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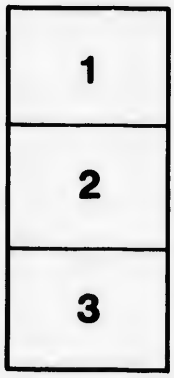

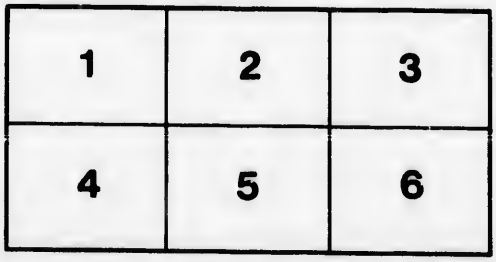

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BULLETIN 101. APRIL, 1896.

Ontario Agricultural College and Experimental Farm

DAIRY BULLETIN

BY THE

DAIRY SCHOOL, GUELPH.

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BULLETIN 101.

DAIRY BULLETIN—DAIRY SCHOOL, GUELPH.

The material for this bulletin was prepared by the instructors of the Guelph Dairy School in connection with the Ontario Agricultural College. Readers will find it a practical, up-to date bulletin, giving the latest information on separators and separating milk; butter-making in separator and cream gathering creameries, as well as in the private dairy; cheese-making in spring, summer, and fall; and milk-testing, including notes on the Babcock tester, lactometer, and methods of dividing proceeds among patrons of cheese factories and creameries according to the latest knowledge on the subject.

The instructors of the Guelph Dairy School for 1896 were:

T. B. Millar and R. W. Stratton, in cheese-making.
Mark Sprague, in separators and separating milk.
T. C. Rogers and J. H. Findlay, in butter-making.
J. W. Mitchell, B.A., in milk testing.
Jas. Stonehouse, in home dairy.

SEPARATORS AND THE SEPARATION OF MILK.

By Mark Sprague, Instructor.

As cream separators are coming more into use every day in the creameries of the Province, we feel that a few hints as to their care and management would be welcomed by all who are interested in butter-making.

As there are six or seven kinds of separators on the market, differing very much in construction, it would need as many sets of directions to make this part of our bulletin complete; but space will not permit of so full a treatment of this special department.

The principle of separation in each machine being the same, we will divide our separators into two classes, viz., belt separators, and steam or turbine separators, the latter being driven by steam direct from the boiler.

1. *Belt Machines.* A stone foundation is not required for those makes of separators that are built with a rubber ring around the upper bearing, but the best results are got from having all separators

solidly placed or set. First, place the intermediate, or jack, in position. Level it and put it in line with the driving shaft. Then fasten it in position with bolts or lag-screws, bearing in mind that it may be placed immediately under, or several feet either way from the centre of the driving shaft, as best suits the requirements, and taking care that the pulley on the driving shaft be of sufficient width to carry the belt and allow of its being shifted from the tight to the loose pulley of the intermediate, and *vice versa*, and of the proper size to give the exact speed required.

Next, place the frame of the separator in position, far enough from the intermediate to give the proper tension to the endless belt. Level the machine both ways by placing your level on the top of the cast frame, which is turned true for this purpose. Line the separator with the intermediate by bringing the right hand outside surface of the spindle pulley in line with the centre of the face of the large intermediate pulley, having the vertical centre line of the spindle level with the under side of the intermediate pulley; then bolt the separator securely to the floor or foundation, unless it be one that has the spindle and bowl connected by a socket joint. If the spindle is so connected, bolting down will be unnecessary.

Bear in mind that the separator bowl should revolve or turn to the right, or with the sun, and that the intermediate should run from the separator. Never put the idler or tightener on the draw-side of the belt. Where only one separator is used, put on all the belting and start the separator with the engine, taking from ten to fifteen minutes to reach the proper speed. Wipe all bearings to free them from dust or dirt, and see that all oil tubes are cleaned and free to allow the oil to flow to the bearings. Look carefully after this matter from day to day

2. *Steam or Turbine Separators.* In setting a steam or turbine machine you have only to decide on the place to set it. This separator also must be set solid so as to be free from the possibility of vibration, and must be levelled in the same way as the belt machines. Turbine separators are all fitted with three-quarter steam fittings, but if the separator be placed so that more than twenty feet of pipe is required to reach to the boiler, use a larger pipe to insure sufficient steam to drive it properly, adding one-quarter of an inch in size of pipe for every twenty feet in distance. Take care to remove all scales and cuttings from pipes before placing them in position.

The exhaust pipe is usually made of galvanized iron, four inches in diameter. It may be conducted through the side of the building, provided it is placed so as to drain well, or it may be put through the roof. The latter method is to be preferred, as the danger of

frightening horses is thus done away with. It should be long enough to reach higher than any point of the roof, in order that the draft may not be interfered with. When it is put through the roof, a drain pipe must be connected with the elbow at the lowest point to carry away the condensed steam. This in most cases may be put through the floor or be allowed to run into a pail. Next put the bowl and spindle in place, being sure to have all bearings cleaned and oiled. Then fill the bowl with water, if it be a separator that has steam turned directly against the bowl. This will keep the bowl cool until sufficient speed has been reached to cause a current of air around the bowl, which will keep it cool thereafter. Apply steam gradually, having the regulating valve set so that it will keep the pressure at from forty-five to fifty pounds on the steam guage. If there is no safety valve, the pressure will have to be regulated by the globe valve.

After speed has been reached in either the turbine or the belt separator, the milk should be turned on full feed, until both the cream and the skim-milk flow freely; then it should be closed off till the cream is the desired thickness.

Milk separates best when fresh or new, and at a temperature of ninety degrees. But in creameries the usual practice is to bring the night's and morning's milk together to the factory. In such cases, if the temperature has fallen below eighty-five degrees, the milk should be heated to eighty-five or ninety degrees at least eight or ten minutes before going into the separator. This is done by means of a tempering vat, holding about 400 pounds, and attached to the receiving vat, so as to have a constant and regular flow to the separator.

Heating increases the difference in the specific gravity between the serum and the fat of milk and thus facilitates the separation of the latter. Frozen milk separates better when heated five to eight degrees higher than that which has not been frozen.

After all the milk has been separated, the cream left in bowl can be forced out by putting in some skim-milk or warm water; about two pailfuls will be needed for this purpose. Shut off the feed tap for a few seconds when about one pailful has gone through; then turn it on again.

Always allow the bowl to stop of its own accord after the power has been taken off—never apply any brake or friction to it. Wash in tepid water the bowl and all the parts that come in contact with the milk or cream, cleaning all foreign substances from the skim-milk tubes, etc. Then scald with steam or boiling water and allow to dry, after which the parts may be put together for operation next day.

Two thicknesses of quarter-inch rubber packing placed under the outside edge of the base, before bolting the separator down, improves the running of any separator. Four rubber rings, one under each corner, also have a beneficial effect in making the separator run smoothly and quietly.

In conclusion, we would say to any one who gets a separator: If you are not familiar with it, get some person who has had experience to assist you in setting it up. The very high rate of speed at which cream separators run, makes them somewhat dangerous in the hands of inexperienced operators.

CARE OF MILK FOR CREAMERIES.

By J. H. Findlay, Assistant Instructor.

As it is necessary that the cheese and butter makers should be supplied with first-class material to work with, we should look more closely to the care of the milk. Only milk of a good quality and free from any taint or odor should be accepted at a creamery. The cows should be supplied with good wholesome food, and have access at all times to pure water. The cow's udder should be well brushed each time before commencing to milk, and the milking should be done with dry hands and as quickly as possible, care being taken to get the "strippings," as this is the richest part of the milk. As soon as the milk is drawn from the cow it should be taken to a convenient place and strained and aerated, care being taken to see that the surrounding atmosphere is pure, as milk is very susceptible to taints or odors. The aerating may be done by dipping or pouring the milk from one vessel to another; and milk that is properly aerated will require very little cooling. All pails, strainers, etc., should be of tin and should be washed with warm water and then scalded with boiling water immediately after being used. The butter maker should reject any milk that is tainted in any way and notify the patrons as to its defect. He should also give the remedy if possible. Cleanliness should be practised at all times both by the butter maker and by the patrons supplying the milk.

CARE AND CHURNING OF SEPARATOR CREAM.

By T. C. Rogers, Instructor.

The cream being at a high temperature as it comes from the separator, it is very necessary that ample provision be made for cooling it to a proper ripening temperature immediately after separation. High ripening and churning temperatures give the butter a soft, oily texture that diminishes its value. Plenty of ice should be securely stored at the proper time for use when needed, and a cream cooler should be made to hold ice and water, over which the cream may flow from the separator to the cream vat. This vat should be deep and narrow with a seven or eight inch space around it for water and ice, so that, for ripening, the cream may be cooled to sixty degrees within one hour after separation, and to a lower temperature in warm weather.

In creameries where the cream cannot be quickly cooled to sixty degrees, the butter-maker should persist in cooling until a temperature lower than sixty degrees is reached before night, especially in warm weather when the lactic acid is already developing in the milk before separating.

If the cream is to be held for two days before churning, it should be cooled to fifty-two degrees in winter and to fifty degrees in summer. At these low ripening temperatures, the texture of the butter is better. Cream should be stirred frequently for the first six hours after separation and occasionally afterwards while ripening, to improve the flavor and ripen it more uniformly.

We think that the best results can be attained by using a starter o develop lactic acid in the cream, sufficient to cause it to thicken, or coagulate, about six or eight hours before the time for churning. Our experience is that a good clean flavored starter used in this way improves the flavor and keeping quality of the butter and enables the butter-maker to ripen the cream more uniformly from day to day. The cream should always be carefully examined before retiring at night and the person in charge may arrange to have the temperature gradually lowering somewhat, especially in warm weather, so long as the ripening is not delayed too much.

A Starter.

Take one gallon of skim-milk or fresh whole milk (having a good flavor) for each ten gallons of cream to be ripened, and warm it to ninety degrees; add to it about a gallon and a half of clean water for each ten gallons of milk used in making the starter and set in a clean warm place for twenty to twenty-four hours. Then break up fine by pouring or stirring, and strain into the cream the amount necessary to

ripen it properly in the desired time. When a good flavor is got in this way, it is advisable to propagate it by Pasteurizing the milk used in making the starter from day to day. Do this by setting the milk in boiling water and stirring constantly while it is heating to 160 degrees; then remove and let stand for twenty or thirty minutes. Afterwards place in cold water and stir till it cools to seventy-five or eighty degrees; then add about a quart of the old starter (having the good flavor) to each ten gallons of Pasteurized milk, with a gallon and a half of clean water at the same temperature. Mix and set in a clean warm place. Do not stir again until it is wanted; then use from one to four quarts of the starter in each ten gallons of cream to be ripened, varying according to the condition of the cream, the season of the year, and the time allowed for the cream to ripen.

The starter should be put into the cream vat when the separating begins, to fix the flavor of the cream before any undesirable bacteria develop in it.

Churning.

Separator cream should contain about thirty per cent. of butter-fat and be cooled to fifty-two degrees to fifty-four degrees in winter and fifty degrees to fifty-two degrees in summer, about two hours (and longer if the cream is ripened at high temperatures) before the time for churning. Cream containing a high percentage of butter-fat gives less volume to cool and handle, and it can be churned at a lower temperature, which gives the butter a firmer texture. The churn should first be cleaned with hot water, and then cooled with cold water, before straining the cream into it. The churn should not be filled half full; one-third full is better. Add butter color to the cream before starting, if required to give the butter the proper color to suit the market. It may be added at the rate of about half an ounce of coloring to 1,000 pounds of milk. A smaller quantity of coloring is required in the spring; but, in the fall, the amount may be gradually increased to the above figure. Cream containing a high percentage of butter-fat will thicken in churning, and the desired concussion may then cease. At this stage, add to the cream about one gallon of water to each two gallons of cream being churned (at the same temperature), and continue churning until the butter is about half gathered; then add sufficient water at a lower temperature to keep the butter in the granular form until the cream is properly churned—till the granules are even in size and not larger than grains of wheat. The churn should make from sixty to seventy revolutions per minute, and the time required to churn should be from forty-five to sixty minutes. The lower temperature at which cream can be churned in this length of time, the better will be the texture of the butter. If small specks of butter appear on the first

buttermilk drawn off, then the churning should be continued a little longer, and more water should be added if there is danger of the butter gathering too much by the additional churning. Always run the churn at a high speed when finishing the churning and when washing.

Washing.

The quantity of water used for washing the butter should be equal to the quantity of cream churned, and should be at a temperature of from 54° to 58° in winter and 48° in summer, if the butter is to be salted on the worker; and at 45°, or lower, when it is to be salted in the churn. If the water which you have in summer is too warm, use about two quarts of salt in the water and let it stand for ten minutes before drawing off. Avoid using water at high and low temperatures on the same lot of butter, as it has a tendency to cause white specks and an uneven body in the butter. When the butter is to be packed for export, or held for some time, wash it twice, but only once when it is going into consumption within about a month. Unwashed butter, from cream churned at a low temperature, gives good satisfaction, if it is put up in pound prints and forwarded to market as soon as it is made. This method works well in fall and winter, and where water is scarce. When not intending to wash the butter, the maker will find it an advantage to add an extra quantity of very cold water to the contents of the churn when the granules are the proper size, and revolve the churn quickly for a few turns before drawing off the buttermilk. This will cause the buttermilk to run off the butter more freely and give less trouble when working the butter. It is also well to use a little water to wash the buttermilk from around the butter when near done working, but none on the butter.

Salting.

The butter should remain in the churn to dry for twenty or thirty minutes before salting. Salt for butter should have a fine, even grain, and be kept in a clean, cool place, free from bad odors. The salt should be fresh and clean. The proper time and place to salt butter is while in the churn. Use about one and one-eighth ounces of salt to each twenty-five pounds of milk separated, or to the number of pounds of milk required to make a pound of butter. Sift on about half of the salt; then tip the churn gradually to turn the salted portion under. Sift on some more, and turn the churn the opposite way till the remainder of the unsalted portion is exposed; then sift on the remainder of the salt. Use a long wooden fork or spade to mix the butter and salt evenly. If

the work is done properly, it will not be necessary to revolve the churn. The butter should remain in the churn, if the room is cold enough; if not, it should be removed to the cold storage room for from two to four hours before working. Salting in the churn is the most perfect method of salting butter, as by that method a more even color is obtained and the texture of the butter is preserved in consequence of less working being necessary. When salting butter on the worker, use about one ounce of salt to one pound of washed butter, and one and a quarter ounces per pound of unwashed butter, varying the quantity to suit the taste of the market. About one-half to three-quarters of an ounce per pound suits the English market when the butter is shipped fresh.

Working the Butter.

Work carefully and evenly all parts of the butter alike, turning in and out and doubling alternately on the revolving worker. When the butter is salted on the revolving worker, the worker should be turned twenty-four times to finish the butter at one working. When the butter is to be worked twice, about eight turns the first time will be sufficient, and say ten turns, or just enough to make the color even, the second time. We prefer working butter twice when packing for export, as in this way we get less moisture, a closer body and a more even color. It is also preferable to the one-working method for the inexperienced butter-maker.

When the butter is salted in the churn, ten to fourteen revolutions of the worker will be sufficient, the aim being to remove the excess of moisture and get an even color. This should be done in every case. The butter, when working, should in no case be colder in winter or warmer in summer than fifty-five degrees.

Packages.

Ash or spruce tubs should be soaked for twenty-four hours with a strong, hot brine, or for two days with a cold brine; then be washed clean and lined with parchment paper. Tubs or boxes lined with paraffin wax should also have parchment paper inside. Pack the butter in the tubs or boxes close around the sides and corners. Fill to within half an inch of the top of the tub and finish off level without giving the butter a greasy appearance. Cover the butter with parchment paper or butter-cloth and put on a paste made of salt and water. Then put into cold storage at fifty-six degrees, or as much lower as the temperature can be kept uniform. Changes in temperature have an injurious effect on the keeping of butter. Fresh brine should be added occasionally to keep the paste on the top of the tub in a moist condition.

Shipping.

The tubs or boxes should be clean and the lids fastened on properly; the weight of butter in all the tubs or boxes should be the same, and it should be marked plainly on the outside of each; about half to three-quarters of a pound extra should be added to each, when filling, to make the butter hold out in weight. When the butter is shipped in one-pound prints, it should be securely protected from the sun in warm weather by the use of ice in the shipping box. A piece of clean brown paper laid over the top of the butter will protect it from the sun and heat.

Cream-Gathering Creameries.

Only competent, honest, courteous men should be employed in or about creameries. It would be of very great advantage to the patrons, if the cream-gatherers had a good knowledge of cream-raising, so as to give instruction where needed. There is enough cream, or butter-fat, lost in the skim-milk through carelessness, neglect and ignorance, to pay the entire cost of manufacturing the butter in most of these creameries. The cream-gatherer should be accurate and just in measuring the cream, taking samples properly, and doing all in his power to promote harmony between the patrons and managers of the creamery.

The waggons should be covered to protect the tanks or cans from the sun, that the cream may be delivered at the creamery as cool as possible. After the cream is strained into the cream vat, the butter-maker should examine its condition regarding temperature and lactic acid. A safe rule in warm weather is to cool the cream immediately to fifty-six or fifty-eight degrees, hold at this temperature over night, and churn at about fifty-eight degrees in the morning. When the cream is delivered cold and sweet in the fall, the temperature should be raised to sixty degrees to ripen. Some fresh buttermilk may be used to hasten the ripening process. The cream may be churned at sixty degrees in the fall. For hints on the effects of temperature in churning and washing, also on salting, working, packing, etc., see "Separator Creameries." Perfect cleanliness and fresh air are extremely important factors in a creamery—so important that, without them, success is impossible.

CREAM-GATHERING CREAMERIES AND THE PRIVATE DAIRY.

By James Stonehouse, Instructor.

Whether the object is to make the cream into butter on the farm or to send it to a creamery to be churned and marketed, the first point to be aimed at should be to get pure, wholesome milk, free from any bad taint or odor.

During the summer months, when cows are on grass, this is not difficult to do; but during fall and winter months, when the cows are housed, the conditions are very much changed, and it is during these months that we find it most difficult to get milk free from undesirable taints and flavors, which come most frequently either from the filthy surroundings of the cow or from food which imparts to the milk an objectionable flavor.

Cleanliness must be enforced at every step of the process of butter-making, if we are to have an A1 product.

All pails and other utensils should be thoroughly washed; then scalded, after which they should be placed outside in a pure atmosphere to be well aired.

Always use a brush for washing milk utensils; and after scalding, allow the heat to dry them.

The milk-room should be kept cool, clean, and sweet. Strain and set the milk as soon as possible after milking; and, if deep cans are used, set in water at a temperature of forty-five degrees or below in summer, and thirty-eight to forty degrees or below in fall and winter.

Every farmer who handles milk should use a thermometer, so that he will know when his milk is cooled to the above temperatures, as the loss of cream or butter-fat is much greater when the milk is cooled to only fifty degrees.

To have profitable returns from the handling of milk, plenty of ice should be provided and stored in a convenient place near the milk room. Milk set in deep cans with plenty of ice to keep the temperature at forty-five degrees or below can be skimmed in twelve hours in the summer; but in the fall and winter, it should stand at least twenty-four hours. The longer milk can stand in covered cans and be kept perfectly sweet the thicker and richer the cream will be.

Thick, rich cream has many advantages over poor, thin cream, which will be treated of under the head of "Churning."

Where the skim-milk is not drawn from the bottom of the can, a skimmer six inches in diameter across the top, without any wire around the edge, and tapering to a point six inches deep, with a handle ten to twelve inches long, will be found very convenient for skimming the cream from the top of the can. If the milk is drawn from the bottom of the can, we would suggest having a bottom with four or five inches of a slant, to carry off any sediment that may be on the bottom; and by having the bottom run down to a point, the skim-milk can be drawn off much closer than can be done with a flat bottom.

The per cent. of butter-fat in the cream depends upon the amount of skim-milk in the cream, as cream is simply tiny globules of butter-fat mixed with skim-milk. The amount of cream depends upon the per cent. of fat in the milk, the temperature to which the milk has been cooled, and the length of time it has been standing. There will be more cream on milk containing four per cent. of fat than on milk containing only three per cent. of fat, and there will be more cream on milk cooled to forty-two degrees than on milk cooled to only fifty degrees, other things being equal. No expensive creamer is necessary to get all the cream out of the milk, so long as the proper temperature is maintained, as it is the temperature of the water around the milk which does the work. Any ordinary box or barrel which will hold water will do the work just as well as the most expensive creamer made, if there is plenty of room for ice around the cans.

If the water in the tank becomes foul from milk spilled into it or from any other cause, it should be changed immediately.

Where ice cannot be procured, nor spring water as low as the temperatures indicated, we would recommend a separator for a herd of fifteen to twenty cows. These separators usually leave about one-tenth of one per cent. of fat in the milk, while milk from deep setting without ice, and cooled to only fifty degrees, usually has about one per cent., or ten times as much loss as separator skim-milk, while if the same milk were cooled to forty-two degrees by the use of ice, the loss of fat would be but from one to three-tenths of one per cent. of fat.

If a separator cannot be had, we would prefer the shallow pan system over the deep setting without ice or cold spring water, as all our experiments go to show that the deep setting without ice, either in summer or winter, causes a large loss of butter-fat in the skim-milk. Many people have the idea that in cold weather ice is not needed, but it is a great mistake, as ice is just as important in winter as in summer.

Where the shallow-pan system is followed, the milk should be set in a clean, cool room at a temperature of sixty degrees or lower for thirty-six hours, but no longer, as the cream is all up by that time and of a better quality than if allowed to remain longer, as the cream, being exposed to the air in warm weather, becomes thick and tough and will not run through the strainer into the churn; and such cream should never be accepted in a creamery, for it is hardly possible to make butter free from white specks from such cream. It is also difficult to make good flavored butter in a creamery from a mixed lot of shallow-pan cream, because there are so few milk rooms that are fit to set milk in; and, if cream takes on a disagreeable flavor from its surroundings, it is impossible to make first-class butter from it. Buyers always look for flavor first, and if that is not good, no other quality in the butter will compensate for its loss, and the price is gauged accordingly.

No dairy farmer should be without a Babcock milk tester for testing the milk of each individual cow and also the skim-milk. Each cow should give at least 6,000 pounds of milk per year, which should make about 250 pounds of butter. Each cow's milk should be weighed and the milk tested to ascertain how much butter-fat the cow is giving. The cow which is giving the largest amount of milk and is perhaps considered the most profitable cow in the herd, may be giving much less butter-fat than another cow which gives a much smaller quantity of milk.

The skim-milk should be tested, that the farmer may know whether he is getting all of the butter-fat out of the milk. We have frequently tested skim-milk from farmers, which showed from one to one and a half per cent. of butter fat, which means a loss of about twenty-five per cent. of all the butter-fat in the milk, or, in other words, the butter from every fourth cow was thrown away in the skim-milk.

Care of Cream.

After the milk has been carefully skimmed, the cream should be kept in a covered can with the temperature somewhat below fifty degrees, and stirred well each time fresh cream is added.

If the temperature of the milk room or cellar is not down to fifty degrees, the cream should be set in ice water, if it is separator or shallow-pan cream; but, if it is from deep setting cans raised with ice, there should be no difficulty in keeping it perfectly sweet in an ordinary cellar, because the temperature is low when the cream is taken from the milk. If the cream is cared for in this way, there will be no complaints about sour cream before it is wanted; and, if the farmer is a patron of a creamery, he will

have done his duty in supplying the butter-maker with the raw material in prime condition for making gilt-edge butter. Cream should never be set in open crocks or pails in cellars, pantries, or any other place where the air is not pure, nor where the temperature is above sixty degrees, as it is sure to sour and will often be in churning condition before it is wanted. When the cream can is emptied, it should be thoroughly washed and scalded and placed where it will get plenty of fresh, pure air before it is again needed.

Churning in the Farm Dairy.

The preparation of the cream is the first thing to be thought of, and that should commence at least eighteen hours before churning, if the cream has been kept sweet up to this time.

The first thing to be done is to raise the temperature up to a point at which the acid will begin to develop; and, where no starter is used this will usually be about sixty-five degrees. This is easily done by placing the cream can in a tub of warm water at ninety or a hundred degrees and stirring constantly until sixty-five degrees is reached. Care should be taken in warm weather that it does not go much above this temperature. If it does, the cream is liable to become too sour or overripe before churning time.

If the cream has a slightly acid taste before bringing it from the cellar, it should not be raised above sixty degrees, and that not more than twelve or fourteen hours before churning time.

In cold weather, it is advisable to use a starter, so that the cream may sour more rapidly and at a lower temperature, as cream ripened at a high temperature and kept there till near churning time makes soft butter of a poor texture. A good plan to secure a starter is to take a quart or so of the ripened cream, if it is of a good flavor, and put it into the cream can which is to hold the cream for the next churning, care being taken to keep the temperature low enough (fifty degrees) to prevent the acid germs from developing until the cream is warmed up for ripening, when the acid will develop rapidly. In this case the temperature need not be over sixty degrees to secure sufficient acid or ripeness in eighteen hours. Repeat the starter as before.

The temperature at which cream can be churned varies from fifty to seventy degrees. Where a separator is used and the cream-screw is gauged to give cream with twenty-five to thirty per cent. of fat in it, it can be churned at a temperature of forty-eight to fifty-two degrees, and the butter from such cream comes much firmer, while the loss in the butter-milk is less than from thin cream. The ordinary dairy cream usually has about sixteen to eighteen per cent. of fat in it, and must be churned at fifty-

eight to sixty-two degrees in summer and from sixty-two to sixty-four degrees in winter. The cream should always be strained into the churn to break up any pieces of curd. The time of churning will vary with the temperature of the cream, the breed of cows, and the time they have been giving milk.

Cream with sixteen to twenty per cent. of fat in it and at the right temperature will churn and gather into granules without the addition of any water; but cream with twenty-five to thirty per cent. of fat will thicken up in the churn, so that concussion will cease. At this stage, about ten per cent. of water at the temperature of the cream should be added; and, when it breaks, the same quantity, two or three degrees lower, should be added, so as to prevent the granules from massing together, and to give the butter sufficient liquid to float in, so as to get a good separation from the butter milk. When the granules are about the size of wheat kernels, draw off the butter-milk; then wash with sufficient water to keep the granules apart and at a temperature a little lower than the churning temperature of the cream; and, if the butter is to be packed or held for a market, repeat the washing until the water comes off clear.

Salting in the churn is coming largely into vogue, and we recommend it very strongly as the best method of salting butter, for the reason that we can have our butter free from specks and streaks with the least possible amount of working.

If this method is to be followed, a churn without dashers should be used, and the water for the last washing should be cold enough to harden the butter granules, so that they will not easily mass together while the churn is being revolved after the salt has been added. This is the main point in salting in the churn, and must be carefully guarded to insure good results.

After the washing is done, let the butter drain for fifteen minutes; then salt with one and one-eighth to one and one-quarter ounces to the pound, as considerable of the salt is carried off with the water left in the butter; tip the churn backward and forward as the salt is being added; then revolve the churn very slowly a few times and let it stand for fifteen minutes, after which revolve till the butter masses into a lump. (It should be hard enough to stand revolving four or five minutes before massing.) Now let it stand in the churn or put it away in the butter tray for about three hours, when it will be ready to make up for market with a very slight amount of working, as the salt has been thoroughly mixed with the butter in the granular state, and most of it is already dissolved.

CHEESE MAKING.

By T. B. Millar, Instructor.

Spring Cheese.

In cheese-making, as in all lines of dairying, in order to gain the best results, cleanliness must be observed in every particular by patron and maker alike, the cheese-maker being careful to reject all tainted or sour milk, as first-class goods can be made only from first-class material.

For early cheese, heat the milk to eighty-four degrees or eighty-six degrees Fahr. Stir the milk gently while heating, for quick or rough stirring at this stage causes a loss of butter-fat. The rennet test should then be made as soon as possible, to ascertain the degree of ripeness. To make the test, to eight ounces of milk at a temperature of eighty-six degrees, add one dram of rennet (of known strength), and stir rapidly for ten seconds. If coagulation takes place in from eighteen to twenty seconds, the milk is sufficiently matured, and the rennet should be added at once. If a piece of match one-half inch long be dropped in the milk as the milk is started in motion around the glass, the instant that coagulation takes place can be readily noted by the sudden stopping of the piece of stick. It may be necessary to vary the test a few seconds to suit the conditions of different localities, but with judgment a few trials will enable the maker to tell just when the milk is matured sufficiently for setting

Ripen the milk so that sufficient acid for dipping will develop in two and a half hours after setting. When dipped, the curd should not show more than one-eighth inch acid by the hot iron test. Great care and watchfulness should be exercised at this stage, as the acid develops very rapidly.

Use sufficient rennet (from three to five ounces per 1,000 pounds of milk) to coagulate the milk fit for cutting in from fifteen to twenty minutes. The curd is then cut by using, first, the horizontal knife and then the perpendicular one, cutting continuously until completed. Commence cutting early, taking plenty of time to do it properly.

Stir the curd gently with the hands for ten minutes before any steam is turned on, and be sure that the curd is free from the sides of the vat before applying the steam. Rough handling at this stage means a loss, both in quantity and quality, as a greater percentage of butter-fat will be lost in the whey.

Heat the curd slowly to ninety-eight degrees, taking from about thirty to thirty-five minutes to do so. After the heat is up to the desired point, continue stirring for fifteen or twenty minutes to insure uniform cooking. Draw off a portion of the whey early, stirring

occasionally; then dip the curd with a small acid, from one-sixteenth to one eighth inch, as shown by the hot iron test. Stir well in the sink to let the whey escape before allowing to mat. When the curd is matted firm enough to stand handling without breaking, cut into narrow strips (about six inches wide) and turn every ten or fifteen minutes, or often enough to prevent the whey from gathering in pools on the curd. After they are turned once or twice, these strips may be piled two deep. Keep the temperature at from ninety to ninety-four degrees until the curd is ready for milling. Mill early—as soon as the curd becomes flaky and shows three-quarters of an inch acid by the hot iron test.

Air well by stirring, and salt the curd when it becomes mellow, feels like velvet, and smells like newly-made butter. Use some brand of pure dairy salt, salting at the rate of one and a half to two pounds of salt per 1,000 pounds of milk. At the time of salting, the temperature of the curd should be from eighty-three to eighty-six degrees; and when the salt is thoroughly dissolved, put to press, having the temperature about eighty degrees.

Apply the pressure gently at first, until the whey begins to run clear, then gradually increase the pressure. After the cheese have been in the press forty-five minutes, or rather longer, take them out, pare off all shoulders, and bandage properly by pulling up the bandage neatly, leaving no wrinkles on the side, and trimming the ends so as to leave about three-quarters of an inch of bandage on each end. Turn them in the hoops in the morning, allow them to remain in the press at least twenty hours, and see that each cheese is finished perfectly before allowing it to be taken to the curing-room. The curing-room should be kept at an even temperature of from sixty-five to seventy degrees, and should be well ventilated.

NOTE.—When quick curing cheese is not desired, use less rennet and more salt.

SUMMER CHEESE.

Heat the milk gradually to eighty-six degrees Fahr., and make a rennet test. In very hot weather, it is advisable to make the test before the temperature quite reaches the eighty-six degrees, as it will show how quickly acid is likely to develop. Endeavor to have the milk ripened, so that the curd will be ready to dip with one quarter of an inch acid in from two and one-half to three hours from the time the rennet is added.

Use enough rennet to have perfect coagulation, fit for cutting, in from thirty to thirty-five minutes.

Commence cutting early. See directions for cutting, stirring, and cooking the curd under the heading of "Spring Cheese."

Draw off a portion of the whey early, so as to be prepared for the quick development of acid. Dip the curd when it shows from one-eighth to one-quarter inch acid, and continue to stir by hand until the curd is sufficiently dry before allowing to mat. When matted, cut into convenient strips and turn every ten or fifteen minutes, piling a little deeper each time it is turned, and leaving a space between each column to allow the whey to escape.

Mill early, or when the curd becomes flaky and shows from one to one and one-quarter inch acid by the hot iron test; then air well by stirring immediately after milling.

Mature well before salting. In salting, use at the rate of two and one-half to two and three-quarter pounds of salt per 1,000 pounds of milk; the amount of salt used is regulated by the amount of moisture in the curd.

In warm weather, endeavor to lower the temperature of the curd as much as possible before putting to press.

Fall Cheese.

In making fall cheese, the system is similar to that used in making summer cheese, excepting the following points of difference:

If the milk is working slowly, use some clean flavored starter.

Use enough rennet to have coagulation take place in from forty to forty-five minutes.

Set the milk so that it will be ready to dip, with one-quarter inch acid, in from two and three-quarters to three hours time after setting.

Keep the curd warm, about ninety degrees, until ready for milling. Mill when the curd becomes flaky, showing one and one-quarter to one and one-half inch acid.

Salt at the rate of two and three-quarters to three pounds salt per 1,000 pounds of milk, and put to press at a temperature of from eighty to eighty-five degrees.

Leave the cheese in the press one hour before bandaging.

In the case of gassy milk, note the following points:

The milk should be matured more than usual before setting (some two or three seconds more.)

When cutting the curd, be careful to leave the cubes larger, so as to retain more moisture; then stir for fifteen minutes before turning on the steam.

When cooking, heat slowly to ninety-six degrees, raising it to ninety-eight degrees just before dipping.

Dip the curd with one-quarter inch acid, and do not stir much in the sink after dipping.

Turn frequently, at the same time piling the curd three or four deep in the sink; then mill when the curd becomes flaky, showing one and one quarter inch acid. Air and mature well before salting.

In handling overripe milk, set the milk as soon as possible at a lower temperature than usual, at from eighty to eighty-four degrees; then, as always, make a rennet test. In a case of this kind more rennet should be used, from one-half to one ounce extra per 1,000 pounds of milk.

Commence to cut the curd early, cutting finer than usual, thus enabling you to cook the curd more quickly.

A portion of the whey should be drawn off as soon as possible; and when it can be managed, the curd should be dipped with less acid than usual and then well stirred before allowing it to mat in the sink.

Mill early, or when the curd shows three-quarters of an inch of acid, and try to have the curd in a flaky condition at this stage.

Do not be in a hurry to salt a curd of this description; for if it has been milled at the proper time and well stirred, there is no danger of its getting too much acid in the sink.

With tainted milk, heat to eighty-eight degrees and air frequently by dipping or pouring, until the milk is ready for setting. If you have a sharp, clean flavored starter, it will be an advantage to use a little extra with milk of this kind.

When the curd is heated to ninety-eight degrees, draw off a portion of the whey, and just before the curd is ready for dipping raise the temperature two degrees and stir well.

Dip the curd with a small amount of acid, about one-eighth inch, endeavoring to have it in such a condition that it will not require much stirring in the sink, and keep up the temperature to ninety-two or ninety-four degrees until the curd is ready for milling. Mill when the curd is in a flaky condition and shows one inch acid. Air by frequent stirring and mature well before salting.

When making colored cheese, pour the coloring into a large dipper of milk taken from the vat, then draw the dipper quickly along under the surface of the milk from one end of the vat to the other, and make sure that it is thoroughly mixed before the rennet is added.

The rennet should be diluted with one gallon of pure water to each vat, and the milk should be well stirred for from three to five minutes according to the condition of the milk, after the rennet has been added. In the case of overripe milk, two minutes will be ample time to stir after adding the rennet.

Everything in and about the factory should be kept scrupulously clean.

A STARTER.

By R. W. Stratton, Assistant Instructor.

A starter is some milk in which the lactic acid has been allowed to develop, and is used to hasten the ripening of milk.

A suitable can for keeping it in should first be provided; one similar to the ordinary cream gathering can will do, having double walls with a hollow space between. It should have two lids, one fitting closely inside of the can with a flange to keep it from going below the shoulder, and the other covering over all and fitting close to the outside.

In preparing the starter, use only milk of the best quality, which has been well aired, and is free from any foreign flavor. It is better to use the same patron's milk each day, endeavoring to arrange with some one whom you know to be scrupulously clean, and who has some fresh milkers in his herd, as the acid in milk from fresh cows will develop much faster than in milk from those that are farther advanced in the period of lactation.

Save about twenty pounds for each vat and raise it to a temperature of from eighty to eighty-five degrees; then add one pound of the previous day's starter for every twenty-five or thirty pounds of the fresh milk saved; mix all thoroughly and allow to stand for about one hour. Then add about one-third as much water as there is milk, (in warm weather the water may be added at the time of adding the old starter), stir well, cover up closely, and set in a clean, warm room where an even temperature can be maintained, and do not disturb it until required for use.

Before using, it will be better to remove from one-half to two inches from the surface of the can, as the flavor on the surface will not be found so good as that which is below. Then break up the remainder by stirring it in the can, take out what is required, and pour from one pail to another a few times, when it will have a creamy consistency and be ready for use.

It is better, whenever practicable, to Pasteurize the milk used in making the starter, as it insures a better and more uniform flavor. Especially when making it in small quantities, we would recommend Pasteurizing by following the rule given in the creamery work.

When and How to Use a Starter.

Just when and how much to use cannot be definitely stated. It must be determined by the exercise of good judgment. Suffice it to say, that it is better to err on the safe side, by using too little rather than too much. First apply the rennet test, to be sure of

the acidity of the milk, before adding the starter. A starter may be used with advantage at all times with gassy milk, and in cold weather when milk is being delivered at the factory very sweet. If it is known for a certainty that all the milk being delivered in the vat is perfectly sweet, a little may be added on the start; but the bulk should always be kept until the condition of the milk has been ascertained by the rennet test. Do not ripen the milk so low by two or three seconds when using a starter.

Let it always be remembered that while a good, clean-flavored starter can be used to advantage, a poor flavored one should never be used under any circumstances, as it would spoil the flavor of the whole vat.

MILK TESTING.

By J. W. Mitchell, B.A., Instructor.

Milk-testing is the determination of the quality of milk as regards the per cent. of fat and other constituents in it.

The two instruments commonly made use of in the testing of milk are the Babcock tester, used to determine the per cent. of fat in milk, and the lactometer, to determine the specific gravity of milk.

These two instruments at hand, we are enabled not only to determine the relative values of different milks delivered to a factory, but also to detect the various adulterations of milk.

Babcock Test.

The following is a brief explanation and outline of the Babcock test:

The scale on the neck of the ordinary test bottle is graduated to give a reading of the per cent. of fat only when eighteen grams are used in the test, *i.e.*, the fat extending over one of the larger divisions of the scale weighs *one per cent.*, or the one-hundredth part of eighteen grams. This fact, borne carefully in mind, will explain the various rules for determining the per cent. of fat when eighteen grams cannot be used in a test, as in the case of cream or cheese, in which the per cent. of fat is high.

Note.—The capacity of that part of the neck over which the scale extends is two cubic centimetres (c. c.), and of one of the larger divisions of the scale is .2 (2-10) c. c. Hence, the specific gravity of fat being .9 (9-10), the weight of the fat extending over one of the larger divisions of the scale is $.9 \times .2 = .18$ of a gram.

To Test Milk.

1. By means of a 17.6 c. c. pipette take eighteen grams of milk. Have the milk at a temperature of sixty to seventy degrees.

2. To this, add 17.5 c. c. of commercial sulphuric acid, having a specific gravity of 1.82 to 1.83, and thoroughly mix the acid and milk by giving the bottles a gentle rotary motion.

3. Place the bottles in the machine and turn for about five minutes at a speed varying from 700 to 1,200 revolutions per minute, according to the diameter of the machine (700 revolutions per minute with a machine twenty inches in diameter and faster for a smaller machine.)

4. Add water at from 130 to 150 degrees to bring the fat up into the neck of the bottle.

5. Turn the machine again for about two minutes, and take the reading before the fat cools.

Notes.

1. Be sure that the scale on the bottle is properly graduated. The most convenient way of doing this is to test the same milk in the different test-bottles and compare the readings. A bottle that differs by more than .2 (2-10) in its reading from the rest should be discarded. As the capacity of that part of the neck over which the scale extends should be two c. c., the accuracy of the scale may be tested by filling the bottle to the bottom of the scale with water at the temperature of the room, and then adding two c. c. of water at the same temperature by means of a two c. c. pipette.

2. Mix the milk well to obtain a representative sample. Mix by pouring from one vessel to another, as violent shaking is liable to churn it.

3. Be very careful to measure the exact amount of milk for a test, and to blow the pipette out well.

4. The amount of acid used must be varied to suit its strength. The right amount has been used when the fat presents a bright, golden appearance. Acid that is much too strong or too weak should be discarded, as satisfactory results cannot be obtained from its use.

5. Hold the test-bottle at a slant when pouring in the acid, to prevent the acid from falling directly upon and charring the milk.

6. If the temperature of the room be low, it is very necessary to pour hot water into the testing machine to keep up the temperature.

7. The water added to the test-bottles should be soft or distilled. If hard water be used, add a little sulphuric acid (four or five c. c. to a gallon of water) to soften it; this will prevent the appearance of foam above the fat.

8. Correct readings can never be taken when the fat has cooled. In such cases, set the bottles in hot water before taking a reading. *Always* do this when you have several readings to take. Adopt some *constant* temperature, not below 120 degrees and not above 150 degrees, for the water used for this purpose.

9. A pair of dividers, or compasses, is excellent for taking the length of the column of fat in reading. Read from the highest to the lowest point on the column.

10. The following are the causes of cloudy or burnt readings:

(1) The use of too much or too strong acid.

(2) Allowing the acid to fall directly upon and burn the milk.

(3) Shaking the bottle violently or with an up and down motion, when uniting the acid and milk.

(4) Having the milk at too high a temperature when adding the acid—the higher the temperature, the less acid is required.

(5) Allowing the bottles to stand too long, after adding the acid, before shaking them, will cause dark spots in the fat.

11. Light colored readings and floating particles of curd are due to—

(1) The use of too little or too weak acid.

(2) Having the milk or the acid at too low a temperature—the lower the temperature of either the more acid is required.

NOTE.—Better always to bring the milk to the right temperature (sixty to seventy degrees).

(3) Insufficient shaking of the bottles to unite the milk and acid.

12. See that your test bottles and pipettes are clean before using.

13. After using bottles, rinse them at least twice with hot water. Rinsing with sulphuric acid before rinsing with water, or else using a little sal soda in the first water, is often found necessary.

14. Care and attention to details are the great requisites for accurate milk-testing.

SKIM-MILK, BUTTERMILK, AND WHEY.

1. Skim-milk, buttermilk, and whey may be tested in the ordinary bottle, just as whole milk is tested, taking 17.6 c. c. (or eighteen grams) in the test.

NOTE.—Whey requires only about two-thirds the usual amount of acid.

2. As the per cent. of fat is so small in skim-milk, buttermilk, and whey, a better method of testing these is by the use of the "skim-milk bottle," which has a double-sized bowl. To make the test, using this bottle, take a double measure (2×17.6 c.c.) of the milk or whey, and a corresponding amount of acid, and proceed with the test as in the case of whole milk. In taking the reading, we must call one of the small divisions on the scale .1 (1-10th) instead of .2 (2-10ths) of one per cent., since we have taken a double quantity in our sample, and the scale on the neck of the bottle is just the same as on the ordinary bottle.

To Test Cream, using the Ordinary Test Bottle.

1. By the use of a 6.04 c.c. pipette, take six grams of cream, and to this add twelve c.c. of water to make a mass of eighteen grams in all. Add the usual amount of acid (17.5 c.c.) and proceed as in testing milk. The reading must be multiplied by three to obtain the per cent. of fat in the cream.

2. Another way is by using the ordinary pipette. Take 17.6 c.c. of cream and to this add twice 17.6 c.c., or two pipettes, of water, and mix thoroughly. Then take 17.6 c.c. of the diluted cream and put into the test bottle, add the usual amount of acid and proceed as in testing milk. Multiply the reading by three to obtain the per cent. of fat in the cream.

Weighing instead of measuring the cream is an excellent plan when there are gram scales at hand.

To Test Cheese.

Obtain a representative sample of cheese by taking a plug extending from the outside well to the centre of the cheese; cut this into small strips extending from end to end of the plug, and by the use of gram scales weigh out say five grams of cheese—the amount generally taken. To this add twelve to fifteen c.c. of water at about 130 degrees, and shake the bottle to dissolve the cheese. Add 17.5 c.c., or the usual amount, of acid, and proceed as in testing milk.

To obtain the per cent. of fat in the cheese multiply the reading by eighteen, and divide by the number of grams used in the test. If other than six grams of *cream* be taken in a test, this rule may be applied to find the per cent. of fat.

The Lactometer and the Detection of Adulterations in Milk.

The lactometer is a specific gravity measurer of milk. There are several kinds of lactometers, but the Quevenne lactometer being the most suitable for milk testing, is the one that we shall here describe.

By means of the Quevenne lactometer we compare the density of milk at sixty degrees F. with that of pure water at sixty degrees. It has a scale graduated from fifteen to forty, and indicates a specific gravity of from 1.015 to 1.040. As it is not always convenient to have milk at sixty degrees when taking a lactometer reading, corrections for temperature are made as follows: To obtain the *corrected* lactometer reading, or reading at sixty degrees, add .1 (1-10th) to the lactometer reading for each degree in temperature above sixty degrees, and subtract .1 (1-10th) from the reading for each degree in temperature that the milk is below sixty degrees. Thus, if the lactometer reading at a temperature of sixty-five degrees be thirty-one, the corrected lactometer reading is $31 + .5 = 31.5$; if the lactometer reading be 32.5 and the temperature fifty-seven, the corrected lactometer reading is $32.5 - .3 = 32.2$. This rule is practically correct, if the temperature be kept within a range of from fifty to seventy degrees.

The lactometer reading of pure milk usually ranges from thirty to thirty-two, although it may fall as low as twenty-seven or go as high as thirty-four. The lactometer reading of skim-milk varies from thirty-three to thirty-six.

The composition of milk is about as follows:

Water	86 to 88 per cent.
Fat	3 per cent. and upwards.
Solids not fat	8.5 to 9.5 per cent.

To Find the Per Cent. of Solids not Fat (S.N.F.) in Milk.

Both the per cent. of fat and the lactometer reading at sixty degrees are required in finding this. Every per cent. of fat in milk lowers the lactometer reading by *one* from what it would be if the fat were not present. Hence, to obtain what the lactometer reading would be, if the fat were not present to interfere, we must add the lactometer reading and the per cent. of fat together. This obtained, then every reading of four on the lactometer is due to the presence of one per cent. of solids not fat in the milk. Hence the rule: To find the per cent. of solids not fat (S.N.F.) in milk, add the lactometer reading at sixty degrees (L.) and the per cent. of fat (F.) together and divide by four. Expressed briefly thus:

$$\frac{L. + F.}{4} = S.N.F. \text{ (per cent. solids not fat).}$$

L. = corrected lactometer reading, or reading at sixty degrees.

F. = per cent. of fat.

Example.—Let the lactometer reading of a sample of milk a sixty-four degrees be thirty-one, and the per cent. of fat three. Find the per cent. of solids not fat.

Corrected lactometer reading, $31 + .4 = 31.4$

$$\frac{31.4+3}{4} = \frac{34.4}{4} = 8.6 \text{ per cent. S.N.F.}$$

Watered Milk.

To find the per cent. of pure milk in a watered sample of milk, multiply the per cent. S.N.F. in the watered sample by 100, and divide by the per cent. of solids not fat in the pure milk. This subtracted from 100 will give the per cent. of extra or extraneous water in the milk. To take an example:

L. reading of watered sample 26.5, temp. 55, per cent. of fat 2.8;
L. reading of pure milk 32, temp. 65, and per cent of fat 3.5.
Corrected L. reading of watered sample, $26.5 - .5 = 26$.
Corrected L. reading of pure milk, $32 + .5 = 32.5$.

$$\frac{26+2.8}{4} = \frac{28.8}{4} = 7.2 \text{ per cent. S.N.F. in watered sample.}$$

$$\frac{32.5+3.5}{4} = \frac{36}{4} = 9 \text{ per cent. S.N.F. in pure milk.}$$

Therefore, according to the rule given above,

$$\frac{7.2 \times 100}{9} = \frac{720}{9} = 80 \text{ per cent. of pure milk in the watered sample.}$$

$100 - 80 = 20$ per cent. of extra water in the watered sample.

Note.—When a sample of the pure milk cannot be obtained, use 8.5 in he early part of the season and 9 in the latter part for the per cent. S.N.F. in pure milk.

Points to be Observed.

1. Have the temperature of the milk uniform throughout and as near to sixty degrees as possible when taking the lactometer reading.

2. Always mix the milk well before taking the lactometer reading.

3. A lactometer reading should not be taken when milk is froth ing or foaming.

4. Milk fresh from the cows is saturated with air and should be allowed to stand an hour or more to reach its maximum density, before the lactometer reading is taken.

5. Have the lactometer free from the walls of the vessel and perfectly still when taking a reading.

6. A high lactometer reading accompanied by a low per cent. of fat is indicative of skimming.

7. A low lactometer reading accompanied by a low per cent. of fat is indicative of watering.

8. A normal lactometer reading with a *very* low per cent. of fat indicates both watering and skimming.

Composite Test.

In many butter and cheese factories at the present time, payment is made not according to the old "pooling" system of paying according to the weight of the milk, but by taking the quality as well as the quantity of the milk into consideration—the patron is paid according to the number of pounds of fat, or fat and casein, which he furnishes to the factory. A test of the milk cannot be made daily; so to overcome the difficulty, a small sample, say an ounce, of milk is taken from the milk furnished by each patron and put into a separate bottle or sealer in which is a small amount, five to ten grains (or what will lie on a ten-cent piece) of bichromate of potash. This amount of bichromate will preserve it in a liquid condition for from one to two weeks, at the end of which time a test of the sample is made in the usual way with the Babcock tester to obtain the average per cent. of fat in the milk furnished by the patron during the time. Knowing the per cent. of fat in the milk, one can calculate the number of pounds of fat furnished by the patron.

Points to be Observed in Composite Testing.

1. Be sure to obtain a representative sample from the weigh can.

2. Keep the bottles in a cool place and well corked.

3. The amount of bichromate to be used depends largely upon the weather and the time over which the test extends.

4. Too much bichromate will give rise to unsatisfactory tests, with cloudy readings.

5. Give the bottle a gentle rotary motion every day, after taking a sample, to keep down the cream and to mix the new sample with that containing the bichromate.

6. When the time for testing comes, set the bottles in warm water (one hundred to one hundred and twenty degrees) to melt the cream adhering to the walls of the bottle, and also to melt any other portion of the cream that would not otherwise mix readily with the rest of the milk.

7. Mix the milk well, before taking a test, by pouring from one vessel into another.

8. Proceed with the Babcock test of a composite sample, just as in the testing of ordinary milk.

9. Add the water to the test bottles at two different times, rather than all at once, filling the bottles about to the neck the first time. A clearer reading is thus obtained. Turn the machine about a minute or a minute and a half after each addition of water.

10. Set bottles in hot water before taking the readings.

Payment According to Quality.

While in creameries payment according to quality is always made in proportion to the amount of fat furnished by each patron, in cheese factories two different methods of payment exist:

(1) According to the per cent. of fat in the milk, as in creameries.

(2) By taking into consideration the casein, as well as the fat, of milk. As the per cent. of casein in milk is fairly constant, some constant number, as 2, is added to the per cent. of fat to allow for the casein in the milk.

To illustrate the difference between the two methods: If A and B send *equal quantities* of milk to a factory, testing 3 per cent. and 4 per cent. fat respectively, then, according to the first method, their dividends would be in the ratio of 3 to 4; while, according to the second method, taking 2 to represent the per cent. of casein in milk, they would be paid in the ratio of 3 + 2, *or 5*, to 4 + 2, *or 6*.

To make a division of money according to the second, or fat-casein method, taking 2 to represent the per cent. of casein in milk:

During a certain month milk is furnished to a cheese factory by three patrons, as follows:

A.... 3,462 pounds milk, testing 3.1 per cent. fat.
B.... 5,220 " " " 3.6 " "
C.... 8,371 " " " 4.0 " "

From the above milk are made 1,650 pounds cheese. The cheese sells for 9¾c. a pound and it costs 1½c. to manufacture it; net value of a pound of cheese (9¾c. − 1½c.)=8½c.; 1,650 pounds cheese at 8½c. are worth (1,650 × 8½c.)=$140.25. As seen below, there are 971 pounds of fat and casein.

971 pounds fat and casein are worth.... $140.25

1 pound " " is " .... $\frac{140.25}{971}$ =14.443c.

Name.	Pounds milk.	Per cent. fat.	Per cent. fat and casein.	Total pounds fat and casein.	Value at 14.443c. per pound.
A	3,462	3.1	5.1	176.5	$25.49
B	5,220	3.6	5.6	292.3	42.21
C	8,371	4.0	6.0	502.2	72.53
Total	.....	.....	.....	971.0	$140.23

Oil Test.

This is a churning process for the purpose of ascertaining the richness of cream in butter-fat, and is used mostly in cream-gathering creameries. To make the test: About half fill the glass tubes or bottles with cream, cork them tightly and place in the tin case to receive them.

Next place the bottles in water at from eighty five to ninety degrees to heat the cream to this temperature. Then place in the oil test churn and begin the churning process. Should the cream at any time cool and thicken, place the bottles in warm water again to reheat it to the churning temperature. Continue churning until there is evidence of a clear separation of the fat; then place the bottles in hot water at from 160 to 170 degrees for from fifteen to twenty minutes.

If the separation is complete, the fat will be clear and yellow, and there will be three distinct columns with sharp lines of division between them, viz., a column of oily fat on top and one of whey next, with the casein at the bottom. If there be not a clear separation, cool down to about ninety degrees, churn again, and proceed as before.

To Take a Reading. There is a chart prepared for the purpose. Placing the bottle in an upright position on the "base line" of the chart, move it along until, looking by the right side of the bottle, the top of the column of fat comes even with the top slanting line on the chart. Next, still looking by the right side of the bottle, observe the line to which the bottom of the at comes; the number on this line gives the reading.

Meaning of the Reading. Cream that gives a reading of 100 in the oil test will make one pound of butter for every inch of such cream in a cream pail twelve inches in diameter; an inch of cream testing 120 will make 1.20 pounds of butter, etc.

Notes. 1. Be sure that the cream for this purpose is well ripened, placing some in a warm place over night, if necessary, to ripen it.

2. It is advisable to pull the corks and let the gas out of the bottles a few minutes after beginning to churn.

3. Sometimes the fat, though clear, is somewhat open. In such cases, allow the fat to become cold, and then place in water at about 120 degrees before taking a reading. About 120 degrees is perhaps the best temperature at which to take all oil test readings.

4. An inch of cream testing 100 (or its equivalent of cream of another grade) in a pail twelve inches in diameter is what is known as a *creamery inch.*