

THE
Connecticut Agricultural Experiment Station.
NEW HAVEN, CONN.

BULLETIN No. 119

MAY, 1894

**The Babcock Test as a Basis for Payment
in Cream-gathering Creameries.**

CONTENTS.

	Page.
Notice as to Bulletins and Reports,	2
Defects of the Present System of Payment,	3
The Method of Payment according to amount of Butter-Fat furnished, Apparatus for Sampling and Weighing Cream,	5
Instructions for Sampling and Weighing Cream,	6
The Composite Sample,	8
Apparatus for Testing Cream by Babcock Method, Instructions for Making the Test,	9
Bookkeeping,	11
Comparison of Space System with the Babcock Test System,	15
Tables,	19-24

NOTICE AS TO BULLETINS.

The Bulletins of this Station, usually issued quarterly or oftener, are mailed free to citizens of Connecticut who apply for them, and to others, as far as the limited editions permit.

Applications should be renewed annually before January 1st.

The matter of all the Bulletins of this Station in so far as it is new and of permanent value will be made part of the Annual Report of the Director.

☞ All Bulletins earlier than No. 71 and also Nos. 83, 92, 93, 100, 101 and 109, are exhausted and cannot be supplied.

Bulletin 118, a Bibliography of Exp. Station literature relating to Fungous Diseases, is to be included in the 17th Annual Report which will be shortly ready for distribution.

NOTICE AS TO SUPPLY OF STATION REPORTS.

The Annual Report of this Station, printed at State expense, is by law limited to an edition of 12,000 copies, of which 5,000 copies are bound with the Annual Report of the Connecticut State Board of Agriculture, and distributed by the Secretary of the Board, T. S. Gold, West Cornwall, Conn.

After exchanging with other Experiment Stations and Agricultural Journals, the Reports remaining at the disposal of the Station will be sent to Citizens of Connecticut who shall seasonably apply for them, and to others as long as the supply lasts.

☞ The Station has no supply of its Annual Reports for the years 1877, 1878, 1879, 1880, 1881, 1883, 1884, 1887, and 1891.

THE BABCOCK TEST AS A BASIS FOR PAYMENT IN CREAM-GATHERING CREAMERIES.

BY A. L. WINTON AND A. W. OGDEN.

In Bulletin 108, issued by this Station in May 1891, it was stated that the Babcock test "offers to cream-gathering creameries, a practicable and accurate method of ascertaining the actual quantity of butter-fat which each patron furnishes, so that payments may be based, not on volume of cream supplied, but on *actual butter-fat*, which is the raw material that the creamery manufactures. This is obviously the most satisfactory method of payment."

Since that time, this method of payment has been adopted by several creameries in other states, but nothing of the kind has been attempted in Connecticut, until the present winter.

Several parties having applied to this Station for assistance in introducing the Babcock tester, its practical application to cream-gathering dairies has been carefully studied in a number of creameries during the past season and the results of this experience are given in this bulletin.

Most of the work has been done in coöperation with the Golden Ridge Creamery of Berlin, whose managers were the first to adopt the system here suggested.

DEFECTS OF THE PRESENT SYSTEM OF PAYMENT FOR CREAM.

Most of the cream gathered by creameries in this State, is raised by the submerged, deep-setting system, and is paid for by the "space." The "space" is the volume of a cylinder $8\frac{1}{2}$ inches in diameter and $1\frac{3}{4}$ of an inch high, and the number of "spaces" in each can of milk is read off before skimming, by means of a strip of glass set in the sides of the can on which the space graduations are marked. The unit for payment is therefore a given volume of cream which, to make the system perfectly equitable, should always contain the same quantity of pure butter-fat.*

* Butter is a mixture of butter-fat—its essential, most abundant and most distinctive ingredient—with more or less water, salt and curd. As the quantities of these several ingredients in butter are quite variable, accuracy and simplicity are best secured by basing all calculations on the quantities of *butter-fat*.

That the "space" does not always contain the same quantity of butter-fat and that the differences in the quantity of butter-fat in it are often large enough to make this system of payment unfair, are facts of every day observation in creamery practice, which have also been abundantly confirmed by chemical tests.

Even when the directions of the makers of the apparatus and of the creamery manager are closely followed, the cream raised from milk of one and the same herd, which is fed, handled, and milked as uniformly as possible, will yet show moderate differences in the quantity of butter-fat present, per "space," from day to day.

The time which elapses from the setting to the skimming of the milk, has considerable effect on the number of spaces gathered. For a certain time after setting, the depth of the cream layer and the number of spaces, increase; then follows a period during which the number of spaces slowly decreases, on account of the coalescence of the fat particles, but the per cent. of butter-fat and with it the value of the cream for butter making, is, nevertheless, all the while increasing.

But when the prescribed method of setting is not closely followed by a part of the patrons, differences in the quality of the "space" become so large as to work great injustice to other patrons and generally to those who are producing the most and the best cream. Abundant proof of this will be noticed in the following pages.

Much dissatisfaction comes from the fact that during the winter it is absolutely necessary in some creameries for each patron to measure and record the "spaces" of cream which he raises, so that he may have his cans for use again. The cream-gatherer only makes from two to four trips a week, to get the cream and a copy of the patron's score.

In addition to the defects already noted, it need hardly be said that the dishonest patron may so manipulate his cream as to increase the number of spaces in ways which the cream-gatherer is unlikely to detect.

While the system of setting milk and raising cream now generally in use, if strictly followed, is an excellent one, well suited to our conditions, the system for payment is unsatisfactory because it does not bear a close relation to the actual butter-fat furnished by the several patrons to the creamery.

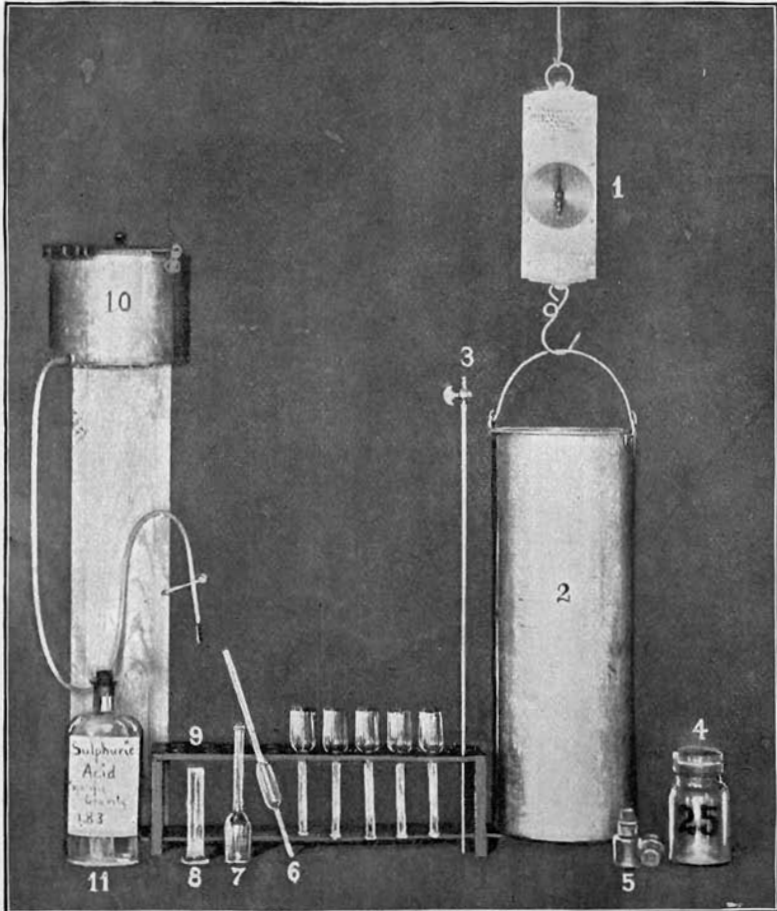


PLATE I.

THE METHOD OF PAYMENT ACCORDING TO AMOUNT OF BUTTER-FAT FURNISHED.

On the following pages is a full description of the system which the Golden Ridge Creamery, at Berlin, Conn., with the advice of this Station, has adopted and which, it is believed, secures to all the patrons fair payment for the cream furnished.

The plan adopted at Berlin is briefly as follows: The cream, skimmed by each patron, is weighed by the cream-gatherer who also takes a sample accurately representing the entire cream, both as to its quantity and its quality. The samples of each patron's cream gathered from day to day, are mixed and make a "composite sample" which is kept from curdling by a preservative and is finally tested by the Babcock method.

From the total weight of cream gathered and the per cent. of fat in it, the actual weight of butter-fat furnished by each patron is determined and is placed to his credit. Spaces are not taken into account.

APPARATUS FOR SAMPLING AND WEIGHING THE CREAM.

See Plate I.

Pail for Sampling and Weighing.—For this purpose, we use a cylindrical pail about eight inches in diameter and 22 inches deep (the precise dimensions are not important) having a stout bale by which it will hang straight from the spring scale and a handle at the bottom to assist in pouring. For patrons that furnish little cream—10 pounds or less per gathering—a pail of half the diameter and one fourth of the capacity may be found useful.

The sampling pail should weigh exactly 5 lbs. and for this purpose, after the pail is otherwise finished, the requisite amount of "soft sodder" should be melted upon, or in it, by the tinner.

Spring Balance.—We use a Chatillon spring balance, weighing 60 pounds by 2 ounces. In order to avoid calculation, the index should be set back one quarter of the circle, which is equivalent to 5 pounds, so that when the empty pail hangs on the balance the index stands at 0. This balance should hang from a proper support at the back of the gatherer's wagon, at such height that the pail full of cream can be hung on it handily but will not touch the ground.

Sampling Tube.—This tube, devised by Mr. Ogden, is of stout brass, 25 inches long, $\frac{3}{16}$ of an inch bore and of metal about $\frac{1}{8}$ of an inch thick.* On the upper end, a small brass stop-cock of the

* See figure 3, Plate I. When the amount of cream furnished by the individual patrons is small, a tube of $\frac{1}{4}$ inch bore may be preferable.

same bore is screwed. Both tube and cock are nickel plated inside and out, to make a smooth, untarnished surface. The tube when not in use should be kept in an upright position to permit draining.

Sample Bottles.—Two sets of sample bottles are used :

(1.) *Collecting bottles.*—Small wide-mouthed bottles, holding from one to one and one half fluid ounces, closed by good corks are suited for carrying the collected samples. Numbers, corresponding to the different patrons, should be burned into the tops of the corks by means of a red hot iron. The bottles themselves are not otherwise marked. These are taken by the cream-gatherer on each trip, to receive the samples that represent every lot of cream collected. See figure 5, Plate I.

The gatherer should be provided with a convenient case, having a compartment for each bottle, and a cover which when closed and fastened, will hold the corks securely in their places.

(2.) *Composite Sample Bottles.*—Half pint "Lightning" fruit jars, or wide-mouthed bottles of convenient size fitted with corks, are used for this purpose. The bottles should not be much larger than is necessary to hold the largest of the composite samples. See figure 4, Plate I.

INSTRUCTIONS FOR SAMPLING AND WEIGHING THE CREAM.

Numbering of patrons.—The patrons are conveniently distinguished by numbers, and the corks of the sample bottles should bear corresponding numbers. To avoid error each patron's number should be posted in a conspicuous place near his creamer.

Skimming.—Patrons should be required to draw off their own cream and to keep it protected from dirt and odors, and at a low temperature. This saves the time of the cream-gatherer, and puts most of the cans more promptly at the disposal of the patron. If separators are used they must be so gauged as to run cream of about the same thickness as Cooley cream i. e., with not more than 25 per cent., preferably from 18 to 20 per cent., of fat. Pan-set cream, or cream that is frozen or sour cannot be accurately sampled, and should be rejected for this, if for no other reason.

Mixing the Cream.—Pour each patron's cream at least twice from one vessel to another. The last pouring should bring it into the weighing pail. *It is absolutely essential that the cream should be thoroughly mixed before sampling. This is the most critical part of the whole operation.* If there is enough cream to fill the weighing pail more than once, each pailful should be carefully mixed and sampled.

Sampling and Weighing.—Lower the sampling tube *with the cock open*, to the bottom of the weighing pail which holds the mixed cream. When it is filled raise it out of the liquid and allow it to drain for a few seconds. By this means the tube is rinsed with the cream to be sampled and any traces of cream adhering to the tube from previous use are removed. With the cock still open, slowly lower the sampling tube to the bottom of the cream pail. After allowing a moment for the cream to rise in the tube to the same height as in the pail, close the cock and raise the sampler carefully out of the cream. As long as the cock is closed the cream in the tube will not flow out, unless the tube is strongly jarred. Allow the cream adhering to the outside of the tube to drain off for a few seconds, then put the lower end into the collecting bottle which bears the patron's number on its cork and open the cock. The cream will then flow out of the sampler into the bottle, which is afterwards securely corked and put into the cream-gatherer's case. Immediately weigh the cream in the cream pail to the quarter or half pound as may be judged expedient and record the weight.

If the patron has more than one pailful, repeat with each pailful the operation of sampling and weighing, putting all the samples in one and the same bottle. *Weigh all cream collected, in one and the same sampling pail and draw a sample from each separate portion weighed.*

In case a patron has so little cream that a single portion drawn by the tube from day to day will not be sufficient to make a composite sample large enough for testing, two or more cores may be taken, *but at every gathering the same number.* If two cores are taken to-day, then two must be taken to-morrow and every day until the test is made; if three cores, then three every day.

Operating according to these directions the sample not only represents the quality of the whole amount of cream, but is also proportional to its quantity. If a patron furnishes twice as much cream to-day as he did yesterday, the sample drawn from to-day's cream will also be twice as large as yesterday's and if there is a decided difference in the quality of cream on the two days this method of sampling will make due account of it in the composite sample.

When the whole quantity of cream is very small, less than half a pailful, it is best not to take a sample in the way above described, but putting the sampler in the cream, apply the mouth to the stop cock and suck the sampler full, close the cock and transfer this sample to the collecting bottle.

The size of the sample taken in this way does not correspond to the quantity of cream, but the possible error thus introduced is inconsiderable when the quantity of cream is small and nearly alike from day to day.

If, however, it is desired to be more exact, small lots of cream can be sampled in the way first described, in a pail having a diameter of four inches.

A given quantity of cream in this pail will have four times the depth which it has in the larger one and the sampler will therefore draw a sample four times as large.

THE COMPOSITE SAMPLE.

Preservative.—Bichromate of potash when added in the proportion of one grain of the salt to two ounces of cream, will keep the latter (in a cool place) in a suitable condition for testing for at least one week. A pistol cartridge shell, of .22-inch calibre, cut to a length of $\frac{1}{4}$ inch, will hold, when loosely filled, enough of finely powdered bichromate to preserve one quarter of a pint of cream.* Convenient measures can be made by cutting off shells to the proper length with a file and soldering on a piece of wire for a handle.

When beginning a series of tests, place in each composite sample bottle the quantity of powdered bichromate of potash required for keeping one quarter of a pint of cream. If the quantity at any time amounts to more than this, more bichromate may be added.

Transferring the Samples.—As soon as the collected samples arrive at the creamery, shake each moderately, pour it into the composite sample bottle bearing the corresponding number and allow the collecting bottle to drain for a moment. Cork the composite sample bottle and give it a rotary motion to mix the new cream with that previously collected, as well as with the bichromate. If this is not done, the thick layer which has risen since the last addition of cream, may adhere to the side of the bottle and finally interfere with taking the portion for testing. Keep the samples in a cool place, but do not allow them to freeze. The small collecting bottles and corks should be put into hot water at once, or before the adhering cream dries to them, should be washed, dried and placed in the cases ready for the next collecting trip. Since only the corks are marked, no confusion of bottles can arise.

* A .22-inch calibre shell cut to $\frac{1}{4}$ inch long holds enough to preserve $\frac{1}{4}$ pint.

A .32-inch calibre shell cut to $\frac{1}{4}$ inch long holds enough to preserve $\frac{1}{2}$ pint.

A .32-inch calibre shell cut to $\frac{1}{2}$ inch long holds enough to preserve one pint.

APPARATUS FOR TESTING CREAM BY THE BABCOCK METHOD.

Test Bottles.—The form of cream bottle devised by Mr. Winton, and described in Bulletin 117 of this Station, is suited for creamery use. (See figure 1, page 9). It has a wider neck than the bottles used for testing milk. The neck is graduated from 0

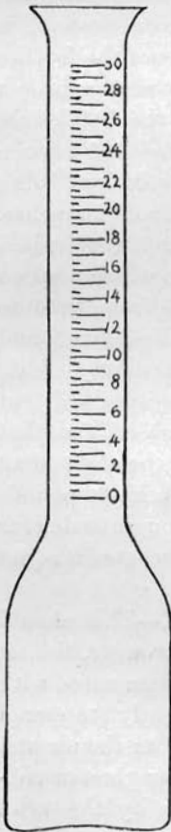


Fig. 1.
Cream
Bottle.

*



Fig. 2.
Pipette
for Cream.

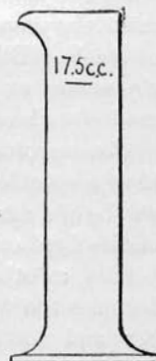


Fig. 3.
Acid
Measure.

to 30 per cent. (figure 4, page 14), but the readings can be readily made to a quarter of a per cent.*

Pipettes.—The cream is measured in a pipette delivering 18 cubic centimeters (figure 2, page 9). The opening at the lower end should be rather larger than for milk pipettes, so that the cream, which is thicker than milk, will deliver readily.*

Acid Measure.—This is a glass graduate, which delivers, when filled to the mark, 17.5 cubic centimeters. (See figure 3, page 9).*

Centrifugal Machine.—The so-called steam turbine testers are especially adapted for creamery use. The power is communicated by a jet of steam, playing into pockets attached to the rim of the wheel which carries the bottles. By this device the time and labor consumed in operating the hand machines are spared and the more complicated machinery of the power testers, is avoided. The escaping steam keeps the contents of the bottles from cooling, and after the last whirling, the fat is at a proper temperature for measuring. The wheel to which the bottles are attached should make, during the test, from 700 to 1200 revolutions per minute, according to its diameter; 700 revolutions being sufficient for the larger wheels with a diameter of about 20 inches, while 12-inch wheels should run at the rate of 1200 revolutions per minute. The machine should have a spindle to which a speed indicator can be applied, and it should be tested from time to time to make sure that it is working properly. We have found in creameries machines which were running too slowly to do thorough work. In ordering machines it should be specified that they shall be fitted with a spindle for testing speed and that when the machine is loaded with the test bottles the shaft shall make the proper number of revolutions per minute with 30 pounds of steam. Be sure that the steam pipe is large enough to deliver *dry* steam and that while the tester is running, the steam is not used elsewhere in such quantity as to interfere.

Commercial Sulphuric Acid (Oil of Vitriol).—This should have a specific gravity of 1.82 to 1.83. If much stronger, the fat will be of a dark color; if weaker the fat will be contaminated with undissolved curd. The acid should be kept in tightly stoppered bottles, as otherwise it rapidly absorbs moisture from the air and becomes too weak. The stopper should be of either glass or rubber and not of cork which is rapidly destroyed by the acid.

* To be had of guaranteed accuracy, of Emil Greiner, 146 William St., N. Y. The test bottles cost \$2.50 per dozen, the pipettes \$1.75, and the acid measures \$1.25 per dozen.

This oil of vitriol is extremely corrosive. It will ruin very quickly, clothing or leather on which it falls and soon makes painful burns if in contact with the skin. If the hands come in contact with it they should be immediately and thoroughly rinsed. Sal-soda or wood ashes will neutralize it and check its corrosive action. The greatest care must be used in handling this acid. It should be purchased of guaranteed strength, from the manufacturer.*

Apparatus for Filling the Test Bottles with Hot Water.—A convenient arrangement for this purpose is shown in figure 10 in plate I. It consists of a four quart pail, the contents of which may be delivered through a piece of small flexible rubber tubing attached to a piece of metal tubing that is soldered on the side of the pail at the bottom. The rubber tubing should be about three feet long and provided with a pinch-cock. For use the pail is filled with boiling hot water and placed on a support a foot or two above the machine, thus giving the necessary head. By opening and closing the pinch-cock, the hot water may be delivered in the bottles, in proper quantity.

Rack for Draining the Bottles.—This is shown in figure 9 in the plate and needs no further comment.

MAKING THE TEST.

Tests need not be made oftener than once a week. If experience proves that bichromate will keep cream as long a time as it preserves milk, three tests each month, or perhaps two tests each month will be sufficient. The Station is now experimenting on this point. For the present, weekly tests are recommended.

The details of the process of testing are best described, substantially, in Dr. Babcock's own words. Certain minor changes are advisable, as the directions here are wholly designed for testing Cream.

Mixing the Sample.—Shake the composite sample bottle until the cream is thoroughly mixed, and of uniform consistency.

Measuring the Cream.—Immediately after mixing, the pipette is filled by placing its lower end in the cream and sucking at the upper end until the cream rises above the mark on the stem; then remove the pipette from the mouth and quickly close the tube at the upper end by firmly pressing the end of the fore-finger to pre-

* The Fairfield Chemical Works, Bridgeport, Conn., supply acid of right strength, for 2½ cents per pound by the carboy.

vent access of air. So long as this is done the cream cannot flow from the pipette. Holding the pipette in a perpendicular position, with the mark on a level with the eye, carefully relieve the pressure of the finger so as to admit air slowly to the space above the cream. In order to more easily control the access of air both the finger and end of the pipette should be dry. When the upper surface of the cream coincides with the mark upon the stem, the pressure should be again applied to stop the flow of cream. Next, place the point of the pipette in the mouth of one of the test bottles, and removing the finger allow the cream to flow into the bottle. After waiting a short time for the pipette to drain, blow into the upper end to expel the cream held in the point. If the pipette is not dry when used it should be filled with the cream to be tested, and this thrown away before taking the test sample.

Persons who have had no experience in the use of the pipette will do well to practice a short time by measuring water into a test bottle before attempting to make a test.

Adding the Acid.—After the cream has been measured into the test bottle the test may be proceeded with immediately, or the bottles may be left for a day or two without materially changing the results; samples that have remained in the test bottles two or three weeks and which had commenced to mould before the acid was added, have given the same amount of fat as samples tested immediately after being measured. If the cream has become coagulated, the curd should be broken up by shaking the test bottle before the acid is added. It is advisable, however, that the test be proceeded with immediately after the samples are measured, if possible.

The volume of commercial sulphuric acid required for a test is approximately the same as that of the cream, or 17.5 c. c. for the ordinary test. If too little acid is added, the casein is not all held in solution throughout the test, and an imperfect separation of the fat results. If too much acid is used, the fat itself is attacked. The acid need not be measured with great accuracy, as small variations will not affect the result.

Great care must be taken in handling the acid to avoid getting any of it upon the skin or clothing, as it is very corrosive. If by accident any is spilled upon the hands or clothes, it should be washed off immediately, using plenty of water. A prompt application of ammonia water to clothing upon which acid is spilled may prevent the destruction of the fabric and restore the color.

When all the samples of cream to be tested are measured ready for the test, the acid measure is filled to the 17.5 c. c. mark with sulphuric acid, and from this it is carefully poured into a test bottle, containing the cream. The acid being much the heavier sinks directly to the bottom of the test bottle without mixing with the cream that floats upon it. The acid and cream should be *thoroughly mixed* together by gently shaking with a rotary motion. At first there is a precipitation of curd, but this rapidly dissolves. Much heat is evolved by the chemical action and the solution, at first nearly colorless, soon changes to a very dark brown, owing to the charring of the milk sugar.

Whirling the Bottles.—The test bottles containing the mixture of cream and acid should be placed in the machine and whirled directly after the acid is added. An even number of bottles should be whirled at the same time and they should be placed in the wheel in pairs opposite to each other, so that the equilibrium of the apparatus will not be disturbed. When all the test bottles are in the apparatus, the cover is placed upon the jacket and the machine turned at the proper speed for about five minutes. The test should never be made without the cover being placed upon the jacket as this not only prevents the cooling of the bottles when they are whirled, but in case of the breakage of bottles, may protect the face and eyes of the operator from injury, by pieces of glass or hot acid.

The machine should be frequently tested with the speed indicator to make certain that the bottles are whirled at the required speed. Too slow motion results in imperfect separation of butter-fat.

If a steam turbine is not used, the test bottles should be whirled immediately after adding the oil of vitriol. In case of delay they must be heated to a temperature of about 200° Fahr. before putting them in the machine.

Filling the bottles with hot water.—As soon as the bottles have been sufficiently whirled, they should be filled to the neck, with hot water. If practicable, distilled or rain water should be used for the purpose. The bottles are most conveniently filled by help of the apparatus already described; the flow of water can be perfectly controlled by the pinch-cock upon the rubber tube. If only a few tests are to be made, the bottles may be filled with a pipette, or by pouring from a graduate. The cover should then be replaced and the machine turned for about two minutes.

Hot water is now added to fill the test bottles about to the 28 per cent. mark, and after whirling for about one minute longer the fat is ready for measuring.

Measuring the fat.—The fat when measured should still be hot to the touch.

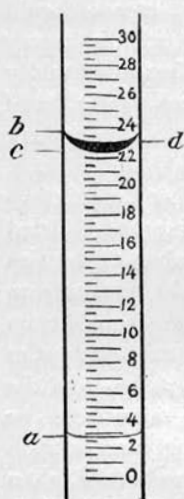


Fig. 4.

To measure the fat, take a bottle from its socket, and holding it in a perpendicular position with the scale on a level with the eye, observe the divisions which mark the highest and the lowest limits of the fat. The difference between these gives the per cent. of fat directly.

The line of division between the fat and the liquid beneath is nearly a straight line and no doubt need arise concerning the reading at this point, but the upper surface of the fat being concave, errors often occur by reading from the wrong place. The reading should be taken at the line where the upper surface of the fat meets the side of the tube and not from surface of fat in the center of the tube nor from the bottom of the dark line caused by the refraction of the curved surface. For instance in Fig. 4 the reading should be taken from *a* to *b* and not to *c* or *d*.

The reading may be made with less liability of error by measuring the length of the column of fat with a pair of dividers, one point of which is placed at the bottom and the other at the upper limit of the fat. The dividers are then removed and one point being placed at the 0 mark of the scale on the bottle used, the other will be at the per cent. of fat in the cream examined.

Sometimes bubbles of air collect at the upper surface of the column of fat and prevent a close reading; in such cases a few drops of strong alcohol (over 90 per cent.) put into the tube on top of the column of fat, will cause the bubbles to disappear and give a sharp line between the fat and alcohol for reading. Whenever alcohol is used for this purpose, the reading should be taken directly after the alcohol is added, as after it has stood for a time, the alcohol partially unites with the fat and increases its volume.

Whenever the fat is not quite clear, more satisfactory results may be obtained by allowing the bottles to stand until the fat

has solidified and then warm them by placing the bottles in hot water, before taking the reading.

The way of reading is illustrated in the figure. The bottom of the clear yellow liquid fat layer is at *a*. The upper surface is represented by *b*, *c*, *d*. The readings are 2.75 and 23.75. The difference, 21.00, is the per cent. of fat in this sample of cream.

After satisfactory tests have been made on all the samples, the cream that remains in the sample bottles is thrown away.

Cleaning the Test Bottles.—If the fat has solidified by cooling, warm until it is melted. This may be done by replacing the bottles in the machine and turning on the steam, or by running hot water over the bottles from the apparatus shown in figure 10 in the plate. Give each bottle a quick motion so as to throw out the fat, then empty out the remainder of the liquid, shaking all the time to loosen the white sediment on the bottom. Fill to the brim with boiling water, and place in the rack to empty and drain. After wiping off the outside with a cloth, the tubes, although not perfectly clean, are free from fat and ready for use again.

BOOK-KEEPING OF THE TEST SYSTEM.

The pounds of cream sent by each patron from day to day, are recorded just as spaces are recorded. The number of pounds of fat to be credited to each patron is calculated from the number of pounds of cream and the per cent. of fat found in the composite sample. If the composite samples are tested four times each month, the sum of the numbers of pounds of fat found at each of the four testings is the amount for which the patron is to be paid. The amount of money to be distributed, divided by the total pounds of fat received by the creamery for the month, gives the price to be paid for each pound of fat. This price per pound of fat, multiplied by the pounds of fat credited to any one patron, gives the amount due him. This work of calculation is made quite simple by the use of tables which have been prepared by this Station.

COMPARISON OF THE SPACE SYSTEM AND THE BABCOCK SYSTEM OF PAYMENT AT FOUR CREAMERIES.

The comparisons of the two systems here given, were all made at the request of the Superintendent or the President of the creameries where the tests were made. The four creameries use

the Cooley system exclusively. Creameries Nos. 1 and 2, allow the patrons during the winter time to do the skimming themselves every other day, or in some cases oftener. At Creamery No. 3, the skimming and the counting of spaces is all done by the cream-gatherers, except on Sundays when it is done by the patrons. The patrons of creamery No. 4, do all of the skimming and count their own spaces.

At the creameries where tests were made of a single gathering, a representative of the Station went with the cream-gatherer over his route, witnessed the skimming (when done by the cream-gatherer), and weighed and sampled the cream. The samples were tested by the Station agent at the creamery. In the week's trial at creamery No. 4, the composite system as here described, was followed, all the work except the testing, being done by the creamery. Details of the tests are given in tables on pages 19 to 24. To facilitate their study, the following explanations are given:

The first column gives the numbers which represent the individual patrons.

Spaces of Cream.—The second column gives the spaces credited to each, which is the basis of payment by the space system.

Pounds of Cream and Per cent. of Fat in the Cream.—The third and fourth columns,—pounds of cream and per cent. of butter-fat in the cream,—furnish the data for calculating the quantity of butter-fat to be credited to each patron.

It should be noticed that, from the number of spaces and the total weight of "cream" given in the tables, it is not possible to calculate the average weight of a space accurately, because some cream-gatherers or patrons "draw closer" than others, that is, draw off more of the skim milk from the cream, after measuring the spaces.

In any case some skim milk is gathered with the cream, and in some cases much more than in others. Again, if the gatherer draws equally "close" from each can, still a larger proportion of skim milk will go with the cream from a can which is half full than from one which is full.

The number of spaces of cream of course is not changed, however much skim milk is poured with it into the cream carrier. Nor on the other hand, is the quantity of butter-fat, credited to the patron by the Babcock System, made either larger or smaller by the amount of skim milk that is weighed with the cream, for

the more skim milk that is added, the lower will be the per cent. of butter-fat shown by the test.

For instance, suppose a patron has 50 pounds of cream which would test 25 per cent. butter-fat, and hence would credit him with $12\frac{1}{2}$ pounds of butter-fat, and suppose he mixes with it 25 pounds of skim milk so that the cream-gatherer credits him with 75 pounds of cream instead of fifty. He gains nothing, for the Babcock test will only show 16.7 per cent. of fat in this mixture, which is equivalent to $12\frac{1}{2}$ pounds of fat, the same that would be credited from 50 pounds of rich cream.

Per cent. of Fat in the Cream.—It follows from the explanation just given that the per cent. of fat in the total quantity of cream weighed, is *of itself* no accurate index of the relative value to the creamery of each patron's cream.

The gatherer may have skimmed one patron's cream much closer than another's, that is, he may have taken with the cream in one case more skim milk than in another.

Pounds of Fat in the Cream.—The fifth column, (calculated from the two preceding columns,) is the basis of payment by the Babcock System. It is not butter but butter-fat, the essential ingredient of butter.*

The other columns of the table are those which deserve the careful study of every manager and patron of a cream-gathering creamery, for they furnish a comparison of the two systems, and show moreover just what is the state of things in the present creamery practice of Connecticut.

Pounds of Fat in 100 "Spaces" of Cream.—This column shows the relative value of the "spaces" taken from the different patrons. Notice in Table I, for example, that while 100 "spaces" of cream from Patrons Nos. 5, 8, 18 and 19 furnish to the creamery 15 pounds or more of pure butter-fat, 100 spaces of cream from Patrons Nos. 12, 15 and 21 supply not more than $11\frac{1}{2}$ pounds.

Spaces of Cream required to make a Pound of Average Butter.—This column expresses in a more popular, but less accurate way, the facts given in the preceding column. Butter in each case is assumed to contain 85 per cent. of butter-fat.

Referring again to Table I, there is seen abundant illustration of the trouble which is spoken of at every 'dairymen's meeting.

* Butter is a mixture of some 80 to 90 per cent. of pure butter-fat with variable quantities of water, salt and curd.

Patrons 5, 8, 18 and 19 furnished cream which required less than 6 spaces to make a pound of butter while $7\frac{1}{2}$ to 8 spaces of the cream from Patrons 12, 15 and 21 were required to make a pound of butter.

The next two columns show *The Payment for the Cream by the Space System* at 4 cents per space, and *Payment for the Cream by the Babcock Test System* at 28+ cents per pound of butter fat.

The price per pound of fat given, was obtained by dividing the sum of the amounts paid each patron by the total number of pounds of fat from his cream. The number of pounds of fat in each patron's cream was multiplied by this price per pound, thus giving the price paid for his cream. The columns which give the cost of the cream by the two systems, both foot up to the same amount in dollars and cents.

These columns give the amounts each man would receive if the same total amount of money was distributed by the two systems.

Percentage difference.—In the last column, the difference in the payment by the two systems, is given in per cents. Those with + sign would receive more by the test system; those with the — sign, less. Supposing, for example, the percentage difference for a patron is + 10, then that patron would receive by the Babcock test system, \$110.00, where he gets by the space system, \$100.00, but if — 10, then he would receive only \$90.00 by the Babcock test system when by the space system he would receive \$100.

In this connection should be mentioned the fact that the purchase of a Babcock milk tester and the drawing of samples of cream in the presence of patrons has in some cases made a very noticeable effect in the quality and quantity of cream furnished.

The superintendent of one of our creameries reports that, during the week immediately following the taking of samples for testing at the creamery, the number of spaces of cream charged to the creamery notably diminished, but at the same time the output of butter increased. The Babcock test, before its adoption as a basis for payment, had paid for itself in this way.

RECORD OF TESTS OF CREAM FROM ONE GATHERING.

CREAMERY NO. 1.

Number of Patron.	Spaces of Cream.	Pounds of Cream.	Per cent. of Fat in the Cream.	Pounds of Fat in the Cream.	Pounds of Fat in 100 Spaces of Cream.	Number of Spaces to make a pound of average Butter. (85 per cent. Butter-fat.)	Value of the Cream by the Space System @ 4 cts. per Space.	Value of the Cream by the Babcock Test System @ 29.83 cts. per Pound of Fat.	Payment by the Babcock Test System would give more (+) or less (-) than by the Space System in per cent.
1	46	31.00	26.50	6.36	13.8	6.15	\$1.84	\$1.90	+ 3.3
2	46	32.00	20.25	6.48	14.1	6.03	1.84	1.94	+ 5.4
3	93	61.00	22.50	13.72	14.8	5.76	3.72	4.10	+ 10.2
4	32	21.50	21.75	4.68	14.6	5.81	1.28	1.40	+ 9.4
5	46	31.25	22.50	7.03	15.3	5.55	1.84	2.11	+ 14.7
6	34	22.25	20.50	4.56	13.4	6.34	1.36	1.37	+ .8
7	53	35.50	19.25	6.83	12.9	6.60	2.12	2.05	- 3.3
8	40	27.75	22.00	6.11	15.3	5.56	1.60	1.83	+ 14.4
9	*	42	29.00	19.75	5.73	13.7	6.23	1.68	+ 2.4
	†	42	31.75	17.50	5.57	13.3	6.41	1.67	- .6
10	*	30	23.75	17.25	4.10	13.7	6.22	1.26	+ 2.5
	†	29	21.00	17.50	3.68	12.7	6.69	1.16	- 5.2
11	*	48	36.00	18.06	6.48	13.5	6.28	1.92	+ 1.0
	†	46	35.75	17.50	6.26	13.6	6.24	1.87	+ 1.6
12	*	15	12.75	12.50	1.59	10.6	.60	.48	- 20.0
	†	37	26.00	17.50	4.55	12.3	6.91	1.36	- 8.1
13	*	36	27.50	18.00	4.95	13.7	6.18	1.44	+ 2.8
	†	27	21.50	16.50	3.56	13.2	6.45	1.07	- .9
14	*	26	21.75	17.00	3.70	14.2	5.97	1.11	+ 6.7
	†	40	28.50	16.00	4.56	11.4	7.46	1.37	- 14.4
15	*	39	27.75	17.00	4.72	12.1	7.03	1.41	- 9.6
	†	19	14.50	16.75	2.43	12.8	6.65	.76	- 3.8
16	*	18	14.75	17.00	2.51	13.9	6.10	.72	+ 4.1
	†	22	16.00	17.00	2.72	12.3	6.88	.88	- 8.0
17	*	24	17.75	16.25	2.88	12.0	7.08	.96	- 10.4
	†	25	16.00	18.75	3.00	12.0	7.07	1.00	- 10.0
18	*	21	17.00	18.50	3.15	15.0	5.67	.84	+ 11.9
	†	14	11.00	18.00	1.98	14.1	6.01	.56	+ 5.4
19	*	15	14.00	17.80	2.49	16.6	5.12	.60	+ 23.3
	†	37	28.00	18.30	5.12	13.8	6.14	1.48	+ 3.4
20	*	36	26.50	18.80	4.98	13.8	6.14	1.44	+ 3.5
	†	69	52.00	15.50	8.06	11.7	7.27	2.76	- 12.7
21	*	70	54.00	15.00	8.10	11.5	7.35	2.80	- 13.6
	†								
		1217		162.64			\$48.68	\$48.68	

* Skimmed and spaces counted by patron.

† Skimmed and spaces counted by cream gatherer.

RECORD OF TESTS OF CREAM FROM ONE GATHERING.

CREAMERY No. 2.

Number of Patron.	Spaces of Cream.	Pounds of Cream.	Per cent. of Fat in the Cream.	Pounds of Fat in the Cream.	Pounds of Fat in 100 Spaces of Cream.	Number of Spaces to make a pound of average Butter.	Value of the Cream by the Space System @ 4 cts. per Space.	Value of the Cream by the Babcock Test System @ 29 ⁵ / ₁₀₀ cts. per Pound of Fat.	Payment by the Babcock Test System would give more (+) or less (-) than by the Space System in per cent.
1	18	13.25	15.75	2.09	11.6	7.32	\$.72	\$.62	-13.9
2	30	23.5	19.00	4.47	14.9	5.70	1.20	1.33	+10.8
3	90	64.75	19.00	12.30	13.7	6.21	3.60	3.65	+1.4
4	18	15.00	12.50	1.88	10.4	8.14	.72	.56	-22.2
5	22	16.50	15.50	2.56	11.6	7.30	.88	.76	-13.6
6	36	21.75	23.00	5.00	13.9	6.12	1.44	1.48	+2.8
7	17	12.75	19.25	2.45	14.4	5.87	.68	.73	+7.4
8	77	57.00	21.00	11.97	15.5	5.47	3.08	3.55	+15.2
9	18	15.25	12.75	1.94	10.8	7.88	.72	.58	-19.4
10	59	45.00	17.25	7.76	13.1	6.46	2.36	2.30	-2.5
11	21	19.75	18.00	3.56	17.0	5.01	.84	1.06	+26.2
12	52	41.50	16.00	6.64	12.8	6.66	2.08	1.97	-5.3
13	68	58.25	18.75	10.92	16.1	5.29	2.72	3.24	+19.1
14	15	17.50	12.50	2.18	14.5	5.85	.60	.65	+8.0
15	109	84.75	18.75	15.89	14.6	5.83	4.36	4.72	+8.2
16	53	46.50	18.00	8.37	15.8	5.37	2.12	2.48	+17.0
17	47	39.75	16.00	6.36	13.5	6.28	1.88	1.89	+5
18	34	25.00	17.00	4.25	12.5	6.80	1.36	1.26	-7.3
19	161	135.50	14.00	18.97	11.8	7.22	6.44	5.62	-12.7
20	9	10.00	13.50	1.35	15.0	5.67	.36	.40	+11.1
21	16	17.00	11.50	1.96	12.2	6.97	.64	.58	-9.4
22	38	28.50	16.75	4.77	12.5	6.77	1.52	1.41	-7.2
23	49	37.50	17.00	6.38	13.0	6.53	1.96	1.89	-3.5
24	35	27.00	16.75	4.52	12.9	6.58	1.40	1.34	-4.3
25	8	8.00	7.25	.58	7.2	11.72	.32	.17	-46.9
26	47	33.00	15.25	5.03	10.7	7.94	1.88	1.49	-20.8
27	49	37.75	16.75	6.32	12.9	6.60	1.96	1.87	-3.5
28	25	20.00	13.50	2.70	10.8	7.87	1.00	.80	-20.0
29	21	16.75	13.00	2.18	10.4	8.20	.84	.64	-23.8
30	27	21.75	18.75	4.08	15.1	5.62	1.08	1.21	+12.0
31	95	48.00	17.00	8.16	12.5	6.77	2.60	2.42	-6.9
32	109	80.75	19.25	15.55	14.2	5.96	4.36	4.61	+5.7
34	160	124.75	18.50	23.08	14.4	5.90	6.40	6.84	+6.9
Total	1603			216.22			\$64.12	\$64.12	

RECORD OF TESTS OF CREAM FROM ONE GATHERING.

CREAMERY NO. 3, ROUTE A.

Number of Patron.	Spaces of Cream.	Pounds of Cream.	Per cent. of Fat in the Cream.	Pounds of Fat in the Cream.	Pounds of Fat in 100 Spaces of Cream.	Number of Spaces to make a pound of average Butter.	Value of the Cream by the Space System @ 4 cts. per Space.	Value of the Cream by the Babcock Test System @ $\frac{28.104}{100}$ cts. per Pound of Fat.	Payment by the Babcock Test System would give more (+) or less (-) than by the Space System in per cent.
20	73	59.00	12.75	7.52	10.3	8.25	\$2.92	\$2.18	- 25.3
21	13	11.50	17.50	2.01	15.5	5.50	.52	.58	+ 11.5
22	48	39.75	18.00	7.16	14.9	5.70	1.92	2.07	+ 7.8
23	34	29.00	15.00	4.35	12.8	6.64	1.36	1.26	- 7.4
24	16	13.75	15.25	2.10	13.1	6.48	.64	.61	- 4.7
25	50	40.00	18.75	7.50	15.0	5.67	2.00	2.17	+ 8.5
26	29	23.25	18.25	4.24	14.6	5.80	1.16	1.23	+ 6.0
27	24	18.25	18.50	3.38	14.1	6.03	.96	.98	+ 2.1
28	7	6.00	18.50	1.11	15.9	5.36	.28	.32	+ 14.3
29	36	28.50	17.00	4.85	13.5	6.31	1.44	1.40	- 2.8
30	32	24.25	19.00	4.61	14.4	5.90	1.28	1.34	+ 4.7
31	18	13.50	19.50	2.63	14.6	5.81	.72	.76	+ 5.5
32	37	26.25	20.00	5.25	14.2	5.99	1.48	1.52	+ 2.7
33	30	24.50	18.50	4.53	15.1	5.63	1.20	1.31	+ 9.1
34	28	22.25	17.50	3.89	13.9	6.12	1.12	1.13	+ 0.9
35	34	26.00	16.00	4.16	12.2	6.94	1.36	1.20	- 11.8
36	33	25.00	17.25	4.31	13.1	6.50	1.32	1.25	- 5.3
37	16	15.25	17.25	2.63	16.4	5.17	.64	.76	+ 18.8
38	32	23.50	19.75	4.64	14.5	5.86	1.28	1.34	+ 4.7
39	23	18.00	18.25	3.29	14.3	5.94	.92	.95	+ 3.3
40	22	18.00	18.25	3.29	15.0	5.68	.88	.95	+ 7.9
41	19	15.75	17.50	2.76	14.5	5.85	.76	.80	+ 5.3
42	21	15.25	18.75	2.86	13.6	6.26	.84	.83	- 1.2
43	98	78.25	18.50	14.48	14.8	5.75	3.92	4.19	+ 6.9
44	8	6.75	16.50	1.11	13.9	6.13	.32	.32	0.0
45	64	48.00	18.50	8.88	13.9	6.13	2.56	2.57	+ 0.4
46	74	54.50	17.00	9.27	12.5	6.79	2.96	2.68	- 9.5
47	26	19.75	19.25	3.80	14.6	5.82	1.04	1.10	+ 5.8
Total	945	743.75		130.61			\$37.80	\$37.80	

RECORD OF TESTS OF CREAM FROM ONE GATHERING.

CREAMERY No. 3. ROUTE B.

Number of Patron.	Spaces of Cream.	Pounds of Cream.	Per cent. of Fat in the Cream.	Pounds of Fat in the Cream.	Pounds of Fat in 100 Spaces of Cream.	Number of Spaces to make a Pound of average Butter.	Value of the Cream by the Space System @ 4 cts. per Space.	Value of the Cream by the Babcock Test System @ 28 $\frac{1}{100}$ cts. per Pound of Fat.	Payment by the Babcock Test System would give more (+) or less (-) than by the Space System in per cent.
1	21	15.50	17.75	2.75	13.1	6.49	\$.84	\$.77	- 8.3
2	98	75.00	17.25	12.94	13.2	6.44	3.92	3.64	- 7.1
3	87	71.25	16.50	11.76	13.5	6.29	3.48	3.31	- 4.9
4	29	23.50	16.00	3.76	13.0	6.55	1.16	1.06	- 8.6
5	19	15.25	15.75	2.40	12.6	6.71	.76	.68	- 10.5
6	19	11.50	24.00	2.76	14.5	5.85	.76	.78	+ 2.6
7	22	15.75	19.75	3.11	14.1	6.01	.88	.88	0.0
8	6	6.00	18.00	1.08	18.0	4.72	.24	.30	+ 25.0
9	7	6.50	14.00	.91	13.0	6.53	.28	.26	- 7.1
10	24	21.00	18.75	3.94	16.3	5.18	.96	1.11	+ 15.6
11	29	21.00	16.75	3.52	12.1	7.00	1.16	.99	- 14.7
12	42	28.25	24.25	6.85	16.3	5.22	1.68	1.93	+ 14.9
13	10	9.00	18.50	1.67	16.7	5.10	.40	.47	+ 17.5
14	18	14.25	18.25	2.60	14.4	5.88	.72	.73	+ 1.4
15	38	30.00	20.00	6.00	15.8	5.38	1.52	1.69	+ 11.2
16	12	10.50	18.25	1.92	16.0	5.31	.48	.54	+ 12.5
17	25	19.00	19.25	3.66	14.6	5.80	1.00	1.03	+ 3.0
18	36	26.25	19.50	5.12	14.2	5.98	1.44	1.44	0.0
19	22	16.00	21.00	3.36	15.3	5.57	.88	.95	+ 8.0
Total	564	435.50		80.11			\$22.56	\$22.56	

RECORD OF TESTS OF CREAM FROM ONE GATHERING.

CREAMERY No. 4.

Number of Patron.	Spaces of Cream.	Pounds of Cream.	Per cent. of Fat in the Cream.	Pounds of Fat in the Cream.	Pounds of Fat in 100 Spaces of Cream.	Number of Spaces to make a Pound of average Butter.	Value of the Cream by the Space System @ 4 cts. per Space.	Value of the Cream by the Babcock Test System @ $30\frac{1}{100}$ cts. per Pound of Fat.	Payment by the Babcock Test System would give more (+) or less (-) than by the Space System in per cent
1	56	39.5	15.50	6.12	10.9	7.78	\$2.24	\$1.89	-15.1
2	108	80.5	17.50	14.09	13.0	6.51	4.32	4.36	+ .9
3	115	93.6	17.50	16.38	14.2	5.97	4.60	5.08	+10.4
4	69	55.8	15.50	8.64	12.5	6.79	2.76	2.68	-2.9
5	96	60.3	18.25	11.00	11.5	7.42	3.84	3.41	-11.2
6	128	88.5	18.00	15.93	12.4	6.83	5.12	4.94	-3.5
7	107	74.8	18.50	13.83	12.9	6.58	4.28	4.28	0.0
8	28	20.7	15.75	3.27	11.7	7.28	1.12	1.01	-9.9
9	25	21.5	18.50	3.98	15.9	5.34	1.00	1.23	+23.0
10	55	39.8	17.50	6.96	12.6	6.72	2.20	2.16	-1.8
11	37	29.1	17.25	5.02	13.6	6.26	1.48	1.55	+4.7
12	15	10.5	14.00	1.47	9.8	8.74	.60	.46	-23.3
13	135	100.0	14.25	14.25	10.5	8.05	5.40	4.42	-10.0
14	51	41.7	17.00	7.09	13.9	6.11	2.04	2.20	+7.8
15	29	23.0	16.50	3.80	13.1	6.49	1.16	1.18	+1.7
16	40	28.1	14.00	3.94	9.8	8.63	1.60	1.22	-23.8
17	9	6.0	12.75	.77	8.5	9.94	.36	.24	-33.3
18	48	36.0	13.75	4.95	10.3	8.24	1.92	1.53	-20.3
19	68	48.3	20.00	9.66	14.2	5.98	2.72	2.99	+10.0
20	29	21.5	15.50	3.33	11.5	7.40	1.16	1.03	-11.2
21	27	20.0	17.00	3.40	12.6	6.75	1.08	1.05	-2.8
22	100	68.0	23.25	15.81	15.8	5.38	4.00	4.90	+22.5
23	53	41.0	17.50	7.18	13.5	6.27	2.12	2.22	+4.7
24	90	61.2	22.50	13.78	15.3	5.55	3.60	4.26	+18.4
25	91	68.8	19.25	13.23	14.6	5.85	3.64	4.10	+12.6
26	29	26.0	14.00	3.64	12.6	6.77	1.16	1.13	-2.6
Total	1638			211.52			\$65.52	\$65.52	

RECORD OF TESTS OF COMPOSITE SAMPLES REPRESENTING THE
CREAM GATHERED IN ONE WEEK.

CREAMERY No. 4.

Number of Patron.	Spaces of Cream.	Pounds of Cream.	Per cent. of Fat in the Cream.	Pounds of Fat in the Cream.	Pounds of Fat in 100 Spaces of Cream.	Number of Spaces to make a Pound of average Butter.	Value of the Cream by the Space System @ 4 cets. per Space.	Value of the Cream by the Babcock Test System @ 31.83 cts. per Pound of Fat.	Payment by the Babcock Test System would give more (+) or less (-) than by the Space System in per cent.
1	82	62.75	17.00	10.67	13.0	6.53	\$3.23	\$3.33	+ 1.5
2	188	141.00	15.50	21.86	11.6	7.31	7.52	6.83	- 9.2
3	396	299.75	16.00	47.96	12.1	7.02	15.84	14.98	- 5.4
4	400	330.75	16.00	52.92	13.2	6.42	16.00	16.53	+ 3.3
5	282	240.25	16.50	39.64	14.1	6.04	11.28	12.38	+ 9.7
6	282	233.75	16.50	38.57	13.7	6.21	11.28	12.05	+ 6.8
7	423	294.00	16.50	48.51	11.4	7.41	16.92	15.16	-10.4
8	98	82.50	14.00	11.55	11.8	7.21	3.92	3.61	- 7.9
9	414	277.25	18.00	49.90	12.1	7.05	16.56	15.59	- 5.9
10	125	93.25	17.50	16.32	13.0	6.51	5.00	5.10	+ 2.0
11	47	31.25	14.00	4.38	9.3	9.12	1.88	1.37	-27.1
12	444	334.50	17.00	56.86	12.8	6.63	17.76	17.76	00.0
13	70	56.00	17.00	9.52	13.6	6.25	2.80	2.97	+ 6.1
14	341	247.75	20.25	50.17	14.7	5.77	13.64	15.67	+14.9
15	78	60.75	11.00	6.68	8.5	9.92	3.14	2.09	-33.4
16	144	115.25	17.25	19.88	13.8	6.16	5.76	6.21	+ 7.8
17	95	78.00	15.25	11.89	12.5	6.79	3.80	3.71	- 1.9
18	100	82.50	15.50	12.79	12.8	6.65	4.00	3.99	- 0.2
19	194	138.25	17.00	23.50	12.1	7.01	7.76	7.34	- 5.4
20	302	201.25	17.00	34.21	11.3	7.50	12.08	10.69	-11.5
21	400	271.00	22.00	59.62	14.9	5.70	16.00	18.63	+16.5
22	120	87.00	17.00	14.79	12.3	6.90	4.80	4.62	- 3.7
23	99	68.50	15.25	10.45	10.5	8.05	3.96	3.26	-17.7
24	86	66.00	17.75	11.71	13.6	6.24	3.44	3.66	+ 6.4
25	333	230.50	19.25	44.37	13.3	6.38	13.32	13.86	+ 4.1
26	113	81.75	19.50	15.94	14.1	6.03	4.52	4.98	+10.2
27	134	103.25	15.50	16.00	11.9	7.12	5.36	5.00	- 6.7
28	56	38.75	14.25	5.52	9.9	8.62	2.24	1.72	-23.2
33	100	66.00	24.50	16.17	16.2	5.25	4.00	5.05	+26.2
35	51	38.50	14.50	5.58	10.9	7.77	2.00	1.74	-14.7
5997	4452.00			767.93			\$239.88	\$239.88	