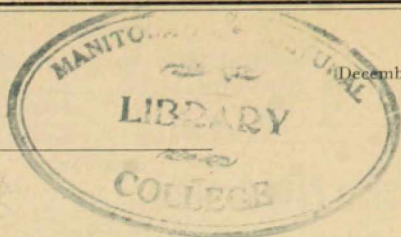


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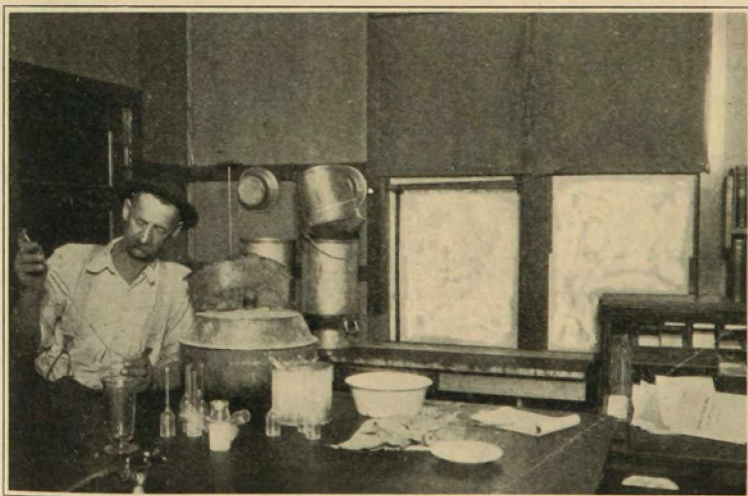


December, 1924

MAKE THE DAIRY PAY

TESTING AND HANDLING MILK AND CREAM

By FLOYD E. BALL
Deputy State Dairy Commissioner



Test Each Cow and Get Rid of the "Boarders"

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The Colorado Agricultural College

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FOREWORD

The farm separator was the big factor in changing the dairy farmer's marketing system. In the early days of the dairy development in this country, we had the whole-milk creameries and the factory separator. The creameries, in an effort to expand their milk supply territory, established skimming stations in convenient locations as to hauling distance and reasonable shipping distance. After the farm separator made its appearance the skimming station was gradually replaced by the cream receiving station.

The cream receiving station has been a large factor in developing the dairy industry in sections of this State where the cow population and herds were small, the farms far apart and the amount of cream produced within a reasonable distance too limited to profitably operate a local creamery.

By means of the cream receiving station the dairy farmers are furnished a home market, the skim milk is kept on the farm where it belongs for the feeding of calves, hogs and chickens, thus making the dairy industry more permanent.

The station system of buying cream is being practiced by nearly all creameries in Colorado. The purpose of this bulletin is to secure uniform and accurate methods of testing and bring information to the attention of the producer, station operator and dairy manufacturer, which will bring about a mutual understanding of each others' problems. Co-operation of the parties mentioned above will aid greatly in effecting changes of great economic importance to the dairy industry in Colorado.

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MAKE THE DAIRY PAY

By FLOYD E. BALL, Deputy State Dairy Commissioner

In reviewing the past twenty-three years of the dairy industry in Colorado, we find that the industry has developed rapidly, when we consider the fact that the main industries in the early days were the ranging of sheep and cattle, and mining. Figures show that at the beginning of 1900 the total value of all dairy products manufactured in Colorado was \$3,257,625.00, in 1913, \$7,900,000, in 1922, \$20,214,795.00 and in 1923, \$23,348,256.00. During the year 1923, the total value of all dairy products passed the combined values of all precious metals, equalled the combined values of gold, silver, zinc, lead, coal and potatoes, equalled the combined values of wheat and potatoes, and passed the combined values of gold and sugar beets. This is a very good showing for the dairy industry when Colorado is known as a mining state and is credited as being the leading beet-sugar producing state in the Union.

FUTURE OF DAIRYING

When we compare Colorado with the dairy states in this country, we find that she is in her infancy as far as the dairy industry as a whole is concerned, but with our natural advantages, such as climate and feed conditions, Colorado can be made one of the leading dairy states in the Union. The prospects at this time for future dairy development are encouraging.

However, there are two things that we, as producers and manufacturers of dairy products, must keep in mind and practice. They are herd improvement and quality of production. The consuming public is rightfully demanding good quality in any product and when competition is keen, a good-quality product is the one that sells best. On the other hand, the dairy farmer who is milking high-producing cows is the one who is getting ahead and making money.

HERD IMPROVEMENT

Dairying, when properly conducted, is one of the most profitable lines of livestock farming; but as a rule the average dairy farmer neither knows nor suspects the amount of profit or loss from each cow in his herd, which is the keynote to success in the dairy business. It is not the amount of money taken in or handled, but the money that stays in the pocket that counts. Every cow must eat, whether she produces much or little and she can return no profit to the owner until she has first paid for her board. To advance permanently in dairying, herd improvement must go on.

Herd Records.—Successful business concerns have a system of keeping records of all transactions in order that they may

The barn sheet and permanent record sheet are used by a number of dairy farmers in Colorado. The forms submitted are a combination of many forms that are in use by the U. S. Department of Agriculture and many agricultural colleges.

Permanent Record.—In order to have a record that is permanent and one that can be referred to easily, it is well to have an individual sheet for each cow. The following will be found to be very satisfactory:

Year.....19.....

Owner's name..... Address.....
 Name of cow..... Age..... Breed..... Weight..... Fresh.....
 Date bred..... Sire..... Dam.....
 Date calved..... Date dry..... Date sold..... Price.....

[illegible]

Remarks:

HOW TO GET HERD IMPROVEMENT

In order to secure herd improvement, we must intelligently practice proper breeding, feeding and weeding. These three factors are fundamental and are practical, sound, business methods, which can be applied to all dairy herds if the owners expect to be successful in dairying and in building up the dairy industry to a higher plane.

Permanency of the dairy industry will not be measured by the total number of cows milked but will be measured by the number of cows milked that are returning a reasonable profit above cost of feed.

BREEDING

Dairy animals are bred, fed and developed for the express purpose of producing milk. The efficiency of the individual cow depends upon whether her ancestry has been intelligently selected and bred for butterfat production. Since like tends to beget like in individuality as well as in production, it is advisable to use only pure-bred bulls whose ancestors for at least five generations have been real performers as milk producers.

We can increase the production to a limited extent with the present herd by employing better methods of care and feeding, but for lasting results the dairy farmer must plan for the future herd and aim for each succeeding generation to be better and more economical producers than the last. This can be accomplished by knowing the individual performance of each cow in the herd and then intelligently selecting and breeding accordingly.

Pure-bred Bulls.—It has been demonstrated repeatedly that the cheapest and easiest way to improve the herd is by using a good pure-bred bull. To give an idea of the amount of increased production to expect by using good purebred bulls, results of an experiment at the Iowa Agricultural College are presented. The men in charge purchased a number of scrub cows and conducted an experiment to determine the influence of purebred sires and of feed and environment on milk production. Purebred bulls of the Holstein, Guernsey and Jersey breeds were used on the scrub cows. Taking the three breeds as a group, the daughters of the scrub cows showed an average increase of 39 percent in milk and 25 percent in butterfat production. The second generation of grades of the three breeds taken as a group, showed an increase of 130 percent in milk and 109 percent butterfat production. Such an increase gives an idea of what may be expected in increased production by using a good purebred bull on your cows. This showing certainly is a great tribute to a purebred sire.

FEEDING

Feeding, care and management go hand in hand, and in

order to secure maximum results in the production of milk, these factors must be given careful attention. Space will not permit going into detail regarding the importance of proper feeding and the influence of the three factors mentioned. However, the results secured by placing a herd under the proper environment and the benefits of fall freshening will be considered.

Environment.—Referring to the Iowa experiment again, the cows that were four years old when brought to the experiment station produced on the average of 3,084.6 pounds of milk and 149.2 pounds of butterfat. When given good feed and care, they steadily increased in production until at seven years of age, they were producing 4,907.7 pounds of milk and 229.9 pounds of butterfat, or 59 percent more milk and 54 percent more butterfat than they did during the first year at the station.

An increase of only 10 percent in milk and 8 percent in butterfat yield was expected as the result of maturity of the animals, and consequently the greater part of the increase obtained must be attributed to feed and care or environment. After deducting the natural increase, we still have an increase of 49 percent milk and 46 percent in butterfat, which is no small increase and shows the importance of feed and care or environment.

Fall Freshening.—The United States Department of Agriculture, after studying many thousands of individual cow-records, found the interesting fact that when cows freshen in the fall, particularly during the months of October, November and December, they produce 4 percent more milk and butterfat than if allowed to freshen in the summer months. Also, the price of butterfat is usually higher during the fall and winter months.

WEEDING

Since there is a great variation in the production of individuals of the same breed, it is necessary to keep records on each cow to discover and dispose of the unprofitable or "boarder" cows. It does not pay to keep "boarders". They reduce the profits, increase the cost of milk production and take all the pleasure out of dairy work. We must be careful in the weeding-out process and be sure not to dispose of a valuable animal. Do not dispose of an animal on one or two tests, but get a year's record on all animals before you sell, as it is the amount of butterfat produced in a year that tells the story.

The following table has been compiled by the United States Department of Agriculture from records from cow testing associations all over the country, and shows in a very comprehensive manner the relation existing between butterfat production and return above feed cost in dollars and cents:

RELATION BETWEEN BUTTERFAT PRODUCTION AND RETURN
ABOVE FEED COST

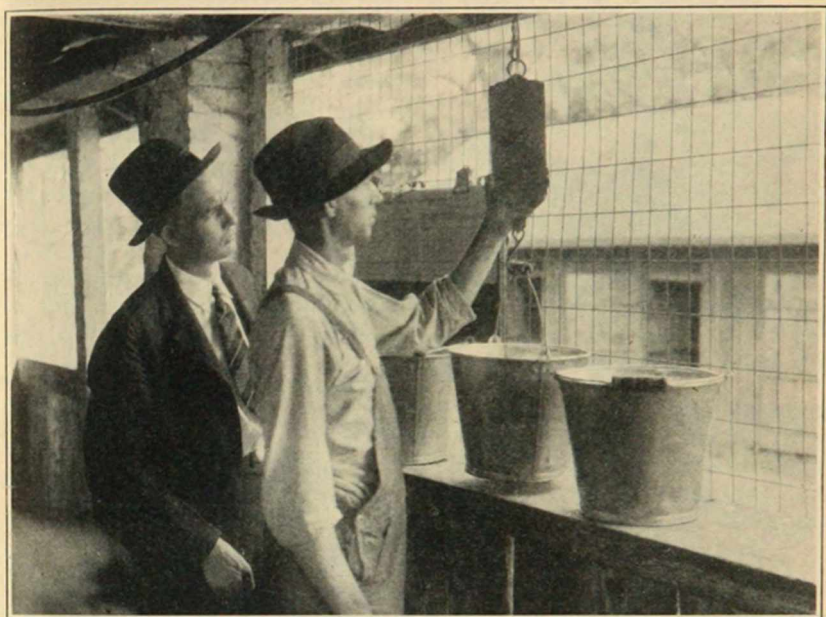
Group	Average pounds of butterfat produced in one year	Average income above feed cost for one year \$ 30.00 (loss)
1	24	19.00 (loss)
2	50	8.00
3	100	25.00
4	150	40.00
5	200	55.00
6	250	70.00
7	300	85.00
8	350	99.00
9	400	115.00
10	450	126.00
11	500	136.00
12	550	158.00
13	600	

A glance at this table reveals that the cow giving 600 pounds of butterfat returns \$158.00 annually, above her feed cost, while the cow producing 100 pounds makes a return of only \$8.00. With six times the production the return is seen to be nearly twenty times as great, which conclusively shows the absolute necessity of weeding out the low producers and replacing them with more profitable individuals.

Cow-Testing Associations.—In districts where the herds and cow populations are large, the work mentioned above is usually carried on through cow-testing associations. In these organizations a trained tester is employed, who spends one day every month with each of the members in the association. Arriving on the farm, usually in the afternoon, he weighs and samples the milk from each cow at milking time. He also weighs the concentrates and roughages given to each cow in the herd. The following morning this is repeated, after which the samples of milk are tested for butterfat. From this day's record he computes the milk and fat production and cost of feed for each cow for the current month. Naturally such records are not as exact as if every milking were weighed but the results are within 2 percent of the actual production of the cow. Considering the low cost of cow-testing-association work (\$3.00 to \$3.50 per cow per year), and the fact that these records have been shown to be within 2 percent of actual production, there is no cheaper way of keeping complete records on the herd than by this means, in places where there are sufficient cows to form such an organization. It would cost the average dairyman more in time, effort, supplies, etc., to do this work himself than to pay the \$3.00 to \$3.50 per year and have it done for him, receiving the additional advantages that go with cow-testing-association work as carried on at the present time under the supervision of the State Dairy Commissioner with the aid of the United States Department of Agriculture.

Individual Testing.—The weighing and testing of the milk from each cow is strongly recommended to determine her value

but if the work is not properly done the results are of no value and may give discredit where credit belongs.



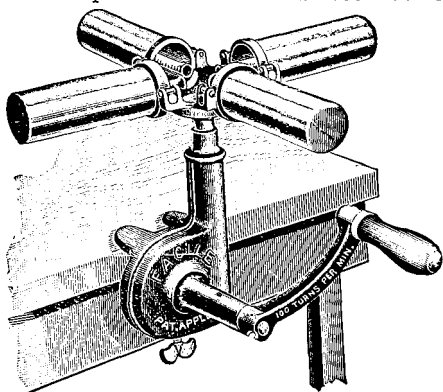
INDIVIDUAL RECORDS ARE NECESSARY TO ELIMINATE BOARDERS FROM THE HERD. WEIGH THE MILK FROM EACH COW AND RECORD IT.
(Courtesy U.S.D.A.)

In order that the results may not be misleading, all the milk from each cow must be carefully weighed and, to arrive at a true test, a representative sample must be taken. Just as soon as the cow is milked, weigh the milk, record weight, then pour the milk from one pail to another at least three times and dip the sample out at once. Keep the sample in a tightly covered jar or bottle until tested. Do not allow the sample to sour before testing.

A single test of this kind does not give much information regarding the cow's value but if carried on during the entire lactation period, that is weighing and sampling at least one day each month for the year, one will have a good idea of what the cow is worth. Do not condemn a cow on one test but give her a chance to perform for a year with proper feed and care, then if she does not return a reasonable profit over feed cost, send her to the butcher.

Producer is Loser.—If the factors mentioned above were practiced intelligently in Colorado on our present cow population, the increased production secured would amount to 31,119,-

569 pounds of butter or enough butter to feed 1,944,973 people at the present rate of butter consumption.



A FOUR-BOTTLE HAND BABCOCK TESTER.

No doubt such increases bring the thought of over-production to mind. This is not of immediate concern and should not worry us because all the dairy farmers will not put these important factors to work at the same time and it is impossible to get immediate results. It will take time to secure the increased production mentioned and it will be brought about so gradually that increased consumption and the increase in

population will absorb it. Should a temporary over-production be produced it will not vitally affect the dairy farmer who can raise his own feed and is milking paying cows. Also remember that the same production can be secured economically by milking fewer but better cows.

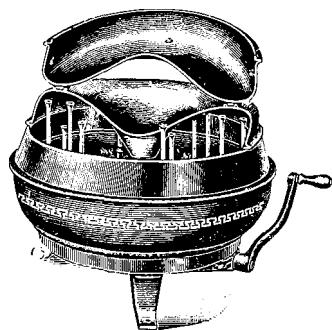
EQUIPMENT NECESSARY FOR HERD TESTING

The size of the testing outfit depends upon the size of the herd but for a small herd, the equipment listed below will be satisfactory:

One automatic scale (30 lb. capacity)	\$ 5.50
One 4-bottle Babcock tester with necessary glass-ware equipment for milk	7.50
One dairy thermometer	1.25
Commercial sulphuric acid (1 quart)25
Total cost	\$14.50

An 8-bottle covered machine with glassware complete will cost about \$18.00. When many tests are to be run at one time, it is a saving of time to have a larger machine. It is advisable not to purchase more than one-half gallon of sulphuric acid at one time because the acid weakens with age.

Cream-test scales will be found to be expensive, the cost ranging from \$10.00 to \$20.00 for the one-bottle size. Cream bottles will be needed for making cream tests which will cost about 25 cents apiece.



AN 8-BOTTLE BABCOCK HAND TESTER.

Remember accurate cream tests cannot be made without scales.

Dairy Information.—Any person desiring information pertaining to bull associations, cow-testing associations, feeding, pastures, or other matters pertaining to the dairy industry should address their inquiries to the State Dairy Commissioner, or Animal Husbandry Department at the Agricultural College, Fort Collins, Colorado.

PREPARATION OF MILK AND CREAM SAMPLES FOR MAILING

The State Dairy Commission will be very glad to test samples of milk and cream that reach the office in good condition. Samples arriving in a leaky, unsatisfactory condition will not be tested, because the result would not be accurate and would be misleading, but the sender will be notified of the probable cause of his trouble.

The following suggestions will serve as an outline to be followed:

1. Secure a representative sample by pouring milk or cream from one can to another at least three times. Sample must be smooth, free from streaks and lumps.

2. Fill a clean sample bottle. The bottle or jar should have a capacity of from two to four ounces. If the sample is not to be tested for adulterations or preservatives and is likely to be more than twenty-four hours in transit, add two or three drops of formaldehyde to prevent souring.

3. Seal the sample air tight. Test by inverting for an hour on white paper to see if the cover leaks.

4. Wipe the sample jar clean and dry, and pack well with plenty of soft, white paper in a small wooden or strong pasteboard box. Send by parcel post.

5. At the same time the shipment is made, send a letter stating what tests are desired. Give the name and address of the person taking the sample, of the person whose milk or cream was sampled, and of the person to whom analysis is to be sent.

QUALITY PRODUCTION

The principle of paying according to quality is as fundamental to good business in buying milk and cream as it is in buying other farm commodities. Everyone will agree that the principle is correct but a practical method of buying on a quality basis must be developed before it can be satisfactorily carried out. However, the producer and manufacturer should keep quality uppermost in their minds because the consuming public is becoming more and more appreciative of the value of wholesome food products of good quality, and is rightfully demanding a better quality of dairy products. Butter is sold largely on the quality basis, and it is logical, therefore, to buy cream on the same

basis. If all the butter produced in Colorado had scored 93 and brought a 93-score price, the returns would have been \$968,200.00 greater for the year 1922.

ESSENTIAL FACTORS IN PRODUCING CLEAN MILK

Clean milk is milk of good flavor from healthy cows, free from dirt and containing only a small number of bacteria, none of which are harmful. The chief requisites in production of clean milk are:

Healthy Cows and Attendants.—Raw milk from cows afflicted with tuberculosis, or udder diseases, is unsafe for consumption. No slimy, ropy, or watery milk, or milk which is abnormal in any respect, or which comes from an animal that appears sick or out of condition, should be sold for human consumption. Naturally the attendants of the cows must be in a healthy condition and must not associate with persons suffering from infectious diseases.

Clean Cows and Attendants.—Under farm conditions, cows accumulate filth and manure on their bodies and if their flanks, udders and teats are not cleaned before milking, there is a good chance that some of these materials will fall into the milk pail during the process of milking and naturally pollute the milk with their respective odors and certain species of bacteria. The milkers should milk with clean, dry hands and protect the milk from contamination with dust, dirt and other impurities.

Clean Stables.—Whenever possible, the stable should be on high ground with good natural drainage. The barnyard should be kept dry and free from manure to avoid any unnecessary contamination. The stable should be kept clean, well lighted and well ventilated, to eliminate strong animal and manure odors. A separate building or milk house for handling the milk and dairy utensils is necessary.

Proper Feed and Water.—Certain moldy or decayed feeds, wild onions, etc., impart objectionable flavors to milk and cream. The danger from these feed flavors may be greatly minimized by feeding such feeds, four to six hours before milking. In case of wild onions and other pasture feeds or weeds, the cows should be removed from such pasture from four to six hours before milking. Plenty of clean, pure water is required for the herd and for the washing of the milk pails and other dairy utensils.

Small-Top Milk Pails.—Under bad conditions, considerable amount of dirt may fall from the cow into the milk pail. Thus it is advisable to use small-top or hooked milk pails.

Clean Utensils.—The utensils must be clean and as sterile as possible. All dairy utensils should first be rinsed with cold or luke-warm water, washed thoroughly in hot water containing some washing powder and then scalded with boiling hot water, or steam if available.

Necessary to Cool Milk Promptly.—Milk should be removed from the stable to the milk house as soon as drawn from each cow and cooled immediately to 50 degrees F. or lower and kept cool until delivered. Producers are losing thousands of dollars annually, due to the fact that the milk is not cooled promptly and efficiently.

ESSENTIAL FACTORS IN PRODUCING GOOD CREAM

All of the essential factors mentioned in producing clean milk, up to the cooling process, must be considered as essential factors in producing good clean cream. Additional factors to be considered are:

Location of Cream Separator.—The cream separator should be located in a separate building or milk house. The milk should be separated as soon as possible after milking, for it is then warm and in good condition to secure clean separation. The temperature of the milk has a direct effect on the percentage of fat in the cream and the skimmilk. The best practical temperature at which to separate the milk on the farm is about 90 degrees F.

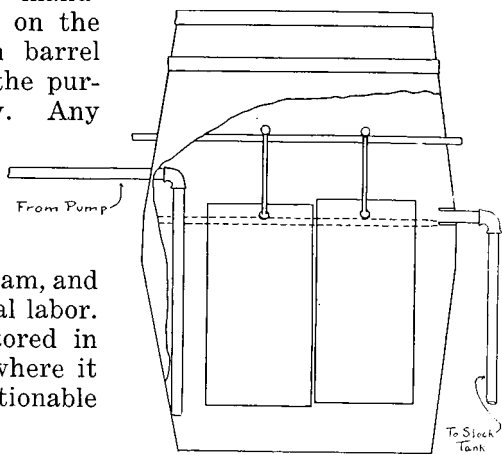
Cleanliness of Separator.—The cream separator collects many of the impurities contained in milk. The impurities are found in the slime deposits and unless the separator is washed thoroughly and freed from all these impurities and small amounts of milk of the previous separation, the separator bowl becomes a seat of contamination and the source of unclean, unwholesome and filthy cream, and bad effects of which cannot be overcome. It is impossible to make good butter from poor cream.

How to Wash the Separator.—After each separation, flush out the bowl thoroughly with water until the discharge from the skimmilk spout is clear. Then take the bowl apart and wash bowl, spouts, supply tank and buckets with a brush in moderately warm water containing some washing powder. Then rinse the parts in scalding hot water and steam them, if steam is available. Allow the parts to drain in a clean place, well protected from dust and flies.

Cool Cream Promptly.—Immediately after separation, place the cream in a cooling tank filled with cold water and keep it there until it leaves the farm. It is advisable to stir the cream twice daily to keep it smooth and free from lumps. Never mix warm cream with cold cream. It is advisable to keep all skim-mings separate until day of delivery. If this is not possible you should at least use two cans, one for the fresh, warm cream and the other for the cold cream of previous separations. Deliver the cream as often as possible.

How to Cool Cream.—The only practical way to cool cream

on the average farm is to set the cream in a suitable tank filled with cold water. Many manufactured tanks are now on the market, but a common barrel may be made to serve the purpose very satisfactorily. Any tank through which fresh water passes to the stock tank will prove very helpful in assisting cream producers to deliver good cream, and with very little additional labor. Cream should not be stored in a cellar or other place where it is liable to absorb objectionable odor.



A BARREL ARRANGEMENT THAT MAKES A SUITABLE COOLING TANK

WHY CREAM TESTS VARY

The question is often raised by producers selling cream to creameries, why it is that their tests vary from time to time. A slight variation in the test will change the producer's proceeds quite materially and it is reasonable to expect him to watch the cream tests very closely as the test received determines the amount of money he will receive for his product. Variation in tests are due to a great many uncontrollable causes and frequently the cream buyer is unjustly accused of misreading tests.

Everyone familiar with the farm separator must acknowledge that it is one of the most highly perfected pieces of farm machinery in use. We expect it to do perfect work and it does, but it is expecting too much from even such a perfect machine to think that the same tests will result week after week and season after season, when there are so many variable and uncontrollable conditions entering in which will cause differences in richness of cream.

Aside from wear or mechanical adjustment and abuse by improper usage, the following factors will cause variations in tests.

Temperature of the Milk.—Separate the milk as soon after milking as possible, for it is then warm and in good condition to secure a clean separation. No separator will skim cold milk as well as warm milk. The best practical temperature at which to separate the milk on the farm is 90 degrees F. In winter it is advisable to warm the separator by running hot water through it, otherwise there will be a wide variation in the cream test and also loss of fat in the skimmilk.

Richness of Milk.—The richer the milk, the richer will be the

cream. Any condition that affects the richness of the milk will also influence the richness and the test of the cream. Refer to page 27 for factors affecting the fat content of milk.

Cream Screw.—The richness of the cream obtained from any farm separator is mainly determined and regulated by the cream screw. If the cream screw is turned so as to move the opening nearer the center, it will deliver richer cream. The cream screw should be set so that it will produce cream testing about 35 or 40 percent

Rate of Inflow.—If more milk is run into the machine than the capacity of the machine calls for, there is excessive loss of fat in the skimmilk. If the machine is underfied the test will be increased.

Speed of Machine.—The separator should be run at a uniform and proper speed as recommended by the manufacturer.

Flushing the Bowl.—The amount of skimmilk or warm water that is used to flush the bowl and allowed to run into the cream can, will also affect the test of the cream. Experimental data shows that cream tests may be lowered from 1 to 10 percent according to the amount of milk or water used for flushing.

Unclean Separator.—The separator bowl should be cleaned thoroughly each time it is used. If this is not done properly the outlets for the skimmilk and cream may become clogged. This will cause inefficient skimming and is likely to cause variation in the test of the cream, and dirty separators will seriously affect the quality of cream.

The above conditions are likely to vary from time to time to a greater or less degree; therefore, a cream producer might expect to have a variation in his cream test.

DOES SOUR CREAM TEST MORE THAN SWEET?

Many have been led to believe that by holding their cream until it is real sour, they will get a higher test. This would be true under one condition, that is, if a can of cream were allowed to stand for a long time at a high temperature there would be enough moisture evaporate to increase slightly the percentage of fat, but this would be very slight, and in that length of time the cream would no longer be fit for human food. Still this would not bring a higher price, as the extra percentage of fat would only make up for the loss in weight from the moisture which evaporated. To illustrate: If there were 80 pounds of sweet cream, testing 30 percent fat, in this amount there would be just 24 pounds butterfat. Allow the cream to stand until 5 pounds of moisture has evaporated. This would then leave 75 pounds of cream, testing 32 percent. We would still have 24 pounds butterfat, but needless to say, the butter made from this 75 pounds of so-called cream would not be fit for human consumption.

TESTING AND HANDLING MILK AND CREAM

MILK TESTING

Sampling.—The sampling of milk is the most important operation in determining the butterfat content. Unless the sample is representative of the milk from which it is taken, the result of the test cannot be correct no matter how skillfully the work may be carried out. Before taking a sample for testing, the milk should be thoroughly mixed, either by pouring from one vessel to another at least three times, or by stirring it well with an ordinary stirring rod. Pouring from one vessel to another is considered the best method for mixing whole milk. Frozen or partly frozen milk should never be sampled for testing, since a sample of such milk will not be representative unless it is warmed gradually to a temperature of 70 degrees F.

Composite Samples.—The law provides: "In sampling milk from which composite tests are to be made, to determine the percent of butterfat contained therein, no such sample or sampling shall be lawful unless a sample be taken from each weighing and the quantity thus used shall be proportional to the total weight of milk sampled."

The sampling should be done the same as for taking sample for other tests, with the exception that the composite sample must be proportional to the quantity of milk from which it is taken.

Correct composite samples may be obtained by the use of the McKay Sampler.



A MILK SAMPLE BOTTLE.

Care of Milk Samples.—Samples of milk should be placed in air-tight receiving bottles, in order to prevent any evaporation. Should evaporation take place, the percent of fat increases, causing inaccurate returns. Tight sealing prevents evaporation.

Milk samples should not be permitted to sour before testing, as souring causes flakes or lumps of curd to form, which requires extra care in dissolving before testing. Souring may be prevented by keeping in a cool place or by use of some preservative, as formaldehyde or corrosive sublimate. If formaldehyde is used, use one part of formaldehyde to 1000 parts of milk. A tablet of corrosive sublimate will preserve 1 pint of milk for more than a week. When preservatives are added, the sample should be shaken to insure thorough mix-

ing. After each addition of milk to the bottle, shake again, giving it a rotary motion until the contents are thoroughly mixed.

METHOD OF MAKING TESTS

Preparation of Sample for the Test.—Before testing, the samples in good condition should be brought to a temperature from 65 degrees to 75 degrees F. by placing in a waterbath. The contents of each bottle should be mixed thoroughly before pipetting into the test bottle.

The mixing of the sample is best accomplished by shaking the sample bottle and pouring the contents from one bottle to another several times.

Samples in which the fat has separated from the milk in the form of flakes or lumps should be gradually heated to a temperature of at least 100 degrees F., or until all lumps of butterfat have disappeared; the sample should be thoroughly shaken and gradually cooled. Be sure to shake continuously during the process of cooling. After the proper temperature has been reached be sure to pipette samples into the test bottle at once.

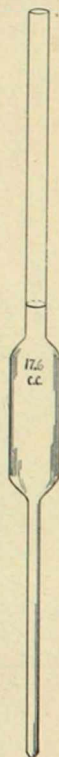
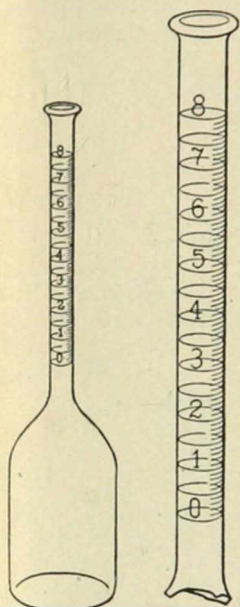
Milk Test Bottle.—An 8 percent, 18-gram, so-called 6-inch milk test bottle is approved by the Dairy Commissioner. The total percent graduation shall

Type of Babcock milk-test bottle conforming to the requirements of the State Dairy Commissioner, showing graduations.

be 8. The graduations shall represent whole percent, five-tenths percent, and tenths percent. The neck shall be cylindrical for at least 9 mm. below the lowest and above the highest graduation mark. The top of the neck shall be flared to a diameter of not less than 10 mm.

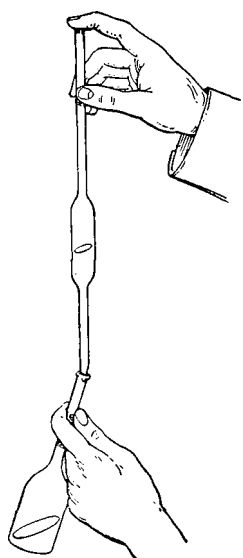
Measuring the Milk into Test Bottle.—Use a standard 17.6 cc. milk pipette and a standard 8 percent milk test bottle. Place the lower end of the pipette well down in the properly prepared sample and draw the milk into the pipette until it reaches a point in the pipette a short distance above mark around the upper stem. Then the forefinger is quickly placed over the upper end before the milk runs down below the mark. The pipette is then held vertically, with the mark around the stem on a level with

A 17.6 cc. milk pipette.



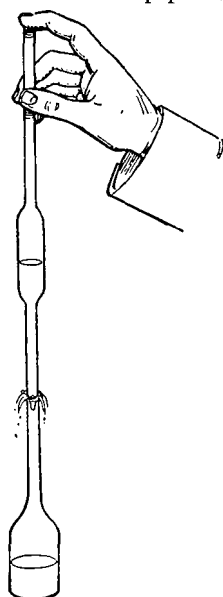
the eye, then gently relaxing the pressure of the finger on the end of the pipette, air is admitted and the milk is allowed to flow slowly out until the top of the milk column just reaches the mark around the stem of the pipette.

Transferring Sample of Milk to Test Bottle.—Incline the test bottle at an angle and place the lower point of the pipette within the neck and against the side of the test bottle. By raising the finger the milk is allowed to flow slowly down the inside of the neck of the bottle, thus allowing an exit for air in the bottle. This is not necessary when you have the long, narrow-nosed pipette which fits inside the neck of the bottle and the end of the pipette extends down into the bulb of the bottle. Blow the last drop of milk out of the pipette before removing it from the bottle.



RIGHT WAY OF ADDING MILK TO THE TEST BOTTLE.

Not a drop of the milk should be allowed to spill outside the bottle in transferring from the pipette. In transferring milk, the pipette must never be held vertically in a line with the neck of the test bottle, as the narrow neck may easily choke up with milk and run over the top. Mark each bottle with a number corresponding with the name or number of the respective patron on the test sheet. All the tests should be made in duplicate so that one test will serve as a check on the other for accurate work.



THE WRONG WAY OF ADDING MILK TO THE TEST BOTTLE.

Add Acid—The milk and acid should be the same temperature, between 65 and 75 degrees F. Add 17.5 cc. of Commercial sulphuric acid, specific gravity being 1.823 to 1.385, acidity of 90.6 percent to 91.0 percent, to the test bottle. Hold the test bottle at an angle, carefully pouring acid down the side of the test bottle and do not let it drop through the body of the milk, the bottle being turned slowly at the same time so that any milk adhering to the neck will be washed down. By observing this precaution, charring of the milk and also spilling of the acid is avoided.

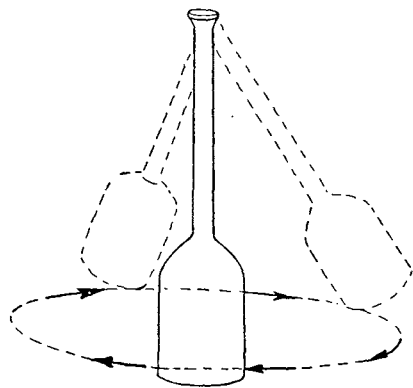
If the acid has been properly added there will be two distinct layers of acid and milk in the test bottle without much of a dark layer between them.

Sulphuric acid is an extremely corrosive liquid, which attacks the skin, the clothing, wood, and most of the common metals. Should the acid be spilled on the clothing, it should be immediately washed off with plenty of water, and ammonia water applied; this in turn must also be washed off. For these reasons acid should never be left any place where children have access to it.



METHOD OF ADDING ACID

Mixing Milk and Acid.—The mixing of the two is done best by giving the bottle a rotary shaking motion, being careful not to allow any casein to get into the neck of the bottle. Such mixing should be continued until the whole mass becomes liquid and free from solid particles of casein, and the color of the liquid appears uniform. Then the bottle should be allowed to stand for about three minutes, and given another gentle rotary motion before placing it in the tester or centrifuge.



MIXING THE ACID AND MILK IN THE TEST BOTTLE.

First Whirling.—The test bottles containing the mixture of milk and acid, after being properly mixed as stated above, are now placed in the tester or centrifuge and arranged in pairs at opposite sides of the center so that they will be in balance when rotating. Whirl the bottles at the proper speed of the machine for five minutes. If the test bottles containing the mixture of milk and acid are held over and allowed to become cool, they should be heated to

at least 170 degrees by setting in a hot water bath before whirling or between whirlings. Some testers are equipped with heaters to be used during cold weather.

Speed of Tester or Centrifuge.—The proper speed of testers with wheels of different diameters has been calculated as follows:

Diameter of wheel in inches	Revolutions of wheel per minute
10	1,074
12	980
14	909
16	848
18	800
20	759
22	724
24	693

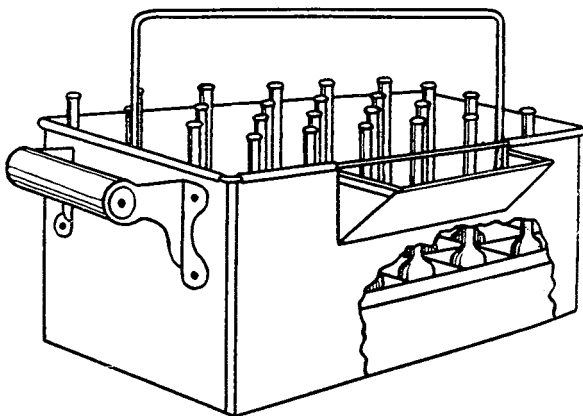
Adding the Water—The tester is then stopped and hot soft water at a temperature of at least 170 degrees F. (preferably near that of boiling water, 212 degrees F.) is added until the bowl of the bottle is filled up to where the neck of the bottle begins.

Second Whirling—After the water is added the bottles are whirled for two minutes.

Add Water the Second Time—After the bottles have whirled two minutes, enough hot soft water of the same temperature as in the first case is added until the butterfat column floats well within the graduated scale.

Third Whirling—After the second addition of hot water, whirl the bottles for one minute. When whirling the bottles remember that the five, two, and one-minute periods of whirling should not include the time required for starting and stopping but actual time of whirling at proper speed.

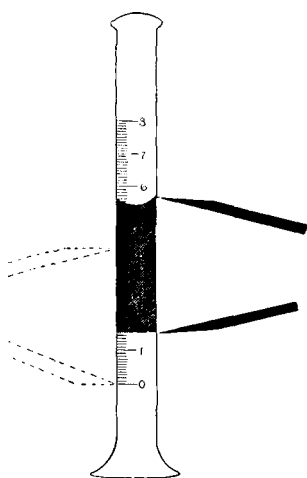
Place Bottles in Waterbath.—After the third whirling, remove the bottles from the machine and place them in hot waterbath in which the water is maintained at a temperature of 130 degrees F. and let stand for at least 5 minutes. The water in the waterbath should surround all the butterfat in the neck of the bottles. This is done in order that the butterfat may be brought to that



A WATERBATH WHICH IS USED TO CONTROL READING TEMPERATURES.

at which we secure the proper expansion of the butterfat globules and at which the bottles are standardized. Fat, like other substances, expands and contracts with heat and cold, so to get a correct reading, the hot waterbath is used.

How to Read Milk Tests.—If the test has been properly conducted, the fat column will be clear and of a golden, yellow



METHOD OF READING
MILK TESTS.

color. Milk test should be read at a temperature of 130 degrees F. This temperature will insure sharply defined upper and lower limits of the fat column. In reading the tests, hold the bottles vertically and on a level with the eye. Then measure the test by using a pair of sharp-pointed dividers, placing one point of the dividers at the extreme bottom of the fat column or lower meniscus and the other point at the extreme top of the upper curved surface of the fat column or upper meniscus. Then lower the dividers until the lower point rests on zero graduation of the test bottle, the graduation where the top leg rests, if noted and read, will be the percent of fat. Care must be taken to hold dividers rigid while lowering.

Place the reading secured on the receiving sheet in its proper place. Always read each test twice to make sure no mistakes have been made. If your check test does not agree with the first reading something is wrong and test should be re-run. In reading milk tests do not use glymol or any other reading oil.

DIFFERENT STEPS IN TESTING MILK BRIEFLY STATED

1. Secure a representative sample.
2. Mix each sample thoroughly at a temperature between 65 and 75 degrees F.
3. Fill immediately a 17.6 cc. pipette to mark around stem of pipette.
4. Transfer milk from pipette to test bottle.
5. Add about 17.5 cc. of acid to test bottle.
6.
 - a. Mix milk and acid thoroughly by rotary motion.
 - b. Let stand for at least 3 minutes.
 - c. Mix again before placing in machine.
7. Place bottles in machine and whirl at proper speed for five minutes.
8. Stop machine, add enough hot soft water of a temperature at least 170 degrees F. to fill bulb of bottle.
9. Whirl as before for two minutes.
10. Stop machine, add enough hot soft water of a temperature at least 170 degrees F. so the butterfat column will float within the graduated scale.
11. Whirl as before for one minute.
12. Stop machine, remove bottles and place them in a hot

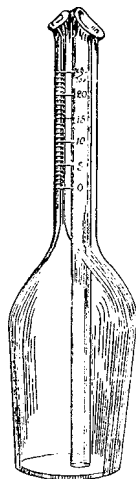
waterbath maintained at a temperature of 130 degrees F. for at least five minutes before reading.

13. Read test accurately at a temperature of 130 degrees F.
14. Record test as read, opposite patron's name.

TESTING SKIMMILK AND BUTTERMILK

In general, skimmilk and buttermilk is tested with the Babcock test in the same manner as whole milk except double-neck test bottles are required which are especially constructed for this purpose. The skimmilk test bottle differs from the whole-milk test bottle in having two necks, one of small bore graduated to read to one-hundredth percent for the fat column, and one extending nearly to the bottom of the bottle for filling.

Measure the liquid into the test bottles with the 17.6 cc. pipette used for whole-milk testing. Use about 26 cc. ($1\frac{1}{2}$ measures) of sulphuric acid instead of 17.5 cc. as in whole-milk testing. It is better to add the acid in two portions of about 13 cc. each, shaking after each addition. Great care must be taken while shaking to be sure that no particles reach the fat tube. The first whirling should be for ten minutes. The rest of the test is conducted as in whole-milk testing. If the fat is in the lower part of the tube it may be forced into the graduated part by the pressure of the finger at the mouth of the filling tube. The skimmilk test is valuable for testing the completeness of the skimming and should a test fail to reveal the presence of butterfat, it is an indication that the testing was poorly done and should be repeated as all skimmilk contains some butterfat.



A skimmilk test bottle.

WHY MILK TESTS VARY

The percentage of fat in normal milk varies a great deal from milking to milking and from day to day. Wide variations are puzzling and are usually looked upon with suspicion, while in reality it is quite natural for butterfat tests to vary. Anderson of the Michigan Agricultural College studied 200 seven-day records made under ordinary herd conditions, and 2,000 seven-day advanced registry records and found that one may expect, during seven consecutive days, the cows in a herd to vary in the percentage of butterfat in the milk at different milkings, about as follows: 30 percent of the cows will vary 1 percent or less, 50 percent of the cows will vary 1.1 to 2.0 percent, 14 percent will vary 2.1 to 3.0 percent, while the remaining 6 percent will show a much greater variation, even as much as 3 percent. In other words, we need not be surprised if 6 percent of the cows in the

herd yield milk that tests 3 percent of fat at one milking and 6 percent at another milking. Applying these figures to a herd of 100 cows, the average variation for the entire herd would be 1.5 percent and small herds will not come true to the average so the herd milk may be expected to vary from time to time.

All of many causes of these variations are unknown but the following are the main factors which cause the fat contents of milk to vary:

Individuality of Cows.—Some cows have the inherent ability to produce milk of a higher butterfat content than others.

Breed of Cows.—All breeds of dairy cattle do not produce milk of the same butterfat content. The average butterfat composition of milk for the different dairy breeds is as follows: Jersey, 5.35 percent; Guernsey, 4.98 percent; Brown Swiss, 4.24 percent; Shorthorn, 4.05 percent; Ayrshire, 3.66 percent, and Holstein, 3.45 percent.

Time Between Milkings.—The greater the interval between milkings, the lower the test of the milk, and the shorter the interval, the higher the test. There is a tendency for the morning's milk to test higher in fat content. If the interval between milkings is 10 to 14 hours, one may expect a variation in fat percentage of the two milkings of from .5 to 1 percent.

Complete Milking.—If part of the milk is left in the cow's udder the percent of fat will be low, due to the fact that the last part of the milk is especially rich. Van Slyke at the New York station found that the first milk drawn from a Guernsey cow contained but .76 percent fat, the second, 2.60 percent, the third 5.35 percent and the last, 9.80 percent.

Weather Conditions.—It has been shown that the tendency is for cows to give milk richer in fat in cold weather. During the hot summer months, the milk generally contains less fat. Cows exposed to severe weather conditions will shrink in milk flow and may yield milk low in fat.

Season of Year.—No matter when a cow freshens, the tendency is for her to give milk richer in butterfat during the winter months, and with a lower test during the summer. When spring comes, there is always a drop in tests and milk plants have come to expect complaints about tests at this time of year. Cows that freshen in the fall will produce more milk and butterfat than those that freshen in the summer.

Physical Condition.—Cows in high physical condition at time of calving will give milk containing 1 to 2 percent more butterfat than normal. Cows that are sick or off feed may produce milk that is either high or low in test.

Stage of Lactation.—The first month after freshening the cow usually gives richer milk than during the following month or two. The fat percentage then usually remains fairly constant until toward the close of the lactation period, when it gradually

increases. The cause of this gradual increase in fat is thought to be due to a decrease in the flow of milk and the fact that the production of fat by the mammary glands appears to be more constant than the production of milk, so uniform fat production is continued by means of a higher percentage of fat.

Age of Cow.—The annual yield of both milk and fat by a cow normally increases from the first lactation until she is mature. Maximum production is usually reached at from 7 to 9 years of age, although the 3-year-old production is usually not much greater than the 2-year-old because of teething. After studying all the available data on the effect of age of the cow on the yield and fat content of milk, Eckles found that on the average, a two-year-old may be expected to produce about 70 percent, a three-year-old, about 80 percent, and a four-year-old, about 90 percent of the milk and butterfat she will produce under the same treatment when mature. A good dairy cow usually shows no marked decline in production until after 12 years old.

Influence of Feed.—If a cow receives sufficient nutrients to maintain her body weight, the percentage of fat cannot materially change for any considerable period of time by greater or less liberality of feeding or by supplying any particular kind of feed. Cows that are greatly underfed may produce milk somewhat lower in fat percentage than normal. All experiments conducted up to the present time show that there is no positive evidence of any continued direct effect of a feed in stimulating milk production or increasing the percentage of fat. No kind of feed or care will cause a Holstein to give milk rich in fat like the Jersey. However, a cow may be fattened before freshening and caused to milk off this body fat in the first month of lactation, thereby raising the percent of butterfat in her milk.

CREAM STATION INFORMATION

By the term "cream station", we refer to the place of business, the room or building, in which purchasing agents known as station operators receive, purchase or handle cream for sale or shipment.

Purpose.—Generally speaking the purpose of a cream station is to create a local market for the small cream-producer and to insure the creamery firm of a more steady cream supply.

The cream station has been a large factor in developing the dairy business in Colorado, especially in sections of the State where the herds are small, farms are far apart and the cow population is relatively small. The cream supply is naturally limited and it is impossible in such districts to operate a local creamery profitably.

Cream stations which are operated by intelligent and competent persons who are interested in the development and welfare of the dairy business, have proven an asset both to the producer and creamery.

Location of the Station.—Cream is a delicate food product capable of absorbing flavors and odors. It is important therefore, that the receiving station be so located that its surroundings are clean and free from objectionable odors and flavors. It is required that the station be located on a well-drained piece of ground, at least 50 feet from any contaminating surroundings. For business reasons, cream stations should not be located back of other buildings but located in buildings that are accessible to the farmer.

Size of Stations.—The size of a cream station will naturally depend upon the amount of business handled. The tendency in the past has been to make cream stations too small rather than too large, thus impeding the growth of the business. Under no circumstances shall the station contain less than sixty-four square feet of floor space.

Limited floor space handicaps the operator in his work, especially on busy days.

The following capacities and sizes give a fair estimate of the size of the building needed:

CAPACITY	SIZE
100 gallons per week.....	10 x 12 feet
250 gallons per week.....	14 x 16 feet
500 gallons per week.....	16 x 18 feet
1000 gallons per week.....	20 x 24 feet

Building or Room.—A separate room or building is required for the operation of any cream station and shall be used exclusively for the handling of dairy products.

Sanitary Surroundings.—Cream shall not be handled in connection with any business which is in any way contaminating by means of odors or otherwise. No new license will be granted

for the operation of a milk or cream station or any dairy plant in a building in which live poultry is handled, and firms renting space for such stations or plants should protect themselves in their contracts against live poultry being handled in the same building. After July 1, 1926, no renewal of a milk or cream station or dairy-plant license will be granted for operation in a building in which live poultry is handled.

Walls and Ceilings.—A clean, smooth, tight, well-painted, and washable wall-surface shall be provided. It is preferable to us a paint of light color. All stations where dimension lumber is exposed shall be ceiled and painted.

Floor.—The floor shall be water tight. A smooth, well-finished cement floor sloping to a drain, is the most desirable but a tight wood floor of well-matched lumber and painted is satisfactory if kept clean.

Light and Ventilation.—All stations shall have ample, natural light provided by means of doors or windows, and there shall be sufficient ventilation at all times of the year. The room or building shall have outside openings on at least two sides of the cream room and all stations except modern-type stations, established after July 1, 1923, are required to have one-tenth as much outside window space as floor space.

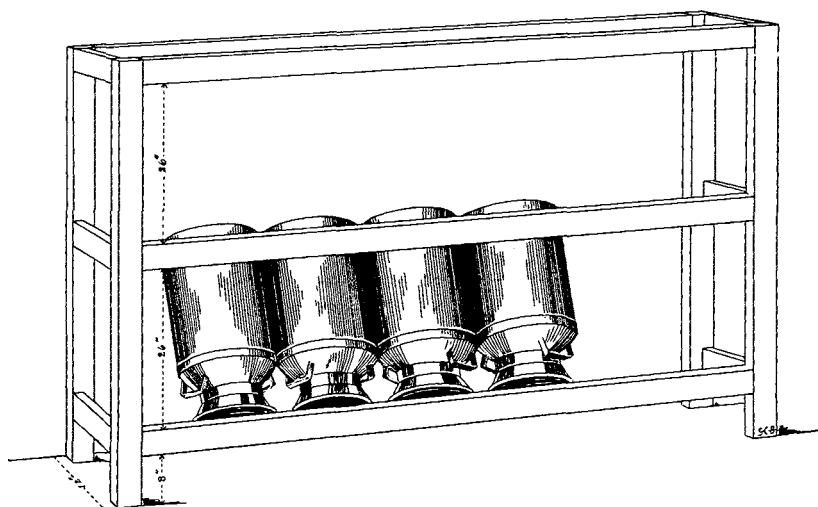
Screens.—All windows, other openings and doorways shall be screened during fly season with tightly fitting screens. Screens on doorways shall be provided with springs so that they will be self-closing. Fly season shall be calculated from May 1st to November 1st.

Drainage.—Suitable drainage should be provided by means of connections with sewer systems or cesspools, or all waste must be removed to a point not less than fifty feet from the building and if deposited on surface it is necessary that no nuisance shall be created.

Plumbing.—Where proper water system is available, stations should be provided with a supply of water and equipped with a sink for washing and cleaning properly, the same to be connected with suitable drainage.

CREAM-STATION EQUIPMENT

Can Rack.—The law requires that cream cans be removed from railroad depots within twenty-four hours after their arrival, covers removed and cans inverted in pure air. Naturally a can rack is necessary and said rack shall be built on the inside, not outside, and of sufficient size to hold all surplus, empty cans which are likely to be on hand at any time.



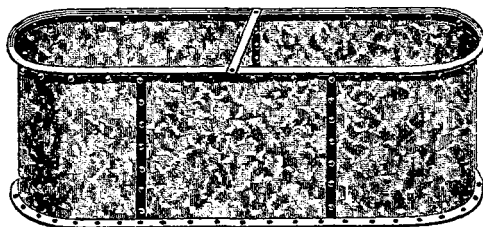
AN INEXPENSIVE, BUT WELL-MADE CAN-RACK.

A very convenient three-tier can-rack may be constructed very cheaply by constructing one of 2 x 4's and placing it against a wall as illustrated. The crosspieces on which the mouths of the cans rest should be about 12 inches from the wall and the lowest one should not be less than 8 inches from the floor. The space between tiers should be about 26 inches.

Nails in the racks opposite the can bottoms will serve as hangers for the lids in cases when the lids are not fastened to the cans.

The can rack should be made of dressed lumber and should be painted as it will not only improve the appearance of the station but will be easier to keep clean. If galvanized pipe is used as crosspieces in place of the 2 x 4's it will be found to be much more sanitary.

Cooling Tank.—Cream is a highly perishable product and in order to help preserve its quality, cooling tanks should be provided wherever there is an available water supply.



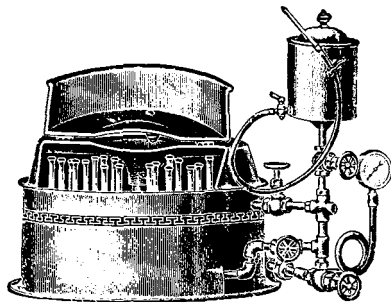
A GALVANIZED TANK SUITABLE FOR A COOLING TANK IF CONNECTED WITH A DRAIN.

Babcock Tester.—The Babcock tester, or centrifuge, in which the bottles are whirled should be set level and on a solid foundation in order that it may run smoothly. If the machine shakes it will

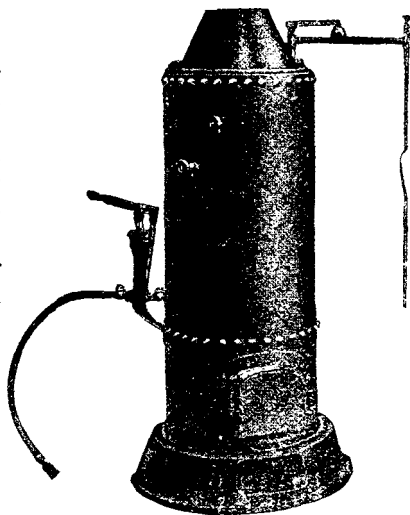
cause a remixing of the fat and consequently an inaccurate reading. A twelve-bottle tester is large enough for the average station.

Hot-Water Facilities. — An abundance of hot water is absolutely necessary to the successful operation of a cream station. A steam boiler or adequate facility for heating plenty of water is required. An upright tubular boiler with steam fittings and connections is the best and most efficient means of securing plenty of hot water. A boiler will also provide steam for running the Babcock tester. When stations are equipped with oil stoves, they must have at least two burners and the hot-water tank must have a heating capacity of at least three gallons.

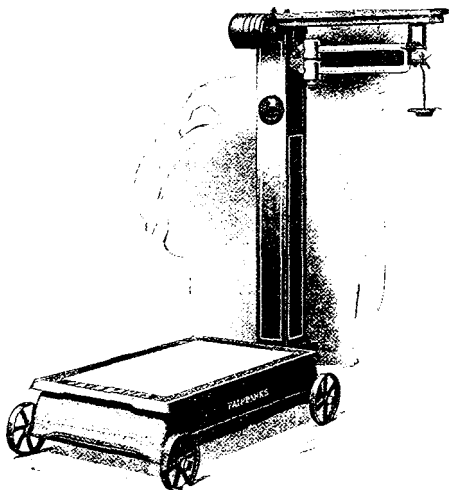
Wash Sink.—Where proper water system is available, cream stations should be provided with a supply of water and equipped with facilities for properly washing and sterilizing cream cans



A STEAM BABCOCK TESTER.



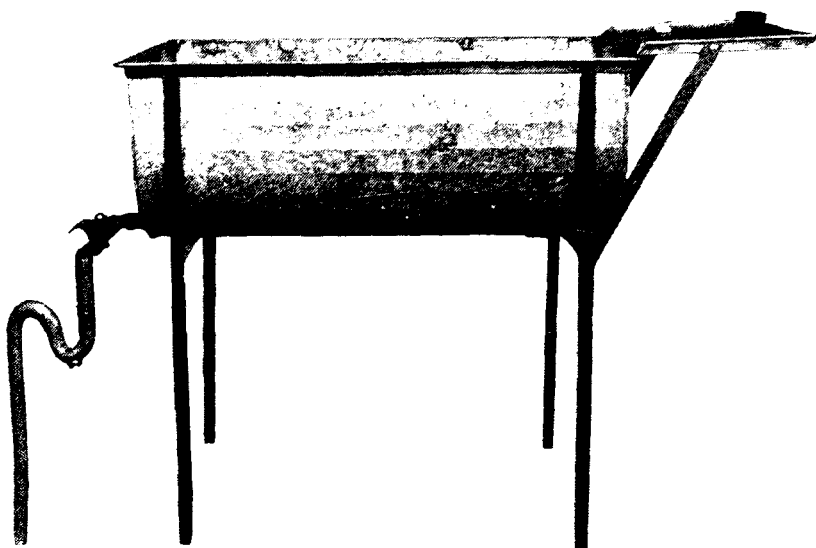
A STEAM BOILER



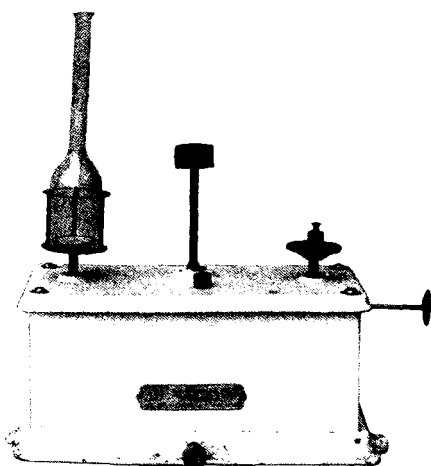
WEIGHING SCALES.

and other station equipment. Such equipment should be connected with a suitable drainage system. A sink made of half-round galvanized steel, large enough to hold a ten-gallon cream can, is suitable. The two-compartment sink, with steam jet for sterilizing, is recommended, since it enables the operator to wash properly, rinse and sterilize the cream cans, which aids in better quality.

Weighing Scales.—The scales for weighing cream are pre-



A WASH SINK.



ONE BOTTLE TORSION SCALE.

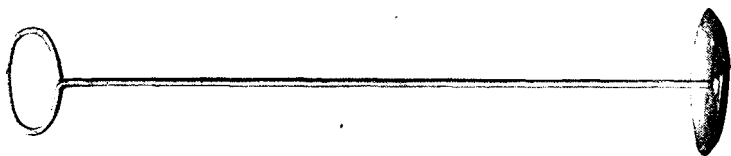
ferably the platform type, and should have a capacity of at least two hundred pounds and the beam should be marked with the standard graduations.

Testing Scales.—All cream samples for testing must be accurately weighed on scales sensitive to at least ten milligrams. The cream scales should be balanced on a level, solid shelf fastened securely to the wall away from air drafts, or on a platform that is mounted on a 4 x 4 post that extends down through, but not touching, the floor and is set securely in the ground.

If this kind of a platform is used, vibration is eliminated and samples can be weighed while the testing machine is running.

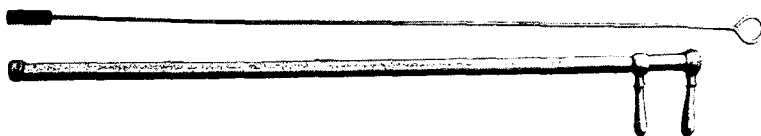
Test Weights.—The 9-gram weight is recommended due to the fact that the 9-gram bottles have been adopted. It sometimes happens that these weights are inaccurate. When in doubt on this point, the operator should have his weight checked by either the field man or the general office. The weights should always be kept free from dirt and grease, as any accumulation of dirt will result in an inaccurate test.

Stirring Rod.—A stirring rod is required in each station in order that the cream may be thoroughly stirred before sample is taken with the McKay sampler.



A stirring rod.

McKay Sampler.—The McKay sampler is a device for taking a sample of milk or cream for testing to determine the butterfat content of the milk or cream. To secure a representative and legal sample of cream according to the Colorado law, the sample must be taken with a McKay sampler, which is to be equipped with a stripper handle and a metal plunger. See page 41 for manner of using McKay sampler.



A McKay sampler showing plunger.

Thermometer.—In order that proper temperatures may be observed, an accurate dairy thermometer is required.

Waterbath.—In order that the proper reading temperatures may be maintained a waterbath is necessary and is required by law. The law requires that all tests shall be maintained in a waterbath for five minutes at a temperature between 120 and 130 degrees F. until read.

Cream Pipette.—The cream pipette will be found a convenient instrument to use in transferring the cream to the test bottle for weighing. Remember that cream tests are to be weighed, not measured.

Test Bottles.—Cream-test bottles are of two sizes, 9 and 18 grams,



A dairy thermometer.



Cream pipette.

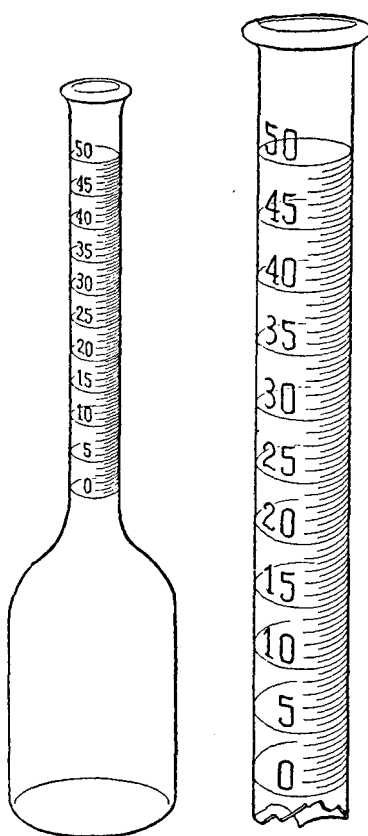
and are graduated to read the percentage of fat according to size. The 50 percent, 9-gram, 6-inch cream-test bottle is recommended and approved by the State Dairy Commissioner. The total percent graduation shall be fifty. The graduation shall represent 5 percent, 1 percent, and .5 percent. The charge of the bottle shall be 9 grams. The total height of the bottle shall be 6.5 inches. The capacity of the bulb up to the junction of the neck shall not be less than 45 cc.

Dividers.—Dividers should be sharp-pointed and move with plenty of friction at the hinge, but not too tight as they spring and give incorrect reading. Dividers which are loose and likely to slip should be either repaired or discarded.

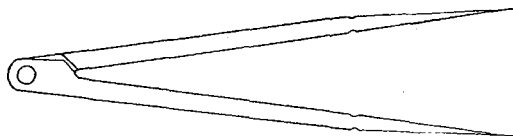
Acid.—For cream testing, commercial sulphuric acid with an acidity of 90.6 to 91 per cent, and a specific gravity of 1.823 to 1.825 is recommended as it seems to give the best results. All cream-testing acid may not be suitable for milk. No certain acid can be specified as

being the best in all cases, due to the variations in creams, but for the best average results, acid between the limits just mentioned gives the best results.

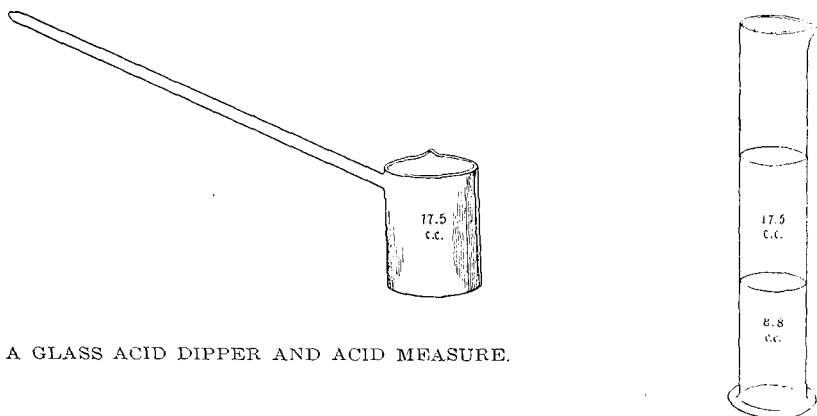
Such acid should not be left in an open container, as the action of the air will very soon cause it to become weak and unfit for use.



A 9-gram cream-test bottle conforming to the requirements of the State Dairy Commissioner, and showing graduations.



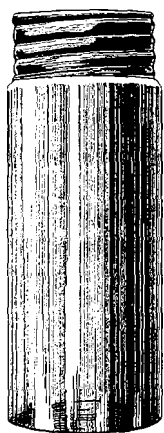
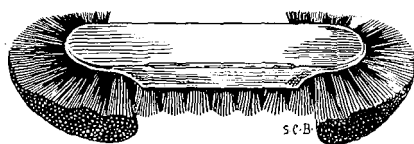
Dividers used in measuring the butterfat column



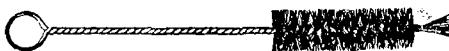
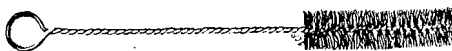
A GLASS ACID DIPPER AND ACID MEASURE.

Acid Measure.—The acid measure or dipper is a guide to the amount of acid to use and furnishes a convenient means of transferring the acid to the test bottle. The 9-gram acid measure or dipper is recommended.

Sample Bottles.—Any wide-mouthed bottle holding enough for two samples is suitable. However, since operators are required by law to use the McKay sampler, it is best to equip station with four-ounce bottles. Any sample bottle that is used must have a tightly fitting top or cover to prevent evaporation of moisture. A cream station should have a double set of sample bottles as all tested samples are required to be held until the close of the next test day.

CREAM SAMPLE
BOTTLE.

CAN BRUSH

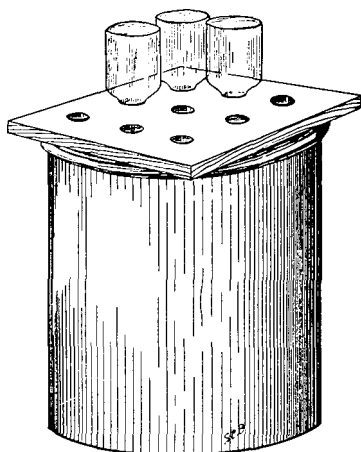
TEST-BOTTLE
BRUSHES

Brushes.—Test-bottle brushes are necessary for cleaning bottles in which dirt sticks badly. Can brushes are necessary in order that all cans may be thoroughly washed.

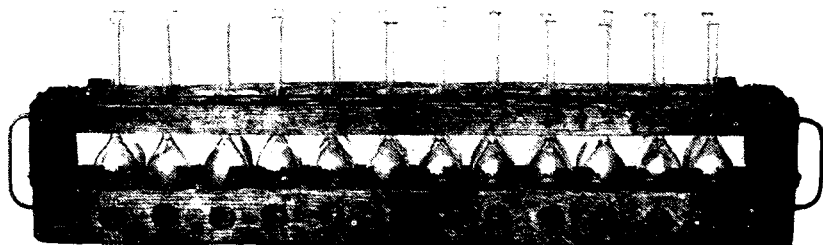
Waste Jar.—An earthenware jar with proper cover should be provided for disposing of the test when finished. A wooden cover, bored full of $\frac{7}{8}$ -inch holes through which the necks of the test bottles can be inserted and left to drain, will be found convenient.

Bottle Rack.—By using a test-bottle rack, the bottles are easier to handle, will drain better and some of the breakage will be eliminated.

Glymol.—Glymol is a high quality of white mineral oil. It is best to use it colored. The purpose of glymol is to flatten the meniscus on top of the fat column and secure a straight and sharply defined line for reading. Use only a few drops of glymol and add it immediately before reading the test. Do not use glymol in reading milk tests.



AN INEXPENSIVE WASTE JAR FOR DRAINING TEST BOTTLES.



A BOTTLE RACK.

Washing Powder.—A mineral washing powder is the only effective cleaner for station work. Soap will not do the work required.

Supplies.—Clean towels or cloths should be provided for the station operator. Station should be equipped with a broom and mop in order that the operator may keep the floors clean.

MODERN TYPE STATION

In many localities in the State, too much competition has had a demoralizing effect on the cream-station system. An instance can be cited: Eight creamery companies opened up stations at the same shipping point; this resulted in a division of the

cream and reduced the cream available to each concern, thus multiplying the expense of handling the cream and increasing the cost of securing the butterfat, which was a loss to the farmer.

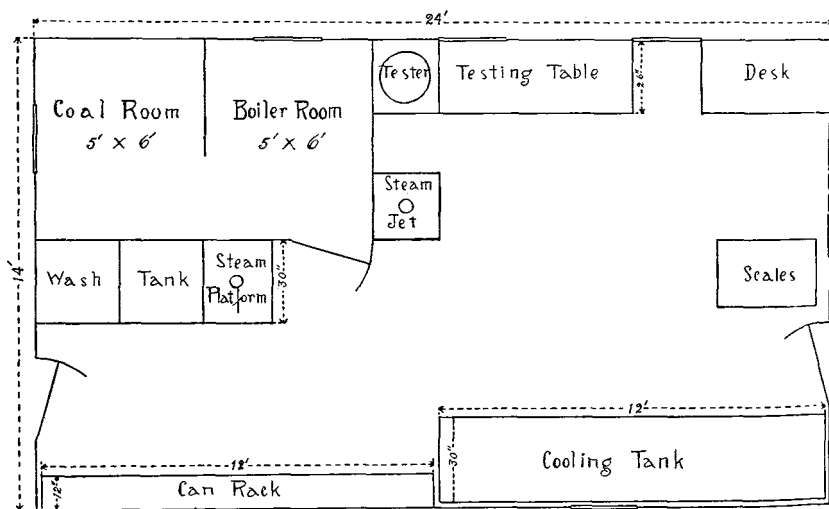
Another factor that has a demoralizing effect on the dairy industry is the establishment of cream stations in towns by a few firms during the flush season. Usually the stations are started in undesirable locations, lack the proper facilities for receiving and handling the cream and are not properly equipped for cleaning cans and other utensils.

You can readily see that this type of station is a distant detriment to the dairy industry and in order to secure the proper operation of cream stations and to put same on a permanent basis, the State Dairy Commissioner issued the following regulations pertaining to cream-receiving stations that were effective June 1, 1923:

REGULATIONS

When Required.—It is desirable that all new stations should be of this type when possible, and whenever a new station is to be erected in a town already having two or more, it must be of this type, and conform to the following requirements:

Kind of Room or Building.—A separate room or building is required for the operation of a cream-receiving station, and adequate floor space is required. It is recommended that such room or building shall not contain less than 192 square feet of floor space. The room or building shall have outside openings on at least two sides to provide proper ventilation. The main entrance shall face the street, and there shall be no windows or doors into other rooms, unless to office, boiler room, or can-rack room.



A WELL-ARRANGED CREAM STATION.

Sanitary Surroundings.—The surroundings of a cream station should be sanitary in every sense of the word, as cream readily absorbs any undesirable odors, and decayed substances harbor flies. Stations shall not be

located within fifty feet of chicken yards, hog pens, or objectionable buildings or unsanitary conditions that cannot be removed. The outside portion of the station should be neat and clean in appearance, and provided with some sort of platform or sidewalk.

Walls and Ceilings.—A clean, smooth, tight, washable surface shall be provided.

Floor.—The floor shall be of cement with a smooth finish, and extend so as to form a concrete base-board, and floor shall be properly drained and trapped, the drain to be connected with sewer system, septic tank, or covered cesspool, or delivered through closed drain with trap. Where sewage is deposited on surface which shall be not less than fifty feet from building, it is necessary that no nuisance shall be created.

Light and Ventilation.—All cream stations shall have ample light, and it is recommended that there be one-sixth as much window space as floor space.

Screening.—All windows, other openings and doorways shall be screened during fly season with tightly fitting screens. Screens on doorways must be self-closing. Fly season shall be calculated from May 1st to November 1st.

Equipment.—Equipment shall consist of:

1. Can rack inside of station of sufficient size to hold all surplus empty cans.
2. Cooling tank of sufficient capacity to hold all cream received in one day's business. This may be remitted by special permission where water supply is inadequate.
3. Babcock tester.
4. Steam boiler or adequate facilities for heating plenty of water.
5. Wash sink with proper drain.
6. Platform scale, capacity 200 pounds or over, with standard graduations.
7. Test scales sensitive to ten milligrams.
8. Stirring rod.
9. McKay sampler equipped with stripper handle and metal plunger
10. Dairy thermometer.
11. Waterbath.
12. Cream pipette.
13. Test bottles.
14. Dividers with sharp points or edges.
15. 9 cc. acid measure or dipper.
16. Sample bottle (4 oz.)
17. Test-bottle brush.
18. Test-bottle rack.
19. Separate receptacle for emptying test bottles.

Supplies.—Supplies shall consist of: 1. Sulphuric acid of standard required by State Dairy Commissioner.

2. Colored glymol or other approved reading oil.
3. Washing powder.
4. Clean towels and cloths.
5. Broom and mop.

METHODS OF RECEIVING CREAM

The primary function of the operator of a receiving station is to buy cream and his success depends on his personality, business methods, and the condition in which he keeps his place of business and equipment. The best cream buyers are those who have made it their business to become generally informed on the

subjects of dairying and dairy problems. His intimate acquaintance and association with the cream producer places him in a position to offer helpful suggestions which are bound to result in a better and more economical production on the one hand and a decided improvement in the quality of cream on the other. In other words, his station becomes a dairy service station.

Nearly every person has a particular business method of his own which he follows. Some never get the habit of doing work systematically.

The following steps will serve as a guide and aid to all who are just taking up this work, and the suggestions may be worth the consideration of older followers of the business:

1. Write the patron's name plainly upon the receiving sheet.
2. Balance the weighing scales.
3. Weigh the cream carefully.
4. Record the gross weight of cream and can.
5. Note the appearance and quality of the cream.
6. Sample as required by Colorado law.
7. Place the number of the sample bottle after the patron's name.
8. Empty cream into company can.
9. Rinse the patron's cream can thoroughly, but do not use an excessive amount of hot water.
10. Wash patron's can thoroughly, sterilize and drain it.
11. Weigh the empty can for tare weight.
12. Record weight of empty can. In case there is no space on the receiving sheet for the tare weight, subtract the weight of empty can from the gross weight of the can and cream obtained in step No. 4, and enter the remainder on the receiving sheet as the weight of the cream paid for.
13. Return can to patron, at the same time handing him a check for the previous delivery, and also a statement of the amount of cream and grade just received and the price being paid for butterfat.

The common practice is to pay the patron for his cream the same day that he delivers it. This is not desirable and is not recommended, for the reason that when an operator is rushed he is not apt to do so careful and accurate work.

SAMPLING CREAM

The sampling of milk and cream for butterfat tests is one of the most delicate problems with which the station operator has to deal. It is the most difficult and important step in the butterfat determination. If a proper sample is not obtained, the ultimate test will not be correct, no matter how carefully the succeeding steps may be carried out.

How to mix the cream.—The purpose of thoroughly mixing the cream before sample is taken is to cause every portion of it to be alike in fat content, so that any sample taken out will be

representative in fat content of the entire container. To accomplish this, stir the cream thoroughly with the stirring rod, giving the cream a vigorous boiling motion. Be sure to scrape the sides and shoulders of the can, because thick heavy cream is likely to stick to the sides of the can. Making sure that these scrapings are thoroughly mixed with the other portions of the cream, and sample immediately with McKay sampler.

Heavy and Frozen Cream.—It is hard to secure a representative sample from thick, lumpy, or frozen cream. Such cream should be gradually heated to 110 degrees in a waterbath until, by continuous pouring and stirring, the body of the cream has become smooth, free from lumps and of a uniform texture. If the above steps are not followed before securing sample you will not have a true or representative sample.

How to take Sample.—To secure a representative and lawful sample, the McKay sampler must be used. For those who are not familiar with the McKay the following suggestions may help:

1. To get a sample which represents the average quality, the milk or cream delivered must be thoroughly stirred.
2. See that all openings of the sampler are closed, and the plunger is drawn back.
3. The sampler is then lowered into the cream to the bottom of the can, when it is opened to allow it to fill, and then closed again.
4. After it is filled raise the sampler from the can, lowering the stripper handle as you remove the sampler, so that all cream adhering to the outside of the sampler is cleared off.
5. In emptying the sampler, the handles are manipulated to leave a small opening at the bottom, and the plunger is pushed down to force the cream out of the tube into a clean, dry, sample bottle that is equipped with an air-tight cover. In case your sample bottles are not large enough to hold the full charge of cream, you might empty the charge of cream into ordinary tin cups. Pour the cream from one cup to another several times until it is thoroughly mixed and then fill sample bottles. Be sure that the cups are thoroughly washed after sampling each patron's cream.
6. Wash the sampler in hot water and hang up to drain after each patron's cream is sampled.

Note:—It may seem troublesome or unnecessary to go to all detail mentioned above, in order to secure a sample, but it is well to remember that your right to do business depends upon your giving a correct test to the producer.

Care of Samples.— All milk and cream samples shall be kept tightly covered to prevent evaporation of moisture. After the samples of cream received during the course of the day's business have been tested, they shall be retained or held in tightly

covered, properly labelled sample bottles until the close of the next test day, preferably in a cool place.

CREAM TESTING

The Babcock test is the most satisfactory and practical means of determining the amount of butterfat in milk or cream. The point never to be lost sight of in testing milk or cream is that the small quantity taken for the test must be truly representative. No matter how carefully the test is carried out, if the sample taken does not accurately represent the milk or cream to be tested, the results will be inaccurate and worthless.

When to Test.—Testing should be done at the time when the operator is least likely to be disturbed, as they are responsible for correct returns to the producer. To make a lawful test it will require at least 25 or 30 minutes.

Balance Test Bottles on Scales.—While your cream sample is heating, mark each test bottle plainly with the same number given the corresponding sample bottle. Place the test bottle in the left-hand holder and balance the scale carefully with the bottle on it. (This is done by moving the counter weight back and forth until the point of balance is found.) Put the 9-gram weight on the right-hand pan. Always lock the scales before placing or removing bottles or weights from them.

Preparing Cream Sample for Testing.—The preparation of cream for testing does not differ materially from that of milk. Cream samples should be heated in a waterbath until the cream has reached a temperature between 65 and 75 degrees F. Then mix sample thoroughly by shaking or pouring from one bottle to another until the cream is uniform in color, smooth and free from all lumps. The sample then should be taken quickly for testing.

In the case of cream sample in which the fat has become separated, frozen, churned, or changed into a tough, leathery condition, it is heated to a temperature of 110 degrees F. to melt the fat, after which it is continuously shaken until cooled to 70 degrees F. or lower, and then the sample is taken and weighed as quickly as possible. Agitation during the process of cooling is essential to keep the melted fat from separating so rapidly as to prevent obtaining a uniform mixture.

Weighing Test.—Your scales and bottles in balance, the next step is to transfer, by means of a wide-mouthed pipette, enough of the thoroughly mixed cream to the test bottle to bring it again in the balance with the 9-gram weight. No cream should be allowed to get on the outside of the bottle or on the scale pan while weighing. If too much cream should be added to the test bottle, the excess may be removed with a clean wire or glass rod. Be careful that the test is weighed accurately.

To insure accuracy, all samples of cream should be tested in duplicate. If the results of the duplicate tests do not agree, there is an error somewhere and the work should be repeated.

Adding Acid.—Before adding acid to the cream in test bottle be sure that it is of the same temperature as the cream. Unless the cream and acid are brought to the same temperature (between 65 and 75 degrees) at the time of mixing, the action of the acid may cause burnt or cloudy tests. Add about 9 cc. of the proper strength of concentrated commercial sulphuric acid. This acid is then added carefully by inclining the test bottle at an angle and pouring the acid slowly and carefully into the bottle, at the same time revolving the bottle so that the acid may wash down all traces of cream which have been left in the neck of the bottle.

Rich cream will require a little less acid than thin cream, and sour cream will require a little less than sweet cream.

Mixing Cream and Acid.—After adding the acid, the next step is to mix the contents by a gentle rotary motion, avoiding spilling or shaking acid particles into the neck. Incomplete mixing invariably means a poorly made test. After mixing, each bottle should be allowed to stand a short time, until the desired uniform color is obtained. In case of strong acid sometimes it is necessary to add a small amount of hot water to check the action of the acid.

Adding Hot Water.—Before adding the hot water give the bottles a second gentle rotary motion. Then carefully add enough clean, hot, soft water of 180 degrees F. to fill the bottle up to the neck. Do not pour the hot water directly on the fat column but incline the bottle at an angle and add the water slowly and carefully. If soft water cannot be obtained, add a few drops of sulphuric acid to the hard water before putting into the bottle. The use of hard water will cause air bubbles on top of the fat column.

Whirling.—The test bottles must be placed in the testing machine or centrifuge so that they will be evenly balanced and whirl for five minutes at the proper speed, according to tester. The periods of whirling given mean the time during which the tester is run at full speed, and do not include the time used in starting and stopping machine. See page 24 for table for different sizes of testing machines.

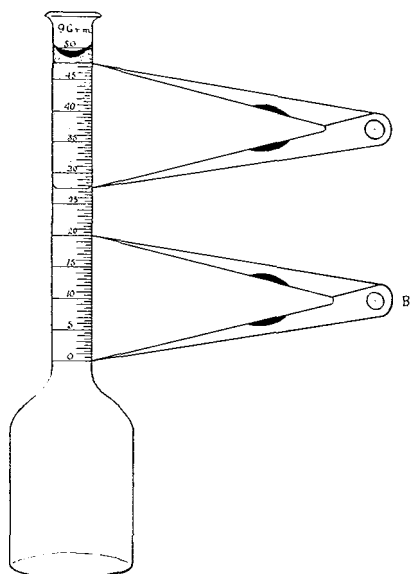
Adding Hot Water the Second Time.—After running the machine for five minutes, stop and add enough water of a temperature of 180 degrees F. to each bottle so that all butterfat floats within the graduated scale.

Second Whirling.—After the hot water has been added the second time, the bottles should be whirled for two minutes.

Reading Temperature.—After the second or two-minute

whirling, remove the test bottles from the machine and place them in a hot waterbath for at least five minutes, the temperatures of the water should be between 120 and 130 degrees F., and water shall be deep enough to surround the fat in the necks of all bottles. All tests shall be maintained at the temperature mentioned above until read.

Reading Test.—If the test has been properly run, the butterfat column should be a clear golden-yellow or straw-color liquid without any curd or sediment at the base or scum on top. If the butterfat column is as it should be, take one test bottle from



METHOD OF READING CREAM TESTS.

the waterbath and add a few drops of glymol and read immediately. Glymol must not be dropped in, but must be allowed to flow down the side of the neck. In reading the test, hold the bottle perpendicular and on a level with the eye. The test is then measured by means of sharp-pointed dividers, by placing one point of the dividers at the bottom of the lower end of the fat column or meniscus and the other point at the top of the fat column, which is the division line between the butterfat and glymol. The dividers are then carefully lowered until the lower point of the dividers rests on the zero graduation around the neck of the bottle and the point to which the upper arm of

the dividers reaches is noted and read. It is well to recheck this operation to be sure the dividers have not slipped. All readings should be read to the nearest one-half percent indicated on the scale on the test bottle. When reading is completed it should be recorded opposite the patron's name, being sure that the number on the test bottle corresponds to the number given the patron's name.

DIFFERENT STEPS IN CREAM TESTING BRIEFLY TOLD

1. Heat sample to a temperature between 90 and 110 degrees F.
2. Balance test bottles on scale.
3. Mix sample thoroughly.
4. Weigh test or tests accurately.

5. Cool tests to temperature of between 65 and 75 degrees F.
6. Add acid of same temperature. (About 9 cc.)
7. Mix well with a gentle circular motion. (Let set until coffee brown color is obtained.)
8. Add hot water of temperature of 180 degrees F. up to neck of bottle.
9. Whirl five minutes at proper speed, according to tester.
10. Add hot water of temperature of 180 degrees F. until all butterfat floats within the graduated scale.
11. Whirl two minutes.
12. Place test bottle into hot waterbath, maintained at a temperature of 120 to 130 degrees F. for five to ten minutes. (The water in the bath should surround the fat column.)
13. Add carefully about three drops of colored glymol or colored reading oil as each test is read.
14. Read test by measuring with sharp-pointed dividers from bottom of butterfat column to the division line between the butterfat and glymol.
15. Read tests carefully.
16. Record tests as read opposite patron's name.

LICENSES AND PERMITS

License Required by Law.—In section 9 of the Colorado Dairy Code, as amended by the twenty-fourth general assembly, March, 1923, provision is made requiring that any person desiring to sample or test milk, cream, or other dairy products for the purpose of determining the value of such products when bought and sold, shall hold a license granted by the State Dairy Commissioner.

License Fee.—The same section of the Colorado Dairy Code mentioned above provides that all persons who secure a sampler's or tester's license must pay a license fee of three dollars (\$3.00) for the testing year or any part of a year.

When to Pay License Fee.—The three-dollar license fee must accompany the application for examination or application will not be accepted. Make draft or postoffice money order payable to State Dairy Commissioner.

License Fee Refunds.—All money collected by the Dairy Commissioner is turned over to the State Treasurer and no refund will be made.

How to Make Application.—Write to the State Dairy Commissioner, Fort Collins, Colorado, for an application blank for examination, or secure one from the fieldman of the creamery that engaged you. Fill out the application properly, attach license fee and mail to State Dairy Commissioner, Fort Collins, Colorado.

All applicants for examination must be at least 16 years of

age, and must have tested, prior to the time of their application, at least ten samples of milk or cream under the supervision of a licensed operator, or a creamery field superintendent, and according to the directions printed in this bulletin.

Statement of Applicant.—If inspection shows that applicant made any mis-statements on application blank, his license will be cancelled.

When to Start Operating.—All newly employed operators, whether samplers or testers, must have their applications in the State Dairy Commissioner's office and hold receipt that application has been received and accepted before starting operations. To start operating before you secure permission from the State Dairy Commissioner is a violation of the Colorado Dairy Code.

Substitutes.—The best method of solving the substitution problem in case of sickness or important business at a distance, is to have some member of the family or a friend hold a license so that he may readily fill the vacancy made by such an unexpected absence. The regular operator's license is subject to cancellation in case he leaves the station in charge of an unlicensed person. When there are two or more licensed operators in a plant, each operator is required to place his initial on the daily report after all samples tested by them.

Written Examination.—As soon as application for examination is received at the office of the State Dairy Commissioner, notice will be sent to the applicant to appear for the examination within seven days from date of notice, before the justice or notary named in the application. As soon as the examination has been taken and returned from the notary, the papers will be gone over and carefully graded. If a passing grade is earned, a license will be issued subject to further examination by a representative from the Dairy Commissioner's office.

The license will be mailed with a report showing the grade secured on the examination and a receipt for the license fee if it was paid by the applicant. In case the fee was paid by some other party the receipt will be mailed to him.

Practical Examination.—After a license has been issued on written examination, a personal examination will be given by a representative from the Dairy Commissioner's office. The examination will cover such points as the condition of the station, a demonstration of the testing work, and a review of some important points in this bulletin pertaining to your station work.

Failure on Examination.—If applicant fails to make a passing grade on the first examination taken before a notary public, a notice of failure will be sent to the person failing and a second examination will be granted five days from date of notice.

Applicants that fail on second written examination or on practical examination will not be granted a license or permitted

to do testing. Permit issued upon receipt of application for examination will be cancelled at the time the applicant is notified by the office of such failure, and another application for examination will not be accepted within 90 days from date of failure.

Milk and Cream Samplers.—Occasionally persons sample milk and cream but do not test same for butterfat content. Such persons will be required to take the same examination as the testers. Sampling is considered the most important step in determining the butterfat content of milk and cream. It is essential and necessary that samplers have a thorough knowledge of testing work.

Examination Questions.—Examination questions will be taken from the list given on pages fifty-one to fifty-eight inclusive.

How Long License Is Valid.—Sampler's or tester's licenses are valid from date of issue until the following June 30th, subject to cancellation by the State Dairy Commissioner at any time that he shall find that the person holding said permit is incompetent or guilty of violating any of the provisions of the dairy laws or regulations.

License Posted.—Every operator is required by law to keep license or permit posted in his station or test room in plain view at all times.

Renewal of License.—Application for renewal of license will be mailed from the State Dairy Commissioner's office June 1 of each year and operators are requested to fill out renewal blank and return by mail with the necessary three-dollar license fee by June 15. This will give the office sufficient time to go over the applications, so that new licenses may be issued and be in your hands by July 1. No renewal will be made following the expiration of a license without another examination and then not for 30 days. If operators continue testing without a renewal, they will render themselves liable to prosecution.

Transfer of License.—Licenses or fees are not transferable; neither is it lawful for any person to sample or test under another person's license. In case an operator desires to transfer from one town to another or from one company to another, the State Dairy Commissioner must be notified in advance of change of location and receive notice of continuance of license. Otherwise operator's license is automatically cancelled.

Temporary Permits.—In case of emergencies such as death, sickness or resignation of an established operator, without notice, the field superintendent may procure the services of the best man available and instruct him thoroughly in the methods of testing. In case of this kind it is advisable to phone or wire and get permission for the new operator to start. Also see that the applicant's application and fee is in the mail before you leave the station.

When temporary permits are granted it is with the positive understanding that the party who receives the temporary permit is to take the regular examination for a sampler's or tester's license.

No temporary permit will be granted, under any circumstances, in connection with a cream station not previously established and in continuous operation.

INSPECTION

Provision is made by law for the inspection of all places where dairy products are handled or produced. This inspection will be made by a representative from the State Dairy Commissioner's office who will make written report of the conditions found, with recommendations. A duplicate copy of this report in case of the milk and cream station will be left with the operator. The original will be forwarded to the State Dairy Commissioner's office by the inspector.

Purpose of Inspection.—Inspections will be made from time to time, to cover such points as sanitation, testing work, and other points provided by the dairy laws and regulations.

Points Considered in Scoring a Station.—A plan of scoring receiving stations will be followed in order that the operator will know what to expect and can govern himself accordingly. Naturally an ideal station would score 100 percent. In order to determine the score of a station the ten points listed below will be considered and compared to an ideal condition:

1. External Appearance. Points Allowed 10.—A separate room or building is required for the operation of a receiving station. It should be located on a well-drained, slightly elevated piece of ground, sloping away from the station in all directions.

The room or building shall have outside openings on at least two sides to provide for proper ventilation. The outside portion of the receiving station shall be neat and clean in appearance and provided with some sort of porch or platform. If a frame building, it should be painted.

2. Sanitary Surroundings. Points Allowed, 10.—The surroundings of the receiving station should be sanitary in every sense of the word, as milk and cream readily absorb any undesirable odors, and decayed substances harbor flies. Receiving stations should not be located within fifty feet of chicken yards, hog pens, or objectionable buildings or open rooms in which oils, poultry or other strongly flavored products are handled. The outside portion of the station should be neat and clean in appearance and provided with some sort of platform or sidewalk.

3. General Equipment. Points Allowed, 10.—All equipment mentioned on page 39 under heading of "Equipment and Supplies" is required for each receiving station except cooling tank or drain,

providing waste water disposed of does not create odor or attract flies. The cooling tank and drain is required of modern-type stations. In case of sampling station, the testing equipment is not required. The operator's permit or license and station permit or license shall occupy a conspicuous place on the wall. In case permit or license is not posted, the inspector shall grade operator zero on general equipment.

4. Ventilation and Light. Points Allowed, 10.—A receiving station shall have ample natural light, and it is recommended that one-tenth as much outside window space as floor space be provided, except in case of modern-type station which is one-sixth. Sunlight is an excellent disinfectant, and light is necessary if the operator is to do efficient work. Outside openings are required on at least two sides of the cream receiving room. A cool room is essential for keeping milk or cream.

5. Drainage. Points Allowed, 10.—Suitable drainage shall be provided by means of connection with sewer system, septic tank, or covered cess pools or all waste must be delivered through a closed drain with tap and deposited at a point not less than fifty feet from the building.

6. Freedom From Flies or Vermin. Points Allowed, 10.—All windows, other openings and doorways shall be screened during fly season with tightly fitting screens. Screens on door ways shall be self closing. Fly season shall be calculated from May 1 to November 1.

7. Neatness of Interior. Points Allowed, 10.—A well-arranged, neat station facilitates the operator's work. Suitable places must be provided for bottles, scales, etc., and articles kept therein. The receiving station shall be used exclusively for the handling of dairy products and at time of inspection if there is any other business being conducted in receiving room or any unnecessary materials or junk are found, the inspector shall make a severe cut.

8. Walls and Ceilings. Points Allowed, 10.—Walls and ceilings should be finished with a hard, clean, smooth, tight washable surface. Plastered surface is preferable. Tightly fitting boards painted in some light color are next in desirability. The surface must be kept clean and free from dirt.

9. Cleanliness of Floor. Points Allowed, 10.—The floors shall be water-tight. A cement floor is the most desirable floor as it can easily be kept clean. Tightly fitting, well painted boards are satisfactory, and must be kept free from dirt at all times.

10. Cleanliness of Utensils. Points Allowed, 10.—All station utensils must be kept scrupulously clean at all times. No excuses will be accepted. Stirring rod, McKay sampler, sample jars, test bottles, pipettes, and all vessels coming in contact with

the cream must be washed thoroughly each day. The personal appearance of the workman is also considered here.

CLASSES OF STATIONS

By the above method of scoring and inspection, the stations will be graded into five general classes as follows:

A+ 90 to 100—A clean, attractive, well-equipped and well-kept station.

A 85 to 89—good.

B+ 80 to 84—fair.

B 70 to 79—poor.

C Below 70—undesirable.

Should the station score 70 percent or less or show evidence of neglect or carelessness on the part of the operator, but show no violation of law, it will be rated undesirable, and the letter "C" will be stamped in bold-face type upon the license.

All stations rated in class C will be given a written notice of a time limit set for them to make class B or better. Such notice may be for one hour or fifteen days. If upon inspection after the time limit has expired, the station does not make class B or better, the station will be closed.

When station is decidedly unsanitary, the permits or license held are not posted in a conspicuous place, or other provisions of the dairy law are violated, the license or licenses will be cancelled and the station closed.

The purpose of this system is to carry on the inspection work in a business-like manner so that all stations and operators are treated alike and to improve the quality of Colorado butter by raising the standard of cream production and cream handling.

INSPECTION OF DAIRIES

The dairies furnishing the milk and cream going into these stations will be scored in a similar manner, and by building up the places where the cream is produced and handled before the raw material reaches the place of manufacture, a far-superior product of butter will be produced. The production of a high-grade butter in Colorado means an increased demand which in turn, means larger profits for all concerned in supplying such a market.

When dairies are scored the following score card will be used.

EQUIPMENT.	SCORE		METHODS.	SCORE	
	Perfect	Allowed		Perfect	
COWS.			COWS.		
Apparently in good health..... 1	6		Clean..... 8		
Tested with tuberculin within a year and no tuberculosis is found, or if tested within six months and all reacting animals removed..... 5			(Free from visible dirt, 6.)		
Tested within a year and reacting animals are found and removed (clean and wholesome)..... 1			STABLES.		
(clean and fresh)..... 1			Cleanliness of stables..... 6		
STABLES.			Floor..... 2		
Condition of stable..... 1	2		Walls..... 1		
Well drained..... 1			Ceiling and ledges..... 1		
Free from contaminating surroundings..... 1			Mangers and partitions..... 1		
Condition of stable..... 4			Windows..... 1		
Well sound floor and proper litter..... 2			Stable air at milking time..... 5		
Smooth, tight walls and ceiling..... 1			Freedom from dust..... 3		
Proper stall, tie, and manger..... 1			Freedom from odors..... 2		
Provision for light: Four sq. ft. of glass per cow..... 4			Cleanliness of bedding..... 1		
Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft., 1 (Deduct for uneven distribution.)..... 1			Barnyard..... 2		
Provision for fresh air, controlled flue system..... 3			Clean..... 1		
Windows hinged at bottom, or sliding windows, 1; other openings 0.5.)..... 3			Well drained..... 1		
100 feet of space per cow, 500 less than 500 ft., 2; less than 300 ft., 1; less than 300 ft., 0.)..... 1			Removal of manure daily to 50 feet from stable..... 2		
Provision for controlling temperature..... 1			MILK ROOM OR MILK HOUSE.		
UTENSILS.			Cleanliness of milk room..... 3		
Condition and condition of utensils for cleaning (clean, convenient, and abundant.)..... 1			UTENSILS AND MILKING.		
Top milking pail..... 5			Care and cleanliness of utensils..... 8		
Cooler..... 1			Thoroughly washed..... 2		
Milking suits..... 1			Sterilized in steam for 15 minutes..... 3		
ROOM OR MILK HOUSE.			(Placed over steam jet, or scalded with boiling water, 2.)..... 3		
Condition: Free from contaminating surroundings..... 1			Protected from contamination..... 3		
Condition of milk room..... 2			Cleanliness of milking..... 9		
Walls, and ceiling..... 1			Clean, dry hands..... 3		
Ventilation, screens..... 1			Udders washed and wiped..... 6		
Rooms for washing utensils..... 1			(Udders cleaned with moist cloth, 4; cleaned with dry cloth or brush at least 15 minutes before milking, 1.)		
Handing milk..... 1			HANDLING THE MILK.		
For steam..... 1			Cleanliness of attendants in milk room..... 2		
Water, 0.5.)..... 1			Milk removed immediately from stable without pouring from pail..... 2		
Total 40			Cooled immediately after milking each cow..... 2		
			Cooled below 50° F..... 5		
			51° to 55°, 4; 56° to 60°, 2.)		
			Stored below 50° F..... 3		
			57° to 55°, 2; 56° to 60°, 1.)		
			Transportation below 50° F..... 2		
			(51° to 55°, 1.5; 56° to 60°, 1.)		
			(If delivered twice a day, allow perfect score for storage and transportation.)		
			Total 60		

Equipment..... + Methods..... = Final Score

NOTE 1.—If any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited.

NOTE 2.—If the water is exposed to dangerous contamination, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

DAIRY-PLANT LICENSES

Required by Law.—Section 9 of the Colorado Dairy Code as amended March, 1923, provides that all milk and dairy-manufacturing plants and milk and cream receiving stations shall be licensed and pay a license fee.

How to Secure Dairy Plant License.—The law provides that upon application and payment of a yearly license fee, a temporary permit may be issued by the State Dairy Commissioner. The plant is then inspected and if it complies with the dairy laws and regulations, a license shall be granted. Application blanks will be furnished by the State Dairy Commissioner upon request.

License Fee Required.—The license fee for each milk or cream receiving station is two dollars (\$2.00). The license fee for each creamery, condensery, cheese factory, ice-cream factory, milk plant, concentrator, or other dairy-manufacturing plant, is ten dollars (\$10.00). All license fees must be mailed with application.

When to Start Operation of Dairy Plant.—It is unlawful to start operating any kind of a dairy plant before permission has been granted by the State Dairy Commissioner. Make application in due form, pay license fee and secure permit before starting.

License Required to Be Posted.—Creamery concerns are required to post dairy-plant permits or licenses in the plants designated on face of permit or license.

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QUESTIONS AND ANSWERS WHICH SUCCESSFUL APPLICANTS FOR A SAMPLER'S TESTER'S OR FIELD-MAN'S LICENSE SHOULD KNOW.

All applicants should be prepared to answer any of the following questions regardless of whether they expect to be field superintendents or samplers or testers in a dairy plant. A full knowledge of all the sampling and testing work is necessary for all license holders. All persons are required to test at least ten samples of milk or cream under supervision of a person holding a license and according to the directions printed in this bulletin before taking the examination.

1. Q. *What is the purpose of the law requiring all persons sampling or testing milk or cream to be licensed?*

A. To assure the State Dairy Commissioner that the holder of the license is capable of properly sampling and testing milk or cream and is qualified to handle products in the best possible manner.

2. Q. *For what reason may a sampler's or tester's license be cancelled?*

A. License is subject to cancellation by the State Dairy Commissioner at any time that he shall find that the person holding said license is incompetent or guilty of violating any of the provisions or regulations of the dairy laws.

3. Q. *Is it necessary to prove intent to defraud in determining liability under the law in making false tests?*

A. No. The burden of the accuracy and correctness of the test lies upon the shoulders of the operator.

4. Q. *What is the penalty imposed upon any licensee for making false returns of butterfat contained in milk or cream?*

A. A fine of not less than \$10.00 nor more than \$200.00 and not over 60 days in jail for each offense is the penalty, and license can be cancelled.

5. Q. *When can an applicant start to sample and test milk and cream?*

A. No one can sample and test milk and cream until he has secured permission from the State Dairy Commissioner.

6. Q. *What should be done with a sampler's or tester's permit or license when received by applicant?*

A. The law requires that the permit or license shall be posted in the test room or station in plain sight.

7. Q. *How long is a sampler's or tester's license valid?*

A. A license is valid from date of issuance until the thirtieth (30th) day of the following June.

8. Q. *How can samplers or testers renew their license?*

A. Licenses may be renewed by paying a three-dollar

(\$3.00) fee and making application on blank form furnished by the State Dairy Commissioner.

9. Q. *When should a sampler's or tester's license be renewed?*

A. All licenses become null and void upon June 30 and must be renewed before that date. Even though previous license has only run a short time, the law does not allow anyone to test even for a week without having made application and paid fee.

10. Q. *What should be done in case a sampler or tester desires to change firms or locations?*

A. Licensee must notify the State Dairy Commissioner in advance of change of firms or location and receive notice of continuance of license, otherwise said license is automatically cancelled. Such transfer will not be granted to any licensee under investigation by the State Dairy Commissioner pending results of such investigation.

11. Q. *Where should a cream separator be kept?*

A. A separator should be kept in a separate dairy room or building provided for that purpose.

12. Q. *How often should a separator be washed and why?*

A. The bowl and all parts of a cream separator that come in contact with milk or cream should be washed and scalded after each separation. This is necessary to secure efficient separation and furthermore, dirty utensils are classed as unsanitary by law and must not be used.

13. Q. *What is the meaning of the term "unsanitary?"*

A. "Unsanitary" is a term fully defined in the law itself but, in general, means the same as insanitary.

14. Q. *How thick should cream be skimmed and why?*

A. Cream should be skimmed to a thickness of between 35 and 40 percent. Thick cream keeps better than thin cream. Also it saves express charges. More skim milk is kept on the farm for feeding calves and pigs. If cream is skimmed too thick a thorough separation is not probable and some cream is lost in transferring from one vessel to another.

15. Q. *How can cream be skimmed near the same thickness each time?*

A. (a) Cream may be skimmed at approximately the same thickness each time by using the same amount of water to flush the bowl of the separator each time;

(b) By keeping the cream screw the same;

(c) By running the separator at the proper speed as designated by the manufacturer;

(d) By having the temperature of the milk the same;

(e) By keeping a uniform inflow to the bowl; and

(f) By washing the separator thoroughly after each time it is used.

16. Q. *Under what conditions should cream be kept on the farm?*

A. Cream should be kept in a cool sanitary place, the temperature should be below 50 degrees F. Odors of vegetables, oils, etc., must not be present. A spring house or a building provided with cold, running water is best. A cellar or cave is not a good place to keep cream because the air is seldom pure and the temperature is not low enough in summer.

17. Q. *How cool should cream be before it is mixed with other cream of previous skimmings?*

A. Always cool cream to between 40 degrees and 50 degrees F. before mixing with other cream. Stir thoroughly each time different batches are added together. Do not mix warm cream with cool. Do not mix warm and cool milk together.

18. Q. *How would you keep cream from souring?*

A. Produce clean milk. Use a clean separator. Cool cream promptly to 50 degrees F. or lower after separation. Never mix warm with cool cream. Keep each separation separate until day of delivery. Use proper care in delivering to market.

19. Q. *What is low-grade, filthy or unsanitary cream?*

A. Cream that has been produced under one or more of the following conditions is low grade: (1) Cream produced from milk drawn within eight days before or four days after calving; (2) Cream produced from milk drawn from cows that are kept in barns or stables which are not reasonably well lighted and ventilated; (3) Cream produced from milk drawn from cows that are kept in barns or stables that are filthy from an accumulation of animal feces; (4) Cream produced from milk which is drawn from cows which are themselves filthy or in an unhealthy condition; (5) Cream which has been exposed to foul or noxious air or gases; (6) Cream which has been kept exposed in dirty, foul or unclean places or under unclean conditions or where transmissible human disease exists; (7) Cream produced by the use of a cream separator that has not been thoroughly washed, cleansed and scalded after previous use; (8) Cream produced by the use of a separator placed or stationed in any unclean or filthy room or place; (9) Cream which, when delivered at the point of shipment, is more than three days old, during the months of May to October inclusive, or more than four days during the months of November to April inclusive. (10) Cream to which has been added any foreign substances, coloring matter, chemical or preservative.

20. Q. *What are the chief causes of bad flavors in milk or cream?*

A. Bad flavors in milk or cream are caused by unclean cows, dirty methods in milking, unclean utensils, insanitary surroundings, and some weeds and feeds.

21. Q. *How should milk or cream be taken to market?*

A. Take milk or cream to market in clean sanitary cans, well protected from the sun and road dust while delivering. In warm weather wrap dampened blankets around the cans and over the tops. In severe winter weather, milk or cream should not be permitted to freeze while delivering.

22. Q. *How often should cream be delivered to conform with the law?*

A. Cream should be delivered at least every three days during the months of May to October inclusive and at least every four days during the months of November to April inclusive.

23. Q. *State fully the method you use to secure a lawful sample of milk and cream?*

A. The law on sampling reads as follows: It is hereby required in making tests of milk or cream for the purpose of determining the value of such milk or cream when bought or sold, that the milk shall be poured from one vessel to another, and that cream shall be poured from one vessel to another at least three times before sampling, unless the said milk or cream is thoroughly stirred and sampled by the McKay Sampler, or some other recognized sampler that will secure a representative sample. The ordinary stirring rod commonly used is not a recognized sampler.

24. Q. *How soon after thoroughly mixing milk or cream should a sample be taken?*

A. Samples should be taken at once after mixing.

25. Q. *How large a sample should be taken?*

A. Two ounces is the preferred amount for a sample.

26. Q. *How should a can of frozen or lumpy cream be treated to secure a uniform sample?*

A. Cream should not be allowed to freeze. If frozen, place in waterbath of not over 110 degrees F. Warm until pouring a few times will give a smooth body, free from any lumps or streaks. Then take sample and cool cream as quickly as possible.

27. Q. *How should cream samples be treated immediately before weighing the test?*

A. Cream samples should first be heated in a waterbath to a temperature between 90 and 110 degrees F. Mix the sample thoroughly by pouring from one jar to another until cream is smooth and of a uniform color.

28. Q. *How should cream samples be cared for?*

A. Use clean bottles with tight seals and keep in a cool place.

29. Q. *How long should remainder of sample not used for test be kept?*

A. Keep remainder of all samples until the close of business on the following test day. This is a strict requirement.

30. Q. *Is the Babcock test accurate?*

A. Yes, it is if the method of operation is understood and care is taken to work it carefully.

31. Q. *Does the Colorado state dairy law impose a penalty upon any false determinations in testing*

A. Yes.

32. Q. *What is the correct rate of speed for 12 and 18-inch testing machines?*

A. For the twelve-inch machine, 980 revolutions is the correct rate; eighteen-inch machines, 800 revolutions. See page 24.

33. Q. *Are test bottles always correctly graduated and marked?*

A. They usually are, but instances have been noted in which they were false. The law imposes a penalty upon the sale or use of inaccurate glassware.

34. Q. *Why should cream be weighed into test bottles instead of measured?*

A. The specific gravity of cream varies with its fat content and other conditions. It is also difficult to transfer all of the cream in the pipette to the test bottle. Therefore, measuring will not give an accurate test.

35. Q. *What precautions should be observed in the weighing of cream tests?*

A. Use clean, sensitive scales, set level. Protect them from jarring and drafts while weighing. If any cream is spilled on the balance, remove it before weighing is completed.

36. Q. *What is the correct weight for cream tests?*

A. Nine grams is the correct weight.

37. Q. *How much sulphuric acid should be used when testing cream?*

A. Use enough acid so that the mixture of acid and cream has a coffee-brown color after mixing and standing one minute. Usually 8.8 cc. for nine grams is the amount required.

38. Q. *What kind and what strength acid should be used for cream testing?*

A. Commercial sulphuric acid, specific gravity 1.823 to 1.825 and acidity of 90.6 to 91 is standard.

39. Q. *At what temperature should cream and acid be before mixing?*

A. They should be at a temperature between 65 degrees and 70 degrees F.

40. Q. *What effect does acid have on milk or cream?*

A. Sulphuric acid dissolves all milk solids other than fat and liquefies the fat due to development of heat.

41. Q. *If the fat columns of the tests are either curdy, milky, dark or charred, what should be done and why?*

A. Make another test because either of the above conditions will cause an inaccurate and unlawful test.

42. Q. *What is the cause of curd in the fat column?*

A. It is caused by too wide a variation in temperature at time of mixing acid, milk or cream, or using too little or too weak acid.

43. Q. *What is the cause of milky fat column?*

It is caused by adding hot water too rapidly to the test after the mixture has cooled, or by letting the hot water fall directly upon the mixture instead of allowing the water to flow down the side of the neck of the bottle, or by allowing the mixture to stand too long before first water is added.

44. Q. *What causes bubbles of air on top of fat column and how can their presence be avoided.*

A. Air bubbles are due to hard water. Hard water may be softened by boiling or by the addition of a few drops of sulphuric acid.

45. Q. *What is the cause of a dark or charred fat column?*

A. Too warm milk or acid, or too much or too strong acid will cause it.

46. Q. *How do unclean bottles affect a test?*

A. Any adhering fat will make the test higher. Dark specks will also rise in the fat column when tests are made in dirty bottles.

47. Q. *How should test bottles be placed in testing machine?*

A. Bottles should be so placed in machine that they will balance each other when whirling.

48. Q. *How many minutes should cream test bottles be whirled in the machine?*

A. First whirling should be for five minutes, second, two minutes.

49. Q. *How should reading temperatures be regulated?*

A. Regulate them by placing the bottles in a hot waterbath of the reading temperature for at least five minutes. The water in the waterbath must surround the fat in the neck of the bottles.

A. See illustrations page 44.

50. Q. *At what temperature should cream tests be read?*

A. Read them at 130 degrees.

51. Q. *How should the length of the fat column be measured when reading cream tests?*

52. Q. *What is glymol?*

A. Glymol is a high quality of white mineral oil. It is best to use it colored.

53. Q. *How much glymol should be used and when should it be added?*

A. Use only a few drops of glymol and add it immediately before reading.

54. Q. *How should glymol be added?*

A. It must not be dropped in bottle but must be allowed to flow gently down the side of the neck of the bottle.

55. Q. *Why is glymol used in cream testing?*

A. It is used to remove the meniscus on top of the fat column and secure a straight and sharply defined line for reading.

56. Q. *Should glymol be used for reading milk tests?*

A. No.

57. Q. *State briefly the different steps to be observed in cream testing.*

A. Answer this question by stating the sixteen steps outlined on page 44.

58. Q. *What should you do when in doubt about the correctness of any part of your work?*

A. When in doubt, get in touch with the State Dairy Commissioner's office.

59. Q. *How should cream be cared for at the cream station?*

A. Cream brought to the station is under the licensed operator's care and it is his duty to keep it in the best condition possible. Empty the cream after careful weighing and sampling, into clean, well-aired cans. The cans of cream should be placed in a cooling tank or held at a temperature as near 50 degrees F. as possible. The cans should not be covered tightly but should be well protected from dust and flies. First-grade cream should not be mixed with poor-grade cream as such mixing will spoil the good cream. Every time more cream is added to a partly filled can, the entire amount should be thoroughly stirred. Frequent stirring is beneficial to the cream.

60. Q. *Can sour cream be tested?*

A. Yes, but cream in a sour or bad condition is much harder to sample and test accurately than sweet cream.

61. Q. *Should cans be borrowed from cream stations or creameries?*

A. Cans should not be borrowed from station operators or creameries, as in this way many milk or cream cans are not only lost, but others are returned in damaged and insanitary condition. The law forbids station operators to loan milk or cream cans bearing a trade mark or brand to their patrons or others desiring them.

62. Q. *How long may empty cans be left at the railroad station after arrival?*

A. They must not be left longer than one day. They

should be taken away from the railroad station as soon as possible.

63. Q. *Should can racks be provided for empty cans?*

A. Yes. Can racks are necessary for the purpose of inverting empty cans in pure air as required by law. Such racks should be large enough to hold all surplus, empty cans which are likely to be on hand at any one time. Said racks are required to be built on the inside of station or can room.

64. Q. *What should be done with any cream held over after a shipment is made?*

A. Weigh, sample, test and record the results on the daily sheet in pounds butterfat as well as pounds cream.

65. Q. *How would you check your work to locate shortage?*

A. Make a composite on the day's work. If it does not check out, have the weighing and testing scales examined.

66. Q. *How much sulphuric acid should be used when testing milk?*

A. About 17.5 cc. is correct.

67. Q. *At what temperature should milk tests be read?*

A. Read milk tests at 130 degrees F.

68. Q. *How should the length of the fat column of milk tests be measured or read?*

A. See illustration on page 25.

69. Q. *State briefly the different steps to be observed in milk testing.*

A. Answer this question by stating the fourteen steps outlined on page 25.