

CREAMERIES.

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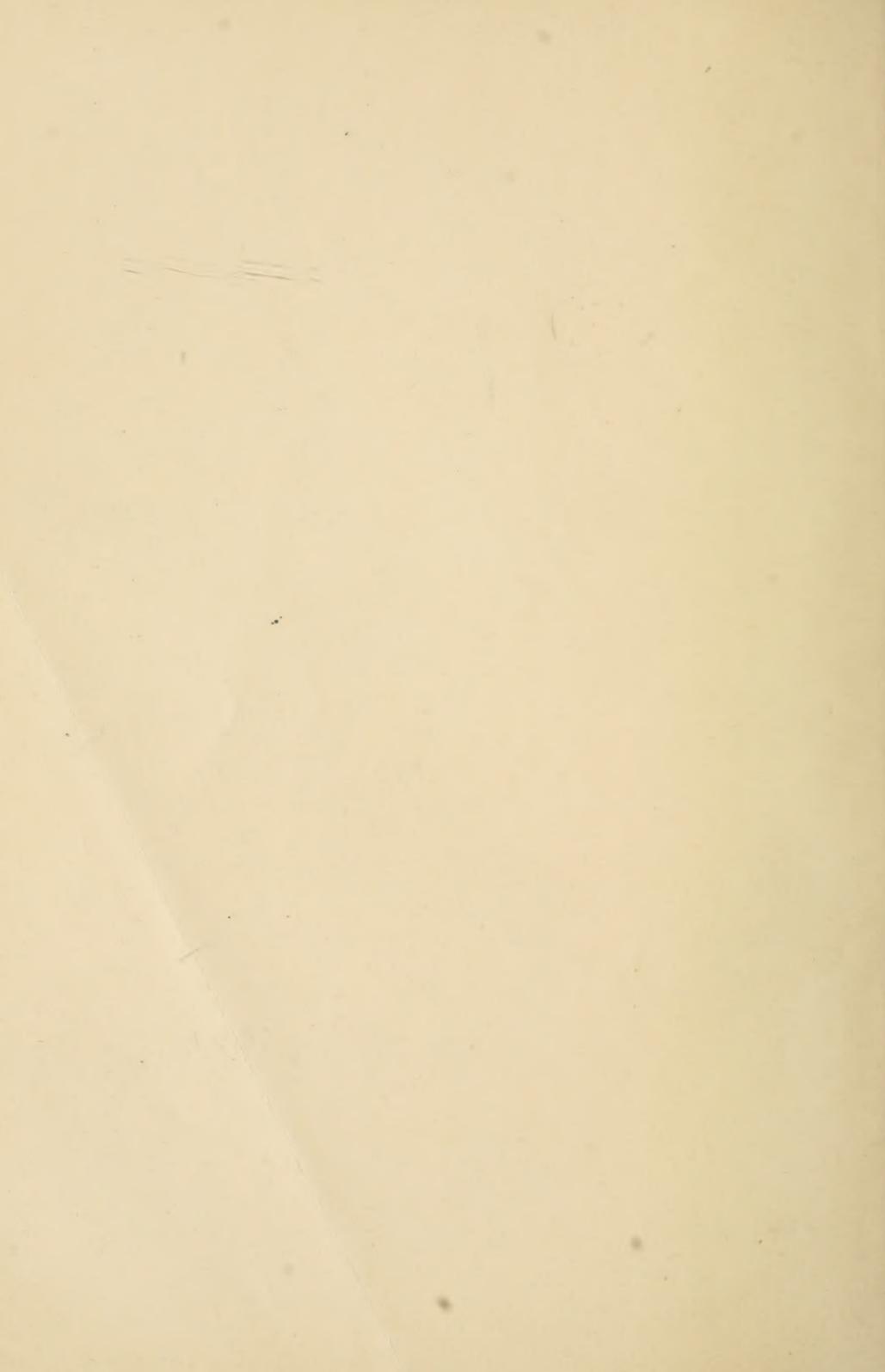
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UNITED STATES OF AMERICA.







ASSOCIATED DAIRYING:

CREAMERIES

AND

CREAMERY BUTTER

CHEESE AND CHEESE-MAKING,

OUR

DAIRY HOUSES AND THE BEST BUTTER.

By E. L. Resh



LANCASTER, PA.

S. H. ZAHM & CO.,

1879.

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PREFACE.

IF any among those who make and sell, or buy and eat, the golden products of the dairy, may think it worth their while to look into these pages, they are reminded that the aim, as the title indicates, is to present these leading features: the making of butter at creameries, the production of cheese by the factory system, and the labor-saving methods now within the reach of every dairyman and dairywoman in the land. Many of those who make our butter and cheese, though they have not themselves departed from the earlier ways, are yet well aware of the changing processes of these later years, and of the wonderful results brought about by the system of associated effort on the part of dairymen elsewhere; to others it is all familiar as an oft-told tale; for years they have helped through the whole of it, they have tested every plan which has promised to benefit them, have sifted what was of value and settled on that best suited to their wants. Again, there are those who are conscious of the change mainly as they feel it in the lessened prices they are receiving for their products. If any among them all shall find anything which will be of use in producing a better article at less cost of time and labor, or having already reached the highest results, if it will show them how they can aid their neighbors without loss to themselves, the charge of uselessness, at least, cannot be brought against our little work.

The dealer in these articles, from the position he occupies in relation to the other two interested classes, has often

opportunities for acquiring information not possessed by them ; but even he, perhaps, may find an idea here and there which will suggest how the interests of all concerned may be advanced.

While it is sometimes true that the less we know about the production of that which we eat the better it will be relished, there will be found here, in the plain descriptions of the modern mode of manufacturing, nothing, it is hoped, that may tend to dull any one's appetite for these standard articles, which are, when properly made, at once toothsome luxuries and substantial additions to the bill of fare.

Acknowledging our obligations to those who have kindly given descriptions of their processes and apparatus, and to the authors from whom we have quoted, it may not be amiss to add, that those who wish to know more about the subjects treated, will find much in regard to almost everything connected with dairying, from the pens of its leading exponents, in the voluminous reports of the Dairy Associations of the various States where the industry is prominent, and especially in those of the American Dairymen's Association, from its organization to the present time.

April, 1879.

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ASSOCIATED DAIRYING.

I.

INTRODUCTORY.

DO you ask, "What is a creamery?" Let me tell you here—or better, come with me and see. We will look at the surroundings first. Here are farms on all sides, and every one has its herd of cows. The cow is the basis of the creamery, and there are three hundred or more on the farms within two miles; that one there has ten, the next one four; on that large one yonder there are fifty. This one on the other side of the road has twenty-eight—six Jerseys, five Holstein, and the rest we call natives, but they are none the worse for that. We are almost there now; it is that plain-looking building, out of which the spring seems to come. This man with the milk cans on his wagon is going there too.

"What large cans they are!" Yes, those of the city milk dealer would look small beside them. But here it is, we will go inside. There is not much to be seen; four huge pans—three of them are full of milk, and the cans we saw on the wagon just now are being emptied into the fourth. One of these pans is filled every time the cows are milked; that one at the end has yesterday morning's milk; the cream is thick on the top of it. The next one was filled yesterday evening, this one this morning, and the last one now. Each one holds fifteen hundred quarts of milk, over three thousand pounds. Besides those pipes full

of spring water and this delightfully cool air, there is not much in this room, and we will go to the next.

The water in the pool here is cold, and those deep round cans in it are full of cream; there is a churn and a butter worker, and these boxes and tubs are full of butter, and there is more in the cellar below. In that room at the end they make cheese. Now we can go.

“But you have not told us what a creamery is. We will get our Webster and look for a definition.”

You will not find it there. It is one of the new words awaiting its turn to go into the next revised edition. It was not common enough fifteen years ago to come under the eye of the lexicographer. To-day it is to be found in every agricultural journal, and in almost every country newspaper that has market reports. But to many persons it conveys rather an uncertain meaning. They see that creamers and creameries are being discussed, and that creamery butter sells for more than any other. If they ask the butter dealer what *it* is, he will answer, “The best butter that I sell.” If they ask the maker of fancy dairy butter from June grass and white clover hay, he says, “It is the butter that is hurting my business, but it is not as good as mine.”

It may strike the patrons of some of the older of these institutions as odd, that any one should not know anything about what, to them is as familiar as the houses in which they live. There are, however, a good many people who do not. To these we would say, *A creamery is an establishment where the milk from a neighborhood is collected, and butter and cheese made from it.*

At first the name was only applied where both butter and cheese were made. When butter alone was made it was a butter factory; when cheese alone, a cheese factory. But

latterly, it is given when only butter is made from the milk gathered in from the farms around. The milk depots where milk is collected and shipped to the city markets bear the appellation—sometimes, and of late all the new fixtures for setting milk for cream are called creamers, and it naturally follows that the place where they are brought together and used will be a creamery. “Old Creamer” was a pet name for one of the best cows the country ever held, and cream, the root of them all, does not every one of us know what that is?

Creameries are part of a system which has revolutionized dairying in many sections of our country within the last quarter of a century, and the origin, history and bearings of which are well worth all the attention we can give them in these pages.

ORIGIN AND GROWTH.

At first glance it may seem strange that *all* of the five thousand creameries, butter factories and cheese factories in the United States, with the exception of scarcely two hundred, are north of latitude forty-one, and between the Hudson and the Missouri, while of the eleven million cows which the country probably now contains, fully seven million chew the cud and give milk outside of these limits. These could supply milk enough to run thirty thousand establishments, with over two hundred cows to each. It is easy to see why there are none in those sections where only a single cow or half-a-dozen are kept on a place, mainly for the milk and butter they furnish for home use, where the houses are far apart and the roads often not good; but it is not so easy to understand why there are as yet none in others where cows are plenty and the farms small. In New York, which has more creameries and factories than any other State, the dairymen who support them

keep on an average but thirteen cows. This is less than the average in many other localities, and the wonder is that in these some plan of handling the milk, or at least the cream, at one point under the eye of one skilled person, has not long ago been devised, and thus a uniformity and improved quality of product secured that will hardly be attained so long as the work must be done by many hands overburdened by the numberless tasks that come to the workers on a farm. When the idea first suggested itself to those who would be most interested and benefited by it, it is hard to guess, but it must have occurred to more than one farmer and farmer's wife and dairymaid long before the first factory was built.

The peasants of Switzerland and some other parts of Europe have for a long time not only driven their cows and goats and sheep together and pastured them through the summer under the care of one of their number, but they have had the milk made into cheese in common and divided among the owners in proportion to the number of animals each one had in the common herd or flock. With them it was a necessity; poor and possessed of but a few cows, they could not individually make cheese of the kind for which their wealthier neighbors were finding a profitable sale; but by uniting they were able to make the same kind and find a market, which each could not have done alone, for it must be remembered that the poor man's single cow or scanty flock will not give milk enough in a day to make a Swiss cheese.

In this country, Mr. A. Picket, of Jefferson county, Wisconsin, seems to have been one of the first to carry into practice the idea of co-operation in cheese-making. From a paper read before the Wisconsin Dairyman's Association, by Mr. J. G. Picket, we extract the following account of this early effort:

“The pioneer settlers of Wisconsin had arrived at that point of refinement when they longed for cheese. My father saw the opportunity, and so in the spring of 1841 set about supplying the demand. He had driven from Ohio ten cows, but he was satisfied that with that number he could not supply the demand. There were no cows to be bought, and had there been any for sale there was no money to pay for them. The idea suggested itself to my mother, Why not co-operate with our neighbors in cheese-making? It was a capital and original idea, and was at once adopted by the head of the family.

“The plans all being completed, on the first day of June, 1841, my mother, with myself as assistant, made from the milk of thirty cows, owned by six patrons, the first cheese, I verily believe, made under the co-operative system in Wisconsin.

“All the cattle belonging to a settlement in those days grazed together in one herd, and at night the cows were all driven to my father’s yard and milked by their respective owners, and the milk was weighed in pails by the old-fashioned steel-yards.

“The little kitchen factory was operated on precisely the same principles as are the mammoth cheese factories having the patronage of a thousand cows at the present day; though the implements were rude and to a modern cheese-maker would seem wonderful. The patrons drew their respective shares in cheese, instead of cash, and were happy.

“The experiment proved so satisfactory that in the following year, 1842, five more cows were added by the arrival of two new families, and the cheese became known from Madison to Milwaukee.”

This county had in 1877 forty-two cheese factories and

creameries, which turned out butter and cheese by hundreds of tons. But the one started thirty-eight years ago, long before any of these, owed its existence to the quick wit of a woman; one, too, who did not shrink from the added duties which it brought upon her. At present a few of the best cheese factories in the country are managed by women.

In 1844, Lewis M. Norton built a cheese factory in Goshen, Conn. Here the milk was coagulated on the farms, and the curds brought to the factory to be made into cheese. This plan was afterwards tried in Ohio, but it was found that the condition in which the curds from the different farms were brought in varied so much that it was often impossible to make good cheese.

There were doubtless other trials made in various parts of the country, but to Jesse Williams, of Rome, Oneida county, New York, is generally accorded the honor of originating the system of associated dairying, which bears the distinctive title of "American." The locality in which he lived was devoted more to cheese-making than to butter, and like the others already named, his efforts were exerted in the direction of cheese.

The story of what he did is as simple as it is interesting. Being an expert cheese-maker and able to produce a prime article, he was enabled to contract the product of his dairy for a whole year in advance. In the spring of 1851, one of his sons being about to commence farming on his own account, the father included both his own and the son's cheese in the contract for that year. The young man had, however, never paid special attention to the making of cheese while at home, and had doubts as to his ability to produce an article that would prove acceptable to the contracting parties. In the discussions that followed as to what had best be done under

the circumstances, it was finally suggested that the milk should all be taken to the father's dairy-house and the cheese made under his supervision. The idea once acted on and successfully carried out, the plan would easily extend itself until it included the farm dairies of a whole neighborhood.

From the circumstances connected with this early beginning, it has more than once been said that this system was accidental, like others that have brought about great changes in methods of labor and the conditions of society resulting therefrom. Whatever view of its origin we may take, it affords a striking example of the general tendency of the age to remove the manufacture of most articles of universal use from the hands of the isolated individual and concentrate it in workshops, where one man can do the work of ten—the spirit of the age touching one of the most important branches of human industry.

Though a beginning had now been made, the new system did not at once assume great proportions. From the statistics accessible it appears that not until three years later, in 1854, was the next factory built. In that year four were started, the year following two more, and the number slowly increased until the first years of the war; then they suddenly sprang up all over the northern dairy districts. In 1864 there were over four hundred in operation in New York, the single county of Oneida having eighty, and they had extended East and West. Last year there were eleven hundred and forty reported in the State.

Butter factories came in somewhat later than cheese factories. There was one reason for making cheese on the associated plan that did not apply to butter. The last could be made by the owner of even a single cow, because the cream could be kept until there was enough to churn into butter;

but the cheese that was wanted must be made from sweet milk, and of this the owner of a few cows only (like the Swiss peasant) could not command enough in a day to make a cheese, and he was practically debarred from the business when working alone.

No other State has as many as New York. Maine has had some sixty cheese factories, but for some reason they have hardly met the expectations of their projectors. Vermont has a number of creameries. In Northern Pennsylvania there are about a hundred cheese factories, and their motto "full cream" calls for the best that can be made. In several of the counties on the southern border, creameries as well as cheese factories are scattered at wide intervals.

In the dairy districts of Ohio they followed soon after the great strides made in New York, and the largest butter-makers in the world now conduct their operations in one of the northern counties of that State. Cheese also is made in immense quantities and in every variation of form and quality. The Pentagon buildings of Straight and Son at Hudson are probably the finest cheese-curing houses to be found anywhere.

In Illinois the first cheese factory was built in 1867, and the first creamery in 1868, the latter was one of those which have since made western creamery butter famous all over the country, and helped so much in developing the dairy interests of the West.

In Iowa the first creamery was started in 1872, and there are now about one hundred built and in course of construction. A very fine one is located at Muscatine. The butter of Iowa has received the highest awards at two great exhibitions, one at the dairy exhibit at the Centennial, when John Stewart, of Anamosa,* stood first, and the other at the late International dairy fair at New York, where the premium

* Then of Manchester.

for the best butter made anywhere went to H. D. Sherman and Co., of Monticello. The system has gained a strong foothold here, and the State will in years to come furnish the world with a large share of its butter and cheese.

In some other States besides these, a beginning has been made. The system has found favor in Canada, and some of the finest dairy products of the present time find their way into the markets of the world from here.

In England it has attracted much attention, and no wonder; in certain lines of cheese the American has crowded their own almost out of the market; as a late English paper has it, "Let dairy farmers only use their eyes, and they will find this persevering Yankee pushing his cheese into every little shop both in our towns and villages and even hawking them to our door, whilst we are holding ours because he is selling a better and a cheaper article."

In Russia there are some factories, and the government has aided some of her young men in attaining a thorough knowledge of the best processes, and acquiring skill in their application; and cheese and butter may be among the things which this almost limitless empire will in the future offer to the people of other countries.

Our own system differs from those of the old world because the resources and genius of our people are different. Its advantages, in the words of Professor Arnold, one of its most untiring champions, are that "the parties engaged in it become mutual instructors. First, by an examination of each other's work; the manufactories being in a manner public and open for inspection. Second, by organizations for mutual giving and reception of information relating to their art, and thus knowledge is developed by which milk is more profitably produced, goods more skillfully and cheaply manufactured and more systematically and successfully handled."

II.

FOR AND AGAINST. HOW TO START.

WHEN the system first began to be discussed there were urged for and against it the same reasons that we hear to-day when it is suggested in a locality where it has never been introduced ; but the experience of a quarter of a century makes it possible to speak of many things about it with a certainty that could not be done when it was yet an untried scheme.

In its favor can now be urged as facts what could then only be held out as promises, that :

It will enable the milk producers of a neighborhood to have their milk taken from their hands as soon as it is drawn from the cow, and thus save them all further labor and care.

The expense of manufacturing is less when conducted at one place with all the facilities, than when done at five or fifty places.

It will raise the average quality of butter and cheese until in many instances they equal, and in some instances surpass, the best ever made in the neighborhood before its introduction.

The objections which are usually made to the system are about as follows :

1. It entails additional labor in hauling the milk to the creamery or factory.

2. It makes an additional expense to the farmer and dairyman, who must pay for doing work which could be done at home without detriment to his other work.

3. It discriminates against the production of good rich milk, because poor or watered milk brings the same price per pound or quart.

4. There is danger of the milk souring before it reaches the creamery.

5. Milk will not yield as much butter when shaken about as it must be in transporting, as when it is set for cream at once when drawn and allowed to remain undisturbed.

6. The whey and skim milk are lost to the producer.

7. The factories are not in operation all the year round, and there must consequently be some arrangement for making butter and cheese at home part of the time.

8. The milk must be delivered at certain stated hours in the morning, and it is often inconvenient to make every thing else subservient to the requirements in regard to this.

9. *It tends to overproduction.*

That it saves labor and care are strong considerations in its favor. In fully five-sixths of the farm dairies of the country, the labor and care and watchfulness inseparable from butter-making and cheese-making by the old methods, bear heaviest on the women; and anything that will take away even a portion of these should be welcome. As a rule it is only on those farms where dairying is the main business or is done on a large scale that special help is procured or men do the work. In itself there is nothing detrimental to health, but when as is often the case the production of milk is secondary to other things in the economy of the farm, yet the money to be got from it is too great an item to drop, and the income will not allow sufficient help to be hired, then the labor connected with handling the milk when the work is done at home is the last straw that breaks down the woman whose ordinary household duties are

as much as her strength will bear, and she helps to swell the list of women in ill-health which is already so large that it is a text always within sight for the modern physiological lecturer to comment upon. It is not only that the work is got rid of when the milk is sent away at once, but it is *off the mind*, which alone is often a great relief.

The objection that it makes more work for the farmer because he must hitch up a team and drive to the factory at least once, or, where milk is to be delivered morning and evening, twice a day, when if the butter was made at home, he would need to market that only once or twice a week, or if it were packed, or cheese made, still less frequently, would be a valid one if it were necessary for him to haul the milk himself, and in many places would be enough to prevent the system from ever gaining a footing. But it is not necessary. We can recollect when in some of the thickly settled parts of the East the farmer went twice a week "in the early morning, before the break of day" to the butcher shop to get his fresh beef; at present it is delivered at his gate in these same localities by the butcher's wagon, every day, if it is wanted, as far as ten miles away from the shop. The same can be and is done at the creamery with the milk. There will be some one easily found in every neighborhood where there is a creamery, ready and anxious for the job of gathering it up morning and evening, or the proprietor or manager can contract to do it himself. In many dairy districts, where dairying is the main work of the farm and but a few acres in every hundred are plowed and cultivated, there is not such a variety of work as where the farming is more of a mixed character. There the farmers prefer to deliver the milk themselves, and the incessant rattling of their wagons for a few hours in the morning and evening is a feature of rural life here that strikes the transient visitor at once by its novelty.

In others the first-named plan is taken, and where the milk from a thousand cows is to be collected, perhaps twenty thousand pounds a day, as many as six teams over the same number of routes may be needed to bring it in within the hours of delivery. Where only a few hundred cows are the extent of the operations, and the farms are close by, two or even one wagon can do it.

The second claim that the expense of manufacturing is less than by the farm dairy method is clear. There is a great saving in time. We have seen two men make up the milk of four hundred and fifty cows into cheese, and have time enough left to play in a base-ball club three afternoons in a week, and without neglecting the cheese either. This was in the early part of the season, before there were many cheeses on hand. Later, when it accumulated in the curing-rooms, and needed turning and rubbing daily, they had the assistance of a woman, but still kept up the base-ball. Will any one suppose that if this work had been done at, say twenty private dairies, it would not, in the aggregate, have taken at least four times as long?

In butter-making the saving of time is also very great. It has been estimated that it requires only from one-eighth to one-tenth the time that it would at home by the old methods. If the facilities afforded by the later methods of handling the milk and raising the cream are at hand, the difference will not be so striking, in fact it may be nearly equalized; but it is in the very nature of things more expensive to fit up ten places instead of one, taking the difference in size into account. A one-horse wagon costs more in proportion than a two-horse one, and so with everything where labor is an important element in the cost. There is, besides, the saving effected in buying the material, salt, cheese-boxes, and other articles in large quantities, as is done at a factory.

It is true that there is an expense for hauling the milk and making the butter and cheese, that must be paid for in money or its equivalent, which might be "kept in the family." This will have less weight when it is found that the money receipts, after this expense has been deducted, are equal to what they were when the work was done at home.

The third claim, that it will raise the average quality of butter and cheese, has been proven quite true. There are many first-class groceries where formerly there were a dozen different grades of butter sold, and now only one, and that is good, and comes from a creamery. An evenness is secured that cannot be attained otherwise. There is no excuse for carelessness here. The manager has but this to manage, the workman has only this work to do, and the skill that comes from doing one thing, and one only, with all the opportunities for learning, must be his if he is fit for his place.

The butter-maker who uses the milk from his own dairy only has one advantage—but how often he fails to improve it—he can select his cows and the food for them until he has exactly what will enable him, if he understands his business, to make a higher quality of butter than can be made at a creamery, unless it be an equally select one. When we take the best creamery butter and place it alongside of the products of the best fancy dairies, there will be but few, very few, indeed, of the latter that will surpass it in all the qualities that make butter of the highest excellence; and even if there were many more than there are of these, the truth would still remain that for the vast majority of dairymen it would improve the butter many degrees. Nowhere has it made such a change as in the west. Not more than a dozen years ago the men who wrote about dairying were agreed, without exception almost, that the west could not compete

with what were then considered the natural dairy regions. They pointed to the butter from there and called it "grease;" but to-day that same country, from which nature was supposed to have withheld her dairy gifts, is selling its creamery products, tons on tons, in the open market, at higher figures than the old dairy centres can get for theirs.

In regard to the difference in the quality of milk, it will usually be found that the milk from the ordinary herds differs more in quantity than in richness. Good feed and treatment will increase the quantity of milk, but it will not (we know this is disputed) increase the percentage of butter and cheese much. Each pound or quart of milk will make about the same quantity of butter. There will be *more* quarts, and therefore more pounds of butter, but the general average at the creamery will neither be increased nor decreased. Of course, when a man has an exceptionally good butter herd—one that will yield him a pound of butter for every eight quarts of milk, he will not want to mix it with his neighbors', that makes only a pound to sixteen quarts—he would be foolish if he did at the same price per quart. This difficulty can be met by the plan recently put into operation in Wisconsin, to which we shall refer further on. With watered milk there is little trouble at a creamery—what with cream gauges, per cent. glasses, and lactometers, there is very little chance to add water without detection. Public opinion among dairy-men in the vicinity of a creamery is so strong against this practice, to say nothing of the law, that it furnishes, with the tests that can always be made, an effectual safeguard.

Some of the creameries show a very full butter yield from a given quantity of milk. We have in mind one where large pans are used, that last year made in June one pound of butter from every twenty-six and a half pounds of milk, and some

reports which have come under our eye show as low as twenty-one to the pound of butter, from ordinary cows, of course. Some tests that have been made would go to show that the cream will not all rise after the milk has been at rest for some time, and is afterwards shaken up, but the yield above referred to shows that actually more butter is got out than is usual at home. Where the skim milk is sold or cheese is made from it, no fault could be found on this score.

There is not much danger of the milk souring if the cans are kept perfectly clean. There is sometimes in hot weather a taint developed in milk soon after it is drawn, not only when the milk is taken away, but at home. Much very bad butter is made at these times, as well as cheese that will not stay in the bandage. Heating the milk enough to check this but not to scald it, and then cooling, is an effectual remedy. This can be done more readily at the creamery and factory than at the farm.

The whey and skim milk can be returned to the producer if desired. They can take it home themselves when they have brought the milk, taking as much as they had milk, water enough will usually have been added to balance the cream and caseine taken out. Sometimes an arrangement can be made by which it can be run to some point, not too close, and there fed to pigs or calves.

In the great cheese manufacturing centres the cows are allowed to dry in the fall, and during the winter there is not much milk to care for. The most inconvenience from factories not being in operation all the time is felt in the early spring months, when many of the cows are fresh. Some creameries are now operated all the year round, but in many sections in the extreme north this does not seem desirable, and would hardly be profitable if generally attempted.

It is sometimes rather an inconvenience that the milk must be delivered at certain hours ; but then, as the limits in the morning are usually between half-past five and eight o'clock, sometime during these two hours and a half will suit just as well as if the whole day were open to choose from. When the milk is taken away from the door, it must be ready in time, and this will teach lessons of punctuality, which we must learn in many things ; in these days we are all more or less travelers on the railways, and though the trains never wait, we generally manage to go when we want to.

It tends to overproduction. It looks that way now to some, but we think it would hardly be fair to charge this on the system. Dairying for many years was more profitable than most other departments of farming, and there was a gradual and steady extension of the industry which always follows when anything pays, and the level is by and by reached. There is not yet more butter and cheese than can be used, but the price is low, and so are other things. If there is overproduction it will surely cure itself ; the law of supply and demand operates here as elsewhere, and if the system tends to give the millions cheaper and better food, so much is gained to the world at large. We quote from *Willard's Dairy Husbandry*, "Aside from the burthens of toil, and the drudgery from which this system operates to relieve our farmers, it has developed another great economic principle, the means of producing food cheaply, a principle which the Creator in his infinite wisdom is now impressing upon the minds of people by the establishment and wide dissemination of this system."

HOW TO START.

When the question of a creamery or no creamery, factory or no factory, is once started in a community, the plan under

which it is to be operated has a prominent place in the discussion.

In the early days they were for the most part run on the co-operative plan. A few persons would agitate the subject until finally a meeting would be called, and the milk producers of a neighborhood would agree to organize an association for the purpose of making cheese or butter. They would elect officers—a president, secretary and treasurer—and form a joint stock company for the purpose of raising funds to put up the buildings and furnish the apparatus needed.

There would be a committee on building, and when it once went into operation, a committee on management and the sale of the products; but it was soon found that to put the management in the hands of one man would tend to more promptness of action when anything needed to be done; and before long individuals put up buildings on their own account, and conducted the business on the same basis as before—that is, giving each patron of the factory a share of the proceeds in proportion to the quantity of milk furnished by each—after charging a certain fixed price per pound for making and selling.

At present they are largely run on the plan of buying the milk outright. The butter and cheese thus becomes at once the property of the proprietor or conductor of the factory. Those who furnish the milk know exactly what they are getting, and the business for the manufacturer partakes more or less of the risk attached to all enterprises where the raw material is bought and the finished products taken into another market at a future time. In some districts an individual or firm now runs a number of factories; one firm in Central New York had the past season over twenty, and another in Ohio thirteen. This wide control by one central power gives an

opportunity to have a number of manufactories under the care of persons of the very highest skill, and the selling also being under the control of one person, reduces the expenses of this part of the business to the minimum; but the co-operative feature does not belong to this modification of the system.

One of the most popular plans is one already referred to, namely, to appoint an experienced man as manager and salesman. Every operation at the factory is conducted under his personal oversight, and he does the selling at such times from week to week, or month to month, as seem most likely to bring the best returns. After every sale he settles with the patrons, dividing the proceeds in proportion to the number of pounds of milk they have furnished, first deducting his charges for making, which the past season averaged probably one and a half cents per pound for cheese, and three cents or more for butter, the manufacturer furnishing everything but the milk.

From what has been said, it will be seen that two different and distinct plans present themselves :

1. The co-operative, where everything is done by associated effort, and the proceeds divided pro rata.
2. The commercial, where the milk is sold to the manufacturer at once.

The different modifications have already been alluded to. The second is more in accordance with general business usages, and the first offers a fine opportunity to test the value of co-operation in production, which has often been held out as the hope of the producing classes in the future.

The risks in the second method are of different kinds. Sometimes when an individual builds a creamery on his own account, and runs it a while, some trifling unpleasantness oc-

curs and some of the patrons stop off with the milk, and he loses on his investment, when if it was run on the co-operative plan, and each had an interest in its success, they might continue on. It often takes considerable capital to tide over the periods of depression in the trade. During the past year one of the firms mentioned had contracted with some of the milk producers for milk at one dollar per hundred pounds: had they closed such contracts at all the twenty odd factories which they were conducting, the loss to them would have amounted to five hundred dollars a day; but fortunately they had not. The co-operative system would have distributed the lessened income among the entire number of patrons, probably eight hundred or more. There has been complaint, too, at some where a fixed price is paid the manufacturer, and in a few sections the dissatisfied dairymen propose putting up new ones, and running them on their own account entirely.

It is these periods of low prices, that bring out the weak spots in any system. The dairy industry must at present take its turn with the rest; it has always been a profitable one, and where conducted on correct principles will be likely to remain so, though hardly ever to the same extent that it has been. With the best cheese at twenty and twenty-five cents a pound, as it was during the war and since, the profits were too much above the average to continue.

III.

CREAMERS' AND OTHER APPARATUS.

When the fixtures of a factory are spoken of, we recall at once the costly and complicated machinery seen in factories where cotton, or iron, or wood, are made into the thousand and one articles which we see everywhere. In butter and cheese making only a few and simple pieces are really needed. The cream must be raised, preserved in good condition, and churned; the butter worked, salted, packed and marketed; but there is nothing needed for doing either of these, except the simplest fixtures, though there is here as everywhere a wide difference between the best and the worst. For cheese, the milk must be set and curded, the whey separated, and the curd ground, salted, pressed and cured, and neither of these operations needs complex apparatus.

Creamery apparatus and dairy apparatus do not differ essentially. Size is the main distinction, and we shall here speak of both, because what will answer for a large dairy house will be nearly what is needed in a small creamery. We cannot however touch this subject of apparatus and fixtures without some reference to the different plans and vessels for long years in use for cream raising.

In the order of time the earthen vessels come first, and then shallow wooden tubs, which are still used for the purpose in some foreign lands, followed by the shallow tin pans. While there are yet many earthen pots or crocks used in some sections, they have been gradually supplanted in the dairies of this country by the tin pans, which are more

easily cleaned and more conveniently handled. In some essential points the former were superior; and those who use them, though often told that they are behind the age, are not so very far wrong after all. The deep cans or cooler pails now used in many creameries and dairies come next. These, or something similar, set in ice water, are used in the Swedish system of deep setting which has attracted so much attention within the last ten years. Tight boxes or tanks, made of two-inch pine plank, hold the water, and when the temperature of this is kept about thirty-eight degrees with ice, the cream rises in ten to twelve hours. The cans are from nineteen to twenty-five inches in depth and from eight to ten inches in diameter, and are usually set in the water nearly to their tops and left uncovered. When earthen pots were used there was often a wooden tank with cover to hold the water, in which they were set. Sometimes there was no cover to the tank or box, and the milk vessels had round covers of wood or slate, or a tin plate placed directly on them. This is yet common enough where the milk is set in this way as well as when it stands in cupboards; and on shelves in our kitchens, as it does on thousands of farms, and when the cover fits well, the outside air is pretty thoroughly excluded. Those who have always insisted that the milk must be aired, have of course not put on the covers, at least not until the airing was completed. Tin covers are perhaps the best. In the deep cans, when covered in this way, and in a cool or cold place (not so cold as to freeze, however,) the milk keeps sweet a long time, at least until all, or nearly all, the cream has come to the top. When the cans are set in water, they can be made air-tight by having the cap extend down the outside a few inches until the edge comes below the surface of the water; but care must be taken to lift the can high

enough to have the cap entirely clear of the water when the can is to be uncovered, otherwise the water will rush in when the cap is drawn up; and the water must never be allowed to come within an inch of the top of the can—if it does, there may some of it run into the milk.

Of the various arrangements which have lately been brought prominently before the public, and which use the deep can, we shall refer to a few which will serve as types of all.

That of Mr. L. S. Hardin consists of a box with double sides and a close-fitting door, so as to entirely exclude the surrounding atmosphere. A shelf for ice is placed inside near the top of the box. As it is the nature of heated air to ascend, this secures a uniform temperature. A space of one inch is left on each side of the shelf to allow the air to pass around the ice. The cans are twelve to twenty inches deep, and eight inches in diameter, and they have covers which fit over them on the outside. At first the drippings from the ice were allowed to fall on the cans and collect on the floor of the box, so that the cans would stand in cold water to the depth of several inches, but for the shelf there is now substituted a pan containing a wooden rack. The ice is placed on the rack, and the pan holds the water from the melting ice, and provision is made for running the water out above the cans. The door is also extended all the way to the bottom, which makes it easier to lift the cans in and out of the box. The milk is allowed to stand from thirty-six to seventy-two hours before skimming; is skimmed sweet, and can be used for cheese-making or by those who buy sweet skim milk.

Some of the best butter makers in the country commend this method, after having thoroughly tested it alongside of the shallow pans, and the deep cans set as in the Swedish system.

The Cooley creamer, which is of later introduction, is also

a double-box, water tight, and opening by a lid on top. The cans are of similar size and shape to those used in Hardin's. The box is kept filled with water, and the cans with the milk are entirely submerged—having water over top as well as around them. The cover with which each can is fitted, is in the shape of a deep tin dish, and, inverted on top of the can, keeps out the water on the principle of the diving bell. It is kept in place by a strip of wood running over top of it, from side to side of the box. Each can is also fitted with an ingenious attachment, by which the milk can first be drawn out below, and the cream afterwards be poured out, and there is also an arrangement for drawing off the milk from each can without taking it out of the box. The box is supplied with water through a pipe at the bottom, and near the top there is an opening for the warmer water to pass off. The time needed to raise the cream depends on the temperature at which the water is kept. At fifty to sixty degrees, it will require from twenty-four hours upwards, but when broken ice is kept in the water and the temperature reduced below forty degrees, the cream will come up in ten or twelve hours. We have seen very fine butter made from cream raised in this creamer. It will be seen that both these methods provide for a uniform temperature throughout the vessel in which the milk cans are set; in the one the air inside of it is cooled, in the other the water in which the cans are submerged.

The creamer of Mr. O. S. Bliss is constructed with reference to cooling from the top. The cans used in this are about twelve inches in depth; the diameter is seven inches at the bottom, and ten at the top; the box has double sides, like the two just described, and opens partly on top and partly at one side. The lower portion is water tight, and in this the cans are placed in water nearly their full depth; over

There is a sheet-iron partition with holes cut in it to fit the top of the cans, their covers thus becoming, as it were, a part of the partition; on this the ice is placed in large pieces; and the top of the milk in the cans receives the first effect of the cooling process. In the latest form of this creamer the cans are all connected at the bottom, so that the milk to fill the whole of them can be strained in at one place, and when the cream has risen, the milk can first be drawn from all without taking the cans out of the box, and afterwards the cream can be drawn in the same way. This saves all lifting and handling, and makes an arrangement so convenient that it would seem nothing more could be desired. Long narrow tanks can be used in place of the cans if these are preferred.

The manner of cooling from the top, is the essential principle in this creamer. It is the result of much study and experiment in cream raising on the part of Mr. Bliss, who is well-known as the efficient Secretary of the Vermont Dairyman's Association, and, it will be seen, combines the advantages of both the can and the pan system of setting.

The latter we shall now examine. We can however look at only a few of the great number made. They are nearly all patented, as are the several plans of deep setting just mentioned. The pans are mostly rectangular in form, varying in width from two feet to six, and in length from four feet to twenty, and in depth from six to eighteen inches. When they are six inches in depth, each square foot of surface will contain about thirty-two pounds, or nearly three and three-quarter gallons of milk. They should be made of the best tin: dealers often lay stress on the fact that theirs is $\times \times \times \times$ (four cross). They are usually placed inside of an outer receptacle, like the pan in form, only enough larger to

leave a space between the two through which water can be run; the outer is made of wood or galvanized iron. In their simplest form they can be put together by any worker in tin and wood, and fitted with faucets and pipes to supply the water for cooling or warming the milk. As there are many manufacturers who make a specialty of this kind of work, and build largely, they can often furnish all that belongs to a complete pan or set of pans, all ready to put together, shipped in compact shape, at a less price than the materials alone will cost if bought separately away from the commercial centres.

There are points of excellence claimed for all of those most commonly used, but some have more than others. The aim in all is to facilitate the work as much as possible, and afford means of controlling the temperature; but there are different theories in regard to the proper temperature, and the means of attaining it, and the pans are constructed on different plans. We will describe several of those in common use as plainly as we can, naming some special ones which will give an idea of what is needed.

The "Iron-clad" pan is double, with the outer of galvanized iron. It is set on standards two or two and a-half feet from the floor. The outer pan fits the inner tightly at the top, but leaves a space at the sides and below. The water circulates freely around the inner pan, which contains the milk, and the milk can be cooled in a short time after it is poured in. The faucets and pipes are of the best material, conveniently arranged, so there need be no stepping over the pipes where they cross the floor, and everything is soldered and attached in such a way that there can be no leakage nor spattering of sour milk on the floor, which is important; and all can be readily taken apart for cleaning.

The milk pan is japanned on the outside, and the vat on the inside, both where the water comes in contact with them. Four are needed to complete a set where the milk is to stand forty-eight hours before skimming; a heating arrangement is attached when wanted, by which the milk can be warmed to any temperature desired. They are also sometimes furnished with glass covers; these afford a good protection against flies and dust. There are means of ventilation below the covers to suit those who want the animal odor to escape.

The "Smith Refrigerating Creamer, or Creamery Vat" is a very complete piece of apparatus. It can be used as an ordinary pan for setting milk for cream only, and also for making cheese from the skim milk afterward. The inner pan is surrounded by a wooden covering, with the usual space between the two for the water to circulate. Two hollow tin partitions run lengthwise; they are about one and a half inches in thickness, and divide the creamer into three long narrow compartments, 10 or 12 inches wide, 18 inches deep. Cold water, for cooling, is run through the hollow partitions as well as around the sides, and there is a tight-fitting cover to it under which ice-pans can be placed after the milk has been cooled as low as can be done with water. There are small flues in the cover that can be opened to allow any vapor that arises to pass off. When it is desired to raise the temperature of the milk, this is first done, either by running warm water in place of cold around it, or by injecting steam directly into it; and then it can be cooled either rapidly with ice, or more slowly with water. After the cream has risen it can either be skimmed off, or by means of a faucet in the bottom, the milk can first be drawn off below, and then the cream run off into the cream vat, or directly into the churn. If cheese is to be made, the milk can remain, the partitions be removed,

and the cheese made in the vat; or the milk can be run directly into a cheese vat, if that can be placed a few feet lower. This creamer received the highest award at the International Dairy Fair in New York.

A "Creamer" used in some of the Iowa creameries, also has long narrow compartments, and space for ice or water around the milk; it is much liked by those who have it in use.

The Arctic milk cooler of Mr. I. H. Wanzer, also manufactured and used in the west, has a cover, and cools the milk from the top either by running cold spring water over the cover, or by the use of ice for this purpose. Like all others provided with tight covers, it can be set and filled with milk in a room where other work is going on, as in the manufacturing room of a creamery, which can not always be done with open vessels without danger of contaminating the milk and its products.

Of churns and butter workers there are great numbers. The main thing aimed at in both of these now is to preserve the grain of the butter unbroken while gathering it, and incorporating the salt most thoroughly.

The common cheese vat is oblong, sixteen or eighteen inches deep, raised from the floor a foot or two, and is double, with the outside of wood two inches thick, the inside of tin, and a space between the tin and wood for water or steam to warm the milk, or water to cool it. The curd knives are in the form of a series of narrow blades, set in a frame one above the other horizontally, or one alongside of the other vertically. The curd mill is placed on top of the vat, and has a cylinder with either pegs or knives.

The cheese presses are of various forms. In the large creameries or factories a gang press is used, by which a num-

ber of cheese are pressed at once. The hoops in which the cheese are pressed are of the forms with which we are familiar in the various sizes of cheese, and are of wood or galvanized iron.

IV.

METHODS OF CONDUCTING CREAMERIES AND MAKING CREAMERY BUTTER.

IN the earlier days of associated dairying, when exceptionally high prices were being obtained for cheese, it was apparent to those who conducted the establishments where butter alone was made, that the caseine of the skim-milk could be put to better use than in feeding calves and pigs, and they commenced turning it into cheese, and their butter factory became a creamery of *one kind*; but as the cream was nearly all taken for butter, the product was a very thin skim-cheese.

On the other hand, the cheese-makers saw that they could take some of the cream out of their milk and turn it into butter to their evident profit, and continue to make a fair cheese, that would sell nearly or altogether at the same figures as when the cream was all in. Their cheese factory then became a creamery of *another kind*. By the last process only the cream was taken for butter that raised over night from the evening's milk at a temperature of 60 degrees. This made delicious butter, because only the best of the cream was obtained, and it was this butter that helped to establish the reputation which creamery butter now bears. It will thus be seen that there were two kinds of creameries, and as has already been remarked, when butter alone was made the name was not at first applied; it will here be used in its wider meaning, as now applied to the making of butter and cheese, but not to cheese-making alone.

The different plans of operating a creamery may be best presented by showing how creameries of the various kinds already established are conducted. To describe what has been done may be more satisfactory than to give the details of what might be done.

Many of the older creameries are run on the *pail and pool* system, where the spring water is made to flow through a pool in the building, and the deep cans or coolers are used for setting the milk. One of the most successful that we know is operated in this way. It is located in Southern New York, and is not a large one, taking the milk of only 200 cows. These are rather above the ordinary dairy cow; a sprinkling of Jerseys among them gives somewhat of a Jersey character to the butter.

The building is 60 feet long and 25 feet wide, partly two-story, built on ground sloping to the south, with its ends north and south. The north end was excavated about eight feet, and leveled. The south end was also leveled a few feet lower than the other end. The foundation walls come two feet above ground. The superstructure is of frame, with eight-inch posts, boarded inside and outside, with an air-space of eight inches between. It is two story, but as the lower story runs against the bank at the north end, this has been arranged for a cellar.

The pool is at the south end, twenty feet square. The water flows in at the northwest corner, in an underground pipe, from the spring a few yards away, at a temperature of 53 degrees, five or six gallons a minute, and has its outlet at the southeast corner. The whole pool is kept under water to the depth of about eighteen inches. It is in four divisions, and the water can be raised or lowered in each one. It has a floor of pine plank, under the water. On this the cans

stand. The cans are not covered; they are scarcely ever covered at any of the creameries. Loose planks are thrown across from one division to the other, and are used to walk on when the cans are carried in or removed from the water. In the southwest corner is a small platform, close to the water, on which the butter is worked in the warm weather.

The remainder of the lower story is divided into two rooms. In the middle one stands the cheese vat, and the cheese is made here. At the north, on the east side, is the churning, and alongside is a room for the small boiler and steam engine used in churning and furnishing the heat and steam for cheese-making. The second story has a room in the southeast corner for the butter and cheese-maker to sleep in, and alongside of it is a store-room. All the rest of the story is used as a cheese-curing room. The cheese are arranged on tables and on tiers of shelves, one above the other.

The milk is delivered morning and evening, and fifty of the deep cans hold one "mess" of milk. As the milk stands in the cans forty-eight hours before it is skimmed, two hundred cans are required. Churning is done every day, and the butter worked with an Orange county butter-worker, salted, and allowed to stand some hours, and worked again, and is then packed either in return tubs and sent to New York fresh, or packed away in half firkins and placed in the cellar for a future market. When the cows were in their full flow, 200 pounds of butter were made a day, and even the past dull season none was sold under twenty-five cents a pound. The milk was paid for on the basis of the butter market, and thirteen quarts of milk to a pound of butter. If the butter sold for twenty-six cents a pound, the patrons would receive two cents a quart for the milk.

The skimmed milk was made into cheese. Six of these,

averaging 40 pounds each, were made a day, at the same time when 200 pounds of butter a day were being made. The yield of butter through the season was about 200 pounds to each cow, and about the same of cheese.

One of the other kind—conducted on the plan of skimming only the evening's milk—we saw in the afternoon of a hot day in August. When we went to it, we met on the road an open, uncovered wagon, with two horses, containing ten large carrying cans, with a capacity varying from 200 to 450 pounds each. There were ten on the wagon, and two vacant places showed that two had been taken off. The driver stopped as we passed, and showed us the way to the creamery, and also told us that his route extended a distance of eight miles from it; that he went twice a day, making thirty-two miles going and returning each day. As we passed on, we saw where the cans were left that had been on his wagon when he started out. They stood before the gates of two farm houses, on platforms of a single plank about three feet from the ground, ready to receive the milk from the evening's milking. In this way he drove on until the end of his route was reached, leaving a can with each of the patrons. The creamery soon came in sight. It was one of the largest we ever saw—130 feet long and 40 feet wide. It was two stories high, with walls of blue stone, and a good double-boarded frame superstructure. Towards evening it commenced raining, and when the time came for delivering the milk it was still raining rapidly; but no account is taken of this. The farmers who delivered their own milk came hurrying up to the receiving window, had their cans hoisted up and drawn in by the lad at the crane. The milk was poured into a weighing can on a scales that admitted of weighing four different lots before the can needed to be

emptied. The weight of each one's milk is put down in the book, the gate of the weighing can opened, and the milk runs along an open tin spout into the vats. The wagon drives away and another takes its place. It was now growing dusk, and the wagons that had been out gathering up milk were coming in. There were three besides the one I had met, but none had quite such a long route, though one of the others had six miles and it took him five hours to make the round trip. He started at three o'clock in the morning and in the afternoon at the same hour and by eight was back at the factory, but until he got home and his cans cleaned it was nine. The milk was distributed through four vats that held each 5000 pounds of milk. Neither was quite half full, and cold water was run around them to cool the milk as fast as possible. It was stirred to help the cooling down to sixty degrees; then it was allowed to remain at rest for the cream to raise over night. The next morning it was skimmed. The morning's milk, as soon as it came in, was distributed through all the vats and cheese made. At the time when the cows were giving most milk, sixty-two cheese—three thousand pounds—a day were made. The milk was taken from over eleven hundred cows.

The butter was made in a sub-cellar; churning was done every two or three days, and about one pound of butter was made to every hundred pounds of milk. The cheese was nearly full cream, and about 50,000 pounds were in the curving room at the time of our visit. Four men were employed about the creamery, and one dollar a hundred pounds was paid for the milk. The men who hauled the milk from a distance got three dollars per cow for hauling. They had a contract for the full season, to November, with the proprietor of the creamery, and he deducted that amount from the patrons, at

the final settlement with them at the close of the season. For bringing it in from the immediate vicinity less would, as a matter of course, be paid ; but to go eight miles, even far as it may seem, the price paid seemed to us ample, as one man and his two-horse team could easily bring the milk from 250 cows. This building had four divisions on the first floor—a boiler and engine room at one end, then the manufacturing room with the four large vats, the press room with a large horizontal gang-press, and finally an immense curing room. There was also one room above this, very large, but not extending the whole length of the building. These two rooms contained the cheese on hand. The ground sloped away from the building on one side, and the whey was run down here in a pipe into a tank, out of which it was pumped into the cans in which the milk was brought, at least so much of it as was wanted for the pigs and calves on the farms.

Everything was in nice shape, and showed good management, and the butter and cheese which we tasted were good ; but we could not help observing that it was less desirable to collect the milk from such a large territory, than from the immediate neighborhood, when cows enough were kept. The milk is exposed to the heat too long, and where the roads are rough and hilly—here they were level and good—the labor of transportation is too great.

When large pans are used and no cheese made, the labor about a creamery is much less than at either of those described. One of these which occurs to us now is simply a stone dairy-house enlarged, built on ground sloping to the south—it were better north—the lower story half under ground. There are six pans, six feet by sixteen, and they occupy all of one room forty-four feet long by twenty wide, leaving only narrow passage-ways between them, and along

one side of the room between their ends and the wall. They stand nearly against the wall on the north side, and the water for cooling comes in through a pipe here. They hold the milk of three hundred cows, and the milk stands in them thirty-six hours before the cream is taken off. The milk is run out below, and the cream is sometimes skimmed off, and sometimes dipped out with a large scoop and run into the cream-vat which stands in a separate room at the east end.

Water from the spring is kept around this tank all the time, and the temperature of the cream never goes above sixty degrees. The churning is done in this room every other day, by a power churn holding 150 gallons of cream. The power is a small steam engine outside. The boiler, besides making steam for this, also warms the water around the pans in cold weather, for butter is made here all the year round. On the south side of the milk room, shaded by a porch with vines running up in front, is the work room, where the butter is worked and some of it made into pound and half-pound prints. There is a large lever press for doing this neatly and expeditiously. It is marketed as soon as made, at least as often as twice a week, and always sells for the highest market price. Much of it goes to customers who will "take no other," and this brings more than market price. There is plenty of spring water here, and a great deal is needed, the aim being to cool the milk as rapidly as possible until it is brought down to 60 degrees, and then to keep the butter as near to that temperature as possible all the time, until it goes into the hands of the consumer.

Good butter can be made in more than one way, if the three essentials—good milk, temperature, and cleanliness—can be commanded. Two letters, both from manufacturers of creamery butter of the highest class, are now before us. In

regard to their mode of making butter, one says, "We use a patent milk vat which allows water to run around the milk. We use ice, but not in the milk, and let the milk stand thirty-six hours if it does not show signs of thickening. Never let the milk thicken before we take off the cream. Churn at a temperature of 58 to 60 degrees in summer, 62 to 65 degrees in winter, in a square box revolving churn: do not let the butter form in mass before we wash out the buttermilk: salt one ounce per pound: set by twenty-four hours: then work and wash thoroughly until all the buttermilk is out. Our butter rooms are usually half below and half above ground. This is the substance of our mode of manufacturing, and we have made, and shipped to Philadelphia, eight thousand pounds per week."

The other writes, "Our theory is that it is full as well to let the cream remain on the milk until it has matured, say, from twenty-four to thirty hours, but for fine butter, the less milk you take off with the cream the better. We use the ordinary deep cooler for setting our milk, from eight to nine inches in diameter and twenty inches deep. According to our view, the cream must stand at a proper temperature, for a sufficient length of time after it is taken off, for it to go through the ripening process. In other words, it should have a certain degree of acidity before churning, and the less milk there is in the cream to sour, the better flavored butter we will get. We use the ordinary square box revolving churn, and none but the best factory filled salt. In warm weather we receive milk twice a day, but have never made any distinction between the night and morning's milk for fine butter. We expect to make this season fifteen hundred pounds a day in two factories."

Washing the butter is, by many, preferred to working it, for

removing the buttermilk. If done properly, it does this more effectually than working. One of the best methods is that in use at some of the creameries where fancy butter is made. The churning is done as usual, with a moderate motion, till the butter begins to come, with the contents of the churn about 60 degrees. Cold water is then added at several intervals until the temperature is reduced about 5 degrees, the churning being continued with a slower motion until all the butter forms in small granules (which it will always do if the temperature is low enough), and these will be free from buttermilk in their interior. Of course they will rise to the top in the churn, and may be dipped out into a bowl of cold water, and washed by stirring until the milk is all out, or the buttermilk may be run out of the churn if a strainer is placed inside the opening, and the water poured in, and the washing be done in the churn; the water being withdrawn and fresh added until the milk is all removed, which will be when the water becomes only slightly discolored. This is quickly and easily done. As soon as the water is drawn off, it is ready to salt. In this condition the salting can be done without much working. The grain remains unbroken, and butter of the highest flavor and best quality is obtained. There are those who believe that the aroma of butter is lost by washing, but this need not be if it is properly done.

Washing in brine is still more effective. Mr. Lewis T. Hawley, of Syracuse, N. Y., in a recent essay,* referring to what he said in 1875 in regard to this method, which he had practised for several years previous to that date, says, "Instead of transferring the butter into a sieve, as I have directed in my old essay, I would draw off the buttermilk as soon as the butter comes to the size of a wheat kernel, and pour on

* Transactions of American Dairymen's Association, 1879.

cold saturated brine (made from pure dairy salt), enough to float the butter, and let it stand some thirty minutes. Then draw off the brine, and float the butter again in cold saturated brine, letting it stand some forty minutes. The object of letting it stand in the brine is to more perfectly dissolve the cheese matter and sugar of milk, so that when you draw off the brine you leave the butter nearly or quite free from the two substances, which, when coming in contact with oxygen, form butyric and other acids, so deleterious to butter. Then carefully transfer the butter in the same form, without any working, into a thoroughly cleansed firkin or vessel (air-tight), which you have partly filled with pure saturated cold brine. When you have filled the firkin with butter, head it up, having a hole in the head, so that the firkin can be filled full of brine, and keep it in a cool, sweet place.

“I predict that butter will be kept and sent to market in this condition, and when customers use butter without salt, it can be taken from the brine while in this pellet form, and washed with fresh water entirely free from salt, and worked together for the table; or, when wanted flavored with salt, it can be worked into shape for use. In either case it can be placed in market and on the table, in large or small quantities, superior in quality to butter treated and shipped to market in the usual way.”

Messrs. Whitman & Burrell, of Little Falls, N. Y., give a description of Prof. Arnold's patent process of making butter and cheese from scalded milk, and buttermilk, the product of scalded milk, which we include here. The method as given, applies to milk as handled in large quantities, and worked in their creamery vat; but, slightly modified, will answer equally well when there is but a little, or with any of the vats or pans in common use. They charge a small royalty for its use.

Their directions are as follows :

“ 1st. Have the patrons bring the milk to the factory while it is warm, immediately after it is drawn from the cows, and run the milk directly into the vats from the weighing cans.

“ 2d. After a portion of the milk is in the vat, and while the rest is being received, turn a jet of steam directly from the boiler (be particular that only pure clean water is used in the boiler), into the milk, and heat the entire mass of milk up in this way to 132 degrees Fahrenheit. If any of the milk at any time has a bad flavor about it, if detected in time, discard it, of course, but if it gets into the vat with the mass of milk, then heat up to 140 degrees to 145 degrees ; then at once turn on the cold water and run it around the tin vat and also through the partitions ; this will cool the milk very rapidly to the temperature of the water, and the cream, which will begin to rise just as soon as the jet of steam used to heat the milk is turned off, will be coming to the surface rapidly ; then the application of the ice and salt in the ice pans will rapidly thin the mass of milk again, as it nears the freezing point, and the cream will be gathered on the surface.

“ Heating the milk serves two purposes. First, it kills any taint in the milk, and destroys that which makes butter become rancid ; and milk which is heated immediately after being drawn from the cow to 130 degrees, and then cooled as quickly as possible, will keep sweet very much longer than milk not so treated. Observe that the milk is not heated up sufficiently to give it a scalded flavor. The second important feature secured by heating the milk is, that when it is thus hot the milk expands (milk is expanded, and therefore thinner, at the freezing and boiling points), and while in this state the cream globules are released.

“ 3d. In the Arnold process, now under consideration, the

cream from the milk, which has been treated as above described, is at once placed in the churn *while sweet*, and the temperature raised to 60 degrees or 62 degrees (the churning point), by means of a jet of steam being thrown directly into the cream. Now churn; as soon as the butter comes, appearing in kernels, so to speak, about the size of wheat, throw in a pailful or so of clear cold water, and churn again for a moment only. Do not gather the butter in the churn as is usual, but at once draw off the buttermilk and run cold water into the churn, and thoroughly rinse the butter once in this way; then take the butter out carefully into the butter-bowls, add and incorporate the salt with just as little working or manipulating as possible, and then put aside until the next day, when it should be worked again in such a way as not to break the grain; then pack and store in a room where the temperature is about 60 degrees or 62 degrees. It can then be shipped to market in three or four days afterwards, or kept for months if desired; for the heating of the milk, as before stated, kills the germs in the milk that tend to make butter rancid. While ordinarily good butter cannot be made from *sweet* cream, by this plan most *delicious butter* is produced of *excellent keeping qualities*. All butter for hot climates should be made in this way.

“4th. But to return to the skimmed milk. While the cream is being churned the skimmed milk should be heated up for cheese-making to about 86 degrees, and by this time the butter has ‘come,’ so that the sweet buttermilk can be drawn off as heretofore described. Add all this sweet buttermilk to the mass of skimmed milk, and then add the rennet and coloring, and proceed to make cheese as usual, gradually heating up to 96 degrees or 98 degrees, etc. Let the whey become somewhat sour or acid before separating the curd from the

whey ; this course is better for skim-milk cheese than pursuing the Cheddar plan of cheese-making from full or unskimmed milk, which provides for running off the whey while it is sweet, and then letting the curd itself become acid before salting. By this Arnold process, run off the whey after it becomes slightly acid, then pack the curd in the vat and keep it warm by letting the cover of the vat down over it to exclude the cold air ; after remaining in this way for a few moments, cut the curd up into "chunks," and run through the curd mill ; then salt and put to press. After the cheese are taken from the press, try and keep them in a room where the temperature can be kept at 70 degrees, and you will have a very fine palatable cheese, considering that it is skimmed (no cream worth speaking of being left in it). At all events the skimmed cheese thus produced from scalded milk and butter-milk—the product of scalded milk—will be decidedly better and bring more in market than the ordinary skims."

Heating the milk before it is set for cream is not new, but it was never practiced to any great extent until within the last few years. It is sometimes objected that it is too much of a forcing process to heat milk to 130 or 140 degrees, and then cool low down with ice. But there is no use in disputing the fact that fine butter which keeps well is made in this way. When the cooling is done with water alone, it takes more room to hold and store the milk, because more time is required ; and the butter too should be fine, for if the germs of taint have been destroyed, there will be no danger of the milk spoiling after heating, even if it must stand twenty-four or forty-eight hours for the cream to rise.

In starting a creamery it is important to get what is needed to turn out a good product. The building should be constructed with reference to the work to be done. It need

not be expensive. In some sections buildings that have once served other purposes have been made to do duty for this. If it can be cleaned, renovated and furnished with the proper apparatus, there is no reason why a blacksmith shop, or a distillery, even, should not be turned into a creamery, any more than there is why it should not be changed into a dwelling for men and women—and the last has often been done. But it will generally be found better to put up a building specially adapted to the purpose, unless where there is already a well-built dairy house, to which the necessary additions can be made that will fit it for the more extensive operations.

Frame buildings are the cheapest, and, when placed on a stone foundation, and tightly boarded inside and outside of the frame, properly lined with building paper between the boards, with tight doors, and shutters to the windows, they can be kept at a very even temperature when favorably located. Cold spring water, when there is plenty of it, affords the readiest means of reducing the temperature in warm weather. An ice house is almost indispensable, and the creamery can be cooled by first passing the outside air under the ice before allowing it to enter. A sub-earth duct, as described farther on, might afford one of the best means of maintaining an equable temperature at all times.

It is not easy to give a plan of a creamery that would be adapted to all situations. The descriptions of the several kinds already given, will enable any one to comprehend about what is needed; and while as much money can be spent on building and furnishing one as the purse will allow, or the taste demand, it is not necessary that it should, in these cheap times, cost more than \$2000, including all the apparatus for making butter and cheese from the milk of 600 cows.

There are, in some places, dairy houses which are better furnished than others around them. They contain, perhaps, a horse-power or water-wheel for churning, or a butter worker—which makes this part of the work easier there than at the others, and all the cream from the other farms is brought here to be churned, and the butter worked and prepared for market, but each lot is kept separate, and is turned over to the owner as soon as ready for market. It has been suggested that if the cream could in all cases be raised at the farm, a much wider scope of country could be covered by one creamery's operation than is practicable when the whole of the milk must be conveyed there, and it would also be more easy to fix the exact value of each man's product, as the cream does not vary as much as the milk. But the percentage of butter in cream does vary considerably. If it is raised in open shallow pans, the cream will be thicker, and yield more butter to the same quantity, than when raised in deep cans and kept covered. In the latter there may be five pounds of cream from the same milk that would in the open pans give but three, and both turn out the same quantity of butter. It would then be difficult to fix the exact value on cream, unless raised under precisely the same conditions.

In Wisconsin a new departure in this direction has been made the present winter, which promises to do much towards the final settlement of the "bad butter" question. Deep cans of uniform size and construction are furnished to each patron, and the cream is collected and *paid for by the inch*. The cans are made with an opening in the centre of the bottom from which a tube runs up to within five inches of the top, where it turns and passes out through the side of the can; the water or air circulates through this tube, and cools from the centre as well as from the outside, and the milk can

stand longer without souring than in other cans. A graduated glass tube inserted at the side of the can shows the amount of cream to the fraction of an inch. The can is, we believe, patented.

The "Badger State Creamery," which is the name of the association having this in hand, propose to collect the cream from the milk of 4000 cows, and extend their operations over the greater portion of the county in which the creamery is located. Local collectors will be appointed, who will visit each of the patrons every few days, take the cream from the cans, and credit the amount. These will deliver it at convenient centres, to wagons passing directly through a number of the local districts, and thus save much driving.

This plan is attracting much attention, and if successful the present season, will doubtless be further extended. The cream can be collected at much less cost than the milk could be, and there is the additional advantage of leaving the skim milk on the farm. In those sections of the country away from the markets, where local dealers now go from house to house once a week and gather up the butter, if this plan were adopted, instead of the weekly visit of the butter dealer, there would be the semi-weekly or tri-weekly call of the cream collector; and there would be *one*, or at the most, two kinds of butter made. We say two kinds because it might be found desirable to keep the cream that was just right from that which may, from any cause, show excessive sourness or taint; but the butter that would be made could hardly fail to be an improvement on that which the dealer now collects, and the value of the cream could be gauged, certainly, with more accuracy than can the value of the unnumbered grades of butter which now pass through the hands of dealers.

V.

CHEESE AND CHEESEMAKING.

IT is often pointed out that the consumption of cheese in this country is less than we should expect, by comparison with other countries; and it is now generally conceded that the cause is to be found in the inferior quality of much of the cheese offered for sale at home.

Our cheese makers have for years made strong efforts to supply the people of England with the sort of cheese they wanted; and from the immense quantities sent there and sold, it would seem they had succeeded.

It has been hoped that the introduction of cheese into the army rations would help to increase the demand here, and so it will to a limited extent; but the twenty thousand men of which the army consists are no more than the inhabitants of one of our smaller cities, and many of our rural counties have each more than three times as many. And if our markets could be supplied with an article that would meet the tastes of the people, it would increase the demand many hundreds of times more than the army can. But the plain truth is, the great bulk of the cheese sold in our groceries and from the market stalls, is relished by comparatively few. Many of those who eat it do so under protest, because it does not taste like healthy food. A taste for it may be acquired, as it may for many things that had better never go into the stomach. If cheese of the right kind were to be obtained, much more would be used. Made from unskimmed milk, it would be a

cheaper article of food at higher prices than it now brings; cheaper, when its nutritive value is taken into account, than beef. And yet there are many families who never have it on their tables, because they have already tried so often to get some that was good, and have failed, that they have given up in disgust. At the late dairy fair in New York, it was our good fortune to taste some Cheddar cheese from Somersetshire, England, that had a mild, rich, mellow, agreeable taste, so far removed from the cheese ordinarily sold here, that one wonders how the same name could be applied to two articles differing so widely. We had also an opportunity of tasting some of the premium cheese from half a dozen different States, and candor compels us to say, that while they were above the average, in our opinion not many of them were of the kind that must be made before the people of this country will generally have cheese on their tables as a standard article of diet.

At the present time, when cheese is so low that it pays a very small profit at best, and in many instances is made at a loss, it will be well to inquire whether some radical change must not be instituted in the methods and processes of manufacture.

The factories which have been in operation heretofore, and more besides, may be able to find sale for all they can make in the markets they have built up. But there seems to be room for another class, and it looks as if some of these might best be located in districts where there are none at all at present; and it is not at all unlikely that in the future we shall find them scattered over the country, one or more in every county in which enough milk is produced, not to make cheese for export nor for the great city markets, but to supply the local demand, and to do this, besides the larger cheese for cutting by the grocerymen, make cheese of such a size that a

household can take one entire every time they buy. This would be a step towards reducing the cost to the consumer without any reduction in the price received for it by the maker. There would not then be a necessity for cutting by the retailer and the loss by drying, to say nothing of the inconvenience, and the addition which must be made to the first cost to pay him for all this.

Let us make our meaning plain. In a locality where cheese has never been made, but large quantities of butter—it may be in a county or centre of fifty thousand people—a creamery is started; it makes butter only through the winter—in summer the demand for butter is not so great, and in former years the butter would have been packed; but as winter dairying becomes more and more extended, the difference in price of butter in summer and winter is not so great, and it will not pay to hold the summer's product. Part of the summer's milk can then be made into cheese, or all, if desired, and the cheese, which should be of the styles suited to the demand, could be sold to the grocers or taken to the market towns and sold direct by the maker; in this way the markets would not be so likely to become glutted, as would inevitably be the case if the present mode and system were indefinitely extended.

The fact that some regular cheese factories have been erected in some of the butter-producing districts, and after a few seasons' operations were closed, does not prove that the plan suggested will not be found desirable. One reason for the partial failure of some of these is to be found in the fact that too great a return was expected for the milk. The average quantity of milk to a pound of cheese is about ten pounds, nearly five quarts. Often the only milk sold in these districts is that which goes into the villages or to the

nearest town or city. For this a high price has been the rule—not less than three cents per quart, sometimes eight—and when it came to furnishing milk to the factory, the producers expected something like these figures; where in butter-making, if the average is about twenty-six pounds of milk to a pound of butter, and the butter averages twenty-five cents a pound, they would have less than one cent a pound, or about two cents a quart for the milk, if we estimate the value of the skim-milk to be equal to the cost of making the butter. But milk could not be bought for two cents a quart, and consequently the factories could not compete with those in the great dairy districts where milk is sold in unlimited quantities at one dollar per hundred pounds, and often less.

The kinds of cheese that would sell best would soon be discovered. A small Cheddar loaf, or nutmeg, pineapple, or a square cheese of small size, the “Young America,” might be tried, or some soft cheese for immediate sale. The present winter a small soft cream cheese was sold in the groceries of New York in one pound boxes at thirty-five cents a pound. Even imitations of the strong-smelling foreign cheeses might find some buyers, because, bad as these smell, their taste is often very good; but something different from these must be made to sell to those whose taste has never been cultivated in that direction, and also very different from the gum-biting stuff which is the best that many grocers are now able to get.

The cheese-maker of the future will, without doubt, make more of the kind of cheese that people can eat without doing violence to their senses of taste and smell. If he does not, he must expect to see less eaten rather than more; for we are guided by our taste in choosing what to eat, and when the tongue or nose pronounce against cheese or any other article of food, analysis showing the large proportion of nutritious

matter it contains will be of no use, if it does not suit the taste—we will get the equivalents in something else that does, even if we must pay more for them.

A cheese factory is precisely similar to the large creamery described in a former chapter, except that it has no provision for making butter. The building, the vats for coagulating the milk, the boiler for heating it, and the curd-mill and presses, are all the same. The milk is brought in as there, but it is not skimmed—instead of being allowed to remain at rest in the vats during the night, it is stirred at intervals by hand, or a stirring apparatus is attached which is run by the water as it flows away, after cooling the milk in the vats. The vats are only made half full in the evening, the morning milk being distributed in the same way. Where the milk is only brought once a day, as it may be in the cooler weather, there is, of course, none to go into them in the evening.

Before describing the process of making cheese, it may be well to say something about rennet, which, as is well known, is an important agent in the formation of cheese. A rennet, as the dairymen of this country know it, is the fourth or larger stomach of a calf; it is also called a “vell.” That from a calf which has lived altogether on milk is much the best, and if it has gone entirely without food for the last ten or twelve hours of its life the strength will be all the greater. Care must be taken not to use too much water in cleaning; wiping lightly with a moistened cloth until it is clean is the better way. If then blown up like a bladder and hung up and dried, or preserved in salt, it will retain its power of coagulating milk for years.

From this it would appear that during the time the calf had gone hungry nature had prepared the active agent, whatever it may be, for digesting the milk which the calf would drink,

and collected it about the inner surface of the stomach ; and also that the longer this goes on the stronger the rennet, until the usual limit between the times of feeding is passed ; after this the stomach becomes inflamed and is spoiled for the cheese-maker's use.

There are different views held by scientific men in regard to the manner in which rennet acts. The ferment or yeast-plant which is the active agent in bread-raising, is an organized ferment—that is, it grows and develops like other plants, a very small portion of it being enough to furnish the seed, so to speak, for filling a large vessel, if the material in which it is placed and the conditions are right.

The experiments of Hallier, the German microscopist, with rennet, seemed to prove that it was a ferment of the same character ; but of late another view, that it acts by contact, and is an organic, but not an organized, ferment has been prominently brought out, notably by Prof. Caldwell at the last meeting of the American Dairymen's Association, who also suggests that we may yet be able to find other organic ferments in some of the vegetable juices to take the place of rennet, and names the juice of the paw-paw (*Carica papaya*) as one which has been suggested.

Again, it is held that the action of rennet in coagulating the milk and afterwards on the curd when this has been pressed and put away to ripen, is similar to the digestive process, and Prof. Arnold calls cheese "the partially digested coagulum of milk." This is ridiculed by some practical cheese-makers. Without expressing any opinion, we may say that this view looks as if it might be true. Whatever the manner of its action, the fact remains that it has so far been the most available of all that has ever been suggested or tried for fitting the curd of milk for food in such a form that it could readily be preserved for long periods of time.

The liquid or dry extracts of rennet which can now be purchased bring it within the reach of those who could not procure or use the vells. These extracts are prepared in foreign countries from the fresh rennets—those we have seen came from Denmark. Many of the rennets, too, which are used in this country are imported. In preparing rennet for use the vells are cut in pieces and steeped in brine or boiled whey a few days before it is wanted. Dr. Voelcker gives the mode of preparation at a noted English dairy as follows: Slice the half of a lemon; sprinkle it with about six ounces of salt, then pour upon it one quart of boiling water: cover the vessel to retain the steam. When cold put into the liquid one fresh vell; allow the whole to stand for two days, then strain the liquid through a fine cloth and the rennet is ready for use. This quantity is deemed sufficient to coagulate six hundred gallons of milk.

The pieces of rennet should be rubbed several times while being steeped to extract all the strength, and it is recommended to make enough at once to last several weeks at least. Sometimes enough is made to last two months; in this way greater uniformity is secured than when it is made every few days, the rennets not being all alike in strength; but care must be taken that there is no taint in any of them nor in the whey used, or the whole batch may be spoiled. The steeping is best done in stone jars, and the liquid had best be kept in these until wanted for use.

There are many details connected with cheese-making that we cannot attempt to explain here; the experienced cheese-maker knows how to adapt himself to the variations in the milk, the temperature and the kind of cheese he desires to make; but he finds it hard to explain everything unless during the operation, when the eye and the touch and smell can all be brought into

play to determine the different conditions. The process, however, as conducted in the best factories where cheese is made from whole milk, may be outlined as follows :

The milk being in the vat, the first thing to be done is to separate the whey, containing the sugar of milk, most of the water and the mineral matter, from the caseine and the fat which go into the cheese ; the milk is brought to a temperature of 80 or 84 degrees—it is not often necessary to do this by cooling, as it has usually been cooled sufficiently over night or before being brought in. When it is too low, warm water or steam from the boiler must be applied around or in the vat until it is right. The rennet is now poured in and thoroughly mixed by stirring a minute or two ; the milk is then kept at this temperature until it thickens ; as soon as it is firm enough, which may be in an hour or less after the rennet was put in, it is cut. The necessary degree of firmness is ascertained by passing the finger along just under the surface—if there is a distinct break or fracture in the curd in front of the finger it is ready for cutting. This is done with a curd knife, which consists of a series of knives set in a frame, from one-third of an inch to several inches apart, as the curds are to be coarse or fine ; the cutting may first be done horizontally, dividing the curd into layers from top to bottom, and then vertically lengthwise of the vat and crosswise from side to side ; when finished, the curd will be left in cubes of perhaps half an inch on a side when fine curds are made ; where coarse curds, the divisions will be much larger. The whey now separates and the curds begin to settle ; heat is applied either with warm water around the vat or by injecting steam directly into the vat, and stirring the whey and curd, so that every particle, even to the centre of each bit of curd, is gradually brought to the same degree of heat, about

98 degrees, more or less, as the cheesing process is to be hastened or retarded. When this stage has been reached, perhaps two hours and a half from the time of beginning, the heating is discontinued and the particles of curd allowed to settle and pack on the bottom. Three distinct courses are now open: the whey can be withdrawn at once—this is usually done with a syphon over top of the vat, a strainer is put in to prevent any of the curd passing out with the whey, and the curd drained, ground, salted and pressed while perfectly sweet. This was the practice in the earlier years of the factory system, but much of the cheese made in this way did not turn out well, and the plan of allowing the curd to develop more or less acidity in the vat before salting and pressing came into favor. This is what is known as the English Cheddar method, and the change the curd undergoes is called “cheddaring;” in this method the whey is withdrawn early, or at least before showing much acidity, and one end of the vat is lowered and the curd heaped up along the sides and allowed to drain. As soon as it has become firmly packed it is cut into pieces perhaps a foot square, and turned over so that all shall change alike. This is done at intervals until the curd is fit for salting, which is determined by its consistency and general appearance and smell. It is now run through the curd mill and salted and put to press. Another plan is to allow the whey to remain until it becomes distinctly acid; in the meanwhile stirring the curd to prevent it from packing, and when the whey has been drawn and the curd has drained, salt and press as before. From two to three pounds of salt are used to a thousand pounds of milk, and the cheese remain in the press until the following day, when they are taken out and with their bandages around them are placed on the shelves in the curing house, where they remain from twenty days to two or three months or longer.

The daily routine at a cheese factory, beginning in the morning at half-past four or five o'clock, will be first turning and rubbing the cheese on hand, and receiving the milk as it comes in till eight o'clock; then the working of the milk in the vats begins; the various manipulations occupy the time till two or three o'clock in the afternoon, when the pressing is generally finished; then there is the washing up, and from six to eight in the evening milk is again received. The proper curing or ripening of the cheese when made, which is really the cheesing process—what goes before being only the separation of the caseine and fat, and putting in proper form—is most important. The curing house should be of a uniform temperature; about 70 degrees is considered best, but this will depend somewhat on the amount of rennet used and how it was worked. The caverns in the rocks where the French Roquefort cheese are stored have currents of cold air passing through them often as low as 40 degrees F. In the last few years much attention has been given to cold storage; houses kept cold with ice through the summer are used for storing the cheese, but the results so far have not been so uniformly successful as has been hoped for.

The process of cheesing is a complicated one; butter-making is for the most part a simple mechanical operation, but cheese-making is more of a chemical process, and the ever varying conditions of the milk and the temperature, which must be watched in making and curing, require experience, judgment and skill to turn out a uniformly good product, and it is never advisable for one with no experience to commence the business on a large scale. Men experienced in the business whose services can be obtained are to be found in the principal cheese producing districts. They are paid from twenty to fifty dollars and more per month—one who is able to take

charge of the entire business of a factory will command the highest figures.

If any one should inquire, what is the best cheese? it would be hard to answer. We have elsewhere indicated what would probably be considered so by the largest number of persons, but tastes differ very much. The cottage cheese which is made from skimmed milk, which has been warmed in the sun or on the stove till the whey separates, and eaten fresh, is relished by almost every one, if not alone at least with sugar or syrup; by some it is preferred when it has been allowed to stand awhile, until it rivals some of the strong-smelling foreign cheese; each one of which has its admiring devotees, who think nothing equal to their own pet nasal irritator. The cheese properly made from whole milk is something different from these; as a food it can hardly be overestimated, and it should be made in many places where none is made now.

Arnold in his "American Dairying" says: "The choicest cheese, that which is the richest and highest flavored, must like the choicest fruit be consumed not far from where it is produced." If this be true, and there is no reason to doubt it, some of those who have found in the past a great profit in making the finest butter may find in the future that by taking equal pains they will be able to produce an article of cheese that by its delicious flavor and higher value as food will bring them a proportionately greater return for the time and skill spent in its production.

VI.

OUR DAIRY HOUSES. THE BEST BUTTER. CONCLUSION.

THERE are many places where associated dairying can never be practiced; there are others where it might be to the advantage of all concerned, but will not be for a long time, if ever; and even in its strongholds there are those who prefer to have nothing to do with it, and to the private dairy house we must continue to look for a large share of our butter.

We have already referred to the earthen crocks and the small tin pans which are still what the majority of butter makers use, to hold the milk for cream-raising, and among them are some who turn out as fine butter as any that is made, though they do it at what seems to be a greater expenditure of time, trouble and labor, than need be with the best modern appliances within reach. We know that some of them will require proof of the most positive kind to convince them that cream can be raised from milk as well, or as completely, when it stands at a depth of twelve inches, as it can in a shallow pan of three inches; but nevertheless it has been done for years, and is being done now in many of the best dairies in the country.

The earlier opinions in regard to the effect of temperature on cream raising are yet firmly held by many, for reasons which they consider self-evident; but if any one has had his faith in these two cardinal points so far shaken as to look for more evidence, he can easily and at a very trifling outlay obtain the means of testing the matter to his own satisfaction.

Any tinsmith will for a dollar make a deep can like the pails or coolers used so extensively in the creameries. Our own, nineteen and a half inches deep and nine inches in diameter, cost eighty cents with handle and cover, and any carpenter can make a plain, water-tight box of pine plank like those used in the dairies and butter factories of Sweden, large enough to contain the cans, and the necessary water and ice, and furnished with a tight-fitting lid, at a very slight additional cost.

In a few counties in Pennsylvania a modified form of tin pail is used for setting the milk; the depth is eight or ten inches, the diameter six inches at the bottom and eight at the top; by those who have used them they are preferred to small pans.

This form is similar to that fixed on by Mr. Bliss as giving the best results, in the numerous experiments which he has made, and now used in his creamer, noticed under dairy apparatus. His are, however, somewhat larger, and he has found that while in the ordinary deep can there is a ring of milk around the sides near the bottom from which the cream is not all removed, in these it is uniformly separated all through. A further recognition of the advantages which this form—wider at top than at the bottom—has over the ordinary one with straight sides, is to be found in the Fairlamb can, used in the “Badger State” Creamery, already referred to, and elsewhere.

Sixty degrees Fahrenheit was long supposed to be the only temperature at which anything approaching the best results could be obtained. Where cold spring-water could be had, or a deep well-constructed cellar, this was the temperature most easily attainable, and it came to be looked upon as the natural temperature for butter making. The Swedish system

has, however, shown that cream can be raised in much less time when the milk is set in water to which ice has been added, at a temperature of from 50 degrees down to 35, and large quantities of butter have been made in this way, of excellent long-keeping qualities.

When cream can be raised at these low temperatures, as is often done, in ten to twenty-four hours, instead of thirty-six or forty-eight, much is gained. The milk needs to be taken care of only from one-fourth to one-half the time, and a less number of vessels are required, less room to set them, and less labor in handling them.

When cream is raised in the shortest time named above—ten hours—it will always be thin and sweet. It may remain sweet as long as forty-eight hours, or even longer at a low temperature. But the longer it stands, the more it will thicken. Being thin, there is more of it in proportion; four inches is not unusual from ordinary milk, and six inches from good Jersey cows, on cans nineteen inches deep, and this is sometimes urged as an objection because it adds to the labor of churning; but this is not nearly as much as the labor saved in handling and taking care of the milk.

In regard to the saving of labor, we quote from Mr. Hardin, "In shallow setting, the labor consists in filling a large number of pans, lifting them first on to the racks and then off again, skimming a large surface while standing, and at all times of day and night, when the best results are obtained; washing a large number of tins, keeping up a fire in the milk room, fall, spring and winter, night and day; but principally in the great amount of scrubbing to be done, that a large room and all its surroundings should be kept immaculately clean." This, as already shown, is greatly reduced by the use of deep cans or large pans. In the last it

is reduced to the lowest point ; but the milk cannot be cooled as readily as in the cans, except where cooling from the top is brought into play, as is done in Bliss's creamer, the Smith's creamery vat, the creamery pan of the Northwest, and others of that class. This is the most rapid way of cooling, and if combined with cooling around the sides, will suit those who believe in taking the "animal heat" as it is termed, out of the milk in the shortest possible time. Those who wish to keep the temperature gradually falling through as long a time as practicable, can modify it to suit their purpose. Whether the vessel for raising cream had better stand in water or in the air depends on circumstances ; water as it is pumped from the earth or flows from the spring has usually a temperature not far from 50 degrees, and if enough of it can be had, any quantity of milk can with proper arrangements be reduced to the same temperature ; air has, in the latitude of 40° north, between the Rocky mountains and the Atlantic, a mean annual temperature also about the same or a little higher, but it varies from 10 degrees below zero to 100 degrees above, and this variation would be fatal to cream-raising ; but the air can be kept at a uniform temperature in a cellar or in a vault under ground, or in a house in a sheltered position, properly built above ground, without water at all, and when, in addition to these, ice can be had, we have all that is needed to give us entire control of the temperature.

In our best spring dairy houses the body of the milk is surrounded by water, the surface exposed to the air. A tight box into which water is pumped from a well, and continually renewed, answers as well as the spring ; when there is a wind-pump and a cover on the box or trough for the water, this is an excellent plan, but in many localities there are neither

springs nor wind-pumps, and to pump the water from wells by hand is a serious job, and a good cellar or vault is relied on. One well adapted to butter making all the year round can be made by having the main cellar of the ordinary depth of seven or eight feet, and then at one end excavate the ground a few feet deeper, run up a partition or hollow wall between this and the other part, arch over the top, run a flue up from the bottom for ventilation, and it is complete, for maintaining an equable temperature of fifty-five or sixty degrees. If, as in the case of one we know, an opening can be made from the arched portion where the milk is to be kept into a well, high enough above the water to prevent flooding in case the water rises, the moist air which some deem essential, and which they get in their spring houses, can be had here as well.

When there is a spring, the best dairy houses have thick stone walls, at least below, cemented or boarded floors, and excavations or tanks to hold the water at the required height. At present ice is so much used that it has come to be considered almost indispensable for tempering either the air or the water to suit the requirements of the dairy.

The way in which ice can be economized to the greatest extent, and used with the least outlay of labor, is to have the milk-room adjoining the ice-house, with their floors on the same level, and to have a tight compartment made into which to set the milk, *lower* than the ice, and to keep the air in this cold by the ice above. The air should not be allowed to circulate except from the floor of the ice-house to the space where the milk is set, otherwise there will be a waste of ice.

The ice-house is often so placed that this is not practicable, and here, when the setting of the milk is done in air alone, Hardin's method can be used to advantage.

Wilkinson's sub-earth ventilation affords a means of keeping the air in a dairy-house or cellar at the same temperature all the year round, and also of perfectly ventilating the same. This is attained by constructing an underground duct connected at one end with the dairy and at the other with a well sunk in the ground, to the depth at which the duct is placed. This may be ten or twelve feet below the surface of the ground. The length should not be less than two hundred feet, and the size from one to six superficial feet in cross section. It has an earth bottom, the sides and top may be of brick, or stone flags may be set up in the shape of an inverted V. The house can be so constructed that no air can get in except that which comes through the duct ; this will be at all seasons of the year about 50 degrees F., if the proper flow is maintained. It is claimed that the air as it traverses the duct becomes cleared of all noxious gases and odors, and is so dry that matches kept in a cellar supplied with it, light and burn readily. To secure a flow of air through the duct towards the house there is an exhaust shaft which, in the case of cellar or dairy-house attached to the dwelling, may be the chimney of the kitchen. A small stove placed inside of it will furnish the heat to give the upward draft when there is no fire in the kitchen stove. The system is patented, and a number of dairies in various parts of the country are now furnished with it.

The room for churning and working butter should not be too warm nor too cold for the comfort of those who attend to it. Whether the cream had better be churned sweet or allowed to sour, has by the practice of the majority been decided in favor of slight souring ; but the present advocates of churning it sweet have a ready demand for all the fresh butter they offer. When it is soured, it must not stand too long, and the temperature for churning should be from 58° in summer, to 63°

in winter; for whatever may be said in regard to cream raising, it is as yet not disputed that about 60° is the right temperature for churning. Everybody now knows that the grain of the butter should not be injured by improper churning or working. The hands are not to be used for working; for small quantities the ladle will do; when there is more, a smooth table of plank or a marble slab, and a paddle, about ten inches long, and five wide, and a handle at each end, is a very effective means of working in skillful hands. In many places the Orange county worker or something similar is used. This is simply a triangular table, with sides a few inches high, and a round or square lever fastened at one end and held at the other. Then there are various kinds, with round or grooved rollers and circular or oblong tables. The latest idea is to apply simple pressure to force out the buttermilk, without any working at all.

Salting goes with the working, except by the French method; none but the best quality of salt should be used, and it must be well incorporated with the butter; the quantity varying from one-half ounce to an ounce per pound, to suit the market or the particular customer it is intended for. In France much butter is marketed in excellent condition, and even sent to England, without any salt at all.

THE BEST BUTTER.

The standard which has been set up requires an agreeable flavor, sweet, pure, nutty, aromatic and clean; a firmness of body that will not easily become soft; a close and compact texture, with the globules unbroken and the grain distinct. It must not be inclined to change rapidly, nor be strong, tallowy, cheesy, bitter or stale, nor have that pasty, open-grained condition which makes it give under the knife and stick like salve or grease. If it has all the good qualities and

none of the bad, it comes under the class "best," whether made in an eastern dairy or a western creamery.

It has been estimated that in the eastern cities about two pounds in a hundred are sold as "gilt-edged" or "fancy." Some of this goes to hotels, but the most to private families, in the name of the butter-maker, either furnished by himself or through a dealer. It was this mode of marketing that has had much to do with the high prices that have been obtained, and there was a reason for it. Butter as it was found in the ordinary markets varied more than anything else that was bought for the table; and when those who wanted the best that could be had, once found that which was uniformly good and would stay good until it was used, they took it, and rather than be at the risk of changing and at the trouble of searching for it, took one man's make, who by making a study of their tastes, as far as he could discover them from their commendations or complaints, was able to retain their patronage and in a manner cut off competition, and to a great extent fix his own price. Sometimes this price, high as it seemed to others less fortunate, did not more than pay for the extra trouble and cost; often it did, and in many cases the merits of the butter bore no comparison to the extra charge.

The ways of the merchant are not always plain, but it may safely be said that in the open market, butter will bring what it is worth; and the more the average quality of the butter is improved, the less demand will there be for these exclusive makes, which have already most severely felt the effects of the hard times. The demand for good butter will increase, but the supply is likely to increase much faster. The leveling tendency that has been going on since the creamery system began will not stop; and as the leveling is up and not down, there will in time be enough for everybody at prices within the reach of all.

It is believed by many butter makers in the soft water districts that no limestone or hard water region can produce a prime article. In regard to this we quote from Willard:* "With due respect to the opinions of others, it is believed that as nice butter can be made in the hard water districts as in the far-famed butter regions." "There are," he says, "butter makers in the hard water districts of New York, whose butter is pronounced, by competent judges, equal to the best brought into the markets," and adds, "I have seen as good butter made upon the black slate hills of Herkimer county, as any in the soft water regions—butter that would keep at least nine months as sweet as a nut, and as nice as could be desired."

It is not the aim of this work to give the details of milk production, but a few well known and settled points will be referred to, which must be borne in mind if the best, or even good butter is to be made.

The cow, her food and drink and treatment, are the foundations on which the result depends.

The cow must be healthy and well fed. Some of the highest priced butter ever sold in this country has been made from the ordinary dairy cow, without reference to breed, fed on good hay from mixed grasses, with bran and corn meal through the winter; nothing else, except plenty of pure water to drink. Through the summer, good pasture and a little bran, and the same flowing spring water and plenty of shade trees to shield them from the scorching sun, was the treatment.

A poor milker, or one that yields but little butter, should not be kept, but fattened and turned into beef. One that gives milk that is imperfect from any cause, should not be retained in a butter or cheese dairy; the milk from one such

* Dairy Husbandry, p. 236.

will spoil the entire product; and if there is any suspicion of such an one, she should be traced and weeded out.

No matter what the food is, be it grass or hay, grain or roots, there should be enough of it; when ranging over pastures, cows eat until they have enough and then stop; but in the stables it is different—if they are half starved there, and then have feed thrown before them in unlimited quantity, they will eat too much—and regular feeding, enough but not too much, should be the rule all the time.

Stagnant water often contains the germs of minute organisms, and, when the cow drinks it, they develop in the milk to such an extent as to unfit it for use, unless heated at once when drawn; and the purer and cleaner and fresher the water, the better will be the milk—of which over eighty per cent. is water.

Kind treatment will be given by the humane man, and dollars and cents ought to be a sufficient inducement to others, for it would seem no cow would be habitually ill-treated when once her owner thoroughly appreciated the fact that he was being cheated out of part of his income by such a course. Kicking and beating, and dogs that worry them, had better be dispensed with; and quarrelsome cows, old or young, that never give the others a quiet moment when they can get near them, ought to be restrained.

When the milk is good to begin with, the manufacturer can make good butter, if he takes the means to preserve it in good condition until he has the cream out of it. But when the milk from any cause has once begun to show taint, the greatest skill is required to check this and prevent his materials from being spoiled; it can often be done, to some extent, but the product will not belong to the kind we have just been considering; it will find its place lower down in the scale of merit.

CONCLUSION.

To change suddenly from old and tried ways so long as they are reasonably satisfactory, is, in what pertains to dairying, as well as in any other business, not to be advised unless the alternative which presents itself will after investigation promise better results. There are centres in various parts of the country within the limits named in one of our first pages, where the system, which has mainly occupied our attention, has reached its fullest development, and where it will show for itself what are its possibilities.

In New York these will be found from Franklin county in the extreme north, diagonally across the State to the shores of Lake Erie. While it is more general here than elsewhere, the counties of Orange and Delaware in the eastern part of the State have some good creameries. Little Falls and Herkimer, Utica and Rome are surrounded by cheese factories, and farther south, and west, about Sherburne, in Chenango county, and Morrisville, in Madison county, and on to Lake Chatauqua, are creameries where butter is more largely produced. In Pennsylvania cheese factories will be found within easy reach of Meadville, in Crawford county; and at Marshallton, in Chester county, butter has been successfully made from the milk of some two hundred cows kept on four or five adjoining farms.

Wellington, Chagrin Falls, and Hudson, in northern Ohio, are the points in that State around which they cluster. Elgin and Marengo, in Illinois, have become well known all over the country by the excellence of their creamery products, and the enterprise shown in pushing them into the leading markets. Wisconsin has Fort Atkinson as one centre of its dairy interests and at Mazomanie is located the "Badger State Creamery," where, as the reader of previous pages will

recollect, the cream alone and not the milk is collected for butter-making. The creameries at Manchester, Monticello and Anamosa, in north-eastern Iowa, will show what has been done here. There are of course many other points that could be named; these referred to are among the most prominent, and will show what has been and can be accomplished.

The dairy productions of the country are now simply enormous, and statistics go to show that they rank ahead of either of the other three great agricultural products, corn, wheat and cotton, and as far as regards quantity are probably equal to the present wants of the civilized world, though as the needs increase, a corresponding increase in production will naturally follow. The great room for advancement now is in the improvement of the average quality, and those localities that can carry this farthest by the method that is most economical are the ones to which the future of the business promises the best returns.





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