July 29, 1935

To the Committee on Graduate Study:

I submit herewith a thesis written by Mr. E. O. Wurzbach and entitled "Creamery Management", and recommend that it be accepted for nine quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Dairy Husbandry.

L. E. Wylie
Major Professor

At the request of the
Committee on Graduate Study,
we have read this thesis,
and recommend its acceptance.

Paul W. Allen

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Accepted by the Committee

J. A. Detwiler
Chairman

CREAMERY MANAGEMENT

-o-

A THESIS

Submitted to the Graduate Committee
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

By

E. O. WURZBACH

August 1935

PREFACE

The material presented in this thesis has been collected by the writer during a year of graduate work at the University of Tennessee, together with a year engaged in commercial dairy work.

A review of the written material on the subject was made and due credit in each case has been given to the author of such material used in this thesis.

Acknowledgment is due to Professor C. E. Wylie, Head, and Professor Thos. B. Harrison, Creamery Manager, of the University of Tennessee Dairy Department, for their valuable suggestions while both the research work and actual writing of this thesis was in progress.

--E. O. Wurzbach

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INTRODUCTION

A few years ago, the opportunity of a creamery, as well as many other businesses, to make a success was so great that the business could fail only with the poorest of management. But the change of economic conditions, the increase in competition and the general development of the country as a whole, have required every business, in order to be a success, to make short cuts and prevent every possible loss.

One of the first essentials for success of a business is proper management and an important essential of proper management is a good manager. A good manager may make a success of a business under what may seem impossible conditions.

Together with the essentials of a good manager, this thesis deals with the purchasing of raw material, supplies and equipment. While no definite rules can be set up, important points associated with correct buying are pointed out. The organization of a working force, problems of storage (including refrigeration), bookkeeping, and marketing of the dairy products, are included. No attempt was made to explain creamery financing, as it applies to conditions of individual creameries. More emphasis was put on problems that affect all creameries. The method of handling, and the processing of each product manufactured by the University of Tennessee Creamery are explained. Several commercial plants were visited to make a comparison of the different methods of handling the products during manufacturing and differences in manage-

ment. The quality of butter as compared to the quality of cream, and the commercial manufacture of Lactobacillus Acidophilus milk were selected as special research problems, and are included under original investigation.

No attempt was made to cover the subject of "Creamery Management" in detail, either in the survey of literature or original investigation. Books have been written on each phase of creamery management.

The purpose of this thesis is to compile some of the information into one paper that will be a help in creamery management. Original investigation was carried out to explain some of the latest practices being used in creameries today.

Since the footnotes were added after the completion of this thesis, it should be mentioned that the first figure indicates the page reference number; second figure, the bibliography reference; and third figure, the page of the reference.

PART I

REVIEW OF LITERATURE

AND

PERSONAL OBSERVATION

PART ONE

MANAGEMENT

The Manager

Regardless of the type of organization, whether it be cooperative, corporation or privately owned, no factor is as important as the manager himself. A good manager may make a success of a creamery under what may seem impossible conditions. Cases have been pointed out in South Dakota[1] where creameries that were about to fail were taken over and saved by a good manager.

Just why certain men are good managers can be explained only in a general way. Many men have the natural ability to be managers. Others have worked hard from the bottom, mastering each step before a promotion. In large plants a man with an exceptional sales ability may be selected as manager. Some men become creamery managers that have been managers of another business. A few are selected because of their acquaintance and reputation in that community. Today we have many successful managers that have acquired a technical training in college in connection with practical experience.

Essentials of a Good Manager -

It is easy to point to the work of a number of successful managers, but to describe one, or tell just what type of person he is would be a difficult problem. Generally, a good manager combines many good qualifications. The essentials of a good manager may vary by section or by community. In the case of a cooperative creamery, the ability to mix well and be a good fellow may be of greatest importance in one community and of little

importance in another.

Every good manager must understand the creamery business and carry on his work in a business like way. Without business methods and business principles the manager is doomed. He must know how to keep, interpret and understand his records so that he can tell at any time whether the creamery is operating at a profit or a loss. A manager should have good judgment and think out his particular problems. The successful operation of a milk plant or creamery requires, beside general ability, a considerable technical knowledge and training.(2) Sometimes men can be obtained who have the proper personality and general business ability but lack the technical knowledge for successful managing of a milk plant or creamery.

A successful manager is honest, just and fair. He has no favorites among his men or producers, and deals honestly and fairly with all of them. He should have a personality to be fairly well liked by all the employees and people with whom he deals. If he is well liked, it will be to his advantage, provided he has all the other necessary qualities. It is not meant, however, that every successful manager has all these qualifications.

2.3:1

PURCHASING OF MILK AND CREAM

Systems of Dealing with Patrons

The buyer of the raw material should be a good judge of human nature. When calling on a patron or prospective patron, it is advisable to start a conversation along lines which are of interest to the producer. The conditions of the farm, buildings, lawn, as well as the appearance of the farmer himself should interest the solicitor and assist him in determining what topic of conversation is likely to be of greatest interest to the person. The solicitor should have the highest regard for the ideas of his fellow men, even though they may not coincide with his own. By carefully judging what the farmer is most interested in, and gradually working in his purpose, the solicitor is sure to get a hearing. He should get the farmer's ideas or explain his purpose in a friendly way. The farmer's ideas and general interests will give the solicitor a fairly good idea whether he wants his milk or not.(3)

It should be kept in mind, however, that there are seasons when the farmer tries to sell his milk or cream instead of the creamery trying to buy it. An easy way to get milk is to offer a premium for quality. This method stimulates interest on the part of the farmer to sell high quality milk. If the farmer knows his milk is in demand and no premium is paid for quality, he is likely to buy less ice to reduce expenses.

Securing Confidence of Producer -

There is no business concern that is depended on for square dealing to a greater extent than the creamery. Professor A. D.

Burke, Head of the Dairy Department, University of Alabama, in one of his talks to a group of creamerymen, expressed it as the industry built on confidence.(4)

The producers deliver their milk and cream usually without a definite knowledge of the amount of butterfat it contains or the price it will bring. They depend on the management of the creamery for a square deal. If the manager allows any grounds for suspicion, it will cause trouble between the producer and the creamery, and eventually result in loss of patronage. It is therefore important that the creamery maintain unlimited confidence of its patrons. This is most readily accomplished by the manager's willingness to have the patrons become familiar with the methods of management so far as it interests him.

The most common cause of misunderstanding between the patrons and the management of the creamery is found in weighing and testing. The weighing should be done in the presence of the patron, if possible, and the manager should encourage his patrons to be present as often as possible when the testing is done. If this practice is followed, it is very important that the manager or his subordinate explain to them whatever tests may be made. Without knowing the procedure and results to be obtained, their eye may give them the wrong impression. A dissatisfied patron should never be allowed to quit on a mere suspicion of dishonesty. The management should let him use their testing equipment and check the scales. It should work with them to prove it is honest. It is usually possible for

the scrupulous business man, by methods similar to those mentioned, to convince his patrons of the integrity of his firm. However, there are some patrons that remain suspicious regardless of the honesty with which the creamery deals.

The creamery must satisfy the patron with the price he is offered for his butterfat in order to successfully solicit his business. In the long run, the policy which will produce the most satisfactory results is that of consistently paying the highest price in harmony with efficiency of operation.(5)

The creamery must keep the patron's enthusiasm and interest in order to induce him to produce more and to improve quality. The creamery must educate the patron in larger, more economical and more profitable production. It should teach him to produce more pounds of butterfat per cow at less cost per pound. It should emphasize such care in production as to insure top returns for the cream. The average patron is appreciative of such information. Even if it is not new to him, he needs confirmation of his knowledge in order to put it in practice with confidence and with maximum success.

Promptness in Dealing with the Patrons -

The manager of a creamery, as well as all his subordinates, should be prompt in all matters pertaining to the business. The drivers collecting milk or cream should call at each farm at definite, prearranged days and as near to the hour as pos-

sible. Neglect on the part of the driver in complying with this requirement will invariably result in loss of patronage. Checks for products received should also be delivered at a definite time. If checks for milk or cream are sent through the mail, they should be mailed on a definite day so that the patron will always have the satisfaction of knowing when he may expect to receive remittance.

The cash system of paying for cream makes promptness in the matter of remittance a necessity. This system is therefore a good educator for the manager who considers promptness to be of secondary importance. In some localities the cash system is attractive to the producers, but to the manufacturer it has the disadvantage that it increases the cost of bookkeeping, the cost of labor in the testing room and it increases the amount of capital required for carrying on the business. In some territories, it is necessary to pay cash for cream, provided the company has satisfactory standing financially. Some pay once or twice a week; some every two weeks. But regardless of when the payments are made, they should always be made promptly on a definite prearranged day. Instead of paying cash for the cream, it is usually possible to arrange with the patron to pay the day following delivery. By this method the manufacturer can save on labor, as the testing, checks, etc., can all be done at one time. But the patron may not always be in town the day following. So this problem must be arranged to suit the section.

Securing Patrons -

In securing patrons the manager should be reasonably sure the patron will deliver good milk. General appearances of the dairy barn, milk cans, etc., are good indications. The manager should not buy low quality milk or cream in time of shortage and then refuse to buy from him as soon as milk and cream become plentiful. It will lower the quality of product to be sold and cause the patron to lose confidence when he is cut off. The manager should insist on quality raw material and refuse to buy unless the milk or cream is satisfactory. In securing new patrons the solicitor should visit the prospect in order to become acquainted. Then, with careful judgment, he should present his proposition to the farmer. When the solicitor has become acquainted with a producer, but has been unable to buy his raw material, he should carry on a systematic campaign until the producer decides to sell his raw material to him. This is known as the follow-up system for securing patrons.(6)

In carrying on a campaign for patrons, it should be the object of the solicitor first to find out who are the leaders of the community, as it is his interest to have these men fully understand his proposition. A solicitor who has a good and fair proposition to make to the producers will always be more readily received by the more intelligent of the farmers and it is that class of people that usually command leadership. Therefore when the leader takes kindly to a proposition, it is an indication of good progress. The solicitor should not, however,

be deceived and work with people who expect to receive such personal advantages as will not be shared with the others who later may become patrons. He should not promise any of his patrons anything he cannot give them or live up to.

The buyer of all raw material should have systematic and simple but comprehensive records from which he can readily obtain desired information with reference to his territory. If the milk territory is large, he may have a map laid off in squares and have all his patrons located. By a pencil mark he may locate patrons he would like to have, but does not as yet have as patrons. As they become patrons they are marked in ink. By this method the manager knows his territory and can start a new man out and expect reasonably good results. When a dairyman promises to send his cream or milk to a specific creamery, the management should see if he notified the company he had been sending to in due time so that that company might get someone else if necessary. If he would quit one company without notice before-hand, he would probably do this consistently with any other concern, which would prove highly disasterous in case of a milk shortage at the time.

Card records may be kept in three different files as: File A, active patrons; File B, discontinued patrons; and File C, prospective patrons. A small card 4-6 inches should be large enough. Form 1 should serve as an illustration.(7)

Card Record of Patrons
Form No. 1

Name_____ Address_____

Route_____ No. of cows_____

Disposition of product_____

Reasons for not selling to us_____

Called on him, dates_____

Result_____ * Remarks *

_____

Started to sell to us, date_____

Discontinued, date_____

Cause_____

_____

This, together with the territory map, will help the manager plan his work and greatly assist a new man.

Also it is a good practice to keep a daily record of active and discontinued patrons. This may be made out in table form or just a slip turned in to the office, giving information of patron discontinuing.(8)

8.1:107

Purchasing Cream

All cream should be bought on a quality basis. The butter that is made from fresh sweet cream will return more money and be a more wholesome food than butter made from old, off-flavored, sour cream. When a manager pays the same price for all the cream, regardless of quality, he is encouraging carelessness and lack of interest in the production of cream. Farmers can be encouraged to bring in fresh, properly cared for, and promptly cooled cream of high quality by paying a premium for it. Farmers, like most other people, don't mind working when they receive something in return.

Grading the Cream - Some creameries accept only the first grade cream, others receive first and second grade, and others receive first, second and even a third grade cream.

There are a number of factors which cream can be graded on. In some creameries the acidity is the only factor on which quality is based, while others have a more elaborate system, including flavor, acidity, richness, body and cleanliness.(9)

A. Flavor is judged by tasting the cream and by estimating the quality of butter that can be made from it under ideal conditions.

B. The acidity of the cream may be determined by a decinormal alkali, using phenolphthalein as an indicator, or by an alkali solution prepared from alkali tablets. It is often convenient to prepare the solution of such a strength that it will be appliable for rapid determination method.

C. Richness--It is generally believed that 28-35 percent butterfat will churn out well. Except in extreme cases, richness is not as important as other factors.

D. Body--The body should be smooth and uniform. It may be injured by being partly churned, by being frozen or by being curdy. Cleanliness of the cream and container may be considered in connection with body or may be considered separately.

In the past, and in some creameries today, the market value of different grades varies with the market conditions. When cream is plentiful, the creameries stick closer to grading. But when cream is scarce and there is an increased demand for butter, the creameries may pay as much for second grade as for first grade cream.

National Cream Quality Improvement Program - Slightly over a year ago, the Pure Food Department of the United States government seized and condemned several cars of butter in the east. The price of butter at that time was such that the loss on each car was about $5,000.00. Naturally, the industry woke up in a hurry and sent committees to the Pure Food Department in Washington to see what it was all about. They found that the Pure Food Department had perfected a new filter test for butter by which test they could determine the amount of extraneous matter in butter.(10) Incidentally, they found that half a dozen other industries were being cleaned up in like manner. Among these were the salmon, blueberry and apple industries.

The committee also found that the Pure Food Department, through microscopic examination of the extraneous matter found in butter, was fully aware of the fact that at least 90 percent of this extraneous matter was in the cream when it left the farm.

The food department, however, made it plain that they would not force the farmer to take care of his cream. This was left up to the creameries and milk plants. Further, they made it plain that if a creamery is able to perfect a straining method that removes extraneous matter from the cream, that program is not enough. The Pure Food Department insists that the manufacturer shall not buy cream that contains an excessive amount of extraneous matter.(11)

When one stops to consider that in 1933 there were probably five million farms in the United States, which produced cream for butter, one can realize what a gigantic task the butter manufacturer has before him.

Inspection of Plants - Pure food inspectors already have visited scores of creameries. They are very thorough in their inspections, and in practically all cases, they take samples of both butter and cream, which in turn they forward to their district office for chemical and filter testing.

The industry has been given to understand that, after a reasonable length of time has been given to the industry for getting its house in order, inspectors will visit all creamery plants and start making filter tests of cream on the cream

docks. If they find that any of this cream contains an excessive amount of extraneous matter, the cream will be condemned on the platform and dumped down the sewer. This means that the industry must work thoroughly and rapidly in order to be ready for inspection.(12)

Guaranteeing Butter to Purchaser - When this program was first started, many small manufacturers did not take the matter seriously. They felt like their cream and butter was good enough anyhow and, that it was mostly a program for the large butter manufacturer.

Filter tests of butter picked up in various markets in the east have shown conclusively that 92 score butter is just as likely to contain an excessive amount of extraneous matter as is 88 score butter. In fact, of several hundred tests made from samples picked up in Chicago at that time, the sample which contained the most extraneous matter was butter which, the day before, had scored 92⅛ on the Chicago Board.(13)

In the light of all these facts, large receivers of butter are already taking steps to protect themselves against loss in case butter which they purchase is later condemned by the government. In a very short time it will not be possible for any manufacturer, large or small, to sell butter on the eastern market unless the bill of lading of that butter is accompanied by a bona fide guarantee from the manufacturer that he (the manufacturer) will stand any loss entailed through condemnation proceedings by the government.(14)

12.5:4
13.Ibid.
14.Ibid.

Creameries and Cream Stations - All operators must understand the history of this program. When they do understand it, they will recognize at once the necessity of the program. Also they will be in a position to explain to the producer in an intelligent manner the reason for it.

Naturally, the first thing an operator must do, as regards to physical condition of the plant or station is to see that it is in a sanitary state at all times, ready for inspection by anybody. It may be that the plant or station will need painting, either inside, out, or both.

The operator should taste and grade each delivery of cream that comes to his plant. Otherwise, he will not be able to know with certainty just what grade of cream he is receiving. In tasting cream, the operator should use a grading rod instead of dipping his finger into the cream. These rods can easily be washed and it is the only sanitary method of tasting cream. At all times the operator must segregate first and second grade cream. As he becomes more educated in differentiating between them, this will not prove a difficult task.

It is generally conceded that one gallon of second-grade cream divided equally among six ten gallon cans of first-grade cream will cause all six cans of first grade cream to become second-grade cream.(15)

Third-grade cream is not to be purchased. The operators of all manufacturing plants should be instructed on running sediment tests for cream. Whenever possible the test should be made in presence of producer.

The farmers have to be educated as to the importance of the program, the importance of good cream, why the plant has to grade the cream and condemn all cream that is too bad. The manufacturer must be patient, and in a kind way win their support. They should be given educational matter whenever possible. As producers understand the reason and necessity for this campaign, the manufacturer is sure to have their support.

Most plants already are equipped with a satisfactory can washer. While it is possible to do a good job of washing and sterilizing without a satisfactory can washer, it is likely that in a short time every plant will have to be equipped with a satisfactory washer approved by the state dairy department.(16) The cans should be stacked on the inside on a rack where they can be aerated.

The Producers - In handling the producers, it should be done in an organized way. They should be treated as humans and taught to understand. The producer must be educated and kept that way. Under all probabilities, if he understands the problem thoroughly, the creamery will have his cooperation, and this factor is what the creamery needs for success.

All creameries do not expect the average producer of cream to wash the cows' flanks and udders, but it is reasonable of them to ask him to use a curry comb and brush and remove the loose dirt from the cows' flanks and udders before milking. The milker should see that his hands are clean. Together with this he should milk in clean and sterilized utensils, for the preliminaries are of no use if the utensils are not sterile.

The milking pail should be of a sanitary type. This will keep some of the dust and dirt out of the milk.

It is inevitable that some dirt will get into the bucket of milk. This dirt contains bacteria, but if the milk is strained into a holding can through a sanitary filter strainer immediately after milking the cow, most of the dirt will be removed, and with it will be removed most of the bacteria which cling to the dirt.(17) By straining immediately after milking, the bacteria will not have had time to develop to any degree. I might add to remind the reader, that the writer is speaking of the production of milk that is to be separated and cream sold; not of production of market milk.

The separator must be cleaned and sterilized after every separation. The idea that the separator need only be washed once a week or even once a day is untrue. If the separator is left dirty for 12 hours, billions of bacteria can develop in the bowl. Now it is time to use it again and when one does, he is sure to innoculate the milk and cream from the next milking. Also the separator acts as a clarifier and if the bowl is already full of dirt and slime, it will not accomplish much on the second use. By all means, the separator must be washed and sterilized twice daily.

As the cream comes from the separator and falls into a receptacle, a thick foam is whipped up into the receiver can. Dirt or flies that may come in contact with the stream of cream coming from the separator are washed down into the

receiver can and lost to sight in the thick foam. After taking excellent care of the milk and cream right up to the point of separation, a producer has not done his best unless he strains the cream coming from the separator as it enters the receiver can. The same thing applies as is best for market milk producers. Cool the cream at once.

There are bacteria in the cream when it comes from the separator. Some may be harmful and some are harmless. But for the manufacturer to produce good butter from the cream, the bacteria must be checked at once. The lower temperature maintained is the greatest surety toward checking the onslaught of bacteria. And if the manufacturer can make good butter from the producers' cream, he will give him the best price at that time.

If the cream is cooled in the can it should be stirred in the process to speed up cooling. If the cream is not cooled immediately after separating and this warm cream is mixed with cream already cooled, the animal heat in the fresh cream will warm up the cold cream and will spoil both batches of cream.

After the cream is cooled, it should be held at a low temperature (as low as possible) in order to keep in check the development of bacteria. A cooling tank is best for this purpose, provided that freshly pumped water continually runs through the tank. If such an arrangement is not possible, then a cooling sack properly handled is preferable. But some cooling device as an ice box, etc., that provides

colder temperatures keeps the cream in much better condition.

When cream is thoroughly cooled, it should have a tight cover to prevent the entrance of dirt into the cream and to prevent the development of bacteria in it. Bacteria require oxygen for their development. Accordingly, the less oxygen that comes in contact with the cream, the less will be the development of bacteria, yeast, and mold.(18)

After cream has been produced under proper conditions and cared for properly, it stands to reason that it should be transported to town under some practical cooling conditions. In order that all the good work that has been done on the farm will not be undone by exposing the cream to dirt and high temperatures on its way to market, wet sacks, blanketed cans, tarpaulin over the cans and stopping on the way at filling stations and wetting the sacks down, all help to keep the cream in good condition.

When the cream gets to the plant, it should be graded immediately. The cream grader should be a capable person with a sensitive taste and smell for detecting off flavors or odors. In the next paragraph is a suggested method of grading that was before the Tennessee Cream Improvement Committee.

Definition of Grades - The term, "extra grade cream" shall mean cream that is sweet in taste, clean and sound, free from undesirable flavors and odors. It contains not less than 25 percent butterfat and its acidity does not exceed .20 percent, calculated as lactic acid, and shall be delivered at inter-

vals of not more than every other day.

The term, "grade one sour cream" shall mean cream that is clean to the taste and smell, sound and smooth and free from undesirable flavors and odors. It contains not less than 25 percent of butterfat and shall not be over four days old at the time of delivery.

The term, "grade two sour cream", shall mean cream that is more than four days old. It must be clean and sound, and may have an undesirable flavor or odor, but it must be free from mold and dirt.

The term, "unlawful cream", shall mean cream that is unwholesome, contains dirt, mold, excess yeast and other foreign matter, or which is unfit for human consumption, rancid, putrid, decomposed or shows putrifactive action.

The construing of these terms may be different in other states. It may be graded as sweet cream, that is, good sweet cream; cream that will make a 90 score butter or better, as No. 1, and that will make below 90 score as No. 2; while that which is unfit for consumption shall be rejected.

Another method would be: Grade 1 - cream that is sweet or practically so and free from off flavors and aromas at time of delivery; Grade 2 - cream that may be sour but free from off flavors and aromas, yeast and mold; Grade 3 - cream that does not apply to 1 or 2 but free from putrification.(19)

The following is a definition of cream grades adopted by the Tennessee Cream Improvement Association on April 19, 1934.(20)

19.11:127
20.6:1

"Extra--Extra quality cream, that which is sold at intervals of not more than two days, having clean, pleasant flavor and odor.

Premium--Premium cream, that which is sold at intervals of not more than four days and is free from undesirable flavors and odors at time of delivery.

Regular--Regular cream, that which is sold at intervals of more than four days; and cream sold at intervals of four days or less that contains undesirable flavors and odors, but is not of such quality as to warrant placing it in the onion or rejected grade.

Onion--Cream that has onion, garlic or other pronounced weed flavor.

Rejected--Cream which is rancid, moldy, dirty, oily or otherwise unwholesome. Cream of this grade " shall not be purchased under any consideration.

The differential is usually about three cents between each of the different grades.

The Price of Cream -

The creamery does not have the same difficulty in arriving at the price of cream as is the case with purchasing milk. Cream is bought by the pound of butterfat. The price per pound of fat depends on the price received per pound of butter sold by the creamery. The price per pound of fat should vary with the quality of cream purchased.

The Purchasing of Raw Milk

In order for the creamery to put a good product on the market, the management must see that the milk is carefully produced and properly cared for after production. It is not the scope of this paper to go in complete detail concerning milk production. But the milk plant should know what is being purchased and why. The bacteriologist, having run all tests to determine the quality of milk in the laboratory, should visit the producer farms periodically to warn those who are producing bad milk and help them solve the trouble. Those that are producing good milk should be complimented occasionally on their good work.

Production of Clean Milk -

The production of clean milk is neither difficultnor expensive. Unfortunately, the idea is prevalent among dairymen that the production of a good grade of market milk requires an outlay of a large amount of money. This is not the case, for many dairymen are producing a good grade of market milk, with what would be rated as poor equipment and on the other hand, dairymen who have invested large amounts of money are producing milk of poor sanitary quality. These statements do not necessarily mean that because a dairyman is producing milk he is making money, but if a man is engaged in milk production, it will, in most cases, cost him no more, and in any case very little more, to produce clean milk over what it would cost to produce dirty milk.(21)

21.9:34

One of the first essentials is, the dairyman must have clean hands. He must have a clear knowledge of what is meant by cleanliness. He must pay attention to small details that insure cleanliness and have the ability to see these details. If he does not, he will never produce very clean milk. The helpers must be healthy, they must have health cards. In the case of certified milk, the helpers are examined physically sometimes every month. They should be clean and keep clean. It is remarkable to notice the difference in the count of milk handled by different men. Wet milking is a factor. Wet milking causes a much higher count milk. The milking a little of the fore milk out of each teat helps to produce a low count milk. The loss of fat in this small amount of milk removed is very small. The extra time required is little, but the improved quality of the milk is noticable.

The first prerequisite in the production of clean milk is to have healthy animals. They should be tested for tuberculosis and watched closely for any disease that may suddenly appear. If the cow has garget, a bruised quarter, a leg broken, and there is a question whether the milk is good, leave it out. The milk lost is not worth the chance. The fever of one bruised quarter may affect the others. A broken leg may cause abnormal milk by high fever. Colostrum milk should not be used as it will cause trouble in the plant.(22)

The flanks and udder should be brushed off, which is more easily done when they are clipped. The udder should be washed

well or at least wiped off with a damp cloth.[23]

All pails and utensils should be properly constructed to insure better cleaning, and then they should be cleaned and sterilized either with steam, hot water or some hypochlorite solution, after and before using.

The feeding, if it is done in the milking barn, should be done before or after milking and no sweeping should be done just before milking. There should be as little dust flying around in the air as possible. The small top pail should be used. Individual cows with high count should be removed from the herd.[24]

No matter what pains are taken in production, there will always be some bacterial contamination. So, in order to prevent their growth, the milk should be properly cooled. Most of the bacteria found in milk will not grow at low temperature, and in order to prevent bacterial growth, market milk should be cooled and kept cold until it is consumed. Milk that is to be pasteurized should be kept cold before pasteurizing and should be cooled back down immediately after pasteurization. The production of milk for pasteurization should be as careful as that of raw milk sold in bottles. Even when the so-called "germicidal action" of milk has been taken into consideration, it has been found that if milk is cooled as soon as it is drawn, it will subsequently have less bacteria per c.c., than if it is allowed to stand for some time without cooling. Milk should never be higher than 50° F. if it is to be pasteurized.[25]

23.9:140 24.Ibid:146 25.Ibid:151

Methods of Buying Milk -

There are various systems in use by milk dealers of paying for the milk purchased from the producers. Formerly the most common system was to buy by the can, gallon, or quart. This system, however, is not accurate and is seldom, if ever, being used today.

Most milk is bought by weight on the butterfat basis. As soon as it arrives at the dealers' plant, it is weighed and samples are taken for the butterfat test. The practice of paying for milk on a quality basis is also more common than formerly. But there is not as much quality buying as should be done. Some milk dealers pay the producer premiums for extra quality, based on such factors as bacterial count, temperature, score of dairy, health of cattle, etc. Such systems encourage the producer to produce high-grade milk.(26)

Buying Milk by Weight - Although the proportion of dealers who are using the weigh system is much larger than formerly, yet a considerable number of small dealers still use can measure system of determining quantity of milk received from producer. In a recent investigation carried on by Kelly and Clement(27), some interesting information was obtained, which illustrated the inaccuracy of the system of determing the quantity of milk by the measure system alone. Observations were made on a total of 346 shipments of milk, consisting of 1,102 cans. The cans of milk were examined on arrival at the plant before they were dumped into the weigh cans. Cans that were not full were measured with a stick so

26.9:134 27.10:169

an accurate check was made on fullness. Table No. I below shows difference between quantity of milk dumped as shown by measure and the actual amount received, as shown by weight.(28)

TABLE I - DIFFERENCE BETWEEN WEIGHT AND MEASURE.

No. of Cans	Quantity Received According to Can Measure (gallons)	Weight (pounds)	Actual Quantity Received Allowing 8.6 pounds to the Gallon (gallons)	Difference	
				Gallons	Perct.
1103	6185.32	521,910	6068.72	116.60	1.88

Thus the difference for the total quantity of milk received was 116.60 gallons, or 1.88 percent. This difference was no doubt due primarily to the poor cans that were used. It cannot be expected that dented and battered cans will hold the full amount.

Methods of Arriving at Prices -

Sales of milk by milk dealers to consumer vary somewhat, being influenced by such factors as weather, temperature, day of week, number of people away, etc. These variations, however, are not great, and it can be safely said that the consumption of milk from week to week is relatively stable. Production, however, varies greatly during the year so that the supply of market milk available does not coincide with the demand. Usually there is a considerable surplus in May and June and a shortage in October and November. Owing to this uneven production of milk and the failure of the production to coincide with the fluid milk demands and with the limited unevenness of consumption, it is necessary for the

milk dealer to carry at certain seasons of the year considerable surplus milk, which must be disposed of in the form of manufactured milk products.

A few years ago the flat contract price was the prevailing system of purchasing market milk. The dealer would contract for the entire supply of the producer, and, owing to the relatively low production in the fall months, he would have to make contracts with enough producers to supply the demands of his consumers at that time. He would, therefore, have to carry a considerable surplus during the spring months when production was relatively high. He could, of course, realize on his surplus milk only what it was worth for manufacturing into by-products. Therefore, in most cases, he made his contract price for all milk received low enough to compensate him for any loss sustained on the surplus. In some cases the dealer would determine the amount of the surplus and pay the producer a lower price for all milk which he had to dispose of in other forms than market milk. This system was unsatisfactory to the producer.(29)

During the last 10 or 15 years more equitable buying plans, based as far as possible on economic laws, have been worked out. This has been to a large degree because of the bargaining power of the producers' cooperative associations which have been organized during the period.(30)

In general the various buying plans attempted to accomplish the following:(31)

1. Insure a supply of high quality of milk, suffi-

29.10:170 30.Ibid:173 31.Ibid

cient to meet the demands of the market at all times.

2. Secure from the dealers prices for milk based on its value in different uses, as fluid milk, cream, butter, cheese, etc.
3. Distribute the payment from the dealer to each producer in accordance with the evenness of his production throughout the year.

In general, there are three main plans for buying milk which attempt to carry out the above subjects:(32)

1. The basic surplus plan.
2. The classification or use price plan.
3. The combination plan.

The Basic Surplus Price Plan--Under this plan the producer is compensated for producing an even volume of milk throughout the year. He is assigned a definite volume of production and for amounts over and in some cases under this basic volume, he receives a surplus or lower price. Each producer's basic quantity is usually determined by his average production during the previous October, November and December, the period of the year when supply and demand most nearly balance. For all milk produced above this basic volume, he receives surplus prices.(33)

In some markets each producer is permitted to make an estimate of his future production and this becomes his base.

32.10:173 33.Ibid

For all milk produced above or below this estimated volume he is penalized. This is sometimes called the "contract" plan and is employed by Connecticut Milk Producers' Association. Each producer signs a contract with the association, stating the quality of milk he proposes to deliver daily during the next 12 months. Penalties are provided for any excess production above the contracted quantity or for any shortage below the contracted quantity.

Under the basic surplus price plan, the actual prices are usually arrived at by negotiations between representatives of the dealers and of the producers. In arriving at the basic or market milk price, such factors as business conditions, market demands, probable production, cost of production, etc., are considered, while the surplus price is usually based on the market quotations for butter, cheese, etc.(34)

The Use Price Plan--This plan recognizes the fact that milk, used in different ways, has different values. There are at least two classes of milk under this plan. The Connecticut Milk Producers' Association plan, which is a combination of the basic surplus and the use price plan, provides for four classes: Class 1, all milk sold in fluid form; Class 2, milk made into cream that is sold in fluid form; Class 3, milk made into manufactured products, except butter; and Class 4, milk used in making butter. In some markets all milk not used in fluid form is used as cream. In that case only two classes are required. Prices for the different

34.10:173

classes are determined by negotiation between representatives of the producers and of the dealers. The price for class 1 is usually based on market conditions, such as total production in relation to demands for milk in fluid form. Prices for other classes are based on market quotations for cream, butter, cheese, etc. Records of the sales of the dealers are necessary in order to determine the amounts of milk going into the various classes.

The Combination Plan--This is a combination of the basic surplus price plan and the classification or use price plan. The milk is sold by the producers' association in accordance with the classification or use price plan, i.e., the dealers pay the fluid milk price and the surplus price for the milk received in accordance with the uses that are made of it, whether for fluid milk, cream or butter. The returns to each individual producer, however, are determined by a method similar to the basic surplus price plan. This plan is used by Connecticut Milk Producers' Association.(35)

The Plans Compared -

The chief objection that might be raised against the basic surplus price plan is that changes in market conditions and demands for milk will not necessarily change the price that a producer will receive for his basic quality. In some cases this has brought about a modification of the plan, and when there is an increased demand for fluid milk, the class 1 price has been offered to the producers for quantities above their established basic amounts.

35.10:174

The "contract" basic surplus plan used by the Connecticut Milk Producers' Association places upon the producer the responsibility for the quantity he should attempt to produce each month and is more flexible than the basic surplus plans used in the Baltimore, and Philadelphia milk sheds, where the basic amount is determined by previous production. Under the "contract" plan the producer is penalized for underproduction as well as for over-production, whereas under the usual basic surplus plan, he is not penalized for underproduction.

The use price plan may not directly bring a seasonal coordination of production to consumption. This may be accomplished in part, however, by raising or lowering the basic price, when there is a relatively small or large surplus over demand for fluid milk. In some markets, also, prices are negotiated each month.

Both the basic price plan and the use price plan have been successful in certain territories where they have been adopted, but it would not follow that either plan would be successful in some other territory. Either plan must be adapted to the particular conditions of the milk shed in which it operates.(36)

36.10:175

Systems of Milk and Cream Delivery

Frequent delivery of the raw product to the creamery is one of the principal factors in the manufacture of a good product by the creamery. It is generally understood by the farmers that milk must be delivered every day. The milk producers realize that unless the milk reaches the plant in good condition, they will suffer a financial loss, as the creamery must refuse to receive bad milk. The cream producer has the general idea that delivery once a week, at the most twice a week, is sufficient.

The change from making butter on the farm to the manufacture of butter in the creamery, the development of diverse types of creamery organizations according to local conditions, the increased diversity of manufactured dairy products, and the growing keenness of competition among creameries for the raw material, milk and cream, have resulted in the development of numerous distinct systems of buying butterfat from the farmer. These systems may be conveniently grouped under four headings: namely, direct deliveries of milk and cream; milk and cream routes; cream stations and country milk Receiving Stations; and the direct shipper system. (37)

While some creamery organizations have adopted and operate one system exclusively and buy all their raw material by that method, most creameries operate a combination of two or more of the several systems mentioned above.

Direct Delivery of Milk and Cream -

In this system, milk or cream is hauled by the farmer

37.11:112

direct to the creamery. This is the oldest system of getting milk and cream to the creamery. It is the system that first marked the innovation of making butter in the factory instead of on the farm. It started by having the farmers haul their milk to the creamery where it was pooled and separated by gravity. Simultaneously, also, the practice of skimming the milk on the farm by gravity and the hauling of cream developed. When the centrifugal cream separator for factory use appeared, skimming on the farm was largely abandoned and the farmer hauled his milk to the creamery where it was separated with the centrifugal cream separator. Then the farm cream separators changed the place of skimming back to the farm. The direct system of hauling milk started with the development of the milk plant.

This system whereby the farmer hauls his own milk or cream to the creamery, has the advantage that the creamery comes in constant and individual contact with its patrons. Any disputes arising over quality, weights, tests, etc., can be readily, quickly, and usually satisfactorily settled. In case of dissatisfaction the patron can see his milk or cream being weighed and tested.

If the farmer hauls his own milk and cream, he will usually take good care of it, while enroute to creamery. In the case of cream; the farmer who hauls his own cream, usually delivers it at reasonably frequent intervals. This enables the creamery to secure a fairly fresh cream of good quality. If the quality of the cream or milk is not as it should be, the defect

and its probable cause may be explained and instructions for improvement given direct to patrons.

The greatest drawback to this system is that it limits the milk and cream supply to a narrow radius. If milk is delivered, the volume may be large enough to enable direct hauling a greater distance.

The Milk and Cream Route System -

In this system a hauler has a certain route he makes with a truck. He begins at one end and usually picks up last the milk or cream that is nearest to the creamery. A milk route is run every day, while a cream route is run about once or twice a week. By making agreements with the driver, cream producers along a milk route can usually send their cream with him on certain days.

The hauler may be employed by the creamery and the creamery furnish all or part of the conveyance, or the driver may furnish his own conveyance and take care of upkeep. The driver may be paid a salary by the creamery with creamery conveyance, he may be paid part salary and a certain percent commission, or he may be paid salary and furnished conveyance, but the driver has responsibility of upkeep, or the driver may own his own conveyance and charge each producer for hauling his milk or cream, according to the amount he has to be hauled.

This system has the advantage of one man hauling all the cream. It pays the driver to do the job and still small producers get their raw product marketed at a reasonably low price.

It encourages the milking of cows. The same driver may haul their ice. The driver collects the cream at the farmers' door. He may weigh and sample the cream there. But this method often causes serious losses through improper sampling, cream remaining in farmers' containers, etc. The best method is for the driver to pick up producer's can of cream and take it to the creamery to be weighed, sampled, tested, and can washed clean.

Its disadvantages lie in the fact that by the route system the creamery operator is no longer in direct touch with the patron. It involves dealing with the patron through the hauler. The success of this system largely depends on the efficiency, conscientiousness, and loyalty of the cream or milk hauler. The cream or milk hauler who is so little interested in his business that he permits the patron to become careless in the handling of cream or milk, or who, for private gain, undermines the faith of the patron in the integrity of the creamery, is obviously a costly liability, rather than a valuable asset to the creamery. The driver should be interested and intelligent enough to carry messages correctly from creamery and present them to the patron in the right way.

The hauler either receives a commission of so many cents per pound of butterfat delivered, or he is hired by the day or by the month, or receives both wages and commission. If the hauler is paid a salary, he is likely to lose interest and think only about putting in his time. If he is paid on commission alone, he is likely to concentrate on volume and neglect

the quality of cream. If the hauler owns his own truck and just charges the patrons for hauling the cream, he is wont to become independant and disobey instructions of the creamery.

The Cream Station and Country Milk Receiving Station -

During the time of the whole milk creamery, in an effort to expand its milk supply territory, the management would establish skimming stations located at a convenient hauling distance, or at a reasonable shipping distance. The farmers brought their milk to these skimming stations, where it was tested and skimmed with a centrifugal separator. The cream was hauled or shipped to the creamery and the skimmilk was hauled back by the farmer.

The Cream Station-- With the introduction of the farm separator, the skimming stations soon disappeared and cream stations took their place. Under this system the farmers skim the milk at their places and haul the cream to the cream station, and the cream station ships it to the creamery.

In the majority of cream stations, the cream is weighed and tested, and the station operator pays the farmers direct. One of the advantages of this system is that the farmer can see his cream tested and get his money upon delivery of the cream. But on the other hand, this system often brings about hasty and inaccurate testing and sampling, and unreliable tests result. By inaccuracy the station operator may lose considerable amount of fat.

Some stations merely weigh and sample the cream and send the mixed cream and samples to the creamery. The creamery then sends the patrons their checks. Here the creamery often experiences serious difficulties in making the station fat check with the creamery fat.

The operators are usually paid a commission. A large volume means more money to them. Competition between stations and buyers often causes the cream to be of poor quality.

The cream station may be fully equipped with scales, testers, hot water, steam, etc., or it may be a store room with a pair of scales and testers, or it may just be in the back part of a country store.

The Country Milk-Receiving Station--Country milk receiving and cooling stations have been established either by producers' organizations or by city milk plants to provide a means for assembling and cooling milk before shipment to the city. They may be at points varying from less than 30 miles to more than 400 miles from the city.

The principal function of this receiving station is to furnish a place where the milk from the producers can be received, weighed, cooled and shipped to the city market. The milk is received, weighed and cooled immediately and cans washed and returned. The milk is not left exposed, so it reaches the creamery in good condition. The producer sees his weighing and testing. Surplus milk can be left in the country to be manufactured into by-products and save transpor-

tation. There is less can cost to producer and less likelihood of cans to be lost. The producer need not cool the morning milk provided it reaches station shortly after milking. Payment to producer is prompt. It assists in developing dairying in that community. There is a closer contact between producer and distributer. The station operator can keep close check on quality of milk coming in. This permits longer shipment and a better quality of product to reach the city.(38)

Here again the success depends a great deal on the operator. Carelessness may result in fat loss and poor quality.

Independent Cream Buyers -

In this case some independent cream buyer operates a cream station of his own. He buys the cream from the farmers, usually at lowest price possible. He then resells the cream to the creamery and tries to make a profit on it. He usually goes into the business with the idea of making some easy money. As soon as conditions become unfavorable he retires from the business. His interest is to make money. The more cream he buys, the more money he is netted. So the creamery can usually depend on this cream being of poor quality.

Farmers' Cooperative Marketing Association -

This system is the organizing of the farmers to obtain higher prices. The farmers usually pool their milk or cream and have their secretary or some other representative officer of the association do the selling. Milk producers' associa-

tions often find it necessary to build their own plant. Even then, unless they have wonderful cooperation between themselves they are likely to make a failure.

Cream bargaining associations pool their cream and sell to the highest bidder. This makes it uncertain for the creameries. They may sell to one creamery today and to another tomorrow. Efforts to sell to the highest bidder frequently result in holding the cream so long and under such adverse conditions that it deteriorates, and the creameries may refuse to accept the cream.

The Direct Shipper System -

This system is used mostly for cream. Milk may be shipped in if the distance is not too far, if the train makes quick connections, and if the milk is kept cold.

This system is satisfactory for cream patrons. It gives the creamery a practically unlimited territory from which to receive cream. This method eliminates the middle man and his commission, and avoids loss of fat enroute to creamery. It saves the creamery shipping cans. The cream is shipped to the creamery in the farmer's can, weighed, tested and can returned clean. The check is sent through the mail.

The Buyer

The qualified buyer is the one that obtains the most value for his money without defrauding the salesman of money which is justly due him. A business transaction has been defined as being an exchange of values. Therefore, if a permanent business relationship is established between two firms, the business transaction between them must be mutually beneficial.[39]

Present Value -

The unqualified buyer is ignorant of values. He may realize his own ignorance and imagine the salesman is taking advantage thereof. As a result he may make an arbitrary offer that is even less than the cost of the goods to the manufacturer. He is not willing to pay the price of the goods offered by the salesman regardless of the fairness in price offered by him.

The salesman that is anxious to do business studies the character of the buyer. It is soon clear to him that he is dealing with a man that is either ignorant as a buyer or perhaps a man that is unwilling for the manufacturer or dealer to make a fair profit. The latter class of men is not considered as desirable to do business with and some firms may even refuse to seal them goods. If the salesman considers that the buyer belongs to the first class mentioned, he may be inclined to ask a price high enough so he can afford to

39.1:123

reduce it as much as he thinks necessary. The buyer in this case is placed at a disadvantage and it is quite likely that he will pay more than market value for the goods he buys.

The successful buyer studies the goods he purchases. He should know the source of raw material from which they are manufactured, the cost of such material, fluctuation in value thereof, if any, cost of manufacturing, cost of selling, value of patent rights, and the legitimate profit for the manufacturer and dealer.

The general market value of an article is ascertained by writing to various firms handling that particular article. Information thus obtained should be filed. In the case of equipment, it may be filed under general names as churns, vats, engines, testers, etc., alphabetically.

Future Value -

A buyer will know how to buy and when to buy if he has a fair conception of the future value of the goods. Consider such an article as coal, which fluctuates more or less in value. In order to determine the advisability of buying several months' supply at a time, the buyer should consider the principal factors that determine the value of the coal, such as general demand, labor strikes, transportation, and local conditions. Under transportation should be considered both the ability of the transportation company to give prompt service as well as difference in rate between large and small quantities. Some factories are so located that they can take

advantage of water rates at certain seasons of year, while at other times they must ship by rail. Under the head of local conditions should be considered price charged by local dealers, cost of drayage, amount of money available, interest on money, storage facilities, loss of fuel, value of coal, etc.(40)

Quality and Necessity -

The buyer should be able to make a wise choice as to quality and determine whether the article in question is absolutely needed. Goods are often bought because they are cheap and it is expected they will be needed later on. A few mistakes of this nature will be sufficient to reduce the annual dividend several percent. In order that the buyer may know what is needed, it is well for him to keep a want book in which to write down articles needed so that they may be ordered together with the next regular order.(41)

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40. 1:124
41. Ibid.

How to Buy

Contracting for a Year's Supply -

Most creameries buy supplies in small lots, placing orders for them with various dealers. For this reason the dealers find it necessary to have their traveling solicitor make frequent calls in order to be assured of his amount of the business. The cost of such calls is naturally charged up against the cost of selling the goods and the buyer has to pay the expense. Many of such expenses could be eliminated if creamery managers would estimate the amount of supplies required for the coming year. This is readily done, especially after a creamery has been operated for a year or more, as its requirements per month will vary from month to month about the same as they did the previous year. A manager should be able to estimate in a fair degree of accuracy if the business will show a general decrease or increase for the year. The inventory record of supplies of the previous year will present a fair estimate of the supplies needed per month the coming year. Therefore, whenever submitting an order to dealers for bids, they may be requested to submit bids under various specified conditions. For example, a buyer might request that the dealers submit bids on the entire order to be shipped in one shipment at a definite stated time; also that they submit bids on the same order to be shipped in four separate shipments, each shipment to consist of a definite stated quantity, which will naturally vary in accordance with the demand; as a third bid, he might request dealers to submit bids on monthly shipments in amounts as stated by the purchaser. (42)

42.1:125

In determining the size of shipment to take at each delivery, a buyer should consider the difference in cost, amount of money available, rate of interest, storage facilities, and cost of transportation.(43)

In submitting the order to the various dealers for quotations, it is convenient to have a blank for that purpose. A duplicate should be kept in the office for reference. After the quotations have been received and compared, the successful bidder is notified. The quotations are filed in a letter file. For convenience, this file may be marked as file No. 1.

The promptness in making remittance for goods purchased is an important factor in securing lowest rate from the dealer.(44) If the firm buying is in such financial circumstances that he can pay cash, that will be most satisfactory to all concerned, and by that method he will secure the lowest quotations. A business firm should have a definite time, say the tenth of each month, when all bills are paid, and it is business policy to arrange for having all checks for goods purchased, not including material purchased which are usually paid oftener, mailed promptly on that date.

Some firms allow a special cash discount on accounts paid within a time designated on the bill. Such bills should always be paid promptly as the discount is usually large enough to be profitable to the buyer. When entering such bills in the purchase journal, the labor of the bookkeeping is reduced by deducting the discount on the bills and entering the actual amount paid.(45)

43.1:125 44.Ibid:126 45.Ibid.

Records

The person who receives merchandise purchased, whether he be a special receiving clerk or the buttermaker, should have an entry thereof in a book kept for that purpose. This book is known as "the receiving book". This record should state when goods are received, name of shipper, kind of goods, amount, and the condition in which the goods were received. In larger creameries, the manager will often furnish the receiving clerk with a memorandum of kind of goods purchased and from whom purchased. On this memorandum, however, he should not include the quantity, as by receiving the information, the receiving clerk might neglect to check it when received. If the goods are short, the factory is notified at once. If damaged in transportation, the railroad inspector or motor transfer line is notified and claim is filed for amount of damage.(46)

Filing of Invoices and Bills -

The invoice of goods ordered is usually received before the goods arrive. Upon receipt thereof, the invoice is checked against the order filed in file No. 1. When the goods are received, the invoice is checked against the receiving book; the extensions are also checked, and if found to be correct, the invoice is pinned to the order and returned to file No. 1.(47) These items should be filed in alphabetical order, according to firm names, and each firm's invoice should be filed in order of dates.

At the close of each month, the various firms usually send

46.1:126
47.Ibid:127

bills. If not, bills should be called for. Upon receipt of the bill, it is checked against invoice No. 1 and if found correct, it is marked "O.K.", pinned together with the various invoices, and filed alphabetically in a similar file marked "No.2". It is now ready for payment and a check, together with the bill, is mailed to the creditor. A receipted bill is returned to the purchaser. This is pinned to the invoices and filed for future reference. A similar file may be used, but it should be marked, giving the period of time covered by the bills it contains. A large creamery may use a separate file for each month and the file is then marked with the name of the month and the year. A small creamery may be able to file in one file all its bills for the entire year. The file is then marked with that year.(48)

Supply Room Records -

In smaller plants the buttermaker may be in full charge of the supply room. It speaks well for a buttermaker if he keeps his supply room as it should be kept, with shelves and cupboards around the walls for the various articles, such as parchment paper, butter color, tub tins, etc., with tubes, barrels and boxes piled in systematic order. There should be a place for everything and everything should be in its place. By keeping the supply room in order, less goods will spoil, less work will be required in taking monthly inventories, and less room will be required for holding the supplies.(49)

Receiving Goods from Supply Storage Room -

The larger creameries may have a special stock clerk who receives the supplies from the receiving department and places them in the supply room. The various departments receive their

48.1:127 49.Ibid.

supplies from this stock clerk on written orders signed by the foreman of that department.(50)

The following form may be considered as a convenient one to follow:

Form No. 2
Creamery Order for Supplies(51)

No. 220

Date_____

Please deliver to our department the following supplies:

4,000 butter wrappers

Butter Mfg. Dept.
(signed) J. R. Brown

These blanks may be put up in pads about four inches by five inches in size. They may or may not be written in duplicate.

Monthly Inventory Record of Supplies -

The monthly inventory record of supplies on hand is of value: first, for determining the amount of supplies you need during the month; second, as a guide for placing orders for supplies; third, as a check record on the waste in supplies; and fourth, as a record in case of fire loss.(52)

The following form No. 3 represents an inventory blank, which may be made to cover the entire year. This blank is self-explanatory. The purchases are entered from the purchase journal. The amount used during the month is equal to the amount on hand on the morning of the first day of the month, plus purchases made during the month, less the amount on hand on the morning of the first day of the next month.(53)

50.1:128 51.Ibid. 52.Ibid. 53.Ibid.

Form 3

Inventory of Supplies[54]

Article	January						February					
	On Hand		Purchased		Used		On Hand		Purchased		Used	
	Amt.	Cost	Amt.	Cost	Amt.	Cost	Amt.	Cost	Amt.	Cost	Amt.	Cost
Coal	20T	$ 60	30	$ 90	25	$75	25	$ 75				
Butter tubs	150	39	600	156	500	130	250	65				
Butter boxes												
Butter wprs.												

In order to facilitate the work of taking the inventory, a record such as Form 3 will be of much value. This blank is fastened to the shelves on which the supplies are kept. Whenever the buttermaker removes supplies, an entry is made on this record. In the case of a stock clerk, the total amount of supplies delivered in accordance with his order blanks are entered daily or weekly and at the close of the month, these records contain full information in reference to the amount of supplies on hand. By that system one annual inventory count of supplies on hand is usually found to be sufficient.

54.1:129

LABOR

Organizing a strong Working Force

The organization of a strong working force is most readily accomplished by employing capable men, mentally as well as physically, by properly training and educating the employees, and by creating loyalty among them.

Hiring the Employee -

In employing men, it is best to employ those that seem to have the ability to work up to more responsible positions. The employee who is not seeking additional responsibility will never prove satisfactory in any position. The man who is in demand is one who has capacity for work, who will not shirk details, who is anxious to learn, and who is of a strong moral character.

To secure better information about the person applying for a job, most creameries have application blanks to be filled out by them. The form of application blank may vary slightly with different creameries, but the contents are practically the same. Most forms inquire about the work he has done previous to the time of that particular application. Another form may be used to secure information from the persons given as references. In these forms questions are asked about the physical, mental and moral character, and other necessary qualities.(55)

Employment of Personal Friends and Relatives--Employment of personal friends and relatives may have some advantage, but has many more disadvantages. Employees connected with the management by friendship or family ties often create a feeling of dissatisfaction among the other employees. The foreman or the superintendent is at times, even without realizing it, in-

clined to favor such employees more than their fellow workers and unless they are of exceptionally strong character, they will often believe they can get along by doing less work or even work of poorer quality and are tempted to take advantage of this circumstance. At some cooperative creameries, it is customary to employ personal friends or relatives of the directors, but it is often found that such employees return less in labor than they are paid for.(56)

Training and Educating the Employees -

The superintendent or other person in charge of subordinate employees should take an interest in them and the way they perform their work. If the employees do various kinds of work during the day, then it is beneficial to have each keep a systematic record of his day's work. To illustrate, a young man who started as a helper in a small creamery made a written outline of his day's work even to the extent of marking the time he took to perform his various duties. Thus his attention was daily called to the quantity and quality of his own work, and as a result he made rapid advances.(57)

Encouraging originality--The management should encourage originality among its employees. Wherever the leader of an establishment has developed his own originality and that of the employees, he often finds this to be a source of great income to the employers. In order to promote originality, the employer should reimburse his employees for new ideas and inventions in proportion to the value thereof to the firm. Some large industrial concerns offer premiums for useful ideas and

56.1:84 57.Ibid:87

inventions made by the employees. Such inventions are usually along the line of work in which the employee is engaged. The same policy along similar lines is being adopted by manufacturers of dairy products. It is deserving of even wider adoption, for it gives added pleasure and dignity and it stimulates the employee to more effective work because he likes to work and not because he has to. Originality is very important to consider in the organization of a working force; it often determines the success or failure of an enterprise.(58)

Creamery meetings--The first creamery school in connection with a private creamery was that of a large creamery of Omaha about 1911.(59) The manager or superintendent or both should meet with the men about once a week and discuss present problems with them. The employees should be taught the value of thinking for themselves and express their ideas. Each subject taken up should be thoroughly discussed by the employees as well as by the employers. They may be divided in groups. The plant men may discuss problems of buttermaking, ice cream making, etc., while the salesmen may discuss problems of salesmanship.

Creating Loyalty Among the Employees--The employer who is taking an active interest in the welfare of his employees will invariably succeed in gaining their confidence and loyalty. It is to the advantage of the business concern to have the employees feel keenly that they are part of the organization. It is also important that there should exist the very best feeling among employees so that the work of different departments will be carried on harmoniously. Social gatherings and entertainment

58.1:87 59.Ibid:88

of various kinds are becoming more customary as factory functions. The employees thus become better acquainted and warmer friends, and they become more loyal to the company by which they are employed.(60)

Organization of the Working Force -

In a small plant with only two or three helpers, the problem of organization is not very difficult. A man of ordinary intelligence can readily organize such a small force so that it will render the greatest amount of service.

Division of Responsibility--As the creamery becomes larger the organization of labor becomes a more complex problem. Each employee is responsible to some one above him. The general manager is held responsible to the directors and the superintendents are held responsible to the general manager. The superintendent of the manufacturing department will in turn hold the buttermaker and ice cream maker responsible for their respective divisions. The object is to hold each individual employee responsible for the performance of a certain task. The organization thereby becomes so permanent that even if the manager or superintendent is absent, the work in the department will be carried on with the same degree of accuracy as if he were present.(61)

The superintendent should maintain this perfection of organization and outline the work for his subordinates. He should always know the details of the work allotted to each individual employee in his department.(62)

The superintendents should hire the employees for the

60.1:89 61.Ibid 62.Ibid:91

respective departments. Some managers prefer to hire the employees themselves. Under the latter system, the superintendent will not be held in as high esteem and respect by his subordinates and his work may therefore suffer in efficiency. The manager naturally hires the superintendents, but he should give them full authority to hire men for their respective departments. However, if the superintendent is a man of diplomacy and unselfishness, he will consult the manager in reference to the man he is about to employ, as to qualifications, salary, etc.(63)

Surety Bond for Employees -

An employee holding a responsible position in charge of money or valuable property should give to his company a surety bond to the amount determined by the directors of the company. By this the employer is insured against loss due to fraud or dishonesty of the employee.

63.1:91

Paying for Labor

Productive and Nonproductive Labor -

Productive labor is the active manufacturing labor. In the creamery and ice cream factory, such labor is produced by the butter maker, ice cream maker, and their subordinates and is charged directly against the department in which they labor. The superintendent of the manufacturing department will be considered under productive labor if he himself is engaged in the work of manufacturing; if he is merely supervising the work, then his time will be considered under nonproductive labor. Nonproductive labor includes the labor of clerks, bookkeepers, superintendents, etc. It is noncreative labor, but it is required for making the organization more efficient. Such labor may be charged directly against a definite department for such as are working for that department exclusively, but usually the employees engaged in nonproductive labor are working for more than one department and their wages must therefore be proportioned among the various departments.(64) Such labor is often known as indirect labor.

Payment of labor may be according to one of several systems; the day-wage system, the piecework system and the premium system.(65)

The Day-Wage System--This system provides for a definite compensation per unit of time. It is the oldest system. It has the advantage that the employee is not so tempted to sacrifice quality for speed. But, all men on the same job, regard-

64.1:92
65.Ibid

less of skill, have to be paid the same to prevent dissatisfaction. This is a good system when each employee has a definite amount of work outlined for the day and is responsible for the completion of such work.

The Piecework System--This system provides for a definite compensation per unit of labor. The manufacturer has the advantage that he has a fixed rate of cost for labor and that the same amount of work will be accomplished in less time. The only disadvantage to the manufacturer is that the employee is tempted to sacrifice quality for speed.

This system appeals more strongly than the day-wage system. The industrious and skilled laborer receives his advance over the less ambitious and inexperienced. Under this system the employees feel greater freedom and independence, which tends to create satisfaction.

In deciding on a piece rate, great caution is necessary, for if the rate is too high and it is found necessary to reduce it, later dissatisfaction will always result among the employees. A rate should not be fixed before the matter has been thoroughly studied through a series of experiments.(66)

The Premium and Percentage System--This system provides for the payment of the entire salary or a part thereof on some premium or percentage basis. The creamery may pay the buttermaker a small monthly wage with a certain percent of the profit made on the butter. He may get paid for new cream patrons,

new butter customers, quality of the butter he makes, etc.[67]

If the premium and percentage method is properly managed, it should prove a success. It makes the employee feel as though he has a financial interest in the business, and as a rule the company receives good service from these employees.[68]

Prompt Pay -

The employees are usually in need of money as soon as it has been earned. If they are paid promptly it creates a better feeling toward the employer. If the employees are paid monthly they should receive their wages not later than the first day of the following month. It is more satisfactory to pay all employees at the close of each week. Some business concerns pay their employees on the tenth, fifteenth or twentieth of each month for work done the previous month. Such a method of withholding the employees' money can scarcely be considered business-like. It shows poor management, or the company is holding the employees money for the sake of using it.[69] However, it should be remembered that in the case of route salesman where the number employed is large, it is impossible to pay off the last day of the week. In this case the creamery should pay as soon as possible after the week closes.

Time Keeping -

In creameries, it is perhaps most satisfactory for the superintendent to keep a card for each employee working as a day laborer. The time clock is used in some large creameries, but

67.1:93 68.Ibid 69.Ibid:94

it is more satisfactory if such a feeling can be created among the employees that the time clock will be unnecessary. The time clock, regardless of how useful it is, may impress the employees as being an indication of mistrust and as a result may destroy loyalty on the part of the employee.(70)

70.1:195

CRANES JAPANESE LINEN MADE IN U.S.A.

Dry Storage

Every creamery or milk plant must have a suitable place to keep goods and supplies that are constantly being used in the plant, as: sugar, salt, gelatin, powdered milk, bottle caps, butter wrappers, butter cartons, ice cream containers and an unlimited number of other things.

The dry storage room should be accessable and sufficiently large to store a full supply. The creamery can save money by buying a large amount of goods or supplies at one time. Sometimes the manager knows that certain goods are going up in price. He will want to store up a big supply. The store room should be clean and dry. It should have a sufficient amount of shelves to have everything arranged. In storing chlorine sterilizers in the form of powder, it may be necessary to have the store room dark.(71)

71.24:58

Refrigeration

One of the chief requirements in any creamery is adequate means for keeping the products it handles properly cooled, while stored during the day or over night. It is very important to keep the temperature low enough. Bacterial action due to too warm storage room may cause serious losses financially.

In order to have maximum cooling efficiency, the room must be well insulated on all sides, floor and ceiling. Care should be taken that the room is not built directly over large steam lines and similar conditions should be avoided.

In cold climates where natural ice is available, small creameries have to choose between natural ice and artificial refrigeration. In deciding which to use, the comparative cost is the most important factor. However, it should be remarked that mechanical refrigeration is often, then, of more value than can be estimated, because of the better results obtained.

Mechanical Refrigeration -

Mechanical refrigeration is more satisfactory than natural ice and is being widely used.

"The principle involved in mechanical refrigeration is that when a substance passes from a liquid to a gaseous state the change is accompanied by the absorption of heat, called 'latent heat'. The coolness produced by the rapid evaporation of perspiration from the body is familiar to all. In mechanical refrigeration, the rapid evaporation of the liquid refrigerant into a gas absorbs the surround-

ing heat and produces cold."[72]

Several systems of artificial refrigeration are in use and several different chemicals are used as refrigerating media; the absorption and compression systems are the most common, and ammonia, carbon dioxide and sulphur dioxide are the chemicals most frequently used.

Absorption System--This system has not been adopted so generally as the compression system, and is used for plants of large capacity only.[73]

General Principles--This system of refrigeration is based on the fact that water has the power of absorbing various vapors having a low boiling point, and that such vapors are again readily separated from the water by heating the liquid.

In reality, there is much similarity between the compression system and the absorption system.

Operation--This system may be operated without any great amount of steam, the only steam required being that used for the pump and the exhaust steam for the generator.

The strong-aqua tank is charged with aqua ammonia containing 29⅓ percent of anhydrous ammonia. The ammonia is pumped from the strong-ammonia tank to the generator, where it is heated and the anhydrous ammonia distilled off. This ammonia gas enters the condenser, where it is condensed, and from there it enters the ammonia receiver as liquid ammonia. From the receiver, the ammonia is admitted through the expansion valve to the brine cooler. Here it is again converted into a gas, taking up heat from the brine. From the brine cooler,

72.19:374 73.1:81

the gas enters the absorber to be reabsorbed by the water. The absorber and the generator are so connected that the water in the generator, from which the anhydrous ammonia has been distilled, is again transferred to the absorber and thus the cycle is completed.(74)

Compression System--The system most commonly found in milk plants is the compression system, in which the ammonia is used as the refrigerating medium.

"There are three principal steps in the operation of the compression system of mechanical refrigeration:

1. The compression of the ammonia gas. The ammonia gas is drawn in the suction side of the compressor, compressed and discharged under a pressure of 125 to 175 pounds per square inch on the return stroke of the compressor. The compressor is simply a special design pump which takes the gas at a low pressure and compressed it, thus reducing its volume and increasing its temperature."

2. "Condensation of the ammonia gas. From the discharge side of the compressor the gas is forced into the condenser. Sufficient heat is removed to change the gas to a liquid, but it is still under high pressure and is ready to expand into a gaseous form and absorb heat in the process. The condenser consists simply of coils of pipes over which cold water flows, thus reducing the temperature of the ammonia gas passing through the pipe. This water can later be used in the plant for other purposes.

   In small plants, the condenser often consists of a pipe within a pipe. The cooling water passes through the inner tube while the gas coming from the compressor passes through the outer tube."

74.1:83

3. "After the ammonia has been liquified by the condenser, it first passes to a liquid receiver; hence the liquid, still under pressure, is passed through what is termed an expansion valve. This valve can be adjusted so as to allow the liquid to pass through in very small quantities. By thus passing through a very small opening under high pressure, into the cooling coils where the pressure is low (these coils being connected with the suction side of the compressor), the refrigerant is again changed to the gaseous state. In reality, the passing of the liquid through the small opening to the cooling coils, where the low pressure is maintained, causes it to boil, at a temperature low enough to absorb heat from the surrounding air. The expanded gas circulates through these cooling coils, takes up the heat in the surrounding air, and cools the room. From the cooling coils the ammonia gas is drawn back to the compressor on the suction stroke and the cycle is repeated." (75)

Utilizing Refrigeration--There are two methods of transferring the cold produced by the refrigerating machinery to the milk storage rooms, milk cooler or other places where cooling is to be accomplished, namely:(76)

1. Direct expansion system

2. Brine system

(1) In the direct expansion system, the coils in which the refrigerant is evaporated are placed in the room to be cooled. The heat absorbed by the change of the refrigerant to the gaseous state is thus absorbed directly from the aid in the room. In the case of milk coolers the liquified ammonia is expanded directly into the cooling coils, and the change to

75.19:374
76.10:375

the gaseous state absorbs the heat from the milk flowing over the outside of the cooler.(77)

(2) In the brine system, the coils into which the refrigerant is expanded are placed in a tank called a brine tank. This tank contains a solution of calcium chloride or of common salt. The brine solution is used in preference to clear water because it has a low freezing point, so that a low temperature can be maintained without danger of freezing the solutions. Calcium salt is much better than sodium salt. It is less corrosive. The brine from this tank is passed through coils in the cold room to be cooled and also through coils of lower section of milk cooler. After passing through these coils, it is returned to the tank, its temperature is again reduced and the process is continued.(78)

Strength of Brine--In making up a new brine solution, the calcium chloride or salt should be dissolved before emptying into the brine tank.(79) If "dumped" in, it will be hard to control the strength of the brine.

The degree of concentration of the brine solution will depend on the temperature desired. A stronger solution will be needed for low temperatures, in order to prevent freezing. Too much concentration, however, is to be avoided, as a solution that is too strong is likely to clog the pipes, and absorb less heat as its specific heat is lower.(80) The salometer test of average strength brine is 85-89.(81) It is best to have the brine slightly alkaline to prevent corrosion.(82)

77.10:375
78.Ibid
79.11:37
80.10:376
81.11:37
82.Ibid

Size of Compressor--The size of machine required for small plants, if milk is to be cooled with water from pasteurizing temperature to 75 degrees and then cooled with refrigeration, a capacity of approximately 1 ton per 100 gallons of milk handled will be required.(83)

Indirect System of Refrigeration -

In some large, modern milk plants, an indirect system of cooling is used. With this system, the cooling coils are located in a compartment or room outside of room to be cooled. Air is forced over these coils, by means of a fan, into the cold storage room. This cooled air is forced into the room through flues, which have openings into the room. The warmer air in the cold room passes out through flues, back to the bunker room, in which the cooling coils are located, and after being cooled is again blown through flues into the room.(84)

One of the main advantages of this plan is that it acts as a ventilating system as well as a cooling system, resulting in a pure dry atmosphere in the room. In some cases the air is completely changed every six minutes.(85)

Care of Refrigerating Machinery -

Although the operation of refrigeration machinery is simple, like any other machinery, it must be given good care. The following directions for care of the refrigerating machinery are given by Bowen(86), in the United States Department of Agriculture Bulletin No. 98:

83.12:1
84.10:377
85.Ibid
86.20:1

"In caring for machinery of any kind, one of the most important things is cleanliness, and especially is this true of refrigerating apparatus. If the cooling and condensing surfaces are allowed to become coated even slightly, their heat transferring efficiency will be lowered materially.

"Where atmospheric condensers are used, it is an easy matter, when the surface becomes coated, to clean them with a brush, provided the coating is not of the nature of a scale. If the substance is hard, it will be necessary to employ files or steel scrapers in removing the scale. in double pipe condensers and coolers, it is not such an easy matter to clean them, as it is necessary to take off a return bend from the end of the condenser or cooler in order to examine or clean them. This should be done frequently, and if the inner tube is found to be coated with a soft substance, it can be removed by the aid of an ordinary flue brush. If, however, the coating is in the form of scale, it will be necessary to bore it out on a lathe or tube boring machine.

"The life and satisfactory operation of all mechanical apparatus are dependent on proper care as well as on original design. It is therefore necessary that such apparatus should receive frequent and careful inspection and prompt correction of all defects found. As cleanliness is essential for the satisfactory operation of machinery of all kinds, the wearing parts of the machine should be kept free from dirt and grit and always open, well lubricated and adjusted. The clearance of the pistons should be adjusted to a minimum, both in the steam and compressor cylinders.

"In operating an ammonia plant the gages should be carefully watched, as they are the indicators of the work being done. The suction or low-pressure gage is controlled to a great extent by the expansion valve in the liquid line; consequently, opening it will increase the low pressure, as the more the valve is open the more gas will be pumped, provided the machine is run at a constant speed. If the speed of the compressor is increased, the amount of work will be proportionately increased, provided the valves are large enough to handle the additional amount of gas, and vice versa. If the expansion valve is opened too wide for the speed at which the machine is running, the suction pipe will frost back to the machine and even the top of the compressor may be covered with frost. For satisfactory

operation in a refrigerating plant, a slight frost should cover the suction pipe close to the machine.

"If the temperature of the brine in the cooling room is high, a correspondingly high back pressure should be carried, and, on the other hand, a low brine temperature requires a low back pressure. Should a very low brine temperature be required, in addition to a low back pressure, the machine should be run at a faster speed, depending upon the relative capacity of the machine and the work to be done. It is necessary in the maintenance of low temperature to keep the system free from air and deleterious gases, and plenty of cooling water should be supplied to the condenser when the plant is in operation.

"For small plants the receiver should be of suitable size to hold all the refrigerating medium in a liquid form. It is usually located just below the condenser, or as near to it as local conditions will allow, so that the liquified gas may return to the receiver by gravity.

"In order that the amount of refrigerant contained in the system may be seen at a glance, the receiver should be provided with a glass gage similar to that placed on steam boilers to show the amount of water. This is especially true in small plants, where the attendant may not have had the necessary experience to enable him to judge of the amount of refrigerant in the system, and by observing the line of the liquid in the glass gage each time before starting up the compressor, he will be able to note any loss of the refrigerant which he might not be able to do by other methods.

"Some manufacturers, however, object to placing a gage of this kind on the receiver, as they contend that there is a possibility of loss of refrigerant by the breaking of the glass, and perhaps some danger should anhydrous ammonia be the refrigerant used. There is little danger, however, as the pressure and the temperature is nearly constant and automatic ball-stop valves may be used that will shut off the flow should the glass break.

"It should be distinctly understood, however, that the foregoing refers to new plants and not to old ones. Under no circumstances should air at high

pressure be pumped directly into an old system, after repairing, or into one that has been standing idle for some time, as an explosion is likely to occur, due to the vaporization of oil which may have been lodged in the coils. The temperature of the air when pumped into the system at a high pressure, is liable to exceed the flash point of the oil, resulting in an explosion.

"For the same reason it is also dangerous, especially in the case of small, fast-running machines, to allow too much air to enter when pumping out the compressor in case it becomes necessary to pack the stuffing box; for should the attendant neglect to purge the condenser after the operation, the air in the system will be carried along with the ammonia gas, necessitating a higher pressure and a consequent higher temperature than would otherwise be attained; and should the temperature in the system be too great, there is danger of the oil which may be deposited in the coils reaching a point where flashing will take place, which will result in an explosion.

"In small installations usually found in milk plants, creameries, and dairies, the condensers are of small dimensions; consequently, they cannot hold large quantities of excess air. Hence, great care should be taken to thoroughly purge the system of air when starting up after pumping out the compressor, by blowing the air from the system. Manufacturers provide cocks for this purpose.

"In cleansing old plants or those that have been shut down for a long time, from deposits of oil, it is a good plan to pump hot ammonia gas into the system. The gas should be taken from the line just before it enters the condenser. If taken from the top of the condenser the gas will probably contain air and other impurities which would be liable to cause an explosion.

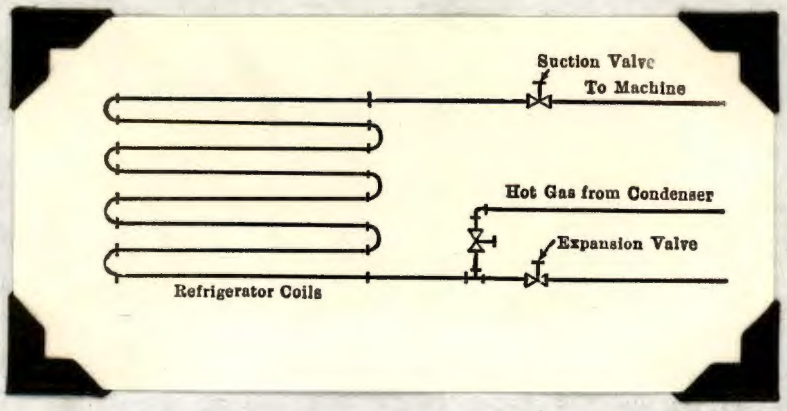


Fig. 1--Conventional Diagram of Cooling System.(87)

"Referring to the conventional diagram fig. 1, the method of operation should be as follows: Connect a temporary pipe line with valve from the lowest part of the condenser or to the pipe line just before entering the condenser. Close the expansion valve and pump hot ammonia gas into the valve opened slightly and occasionally open it wide quickly to allow the oil to be carried out and deposited in the oil trap, from which it can be drawn off.

"Before starting up the plant, care should be taken to see that all oil cups are filled and the oilways open, in order that all wearing surfaces may be well lubricated before the machine is started.

"To start--(1) Turn the water on the condenser and water jacket, and open the discharge valve of the compressor; (2) start the machine slowly at first and after the machine is in motion and the pressures are at proper point open the suction valve on the compressor gradually; (3) open the expansion valve sufficiently to give the required back pressure and the machine is in full operation.

"To stop--(1) Close the king valve which is between the receiver and the expansion valve and pump the low pressure to zero. This is considered better practice than closing the expansion valve each time the machine is stopped, thereby necessitating

87.20:2

readjustment of the expansion valve upon starting up again; (2) Open all drips and drains and shut down machine; (3) Close the suction and discharge valves, and all oil cups and water valves; (4) Clean the machine thoroughly and examine all bolts and nuts to see that they are tight and see that the bearings are properly adjusted."(88)

88.20:2

BOOKKEEPING

This subject may be treated from many different angles depending upon the point of view and experience of the person by whom it is handled. A professional accountant might handle the subject in a different way from a creamery executive. Most creameries have some system of bookkeeping. It would be needless to describe one system and impossible to describe all systems. Every system is worked out to suit that particular business or situation, although all systems have the same principles.

Opportunity has been so abundant in our country that in many cases the older executives could not fail except with the poorest of management. The best business opinions of today seem to indicate that this epoch of business has come to a close for most industries.(89) It is therefore necessary to make all short cuts and prevent all losses to maintain the business on a sound basis. A good system of bookkeeping is one of the essentials. The manager must know what his business has done and is doing to more successfully operate it in the future.

Before a manager can profit by the use of accounting facts he must first secure a good system in his own business at a reasonable cost. It is useless to produce accounting data if the cost is more than the value of the product. The facts about a company should be produced promptly. Reports a month or two old may make a small loss large.(90)

89.7:3
90.Ibid:6

Kind of Records

Every business keeps what may be termed three kinds of records: alibi, historical, and control. Alibi records pay their own way. An alibi record is one that enables the employee to say to the management, "Oh yes, I did that last week." A control record is one that enables the management to say to an employee, "You must do this by noon today." A historical record tells the story of past operations. A control record establishes requirements of the success of future operations. The job is for the management to get rid of the alibi records and use historical records to establish controls.(91)

91.8:7

Records Kept

A record of purchases should be kept. A milk and cream purchase record is kept.[92] The form and size depend on the size of the business. A record should be kept of every pound of milk that is received. At the end of the day the record should show how much raw material each department received. The amount received by the plant over that received by each department will be the surplus. If a record of the milk and cream received is kept from the time it enters the plant until it is checked out to the routes, many losses may be eliminated, which often amount to a great loss in a week's time.[93] The monthly purchase record furnishes a record of all purchases made during the month, including all items which have been paid, such as labor, insurance, interest, depreciation, etc.[94]

A record of all sales should be kept, including cash sales, credit sales, sales to patrons and any goods disposed of on consignment. The cash and credit sales are often recorded by each salesman for his own record, in which case the salesman is held responsible for all goods he checks out from the plant.

The creamery business is of such a nature that it is difficult to estimate profit or loss daily. Therefore a complete record of profit and loss should be made monthly. In order to do this correctly, a monthly record of inventory must be kept.[95]

The financial statement is a summary of the firm's resources and liabilities and as such it shows the financial

92.1:335 93.22:18 94.1:342 95.Ibid:345

condition of the firm. The monthly statement of profit and loss should be checked against the financial statement. The monthly statement may be considered correct if the resources of the firm show an increase above the liabilities equal to the monthly profit.(96)

96.1:345

Cost Accounting

Need of Cost Accounting -

This subject is to a great extent self-explanatory. Many not only believe the need of cost account, but are proceeding to do something about it. Cost accounting, as a vital factor of successful business administration, has in the last few years been brought home in various ways to many manufacturers, who, before had never seriously appreciated its importance.(97) The importance of efficiency in business organization likewise has never been so generally recognized as it is now. The degree of efficiency is dependent upon management and management is dependent upon adequate cost accounting for proper guidance. These are considered as fundamental truths, and generally understood. But regardless of how efficient the management proves, there is always room for some improvement.(98)

An Adequate Cost Accounting System -

"Briefly, it is a system which will give the management the maximum amount of information for the minimum amount of expense."(99) Cost systems can be too elaborate and cost more to operate than they are ever worth. One company installed a very complex cost system. As a system, it was perfect. It covered everything; not a single phase of the operation of the business was overlooked. It provided voluminous reports. Only one thing was forgotten, and that was how much it would cost to operate. When it was completed and in operation, it consisted of an exceedingly fine and expensive history. As many as 45 differently stated monthly

97.8:25 98.Ibid:26 99.Ibid

reports were laid on the manager's desk not earlier than 45 days after the end of the period covered by the reports. It took several accountants to supervise it and the information was available so late that it was of practically no value to the management, to say nothing about the bewildering effect that 45 different reports might have had on the manager. Needless to say, this system was discarded and as a result of over-emphasis on cost accounting, the management is still antagonistic toward any cost accounting system.(100) On the other hand, too many businesses are relying to an extreme on guess work and inadequate information, preferring to save the necessary over-head involved in the operation of a cost accounting system which might give them useful and valuable information.(101)

Accountants can increase their value with their company by persistently developing adequate and comprehensive cost accounting, keeping always in mind the minimum of expense. The only purpose of any cost accounting system is for the gathering of information. It can be nothing more than a history and its value depends on the date of this history. Old history may be valuable for seasonal variations, personal forecasting and preparing for the future. The presentation of this information is entirely an individual problem between the accountant and the management as to whether it should be purely history, or as a forecast of the future, or both. There are two important things that should be taken into consideration: (1) What kind and how much information

100.8:26 101.Ibid

shall be obtained? (2) How soon can it be obtained? The plan should be examined to determine whether or not some parts of it might be eliminated temporarily in favor of economy or for other information, which is not being obtained. This may be a saving in expense and produce valuable information, which is not being received. This is just in a general way, as it is impossible for anyone to point out short cuts in cost finding without knowing the circumstances of each case.(102)

Practical Forms -

It is quite essential for the success of a cost accounting system that a general deal of study and thought be given to the forms used in gathering data. The general tendency for most accountants is toward detail in designing their forms. This has its advantage if there is maintained the willingness to sacrifice here and there for the ultimate good of the whole. Naturally, the purpose should always be kept in mind when designing forms. That is, the right kind of information must be gathered easily and accurate results readily obtained so that they can be of utility in the administration of the business and as well be used in comparison with like information from other plants.(103)

Management Requirements -

In analyzing one's cost accounting needs, it might be well to begin at the end and work backward. First one must consider the results and information which the management wishes to obtain. This can be followed back through the general ledger and accounting system, the purchasing section,

102.8:27 103.Ibid:28

production, sales and delivery and administrative divisions. Each one of the first three, namely the purchasing department, production and sales and delivery are worthy of a separate and detailed treatise. One of the important factors in the successful operation of any cost accounting system is the degree of confidence into which the employees are taken, who are responsible for the original data. Knowledge by them of the purpose of cost accounting is quite essential in obtaining their cooperation. And obviously their cooperation is necessary, as in the final analysis the success of any accounting system is dependent upon the individuals who operate it.(104)

The results to be obtained from a cost accounting system can be placed generally under two main classifications. First the mechanical reports, second the representation and utility of these reports. For example, we may take a company named "Company A". Here the accountant so designed his cost system that it became an integral part of his general accounting system. The point where cost finding left off and the general accounting system began was almost impossible to determine. The purchasing department was so organized that all invoices were recorded and in one operation became an accounts payable record and a break down of charges to departments. The payroll was likewise divided. The general ledger being also divided by departments, it became the resting place through department accounts of all departmental costs. After the trial balance was completed, it was necessary to prepare a de-

104.8:28

partmental expenses distribution sheet before the detailed operating statement of the month's business could be made. Thus we find a complete tie-up between the general accounting and the cost accounting systems.(105) The departmental expense distribution sheet must of necessity be in perfect balance with the general ledger. This sheet then formed the base from which supplemental break down of costs were made. This sheet showed in detail the overhead applicable to each single department of the business. First there was the production division, divided into receiving, pasteurizing, bottling, and maintenance, including engine and refrigerating departments and butter and ice cream processing. Then the sales and delivery divisions included general delivery expenses, and all the shops, such as garage, barn, wagon and paint shops and other maintenance departments. Thus was brought to light a multiplicity of information and uses for it, as the cost of these single departments could be broken down to any desired limits. To supplement this sheet "Company A" could also develop a raw material distribution report which showed monthly the exact charge to each product of raw materials used in the actual product sold. This also formed the source of original entry to the general ledger. Taken by themselves, the monthly operating statement, the expense distribution sheet, formed three valuable reports showing at a glance the trend of the operation of the business. All three of these reports were usually obtained by the fifteenth of the month and whenever desirable any part of the

105.8:29

business could be further analyzed and valuable comparisons made.(106) Naturally to support these there were a number of supplementary statistical recapitulations, particularly of unit and money sales.(107)

106.8:32
107.Ibid:33

MARKETING DAIRY PRODUCTS

This subject will be taken up in a general way as the marketing problems are different in every city. There are some principles that are true in all cases.

Salesmanship

The selling of goods may be defined as an exchange of values; the act of selling is known as a business transaction. In order that a business transaction may lead to a permanent business relationship, the transaction should be of mutual benefit to the parties concerned. The one who buys the goods must feel satisfied that he obtained as good value for his money as could be obtained anywhere. The one who sells the goods should likewise be satisfied with the transaction. If either of the two parties attempts to take advantage of the other, the result will be that business relationship between the two will sooner or later be discontimued.(108)

The Salesman -

The one who sells the goods is known as the salesman. The art of selling goods becomes more important as competition becomes stronger and as business becomes more centralized. The salesman of today is therefore a man who must meet many requirements.(109) He is representing the company and his actions not only affect him but the company as a whole.(110)

1. "He should be honest, be of good Moral character, and of a strong but pleasing personality."(111) He should cultivate a taste for good company, for a man's character is often judged

108.1:226 109.Ibid 110.21:70 111.23:226

by that of his associates, and the modern business man is won most readily by that salesman who is of a strong character and personality. After he has won the confidence of the buyer, a salesman is often tempted to sell a bigger order of goods than would be profitable for the purchaser to buy, but the salesman should look after the interest of his customer the same as he is looking after the interest of the firm by which he is employed. He should present the goods as they are, not making any statements without authority from his firm or statement he or the firm is unable to back up.(112)

2. "He should cultivate acquaintance with his customers and always be glad to see them."(113) A salesman who is afraid of meeting a customer after he has called on him a few times does not understand the secret of gaining his friendship. The salesman should be ready to observe good qualities in the customer. A salesman's opportunity to be of help to his customers in any way should be considered as a privilege, as it will result in mutual friendship, which is a strongest asset for a salesman to posses.(114)

3. "He should know the goods he sells and have confidence in the house he represents."(115) The man who sells a dairy product should know how such a product is manufactured, and if he is without technical knowledge, then he should work for some time in the manufacturing plant. Even though he may have a fair technical knowledge, he should spend a few days

112.23:226 113.Ibid:227 114.Ibid 115.Ibid

in the factory which manufactures the goods he is to sell.(116)

It is not merely the general principles of manufacturing common to all plants making the same line of goods, that should be studied, but especially such phases of the work in which the factory he represents excels the others. Particular attention should be given to sanitation, quality of raw material used, scientific principles involved in manufacturing, and quality and appearance of the finished product.(117)

Experience thus obtained enables the representative to present properly the merits of the goods he sells. It also gives him enthusiasm and confidence in his firm. It is a difficult task for anyone to sell an unknown product even at an average price; it is comparatively easy to sell a product at an advance in price, if the salesman is fully aware of the superiority of that product.(118)

4. "He should familiarize himself with the quality of goods sold by his competitors and with their methods of selling."(119) This is entirely for the purpose of self-education and not for the direct purpose of taking undue advantage of such knowledge. A salesman should hold his competitors in high esteem. He should never speak about them when he sells goods, for if he does, it is an indication that he is afraid of them and it makes him weaker in the eyes of the prospective customer.(120)

116.1:227
117.Ibid
118.Ibid
119.23:228
120.1:228

5. "He should have self-confidence."(121) The one who lacks self-confidence will never be able to talk convincingly. Self-confidence should not be confused with self-conceit, for that is a very undesirable quality to possess.

6. "He should be judge of human nature."(122) The people he has to deal with are of different temperaments. They have different ideas, they do business in a different way. It is therefore necessary that the salesman judge the individuality of the prospect. If it is a retail customer, he must study his actions and talk and decide quickly the type of sales talk that would interest the retail customer most. If it is a wholesale prospect, the nature and volume of his business has much to do with shaping of the man. A man running a large retail grocery business in a large town requires different approach than a man with a grocery business in a small town.

The approach is a very important part of the sales work. A salesman's approach may make the prospect either like or dislike him. If it is the latter, his chances are few. In order to appeal favorably, he should be polite, he should not inconvenience the prospect. If he finds the prospect busy, it would possibly be better to call later. A salesman is at a disadvantage when trying to interest a person who for the time being has urgent business to attend to. The salesman should make his talk brief and convincing. He should watch the prospect to see if he is interested and which points to stress most. The financial interest of the mer-

121.23:228 122.Ibid

chant of the interest of the prospect should be kept in the background until the product is sold. Then definite arrangements as to collections should be made. If it is not apparent to the prospects that they will gain something by handling or using the product, it is likely that they will not be interested. The salesman should know when to talk, when not to talk and when to withdraw.(123)

7. "He should be persistent".(124) Because a few attempts fail that should not cause discouragement. He should take advantage of each failure as well as each success by reviewing each selling talk, singling out the mistakes as well as the strong points of the talk.(125) It is often necessary to make more than one call to sell a prospect. But determination to sell should not be carried too far on prospects determined not to buy.

The salesman should furthermore keep a permanent daily record of the number of calls made, number of selling talks and number of sales made. This should be summarized weekly or monthly. The purpose of this is to increase efficiency.

8. Some salesmen have the natural ability. With little or no experience they are able to take a route over and make remarkable increases. These men are desirable. However, many good salesmen have developed from men that were willing to work and learn.

Manager's Relation to Salesman -

1. "He should be able to impart enthusiasm to the salesman."(126)

123.23:228 124.Ibid:229 125.Ibid. 126.Ibid.

This cannot be accomplished unless the manager himself has enthusiasm. Before the salesman starts to work, the manager should take charge of him for the purpose of stirring his enthusiasm to the greatest extent. A manager should never send out a salesman before that has been done, for without enthusiasm, the salesman will fail to present a forceful selling talk.(127)

2. "He should stand back of his salesman."(128) The quality of goods delivered should be the same as that represented by the salesman, and it should be uniform and remain so. The practice of starting a new customer, supplying him with a high quality product for a short time and then gradually reducing the quality should be discouraged. A manager of such ideals cannot expect his salesman to continue to retain business or remain enthusiastic or to maintain loyalty and respect for his firm, all of which are necessary for success.(129)

3. "He should be in close touch with his salesman and his customers."(130) He should show an interest in the salesman, put in a good word and compliment him whenever possible. Salesmen doing well should not be complimented too much. The manager may write the merchants occasionally to keep in touch with them. If this is done, the salesman should have a copy of the letter.

127.23:229
128.Ibid:230
129.1:230
130.23:231

Methods of Marketing

Selling Direct to the Consumer -

This system of marketing has become more and more popular in later years. It cuts out one middle man. The product is delivered fresh direct to consumer. Any trouble with the product can be taken up with the company. It's a special service to the customer. In many cases the milk is delivered before breakfast. There is also the advantage that the retail trade is numerous small customers instead of few large customers. The sales are more uniform. It is not likely that many retail customers will quit in one day, while the quitting of one large wholesale customer will make a large difference in the day's sales. The price received for retail milk is more than that received from wholesale trade. Plants today prefer retail to wholesale trade.

Marketing Through Retail Establishments -

This includes sales to groceries, cafes, hotels, etc. The retailer deals direct with the customer. The products are sold to the retailer at a lower price so that it will pay him to handle the products. Many consumers, especially the less wealthy ones, prefer to go to some retail establishment to purchase their milk and save a cent or two on every quart. This cuts down delivery expense, which makes it possible for the creamery to sell the milk cheaper through retail establishments. Some stores make daily deliveries with groceries, at which time the milk can be delivered at no extra cost to the consumer. This system has the disadvantage that the milk usual-

ly does not reach the consumer as fresh as by direct delivery. Most creameries sell part of their milk to retail establishments. This system has the advantage that larger amounts of milk can be delivered by one man and truck. The wholesale salesman usually sells cases of quarts while the retail salesman sells just a few quarts.

SUMMARY OF SURVEY OF LITERATURE

1. The success of a creamery depends largely on the manager.
2. The creamery should deal fairly with the producers of milk and cream.
3. Milk and cream should be bought on a quality basis.
4. The most satisfactory milk deliveries are by direct deliveries and milk routes, while the most satisfactory cream deliveries are by direct delivery, cream routes and direct shippers.
5. In buying supplies and equipment, the present value, future value and quality of goods should be considered.
6. When buying supplies and equipment, the necessity of buying the goods should be determined and a year's supply should be contracted whenever possible.
7. A complete record should be kept of the supplies in the supply room, and as supplies are issued to each department, a charge should be made against that department. An inventory record of supplies should be made monthly.
8. The working force should be well organized within the departments and the departments should cooperate with each other.
9. The management should show an interest in the employees, and train and educate them on the work outlined for them.
10. The dry storage room should be well arranged and of sufficient capacity to store all necessary supplies.
11. The compression system of refrigeration is most commonly used in plants, the refrigeration being done by the

circulation of cold brine, or the direct expansion of ammonia into coils.

12. The refrigerating machinery should be well understood and cared for.

13. Sufficient amount of bookkeeping should be done for the manager to know at the beginning of each month the profit or loss made the previous month.

14. Cost accounting is becoming more necessary, especially when the losses of operation have to be reduced to a minimum.

15. A good salesman usually has honesty, persistency, self-confidence, is a good judge of human nature and of a good moral character.

16. Milk and milk products are sold direct to consumer and through retail establishments.

PART II

ORIGINAL INVESTIGATION

GRAVES
JAPANESE TAPE
MADE IN U.S.A.

PART II

ORIGINAL INVESTIGATION

Plan

Little need be said about the importance of creamery management. Operators today realize that with the present keen competition it is necessary to have a well managed organization. The successful manager today is not the one that sits back in his chair and causes a lot of trouble because he thinks his margin for profit, or spread, is not large enough. The successful manager is the man that studies his problems out, minds his own business and prevents any losses that might occur in his plant so that his business might carry on successfully with the small spread it may have to work with.

In the investigation of creamery management and operation, two parts will be included. The first part, Section A, will deal with studies of the operations in the University Creamery and other creameries that were visited. It should be kept in mind that all the information that was desired from outside creameries could not be obtained as such information is not readily released for fear it may get into the hands of a competitor. The second part, Section B, will deal with experimental problems that occur in creamery operation. All problems that are enumerated were worked on at the University of Tennessee Creamery and laboratory and were considered under practical conditions as may occur in any creamery. All the actual work of investigation and experimentation was done by the writer and results listed as obtained.

SECTION A

INVESTIGATION OF PLANTS

Plant Operations at the University of Tennessee Creamery

Receiving Milk at the Plant -

All the milk is brought in with trucks from the producers and received at the receiving platform. The milk is unloaded and conveyed in to the receiving room where the milk is graded and dumped. The cans are washed good, steamed and dried and returned to the trucks to be carried back to the producer.

All the milk is received in the morning except possibly in flush season when the University of Tennessee Creamery separates the surplus milk of the Knoxville Milk Producers' Association. It is their aim to have all milk received by noon so as to avoid hauling during the heat of the day, and so the work of receiving at the plant may be completed early in each day.

Grading, Sampling and Testing -

The quality of product sold depends a great deal on the raw products received. The milk receiver has instructions to receive only good milk. The milk is dumped and weighed as soon as received. The temperature is checked by clock type thermometer with a bulb extending in receiving vat. Each can must be examined to determine its condition as shown in Figure 2.



Fig. 2--Inspection of Milk on Arrival at Plant.

This is done by smelling and tasting. The milk with objectionable flavors and odors is rejected. The fingers and hands are not put in the milk. Small sanitary spoons and stirring rod are used to taste the milk. The odor is checked immediately after the lid of each can is removed. The tight lid holds the odors in,when enroute to creamery. If the milk appears to be high in acid, an acid test is run. The lactometer is used to detect watered milk. This test is only run when there is some reason for suspicion.

As soon as all the milk from one producer is dumped, a sample is taken for butterfat test. The milk in the weigh tank is stirred well before sampling. Composite samples are taken for milk which is tested every week.

Pasteurizing -

From the time the milk is received and dumped, it is handled rapidly to prevent contamination as much as possible. After the milk is weighed and sampled, it passes into a small tank through a strainer and is pumped through the preheater, through a filter into the pasteurizing vat, as in Figure 3.



Fig. 3--The Preheater.

The above figure shows the preheater through which the milk passes before going into the pasteurizing vat, as depicted in Figure 4.

The milk is pasteurized in new Cherry-Burrell spray pasteurizers. The pasteurizers have automatic controls to stop heating when the milk reaches 143° F. The milk is held at this temperature for 30 minutes, at which time, it is ready to start over the cooling board. Cold water is also turned on in the vat jacket so as to partly cool the milk down in the vat. The recording thermometer chart will then show the 30 minute holding period. In order to pasteurize milk properly, it is necessary to heat it to 143° for 30 minutes. This is necessary for the distruction of all disease producing organisms and a reduction of the total bacteria count. Proper pasteurization and economy in the use of heat, power and labor is accomplished at the University Creamery by the automatic temperature control on the vats.

The heating of the vat is not done by releasing live steam in a jacket holding water. The jacket has only a small amount of water in the bottom. This water is heated with live steam. The water is pumped to the upper part of the vat and sprayed down the sides of the vat, thereby heating the milk in the vat. As the sprayed water reaches the bottom of the vat, it is reheated and repumped through the system, thus causing continuous heating. By this system, the difference in temperature between the heating media and milk to be heated is not great. As soon as the milk in the vat reaches 143° F., the pump is cut off. This is done by tripping a mercury bulb, which cuts off the current.

When the pump is cut off, live steam is forced against a

bulb in the jacket, due to the water not being circulated, which causes the steam valve to shut off.

This automatic control prevents the milk from being heated too hot and causing the cream line to be shorter.

Cooling -

After the milk is properly pasteurized, it is quickly cooled over the surface cooler to 40° F.

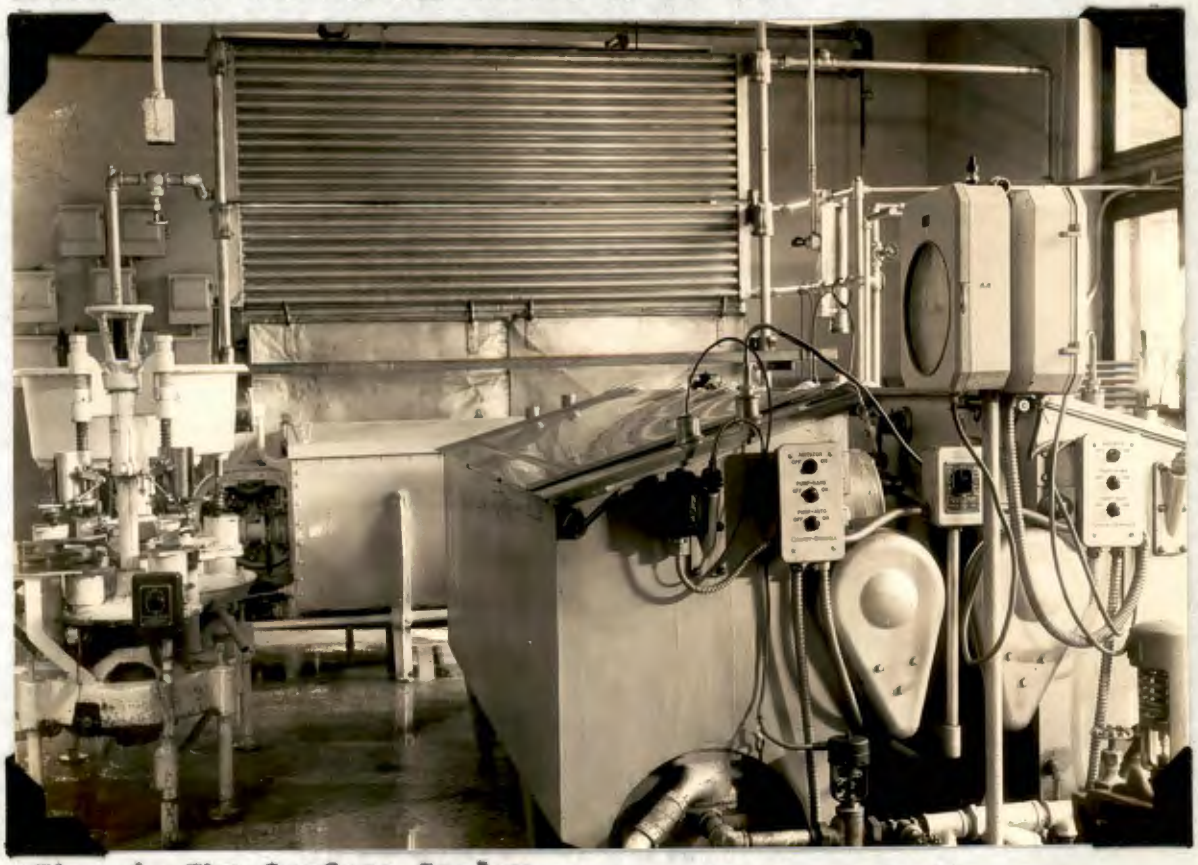


Fig. 4--The Surface Cooler

The upper section of the cooler has water circulated through it, while the lower section has brine circulating through it.

The milk is not allowed to run over the cooler too fast as it may cause improper cooling. The cooler is of sufficient capacity to run the milk over as fast as the bottling machine

can bottle it.

Bottling and Capping -

As the milk comes from the cooler, it flows by gravity direct to the bottle filler and capper. Figure 5.

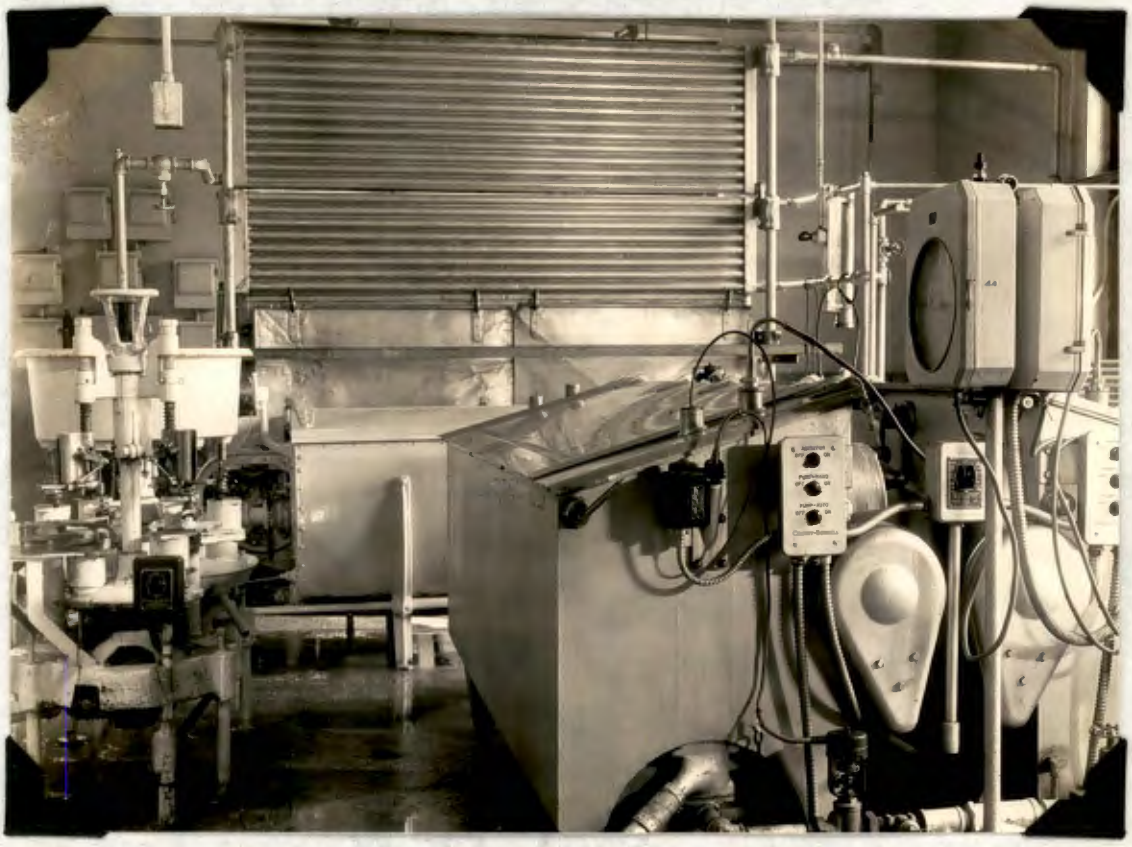


Fig. 5--The Bottle Filler and Capper.

The milk is bottled and capped by the machine. The line leading to the filler bowl has a float on it so that when short stops are made, the bowl will not run over. When longer stops are made, the milk has to be cut off at the pasteurizer as the pan on the bottom of the cooler will run over. The brine is cut off at the same time.

Bottle Washing -

The bottle washing is done by a Ladd No. 42 bottle washer.



Fig. 6--Ladd No. 42 Bottle Washer.

The type of bottle washer works very well for small plants. All bottles as they reach the bottle filler are clean and sterile. The cost of washing bottles is very low.

Storing -

As soon as the milk is bottled, it is put in a milk storage room which is kept between 38°-40° F. Here the milk is kept until it goes out on the route.

Cleaning -

As soon as all the day's run is completed, all parts of the apparatus are cleaned thoroughly by first running slightly warm water through the lines, pump, vats and cooler. The vats and cooler are then washed with hot water and washing powder, then rinsed with clean water and steamed. The lines and pumps are then taken down and washed in a special vat as shown in Figure 7.

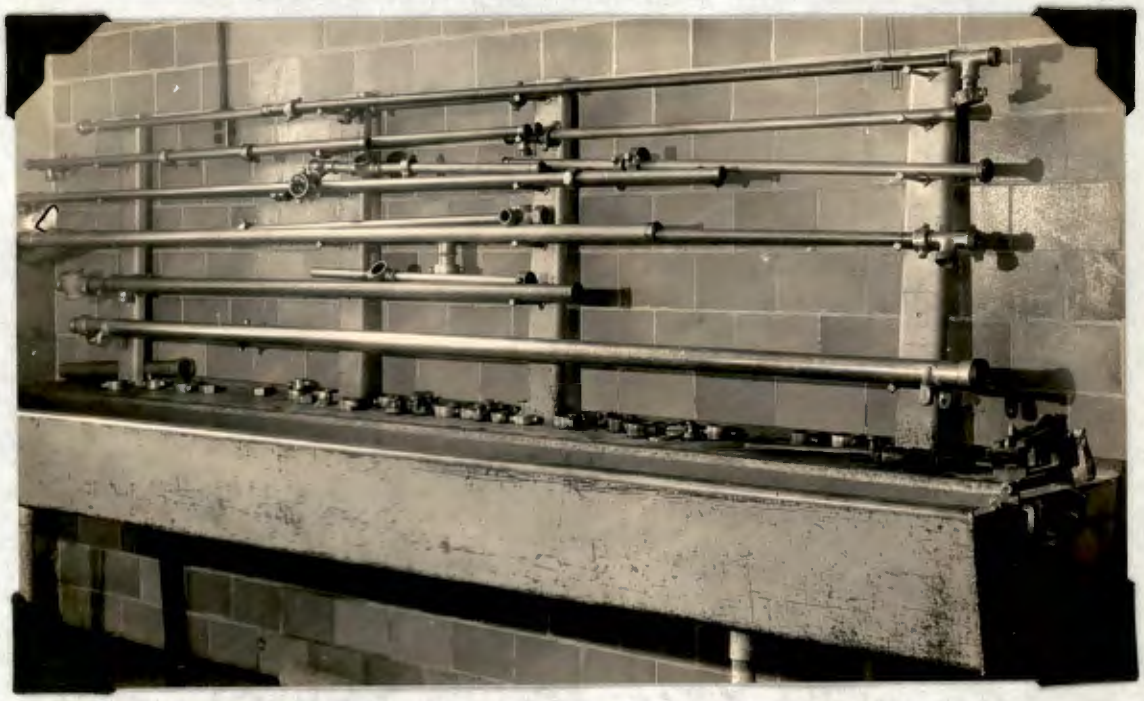


Fig. 7--The Line Washing Vat.

The lines are washed with hot water, washing powder and line cleaning brush. The parts are then washed with clean water, hung on a rack shown above vat, and steamed well. All parts of the apparatus are taken down and cleaned well each day.

Wastes During Handling Milk -

One of the main aims of the milk plant operator is to keep the losses in the plant as low as possible. These

losses vary considerably at different plants, depending mostly on the competence of the men in charge.

Conditions at the University of Tennessee Creamery are well managed. A check is kept on the milk from the time it is received until it is checked out to the routes. The loss during processing is small.

The number of lines used is too large for the size of the creamery. This is due to the fact that the building was not built for the creamery as it is today. Increased loss and labor of this kind cannot be controlled by the present manager. The creamery being a one-story building, it is necessary to pump the milk twice; once from the receiving tank and once from the pasteurizer. The agitation given the milk is not severe enough to injure it in any way.

All leaks and spillage are watched closely. The vats are placed so they will drain well. All cans are drained well in dumping. Milk and cream returned from routes is used for making butter, the milk being separated before being used.

As soon as motors and other machinery are not used, they are shut off. To avoid loss of refrigeration, the brine is cut off as soon as the milk or cream is over the cooler. The machinery is kept well oiled but waste of oil is avoided.

In the cleaning of cans and equipment, the employees are instructed to use certain amounts of washing powder, by measure, with a certain amount of water, to avoid unnecessary waste. When too much water is used, it also increases the waste of washing powder. When not in use, the water hose is not kept running.

The employees are instructed not to enter the milk storage room unless necessary and then the door is open as little as possible to avoid the loss of refrigeration.

Buttermaking

Receiving the Cream -

The cream is received from the producers in two and one-half gallon, five gallon, and ten gallon cans. The producers of the two cream routes have one or more two and one-half gallon cans, according to the amount of cream they have. These cans were bought in a lot by the creamery and sold to the producers at cost. A small amount was deducted from each check until the can or cans were paid for. All the cans are in good condition and are kept clean by the creamery, being washed immediately after dumping. If the cream is produced carefully and cooled, it will not be contominated by old, dirty, and rusty cans by this system. The uniformity of containers adds to appearance and ease in handling and grading. As the cream is received, it is graded, sampled and weighed. The receiver tastes and smells the cream to detect any off-flavors and odors. It is assorted according to grade, the onion cream being grouped by itself. Cream unfit for human consumption is rejected.

Pasteurization and Neutralization -

As soon as possible after the cream is received, it is pasteurized for buttermaking. The cream received, together with the cream separated extra in the plant is poured in a Cherry Burrell spray vat through a strainer.

Neutralization--In the using of sour cream for buttermaking, it is necessary to neutralize the acidity. It is a neutralization of the lactic acid in the cream. The purpose of neutralization is to avoid excessive fat losses. It also guards against

production and development of off flavors, and improves the keeping quality of the butter.

After all the cream is in the vat and agitators running, the cream is heated slowly to about 90°F, never over 100° F. After the cream is heated to about 90°F., the steam is cut off. A representative sample of the cream in the vat is taken and an acid test is run on the cream. Care should be taken that the sodium hydroxide is one-tenth normal and that the test is accurate. From this is calculated the amount of lactic acid that has to be neutralized. For convenience we will say the acid test and the cream was .50% and the weight was 1,800 pounds. The cream is neutralized to .25% acid. .50 - .25 = .25% acidity that must be neutralized. .25% x 1,800 lbs.= 4.5 lbs. lactic acid to be neutralized. Since the acidity was not over .50% to begin with, all the acid to be reduced may be neutralized with C.A.S. (Standard Acidity Neutralizer). It requires .77 lbs. C.A.S. to neutralize 1 lb. of acid. So .77 multiplied by 4.5 equals 3.66 lbs. of C.A.S., which neutralizes this vat of cream to .25% acidity. The amount of C.A.S. is weighed out and added to about two gallons of warm water. After it is well dissolved, it is added slowly to the cream through a strainer. The agitator is running.

If the acidity is over .50 to begin with, it is neutralized down to .50 with magnesium lime. By the same prodedure, the amount of acid to be neutralized by the lime to reduce the acidity to .50% is figured. By making a lime mix of 20 lbs. of magnesium lime in a ten gallon can filled with water, it will

take 1.64 pints of lime mix to neutralize 1 pound of acid. The lime mix is diluted with an equal amount of warm water and strained into a vat. It should be added slowly and stirred well to keep it from settling to the bottom. Unless the acidity is unusually high, all the acid to be reduced may be neutralized with lime. If too much lime is used, it may cause a lime-like flavor in the butter.

Other neutralizers that may be used are soda neutralizers, including sodium bicarbonate (baking soda), sodium carbonate (soda ash), and a mixture of sodium carbonate with sodium bicarbonate, and mixed soda and lime neutralizer (neutrola). The lime neutralizer has the advantage over soda neutralizers in that it has a higher alkalinity with no danger of foaming. The cost is low and does not damage butter when properly used. Lime is also an ordinary constituent of milk. However, lime is not completely soluble, settles readily and may cause a limy flavor. The soda is a quick acting and thorough neutralizer and during the process of foaming may release some of the off flavors in the cream.

After the neutralizer is added to the cream and has had some time to act, the steam is again turned on in the vat and heated up slowly to 150°F., at which point the heating is automatically stopped. It is held for 30 minutes. If the vat used does not agitate the cream well, it may be necessary to increase the agitation with a stirring rod. If foam is allowed to collect on top of the cream, the pasteurization may not be complete and the foam may not allow some off-flavor or odor to be driven off.

Cooling -

After the cream is held for 30 minutes, it is pumped through a filter and over the surface cooler to be cooled to ripening temperature. From the cooler, the cream runs into a ripening vat.

Ripening -

The cream is held over night at a temperature near the churning temperature. The churning temperature in March is about 53° and about 40-45° in June. The cream is cooled to a lower temperature in summer as the temperature rises over night. The cream is seldom ripened with starter due to the arrangement. Cream ripened with a good butter culture usually makes better butter. But ripening with a bad culture is worse than no culture at all.

Churning -

After the cream is held over night, the temperature is checked. If it is too warm, brine is turned on in the revolving coils in the vat and the cream is cooled to the churning temperature, which varies with the time of the year. In June it is about 43-45° F. The churning temperature will also vary with the churn. No definite rules can be set up as the operation temperatures. They vary with the operator, season, weather, equipment, etc.

The churn is run about one-fourth full of clean tap water and allowed to revolve about five minutes. All this water is allowed to drain out. A representative sample of the cream is taken and an acid and fat test run. The cream is then run in the churn through a strainer that fits in the churn door

opening. The cream is rinsed out of the vat and enough water used to just flush the cream out of the line. The pump is cut off as soon as water starts coming out the end of the line. Then the door is fastened good, everything is cleared away from the churn, the churn is put in high gear and started to run. The churn is a Model 81 Cherry Burrell Single Roll.

Extra care is taken to have the churning temperature correct for that particular time and season. If the cream is too cold, it will soon whip up and fill the churn to where the drop is so small that the time of churning will be extra long. Sometimes it may be necessary to remove part of the cream. If the cream is too warm it will churn too fast and cause the butter to be soft, poor body and cause a big loss of fat in the buttermilk.

It takes about 45 minutes to churn a vat of cream. The extent to which the cream is churned is watched through the glass peep-hole on the end of the churn. After the cream "breaks" tiny small granules can be seen on the glass after it is churned enough so the granules of butter will be gathered enough to not be seen on the glass, about ten to fifteen more rounds and the churn is stopped to see if it is sufficiently churned. The granules should be the size of a good sized pea with no tiny granules. The tiny granules can be seen if too small on the inside of the churn door, as it is opened.

After the butter is churned enough, the buttermilk is drained outside the building into barrels by means of a hose.

The buttermilk is allowed to drain off well.

Washing -

In washing butter, the amount of water used is equal to the amount of cream to begin with. This is divided into two washings in butter that is made from some cream that is not so good. The washing has a tendency to wash some of the off-flavors out of the butter. But on the other hand, washing will wash some of the good flavors out. So when the butter is real good, it is only washed once. The amount is two-thirds the amount of cream to begin with.

The temperature of the wash water is within two degrees of temperature of the buttermilk. If the cream was churned too warm, the wash water is used 2° F. colder than the buttermilk. If the wash water is considerably warmer than the butter, it will warm up the outside of the butter granules and cause them to be soft on the outside and firm on the inside. If the water is too cold, it will cause the granules to harden on the outside.

The amount of wash water is added and churn run 4-6 rounds in high gear for each washing. It is run 6-8 rounds if only one washing used.

Moisture -

After the butter is washed, all the water is allowed to drain out. The water will not all drain out the drain of the University churn so the last water is drained out the door. Then, in order to have the proper amount of moisture (16%), 3½ gallons of water are added for about 1,800 pounds of 34%

cream. The amount varies. After the butter is worked, a moisture test is run. If it is lacking, more water is added to bring it up to 16%.

Salt -

Before the butter is started to work, the salt is added by pouring it in a groove in the butter. The salt added is 3 percent of the amount of fat in the churn. It may be added as a mash, mixed with water, as a brine, or dry. It is usually added dry.

Color -

The color is usually added to the cream just as it is put in the churn. If it is not added, then it may be mixed into a salt mash. The first method is usually used. The amount of color added varies with the season and demand. It varies from about 1½ ounce in March to about ½ ounce in April per 100 pounds fat.

Working -

After the water for moisture and salt is added, the butter is ready for working. The workers are put in gear, the churn in low gear and started. The amount of working necessary varies considerably with the churn, season, etc. It is worked from 120-150 revolutions, depending on conditions. It may be more or less. It is worked until the butter has a compact body, close-knit grain, tough waxy texture and free from drops of water. If worked too long, it will start sticking to the sides of the churn.

Pulling the butter -

After the butter is well worked, it is put in regular butter Fridays or 96 pound special made poplar boxes for storing butter. If butter is stored, the moisture is usually run up to 19 percent to take care of loss of moisture in storage.

The butter is removed from the churn with ladles. The butter is never touched with the hands. After it is removed from the churn, it is put in the milk storage room to cool before cutting.

Record -

It is desirable to keep a record of the churning operations so that they may be used as a reference from day to day; also a new man can get an idea of the temperatures and times used. The following is a record kept by the writer on a form that is used daily by the University of Tennessee Creamery:

Form 4

Daily Churn Record

Butter Maker E. O. Wurzbach
Date Pasteurized 3/25/35 Date churned 3/26/35
Pounds of Cream 1750
Average Test in Pasteurizer 27 In Ripening Vat 26
Pounds of Fat 472.5
Acidity Before Pasteurization .70
Acidity Before Churning .20
Pints of Neutralizer Added 5.8 / 3½# soda
Churning Temperature 53°
Color Added 5.86 oz. Rate per 100# Fat 1½ oz.
Time of Churning 45 min.
Temperature of buttermilk 58° F.
Temperature of wash water 60° F.
Size of granules Pea

Form 4 (Cont.)

Test of buttermilk .18% Fat
Pounds of salt 17.5 Rate per 100# Fat 3%

No. Revolutions Worked 125

1st Moisture Test 15.0
2nd Moisture Test 16. %
3rd Moisture Test

Pounds of Butter 597 Cubes or Tubs 6 @ 23 lbs.
Pounds of Overrun 125 % Overrun 25
Remarks Very Good Butter

Starter and Buttermilk

Starter Making -

In order to make a good cultured buttermilk, it is necessary to have a good starter culture. The original culture itself is not started at the University Creamery, as they do not have the necessary equipment to carry on these operations. The start for a culture is usually obtained from Hansen's Laboratories, or Iowa State College. This is only done when a complete new culture is desired.

When a new culture is obtained, it is usually received in liquid form in a 20-gram bottle. This bottle is poured in a quart milk bottle two-thirds full of milk that has been well pasteurized.

Pasteurization-- It is very important that the milk used be of high quality and well pasteurized. In this plant, milk that has been pasteurized and bottled for the routes is used. The milk is mixed well by shaking the bottle. About one-third of the milk is poured out of the bottle and cap put back on. Then a quarter pound butter parchment paper is placed over the lips of the bottle and fastened by a rubber band around the neck.

The bottles are now put in a wire case and submerged in steel box type pasteurizer., as in Fig. 8.

It is large enough to hold one case of quarts. The water level is adjusted by an overflow pipe so that the water level is just above the level of the milk in the bottles. Live steam is released through a pipe in the bottom of the pasteurizer

through a pipe with small holes in it. A lid fits over the top to prevent too much loss of heat.

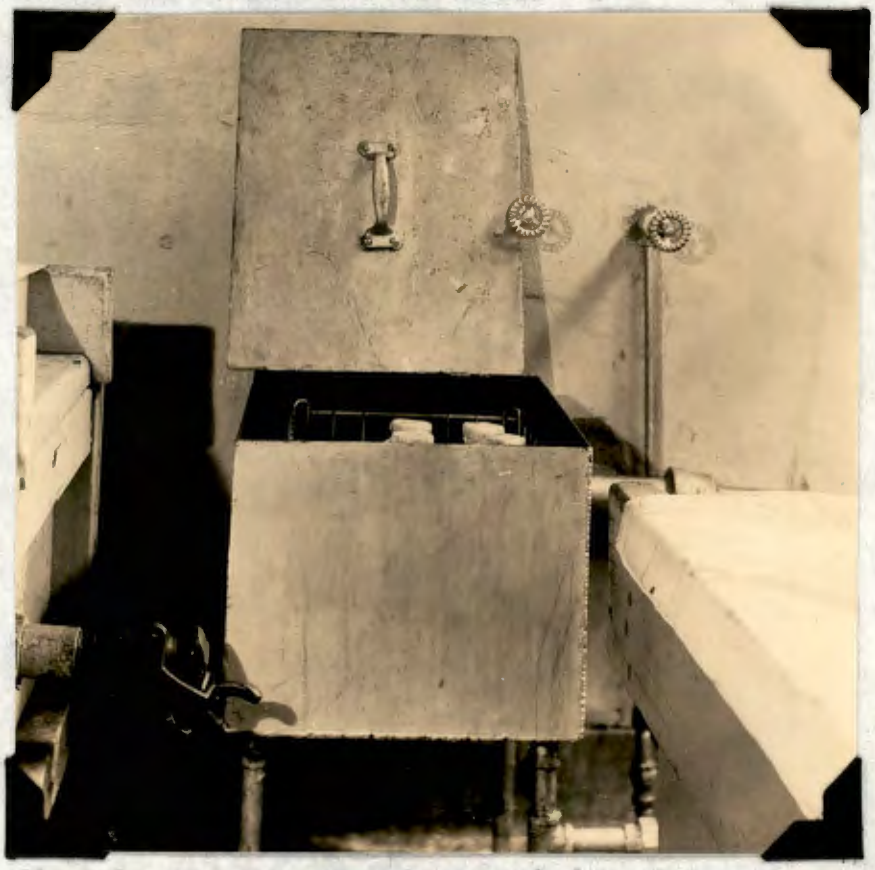


Fig. 8--The Starter Pasteurizing Vat.

The steam is turned on slowly to prevent too fast heating of the milk. The water is gradually heated up to about 190-200° F., to make sure the milk in the bottles is above 180° F. This temperature is held for 30-40 minutes and then cooled down gradually by turning in tap water, to 70° F. In summer the tap water may be above 70° F., so ice is used to lower the temperature the last few degrees. It is held at this temperature long enough to be sure the milk in the bottles is 70° F.

Innoculation--Three to four different cultures are carried. Two to three bottles are carried for each culture.

Before innoculation, the bottles to be innoculated from are judged. The starter body is examined. The body should be good and firm and break away clean from the side when the bottle is tilted. Then the bottle is shaken well. The curd should be smooth with clean, distinct aroma of that of good butter. The best bottles are selected and it is from these that the freshly pasteurized and cooled bottles are innoculated.

The culture is transferred by means of 9 c.c. pipettes. The pipettes are sterilized in an autoclave at 15 pounds pressure for 30 minutes, which makes them absolutely sterile. When innoculating, a Bunsen Burner is used to flame the pipettes to kill any bacteria that might be floating around on dust particles in the air. The bottle to be innoculated from is shaken well and parchment paper raised just enough to remove sample. Same is true when it is put in bottle to be innoculated. The amount of innoculation varies from 9 c.c. to about 27 c.c. From 9 to 18 cc. is the usual amount, depending on the condition of the culture. If it appears to be a little green, more is added. If it is overripened, the amount is cut down.

After the innoculation, the bottles that are innoculated from are further judged for flavor and body by tasting. The flavor is a distimct, clean acid flavor. By this can be told which bottles are likely to have the best flavor of the bottles just innoculated.

Incubation--The freshly innoculated bottles are shaken

well to distribute the bacteria fully. Then the bottles are placed in an incubator, which is suspended in the milk storage room. The temperature is controlled by a thermostat. When the temperature reaches 72° F., the light bulbs which furnish the heat are cut off. When the temperature goes down to 70° F., the lights are turned on again. The incubator is in the milk storage room because in the hot season of the year, the room temperature of other rooms is above 70° F. So without some system of cooling, the incubator would never be as low as 70° F. This incubator provides a practically constant temperature which is very essential for good starter making.

The bottles are incubated in this incubator for about 16 hours. In this time the milk has had time to curdle and have some extra time to develop the desirable aroma. At the end of this time the bottles are taken out of the incubator and cooled by being left in the milk storage room.

These bottles are usually incubated by morning. They are kept cooled during the day and that evening are used to innoculate into some freshly pasteurized milk, thus repeating the same procedure. The cultures are transferred six days out of every week.

Cultured Buttermilk Making -

The amount of cultured buttermilk made is not large enough to warrant the making of starter in large quantities. After innoculation, the quart bottles used to carry the mother starter are used in innoculating the milk for buttermilk. A sufficient number of bottles is carried for this purpose.

In making buttermilk, the fresh whole milk is separated. The skimmilk is run into a nickel-lined jacketed vat. The foam is removed from the skim and the milk is heated up to 190° F., and held for 30 minutes. Then the milk is cooled down to 88° F., by running water into the jacket. At this temperature the milk is innoculated. The amount made in each quart bottle is used for every ten gallons of skimmilk. After the milk is innoculated, the skim is agitated for a short time to distribute the culture well. Now, the innoculated milk is drawn out of the vat into ten gallon cans and put in the milk storage room.

Innoculating the skimmilk at such a high temperature gives it time to coagulate before it gets too cold. By morning, the milk is coagulated and cooled. It is then stirred well with a stirring rod and bottled.

By this system the milk does not have to be cooled over the same cooling board that sweet milk has to be cooled over a short time later. It also saves much labor. There is some objection, however, to innoculating the milk at such a high temperature. The streptococcus lactis, s. citrovorous, and s. paracitrovorous grow better at 70°F., than do some undesirable bacteria. Therefore, by innoculating at such a high temperature, the bacteria that may survive pasteurization are given a better chance.

Ice Cream Making

The ice cream business of the University Creamery is not very large. It is limited to sales to the University Cafeteria. During the time of the year when the course in ice cream making is taught, the class makes all the ice cream for the creamery.

Figuring the Mix -

In making up an ice cream mix, unless the formula had been previously worked out and there are products on hand to fulfill the requirements, the mix has to be figured.

The following is a problem worked out by the writer using the products on hand that particular day. It was required to make up 200 lbs. of mix having 11.5% fat, 10.7% serum solids, .4% gelatin and 15% sugar using 43% cream, 4% milk and skimmilk powder 97% solids.

Ingredients	Pounds	% Fat	Pounds Fat	S.S.	T.S.
Cream	21.30	43	9.16	1.093	10.25
Milk	58.62	4	2.34	5.062	7.402
Powder	4.68			4.539	4.539
Sugar	15.0				15.00
Gelatin	.40				.38
TOTALS	100.00		11.5	10.67	37.56

The mix is figured on a 100 lb. basis and then the pounds of each ingredient is multiplied by two.

Step 1. The sugar required = 15% x 100 = 15 lbs. sugar,
.4% x 100 = .4 lbs. gelatin.

Step 2. 100 - 15.4 (Gelatin + Sugar) = 84.6 lbs. Dairy products Required. 84.6 - 11.5 (Fat) = 73.1 lbs. milk serum Required.

Step 3. 73.1 x .09 (Serum equals 9% solids) = 6.579 lbs. solids in Normal Serum.

Step 4. 10.7 (S.S. Required) - 6.579 = 4.121 lbs. Serum Solids Short.

Step 5. .97 (% Solids in Dry Skim) - .09 (Solids in Normal Serum) = .88% Available in Powder.
4.12 (lbs. S.S.Short) ÷ .88 = 4.683 pounds of powder to be used.

Step 6. 4.68 (powder used) + 15 (sugar) + .4 (gelatine) = 20.08 lbs. accounted for.
100-20.08 = 79.92 to be made up by milk and cream.

Step 7. 79.92 x .04 (% fat of milk) = 3.1968 lbs. fat if only milk used. (But 11.5 lbs. fat are required)
11.5 - 3.1968 = 8.303 lbs. fat short.

Step 8. 43 (% Cream) - 4 (% Milk) = 39% (% Fat Available in Cream allowing 4% for the milk)

Step 9. 8.303 ÷ 39% = 21.30 lbs. cream used.

Step 10. 79.92 - 21.30 = 58.62 lbs. milk used.

As the weight of each ingredient is figured out, it is filled in in the above table. Now we have the amount of each which totals up to 100 lbs. mix.

Step I. To figure the pounds fat.
21.30 (lbs. cream) x 43% = 9.16 lbs. fat in cream.
58.62 (lbs. milk) x 4% = 2.34 lbs. fat in milk.

Step II. To figure the Serum Solids.
21.30 (lbs. cream) - 9.16 (fat in cream) = 11.14 lbs. skim in cream used.
11.14 x .09% (Normal % Serum) = 1.093 lbs. S.S.incream.
58.62 (lbs. milk) - 2.34 (Fat in milk) = 56.28 lbs. skim in milk.
56.28 x .09% = 5.062 lbs. S.S. in Milk.
4.68 (lbs. powder) x 97(% solids) = 4.539 lbs. S.S. in Powder.

Step III. To figure total solids.
9.16 (fat in cream) + 1.093 (S.S. in cream) = 10.25 T.S. in cream.
2.34 (fat in milk) + 5.062 (S.S. in milk) = 7.402 T.S. in milk.
Total solids for powder is same as its S.S.
" " " sugar " " " " weight.
.4 (lbs. gelatin) x 95% = .38 Total solids for gelatin.
The totals of the above table show the mix is balanced.

The following is a day's problem when 34% cream, 3.8% milk, and condensed milk with 8% fat and 20% Solids not Fat (S.N.F.) was used. The mix was to contain 14.5% sugar, .4% gelatin, 11.8% fat, and 10.4 Serum Solids (S.S.):

Ingredients	Pounds	%Fat	Lbs. Fat	Lbs. S.S.	Lbs. T.S.
Cream	23.85	34	8.109	1.40	9.509
Milk	28.80	3.8	1.094	2.494	3.588
Cond. Milk	32.46	8.	2.59	6.490	9.08
Sugar	14.5				14.5
Gelatin	.4				.38
TOTALS	100.00		11.799	10.39	37.057

Step 1. 14.5 (lbs. sugar) + .4 lbs. (Gel.) + 11.8 lbs. (fat) =26.7 lbs. (known)

Step 2. 100 - 26.7 = 73.3 lbs. milk serum needed.

Step 3. 73.3 x .09(% in normal serum) = 6.597 S.S. in serum milk.

Step 4. 10.4 (S.S. required) - 6.597 = 3.803 shortage to be made up with condensed milk.

Step 5. 100% - 8% (% fat in cond.) = 92% serum in condensed milk. 92% x .09% = 8.28% normal serum.

Step 6. 20% (% S.N.F. in cond.) - 8.28% = 11.22 S.S. available in cond.
3.803 lbs. (shortage) ÷ 11.22% = 32.46 lbs. of condensed milk to be used.

Step 7. 2.46 x .08 (% fat in cond.) = 2.596 fat furnished by cond.
11.8 (amount desired) - 2.596 = 9.204 lbs. fat to come from milk and cream.

Step 8. 100 - (14.5 sugar + 32.46 cond. + .4 gel.) = 52.65 to be made up by milk and cream.
52.65 x 3.8% = 2.001 lbs. fat is weight made up by milk alone.

Step 9. 9.204 (fat to come from milk and cream) - 2.001 = 7.203 fat to come from cream.
34 (% cream) - 3.8(% milk) = 30.2% (available in cream)

Step 10. 7.203 ÷ 30.2 = 23.85 lbs. cream .

Step 11. 52.65 - 23.85 = 28.80 lbs. milk to use.

The fat, serum solids and total solids is figured the same as in first mix except to find S.S. of condense 32.46 (lbs. condensed used) is multiplied by 20% (S.N.F. in condensed) = 6.490 lbs. S.S. (Serum Solids)

By totaling amounts figured the mix will have 11.799% fat and 10.39% S.S.

Making up the Mix -

After the mix is figured and the amount of each ingredient is known, the mix has to be made.

If cream, milk, skimmilk powder, sugar and gelatin are used, the cream and milk are put in a 50 gallon starter vat and heated to about 110° F. The sugar, gelatin and powder are mixed dry and then poured slowly into the vat. Occasionally extra agitation is given with a stirring rod to completely dissolve the sugar, powder and gelatin. The mix is gradually heated up to 150° F. and held for thirty minutes. Then it is run through the homogenizer at 2,500 pounds pressure. From the homogenizer it is run over the cooler and cooled to 40°F. It is drawn off the cooler in ten gallon milk cans and put in the storage room to age. The mix is always aged as much as four hours. The usual procedure is to let it age over night.

Freezing -

The freezer is first rinsed out good with cold water. The freezer is run about three revolutions with the water

in it. The freezer is checked to see that it is good and clean. It is an old style Creamery Package Freezer. Cold brine circulates through the jacket to do the freezing.

The mix is weighed out, usually divided evenly to have a certain amount of batches to freeze. The amount is usually about half the capacity of the freezer. The mix is poured in the hopper. Then the freezer is started, the mix is turned in the freezer and brine started circulating through the freezer. The brine is usually about 0° F.

The mix is first frozen and then whipped to obtain swell. After about 6 or 8 mimutes a small portion of the ice cream is drawn out on a large spoon or paper dish. When the small sample drawn out is in a semi-solid condition, stands up well, appears to be firm and has lost its sheen, it is frozen enough and the brine is cut off. Now it is left running to whip the cream up. The amount of overrun desired is measured by the height to which the ice cream comes up to in the freezer after being whipped. The overrun is figured by weight of ice cream removed from the first batch and then by letting it whip up to that same height the next batch, the overrun is just about the same. The amount of overrun usually is from 90 to 100 percent.

After the ice cream is whipped enough to obtain the desired overrun, it is drawn out as quickly as possible and placed in the hardening room. The cold air is circulated over and around the freshly frozen ice cream by means of a fan to harden it quicker. The ice cream is

not allowed to soften, before it enters the hardening room as this practice will cause coarseness. When cups are filled the ice cream is drawn out in cans and the cups are filled from the cans. This practice prevents the losing of the overrun of the part that is not drawn out immediately. If the freezer is full, it may cause too much overrun. Also unless the ice cream is drawn out quickly, it may warm up in the freezer.

Flavoring -

In making vanilla ice cream, 1½ ounces of vanilla extract is added for 50 pounds of mix, the vanilla usually added as the mix is freezing.

In making fruit and chocolate ice cream, 1 gallon of fruit or chocolate is used to 50 lbs. mix. Fruit ice cream is usually colored to be natural.

Sherbets -

The sherbets are made up of the following:

Apricot Sherbet

5½ gallons of 4% milk
20 pounds sugar
3 oz. gelatin
2 oz. lemon concentrate
1 oz. citric acid
1½ cans of apricots (8# cans)
color added to be of a golden yellow.

Pineapple Sherbet

5½ gal. of 4% milk
19 lbs. sugar
9 oz. of 50% solution of citric acid
3 oz. of gelatin (dissolved in 2 qts. hot water)
1 oz. of lemon concentrate
1 can of crushed pineapples

Lemon sherbet is made up the same as the pineapple sherbet except the pineapple is not used. Lemon concentrate is used for flavoring.

Making the Sherbet -

In making up the sherbet the sugar is mixed with the milk. The gelatin is dissolved in 2 quarts of hot water and added to the milk and sugar very slowly with severe agitation. It is then run in the freezer and started freezing. The lemon concentrate, citric acid and fruit are added just long enough before the sherbet is drawn so it will have time to mix in well.

Custard Ice Cream -

The custard is made of:

1.3 lbs. sugar
3.9 lbs. cream (25%)
.5 lbs. skimmilk powder
2.3 lbs. of 4% milk
2 lbs. of eggs or 1½ doz.

The eggs are beat; the mixture of sugar and powder is added and beat again. The milk and cream is then stirred in. It is then heated slowly to 180° or until it coagulates. Now it is cooled and placed in storage until use.

To make a custard ice cream, 90 pounds of vanilla mix and 10 pounds of custard mix are mixed and frozen.

Record

The following is a form used to keep a record of the ice cream made:

Form No. 5

UNIVERSITY OF TENN. CREAMERY ICE CREAM RPT. NO.__

Date of Mixing_____ Date of Freezing_____ Age of Mix__

Materials	lbs.	% fat	# fat	% SNF	# SNF	%TS	#TS	Cost per lb.	Total
Cream									
Milk									
Cond.									
Flavor									
Sugar									
Gelatin									
Water									
Total									

No. Cans Filled Gal. Containers Filled Gal. %Swell_____

___ 5-gal. _____ ____Qts. _____ Cost per gal._

___ 3-gal. _____ ____Pts. _____

___ 2-gal. _____ ____Bricks _____

____1-gal. _____ Total _____

Total _____

Cottage Cheese Making

The cottage cheese is made out of fresh skimmilk that has been pasteurized at 143° F., for 30 minutes. Usually 100 gallons is pasteurized and run into a 100 gallon cheese vat.

Setting -

The temperature at which the skim is set varies with the season from 68° F. in the summer to 75° F. in the winter. In July it is set about 68° F.

The cheese is ripened by adding about 4 pints of commercial starter distributed in the milk followed by 30-40 drops of rennet, depending on its strength, in 1 quart of water. The rennet is diluted with water to more evenly distribute same in the milk. The milk is stirred well with a stirring rod to evenly distribute the starter and rennet, for lack of distribution causes an uneven curd.

The cheese is usually set around four o'clock in the evening so it will be ready to cut about eight o'clock the next morning, giving it about 16 hours to ripen. During ripening, a cover is placed over the vat to prevent anything from getting in the milk.

Cutting -

The curd is usually ready to cut in about 16 hours of ripening. The cutting time is determined by the condition of the curd. It is cut when the curd becomes a soft, jelly-like coagulum that is firm and will break with a clean split when a spoon is used. The acid at cutting is usually about .58-.63%. The curd is cut with wire blade cheese knives,

the horizontal knife being used first. The curd is carefully cut to make even cubes. These uniform curd cubes cook evenly.

Cooking -

As soon as the curd is cut the whey will begin to separate rapidly. After a short time the curd is slowly heated. First the curd is well covered with water, about 160°, to assist in cooking. This water is added through a dipper strainer or over a cheese fork to prevent pressure of being against cheese cubes. The jacket is filled up with cold water and steam is turned on slowly. The heating is done slowly and a cooking temperature of about 120°F., is reached in about 2 hours. The temperature of cooking varies with the curd, acidity and temperature at which it is pasteurized. The time of cooking also varies with the same conditions.

The amount of cooking applied is judged by the condition of the curd. As the curd cubes become firm enough, the cooking is stopped. The cubes are pressed between the thumb and the first finger to check firmness. When breaking a curd cube open, it should show a clean break. The curd is not cooked too long as it will become tough. While cooking, the cheese is stirred just enough to prevent the cubes from matting together along the sides and bottom of the vat. It is not stirred too much as the cubes will break up. In examining the curd, a few cubes are washed in cold water, which gives a good idea of the condition the curd will

be in after drained and washed.

Draining the Curd -

After the curd is cooked enough, the steam is cut off. The vat strainer is inserted and gate opened. The first part is caught and poured back in the vat as it usually contains considerable curd. The gate is opened wide to let the whey drain off. The hot water is released from the jacket and is filled with cold water to prevent further cooking.

When the whey has been removed until the curd begins to be visible, the gate is closed and the vat is filled one-third full of cold water. By not drawing all the whey off, it does not give the curd a chance to mat. The curd seems to retain the cube form better if not cooled too rapidly. A second and sometimes a third application of water is necessary to properly wash and cool the curd perfectly. It is always cooled to the temperature of the water. After the last washing, the curd is allowed to drain fairly dry before the application of salt. The curd is trenched and piled along the sides of the vat. The time of draining is usually around two hours, depending on the condition of the curd.

Salting -

Salt is added to the curd while it is still trenched at the rate of about 2 lbs. for each 100 gallons milk. The yield secured is usually uniform, being from 16 to 17 pounds

per 100 pounds of milk. About half of the salt is sprinkled over the curd. The curd is then turned and the remainder is poured on. The salt is then mixed well with the curd.

Creaming -

After the salt is well mixed in, the curd is piled in one end of the vat. The curd is then creamed well at the rate of about 4 gallons of 20% cream to every 100 gallons of milk. Most of the cream is mixed with the curd in the vat. The cheese cartons are filled in the vat as each carton is filled, a small amount of cream being poured on top of the carton. Most of this last amount of cream remains on top of the cheese for the customer to see when he or she removes the lid of the carton.

The cheese is put up in 12 oz. cartons and gallon crocks. All cheese is packaged the same day it is made. The date is stamped on the cartons to prevent it from becoming old. As soon as the cheese is cartoned, it is put in the milk storage room and kept cold until delivery.

Records -

In order to keep a record of the cheese, and conditions under which it was made, a report is kept. It also influences the cheese maker to be more accurate in his processing. If trouble is encountered, the manager can check on the cheese maker. The report shows the variations in the processing, temperatures, etc., with different seasons of the year.

The following is a report of the cheese made in one day on a form used daily by the University Creamery.

Form No. 6

COTTAGE CHEESE REPORT

Cheese Maker Belew Date 6/18/35

Gal. Skim Used 100

C.C. Rennet Used 40 drops

Pints Starter Used 4

Temperature Set 68°

Time of Setting 3:00 P.M.

Time of Cutting 8:00 A.M.

Condition of Curd Firm

Acidity of Whey .60

Time of Heating 2 hours

Heating Temperature 120

Temperature of Wash Water 75° F.

Time of Draining 2 hours

Pounds of Salt Added 2 #

Pounds of Cream Added 12 # of 35%

Pounds of 4% Milk Added 20#

Containers Filled:

	No.	Pounds
3 Gal. Crocks		
2 Gal. Crocks		
1 Gal. Crocks	4	32
12 oz. Cartons	158	118
9 oz. Glasses		
Total		150

Yield per 100 lbs. Milk = 17.6# cheese

Cheddar Cheese
Making

Cheddar cheese making has just recently been started at the University Creamery. It was started with the idea of utilizing some of the surplus milk on the market during the spring and summer season and making it possible to pay the farmers more for the milk than the regular surplus price. From all observations, it appears that the result will be a success.

The Milk -

The milk first used in making the cheese was pasteurized. Its inconvenience, increased labor and increased time caused the milk to be used raw instead of pasteurized. The milk is of extra high quality. The results thus far are very satisfactory. The high quality of the milk makes it unnecessary to be pasteurizing same.

Ripening the Milk -

The amount of milk used is about 1,700 lbs. The capacity of the vat is about 1,800 lbs. To 1,700 lbs. of milk 35 lbs. of good starter is added to do the ripening. This makes the total milk in the vat 1,735 lbs. The starter is added and milk is stirred well to evenly distribute the starter. The ripening temperature of the milk is 86° F. Care is taken that too much starter is not added as an over development of the acidity at any stage of the manufacturing process affects the flavor, body and texture, color and finish of the cheese.

The color is added after the starter is added and mixed well. If the color is added before the starter, the start-

er may cause white spots in the cheese. The color is added at the rate of 15 c.c. per 1,000 pounds of milk. The milk is allowed to ripen until the acid reaches .21%, never over .22%.

Setting -

The temperature of the milk at setting is 86° F. When pasteurized milk was used, the ripening and setting temperature was 88° F. The amount of rennet added is at the rate of 90 c.c. per 1,000 pounds of milk. The rennet is added to about two quarts of cold water and then mixed in with the milk with sufficient stirring to evenly distribute the rennet. The rennet is added to the milk when it has ripened enough to have developed an acidity of .21%, at the most .22%.

Cutting -

Enough rennet is added so the curd will be firm enough to cut in 30 to 35 minutes. The rennet acts fast and when the curd is ready to cut, it is done immediately as the part of the vat cut last may become too firm. The firmness is judged by inserting the index finger into the coagulated milk full length, about ½ inch below the surface. The split is started with the thumb nail and then slowly raising the index finger to the surface. If the curd breaks apart with a clean fracture without leaving small particles of the coagulated milk on the fingers, and if the whey that commences to separate in the broken surface is clear, not milky, the curd is ready to cut. If the back of the hand is pressed against the surface of the coagulated milk and the curd separates

clean from the side of the vat, it is another indication of the curd being ready to cut.

In cutting, the horizontal knife is used first. It is inserted carefully into the curd at one end of the vat to prevent smashing or jamming the curd. The knife is moved quickly and firmly from end to end of the vat, until it has passed through the whole mass of curd. Then the perpendicular knife is used carefully and quickly to cut crosswise first, and then lengthwise.

Heating the Curd -

When the curd is cut, it is first mixed by hand well. The curd is still soft and has to be handled carefully. The curd is kept stirred with the hand for about 10 mimutes. Then the steam is turned on slowly, heating about two degrees every five minutes. Now the curd cubes have contracted enough to be stirred with a curd rake. The curd will rapidly settle to the bottom and mat up, so it is kept stirred.

The following is the rule used in heating. If, after cutting, the whey around the curd shows

.13%	acidity,	allow	40	minutes	for	heating	to	100° F.
.13½%	"	"	30	"	"	"	"	"
.14%	"	"	25	"	"	"	"	"
.14½%	"	"	20	"	"	"	"	"
.15%	"	"	15	"	"	"	"	"

It is never heated over 100° F.

During the heating and cooking, the curd is kept well stirred, even though great care is taken to not break the curd up while it is soft. If the curd is allowed to mat up

and break again, a new surface is exposed and the loss of fat becomes greater. As the curd becomes more firm, there is less danger of matting, but still has to be stirred occasionally.

Removing the Whey or Dipping -

As a rule the curd is kept in the whey at least 1½ hours. The time of draining depends on the acidity of the whey and the firmness of the curd.

At dipping the curd cubes have become a glistening yellow with a shot appearance. The cubes have contracted to about half the size. When a hand full of curd is squeezed to remove the whey and then the hand opened up, the curd should spring apart. The firmness of curd is usually kept a little ahead of the acid, as when .18% acid is reached, the whey must be removed regardless of the firmness of the curd. If the curd is firm enough and acid low, the whey is not removed until acid is about .16%. The whey is usually removed when the curd is firm enough and the acid of the whey is about .17%.

In removing the whey, the whey strainer is inserted in the gate and whey removed fast. The whey is used to wash the fat off the sides of the vat during the draining. When the whey runs down to where the curd is visible, the curd is stirred vigorously with the hand. When enough whey has run out to keep from carrying the curd to the gate, the curd is shifted to the rear two thirds of the vat in an even layer. A ditch about ten inches wide is cut in the mass of curd

through the center and piled evenly on each side. This allows a better chance for drainage. All the small particles of curd are swept up and put under the mass, as they soon become cold and will not mat in. When all the whey is removed an acid test is run on the whey still draining off. This acidity varies from about .24 - .27%.

Packing -

After the curd in the vat has matted so that the particles stick together, the masses on both sides of the central channel are cut cross-wise into strips with a cheese knife. The width of these strips depends on the moisture in the curd, usually about 8 inches. The more moisture in the curd, the smaller the pieces are cut. As soon as these pieces become matted enough, they are turned individually. A drain is left along the middle of the vat. After the curd is turned, each time, the crumbs of the curd broken off are brushed underneath the masses of curd. After the pieces are turned several times and the whey has fairly well drained away, the pieces are piled two high and then three high, depending on the amount of water in the curd and temperature.

Milling the Curd -

By this time these pieces of curd are large flat masses. The time of milling depends on the curd. The physical condition of the curd determines the time of milling. The acid of the whey is never below .70% at milling. The acidity at milling is usually from .75 to .85 percent. The curd

when ready to mill, has a fibrous texture, somewhat like the white meat of a chicken breast. The pieces of curd tear open. When cut, it has a smooth, close interior. The curd is always milled below 90° F., to prevent an extra loss of fat in the whey. It is milled with a Gosselin curd mill.

Salting -

After milling the curd is stirred with the hand for about 10-15 minutes, or until the pieces are well contracted or healed over. The curd is spread in an even layer. The salt is added at the rate of 2 pounds to 1,000 pounds milk. The salt is applied in 2 or 3 applications and thoroughly mixed after each application. After the curd has again resumed its velvety feeling and cooled to 80° or 82°F it is reach to commence hooping. If pressed at a higher temperature, fat is lost and the pieces of curd do not cement together perfectly. If pressed at lower temperatures, the pieces will not cement together in a solid mass.

Hooping -

In the morning before the cheese maker starts a new vat for the day, he removes the hoop from the press, removes the cheese from the hoop and puts it in the cheese curing room, which is kept at a temperature of 58-60°F. The hoops are cleaned and scalded well. During the process of making that day's cheese, the cheese maker prepares the hoops by placing a pressing cloth in the bottom of each hoop. On this is placed a circle cloth. The bandage is put on the

hoop lining and put in place.

The curd is then put in the hoops. The hoops are filled full enough to produce a good sized cheese, about 33 pounds, hoop and all, is weighed in. After pressing, it will be about a 23-pound cheese.

Pressing -

After the hoops are filled with the cheese, the press cloth and hoop follower is put on and the hoops are put in the press. The pressure is applied slowly at first. The full pressure is never applied in less than 15 minutes after the cheese is put in the press. After pressing for about 30-45 minutes, the hoops are taken out and cheese dressed. The bandage is freed from all wrinkles and trimmed evenly, so that it comes over the face of the cheese about an inch. Plenty of clean, warm water, and soft, clean, press cloth is used to insure a good rind on the cheese. A circle cloth is placed on top of the cheese. A press cloth is put over the circle cloth and the hoop follower is put on. The cheese is put in the press under full pressure. The pressure is great enough to contract the spring about one inch on the gang cheese press. The cheese is left under pressure not less than 15 hours. When the cheese is removed from the press, it is wiped with a clean cloth to remove any fat or particles of curd. It is then weighed and placed on curing room shelves to dry. The cheese is turned daily on the shelves. When the cheese is good and dry, the circle cloths are removed and cheese is parafined.

Record -

A record is kept of each vat of cheese made. The following is a record of one day's process on a form used daily by the cheese maker. The percent of fat and moisture in the cheese is not tested until the cheese is dry.

Form No. 7

Cheese Making Record

Date 7/3/35 Address Knoxville, Tenn.

Name of factory U. T. Creamery Cheesemaker Pearson

		Color (ozs)	Rennet (C.C.)	Salt (lbs.)
Milk used, lbs. 1700	Amount used per 1000 lbs...	15	90	2
Starter used, lbs. 35				
Total lbs. 1735	Total amount...	26	156	3-4
Vat No. 1 Serial No. 53	% Fat in milk received 3.9 raw m.			

TIME OF

adding starter 8:17
adding color 8:20
adding rennet 8:30
cutting 8:58
turning on steam 9:10
" off " 9:40
dipping 11:03
packing 11:10
milling 1:21
salting 2:00
hooping 2:20
pressing 2:30
dressing 3:30
style cheese made D-9
% acid in milk
when received .18
after adding starter .21
when adding rennet .21
whey at cutting .13
at dipping .16-5
at packing .23-5
at milling .82
at salting .94
% fat in vat 3.9
% fat in cheese 38
% moist. in cheese 38
Total lbs. cheese 186.75
Yield cheese 1# vat 2.76
" " 100# milk 10.76
Temp. of milk when received 66°
When starter added 86°
when rennet added 86°
when whey removed 100°
at pressing

Remarks: report use of rennet test or hot iron tests or any unusual happening or condition.

Results good.

Cream and Chocolate Milk

The amount of cream and chocolate milk made is small. The amount made up is just enough to supply the trade that demand it. Since it is not made on a very large scale, certain practices are used to prevent loss.

Whipping Cream -

The cream separated is standardized to 35% fat, pasteurized, and run through the homogenizer without any pressure. This is known as the double cream.

Single Cream -

The single cream is made by standardizing pasteurized 35% fat cream run through the homogenizer without pressure, to 20% fat with cold 4% pasteurized milk. This procedure is most convenient and produces fairly good results. By this method, the cream returned can be churned with little loss of fat.

Chocolate milk -

The chocolate milk is made by standardizing skimmilk to 2% fat with 4% milk. Drinkmor Non-Settling Chocolate Syrup is used at the rate of 1 pint to 2 gallons of milk. Sugar is added at the rate of 4 oz. to 1 gallon of milk. The mixture is stirred very well and bottled.

OPERATIONS OF PLANTS VISITED

Plants in two different states were visited, which are among the best in their particular state. Many helpful ideas concerning plant arrangement and operation were obtained that are difficult to explain in writing. None of the plants will be referred to by name. Each plant is given a number and that number will apply to the same plant so that comparison can be made.

It is impossible for the writer to explain in detail the complete operations of each plant. A general idea of some operations will be given to point out differences between plants. This will be followed by tables listing a number of comparisons made.

Pasteurizing Market Milk -

The milk that was pasteurized for fluid milk purposes was handled in different ways. One plant received the milk, after careful grading, and ran it into a 200 gallon holding tank. From here the milk passed through a preheater, in which the milk was heated up to about 90° F. From the preheater, the milk ran into the pasteurizing vat. Four 200-gallon, steam jacket, glass lined, vats were set in a row. Only one vat was filled at a time. As soon as one vat was filled, the steam was applied slowly. By the time the last vat was filled, the first vat had had time to be heated to 143° F., and held for 30 minutes.

After pasteurization, the milk was pumped through a filter and over a cooler to the bottling machine. The top section of the cooler had water circulating through it and

over a cooling tower. The lower section was refrigerated by direct expansion.

When this system of pasteurization, cooling and bottling is worked correctly, the milk is pasteurized, cooled, and bottled as fast as it is received.

In another plant the milk was received and pumped into larger 500 gallon holding tanks. These were on the third floor. From here the milk flowed back through the system by gravity to the bottling machine on the first floor. From the holding tank the milk passed to the second floor through a filter into a set of tubular coils that heated the milk up to about 98°F. From these coils the milk passed through a set of larger tubular coils, which heated the milk to 145°F. The milk then flowed into 100-gallon circular vats and was held at 143°F., for 30 minutes. There were eight vats for this purpose. The milk then flowed through a filter over a tubular cooler and by gravity to the bottling machine on the first floor.

In a modern creamery which had just been built, the milk was pasteurized in a flash pasteurizer. The milk received was pumped into large holding tanks. The milk then flowed through the pasteurizer, through a cabinet cooler to a bottling machine. The pasteurizer was a regenerative continuous flow. The milk remained in the pasteurizer about 8 minutes.

The other type of pasteurization used was pasteurizing in spray vats that were automatically controlled. This type has already been explained, under "Plant Operations at University of Tennessee Creamery".

The other systems of pasteurizing used by other plants were similar to the ones just explained.

Cooling and Bottling -

In most cases, after the milk was pasteurized, it was pumped through a filter and over a tubular cooler, having water circulating through top section and, cold brine, or by direct expansion, ammonia gas through the lower section. In one case a cabinet cooler was used.

In all cases but one, the bottles were washed by mechanical washers and the bottles were conveyed by a tract to the bottling machine. In one plant a mechanical washer was used but it was made for a small plant and the bottles had to be brushed by hand. In this plant the clean bottles were stacked in cases on trucks and rolled to the filler.

In most of the plants visited, the bottles were conveyed to the filler making it a continuous process. All the fillers were the ordinary rotary type filler. In one plant a Majonnier Vacuum Filler was used. With this system the bottles were removed of air while they were being filled. The bottles are always full and air bubbles are eliminated. According to men in that plant, the cream will rise more quickly in the bottle when that filler is used than when an ordinary filler is used.

Cottage Cheese Making -

Each plant had slightly different ways of handling and processing, though the principles were often the same.

One method used in making cottage cheese was slightly different from the method already described in this paper.

Fresh skimmilk was pasteurized at 120°F., for 20 minutes. The milk then was carried over the cooling board by a pump to the cheese vat. The cheese was set with a butter culture at the rate of about 1 gallon to 150 gallons of milk. The setting temperature of the milk was 70° F. No rennet was used. The milk was coagulated over night. The cutting, cooking, etc., was the same as described for the University of Tennessee Creamery. No hot water was added to the cheese and the cheese was cooked off at a lower temperature.

Chocolate Milk -

The main difference noticed in the methods of making chocolate milk was that one plant viscolized the chocolate milk after it was made up. The product was a smoother and creamy looking milk.

Starter Making-

The general procedure in starter making was similar in all cases, the main difference being the quantity of starter made. In some cases the starter was made up in quart bottles as compared to ten gallon cans in other instances. In most cases the milk was heated in the cans and bottles by injecting live steam into the water in which they are submerged. The temperature in most cases was regulated by controlling the water temperature in an insulated box.

The starter used by most plants was prepared by laboratory methods. In one plant natural starter was used. The starter was produced by natural souring of good, clean milk

and daily thereafter making transfers into well pasteurized milk. The results were very good. When a culture was developed, it was carried on from day to day as laboratory prepared starters. The same starter lasts as much as six months or a year before the contamination is seriously interfered with. In developing the starter, when good results were not obtained, a new culture would be started. According to the superintendent, the time required to develop a culture into a good butter starter was about 21 days.

More information concerning the plants visited is listed in table form to better make a comparison between the plants.

Plant No.	Education of Manager	Stories in Building and Pounds of Milk Received.	Appearance of Building and Amount of Business done.
1	University degree in dairying and practical exp.	1 story. About 2500 lbs. received daily.	Small building; good business according to size; everything clean.
2	University 3 yrs. Course in engineering. Grew up in milk business.	1½ stories. Receive about 170,000 lbs. daily.	Practical building; well painted. Small overhead for amount of business done. Surpassed by only 2 bus. having elaborate bldgs
3	College Degree in Dairying. Work on Masters'. Teaching and pract. exp.	3 stories. Receive about 300,000 lbs. daily.	Beautiful building. Appears well to visitors. Do most business in that city. Appearance excellent throughout.
4	College Degree in Agriculture and Dairying. Worked his way up.	3½ stories. Receive about 270,000 lbs. daily.	Very modern and beautiful bldg. Ranks 2nd in that city. Much increased business in new bldg. over that obtained in old.
5	University Degree but not in dairying. Has managing ability.	4 stories. 2 are used for storage. Receive about 17,000 lbs. daily.	Much too large for business. Frequent remodeling. Overhead too large. Business fair but below capacity.
6	Mostly practical experience.	2 stories. Receive about 13,000 lbs. daily.	Building not very attractive or well arranged. Bus. fair
7	Started in dairying as hobby. Then decided on it as life work.	1 story. Receive about 8,600 lbs. milk daily.	Building good; unattractive equipment. Management poor. Small business

Plant No.	Location of Patrons	Purchasing Raw Material, Milk and Cream
1	The greatest distance of the milk patrons is about 40 miles, mostly in one count. Fartherest cream. patron 50 mi.	Milk bought on base price except that which goes into butter. Surplus milk controlled by organization. Cream is graded.
2	The fartherest milk producer is about 50 miles; cream prod. 60 miles. Milk producers grouped in 2 directions.	Base price paid for milk with average when production increase over demand in spring. 25% of this is manufacturing milk, rest surplus Cream is graded.
3	Milk comes as far as 90 miles, most within 40 miles. Cream and milk from all parts.	Base price paid for winter avg, 25% of which is manufacturing milk; rest of milk over base is surplus. Cream graded but not very closely.
4	Milk from scattered area within 90 miles. Cream patrons scattered.	Milk bought in 3 classes: fluid milk, manufacturing purposes and surplus. Cream graded not closely.
5.	Milk patrons are within an average of about 60 miles. Do not buy cream.	All milk going into market milk, cot. cheese, bottled cream or b.m. Paid class 1 price. Milk for ice cream class 2. Milk going into butter 2 cents above N.Y.Extras.
6	Milk patrons within 60 miles. Do not buy cream. Buy butter to supply customers.	Market milk, cottage cheese, bottled cream is class 1; ice cream class 2, and butter class 3.
7	Within 50 miles. Do not buy much milk. Have own herd.	Base price for class 1, including mkt. milk, cot. cheese, b.m., and bottled cream. Second price for class 2--ice cream milk. Third price for class 3--milk for butter, 2¢ above N. Y. Extras.

Plant No.	Labor Hiring	Labor Training and Education
1	Most jobs are filled only with those interested in dairying. The salary is little above the average and organization is good.	If no exp., men to work in the plant are started with bottle washing. Some started on route.
2	For the better jobs men are selected that are interested in Dairying and have ability. When open, good jobs are given men in the org., rather than expt. outsider. Salary good to executives and low to common laborer.	Plant men started in at odd jobs in plant. Route salesmen work in plant one week before going on route to understand principles.
3	Pay good salaries for executive positions. Cater more to men with college degrees, especially in dairying. Hire ordinary men that want work for bottle washing, etc.	College men usually put on particular jobs. Route salesmen work in plant and are taught all principles.
4	Higher executives receive good salaries; Men doing plant operations, small pay. Aim is to put plant on paying basis.	Inexp. man given chance to work up. College grad. little distinction. Route men taught processes
5	Executive positions usually filled with men from other plants in same organization. Pay average salaries for men in plant.	Route men spend 2 or 3 days in plant. Plant men usually hired for particular jobs.
6	A high school education is preferred.	Man put on particular jobs and watched.
7	Hire mostly common laborers with little experience.	None--other than teaching particular job.

Plant No.	Time Keeping and When Paid	Salaries and Bond Put Up
1	No time is kept. Employees leave when all work is done. They are paid by manager on 1st and 15th of month.	Men in plant not lower than $17.00 per week. No bond required for salesman. (Business limited)
2	Each has his required work to do but must cooperate. Paid weekly. Route men paid small salary and commission on collections.	No man lower than $14.00 per week to $21.00 per week for working in plant. Salesman required $100.00 bond and $2.50 per week until $100.00 put up making a total $200.00.
3	Have required time to put in. No time clock used. College boys put on special jobs. Paid weekly. Route men paid on point system on sales.	No man paid lower than $14.00 per week. Pay good salaries. Route men required to put up $100.00 cash bond.
4	Time checked by superintendent. Employees paid monthly and bi-monthly.	Lowest salary $14.00 per week. Route men required to put up cash bond of $100.00. Salaries low.
5	Time is kept with time clock. Pay by the week. Usually given time off in winter for overtime in summer.	Lowest salary in plant $14.40 weekly Route men receive $10.00 salary and commission on collections. Bond required of route men.
6	Each has certain amount of work to do. Paid weekly.	Route men receive comm. on collections with $15.00 weekly guarantee. Bond required through bond co.
7	Men paid monthly. No system of time keeping.	Salaries low. Lowest salaries in plant $30.00 per mo. Route men paid salaries. No bond required. Results poor.

Plant No.	Marketing the Milk	% of dollar income paid producer for raw mat.	Kind of ice cream freezer used.	Making Cultured Buttermilk with Butter flakes in it.
1	Milk is sold wholesale & retail by truck. 80% sold wholesale. (ltd.)	60%	Creamery Package with cold brine circula'n	Make just ordinary cultured buttermilk.
2	Milk sold wholesale, retail. Wholesale delivery by truck; retail by truck and wagon. Ap. 60% sold wholesale. Advt. by radio and billboards.	53%	Cherry Burrell direct expansion triple dash.	The milk has about 1% fat. The milk is coagulated in the churn overnight. The next morning butter color is added, churned till small fat granules form.
3	Wholesale delivery by truck; retail truck & wagon. Advt. by radio, billboards. Free clubroom	56%	Cherry Burrell	The cultured milk is made. Then commercial butter flakes are added.
4	All wholesale and retail milk delivered by truck. Majority sold wholesale. Advt. by radio, colored bottles, billboards.	59%	Cherry Burrell & Vogt Continuous Freezer.	Cream churned in small churn at low temperature and churn stopped when granules small & flaky. Then added to cultured milk.
5	Retail and wholesale delivery by truck. About 85% retail. Adv. by radio.	60%	Cherry Burrell & Vogt Continuous Freezer.	Make only cultured butter milk.
6	Market by truck wholesale and retail with about 50% of each.	58%	Cherry Burrell	Churn cream till small flakes form. Cool with ice water and skim flakes off. Add 1 lb. flakes to 10 gal. cultured milk.
7	Market about 60% wholesale. Use only trucks.	57%	None	Make only cultured butter milk.

SECTION B

EXPERIMENTAL PROBLEMS

Plan of Research

In addition to the general investigation of creamery management and plant operations, special research was done on problems related to creamery management. The main problem of research dealt with the relation of quality of cream to the quality of butter made from it.

Buttermaking is a very important part of plant operations. The quality of butter sold by a creamery is reflected on the company operations, whether it be good or bad. When a high quality of butter is made by a creamery, the customers will have a good feeling toward that company and may cause them to buy other products also. The customers soon associate poor quality butter with unclean methods and practices about the plant.

A vast amount of research and experimentation has been done on buttermaking. A great many discoveries have been made in the practices of buttermaking. But, research workers find that they have about reached the end in trying to improve the quality of butter by different and improved practices in the actual making of the butter. Since butter is made from cream, it is important to understand the relation of the quality of cream used to the quality of butter made from it.

Quality of Butter Compared to Quality of Cream

Procedure

In distinguishing the quality of butter made from the cream, the scoring was done more on a comparative basis than on the particular score of one piece of butter. The variations in the physical condition of the judge makes it impossible for him to score butter exactly the same every day. By scoring the butter on a comparative basis, it will be more accurate and make the experiment more dependable.

In order to have the different kinds of cream churned out at the same time, a special churn was designed and constructed. If a large churn had been used, the cost would have been very high and time required to complete experiment too long. Had small hand churns been used, the time required to get a sufficient number of samples to compare would have been too long. A new type of churn was designed, different from any ever made. The amount of each kind of cream churned at a time was not over a pint, and six samples of cream were churned at one time.

The churn was so designed that quart fruit jars could be used. The jar was put in a trough with compartments just the size of the jars. A top was put on to hold the jars in place. When the churn was running, the jars turned on an axis, thereby giving the same effect as a large barrel churn, shown in Figure 9.

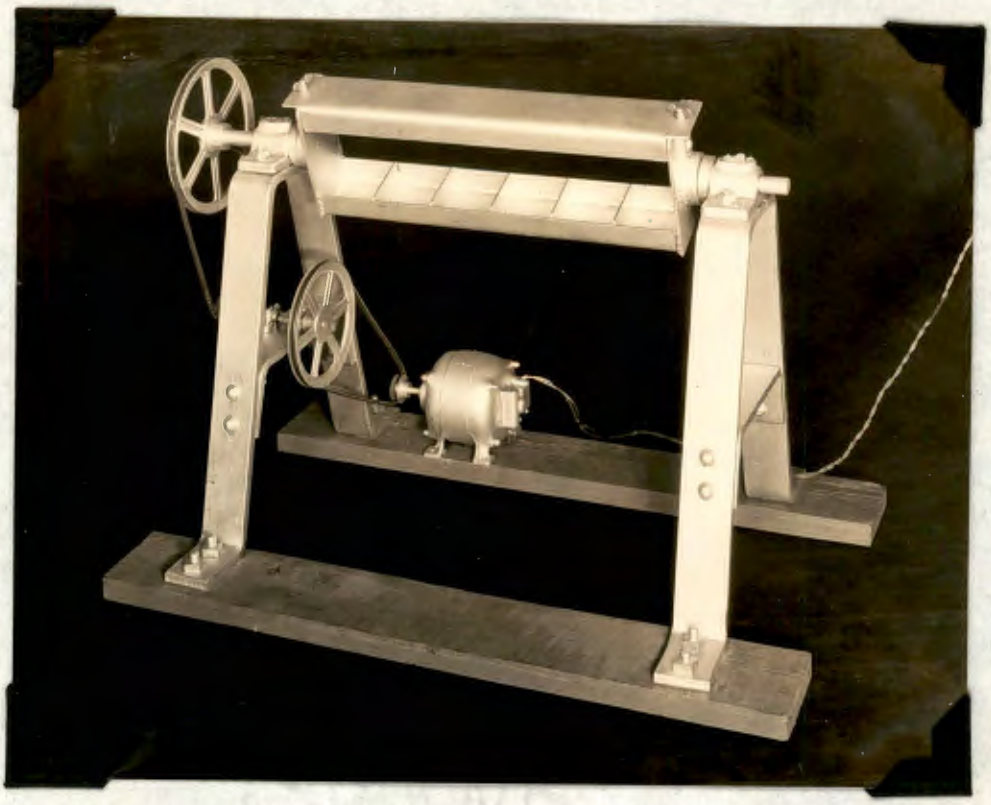


Fig. 9--Churn Used in Experimental Work.

Process of Churning -

The cream that was produced under different conditions or handled differently, was tested for the following:

1. Percent of fat in the cream.
2. Percent of acid in the cream.
3. Temperature of the cream.
4. Sediment in the cream.
5. Flavor and odor of the cream.

About two-thirds of a pint sample was removed from each lot of cream and poured into the square quart jars, which had previously been washed thoroughly and sterilized.

Figure 10, on the following page, shows the cream in the jars just before the churn is started.

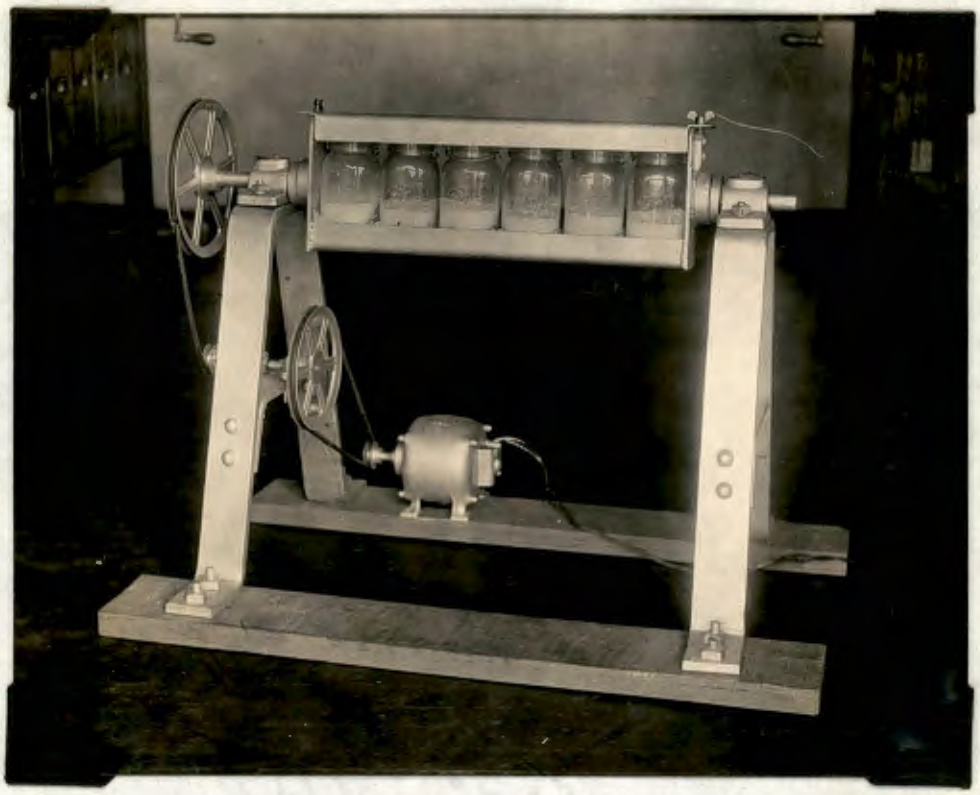


Fig. 10--Experimental Churn with Cream in Jars.

The churning temperature on an average was 60 degrees. At this temperature, it took about 45 minutes to do the churning. All jars of cream did not churn at the same time due to the variation in the cream. As each jar had churned sufficiently, it could be seen while still revolving, and was removed.

The buttermilk was removed with a small strainer held over the top of the jar. The strainer holes were the same size as that used in draining cottage cheese. After the buttermilk was removed, it was washed and then worked slightly with two wooden ladles (Fig. 11), by working the small amount of butter from one ladle to the other.



Fig. 11--Ladles Used in Working Samples of Butter.

The samples of butter were arranged in order and labeled, for judging and scoring.



Fig. 12--Samples of Butter at Scoring.

The procedure of churning the cream worked very satisfactorily and gave a good comparison of the quality of butter made from different kinds of cream.

The Effect of Age of Cream on Quality of Butter

Many producers as well as creamerymen still believe that cream need not be delivered more than once a week. It is known that every kind of food deteriorates with age. To check the quality of butter made from cream of different ages, sixty-eight samples were churned.

Production of the Cream -

The cream used in this experiment was produced under as near the same condition as possible each day. The same methods of handling were used. Each day's cream was separated and cooled about the same time. The cream was held in the milk storage room, which was maintained at a temperature between 38-40°F. Table 2 shows the results. In reading the table for flavor and odor of cream: Bad = old flavor and odor, with high acid and off flavors; Medium = slightly off flavored with fairly high acid; Fair = no off flavors, just high in acid; Good = no off flavors and acid about 2 percent; Very Good = Sweet cream with no off flavors.

TABLE II. RELATION OF SCORE OF BUTTER TO AGE OF CREAM.

Samp. no.	No. trials	Fat in cream	Acid of cream when cooled	Temp. cream cooled to	Temp. cream stored at	Flavor of cream when produced	Odor of cream when produced	Acid of cream when churned	Flavor and odor when churned	Score of butter	Date cream produced
1	2	33%	.10%	60°F	39°F	Good	Good	.60%	Bad	86	11-10-34
2	2	33%	.10%	60°F	39°F	Fair	Good	.65%	Bad	86	11-11-34
3	2	24%	.10%	60°F	39°F	Fair	Good	.58%	Bad	87	11-12-34
4	2	32%	.105%	60°F	39°F	Good	Fair	.55%	Med.	88	11-13-34
5	2	35%	.10%	60°F	39°F	Good	Fair	.43%	Med.	88	11-14-34
6	2	40%	.10%	60°F	39°F	Good	Good	.38%	Med.	88	11-15-34
7	2	35%	.10%	60°F	39°F	Good	Fair	.30%	Fair	89	11-16-34
8	2	35%	.10%	60°F	39°F	Good	Good	.32%	Med.	88	11-17-34
9	2	33%	.105%	60°F	39°F	Fair	Good	.32%	Fair	90	11-18-34
10	2	35%	.10%	60°F	39°F	Good	Good	.31%	Fair	90	11-19-34

Note: All samples churned and scored 11-25-34.

TABLE III.* RELATION OF SCORE OF BUTTER TO AGE OF CREAM.

Samp. no.	No. trials	Fat in cream	Acid of cream when cooled	Temp. cream cooled to	Temp. cream stored at	Flavor of cream when produced	Odor of cream when produced	Acid of cream when churned	Flavor and odor when churned	Score of butter	Date cream produced
1	4	33%	.11%	50°F	40°F	Good	Good	.44%	Bad	88	12-6-34
2	4	32%	.10%	50°F	40°F	Good	Fair	.45%	Med.	89	12-7-34
3	4	33%	.10%	50°F	40°F	Fair	Fair	.35%	Fair	90	12-8-34
4	4	34%	.105%	50°F	40°F	Good	Good	.29%	Good	90	12-9-34
5	4	34%	.10%	50°F	40°F	Good	Good	.22%	Good	91	12-10-34
6	4	33%	.10%	50°F	40°F	Good	Good	.10%	Very G.	92	12-11-34

TABLE IV.** RELATION OF SCORE OF BUTTER TO AGE OF CREAM.

1	4	31%	.10%	50°F	40°F	Fair	Fair	.45%	Bad	87	1-8-35
2	4	33%	.105%	50°F	40°F	Good	Good	.41%	Poor	88	1-9-35
3	4	32%	.10%	50°F	40°F	Good	Good	.36%	Poor	89	1-10-35
4	4	32%	.10%	50°F	40°F	Fair	Good	.33%	Med.	90	1-11-35
5	4	33%	.105%	50°F	40°F	Good	Good	.30%	Fair	90	1-12-35
6	4	34%	.10	50°F	40°F	Good	Good	.23%	Good	91	1-13-35

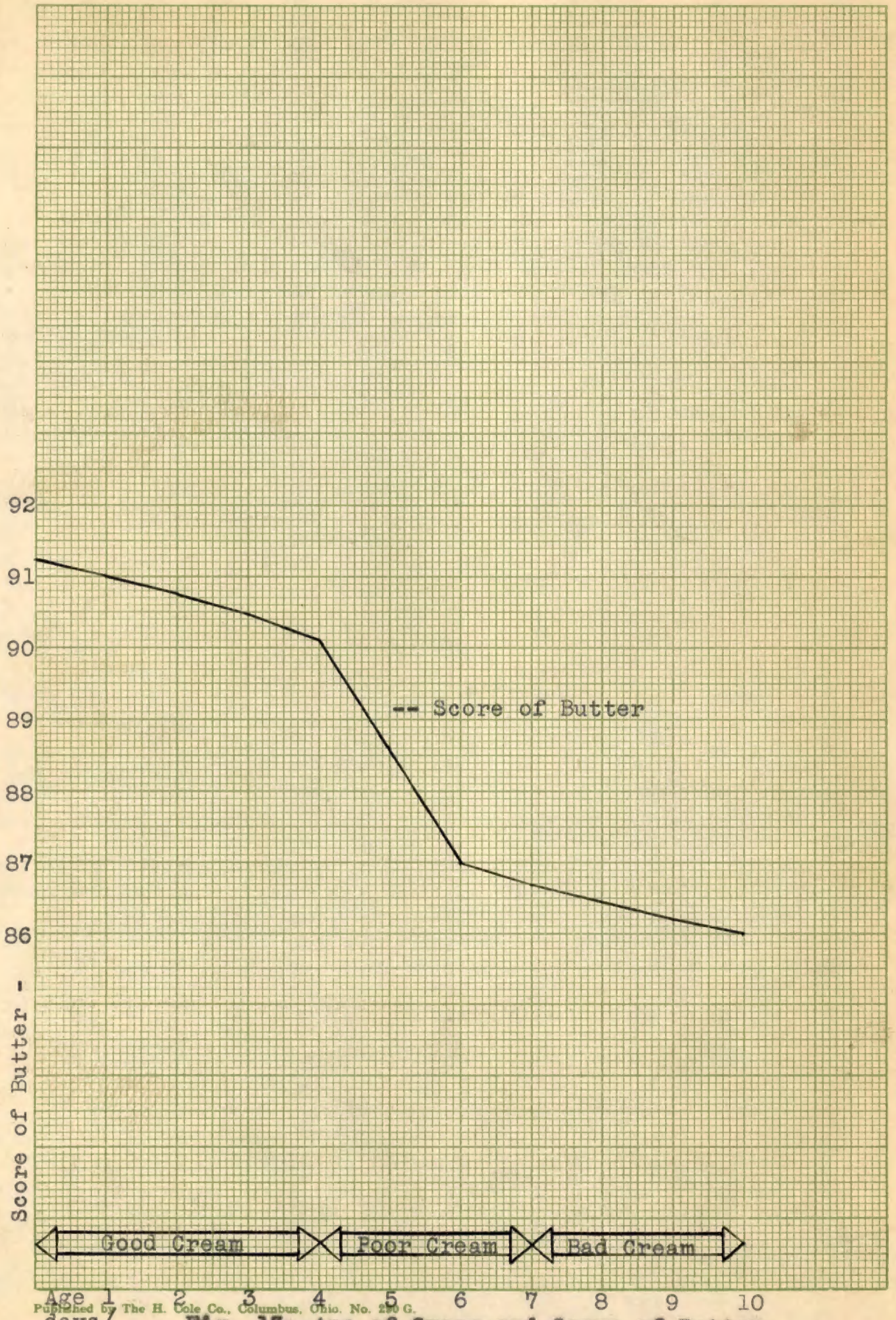
* All 6 samples churned and scored 12-11/34

**All 6 samples churned and scored 1-14-35

The tables 2, 3 and 4, show the score of butter that was made from the cream that was produced and handled under the same conditions. The main factor that caused the variation in score was the age.

These tables show that some samples of cream made a higher score butter than butter made from cream of a lower acidity. It may be noticed that cream, up to four days of age, made good butter.

Figure 13, taken from tables 2, 3 and 4, shows tha relation of the age of cream to the score of the butter made from it.



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Fig. 13--Age of Cream and Score of Butter

The Effect of Handling of Cream on the Quality of the Butter

Often cream is produced under very good conditions but still the quality of the butter is bad. A study was made of cream produced under the same conditions, but handled differently. The conditions considered were as follows: Lot 1 was produced, handled, cooled and kept properly; Lot 2 was not cooled and held at 70°F.; Lot 3 was cooled and put in a dirty can, and held at 45°F.; Lot 4 was not cooled, put in a dirty can and kept at 70°F.; Lot 5, warm fresh cream poured in cold cream from day before and kept at 45°F. The results are shown by Table 5.

TABLE V. RELATION OF HANDLING OF CREAM TO QUALITY OF BUTTER

Samp. no.	Times run	Treatment of Cream	Age of cream at churning (days)	Condition of cream at churning	Score of butter
1	3	Handled correctly.	4	Good	91
2	3	Not cooled. Held at 70°F.	4	Bad	88
3	3	Cooled to 50°F. Put in dirty can.	4	Poor	89
4	3	Not cooled. Put in dirty can.	4	Bad	87
5	3	Warm cream poured on cold cream from day before and held at 45°F.	3 & 4	Med.	90

This table shows that cream may be produced under very good conditions, but when improperly handled the quality of the butter will be low. The cream that was produced, handled and cooled correctly was good cream before churning and made a high score butter. The cream that was recognized as

bad cream made a low score butter.

The Effect of the Acidity of Cream on Quality of Butter

In order to compare the effect of the acidity of the cream on the quality of the butter, samples of cream were taken from lots of cream with different acidities and churned. The score of the butter is shown in Table 6.

TABLE VI. RELATION OF THE ACIDITY OF CREAM TO THE QUALITY OF BUTTER.

No. samples	Acidity of cream at churning.	Fat in cream	Temp. cream stored	Flavor of cream at churning	Score of butter
6	.60%	33%	38-40°F	Bad	86
7	.65%	33%	" -"	Poor	87
7	.31%	24%	" -"	Fair	90
7	.36%	32%	" -"	Med.	89
6	.26%	35%	" -"	Good	90
7	.13%	40%	" -"	Ver.G.	91

Nearly all bad cream has a high acidity. But the quality of the cream for buttermaking cannot entirely be judged by the amount of acid in the cream, as table 6 shows that a sample from a lot of cream with an acidity of .65% made slightly better butter than cream that had an acidity of .60%.

The Relation of the Production and Handling of the Cream to the Quality of Butter

Samples of cream were taken from cans that were received from a cream route at the University of Tennessee Creamery. The samples were taken as the cream was received. The temperature and acidity of the cream were tested. The cream was judged for flavor and odor, and a sediment test was made. A score of 10 on sediment was considered perfect. A sample of each can of cream was churned and the butter scored. To make a more simple comparison, the butter was scored excellent for 92 score butter, very good for 91 score, good for 90 score, fair for 89 score, medium for 88 score, poor for 87 score, and bad for an 86 score.

Each cream producer's farm was visited to check on his methods of production and handling. A card was filled out for each producer. The barn, method of separation, method of cooling, method of straining, and method of keeping the cream before delivery, were recorded.

TABLE VII. RELATION OF THE PRODUCTION OF CREAM TO THE QUALITY OF BUTTER.

No.	Temp.	Cream flavor	Cream odor	Cream acid	Cream sediment	Butter odor	Butter score & flavor	Condition produced
1	60	(lumpy) fair	Good	.55	10	Good	Good	Fair
2	60	Fair	Fair	.50	10	Good	Fair	Fair
4	70	(thick) Good	Good	.40	10	Good	Good	Good
5	66	(curdy) Fair	Med.	.58	10	Good	Fair	Good
6	70	Good	Good	.20	10	Good	Good	Fair
8	64	Fair	Fair	.43	9.5	Fair	Fair	Fair
9	64	(curdy) Fair	Fair	.65	9.5	Good	Fair	Fair
11	68	(thick) Fair	Good	.30	9.5	Good	Good	Fair
14	70	Good	Good	.50	10	Good	Good	Good
16	64	Poor	Old	.51	8	Poor	Bad	Poor
19	62	(lumpy) Med.	Med.	.47	9	Poor	Bad	Fair
20	60	Med.	Med.	.63	9	Bad	Med.	Fair
21	60	Poor	Med.	.72	9.5	Real bad	Bad	Poor
22	61	Fair	Fair	.41	9.75	Med.	Fair	Fair
24	70	(cowy) Fair	Fair	.44	9.	Fair	Bad Cowy	Good
25	62	(bitter) Med.	Med.	.51	10	Bad	Musty Med.	Good
27	63	Poor	Med.	.60	9	Med.	Med.	Poor
28	60	Poor	Old	.70	9	Bad	Old Poor	Poor
29	62	Med.	Med.	.57	10	Bad	Bad	Poor
32	62	Cowy Poor	Med.	.59	9.5	Med.	Cowy Poor	Fair
33	65	(thick) Fair	Good	.41	8.5	Good	Fair	Fair
34	60	(onion) Bad	Cowy Bad	.63	9.5	Bad	Real Bad	Bad
35	62	Bad	Med.	.60	10	Poor	Bad	Poor
36	63	Cowy	Cowy	.69	9.5	Fair	Cowy Poor	Poor

Each number in Table 8 corresponds to the number used on the sample of cream churned and listed in Table 7.

Table 8 lists the actual conditions on each farm.

TABLE VIII. CONDITIONS OF CREAM PRODUCTION.

No.	Cooling	Straining	Separator	Barn	Ice Box	General condition
1	Cellar till skimming then ice box	Yes	No	Yes	Yes	Fair
2	Well box	"	"	"	"	"
4	Ice box	"	Yes	"	"	Good
5	Cool in well trough	"	No	"	No	Good
6	Cellar	"	Yes	"	"	Fair
8	Keep in hole in bank-poor	"	"	"	"	"
9	Cistern	"	"	"	"	"
11	Concrete trough	"	"	No	"	"
14	Basement	"	"	Yes	"	Good
16	Well box	"	No	No	"	Poor
19	Ice box	"	Yes	"	Yes	Fair
20	Well house	"	"	Yes	No	Fair
21	Basement	"	No	No	"	Poor
22	Spring	"	Yes	"	"	Fair
24	Ice	"	"	Yes	Yes	Good
25	Ice	"	"	"	"	Good
27	Cellar	"	No	No	No	Poor
28	Cellar	"	"	"	"	Poor
29	Cellar	"	"	"	"	Poor
32	Cellar	"	"	Yes	Yes	Fair
33	Spring	"	Yes	"	No	Fair
34	Cistern	"	"	No	"	Bad
35	Keep in hole in bank	"	No	"	"	Poor
36	Well box	"	"	"	"	Poor

Santamine and Diversol in Treating Onion Cream

Purpose -

The object of this experiment was to find the difference in the quality of the butter made from onion cream treated with Santamine and butter from onion cream treated with Diversol. Santamine is an organic chlorine, while Diversol is an inorganic chlorine. The cost of Santamine is $1.95 per pound, while the cost of Diversol is 16-2/3¢ per pound.

Procedure -

A can of cream that had a very strong onion flavor was divided into five parts.

No. 1 was treated strongly with Diversol
No. 2 " " mildly " Santamine
No. 3 " " strongly " Santamine
No. 4 " " mildly with Diversol
No. 5 was not treated

The santamine solution was made up 1 oz. to 1 qt. of water. The Diversol solution was made up 1 pound to 1 gallon of water. There were 20 pounds of cream in each lot.

No. 1 was treated with 2⅓ pints of Diversol solution.
No. 2 " " " ½ " " Santamine "
No. 3 " " " 2/3 " " " "
No. 4 " " " 1⅓ " " Diversol solution.

A sample of cream from each lot was churned. The judging was done by seven individuals, familiar with butter but without knowing the treatment of the cream. The judging was done individually. The preference of the judges is listed

in Table 9.

TABLE IX. COMPARISON OF CREAM TREATED WITH SANTAMINE AND DIVERSOL

No. of Judges	Order of Preference of Treated Samples				
	First	Second	Third	Fourth	Fifth
1	No. 2	No. 4	No. 1	No. 3	No. 5
3	No. 2	No. 4	No. 3	No. 1	No. 5
3	No. 4	No. 2	No. 3	No. 1	No. 5

One judge placed samples No. 2 and No. 4 as good butter; No. 1 and No. 3 as a pronounced chlorine flavor, and No. 5 as very bad onion flavor. Three judges placed No. 4 and No. 2 as good butter without onion flavor, but No. 4 retained more of its good butter flavors than No. 2, No. 3; and No. 1 as a pronounced chlorine flavor; and No. 5 as a very bad onion flavor. All judges agreed on the two best samples as either first or second. No. 1 and No. 3 was placed either third or fourth by all judges. In each case No. 5 was placed last.

LACTOBACILLUS ACIDOPHILUS MILK

Object of Investigation

The purpose of this investigation was to work out a procedure whereby lactobacillus acidophilus milk can be made commercially with success.

Characteristics of Acidophilus Milk

To manufacture acidophilus milk successfully requires a thorough familiarity with the characteristics of the organism and its behavior under commercial conditions, and the ability to make qualitative as well as quantitative determinations on methods of obtaining fresh culture. The manufacture of acidophilus milk begins with the isolation of the organism, continues with its being grown in a milk culture in large enough numbers to be of theropeutic value, and is ended by keeping this culture under such conditions as to injure its constituent organisms during the marketing process as little as possible.

Isolation of Lactobacillus Acidophilus

L. Acidophilus is of intestinal origin and is often isolated from that source. The organism is often isolated from the intestine of white rots, dogs, calves and human beings. It is sometimes isolated from dairy products. It is a difficult process but may be done satisfactorily in bacteriology laboratories. The equipment available for this problem was not sufficient to isolate the organisms. The L. acidophilus organism was obtained in a whey culture.

Starting the Culture -

Half pint milk bottles that had previously been sterilized in an autoclave, were filled half full of clean, raw skimmilk. These bottles were then heated in the autoclave for 30 minutes at 15 pounds pressure. The pressure was slowly released and bottles of milk cooled to 98°F., inoculated with 1 c.c. of whey culture at this temperature, and incubated for 20-24 hours. At the end of the incubation period, the firm smooth looking curd in the bottles was put in storage at 40°F., to be used for making acidophilus milk.

Method of Sterilization

The first problem was to find some way to sterilize or sufficiently pasteurize the milk so that an acidophilus culture could be put on the market with a pleasant color, and pleasing flavor and aroma.

At first the milk was heated for 30 minutes at 15 pounds pressure. This produced complete sterilization but also produced a caramelized flavor, aroma and color.

Heating without Pressure

A Cold-Pac canner was tried. This consisted of a vessel with a lid and a wire rack in the bottom to hold the bottles. Water was added until it just covered the milk in quart bottles, which were about half full of milk. Heat was applied with an electric stove. Table 10 shows the results.

TABLE X. EFFECT OF HEATING WITHOUT PRESSURE

Heater	Temp. heated to	Time held min.	Condition of milk after sterilized	Condition of milk after coagulation	Days heated	Temp. held between heatings
Canner with elect. stove	190°F	30	Good	Gas and contamina'n	3 consec.	Room
	200°F	45	Fair	"	"	"
	212°F	60	Caramelized	"	"	"

When the milk was heated to 190°F., it remained in good condition but the L. acidophilus could not work freely, due to the contamination remaining in the milk. When the milk was heated to 212°F., for 1 hour the good flavor and appearance of the milk was destroyed and still the milk was not sterilized.

Heating Under Pressure

Since heating for 30 minutes at 15 pounds pressure produced a caramelized milk, heating at different temperatures was tried. The bottles of milk were heated in the autoclave one day and then held at room temperature till heating the next day. Table 11 shows the effect of heating at different pressures for a certain length of time.

TABLE XI. EFFECT OF HEATING UNDER PRESSURE

Trials	Lbs. pressure	Min. held	Temp. held between heatings	Number of days heated	Results
2	5	15	Room	1 day	Not sterile
2	5	5	"	2 consecutive	" "
2	8	5	"	" "	" "
10	8	8	"	" "	Good results
3	10	8	"	" "	Slightly caramel.

The results show that when the milk was heated at 8 pounds for 8 minutes on two consecutive days the sterilization was complete enough to produce good acidophilus milk.

The Mother Culture

The mother culture was carried as was explained in starting the culture. The milk was sterilized at 15 pounds pressure for 15 minutes and cooled to 98°F. At this temperature it was innoculated with previously coagulated milk and incubated for 20-24 hours. Transfers were made three or four times a week. By very careful procedure this method worked satisfactorily. The culture may easily become contaminated as the L. acidophilus are not very vigorous.

A system was worked out whereby a new culture could be started frequently in case of contamination. A pure culture of L. acidophilus would be plated out on agar and incubated at 98°F. Then a colony of L. acidophilus would be carefully transferred into sterile milk and incubated as before. By this method absolutely pure cultures were reproduced.

Agar Used -

In the plating of these bacteria, whey agar was used. The colonies were very small and hard to pick. By experimentation, it was found that when a quart of corn was soaked in 70°F., water for 2 days and then this water used in making up the whey agar, the L. acidophilus bacteria would grow more vigorously and produce a larger colony. The writer found that soaking the corn for two days produced better results than when soaked only one day at room temperature.

Incubating Equipment -

To produce acidophilus milk in a reasonable length of time and with the least amount of trouble, it must be in-

cubated at 98°F. Various methods of incubation were tried. It was found that the best results were received when a 2' x 2' x 2½' insulated box was used. A 25 watt globe was used to keep the temperature at 98°F. By this method no expensive thermostat was needed. The size of the box was no factor other than the fact that the 25 watt globe just furnished enough heat to maintain a temperature of 98°F.

Storing

The milk, after coagulation, was stored in a milk storage room at 40°F. The curd kept in very fine condition, the high quality flavor and aroma was not reduced in any way, and there was no noticable reduction in the number of bacteria.

Flavoring

The flavor of L. acidophilus milk is not pleasing to everyone. The experimenting done on flavoring was to make the acidophilus milk more palatable. When customers understand the high medicinal value of this cultured milk and if it has a pleasing flavor, they will use more of it.

The flavors used were: orange, cherry, chocolate, and raspberry. About 2 tablespoons of chocolate syrup, ½ teaspoonful of salt and 2-4 tablespoonfuls of sugar were used in making up a quart of chocolate acidophilus milk. Of the other flavors, about 1 teaspoon of flavoring with the same amount of sugar and salt as used for chocolate, were used in making up a quart. When produced commercially, lactose sugar may be used. Lactose sugar will not only

sweeten the product but will produce very favorable conditions for the L. acidophilus bacteria to grow in the intestinal tract.

In order to get many opinions as to which flavor was the best, a quart of each of the above flavors, including plain, was made up. Twenty different individuals were given a sample of each of these five bottles and asked for their opinion. The flavors were listed by them in the order of their preference as to first, second, third, fourth and fifth. Table No. 12 gives the number of times each was preferred.

TABLE XII. PREFERENCE OF FLAVORS OF ACIDOPHILUS MILK

Kind	First	Second	Third	Fourth	Fifth
Raspberry	8	5	3	5	0
Chocolate	8	4	6	3	1
Plain	5	3	4	4	1
Orange	1	5	6	4	2
Cherry	0	2	2	4	13

Raspberry and chocolate were preferred most, with the raspberry slightly more than the chocolate. Plain, orange and cherry were preferred in order. The plain was preferred by those familiar with acidophilus milk and who had drunk it before. The writer found that it is easy to cultivate a taste for plain acidophilus milk. The more it is used, the better it was liked. The bright color of the cherry seemed to make a bad impression.

SUMMARY AND CONCLUSIONS

INVESTIGATION OF PLANTS

1. Most managers of plants visited are college graduates.
2. The general appearance of the buildings and equipment, of plants visited, corresponds to the amount of business done by that plant.
3. The milk, in all the plants visited, is bought on a differential basis.
4. An average of 57.57% of every dollar received by these plants for milk and milk products is paid to the producer for the raw product.

EXPERIMENTAL PROBLEMS

The Relation of the Quality of Butter to the Quality of Cream

1. With present knowledge of the manufacturing of butter, more improvement can be made in producing a high quality butter by stressing cream improvement, rather than emphasis on manufacture of butter.
2. The age of the cream is an important factor in the quality of butter made from it.
3. The quality of butter made from cream declines rapidly after the cream reaches four days of age.
4. Unless cream is handled properly after production and delivered at least twice a week, the cream will be of poor quality, regardless of the care in production.
5. The acidity of the cream is of slight importance, except in extreme conditions, in determining the quality of cream, but bad cream usually has been handled so

carelessly that the acidity is also high.

6. The quality of the butter usually corresponds to the care in production and handling of the cream.
7. The quality of the cream received by the plant does not always correspond to the amount of equipment and the possibility of good cream production. Some producers sell a higher quality cream after production and handling with poor equipment and good care than other producers with good equipment and poor care.
8. Diversol and Santamine were both good in removing onion flavor from cream in the experiment conducted.
9. The cream that was produced, handled and cooled properly, was good cream before churning, and made a high score butter. The cream that was recognized as bad cream made a low score butter.

Lactobacillus Acidophilus Milk

1. By very careful handling to prevent contamination, Lactobacillus Acidophilus may be carried in sterilized milk.
2. It is difficult to sterilize milk without pressure, and prevent a cooked or caramelized flavor and color.
3. Milk heated for eight minutes at eight pounds pressure on two consecutive days, gave good results in making L. Acidophilus milk.
4. The colonies of L. Acidophilus grow best on whey agar prepared with a solution made by soaking corn.

5. An insulated box may be used successfully in incubating acidophilus by using a small watt bulb to maintain the temperature at 98 degrees fahrenheit.
6. A small pressure canner may be used for producing acidophilus milk commercially.
7. Acidophilus milk made by sterilizing the milk under pressure is a pure culture, provided the culture used for innoculation is pure.
8. Some individuals prefer flavored acidophilus milk to plain.

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