CONTINUOUS VACUUM DRYING OF WHOLE MILK FOAM

Projected Commercial Manufacture
—with process diagrams and costs

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AN INTENSIVE research and development program in our Engineering Laboratory has achieved a new and improved form of dry whole milk. This product has excellent fresh flavor, ready dispersibility in cold water, and long refrigerated storage life[8].

The process for making it consists of evaporating pasteurized whole milk to a concentrate, dispersing nitrogen gas into it, and drying it continuously as a foam. Drying is done on an endless metal belt in an evacuated chamber.

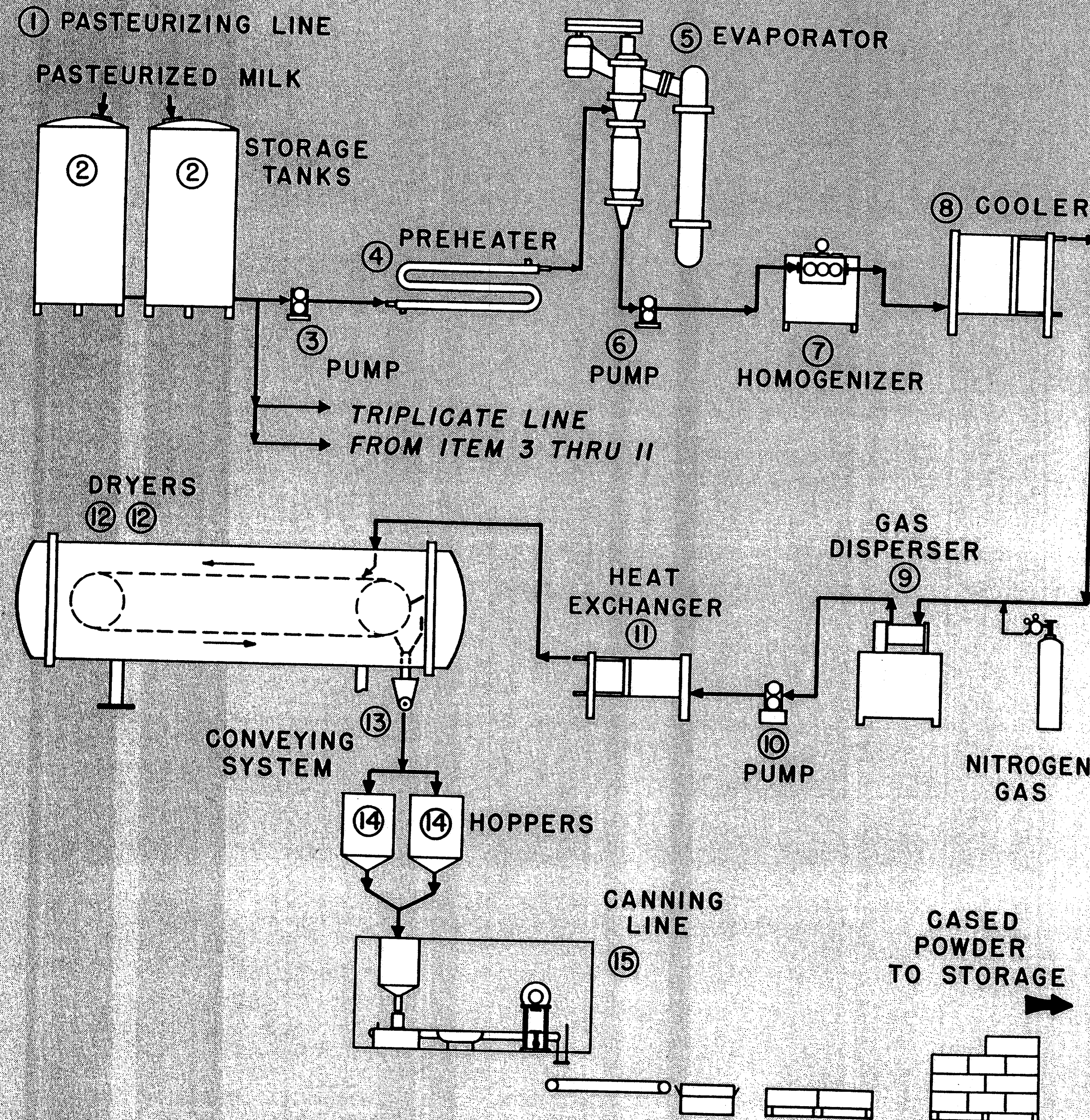
The development of the process and the properties of the product have already been described in earlier publications[1, 2] and in two forthcoming articles[3, 4]. Recently a small-scale retail market test of the product has been run with favorable results[5].

Engineering and economic studies have been made for the production of this new dried whole milk on a commercial scale. This publication presents the results of such a study for a plant designed to produce about 15,000,000 quart-equivalents of powder a year. Included are a description of the process as visualized for commercial use, a list of the equipment required and its cost, the estimated capital investment required, and estimated manufacturing costs.

The Commercial Process

The recommended design for the first commercial plant to be built would include two continuous vacuum dryers, both to be operated for 120 hr (five days) each week. At the end of this operating period, the dryers would be shut down for two days. During this interval, they would be cleaned and sanitized. And any necessary maintenance operations and mechanical adjustments would be made in preparation for the next week's run.

The processing steps for commercial operation are shown in the accompanying flowsheet. Raw milk is pasteurized (1) by standard HTST procedure (16½ sec at 162F), except that the milk is heated in two steps. After heating first to 140F, the milk is passed through a holding coil with 30-sec retention time before final heating to 162F.



FLOWSHEET of commercial process for continuous vacuum drying of whole milk foam.

The pasteurizing line has a capacity of approximately 1,000 gal per hr. It will process in 16 hr the quantity of milk needed to run the plant for 24 hr. Cleaning of this line will be done daily.

Pasteurized milk is stored in cold-wall tanks (2) and fed to the process as required. Two storage tanks are used so that one can be cleaned and sanitized while the other is in use.

Items (3) through (11), the concentrate preparation line, are furnished in triplicate; that is, three parallel lines are installed. Each line is properly sized to prepare and deliver concentrate to one dryer. At the start of the weekly operating run, two of these concentrate lines will be placed in operation, one feeding each dryer. The third line will be in standby condition, cleaned and ready for

TABLE 1 – EQUIPMENT SUMMARY AND COSTS

Chief items of processing equipment. Numbers correspond to those on the flowsheet. Prices are f.o.b. manufacturer's plant, except as noted, and as of 4th quarter 1968. Equipment surfaces in contact with fluid milk or concentrate are of stainless steel or equivalent.

DESCRIPTION

1. **PASTEURIZING LINE** –
   a. Raw milk feed tanks; two required. Silo type, 20,000 gal each. Sanitary construction; jacketed for cooling. Side-entering agitator, remote-reading level indicator. Price for two $33,000
   b. Raw milk feed pump. Sanitary, positive delivery type, variable speed drive. To deliver 900-1100 gal per hour .... $ 1,350
   c. Plate-type heat exchanger. Contains two sections: (1) to heat raw milk from 40F to 140F, by "regenerative" heat transfer from pasteurized milk, which is cooled at the same time from 162F to 62F; (2) to heat raw milk from 140F to 162F by vacuum steam or hot water .... $ 5,400
   d. Holding coil – to give 30-sec holding time to milk at 140F. Sanitary stainless steel tubing............. $ 1,120
   e. Homogenizer. Single-stage, 3000 psig. Adjustable capacity within range of 900-1100 gal per hr by changing drive pulley and V-belts .... $ 8,800
   f. Holding coil – to give 16½-sec hold to milk at 162F at flow rate of 1050 gal per hr .... $ 1,040
   g. Flow diversion valve. With controls .... $ 1,900
   h. Cooler. Plate-type heat exchanger, to cool pasteurized milk from 62F to 40F using refrigerated solution at 30F .... $ 2,700
2. **PASTEURIZED MILK STORAGE TANKS** – two required. Similar to Item (1a) above but of 15,000-gal size each. Price for two $28,000
3. **FEED PUMPS** – one for each of three concentrate preparation lines. Positive-delivery type, variable-speed drive, capacity approximately 320 gal per hr. Price included in evaporator price
4. **PREHEATER** – to heat 320 gal per hr of milk from 40F to 135F before entering evaporator. Sanitary, stainless steel. Three at $1,800 each.............................. $ 5,400
5. **EVAPORATORS** – three required. Mechanically-agitated thin film type, approximately 60 sq ft of heat transfer surface each. To evaporate 2,000 lb of water per hr each at 135F milk boiling temperature. Price includes erection of equipment but not piping and wiring, and includes feed and product pumps. Three at $57,000 .... $171,000
6. **PRODUCT PUMPS** – three required. Positive delivery, variable-speed drive, sanitary. To pump 80 gal per hr of 45% solids concentrate at 135F. Price included in evaporator cost
7. **HOMOGENIZER** – two-stage, 3000-500 psig, variable speed drive. To homogenize 80 gal per hr of concentrate at 135F. Three required at $6,800 each $20,400

DESCRIPTION

8. **CONCENTRATE COOLER** – plate type; to cool 80 gal per hr of concentrate from 135F to 55F using refrigerated solution at 28F. Three required at $1,600 ea. ... $ 4,800
9. **SCRAPED SURFACE GAS DISPERSING UNIT** – single-tube type with full-length agitator and cooling jacket. To disperse nitrogen gas into 80 gal per hr of concentrate and simultaneously cool to within range of 48-32F using refrigerant at 28F. Internal volume for concentrate approximately 6 gal, jacketed area approximately 9 sq ft. Three required at $6,000 ea. $18,000
10. **PUMP** – to feed approximately 95 gal per hr of gassed concentrate to dryer. Positive delivery, variable-speed drive, sanitary type, Three required at $950 .... $ 2,850
11. **HEAT EXCHANGERS** – to adjust temperature of 95 gal per hr of gassed concentrate to approximately 45F before entering dryer. Plate type; 3 required at $1,400.$ 4,200
12. **DRYERS** – two required. Continuous, vacuum-chamber dehydrators operating at 19 mm of mercury absolute pressure. Endless solid stainless steel belt 4 ft wide x 98½ ft long. Cooling and heating drums 8½ ft diameter and 36 ft apart on centers. Including all necessary auxiliaries and controls, and installed in plant. Price for two $910,000
13. **CONVEYING SYSTEM** – screw conveyor, totally enclosed and air-tight. To convey powder from bottom of receivers on two dryers to two storage hoppers. Stainless steel .... $ 7,500
14. **HOPPERS** – two required. Each hopper to hold 8 hr production of powder. Stainless steel, cone bottom, air-tight; internal volume approximately 300 cu ft each. Price for two.. $ 6,000
15. **CANNING LINE** – to take powder from hoppers, weigh-fill and seal into No. 10 cans. Cans then labeled, cased and palletized. Can filling and sealing to be done inside an enclosure filled with inert gas (nitrogen and/or carbon dioxide) so as to prevent contact of oxygen (air) with the powder $85,000
16. **AIR COMPRESSOR** – to provide central compressed air supply, to operate pneumatic control instruments, valves, etc. .... $ 4,500
17. **CLEAN-IN-PLACE SYSTEM** – with pumps, tanks, valves, automatic programmer, etc., for cleaning milk processing equipment $13,000
18. **REFRIGERATION UNITS** – two units of 15 tons each. To provide central supply of refrigerated cooling solution at 28F for equipment items 1a, 1h, 2, 8, 9, and 11. Price for two $20,000

Total processing equipment $1,355,960

use. After a period of operation, for example 18 hr, the third concentrate line will be started up and the first one shut down for cleaning. After the first line has been cleaned and is ready to operate again, it can be started up and the second line shut down for cleaning. In this way, whenever the plant is operating, two concentrate lines will be in use, with the third line either being cleaned or in standby condition ready for use when needed.

Shutting down and cleaning the concentrate lines is required to remove deposited solids from the heat-transfer surfaces and to prevent bacterial build-up within the lines. It is estimated that each line can be run for 24 hr before it will require cleaning. This interval can easily be lengthened or shortened if shown to be desirable by operating experience after the plant has been placed in service.

Referring again to the flowsheet, pasteurized milk is pumped (3) through a preheater (4) to raise its temperature to 135F, then fed into the mechanically agitated thin-film evaporator (5). Here it is concentrated under vacuum (boiling at 135F) to 45% solids. Next the concentrate, at 135F is homogenized (7) and passed through a plate heat exchanger (8) to cool it to approximately 55F. Now a metered quantity of nitrogen gas, about 20% of the concentrate volume, is added and dispersed into the concentrate in the form of very fine bubbles by means of the scraped-surface gas dispersing unit (9). This is a type of machine often used in making ice cream. It consists of a jacketed cylinder surrounding a rapidly rotating longitudinal shaft with blades that wipe against the tube wall. Cooling liquid in the jacket is used to remove the heat generated by mechanical agitation and to lower the concentrate temperature to between 32-48F. After passing through pump (10), the gassed concentrate enters heat exchanger (11) for final temperature adjustment.

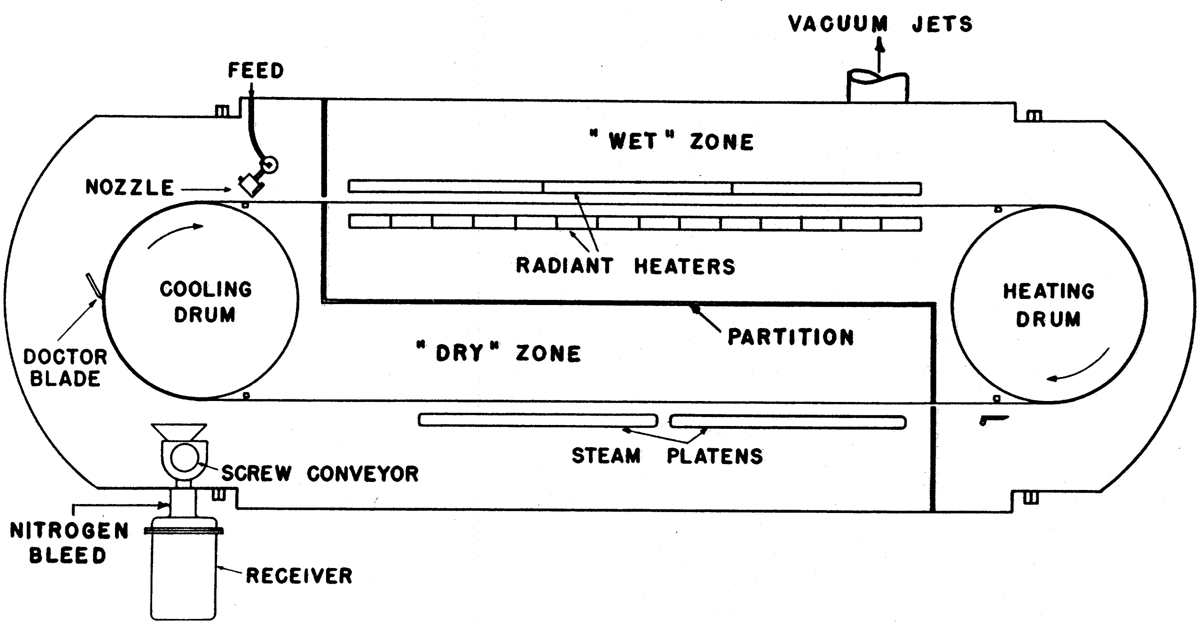
In the dryers (12) the concentrate is dried continuously to about 4.0% moisture on an endless stainless-steel belt (see diagram). Drying time is about 80 sec, and chamber pressure 19 mm of mercury absolute. Electric heating rods positioned above and below the belt supply by radiation most of the heat needed to remove the water. The dried milk is removed from the belt at the doctor blade and falls into one of two cylindrical receivers which are at the same pressure as the dryer. When a receiver is full, product collection is switched to the other receiver, and the full receiver is isolated from dryer by a tight-closing butterfly valve. This receiver is then brought up to atmospheric pressure by admitting nitrogen gas, and a second valve at the base of the receiver is opened to allow the powder to drop into the conveying system (13 on flowsheet) which transfers it to the storage hoppers (14).

The continuous vacuum dryers (see diagram) are a commercially available type[10], with modifications as developed by USDA to improve their performance in drying whole milk foam. Modifications included: (a) relocating the point of placing concentrate on the belt[1, 4]; (b) developing a new extrusion-type feed nozzle[1, 4]; (c) revising the location and spacing of the electrical radiant heating elements[2]; (d) revamping the doctor blade system to improve performance and blade life with dried milk[4]; and (e) partitioning the interior of the dryer to separate it into a "wet zone" of high relative humidity and a "dry zone" of low relative humidity[2].

In the "wet zone," about 90% of the water is removed from the concentrate. In the "dry zone," the milk is finish-dried and cooled before being scraped off the belt. Creation of the dry zone by partitioning reduced moisture pick-up within the dryer in the cooled product. Low humidity in the dry zone is maintained by a slight bleed of nitrogen gas.

The product from the dryer possesses a fresh, natural whole milk flavor. However, it has been found that if the powder is exposed to air, it absorbs oxygen. Then later during storage it develops an unpleasant "oxidized" flavor. This objectionable flavor frequently appears in commercial spray-dried whole milk powders. But it can be prevented in the vacuum-dried product if the powder is excluded from contact with air after drying[8].

To accomplish this, all handling of the powder until it is sealed in the can is done in closed equipment containing oxygen-free nitrogen at a pressure slightly above atmosphere. Before beginning the 120-hr weekly operating run, the conveying system, hoppers, and the enclosed canning line are purged with carbon dioxide and then nitrogen to remove all air. A continuing bleed of nitrogen gas into these powder-handling items maintains them in oxygen-free condition. Empty cans and lids are fed into the canning line enclosure through



a system of feed chutes in which they are also purged of air. Filled cans exit from the enclosure through an air lock.

Powder is fed from the hoppers (14 on flowsheet) to the enclosed canning line, where it is filled by weight into No. 10 cans and sealed. Net weight per can is 2.62 lb, which on reconstitution yields 10 quarts of fluid milk. The canning line can handle in two shifts the daily output of the plant.

After leaving the canning line, the cans are labeled, packed six to a carton, palletized, and placed in cold storage, preferably at 0F, until shipped.

Assumptions for Commercial Plant

In designing the projected commercial plant and making the cost calculations for it, it was necessary to make a number of assumptions concerning conditions under which the plant would operate. These assumptions are believed to be logical and typical of conditions that might actually exist. The more important ones are listed here:

1. The plant would operate for 24 hr a day, 5 days a week, and for 50 weeks a year, or a total of 6,000 operating hours a year.
2. The capacity of each of the two continuous vacuum dehydrators is 340 lb of powder per hr, containing 4.0% moisture. (Also see following discussion under "Capacity of Commercial Plant.")
3. The overall loss of milk in the complete process is 2% of the milk purchased.
4. The drying plant would be located adjacent to an existing fluid plant that receives bulk farm milk for reshipping or processing, or both. The drying plant would receive milk by pipeline from the fluid plant. It is assumed that in the fluid plant the milk is clarified and its butterfat content is standardized to the desired value of 27.8% on the moisture-free basis, and that the milk is delivered to the drying plant at 40F. For cost estimation purposes, the drying plant is charged $4.50 per hundredweight at 3.50% butterfat basis, for milk delivered to the drying plant. (See also "Cost of Raw Milk versus Selling Price.")
5. Disposal of waste water containing milk solids from cleaning and washing operations, and

of sanitary wastes, will be to the same treatment system that already serves the existing adjacent fluid milk plant. The drying plant is charged $20.00 a day or $5,000 a year for this waste disposal. If the plants are located within a municipal sewer district, the waste would go to the municipal sewage treatment plant. Over 95% of the water supplied to the drying plant is used for cooling purposes only, and will contain virtually no milk solids. This spent cooling water could be discharged to a stream if one is nearby, or into storm sewers.

6. The fluid milk fed to the process will have the following composition: butterfat 3.37%; solids-non-fat 8.75%; total solids 12.12% (butterfat 27.8% on moisture-free basis).

7. The weight of dried powder assumed as equivalent to one quart of milk is 0.262 lb (118.88 gm) with a moisture content of 4.0%. This quantity will reconstitute to one quart of milk containing 3.25% butterfat, 8.45% solids-non-fat, and 11.70% total solids.

There are no official standards for the composition of beverage milk reconstituted from dry whole milk. The values stated were chosen after studying the official standards of the individual states for fluid whole milk, as given in Agricultural Handbook No. 51[9]. According to that source, 3.25% butterfat and 8.45% solids-non-fat equal or exceed the minimum standards in most states, and 11.70% total solids is the average value for all states that specify a minimum.

8. All product is packed in No. 10 cans, each holding 10 quart-equivalents of powder (2.62 lb or 1189 gm). Sales will be aimed at institutional, military, and export markets.

9. Storage and distribution of the powder after canning will be at nominal 0F.

Capacity of Commercial Plant

The capacity of the two dryers determines the design capacity of all other equipment in the commercial plant. The process was developed on a nominal "one-sixteenth scale" pilot-plant model of a commercial dryer (modified for drying milk as described above). It has not been operated on a full-size dryer. Hence, the output of the commercial dryer is not known exactly, but had to be extrapolated from pilot-plant data.

Considerable study was devoted to selecting the most reliable method of scaling up to the commercial dryer. The method arrived at appears to be logical, and is based on the ratio between the small and large dryers of the heated belt area in the "first drying zone." Referring to the dryer diagram, this is the area of foam-covered belt, between the feed nozzle and the heating drum, which lies directly between the banks of electrical radiant heaters. Analysis of the pilot-plant data showed that 90% of the total removal of water from the concentrate takes place in this zone. The stated area ratio gives a capacity for the commercial dryer of 340 lb of powder per hr, at 4.0% moisture. It is believed that this capacity is somewhat on the conservative side, and could be exceeded after operating experience has been acquired on the commercial dryer. To accommodate higher output from the dryers, the capacity of other equipment items was made 10% higher than that corresponding to a dryer output of 340 lb per hr.

Input and Output Quantities

With a dryer capacity of 340 lb of powder per hr, the output of the plant, as product in No. 10 cans, would be 61,955 quart-equivalents of powder per 24-hr day (6,196 No. 10 cans). On an annual basis this would be 15,489,000 quart-equivalents in 250 operating days.

Input of raw milk would be 131,300 lb per day, five days a week, or a total of 32,821,000 lb a year.

Costs of Commercial Plant

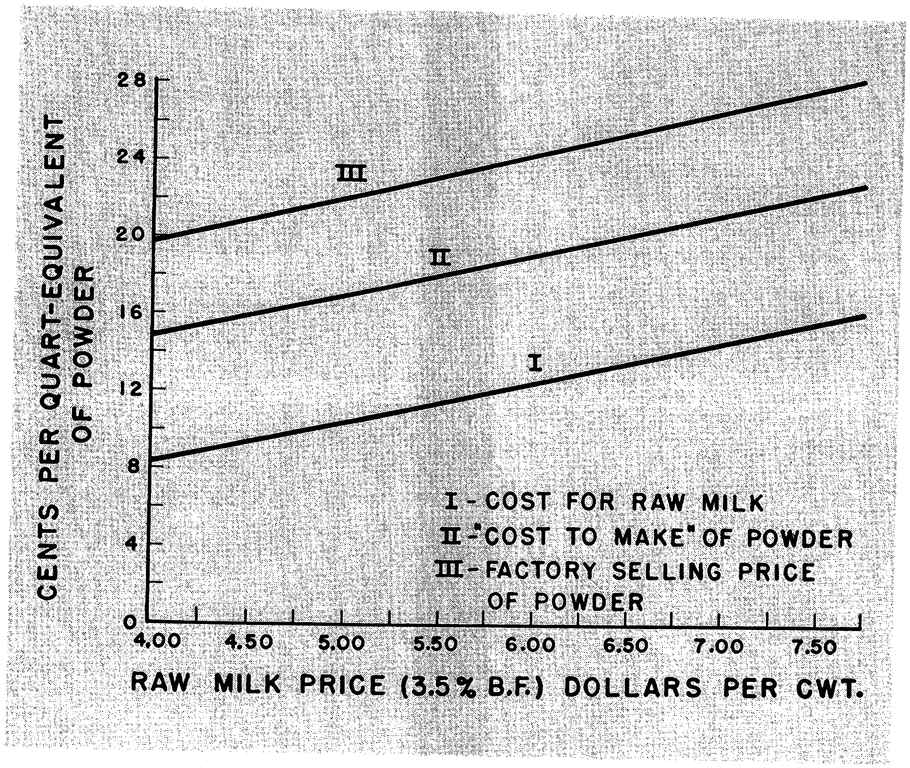
Processing Equipment: The equipment summary (Table I) lists major items of processing equipment, the number of units of each item, and the estimated cost of each. These costs are based, in so far as possible, on vendors' quotes or published cost data, as of 4th quarter of '68.

Capital Costs: Table II lists fixed capital expenditures required to erect a complete plant, ready to operate.

Working capital required also is shown in this table. This amount is approximately equal to one month's sales receipts.

Daily Operating Costs: Table III gives the costs of running the plant on a prorated daily basis. The left-hand column is dollars per day of operation. The right-hand one is cents per quart-equivalent of product.

Financial Analysis: Table IV presents significant overall dollar items on an annual basis.



HOW PRICE of vacuum foam dried whole milk powder relates to manufacturing costs and price of whole milk.

For purposes of computation, return on investment has been taken arbitrarily as 12% per year on original fixed capital investment.

Payments for federal corporate income tax were taken as 51% of net income before taxes.

Startup Expense: When starting any new manufacturing plant, some time will elapse before production is established on a satisfactory basis as to quality and quantity of product. While operating costs are, of course, incurred during startup, there may be little production of salable product to offset these expenses. For the current case, it is estimated that $100,000 should be allowed for startup expenses not compensated for by sales of product. This assumes about one month's operations before satisfactory production would be established.

While startup expense has not been shown in the figures on capital requirements in Table II, neither has the investment tax credit which would be allowable against federal corporate income tax liability. This credit would amount to approximately $135,000. So the investment tax credit, through reduction of federal income taxes, should serve to offset the otherwise non-reimbursed startup expenses.

Summary Sheet: Table V summarizes the more important physical quantities and dollar items involved in the cost estimate.

Effect of Raw Milk Price

The cost estimate assumes a charge for raw fluid milk of $4.50 per hundredweight at 3.50% butterfat basis. The current price of manufacturing milk is somewhat below this figure. However, the $4.50 price is intended to cover also the has operated a continuous vacuum dryer on citrus juice for several years. In its experience with citrus, an average of 120 hr of dryer operation a week is as much as can be expected[6]. Thus, to achieve any sizable increase in plant output, the installation of another dryer would be necessary.

For the two-dryer plant as described under "The Commercial Process," the addition of one more dryer could increase plant capacity by as much as 40%, without the need for installing any other equipment. This achievement would be possible because with three dryers, two could be kept in operation. The number of dryer operating hours per week would thus be increased from (2x120) or 240, to (2x24x7) or 336, a gain of 40%. Each of the three dryers would operate for an average of 112 hr a week.

If planned in advance, suitable provision could readily be made for the addition of a third dryer with minimum difficulty and expense. It is estimated that the total cost of installing a third dryer later would be about $500,000. So, for an added capital expenditure of 22%, plant capacity could be increased by about 40%.

With full utilization of this added capacity, it should be possible to reduce the factory selling price per quart-equivalent by about ¾ ¢, while still earning a 12% after-tax annual return. Al-

TABLE III (CONTINUED)

	Cost per Day Dollars	Cost per Qt-Equiv* Cents
3. Operating labor: 20; total for three shifts	463.60	0.748
4. Indirect labor:		
Plant manager, $12,000/year	48.00	0.077
Plant superintendent, $10,000/year	40.00	0.065
Laboratory head, $10,000/year	40.00	0.065
Laboratory assistant, $7,500/year	30.00	0.048
Mechanic, $3.00/hr	24.00	0.039
Shipping and receiving man, $2.50/hr	20.00	0.032
Secretary-typist, $4,000/year	16.00	0.026
Total indirect labor	218.00	0.352
5. Maintenance and repairs: 3% of fixed capital per year	274.08	0.442
6. Operating supplies: 10% of item 5	27.41	0.044
7. Utilities:		
Steam, 10,000 lb/hr at 80¢/1,000 lb	192.00	0.310
Electricity, 23,000 kwhr/day at 1.1¢	253.00	0.408
Fuel for fork-lift truck	1.50	0.002
Water, 1,100,000 gal/day at 12¢ per 1,000 gal	132.00	0.213
Total utilities (7)	578.50	0.934
Total direct production costs (A) (sum of 1 to 7)	8,450.52	13.640
B. Fixed Charges		
8. Insurance: 1% of fixed capital per year	91.36	0.147
9. Taxes (real estate): 2% of fixed capital per year	182.72	0.295
10. Depreciation: Straight-line method. 12-year on equipment, 35-year buildings	694.58	1.121
11. Rent: Pressure storage vessel for liquid carbon dioxide, $74.40 per month	3.57	0.006
Total fixed charges (B) (sum of 8 to 11)	972.23	1.569
C. Plant Overhead Costs		
12. Non-wage payments: Social security, unemployment insurance, workmen's compensation, vacation, etc. 20% of payroll	136.32	0.220
13. Laboratory supplies	12.00	0.019
14. Waste disposal	20.00	0.032
Total plant overhead (C) (sum of 12 to 14)	168.32	0.272
Total factory manufacturing costs (I), (sum of A, B, and C)	9,591.07	15.481
II. General Expense		
D. Interest on Working Capital ($269,000 at 7¼%)	78.01	0.126
E. Research and Development ½% of gross sales	64.55	0.104
F. Administrative and General	100.00	0.161
Total general expense (II) (sum of D, E, and F)	242.56	0.392
III. Cost to Make (Sum of I and II)	9,833.63	15.872
IV. Selling Cost, 6% of gross sales	774.61	1.250
V. Returns, Allowances, Discounts—½% of gross sales	64.55	0.104
VI. Taxes on Income—51% of profits before income taxes	1,141.05	1.842
VII. Net Profit after Income Taxes, 12%/year of fixed capital	1,096.30	1.769
VIII. Factory Selling Price (Sum of III to VII)	12,910.14	20.838

*Quart-equivalent is weight of powder needed to reconstitute one quart of fluid milk. It equals 0.26208 lb, or 118.876 g.

ternatively, if selling price were kept the same, annual return on total fixed capital investment would increase to about 15%.

Production for Retail Market

Up to this point, the commercial plant under discussion has been assumed to package its entire output in No. 10 cans for institutional, military, and export markets. Some prospective manufacturers, however, might prefer to devote the entire output to the retail market. Such a manufacturer might be, for example, a vertically integrated supermarket chain. Or it might be a dairy products company with an established brand name and nationwide distribution.

To produce for the retail market, the plant as discussed above would need little if any physical change except in the packaging line. That, of course, would be equipped to turn out a retail pack rather than institutional. The cost of the packaging equipment might be a little higher, but the increase should not be significant. Therefore, the basic data on processing equipment and capital requirements, as presented in Tables I and II, are applicable also to the plant manufacturing for retail sale.

In Table III, Daily Operating Costs, some differences would arise. Packaging material costs would be appreciably higher for a retail pack. The exact cost would depend on such factors as type of container, size of package, and the material used. Any retail package chosen would have to have a very low transmission rate for both water vapor and oxygen to assure adequate product life.

It has been stated earlier that the product will be stored by the manufacturer and distributed at zero degrees. It is intended that the product will be retailed from the dairy case (40F). A detailed study of supermarket operations (Colonial Study) published in 1963 by "Progressive Grocer" indicated that the percent margin on products sold out of the dairy case ranged from 9% to 24%, averaging 16.6%. Non-fat dry milk, sold off the shelf, averaged 18.3% margin. Thus it is reasonable to expect that the percent margin for this new product, retailed out of the dairy case, would be in the vicinity of 16.6%. (End)

TABLE IV – FINANCIAL ANALYSIS (ANNUAL BASIS)

1. Gross sales (250 days x $12,910.14/day)	$3,227,535
2. Returns, allowances, discounts, ½% of (1)	16,138
3. Net sales	3,211,397
4. Production cost (250 days x $9,591.07)	2,397,768
5. Gross profit	813,629
6. Other costs of operation:	
Administrative and general	25,000
Interest on working capital ($269,000 at 7¼%)	19,503
Research and development (½% of gross sales)	16,138
Selling expense (6% of gross sales)	193,652
Total, other costs	254,293
7. Net profit before income taxes	559,336
8. Taxes on income (51% of item 7)	285,261
9. Net income	274,075
10. Earned on fixed capital (F.C. = $2,283,960)	12.00%
11. Cash flow:	
Net income	274,075
Depreciation	173,645
	447,720
12. Pay-out time on fixed capital (fixed capital divided by cash flow)	5.1 years

TABLE V - SUMMARY

Two-Dryer Commercial Plant for Continuous Vacuum Drying of Whole Milk Foam

	Per Hour	Per Day*	Per Year
Input to plant—raw milk, pounds	5470	131,300	32,821,000
Output of plant:			
Pounds of powder at 4% moisture	676.5	16,237	4,059,290
Quart-equivalents of powder	2581	61,955	15,489,000
No. 10 cans (2.62 lb. each)	258	6,195	1,548,900
Cases (6-No. 10 cans)	43	1,032	258,148

Selling price per quart-equivalent	21.0¢**
Per No. 10 can	$2.10
Per Case (6, 10's)	$12.60
Annual sales at $12.60 per case	$3,252,600
Cost for raw milk	$4.50 per cwt @ 3.50% BF

Investment:	
Processing equipment	$1,356,000
Total fixed capital (includes processing equipment)	2,284,000
Working capital	269,000
Startup expense (estimated)	100,000
Total capital (fixed, working and startup)	$2,653,000
Annual return on fixed capital after federal corporate income tax	12.0%
Investment tax credit (approximately)	$ 135,000

*Five days a week

**Daily Operating Costs, Table III, shows 20.84¢, rounded off here to 21.0¢.

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