

Kansas State Agricultural College.

EXPERIMENT STATION.— Bulletin No. 181.

ED. H. WEBSTER, *Director.*

STATE DAIRY COMMISSIONER'S BULLETIN No. 2.

The Permit System of Cream Buying.

***Information for Persons About to Engage in
Sampling and Testing Cream in Kansas.***

This bulletin supersedes all previous instructions and publications.

BY

D. S. BURCH, *Dairy Commissioner.*

WM. F. DROGE, *Deputy Dairy Commissioner.*



MANHATTAN, KANSAS.

MARCH, 1912.

PREFACE.

The importance of the cream-receiving station in the dairy industry of Kansas calls for a publication calculated to guide buyers along proper lines of dairy sanitation and conformance with law.

The well-managed station is a convenient and profitable market for cream. The poorly managed station is a menace to public health. This bulletin has been prepared especially for persons about to engage in the business of receiving, sampling, and testing cream.

Though educational in nature, it presents the principles upon which the dairy law of Kansas is based. The laws governing the buying of cream and other dairy products should be studied and their spirit as well as their letter carefully observed. No person, dairy official, or agent of any company, has authority to give orders or instructions not in strict accordance with the provisions of these laws, copies of which will be furnished on request. D. S. BURCH, *Comissioner*.

MANHATTAN, KAN., November, 1911.

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The Permit System of Cream Buying.

BY

D. S. BURCH, Dairy Commissioner.

WM. F. DROGE, Deputy Dairy Commissioner.

CHAPTER I.

Cream Station Equipment.

The operator, through business methods and by means of his personality, determines the success of his business, but proper station equipment is in all cases necessary for efficient work.

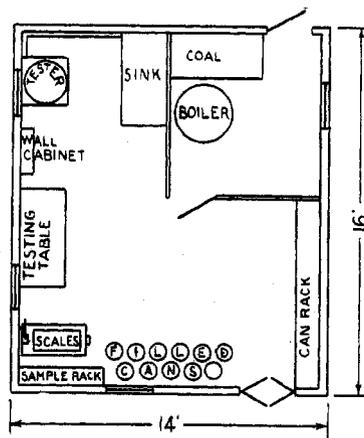
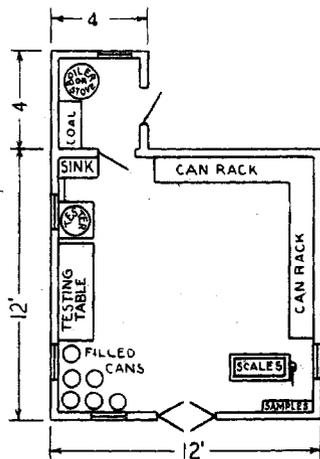
Location of Station.—A cream station should be a building where no other produce is bought, sold, or handled. It should face a main street and be built on well-drained ground. Stations should not be built on alleys or back of other buildings.

Size of Station.—The following table gives the approximate size of a cream station necessary for the successful handling of the stated amount of business:

	<i>Size of floor space.</i>
24 cans per week or less.....	10 x 14 ft. or larger.
25 to 50 cans per week.....	14 x 16 " " "
51 to 75 cans per week.....	16 x 20 " " "
76 or more cans per week.....	20 x 24 " " "

The tendency in the past has been to make cream stations too small rather than too large, thus impeding the growth of the business. There should always be room for all the empty cans inside of the station. A cramped space handicaps the operator in his work and, especially on busy days, reduces the rapidity with which he can handle the cream received.

Walls and Ceiling.—Whatever the construction of the building, the interior should be clean, smooth, and well painted, preferably a light color. Decorations should be few and well chosen. The buyer's permit must occupy a conspicuous place. The window surface should be at least one-tenth as large as the area of the floor. Do not paper the walls or ceiling of a



Floor plans of well-arranged and well-equipped cream stations.

cream station. The paper soon becomes torn and presents an untidy appearance, as well as being a harbor for dirt and insects.

Floor.—A smooth, well-finished cement floor, sloping to a drain, is the most suitable material for underfoot in a cream station. A tight wood floor of well-matched lumber is also satisfactory if kept well-painted and clean.

Outside Conveniences.—A covered porch over the principal door affords a very desirable protection against wind, rain and sun. Well-fitted screens should be provided for windows and doors. A load of crushed stone or gravel spread in front of the cream station will greatly reduce the amount of dirt carried into the station. Some efficient system of drainage by which waste water can be quickly disposed of should be provided. In the absence of a better system, a fifty-foot line of drain tile, laid four feet in the ground and opening into a ditch or gully, is recommended.

The equipment of a modern cream station consists primarily of the following :

Can Rack.—For the purpose of inverting empty cans in pure air as required by law, a can rack is necessary. Such a rack should be large enough to receive all empty cans which are likely to be on hand at any time. A very convenient can rack may be constructed of substantial uprights, to which are

nailed four-by-one crosspieces, as illustrated. The crosspieces on which the mouths of the cans rest are about twelve inches from the wall, and the lowest one should be not less than eight inches from the floor. Eight-penny nails may be driven just above each can to receive the lids. A more sanitary, though somewhat more expensive, rack may be provided by substituting 1 1/4-inch galvanized-iron piping for the wooden crosspieces. The piping collects less dust than the wood and is more easily cleaned.

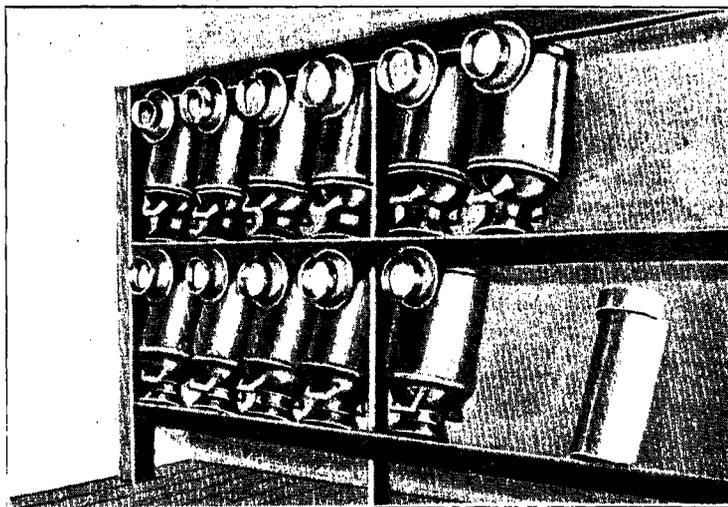


FIG. 3.

An inexpensive but well made can rack.

Boiler and Steam Fittings. —A steam boiler provided with the proper connections and fittings is the best source of steam and hot water for washing cans, sample jars, and apparatus. To prevent excessive heating of the station during the summer months, the boiler should be partitioned off from the room in which cream is received. By firing the boiler in the morning and allowing the fire to go out soon after testing, enough hot water will be provided for the entire day.

Sanitary Sink. —A cream station should contain a sink in which cans and glassware may be conveniently washed. The half-ground galvanized-steel sink, large enough to receive a ten-gallon can, is very suitable. The two-compartment sink is also finding favor. A waste pipe emptying into a drain should

be provided for the removal of dirty wash-water. The practice of allowing wash-water to stand in the sink or in an open bucket under the sink is insanitary.

Babcock Tester.—The Babcock tester, in which the bottles are whirled, is made in various styles, any of which are satisfactory if they are: (1) So covered as to protect the operator from acid and broken glass in case of accident; (2) firmly mounted on a rigid level, support; (3) of sufficient size to handle readily an average day's business. A twenty-four bottle tester is large enough for any cream station and a twelve-bottle tester is sufficient for the average.

Weigh Scales.—Scales for station use should be accurate and sensitive to a quarter of a pound.

Cream Sampler.—The stirring-rod and cream sampler here illustrated is superior to the ordinary stirring-rod which has a round bottom and generally fails to move the cream at the bottom of the can. Any tinner can make it by soldering a strip of heavy tin to the bottom of the ordinary stirring-rod and making the holes as illustrated. The tin should be attached not less than one-half inch from the rim of the sampler in order not to interfere with the filling of the sample jars.

Sample Jars.—Any clean wide-mouthed bottle holding enough cream for two samples is suitable for receiving cream samples. It should be provided with a tightly fitting screw-cap or cover to prevent evaporation of moisture. A cream station should have one-third more sample jars than the greatest number of patrons likely to deliver cream any one day.

Cream Scales.—All cream samples for testing must be accurately weighed on sensitive scales, as required by ruling 14,* which reads as follows:

RULE 14.—The use of the pipette for measuring the amount of cream used in testing is not approved. Persons testing cream shall weigh the samples accurately on a scale to be approved by the dairy commissioner. The weight of cream shall conform to the style of test bottle and shall be exactly 9 or 18 grams. This ruling shall take effect and be in force July 1, 1912.

* **PAYING FOR CREAM THE DAY IT IS RECEIVED.**—An order issued from the office of the Dairy Commission at a previous date, and commonly, though erroneously, known as rule 14, prohibited the payment for cream the day it was received. This order was not approved by the board of regents, as required by section 2 of the dairy laws, and is therefore not official. The constitutionality of this order is doubtful. The only official ruling dealing with payments for cream is ruling 16. The official instructions for testing are given in this bulletin.

RULE No. 16.—No person or persons, firm or corporation purchasing

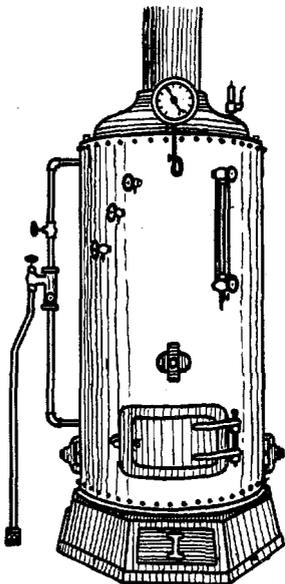


FIG. 4.
Boiler suitable for cream station work.

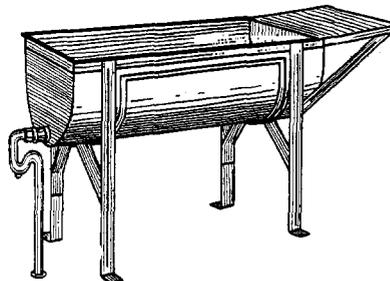


FIG. 5.
Sink with sanitary drain.

The scales should be protected from moisture, dirt and flies by a box or oilcloth cover placed over them when not in use. As provided in section 5 of the dairy law, a dirty scale is considered inaccurate and its use is illegal.

Any clean scale which is sensitive to one drop of cream and to at least one-tenth of a gram is approved for cream-testing purposes.

Acid.—Sulphuric acid, when not in use, should be kept tightly corked, as it absorbs moisture from the air and may thus become too weak for use.

Pipette.—A pipette is convenient for many purposes, but must not be used for measuring the charge of cream for testing. One with a rather large mouth is preferred, as it will become clogged less readily.

Test Bottles.—A cream station should be equipped with about twice as many bottles as are necessary to fill the tester. Bottles are most easily washed just after they have been used. Use a slender brush with a



FIG. 6.
Nelson stirring rod and cream sampler.
(Invented by N. C. Nelson, station operator, Eskridge, Kan.)

milk or cream by the Babcock test shall pay for the milk or cream so purchased until the Babcock test has been fully and accurately made in accordance with the provision of section 5 of chapter 237 of the Laws of Kansas, and in accordance with the instructions for drawing samples and conducting the test issued by the dairy commissioner. In no case shall any part of the sampling or testing as prescribed by the dairy commissioner be omitted or be carelessly or hastily performed.

tuft of bristles on the end. The 9-gram, fifty per cent, six-inch bottle, graduated to one-half per cent is recommended for station use. The 9-gram and 18-gram, fifty per cent, nine-inch cream bottles also meet with official approval. The 18-gram, six-inch bottle is not approved.

Acid Measure.—The acid measure is a small glass cylinder generally marked at about 8.8 and 17.5 cc. for measuring the amount of acid used in testing.

Water Bath.—The water bath here illustrated gives excellent satisfaction as a means of holding tests at 120° for ten minutes, as required by law. A metal carrier receives the bottles and holds them upright when in the bath water. Station equipment should always include an accurate thermometer.

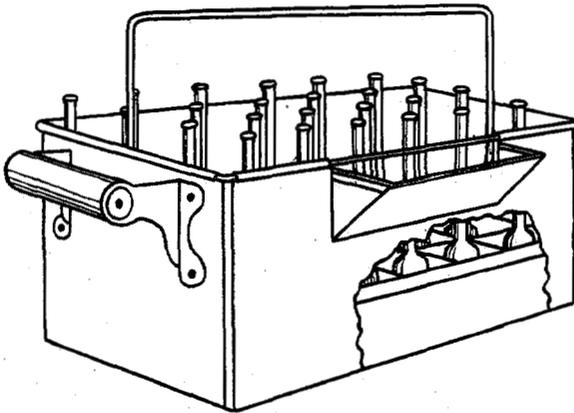
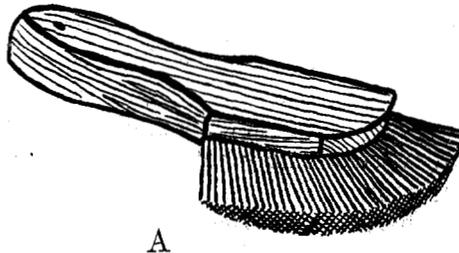


FIG. 7.
Water bath.



A



B

FIG. 8.

Two useful brushes.
A—For washing cans.
B—For washing test bottles.

Dividers.—Dividers should be sharp-pointed and move with plenty of friction at the hinge. Dividers which are likely to slip should be either repaired or discarded.

Washing Powder.—Use a mineral washing powder. Soaps containing animal or vegetable fats, or washing powders which produce suds, are not suitable for cream station work.

Soft Water.—Water containing minerals, especially lime, is unsuitable for testing and is inefficient for washing glassware. When acid is added to well or spring water, the minerals are acted upon, often with the production of gas and the precipitation of insoluble compounds. The latter frequently cause spotted or cloudy tests. Use clean rain-water or melted ice. If such forms of soft water are not available, boil the hard water and let stand for twenty-four hours.

Sanitary Accessories.—Supply of hot water. Scrubbing-brush and pail. Dust-cloth. Brushes for cleaning cans and glassware. Clean towels and wash-cloths.

CHAPTER 2.
**Official Instructions for Receiving and
Sampling Cream.**

RECEIVING CREAM.

Success in receiving and in testing cream calls for systematic methods and a businesslike attitude toward patrons. When a can of cream is received:

1. Write the patron's name plainly on the receiving sheet.
2. Balance the weigh scales.
3. Weigh the cream carefully.
4. Record the gross weight of cream and can.
5. Sample as described in the pages following.
6. Rinse the empty can with about a pint of hot water.
7. Place the patron's can in the sink and wash it thoroughly. After draining it well, place the can on the scales and weigh it.
8. Subtract the weight of the can from the gross weight of can and cream and enter the remainder on the receiving sheet as the weight of cream to be paid for.
9. Return the can to the patron, at the same time handing him a check for the previous delivery and stating the amount of cream just received and the price being paid for butter fat.

SAMPLING CREAM.

No less will be expected of a person who merely samples cream than of one who both samples and tests; in fact, both must satisfactorily pass an examination covering the entire process of receiving, sampling, testing, and paying for cream.

Sampling is the foundation of the test, and no tester, however skillful, can arrive at the proper test of a delivery of cream if the sample was improperly taken. Neither can sampling be done to the best advantage if the sampler does not understand the operations that are to follow. The authors recommend that the testing be done by the person who takes the samples.

How to Mix the Cream. — The purpose of thoroughly mixing the cream is to cause the sample taken to represent truly the richness of the cream. The average amount of cream delivered at stations by Kansas dairymen is slightly more than twenty pounds. One pound is equivalent to 456.6 grams, and twenty pounds will therefore weigh 9132 grams. If a 9-gram sample is used for testing, the sample is less than one one-thousandth of the entire amount; if an 18-gram sample is taken, it is less than one five-hundredth. In any case, the sample is so small that if it has been inaccurately taken, the error will be multiplied many times when payment is made for the cream. The importance of thoroughly mixing the cream is evident from the following simple comparison :

We will presume that you have a barrel of water containing ten thousand small green peas whose tendency is to come to the top just as fat globules in cream rise to the surface. This barrel and its contents have been undisturbed for twenty-four hours. You have a tin cup with a long handle. The tin cup will contain one one-thousandth as much water as the barrel contains. To secure an accurate sample of the peas in the water, you must, under the circumstances, get just ten peas, or one one-thousandth of the total number, every time you take a sample. If more or fewer peas than exactly ten are found in the cup, the sample is obviously inaccurate. The first step will be to mix thoroughly the contents of the barrel so that there will be just as many peas in the central and lower parts as there are at the top where they have risen. The quickest and best method of mixing is to pour the contents of the barrel from one receptacle to another several times and take the sample before the peas have had time to rise to the surface. The stirring-rod could be used for the mixing process, but would require a much longer time to secure a uniform mixture and obtain an accurate result.

This simple example shows the principle involved in getting an accurate sample of cream for testing. The pouring or mixing must be thoroughly done both just before transferring the sample from the cream into the sample jar and also before putting the required amount of the final sample into the test bottle. If cream is very thick or is frozen, the foregoing comparison emphasizes the importance of heating the cream until it is in a fluid condition.

How to Take the Sample from the Cream Delivered.—To secure an accurate sample of cream, pour the cream from one can to another at least twice, or stir thoroughly, using both an up-and-down and a sideward movement. Then take, from as near the middle of the cream as possible, enough cream to make at least two tests. "The middle" refers to the distance about halfway from the bottom of the can to the top of the cream. Transfer the sample to a clean, dry sample jar. Mark the jar plainly with a number, and place the same number before the name of the patron on the receiving sheet, thus keeping an accurate record of each delivery of cream.

Whether to pour or to stir the cream should be determined by the following circumstances :

Always mix by pouring: If the amount of cream delivered exceeds twenty pounds ;if the cream is lumpy, curdy or gassy ; if there is a necessity for taking the sample quickly.

Cream may be mixed by stirring: If the cream is very thick or doughy; if the cream is frozen and is being thawed out; if not more than twenty pounds of cream is received; if there is plenty of time to stir the cream thoroughly.

In case the receptacle in which a small amount of cream is delivered is so full that the cream can not be stirred without being spilled, pour the cream into a larger can and stir it well before sampling. In many cases it will be necessary both to pour and to stir.

CHAPTER 3.

Official Instructions for Testing and Paying for Cream.

WHEN TO TEST.

Testing should be done at the time when the operator is least likely to be disturbed. The period required is at least one hour for an ordinary day's business. The hours commonly employed are from eight to nine o'clock A. M. and 4 :30 to 5 :30 o'clock P. M. The afternoon hours are recommended to operators using hand testers, as the day's work can be completed and the checks written in the evening or early the next morning. Operators using steam testers will find morning testing advisable, as they will have plenty of steam or hot water from the boiler during the day. Samples may be left for forty-eight hours provided they are tightly covered and kept in a cool place, but daily testing is advised whenever eight or more samples are at hand.

HEATING THE SAMPLES.

When ready for testing, place in warm water the sample jars containing the cream and heat the water until the cream reaches a temperature of 110° F.

The heat causes the cream to become fluid, and the fat globules can then be more thoroughly mixed. Do not allow the temperature to exceed 110° or the fat will become liquefied and rise to the top, making accurate sampling difficult.

MIXING THE SAMPLE BY POURING.

Pour the sample back and forth from one jar to another until the cream is uniform in color and smooth in physical condition. Cream containing lumps or yellow streaks is incompletely mixed.

WEIGHING THE SAMPLE.

See that the balance used for weighing the cream is clean, level, and protected from air currents.

After carefully leveling the scale and balancing the bottle (or bottles), weigh out the required amount of cream, nine or

eighteen grams, using a pipette to transfer the cream from the sample jar to the test bottle. If too much cream should be added, a clean wire or slender glass rod may be used to remove the excess. Mark each test bottle plainly with the same number given the corresponding sample jar.

To lengthen the life of the scales, always use the arrest rod to bring the pointer back to the center before you add or take cream or weights from either scale pan.

WHEN TO EMPTY SAMPLE JARS.

Do not empty the sample jars until all of the tests have been made and the tests recorded. Occasionally a bottle may break or a test be so cloudy that it can not be read and a second test will be necessary.

COOLING THE CREAM SAMPLES.

When the required amount of cream has been weighed out in each bottle, place the bottles in cold water and allow them to remain until the cream is at a temperature of 68° F. Unless the cream is cooled, the action of the acid may be too rapid and the tests may be burnt or cloudy.

Now add to each bottle the proper measure of acid. This will be from five to nine grams for nine grams of cream, a low-testing cream requiring the most acid. The acid should be at a temperature of 68°. While adding the acid, hold the bottle at an angle, at the same time revolving the bottle so that the acid will wash down all the cream which adheres to the inside of the neck.

Mix the contents with a gentle rotary motion until all of the curd has been dissolved and the sample is of a dark chocolate color. The darker the color of the mixture, the darker will be the color of the butterfat in the test, and *vice versa*. The use of less than nine cc. of acid will require a longer time for the proper color to be reached, but will result in the saving of acid.

OPERATING THE TESTER.

Now fill the bottles to the bottom of the neck with hot soft water (180° F.) and place them in the centrifuge (Babcock tester). The bottles should be so arranged that the tester is balanced. Whirl the tester for five minutes. This period means the time during which the tester is running at full speed and does not include the time used in starting or stopping

it. A tester fourteen inches in diameter requires a speed of about 900 revolutions a minute and one twenty inches in diameter about 750 revolutions.

Stop the tester and add enough water (180° F.) to bring the fat up into the graduated neck. Unless a steam tester is used, place the bottles in a hot water bath (180° F.) until the fat is liquefied, which process will require about five minutes.

Whirl the tester for two minutes more. After the second run, take the bottles out of the tester and place them for ten minutes in a water bath of 125°. The water should be deep enough to *surround the fat* in the necks of all the bottles, and the temperature of the water must not be allowed to become lower than 120°, the temperature required by law. The careful use of the water bath will contribute greatly in cutting down shortage caused by the overreading of tests.

READING THE TESTS.

Before reading a test, first observe the color. It should be a golden yellow, free from specks. Do not attempt to read any tests which contain dark, cloudy, foreign matter or pieces of curd, especially when they cause the lower line of the butterfat to be irregular. Retest all such samples.

In reading the clear tests, hold the bottle perpendicular and on a level with the eye. A mirror hung on the wall will assist the operator to hold the tests at the proper height.

Place one point of the dividers at the lower end of the fat column and the other point at the middle of the dark line found in the upper curved portion of the fat column. This curved or crescent-shaped line is known as the meniscus.

Hold the arms of the dividers rigid and move the lower arm down until the point is at the zero mark of the test bottle.

The upper arm will point to the line indicating the per cent of fat. Enter the test on the receiving sheet in the space provided. Be sure that the number of the test bottle agrees with the patron's number. Empty the contents of the test bottle into a slop jar.

Unless it contains preservatives or is in bad condition, do not throw away cream left in sample jars when testing is done, but add this cream to the next shipment. Cut down waste of cream and running expenses wherever possible.

POINTS ON WASHING GLASSWARE.

As soon as you have finished testing, wash all dirty bottles, sample jars, pipettes, and brushes in hot soft water containing a mineral washing powder. Test bottles can generally be perfectly cleaned by filling each half full, inverting it, holding the thumb over its mouth and shaking the bottle vigorously. Use a slender brush if necessary. Do not mix washing powder and strong acid in a test bottle, but weak acid and washing powder will often remove sediment which water will not dissolve.

Do not use soap for washing test bottles. Fat may cling to the inside of the bottle and cause the next test to be inaccurate.

Sample jars and test bottles should be inverted and allowed to drain until dry. If glassware does not drain clean, too much washing powder has been used. Scald all metal utensils.

Why Cream Tests are Read to the Center of the Meniscus at 120° F.

The proper reading of cream tests at the temperature of 120° F. (required by section 5 of the dairy laws) was officially determined by Webster & Gray in a large number of tests conducted under authority of the United States Department of Agriculture. By comparing the results of chemical analysis with readings of the Babcock test, the investigators found that the correct test was obtained thus: First, note the entire length of the fat column at 120° F., then deduct from this four-fifths of the height of the meniscus and add to the remainder two-tenths of one per cent.

In the accompanying sketch the total height of the fat column is from 6 per cent to 39 per cent. The meniscus*, or curved portion, extends from 37 1/2 per cent to 39 per cent, thus occupying a space of 1 1/2 per cent. Four-fifths of 1 1/2 is 11/5 which, deducted from 39 per cent is 37 4/5, or 37.8. Adding .2 of a per cent to 37.8 gives 38 per cent, the proper height for reading the test. The lower line of the fat column is at the 6 per cent mark, thus giving a test of 32 per cent. For all practical purposes the test may be read with the bottles now

* For information concerning the use of glymol or fat-saturated alcohol in reducing the meniscus to a straight line and facilitating the reading of the test, write to the Department of Dairy Husbandry, Manhattan, Kan.

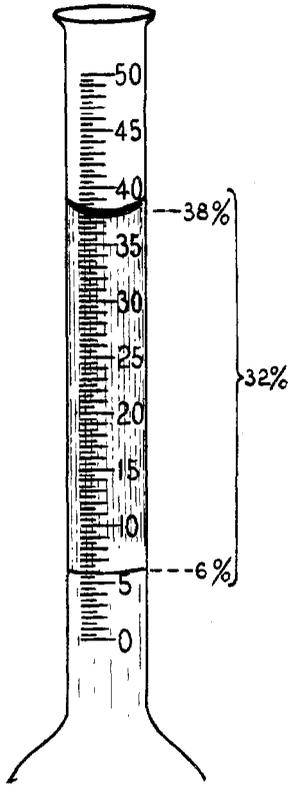


FIG. 9.
Correct reading of cream test at
120° F.

in use, from the bottom of the fat to the center of the meniscus as shown by the dotted lines in the illustration.

Paying for Cream.

In determining the amount of butterfat in a delivery of cream, multiply the pounds of cream by the test and point off two demical places. This will give the number of pounds of butterfat. To find the amount of check due patron, multiply pounds of butterfat by the price per pound paid for butterfat.

What to Do with Half Pounds and Half Per Cents.

For commercial purposes it is unnecessary to deal with fractions of pounds and per cents when making a record of delivery and tests of cream. The weight of the cream will seldom be exactly on the half-pound and the most satisfactory method is to credit the patron with the nearest number of entire pounds. If the net weight of the cream should be 21 3/4 pounds, credit the patron with 22 pounds. If the cream should weigh 21 1/4 pounds, the figure recorded should be 21.

Follow the same plan in making a record of the tests. In case either the test or the weight, should be exactly on the one-half mark, credit the creamery with the one-half per cent of test and the farmer with the one-half pound. If one follows such a plan the check paid the farmer will, in the vast majority of cases, be absolutely equitable for all practical purposes.

CHAPTER 4. Testing Milk and Skim Milk.

The Babcock test for milk is made in a manner similar to that used for cream, but the following changes should be noted :

Secure a milk test bottle graduated to 8 per cent. Do not attempt to test milk in a cream bottle. The milk may either be weighed out to exactly 18 grams, or be measured out with a 17.6 cc. pipette, which also holds exactly 18 grams of milk. Either method is accurate. Add about 17.5 cc. of acid. Do not add water as in the case of cream, but first whirl (in the tester) the mixture of milk and acid for five minutes ; then add water to the bottom of the neck of the bottle, whirl for two minutes; and then add enough water to bring the fat well into the neck of the bottle and whirl for one minute more. Place the bottle in the water bath (120° F.) for ten minutes. The test should be read from the bottom of the fat column to the extreme top of the meniscus.

TESTING SKIM MILK.

Skim milk is tested in about the same manner as whole milk, with the following slight changes:

About 20 cc. of acid instead of 17.5 should be used. A special skim-milk bottle should be secured in which the test may be read to one one-hundredth of one per cent. The tester should be kept as hot as possible during the time that the bottle is being whirled. Since the fat globules in skim milk are very small and are not completely brought to the surface with the ordinary speed, the speed of the tester should be increased at least ten per cent. Samples of skim milk which contain less than one one-hundredth of one per cent butterfat are exceedingly rare, and in case the test fails to reveal the presence of any butterfat, the probability that the testing was poorly done is very much greater than that the skim milk contained no butterfat.

TESTING OTHER DAIRY PRODUCTS.

The authors do not advise the testing of ice cream, condensed milk or butter by station operators. Special apparatus

and very great care are necessary to secure accurate results, and the products mentioned should be sent to the office of the Dairy Commission for analysis.

HOW TO PREPARE AND SEND SAMPLES OF MILK AND CREAM FOR TESTING.

In order that analyses of samples of milk or cream sent to the dairy commissioner may have commercial or legal value, they should be prepared and sent in the following manner :

1. Select a dry, clean sample jar or suitable wide-mouthed bottle, holding from 50 to 100 cc. or about one-fifth of a pint.
2. See that the jar or bottle is provided with a tightly fitting screw cap or cork.
3. If a screw cap is used, place a paraffined milk-bottle cap inside the lid.
4. Pour the milk or cream from one can to another at least three times—until the mixture is smooth and free from lumps. Take the sample from the center of the liquid.
5. Fill the sample bottle full and apply the cover tightly. If the sample is likely to be more than twenty-four hours in transit, add two drops of formaldehyde to prevent the development of bacteria.
6. Allow the sample to stand upside down on white paper for one hour to ascertain whether the cover leaks.
7. As an extra precaution, dip the cover and neck of the filled jar in melted paraffin several times, or seal with wax.
8. Wipe the sample bottle clean and dry, wrap it in white paper and pack it with plenty of soft white paper in a small wooden or pasteboard box. Mail it or send it by prepaid express.
9. Send with the shipment a letter stating the name and address of person who took the sample, of the person whose milk or cream was sampled, and of the person to whom analysis is to be sent.
10. State definitely what tests are desired, whether for butterfat, solids, adulterations, or preservatives.

This service is rendered free of charge to residents of the state. About ten days are required for an analysis to be made and reported upon. Should samples arrive in a leaky or unsatisfactory condition, no test will be made, but the sender will be notified of this fact and of the probable cause of the trouble.

On request, accompanied by six cents in stamps to cover postage, a special sample bottle and mailing case will be furnished applicants who desire to have milk or cream tested. Address The State Dairy Commissioner, Manhattan, Kan.

Composition of Milk and Cream.

The following figures will enable persons receiving the results of an analysis to compare their figures with those for normal milk, cream, and skim milk. It should be understood, however, that the figures below are not the legal standards, but merely the results of average and typical samples. Average milk contains :

87.4 per cent water.
3.7 per cent fat.
3.2 per cent casein and albumin.
5.0 per cent milk sugar.
.7 per cent ash.

100.0

Casein and albumin are the constituents of milk which enter largely into the making of cheese. Milk sugar is the constituent which is acted upon by bacteria in the souring of milk. The ash is the mineral matter.

When milk is skimmed to a 35 per cent cream the composition of the skim milk and cream becomes about as follows:

Cream.

57.0 per cent water.
35.0 per cent fat.
3.5 per cent casein and albumin.
4.0 per cent milk sugar.
0.5 per cent ash.

100.0

Skim Milk.

90.2 per cent water.
0.1 per cent fat.
3.6 per cent casein and albumin.
5.3 per cent milk sugar.
0.8 per cent ash.

100.0

Official Testing of Weights, Scales, and Glassware.

In addition to testing samples of dairy products free of charge, the Dairy Commission offers to test and certify to the accuracy of weights, cream scales, and glassware under certain conditions.

Weights used in cream testing and for moisture tests, namely, 9-, 10-, and 18-gram weights, must be accompanied by four cents in stamps to cover mailing them and a report on their accuracy. Weights which are found to be accurate will be returned in a sealed package, bearing the seal of the dairy commissioner's office. Weights which are inaccurate will not be returned, but the sender will be notified of the degree of error. The maximum degree of error allowed is one-twentieth of one gram. The dairy commissioner does not sell weights, but persons wishing new weights tested may have them sent from the supply houses to the dairy commissioner, who in turn will send them to the person ordering same. All packages must be accompanied by stamps, and must be marked plainly with the name and address of the person to whom the weights are to be sent.

The officers of the Dairy Commission do not undertake to repair broken scales or to adjust scales which are in poor condition as the result of abuse, but in so far as such work will not interfere with their regular duties, they will, at the time of inspection, test doubtful cream scales for accuracy when request for such service is made.

Glassware on which the accuracy of the test directly depends, namely, test bottles and milk pipettes, are required by law, section 5, to be officially tested and to be marked with the initials "S. D. C." Inaccurate glassware is a frequent cause of inaccurate tests. To control this situation, all milk and cream bottles and milk pipettes sent to the office of the dairy commissioner by mail or prepaid express will be tested, and those found accurate will be marked with the initials "S. D. C.," for which service a nominal charge of three cents apiece will be made to cover actual expenses connected with such testing. Remittance may be made by money order or by stamps.

Glassware found to be inaccurate will be destroyed. Shipments of glassware ordered from creamery supply houses may be sent to the dairy commissioner's office for testing upon the same terms. Postage must accompany packages to be mailed. Express packages will be sent "collect."

CHAPTER 5.
**Checking Out with the Creamery on
Weights and Tests.**

Section 6 of the state dairy law provides that all tests shall be within one per cent of the exact amount of butterfat contained in the cream as determined by test of the state chemist made on samples taken by the dairy commissioner or his deputies. Where a shortage or surplus exceeding that amount is found, either in individual deliveries or in shipments to the creamery, the tests made by the operator are classed as inaccurate, false, or fraudulent and he is subject to the penalties provided in section 11. Whether the error was due to carelessness, incompetence or willful manipulation, the operator will be considered unfit to sample or test cream and his permit will be promptly canceled.

The Babcock test in itself is accurate; and where errors occur, the trouble is found to lie in a variety of causes, all of which can be remedied by the observing operator.

WHAT TO DO IN CASE OF A SHORTAGE.

When the creamery reports a shortage of butterfat, first compare the number of cans and the net weight of the cream shipped from the station with the figures reported by the creamery.

If these figures agree, the fault lies probably in the sampling or the testing, and the test given has for one or more of the following reasons been too high:

1. Neglecting to take the sample in the manner described in the chapter on sampling.
2. Failure to keep sample jars tightly covered.
3. Keeping sample jars in too warm a place.
4. Taking more than a 9- or 18-gram sample.
5. Including mineral matter or curd in the test if not clear.
6. Reading tests at a point higher than the center of the meniscus.

7. Failure to keep the tests at from 125° to 120° for ten minutes.
8. Slipping of dividers.
9. Inaccurate glassware.
10. Use of dirty or incompletely washed test bottles.

WHAT TO DO IN CASE OF EXCESS.

If an excess of butterfat is reported when cans and weights agree, the tests given have been too low, and more butterfat has been received than was indicated on the operator's report. The cause may have been due to inaccurate sampling, as noted before, or for one or more of the following reasons:

1. Taking less than a 9- or 18-gram sample.
2. Running the tester at too low a speed.
3. Failure to keep tests at 125° F. to 120° F. for ten minutes.
4. Reading tests at a point lower than the center of the meniscus.
5. Inaccurate glassware.
6. Slipping of dividers.
7. Carelessness in reading the proper figure.

REASONS FOR TAKING A COMPOSITE SAMPLE.

Every station operator should, both as a protection to himself and as a source of satisfaction, make a composite test of every shipment of cream. If his total butterfat, as shown on the entry sheet, checks out with the butterfat shown by composite test, any error reported may logically be due to some mistake on the part of the creamery or to loss of butterfat in transit.

HOW TO MAKE A COMPOSITE TEST.

1. Weigh all the cans in the shipment and record the net weight of all the cream.
2. Stir each can of cream thoroughly and take a sample with the McKay sampler.
3. Place the sample from each can in the inner vessel of a double boiler.
4. When the cream has been warmed to 100° by hot water in the outer vessel of the double boiler, stir the cream well and with a clean dipper take a sample for testing.
5. Proceed as with any other test.

The number of pounds of cream in the shipment, multiplied by the composite test, should equal the total number of pounds,

of butterfat to be paid for as shown by the entry sheet. The composite test is *not the numerical average* of the individual tests unless every patron delivers exactly the same number of pounds of cream.

If a McKay sampler is not a part of the station equipment, fairly accurate results may be obtained thus:

Fill all the cans in the shipment to exactly the same height; mix each thoroughly by pouring and with the cream sampler take from each can a full sample jar of cream. Mix the contents of all the jars well, take a 9- or 18-gram sample and proceed in the usual manner. When the test has been made, return the unused portion of the samples to the shipment of cream.

The amount of wash-water used in rinsing cans will not affect the result, since the lowering of the test by the addition of wash-water will be exactly compensated for by the increase in weight.

The station check blank here outlined will assist the operator in checking up his shipments and protecting himself against charges of inaccurate testing :

Station Check Blank.

Place Date

Operator

CREAM RECEIVED AS SHOWN BY ENTRY SHEET AND INDIVIDUAL TESTS.			CREAM RECEIVED AS SHOWN BY COMPOSITE TEST.				Error.		
Total deliveries received.	Pounds of cream received.	Total pounds of fat to be paid for.	Gross weight of cream and cans.	Weight of cans.	Weight of cream including wash-water.	Comp. test.	Total fat.	Short.	Over.

Remarks

Pounds over from last shipment Test.....

Pounds not shipped to-day..... Test.....

The McKay Sampler.

The McKay sampler is a device for taking a vertical sample of milk or cream, which shall truly represent the richness of all portions. The amount of the sample also conforms to the amount of cream in the can. Since the ingredients of milk and cream tend to separate quickly on standing, a vertical column of the entire amount is a more nearly accurate sample than the same amount taken from any one portion of the cream. The McKay sampler consists essentially of two tubes, one within the other, as illustrated. Each tube is provided with a short horizontal handle, and each has vertical portions of one side removed. By turning the handles the sampler may be opened or closed. The sampler is used as follows:

Insert it, closed, in the can of milk or cream to be sampled, until it touches the bottom. Open it by turning the handles. When it is full, close it and withdraw it. Carefully empty the contents into the inner vessel of a double boiler, the outer vessel of which contains hot water. If the cream sampled is very thick, use the plunger (also illustrated) for removing all the cream from the inside of the sampler. If a composite sample of several cans is desired, mix all the samples taken and proceed with the test in the usual manner.

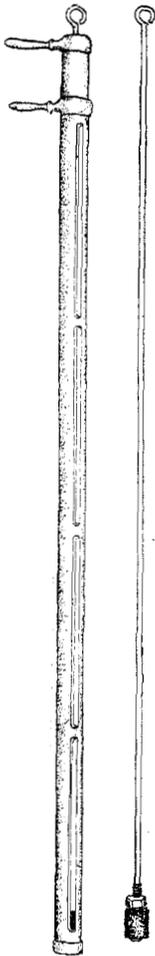


FIG. 10.

McKay sampler,
 showing plunger.

CHAPTER 6.
System of Examinations, Permits and Inspections.

As provided in section 9 of the Kansas dairy law, any person desiring to sample or test cream must first secure a permit bearing the seal and signature of the dairy commissioner.

Examinations are of two classes—temporary and final. Persons passing the temporary examination will be granted a temporary permit, which is good until the final examination is held. Failure to take the final examination when the person is notified to do so revokes the temporary permit. Persons passing the final examination will be granted a special form of permit until their place of business can be officially inspected.

Three grades of permits will be issued, according to the condition in which the station is found at the time of inspection. The operator of a clean, attractive station, provided with a full equipment and scoring 85 or more at the time of inspection, will receive a first-grade permit, bearing a blue seal. If the station is untidy or less well equipped, and scores between 70 and 85, the operator will receive a second-grade permit, bearing a red seal. In case the station scores less than 70, or shows evidence of neglect or carelessness on the part of the operator, but does not violate the provisions of the law, a third-grade permit, bearing a yellow seal, will be granted.

Where the station is unsanitary, if the permit held is not in a conspicuous place, or if other provisions of the dairy law are violated, the permit will be canceled and the station closed up.

The purpose of this system is to improve the quality of Kansas butter by raising the standard of cream stations in the state. The cooperation of all is urged to that end. Requests for inspections will be acted upon in due course of time, but under no circumstances will a particular date for an inspection be named. Where it is plainly evident that special sanitary preparations have been made for the visit of the inspector another inspection will be made.

HOW TO MAKE APPLICATION FOR AND TAKE EXAMINATION.

Write to the dairy commissioner, Manhattan, Kan., and request that an application blank be sent. Or, in case creamery field superintendents can furnish the official blanks (with which they are supplied at frequent intervals), fill out the blank and mail it to the dairy commissioner.

If a final examination is scheduled at a convenient point for a date within sixty days from the time the application is received, and found satisfactory, the applicant will be notified to appear at such place at the specified time to take his examination.

If a final examination is not scheduled, a temporary examination may be taken before a notary public in the town where the applicant resides. Applicants for temporary examination must be at least eighteen years of age, and must have tested, prior to the time of their application, at least ten samples of milk, under the supervision of a person holding a permit and according to the directions printed in this bulletin. Should the applicant fail to pass, a second temporary examination will be granted him. Not more than two temporary examination papers will be issued, but an applicant with a good record, who is sincere in his efforts to secure a permit, may take as many final examinations as he chooses. Failure to appear within ten days before a notary public, when the applicant has been notified that papers have been issued, revokes the right to subsequent temporary examinations, unless satisfactory reason is given. Sickness will not be accepted as an excuse unless certified to by a notary public or the attending physician.

Station operators holding either temporary permits or three-year permits about to expire will be notified of the place and date of the examination at which they are to appear.

Permits are not transferable; neither is it lawful for any person to sample and test cream under another person's permit. Furthermore, the fact that one has made application for an examination does not permit him lawfully to sample or test cream until he has actually secured this permit and displayed it in a conspicuous place in his station. Examination questions will cover the contents of this bulletin and the provisions of the law and rulings based thereon.

RELATION BETWEEN BUYER AND THE DAIRY COMMISSIONER.

The officers of the State Dairy Commission are charged with regulating and directing the development of the dairy industry in Kansas along the lines established by law. The policy of regulation is twofold. It consists, first, of encouraging those doing a legitimate business to extend their business, and, second, to punish by law, or to eliminate from the commercial field, persons handling dairy products in an unclean, unscrupulous or dishonest manner. The attitude of the dairy commissioner and deputies toward a person engaged in handling dairy products is therefore determined by the attitude of such person toward the law. But in all cases inquiries or correspondence bearing on the scope of the work will receive prompt and careful attention, to the end that all may be fully informed.

A WORD TO CREAMERY FIELD SUPERINTENDENTS.

The standard of cream stations in Kansas can be raised to a very great extent by efficient work on the part of field superintendents. The majority of superintendents are well informed on dairy matters and thoroughly understand the testing and handling of milk and cream. They are able to exert a very beneficial influence by making the buyers interested in their work and by giving them a friendly warning when the station does not conform to the dairy law. Every visit of a field superintendent should be a critical inspection. Less leniency on the part of creamery field superintendents will materially reduce the number of stations which the dairy commissioner and deputies are obliged to close every month because of unsanitary conditions or violation of the law.

In case the instructions of field superintendents are not heeded, the latter are urged to report the conditions and circumstances, and an official inspection will be made.

THE QUESTION OF SUBSTITUTES.

If a station operator holding a permit is sick or is suddenly called away on important business, the lawful management of such a station in his absence is a problem which an operator may be called upon to solve at any time.

The best and simplest solution to this difficulty is to have a substitute holding a permit. In many cases the operator's son, wife, or daughter has taken the examination and been granted a permit, and the work may be taken up by such a substitute without interruption. When no person holding a permit can

be secured and the operator expects to be absent for less than a day, as competent a person as possible should be secured and the cream merely received and placed in separate cans. The sampling and testing is done by the operator when he returns. Under no circumstances is it lawful for a person not holding a permit to sample or test milk or cream.

SYSTEM OF INSPECTION AND COMPLAINTS.

The law provides for the inspection of all places of business where dairy products are handled. In making inspections of cream stations, the dairy commissioner and his deputies will give the operator a written report of conditions found, together with such written instructions as they may deem necessary. A second copy of the inspection report will be sent to the creamery or company represented, and a third will be kept on file in the dairy commissioner's office.

The law also provides for official action on all written complaints or reports wherein are given the names and locations of persons violating the state dairy law. The investigation of complaints supersedes the general inspection. Any person may file a complaint with reference to matters which come under the jurisdiction of the dairy commissioner.

The Control of Flies.

The fly is one of the most formidable enemies of pure dairy products and of health, but it can be controlled:

First, and best, by the use of well-fitted screens.

Second, by fly-catchers of a wide variety of makes.

Third, by removing from the vicinity all matter in which flies commonly breed.

Flies in cream stations and dairy establishments will not be tolerated, and no excuse will be accepted for their presence. Torn screens should be immediately replaced. The lower portion of screen doors, which usually wears out quickly, should be protected by a heavy, coarse-mesh screen or by wooden slats.

From March 1 to November 1, and at all times when flies are prevalent, places where dairy utensils, milk-bottle caps, and containers of dairy products are kept must be protected against flies, either by screens, or by being kept under cover, or by both. Readers are urged to correspond with the State Board of Health, Topeka, Kan., for additional information on the control of the house fly.

CHAPTER 7.
**Common Station Difficulties and Their
Solution.**

SAMPLING AND TESTING.

QUESTION. How is frozen cream sampled?

ANSWER. Place in hot water the can containing cream. A large wash-boiler half full of water kept hot by an oil stove will supply this need in freezing weather. When the cream is thawed out, sample it in the usual manner. In no case should the temperature of cream exceed 110°.

Q. How is sour milk sampled and tested?

A. Do not attempt to sample sour milk. A sample of milk to be tested should have been kept sweet by the addition of a preservative such as formaldehyde or a corrosive sublimate tablet.

Q. What are the principal causes of curd at the bottom of a cream test?

A. The addition of water before the acid had completely dissolved the curd; the use of too weak acid; failure to mix thoroughly.

Q. What is the cause of dark specks in the test?

A. The use of hard water is the chief cause.

Q. Is smoking permissible in a cream station?

A. No. Tobacco smoke is considered a contaminating influence. Operators are authorized to post a notice in their stations bearing the words:

NO SMOKING.

BY ORDER OF STATE DAIRY COMMISSIONER.

Operators as well as patrons and visitors must conform to this requirement.

Q. How full should cans be filled?

A. The amount of cream in a can must be determined by the condition of the weather and the cream. For average conditions, the sketches show the proper depth to fill cans.

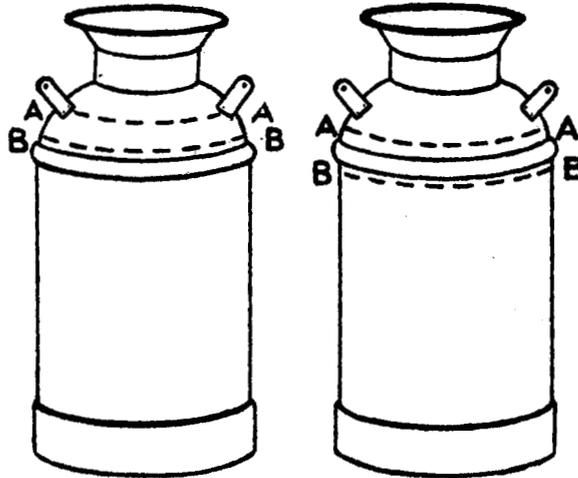


FIG. 11.

First grade cream.
 AA.—Height in cool weather.
 BB.—Height in warm weather.

Second grade cream.
 AA.—Height in cool weather.
 BB.—Maximum height in warm weather.

Q. How should twelve test bottles be arranged in a 24-bottle tester consisting of twelve double pockets?

A. Each set of pockets should be considered a unit, and each unit should be balanced on the other side of the tester by another unit. The illustrations (figure 12) show how the bottles should be arranged.

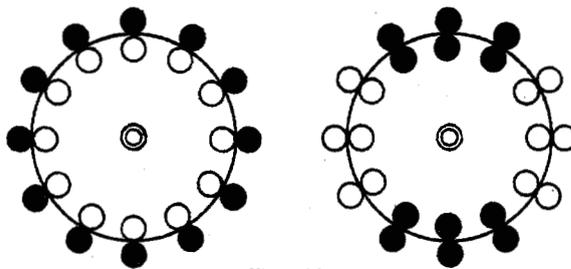


FIG. 12.

Incorrect way.

Correct way.

How to balance the tester.

Q. Is it necessary to place weights and bottles in the center of the scale pan when weighing out cream samples?

A. With most scales this practice is unnecessary, but with some styles of torsion balances, a very noticeable error will result if it is not done. Test your scales for this defect.

Q. What should be done in case acid gets on the flesh?

A. Rinse the flesh quickly with a large quantity of water; and, in case the burn is serious, apply baking soda, ammonia, or washing powder. Never use the mouth on a pipette for measuring out acid.

Q. How can dirty test bottles be cleaned when all ordinary methods fail?

A. Put enough strong acid in them to cover the bottoms. Let them stand over night. Then empty them and boil them in strong lye water for an hour. Fill them half full of small shot and shake them well, then use a brush. Finally rinse the bottles with clean, warm soft water.

Q. What is the cause of dark or burnt tests?

A. Either you have added too much acid; you have allowed the acid to act on the cream too long; or the bowl of the test bottle is of too small capacity. If the temperature of either the acid or the cream exceeds 70° F., the tests are likely to be burnt.

Patron's Questions and Their Answers.

1. Patron: Why was my test lower than last time?

Operator: Authorities have found that any of the following circumstances will cause the cream test to drop considerably:

- a. More water or skim milk than usual was used in flushing the bowl of the separator.
- b. The speed of the separator was too low.
- c. The separator was incompletely washed.
- d. Milk was allowed to flow into the separator bowl too rapidly.

2. Patron: Does sweet cream test the same as sour cream?

Operator: Yes. The amount of butterfat in the cream is not affected by souring, but cream in bad condition is more difficult to sample. The better the cream the more accurate the test will be.

3. Patron: How thick should I skim my cream?

Operator: As close as possible to 35 per cent.

4. Patron: What is the objection to a 25-per-cent cream?

Operator: You give away too much skim milk, which is a good feed for young stock. Furthermore, a 25-per-cent cream does not keep well.

5. Patron: What is the objection to a 45-per-cent cream?

Operator : You cannot skim so thick a cream without losing a great deal of butterfat in the skim milk in the course of a year. There is also considerable mechanical loss from the amount of cream which adheres to the cans and utensils.

6. Patron: What is the best breed of cows to keep when cream is sold?

Operator : The Jersey, Holstein, Guernsey and Ayrshire are considered the best. Some strains of Short-horns and Red Polls are also good.

7. Patron: What are the poorest breeds for dairy purposes?

Operator: All breeds which are raised chiefly for beef.

8. Patron : How can I tell my best cows from my poorest?

Operator: By weighing all the milk produced by each cow in a year and testing the milk for butterfat at frequent intervals.

9. Patron. How much milk and butterfat should a dairy cow give in a year?

Operator: At least 6000 pounds of milk and 225 pounds of butterfat. Under Kansas conditions a cow must give 4000 pounds of milk or 160 pounds of butterfat to pay for her keep. The greater the amount above that the more profitable is the cow.

10. Patron: What is the world's record for butterfat production by one cow?

Operator: At the present time it is 998 and a fraction pounds of butterfat in 365 days. This record is held by a Holstein cow.

11. Patron: Is the Babcock test always accurate?

Operator : Yes, if properly handled.

12. Patron: What protection has the patron against inaccurate testing?

Operator: All persons paying for cream on the basis of the Babcock test must first pass an examination and secure a permit granted by the state. Every operator is examined at least once every three years.

13. Patron : What determines the price of butterfat?

Operator: The condition of the butter market is the chief factor. This is determined by supply and demand, No one can predict accurately what the butter market will be, but it is generally much higher in winter than in summer.

14. Patron: Are silos a success, and is silage a good winter feed?

Operator: Yes, decidedly so, if the silos are properly made and filled.

15. Patron: What is the best make of cream separator?

Operator: The one which will skim the closest, last the longest and be the easiest to clean thoroughly. Do not purchase one until you have investigated several makes and have had the agents give practical demonstrations. Inquire among your neighbors. Do not buy a separator entirely on the strength of an advertisement or of unsubstantiated claims.

16. Patron: What place on the farm is the best for keeping cream?

Operator: The coolest, cleanest place available. This is generally a spring house or a building provided with a tank of cold water, changed frequently.

17. Patron: Is not a cellar or cave a good place to keep cream?

Operator: No. The air in a cellar or cave is seldom pure, and the temperature is not low enough in summer.

18. Patron : Where should a cream separator be kept?

Operator: The separator should be kept in a separate room or building provided for the purpose. The building should be at least fifty feet from the stable and the yards where animals are kept.

19. Patron: How often should a cream separator be washed?

Operator: The bowl and all parts of a cream separator which come in contact with milk or cream should be thoroughly washed and scalded after each separation. It is unlawful to use a dirty separator or dirty utensils.

20. Patron: What causes cream to become sour?

Operator: The action of bacteria. The souring of cream is delayed by—

Keeping it clean.

Keeping it cold.

21. Patron: What are the chief causes of the bad flavors in cream?

Operator: Pastures containing strong-flavored weeds. Keeping cream in calves and cellars. Action of objectionable bacteria.

22. Patron: What is the best time of the year for cows to freshen?

Operator: In October or November, provided the young calves are given adequate winter shelter. A cow freshening in the fall produces from 30 to 40 more pounds of butterfat in a year than the same cow freshening in the spring. Moreover, most of the additional butterfat is produced when prices are highest.

What to Do with the Dissatisfied Patron.

The cream buyer is indeed fortunate who does not have to contend with one or more patrons who are continually dissatisfied with their tests, the price, and their treatment in general. Experience has shown that a patron of this sort is best handled as follows:

Give him courteous treatment, but no favors.

Refrain from arguing with him about his cream.

Do not test a sample of his cream delivered elsewhere unless you personally take the sample of his cream.

Be frank and open with him, and invite him to see his cream weighed, sampled and tested in accordance with the rules of this bulletin.

CHAPTER 8. Cream Station Conveniences.

Double screen doors swinging both ways are of great convenience in permitting the operator carrying a can of cream to push open the door without setting the can of cream down. A particular advantage lies in the fact that the doors are open just long enough to allow the operator to pass through, thus aiding in the control of the fly pest.

A *clip board* consists of a light piece of wood of handy size to which is attached a spring clip. When placed near the weighing-in scales, this is of great assistance in keeping records of patrons' names, the number of sample jars, the weight and the test of cream.

A *small bill file*, such as is here illustrated, has been found a convenient device for keeping cream checks before they are issued to patrons. As soon as the checks are written, they are filed alphabetically. When called for, they can be found in their place and issued to patrons without delay.

A *piece of carpenter's chalk*, six large pieces of which can be purchased for five cents, will facilitate the reading of tests. Pass the chalk over the graduations on the test bottles several times. The divisions and figures will show up as a distinct white against the yellow background. Chalk is considered superior to a soft lead pencil, which is commonly used for the same purpose.

In reading the tests at 120° F. as required, the bottles are uncomfortably warm to the unprotected hand. Place the inverted lid of a sample jar in the palm of the hand and set the test bottle in the lid.

Especially when a steam tester is used, the vibration often interferes with the use of cream scales at the same time. An ingenious creameryman of Winfield, Kan., solved the difficulty by cutting a hole in the floor and driving a three-inch pipe several feet into the ground below. The cream scales were mounted on a platform firmly attached to the top of the pipe

as illustrated, and will be henceforth undisturbed by any influence except an earthquake. In no case should the tester be attached to the same table on which sensitive scales are kept.

Small hoops, covered with screen or mosquito netting and placed over cream cans, are

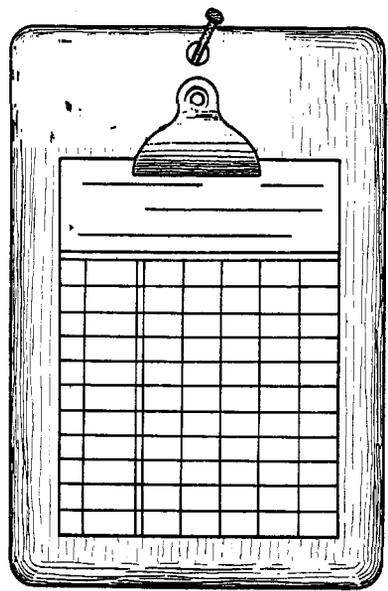


FIG. 14.

raised platform between the station and the street. Such a convenience, when possible, lessens the work of loading heavy cans of cream upon the dray. It also keeps the bottoms of the cans off the ground, thus reducing dirt in the station.

The practice of leaving a few buttered cream cans in

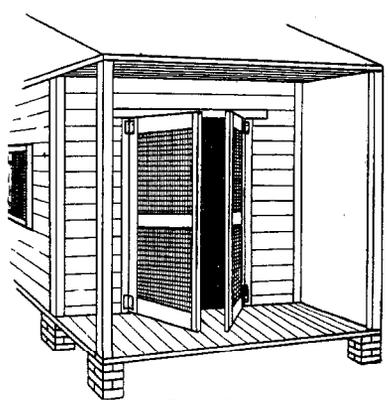


FIG. 13.
Double swinging doors.

excellent means of keeping flies out of cream without the necessity of keeping the covers on the cans in warm weather. These are especially useful for cans of cream in poor condition. The volume of fermenting cream can be materially reduced by vigorous stirring at frequent intervals.

A very convenient means of loading or unloading cans is a

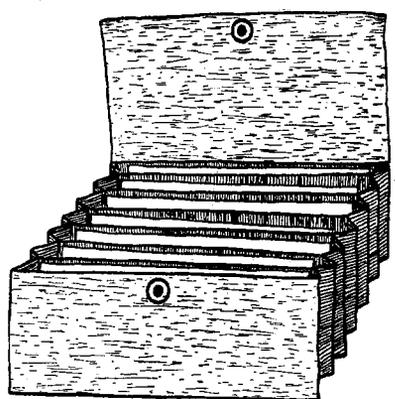


FIG. 15.
Check file.

front of a cream station for advertising purposes is not consistent with good business methods. Have a neat sign painted, giving the name of the operator or of the company represented. A space may be reserved for a chalk or stenciled number showing the current price being paid for butterfat.

Perhaps the chief criticism of cream stations in general is their untidiness. As few of

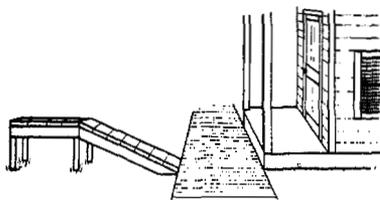


FIG. 17.

Cream loading platform.

necessary, provide several cabinets.

Either of the cups illustrated is useful for adding water to test bottles in making the tests. They are easily handled and will not cause the bottles to overflow. The holes should be about as large as the points of common lead pencils.

A drain board for test bottles may be made by boring seven-eighths-inch holes in a piece of one-inch board. The board is placed over a large earthenware jar, and the bottles may be inverted as illustrated. Care should be taken not to break the necks of the bottles by striking them against the jar.

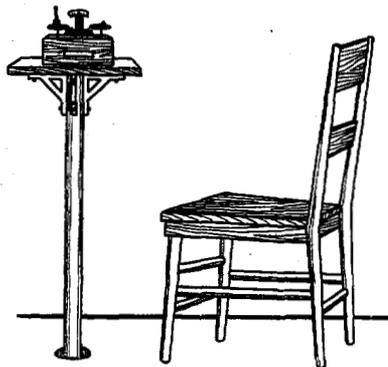


FIG. 16.

Vibration-proof test table.

the many utensils and supplies have a definite place, the various appliances constantly collect dirt. Paint any large, well-made wooden box a light color. Provide it with shelves and a hinged door and fasten it to the wall as a cabinet. Towels, washing powder, glassware, and brushes may thus have a definite place. If

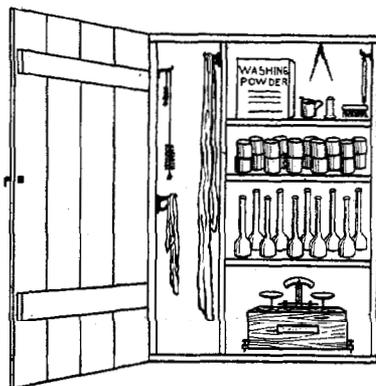


FIG. 18.

Wall cabinet for apparatus and supplies.

A *simple water bath* for a small number of tests can be made by any tinner as follows: Make a heavy tin or copper cylinder, six inches or more in height, according to the size of the test bottles, and four inches in diameter. Half an inch from the top, punch a quarter-inch hole to prevent the water from flooding the tests. Fill the bath with water at 125° F. up to the hole and place the test bottles in the water for ten minutes.

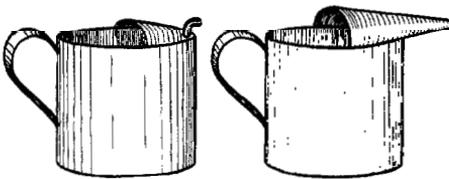


FIG. 19.
 Convenient cups for adding hot water
 to test bottles.

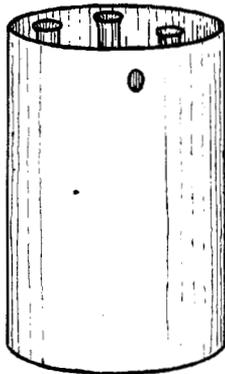


FIG. 21.
 Simple water bath.

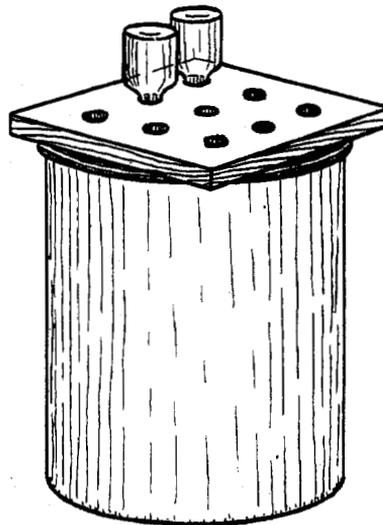


FIG. 20.
 Draining board and refuse jars.

The proper care of the stirring-rod is a problem solved thus: After the rod has been used the first time, allow most of the cream to drain; rinse off the rest with a small amount of water. Then place the stirring-rod in a clean empty cream can and put the cover on loosely to keep out flies. Repeat the process every time the rod is used until the first can is filled with cream. Then place the next delivery of cream in the can that formerly contained the stirring-rod, and transfer the stirring-rod to another clean can.

CHAPTER 9.

Bacteria Affecting Milk and Cream.

By W. F. DROGE, Deputy Dairy Commissioner.

Bacteria are very small one-celled organisms, so small that they can be seen only with a high-power microscope. These organisms are present in almost every nook and crevice in the world, from the top of snow-capped mountains to the bottom of the sea. They are found in the soil, in the air, and in our food. They are very abundant in milk and cream.

The terms "bacteria," "bacilli," "germs," and "microbes" are practically synonymous. The word "bacteria" suggests to the average person such organisms as produce disease. A great many bacteria do produce disease, but a large proportion of them do not. However, most of the latter class are objectionable. Milk is an excellent food for bacterial growth, and nearly all types find it a good place in which to thrive.

TYPES OF BACTERIA WHICH DO NOT PRODUCE DISEASE.

Lactic Acid Bacteria—Under this type of organism come all those varieties which act upon the milk sugar by changing it to lactic acid. This acid causes the milk to become sour much as when vinegar, lemon juice, or other sour substances are added to milk. When enough of these acids are added, the milk will curdle, and this same action takes place when the bacteria produce lactic acid. Acid is the only substance which will directly sour milk and cream. The lactic acid bacteria cause the natural souring of milk. These types gain entrance from various sources. They are found in the teats and udders and on the hair and skin of cows, on the hands and clothing of milkers, and in water, hay and manure. Milk is the natural habitat of these bacteria; and if it is kept at a temperature suitable to them, they will increase in numbers very rapidly.

The common milk-souring bacteria thrive best at about 78° to 80° F., while most of the disease-producing organisms grow best at blood temperature, or about 98° F.

There are several varieties of bacteria which produce gas in milk and cream:

Bacillus Coli Communis. A common gas producer is the *bacillus coli*, the organism commonly found in the colon of the intestines of man and animals. When a large number of these organisms are found in milk, it indicates contamination with animal feces or stable manure. These bacteria are often the cause of bad flavors and foul odors.

Bacterium Aërogenes. The *bacterium lactis aërogenes* belongs to the lactic acid group, but it produces both acid and gas. It is the organism that causes the gas spaces in cheese curd.

BACTERIA CHANGES IN MILK AND CREAM.

When milk or cream is kept at a temperature of about 80° F., the number of acid bacteria increases very rapidly, and so much acid is produced that in a short time the milk will become sour. The number of bacteria increases as the acid increases until a certain per cent (about .7 per cent) is reached. Here the acid becomes so strong that it kills the lactic acid bacteria, and after this point has been passed other types which are more resistant to acid will predominate. These are mostly putrefactive bacteria or those which putrefy the proteids.

The putrefactive bacteria in milk belong to the same class as, and many are identical with, those which cause the decay of meat when it is exposed to the air.

BACTERIA PRODUCING ABNORMAL CONDITIONS IN MILK.

Slimy or ropy milk is caused by an organism which produces a gelatinous substance. Milk so affected can be drawn out in long threads. Its occurrence is usually in milk over twenty-four hours old.

The source of this organism may be the wash-water, the rinse-water, or particles of dirt or dust. When it once gets into a can of milk, it is easily transferred to other cans and unless proper precautions are taken and all utensils are thoroughly cleaned and scalded, it may cause a great deal of trouble and financial loss.

Bitter milk is caused chiefly by bitter weeds eaten by cows, but is occasionally caused by bacteria.

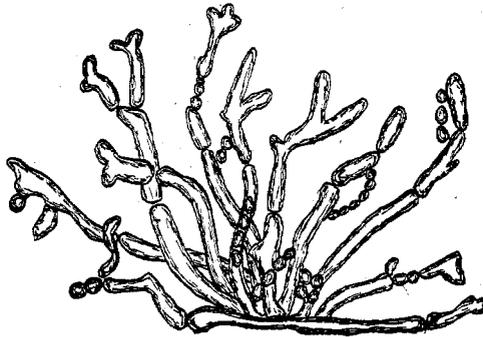
Soapy and colored milk is caused by certain undesirable kinds of bacteria whose occurrence in this country is rare.

Yeasts are often a great source of trouble, especially in old cream. They can easily be detected, as they produce a large

amount of gas, causing the cream to swell and give off odors similar to those that rise from sour bread dough.

Molds are abundant in old cream that has been handled and kept in damp, musty rooms, cellars or caves.

A type called *oidium lactis* is thought to be the cause of fishy flavor in butter.



The organism thought to cause fishy flavor in butter.
 (It is on the border line between a bacterium and a mold.)

DISEASE-PRODUCING BACTERIA.

Among the disease-producing bacteria commonly found in milk or cream are those causing tuberculosis, diphtheria, typhoid fever, scarlet fever, and foot-and-mouth disease. Less common are those causing cholera, lockjaw and anthrax. All these usually gain access to the milk from diseased animals or their attendants and milkers. One person or animal may spread the disease throughout a whole community. Every precaution should be taken in preventing diseased persons or animals from coming in contact with others, and milk from such animals should not be used for any purpose whatever unless it is boiled; even then it should be fed only to stock. When an epidemic breaks out among cattle, notify the State Live Stock Sanitary Board, Topeka, Kan.

Tuberculosis.—Tuberculosis is one of the most serious diseases which confronts the dairyman. It has been rapidly increasing for the last twenty-five years, both in cattle and in the human race. It is widely distributed, but is more prominent in countries that have long been settled and are thickly populated.

Among the human diseases there is only one other, pneumonia, that claims more victims than tuberculosis, but as this

takes only persons of low vitality, usually, the very young and the very old, it is not of so much economic importance as tuberculosis. Tuberculosis claims mostly men and women of middle age.

In 1910 more people in the United States died from tuberculosis than were killed during the four years of the Civil War. In spite of all our modern methods of prevention, this dreadful disease is steadily increasing. One out of every seven deaths is caused by tuberculosis.

In cattle the disease is more virulent than in man ; and where once it gets a foothold, it is apt to run through the whole herd.

There has been much dispute about whether or not tuberculosis from cattle is transmitted to human beings, but the probability of such transmission is now conceded.

The bacterium of tuberculosis is a small rod-shaped organism. When it attacks animal tissues, it forms little masses of cheesy or waxlike yellow tubercles. When a lung or other infected organ is examined, these little tubercles can be plainly seen. The lungs and air passages are most commonly affected, but other organs, as the spleen, the kidneys, and sometimes the milk ducts and the udder are also affected. When the disease is located in the udder, the milk is dangerous as an article of food.

The examination of milk for tubercle bacilli does not always show that the animal is infected, and the only sure and practical method is by the tuberculin test. This should be performed by a competent veterinarian.

Typhoid fever. — Typhoid fever is often spread by the use of infected milk. Cows do not have this disease, but the milk, after being drawn, becomes infected, usually from persons who milk the cows or otherwise handle the milk, or from wash-water that is infected. It may also be carried to and from the dairy in empty bottles or vessels. Such containers should all be scalded before being used.

Diphtheria is a serious and often fatal disease among children. Many cases of diphtheria have been attributed to the milk supply. A diphtheria patient may recover from the disease but still carry the organism in the throat. If such a person is allowed to handle milk, the disease may be easily transmitted to others. A convalescent from diphtheria should keep away from places where milk and cream are handled until he is certain that he is free from the organism.

Scarlet fever is another disease often spread by the use of infected milk. Although not so fatal as diphtheria, its relation to milk is about the same. The organism has not yet been found, but the disease is very contagious and easily transmitted.

Diseases of the Intestinal Tract.—The death rate in the human race is the greatest among children under one year old, and the majority of these deaths are due to disorders of the intestines. There are many causes for such disorders, but much can be attributed to milk, as it is the principal food fed to infants. Dysentery, diarrhea, cholera morbus, and summer complaint are usually caused by bacteria which get into the body with the milk. Too great care can not be taken in the production of milk for babies.

Disease Germs Less Common in Milk.—Such diseases as lockjaw, anthrax, and foot-and-mouth diseases are very rare, but, when they do occur, they are violent and fatal. Although transmitted through milk, these diseases can usually be detected in the animals before infected milk is consumed.

The following table will show the number of bacteria to the drop found in a sample of average milk kept at room temperature and tested at various times:

First test	7,650	bacteria	a drop.
1 hour later	26,950	"	"
2 hours later	30,300	"	"
4 hours later	34,000	"	"
7 hours later	50,100	"	"
9 hours later	102,000	"	"
25 hours later	425,000	"	"

HOW TO CONTROL BACTERIA IN MILK AND CREAM.

Sterilization.—This is the practice of subjecting milk to a high degree of heat, at least the boiling point. The heating may have to be repeated for three consecutive days to kill all bacteria and their spores; it *must* be repeated a sufficient number of times for the accomplishment of the desired result.

Sterilization is not satisfactory on a commercial scale, as the boiling of milk coagulates the albumin and renders it hard to digest.

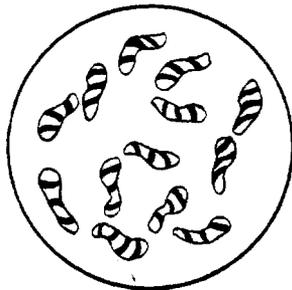
Pasteurization.—This is the practice of subjecting milk to a temperature of from 140° to 180° F. for a few minutes and immediately cooling it. This method destroys most of the common types of bacteria and especially the lactic acid bac-

teria, but it kills neither the spores nor all the bacteria of the objectionable or harmful types.

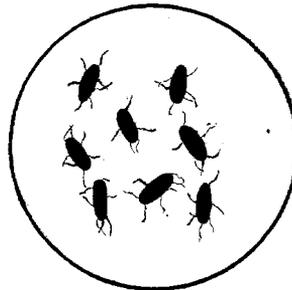
The chief objection to the pasteurization of milk is that such milk is apt to be kept too long, and that thus the harmful types of bacteria, although they have no apparent effect upon the milk, will increase in such numbers as to render the milk dangerous. The tubercle bacillus, however, is killed by efficient pasteurization.

The safest and most practical method of controlling bacteria is by producing milk under sanitary conditions and immediately cooling it and keeping it cool.

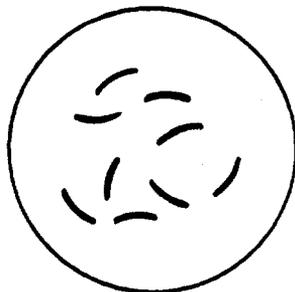
BACTERIA DANGEROUS TO HUMAN LIFE.



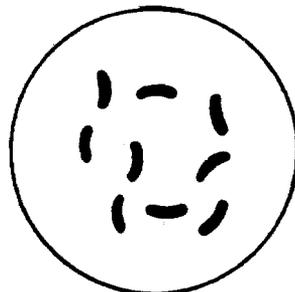
Bacteria causing diphtheria.



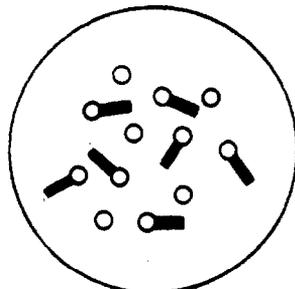
Typhoid bacilli.



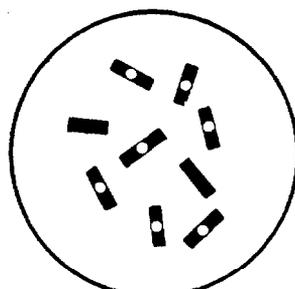
Tubercle bacilli—human.



Tubercle bacilli—in cattle.

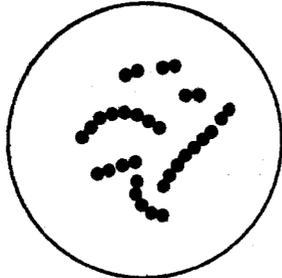


Bacteria causing lockjaw.

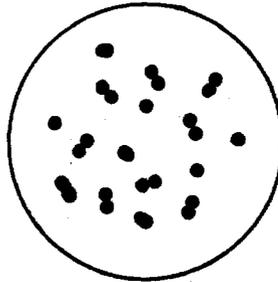


Bacteria causing anthrax.

BACTERIA CAUSING CHANGES IN MILK.



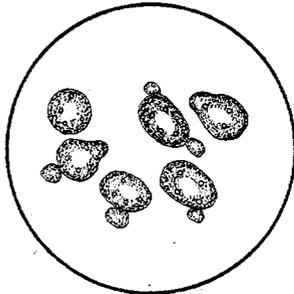
Lactic acid bacteria.
(In groups and chains.)



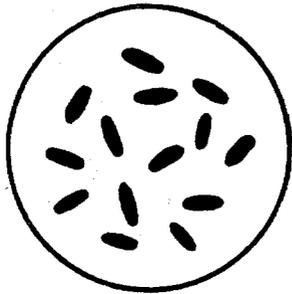
Lactic acid bacteria.
(Single and in groups.)



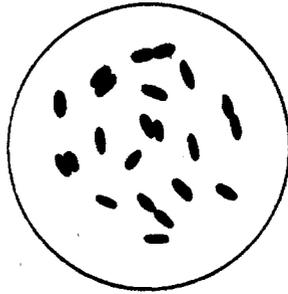
Lactic acid bacteria.
(In chains.)



Yeast cells—the cause of foamy cream.



Hay bacillus, often a cause of decomposition in cream.



Colon bacilli, responsible for many objectionable flavors.