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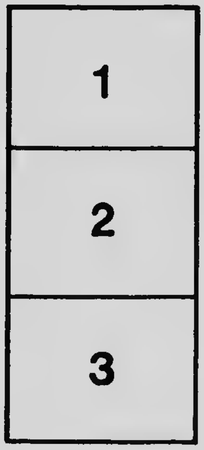
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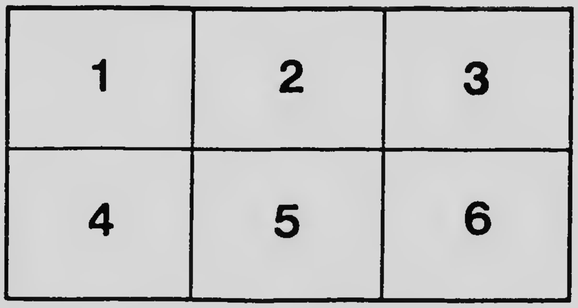
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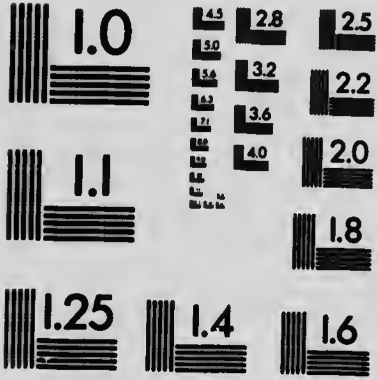


BULLETIN 205.] OCTOBER, 1912.

Ontario Department of Agriculture.

ONTARIO AGRICULTURAL COLLEGE

DAIRY SCHOOL BULLETIN

Part I.

Cheese Making and Butter Making.

INTRODUCTION.

The supply of Dairy School Bulletin, number 172, published in May, 1909, is exhausted. It has been thought well to issue two bulletins to take its place, one for the use of farmers, and the other of special interest to cheese and butter makers.

Factorymen who are desirous of securing a copy of the bulletin published in the interests of the farmers may do so upon application to the Ontario Department of Agriculture, Toronto.

While the bulletin presented herewith is quite complete, cheese and butter makers will find additional information of value in the annual reports of the Dairymen's Associations. These reports may be secured upon application to the Department.

It is gratifying to note the hearty co-operation on the part of the makers and producers with the dairy instructors of the Province in their efforts to raise the standard of cheese, and establish uniformity. While much improvement has been made during the past few years in factory conditions and methods of work, we must be prepared to make still further advance, if we are to maintain the proud position which Ontario cheese now holds in the British markets.

THE ALKALINE SOLUTION: ITS PREPARATION AND USE.

By R. Harcourt, B.S.A., Professor of Chemistry.

Causes of Acidity in Milk. The development of acid is caused by the breaking down of milk sugar into lactic acid, through the influence of certain acid-forming ferments in the milk. But even sweet milk, immediately after it is drawn from the udder, will have an acid reaction with certain indicators. This acidity is not due to lactic acid nor any free acid in the milk, but to the acid nature of the ash constituents, possibly also to the carbonic acid gas it contains, and to the acid nature of the casein. When phenolphthalein is used as an indicator, freshly drawn milk will generally show as much as .10 per cent. of acid and immediately after exposure to the atmosphere, lactic acid germs commence breaking down the milk sugar. At a temperature of 70° to 90° F., these germs multiply at an enormous rate, consequently lactic acid will develop very rapidly in milk during a warm or sultry day or night. Cooling retards the action, but even at a temperature of 40° to 50° F. they will multiply and considerable lactic acid will be formed. Milk intended for cheesemaking should not contain more than .20 per cent. acid when delivered at the factory; where as it does not usually smell or taste sour until it contains .30 to .35 per cent. A further development of acid will cause the milk to curdle, or, in other words, will produce coagulation of the casein. There is, however, a limit to the development of acid; for, after a certain point, the germs which break down the milk sugar are destroyed by the acid they produce, and there is no further increase in acidity.

In many ways a knowledge of the acid contents of milk or its products is of value. In most cases, a determination of the percentage of acid in the milk when delivered at the factory will indicate the care the milk has received previous to that time. The acid test may be of value in selecting milk best adapted for pasteurization, or for retail trade, or manufacture of high-grade products. At the present time, however, the chief uses made of the alkaline solution in dairy work are to determine the acid in cream intended for churning, and the acid in milk and whey in the various steps in the process of the manufacture of cheese. Both in ripening cream and in cheesemaking, acid is developed, and the alkaline solution is now frequently used to measure the amount of acid present and thus control the work.

How to Measure the Acidity. The measurement of the amount of acid or alkali in a solution depends upon the fact that it always takes a definite quantity of alkali to neutralize a definite quantity of acid. Thus, for instance it always takes a definite quantity of caustic soda to neutralize a definite quantity of lactic acid, sulphuric acid, or any other acid. If, then, we know the strength of a given caustic soda solution and measure the amount of it used to render a definite amount of milk or cream neither acid nor alkaline, but neutral, we can figure the amount of acid in the sample taken. To make such a determination we require the following:

1st. A standard solution of caustic soda, usually made of the strength known as .111 normal.

2nd. An indicator—some chemical which, added to the milk, indicates by change of color when enough of the alkaline solution has been added to render the milk neutral. Phenolphthalein is the one most commonly used for this purpose. It is made b[illegible]solving 10 grams of phenolphthalein in 300 c.c. of 80 per cent. alcohol.

3rd. A burette, graduated to 1-10 of a cubic centimeter, in which to measure the amount of the solution [illegible]sed.

4th. A pipette, to measure the milk or cream.

5th. A glass or porcelain cup, and a stirring rod. A complete outfit suitable for use in butter and cheese factories may now be procured from almost any of the dairy supply firms.

For the information of those who want to make their own alkaline solution or who may wish to check the strength of a solution on hand, the following directions are given:

Preparation of Solutions. The caustic soda solution may be prepared by a druggist or one who has a delicate balance at hand by carefully weighing out 4.4 grams of pure sodium hydroxide and dissolving in one litre (1,000 c.c.) of water. But impurities in the sodium hydroxide and lack of delicate enough balance make this method unreliable.

The most accurate way of preparing this solution is by standardizing it against an acid diluted to the same strength as the alkaline solution wanted. As it requires an experienced chemist to prepare this acid of the strength required, it is important that it be got from a reliable source.

Having on hand, then, a .111 normal solution of acid, the object is to make a solution of the alkali, 1 c.c. of which will exactly neutralize 1 c.c. of the acid. For this purpose, dissolve 5 grams sodium hydroxide (NaOH) in one litre of water. If the soda contains much carbonate, it must be removed by adding a little of a solution of barium hydroxide, boiling, and filtering off the precipitated carbonates. The relative strength of the acid and alkali solution is next determined. This is done as follows:

Rinse out a clean burette two or three times with the acid solution, and then fill it with the same. Note the exact point at which the surface of the liquid stands in the burette; measure out 10 c.c. of the alkaline [illegible] and deliver into a clean beaker, glass or porcelain cup. Dilute [illegible] 50 c.c. of water, add three or four drops of the phenolph[illegible]ndicator, and then stirring all the time, let the acid from the [illegible]op slowly into the alkaline solution, until the color first pro[illegible] by the indicator is just destroyed. This is the neutral point. Now, again note the exact point at which the surface of the liquid stands in the burette. The difference between the two readings is the amount of acid required to neutralize the 10 c.c. of alkali. If care be taken in coming to the neutral point slowly, it will be seen that one drop finally destroys the last of the light pink color. This work should be repeated until accuracy is assured. The following is an example of results:

1st. 10 c.c of alkali required 11.5 c.c. of acid for neutralization.

2nd. 10 c.c. of alkali required 11.45 c.c. of acid for neutralization.

3rd. 10 c.c. of alkali required 11.5 c.c. of acid for neutralization.

In this case, we would accept 10 to 11.5 as the relative strength of the two solutions. The alkali is, therefore, the stronger, and must be diluted. If 1.5 c.c. of water be added to 10 c.c. of the alkali solution, 1 c.c. of the alkali ought to exactly neutralize 1 c.c. of the acid. Therefore, for every 10 c.c. of the alkali solution add 1.5 c.c. of water. Measure out the amount of the solution and pour into a clean dry bottle. Calculate the amount of water required to dilute the alkali to the proper strength, and add it to the contents of the bottle. Mix well, and test correctness of work by proving that 10 c.c. of the one solution will exactly neutralize 10 c.c. of the other. If it does this, the solution is correct.

Testing the Acidity of Milk or Cream. By means of a pipette (a 10 c.c. is a convenient size) measure out a definite quantity of the milk or cream to be tested and deliver into a beaker or cup. If distilled or rain water is handy rinse out a pipette once, and add the rinsings to the sample. Dilute with 50 c.c. of water, and add three or four drops of the indicator. Now, having the alkaline solution in the burette, carefully note the point at which the surface of the liquid stands in the burette and then cautiously let it drop into the cream or milk being tested. Keep the sample well stirred while adding the alkali. The acid in the sample will gradually be neutralized by the alkali added until at last a uniform pink color appears, which will slowly fade away. The most delicate point is the first change to the uniform pink color, which the sample shows when the acid contained therein has been just neutralized. Because of the influence of carbonic acid of the atmosphere the pink color is not permanent unless a slight excess of alkali solution has been added. The operator should not, therefore, be led to believe by the disappearance of the color after a short time, that the neutral point has not been reached. Having decided on the neutral point, again read the burette at the surface of the liquid, and the difference between this reading and the first is the amount of alkali solution used to neutralize the acid in the sample taken.

The calculation of the per cent. of acid is simple. The alkaline solution used is of such a strength that when a 10 c.c. pipette is used, the number of cubic centimeters of alkaline solution required to neutralize the acid in the milk or cream has simply to be multiplied by 0.1. Thus, if 5.6 cubic centimeters of the alkali be used then $5.6 \times 0.1 = .56$ per cent. acid.

To insure accuracy the utmost care and cleanliness must be observed in every detail of the work. All water used with the milk or cream or in making the alkaline solution should be either distilled or pure rain water. The burette and pipette, after being washed, must be rinsed out two or three times with the solution they are intended to measure.

The knowledge the operator may gain from such tests will not only make it possible for him to turn out more uniform products, but it will also enable him to act with confidence and more intelligently to pursue the work he may have on hand.

MILK AND CREAM TESTING.

G. Rickwood.

It is necessary to test milk in order to ascertain its commercial value. The percentages of the different constituents of milk, especially fat and casein, will differ considerably in different milks, and for this reason we must have some means of knowing the extent of this variation. If the milk is used for buttermaking, then the fat of the milk will be the index of its value, for it is the fat alone which is used for the manufacture of butter. In the manufacture of cheese, fat and casein are used, and in order to know the true value of milk for this purpose, we must know the amount of fat and casein which the milk contains. It can readily be seen that a rapid, accurate, inexpensive and reliable test would be of inestimable value to the dairyman. For testing milk-fat, the Babcock test has been found to give best results, and it is one of the necessary qualifications of a dairyman that he understand, and be able to operate this test. It is rapid, in that it only takes a few minutes to make a test. Its accuracy has been vouched for by chemists who have made analysis of milk in order to compare results obtained by the Babcock test. It is inexpensive, as the prices range from about $4 for a small size hand machine, to $25 or $30 for a large factory size machine. It is also reliable. Anyone with a little experience and using necessary precaution can obtain accurate results. The details necessary to consider in making a fat determination by the Babcock test are given briefly as follows:

1. Have the milk at a temperature of 60° to 70° F.

2. Mix the milk thoroughly by pouring it from one vessel to another, allowing it to run down the side of the vessel to prevent foaming. If the sample is not thoroughly mixed, a representative sample cannot be obtained.

3. With [illegible].6 c.c. (cubic centimeter) pipette, measure this quantity of milk into [illegible]ilk test bottle. To do this, suck the milk into the pipette, and quickly place the forefinger over the top to prevent the milk running out. Allow the milk to drop out until the surface of the milk is level with the 17.6 c.c. mark, which is on the stem above the bulb. Now place the tip of the pipette into the top of the bottle and allow the milk to run out slowly by removing the forefinger.

4. Add to the milk in the bottle, 17.5 c.c. of commercial sulphuric acid at a temperature of 60° to 70° F., having a specific gravity of 1.82 to 1.83. Hold the bottle slanting and allow the acid to run down the side and under the milk. Use a graduate for this purpose. It is not a safe practice to use the pipette, as the acid may be drawn into the mouth, causing severe burning.

5. Mix the milk and acid thoroughly by giving a gentle rotary motion. Do not close the neck of the bottle while mixing.

6. Place the bottles in the machine, making sure they are properly balanced, and whirl at full speed for five minutes. The speed is indicated on the machine. Do not exceed the speed so marked.

7. Add hot water at a temperature of 140° to 160° F. to float the fat into the neck of the bottle.

8. Whirl again for two minutes.

9. Remove the bottles from the tester and set in a water bath, which reaches to the top of the fat, at a temperature of about 140° F. for a few minutes before taking the reading.

Theory of the Babcock Test.

A 17.6 c.c. pipette will deliver, practically, 17.5 c.c. of milk.

17.5 c.c. at an average specific gravity of 1.032 = (17.5 × 1.032) = 18.06 grams.

18 grams is the weight of the milk required for a test.

The volume of the neck of the milk test bottle between zero and 10 is 2 c.c.

2 c.c. of melted fat, at a specific gravity of .9 = (2×.9) = 1.8 grams.

The relation of 1.8 is to 18, as 1 is to 10, or 10 per cent. of the original volume of the milk. This is why that weight or volume of milk is taken and why the neck of the bottle is divided into 10 equal parts.

Notes.

1. Always make sure that the bottles and pipettes are clean before using.

2. Be careful to get the exact measurement of milk for the test.

3. If the milk is covered with thick cream, or is partially churned, it may be prepared for sampling by heating, then pouring from one vessel to another. Heating to 100° to 110° F. is sufficient for this. When it is thoroughly mixed, take the sample as quickly as possible and cool to about 60° F. before adding the acid.

4. If the sample is frozen, warm both the frozen and liquid parts and mix thoroughly. Never test a sample immediately after being drawn from the cow. Allow to stand at least one hour.

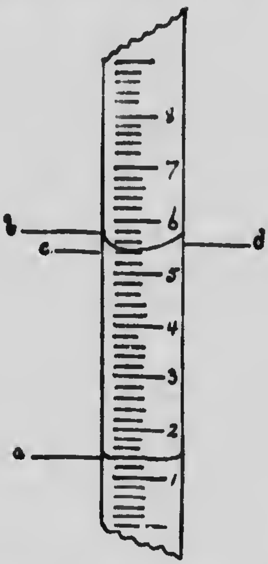
5. If the milk is sour or thickened, it is necessary to add an alkali to dissolve the casein. A small amount of strong ammonia or concentrated lye will answer, stirring and mixing it well until the sample has become liquid again.

6. The quantity of acid must vary with its strength. If it is too strong use less, if too weak use more, but if the acid is very much too weak or too strong, it should not be used. Weak acid is preferred to strong acid. Carboys or bottles containing acid should be stoppered with glass or earthenware stoppers, as the acid is very corrosive and will burn or eat stoppers made of organic material or metals.

7. Avoid pouring the acid directly on the milk. After the acid is in the bottle there should be two distinct layers—milk on top and acid underneath, with no charred material in between. Do not allow it to remain long in this condition.

8. The water added to the test bottles should be soft or distilled. If hard water is used the addition of about 8 or 10 cubic centimeters of sulphuric acid to the gallon will soften it. This will prevent foam above the fat.

9. It is advisable to use a pair of dividers or compasses for measuring the fat column. The points should be placed at the upper and lower limits of the column to get the length, and then place one point at zero and the position of the other point will show the percentage of fat in the



sample tested. The accompanying illustration will show the correct method of reading milk tests when the fat is at 130° to 140° F. Correct reading A to B, not to C or D.

10. Burnt or cloudy readings may be caused by:

(a) Having the temperature of the milk or acid too high.
(b) Using acid which is too strong, or using too much acid.
(c) Allowing acid to drop directly on and through the milk.
(d) Allowing the milk and acid to stand too long before mixing.

11. Light or cloudy readings or floating particles of curd are usually caused by:

(a) Temperature of milk or acid too low.
(b) Using too weak an acid or not enough acid.
(c) Careless mixing, or insufficient shaking to unite the milk and acid thoroughly.

12. The accuracy of the test bottles and pipettes used in Canada is provided for in an Act of the Dominion Parliament known as the Milk Test Act, which requires that all bottles and pipettes shall be tested for accuracy of graduation by the Standards Branch, Department of Inland Revenue at Ottawa, and that each bottle and pipette shall be marked at the time of testing with the letters G.R. (or first letter of reigning Sovereign) inside the Crown, thus: | G.R. |.

13. Carefulness and exactness are absolutely essential in every detail if accurate results are to be obtained in milk testing.

14. Sulphuric acid weighs about 18 lbs. to the gallon and costs 2½ to 4 cents per lb. A gallon will make 250 to 260 tests.

Composite Samples.

A composite sample is a sample composed of a number of smaller samples taken from the same source at different times and kept by use of preservatives, the object being to obtain an average test of the number of smaller samples without the labor and expenses involved in the testing of each lot separately. This method is used by cheese factories and creameries, and by Cow Testing Associations. In creameries and cheese factories a small sample is taken from each daily delivery of each patron and kept in bottles, one for each patron. Several kinds of preservatives are used, the most common being a mixture of seven parts of Potassium Bichromate to one part of Mercuric Bichloride (Corrosive Sublimate). Potassium Bichromate may be used alone if the samples are not to be kept longer than two weeks, enough being added to give the milk a lemon yellow color. If the mixture is used, it will require as much as will lie on a ten cent piece to preserve a pint for one month. Corrosive sublimate may be used, but it is rather dangerous, as it does not give any color to indicate that the milk contains poison. Formalin is sometimes used, about 20 drops (1 c.c.) per pint of milk, but it also is colorless. Tablets are now being prepared and sold by the Dairy Supply Houses, which may be used with excellent results. The amount of preservative used will depend to a certain extent upon the condition and size of the sample and the length of time over which the testing period extends, and also the manner in which it is treated. At the end of the period the mixture of samples may be tested with the Babcock Test, and if the work of sampling has been done properly the test should be an average percentage of the fat in the different lots of milk.

Notes on Composite Sampling and Testing.

1. Pint or half pint milk bottles stoppered with cork or rubber stoppers answer fairly well for composite sample containers, although bottles fitted with glass stoppers are preferable, as they are not so likely to carry mould spores into the milk

2. The bottles should be kept tightly stoppered to prevent evaporation of the moisture, which will cause the test to be too high.

3. Better results can be got by keeping the bottles in a cool place and out of direct sunlight.

4. It is absolutely necessary that each bottle should have a distinguishing mark—either name or number. Stove pipe, or bicycle enamel, answers very well for the purpose. Paint is not so lasting. Another method is to write the name or number on a gummed label, stick it on the bottle, and coat it over two or three times with shellac, or the glass may be roughened with a whetstone or file, and the number written on with a lead pencil.

5. Place the preservative in the bottle before any milk is put in. It may be necessary to add a little more later if the sample shows indication of spoiling. Avoid using too much preservative as it hardens the casein in the milk, making it difficult to test and oftentimes causing a burnt or charred reading.

6. The sample for the composite jar should be taken after the milk has been poured in the weigh can. An ounce or half ounce dipper is often used for this purpose. A sampling tube, or milk "thief," is also very satisfactory. It is very difficult to accurately sample frozen milk, and patrons should be warned against sending milk in that condition.

7. Each time a fresh sample is added, the jar should be given a gentle rotary motion to mix the cream and the fresh milk with the part containing the preservative. Avoid shaking the jar violently, as that has a tendency to churn the contents.

8. To prepare composite samples for testing, heat the sample to 105° to 110° F. by placing in warm water, to loosen the fat adhering to the sides of the bottle, then mix thoroughly by pouring. Take the sample quickly and place in the test bottle. Set the test bottle in water at 60° to cool the milk before adding the acid. Strict attention paid to this point of cooling will usually prevent burnt readings. Sulphuric acid appears to act more strongly on samples containing preservatives, therefore it is advisable to use slightly less acid. If difficulty is experienced with burnt readings caused by an excessive amount of preservative, it is recommended to add the hot water at two different times, filling to the bottom of the neck of the bottle and whirling one minute and then filling to about the 8 per cent. mark and whirling again for another minute.

9. To find the correct average test of the milk from a herd of cows, find the total pounds of fat and total pounds of milk, multiply the pounds of fat by one hundred and divide by the pounds of milk. There is often considerable difference between the correct average test found in this way and the test obtained by adding the different tests together and dividing by the number of cows tested.

Example:

Correct Average Test.

Cow No.	1—340 lbs. milk,	testing	4.3	per cent.	= 14.62	lbs. fat.
" "	2—460 " "	"	4	"	= 18.40	" "
" "	3—760 " "	"	3	"	= 22.80	" "
" "	4—620 " "	"	3.5	"	= 21.70	" "
Total....	2180 lbs. milk				77.52	lbs. fat.

If 2180 lbs. milk contain 77.52 lbs. fat,
then 100 lbs. milk (per cent. = 100) $\frac{100 \times 77.52}{2180} = 3.55$ per cent.

Incorrect Average Test.

$4.3 + 4 + 3 + 3.5 = 14.8$, divided by number of cows $= \frac{14.8}{4} = 3.7$ per cent.

Cream Testing.

The percentage of fat in cream can be obtained as easily and as accurately by the Babcock Test as the percentage of fat in milk, and this is one reason why the Oil Test is being replaced by the Babcock Test in cream gathering creameries.

Cream test bottles with specially graduated necks to contain 30, 40, or 50 per cent. of the quantity taken are used.

The same weight of cream as of milk is necessary, namely, 18 grams, but since cream has less specific gravity, or is lighter, than milk, due to the larger proportion of fat, it is necessary to use more than 17.6 cubic centimetres. Sweet cream testing 25 per cent. fat has a specific gravity similar to that of water, so that if an 18 c.c. pipette is used, and the pipette is rinsed with a small quantity of water, the weight of the cream will be nearly 18 grams. Very rich cream, ripe, or gassy cream, or fresh cream from the separator, cannot be measured with an 18 c.c. pipette and have 18 grams in weight. It is therefore necessary to weigh such cream to get accurate samples. Several satisfactory cream scales are on the market. The Torsion, Fairbanks, and Philadelphia are classed among those giving satisfaction.

No definite amount of sulphuric acid can be given for testing cream, as some samples seem to require more than others in order to get satisfactory results, but as a rule less than 17.5 c.c. are required. A good guide is to notice the color of the mixture of cream and acid. It should be a dark chocolate color, but not black.

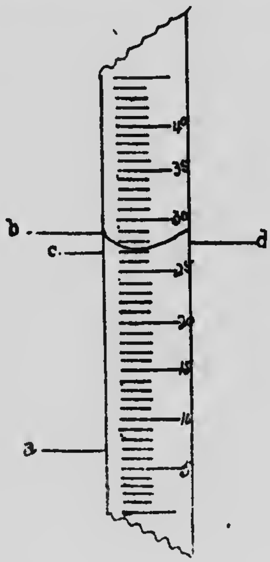
In milk testing the bottles are whirled for 5 minutes before adding the water, but in cream testing this is not practised, as it usually results in cloudy readings.

The usual method is to add hot water immediately after mixing the cream and acid and whirl for five minutes; or better still, add the water at two different times, filling up to the neck of the bottle and whirling

4 minutes, and then filling nearly to the top and whirling again for 2 minutes. The fat column should be a bright, golden color.

Cream tests should be read at a temperature of 130° to 140° F., and the fat measured to the bottom of the meniscus or curve at the top of the column. Errors due to expansion of fat amount to from one-half to one per cent., if the reading is taken immediately after whirling in a steam tester.

The accompanying illustration shows the correct methods of reading a cream test in a 6-inch gram bottle. Correct reading A to C, not to B or D.



Composite samples of cream are made and cared for similar to those of whole milk, but the sample for the composite bottle needs to be taken with greater care and accuracy.

The variation in the percentage of fat and the variation of the pounds of cream cause a wide range in the commercial value, therefore it is necessary to take a proportionate, or aliquot, sample as well as a representative sample.

This is done very easily where the cream comes to the creamery in individual cans, by using a sampling tube, or a graduated pipette, and taking one cubic centimetre for every pound of cream delivered. Where the haulers take the sample at the time of collecting the cream, it is rather difficult to carry out this principle, and some buttermakers relieve the hauler entirely of this responsibility, and only ask that they take a representative sample, the buttermaker taking the proportionate sample from this when it arrives at the creamery.

The following tests show a comparison of weighed and measured tests from monthly composite samples:

Measured.	*Weighed.*	*Measured.*	*Weighed.*
17.5 p.c. fat.	18 p.c. fat.	33.5 p.c. fat.	34 p.c. fat.
18.5 " "	19 " "	34 " "	35 " "
22 " "	22.5 " "	37 " "	38 " "
28 " "	29 " "	36.5 " "	37.5 " "
29.5 " "	30.5 " "	41 " "	42.5 " "

The Oil Test.

This means of ascertaining the butter value of cream is still employed in a few sections. It is simply a churning process.

The cream collector is supplied with a pail 12 inches in diameter in which the depth of the cream supplied by the patrons should be carefully measured. After thoroughly mixing the cream the collector should take a representative sample, filling the test tubes carefully to the mark, which should be five inches from the bottom.

To Make an Oil Test. Upon arrival at the creamery, set the samples in a warm place, as over the boiler, and leave over night to ripen thoroughly. They will not churn properly unless well ripened.

The next morning, place the samples in water at a temperature of about 90° F., and as soon as the cream will flow freely from one end of the tube to the other, place in the oil test churn and begin churning. Should the cream at any time cool and thicken, place the samples in warm water to liquefy the cream again. Continue churning until there is evidence of a clear separation of the fat, then place the samples in hot water, at a temperature of from 160° to 170°, for from fifteen to twenty minutes.

If the separation be 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 clear fat on top, one of whey next, and one of curdy matter at the bottom. If there be not a clear separation, cool to about 90 degrees, churn again and proceed as before.

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

A small rule made specially for this purpose is more convenient than a chart. This, however, will give a correct reading only when the test-tubes have been filled precisely to the mark. The chart consists of a sliding scale, and gives the proportion of oil regardless of the depth of cream taken or the diameter of the test-tubes.

Sometimes the fat, though clear, is somewhat open. In such cases, or when the fat is not clear, allow the samples to become cold, and then place in water at a temperature of about 120 degrees F. before taking a reading. About 120 degrees F. is a very suitable temperature at which to take readings.

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 12 inches in diameter; cream testing 120 will make 1.2 pounds of butter per inch. To find the pounds of butter, multiply the number of inches by the reading and divide by 100.

Theory of the Test. A standard or creamery inch is one inch of cream (in a 12 inch pail) testing 100.

One inch, therefore, contains 113 cubic inches. One pound of butter contains about 25 cubic inches of butter oil, which is 22 per cent. of 113. Therefore, any cream which will yield 22 per cent. of its volume in butter oil will yield one pound of butter per inch. Tubes filled to the depth of five inches with cream which gives 1.1 inches of butter oil will yield one pound per inch, as 1.1 is 22 per cent. of 5.

A reading of 100 by the oil test would, therefore, theoretically, be equal to 22 per cent. of fat.

Disadvantages of the Oil Test.

1. It places a premium on sour cream by measuring in the pail, because the sour cream occupies greater bulk than sweet cream.

2. More time, labor and expense is involved by churning every sample at each delivery.

3. The difference in churnability of the various samples makes it difficult to get good results.

4. The chart is graduated to read in tens, so that the test of the cream must be read in tens, although the correct reading may be between.

5. The amount of cream is measured, while in the Babcock test it may be accurately weighed.

6. It is very difficult to have the number of pounds of butter shown by the chart and the churn results agree.

Skim-Milk, Buttermilk or Whey.

As the percentage of fat in skim-milk, buttermilk and whey is usually very small, the best method of testing these is by the use of the double-neck test bottle. There are several different kinds of double-neck bottles in use, but those having the two necks joined together, and extending perpendicularly from the centre of the bottle, seem to give best results, as they are much stronger and less liable to give burnt readings.

The latest form of double-necked bottles are graduated to read in hundredths of one per cent. up to twenty-five hundredths, and the manufacturers claim that it is not necessary to add anything to the reading. The difficulty that was often encountered by having the contents foam and bubble over has been largely overcome by having a vent put in the tube in the bulb of the bottle. This also aids in emptying.

17.6 c.c. of skim-milk, buttermilk, or whey are taken into a test bottle and the test is completed in the usual way. Very fine readings can be taken, as a small amount of fat can be made to extend over a long space in the small neck. Considerable difference of opinion exists amongst authorities on milk testing with regard to the correct method of reading the double-neck bottle; but chemical analyses indicate that the addition of 0.5 to the Babcock reading would give the most accurate results.

The fat column in the small neck can be raised or lowered slightly to assist in getting accurate readings by pressing the finger gently on the top of either neck.

It is recommended to use a little more than 17.5 c.c. of acid in testing skim-milk; also to turn the tester a few revolutions faster per minute, and whirl for a longer time. Whey does not contain such a large percentage of solids as milk, and usually about 10 c.c. of acid are sufficient to cause a clean separation of fat.

The whole-milk bottle is not suitable for testing skim-milk, buttermilk, or whey, as it is almost impossible to make an accurate reading of such a small amount of fat when it is extended over a broad surface. However, the milk test bottle might be used to indicate whether or not much fat is being lost.

Testing Cheese for Fat.

1. Obtain a representative sample by cutting a slice from the outside to the centre of the cheese, or by taking plugs from different parts.
2. Cut the sample as finely as possible and weigh 2 grams or 5 grams into a milk-test bottle, or 9 grams into a cream bottle.
3. Add sufficient warm water at a temperature of 120 degrees F., to make about 18 grams in the bottle.
4. Keep the sample warm and mix occasionally, until the cheese and water form an emulsion.
5. Measure 17.5 c.c. of acid. Add a little at a time and continue mixing until the curd is all dissolved.
6. Sometimes, slightly more than 17.5 c.c. of acid are required for a test. Sufficient has been used when the mixture turns a dark chocolate color.
7. The hot water may be added before whirling in the tester.
8. To find the per cent. fat multiply the reading by 18 and divide by the number of grams used. For example: 5 grams give a reading of 8.5, the percentage of fat in the cheese $= \frac{8.5 \times 18}{5} = 30.6$.

Babcock Test for Butter.

1. Secure a representative sample of butter and place the vessel containing the butter in a tub of water at 100° F., and stir until the butter becomes a thin paste.
2. Weigh 4.5 grams or 9 grams into a cream bottle.
3. Add enough water at 70° F. to make 18 grams.
4. Add 17.5 Sulphuric Acid and mix thoroughly.
5. Continue the test the same as a test for cream.
6. Per cent. of fat = $\frac{\text{Reading} \times 18}{\text{No. of grams used}}$.

Example. 4.5 grams butter taken.
Reading = 22.
Per cent. fat=22×18÷4.5=88 per cent. fat.

The Lactometer and the Detection of Adulterations in Milk.

The lactometer is a special form of hydrometer used to determine the specific gravity (sp. gr.) of milk. The term specific gravity means the weight of a certain volume of any liquid or solid substance compared with the weight of the same volume of pure water at 4° C.

There are different kinds of lactometers, but the Quevenne is the most suitable for milk-testing. By means of it we can determine rapidly the relative weights of milk and water.

The Quevenne lactometer is standardized at a temperature of 60° F.; if the milk to be tested varies from this, corrections may be made according to the following rule: For each degree in temperature *above* 60, add .1 ($\frac{1}{10}$) to the lactometer reading, and for each degree *below* 60, subtract .1 ($\frac{1}{10}$) from the lactometer reading. This rule is practically correct, if the temperature is kept within a range of from 50° to 70° F. It can be readily recalled when we remember that the density of milk *increases* with a *reduction* of temperature and decreases with a rise in temperature. The scale on the lactometer is graduated from 15 to 40, and indicates a specific gravity of from 1.015 to 1.040.

Note. The correct lactometer reading (or L.R. at 60° F.) + 1,000 ÷ 1,000 indicates the specific gravity.

The lactometer reading of whole milk usually ranges from 29 to 34, although it may fall as low as 27, or go as high as 35. The lactometer reading of skim-milk varies from 33 to 38. The reading should be taken soon after placing the instrument in the milk; if cream be allowed to rise on the milk, the reading will be too high, and the bulb of the lactometer will be floating in partially skimmed milk. Milk should be cooled and allowed to stand some time (one to three hours) after being milked before taking the lactometer reading. Otherwise the readings will be too low.

The composition of milk is about as follows:

Fat	3.6	per cent.	
Casein	2.5	"	8.9 solids not fat.
Albumen	.7	"	
Sugar	5.0	"	
Ash	.7	"	
Water	87.5	"	
	100.00		

It is the solids not fat in milk that cause its specific gravity to exceed that of water, and consequently its lactometer reading to be greater, as the percentage of solids not fat increase.

A number of different rules have been prepared for the calculation of milk solids when the lactometer reading and the percentage of fat are known. Of these, the following has been quite generally adopted. To find the per cent. of solids not fat in a sample of milk, add two-tenths of the per cent. of fat to one-quarter of the lactometer reading; and to find the per cent. of total solids add one and two-tenth times the per cent. of fat to one-quarter of the lactometer reading.

The following rule also is sufficiently accurate for practical purposes and has simplicity to recommend it. To determine the per cent. solids not fat, add the lactometer reading at 60 degrees and the per cent. of fat together and divide by four (4). Example: L. R. = 32, Fat 4% $\frac{32+4}{4} = 9\%$ S.N.F.

Adulterations.

By the use of the Babcock test in conjunction with the lactometer, we are enabled to determine both the nature and the extent of an adulteration.

The percentage of fat in milk varies and can also be influenced by skimming, therefore the lactometer alone is of little use in determining adulterations. The solids-not-fat are fairly constant, and thus afford a means of detecting adulterations.

Watered Milk. To find the per cent. of pure milk in a watered sample, multiply the per cent. S.N.F. in it by 100 and divide by the per cent. S.N.F. in the pure milk. This subtracted from 100 will give the per cent. of extraneous water in the watered sample. To take an example:

The per cent. of solids-not-fat in a sample of pure milk is 9; but after being watered the per cent. of solids-not-fat in the watered sample is 7.2. Find the per cent. of pure milk in the watered sample.

Per cent. of pure milk in watered sample, $\frac{7.2+100}{9} = 80$ per cent.

Per cent. of extraneous water $= 100 - 80 = 20$ per cent.

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

The per cent. of ***water added to the pure milk*** may be estimated as follows: The per cent. S.N.F. in a pure sample, multiplied by 100, divided by the per cent. S.N.F. in the watered sample, less 100. The above may

$\left(\frac{9 \times 100}{7.2}\right)$—100 equals 25 per cent. water added, or

be worked out as follows:

To 80 lbs. pure milk, 20 lbs. water were added, then to
1 lb. pure milk, $\frac{20}{80}$ lbs. water were added.
To 100 lbs. pure milk, $\frac{20}{80} \times \frac{100}{1}$ lbs. water were added,
equals 25 lbs. water added to 100 lbs. milk, or 25 per cent.

Notes.

1. Have the temperature of the milk uniform throughout, and as near 60° F. as possible when taking the lactometer reading.

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

3. Do not have milk on the upper part of the stem of the lactometer when reading, as this weighs the lactometer down and causes the reading to be too low.

4. Have the lactometer free from the side of the vessel, and perfectly still when taking a reading.

5. A high lactometer reading accompanied by a low per cent. of fat indicates skimming, *e.g.*, L. equals 34, F. equals 2.4.

6. A low lactometer reading accompanied by a low per cent. of fat is indicative of watering, *e.g.*, L. equals 22, F. equals 2.4.

7. A normal lactometer reading with a very low per cent. of fat indicates both watering and skimming. Also, if the lactometer reading of a sample of milk be low, yet not so low accordingly as the per cent. of fat, this is indicative of both watering and skimming. Both of the following indicate watering and skimming; L. equals 31, F. equals 2; L. equals 26, F. equals 1.8.

The Hart Casein Tester.

This is a simple test for determining the casein content of milk. The test has been introduced by Dr. E. B. Hart, of the Wisconsin Experiment Station, and its development and use is likely to prove of considerable value to the cheese branch of the dairy industry. No more ability or skill is required to make a casein test than is necessary in making a Babcock test for fat, and the test can be completed in a few minutes.

The principles involved in this method as outlined by Dr. Hart are:

1. The construction of a special bottle with a graduated scale whereby the percentage of casein can be read when a definite volume of milk is used for a test.

2. The precipitation of the casein by dilute acetic acid.

3. The agitation of the precipitate with chloroform to dissolve the fat.

4. The application of a definite centrifugal force in order to mass the casein into a pellet.

5. Reading the per cent. of casein.

The details connected with the determination of casein are briefly as follows:

1. Measure 2 c.c. of chloroform into the test bottle.

2. Add to this 20 c.c. of a .25 per cent. solution of acetic acid at a temperature of 70 degrees F.

3 Measure accurately 5 c.c. of sweet milk at a temperature of 70 degrees.

4. Place the thumb over the opening of the bottle, turn the bottle over by rotating the hand and shake the contents vigorously for fifteen to twenty seconds.

5. Place the tests in the centrifuge and whirl for 7½ to 8 minutes at a speed of 2,000 revolutions per minute for a 15 inch diameter machine.

6. After whirling, allow the tests to remain for ten minutes to allow the pellets to relax slightly, before taking the readings.

Notes on the Casein Test.

1. Use only the best quality of chloroform.

2. See that the temperature of the milk and acid is as nearly 70 degrees F. as possible.

3. Use a watch to take the time in shaking the test and do not mix more than 20 seconds.

4. Make sure that the speed of the tester is correct. It is advisable to use a metronome for this purpose when the whirling is done by hand power.

5. Curdled samples of milk cannot be tested for casein.

6. Composite samples preserved with bichromate of potash for from three to four days can be tested more or less satisfactorily, but samples containing other preservative and those with bichromate of potash which are kept for a longer time, do not appear to give reliable results. Therefore, the test will need to be improved in this particular before it will be suitable for factory conditions.

7. A comparison of the results of the Casein Test with those of chemical analysis, conducted at the Ontario Agricultural College during the summer of 1908, shows the casein test to be quite accurate. The average percentage of fat in 22 samples of sweet milk was 3.72. The average percentage of casein in these samples as determined by the Hart method was 2.395, and by a chemical analysis 2.415—a difference of only .02 per cent.

BOILERS, ENGINES, STEAM-FITTING.

GEO. TRAVIS.

Of all the apparatus necessary for the manufacturing of cheese and butter, the steam boiler seems to be the most essential. From it we get steam power for operating the other machinery, and steam for regulating the temperature of the milk and cream, and for other heating purposes as well; hence the selection, setting and care of the boiler, coupled with the construction of the arch and chimney so as to get the best results from the economic viewpoint, are matters of great importance to cheese and butter manufacturers.

SELECTING A BOILER.

When selecting a boiler, get one of sufficient capacity to furnish all the steam required without forcing the fire under it. A boiler cannot be forced beyond its capacity without injuring it. There would also be a waste of time and fuel forcing a steam boiler.

SETTING BOILER.

In setting a boiler a good substantial foundation for the arch or furnace should be provided. The arch is really a part of the boiler and unless it is properly built, good results cannot be obtained.

It is best to get a plan for building an arch from some reliable boiler maker. Then have the masonry done by an expert. Provide good fire brick for lining and have them laid with fire clay. Make the side walls of the arch thick with good common brick. This will make it more substantial and retain the heat longer, thus lessening the cost of fuel.

CHIMNEY.

Where coal is being used for fuel the chimney should be built of brick. The area should be at least one-fifth greater than the combined area of all the flues. The height depends largely upon its location—the higher the better.

FIRING THE BOILER.

Boilers newly set should not have fires put under them until the mortar of the brick work has had time to harden naturally. When fire is started, heat very slowly and let the steam go through all the pipes before any pressure is put on them.

Care of Boiler.

Before lighting the fire in the morning, care should be taken to see that the boiler has sufficient water in it. The glass gauge in the water column cannot always be depended on at sight, therefore it is best to open the tap at the bottom of the glass to make sure that the pipes leading to, or from it, are not stopped with scale or mud. See that the safety valve is in working order. This is the most important valve in connection with the boiler. Every boiler should have a blow-off pipe at the bottom. In addition to this, it should have a surface blow-off or some "scumming" apparatus. Nearly all foreign matter held in solution in water on first becoming separated by boiling, rises to the top in the form of what is commonly called "scum," in which condition much of it may be removed by the surface blow-off. If not removed, however, the heavier particles will be attracted to each other until they have become sufficiently dense to fall to the bottom, where they will be deposited in the form of scale, covering the whole internal surface of the boiler below the water line, with a more or less perfect non-conductor of heat. Where the water is very hard, some good boiler compound may be used with good results. Different waters require different treatments. For ordinary water "sal soda" is all that is necessary.

The blow-off at the bottom should be opened enough each day to let any lime or mud that might have accumulated, escape. If this is not done, there is danger of the pipe being filled with dirt, thus excluding the water from the pipe. Then there is a danger of it becoming hot and bursting, causing a great deal of trouble.

If the pipe from the pump or injector which feeds the water into the boiler be attached so that the water will be fed in through the blow-off pipe, this danger will be largely overcome.

Pipe Fitting.

As there are also more or less steam pipes about the factory that need repairing, it is quite necessary that the maker should know how to do his own pipe fitting.

For ordinary work the tools required are, pipe, tongs, cutter, vise, and stock and dies. With these at hand any pipes or joints that may be leaking can be quickly repaired and will save the expense of sending out for a steamfitter. Steam escaping from bad joints or leaking valves makes a disagreeable noise, and money is evaporating into the air.

Engine.

The engine bed or foundation should be solid. If possible have the engine in a room separate from the boiler, as there is always more or less ashes and dust from the furnace and flue. This makes it difficult to keep clean. Any sand or grit lodging on the slides help to wear them out sooner than it otherwise would.

Some of the chief points to be observed are: See that it is kept clean, well oiled, and properly packed to prevent steam from leaking.

Before starting the engine, open the taps of the cylinder to let the water out, turn the fly-wheel over once, then open the throttle valve gradually until the engine gets in full motion.

Pulleys and Belting.

The following rules for finding the size of pulleys and the required length of belting will be found useful in fitting up a creamery or in placing additional machinery.

To find the diameter of a driven pulley, multiply the diameter of the driver by its number of revolutions, and divide the product by the number of revolutions the driven pulley should go. The result will be the diameter of the driven pulley.

Example. Diameter of pulley on the engine, 40 inches; speed of engine, 160 revolutions; speed in main shaft, 200 revolutions: $40 \times 160 \div 200 = 32$, which is the diameter in inches required for the driven pulley.

To find the required size of a driving pulley, multiply the diameter of the driven pulley by the number of revolutions it should make, and divide the product by the revolutions of the driver.

Example. Diameter of the pulley in intermediate is 4 inches, which is required to run 900 revolutions per minute; revolutions of shaft, 200: $4 \times 900 \div 200 = 18$, which is the diameter in inches of the pulley required to drive the intermediate at proper speed.

To find the length of belt for any two pulleys, add the diameter of the two pulleys together, divide this sum by 2, and multiply the quotient by $3\frac{1}{4}$. Add the product to twice the distance between the centres of shafting, and the result will be the required length of belt.

Example. Two pulleys are 8 and 24 inches in diameter, and 8 feet is the distance between the centres of shafting. $8+24=32$, $32 \div 2=16$, $16 \times 3\frac{1}{4}=52$ inches$=4$ feet 4 inches, and 4 feet 4 inches + 16 (twice the distance between the centres and the shafting)$=20$ feet 4 inches, which is the length of the belt required.

Rules. To find the circumference of a circle multiply the diameter by 3.1416. To find the diameter of a circle, multiply the circumference by .31831. To find the area of a circle multiply square of diameter by .7854. Doubling the diameter of a pipe increases its capacity four times.

SEPARATORS AND THE SEPARATION OF MILK.

GEORGE TRAVIS.

Factory or power separators may be divided into two classes—the steam or turbine, and the belt machine. A book of directions is furnished with each new separator, therefore general directions only can be given.

Turbine Separator.

In setting it up, a solid foundation should be provided. It does not matter how solid a wooden floor is, it will vibrate more or less from the running of a churn or other machinery. With a stone, brick or cement foundation a separator is independent of any vibration from other machinery and will run much better, and for a longer time. If setting the separator on a cement floor probably the most permanent method of fastening it down is as follows: First mark the exact location for the holes. With a square draw a line through the centre where the holes should be, then drill the cement to the desired depth (6 to 7 inches). To do this a common cold-chisel may be used providing the bit is wide enough for the body of the chisel, though a pointed chisel for this purpose is preferable. The dust may be removed from the hole while drilling by a small bellows, or blowing through a small rubber or glass tube. Have the bolt head somewhat rounded and place the bolt in the hole with the threaded end up, making sure to have it perpendicular and in line, and the necessary height above the floor, then pour melted lead in the hole around the bolt. If a method is desired whereby the bolts can be removed from the floor, drill holes as above, plug with wood, bore with a bit at least one-eighth of an inch smaller than the lag screws used and fasten down with lag screws. Another method whereby separators may be changed without drilling new holes is to drill the holes in the cement nearer to the centre than any separator will be likely to require, fasten a 2 inch by 4 inch piece of wood to the floor and bolt the separator to it.

In putting down a cement floor to be used for separators, it is well to have a pier built about two inches higher than the floor and about the size of the separator base. This tends to prevent dirt from lodging under the separator when scrubbing the floor.

If a stone or brick pier (bricks are neatest) has to be built, the nature of the soil will determine the depth to excavate, and the size of the frame or base of the separator will determine the length and breadth. The exact specifications are given in the book of instructions furnished with the separator.

Place the separator in position, being careful to have the separator frame perfectly level every way. Determine this by placing the spirit level upon the planed top of the frame.

The pipe to convey the steam to the separator may be the same size as the fittings of the separator, provided the distance from the boiler is not over twenty-five feet. When the distance is more than this, the size of the pipe should be one-quarter inch larger for every twenty-five feet of piping, to overcome the effects of friction and condensation of steam.

Exhaust pipes are usually made of galvanized iron, and should never be reduced in size at any point smaller than the outlet on the separator, and should be put up as straight as possible to convey the steam from the separator. It may be carried out at the side of the building. In either case, a piece extending upwards should be put up to cause a draught. Placing the exhaust pipe out through the roof is preferable when the surroundings will permit it. Have the pipe long enough to be higher than any part of the roof, in order that the draught may not be interfered with by change of wind. A drain pipe must be provided in any case at the lowest point on the pipe, to allow water to escape readily. If this should be in the making-room, a trap to prevent annoyance from escaping steam may be put on the drain pipe.

Belt Separator.

The directions given for the foundation of a turbine will apply to this. First place the intermediate or jack in position. This should be at an angle of at least 45 degrees in front or behind the driving shaft. Level it by placing a level perpendicularly on the planed rim of the separator pulley of the intermediate. Be sure to have the shaft of the intermediate parallel with the driving shaft.

The pulley provided for the driving shaft should be of sufficient width to allow the belt to be shifted from the tight to the loose pulley of the intermediate, and of the proper size to give the exact speed required.

Next place the frame of the separator in position. Level it in all directions by placing the level on the planed top of the frame. Line the separator with the intermediate, so that looking from the intermediate the right hand edge of the small pulley of the separator is in line with the right side of the large pulley of the intermediate, having the vertical centre line of the spindle level with the under side of the intermediate pulley.

The separator bowl should revolve to the right, or with the sun, the same as the hands on a watch. The intermediate should run from the separator, so as to place the draw belt on the upper side of the intermediate pulley, with a view to remove some of the weight of the bowl from the foot-step bearing when the separator is running. If an idler or belt-tightener is used, always place it on the "return" side of the belt—*never* on the "draw" side.

Do not use the belt tightener any more than is absolutely necessary, as it shortens the life of the belt very materially. It would be an improvement if the intermediate could be adjusted to suit the stretching of the separator belt.

Wipe all the bearings well with a cloth, to remove all grit and dust. A little coal oil upon the cloth will be found helpful where any coating of dried oil is met with. See that all oil tubes are clear and free to feed oil. Wash the bowl and all parts that the milk comes in contact with. If everything has been properly attended to as directed it is ready to start. If a turbine, turn on steam very gradually to allow the water to [illegible] out of the steam pipes, when the required amount of steam may be [illegible]ned on. When speed has been reached, start the feed of milk.

If a belt machine, and only one in use, put all belts in position, and start the engine slowly, allowing the speed to increase gradually. If more than one separator is used, it is better to start the engine at full speed, then shift the belt from the loose to the tight pulley after starting the separator by pulling the belt with the hand until the bowl has attained some speed. Then shift the belt from the loose pulley part way on to the tight pulley, moving it at intervals until on full. From 6 to 10 minutes should be required to get up speed. Full speed is ascertained by means of speed indicators. A 100 notch wheel should be counted for one minute, and a 50 notch wheel for one-half a minute, in order to know the number of hundred revolutions the bowl is revolving per minute. After speed has been reached, the milk should be turned on full speed, until both cream and skim-milk flow from the respective spouts; then it should be closed off until the cream is of the desired thickness. The cream should be the guide in operating the separator.

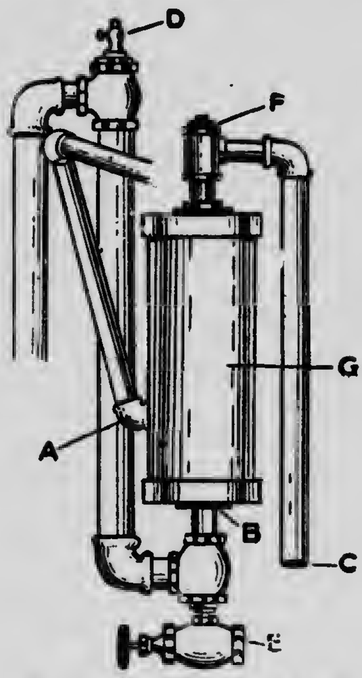
The cream left in the bowl when all the whole milk has been put through should be forced out with warm water. From one to two pails will be needed for this purpose. Shut off the feed-tap for a few seconds when about half the quantity has gone through; then turn it on again, allowing the remainder to complete the operation. Pure warm water is preferable to skim-milk, as it is nearer the specific gravity of the cream, and consequently displaces it more readily.

Allow the bowl to stop of its own accord after the power has been removed; never apply any brake or friction to the intermediate. Remove the solid matter found at the extreme outside of the bowl and burn it at once. Clean out all milk tubes with the spiral provided; wash with tepid water thoroughly; scald with steam or boiling water; then place on a draining rack where the bowl and its parts may dry. Never close the bowl when wet inside, as it will cause it to rust. Leave it open when not in use so it will be thoroughly dry.

In ordering the parts for the separator always specify exactly what is wanted by the use of the proper name and number of the same. This can be found by consulting the book of instructions furnished with all machines. A duplicate set of the delicate or wearing parts of any machine should be kept on hand for emergencies.

Milk fresh and warm from the cow is in the best possible condition for a perfect separation. The difference in specific gravity between the fat and other portions of the milk is then greatest, and it is also more fluid, as there is no development of lactic acid, nor chemical changes due to its exposure to the air. At the creamery, it is not met with in this favorable condition; consequently it is necessary to produce artificially as many of the favorable conditions as possible to get the best results. When milk is received at a temperature below 85° it should be heated to from 90° to 100°.

A tempering vat should be elevated at a suitable height to allow the milk to flow into the separator; and it should contain enough milk to employ the separator for at least four minutes. If large bodies of milk are heated to the desired temperature in a vat before separating, acid develops too rapidly and clogging of the separator bowl is likely to follow.



SKIM-MILK OR WHEY PASTEURIZER.

A. Milk inlet 1¼" pipe. B. Steam inlet. C. Overflow 2". D. Small valve on steam pipe to prevent suction of skim-milk back into steam pipe. E. Valve to drain heater. F. Plug which may be removed in order to see if heater is filling with material from skim-milk. G. Heater 6" diameter, 18" long with caps screwed on each end.

Should any accident happen whereby the separator is stopped, the milk would likely develop acid enough to thicken, when it could not be separated.

While it is doubtless true that better butter can be made by pasteurizing the whole milk before separating, still the improvement is not enough to compensate for the extra labor required in cleaning the separator and utensils. There is also the fact that the separator bowl will need to be retinned often if separating pasteurized milk.

If the skim-milk is to be pasteurized after being separated, it may be elevated by a pump, and just before entering the tank, allowed to pass through a heater used for pasteurizing.

The cut will show how the heater may be made. A union should be put in the steam pipe somewhere near the heater, as it will be necessary to take the heater apart quite often to be cleaned. This can be done best by burning in the furnace.

For dividing the skim-milk among patrons, the skim-milk weigher is found to be quite satisfactory.

CREAMERY BUTTERMAKING.

M. ROBERTSON.

Owing to the fact that the greater number of our creameries are operated on the cream-gathering system, this part on buttermaking will pertain altogether to the above-mentioned system of operating a creamery. To those interested in the care of milk for whole milk creameries, we would refer them to "Care of Milk" for cheesemaking, which is discussed in this bulletin. The same directions would apply to milk for creamery supply.

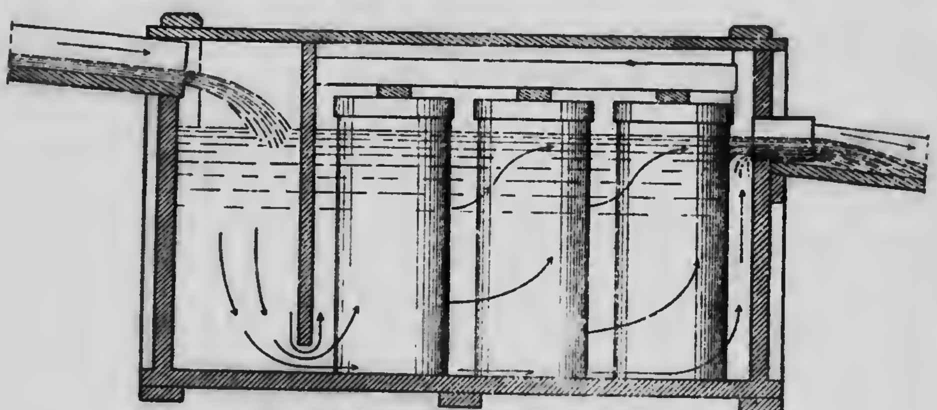
With the hand power separator as an important factor in our present creamery system, much of the work which was formerly done at the creamery is now done on the farm. The responsibility for doing this work well has been transferred from the buttermaker to the patron; hence much depends on the patron's knowledge of, and interest in, the work.

Care of Separators and Utensils.

Cleanliness is essential in all good dairy practice. All utensils and machinery should be of the very best, with no open seams or crevices in which dirt may lodge. No rusty cans or pails should be allowed in dairy work. Every piece of dairy machinery, every utensil used, should be thoroughly cleansed immediately after being used. First rinse with warm (not hot) water, then wash in water as hot as the hand will bear, using some washing compound in this water. Lastly, scald with the hottest water that can be obtained. After scalding, place outside in a pure atmosphere to dry. Never use the so-called "dish cloth" to dry dairy utensils; scald them, and they will dry themselves. Use a brush when washing to cleanse each part. The separator must be washed after each operation. The "once per day" washing is a filthy, as well as expensive habit, as a separator will rust when not properly cared for.

Care of Cream.

Keep the cream in clean, well-tinned vessels, preferably shot-gun cans. Cover the can to keep out all dust and foul air. *Cool quickly,* immediately after separating, to at least 50° F. Maintain this low temperature until the cream is delivered at the creamery, or to the hauler. If a cold well, or spring water, is available, this may be used for cooling. If cold water is not available, then an abundant supply of ice (one ton per cow) should be secured for cooling purposes. The loss entailed by the manufacture of poor butter, from improperly cooled cream, would pay for mountains of ice. Where cold well or spring water is available, the cream can be effectively cooled by placing the shot-gun cans in a box, as illustrated below, through which the water runs from the well or pump, to the watering trough.



Tank for Cooling Cream in Cans.

With a box made according to the illustration, an abundance of cold water passes around the cream, and little stirring is required. Cream should be delivered to the creamery at least every other day.

Percentage of Fat Required in the Cream.

The separator should be regulated and operated so as to deliver a cream which will test between 30 and 35 per cent. fat. By this we mean that every hundred pounds of the cream will contain from 30 to 35 pounds of fat. The reasons for desiring this percentage of fat in the cream are:

1. The high testing cream is less bulky, therefore it will take less cooling and work in caring for it.

2. It will leave more valuable skim-milk at home for feeding purposes.

3. It will mean less quantity for the cream haulers, also less vat room at the creamery and a smaller quantity of ice will be needed for cooling purposes.

4. A more exhaustive churning can be obtained from a rich cream than can be got from a thin testing cream, which means less loss in the buttermilk and more money for the patron. Also the high testing cream can be churned at a lower temperature and a better quality of butter be made.

5. The cream with a high percentage of fat will keep sweet much longer than will a low testing cream, providing other conditions are equal, therefore it is more likely to reach the creamery in proper condition.

Transportation of Cream.

Where possible, the ideal method of getting the cream from the farm to the creamery is for the patrons to deliver their own cream. This plan saves the cream-hauling cost, which is one of the big items of expense in connection with our present system of operation. Also, the patron and maker are brought more in contact with each other, which tends to discourage the sending of poor cream.

Where the patrons are unable to deliver their own cream, it should be hauled to the creamery in individual cans. By this method each patron's cream reaches the creamery unmixed with that of other patrons' and the maker is able to inspect the cream and assist those who are sending poor cream in improving the quality; also the weighing and sampling are directly under the maker's control.

Where cream is mixed in large cans or tanks by the cream collectors, it is very discouraging to those patrons who are taking proper care of their cream. The sampling and weighing must also be done by the hauler, which is often far from satisfactory.

Receiving the Cream.

Where patrons are delivering their own cream, or where individual cans are in use, the maker should inspect each can, rejecting all cream unfit for the manufacture of good butter. Each can should be carefully weighed and sampled and the weights recorded on a cream report sheet. Sampling should receive careful attention. The use of the McKay sampler is of great assistance in securing a proper sample for the test.

Where large cans are used, which necessitates the driver doing the weighing and sampling, the drawer's load should be weighed when it reaches the creamery. The weight is then compared with the total weight recorded on the driver's cream books. This is a check on the driver's weighing. To check the carefulness of his sampling, his samples should be tested ocasionally, and the total fat which he has on his cream books figured out. Then by taking a representative sample of his load of cream the total fat on his wagon may be found. In this way the fat on his wagon and the fat on his cream book can be compared and the accuracy of his work determined.

Pasteurization.

Immediately after the cream is received it should be pasteurized. By pasteurizing we mean the heating of the cream to a temperature of 180° to 185° F., and then quickly cooling to ripening or churning temperature. No phase of our creamery work is so beneficial as pasteurization. No phase of the work is so generally neglected. Why? Many creamery men say "it is too expensive," others say "it is too much labor." Neither answer is correct. Our creameries are not pasteurizing for the same reason that our creamery patrons are not storing ice to cool their cream. They do not know, or realize, the great benefit to be derived from it. The patron who neglects a supply of ice, or other facilities for cooling his cream, and the creameryman who neglects to pasteurize are both in the same canoe. Both are floating down, instead of paddling up, the stream of progress, as they should, and as they would, did they once realize the benefits that would accrue from cooling and pasteurizing.

What Does Pasteurizing Do?

1st. It kills the greater number of bacteria in the cream. Some of these bacteria are disease producers; others injure the flavor of the butter.

2nd. It assists in making a more uniform product of butter.

3rd. It creates a clean seed-bed for the sowing of a pure lactic acid culture.

4th. It enhances the keeping quality of the butter.

Ripening.

By the term ripening, we mean the souring of cream. This is done by the addition of a pure, lactic acid culture to the cream immediately after pasteurizing and cooling. In most of our creameries the cream is ripe enough before it reaches the creamery. The benefit of the culture in this kind of cream is the production of a desirable and uniform flavor in the butter.

Cool the cream to a temperature between 60° to 70° F. Use about 10 per cent. of good culture (more if the cream is very bad), and allow the cream to develop .4 to .5 per cent. acidity. When the proper percentage of acidity has developed, cool the cream to churning temperature, and churn as soon as possible. Pasteurization and a good culture will do more to improve the quality of Ontario butter than any other treatment which the cream can receive.

How to Prepare a Culture.

A culture is a propagation of pure lactic acid germs, used for ripening cream and milk. (The preparation of a culture is described under Cheesemaking in this bulletin, and as the preparation for both cheese and butter is the same, the method of preparing a culture will be found under the above heading.)

Churning and Working.

By churning we mean the gathering of the fat globules together into butter, by means of concussion. The question is often asked, "What is the proper churning temperature of cream?" No definite temperature can be given. The churning temperature is influenced by:

1. The character of the butter-fat.
2. Acidity of the cream.
3. Percentage of fat in the cream.
4. The amount of cream in the churn.

1. The fat is influenced by the proportion of soft and hard fats. Also by the period of lactation, and feed of the cows.

2. A ripened cream is more easily churned than an unripened cream.

3. The richer the cream (up to 35 per cent.) the more quickly it will churn, because, other conditions being equal, the fat globules are more numerous and come in contact more easily.

The churning temperature may range from 50° to 60° F., and even wider. Aim to have the cream churn in not less than 30 minutes and not more than 45. If cream is churned too quickly there will be a heavy loss of fat in the buttermilk; the butter will be soft and mushy; it will be hard to wash free of buttermilk; and will have poor keeping qualities. If the cream is churned too cold it will take much longer to churn, wasting time and power and the butter will tend to gather in hard, small granules, which will be difficult to work and salt. Avoid either extremes; try to have the cream churn in proper time. The butter should be of a waxy texture, which will "knead" easily, when working in the salt.

Stop the churn when the granules of the butter are about the size of large grains of wheat. Draw off the buttermilk and wash well with water somewhere near the churning temperature of the cream. Use about the same amount of wash water as there was cream to start with. Nothing but pure water should be used. If the butter has been churned at the proper temperature, and the churning "stopped" at the right time, one washing should be sufficient. Where the butter is soft and mushy two washings are advisable. About 10 to 12 revolutions of the churn are sufficient for washing.

Salting and Working.

Butter is salted, or not salted, according to the requirements of the market for which it is made. The amount to use depends on the market. From four to six pounds of salt for every one hundred pounds of butter fat, or from three to five pounds for every hundred pounds of butter contained in the churn, should be sufficient.

After the butter has been washed and drained, sprinkle on about half the amount of salt, then revolve the churn one-half turn, and add the remainder of the salt. Now adjust the rolls and work until the salt is evenly mixed through the butter. Uneven mixing of the salt causes mottled butter. Usually from fifteen to eighteen revolutions of the churn are sufficient.

Use only the best brand of salt. Sift the salt with a fine sieve before applying it to the butter. Keep the salt in a clean place, as it readily absorbs foreign odors.

Printing and Packing.

The neatness, style and kind of package is a creameryman's advertisement to the trade. The packages, in whatever form they are put up, should be neat, clean and attractive.

If made into pound blocks, they should be oblong with square corners and have no holes or finger marks. The prints should weigh 16¼ oz. to allow for shrinkage. Each wrapper should have printed on it, in tasty form, the name of the creamery, together with some special trade mark. The prints should be packed in boxes suitable for shipping.

If the butter is put into 56 lb. boxes, the boxes should be made of spruce, well paraffined, and lined with good parchment paper. Two sizes of paper are best for lining. One, a paper 12½ inches in width, and the other narrower, 11½ inches, and both 52 inches in length. These papers should be soaked for 24 hours before using, in a strong brine solution, containing one ounce of formaldehyde to prevent mould. The butter should be packed solidly, and the top neatly finished Weigh each box of the butter. A 56 lb. box should contain from one half to three-quarters of a pound extra, to allow for shrinkage.

Storing and Shipping.

As soon as packed, the butter should be immediately put in the creamery refrigerator. This refrigerator should be kept at as low a temperature as possible—below freezing is best. The butter should reach the market as soon as possible. It is a perishable article, and depreciates with age.

In shipping, see that the boxes are handled carefully, and that they are not soiled. Ship in well-iced refrigerator cars; examine each car before loading. Refuse cars that are dirty and foul-smelling.

Cleaning the Churn.

Start the churn revolving on the slow gear, rinse out all particles of butter with three or four pails of hot water, let this drain out and fill churn one-fourth full with boiling water with a small handful of Wyandotte added; wash off the rolls and place these in the churn and wash with the fast gear for one or two minutes. (If left much longer it will wear the holes in the end of the board for the rolls.) Allow to drain, take out rolls and rinse with two or three pails of hot water. Once or twice a week the churn should be steamed and given a wash with lime water. This will keep the churn sweet and clean, and by giving the rolls and inside of the churn a scrub with dry salt occasionally it will prevent the butter adhering.

A Good Whitewash for a Creamery.

Take one-half bushel of unslacked lime; add sufficient boiling water to slack it, and keep it hot. Then prepare one-quarter bushel salt, by dissolving in warm water, two pounds of glue dissolved in seven pounds of water; add six ounces of bi-chromate of potash and one-half pound of whiting. Mix salt, glue, bi-chromate and whiting together and add to the lime. Apply with brush or spray.

CHEESE-MAKING.

Alex. McKay.

The Curd Test.

Provide tin or porcelain cups sufficient in number to test the milk of at least the number of patrons supplying milk to the factory. A convenient size is two inches in diameter and three inches deep. Each cup should be plainly numbered. Provide a box of tin or galvanized iron with a neat fitting cover, large enough to hold the cups. For convenience, this box should have both water and steam connections. In taking the samples for making the tests place the number of the cup opposite the patron's name from whose milk the sample was taken. Place them in the box already described, adding water to the depth of the milk in the cups. Raise the temperature of the samples to 86° F. Set the samples by using one dram of a dilute rennet solution made of a strength of one part rennet to twenty-four of water. Stir in the rennet with a knife having a solid metal handle, being careful to sterilize the knife between the stirring of each sample so as not to contaminate one sample with flavors from another. When firm enough, cut with the same knife, using the same precautions to sterilize between the cutting of each sample. Raise the temperature gradually to 98° F. and handle the same as nearly like the milk and curd in the vat as possible. If looking for "bitter" flavors, and the milk is in a sweet condition, it may be advisable to add a few drops of culture to the samples before setting, as this flavor is rarely detected without acid. This test is particularly valuable in detecting flavors which develop in the curd but cannot be detected in the milk. It is also valuable for convincing patrons who may doubt that the flavor of their milk is as bad as represented by the cheese-maker, as it is possible to have them see and smell the curd made from each patron's milk as delivered at the factory.

THE PREPARATION AND USE OF A CULTURE.

First provide suitable cans of good tin, which are well soldered, and about twenty inches deep and eight inches in diameter. It is better to have a duplicate set, as this gives a better opportunity for keeping them in good condition. When the milk is in small lots it can be more readily heated and cooled than if kept in larger quantities. For convenience in heating and cooling, a special box large enough to hold the cans containing the culture for one day's use should be provided. This box should be made of wood, or if made of metal, should be insulated, so as to maintain a constant temperature while the culture is setting. This is essential if best results are to be obtained. The box should be supplied with steam and cold water connections.

Better results may be obtained by using the milk from the same source each day, as we are more likely to get a uniform flavor and acidity from day to day by so doing. After selecting the milk, place the cans in the tank with cold water, and cover the cans with a granite plate, thus guarding against contamination from outside sources. Heat gradually to a temperature of 185° F. This may be done without stirring the milk. Hold at this temperature for a few minutes to make sure that the milk in the cans has reached this temperature. Then run off the hot water and turn on cold water, and cool (in the same manner without stirring the milk), to a temperature of about 60° F. In case proper means for heating and cooling, such as described, are not available, then stirring will be necessary. Now add a small amount of the mother culture sufficient to give the desired acid at the time required for use. In our work we find that about one ounce (by measure) to ten pounds of milk gives very good results. In starting a culture it is advisable to use a commercial, or pure culture. These may be obtained from the Bacteriological Department of the College, or from any of the dairy supply houses. Special temperatures are required for the first propagation of these cultures. Empty the mother culture into a quart of pasteurized milk cooled to a temperature of 75° to 80° F., and allow to stand until coagulation takes place. It is advisable to propagate a commercial culture at least two or three times before using. If the culture is to be kept more than 24 hours, it is advisable to set accordingly, by using a lower temperature and using less of the mother culture. Aim to produce the same acidity from day to day. When the culture is first broken up, take out a small quantity to propagate the culture for next day. A glass sealer should be provided for this purpose. The indications of a good culture are as follows: The whole mass is coagulated, no liquid is found on top, and it has a mild acid flavor, pleasant to the taste and smell.

A culture may be used to advantage when the milk is maturing slowly, or when it is tainted or gassy. One-half of one per cent. is the greatest quantity that should be used, and this only when the milk is known to be in sweet condition.

Milk should be set slightly sweeter when culture is used. With gassy milk its use is especially beneficial. Culture with bad flavor or with too high an acidity should not be used. All utensils must be thoroughly cleansed and sterilized before using in culture making.

Co-operation Between Maker and Patron.

That there has been a marked improvement in the milk delivered to the factory for cheese-making is quite apparent from the improved quality of the cheese produced, but there is still room for more co-operation between the maker and his patrons; first by the maker keeping his factory and its surroundings in a better condition as to cleanliness and sanitation, thereby making it a more attractive place, which the farmer can look at with pride instead of disgust; secondly, by returning the by-product, whey, in better condition. This latter can be accomplished only by the pasteurization of the whey and the proper cleaning of the tank. It is useless heating the whey unless it is all removed each day and the tank thoroughly washed.

There can be no hard and fast rules given for heating the whey, as this must be varied according to the conditions at the factory, although there are a few general principles which must be observed if this work is to be done successfully and profitably. The heating should be commenced as soon as possible after the first whey is put into the tank. This should be done for two reasons—first, to take advantage of the temperature the whey is already at, and second, to prevent the further development of acidity. The whey should be heated to at least 150° F. in order to obtain the best results. Care should be taken not to exceed 160° F., as heating above this temperature will cause the whey to become slimy.

The benefits to be derived from pasteurizing whey are: It conserves the food value of the whey in the preventing of the development of acid; it insures a more even distribution of the fat in the whey; it also prevents the spread of contagious disease through the whey when being returned to the farm and fed to young stock; the sweet whey is not so hard on the cans as is sour whey, and the cans are more easily cleaned when the whey is kept clean and sweet. According to experiments made, the whey may be heated at a cost of from 50c. to $1.00 per ton of cheese, according to the efficiency of the equipment of the factory.

Milk for Cheese-making.

To obtain the best results, it is necessary to have the milk delivered at the factory clean, sweet, and of good flavor, and we would strongly advise cheese-makers to reject all milk which is not in a fit condition for the manufacture of first-class cheese. The maker who receives milk other than of this kind is acting dishonestly towards his better patrons who are furnishing a first-class quality of milk.

Testing for Ripeness.

This may be done with the acidimeter or the rennet test; good results may be obtained by the use of either test.

No definite degree of acidity can be given as a rule to go by. The proper rule is to set at the acidity that will give the best results later in the process or will allow the curd to remain in the whey until properly "firmed," which will usually take from 2¾ to 3 hours from the time of setting to the time of dipping the curd with the right amount of acid developed. This will be found to be slightly less than the acidity of the milk at setting as shown by the acidimeter.

If using the acidimeter and making colored cheese, the acidity should be ascertained before adding the color to the milk, as it is more difficult to detect the neutral point with the color added.

Another point to note carefully when using the acidimeter is the effect of the presence of rain water in the milk. When the milk is diluted, less milk is taken in the sample, and will show a less degree of acidity than is contained in the milk to the extent of the percentage of dilution, thereby misleading the operator.

If color is used it should be thoroughly mixed with the milk before the rennet is added, using one to one-and-one-half ounces of color per thousand pounds of milk. Add color in amount as the market may require.

When making early spring cheese it is usually necessary to make a quick-curing cheese in order to reach an early market.

To make this class of cheese it is advisable to use a large quantity of rennet and a small quantity of salt, as this hastens the ripening process and overcomes the tendency of milk at this time to make a dry, hard cheese due to the low per cent. of butter-fat in the milk and the tendency of this class of milk to develop acid rapidly. Heat the milk to 86° F. and stir slowly while heating. When the desired acidity is obtained, add the rennet, using four or five ounces per thousand pounds of milk, or sufficient to coagulate the milk firm enough for cutting in fifteen or twenty minutes.

Commence to cut early, using the horizontal knife first, cutting slowly lengthwise of the vat.

Then with the perpendicular knife cut crosswise and afterwards lengthwise of the vat. We would advise strongly the use of the ¼-inch wire knife, as this leaves the curd in better condition for the moisture to escape with the least possible loss in the whey, as the cubes are smaller, and more uniform, and are not so easily broken as the larger ones.

Commence stirring at once with agitators or the McPherson rake. Stir carefully for ten or fifteen minutes, then see that the curd is free from the sides of the vat before applying heat. This loosening of the curd from the sides of the vat can be done at this stage with less loss than if done immediately after cutting, as the curd has become somewhat firmer and does not break up so readily. Curds should be handled carefully and in such a manner that the cubes will not be broken, nor allowed to mat together. Rough handling or breaking of the curd causes a serious loss to both quality and quantity.

Heat to a temperature of 98° F. in 1½ hours from the time of setting. We formerly advised taking the agitators out soon after heating was completed with the idea that we were able to firm the curd better with the small rake, but since the introduction of the ¼-inch knife, we have found that we get better results, with less labor, by allowing the agitators to run for a longer time.

We still advise removing part of the whey so as to guard against the danger of a rapid development of acid at the time of dipping, as the curd can be removed more quickly with a small amount of whey. This can be accomplished by removing one of the paddles until the whey is reduced; then replace the paddle and allow the agitators to do the stirring, as they do it more gently and with less danger of harming the curd. There is nothing gained by harsh treatment of the curd, as such treatment will allow the moisture to escape only in so far as it breaks the curd. It is much better to allow the curd to firm by natural agencies, namely, acid development, heat, and rennet action. Acid usually develops very rapidly in the spring, therefore it is necessary to be prepared to remove the whey quickly when sufficient acid has been developed, which may be from .16 to .19 per cent. as shown by the acidimeter. Curds at this stage should be nice and firm (not hard or harsh), and be kept in a loose, open condition in the sink a sufficient length of time to allow the free moisture to escape, as the moisture can be removed at this stage with very much less loss than it can later on. Leave the curd about 8 inches deep in the curd sink. When it is well matted, cut into strips 6 to 8 inches wide and turn upside down, and in about fifteen minutes turn again, piling two deep. Continue turning every fifteen minutes until the curd is ready to mill. When the curd is well matted and flaky and shows .7 to .8 per cent. of acid it should be milled, and well stirred afterwards. This stirring should be repeated often enough to prevent the curd matting until ready to salt. This will be when the curd has mellowed down nicely and shows 1 to 1.2 per cent. of acid. Stir and air the curd well before adding the salt, as this improves the texture and flavor of the cheese. Salt at the rate of 1½ to 2 pounds of salt to 1,000 pounds of milk. It is important that the temperature of the curd from dipping to milling should not go below 94° F. After milling allow the curd to cool gradually to about 85° F. when ready to salt. Put to press at a temperature of 82° to 84° F. Weigh the curd into the hoop, tighten the press gradually and leave the cheese 45 minutes before taking out to dress. When dressing, use plenty of clean hot water and what are commonly called "shirts." These cloths help to make a good rind on the cheese, keep them clean, and cause the cheese to come out of the hoop more readily. Turn all the cheese in the hoops every morning, and allow no cheese to be taken to the curing-room that do not present a clean, neat appearance.

Summer Cheese.

In making summer cheese one ounce of color to one thousand pounds of milk is usually sufficient, but this may be varied according to the requirements of the market. Use from 3 to 3½ ounces of rennet extract per thousand pounds of milk, or sufficient to coagulate the milk for cutting in 25 to 30 minutes. If this limit is exceeded we have too great a loss in the whey. The cutting and firming of the curd is the same as given for spring cheese.

It may be necessary to raise the cooking temperature slightly higher, as we may be dealing with milk of a different composition from that used in the spring. The acidity should be allowed to develop to such a point that is found from day to day to give the best results in the working of the curd later in the process, aiming to have the curd with good body, well matted and in a flaky condition when ready to mill. At this time it should have an acidity of .7 to .8 in about two hours from the time of dipping. The curd should be well stirred after milling, and, if cut crosswise of the grain, the stirring may be done better and with much less labor. Curd should be well matured, stirred, aired thoroughly and cooled to a temperature of 85° F. before salting. Use from 2 to 2½ pounds of salt on the curd from one thousand pounds of milk.

Fall Cheese.

When making fall cheese it is a mistake to use too much culture or to ripen the milk too much, giving the cheese the appearance of having been made from over-ripe milk, which is very objectionable in fall cheese; rather use a smaller amount of culture, not more than one-quarter of one per cent., and add it to the milk when there is a small quantity in the vat, as it starts a gradual fermentation which continues all through the process. Always heat the milk to at least the temperature of the culture before the culture is added. Set slightly sweeter than usual, as we are able to work closer to the "sweet line" all the way through, owing to the fact that we receive the milk in better condition.

Gassy Milk.

The presence of gas in the milk retards the development of acid, and as acid is necessary in the manufacture of cheese, we should make the condition as favorable for its development as possible without injury to the body of the curd. To do this, use ¼ to ½ per cent. of good culture, as by so doing we introduce into the milk an abundance of the lactic acid bacteria, which will, under favorable conditions, overcome the gas-producing bacteria.

The next step is to ripen the milk slightly more than usual before setting. When cutting, aim to have the cubes as even in size as possible. Allow the acid to develop slightly farther before applying the heat, stir carefully, and heat slowly, aiming to have the curd in normal condition at dipping. Use the same temperature for cooking and the same acid for dipping as with a normal curd. A gassy curd does not require so much stirring as a normal curd, because the moisture leaves it more readily. Mill as soon as the curd is well matted and the acidity has developed to .8 to .85 per cent. About half way between milling and salting commence piling the curd. Allow it to stand 15 or 20 minutes, then spread it out, stir and pile again. Continue to do this until the curd feels mellow. Give plenty of fresh air before salting. Use a normal amount of salt and put to press at a temperature of about 80° F., if possible.

Over-ripe Milk.

What is over-ripe milk? It is milk with one of the agents used in cheese-making out of proportion; or milk with the lactic acid developed in too great a degree in order to obtain the very best results in converting the milk into cheese. What are the agents used in separating the solids from the moisture or water content of the milk? They are rennet, heat, and acid development, together with the cutting of the curd to get it into a convenient condition for the escape of the moisture. The heat should not be applied until enough milk is in sight to fill the vat. Why? Because as we raise the temperature, we make more favorable conditions for the development of acid. Heat as quickly as possible to 82° or 83° F., and after testing for acidity, set at this temperature. Why? Because, first, 82° is less favorable for acid development than 86° F., and the time for heating to 86° is saved; and what is more important, you are able to get the rennet in sooner and a larger quantity of it, thereby getting the acid under control more quickly; if not under control, it is difficult to get it to work in conjunction with the other agents which contract and expel moisture from the curd. In handling over-ripe milk it is always advisable to use more rennet—at least one ounce more, per thousand pounds of milk, for several reasons: first, that it may coagulate the milk more quickly; second, it gives a firmer curd more quickly, and renders the curd less liable to be broken when handling it, thereby saving to a great extent the great loss which usually is sustained from making over-ripe milk into cheese. It also helps to break down the caseous matter in the cheese, giving it a better texture. Commence cutting the curd early and cut rapidly so as to keep pace with the rapid firming of the curd. If this is not done the curd will get into a condition which makes it very hard to cut properly. Use the ¼-inch knife rather than cut the curd four times, as it leaves the curd more uniform and in better condition than when it is chopped finely. Heat quickly, and if necessary, raise the temperature two or three degrees higher than for normal milk.

Here is where a great many cheese-makers make a mistake, by stopping the stirring and running off part of the whey when the curd is quite soft; while the whey is running off, the curd is matting, then they go at it with the little rake and break it all up, thereby liberating a lot of the milk solids, giving them a high acid reaction in the whey, and the result is, they have a sweet curd and a sweet cheese. Just stop and think for a minute which is likely to do the more effectual work, you with the rake, or the acid development in conjunction with the heat and rennet action? The natural tendency for this kind of curd is to run together, so the best way is to keep it stirred in all the whey until it firms up a little. Hard raking does not firm the curd, except in so far as it breaks the cubes. If agitators are used, the curd can be kept apart and the whey lowered quite soon enough without resorting to this rough handling. One can readily see th[illegible]he whey be lowered quite close to the curd while it is in a soft co[illegible] that it will be quite difficult to keep it from matting; and while yo[illegible] keeping it apart with a small rake, you are breaking it up, causing a loss, and also causing rough texture in the cheese. It is always advisable to have the whey run down shortly before the dipping point is reached to avoid being caught with too much acid. When the curd is in a soft condition it is advisable to dip with slightly less acid and to keep it in a loose open condition in the curd sinks until all the surplus moisture is drained from the curd. If the curd is still a little weak, mill slightly earlier than usual. If not, treat as a normal curd. Mature the curd well before salting.

Ripening or Curing Cheese.

The ripening or curing of cheese is one of the most important points in the process, as no matter how well a cheese is made, if the curing is not properly done the quality cannot be the finest. Therefore it is necessary to provide a room where the temperature can be controlled at all times. It is important some means be provided to control the moisture in the room so as to prevent the growth of mold, which occurs where too much moisture is present. An excessive shrinkage takes place if there is too little moisture in the room. Proper temperature and moisture may be obtained by building an ice chamber in connection with the curing room and having a free circulation of air over the ice. This cools the air and causes a deposit of the moisture on the ice. In putting the cheese in the curing room, place them straight and even on the shelves and turn them every morning except Sunday. Keep the room well swept and looking clean and tidy. Use good strong cheese-boxes, have them dry, and of such a size as to fit the cheese nicely.

Weigh carefully, and stencil the weights neatly on the boxes. Load the cheese on clean wagons, and provide canvas covers to protect them from rain and heat while on the way to the station.

REPORT OF THE CHEESE MEETING OF THE WESTERN DAIRYMEN'S ASSOCIATION, O. A. C., DECEMBER 13, 1911.

Mr. D. A. Dempsey, Stratford, occupied the chair, and in opening the meeting called attention to the general high prices and good quality of the cheese during the past season. He referred to the many innovations in the dairy business, such as shipping milk and cream to the cities for ice cream, homogenized milk, etc., which are lessening the cheesemakers' supply considerably, but believe the people who had stood by the factory would reap the greatest benefit in the end.

Mr. Dempsey next called on Professor Dean, who welcomed the delegates to the College, and then took up some of the main points in the work done at the Dairy Department in the past year.

Two cheese made from the same weight of milk were exhibited. They furnished a striking object lesson in the difference in real value of milk for cheese-making purposes and of the unfairness of paying for milk by weight. Though many factors influence the make, it was found that the relation of the yield of cheese to the fat and casein is fairly constant, between 1.5 and 1.6 pounds of cheese for each pound of fat and casein in the milk.

Professor Dean then made reference to some investigational work carried on to clear up a number of objections to the Hart-Casein Test.

The following table shows the results, tested Saturday, December 9, 1911.

No. of Test.	Per Cent. of Casein.	Method of Testing.	Operator.
1 and 2	2	With motor	Mr. McKay.
3 and 4	2	With hand speed 56	Mr. Rickwood.
5 and 6	1.9 and 1.9	" " " 54	" "
7 and 8	1.9 and 1.9	With motor (acidity .15) (Monday, Dec. 11)	Mr. McKay.
9 and 10	2 and 2.1	With hand speed 56	Mr. Golding.
11 and 11	1.9 and 1.9	" " " 56	Mr. Rickwood.
12 and 12	2.2	" " " 50 (turns)	" "
13 and 13	1.9 and 1.9	With motor (acidity .2)	Mr. McKay.
0 and 0	2.4 and 2.4	" " " .55) (Tuesday, Dec. 12)	" "

The tests were made between Saturday, December the 9th, 1911, and Tuesday, December the 12th, 1911, and a number of factors, including the personal factor (the work was carried on by three men), percentage of acid, speed of the machine, and the temperature of the milk and acid, were dealt with. The extreme variation of the personal factor was 2-10ths of 1 per cent., which the Professor considered within the limits of error. From Saturday to Monday the sample had developed .15 per cent. of acid, and tested 1.9. On Monday night with .2 per cent. of acid it still tested 1.9. By Tuesday it had developed .55 per cent. acid, which meant coagulation. The presence of this amount of acid evidently tended to too much loss.

One tester was run by electricity, and one by hand. The speed varied from fifty to fifty-six. Fifty-six is the proper speed for the machine. Where the speed was fifty, 2 per cent. was got, while with the full speed it was 1.9 per cent. The packing of the casein in the Hart Casein Test is the result of centrifugal force. It is safe to conclude all these results are within the limits of error, but further experiments and tests will be needed before definite statements could be made on this point.

With regard to the effect of temperature of milk and temperature of acid, in one case where the temperature of the milk was 76 degrees, the increase in the percentage of casein was 2-10 of 1 per cent. All other cases were within the limits of error, that is, the tester got 2.2, 2.1, 2.2, 2.4, 2.1, 2.15, 2.1, and 2.1, the temperature of the acid varying from 70 to 74 degrees, and the temperature of the milk from 64 to 78. With reasonably careful work, accurate results or results within the limit of error could be got with the Hart Casein Test for milk.

Experimental work was carried on to ascertain the loss from over-ripe milk during hot weather. As an average of four years' tests it was found there was a loss of 2.1 pounds of cheese per thousand pounds of milk. No plainer lesson on the importance of having the milk delivered in a sweet condition could be shown.

Some very surprising results were obtained from moisture tests of the rind, first, second and third inches of cheese, when the cheese was green, when one month old and over, every week during the ripening period. It was found the loss was practically altogether in the rind and first quarter of an inch of the cheese. Under good average curing conditions there is practically no loss after the first quarter inch, and none after the first inch. Tests of a large number of samples from both Western and Eastern Ontario have shown the moisture content to be practically the same for cheese one month old as for green cheese.

Asked as to how he would account for loss of weight, Professor Dean said in some cases this could not be done, while in others the loss could be accounted for through loss of moisture in the rind. His own judgment was that there were losses other than moisture. He held the theory that in the process of ripening, gases are produced at the expense of cheese-making material, thus accounting for extra loss.

The effect of temperature during the ripening process was dealt with. Experiments have been conducted for the last ten years, and the best all-round results were got by taking the cheese directly from the hoops, putting them in ice-cold storage, and ripening them at a temperature of 40 degrees. For the season of 1911 cheese treated in this way averaged 93.43 points when scored by Mr. Herns. Cheese left in the ordinary ripening from one week, and then transferred to cold storage, averaged 92.96 points, and cheese ripened in the ordinary room with a temperature of 60 to 75 degrees averaged 90.42 points. Thus we have better quality and less shrinkage in the cheese put directly in the temperature of 40 degrees.

Mr. Herns reported that thirty-three factories pay by test in Western Ontario, an increase of five over 1910. There were twenty-one cool curing rooms. Eleven factories fed the whey at the factory, six less than in 1910. The temperature of the curing rooms averaged 72 degrees for the month of August, one degree higher than the average for the same month last year.

Thirty-seven whey tanks were cleaned every day, thirty-eight every week, twenty-nine every two weeks, and thirty-three every month. An increasing amount of attention is being paid to this work in the west.

After considerable discussion on the cooling of cheese, a committee on Resolutions was appointed, which drafted the following resolution:

"Whereas in the opinion of this meeting some definite temperature should be established for milk sent to cheese factories;

"Be It Resolved,—That the night's milk for daily delivery be cooled immediately after milking to a temperature of 65 degrees or under, and that the temperature of this milk should not be higher than 70 degrees when delivered at the factory. If for any reason it is found necessary to mix the night's and morning's milk, the night's milk under these conditions should be cooled to a temperature of 60 degrees Fahr. or under, immediately after milking, and milk so mixed should be delivered at the factory at a temperature not higher than 75 degrees F. To keep milk over Sunday for Monday morning delivery, it is recommended that the milk be cooled immediately after milking, to a temperature of 60 degrees or under, and held at this temperature until delivered at the factory."

This resolution carried, and it was decided to have copies printed to be read at the annual meeting of each factory.

Two experiments in salting were conducted at the College. One along the line of basing the weight of salt on the weight of milk versus the weight of curd, gave no difference in the cheese; in the other experiment, the use of two pounds of salt per 100 pounds of curd was compared with 2¼ pounds. Seventeen experiments were made, and the milk averaged 3.5 per cent. of fat, and 2.2 per cent. of casein. So far as results indicate, it would seem advisable to use 2¼ to 2½ pounds of salt per 100 pounds of curd, rather than 2 to 2¼ pounds, a better flavor being obtained by the heavier salting. The quantity best to use seems to depend on how the work is done, and the condition of the curd in regard to moisture at the time of salting.

The question of the yield of cheese from milk poor in fat compared with that from milk rich in fat, and the percentage of fat in cheese made from rich milk, and that from normal milk, was then discussed. Twenty experiments were conducted at the College from April the 3rd to the last of October. Two lots, "A" and "B," were made. In fat content "A" lots averaged 35.72, and "B" lots 36.11. The average test of the milk for the season was 3.4 fat, and 2.23 casein for "A," and 3.7 fat and 2.4 casein for "B."

Two cheese exhibited, one from milk testing 3.7 per cent. fat and 2.4 casein, and the other from milk testing 4 per cent. fat and 2.9 casein weighed 72 pounds and 79.25 pounds respectively. The average percentage loss in the whey from A and B lots made throughout the season was 1.7 per cent. and 1.9 per cent. respectively.

According to this work there is no great difference in the fat per 100 pounds of cheese, but there is a difference in the size of the cheese made from the same quantity of milk. It hardly stands to reason that two lots of milk from which these cheese were made should be paid for at the same rate per pound. This difference in yield is, no doubt, partly due to the high percentage of casein.

REPORT OF THE CREAMERY MEETING OF THE WESTERN ONTARIO DAIRYMEN'S ASSOCIATION, O. A. C., DECEMBER 14, 1911.

The President, Mr. W. W. Waddell, Kerwood, occupied the chair, and called on Professor Dean, who, after welcoming the butter-makers to the College, briefly referred to the increase in the sale of cream or various "side lines," such as the manufacture of ice cream. He also called attention to the necessity of the creamery men keeping on the alert to prevent the sale of renovated butter, or of oleomargarine, which some members maintained is being sold as "Glen Crown Creamery."

Composite Samples.

The work of comparative testing from weekly and monthly composite samples was then discussed. Professor Dean believed that, while the right and best way is to test each and every delivery of cream, yet monthly composite samples give for all practical purposes a fair and accurate result, and show the average quality of cream delivered for the month. Experimental work with three patrons throughout the whole season showed a difference of less than 1 per cent. between fat determined by the daily test, and fat determined according to the composite plan tested monthly.

Where composite samples were left exposed to the air, evaporation apparently took place, and it was found that the average of fat was 2.6 per cent. higher where the bottle was left open in a warm room, than in the test made in the usual way. Composite samples should be kept in a cool place, and in closed bottles, if accurate results are to be arrived at by this plan.

Some work was done in keeping cream in crocks. There was little difference in the temperature or acidity of the cream, whether kept in a well-glazed crock, or in one chipped or cracked, but the cream in the latter in every case had a bad aroma in from 44 to 52 hours after placing the cream in the crock. This is doubtless one reason for many patrons' cream being off in flavour.

Pasteurizing of Cream.

Professor Dean also called attention to experiments made by the Guelph Creamery Company in the pasteurization of cream, which had been carried out at a cost of about three cents per hundred pounds of butter, all the cooling having been done with water. The cost of pumping was included in this.

Lbs. Cream.	Lbs. Coal.	Power K.W.H.	Water, gal.	Lbs. Butter.	Cost.
2455	73	4.25 .041 cts. per lb.	1690 of butter.	876	Coal 14.7 Water 16.9 Power 4.8 36.4c.
4600	125	4.6 .032 cts. per lb	2240 . of butter.	1601	Coal 25 Water 22.4 Power 5.2 52.6
3400	85	3.2 .026 cts. per lb	1110 . of butter.	1210	Coal 17 Water 11.1 Power 3.6 31.7
1749	58	4.3 .032 cts. per lb	502 . of butter.	670	Coal 11.7 Water 5. Power 4.7 21.4

The cost of pasteurizing here has reference to only the mechanical part of the work; just the water, coal, and the power used in pasteurizing the cream. The cream came in at temperatures ranging from 60 to 72 degrees.

Live steam was used for heating and the condensed steam allowed to escape. Electric power costing 1⅛ cents per kilowatt hour was used. Coal cost $4.00 a ton and water .10 cents per 1000 gals. The cream was cooled in each case to the temperature at which it arrived at the Creamery. The water was ten cents per thousand gallons as it reads on the meter. City water was supplied from the city main and the cream pasteurized at 170 degrees. The labor problem was omitted altogether. In the last experiment the water was pumped, using an exhaust pump, and the cost was about the same.

Where two cooling vats were used better and quicker work was done than where only one was employed.

Mr. Rickwood discussed "The Results obtained from collecting cream in ordinary milk cans and in jacketed cans on temperature and acidity of cream delivered."

During June, July and August the cream haulers took a jacketed can and an ordinary can on the same waggon. They divided the patrons' supply of cream after it was weighed, putting half in each can and cared for each as on an ordinary trip. When the cream came to the factory, the temperature of the cream, the amount of fat, the weight and the acid were taken. The temperature in July was 74 degrees in the ordinary can and 69 degrees in the jacketed can. There was very little difference in the acidity. On July 5th, which was very hot, the temperature in the ordinary can was 77 degrees, in the jacketed 73 degrees. On August 10th the ordinary can was 79 degrees and the jacketed can 74 degrees, and on August 17th they were 74 and 71 degrees respectively. There was a difference of three to four degrees in nearly every case between the jacketed and the ordinary can. Some of this cream came twelve miles in an open wagon. Mr. Rickwood's experiments were carried out with ordinary thirty-gallon and ordinary jacketed cans.

Mr. Forrester affirmed that the cream that was brought in on a closed wagon and well covered would be from five to seven degrees cooler than where it came in exposed to the sun on a long haul of ten to twelve miles. This work was done with eight-gallon cans.

Mr. Herns, after reviewing the growth of the creamery business, and the work of the past season, dealt with the question of moisture, salt, churns, and pasteurizing. Buyers say there is a lack of uniformity of salt in some Western Ontario butter, while Quebec butter does not show this. Mr. McMillan thought that much of the lack of uniformity resulted from not estimating the amount of butter in the churn at different times. This could be done by weighing and testing the cream, and weighing the salt. In reply to an enquiry by Mr. Herns on the salt test. Mr. Rickwood replied that by allowing a churning to drain some time before salting, a different result was secured than when it was worked immediately after salting. Having the salt wet or dry also varied results, as butter retains more wet salt than dry.

Mr. George A. Putnam, Director of Dairy Instruction, was next called on, and thanked the dairymen, cheese-factory men, and creamery men for their hearty co-operation in dairy instruction work. He stated that the attitude of the producer, the manager, the owner, and the maker had changed greatly in the last few years. This has been largely due to co-operation, and having first-class men in the extension work. Mr. Putnam believed the most important feature of all is to get the raw material to the creamery in proper condition, and hoped to see more attention paid in the not too distant future to the special instruction of patrons in this particular.

Mr. Lund took up the question of using powdered milk as a "starter," where the regular skim milk could not be obtained. It contains only two per cent. of moisture, so that bacteria have very little chance to increase in it. In mixing it, one should aim to have the same percentage of solid in the mixed liquid as in the skim milk, so that one part of powder to ten parts of water makes it about right. Twelve churnings were made, part with regular skim milk starter, and part with powdered milk starter. These all scored practically the same, and there seems no danger of getting a bad flavor with the powder.

Mr. Barr devoted three months during the summer of 1911 in conducting experiments on the pasteurization of cream and the use of pure cultures, the object of the work being to obtain some definite information on pasteurizing and using a culture in all kinds of cream. The work was conducted at the Renfrew Creamery, Renfrew, Ont., the cream being selected from the regular supply. This cream was put in one of the creamery cream vats and divided into different lots, each lot being treated differently.

The following tables will show the result of the average score on the flavor of the butter from a number of these experiments:

AVERAGE SCORE ON THE FLAVOR OF THE BUTTER FROM THE SAME CREAM SWEET, AND AFTER STANDING 24 HOURS AT A TEMPERATURE OF FROM 51 TO 62 DEGREES.

Condition of Cream.	Average Acidity in Cream.	Average Score for Flavor—Possible 45.			
		Raw Cream without Starter.	Raw Cream with Starter.	Past. Cream without Starter.	Past. Cream with Starter.
Sweet........	.30%	40.79	41.58	41.87	41.92
Sour..........	.55%	40.64	41.05	41.75	41.79

These experiments show that when the cream is delivered to the creamery fairly sweet and clean in flavor, there is not a very great difference in the flavor of the butter from raw cream with starter and the two lots pasteurized. These three lots, however, scored considerably higher than the lots from raw cream without starter. There is little difference between the lots from sweet cream and those from sour cream, or the same cream kept 24 hours longer.

Total score sweet cream lots 41.54
Total score sour cream lots 41.30

AVERAGE SCORE ON THE FLAVOR OF THE BUTTER FROM CREAM DELIVERED AT THE CREAMERY IN A SOUR AND SLIGHTLY TAINTED CONDITION.

Average Acidity in Cream when received.	Average Score or Flavor—Possible 45.			
	Raw Cream without Starter.	Raw Cream with Starter.	Past. Cream without Starter.	Past. Cream with Starter.
.54%	38.75	36.47	40.73	41.10

This table shows plainly that adding starter to raw sour cream did not improve the flavor, also that pasteurization improved the flavor a good deal.

The loss in pasteurizing all kinds of cream showed a little over three-quarters of one per cent. The higher the acidity the greater the loss.

Mr. Barr was of the opinion, however, that it would pay creamery men to pasteurize, as the improvement in quality would more than pay for the loss and extra cost of pasteurizing. From the results of the experiments conducted, he considered that it was doubtful if it would pay to use a pure culture in pasteurized cream. He favored heating the cream to 150 degrees and holding it at that temperature for about 20 minutes.

EXTRACTS FROM A SPEECH BY MR. G. G. PUBLOW, CHIEF DAIRY INSTRUCTOR FOR EASTERN ONTARIO, BEFORE THE EASTERN DAIRYMEN'S ASSOCIATION, IN JANUARY, 1912.

Note.—Mr. Publow visited Great Britain last summer (1911) in the interests of the dairymen of this Province, and there gained a great deal of valuable information regarding Canadian cheese in the British markets which should be invaluable to both makers and patrons of our factories. The following are a few of the outstanding points:

"In order to obtain as full information as possible I interviewed a large number of merchants dealing in Canadian produce in the principal cities of Great Britain, and succeeded in obtaining much that should be of assistance to us in the preparing of goods to suit the English consumer. It seemed to be the general opinion amongst all those men that what we consider our best Canadian cheese are suitable for any of their markets and compare very favorably with their home-made cheese and those from other countries. They also stated that they had noticed a general improvement in our cheese from year to year. In comparing our average cheese with the average English and Scotch makes, it was evident, however, that they excelled us somewhat in flavor and texture, and the principal reason for this is the superior condition of the milk supply, the sanitary conditions at their dairies being much ahead of ours. I was much surprised to find the demand in England very strong for a mild-flavored cheese, for I had been given to understand that the English people were lovers of cheese with a well-developed, or even sharp flavor. But I was informed that the English demand for milder cheese was growing by leaps and bounds, the quality that was in greatest demand, and at best prices, being those of mild flavor, close, smooth cutting, with a meaty texture. This fact should at once cause us to realize the need of better care of the milk at the farms, as it is only possible to make such cheese from clean sweet milk. An enormous market exists in Great Britain, but at the same time we should not forget that there will always be competition of a formidable character, which will require our best efforts to meet.

"Amongst the more common complaints was that of broken boxes, and it was quite evident that the trouble is largely due to the boxes themselves, many of them not being properly built. Every care possible is exercised in handling the boxes by the transportation companies, who are obliged to cooper or replace breakages for which they or their employees are directly responsible. The covers fall off, the heads and bottoms fall to pieces; many boxes are too large for the cheese and others are not high enough in the band, all of which tend to give the shipments an unsightly appearance.

"As a rule our cheese are stored in the transportation companies' warehouses and samples only are taken to the importers' salesrooms, where sales are made according to samples, and delivery is given to the retail men by the transportation company. Of all the places visited, I found the best facilities for storing cheese at the Commercial Surrey Docks, London. The facilities there are all that could be desired. There appeared to be a larger percentage of broken boxes at Bristol than at any other place, this being accounted for by the extra handling the cheese received as a result of having to be reshipped by train, and consequently more complaints regarding the frailty of our cheese boxes were made to me at that place."

"Practically all merchants complain of the losses in weights, which vary from one to three pounds on a box. This bears out arguments of past years against the shipping of our cheese in such a green, uncured condition. I found some lots running from three-quarters of a pound to two pounds a box short I also saw a few cheese weighed singly which fell short from three to five pounds a box. This, of course, was not a natural shrinkage. Evidently they had been improperly weighed at the factories. Not much complaint is made if they do not go over one pound short, in fact I was told that they rather expected it, and considered it a natural shrinkage, but when they fell short two and three pounds, and sometimes more, then there was trouble for someone, as frequently the margin of profit looked for was offset. The lots from the Eastern Section that were running short were generally found to be from factories that were following the practice of shipping to the hoops. Our competitors are much wiser in this respect, and very few Scotch or English cheese are placed on the counter before they are two months old, while cheese from New Zealand seldom reach their destination much under three months. The loss of weight is inseparably connected with their next common complaint, which is that of leanness of quality. This year this defect was more pronounced than usual, as, owing to the great shortage of cheese in Great Britain, the cheese went to the consumer almost immediately after their arrival from Canada. This is a defect easily remedied, and means that we simply must discontinue the practice of shipping our cheese at such an early date.

"The greatest general complaint on quality is to the effect that our cheese are not smooth enough in texture, not spreading easily, especially our summer or hot weather cheese. We cannot remedy this condition by leaving more moisture in the curd, without having a pure milk supply. Much of the dry texture is due to over-salting and high-curing temperatures. It is along these lines that other cheese excel ours, but with proper facilities for cooling the milk and cool-curing rooms for the cheese, there is no reason why they should.

"Frequent complaints are made against the size of many of our cheese, many being too heavy for the general trade. Many of the retail stores are in charge of women or girls, and cheese weighing over 80 lbs. are hard for them to handle, and the smaller cheese, ranging from 75 to 80 lbs., enjoys the greatest popularity on this account. Occasionally shipments of 100 lbs. cheese are wanted for window show purposes, but these are not frequent. In many of our sections the size of cheese has increased owing to the increased cost of boxes, but the practice does not meet with favor in England, and we should bear in mind that if we are to cater to this market, we must give them the goods which the people desire."

"I found that practically every man who was getting our best types of cheese said that they were practically as good cheese as they required, and I came to the conclusion that all we had to do was to imitate our best conditions. If we can get all our conditions as good as our best, we need not be afraid of any competition. It is up to us to improve our average conditions. We must have better sanitary conditions under which the milk is produced, and it must be delivered at the factory at a lower temperature, and we must keep the cheese for a longer period It is not advisable for us to increase the moisture in our Canadian cheese. They want a close cheese, and they want them smooth and meaty. They want a cheese that will spread easily, but it would not be safe for us to increase the water content in these cheese unless we get sanitary milk and better conditions in which to ripen them. That is the one way in which our people would get more money."

"Cheese from one factory that were sent to the Old Country on a special order, when they were held for some time, were found to be rank in flavor, and samples were returned to this country. They were the foulest smelling cheese I ever saw, and I think it could be traced largely to the water. What we are concerned about is the manner in which the cheese go to the consumer. When they are shipped earlier many of the taints are not noticed. I wish I had had some of the makers with me, because if they had seen some of our cheese in the Old Country they would practise different methods.

"Wherever there is the least suspicion of the water being wrong, the wash water should not go into the whey tanks. Arrange, if possible, to drain the wash water from the tank. If, however, the wash water goes into the whey tank and is thoroughly pasteurized, there is no danger of any taint going back into the cans."

"The sounder the milk is the more moisture you can leave in the cheese with safety, but the more moisture you leave in them the more necessary it is to have a lower temperature to cure them. The reason our cheese show that leanness is largely due to heavy salting, and high acidity at time of dipping."

Asked what acid test was used, Mr. Publow said: "They test by the iron, but nearly every factory has the acidimeter test. Cultures are used and all the work done thoroughly."

"Cheese are sold according to quality, and very little according to the country it comes from. For instance, a shop keeper is going to retail ten cheese a day (many of them sold more than that). The first thing in the morning, the cheese are taken out of the boxes and stripped of their bandages, cut up, labelled, and placed on the counter. Those of mild, clean flavor, and close smooth body and texture, being labelled finest Cheddar, best Cheddar, and so on, and the best price asked (it may be eight pence per pound). Those that are slightly open or coarse in texture, or acid in flavor, may be sold for sevenpence, or may be marked down to sixpence. Before I came away I saw them selling from sevenpence to tenpence, according to quality. I saw cheese from the same factory, graded, and a difference of six cents being asked for them on the counter. If such a thing as that would take place in this country there would be very little need for men to go around trying to persuade cheesemakers and farmers to do what is in their best interests. This grading is largely done by the retail man, and it appeared to me as though that was where he made his money. Supposing I bought 500 finest Brockvilles or finest Bellevilles or finest Peterboros, and when I came to cut these cheese up I found that they were not up to the standard, I would likely return them to the importer, or ask him to make good. If I had bought them as slightly under finest, I would expect to find a percentage of fine cheese, and the larger the percentage of fine cheese in the lot, the more money I would make, and, as a result of the large percentage of fine cheese from many factories, certain brands were in splendid demand."

"I found that not only were our cheese being sold in the large cities and towns, but they were sold in the country villages as well. When I visited the Cheddar Valley (the home of English Cheddar cheese), I found cheese from this Ingersoll section being retailed there, and it was giving good satisfaction. The best cheese (of English make) I saw was at this place. I was very much surprised to find that there was only a small quantity of cheese made in the Cheddar Valley. When speaking to some of the farmers of this place, they said that they had turned their attention to the city milk supply, as owing to the increased demand for milk and cream, the price realized per gallon was greater than if it had been made into cheese, and there was a saving in labor as well, and that they were not likely to go back to the manufacture of cheese."

"I also had the privilege of visiting several of the farms and dairies in Scotland, and had the opportunity of seeing the conditions under which the milk was being produced and manufactured, and there is no doubt but what the English and Scotch makers have a great advantage over our Canadian makers, as they, nearly all, have full control of the milk supply. As a rule the cheese-maker pays the farmer a cheese rental for the cows, the farmer furnishes the feed, and the cheese-maker takes full charge of the herd for a year; the milking and caring for it is under his supervision. The milk is not allowed to remain in the stable for any length of time after it is drawn, but is taken direct to the dairy, where it is strained and cooled. There was every evidence that they realized the importance of cleanliness in connection with their work. I found the stables very clean, some of them being scrubbed twice a day. The cows were brushed and the udders washed before milking. As a rule the milking was done by women, and in some cases I saw them washing their hands after milking a cow, before milking another, and this appeared to be their regular custom, as they had been given no previous notice of my visit. I was anxious to see their every-day conditions, for when comparing their make of cheese with ours, I was somewhat at a loss to know why it was that they could retain so much moisture, and have the flavor remain sound. If there is one thing more than another that will impress you, when visiting those dairies, it is the thoroughness with which the makers do their work. They do well, what they know. When discussing with them their method of making, they laid special stress on having the milk work slow. They did not want it to work faster than three to three and a half hours. The curds are cut rather coarse (the curd knives used are similar to our old style ½-inch mesh), they heat slowly, and pay special attention to the raking and firming of the curds in the whey. They appear to aim at uniformity in size and neatness in finish, in fact, all of them were as well finished as the best at this show to-day, which is saying a good deal. They press for three days. They are taken out of the hoops every morning and turned, and special care is taken to insure good rinds. This would appear to be very essential, as their cheese are taken to market without boxes. The output of each dairy is placed separately on the floor of the warehouse and sold in block, and being neatly finished, and even in size, they look very attractive. Many of the dairies (owing to their good reputation) were bringing from two to four shillings a hundred weight more than the regular market price. I would advise factorymen here who are making a superior quality to brand the cheese with the name of the factory and the district in which it is made, for the time is not far distant when you will be rewarded for your pains."

"As to the future outlook for our cheese on the English market I would say that if we study the tastes of the people, and give them what they think most of, it appears to me as though the market would be almost unlimited. The thing for us to do is to continue our work of education for a clean, cool milk supply, and have the curing-rooms of our factories so improved that the temperature can be controlled close to 60 degrees, and keep the cheese until they are sufficiently ripe to give a good account of themselves, thus we will be doing the proper thing."