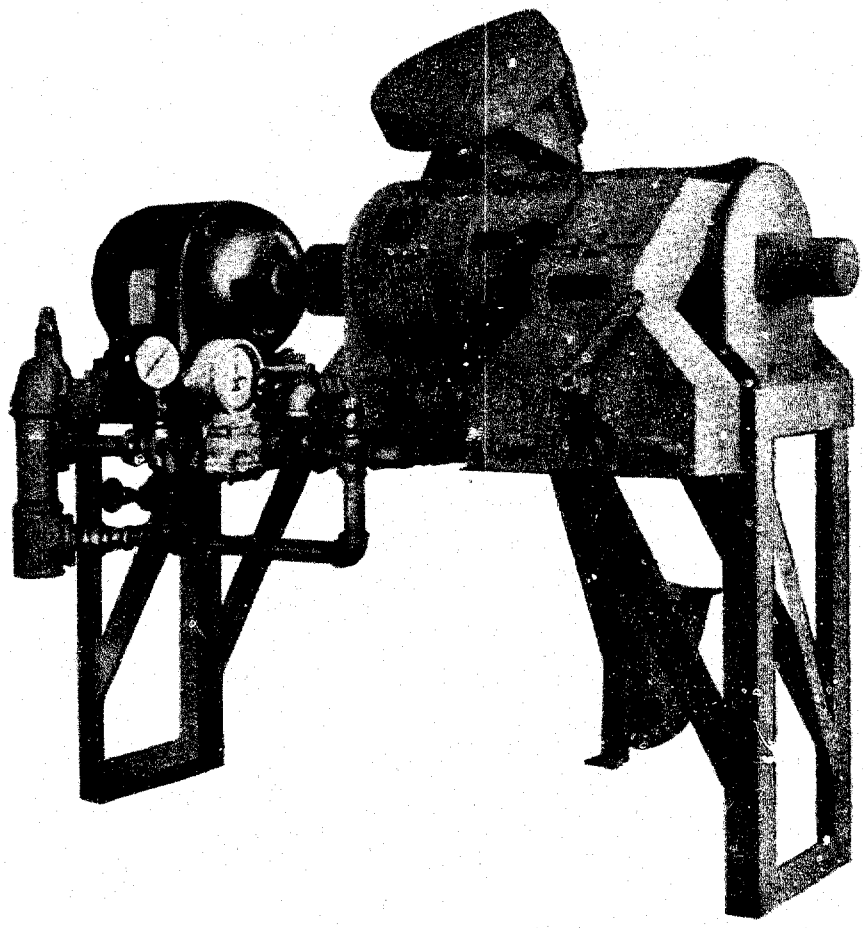


Figure 5 -- Molasses Mixer

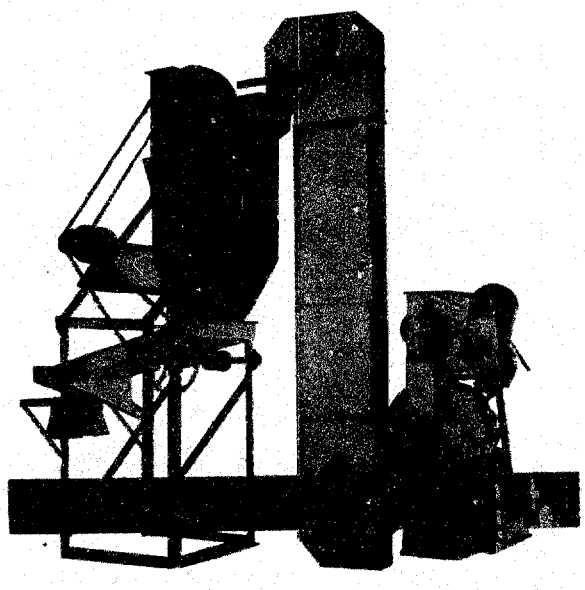


Figure 6 -- Pelletizing and Bagging Equipment

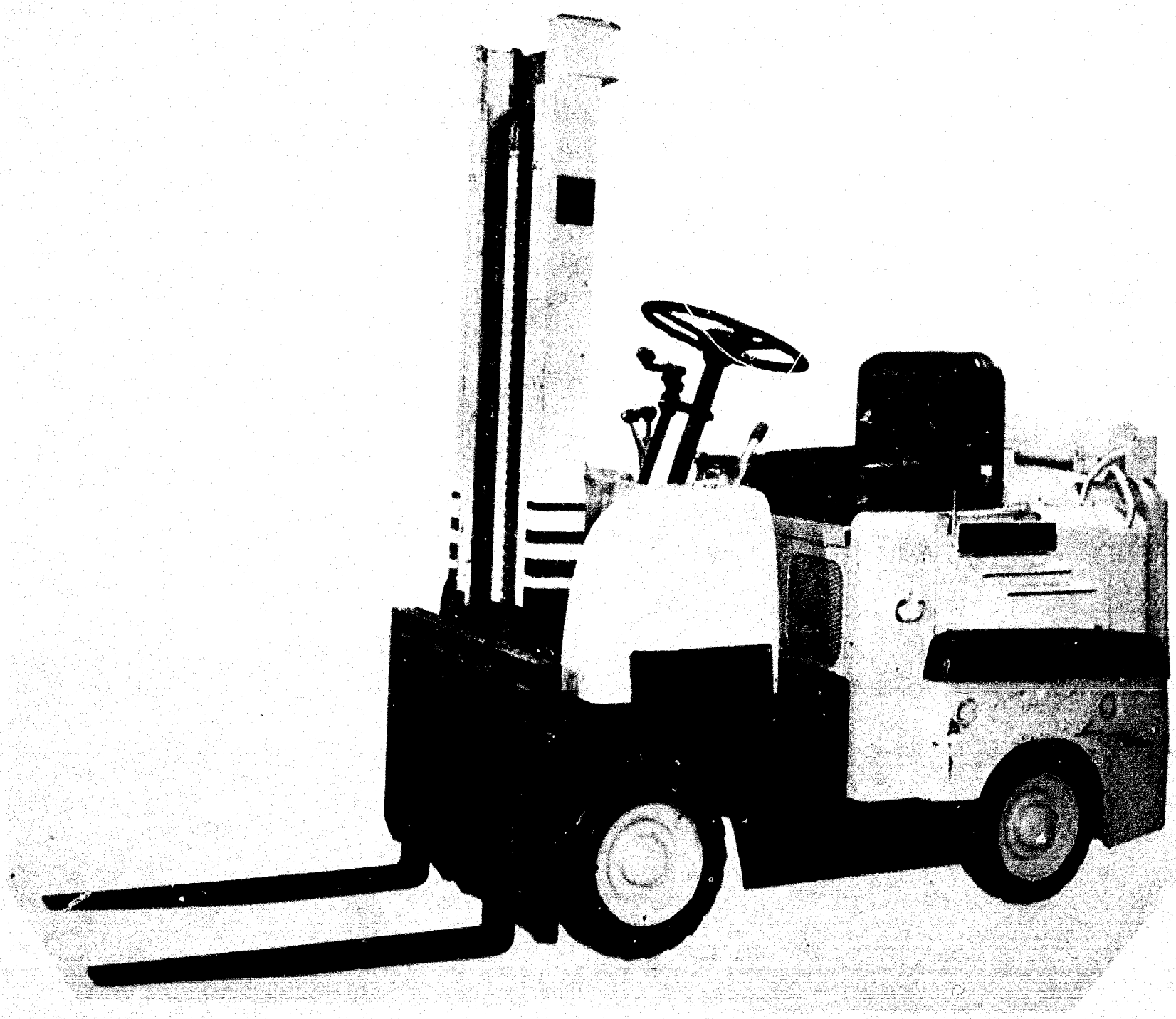


Figure 7 -- Fork Lift Truck

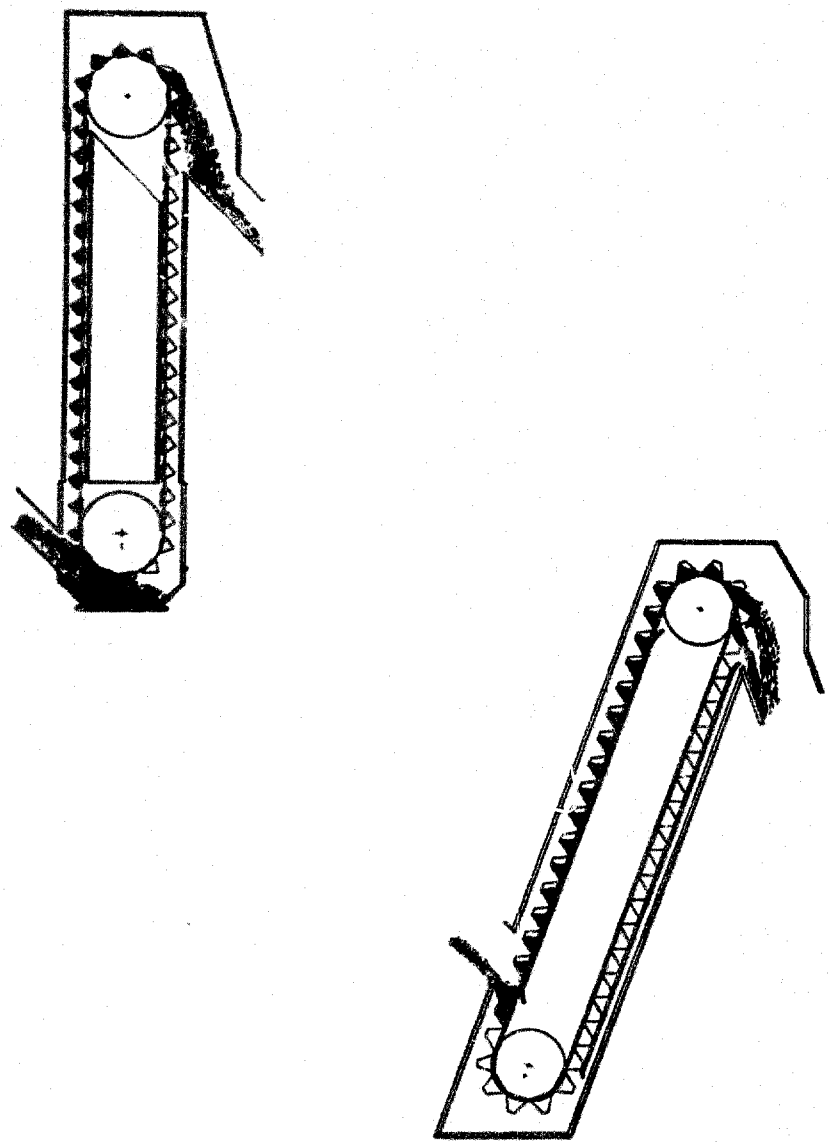


Figure 8 -- Typical Bucket Elevator Conveyors

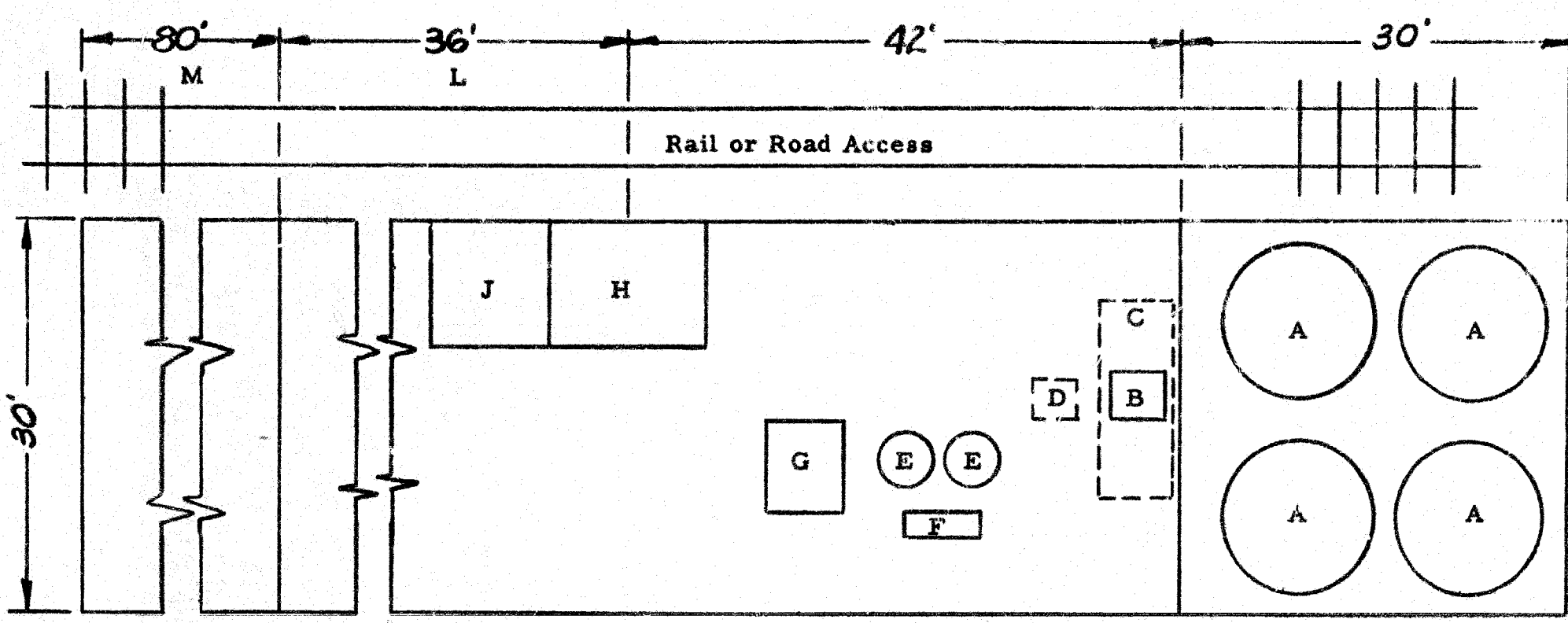
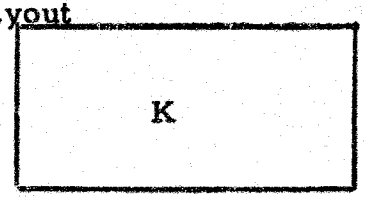


Figure 9 -- Preliminary Plant Layout



Scale: 1" = 12'

Key

A	Grain storage tank
B	Scale
C	Overhead batch bin
D	Grinder in basement
E	Mixer
F	Molasses mixer
G	Pelletizing equipment
H	Office - 120 sq. ft.
J	Rest room - 100 sq. ft.
K	Boiler house - 200 sq. ft.
L	Direct materials - 1000 sq. ft.
M	Bagged feed - 2400 sq. ft.

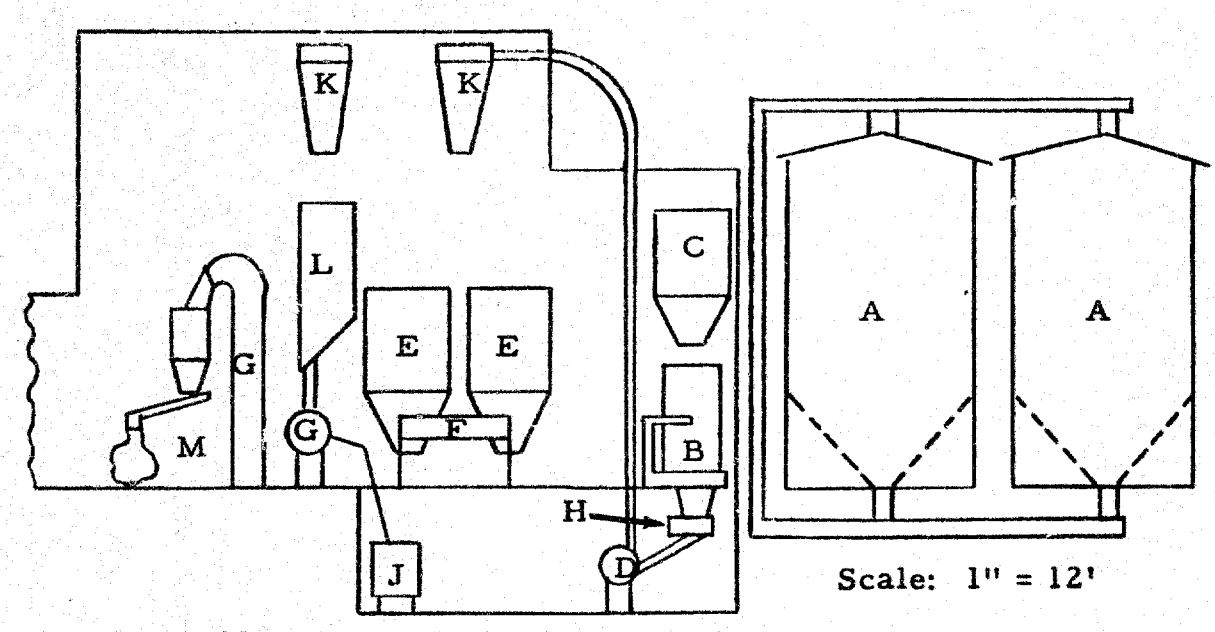


Figure 10 -- Cross-Sectional View of Main Plant Area

Key

A	Grain storage tank	G	Pelletizing equipment
B	Scale	H	Crusher
C	Overhead batch bin	J	Molasses tank
D	Grinder	K	Collector
E	Mixer	L	Bin for molasses mixer
F	Molasses mixer	M	Bagging station

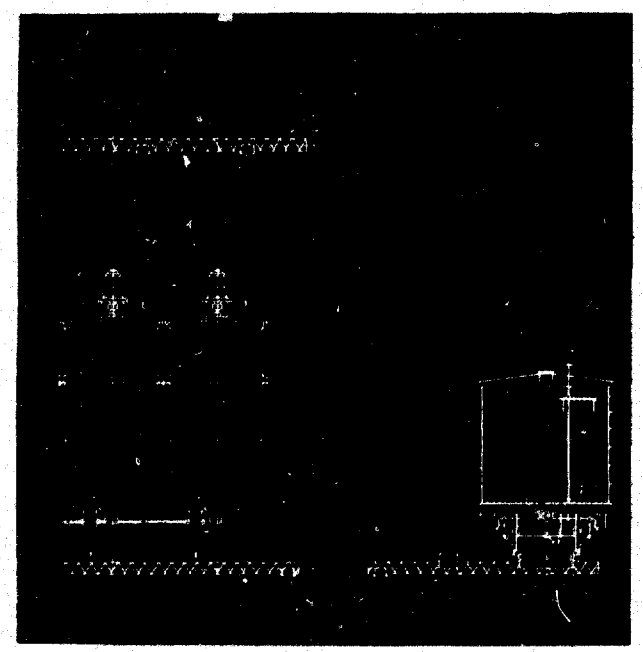


Figure 11 -- Schematic Diagram of Handling Material Received by Rail